MCUXpresso SDK Documentation

Release 26.03.00-pvw2

NXP
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Table of contents

This documentation contains information specific to the mc56f83000evk board.

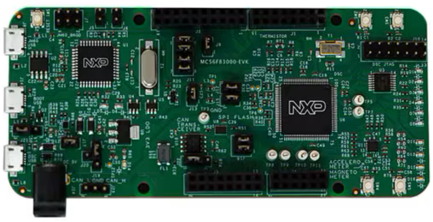
Chapter 1

MC56F83000-EVK

1.1 Overview

The MC56F83000-EVK is an ultra-low-cost development platform for digital signal controller MC56F83xxx MCU.

- The kit is form-factor compatible with the Arduino™ R3 pin layout and features ROM bootloader supporting SCI, IIC and CAN.
- Peripherals enable rapid prototyping, including a 6-axis digital accelerometer and magnetometer to create full eCompass capabilities, 6 buffered LEDs indicating PWM signals, 4 user LEDs, 4 user push-buttons for direct interaction, an SPI interfaced Flash memory, a high speed CAN transceiver circuit, a USBOTG connector and a USB to UART bridge circuit.
- The MC56F83000-EVK features onboard debugger OSJTAG circuit enabling debugging and programming with CodeWarrior.



MCU device and part on board is shown below:

- Device: MC56F83789
- PartNumber: MC56F83789VLL

1.2 Getting Started with MCUXpresso SDK Package

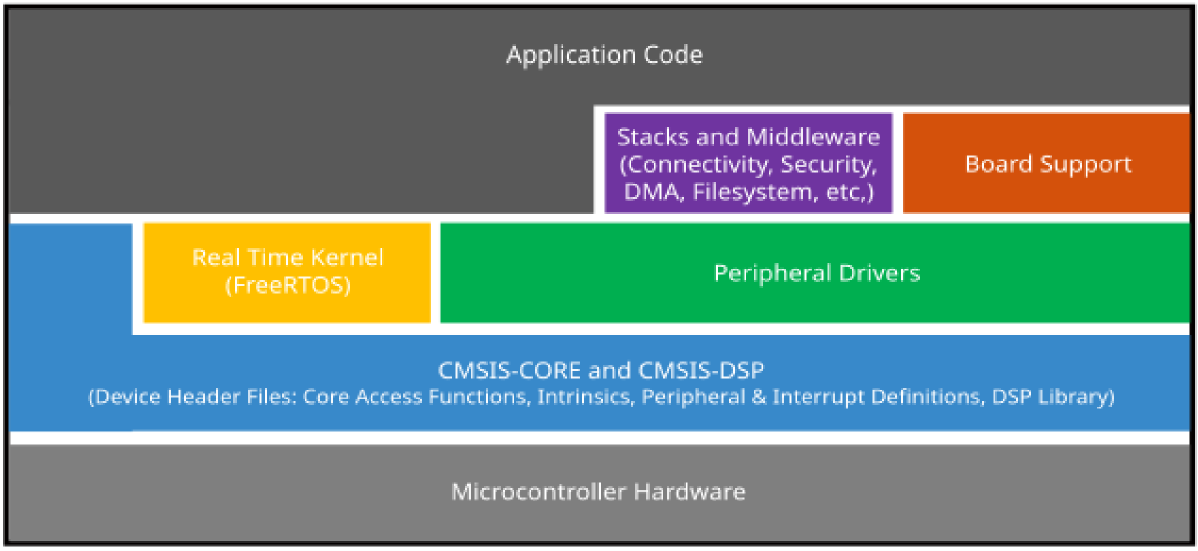
1.2.1 Getting Started with Package

Overview

The NXP MCUXpresso software and tools offer comprehensive development solutions designed to optimize, ease, and help accelerate embedded system development of applications based on general purpose, crossover, and Bluetooth-enabled MCUs from NXP. The MCUXpresso SDK includes a flexible set of peripheral drivers designed to speed up and simplify development of embedded applications. Along with the peripheral drivers, the MCUXpresso SDK provides an extensive and rich set of example applications covering everything from basic peripheral use case examples to full demo applications. The MCUXpresso SDK contains optional RTOS integrations such as FreeRTOS and Azure RTOS, and various other middleware to support rapid development.

For supported toolchain versions, see *MCUXpresso SDK Release Notes* (document MCUXSDKRN).

For more details about MCUXpresso SDK, see MCUXpresso Software Development Kit (SDK).



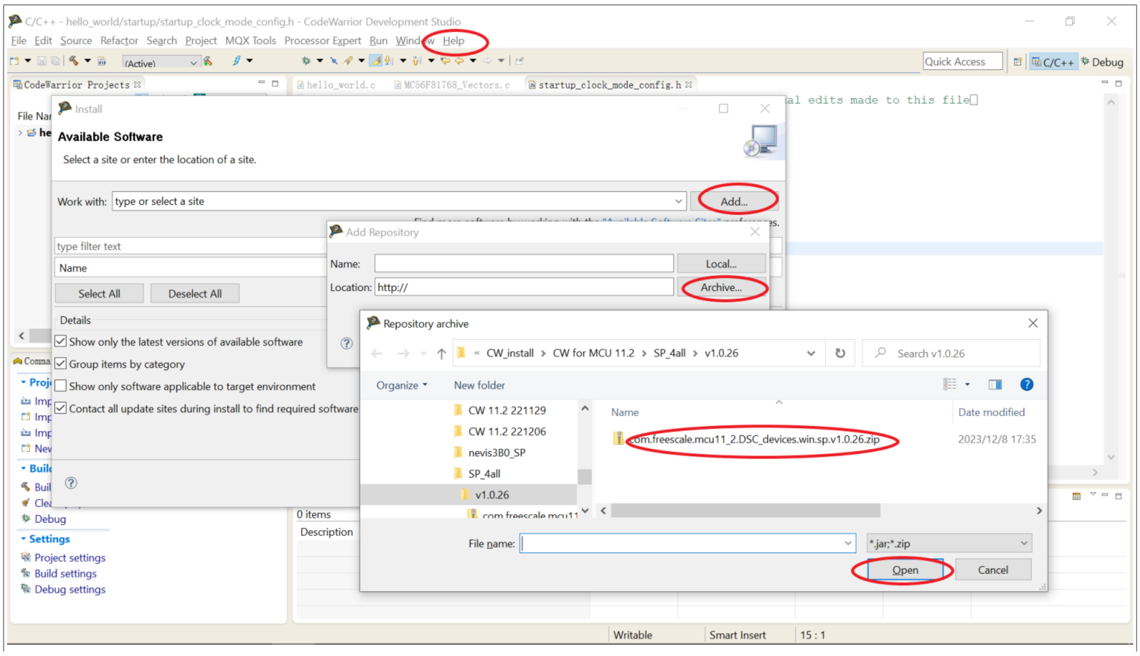
Build and run SDK example on codewarrior

Install CodeWarrior Take below codewarrior specific combination as example

- CodeWarrior Development Studio v11.2 + CodeWarrior for DSC v11.2 SP1 (Service Pack 1)

Steps to install CodeWarrior

- Download the following packages from CodeWarrior for 56800 Digital Signal Controller v11.2, and ensure to keep them in the same folder.
  - CodeWarrior for DSC v11.2: CW_MCU_v11.2_b221206.exe.
  - DSC support package: com.freescale.mcu11_2.dsc.updatesite.zip.
  - DSC device ServicePack1: com.freescale.mcu11_2.DSC_devices.win.sp.v1.0.26.zip.
- Install CodeWarrior for DSC v11.2.
- Install ServicePack1 within CodeWarrior from the menu. Click the **Help** menu -> select **Install new software -> Add -> Archive** -> select the downloaded SP1 -> open -> check **MCU v11.2 DSC Service Packs** -> click **Next**.

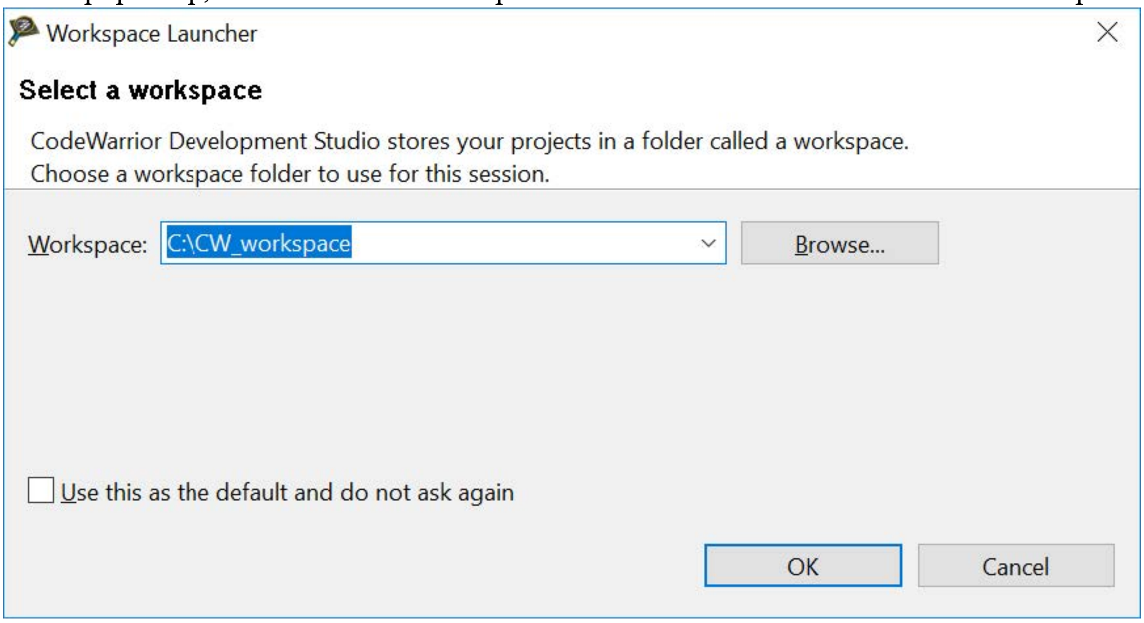


NOTE

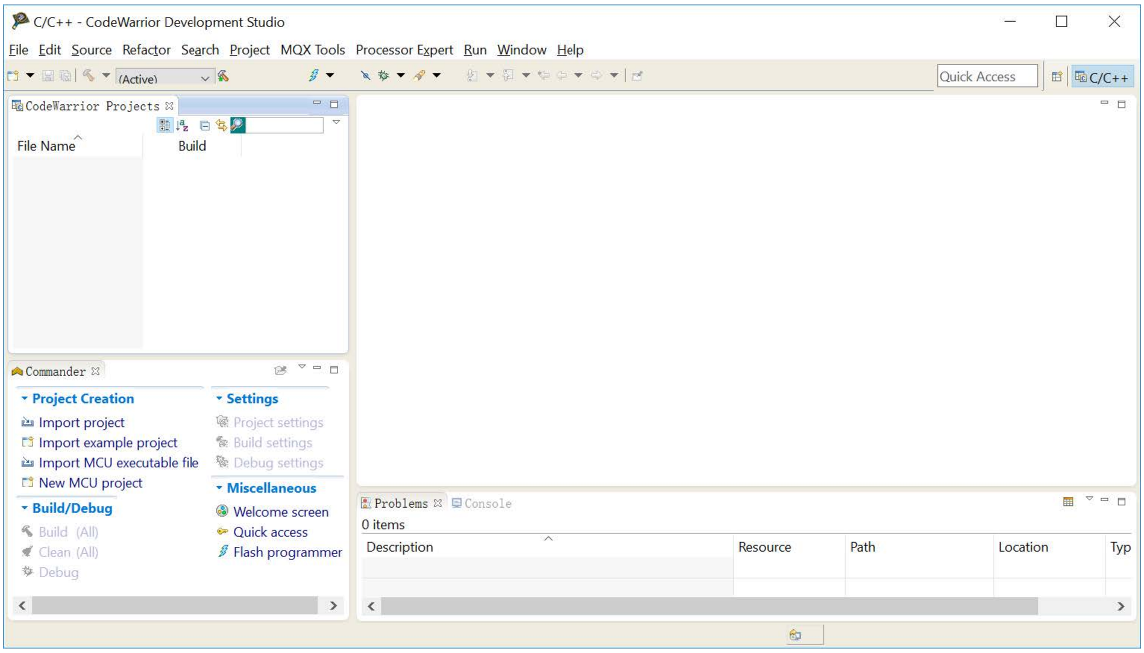
- CodeWarrior for DSC only support Windows.
- Check the corresponding board release note for specific requirement of codewarrior and service pack version.

Build an example application To build the hello_world example application, perform the following example steps:

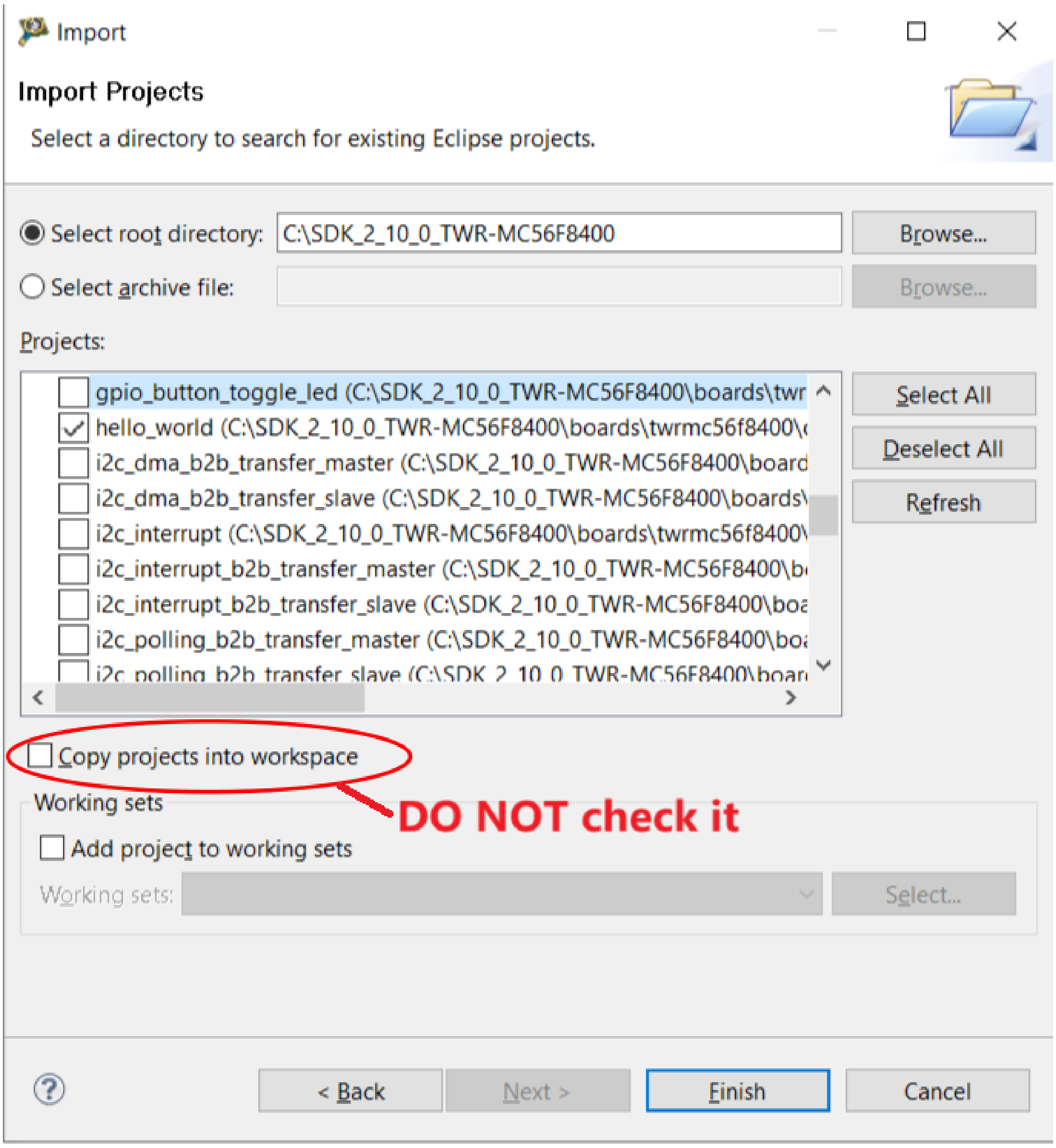
1. Launch CodeWarrior and in the workspace launcher, choose a workspace which holds the projects to use. If the dialogue box does not pop up, enter a workspace folder and create one workspace.



Then the CodeWarrior Development Studio workspace with empty projects appears.



2. Import the project into the workspace. Click **Import project** in the **Commander** pane. A form pops up. Click **Browse** to the SDK install directory. Take TWR-MC56F8400 SDK as an example, all available demo projects are shown. Select the hello_world project in the list and click **Finish**.



NOTE

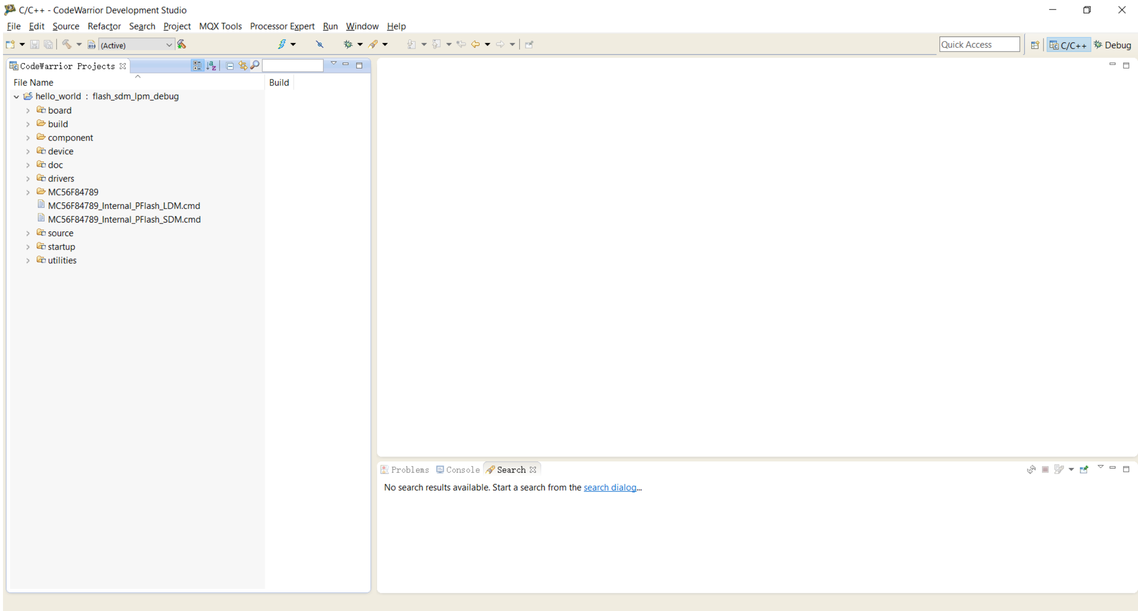
- If you already know the project location, navigate to the folder when clicking **Browse**, and only one project can be seen. To locate most example application workspace files, use the following path

  ```
  <install_dir>/boards/<board_name>/<example_type>/<application_name>/codewarrior
  ```

  Take TWR-MC56F8400 SDK as an example, the `hello_world` workspace is located in

  ```
  <install_dir>/boards/twrmc56f8400/demo_apps/hello_world/codewarrior
  ```

3. Select the desired build target from the drop-down menu. For this example, select **hello_world** – **flash_sdm_lpm_debug**



4. To build the demo application, click **Build (All)** in the **Commander** pane.
5. The build completes without errors.

Board debugger setup Board debugger info:

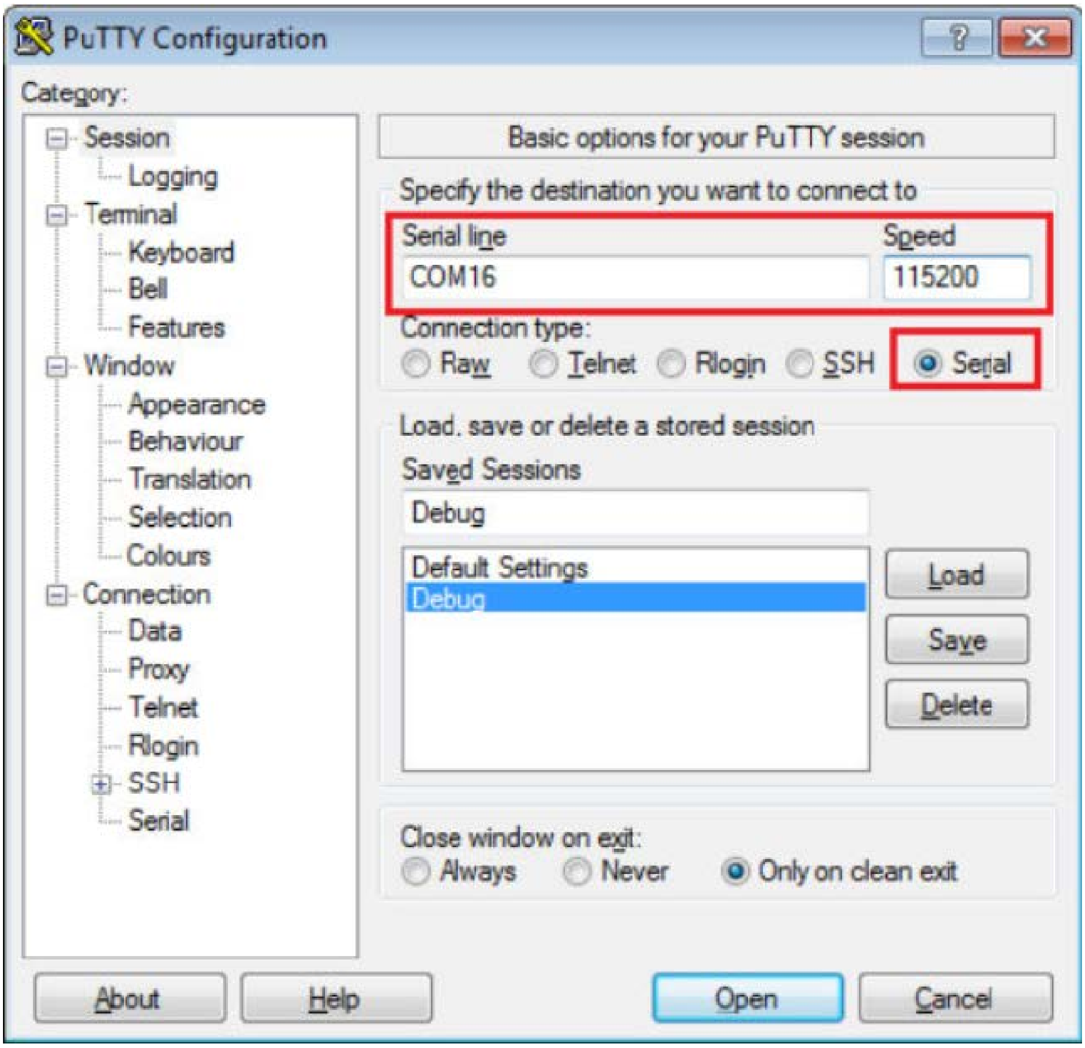
- Default debugger is OSJTAG.
- Onboard debugger USB port is J8, which set the debugger and COM port.
- Onboard debugger firmware update jumper is J6.

To download and run the application, perform the following steps:

- Connect USB cable between the host PC and the debugger USB port.
- Install the debugger driver and USB CDC driver as PC hint if it is the first time you run it on the PC. The debugger and USB CDC driver are provided by CodeWarrior by default.
- The CodeWarrior may prompt to update the debugger firmware, which requires to connect the firmware update jumper on board and then follow the instruction by CodeWarrior to finish the firmware update.

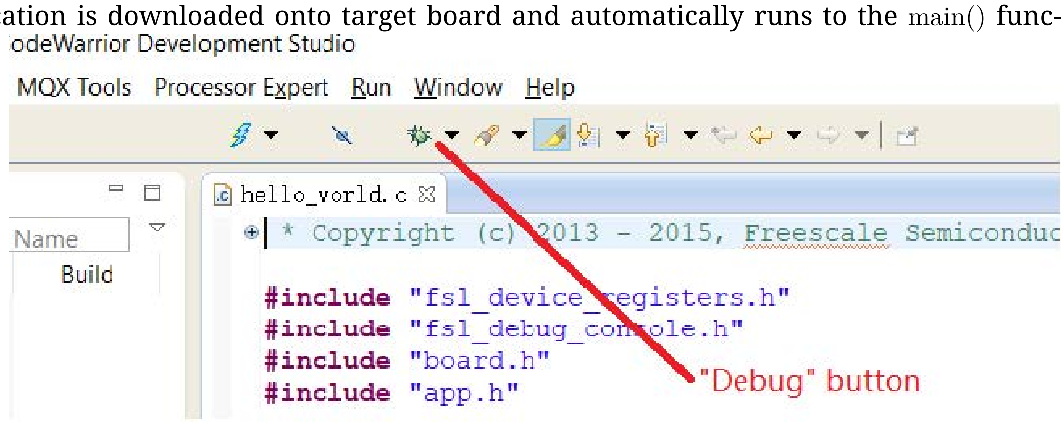
Run an example application To download and run the application, perform the following steps:

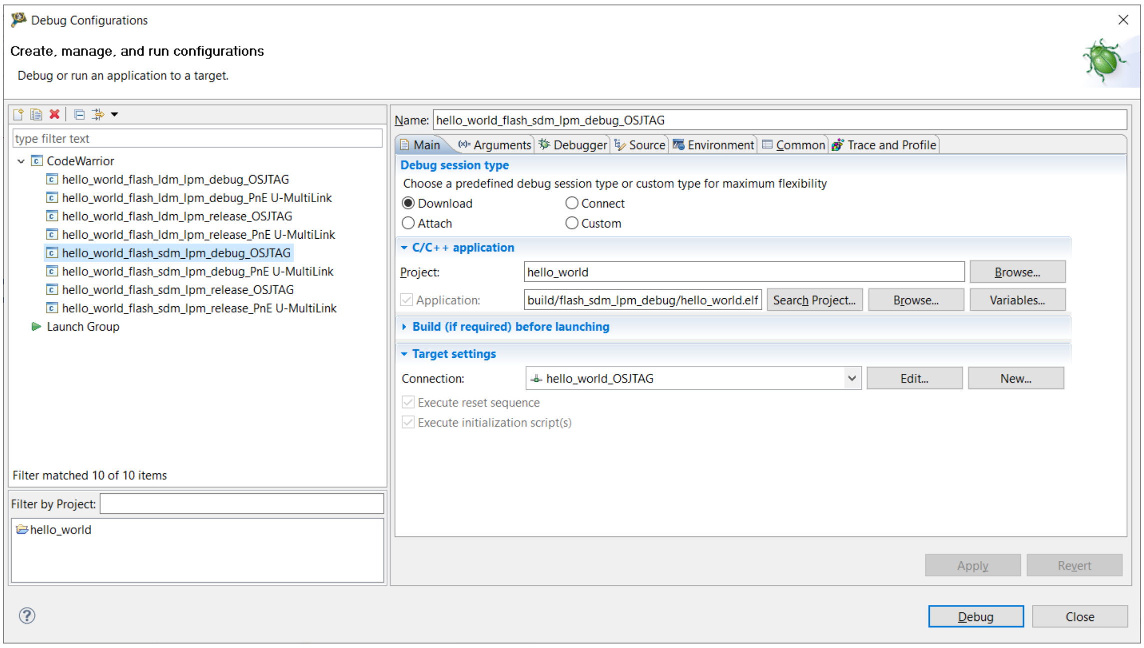
1. Open the terminal application on the PC, such as PuTTY or TeraTerm, and connect to the debug COM port (see *How to determine COM port*). Configure the terminal with these settings:
   - 115200, defined by BOARD_DEBUG_UART_BAUDRATE in the *board.h* file
   - No parity
   - 8 data bits



- 1 stop bit

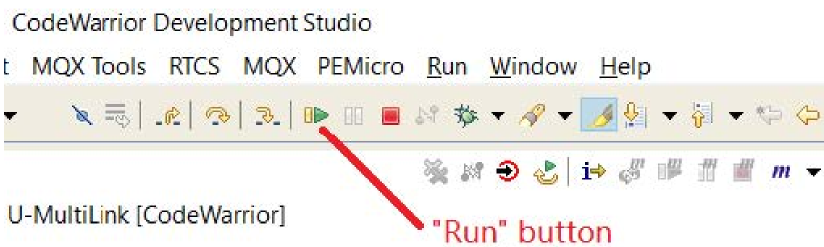
2. For this example(TWR-MC56F8400 hello_world), click **Debug** in the **Commander** pane, and select the hello_world_flash_sdm_lpm_debug_OSJTAG launch configuration. Then the application is downloaded onto target board and automatically runs to the main() function.



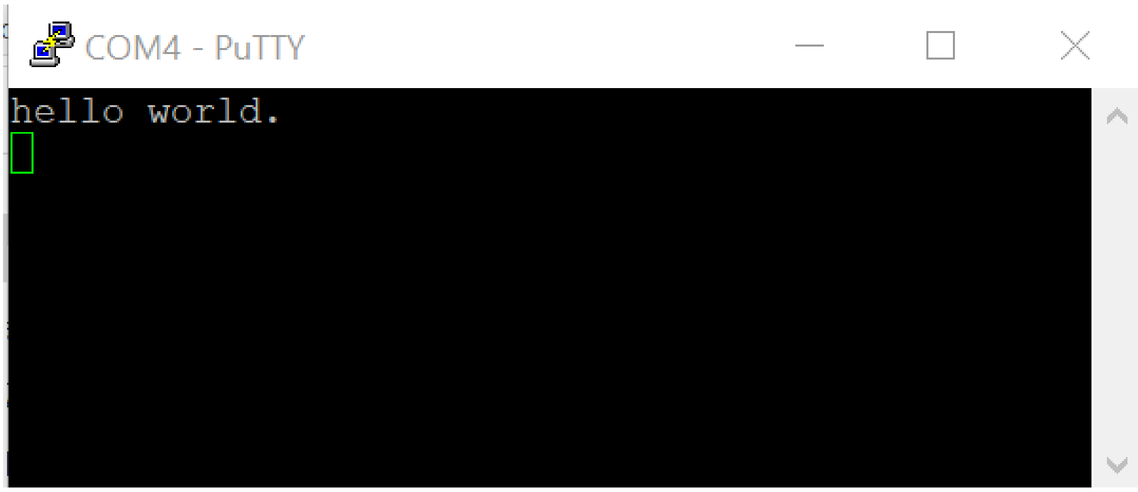


Note:

- Generally there are four build configurations for DSC SDK examples: flash_sdm_lpm_debug, flash_sdm_lpm_release, flash_ldm_lpm_debug, and flash_ldm_lpm_release.
  - *_debug: uses optimization level 1
  - *_release: uses optimization level 4
  - sdm: small data memory model
  - ldm: large data memory model
  - lpm: large program memory model
- Select corresponding launch configuration based on build target and debugger type.
- Some examples may require specific hardware settings, check each demo readme document, which includes detail instructions for HW and SW settings.



3. To run the code, click **Run** on the toolbar.
4. The hello_world application is now running and a banner is displayed on the terminal.

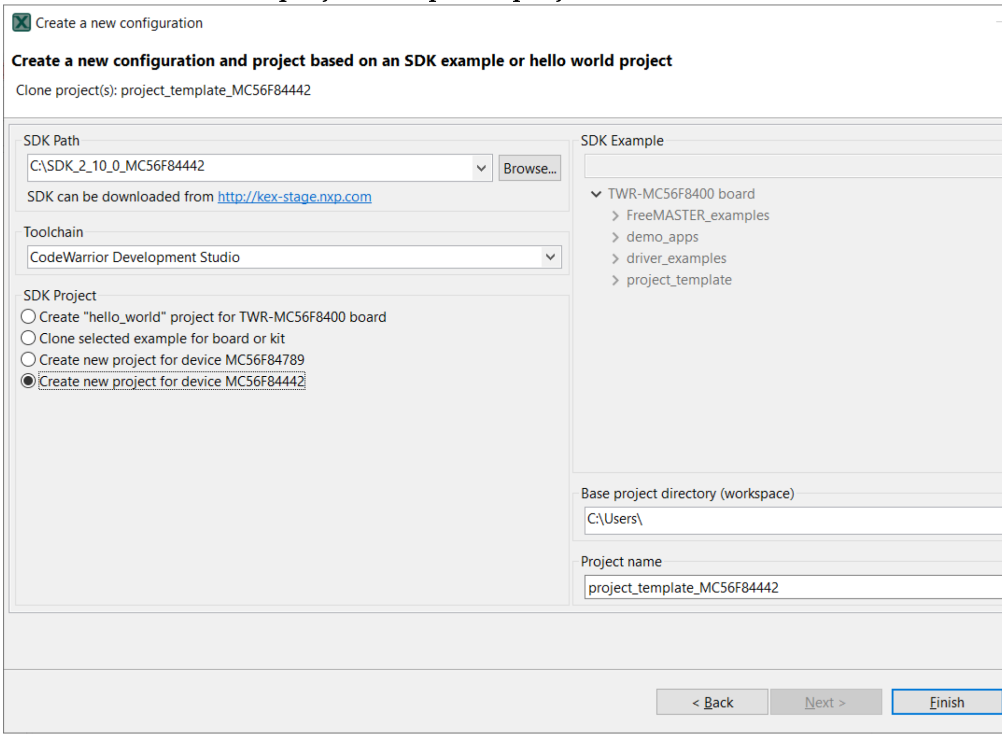


Project template for a specific DSC part

For device with specific part number, the easiest way to set up customer own project based on MCUXpresso DSC SDK peripheral driver, is the project_template. MCUXpresso Config Tool is used to generate the project_template.

The project_template provides basic MCUXpresso DSC SDK software framework, including startup, linker file, device header file, debug setting, peripheral driver, FreeMASTER, and so on.

Steps to generate the project_template for specific derivative part number by MCUXpresso Config Tool

1. Download the specific device SDK package and unzip it. note: The project template requires FreeMASTER, middleware FreeMASTER selection is a must when downloading DSC SDK from nxp website
2. Use MCUXpresso Config Tool to create a project_template project as below(take 

MC56F84442 as example).
3. Import the generated template_project into CodeWarrior IDE and start the development.

NOTE

- The default created project template by Config Tool is project_template_{part_number}. User could modify the default name in **Project name** textbox.
- All peripheral drivers files are included in the generated project_template project. They are same as the peripheral drivers within SDK package. If some drivers are not used or required, users may delete them in CodeWarrior, or delete them directly under folder *${project_path}/drivers*.

How to determine COM port

This section describes the steps necessary to determine the debug COM port number of your NXP hardware development platform. All NXP boards ship with a factory programmed, onboard debug interface, whether it is based on MCU-Link or the legacy OpenSDA, LPC-Link2, P&E Micro OSJTAG interface. To determine what your specific board ships with, see Default debug interfaces.

1. **Linux**: The serial port can be determined by running the following command after the USB Serial is connected to the host:

   ```
   $ dmesg | grep "ttyUSB"
     [503175.307873] usb 3-12: cp210x converter now attached to ttyUSB0
     [503175.309372] usb 3-12: cp210x converter now attached to ttyUSB1
   ```

   There are two ports, one is for core0 debug console and the other is for core1.

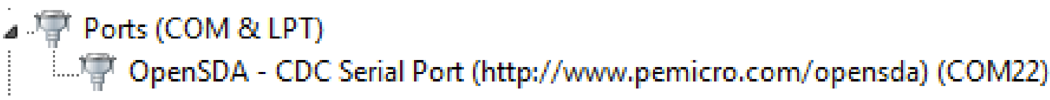
2. **Windows**: To determine the COM port open Device Manager in the Windows operating system. Click the **Start** menu and type **Device Manager** in the search bar.

   In the Device Manager, expand the **Ports (COM & LPT)** section to view the available ports. The COM port names are different for all the NXP boards.

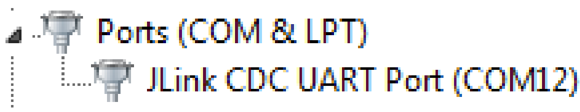
   1. **CMSIS-DAP/mbed/DAPLink** interface:

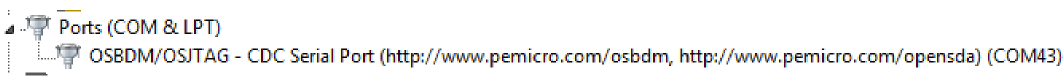
   2. **P&E Micro**:

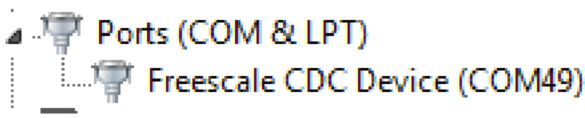
   3. **J-Link**:

   4. **P&E Micro OSJTAG**:

   5. **MRB-KW01**:

1.3 Getting Started with MCUXpresso SDK GitHub

1.3.1 Getting Started with MCUXpresso SDK Repository

Welcome to the **GitHub Repository SDK Guide**. This documentation provides instructions for setting up and working with the MCUXpresso SDK distributed in a **multi-repository model**. The SDK is distributed across multiple GitHub repositories and managed using the **Zephyr West** tool, enabling modular development and streamlined workflows.

Overview

The GitHub Repository SDK approach offers:

- **Modular Structure**: Multiple repositories for flexibility and scalability.
- **Zephyr West Integration**: Simplified repository management and synchronization.
- **Cross-Platform Support**: Designed for MCUXpresso SDK development environments.

Benefits of the Multi-Repository Approach

- **Scalability**: Easily add or update components without impacting the entire SDK.
- **Collaboration**: Enables distributed development across teams and repositories.
- **Version Control**: Independent versioning for components ensures better stability.
- **Automation**: Zephyr West simplifies dependency handling and repository synchronization.

Setup and Configuration

Follow these steps to prepare your development environment:

Development Tools Installation This guide explains how to install the essential tools for development with the MCUXpresso SDK.

Quick Start: Automated Installation (Recommended) The **MCUXpresso Installer** is the fastest way to get started. It automatically installs all the basic tools you need.

1. **Download the MCUXpresso Installer** from: Dependency-Installation
2. **Run the installer** and select **"MCUXpresso SDK Developer"** from the menu
3. **Click Install** and let it handle everything automatically

Manual Installation If you prefer to install tools manually or need specific versions, follow these steps:

Essential Tools

Git - Version Control **What it does**: Manages code versions and downloads SDK repositories from GitHub.

Installation:

- Visit git-scm.com
- Download for your operating system
- Run installer with default settings
- **Important**: Make sure "Add Git to PATH" is selected during installation

Setup:

```
git config --global user.name "Your Name"
git config --global user.email "youremail@example.com"
```

Python - Scripting Environment **What it does**: Runs build scripts and SDK tools.

Installation:

- Install Python **3.10 or newer** from python.org
- **Important**: Check "Add Python to PATH" during installation

West - SDK Management Tool **What it does**: Manages SDK repositories and provides build commands. The west tool is developed by the Zephyr project for managing multiple repositories.

Installation:

```
pip install -U west
```

Minimum version: 1.2.0 or newer

Build System Tools

CMake - Build Configuration **What it does**: Configures how your projects are built.

Recommended version: 3.30.0 or newer

Installation:

- **Windows**: Download `.msi` installer from cmake.org/download
- **Linux**: Use package manager or download from cmake.org
- **macOS**: Use Homebrew (`brew install cmake`) or download from cmake.org

Ninja - Fast Build System **What it does**: Compiles your code quickly.

Minimum version: 1.12.1 or newer

Installation:

- **Windows**: Usually included, or download from ninja-build.org
- **Linux**: `sudo apt install ninja-build` or download binary
- **macOS**: `brew install ninja` or download binary

Ruby - IDE Project Generation (Optional) **What it does**: Generates project files for IDEs like IAR and Keil.

When needed: Only if you want to use traditional IDEs instead of VS Code.

Installation: Follow the Ruby environment setup guide

Compiler Toolchains Choose and install the compiler toolchain you want to use:

Toolchain	Best For	Download Link	Environment Variable
ARM GCC (Recommended)	Most users, free	ARM GNU Toolchain	ARMGCC_DIR
IAR EWARM	Professional development	IAR Systems	IAR_DIR
Keil MDK	ARM ecosystem	ARM Developer	MDK_DIR
ARM Compiler	Advanced optimization	ARM Developer	ARMCLANG_DIR

Setting Up Environment Variables After toolchain installation, set an environment variable so the build system locates it:

Windows:

```
# Example for ARM GCC installed in C:\armgcc
setx ARMGCC_DIR "C:\armgcc"
```

Linux/macOS:

```
# Add to ~/.bashrc or ~/.zshrc
export ARMGCC_DIR="/usr" # or your installation path
```

Verify Your Installation After installation, verify everything works by opening a terminal/command prompt and running these commands:

```
# Check each tool - you should see version numbers
git --version
python --version
west --version
cmake --version
ninja --version
arm-none-eabi-gcc --version # (if using ARM GCC)
```

Troubleshooting Installation Issues **"Command not found" errors**:

- The tool isn't in your system PATH
- **Solution**: Add the installation directory to your PATH environment variable

Python/pip issues:

- Try using `python3` and `pip3` instead of `python` and `pip`
- On Windows, run the Command Prompt as an Administrator

Slow downloads:

- Add timeout option: `pip install -U west --default-timeout=1000`
- Use alternative mirror: `pip install -U west -i https://pypi.tuna.tsinghua.edu.cn/simple`

GitHub Repository Setup This guide explains how to initialize your MCUXpresso SDK workspace from GitHub repositories using the west tool. The GitHub Repository SDK uses multiple repositories hosted on GitHub to provide modular, flexible development.

Prerequisites Verify the requirements:

System Requirements:

- Python 3.8 or later
- Git 2.25 or later
- CMake 3.20 or later
- Build tools for your target platform

Verification Commands:

```
python --version    # Should show 3.8+
git --version       # Should show 2.25+
cmake --version     # Should show 3.20+
west --version      # Should show west tool installation
```

Workspace Initialization The GitHub Repository SDK uses the Zephyr west tool to manage multiple repositories containing different SDK components.

Step 1: Initialize Workspace Create and initialize your SDK workspace from GitHub:

Get the latest SDK from main branch:

```
west init -m https://github.com/nxp-mcuxpresso/mcuxsdk-manifests.git mcuxpresso-sdk
```

Get SDK at specific revision:

```
west init -m https://github.com/nxp-mcuxpresso/mcuxsdk-manifests.git mcuxpresso-sdk --mr {revision}
```

Note: Replace `{revision}` *with the desired release tag, such as* `v25.09.00`

Step 2: Choose Your Repository Update Strategy Navigate to the SDK workspace:

```
cd mcuxpresso-sdk
```

The west tool manages multiple GitHub repositories containing different SDK components. You have two options for downloading:

Option A: Download All Repositories (Complete SDK) Download all SDK repositories for comprehensive development:

```
west update
```

This command downloads all the repositories defined in the manifest from GitHub. Initial download takes several minutes and requires ~7 GB of disk space.

Best for:

- Exploring the complete SDK
- Multi-board development projects
- Comprehensive middleware evaluation

Option B: Targeted Repository Download (Recommended) Download only repositories needed for your specific board or device to save time and disk space:

```
# For specific board development
west update_board --set board your_board_name

# For specific device family development
west update_board --set device your_device_name

# List available repositories before downloading
west update_board --set board your_board_name --list-repo
```

Best for:

- Single board development
- Faster setup and reduced disk usage
- Focused development workflows

Examples:

```
# Update only repositories for FRDM-MCXW23 board
west update_board --set board frdmmcxw23

# Update only repositories for MCXW23 device family
west update_board --set device mcxw23
```

Step 3: Verify Installation Confirm successful setup:

```
# Verify workspace structure
ls -la
# Should show: manifests/ and mcuxsdk/ directories

# Test build system
west list_project -p examples/demo_apps/hello_world
# Should display available build configurations
```

Advanced Repository Management The west extension command `update_board` provides advanced repository management capabilities for optimized workspace setup with GitHub repositories.

Board-Specific Setup Update only repositories required for a specific board:

```
# Update only repositories for specific board, e.g., frdmmcxw23
west update_board --set board frdmmcxw23

# List available repositories for the board before updating
west update_board --set board frdmmcxw23 --list-repo
```

Device-Specific Setup Update only repositories required for a specific device family:

```
# Update only repositories for specific device, e.g., MCXW235
west update_board --set device mcxw23

# List available repositories for the device family
west update_board --set device mcxw23 --list-repo
```

Custom Configuration For advanced users who want to create custom repository combinations:

```
# Use custom configuration file
west update_board --set custom path/to/custom-config.yml

# Generate custom configuration template
cp manifests/boards/custom.yml.template my-custom-config.yml
```

Benefits of Targeted Setup **Reduced Download Size**

- Download only components needed for your target board or device
- Significantly faster initial setup for focused development
- Typical reduction from 7 GB to 2GB

Optimized Workspace

- Cleaner workspace with relevant components only
- Reduced disk space usage
- Faster repository operations

Flexible Development

- Switch between different board configurations easily
- Maintain separate workspaces for different projects
- Include optional components as needed

Repository Information Before setting up your workspace, you can explore what repositories are available:

```
# Display repository information in console
west update_board --set board frdmmcxw23 --list-repo

# Export repository information to YAML file for reference
west update_board --set board frdmmcxw23 --list-repo -o board-repos.yml
```

This command lists all the available repositories with descriptions and outlines the included components in the workspace.

Package Generation (Optional) The `update_board` command can also generate ZIP packages for offline distribution:

```
# Generate board-specific SDK package
west update_board --set board frdmmcxw23 -o frdmmcxw23-sdk.zip
```

Note: Package generation is primarily intended for creating custom SDK distributions. For regular development, use the workspace update commands without the `-o` option.

Workspace Management

Updating Your Workspace

Keep your SDK current with latest updates from GitHub:

For Complete SDK Workspace:

```
# Update manifest repository
cd manifests
git pull

# Update all component repositories
cd ..
west update
```

For Targeted Workspace:

```
# Update manifest repository
cd manifests
git pull

# Update board-specific repositories
cd ..
west update_board --set board your_board_name
```

Workspace Status

Check workspace synchronization status:

```
# Show status of all repositories
west status

# Show detailed information about repositories
west list
```

Troubleshooting

Network Issues:

- Use `west update --keep-descendants` for partial failures
- Configure Git credentials for private repositories
- Check firewall settings for Git protocol access

Permission Issues:

- Ensure write permissions in workspace directory
- Run commands without sudo/administrator privileges
- Verify Git SSH key configuration for authenticated access

Disk Space:

- Full SDK workspace requires approximately 7-8 GB
- Targeted workspace typically requires 1-2 GB
- Use board-specific setup to reduce workspace size

Repository Management Issues:

- Verify board/device names match available configurations
- Check that custom YAML files follow the correct template format
- Use `--list-repo` to verify available repositories before setup

Next Steps With your workspace initialized:

1. Review *Workspace Structure* to understand the layout
2. Build your first project with *First Build Guide*
3. Explore *Development Workflows MCUXPresso VSCode* or *Development Workflows Command Line* for the details on project setup and execution

For advanced repository management, see the west tool documentation.

Explore SDK Structure and Content

Learn about the organization of the SDK and its components:

SDK Architecture Overview The MCUXpresso SDK uses a modular architecture where software components are distributed across multiple repositories hosted on GitHub and managed through the west tool. This approach provides flexibility, maintainability, and enables selective component inclusion.

Repository Organization Based on the manifest structure, the SDK consists of four main repository categories:

Manifest Repository The manifest repo (mcuxsdk-manifests) contains the west.yml manifest file that tracks all other repositories in the SDK.

Base Repositories Recorded in submanifests/base.yml and loaded in the root west.yml manifest file. These are the foundational repositories that build the SDK:

- **Devices**: MCU-specific support packages
- **Examples**: Demonstration applications and code samples
- **Boards**: Board support packages

Middleware Repositories Recorded in the submanifests/middleware subdirectory, categorized according to functionality:

- **Connectivity**: Networking stacks, USB, and communication protocols
- **Security**: Cryptographic libraries and secure boot components
- **Wireless**: Bluetooth, IEEE 802.15.4, and other wireless protocols
- **Graphics**: Display drivers and UI frameworks
- **Audio**: Audio processing and voice recognition libraries
- **Machine Learning**: AI inference engines and neural network libraries
- **Safety**: IEC60730B safety libraries
- **Motor Control**: Motor control and real-time control libraries

Internal Repositories Recorded in submanifests/internal.yml and grouped into the "bifrost" group. These are only visible to NXP internal developers and hosted on NXP internal git servers.

Repository Hosting Public repositories are hosted on GitHub under these organizations:

- nxp-mcuxpresso
- NXP
- nxp-zephyr

Internal repositories are hosted on NXP's private Git infrastructure.

Benefits of This Architecture **Selective Integration**: Projects include only required components, reducing memory footprint and build complexity.

Independent Versioning: Each component maintains its own release cycle and version control.

Community Collaboration: Public repositories accept community contributions through standard Git workflows.

Scalable Maintenance: Component owners can update their repositories without affecting the entire SDK.

Workspace Management The west tool manages repository synchronization, version tracking, and workspace updates. All repositories are checked out under the `mcuxsdk/` directory with their designated paths defined in the manifest files.

Workspace Structure After you initialize your SDK workspace, it creates a specific directory structure that organizes all SDK components. This structure is identical for both GitHub Repository SDK and Repository-Layout SDK Package.

Top-Level Organization

```
your-sdk-workspace/
  manifests/        # West manifest repository
  mcuxsdk/          # Main SDK content
```

The `mcuxsdk/` directory serves as your primary working directory and contains all the SDK components.

SDK Component Layout Based on the actual SDK structure, the main directories include:

Directory	Contents	Purpose
arch/	Architecture-specific files	ARM CMSIS, build configurations
cmake_	Build system modules	CMake configuration and build rules
compo	Software components	Reusable software libraries and utilities
devices	Device support packages	MCU-specific headers, startup code, linker scripts
drivers	Peripheral drivers	Hardware abstraction layer for MCU peripherals
examp	Sample applications	Demonstration code and reference implementations
middle	Optional software stacks	Networking, graphics, security, and other libraries
rtos/	Operating system support	FreeRTOS integration
scripts	Build and utility scripts	West extensions and development tools
svd	Svd files for devices, this is optional because of large size. Customers run `west manifest config group.filter +optional` and `west update mcux-soc-svd` to get this folder.	

Example Organization Examples follow a two-tier structure separating common code from board-specific implementations:

Common Example Files

```
examples/demo_apps/hello_world/
  CMakeLists.txt        # Build configuration
  example.yml           # Example metadata
  hello_world.c         # Application source code
  Kconfig               # Configuration options
  readme.md             # General documentation
```

Board-Specific Files

```
examples/_boards/your_board/demo_apps/hello_world/
  app.h                      # Board specific application header
  example_board_readme.md    # Board specific documentation
  hardware_init.c            # Board specific hardware initialization
  pin_mux.c                  # Pin multiplexing configuration
  pin_mux.h                  # Pin multiplexing header definitions
  hello_world.bin            # Pre-built binary for quick testing
  hello_world.mex            # MCUXpresso Config Tools project file
  prj.conf                   # Board specific Kconfig configuration
  reconfig.cmake             # Board specific cmake configuration overrides
```

Device Support Structure Device support is organized hierarchically by MCU family:

```
devices/
    MCX/                    # MCU portfolio
        MCXW/               # MCU family
            MCXW235/        # Specific device
                MCXW235.h           # Device register definitions
                drivers/            # Device-specific drivers
                gcc/                # GNU toolchain files
                iar/                # IAR toolchain files
                mcuxpresso/         # MCUXpresso IDE files
                startup_MCXW235.c # Startup and vector table
                system_MCXW235.c  # System initialization
```

Middleware Organization Middleware components are categorized by functionality and maintained in separate repositories. Based on the manifest files, common middleware categories include:

- **Connectivity**: USB, TCP/IP, industrial protocols
- **Security**: Cryptographic libraries, secure boot
- **Wireless**: Bluetooth, IEEE 802.15.4, Wi-Fi
- **Graphics**: Display drivers, UI frameworks
- **Audio**: Processing libraries, voice recognition
- **Machine Learning**: Inference engines, neural networks
- **Safety**: IEC60730B safety libraries
- **Motor Control**: Motor control and real-time control libraries

Documentation Structure SDK documentation is distributed across multiple locations:

- `docs/` - Core SDK documentation and build infrastructure
- Component repositories - API documentation and integration guides
- Board directories - Hardware-specific setup instructions

For complete documentation, refer to the online documentation.

Understanding Example Structure Each example has **two README files**:

1. General README: `examples/demo_apps/hello_world/readme.md`

- What the example does
- General functionality description
- Common usage information

2. Board-Specific README: `examples/_boards/{board_name}/demo_apps/hello_world/example_board_readme.md`

- Board-specific setup instructions
- Hardware connections required
- Board-specific behavior notes

Tip: Always check both readme files - start with the general one, then read the board-specific one for detailed setup.

Development Workflows

Get started with building and running projects:

Building Your First Project This guide explains how to build and run your first SDK example project using the west build system. This applies to both GitHub Repository SDK and Repository-Layout SDK Package.

Prerequisites

- GitHub Repository SDK workspace initialized OR Repository-Layout SDK Package extracted
- Development board connected via USB
- Build tools installed per *Installation Guide*

Understanding Board Support Use the west extension to discover available examples for your board:

```
west list_project -p examples/demo_apps/hello_world
```

This shows all supported build configurations. You can filter by toolchain:

```
west list_project -p examples/demo_apps/hello_world -t armgcc
```

Basic Build Process

Simple Build Build the hello_world example with default settings:

```
west build -b your_board examples/demo_apps/hello_world
```

The default toolchain is armgcc, and the build system will select the first debug target as default if no config is specified.

Specifying Configuration

```
# Release build
west build -b your_board examples/demo_apps/hello_world --config release

# Debug build (default)
west build -b your_board examples/demo_apps/hello_world --config debug
```

Alternative Toolchains

```
# IAR toolchain
west build -b your_board examples/demo_apps/hello_world --toolchain iar

# Other toolchains as supported by the example
```

Multicore Applications For multicore devices, specify the core ID:

```
west build -b evkbmimxrt1170 examples/demo_apps/hello_world --toolchain iar -Dcore_id=cm7 --config␣
↪flexspi_nor_debug
```

For multicore projects using sysbuild:

```
west build -b evkbmimxrt1170 --sysbuild ./examples/multicore_examples/hello_world/primary -Dcore_
↪id=cm7 --config flexspi_nor_debug --toolchain=armgcc -p always
```

Flash an Application Flash the built application to your board:

```
west flash -r linkserver
```

Debug Start a debug session:

```
west debug -r linkserver
```

Common Build Options

Clean Build Force a complete rebuild:

```
west build -b your_board examples/demo_apps/hello_world -p always
```

Dry Run See the commands that get executed without running them:

```
west build -b your_board examples/demo_apps/hello_world --dry-run
```

Device Variants For boards supporting multiple device variants:

```
west build -b your_board examples/demo_apps/hello_world --device DEVICE_PART_NUMBER --config␣
↪release
```

Project Configuration

CMake Configuration Only Run configuration without building:

```
west build -b your_board examples/demo_apps/hello_world -Dcore_id=cm7 --cmake-only -p
```

Interactive Configuration Launch the configuration GUI:

```
west build -t guiconfig
```

Troubleshooting

Build Failures Use pristine builds to resolve dependency issues:

```
west build -b your_board examples/demo_apps/hello_world -p always
```

Getting Help View the help information for west build:

```
west build -h
```

Check Supported Configurations To see available configuration options and board targets for an example, refer to the below command:

```
west list_project -p examples/demo_apps/hello_world
```

Next Steps

- Explore other examples in the SDK
- Learn about *Command Line Development* for advanced options
- Try *VS Code Development* for integrated development
- Refer *Workspace Structure* to understand the SDK layout

MCUXpresso for VS Code Development This guide covers using MCUXpresso for VS Code extension to build, debug, and develop SDK applications with an integrated development environment.

Prerequisites

- SDK workspace initialized (GitHub Repository SDK or Repository-Layout SDK Package)
- Development tools installed per *Installation Guide*
- Visual Studio Code installed
- MCUXpresso for VS Code extension installed

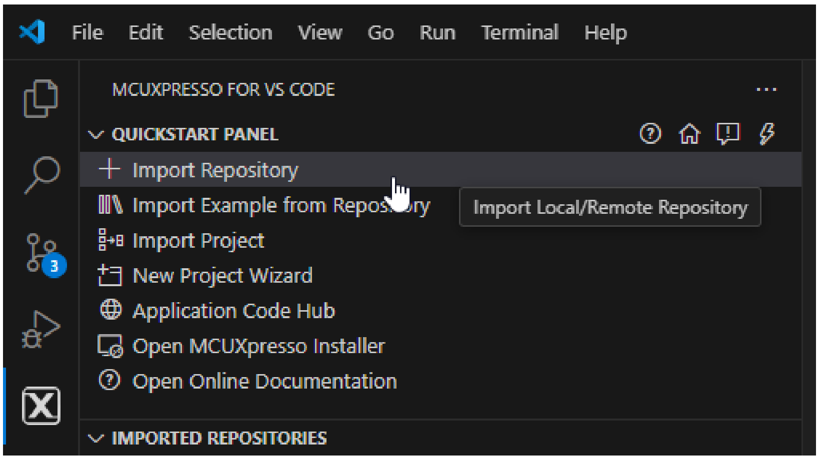
Extension Installation

Install MCUXpresso for VS Code The MCUXpresso for VS Code extension provides integrated development capabilities for MCUXpresso SDK projects. Refer to the MCUXpresso for VS Code Wiki for detailed installation and setup instructions.

SDK Import and Setup

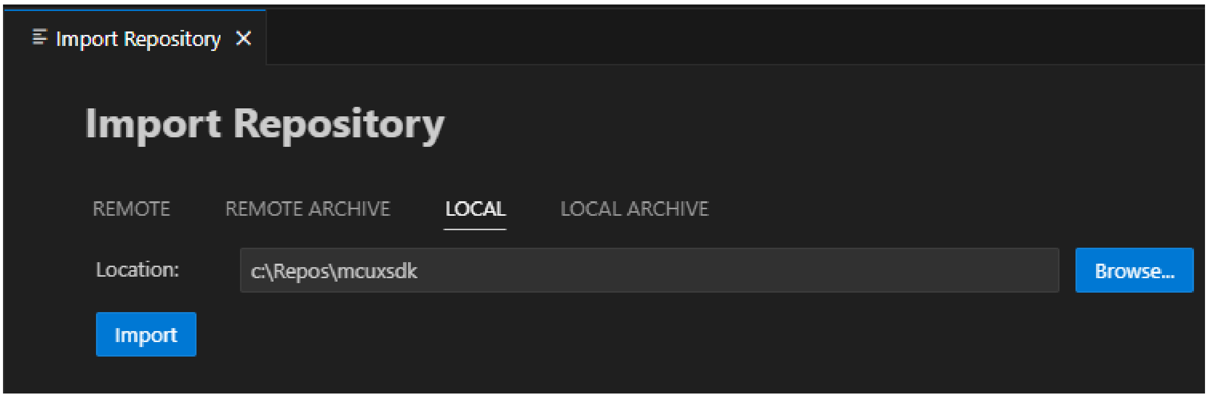
Import Methods The SDK can be imported in several ways. The MCUXpresso for VS Code extension supports both GitHub Repository SDK and Repository-Layout SDK Package distributions.

Import GitHub Repository SDK Click **Import Repository** from the **QUICKSTART PANEL**

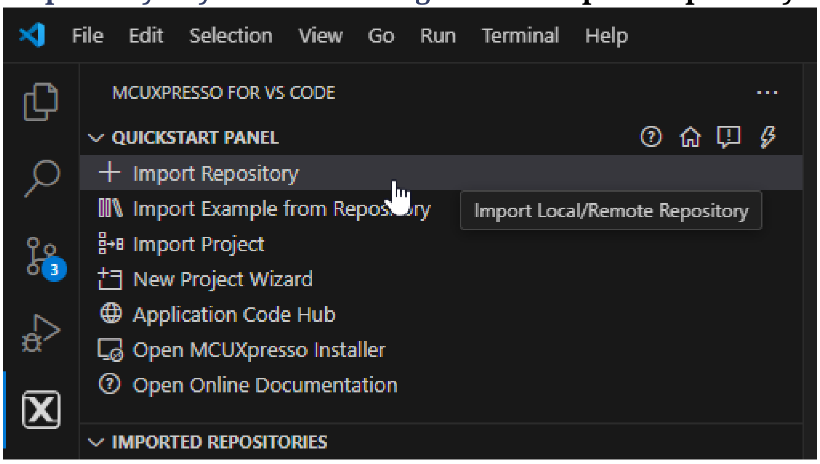


Note: You can import the SDK in several ways. Refer to MCUXpresso for VS Code Wiki for details.

Select **Local** if you've already obtained the SDK according to *setting up the repo*. Select your location and click **Import**.

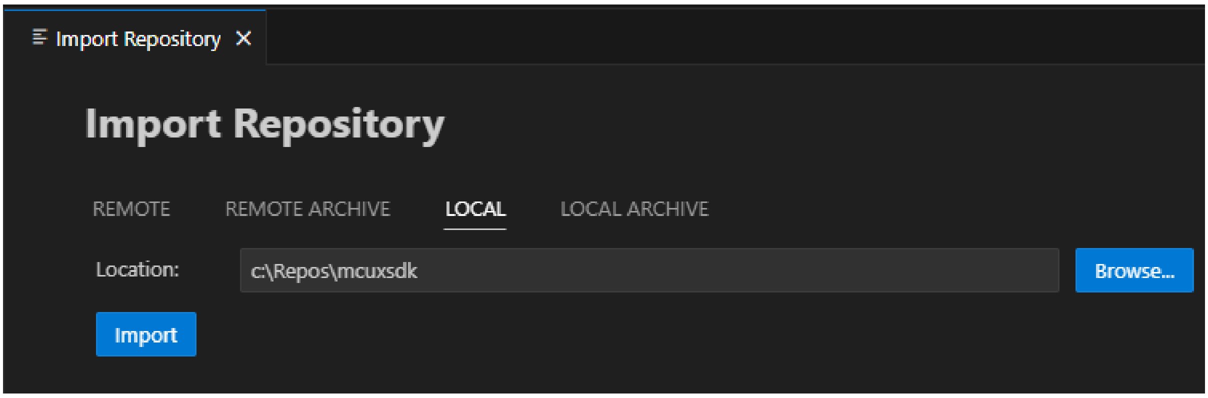


Import Repository-Layout SDK Package Click **Import Repository** from the **QUICKSTART**

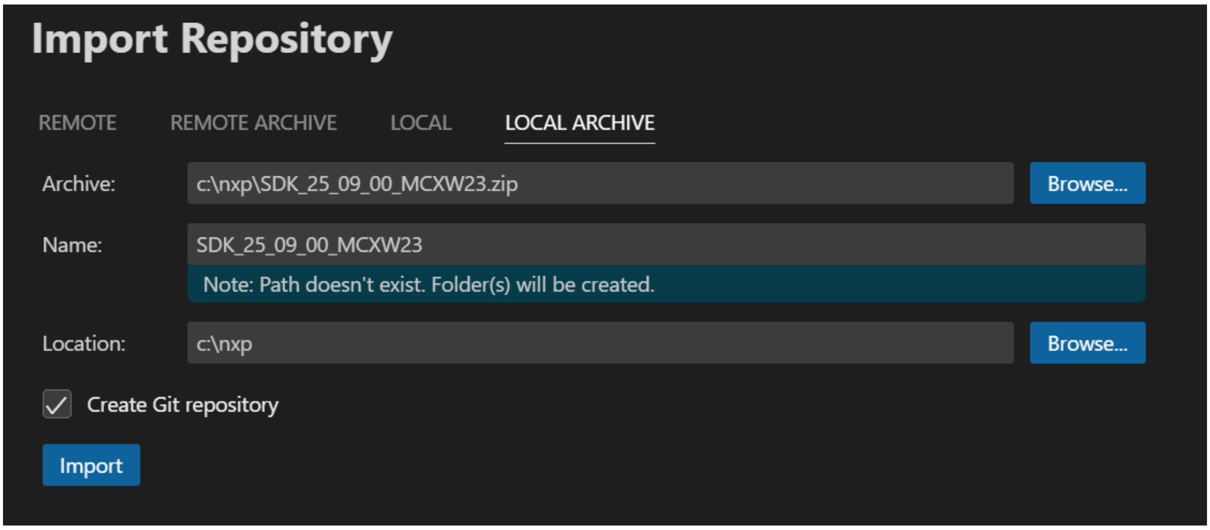


PANEL

Select **Local** if you've already unzipped the Repository-Layout SDK Package. Select your location and click **Import**.



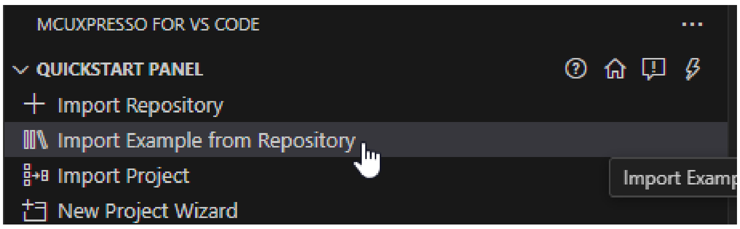
Else if the SDK is ZIP archive, select **Local Archive**, browse to the downloaded SDK ZIP file, fill the link of expect location, then click **Import**.



Building Example Applications

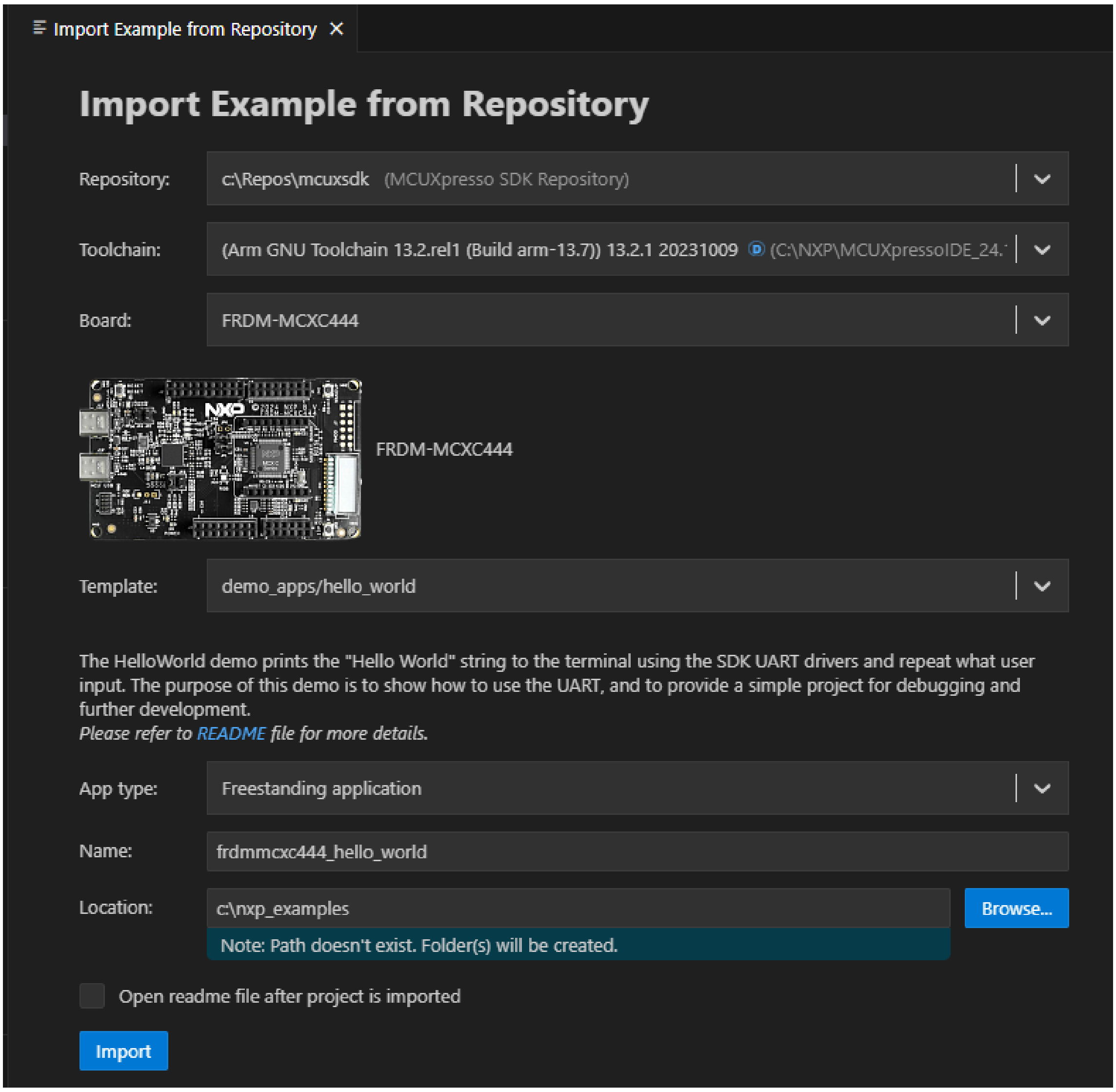
Import Example Project

1. Click **Import Example from Repository** from the **QUICKSTART PANEL**



2. Configure project settings:
   - **MCUXpresso SDK**: Select your imported SDK
   - **Arm GNU Toolchain**: Choose toolchain
   - **Board**: Select your target development board
   - **Template**: Choose example category
   - **Application**: Select specific example (e.g., hello_world)
   - **App type**: Choose between Repository applications or Freestanding applications

3. Click **Import**



Application Types

Repository Applications:

- Located inside the MCUXpresso SDK
- Integrated with SDK workspace

Freestanding Applications:

- Imported to user-defined location
- Independent of SDK location

Trust Confirmation

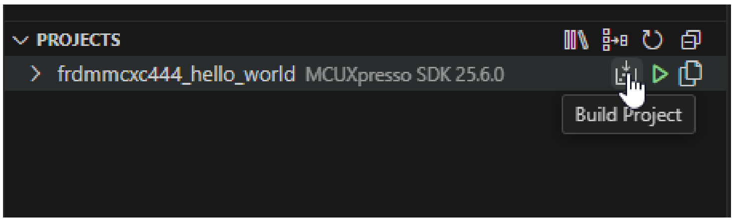
VS Code will prompt you to confirm if the imported files are trusted. Click **Yes** to proceed.

Building Projects

Build Process

1. Navigate to **PROJECTS** view

2. Find your project
3. Click the **Build Project** icon

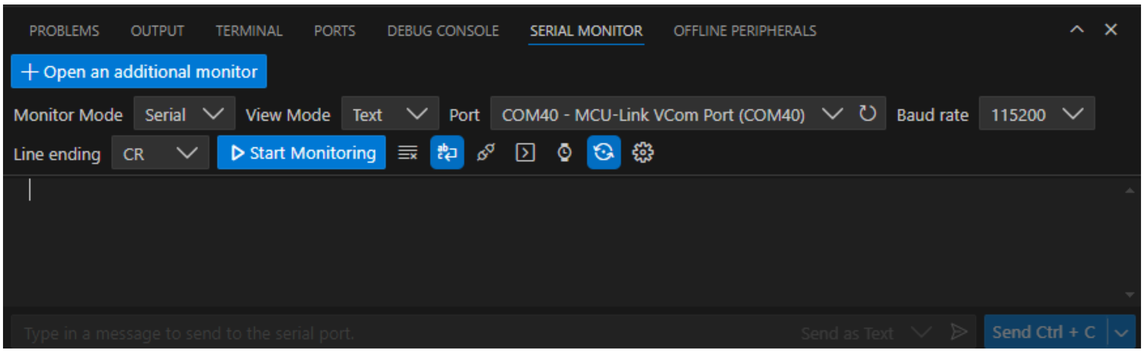


The integrated terminal will display build output at the bottom of the VS Code window.

Running and Debugging

Serial Monitor Setup

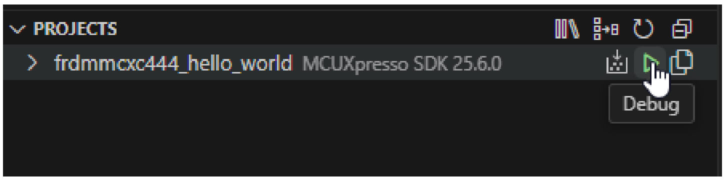
1. Open **Serial Monitor** from VS Code's integrated terminal



2. Configure serial settings:
   - **VCom Port**: Select port for your device
   - **Baud Rate**: Set to 115200

Debug Session

1. Navigate to **PROJECTS** view
2. Click the play button to initiate a debug session

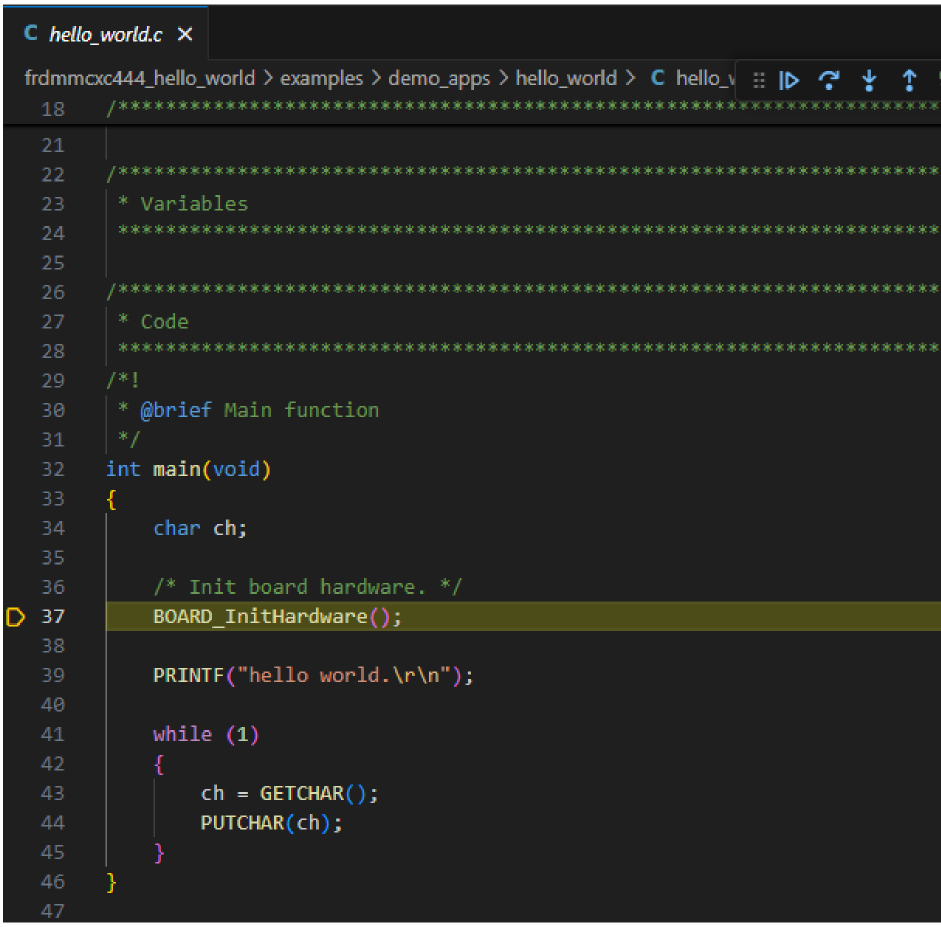


The debug session will begin with debug controls initially at the top of the interface.

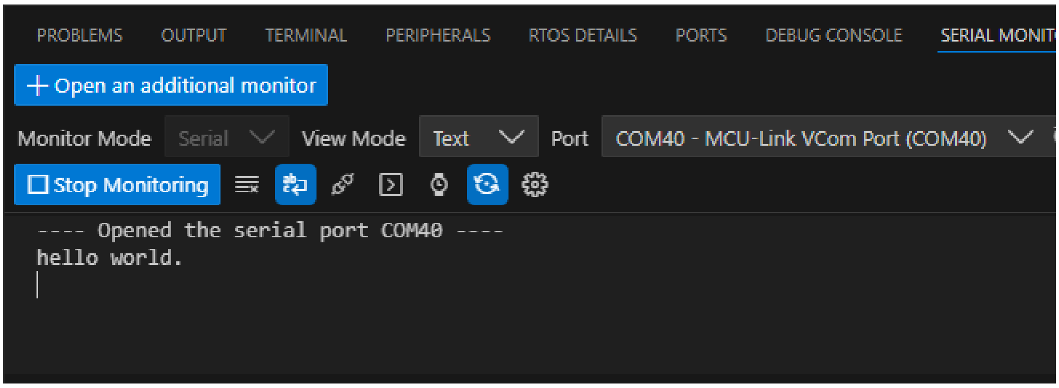
Debug Controls Use the debug controls to manage execution:

- **Continue**: Resume code execution
- **Step controls**: Navigate through code

- **Stop**: Terminate debug session



Monitor Output Observe application output in the **Serial Monitor** to verify correct operation.



Debug Probe Support For comprehensive information on debug probe support and configuration, refer to the MCUXpresso for VS Code Wiki DebugK section.

Project Configuration

Workspace Management The extension integrates with the MCUXpresso SDK workspace structure, providing access to:

- Example applications
- Board configurations

- Middleware components
- Build system integration

Multi-Project Support The PROJECTS view allows management of multiple imported projects within the same workspace.

Troubleshooting

Import Issues **SDK not detected:**

- Verify SDK workspace is properly initialized
- Ensure all required repositories are updated
- Check SDK manifest files are present

Project import failures:

- Confirm board support exists for selected example
- Verify toolchain installation
- Check example compatibility with selected board

Build Problems **Build failures:**

- Check integrated terminal for error messages
- Verify all dependencies are installed
- Ensure toolchain is properly configured

Debug Issues **Debug session fails:**

- Verify board connection via USB
- Check debug probe drivers are installed
- Confirm build completed successfully

Serial monitor problems:

- Verify correct VCom port selection
- Check baud rate configuration (115200)
- Ensure board drivers are installed

Integration with Command Line MCUXpresso for VS Code integrates with the underlying west build system, allowing seamless integration with command line workflows described in *Command Line Development*.

Advanced Features

Project Types The extension supports both repository-based and freestanding project types, providing flexibility in project organization and SDK integration.

Build System Integration The extension leverages the MCUXpresso SDK build system, providing access to all build configurations and options available through command line tools.

Next Steps

- Explore additional examples in the SDK
- Review *Command Line Development* for advanced build options
- Refer MCUXpresso for VS Code Wiki for detailed documentation
- Learn about *SDK Architecture* for better understanding of the development environment

Command Line Development This guide covers developing with the MCUXpresso SDK using command line tools and the west build system. This workflow applies to both GitHub Repository SDK and Repository-Layout SDK Package distributions.

Prerequisites

- GitHub Repository SDK workspace initialized OR Repository-Layout SDK Package extracted
- Development tools installed per *Installation Guide*
- Target board connected via USB

Understanding Board Support Use the west extension to discover available examples for your board:

```
west list_project -p examples/demo_apps/hello_world
```

This shows all supported build configurations. You can filter by toolchain:

```
west list_project -p examples/demo_apps/hello_world -t armgcc
```

Basic Build Commands

Standard Build Process Build with default settings (armgcc toolchain, first debug config):

```
west build -b your_board examples/demo_apps/hello_world
```

Specifying Build Configuration

```
# Release build
west build -b your_board examples/demo_apps/hello_world --config release

# Debug build with specific toolchain
west build -b your_board examples/demo_apps/hello_world --toolchain iar --config debug
```

Multicore Applications For multicore devices, specify the core ID:

```
west build -b evkbmimxrt1170 examples/demo_apps/hello_world --toolchain iar -Dcore_id=cm7 --config␣
↪flexspi_nor_debug
```

For multicore projects using sysbuild:

```
west build -b evkbmimxrt1170 --sysbuild ./examples/multicore_examples/hello_world/primary -Dcore_
↪id=cm7 --config flexspi_nor_debug --toolchain=armgcc -p always
```

Shield Support For boards with shields:

```
west build -b mimxrt700evk --shield a8974 examples/issdk_examples/sensors/fxls8974cf/fxls8974cf_poll -
↪Dcore_id=cm33_core0
```

Advanced Build Options

Clean Builds Force a complete rebuild:

```
west build -b your_board examples/demo_apps/hello_world -p always
```

Dry Run See what commands would be executed:

```
west build -b your_board examples/demo_apps/hello_world --dry-run
```

Device Variants For boards supporting multiple device variants:

```
west build -b your_board examples/demo_apps/hello_world --device MK22F12810 --config release
```

Project Configuration

CMake Configuration Only Run configuration without building:

```
west build -b evkbmimxrt1170 examples/demo_apps/hello_world -Dcore_id=cm7 --cmake-only -p
```

Interactive Configuration Launch the configuration GUI:

```
west build -t guiconfig
```

Flashing and Debugging

Flash Application Flash the built application to your board:

```
west flash -r linkserver
```

Debug Session Start a debugging session:

```
west debug -r linkserver
```

IDE Project Generation Generate IDE project files for traditional IDEs:

```
# Generate IAR project
west build -b evkbmimxrt1170 examples/demo_apps/hello_world --toolchain iar -Dcore_id=cm7 --config
↪flexspi_nor_debug -p always -t guiproject
```

IDE project files are generated in `mcuxsdk/build/<toolchain>` folder.

Note: Ruby installation is required for IDE project generation. See *Installation Guide* for setup instructions.

Troubleshooting

Build Failures

Use pristine builds to resolve dependency issues:

```
west build -b your_board examples/demo_apps/hello_world -p always
```

Toolchain Issues

Verify environment variables are set correctly:

```
# Check ARM GCC
echo $ARMGCC_DIR
arm-none-eabi-gcc --version

# Check IAR (if using)
echo $IAR_DIR
```

Getting Help

Display help information:

```
west build -h
west flash -h
west debug -h
```

Check Supported Configurations

If unsure about supported options for an example:

```
west list_project -p examples/demo_apps/hello_world
```

Best Practices

Project Organization

- Keep custom projects outside the SDK tree
- Use version control for your application code
- Document any SDK modifications

Build Efficiency

- Use `-p always` for clean builds when troubleshooting
- Leverage `--dry-run` to understand build processes
- Use specific configs and toolchains to reduce build time

Development Workflow

1. Start with existing examples closest to your requirements
2. Copy and modify rather than building from scratch
3. Test with hello_world before moving to complex examples
4. Use configuration tools for pin muxing and clock setup

Next Steps

- Explore *VS Code Development* for integrated development experience
- Review *Workspace Structure* to understand SDK organization
- Refer build system documentation for advanced configurations

Using MCUXpresso Config Tools MCUXpresso Config tools provide a user-friendly way to configure hardware initialization of your projects. This guide explains the basic workflow with the MCUXpresso SDK west build system and the Config Tools.

Prerequisites

- GitHub Repository SDK workspace initialized OR Repository-Layout SDK Package extracted
- MCUXpresso Config Tools standalone installed (version 25.09 or above)
- MCUXpresso SDK Project that can be successfully built

Board Files MCUXpresso Config Tools generate source files for the board. These files include pin_mux.c/h and clock_config.c/h. The files contain initialization code functions that reflect the hardware configuration in the Config Tools. Within the SDK codebase, these files are specific for the board and either shared by multiple example projects or specific for one example. Open or import the configuration from the SDK project in the Config Tools and customize the settings to match the custom board or specific project use case and regenerate the code. See *User Guide for MCUXpresso Config Tools (Desktop)* (document GSMCUXCTUG) for details.

Note: When opening the configuration for SDK example projects, the board files may be shared across multiple examples. To ensure a separate copy of the board configuration files exists, create a freestanding project with copied board files.

Visual Studio Code To open the configuration in Visual Studio Code, use the context menu for the project to access Config Tools. See MCUXpresso Extension Documentation for details. Otherwise, use the manual workflow described in detail in the following section.

Manual Workflow Use the following steps:

1. Before using Config Tools, run the west command to get the project information for Config Tools from the SDK project files, for example:

   ```
   west cfg_project_info -b lpcxpresso55s69 ...mcuxsdk/examples/demo_apps/hello_world/ -Dcore_
   ↪id=cm33_core0
   ```

   This results in the creation of the project information json file that is searched by the config tools when the configuration is created. The parameters of the command should match the build parameters that will be used for the project.

2. Launch the MCUXpresso Config Tools and in the **Start development** wizard, select **Create a new configuration based on the existing IDE/Toolchain project**. Select the created "cfg_tools" subfolder as a project folder (for example: ...mcuxsdk/examples/demo_apps/hello_world/cfg_tools/).

Updating the SDK West project **Note:** Updating project is supported with Config Tools V25.12 or newer only.

Changes in the Config tools generated source code modules may require adjustments to the toolchain project to ensure a successful build. These changes may mean, for example, adding the newly generated files, adding include paths, required drivers, or other SDK components. This section describes how to manually resolve the changes needed in the project within the toolchain projects based on the SDK project managed by the West tool.

After the configuration in the Config Tools is finished, write updated files to the disk using the 'Update Code' command. The written files include a json file with the required changes for the toolchain project.

To resolve the changes in the project in the terminal, launch the west command that updates the project. For example:

```
west cfg_resolve -b lpcxpresso55s69 ...mcuxsdk/examples/demo_apps/hello_world/ -Dcore_id=cm33_core0
```

This command updates the appropriate cmake and kconfig files to address the changes. After this, the application can be built.

Note: The cfg_resolve command supports additional arguments. Launch the *west cfg_resolve -h* command to get the list and description.

1.4 Release Notes

1.4.1 MCUXpresso SDK Release Notes

Overview

The MCUXpresso SDK is a comprehensive software enablement package designed to simplify and accelerate application development with Arm Cortex-M-based devices from NXP, including its general purpose, crossover and Bluetooth-enabled MCUs. MCUXpresso SW and Tools for DSC further extends the SDK support to current 32-bit Digital Signal Controllers. The MCUXpresso SDK includes production-grade software with integrated RTOS (optional), integrated enabling software technologies (stacks and middleware), reference software, and more.

In addition to working seamlessly with the MCUXpresso IDE, the MCUXpresso SDK also supports and provides example projects for various toolchains. The Development tools chapter in the associated Release Notes provides details about toolchain support for your board. Support for the MCUXpresso Config Tools allows easy cloning of existing SDK examples and demos, allowing users to leverage the existing software examples provided by the SDK for their own projects.

Underscoring our commitment to high quality, the MCUXpresso SDK is MISRA compliant and checked with Coverity static analysis tools. For details on MCUXpresso SDK, see MCUXpresso-SDK: Software Development Kit for MCUXpresso.

MCUXpresso SDK

As part of the MCUXpresso software and tools, MCUXpresso SDK is the evolution of Kinetis SDK, includes support for LPC, DSC,PN76, and i.MX System-on-Chip (SoC). The same drivers, APIs, and middleware are still available with support for Kinetis, LPC, DSC, and i.MX silicon. The MCUXpresso SDK adds support for the MCUXpresso IDE, an Eclipse-based toolchain that works with all MCUXpresso SDKs. Easily import your SDK into the new toolchain to access to all of the available components, examples, and demos for your target silicon. In addition to the MCUXpresso IDE, support for the MCUXpresso Config Tools allows easy cloning of existing SDK examples and demos, allowing users to leverage the existing software examples provided by the SDK for their own projects.

In order to maintain compatibility with legacy Freescale code, the filenames and source code in MCUXpresso SDK containing the legacy Freescale prefix FSL has been left as is. The FSL prefix has been redefined as the NXP Foundation Software Library.

Development tools

The MCUXpresso SDK was tested with following development tools. Same versions or above are recommended.

- CodeWarrior Development Studio v11.2 with CodeWarrior for DSC v11.2 SP1 (Service Pack 1)

Supported development systems

This release supports board and devices listed in following table. The board and devices in bold were tested in this release.

Development boards	MCU devices
MC56F8 EVK	MC56F83663VLH, MC56F83683VLH, MC56F83689VLL, MC56F83763AVLH, MC56F83763VLH, MC56F83766VLK, MC56F83769AVLL, MC56F83769VLL, MC56F83783AVLH, MC56F83783VLH, MC56F83786VLK, MC56F83789AVLL, **MC56F83789VLL**, MC56F83686VLK

Release contents

Table 1 provides an overview of the MCUXpresso DSC SDK release package contents and locations.

Deliverable	Location
Boards	<install_dir>/boards
Demo applications	<install_dir>/boards/<board_name>/demo_apps
Driver examples	<install_dir>/boards/<board_name>/driver_examples
Documentation	<install_dir>/docs
Driver, SoC header files, extension header files and feature header files	<install_dir>/devices/<device_name>
Peripheral Drivers	<install_dir>/devices/<device_name>/drivers
Utilities such as debug console	<install_dir>/devices/<device_name>/utilities
Middleware	<install_dir>/middleware

MCUXpresso SDK release package

The MCUXpresso SDK release package content is aligned with the silicon subfamily it supports. This includes the boards, CMSIS, devices, middleware, and RTOS support.

Device support The device folder contains the whole software enablement available for the specific System-on-Chip (SoC) subfamily. This folder includes clock-specific implementation, device register header files, device register feature header files, and the system configuration source files. Included with the standard SoC support are folders containing peripheral drivers, toolchain support, and a standard debug console. The device-specific header files provide a direct access to the microcontroller peripheral registers. The device header file provides an overall SoC memory mapped register definition. The folder also includes the feature header file for each peripheral on the microcontroller. The toolchain folder contains the startup code and linker files for each supported toolchain. The startup code efficiently transfers the code execution to the main() function.

Board support The boards folder provides the board-specific demo applications, driver examples, and middleware examples.

Demo application and other examples The demo applications demonstrate the usage of the peripheral drivers to achieve a system level solution. Each demo application contains a readme file that describes the operation of the demo and required setup steps. The driver examples demonstrate the capabilities of the peripheral drivers. Each example implements a common use case to help demonstrate the driver functionality.

Middleware

USB Type-C PD Stack See the *MCUXpresso SDK USB Type-C PD Stack User's Guide* (document MCUXSDKUSBPDUG) for more information

USB Host, Device, OTG Stack See the MCUXpresso SDK USB Stack User's Guide (document MCUXSDKUSBSUG) for more information.

Motor Control Software (ACIM, BLDC, PMSM) Motor control examples.

FreeMASTER FreeMASTER communication driver for 32-bit platforms.

Known issues

This section lists the known issues, limitations, and/or workarounds.

PRINTF issue for program address space When project is compiled with SDM, print the address in program address space malfunction.

- Failed example when SDM
  - PRINTF("%p", main); Root cause: in SDM, %p is treated as 16-bit value, however main in program address space is still considered as 32-bit.
- Workaround(compliant with SDM and LDM)
  - PRINTF("0x%lx", (uint32_t)main);

OSJTAG USB function failure The JM60 USB port, **J8**, is used for OSJTAG and USB CDC bridge. The JM60 USB port cannot work properly after being replugged when board is powered by another power source.

One example of the failure case:

1. Power the board with DSC USB port, **J21**.
2. Replug/Re-power the JM60 USB port.

Demos not support SDM As ROM API is built in LDM, flash driver demo only support LDM.

1.5 ChangeLog

1.5.1 MCUXpresso SDK Changelog

Board Support Files

board

[25.06.00]

- Initial version

clock_config

[25.06.00]

- Initial version

pin_mux

[25.06.00]

- Initial version

CADC

[2.2.0]

- New Features
- Supported platforms which don't have ANA4 expansion MUX.

[2.1.0]

- Improvements
- Added some APIs to support some devices that equipped expansion mux.

[2.0.1]

- Bug Fixes
- Fixed the bug that channel mode set to wrong value.
- Fixed the bug that independent parallel mode set to wrong value.
- Fixed violations of the MISRA C-2012 rules.

[2.0.0]

- Initial version.

CLOCK

[2.1.0]

- Accumulated bug fix
- MISRA warning fix

[2.0.0]

- Initial version.

CMP

[2.0.1]

- Improvements
- Supported MC56F82xxxx and MC56F84xxxx.
  - Bug Fixes
- Fixed violations of the MISRA C-2012 rules.

[2.0.0]

- Initial version.

COMMON

[2.6.3]

- New Features
  - Added bit mask inversion macros to avoid type promotion.
  - Added register operation macros.
- Improvements
  - Make function MSDK_EnableCpuCycleCounter compatible with CMSIS-5 and CMSIS-6.
- Bug Fixes
  - Fixed build issue of CMSIS PACK BSP example caused by CMSIS 6.1 issue.

[2.6.2]

- Bug Fixes
  - Fixed violations of MISRA C-2012 rule for implicit conversions in boolean contexts

[2.6.1]

- Improvements
  - Support Cortex M23.

[2.6.0]

- Bug Fixes
  - Fix CERT-C violations.

[2.5.0]

- New Features
  - Added new APIs InitCriticalSectionMeasurementContext, DisableGlobalIRQEx and EnableGlobalIRQEx so that user can measure the execution time of the protected sections.

[2.4.3]

- Improvements
  - Enable irqs that mount under irqsteer interrupt extender.

[2.4.2]

- Improvements
  - Add the macros to convert peripheral address to secure address or non-secure address.

[2.4.1]

- Improvements
  - Improve for the macro redefinition error when integrated with zephyr.

[2.4.0]

- New Features
  - Added EnableIRQWithPriority, IRQ_SetPriority, and IRQ_ClearPendingIRQ for ARM.
  - Added MSDK_EnableCpuCycleCounter, MSDK_GetCpuCycleCount for ARM.

[2.3.3]

- New Features
  - Added NETC into status group.

[2.3.2]

- Improvements
  - Make driver aarch64 compatible

[2.3.1]

- Bug Fixes
  - Fixed MAKE_VERSION overflow on 16-bit platforms.

[2.3.0]

- Improvements
  - Split the driver to common part and CPU architecture related part.

[2.2.10]

- Bug Fixes
  - Fixed the ATOMIC macros build error in cpp files.

[2.2.9]

- Bug Fixes
  - Fixed MISRA C-2012 issue, 5.6, 5.8, 8.4, 8.5, 8.6, 10.1, 10.4, 17.7, 21.3.
  - Fixed SDK_Malloc issue that not allocate memory with required size.

[2.2.8]

- Improvements
  - Included stddef.h header file for MDK tool chain.
- New Features:
  - Added atomic modification macros.

[2.2.7]

- Other Change
  - Added MECC status group definition.

[2.2.6]

- Other Change
  - Added more status group definition.
- Bug Fixes
  - Undef __VECTOR_TABLE to avoid duplicate definition in cmsis_clang.h

[2.2.5]

- Bug Fixes
  - Fixed MISRA C-2012 rule-15.5.

[2.2.4]

- Bug Fixes
  - Fixed MISRA C-2012 rule-10.4.

[2.2.3]

- New Features
  - Provided better accuracy of SDK_DelayAtLeastUs with DWT, use macro SDK_DELAY_USE_DWT to enable this feature.
  - Modified the Cortex-M7 delay count divisor based on latest tests on RT series boards, this setting lets result be closer to actual delay time.

[2.2.2]

- New Features
  - Added include RTE_Components.h for CMSIS pack RTE.

[2.2.1]

- Bug Fixes
  - Fixed violation of MISRA C-2012 Rule 3.1, 10.1, 10.3, 10.4, 11.6, 11.9.

[2.2.0]

- New Features
  - Moved SDK_DelayAtLeastUs function from clock driver to common driver.

[2.1.4]

- New Features
  - Added OTFAD into status group.

[2.1.3]

- Bug Fixes
  - MISRA C-2012 issue fixed.
    - Fixed the rule: rule-10.3.

[2.1.2]

- Improvements
  - Add SUPPRESS_FALL_THROUGH_WARNING() macro for the usage of suppressing fallthrough warning.

[2.1.1]

- Bug Fixes
  - Deleted and optimized repeated macro.

[2.1.0]

- New Features
  - Added IRQ operation for XCC toolchain.
  - Added group IDs for newly supported drivers.

[2.0.2]

- Bug Fixes
  - MISRA C-2012 issue fixed.
    * Fixed the rule: rule-10.4.

[2.0.1]

- Improvements
  - Removed the implementation of LPC8XX Enable/DisableDeepSleepIRQ() function.
  - Added new feature macro switch "FSL_FEATURE_HAS_NO_NONCACHEABLE_SECTION" for specific SoCs which have no noncacheable sections, that helps avoid an unnecessary complex in link file and the startup file.
  - Updated the align(x) to **attribute**(aligned(x)) to support MDK v6 armclang compiler.

[2.0.0]

- Initial version.

COP

[2.2.3]

- Bug Fixes
  - Fixed violations of MISRA C-2012 rule 10.3.

[2.2.2]

- Bug Fixes
- Added configuration of CWP bits in COP_Init, fixed write protection bEnableWriteProtect cannot be configured as part of cop_config_t.

[2.2.1]

- Bug Fixes
- Fixed violations of the MISRA C-2012 rules.

[2.2.0]

- Improvements
- Updated cop_config_t member naming.
- Deleted COP_Disable API, added COP_Enable to enable/disable COP.

[2.1.0]

- Improvements
- API interface changes:
  - Renamed "COP_EnableInterrupts/COP_DisableInterrupts" to "COP_EnableInterrupt/COP_DisableInterrupt" and remove unnecessary parameter.
  - New Features
- Added APIs to enable/disable the COP COP Loss of Reference counter.

[2.0.0]

- Initial version.

CRC

[2.0.1]

- Bug Fixes
- Fixed violations of the MISRA C-2012 rules.

[2.0.0]

- Initial version.

DAC

[2.0.1]

- Improvements
- Supported MC56F82xxx and MC56F84xxx.
  - Bug Fixes
- Fixed violations of the MISRA C-2012 rules.

[2.0.0]

- Initial version.

DMAMUX

[2.0.0]

- Initial version.

EDMA

[2.0.3]

- Fixed the MISRA-2012 violations.
- Fixed rule 10.3.

[2.0.2]

- Fixed the MISRA-2012 violations.
- Fixed rule 5.8, 9.2, 10.3, 10.4, 11.6.

[2.0.1]

- Code modification for SDM compliance

[2.0.0]

- Initial version.

EVTG

[2.0.0]

- Initial version.

EWM

[2.0.2]

- Bug Fixes
- Fixed violations of MISRA C-2012 rule 10.3.

[2.0.1]

- Bug Fixes
- Fixed violations of the MISRA C-2012 rules.

[2.0.0]

- Initial version.

FLASH

[3.2.0]

- Change file name to fsl_flash.x

[3.1.0]

- Accumulated bug fix
- MISRA warning fix

[3.0.0]

- Initial version.

FLEXCAN

[2.1.2]

- Bug Fixes
- Fixed the violation of MISRA-2012 rule : 10.1, 14.3, 17.7.

[2.1.1]

- Bug Fixes
- Fixed the violation of MISRA-2012 rule.
- Fixed CBT SEG2 potential overflow issue.

[2.1.0]

- Improvement
- Add bEnableTimingCalc member in flexcan_config_t structure to make users can choose to use their desired timing values or use auto calculate timing values to initialize FLEXCAN module.
- Update FLEXCAN_CalculateImprovedTimingValues/FLEXCAN_FDCalculateImprovedTimingValues APIs to improvement the bit timing calculate.
- Add FLEXCAN_CalculateImprovedTimingValuesWithCBT API.
- Move TDC config operations to FLEXCAN_SetFDTimingConfig API.
- Add FLEXCAN_SetBaudRate/FLEXCAN_SetFDBaudRate APIs to enable auto update CAN bit timing configuration base on baud rate parameter.
- Update FLEXCAN_WriteFDTxMb to make it can send both CAN FD frame and classic frame.

[2.0.2]

- Bug Fixes
- Fixed build error by adding macro isolation to all CAN FD codes.

[2.0.1]

- Bug Fixes
- Fixed build warnings.

[2.0.0]

- Initial version.

GPIO

[2.0.1]

- Bug Fixes
- Fixed violations of the MISRA C-2012 rules.

[2.0.0]

- Initial version.

I2C

[2.0.1]

- Bug Fixes
- Fixed violations of the MISRA C-2012 rules.

[2.0.0]

- Initial version.

INTC

[2.0.1]

- Improvements
- Added doxygen comments.

[2.0.0]

- Initial version.

MCM

[2.0.1]

- Improvements
- Supported MC56F82xxx and MC56F84xxx.

[2.0.0]

- Initial version.

PIT

[2.3.1]

- Bug Fixes
- Fixed violations of MISRA C-2012 rule 10.3.

[2.3.0]

- Improvements
- Filtered Preset input to reset PIT counter.
- Support SYNC_OUT output stretch and toggle mode.
- Added PIT_SetPresetFiltConfig() to set FILT register configurations.
- Added PIT_SetSyncOutConfig() to set SYNC register configurations.

[2.2.1]

- Bug Fixes
- Fixed violations of the MISRA C-2012 rules.

[2.2.0]

- Improvements
- Updated pit_config_t member naming.
- Removed some APIs for prescaler and clock source selection.

[2.1.0]

- Improvements
- Updated PIT clock source and PIT prescaler with more meaningful comments.
- Updated PIT_SetTimerPeriod() and PIT_GetCurrentTimerCount() with 16-bit parameter.
- Deleted mask parameter for PIT_ClearStatusFlags/PIT_EnableInterrupts/PIT_DisableInterrupts.
- Added PIT_SetTimerClockSource() API to configure clock source.
- Added PIT_EnableSlaveMode() API to configure slave mode.

[2.0.1]

- New Features
- Added PIT_SetTimerPrescaler() API to configure clock prescaler value.

[2.0.0]

- Initial version.

PMC

[2.1.0]

- Improvements
- Added PMC_SetVrefTrim() and PMC_SetVcapTrim() APIs to support MC56F80xxx.

[2.0.0]

- Initial version.

---

eFlexPWM

[2.2.0]

- New Features
- Supported capture PWM input filter.
- Supported different PWM deadtime count register width.
  - Bug Fixes
- Fixed wrong pwm_sm_pwm_out_t enum order issue.

[2.1.1]

- Bug Fixes
- Fixed build error when soc not support Capture A/B features.

[2.1.0]

- Improvements
- Supported MC56F80xxx.

[2.0.2]

- Bug Fixes
- Fixed clear status flags API doesn’t work issue.

[2.0.1]

- Improvements
- Supported MC56F82xxx and MC56F84xxx .
  - Bug Fixes
- Fixed violations of the MISRA C-2012 rules.

[2.0.0]

- Initial version.

QSCI

[2.0.5]

- New Feature
  - Added common IRQ handler entry QSCI_DriverIRQHandler.

[2.0.4]

- Bug Fixes
- Fixed DMA transfer blocking issue by enabling tx idle interrupt after DMA transmission finishes, and invoke completion callback after tx idle interrupt occurs.

[2.0.3]

- Bug Fixes
- Fixed violations of the MISRA C-2012 rules.

[2.0.2]

- Improvements
- Supported QSCI which has 13-bit integer and 3-bit fractional baud rate selection.

[2.0.1]

- Bug Fixes
- Fixed bug that when starting the non-blocking receive, the rx idle interrupt is not enabled, and when receiving is done the rx idle interrupt is not disabled.

[2.0.0]

- Initial version.

QTMR

[2.0.1]

- Improvements
- Supported to get TMR capture register address.
  - Bug Fixes
- Fixed violations of the MISRA C-2012 rules.

[2.0.0]

- Initial version.

Queued SPI

[2.1.2]

- New Feature
  - Added common IRQ handler entry QSPI_DriverIRQHandler.

[2.1.1]

- Bug Fixes
- Fixed wrong baudrate calculation method.

[2.1.0]

- Bug Fixes
- Fixed wrong definitions of interrupt enable/disable masks.
- Fixed wrong usage of QSPI_DisableInterrupts.
- Fixed wrong type casts.
- Fixed bug for master blocking transfer of rx FIFO overflow.

[2.0.0]

- Initial version.

SIM

[2.2.0]

- Use dedicated SIM driver for MC56F83xxx

[2.1.0]

- Improvements
- Updated support for MC56F82xxx and MC56F84xxx.
  - Bug Fixes
- Fixed violations of the MISRA C-2012 rules.

[2.0.0]

- Initial version.

DSC_XBARA

[2.0.1]

- Bug Fixes
- Fixed violations of the MISRA C-2012 rules.

[2.0.0]

- Initial version.

Chapter 2

MC56F83789

2.1 CADC: 12-bit Cyclic Analog-to-Digital Converter Driver

void CADC_Init(ADC_Type *base, const *cadc_config_t* *psConfig)

Initializes the CADC module, such as scan mode, DMA trigger source, interrupt mask and so on.

This function is to make the initialization for using CADC module. The operations are:

- Enable the clock for CADC.
- Set power up delay and Idle work mode.
- Set DMA trigger source.
- Enable the interrupts(Including High/Low limit interrupt, zero crossing interrupt interrupt, end of scan interrupt and each sample slot's scan interrupt).
- Set scan mode.
- Set disabled sample slot for the scan.
- Set scan control options.
- Set selected channels' mode.
- Set gain for each channel.
- Config conterA and converterB.

Note: The high limit value, low limit value, offset value and zerocrossing mode of each sample slot will not be configured in this function, to set those options, the APIs in "Sample Slot Control Interfaces" function group can be used.

Parameters

- base – CADC peripheral base address.
- psConfig – Pointer to configuration structure. See cadc_config_t.

void CADC_GetDefaultConfig(*cadc_config_t* *psConfig)

Gets an available pre-defined options(such as scan mode, DMA trigger source, interrupt mask and so on) for module's configuration.

This function initializes the module's configuration structure with an available settings. The default value are:

```
psConfig->eDMATriggerSource = kCADC_DMATrigSrcEndofScan;
psConfig->eIdleWorkMode = kCADC_IdleKeepNormal;
psConfig-s>u16PowerUpDelay = 26U;
psConfig->u32EnabledInterruptMask = 0U;
psConfig->eScanMode = kCADC_ScanModeTriggeredParallelSimultaneous;
psConfig->uDisabledSampleSlot.u32SampleDisVal = 0xFF0F0UL;
psConfig->uScanControl.u32ScanCtrlVal          = 0x0UL;
psConfig->eChannelGain[x] = kCADC_SignalGainX1;
psConfig->sampleSlotScanInterruptEnableMask = kCADC_NonSampleSlotMask;
For the default setting of converter, please see CADC_GetConverterDefaultConfig().
```

Parameters

- psConfig – Pointer to configuration structure. See cadc_config_t.

void CADC_Deinit(ADC_Type *base)

De-initializes the CADC module, including power down both converter and disable the clock(Optional).

This function is to make the de-initialization for using CADC module. The operations are:

- Power down both converter.
- Disable the clock for CADC.

Parameters

- base – CADC peripheral base address.

static inline void CADC_SetScanMode(ADC_Type *base, *cadc_scan_mode_t* eScanMode)

Sets the scan mode(such as Sequential scan mode, Simultaneous parallel scan mode, Independent parallel scan

mode) of dual converters.

Parameters

- base – CADC peripheral base address.
- eScanMode – Dual converters' scan mode, please see cadc_scan_mode_t for details.

static inline void CADC_SetScanControl(ADC_Type *base, *cadc_scan_control_t* uScanControl)

The function provides the ability to pause and await new sync in the conversion sequence.

Parameters

- base – CADC peripheral base address.
- uScanControl – The scan control value, please refer to cadc_scan_control_t for details.

void CADC_SetChannelMode(ADC_Type *base, *cadc_channel_mode_t* eChannelMode)

Sets mode for the specific channel(Each channel can be set as single-end, fully differential and unipolar differential(Optional) mode).

Parameters

- base – CADC peripheral base address.
- eChannelMode – The channel mode to be set, please refer to cadc_channel_mode_t for details.

void CADC_SetChannelGain(ADC_Type *base, *cadc_channel_number_t* eChannelNumber, *cadc_channel_gain_t* eChannelGain)

Sets the gain(Supports X1, X2, X4) of selected channel.

Parameters

- base – CADC peripheral base address.
- eChannelNumber – The number of channel, please refer to cadc_channel_number_t.
- eChannelGain – The gain amplification, please refer to cadc_channel_gain_t for details.

void CADC_GetSampleSlotDefaultConfig(*cadc_sample_slot_config_t* *psConfig)

Gets sample slot default configuration including zero crossing mode, high limit value, low limit value and offset value.

```
psConfig->eZeroCrossingMode = kCADC_ZeroCrossingDisabled;
psConfig->u16HighLimitValue  = 0x7FF8U;
psConfig->u16LowLimitValue   = 0x0U;
psConfig->u16OffsetValue     = 0x0U;
```

Parameters

- psConfig – Pointer to configuration structure. See cadc_sample_slot_config_t.

void CADC_SetSampleSlotConfig(ADC_Type *base, *cadc_sample_slot_index_t* eSampleIndex, const *cadc_sample_slot_config_t* *psConfig)

Configures the options(including zero crossing mode, high limit value, low limit value and offset value) for sample slot.

Note: This function can be used to set high limit value, low limit value, offset value and zerocrossing mode of the sample slot.

Parameters

- base – CADC peripheral base address.
- eSampleIndex – Index of sample slot in conversion sequence. Please refer to cadc_sample_slot_index_t.
- psConfig – Pointer to configuration structure. See cadc_sample_slot_config_t.

void CADC_SetSampleSlotZeroCrossingMode(ADC_Type *base, *cadc_sample_slot_index_t* eSampleIndex, *cadc_sample_slot_zero_crossing_mode_t* eZeroCrossingMode)

Sets zero-crossing mode for the selected sample slot.

Parameters

- base – CADC peripheral base address.
- eSampleIndex – The index of sample slot. Please refer to cadc_sample_slot_index_t for details.
- eZeroCrossingMode – Zero crossing mode, please refer to cadc_sample_slot_zero_crossing_mode_t for details.

void CADC_RouteChannelToSampleSlot(ADC_Type *base, *cadc_sample_slot_index_t* eSampleIndex, *cadc_channel_number_t* eChannelNumber)

Routes the channel to the sample slot.

Parameters

- base – CADC peripheral base address.
- eSampleIndex – The index of sample slot, please refer to cadc_sample_slot_index_t for details.
- eChannelNumber – Sample channel number, please refer to cadc_channel_number_t for details.

static inline void CADC_SetSampleSlotLowLimitValue(ADC_Type *base, *cadc_sample_slot_index_t* eSampleIndex, uint16_t u16LowLimitValue)

Sets the low limit value(-32768 ~ 32767 with lower three bits of fixed value 0) for the specific sample slot.

Parameters

- base – CADC peripheral base address.
- eSampleIndex – The index of sample slot. Please refer to cadc_sample_slot_index_t for details.
- u16LowLimitValue – Low limit value(-32768 ~ 32767 with lower three bits of fixed value 0). Original value formation as hardware register, with 3-bits left shifted.

static inline void CADC_SetSampleSlotHighLimitValue(ADC_Type *base, *cadc_sample_slot_index_t* eSampleIndex, uint16_t u16HighLimitValue)

Sets the high limit value(-32768 ~ 32767 with lower three bits of fixed value 0) for the specific sample slot.

Parameters

- base – CADC peripheral base address.
- eSampleIndex – The index of sample slot. Please refer to cadc_sample_slot_index_t for details.
- u16HighLimitValue – High limit value(-32768 ~ 32767 with lower three bits of fixed value 0). Original value formation as hardware register, with 3-bits left shifted.

static inline void CADC_SetSampleSlotOffsetValue(ADC_Type *base, *cadc_sample_slot_index_t* eSampleIndex, uint16_t u16OffsetValue)

Sets the offset value(-32768 ~ 32767 with lower three bits of fixed value 0) for the specific sample slot.

Parameters

- base – CADC peripheral base address.
- eSampleIndex – The index of sample slot. Please refer to cadc_sample_slot_index_t for details.
- u16OffsetValue – Offset value(-32768 ~ 32767 with lower three bits of fixed value 0). Original value formation as hardware register, with 3-bits left shifted.

static inline uint16_t CADC_GetSampleSlotResultValue(ADC_Type *base, *cadc_sample_slot_index_t* eSampleIndex)

Gets the sample result value.

This function is to get the sample result value. The returned value keeps it original formation just like in hardware result register. It includes the sign bit as the MSB and 3-bit left shifted value.

Parameters

- base – CADC peripheral base address.
- eSampleIndex – Index of sample slot. For the counts of sample slots, please refer to cadc_sample_slot_index_t for details.

Returns

Sample's conversion value.

void CADC_GetConverterDefaultConfig(*cadc_converter_config_t* *psConfig)

Gets available pre-defined settings(such as clock divisor, reference voltage source, and so on) for each converter's configuration.

This function initializes each converter's configuration structure with an available settings. The default value are:

```
psConfig->u16ClockDivisor = 4U;(ADC clock = Peripheral clock / 5)
psConfig->eSpeedMode = kCADC_SpeedMode0; (Chip specific)
psConfig->eHighReferenceVoltageSource = kCADC_ReferenceVoltageVrefPad;
psConfig->eLowReferenceVoltageSource = kCADC_ReferenceVoltageVrefPad;
psConfig->u16SampleWindowCount = 0U; (Chip specific)
psConfig->bEnableDMA          = false;
psConfig->bPowerUp    = false;
psConfig->bScanInitBySync  = true;
```

Parameters

- psConfig – Pointer to configuration structure. See cadc_converter_config_t.

void CADC_SetConverterConfig(ADC_Type *base, *cadc_converter_id_t* eConverterId, const *cadc_converter_config_t* *psConfig)

Configures the options(such as clock divisor, reference voltage source, and so on) for the converter.

This function can be used to configure the converter The operations are:

- Set clock divisor;
- Set reference voltage source
- Enable/Disable DMA
- Power-up/power-down converter

Parameters

- base – CADC peripheral base address.
- eConverterId – The converter Id. See cadc_converter_id_t.
- psConfig – Pointer to configuration structure. See cadc_converter_config_t.

static inline void CADC_EnableConverter(ADC_Type *base, *cadc_converter_id_t* eConverterId, bool bEnable)

Changes the converter to stop mode or normal mode.

The conversion should only be launched after the converter is in normal mode. When in stop mode, the current scan is stopped and no further scans can start. All the software trigger and hardware trigger are ignored.

Parameters

- base – CADC peripheral base address.
- eConverterId – The converter Id. See cadc_converter_id_t.
- bEnable – Used to change the operation mode.
  - **true** Changed to normal mode.
  - **false** Changed to stop mode

static inline void CADC_EnableConverterSyncInput(ADC_Type *base, *cadc_converter_id_t* eConverterId, bool bEnable)

Enables/Disables the external sync input pulse to initiate a scan.

Note: When in "Once" scan mode, this gate would be off automatically after an available sync is received. User needs to enable the input again manually if another sync signal is wanted.

Parameters

- base – CADC peripheral base address.
- eConverterId – The converter Id. See cadc_converter_id_t.
- bEnable – Enable the feature or not.
  - **true** Used a SYNC input pulse or START command to initiate a scan.
  - **false** Only use the START command to initiate a scan.

static inline void CADC_DoSoftwareTriggerConverter(ADC_Type *base, *cadc_converter_id_t* eConverterId)

Uses software trigger to start a conversion sequence.

This function is to do the software trigger to the converter. The software trigger can used to start a conversion sequence.

Parameters

- base – CADC peripheral base address.
- eConverterId – The ID of the converter to be started. See cadc_converter_id_t.

static inline void CADC_SetConverterClockDivisor(ADC_Type *base, *cadc_converter_id_t* eConverterId, uint16_t u16ClockDivisor)

Sets clock divisor(Range from 0 to 63) for converterA and conveter B.

Parameters

- base – CADC peripheral base address.
- eConverterId – The converter Id. See cadc_converter_id_t.
- u16ClockDivisor – Converter's clock divisor for the clock source.Available setting range is 0-63.
  - When the clockDivisor is 0, the divisor is 2.
  - For all other clockDivisor values, the divisor is 1 more than the decimal value of clockDivisor: clockDivisor + 1

void CADC_SetConverterReferenceVoltageSource(ADC_Type *base, *cadc_converter_id_t* eConverterId, *cadc_reference_voltage_source_t* eHighReferenceVoltage, *cadc_reference_voltage_source_t* eLowReferenceVoltage)

Sets converter's reference voltage source(Including high reference voltage source and low reference voltage

source).

Parameters

- base – CADC peripheral base address.
- eConverterId – The converter Id. See cadc_converter_id_t.
- eHighReferenceVoltage – High voltage reference source, please refer to cadc_reference_voltage_source_t.
- eLowReferenceVoltage – Low voltage reference source, please refer to cadc_reference_voltage_source_t.

void CADC_EnableConverterPower(ADC_Type *base, *cadc_converter_id_t* eConverterId, bool bEnable)

Powers up/down the specific converter.

This function is to enable the power for the converter. The converter should be powered up before the conversion. Once this API is called to power up the converter, the converter would be powered on after a few moment (so-called power up delay, the function CADC_SetPowerUpDelay() can be used to set the power up delay), so that the power would be stable.

Parameters

- base – CADC peripheral base address.
- eConverterId – The converter to be powered. See cadc_converter_id_t.
- bEnable – Powers up/down the converter.
  - **true** Power up the specific converter.
  - **false** Power down the specific converter.

static inline void CADC_EnableConverterDMA(ADC_Type *base, *cadc_converter_id_t* eConverterId, bool bEnable)

Enables/Disables the converter's DMA feature.

Parameters

- base – CADC peripheral base address.
- eConverterId – The converter id. See cadc_converter_id_t.
- bEnable – Enables/Disables the DMA.
  - **true** Enable the converter's DMA.
  - **false** Disable the converter's DMA.

void CADC_SetConverterMuxAuxConfig(ADC_Type *base, *cadc_converter_id_t* eConverterId, const *cadc_exp_mux_aux_config_t* *psMuxAuxConfig)

Configures selected converter's expansion mux and aux settings.

Parameters

- base – ADC peripheral base address.

- eConverterId – The converter id, see cadc_converter_id_t.
- psMuxAuxConfig – Pointer to cadc_exp_mux_aux_config_t structure.

static inline void CADC_ResetConverterExpMuxScan(ADC_Type *base, *cadc_converter_id_t* eConverterId)

Resets selected converter's expansion mux scan.

Parameters

- base – ADC peripheral base address.
- eConverterId – The converter id, see cadc_converter_id_t.

static inline void CADC_SetConverterExpansionMuxOperateMode(ADC_Type *base, *cadc_converter_id_t* eConverterId, *cadc_expansion_mux_operate_mode_t* eOperateMode)

Sets selected converter's expansion mux operate mode.

Parameters

- base – ADC peripheral base address.
- eConverterId – The converter id, see cadc_converter_id_t.
- eOperateMode – Used to set expansion mux operate mode.

static inline void CADC_SetConverterAuxiliaryControl(ADC_Type *base, *cadc_converter_id_t* eConverterId, uint16_t u16AuxControl)

Sets selected converter's auxiliary control set.

Parameters

- base – ADC peripheral base address.
- eConverterId – The converter id, see cadc_converter_id_t.
- u16AuxControl – The mask of auxiliary control, should be the OR'ed value of cadc_auxiliary_control_t.

static inline void CADC_SetConverterMuxChannels(ADC_Type *base, *cadc_converter_id_t* eConverterId, uint32_t u32MuxChannelMask)

Sets selected converter's mux channels.

Parameters

- base – ADC peripheral base address.
- eConverterId – The converter id, see cadc_converter_id_t.
- u32MuxChannelMask – The mask of mux selection of all mux solts, should be the OR'ed value of cadc_expansion_mux_selection_t.

static inline void CADC_SetExpansionMuxAuxDisabledSlot(ADC_Type *base, *cadc_converter_id_t* eConverterId, *cadc_expansion_disabled_mux_slot_t* eDisabledMuxSlot)

Set selected converter's mux and aux disabled slot.

Parameters

- base – ADC peripheral base address.
- eConverterId – The converter id, see cadc_converter_id_t.

- eDisabledMuxSlot – The mux slot to disabled, please refer to cadc_expansion_disabled_mux_slot_t.

static inline void CADC_SetPowerUpDelay(ADC_Type *base, uint16_t u16PowerUpDelay)

Sets power up delay(The number of ADC clocks to power up the converters before allowing a scan to start).

Parameters

- base – CADC peripheral base address.
- u16PowerUpDelay – The number of ADC clocks to power up an ADC converter. Ranges from 0 to 63.

static inline void CADC_EnableAutoPowerDownMode(ADC_Type *base, bool bEnable)

Enables/Disables auto-powerdown converters when the module is not in use for a scan.

Parameters

- base – CADC peripheral base address.
- bEnable – Enable/Disable auto-powerdown mode.
  - **true** Enable auto-powerdown mode, so when the module is not in use, it will auto-powerdown.
  - **false** Disable auto-powerdown mode, so when the module is not in use, the power will still on.

static inline void CADC_SetDMATriggerSource(ADC_Type *base, *cadc_dma_trigger_source_t* eDMATriggerSource)

Sets DMA trigger source(available selections are "End of scan" and "Sample Ready").

Parameters

- base – CADC peripheral base address.
- eDMATriggerSource – DMA trigger source. Please refer to cadc_dma_trigger_source_t for details.

static inline void CADC_EnableInterrupts(ADC_Type *base, uint32_t u32Mask)

Enables the interrupts(such as high/low limit interrupts, end of scan interrupts, and so on).

Parameters

- base – CADC peripheral base address.
- u32Mask – Mask value for converters interrupt events. Should be the OR'ed value of _cadc_interrupt_enable.

static inline void CADC_DisableInterrupts(ADC_Type *base, uint32_t u32Mask)

Disables the interrupts(such as high/low limit interrupts, end of scan interrupts, and so on).

Parameters

- base – CADC peripheral base address.
- u32Mask – Mask value for converts interrupt events. Should be the OR'ed value of _cadc_interrupt_enable.

static inline uint16_t CADC_GetMiscStatusFlags(ADC_Type *base)

Gets Miscellaneous status flags, such as end of scan status flag, high/low limit interrupt flags and so on.

Note: This API will return the current status of the ADC module, including high limit interrupt status, low limit status flag, zero crossing interrupt status, End of scan interrupt status, conversion in progress status. But some status flags are not included in this function. To get sample slot ready status flag, please invoking CADC_GetSampleSlotReadyStatusFlags(), to get sample slot limit violations status please invoking CADC_ClearSampleSlotLowLimitStatusFlags() and CADC_GetSampleSlotHighLimitStatusFlags(), to get zerocrossing status please invoking CADC_GetSampleSlotZeroCrossingStatusFlags(). To get converters' power status please invoke CADC_GetPowerStatusFlag().

Parameters

- base – CADC peripheral base address.

Returns

Mask value for the event flags. See _cadc_misc_status_flags.

static inline void CADC_ClearMiscStatusFlags(ADC_Type *base, uint16_t u16Flags)

Clears Miscellaneous status flags(Only for "end of scan" status flags).

Note: Only kCADC_ConverterAEndOfScanFlag and kCADC_ConverterBEndOfScanFlag can be cleared. And sample slot related status flags can not be cleared in this function. To clear the status flags of limit violations, please invoking CADC_ClearSampleSlotLowLimitStatusFlags() and CADC_ClearSampleSlotHighLimitStatusFlags(), to clear the status flags of zero crossing mode, please invoking CADC_ClearSampleSlotZeroCrossingStatusFlags().

Parameters

- base – CADC peripheral base address.
- u16Flags – Mask value for the event flags to be cleared. See _cadc_misc_status_flags. Only the enumeration kCADC_ConverterAEndOfScanFlag and kCADC_ConverterBEndOfScanFlag are useful.

static inline uint32_t CADC_GetSampleSlotReadyStatusFlags(ADC_Type *base)

Gets sample slots ready status flag, those status flags are cleared by reading the corresponding sample slots' result.

Parameters

- base – CADC peripheral base address.

static inline uint32_t CADC_GetSampleSlotLowLimitStatusFlags(ADC_Type *base)

Gets sample slot low limit status flags(Each bit represents one sample slot).

Parameters

- base – CADC peripheral base address.

Returns

The value of all sample slots' low limit status. Each bit represents one sample slot.

static inline void CADC_ClearSampleSlotLowLimitStatusFlags(ADC_Type *base, uint32_t u32SampleMask)

Clears sample slot's low limit status flags(Each bit represents one sample slot).

Parameters

- base – CADC peripheral base address.
- u32SampleMask – Mask value of sample slots. This parameter should be the OR'ed value of cadc_sample_slot_mask_t.

static inline uint32_t CADC_GetSampleSlotHighLimitStatusFlags(ADC_Type *base)

Gets sample slot high limit status flags(Each bit represents one sample slot).

Parameters

- base – CADC peripheral base address.

Returns

The value of all sample slots' high limit status. Each bit represents each sample slot.

static inline void CADC_ClearSampleSlotHighLimitStatusFlags(ADC_Type *base, uint32_t u32SampleMask)

Clears sample slot's high limit status flags(Each bit represents one sample slot).

Parameters

- base – CADC peripheral base address.
- u32SampleMask – Mask value of sample slots. This parameter should be the OR'ed value of cadc_sample_slot_mask_t.

static inline uint32_t CADC_GetSampleSlotZeroCrossingStatusFlags(ADC_Type *base)

Gets sample slot zero crossing status flags(Each bit represents one sample slot).

Parameters

- base – CADC peripheral base address.

Returns

The value of all sample slots' zero crossing status. Each bit represents each sample slot.

static inline void CADC_ClearSampleSlotZeroCrossingStatusFlags(ADC_Type *base, uint32_t u32SampleMask)

Clears sample slot's zero crossing status flags(Each bit represents one sample slot).

Parameters

- base – CADC peripheral base address.
- u32SampleMask – Mask value of sample slots. This parameter should be the OR'ed value of cadc_sample_slot_mask_t.

static inline uint16_t CADC_GetPowerStatusFlags(ADC_Type *base)

Gets converters power status(Those power status can not be cleared).

Parameters

- base – CADC peripheral base address.

Returns

The mask value of the converters' power status flag, see _cadc_converter_power_status_flags.

static inline uint16_t CADC_GetConverterExpMuxChannelScanCompStatusFlags(ADC_Type *base)

Gets converter's expansion mux channel scan complete status flags.

Parameters

- base – CADC peripheral base address.

Returns

uint16_t The mask value of converters' expansion mux channel scan status flags, see _cadc_expansion_mux_status_flags.

static inline void CADC_ClearConverterExpMuxChannelScanCompStatusFlags(ADC_Type *base, uint16_t u16FlagMask)

Clears converter's expansion mux channel scan complete status flags.

Parameters

- base – CADC peripheral base address.
- u16FlagMask – The mask value of _cadc_expansion_mux_status_flags.

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CADC driver version.

enum _cadc_misc_status_flags

CADC miscellaneous status flags used to tell peripheral's miscellaneous status, such as zerocrossing, end of scan flags.

Values:

enumerator kCADC_ZeroCrossingInterruptFlag

Zero crossing encountered. IRQ pending if enabled Zero Crossing Interrupt.

enumerator kCADC_HighLimitInterruptFlag

High limit exceeded flag. IRQ pending if enabled high limit interrupt.

enumerator kCADC_LowLimitInterruptFlag

Low limit exceeded flag. IRQ pending if enabled low limit interrupt.

enumerator kCADC_ConverterAInProgressFlag

Conversion in progress, converter A.

enumerator kCADC_ConverterBInProgressFlag

Conversion in progress, converter B.

enumerator kCADC_ConverterAEndOfScanFlag

End of scan, converter A.

enumerator kCADC_ConverterBEndOfScanFlag

End of scan, converter B.

enumerator kCADC_StatusAllFlags

enum _cadc_converter_power_status_flags

The enumeration of converter power status.

Values:

enumerator kCADC_ConverterAPowerDownFlag

The converterA is powered down.

enumerator kCADC_ConverterBPowerDownFlag

The converterB is powered down.

enum _cadc_expansion_mux_status_flags

The enumeration of expansion mux channel scan complete interrupt request status flag.

Values:

enumerator kCADC_ANA4ExpMuxAuxScanCompInterruptFlag

ANA4 Expansion MUX Channel Scan Complete Interrupt flag.

enumerator kCADC_ANB4ExpMuxAuxScanCompInterruptFlag

ANB4 Expansion MUX Channel Scan Complete Interrupt flag.

enum _cadc_interrupt_enable

CADC Interrupts enumeration.

Values:

enumerator kCADC_Sample0ScanInterruptEnable
If sample0 is converted, generate the scan interrupt.

enumerator kCADC_Sample1ScanInterruptEnable
If sample1 is converted, generate the scan interrupt.

enumerator kCADC_Sample2ScanInterruptEnable
If sample2 is converted, generate the scan interrupt.

enumerator kCADC_Sample3ScanInterruptEnable
If sample3 is converted, generate the scan interrupt.

enumerator kCADC_Sample4ScanInterruptEnable
If sample4 is converted, generate the scan interrupt.

enumerator kCADC_Sample5ScanInterruptEnable
If sample5 is converted, generate the scan interrupt.

enumerator kCADC_Sample6ScanInterruptEnable
If sample6 is converted, generate the scan interrupt.

enumerator kCADC_Sample7ScanInterruptEnable
If sample7 is converted, generate the scan interrupt.

enumerator kCADC_Sample8ScanInterruptEnable
If sample8 is converted, generate the scan interrupt.

enumerator kCADC_Sample9ScanInterruptEnable
If sample9 is converted, generate the scan interrupt.

enumerator kCADC_Sample10ScanInterruptEnable
If sample10 is converted, generate the scan interrupt.

enumerator kCADC_Sample11ScanInterruptEnable
If sample11 is converted, generate the scan interrupt.

enumerator kCADC_Sample12ScanInterruptEnable
If sample12 is converted, generate the scan interrupt.

enumerator kCADC_Sample13ScanInterruptEnable
If sample13 is converted, generate the scan interrupt.

enumerator kCADC_Sample14ScanInterruptEnable
If sample14 is converted, generate the scan interrupt.

enumerator kCADC_Sample15ScanInterruptEnable
If sample15 is converted, generate the scan interrupt.

enumerator kCADC_ANA4ExpMuxScanCompleteInterruptEnable
If ANA4 expansion MUX channel scan complete, generate the interrupt.

enumerator kCADC_ANB4ExpMuxScanCompleteInterruptEnable
If ANB4 expansion MUX channel scan complete, generate the interrupt.

enumerator kCADC_HighLimitInterruptEnable
If the result value is greater than the high limit value, generate high limit interrupt.

enumerator kCADC_LowLimitInterruptEnable

If the result value is less than the low limit value, generate low limit interrupt.

enumerator kCADC_ZeroCrossingInterruptEnable

If the current value has a sign change from the previous result in the selected zero crossing mode, generate the zero crossing mode

enumerator kCADC_ConversionCompleteInterrupt0Enable

Upon the completion of the scan, generate the end of scan interrupt, when the scan mode is selected as sequential mode or simultaneous parallel mode. For looping scan mode, the interrupt will trigger after the completion of each iteration of loop.

enumerator kCADC_ConversionCompleteInterrupt1Enable

When the scan mode is independent parallel mode, up the completion of the converter scan, generate te end of scan interrupt. For looping scan mode, the interrupt will trigger after the completion of each iteration of loop.

enumerator kCADC_ALLInterruptEnable

enum _cadc_converter_id

CADC Converter identifier.

Values:

enumerator kCADC_ConverterA

Converter A.

enumerator kCADC_ConverterB

Converter B.

enum _cadc_idle_work_mode

The enumeration of work mode when the module is not used.

Values:

enumerator kCADC_IdleKeepNormal

Keep normal.

enumerator kCADC_IdleAutoPowerDown

Fall into power down mode automatically.

enum _cadc_dma_trigger_source

The enumeration of DMA trigger source.

Values:

enumerator kCADC_DMATrigSrcEndofScan

DMA trigger source is end of scan interrupt.

enumerator kCADC_DMATrigSrcSampleReady

DMA trigger source is RDY bits.

enum _cadc_scan_mode

The enumeration of dual converter's scan mode.

Values:

enumerator kCADC_ScanModeOnceSequential

Once (single) sequential.

enumerator kCADC_ScanModeOnceParallelIndependent

Once parallel independently.

enumerator kCADC_ScanModeLoopSequential
Loop sequential.

enumerator kCADC_ScanModeLoopParallelIndependent
Loop parallel independently.

enumerator kCADC_ScanModeTriggeredSequential
Triggered sequential.

enumerator kCADC_ScanModeTriggeredParallelIndependent
Triggered parallel independently.

enumerator kCADC_ScanModeOnceParallelSimultaneous
Once parallel simultaneously.

enumerator kCADC_ScanModeLoopParallelSimultaneous
Loop parallel simultaneously.

enumerator kCADC_ScanModeTriggeredParallelSimultaneous
Triggered parallel simultaneously.

enum _cadc_reference_voltage_source
The enumeration of converter's reference voltage source.

Values:

enumerator kCADC_ReferenceVoltageVrefPad
VREF pin.

enumerator kCADC_ReferenceVoltageChannelPad
ANx2 or ANx3 pin.

enum _cadc_channel_gain
The enumeration of sample slot connected channel gain.

Values:

enumerator kCADC_SignalGainX1
Gain x1.

enumerator kCADC_SignalGainX2
Gain x2.

enumerator kCADC_SignalGainX4
Gain x4.

enum _cadc_channel_mode
The enumeration of all channels' channel mode.

Values:

enumerator kCADC_ANA0_1_SingleEnd
ANA0 and ANA1 both configured as single ended inputs.

enumerator kCADC_ANA0_1_FullyDifferential
ANA0 configured as fully differential positive input, ANA1 configured as fully differential negative input.

enumerator kCADC_ANA0_1_UnipolarDifferential
ANA0 configured as unipolar differential positive input, ANA1 configured as unipolar differential negative input.

enumerator kCADC_ANA2_3_SingleEnd
ANA2 and ANA3 both configured as single ended inputs.

enumerator kCADC_ANA2_3_FullyDifferential
ANA2 configured as fully differential positive input, ANA3 configured as fully differential negative input.

enumerator kCADC_ANA2_3_UnipolarDifferential
ANA2 configured as unipolar differential positive input, ANA3 configured as unipolar differential negative input.

enumerator kCADC_ANB0_1_SingleEnd
ANB0 and ANB1 both configured as single ended inputs.

enumerator kCADC_ANB0_1_FullyDifferential
ANB0 configured as fully differential positive input, ANB1 configured as fully differential negative input.

enumerator kCADC_ANB0_1_UnipolarDifferential
ANB0 configured as unipolar differential positive input, ANB1 configured as unipolar differential negative input.

enumerator kCADC_ANB2_3_SingleEnd
ANB2 and ANB3 both configured as single ended inputs.

enumerator kCADC_ANB2_3_FullyDifferential
ANB2 configured as fully differential positive input, ANB3 configured as fully differential negative input.

enumerator kCADC_ANB2_3_UnipolarDifferential
ANB2 configured as unipolar differential positive input, ANB3 configured as unipolar differential negative input.

enumerator kCADC_ANA4_5_SingleEnd
ANA4 and ANA5 both configured as single ended inputs.

enumerator kCADC_ANA4_5_FullyDifferential
ANA4 configured as fully differential positive input, ANA5 configured as fully differential negative input.

enumerator kCADC_ANA4_5_UnipolarDifferential
ANA4 configured as unipolar differential positive input, ANA5 configured as unipolar differential negative input.

enumerator kCADC_ANA6_7_SingleEnd
ANA6 and ANA7 both configured as single ended inputs.

enumerator kCADC_ANA6_7_FullyDifferential
ANA6 configured as fully differential positive input, ANA7 configured as fully differential negative input.

enumerator kCADC_ANA6_7_UnipolarDifferential
ANA6 configured as unipolar differential positive input, ANA7 configured as unipolar differential negative input.

enumerator kCADC_ANB4_5_SingleEnd
ANB4 and ANB5 both configured as single ended inputs.

enumerator kCADC_ANB4_5_FullyDifferential
ANB4 configured as fully differential positive input, ANB5 configured as fully differential negative input.

enumerator kCADC_ANB4_5_UnipolarDifferential
ANB4 configured as unipolar differential positive input, ANB5 configured as unipolar differential negative input.

enumerator kCADC_ANB6_7_SingleEnd
ANB6 and ANB7 both configured as single ended inputs.

enumerator kCADC_ANB6_7_FullyDifferential
ANB6 configured as fully differential positive input, ANB7 configured as fully differential negative input.

enumerator kCADC_ANB6_7_UnipolarDifferential
ANB6 configured as unipolar differential positive input, ANB7 configured as unipolar differential negative input.

enum _cadc_channel_number
The enumerator of all channels that can be routed to the specific sample slot.

Values:

enumerator kCADC_SingleEndANA0_DiffANA0pANA1n
Single Endned ANA0 Signal Or Differential ANA0+, ANA1- signal.

enumerator kCADC_SingleEndANA1_DiffANA0pANA1n
Single Endned ANA1 Signal Or Differential ANA0+, ANA1- signal.

enumerator kCADC_SingleEndANA2_DiffANA2pANA3n
Single Endned ANA2 Signal Or Differential ANA2+, ANA3- signal.

enumerator kCADC_SingleEndANA3_DiffANA2pANA3n
Single Endned ANA3 Signal Or Differential ANA2+, ANA3- signal.

enumerator kCADC_SingleEndANA4_DiffANA4pANA5n
Single Endned ANA4 Signal Or Differential ANA4+, ANA5- signal.

enumerator kCADC_SingleEndANA5_DiffANA4pANA5n
Single Endned ANA5 Signal Or Differential ANA4+, ANA5- signal.

enumerator kCADC_SingleEndANA6_DiffANA6pANA7n
Single Endned ANA6 Signal Or Differential ANA6+, ANA7- signal.

enumerator kCADC_SingleEndANA7_DiffANA6pANA7n
Single Endned ANA7 Signal Or Differential ANA6+, ANA7- signal.

enumerator kCADC_SingleEndANB0_DiffANB0pANB1n
Single Endned ANB0 Signal Or Differential ANB0+, ANB1- signal.

enumerator kCADC_SingleEndANB1_DiffANB0pANB1n
Single Endned ANB1 Signal Or Differential ANB0+, ANB1- signal.

enumerator kCADC_SingleEndANB2_DiffANB2pANB3n
Single Endned ANB2 Signal Or Differential ANB2+, ANB3- signal.

enumerator kCADC_SingleEndANB3_DiffANB2pANB3n
Single Endned ANB3 Signal Or Differential ANB2+, ANB3- signal.

enumerator kCADC_SingleEndANB4_DiffANB4pANB5n
Single Endned ANB4 Signal Or Differential ANB4+, ANB5- signal.

enumerator kCADC_SingleEndANB5_DiffANB4pANB5n
Single Endned ANB5 Signal Or Differential ANB4+, ANB5- signal.

enumerator kCADC_SingleEndANB6_DiffANB6pANB7n
Single Endned ANB6 Signal Or Differential ANB6+, ANB7- signal.

enumerator kCADC_SingleEndANB7_DiffANB6pANB7n
Single Endned ANB7 Signal Or Differential ANB6+, ANB7- signal.

enum _cadc_sample_slot_mask
The enumeration of sample slot mask.

Values:

enumerator kCADC_NonSampleSlotMask

enumerator kCADC_SampleSlot0Mask
The mask of sample slot0.

enumerator kCADC_SampleSlot1Mask
The mask of sample slot1.

enumerator kCADC_SampleSlot2Mask
The mask of sample slot2.

enumerator kCADC_SampleSlot3Mask
The mask of sample slot3.

enumerator kCADC_SampleSlot4Mask
The mask of sample slot4.

enumerator kCADC_SampleSlot5Mask
The mask of sample slot5.

enumerator kCADC_SampleSlot6Mask
The mask of sample slot6.

enumerator kCADC_SampleSlot7Mask
The mask of sample slot7.

enumerator kCADC_SampleSlot8Mask
The mask of sample slot8.

enumerator kCADC_SampleSlot9Mask
The mask of sample slot9.

enumerator kCADC_SampleSlot10Mask
The mask of sample slot10.

enumerator kCADC_SampleSlot11Mask
The mask of sample slot11.

enumerator kCADC_SampleSlot12Mask
The mask of sample slot12.

enumerator kCADC_SampleSlot13Mask
The mask of sample slot13.

enumerator kCADC_SampleSlot14Mask
The mask of sample slot14.

enumerator kCADC_SampleSlot15Mask
The mask of sample slot15.

enumerator kCADC_AllSampleSlotsMask
The mask of all sample slots.

enum _cadc_sample_slot_index
The enumeration of sample slot index.

Values:

enumerator kCADC_SampleSlot0Index
The index of sample slot0.

enumerator kCADC_SampleSlot1Index
The index of sample slot1.

enumerator kCADC_SampleSlot2Index
The index of sample slot2.

enumerator kCADC_SampleSlot3Index
The index of sample slot3.

enumerator kCADC_SampleSlot4Index
The index of sample slot4.

enumerator kCADC_SampleSlot5Index
The index of sample slot5.

enumerator kCADC_SampleSlot6Index
The index of sample slot6.

enumerator kCADC_SampleSlot7Index
The index of sample slot7.

enumerator kCADC_SampleSlot8Index
The index of sample slot8.

enumerator kCADC_SampleSlot9Index
The index of sample slot9.

enumerator kCADC_SampleSlot10Index
The index of sample slot10.

enumerator kCADC_SampleSlot11Index
The index of sample slot11.

enumerator kCADC_SampleSlot12Index
The index of sample slot12.

enumerator kCADC_SampleSlot13Index
The index of sample slot13.

enumerator kCADC_SampleSlot14Index
The index of sample slot14.

enumerator kCADC_SampleSlot15Index
The index of sample slot15.

enum _cadc_sample_slot_sequential_mode_disabled
The enumeration for the sample slot to be disabled in sequential mode.

Values:

enumerator kCADC_Sample0Disabled
Disable Sample slot0, the scan will stop at sample slot0 in sequential scan mode

enumerator kCADC_Sample1Disabled
Disable Sample slot1, the scan will stop at sample slot1 in sequential scan mode

enumerator kCADC_Sample2Disabled
Disable Sample slot2, the scan will stop at sample slot2 in sequential scan mode

enumerator kCADC_Sample3Disabled
Disable Sample slot3, the scan will stop at sample slot3 in sequential scan mode

enumerator kCADC_Sample4Disabled
Disable Sample slot4, the scan will stop at sample slot4 in sequential scan mode

enumerator kCADC_Sample5Disabled
Disable Sample slot5, the scan will stop at sample slot5 in sequential scan mode

enumerator kCADC_Sample6Disabled
Disable Sample slot6, the scan will stop at sample slot6 in sequential scan mode

enumerator kCADC_Sample7Disabled
Disable Sample slot7, the scan will stop at sample slot7 in sequential scan mode

enumerator kCADC_Sample8Disabled
Disable Sample slot8, the scan will stop at sample slot8 in sequential scan mode

enumerator kCADC_Sample9Disabled
Disable Sample slot9, the scan will stop at sample slot9 in sequential scan mode

enumerator kCADC_Sample10Disabled
Disable Sample slot10, the scan will stop at sample slot10 in sequential scan mode

enumerator kCADC_Sample11Disabled
Disable Sample slot11, the scan will stop at sample slot11 in sequential scan mode

enumerator kCADC_Sample12Disabled
Disable Sample slot12, the scan will stop at sample slot12 in sequential scan mode

enumerator kCADC_Sample13Disabled
Disable Sample slot13, the scan will stop at sample slot13 in sequential scan mode

enumerator kCADC_Sample14Disabled
Disable Sample slot14, the scan will stop at sample slot14 in sequential scan mode

enumerator kCADC_Sample15Disabled
Disable Sample slot15, the scan will stop at sample slot15 in sequential scan mode

enum _cadc_sample_slot_simultParallel_mode_disabled
The enumeration for the sample slot to be disabled in simultaneous parallel mode.

Values:

enumerator kCADC_Sample0_8Disabled
Disable Sample slot0 and Sample Slot 8, in the simultaneous parallel mode the converter A and converter B will stop at Sample slot0 and Sample slot 8.

enumerator kCADC_Sample1_9Disabled
Disable Sample slot1 and Sample Slot 9, in the simultaneous parallel mode the converter A and converter B will stop at Sample slot1 and Sample slot 9.

enumerator kCADC_Sample2_10Disabled
Disable Sample slot2 and Sample Slot 10, in the simultaneous parallel mode the converter A and converter B will stop at Sample slot2 and Sample slot 10.

enumerator kCADC_Sample3_11Disabled
Disable Sample slot3 and Sample Slot 11, in the simultaneous parallel mode the converter A and converter B will stop at Sample slot3 and Sample slot 11.

enumerator kCADC_Sample4_12Disabled
Disable Sample slot4 and Sample Slot 12, in the simultaneous parallel mode the converter A and converter B will stop at Sample slot4 and Sample slot 12.

enumerator kCADC_Sample5_13Disabled

Disable Sample slot5 and Sample Slot 13, in the simultaneous parallel mode the converter A and converter B will stop at Sample slot5 and Sample slot 13.

enumerator kCADC_Sample6_14Disabled

Disable Sample slot6 and Sample Slot 14, in the simultaneous parallel mode the converter A and converter B will stop at Sample slot7 and Sample slot 14.

enumerator kCADC_Sample7_15Disabled

Disable Sample slot7 and Sample Slot 15, in the simultaneous parallel mode the converter A and converter B will stop at Sample slot7 and Sample slot 15.

enum _cadc_sample_slot_independentParallel_mode_convA_disabled

The enumeration for the sample slot to be disabled for the converter A in independent parallel mode.

Values:

enumerator kCADC_ConvASample0Disabled

Disable Sample slot0, the scan will stop at sample slot0 in sequential scan mode

enumerator kCADC_ConvASample1Disabled

Disable Sample slot1, the scan will stop at sample slot1 in sequential scan mode

enumerator kCADC_ConvASample2Disabled

Disable Sample slot2, the scan will stop at sample slot2 in sequential scan mode

enumerator kCADC_ConvASample3Disabled

Disable Sample slot3, the scan will stop at sample slot3 in sequential scan mode

enumerator kCADC_ConvASample4Disabled

Disable Sample slot4, the scan will stop at sample slot4 in sequential scan mode

enumerator kCADC_ConvASample5Disabled

Disable Sample slot5, the scan will stop at sample slot5 in sequential scan mode

enumerator kCADC_ConvASample6Disabled

Disable Sample slot6, the scan will stop at sample slot6 in sequential scan mode

enumerator kCADC_ConvASample7Disabled

Disable Sample slot7, the scan will stop at sample slot7 in sequential scan mode

enumerator kCADC_ConvASampleReserved

Reserved

enum _cadc_sample_slot_indParallel_mode_convB_disabled

The enumeration for the sample slot to be disabled for the converter B in independent parallel mode.

Values:

enumerator kCADC_ConvBSample8Disabled

Disable Sample slot8, the scan will stop at sample slot8 in sequential scan mode

enumerator kCADC_ConvBSample9Disabled

Disable Sample slot9, the scan will stop at sample slot9 in sequential scan mode

enumerator kCADC_ConvBSample10Disabled

Disable Sample slot10, the scan will stop at sample slot10 in sequential scan mode

enumerator kCADC_ConvBSample11Disabled

Disable Sample slot11, the scan will stop at sample slot11 in sequential scan mode

enumerator kCADC_ConvBSample12Disabled
Disable Sample slot12, the scan will stop at sample slot12 in sequential scan mode

enumerator kCADC_ConvBSample13Disabled
Disable Sample slot13, the scan will stop at sample slot13 in sequential scan mode

enumerator kCADC_ConvBSample14Disabled
Disable Sample slot14, the scan will stop at sample slot14 in sequential scan mode

enumerator kCADC_ConvBSample15Disabled
Disable Sample slot15, the scan will stop at sample slot15 in sequential scan mode

enumerator kCADC_ConvBSampleReserved
Reserved

enum _cadc_sample_slot_zero_crossing_mode
The enumeration for the sample slot's zero crossing event.

Values:

enumerator kCADC_ZeroCrossingDisabled
Zero Crossing disabled.

enumerator kCADC_ZeroCrossingForPtoNSign
Zero Crossing enabled for positive to negative sign change.

enumerator kCADC_ZeroCrossingForNtoPSign
Zero Crossing enabled for negative to positive sign change.

enumerator kCADC_ZeroCrossingForAnySignChanged
Zero Crossing enabled for any sign change.

enum _cadc_expansion_mux_operate_mode
The enumeration for expansion multiplexer.

Values:

enumerator kCADC_ExpMuxManualMode
MUX channel feeding to ANA4/ANB4 is selected as MUXSEL0.

enumerator kCADC_ExpMuxScanMode0
The sample completion of ANA4/ANB4 enableds subsequent selected channel.

enumerator kCADC_ExpMuxScanMode1
The sample completion of ANA7/ANB7 enableds subsequent selected channel.

enumerator kCADC_ExpMuxScanMode2
The sample completion of ANA4/ANB4 or ANA7/ANB7 enableds subsequent selected channel.

enum _cadc_auxiliary_control
The enumeration of conveter's auxiliary control.

Values:

enumerator kCADC_AuxSel0_Config0
Auxiliary select 0 controls AUX_SEL0 = 0, AUX_SEL1 = 0.

enumerator kCADC_AuxSel0_Config1
Auxiliary select 0 controls AUX_SEL0 = 1, AUX_SEL1 = 0.

enumerator kCADC_AuxSel0_Config2
Auxiliary select 0 controls AUX_SEL0 = 0, AUX_SEL1 = 1.

enumerator kCADC_AuxSel0_Config3
Auxiliary select 0 controls AUX_SEL0 = 1, AUX_SEL1 = 1.

enumerator kCADC_AuxSel1_Config0
Auxiliary select 1 controls AUX_SEL0 = 0, AUX_SEL1 = 0.

enumerator kCADC_AuxSel1_Config1
Auxiliary select 1 controls AUX_SEL0 = 1, AUX_SEL1 = 0.

enumerator kCADC_AuxSel1_Config2
Auxiliary select 1 controls AUX_SEL0 = 0, AUX_SEL1 = 1.

enumerator kCADC_AuxSel1_Config3
Auxiliary select 1 controls AUX_SEL0 = 1, AUX_SEL1 = 1.

enumerator kCADC_AuxSel2_Config0
Auxiliary select 2 controls AUX_SEL0 = 0, AUX_SEL1 = 0.

enumerator kCADC_AuxSel2_Config1
Auxiliary select 2 controls AUX_SEL0 = 1, AUX_SEL1 = 0.

enumerator kCADC_AuxSel2_Config2
Auxiliary select 2 controls AUX_SEL0 = 0, AUX_SEL1 = 1.

enumerator kCADC_AuxSel2_Config3
Auxiliary select 2 controls AUX_SEL0 = 1, AUX_SEL1 = 1.

enumerator kCADC_AuxSel3_Config0
Auxiliary select 3 controls AUX_SEL0 = 0, AUX_SEL1 = 0.

enumerator kCADC_AuxSel3_Config1
Auxiliary select 3 controls AUX_SEL0 = 1, AUX_SEL1 = 0.

enumerator kCADC_AuxSel3_Config2
Auxiliary select 3 controls AUX_SEL0 = 0, AUX_SEL1 = 1.

enumerator kCADC_AuxSel3_Config3
Auxiliary select 3 controls AUX_SEL0 = 1, AUX_SEL1 = 1.

enumerator kCADC_AuxSel4_Config0
Auxiliary select 4 controls AUX_SEL0 = 0, AUX_SEL1 = 0.

enumerator kCADC_AuxSel4_Config1
Auxiliary select 4 controls AUX_SEL0 = 1, AUX_SEL1 = 0.

enumerator kCADC_AuxSel4_Config2
Auxiliary select 4 controls AUX_SEL0 = 0, AUX_SEL1 = 1.

enumerator kCADC_AuxSel4_Config3
Auxiliary select 4 controls AUX_SEL0 = 1, AUX_SEL1 = 1.

enumerator kCADC_AuxSel5_Config0
Auxiliary select 5 controls AUX_SEL0 = 0, AUX_SEL1 = 0.

enumerator kCADC_AuxSel5_Config1
Auxiliary select 5 controls AUX_SEL0 = 1, AUX_SEL1 = 0.

enumerator kCADC_AuxSel5_Config2
Auxiliary select 5 controls AUX_SEL0 = 0, AUX_SEL1 = 1.

enumerator kCADC_AuxSel5_Config3
Auxiliary select 5 controls AUX_SEL0 = 1, AUX_SEL1 = 1.

enumerator kCADC_AuxSel6_Config0
Auxiliary select 6 controls AUX_SEL0 = 0, AUX_SEL1 = 0.

enumerator kCADC_AuxSel6_Config1
Auxiliary select 6 controls AUX_SEL0 = 1, AUX_SEL1 = 0.

enumerator kCADC_AuxSel6_Config2
Auxiliary select 6 controls AUX_SEL0 = 0, AUX_SEL1 = 1.

enumerator kCADC_AuxSel6_Config3
Auxiliary select 6 controls AUX_SEL0 = 1, AUX_SEL1 = 1.

enumerator kCADC_AuxSel7_Config0
Auxiliary select 7 controls AUX_SEL0 = 0, AUX_SEL1 = 0.

enumerator kCADC_AuxSel7_Config1
Auxiliary select 7 controls AUX_SEL0 = 1, AUX_SEL1 = 0.

enumerator kCADC_AuxSel7_Config2
Auxiliary select 7 controls AUX_SEL0 = 0, AUX_SEL1 = 1.

enumerator kCADC_AuxSel7_Config3
Auxiliary select 7 controls AUX_SEL0 = 1, AUX_SEL1 = 1.

enum _cadc_expansion_disabled_mux_slot
The enumeration for the expansion mux slot to be disabled.

Values:

enumerator kCADC_ExpaMuxNoDisable
Expansion mux scan not disabled.

enumerator kCADC_ExpMux0Disable
Expansion mux slot 0.

enumerator kCADC_ExpMux1Disable
Expansion mux slot 1.

enumerator kCADC_ExpMux2Disable
Expansion mux slot 2.

enumerator kCADC_ExpMux3Disable
Expansion mux slot 3.

enumerator kCADC_ExpMux4Disable
Expansion mux slot 4.

enumerator kCADC_ExpMux5Disable
Expansion mux slot 5.

enumerator kCADC_ExpMux6Disable
Expansion mux slot 6.

enumerator kCADC_ExpMux7Disable
Expansion mux slot 7.

enum _cadc_expansion_mux_selection
The enumeration of expanssion mux selection.

Values:

enumerator kCADC_MuxSel0_Channel0
MUX's channel 0 for MUXSEL0.

enumerator kCADC_MuxSel0_Channel1
MUX's channel 1 for MUXSEL0.

enumerator kCADC_MuxSel0_Channel2
MUX's channel 2 for MUXSEL0.

enumerator kCADC_MuxSel0_Channel3
MUX's channel 3 for MUXSEL0.

enumerator kCADC_MuxSel0_Channel4
MUX's channel 4 for MUXSEL0.

enumerator kCADC_MuxSel0_Channel5
MUX's channel 5 for MUXSEL0.

enumerator kCADC_MuxSel0_Channel6
MUX's channel 6 for MUXSEL0.

enumerator kCADC_MuxSel0_Channel7
MUX's channel 7 for MUXSEL0.

enumerator kCADC_MuxSel1_Channel0
MUX's channel 0 for MUXSEL1.

enumerator kCADC_MuxSel1_Channel1
MUX's channel 1 for MUXSEL1.

enumerator kCADC_MuxSel1_Channel2
MUX's channel 2 for MUXSEL1.

enumerator kCADC_MuxSel1_Channel3
MUX's channel 3 for MUXSEL1.

enumerator kCADC_MuxSel1_Channel4
MUX's channel 4 for MUXSEL1.

enumerator kCADC_MuxSel1_Channel5
MUX's channel 5 for MUXSEL1.

enumerator kCADC_MuxSel1_Channel6
MUX's channel 6 for MUXSEL1.

enumerator kCADC_MuxSel1_Channel7
MUX's channel 7 for MUXSEL1.

enumerator kCADC_MuxSel2_Channel0
MUX's channel 0 for MUXSEL2.

enumerator kCADC_MuxSel2_Channel1
MUX's channel 1 for MUXSEL2.

enumerator kCADC_MuxSel2_Channel2
MUX's channel 2 for MUXSEL2.

enumerator kCADC_MuxSel2_Channel3
MUX's channel 3 for MUXSEL2.

enumerator kCADC_MuxSel2_Channel4
MUX's channel 4 for MUXSEL2.

enumerator kCADC_MuxSel2_Channel5
MUX's channel 5 for MUXSEL2.

enumerator kCADC_MuxSel2_Channel6
MUX's channel 6 for MUXSEL2.

enumerator kCADC_MuxSel2_Channel7
MUX's channel 7 for MUXSEL2.

enumerator kCADC_MuxSel3_Channel0
MUX's channel 0 for MUXSEL3.

enumerator kCADC_MuxSel3_Channel1
MUX's channel 1 for MUXSEL3.

enumerator kCADC_MuxSel3_Channel2
MUX's channel 2 for MUXSEL3.

enumerator kCADC_MuxSel3_Channel3
MUX's channel 3 for MUXSEL3.

enumerator kCADC_MuxSel3_Channel4
MUX's channel 4 for MUXSEL3.

enumerator kCADC_MuxSel3_Channel5
MUX's channel 5 for MUXSEL3.

enumerator kCADC_MuxSel3_Channel6
MUX's channel 6 for MUXSEL3.

enumerator kCADC_MuxSel3_Channel7
MUX's channel 7 for MUXSEL3.

enumerator kCADC_MuxSel4_Channel0
MUX's channel 0 for MUXSEL4.

enumerator kCADC_MuxSel4_Channel1
MUX's channel 1 for MUXSEL4.

enumerator kCADC_MuxSel4_Channel2
MUX's channel 2 for MUXSEL4.

enumerator kCADC_MuxSel4_Channel3
MUX's channel 3 for MUXSEL4.

enumerator kCADC_MuxSel4_Channel4
MUX's channel 4 for MUXSEL4.

enumerator kCADC_MuxSel4_Channel5
MUX's channel 5 for MUXSEL4.

enumerator kCADC_MuxSel4_Channel6
MUX's channel 6 for MUXSEL4.

enumerator kCADC_MuxSel4_Channel7
MUX's channel 7 for MUXSEL4.

enumerator kCADC_MuxSel5_Channel0
MUX's channel 0 for MUXSEL5.

enumerator kCADC_MuxSel5_Channel1
MUX's channel 1 for MUXSEL5.

enumerator kCADC_MuxSel5_Channel2
MUX's channel 2 for MUXSEL5.

enumerator kCADC_MuxSel5_Channel3
MUX's channel 3 for MUXSEL5.

enumerator kCADC_MuxSel5_Channel4
MUX's channel 4 for MUXSEL5.

enumerator kCADC_MuxSel5_Channel5
MUX's channel 5 for MUXSEL5.

enumerator kCADC_MuxSel5_Channel6
MUX's channel 6 for MUXSEL5.

enumerator kCADC_MuxSel5_Channel7
MUX's channel 7 for MUXSEL5.

enumerator kCADC_MuxSel6_Channel0
MUX's channel 0 for MUXSEL6.

enumerator kCADC_MuxSel6_Channel1
MUX's channel 1 for MUXSEL6.

enumerator kCADC_MuxSel6_Channel2
MUX's channel 2 for MUXSEL6.

enumerator kCADC_MuxSel6_Channel3
MUX's channel 3 for MUXSEL6.

enumerator kCADC_MuxSel6_Channel4
MUX's channel 4 for MUXSEL6.

enumerator kCADC_MuxSel6_Channel5
MUX's channel 5 for MUXSEL6.

enumerator kCADC_MuxSel6_Channel6
MUX's channel 6 for MUXSEL6.

enumerator kCADC_MuxSel6_Channel7
MUX's channel 7 for MUXSEL6.

enumerator kCADC_MuxSel7_Channel0
MUX's channel 0 for MUXSEL7.

enumerator kCADC_MuxSel7_Channel1
MUX's channel 1 for MUXSEL7.

enumerator kCADC_MuxSel7_Channel2
MUX's channel 2 for MUXSEL7.

enumerator kCADC_MuxSel7_Channel3
MUX's channel 3 for MUXSEL7.

enumerator kCADC_MuxSel7_Channel4
MUX's channel 4 for MUXSEL7.

enumerator kCADC_MuxSel7_Channel5
MUX's channel 5 for MUXSEL7.

enumerator kCADC_MuxSel7_Channel6
MUX's channel 6 for MUXSEL7.

enumerator kCADC_MuxSel7_Channel7
MUX's channel 7 for MUXSEL7.

typedef enum *_cadc_converter_id* cadc_converter_id_t
CADC Converter identifier.

typedef enum *_cadc_idle_work_mode* cadc_idle_work_mode_t
The enumeration of work mode when the module is not used.

typedef enum *_cadc_dma_trigger_source* cadc_dma_trigger_source_t
The enumeration of DMA trigger source.

typedef enum *_cadc_scan_mode* cadc_scan_mode_t
The enumeration of dual converter's scan mode.

typedef enum *_cadc_reference_voltage_source* cadc_reference_voltage_source_t
The enumeration of converter's reference voltage source.

typedef enum *_cadc_channel_gain* cadc_channel_gain_t
The enumeration of sample slot connected channel gain.

typedef enum *_cadc_channel_mode* cadc_channel_mode_t
The enumeration of all channels' channel mode.

typedef enum *_cadc_channel_number* cadc_channel_number_t
The enumerator of all channels that can be routed to the specific sample slot.

typedef enum *_cadc_sample_slot_mask* cadc_sample_slot_mask_t
The enumeration of sample slot mask.

typedef enum *_cadc_sample_slot_index* cadc_sample_slot_index_t
The enumeration of sample slot index.

typedef enum *_cadc_sample_slot_sequential_mode_disabled* cadc_sample_slot_sequential_mode_disabled_t
The enumeration for the sample slot to be disabled in sequential mode.

typedef enum *_cadc_sample_slot_simultParallel_mode_disabled* cadc_sample_slot_simultParallel_mode_disabled_t
The enumeration for the sample slot to be disabled in simultaneous parallel mode.

typedef enum *_cadc_sample_slot_independentParallel_mode_convA_disabled* cadc_sample_slot_independentParallel_mode_convA_disabled_t
The enumeration for the sample slot to be disabled for the converter A in independent parallel mode.

typedef enum *_cadc_sample_slot_indParallel_mode_convB_disabled* cadc_sample_slot_independentParallel_mode_convB_disabled_t
The enumeration for the sample slot to be disabled for the converter B in independent parallel mode.

typedef enum *_cadc_sample_slot_zero_crossing_mode* cadc_sample_slot_zero_crossing_mode_t
The enumeration for the sample slot's zero crossing event.

typedef enum *_cadc_expansion_mux_operate_mode* cadc_expansion_mux_operate_mode_t
The enumeration for expansion multiplexer.

typedef struct *_cadc_sample_slot_independentParallel_mode_disabled* cadc_sample_slot_independentParallel_mode_disabled_t
The structure of the disabled sample slots in independent parallel mode.

typedef union *_cadc_sample_slot_disabled* cadc_sample_slot_disabled_t
The union of disabled sample slot for each scan mode.

typedef struct *_cadc_sample_config* cadc_sample_slot_config_t
    The structure for configuring the sample slot.

typedef struct *_cadc_scan_ctrl_sequential_mode* cadc_scan_ctrl_seq_mode_t
    Cadc scan control for sequential scan mode.

    Note: Each member of this structure represent one bit of the word. Asserted the structure's member means delay sample until a new sync input occurs. Cleared the structure's member means perform sample immediately after the completion of the current sample.

typedef struct *_cadc_scan_ctrl_simultParallel_mode* cadc_scan_ctrl_simultParallel_mode_t
    Cadc scan control for simultaneous parallel scan mode.

    Note: Each member of this structure represent one bit of the word. Asserted the structure's member means delay sample until a new sync input occurs. Cleared the structure's member means perform sample immediately after the completion of the current sample.

typedef struct *_cadc_scan_ctrl_independent_parallel_mode_converterA* cadc_scan_ctrl_independent_parallel_mode_converterA_t
    The scan ctrl struture for converterA in independent scan mode.

typedef struct *_cadc_scan_ctrl_independent_parallel_mode_converterB* cadc_scan_ctrl_independent_parallel_mode_converterB_t
    The scan ctrl struture for converterB in independent scan mode.

typedef union *_cadc_scan_ctrl_independent_parallel_mode* cadc_scan_ctrl_independent_parallel_mode_t
    The union for converters in independent parallel mode.

typedef union *_cadc_scan_control* cadc_scan_control_t
    The union of the scan control for each scan mode.

typedef enum *_cadc_auxiliary_control* cadc_auxiliary_control_t
    The enumeration of conveter's auxiliary control.

typedef enum *_cadc_expansion_disabled_mux_slot* cadc_expansion_disabled_mux_slot_t
    The enumeration for the expansion mux slot to be disabled.

typedef enum *_cadc_expansion_mux_selection* cadc_expansion_mux_selection_t
    The enumeration of expanssion mux selection.

typedef struct *_cadc_exp_mux_aux_config* cadc_exp_mux_aux_config_t
    The structure for configuring Cyclic ADC's expansion setting.

typedef struct *_cadc_converter_config* cadc_converter_config_t
    The structure for configuring each converter.

typedef struct *_cadc_config* cadc_config_t
    The structure for configuring the Cyclic ADC's setting.

CADC_SAMPLE_SLOTS_COUNT
    Macro for CADC sample slot count.

struct _cadc_sample_slot_independentParallel_mode_disabled
    #include <fsl_cadc.h> The structure of the disabled sample slots in independent parallel mode.

Public Members

cadc_sample_slot_independentParallel_mode_convA_disabled_t eConverterA

The sample slot to be disabled for the converter A, when the scan mode is set as independent parallel mode.

cadc_sample_slot_independentParallel_mode_convB_disabled_t eConverterB

The sample slot to be disabled for the converter B, when the scan mode is set as independent parallel mode.

union _cadc_sample_slot_disabled

#include <fsl_cadc.h> The union of disabled sample slot for each scan mode.

Public Members

uint32_t u32SampleDisVal

The 32 bits width of disabled sample slot value. This member used to get the disabled sample slot which sets in different scan modes in word type. This member is not recommended to be used to set the disabled sample slot. This member is designed to be used in driver level only, the application should not use this member.

cadc_sample_slot_sequential_mode_disabled_t eSequentialModeDisSample

If the scan mode is selected as sequential mode, the application must use this member to set the disabled sample slot. This member is used to set disabled sample slot when the scan mode is selected as sequential mode. The scan will stop at the first disabled sample slot in that mode. So for the application, this member should be set as one sample slot index that the scan will stop.

cadc_sample_slot_simultParallel_mode_disabled_t eSimultParallelModeDisSample

In simultaneous parallel scan mode, the application must use this member to set the disabled sample slot. In that scan mode, the scan will stop when either converter encounters a disabled sample.

cadc_sample_slot_independentParallel_mode_disabled_t sIndependentParallelModeDisSample

In independent parallel scan mode, the application must use this member to set the disabled sample slot. In that scan mode, the converter will stop scan when it encounters a disabled sample slot. In this mode, the disabled sample slot for converterA and converterB may different.

struct _cadc_sample_config

#include <fsl_cadc.h> The structure for configuring the sample slot.

Public Members

cadc_sample_slot_zero_crossing_mode_t eZeroCrossingMode

Zero crossing mode.

uint16_t u16HighLimitValue

High limit value. Original value formation as hardware register, with 3-bits left shifted.

uint16_t u16LowLimitValue

Low limit value. Original value formation as hardware register, with 3-bits left shifted.

uint16_t u16OffsetValue

Offset value. Original value formation as hardware register, with 3-bits left shifted.

struct _cadc_scan_ctrl_sequential_mode

#include <fsl_cadc.h> Cadc scan control for sequential scan mode.

Note: Each member of this structure represent one bit of the word. Asserted the structure's member means delay sample until a new sync input occurs. Cleared the structure's member means perform sample immediately after the completion of the current sample.

Public Members

uint32_t bitSample0
: Control whether delay sample0 until a new sync input occurs.

uint32_t bitSample1
: Control whether delay sample1 until a new sync input occurs.

uint32_t bitSample2
: Control whether delay sample2 until a new sync input occurs.

uint32_t bitSample3
: Control whether delay sample3 until a new sync input occurs.

uint32_t bitSample4
: Control whether delay sample4 until a new sync input occurs.

uint32_t bitSample5
: Control whether delay sample5 until a new sync input occurs.

uint32_t bitSample6
: Control whether delay sample6 until a new sync input occurs.

uint32_t bitSample7
: Control whether delay sample7 until a new sync input occurs.

uint32_t bitSample8
: Control whether delay sample8 until a new sync input occurs.

uint32_t bitSample9
: Control whether delay sample9 until a new sync input occurs.

uint32_t bitSample10
: Control whether delay sample10 until a new sync input occurs.

uint32_t bitSample11
: Control whether delay sample11 until a new sync input occurs.

uint32_t bitSample12
: Control whether delay sample12 until a new sync input occurs.

uint32_t bitSample13
: Control whether delay sample13 until a new sync input occurs.

uint32_t bitSample14
: Control whether delay sample14 until a new sync input occurs.

uint32_t bitSample15
: Control whether delay sample15 until a new sync input occurs.

uint32_t bitsReserved
: Reserved 16 bits.

struct _cadc_scan_ctrl_simultParallel_mode
#include <fsl_cadc.h> Cadc scan control for simultaneous parallel scan mode.

Note: Each member of this structure represent one bit of the word. Asserted the structure's member means delay sample until a new sync input occurs. Cleared the structure's member means perform sample immediately after the completion of the current sample.

Public Members

uint32_t bitSample0_8
Control whether delay sample0 and sample8 until a new sync input occurs.

uint32_t bitSample1_9
Control whether delay sample1 and sample9 until a new sync input occurs.

uint32_t bitSample2_10
Control whether delay sample2 and sample10 until a new sync input occurs.

uint32_t bitSample3_11
Control whether delay sample3 and sample11 until a new sync input occurs.

uint32_t bitsReserved1
Reserved 4 bits.

uint32_t bitSample4_12
Control whether delay sample4 and sample12 until a new sync input occurs.

uint32_t bitSample5_13
Control whether delay sample5 and sample13 until a new sync input occurs.

uint32_t bitSample6_14
Control whether delay sample6 and sample14 until a new sync input occurs.

uint32_t bitSample7_15
Control whether delay sample7 and sample15 until a new sync input occurs.

uint32_t bitsReserved2
Reserved 4 bits.

uint32_t bitsReserved3
Reserved 16 bits.

struct _cadc_scan_ctrl_independent_parallel_mode_converterA
#include <fsl_cadc.h> The scan ctrl struture for converterA in independent scan mode.

Public Members

uint32_t bitSample0
Control whether delay converterA's sample0 until a new sync input occurs.

uint32_t bitSample1
Control whether delay converterA's sample1 until a new sync input occurs.

uint32_t bitSample2
Control whether delay converterA's sample2 until a new sync input occurs.

uint32_t bitSample3
Control whether delay converterA's sample3 until a new sync input occurs.

uint32_t bitsReserved1
Reserved 4 bits.

uint32_t bitSample4
Control whether delay converterA's sample4 until a new sync input occurs.

uint32_t bitSample5
Control whether delay converterA's sample5 until a new sync input occurs.

uint32_t bitSample6
Control whether delay converterA's sample6 until a new sync input occurs.

uint32_t bitSample7
Control whether delay converterA's sample7 until a new sync input occurs.

uint32_t bitsReserved2
Reserved 4 bits

uint32_t bitsReserved3
Reserved 16 bits.

struct _cadc_scan_ctrl_independent_parallel_mode_converterB
#include <fsl_cadc.h> The scan ctrl struture for converterB in independent scan mode.

Public Members

uint32_t bitsReserved1
Reserved 4 bits.

uint32_t bitSample8
Control whether delay converterB's sample8 until a new sync input occurs.

uint32_t bitSample9
Control whether delay converterB's sample9 until a new sync input occurs.

uint32_t bitSample10
Control whether delay converterB's sample10 until a new sync input occurs.

uint32_t bitSample11
Control whether delay converterB's sample11 until a new sync input occurs.

uint32_t bitsReserved2
Reserved 4 bits.

uint32_t bitSample12
Control whether delay converterB's sample12 until a new sync input occurs.

uint32_t bitSample13
Control whether delay converterB's sample13 until a new sync input occurs.

uint32_t bitSample14
Control whether delay converterB's sample14 until a new sync input occurs.

uint32_t bitSample15
Control whether delay converterB's sample15 until a new sync input occurs.

uint32_t bitsReserved3
Reserved 16 bits.

union _cadc_scan_ctrl_independent_parallel_mode
#include <fsl_cadc.h> The union for converters in independent parallel mode.

Public Members

cadc_scan_ctrl_independent_parallel_mode_converterA_t sConverterA
Scan control for converterA.

cadc_scan_ctrl_independent_parallel_mode_converterB_t sConverterB
Scan control for converterB.

union _cadc_scan_control
#include <fsl_cadc.h> The union of the scan control for each scan mode.

Public Members

uint32_t u32ScanCtrlVal
The 32 bits value of the scan control value.

cadc_scan_ctrl_seq_mode_t sSequential
Scan control for sequential scan mode.

cadc_scan_ctrl_simultParallel_mode_t sSimultParallel
Scan control for simultaneous parallel scan mode.

cadc_scan_ctrl_independent_parallel_mode_t uIndependentParallel
Scan control for independent scan mode.

struct _cadc_exp_mux_aux_config
#include <fsl_cadc.h> The structure for configuring Cyclic ADC's expansion setting.

Public Members

uint16_t u16AuxControl
The mask of auxiliary control, should be the OR'ed value of cadc_auxiliary_control_t.

uint32_t u32MuxChannelMask
The mask of mux selection of all mux solts, should be the OR'ed value of cadc_expansion_mux_selection_t.

cadc_expansion_disabled_mux_slot_t disabledMuxSlot
mux slot to disabled in the scan.

struct _cadc_converter_config
#include <fsl_cadc.h> The structure for configuring each converter.

Public Members

uint16_t u16ClockDivisor
Converter's clock divisor for the clock source. Available setting range is 0-63.

- When the clockDivisor is 0, the divisor is 2.
- For all other clockDivisor values, the divisor is 1 more than the decimal value of clockDivisor: clockDivisor + 1

cadc_reference_voltage_source_t eHighReferenceVoltageSource
High voltage reference source.

cadc_reference_voltage_source_t eLowReferenceVoltageSource
Low reference voltage source.

bool bEnableDMA

Enable/Disable DMA.

bool bPowerUp

Power up or power down the converter.

bool bScanInitBySync

The member user to control the initiate method of the scan.

- **true** Use a SYNC input pulse or START command to initiate a scan.
- **false** Scan is initiated by the assertion of START command only.

cadc_exp_mux_aux_config_t muxAuxConfig

Configuration of expansion mux and auxiliary control.

struct _cadc_config

#include <fsl_cadc.h> The structure for configuring the Cyclic ADC's setting.

Public Members

cadc_idle_work_mode_t eIdleWorkMode

Idle work mode for the module.

cadc_dma_trigger_source_t eDMATriggerSource

Selects the dma trigger source for the module.

uint16_t u16PowerUpDelay

The number of ADC clocks to power up the converters (if powered up), before allowing a scan to start. The available range is 0 to 63 .

uint32_t u32EnabledInterruptMask

The mask of the interrupts to be enabled, should be the OR'ed value of _cadc_interrupt_enable.

cadc_scan_mode_t eScanMode

The scan mode of the module.

cadc_sample_slot_disabled_t uDisabledSampleSlot

The member used to config the which sample slot is disabled for the scan. The scan will continue until the first disabled sample slot is encountered.

cadc_scan_control_t uScanControl

Scan control provides the ability to pause and await a new sync signal while current sample completed.

uint32_t u32ChannelModeMask

The mask of each channel's mode, should be the OR'ed value of cadc_channel_mode_t. Each channel supports single-end and differential(Fully differentail and Unipolar

differential). Some devices also support alternate source mode.

cadc_channel_gain_t eChannelGain[(ADC_RSLT_COUNT)]

The gain value for each channel. Each element of the array represents the gain of the channel. E.g. eChannelGain[0] means channel gain of channel0, which is ANA0.

cadc_channel_number_t eSampleSlot[(ADC_RSLT_COUNT)]

The channel assigned to each sample slot. The index of the array represents sample slot index.

cadc_converter_config_t sConverterA
The configuration for converterA.

cadc_converter_config_t sConverterB
The configuration for converterB.

2.2 The Driver Change Log

2.3 CADC Peripheral and Driver Overview

2.4 Clock Driver

enum _clock_ip_name
List of IP clock name.

Values:

enumerator kCLOCK_GPIOG
GPIOG clock

enumerator kCLOCK_GPIOF
GPIOF clock

enumerator kCLOCK_GPIOE
GPIOE clock

enumerator kCLOCK_GPIOD
GPIOD clock

enumerator kCLOCK_GPIOC
GPIOC clock

enumerator kCLOCK_GPIOB
GPIOB clock

enumerator kCLOCK_GPIOA
GPIOA clock

enumerator kCLOCK_TB3
Timer B3 clock

enumerator kCLOCK_TB2
Timer B2 clock

enumerator kCLOCK_TB1
Timer B1 clock

enumerator kCLOCK_TB0
Timer B0 clock

enumerator kCLOCK_TA3
Timer A3 clock

enumerator kCLOCK_TA2
Timer A2 clock

enumerator kCLOCK_TA1
Timer A1 clock

enumerator kCLOCK_TA0
Timer A0 clock

enumerator kCLOCK_FLEXCAN
Flex CAN clock

enumerator kCLOCK_I2C1
I2C1 clock

enumerator kCLOCK_I2C0
I2C0 clock

enumerator kCLOCK_QSPI1
QSPI1 clock

enumerator kCLOCK_QSPI0
QSPI0 clock

enumerator kCLOCK_QSCI2
QSCI2 clock

enumerator kCLOCK_QSCI1
QSCI1 clock

enumerator kCLOCK_QSCI0
QSCI0 clock

enumerator kCLOCK_DACA
DAC A clock

enumerator kCLOCK_DACB
DAC B clock

enumerator kCLOCK_PIT1
PIT 1 clock

enumerator kCLOCK_PIT0
PIT 0 clock

enumerator kCLOCK_CRC
CRC clock

enumerator kCLOCK_CYCADC
Cyclic ADC clock

enumerator kCLOCK_CMPD
Comparator D clock

enumerator kCLOCK_CMPC
Comparator C clock

enumerator kCLOCK_CMPB
Comparator B clock

enumerator kCLOCK_CMPA
Comparator A clock

enumerator kCLOCK_PWMBCH3
Enhanced Flexible PWM B3 clock

enumerator kCLOCK_PWMBCH2
Enhanced Flexible PWM B2 clock

enumerator kCLOCK_PWMBCH1
Enhanced Flexible PWM B1 clock

enumerator kCLOCK_PWMBCH0
Enhanced Flexible PWM B0 clock

enumerator kCLOCK_PWMACH3
Enhanced Flexible PWM A3 clock

enumerator kCLOCK_PWMACH2
Enhanced Flexible PWM A2 clock

enumerator kCLOCK_PWMACH1
Enhanced Flexible PWM A1 clock

enumerator kCLOCK_PWMACH0
Enhanced Flexible PWM A0 clock

enumerator kCLOCK_USB
USB clock

enumerator kCLOCK_ROM
ROM clock

enumerator kCLOCK_NOGATE
No clock gate for the IP

enumerator kCLOCK_EDMA

enumerator kCLOCK_EWM

enumerator kCLOCK_XBARA

enumerator kCLOCK_NUM
Total IP clock number

enum _clock_name
List of system-level clock name.

Values:

enumerator kCLOCK_Mstr2xClk
Master 2x clock which feed to core and peripheral

enumerator kCLOCK_SysClk
MCU system/core clock

enumerator kCLOCK_BusClk
Bus clock

enumerator kCLOCK_Bus2xClk
Bus 2x clock

enumerator kCLOCK_FlashClk
Flash clock

enumerator kCLOCK_FastIrcClk
Fast internal RC oscillator, 48M

enumerator kCLOCK_FastIrcDiv6Clk
ROSC 8M, derived from kCLOCK_FastIrcClk div 6

enumerator kCLOCK_SlowIrcClk
Slow internal RC oscillator, 200K

enumerator kCLOCK_CrystalOscClk
Crystal oscillator

enumerator kCLOCK_ExtClk
The selected external clock, it could be crystal oscillator, clkin0, clkin1

enumerator kCLOCK_MstrOscClk
The selected master oscillator clock

enumerator kCLOCK_PllDiv2Clk
PLL output divide 2

enum _clock_crystal_osc_mode
Crystal oscillator mode.

Values:

enumerator kCLOCK_CrystalOscModeFSP
Full swing pierce, high power mode

enumerator kCLOCK_CrystalOscModeLCP
Loop controlled pierce, low power mode

enum _clock_ext_clk_src
List of external clock source.

Values:

enumerator kCLOCK_ExtClkSrcCrystalOsc
External clock source is crystal oscillator

enumerator kCLOCK_ExtClkSrcClkin
External clock source is clock in

enum _clock_ext_clkin_sel
List of clock-in source.

Values:

enumerator kCLOCK_SelClkIn0
Clock in 0 is selected as CLKIN

enumerator kCLOCK_SelClkIn1
Clock in 1 is selected as CLKIN

enum _clock_mstr_osc_clk_src
List of master oscillator source.

Values:

enumerator kCLOCK_MstrOscClkSrcFircDiv6
8M, fast internal RC oscillator divide 6

enumerator kCLOCK_MstrOscClkSrcExt
External clock

enumerator kCLOCK_MstrOscClkSrcSirc
200K, slow internal RC oscillator

enumerator kCLOCK_MstrOscClkSrcFirc
48M, fast internal RC oscillator

enum _clock_mstr_2x_clk_src
List of master 2x clock source.
Values:
enumerator kCLOCK_Mstr2xClkSrcMstrOsc
Master oscillator clock
enumerator kCLOCK_Mstr2xClkSrcPllDiv2
PLL output divide 2

enum _clock_output_clk_src
List of output clock source.
Values:
enumerator kCLOCK_OutputClkSrc_Bus
Bus clock
enumerator kCLOCK_OutputClkSrc_Bus2x
Bus 2x clock
enumerator kCLOCK_OutputClkSrc_BusDiv4
Bus clock div 4
enumerator kCLOCK_OutputClkSrc_MstrOSC
Master oscillator clock
enumerator kCLOCK_OutputClkSrc_FircDiv6
8M clock, FIRC/6
enumerator kCLOCK_OutputClkSrc_Sirc
200K clock, SIRC

enum _clock_output_clk_div
List of output clock divider.
Values:
enumerator kCLOCK_OutputDiv1
output clock = selectedClock/1U
enumerator kCLOCK_OutputDiv2
output clock = selectedClock/2U
enumerator kCLOCK_OutputDiv4
output clock = selectedClock/4U
enumerator kCLOCK_OutputDiv8
output clock = selectedClock/8U
enumerator kCLOCK_OutputDiv16
output clock = selectedClock/16U
enumerator kCLOCK_OutputDiv32
output clock = selectedClock/32U
enumerator kCLOCK_OutputDiv64
output clock = selectedClock/64U
enumerator kCLOCK_OutputDiv128
output clock = selectedClock/128U

enum _clock_protection
List of clock register protection mode.

Values:

enumerator kCLOCK_Protection_Off
No protection, and could be changed any time

enumerator kCLOCK_Protection_On
Protected, and could be changed any time

enumerator kCLOCK_Protection_OffLock
No protection and get locked until chip reset

enumerator kCLOCK_Protection_OnLock
Protected and get locked until chip reset

enum _clock_ip_clk_src
List of specific IP's clock source.

Values:

enumerator kCLOCK_IPClkSrc_BusClk
Bus clock

enumerator kCLOCK_IPClkSrc_Bus2xClk
Bus 2x clock

enum _clock_postscale
Mstr 2x clock postscale divider.

Values:

enumerator kCLOCK_PostscaleDiv1
Mast 2X clock = clkSrc / 1

enumerator kCLOCK_PostscaleDiv2
Mast 2X clock = clkSrc / 2

enumerator kCLOCK_PostscaleDiv4
Mast 2X clock = clkSrc / 4

enumerator kCLOCK_PostscaleDiv8
Mast 2X clock = clkSrc / 8

enumerator kCLOCK_PostscaleDiv16
Mast 2X clock = clkSrc / 16

enumerator kCLOCK_PostscaleDiv32
Mast 2X clock = clkSrc / 32

enumerator kCLOCK_PostscaleDiv64
Mast 2X clock = clkSrc / 64

enumerator kCLOCK_PostscaleDiv128
Mast 2X clock = clkSrc / 128

enumerator kCLOCK_PostscaleDiv256
Mast 2X clock = clkSrc / 256

enum _clock_pll_monitor_type
PLL monitor type structure.

Values:

enumerator kCLOCK_PllMonitorUnLockCoarse
PLL coarse unlock, due to loss of reference clock, power unstable…etc.

enumerator kCLOCK_PllMonitorUnLockFine
PLL fine unlock, due to loss of reference clock, power unstable…etc.

enumerator kCLOCK_PllMonitorLostofReferClk
PLL lost reference clock.

enumerator kCLOCK_PllMonitorAll
All PLL monitor type.

enum _pit_count_clock_source
Describes PIT clock source.

Values:

enumerator kPIT_CountClockSource0
PIT count clock sourced from IP bus clock

enumerator kPIT_CountClockSource1
PIT count clock sourced from alternate clock 1

enumerator kPIT_CountClockSource2
PIT count clock sourced from alternate clock 2

enumerator kPIT_CountClockSource3
PIT count clock sourced from alternate clock 3

enumerator kPIT_CountBusClock
PIT count clock sourced from IP bus clock

enumerator kPIT_CountCrystalClock
PIT count clock sourced from crystal clock

enumerator kPIT_Count8MHzIRCClock
PIT count clock sourced from 8MHz IRC clock

enumerator kPIT_Count200KHzIRCClock
PIT count clock sourced from 200KHz IRC clock

enum _ewm_lpo_clock_source
Describes EWM clock source.

Values:

enumerator kEWM_LpoClockSource0
EWM clock sourced from lpo_clk[0]

enumerator kEWM_LpoClockSource1
EWM clock sourced from lpo_clk[1]

enumerator kEWM_LpoClockSource2
EWM clock sourced from lpo_clk[2]

enumerator kEWM_LpoClockSource3
EWM clock sourced from lpo_clk[3]

enumerator kEWM_Lpo8MHzIRCClock
EWM clock sourced from 48 MHz IRC div6 clock

enumerator kEWM_LpoCrystalClock
EWM clock sourced from crystal clock

enumerator kEWM_LpoBusClock
EWM clock sourced from IP Bus clock

enumerator kEWM_Lpo200KHzIRCClock
EWM clock sourced from 200KHz IRC clock

typedef enum *_clock_ip_name* clock_ip_name_t
List of IP clock name.

typedef enum *_clock_name* clock_name_t
List of system-level clock name.

typedef enum *_clock_crystal_osc_mode* clock_crystal_osc_mode_t
Crystal oscillator mode.

typedef enum *_clock_ext_clk_src* clock_ext_clk_src_t
List of external clock source.

typedef enum *_clock_ext_clkin_sel* clock_ext_clkin_sel_t
List of clock-in source.

typedef enum *_clock_mstr_osc_clk_src* clock_mstr_osc_clk_src_t
List of master oscillator source.

typedef enum *_clock_mstr_2x_clk_src* clock_mstr_2x_clk_src_t
List of master 2x clock source.

typedef enum *_clock_output_clk_src* clock_output_clk_src_t
List of output clock source.

typedef enum *_clock_output_clk_div* clock_output_clk_div_t
List of output clock divider.

typedef enum *_clock_protection* clock_protection_t
List of clock register protection mode.

typedef enum *_clock_ip_clk_src* clock_ip_clk_src_t
List of specific IP's clock source.

typedef enum *_clock_postscale* clock_postscale_t
Mstr 2x clock postscale divider.

typedef struct *_clock_protection_config* clock_protection_config_t
Clock register protection configuration.

typedef struct *_clock_output_config* clock_output_config_t
Clock output configuration.

typedef struct *_clock_config* clock_config_t
mcu clock configuration structure.

This is the key configuration structure of clock driver, which define the system clock behavior. The function CLOCK_SetClkConfig deploy this configuration structure onto SOC.

typedef enum *_clock_pll_monitor_type* clock_pll_monitor_type_t
PLL monitor type structure.

typedef enum *_pit_count_clock_source* pit_count_clock_source_t
Describes PIT clock source.

typedef enum *_ewm_lpo_clock_source* ewm_lpo_clock_source_t
Describes EWM clock source.

static inline void CLOCK_EnableClock(*clock_ip_name_t* eIpClkName)

Enable IPs clock.

Parameters

- eIpClkName – IP clock name.

static inline void CLOCK_DisableClock(*clock_ip_name_t* eIpClkName)

Disable IPs clock.

Parameters

- eIpClkName – IP clock name.

static inline void CLOCK_EnableClockInStopMode(*clock_ip_name_t* eIpClkName)

Enable IPs clock in STOP mode.

Parameters

- eIpClkName – IP clock name.

static inline void CLOCK_DisableClockInStopMode(*clock_ip_name_t* eIpClkName)

Disable IPs clock in STOP mode.

Parameters

- eIpClkName – IP clock name.

static inline void CLOCK_ConfigQsciClockSrc(*clock_ip_name_t* eQsciClkName, *clock_ip_clk_src_t* eClkSrc)

Configure QSCI clock source.

QSCI clock could be bus or bus_2x clock. Default is bus clock.

Parameters

- eQsciClkName – IP(only QSCI is valid) clock name.
- eClkSrc – Clock source.

static inline void CLOCK_ConfigI2cFilterClockSrc(*clock_ip_name_t* eI2cClkName, *clock_ip_clk_src_t* eClkSrc)

Configure I2C filter clock source.

I2C filter clock could be bus or bus_2x clock. Default is bus clock.

Parameters

- eI2cClkName – IP(only I2C is valid) clock name.
- eClkSrc – Clock source.

static inline void CLOCK_SetSlowIrcTrim(uint16_t u16Trim)

Set trim value to 200K slow internal RC oscillator.

The factory trim value is loaded during reset. User may call this function to fine tune the 200K IRC oscillator.

Parameters

- u16Trim – Slow internal RC oscillator trim value.

static inline bool CLOCK_GetCrystalOscFailureStatus(void)

Get crystal oscillator failure status.

Note: This function should be called only when crystal osc is on and its monitor(MON_ENABLE in OSCTL2 register) is enabled.

Returns
Crystal oscillator status. true: Crystal oscillator frequency is below 680KHz(typical). false: No clock failure or crystal oscillator is off.

static inline void CLOCK_SetPllLossofRefererntTripPoint(uint8_t u8Trip)

Set PLL loss of reference trip point.

The trip point default value is 2.

Parameters

- u8Trip – Trip point for loss of reference.

static inline void CLOCK_ClearPLLMonitorFlag(*clock_pll_monitor_type_t* eType)

Clear PLL monitor flag.

Parameters

- eType – PLL monitor type.

uint32_t CLOCK_GetFreq(*clock_name_t* eClkName)

Get system-level clock frequency.

Parameters

- eClkName – System-level clock name.

Returns
The required clock's frequency in Hz.

uint32_t CLOCK_GetIpClkSrcFreq(*clock_ip_name_t* eIpClkName)

Get IP clock frequency.

Parameters

- eIpClkName – IP clock name.

Returns
The required IP clock's frequency in Hz.

void CLOCK_SetClkin0Freq(uint32_t u32Freq)

Set Clock IN 0 frequency.

It is a must to call this function in advance if system is operated by clkin0.

Parameters

- u32Freq – Clock IN 0 frequency in Hz.

void CLOCK_SetClkin1Freq(uint32_t u32Freq)

Set Clock IN 1 frequency.

It is a must to call this function in advance if system is operated by clkin1.

Parameters

- u32Freq – Clock IN 1 frequency in Hz.

void CLOCK_SetXtalFreq(uint32_t u32Freq)

Set crystal oscillator frequency.

It is a must to call this function in advance if system is operated by crystal oscillator.

Parameters

- u32Freq – Crystal oscillator frequency in Hz.

void CLOCK_SetProtectionConfig(*clock_protection_config_t* *psConfig)
Config clock register access protection mode.

Parameters

- psConfig – Pointer for protection configuration.

void CLOCK_SetOutputClockConfig(*clock_output_config_t* *psConfig)
Config output clock.

Parameters

- psConfig – Pointer for clock output configuration.

void CLOCK_SetClkConfig(*clock_config_t* *psConfig)
Config mcu operation clock.

Parameters

- psConfig – Pointer for clock configuration.

void CLOCK_EnableUsbfs0Clock(void)
Enable USB FS clock.

uint32_t CLOCK_EvaluateExtClkFreq(void)
Evaluate external clock frequency and return its frequency in Hz.

This function should be called only when internal FIRC(48M) is on. The evaluated result accuracy depends on:

a. FIRC accuracy, now it is +/-1%.
b. Truncation error, because the external clock and FIRC is not synchronised.
c. External clock frequency, low accuracy for lower external clock frequency.
d. MCU mstr 2x clock.

For example, for namely 8M external clock, evaluated result may be range in 8M+/-5%.

Returns
Evaluated external frequency in Hz.

void CLOCK_EnablePLLMonitorInterrupt(*clock_pll_monitor_type_t* eType, bool bEnable)
Enable/Disable PLL monitor interrupt.

This function should be called only when PLL is on and its reference clock is external clock. This function is for safety purpose when external clock is lost due to HW failure. The normal flow to call this function:

a. Call CLOCK_SetClkConfig to enable PLL and external clock to feed the PLL.
b. Call CLOCK_ClearPLLMonitorFlag.
c. Call CLOCK_SetPllLossofReferentTripPoint (optional, setting value is for kCLOCK_PllMonitorLostofReferClk type).
d. Call this function.
e. Enable OCCS interrupt with highest priority 3.
f. When OCCS interrupt occurs, recover clock from the disaster in OCCS_DriveISRHandler function. Such kind of clock recovery is application dependent, and a demo OCCS_DriveISRHandler has been shown in fsl_clock.c

Parameters

- eType – PLL monitor type.
- bEnable – Enable or disable.

FSL_CLOCK_DRIVER_VERSION
    CLOCK driver version 2.1.0.

SDK_DEVICE_MAXIMUM_CPU_CLOCK_FREQUENCY
    Definition for delay API in clock driver, users can redefine it to the real application.

GPIO_CLOCKS
    Clock ip name array for GPIO.

TMR_CLOCKS
    Clock ip name array for quad timer.

FLEXCAN_CLOCKS
    Clock ip name array for FLEXCAN.

I2C_CLOCKS
    Clock ip name array for I2C.

QSPI_CLOCKS
    Clock ip name array for queued SPI.

QSCI_CLOCKS
    Clock ip name array for queued SCI.

DAC_CLOCKS
    Clock ip name array for DAC.

PIT_CLOCKS
    Clock ip name array for PIT.

CRC_CLOCKS
    Clock ip name array for CRC.

CADC_CLOCKS
    Clock ip name array for cyclic ADC.

CMP_CLOCKS
    Clock ip name array for CMP.

PWM_CLOCKS
    Clock ip name array for PWM.

USB_CLOCKS
    Clock ip name array for USB.

ROM_CLOCKS
    Clock ip name array for ROM.

EDMA_CLOCKS
    Clock ip name array for EDMA.

EWM_CLOCKS
    Clock ip name array for EWM.

XBARA_CLOCKS
    Clock ip name array for XBARA.

CLK_GATE_GET_REG_INDEX(x)

CLK_GATE_GET_BIT_INDEX(x)

clock_protection_t eFrqEP
    FRQEP bit field in OCCS PROT register, protect COD & ZSRC.

clock_protection_t eOscEP
    OSCEP bit field in OCCS PROT register, protect OSCTL1, OSCTL2, PRECS.

clock_protection_t ePllEP
    PLLEP bit field in OCCS PROT register, protect PLLDP, LOCIE, LORTP, PLLDB bitfield.

bool bClkOut0En
    Clock output 0 enable, CLKDIS0 bit field in SIM CLKOUT register

bool bClkOut1En
    Clock output 1 enable, CLKDIS1 bit field in SIM CLKOUT register

clock_output_clk_src_t eClkOut0Src
    Clock output 0 clock source, CLKOSEL0 bit field in SIM CLKOUT register

clock_output_clk_src_t eClkOut1Src
    Clock output 1 clock source, CLKOSEL1 bit field in SIM CLKOUT register

clock_output_clk_div_t eClkDiv
    Clock output divider, CLKODIV bit field in SIM CLKOUT register ,it apply to clkout0 & clkout1

bool bCrystalOscEnable
    Crystal oscillator enable, COPD bit field in OCCS OSCTL2 register

bool bFircEnable
    Fast internal RC oscillator enable, IRC48M_EN bit field in SIM MISC0 register

bool bSircEnable
    Slow internal RC oscillator enable, ROPD200K bit field in OCCS OSCTL2 register

bool bPllEnable
    PLL enable, PLLPD bit field in OCCS CTRL register

bool bCrystalOscMonitorEnable
    Crystal oscillator monitor enable, MON_ENABLE bit field in OCCS OSCTL2 register

clock_crystal_osc_mode_t eCrystalOscMode
    Crystal oscillator mode, COHL bit field in OCCS OSCTL1 register

clock_ext_clk_src_t eExtClkSrc
    External clock source, EXT_SEL bit field in OCCS OSCTL1 register

clock_ext_clkin_sel_t eClkInSel
    Clock IN selection(0 or 1), CLKINSEL bit field in SIM MISC0 register

clock_mstr_osc_clk_src_t eMstrOscClkSrc
    Master oscillator selection, PRECS bit field in OCCS CTRL register. When selected kCLOCK_MstrOscClkSrcExt, make sure corresponding pins(crystal osc or clkin pin) has been configured.

clock_mstr_2x_clk_src_t eMstr2xClkSrc
    Master 2x clock selection, ZSRC bit field in OCCS CTRL register

clock_postscale_t eMstr2xClkPostScale
    Master 2x clock post scale, COD bit field in OCCS DIVBY register

uint32_t u32PllClkFreq
    Required PLL output frequency before divide 2

FSL_SDK_DISABLE_DRIVER_CLOCK_CONTROL

Configure whether driver controls clock.

When set to 0, peripheral drivers will enable clock in initialize function and disable clock in de-initialize function. When set to 1, peripheral driver will not control the clock, application could control the clock out of the driver.

Note: All drivers share this feature switcher. If it is set to 1, application should handle clock enable and disable for all drivers.

---

struct _clock_protection_config

#include <fsl_clock.h> Clock register protection configuration.

struct _clock_output_config

#include <fsl_clock.h> Clock output configuration.

struct _clock_config

#include <fsl_clock.h> mcu clock configuration structure.

This is the key configuration structure of clock driver, which define the system clock behavior. The function CLOCK_SetClkConfig deploy this configuration structure onto SOC.

2.5 Driver Change Log

2.6 CMP: Comparator Driver

void CMP_GetDefaultConfig(*cmp_config_t* *psConfig)

Initializes the CMP user configuration structure.

This function initializes the user configuration structure to the default values. It is corresponding to the continuous mode configurations.

Parameters

- psConfig – pointer of cmp_config_t.

void CMP_Init(CMP_Type *base, const *cmp_config_t* *psConfig)

Initializes the CMP.

This function initializes the CMP module. The operations included are as follows.

- Enable the clock for CMP module.
- Configure the comparator according to the CMP configuration structure.

Parameters

- base – CMP peripheral base address.
- psConfig – Pointer to the configuration structure.

void CMP_Deinit(CMP_Type *base)

De-initializes the CMP module.

This function de-initializes the CMP module. The operations included are as follows.

- Disabling the CMP module.
- Disabling the clock for CMP module.

Parameters

- base – CMP peripheral base address.

static inline void CMP_Enable(CMP_Type *base, bool bEnable)

Enables/disables the CMP module.

Parameters

- base – CMP peripheral base address.
- bEnable – Enables or disables the module.

static inline void CMP_SetInputChannel(CMP_Type *base, cmp_input_mux_t ePlusChannel, cmp_input_mux_t eMinusChannel)

Sets the input channels for the comparator.

This function sets the input channels for the comparator. Note that two input channels cannot be set the same way in the application. When the user selects the same input from the analog mux to the positive and negative port, the comparator is disabled automatically.

Parameters

- base – CMP peripheral base address.
- ePlusChannel – Plus side input channel number.
- eMinusChannel – Minus side input channel number.

static inline void CMP_SelectOutputSource(CMP_Type *base, *cmp_output_source_t* eOutputSource)

Select comparator output source.

Parameters

- base – CMP peripheral base address.
- eOutputSource – The output signal to be set, please reference cmp_output_source_t for details.

static inline void CMP_EnableOuputPin(CMP_Type *base, bool bEnable)

Enable/Disable Comparator output pin.

Parameters

- base – CMP peripheral base address.
- bEnable – Enable/Disable comparator output pin. true — CMPO is available on the associate CMPO output pin. false — CMPO is not available on the associate CMPO output pin.

static inline uint8_t CMP_GetComparatorOutput(CMP_Type *base)

Get Comparator output.

Parameters

- base – CMP peripheral base address.

Return values

current – analog comparator output 0 or 1

static inline void CMP_SetHysteresisLevel(CMP_Type *base, *cmp_hysteresis_level_t* eHysteresisLevel)

Sets hysteresis level.

Parameters

- base – CMP peripheral base address.
- eHysteresisLevel – The programmable hysteresis level to be set, please refer to cmp_hysteresis_level_t for details.

static inline void CMP_SetComparasionSpeedMode(CMP_Type *base, *cmp_comparasion_speed_mode_t* eComparatorSpeedMode)

Sets comparison speed mode.

Parameters

- base – CMP peripheral base address.
- eComparatorSpeedMode – The comparison speed mode, please reference cmp_comparasion_speed_mode_t for details.

static inline void CMP_EnableInvertOutput(CMP_Type *base, bool bEnable)

Enable/Disable comparator invert feature.

Parameters

- base – CMP peripheral base address.
- bEnable – Enable/Disable comparator invert feature. true — Inverts the comparator output. false — Does not invert the comparator output.

static inline void CMP_EnableWindow(CMP_Type *base, bool bEnable)

Enable the window function.

Parameters

- base – CMP peripheral base address.
- bEnable – true is enable, false is disable.

static inline void CMP_SetWindowOutputMode(CMP_Type *base, *cmp_window_output_mode_t* eWindowOutputMode)

Set the window output mode.

Parameters

- base – CMP peripheral base address.
- eWindowOutputMode – cmp_window_output_mode_t.

static inline void CMP_EnableExternalSampleMode(CMP_Type *base, bool bEnable)

Enable/Disable external Sample mode.

Parameters

- base – CMP peripheral base address.
- bEnable – true is using external sample mode, false is using interface sample mode.

static inline void CMP_SetExternalSampleCount(CMP_Type *base, *cmp_external_sample_count_t* eSampleCount)

Sets external sample count.

Parameters

- base – CMP peripheral base address.
- eSampleCount – The number of consecutive samples that must agree prior to the comparator output filter accepting a new output state, cmp_external_sample_count_t.

static inline void CMP_SetInternalFilterCount(CMP_Type *base, *cmp_filter_count_t* eFilterCount)

Sets internal filter count.

Parameters

- base – CMP peripheral base address.
- eFilterCount – The number of consecutive samples that must agree prior to the comparator output filter accepting a new output state, cmp_filter_count_t.

static inline void CMP_SetInternalFilterPeriod(CMP_Type *base, uint8_t u8FilterPeriod)

Sets the internal filter period. It is used as the divider to bus clock.

Parameters

- base – CMP peripheral base address.
- u8FilterPeriod – Filter Period. The divider to the bus clock. Available range is 0-255.

void CMP_SetDACConfig(CMP_Type *base, const *cmp_dac_config_t* *psConfig)

Configures the internal DAC.

Parameters

- base – CMP peripheral base address.
- psConfig – Pointer to the configuration structure.

static inline void CMP_SetDACOutputVoltage(CMP_Type *base, uint8_t u8OutputVoltageDivider)

Sets DAC output voltage.

Parameters

- base – CMP peripheral base address.
- u8OutputVoltageDivider – The digital value which is related to the desired DAC output voltage,

static inline void CMP_EnableInternalDAC(CMP_Type *base, bool bEnable)

Enable/Disable internal DAC.

Parameters

- base – CMP peripheral base address.
- bEnable – Enable/Disable internal DAC. true — Enable internal DAC. false — Disable internal DAC.

static inline void CMP_SetDACReferenceVoltageSource(CMP_Type *base, *cmp_dac_vref_source_t* eDACVrefSource)

Sets internal DAC's reference voltage source.

Parameters

- base – CMP peripheral base address.
- eDACVrefSource – reference voltage source, please cmp_dac_vref_source_t

static inline void CMP_EnableInterrupt(CMP_Type *base, *cmp_interrupt_request_t* eInterruptRequest)

Interrupt request to enable.

Parameters

- base – CMP peripheral base address.
- eInterruptRequest – Mask value for interrupts. See cmp_interrupt_request_t.

static inline *cmp_output_flag_t* CMP_GetStatusFlags(CMP_Type *base)
Gets the status flags.

Parameters

- base – CMP peripheral base address.

Return values
Mask – value for the asserted flags. cmp_output_flag_t.

static inline void CMP_ClearStatusFlags(CMP_Type *base, *cmp_output_flag_t* eOutputFlag)
Clears the status flags.

Parameters

- base – CMP peripheral base address.
- eOutputFlag – Mask value for the output flags, cmp_output_flag_t

static inline void CMP_EnableDMA(CMP_Type *base, *cmp_dma_request_t* eDMARequestType)
Enables CMP DMA request.

Parameters

- base – CMP peripheral base address.
- eDMARequestType – eDMA request type, cmp_dma_request_t

static inline uint32_t CMP_GetComparatorResultRegisterAddress(CMP_Type *base)
Get CMP result register address for DMA access.

Parameters

- base – CMP peripheral base address.

Returns
The CMP result register address.

FSL_CMP_DRIVER_VERSION
CMP driver version.

enum _cmp_interrupt_request
CMP Interrupt request type definition.

Values:

enumerator kCMP_InterruptRequestDisabled
interrupt disabled

enumerator kCMP_InterruptRequestEnableOutputRisingEdge
Comparator interrupt request enable rising edge.

enumerator kCMP_InterruptRequestEnableOutputFallingEdge
Comparator interrupt request enable falling edge.

enumerator kCMP_InterrruptRequestEnableAll
comparator interrupt request enable on rising edge or falling edge

enum _cmp_dma_request
CMP DMA request type definition.

Values:

enumerator kCMP_DMARequestDisabled
DMA disabled

enumerator kCMP_DMARequestEnableOutputRisingEdge
Comparator dma request enable on rising edge.

enumerator kCMP_DMARequestEnableOutputFallingEdge
Comparator dnma request enable on falling edge.

enumerator kCMP_DMARequestEnableAll
comparator dma request enable on rising edge or falling edge

enum _cmp_output_flag
CMP output flags' mask.

Values:

enumerator kCMP_OutputFlagRisingEdge
Rising-edge on the comparison output has occurred.

enumerator kCMP_OutputFlagFallingEdge
Falling-edge on the comparison output has occurred.

enumerator kCMP_OutputFlagBothEdge
Rising-edge and Falling-edge on the comparison output has occurred.

enum _cmp_hysteresis_level
CMP Hysteresis level.

Values:

enumerator kCMP_HysteresisLevel0
Hysteresis level 0.

enumerator kCMP_HysteresisLevel1
Hysteresis level 1.

enumerator kCMP_HysteresisLevel2
Hysteresis level 2.

enumerator kCMP_HysteresisLevel3
Hysteresis level 3.

enum _cmp_comparasion_speed_mode
CMP compassion speed mode enumerator.

Values:

enumerator kCMP_ComparsionModeLowSpeed
Low-Speed Comparison mode has lower current consumption

enumerator kCMP_ComparsionModeHighSpeed
High-Speed Comparison mode has higher current consumption.

enum _cmp_dac_vref_source
CMP DAC Voltage Reference source.

Values:

enumerator kCMP_DACVrefSourceVin1
Vin1 is selected as a resistor ladder network supply reference Vin.

enumerator kCMP_DACVrefSourceVin2
Vin2 is selected as a resistor ladder network supply reference Vin.

enum _cmp_window_output_mode
CMP output value of window.

Values:

enumerator kCMP_WindowOuputLastLatchedValue

When WINDOW signal changes from 1 to 0, COUTA output holds the last latched value before WINDOW signal falls to 0

enumerator kCMP_WindowOutputZeroValue

When WINDOW signal changes from 1 to 0, COUTA output is forced to 0

enum _cmp_filter_count

CMP filter count.

Values:

enumerator kCMP_FilterCountDisable

filter is disabled

enumerator kCMP_FilterCount1

1 sample must agrees, the comparator output is simply sampled

enumerator kCMP_FilterCount2

2 consecutive samples must agrees

enumerator kCMP_FilterCount3

3 consecutive samples must agrees

enumerator kCMP_FilterCount4

4 consecutive samples must agrees

enumerator kCMP_FilterCount5

5 consecutive samples must agrees

enumerator kCMP_FilterCount6

6 consecutive samples must agrees

enumerator kCMP_FilterCount7

7 consecutive samples must agrees

enum _cmp_external_sample_count

CMP external sample count.

Values:

enumerator kCMP_ExternalSampleCount1

1 sample must agrees, the comparator output is simply sampled

enumerator kCMP_ExternalSampleCount2

2 consecutive samples must agrees

enumerator kCMP_ExternalSampleCount3

3 consecutive samples must agrees

enumerator kCMP_ExternalSampleCount4

4 consecutive samples must agrees

enumerator kCMP_ExternalSampleCount5

5 consecutive samples must agrees

enumerator kCMP_ExternalSampleCount6

6 consecutive samples must agrees

enumerator kCMP_ExternalSampleCount7

7 consecutive samples must agrees

enum _cmp_output_source
CMP output source enumerator.

Values:

enumerator kCMP_OutputSourceFromFilterCOUT
Set the filtered comparator output to equal COUT.

enumerator kCMP_OutputSourceFromUnfilteredCOUTA
Set the unfiltered comparator output to equal COUTA.

enum _cmp_work_mode
CMP work mode definition.

Values:

enumerator kCMP_WorkModeWindowBypassAndNoExternalSample
window block bypassed, external sampling mode disabled

enumerator kCMP_WorkModeWindowBypassAndExternalSample
window block bypassed, external SAMPLE mode enable

enumerator kCMP_WorkModeWindowEnabledAndNoExternalSample
window block enabled, external sampling mode disabled

typedef enum *_cmp_interrupt_request* cmp_interrupt_request_t
CMP Interrupt request type definition.

typedef enum *_cmp_dma_request* cmp_dma_request_t
CMP DMA request type definition.

typedef enum *_cmp_output_flag* cmp_output_flag_t
CMP output flags' mask.

typedef enum *_cmp_hysteresis_level* cmp_hysteresis_level_t
CMP Hysteresis level.

typedef enum *_cmp_comparasion_speed_mode* cmp_comparasion_speed_mode_t
CMP compassion speed mode enumerator.

typedef enum *_cmp_dac_vref_source* cmp_dac_vref_source_t
CMP DAC Voltage Reference source.

typedef enum *_cmp_window_output_mode* cmp_window_output_mode_t
CMP output value of window.

typedef enum *_cmp_filter_count* cmp_filter_count_t
CMP filter count.

typedef enum *_cmp_external_sample_count* cmp_external_sample_count_t
CMP external sample count.

typedef enum *_cmp_output_source* cmp_output_source_t
CMP output source enumerator.

typedef enum *_cmp_work_mode* cmp_work_mode_t
CMP work mode definition.

typedef struct *_cmp_dac_config* cmp_dac_config_t
CMP internal DAC configuration structure.

typedef union *_cmp_dma_interrupt_config* cmp_dma_interrupt_config_t

CMP dma/interrupt configure union.

Note: , the interrupt request and dma request cannot be used at the same time, that is to say When DMA support is enabled by setting SCR[DMAEN] and the interrupt is enabled by setting SCR[IER], SCR[IEF], or both, the corresponding change on COUT forces a DMA transfer request rather than a CPU interrupt instead

---

typedef struct *_cmp_config* cmp_config_t

CMP configuration structure.

struct _cmp_dac_config

#include <fsl_cmp.h> CMP internal DAC configuration structure.

Public Members

cmp_dac_vref_source_t eDACVrefSource

DAC reference voltage source.

uint8_t u8DACOutputVoltageDivider

divider Value for the DAC Output Voltage, DAC output voltage = (VREF / 256) * (u8DACOutputVoltageDivider + 1).

bool bEnableInternalDAC

flag to control if the internal DAC need to be enabled

union _cmp_dma_interrupt_config

#include <fsl_cmp.h> CMP dma/interrupt configure union.

Note: , the interrupt request and dma request cannot be used at the same time, that is to say When DMA support is enabled by setting SCR[DMAEN] and the interrupt is enabled by setting SCR[IER], SCR[IEF], or both, the corresponding change on COUT forces a DMA transfer request rather than a CPU interrupt instead

---

Public Members

cmp_dma_request_t eDMARequest

dma request type

cmp_interrupt_request_t eInterruptRequest

interrupt request type

struct _cmp_config

#include <fsl_cmp.h> CMP configuration structure.

Public Members

cmp_hysteresis_level_t eHysteresisLevel

CMP hysteresis leveL

cmp_comparasion_speed_mode_t eComparasionSpeedMode

CMP comparison speed mode

cmp_work_mode_t eWorkMode
CMP work mode

cmp_input_mux_t ePlusInput
CMP plus input mux, the definition of this enum is in soc header file

cmp_input_mux_t eMinusInput
CMP minus input mux, the definition of this enum is in soc header file

cmp_dac_config_t sDacConfig
CMP internal DAC configuration structure cmp_dac_config_t

bool bInvertComparatorOutputPolarity
Inverted comparator output polarity.

cmp_window_output_mode_t eWindowOutputMode
only works when cmp work mode is kCMP_WorkModeWindowEnabledAndNoExternalSample

cmp_filter_count_t eFilterCount
Filter Count.Available range is 0-7, 0 is disable internal filter can be used in internal sampling mode only.

uint8_t u8FilterPeriod
Filter Period. The divider to the bus clock. Available range is 0-255, can be used in internal sampling mode. When the filter clock from internal divided bus clock, setting the sample period to 0 will disable the filter

cmp_external_sample_count_t eExternalSampleCount
Available range is 1 - 7, used in external sampling mode only

cmp_output_source_t eOutputSource
cmp output source

bool bEnableOutputPin
the comparator output(CMPO) is driven out on the associated CMPO output pin

cmp_dma_interrupt_config_t uDmaInterruptConfig
CMP interrupt/dma configuration

bool bCMPEnable
flag to control if CMP module start immediately when the configuration is done

2.7 The Driver Change Log

2.8 CMP Peripheral and Driver Overview

2.9 COP: Computer Operating Properly(Watchdog) Driver

void COP_Init(COP_Type *base, const *cop_config_t* *psConfig)
Initializes the COP module with input configuration.

Call this function to do initialization configuration for COP module. The configurations are:

- COP configuration write protect enablement
- Clock source selection for COP module
- Prescaler configuration to the input clock source

- Counter timeout value
- Window value
- WAIT/STOP work mode enablement
- Interrupt enable/disable and interrupt timing value
- Loss of reference counter enablement
- COP enable/disable

note: Once set bEnableWriteProtect=true, the CTRL, INTVAL, WINDOW and TOUT registers are read-only.

Parameters

- base – COP peripheral base address.
- psConfig – The pointer to COP configuration structure, cop_config_t.

void COP_GetDefaultConfig(*cop_config_t* *psConfig)

Prepares an available pre-defined setting for module's configuration.

This function initializes the COP configuration structure to default values.

```
psConfig->bEnableWriteProtect = false;
psConfig->bEnableWait = false;
psConfig->bEnableStop = false;
psConfig->bEnableLossOfReference = false;
psConfig->bEnableInterrupt = false;
psConfig->bEnableCOP        = false;
psConfig->ePrescaler = kCOP_ClockPrescalerDivide1;
psConfig->u16TimeoutCount = 0xFFFFU;
psConfig->u16WindowCount = 0xFFFFU;
psConfig->u16InterruptCount = 0xFFU;
psConfig->eClockSource = kCOP_RoscClockSource;
```

Parameters

- psConfig – Pointer to the COP configuration structure, cop_config_t.

static inline void COP_Enable(COP_Type *base, bool bEnable)

Enable/Disable the COP module.

This function disables the COP Watchdog. To disable the COP Watchdog, call COP_Enable(base, false).

Parameters

- base – COP peripheral base address.
- bEnable – Enable the feature or not.

static inline void COP_EnableLossOfReferenceCounter(COP_Type *base, bool bEnable)

Enables or disables the COP Loss of Reference counter.

This function writes a value into the COP_CTRL register to enable or disable the COP Loss of Reference counter.

Parameters

- base – COP peripheral base address.
- bEnable – Enable the feature or not.

static inline void COP_SetTimeoutCount(COP_Type *base, uint16_t u16TimeoutCount)
Sets the COP timeout value.

This function sets the COP timeout value, if psConfig->bEnableWriteProtect is set to true for calling WDOG_Init, the set does not take effect. It should be ensured that the time-out value for the COP is always greater than interrupt time + 40 bus clock cycles. This function writes a value into COP_TOUT register, when COP count down to zero from the timeout count value, COP_RST_B signal will be asserted. There are some considerations for setting the timeout count afer COP is enabled:

- The recommended procedure for changing TIMEOUT is to disable the COP by invoking COP_Enable(), then call the function COP_SetTimeoutCount, and then re-enable the by invoking COP_Enable() again.
- Alternatively, call the function COP_SetTimeoutCount, then feed the COP by invoking COP_Refresh() to reload the timeout.

Parameters

- base – COP peripheral base address
- u16TimeoutCount – COP timeout value, count of COP clock tick. Use macro definition MSEC_TO_COUNT to convert value in ms to count of ticks, the COP clock rate is source clock divide prescaler.

static inline void COP_SetInterruptCount(COP_Type *base, uint16_t u16InterruptCount)
Sets the COP interrupt value.

This function sets the COP interrupt value, if psConfig->bEnableWriteProtect is set to true for calling WDOG_Init, the set does not take effect. This function writes a value into COP_INTVAL register, if COP interrupt is enabled and COP count down to the interrupt value configured, an interrupt will be triggered. Ensure the COP counter is disabled while the function is called.

Parameters

- base – COP peripheral base address
- u16InterruptCount – COP interrupt value, count of COP clock tick. Use macro definition MSEC_TO_COUNT to convert value in ms to count of ticks, the COP clock rate is source clock divide prescaler.

static inline void COP_SetWindowCount(COP_Type *base, uint16_t u16WindowCount)
Sets the COP window value.

This function sets the COP window value, if psConfig->bEnableWriteProtect is set to true for calling WDOG_Init, the set does not take effect. This function writes a value into COP_WINDOW register. Ensure the COP counter is disabled while the function is called.

Parameters

- base – COP peripheral base address
- u16WindowCount – COP window value, count of COP clock tick. Use macro definition MSEC_TO_COUNT to convert value in ms to count of ticks, the COP clock rate is source clock divide prescaler.

void COP_Refresh(COP_Type *base)
Refreshes the COP timer.

This function feeds/services the COP.

Parameters

- base – COP peripheral base address.

static inline void COP_EnableInterrupt(COP_Type *base)

Enables the COP interrupt, if psConfig->bEnableWriteProtect is set to true for calling WDOG_Init, the operation does not take effect.

This function writes a value into the COP_CTRL register to enable the COP interrupt.

Parameters

- base – COP peripheral base address

static inline void COP_DisableInterrupt(COP_Type *base)

Disables the COP interrupt, if psConfig->bEnableWriteProtect is set to true for calling WDOG_Init, the operation does not take effect.

This function writes a value into the COP_CTRL register to disable the COP interrupt.

Parameters

- base – COP peripheral base address

FSL_COP_DRIVER_VERSION

COP driver version.

COP_FIRST_WORD_OF_REFRESH

COP refresh key word.

First word of refresh sequence

COP_SECOND_WORD_OF_REFRESH

Second word of refresh sequence

enum _cop_clock_source

enumeration for COP clock source selection.

Values:

enumerator kCOP_RoscClockSource

COP clock sourced from Relaxation oscillator (ROSC)

enumerator kCOP_CoscClockSource

COP clock sourced from Crystal oscillator (COSCs)

enumerator kCOP_BusClockSource

COP clock sourced from IP Bus clock

enumerator kCOP_LpoClockSource

COP clock sourced from Low speed oscillator

enum _cop_clock_prescaler

enumeration for COP clock prescaler to input source clock.

Values:

enumerator kCOP_ClockPrescalerDivide1

Divided by 1

enumerator kCOP_ClockPrescalerDivide16

Divided by 16

enumerator kCOP_ClockPrescalerDivide256

Divided by 256

enumerator kCOP_ClockPrescalerDivide1024

Divided by 1024

typedef enum *_cop_clock_source* cop_clock_source_t
: enumeration for COP clock source selection.

typedef enum *_cop_clock_prescaler* cop_clock_prescaler_t
: enumeration for COP clock prescaler to input source clock.

typedef struct *_cop_config* cop_config_t
: structure for COP module initialization configuration.

struct _cop_config
: *#include <fsl_cop.h>* structure for COP module initialization configuration.

Public Members

bool bEnableWriteProtect
: Set COP Write protected

bool bEnableStop
: Enable or disable COP in STOP mode

bool bEnableWait
: Enable or disable COP in WAIT mode

bool bEnableLossOfReference
: Enable or disable COP loss of reference counter

bool bEnableInterrupt
: Enables or disables COP interrupt

bool bEnableCOP
: Enables or disables COP module

cop_clock_source_t eClockSource
: Set COP clock source

cop_clock_prescaler_t ePrescaler
: Set COP clock prescaler

uint16_t u16TimeoutCount
: Timeout count in clock cycles, Use macro definition MSEC_TO_COUNT to convert value in ms to count of ticks, the COP clock rate is source clock divide prescaler.

uint16_t u16WindowCount
: Window count in clock cycles, Use macro definition MSEC_TO_COUNT to convert value in ms to count of ticks, the COP clock rate is source clock divide prescaler.

uint16_t u16InterruptCount
: Interrupt count in clock cycles, Use macro definition MSEC_TO_COUNT to convert value in ms to count of ticks, the COP clock rate is source clock divide prescaler.

2.10 The Driver Change Log

2.11 COP Peripheral and Driver Overview

2.12 CRC: Cyclic Redundancy Check Driver

void CRC_Init(CRC_Type *base, const *crc_config_t* *psConfig)

Enables and configures the CRC peripheral module.

This function enables the clock gate in the SIM module for the CRC peripheral. It also configures the CRC module and starts a checksum computation by writing the seed.

Parameters

- base – CRC peripheral address.
- psConfig – CRC module configuration structure.

void CRC_Deinit(CRC_Type *base)

Disables the CRC peripheral module.

This function disables the clock gate in the SIM module for the CRC peripheral.

Parameters

- base – CRC peripheral address.

static inline void CRC_GetDefaultConfig(*crc_config_t* *psConfig, *crc_protocol_type_t* eCrcProtocol)

Provide default CRC protocol configuration.

The purpose of this API is to initialize the configuration structure to default value for CRC_Init to use. Provides the configuration of commonly used CRC protocols. refer to crc_protocol_type_t.

This is an example:

```
crc_config_t sConfig;
//LoadCRC-16/MAXIM protocol configuration.
CRC_GetDefaultConfig(&sConfig, kCRC_Crc16);
CRC_Init(CRC, &sConfig);
```

Parameters

- psConfig – CRC protocol configuration structure.
- eCrcProtocol – CRC protocol type. refer to crc_protocol_type_t

static inline void CRC_SetSeedValue(CRC_Type *base, uint32_t u32CrcSeedValue)

Set the CRC seed value.

This function is help to write a 16/32 bit CRC seed value.

Parameters

- base – CRC peripheral address.
- u32CrcSeedValue – The value of seed.

static inline void CRC_SetPolynomial(CRC_Type *base, uint32_t u32CrcPolynomial)

Set the value of the polynomial for the CRC calculation.

Write a 16-bit or 32-bit polynomial to CRC Polynomial register for the CRC calculation.

Parameters

- base – CRC peripheral address.
- u32CrcPolynomial – The CRC polynomial.

static inline void CRC_SetWriteTransposeType(CRC_Type *base, *crc_transpose_type_t* eTransposeIn)

Set CRC type of transpose of write data.

This function help to configure CRC type of transpose of write data.

Parameters

- base – CRC peripheral address.
- eTransposeIn – Type Of transpose for input. See crc_transpose_type_t

static inline void CRC_SetReadTransposeType(CRC_Type *base, *crc_transpose_type_t* eTransposeOut)

Set CRC type of transpose of read data.

This function help to configure CRC type of transpose of read data.

Parameters

- base – CRC peripheral address.
- eTransposeOut – Type Of transpose for output. See crc_transpose_type_t

static inline void CRC_EnableComplementChecksum(CRC_Type *base, bool bEnable)

Enable/Disable complement of read CRC checksum.

Set complement of read CRC checksum. Some CRC protocols require the final checksum to be XORed with 0xFFFFFFFF or 0xFFFF.

Parameters

- base – CRC peripheral address.
- bEnable – True or false. True if the result shall be complement of the actual checksum.

static inline void CRC_SetProtocolWidth(CRC_Type *base, *crc_bits_t* eCrcBits)

Set bit width of CRC protocol.

Selects 16-bit or 32-bit CRC protocol.

Parameters

- base – CRC peripheral address.
- eCrcBits – 16 or 32 bit CRC protocol. See crc_bits_t

void CRC_WriteData(CRC_Type *base, const uint8_t *pu8Data, uint32_t u32DataSize)

Writes data to the CRC module.

Writes input data buffer bytes to the CRC data register. The configured type of transpose is applied.

Parameters

- base – CRC peripheral address.
- pu8Data – Input data stream, MSByte in data[0].
- u32DataSize – Size in bytes of the input data buffer.

static inline uint32_t CRC_Get32bitResult(CRC_Type *base)

Reads the 32-bit checksum from the CRC module.

Reads the CRC data register (either an intermediate or the final checksum). The configured type of transpose and complement is applied.

Parameters

- base – CRC peripheral address.

Returns

An intermediate or the final 32-bit checksum, after transpose and complement operations configured.

uint16_t CRC_Get16bitResult(CRC_Type *base)

Reads a 16-bit checksum from the CRC module.

Reads the CRC data register (either an intermediate or the final checksum). The configured type of transpose and complement is applied.

Parameters

- base – CRC peripheral address.

Returns

An intermediate or the final 16-bit checksum, after transpose and complement operations configured.

FSL_CRC_DRIVER_VERSION

CRC driver version. Version.

enum _crc_protocol_type

CRC protocol type.

Values:

enumerator kCRC_Crc16

CRC-16/MAXIM protocol.

enumerator kCRC_Crc16CCITT

CRC-16-CCITT protocol.

enumerator kCRC_Crc16Kermit

CRC-16/KERMIT protocol.

enumerator kCRC_Crc32

CRC-32 protocol.

enumerator kCRC_Crc32Posix

CRC-32/POSIX protocol.

enum _crc_bits

CRC protocol bit width.

Values:

enumerator kCRC_Bits16

Generate 16-bit CRC code.

enumerator kCRC_Bits32

Generate 32-bit CRC code.

enum _crc_transpose_type

CRC type of transpose of read/write data.

Values:

enumerator kCRC_TransposeNone

No transpose.

enumerator kCRC_TransposeBits

Transpose bits in bytes.

enumerator kCRC_TransposeBitsAndBytes

Transpose bytes and bits in bytes.

enumerator kCRC_TransposeBytes

Transpose bytes.

typedef enum *_crc_protocol_type* crc_protocol_type_t
    CRC protocol type.

typedef enum *_crc_bits* crc_bits_t
    CRC protocol bit width.

typedef enum *_crc_transpose_type* crc_transpose_type_t
    CRC type of transpose of read/write data.

typedef struct *_crc_config* crc_config_t
    CRC protocol configuration.

    This structure holds the configuration for the CRC protocol.

struct _crc_config
    #include <fsl_crc.h> CRC protocol configuration.

    This structure holds the configuration for the CRC protocol.

Public Members

uint32_t u32CrcPolynomial
    CRC Polynomial, MSBit first. Example polynomial: 0x1021 = 1_0000_0010_0001 = x^12+x^5+1

uint32_t u32CrcSeedValue
    Starting checksum value

bool bEnableComplementChecksum
    Enable/Disable complement of read CRC checksum.

crc_transpose_type_t eTransposeIn
    Select type of transpose of input data.

crc_transpose_type_t eTransposeOut
    Select type of transpose of output data.

crc_bits_t eCrcBits
    Select 16-bit or 32-bit CRC protocol.

2.13 The Driver Change Log

2.14 CRC Peripheral and Driver Overview

2.15 DAC: 12-bit Digital-to-Analog Converter Driver

void DAC_Init(DAC_Type *base, const *dac_config_t* *psConfig)
    Initializes the DAC resource, including data format, sync signal, operation mode, etc.

    Parameters

    - base – DAC peripheral base address.
    - psConfig – The pointer to dac_config_t.

void DAC_Deinit(DAC_Type *base)

De-initializes the DAC resource, the clock and power will be gated off.

Invoking this function to power down the analog portion of DAC and disable the DAC clock.

Parameters

- base – DAC peripheral base address.

void DAC_GetDefaultConfig(*dac_config_t* *psConfig)

Gets the default DAC configs, such as operation mode, watermark level, sync signal, etc.

```
psConfig->eOperationMode = kDAC_NormalOperationMode;
psConfig->uOperationConfig.sNormalModeConfig.u16DataFIFO    = 0U;
psConfig->bEnableDMA                                    = false;
psConfig->eWatermarkLevel = kDAC_WatermarkValue2;
psConfig->eSyncInputEdge                                = kDAC_RisingEdge;
psConfig->eSpeedMode                                    = kDAC_HighSpeedMode;
psConfig->eDataFormat                                   = kDAC_DataWordRightJustified;
psConfig->eSyncSignal                                   = kDAC_InternalClockSignal;
psConfig->bEnableAnalogPortion                          = false;
psConfig->bEnableGlitchFilter                           = true;
psConfig->u8GlitchFilterCount                           = 29U;
```

Parameters

- psConfig – The pointer to dac_config_t.

static inline void DAC_SetSyncEdge(DAC_Type *base, *dac_sync_input_edge_t* eSyncEdge)

Selects which SYNC input edge is used for updates, available selections are "no active edge", "falling edge", "rising edge", "both edge".

Parameters

- base – DAC peripheral base address.
- eSyncEdge – The input edge to be set, please refer to dac_sync_input_edge_t for details.

static inline void DAC_SetLDOK(DAC_Type *base)

Updates the buffered value of stepSize, minValue ,and maxValue at the active edge of the SYNC_IN signal.

Note: Allows new values of minimum, maximum, and step value to be updated by active edge of SYNC_IN. This function should be invoked once new values of these buffered registers have been written by software. The LDOK bit will be cleared by an active edge of SYNC_IN.

Note: This function is only useful when the operation mode is selected as Automatic operation mode.

Parameters

- base – DAC peripheral base address.

static inline bool DAC_GetLDOKValue(DAC_Type *base)

Gets the value of load Okay bit field.

Note: When the SYNC signal is selected as external SYNC_IN signal, the load okay bit will be cleared by an active edge of the SYNC_IN signal. This function can be used to check whether the active edge of the SYNC_IN signal has reached.

Note: This function is only useful when the operation mode is selected as Automatic operation mode.

Parameters

- base – DAC peripheral base address.

Returns

- **true** The active edge of SYNC_IN signal has not reached when the SYNC signal is selected as external SYNC_IN signal.
- **false** The active edge of SYNC_IN signal has reached when the SYNC signal is selected as external SYNC_IN signal

static inline void DAC_EnableOneShot(DAC_Type *base, bool bEnable)

Enables/Disables Oneshot feature, oneshot feature used to determines whether automatic waveform generation creates one waveform or a repeated waveform within the period defined by the active SYNC edges.

Note: This function only useful when the operation mode is selected as automatic operation mode.

Parameters

- base – DAC peripheral base address.
- bEnable – Enable/Disable oneshot feature.
  - **true** Automatic waveform generation logic will create a single pattern and stop at the final value.
  - **false** Automatic waveform generation logic will create a repeated (continuous) waveform upon receiving an active SYNC edge.

static inline void DAC_WriteDataFIFO(DAC_Type *base, uint16_t u16Data)

Writes DAC buffered data value based on the data format when the DAC is in normal operation mode.

Parameters

- base – DAC peripheral base address.
- u16Data – The DAC data to be converted to analog. If the data format is set as kDAC_DataWordRightJustified then u16Data should range from 0 to 4095, which means the higher 4 bits is useless. If the data format is set as kDAC_DataWordLeftJustified, then the u16Data should range from 16 to 65520, which means the lower 4 bits is useless.

static inline void DAC_WriteStepSize(DAC_Type *base, uint16_t u16StepSize)

Writes Step size based on the data format when the DAC is in automatic operation mode.

Note: This function only useful when the operation mode is selected as automatic operation mode.

Parameters

- base – DAC peripheral base address.
- u16StepSize – The step value to be added to or subtracted from the current value. If the data format is set as kDAC_DataWordRightJustified then u16StepSize should range from 0 to 4095, which means the higher 4 bits is useless. If the data format is set as kDAC_DataWordLeftJustified, then the u16StepSize should range from 16 to 65520, which means the lower 4 bits is useless.

static inline void DAC_WriteMinValue(DAC_Type *base, uint16_t u16MinValue)

Writes the minium value based on the data format when the DAC is in automatic operation mode.

Note: This function only useful when the operation mode is selected as automatic operation mode. If DAC input data is less than the minium value, output is limited to the minium value during automatic waveform generation.

Parameters

- base – DAC peripheral base address.
- u16MinValue – The lower range limit during automatic waveform generation. If the data format is set as kDAC_DataWordRightJustified then u16MinValue should range from 0 to 4095, which means the higher 4 bits is useless. If the data format is set as kDAC_DataWordLeftJustified, then the u16MinValue should range from 16 to 65520, which means the lower 4 bits is useless.

static inline void DAC_WriteMaxValue(DAC_Type *base, uint16_t u16MaxValue)

Writes the maximum value based on the data format when the DAC is in automatic operation mode.

Note: This function only useful when the operation mode is selected as automatic operation mode. If DAC input data is greater than maximum value, output is limited to maximum value during automatic waveform generation.

Parameters

- base – DAC peripheral base address.
- u16MaxValue – The upper range limit during automatic waveform generation. If the data format is set as kDAC_DataWordRightJustified then u16MaxValue should range from 0 to 4095, which means the higher 4 bits is useless. If the data format is set as kDAC_DataWordLeftJustified, then the u16MaxValue should range from 16 to 65520, which means the lower 4 bits is useless.

static inline void DAC_ConfigRefreshFrequency(DAC_Type *base, uint16_t u16CompareValue)

Sets refresh frequency that used to decide when the automatically generated waveform value is updated.

Note: This function only useful when the operation mode is selected as automatic operation mode.

Parameters

- base – DAC peripheral base address.
- u16CompareValue – The compare value(0~65535).
  - **u16CompareValue=0** The generated waveform will be updated every clock cycle.
  - **u16CompareValue=N**(N!=0) The generated waveform will be updated every N+1 clock cycles.

static inline void DAC_EnableDMA(DAC_Type *base, bool bEnable)

Enables/Disables DMA request that to be generated when the FIFO is below the watermark level.

Note: This function is only useful when the operation mode is selected as Normal mode.

Parameters

- base – DAC peripheral base address.
- bEnable – Enable/Disable DMA support.
  - **true** Enable DMA support.
  - **false** Disable DMA support.

static inline void DAC_SetWatermarkLevel(DAC_Type *base, *dac_watermark_level_t* eWatermarkLevel)

Sets watermark level which is used for asserting a DMA request.

Note: When the level of FIFO is less than or equal to the Watermark level, a DMA request will be sent. This function is only useful when the operation mode is selected as Normal mode.

Parameters

- base – DAC peripheral base address.
- eWatermarkLevel – The watermark level of FIFO, please refer to dac_watermark_level_t for details.

static inline void DAC_EnableGlitchFilter(DAC_Type *base, bool bEnable)

Enables/Disables Glitch filter.

Parameters

- base – DAC peripheral base address.
- bEnable – Enable/Disable Glitch filter.
  - **true** Enable glitch filter.
  - **false** Disable glitch filter.

static inline void DAC_SetGlitchFilterCount(DAC_Type *base, uint8_t u8FilterCount)

Sets glitch filter count value(ranges from 0 to 63) that represents the number of clock cycles for which the DAC output is held unchanged after new data is presented to the analog DAC's inputs.

Parameters

- base – DAC peripheral base address.

- u8FilterCount – The count of glitch filter. This count represents the number of clock cycles for which the DAC output is held unchanged after new data is presented to the analog DAC's inputs.

static inline void DAC_SetSpeedMode(DAC_Type *base, *dac_speed_mode_t* eSpeedMode)

Selects speed mode, high speed mode uses more power and low speed mode saves power.

Parameters

- base – DAC peripheral base address.
- eSpeedMode – The speedMode to be set, please refer to dac_speed_mode_t for details.

static inline void DAC_EnableAnalogPortion(DAC_Type *base, bool bEnable)

Enables/Disables the operation of the analog portion of the DAC.

The function controls the power-up of the analog portion of the DAC. If powered up the analog portion, the DAC module will output the value currently presented to the Data register. The analog portion should be powered up when the DAC is in use. If power down the analog portion, the output of the DAC module will be pulled low. The analog portion should be powered down when the DAC is not in use.

Parameters

- base – DAC peripheral base address.
- bEnable – Power up/down the analog portion of the DAC.
  - **true** Power up the analog portion of the DAC, and the DAC will output the value currently presented to its inputs.
  - **false** Power down the analog portion of the DAC, and its output will be pulled down.

static inline uint16_t DAC_GetFIFOStatusFlags(DAC_Type *base)

Gets the fifo status flag of selected DAC instance.

Parameters

- base – DAC peripheral base address.

Returns

The status flags of DAC module, should be the OR'ed value of _dac_fifo_status_flags.

FSL_DAC_DRIVER_VERSION

DAC driver version.

enum _dac_fifo_status_flags

The enumeration of DAC status flags, including FIFO full status flag and FIFO empty status flag.

Values:

enumerator kDAC_FIFOFullStatusFlag

Indicate the FIFO is full.

enumerator kDAC_FIFOEmptyStatusFlag

Indicate the FIFO is empty.

enum _dac_operation_mode

The enumeration of DAC operation mode, including normal operation mode and automatic operation mode.

Values:

enumerator kDAC_NormalOperationMode

Normal Mode to generate an analog representation of digital words.

enumerator kDAC_AutomaticOperationMode

Automatic Mode to generate waveform without requiring CPU or core assistance.

enum _dac_sync_signal_selection

The enumeration of DAC sync signal mode, including internal clock signal and external SYNC_IN signal.

Values:

enumerator kDAC_InternalClockSignal

Internal Clock signal is selected as SYNC signal, data written to the buffered registers is used on the next clock cycle

enumerator kDAC_ExternalSyncInSignal

Peripheral external signal is selected as SYNC signal, the update occurs on the active edge of SYNC_IN signal.

enum _dac_waveform_type

The enumeration of waveform type, such as square waveform, triangle waveform, etc.

Values:

enumerator kDAC_RepeatSawtoothWaveform0

DAC generates repeated sawtooth waveform0. The automatic waveform generation logic will create a repeated sawtooth waveform0 upon receiving an active SYNC edge, and the waveform repeats when it reaches its minimum and maximum value. The waveform increases from starting value to max value firstly. Like this following shown:

```
 /|  /|  /|  /|
/ | / | / | / |
  | / | / | / |
  |/  |/  |/  |
```

enumerator kDAC_RepeatSawtoothWaveform1

DAC generates sawtooth waveform1. The automatic waveform generation logic will create a repeated sawtooth waveform1 upon receiving an active SYNC edge, and the waveform repeats when it reaches its minimum and maximum value. The waveform decreases from starting value to min value firstly. Like this following shown:

```
  |\  |\  |\  |\
  | \ | \ | \ | \
\ | \ | \ | \ | \
 \|  \|  \|  \|  \
```

enumerator kDAC_RepeatTriangleWaveform0

The automatic waveform generation logic will create a repeated triangle waveform0 upon receiving an active SYNC edge, and the waveform repeats when it reaches its minimum and maximum value. In this type the generated triangle waveform rises from the starting value. Like this following shown:

```
   /\      /\      /\
  /  \    /  \    /  \    /
 /    \  /    \  /    \  /
       \/      \/      \/
```

enumerator kDAC_RepeatTriangleWaveform1

The automatic waveform generation logic will create a repeated triangle waveform1 upon receiving an active SYNC edge, and the waveform repeats when it reaches its minimum and maximum value. In this type the generated triangle waveform drops from the starting value. Like this following shown:

```
    /\    /\    /\
\  /  \  /  \  /  \
 \/    \/    \/
```

enumerator kDAC_OneShotSawtoothWaveform0

Automatic waveform generation logic will create a single pattern and stop at the final value. It will remain at the finial value until a new active edge occurs on the SYNC input, and then the waveform will be repeated. Like this following shown:

```
        /|      /|
       / |     / |
      /  |    /  |
_____/   |___/   |____
```

enumerator kDAC_OneShotSawtoothWaveform1

Automatic waveform generation logic will create a single pattern and stop at the final value. It will remain at the finial value until a new active edge occurs on the SYNC input, and then the waveform will be repeated. Like this following shown:

```
:
      |\    |\
      | \   | \
      |  \  |  \
______|   \_|   \___
```

enum _dac_sync_input_edge

The enumeration of sync input edge that used for updates buffered registers, such as Falling edge, etc.

Values:

enumerator kDAC_NoActiveEdge

No active edge is selected, it means the SYNC input is ignored.

enumerator kDAC_FallingEdge

Updates occur on the falling edge of the SYNC input.

enumerator kDAC_RisingEdge

Updates occur on the rising edge of the SYNC input.

enumerator kDAC_BothEdges

Updates occur on both edges of the SYNC input.

enum _dac_speed_mode

The enumeration of DAC speed mode, including high speed mode and low speed mode.

Values:

enumerator kDAC_HighSpeedMode

In High Speed Mode, the setting time of the DAC module is 1us, but the DAC module uses more power.

enumerator kDAC_LowSpeedMode

In Low Speed Mode, the DAC module uses less power but takes more time to settle.

enum _dac_watermark_level

The enumeration of FIFO watermark level.

Values:

enumerator kDAC_WatermarkValue0
Watermark value is 0.

enumerator kDAC_WatermarkValue2
Watermark value is 2.

enumerator kDAC_WatermarkValue4
Watermark value is 4.

enumerator kDAC_WatermarkValue6
Watermark value is 6

enum _dac_data_format
The enumeration of DAC data format, inclding right right-justified and left-justified.

Values:

enumerator kDAC_DataWordRightJustified
The 12 bits data is right-justified.

enumerator kDAC_DataWordLeftJustified
The 12 bits data iss left-justified.

typedef enum *_dac_operation_mode* dac_operation_mode_t
The enumeration of DAC operation mode, including normal operation mode and automatic operation mode.

typedef enum *_dac_sync_signal_selection* dac_sync_signal_selection_t
The enumeration of DAC sync signal mode, including internal clock signal and external SYNC_IN signal.

typedef enum *_dac_waveform_type* dac_waveform_type_t
The enumeration of waveform type, such as square waveform, triangle waveform, etc.

typedef enum *_dac_sync_input_edge* dac_sync_input_edge_t
The enumeration of sync input edge that used for updates buffered registers, such as Falling edge, etc.

typedef enum *_dac_speed_mode* dac_speed_mode_t
The enumeration of DAC speed mode, including high speed mode and low speed mode.

typedef enum *_dac_watermark_level* dac_watermark_level_t
The enumeration of FIFO watermark level.

typedef enum *_dac_data_format* dac_data_format_t
The enumeration of DAC data format, inclding right right-justified and left-justified.

typedef struct *_dac_normal_mode_config* dac_normal_mode_config_t
The structure of configuration when the operation mode is selected are normal operation mode.

typedef struct *_dac_automatic_mode_config* dac_automatic_mode_config_t
The structure of configuration when the operation mode is selected as automatic operation mode.

typedef union *_dac_operation_config* dac_operation_config_u
The union of operation modes' configuration.

typedef struct *_dac_config* dac_config_t
The structure for configuring the DAC.

This structure is used to config the DAC module, to initialize the DAC module, user must set the member of this structure. This structure will cost 20 Byte memory space.

struct _dac_normal_mode_config

#include <fsl_dac.h> The structure of configuration when the operation mode is selected are normal operation mode.

Public Members

bool bEnableDMA

Enable/Disable DMA support.

- **true** Enable DMA support.
- **false** Disable DMA support.

uint16_t u16DataFIFO

The FIFO watermark level, if the level of FIFO is less than or equal to the watermark level field, a DMA request should be sent. The DAC data to be converted to analog. If the data format is set as kDAC_DataWordRightJustified then u16DataFIFO should range from 0 to 4095, which means the higher 4 bits is useless. If the data format is set as kDAC_DataWordLeftJustified, then the u16DataFIFO should range from 16 to 65520, which means the lower 4 bits is useless.

struct _dac_automatic_mode_config

#include <fsl_dac.h> The structure of configuration when the operation mode is selected as automatic operation mode.

Public Members

dac_waveform_type_t eWaveformType

The type of waveform to be generated.

uint16_t u16MinValue

The step size to be added to or subtracted from the current value. If the data format is set as kDAC_DataWordRightJustified then u16StepSize should range from 0 to 4095, which means the higher 4 bits is useless. If the data format is set as kDAC_DataWordLeftJustified , then the u16StepSize should range from 16 to 65520, which means the lower 4 bits is useless.

The minimum value is the lower range limit during automatic waveform generation. If the data format is set as kDAC_DataWordRightJustified then u16MinValue should range from 0 to 4095, which means the higher 4 bits is useless. If the data format is set as kDAC_DataWordLeftJustified, then the u16MinValue should range from 16 to 65520, which means the lower 4 bits is useless.

uint16_t u16MaxValue

The maximum value is the upper range limit during automatic waveform generation. If the data format is set as kDAC_DataWordRightJustified then u16MaxValue should range from 0 to 4095, which means the higher 4 bits is useless. If the data format is set as kDAC_DataWordLeftJustified, then the u16MaxValue should range from 16 to 65520, which means the lower 4 bits is useless.

uint16_t u16StartValue

The start value of the wavefrom, should larger than the minium value and smaller than the maximum value.

uint16_t u16CompareValue

The compare value that used to decide the frequency of REFRESH signal. The available range is 0 ~ 65535.

- **u16CompareValue=0** The REFRESH signal's frequency is equal to the clock's frequency so that the generated waveform will be updated every clock cycle.

- **u16CompareValue=N**(N!=0) The REFRESH signal's frequency is equal to clock's frequency divided N+1 so that the generated waveform will be updated every N+1 clock cycles

union _dac_operation_config

#include <fsl_dac.h> The union of operation modes' configuration.

Public Members

dac_normal_mode_config_t sNormalModeConfig

The configuration of normal operation mode, such as buffered data, watermark level, etc.

dac_automatic_mode_config_t sAutomaticModeConfig

The configuration of automatic operation mode, such as step size, minimum value, maximum value, etc.

struct _dac_config

#include <fsl_dac.h> The structure for configuring the DAC.

This structure is used to config the DAC module, to initialize the DAC module, user must set the member of this structure. This structure will cost 20 Byte memory space.

Public Members

dac_operation_mode_t eOperationMode

The operation mode. The available selections are kDAC_NormalOperationMode and kDAC_AutomaticOperationMode.

dac_sync_signal_selection_t eSyncSignal

The selected sync signal that used to update buffered data, the available selections are kDAC_InternalClockSignal and kDAC_ExternalSyncInSignal

dac_sync_input_edge_t eSyncInputEdge

The SYNC input edge used to update buffered registers. The buffered value will be updated at the selected active edge of SYNC_IN signal.

dac_data_format_t eDataFormat

The data format of DAC instance. The available selections are kDAC_DataWordRightJustified and kDAC_DataWordLeftJustified

dac_operation_config_u uOperationConfig

The configuration of operation mode.

bool bEnableGlitchFilter

Enable/Disable glitch suppression filter.

- **true** Enable glitch filter.
- **false** Disable glitch filter.

uint8_t u8GlitchFilterCount

The count(ranges from 0 to 63) represents the number of clock cycles for which the DAC output is held unchanged after new data is presented to the analog DAC's inputs.

dac_speed_mode_t eSpeedMode

The speed mode of DAC instance. The available selections are kDAC_HighSpeedMode and kDAC_LowSpeedMode.

bool bEnableAnalogPortion

Power up/down the analog portion.

- **true** Power up the analog portion of the DAC, and the DAC will output the value currently presented to its inputs.
- **false** Power down the analog portion of the DAC, and its output will be pulled down.

2.16 The Driver Change Log

2.17 DAC Peripheral and Driver Overview

2.18 DMAMUX: DMA Channel Multiplexer Driver

static inline void DMAMUX_ConnectChannelToTriggerSource(DMAMUX_Type *base, *dmamux_dma_channel_t* eChannel, dma_request_source_t eSource)

Connect the DMAMUX channel to trigger source.

This function will connnect a source to the specify dma channel and enable that channel

Parameters

- base – DMAMUX peripheral base address.
- eChannel – DMAMUX channel index, dmamux_dma_channel_t.
- eSource – DMA request source.

static inline void DMAMUX_DisconnectChannelFromTriggerSource(DMAMUX_Type *base, *dmamux_dma_channel_t* eChannel)

Disconnect the DMAMUX channel.

This function will disable the specified channel and reset the channel source.

Parameters

- base – DMAMUX peripheral base address.
- eChannel – DMAMUX channel index, dmamux_dma_channel_t.

FSL_DMAMUX_DRIVER_VERSION

DMAMUX driver version.

enum _dmamux_dma_channel

List of Dmamux dma channels.

Values:

enumerator kDMAMUX_DMAChannel0

Dmamux dma channel 0

enumerator kDMAMUX_DMAChannel1

Dmamux dma channel 1

enumerator kDMAMUX_DMAChannel2

Dmamux dma channel 2

enumerator kDMAMUX_DMAChannel3
Dmamux dma channel 3

typedef enum *_dmamux_dma_channel* dmamux_dma_channel_t
List of Dmamux dma channels.

2.19 The Driver Change Log

2.20 DMAMUX Peripheral and Driver Overview

2.21 EDMA: Enhanced Direct Memory Access Driver

void EDMA_GetDefaultConfig(*edma_config_t* *psConfig)
Get default edma peripheral configuration.

Note: This function will reset all of the configuration structure members to zero firstly, then apply default configurations to the structure.

Parameters

- psConfig – pointer to user's eDMA config structure, see edma_config_t for detail.

void EDMA_Init(DMA_Type *base, *edma_config_t* *psConfig)
EDMA initialization.

Parameters

- base – eDMA peripheral base address.
- psConfig – pointer to user's eDMA config structure, see edma_transfer_config_t for detail.

void EDMA_Deinit(DMA_Type *base)
EDMA De-initialization.

Parameters

- base – eDMA peripheral base address.

static inline void EDMA_EnableContinuousChannelLinkMode(DMA_Type *base, bool bEnable)
Enable/Disable arbitration before the channel been activate by minor loop link trigger from itself.

A minor loop channel link made to itself does not go through channel arbitration before being activated again. Upon minor loop completion, the channel activates again if that channel has a minor loop channel link enabled and the link channel is itself. This effectively applies the minor loop offsets and restarts the next minor loop.

Note: Do not use continuous link mode with a channel linking to itself if there is only one minor loop iteration per service request, for example, if the channel's NBYTES value is the same as either the source or destination size. The same data transfer profile can be achieved by simply increasing the NBYTES value, which provides more efficient, faster processing.

Parameters

- base – EDMA peripheral base address.
- bEnable – true is channel link to itself without arbitration false is channel link to itself with arbitration

static inline void EDMA_EnableMinorLoopMapping(DMA_Type *base, bool bEnable)

Enable/Disable redefine the minor loop bytes register.

The TCDn.word2 is redefined to include individual enable fields, an offset field and the NBYTES field, the offset will be applied to source/destination address after minor loop complete

Parameters

- base – EDMA peripheral base address.
- bEnable – true is minor loop bytes register redefined to individual enable/offset/minor loop bytes fields. false is minor loop bytes register defined as minor loop bytes fields only.

static inline void EDMA_EnableHaltOnError(DMA_Type *base, bool bEnable)

Enable/Disable the eDMA halt when error occur feature.

Any error causes the HALT bit to set will cause the EDMA halt. Subsequently, all service requests are ignored until the HALT bit is cleared

Parameters

- base – EDMA peripheral base address.
- bEnable – true is Stall the start of any new channels when error occur. false is eDMA service request operation normal when error occur.

static inline void EDMA_SetArbitration(DMA_Type *base, *edma_arbitration_type_t* eArbitration)

set EDMA arbitration type to fixed priority or round robin.

Parameters

- base – EDMA peripheral base address.
- eArbitration – Arbitration by priority or round robin, edma_arbitration_type_t.

void EDMA_GetChannelDefaultTransferConfig(*edma_channel_transfer_config_t* *psTransfer, uint32_t u32SrcAddr, uint32_t u32DstAddr, uint32_t u32BytesEachRequest, uint32_t u32TotalBytes, *edma_channel_transfer_width_t* eTransferWidth, *edma_channel_transfer_type_t* eTransferType)

Get channel default transfer configuration.

Note: 1. This function will reset all of the configuration structure members to zero firstly, then apply default configurations to the structure.

a. No interrupt enabled by this function by default, if application would like to use DMA interrupt please enable it manually by psTransfer->u16EnabledInterruptMask = _edma_channel_interrupt

---

Parameters

- psTransfer – pointer to user's eDMA channel configure structure, see edma_channel_transfer_config_t for detail.
- u32SrcAddr – source address, must be byte address.

- u32DstAddr – destination address, must be byte address.
- u32BytesEachRequest – bytes to be transferred in each request(namely, in each minor loop).
- u32TotalBytes – total bytes to be transferred.
- eTransferWidth – it represents how many bits are transferred in each read/write.
- eTransferType – eDMA channel transfer type.

void EDMA_SetChannelTransferConfig(DMA_Type *base, *edma_channel_t* eChannel, *edma_channel_transfer_config_t* *psTransfer)

EDMA set channel transfer configurations.

Note: 1.This function must not be called while the channel transfer is ongoing or it causes unpredictable results. 2.The psLinkTCD must be configured before invoke this API if scatter/gather function is needed 3.The edma channel request may be enabled after the channel transfer configure done according to the transfer configurations.

Parameters

- base – eDMA peripheral base address.
- eChannel – eDMA channel number.
- psTransfer – pointer to user's eDMA channel configure structure, see edma_channel_transfer_config_t for detail.

void EDMA_SetChannelMinorLoopOffset(DMA_Type *base, *edma_channel_t* eChannel, bool bEnableSrcMinorLoopOffset, bool bEnableDestMinorLoopOffset, int32_t i32MinorLoopOffset)

Configures the eDMA channel minor loop offset value.

The minor offset means that the signed-extended value is added to the source address or destination address after each minor loop.

Parameters

- base – eDMA peripheral base address.
- eChannel – eDMA channel number.
- bEnableSrcMinorLoopOffset – True is enable source address minor offset, otherwise is disable
- bEnableDestMinorLoopOffset – True is enable source address minor offset, otherwise is disable
- i32MinorLoopOffset – Minor loop offset value.

void EDMA_SetChannelPreemption(DMA_Type *base, *edma_channel_t* eChannel, bool bSuspendedByHighPriorityChannel, bool bSuspendLowPriorityChannel, uint8_t u8Priority)

Configures the eDMA channel preemption configurations.

This function configures the channel preemption attribute and the priority of the channel.

Note: , this function is used only in fixed-priority channel arbitration mode.

Parameters

- base – eDMA peripheral base address.
- eChannel – eDMA channel number
- bSuspendedByHighPriorityChannel – True is the channel can be suspended by high priority channel, otherwise cannot.
- bSuspendLowPriorityChannel – True is the channel can suspend low priority channel, otherwise cannot.
- u8Priority – Channel priority.

void EDMA_EnableMinorLoopChannelLink(DMA_Type *base, *edma_channel_t* eChannel, *edma_channel_t* eLinkChannel)

Enable the minor loop channel link and configure the linked channel number.

This function configures the minor link mode. The minor link means that the channel link is triggered every time that the minor loop bytes transferred complete.

Note: Users should ensure that DONE flag is cleared before calling this interface, or the configuration is invalid.

Parameters

- base – eDMA peripheral base address.
- eChannel – eDMA channel number.
- eLinkChannel – The linked channel number.

static inline void EDMA_DisableMinorLoopChannelLink(DMA_Type *base, *edma_channel_t* eChannel)

Disable the minor loop channel link for the eDMA transfer.

Parameters

- base – eDMA peripheral base address.
- eChannel – eDMA channel number.

void EDMA_EnableMajorLoopChannelLink(DMA_Type *base, *edma_channel_t* eChannel, *edma_channel_t* eLinkChannel)

Enable the major loop channel link and configure the linked channel number.

This function configures the major link mode. The major link means that the channel link is triggered when the CITER is exhausted.

Note: Users should ensure that DONE flag is cleared before calling this interface, or the configuration is invalid.

Parameters

- base – eDMA peripheral base address.
- eChannel – eDMA channel number.
- eLinkChannel – The linked channel number.

static inline void EDMA_DisableMajorLoopChannelLink(DMA_Type *base, *edma_channel_t* eChannel)

Disable the major loop channel link for the eDMA transfer.

Parameters

- base – eDMA peripheral base address.
- eChannel – eDMA channel number.

void EDMA_SetChannelBandWidth(DMA_Type *base, *edma_channel_t* eChannel, *edma_channel_bandwidth_t* eBandWidth)

Sets the edma channel stall cycles after each R/W.

Because the eDMA processes the minor loop, it continuously generates read/write sequences until the minor count is exhausted. The bandwidth forces the eDMA to stall after the completion of each read/write access to control the bus request bandwidth seen by the crossbar switch.

Note: : 1.If the source and destination sizes are equal, this field is ignored between the first and second transfers and after the last write of each minor loop. This behavior is a side effect of reducing start-up latency. 2.When executing a large, zero wait-stated memory-to-memory transfer, insert bandwidth control using the TCD_CSR[BWC] bits to avoid: •* Starvation of another master accessing the memory. •* Any delay in writing a TCD duloop the transfer.

Parameters

- base – eDMA peripheral base address.
- eChannel – eDMA channel number.
- eBandWidth – A bandwidth setting, which can be one of the edma_channel_bandwidth_t

void EDMA_SetChannelModulo(DMA_Type *base, *edma_channel_t* eChannel, *edma_channel_modulo_t* eSrcModulo, *edma_channel_modulo_t* eDestModulo)

Sets the source address range and the destination address range for the eDMA transfer.

This function defines a specific address range of source/destination address, after the source/destination address hits the range boundary, source/destination address will wrap to origin value.

Setting this field provides the ability to implement a circular data queue easily. For data queues require loop power-of-2 size bytes, the queue should start at a 0-modulo-size address and the SMOD field should be set to the appropriate value for the queue, freezing the desired number of upper address bits. The value programmed into this field specifies the number of lower address bits allowed to change

Parameters

- base – eDMA peripheral base address.
- eChannel – eDMA channel number.
- eSrcModulo – A source modulo value.
- eDestModulo – A destination modulo value.

static inline void EDMA_EnableChannelAsyncRequestInStopMode(DMA_Type *base, *edma_channel_t* eChannel, bool bEnable)

Enables the edma channel async request in stop mode.

The EARS register is used to enable or disable the DMA requests in Enable Request Register (ERQ) by AND'ing the bits of these two registers in stop mode only.

Parameters

- base – eDMA peripheral base address.

- eChannel – eDMA channel number.
- bEnable – The command to enable (true) or disable (false).

static inline void EDMA_EnableChannelAutoStopRequest(DMA_Type *base, *edma_channel_t* eChannel, bool bEnable)

Enables the edma channel auto disable request after major loop complete.

The eDMA hardware automatically clears the corresponding ERQ bit when the current major iteration count reaches zero.

Parameters

- base – eDMA peripheral base address.
- eChannel – eDMA channel number.
- bEnable – The command to enable (true) or disable (false).

void EDMA_SetChannelMajorLoopOffset(DMA_Type *base, *edma_channel_t* eChannel, int32_t i32SourceOffset, int32_t i32DestOffset)

Configures the eDMA channel major loop offset feature.

Adjustment value added to the source/destination address at the completion of the major iteration count

Parameters

- base – eDMA peripheral base address.
- eChannel – edma channel number.
- i32SourceOffset – source address offset.
- i32DestOffset – destination address offset.

static inline void EDMA_EnableChannelRequest(DMA_Type *base, *edma_channel_t* eChannel, bool bEnable)

Enable/disable the eDMA hardware channel request.

This function enables the hardware channel request.

Parameters

- base – eDMA peripheral base address.
- eChannel – eDMA channel number.
- bEnable – true is start, false is stop.

static inline void EDMA_SoftwareTriggerChannelStart(DMA_Type *base, *edma_channel_t* eChannel)

Starts the eDMA transfer by using the software trigger.

This function starts a minor loop transfer only, the channel will halt when minor loop complete, so application should re-call the function to start the transfer again.

Parameters

- base – eDMA peripheral base address.
- eChannel – eDMA channel number.

uint32_t EDMA_GetChannelRemainingMajorLoopCount(DMA_Type *base, *edma_channel_t* eChannel)

Gets the remaining major loop count from the eDMA current channel TCD.

This function checks the TCD (Transfer Control Descriptor) status for a specified eDMA channel and returns the number of major loop count that has not finished.

Note: 1. This function can only be used to get unfinished major loop count of transfer without the next TCD, or it might be inaccuracy.

a. The unfinished/remaining transfer bytes cannot be obtained directly from registers while the channel is running. Because to calculate the remaining bytes, the initial NBYTES configured in DMA_TCDn_NBYTES_MLNO register is needed while the eDMA IP does not support getting it while a channel is active. In another word, the NBYTES value reading is always the actual (decrementing) NBYTES value the dma_engine is working with while a channel is running. Consequently, to get the remaining transfer bytes, a software-saved initial value of NBYTES (for example copied before enabling the channel) is needed. The formula to calculate it is shown below: RemainingBytes = RemainingMajorLoopCount * NBYTES(initially configured)

Parameters

- base – eDMA peripheral base address.
- eChannel – eDMA channel number.

Return values

Major – loop count which has not been transferred yet for the current TCD.

void EDMA_EnableChannelInterrupts(DMA_Type *base, *edma_channel_t* eChannel, uint16_t u16InterruptsMask, bool bEnable)

Enables the edma channel interrupts according to a provided mask, the mask is a logical OR of enumerator members _edma_channel_interrupt_enable.

Parameters

- base – eDMA peripheral base address.
- eChannel – eDMA channel number.
- u16InterruptsMask – the mask is a logical OR of enumerator members _edma_channel_interrupt_enable.
- bEnable – true is enable, false is disable.

uint16_t EDMA_GetChannelStatusFlags(DMA_Type *base, *edma_channel_t* eChannel)

Gets the eDMA channel status flags.

Note: if the function return error status, application can call EDMA_GetErrorStatusFlags for the detail error status.

Parameters

- base – eDMA peripheral base address.
- eChannel – eDMA channel number.

Return values

The – mask of channel status flags. Users need to use the _edma_channel_status_flags type to decode the return variables.

void EDMA_ClearChannelStatusFlags(DMA_Type *base, *edma_channel_t* eChannel, uint16_t u16StatusFlags)

Clears the eDMA channel status flags.

Parameters

- base – eDMA peripheral base address.
- eChannel – eDMA channel number.

- u16StatusFlags – The mask of channel status to be cleared. Users need to use the defined _edma_channel_status_flags type.

static inline uint32_t EDMA_GetErrorStatusFlags(DMA_Type *base)

Gets the eDMA channel error status flags.

Parameters

- base – eDMA peripheral base address.

Returns

The mask of error status flags. Users need to use the _edma_error_status_flags type to decode the return variables.

void EDMA_ConfigChannelSoftwareTCD(*edma_channel_tcd_t* *psTcd, *edma_channel_transfer_config_t* *psTransfer)

Sets TCD fields according to the user's channel transfer configuration structure, edma_channel_transfer_config_t.

Application should be careful about the TCD pool buffer storage class,

- For the platform has cache, the software TCD should be put in non cache section
- The TCD pool buffer should have a consistent storage class.

Note: Application should be careful when using the minor loop offset feature with this function, please make sure the EMLM bit is asserted, although EDMA_InitChannel will set this bit by default, if the bit is cleared, application can use EDMA_EnableMinorLoopMapping to enable the feature.

Note: This function enables the auto stop request feature.

Parameters

- psTcd – Pointer to the TCD structure.
- psTransfer – channel transfer configuration pointer.

void EDMA_InstallChannelSoftwareTCD(DMA_Type *base, *edma_channel_t* eChannel, *edma_channel_tcd_t* *psTcd)

Push content of software TCD structure into hardware TCD register.

Parameters

- base – EDMA peripheral base address.
- eChannel – EDMA channel number.
- psTcd – Point to TCD structure.

void EDMA_TransferCreateHandle(DMA_Type *base, *edma_handle_t* *psHandle, *edma_channel_t* eChannel, *edma_channel_tcd_t* *psTcdPool, uint32_t u32TcdCount, *edma_transfer_callback_t* pfCallback, void *pUserData)

Creates the eDMA channel handle.

This function is called if using the transactional API for eDMA. This function initializes the internal state of the eDMA handle.

Parameters

- base – eDMA peripheral base address.

- psHandle – eDMA handle pointer. The eDMA handle stores callback function and parameters.
- eChannel – eDMA channel number.
- psTcdPool – A memory pool to store TCDs. It must be 32 bytes aligned.
- u32TcdCount – The number of TCD slots.
- pfCallback – eDMA callback function pointer.
- pUserData – A parameter for the callback function.

status_t EDMA_TransferSubmitSingleTransfer(*edma_handle_t* *psHandle, *edma_channel_transfer_config_t* *psTransfer)

Submits the eDMA single transfer configuration.

Application can submit single transfer when

a. channel is idle, the transfer request will be submitted to eDMA channel TCD register directly
b. channel is idle, a previous transfer request is pending, the new transfer request will be submitted to the installed TCD pool and linked to the pending one.
c. channel is active, the transfer request will be submitted to the installed TCD pool and linked to previous one.

It is suggest that application should check the return value of this function to make sure that the transfer request is submitted successfully.

Note: , 1.Please be aware of that tcd pool maintain is unprotect by default, that is to say, the behavior of multiple task trying to access the same channel is undefine, application can protect the channel by itself or overwrite EDMA_ENTER_CRITICAL_SECTION/EDMA_LEAVE_CRITICAL_SECTION to have edma driver protect the TCD pool maintain. 2.Since the destination major loop offset feature register is reused as scatter gather tcd address, so the two features cannot be used together, if the destination major loop offset feature is used, then the transfer request will be submit hardware TCD directly.

Parameters

- psHandle – eDMA handle pointer.
- psTransfer – pointer to user's eDMA channel configure structure, see edma_channel_transfer_config_t for detail.

Return values

- kStatus_Success – It means submit transfer request succeed.
- kStatus_EDMA_ChannelQueueFull – It means TCD queue is full. Submit transfer request is not allowed.

status_t EDMA_TransferSubmitLoopTransfer(*edma_handle_t* *psHandle, *edma_channel_transfer_config_t* *psTransfer, uint32_t transferLoopCount)

Submits the eDMA scatter gather transfer configurations.

The function is target for submit loop transfer request, the ring transfer request means that the transfer request TAIL is link to HEAD, such as, A->B->C->D->A, or A->A

To use the ring transfer feature, the application should allocate several transfer object, such as

```
edma_channel_transfer_config_t transfer[2];
EDMA_TransferSubmitLoopTransfer(psHandle, &transfer, 2U);
```

Then eDMA driver will link transfer[0] and transfer[1] to each other

---

Note: Application should check the return value of this function to avoid transfer request submit failed

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Parameters

- psHandle – eDMA handle pointer
- psTransfer – pointer to user's eDMA channel configure structure, see edma_channel_transfer_config_t for detail
- transferLoopCount – the count of the transfer ring, if loop count is 1, that means that the one will link to itself.

Return values

- kStatus_Success – It means submit transfer request succeed
- kStatus_EDMA_ChannelBusy – channel is in busy status
- kStatus_EDMA_ChannelQueueFull – It means TCD pool is not len enough for the ring transfer request

void EDMA_TransferStart(*edma_handle_t* *psHandle)

eDMA starts transfer.

This function enables the channel request. Users can call this function after submitting the transfer request or before submitting the transfer request.

Parameters

- psHandle – eDMA handle pointer.

void EDMA_TransferStop(*edma_handle_t* *psHandle)

eDMA stops transfer.

This function disables the channel request to pause the transfer. Users can call EDMA_StartTransfer() again to resume the transfer.

Parameters

- psHandle – eDMA handle pointer.

void EDMA_TransferAbort(*edma_handle_t* *psHandle)

eDMA aborts transfer.

This function disables the channel request and clear transfer status bits. Users can submit another transfer after calling this API.

Parameters

- psHandle – DMA handle pointer.

void EDMA_TransferHandleIRQ(*edma_handle_t* *psHandle)

eDMA IRQ handler for the current major loop transfer completion.

This function clears the channel major interrupt flag and calls the callback function if it is not NULL.

Note: For the case using TCD queue, when the major iteration count is exhausted, additional Interfaces are performed. These include the final address adjustments and reloading of the BITER field into the CITER. Assertion of an optional interrupt request also occurs at this time, as does a possible fetch of a new TCD from memory using the scatter/gather address pointer included in the descriptor (if scatter/gather is enabled).

For instance, when the time interrupt of TCD[0] happens, the TCD[1] has already been loaded into the eDMA engine. As sga and sga_index are calculated based on the DLAST_SGA bit field lies in the TCD_CSR register, the sga_index in this case should be 2 (DLAST_SGA of TCD[1] stores the address of TCD[2]). Thus, the "tcdUsed" updated should be (tcdUsed - 2U) which indicates the number of TCDs can be loaded in the memory pool (because TCD[0] and TCD[1] have been loaded into the eDMA engine at this point already.).

For the last two continuous ISRs in a scatter/gather process, they both load the last TCD (The last ISR does not load a new TCD) from the memory pool to the eDMA engine when major loop completes. Therefore, ensure that the header and tcdUsed updated are identical for them. tcdUsed are both 0 in this case as no TCD to be loaded.

See the "eDMA basic data flow" in the eDMA Functional description section of the Reference Manual for further details.

Parameters

- psHandle – eDMA handle pointer.

FSL_EDMA_DRIVER_VERSION

EDMA driver version.

_edma_transfer_status eDMA transfer status The enumerator used for transactional interface only.

Values:

enumerator kStatus_EDMA_ChannelQueueFull

TCD queue is full.

enumerator kStatus_EDMA_ChannelBusy

Channel is busy and can't handle the transfer request.

enum _edma_channel_transfer_type

eDMA transfer type

Values:

enumerator kEDMA_ChannelTransferMemoryToMemory

Transfer type from memory to memory assume that the both source and destination address are incremental

enumerator kEDMA_ChannelTransferPeripheralToMemory

Transfer type peripher to memory assume that the source address is fixed

enumerator kEDMA_ChannelTransferMemoryToPeripheral

Transfer type from memory to peripheral assume that the destination address is fixed

enumerator kEDMA_ChannelTransferPeripheralToPeripheral

Transfer type from Peripheral to peripheral assume that both source and destination address are fixed

enum _edma_channel_interrupt_enable

eDMA interrupt source

The eDMA peripheral support generate interrupt when half of the total request bytes transferred or all of the request bytes transferred.

Values:

enumerator kEDMA_ChannelErrorInterruptEnable
Enable error interrupt

enumerator kEDMA_ChannelMajorLoopCompleteInterruptEnable
Enable interrupt while major count exhausted.

enumerator kEDMA_ChannelMajorLoopHalfCompleteInterruptEnable
Enable interrupt while major count to half value.

enumerator kEDMA_ChannelAllInterruptEnable
Enable all the interrupt.

enum _edma_channel_status_flags
_edma_channel_status_flags eDMA channel status flags.

Values:

enumerator kEDMA_ChannelStatusErrorFlag
eDMA error flag, an error occurred in a transfer

enumerator kEDMA_ChannelStatusMajorLoopCompleteFlag
Major loop complete flag, set while transfer finished, CITER value exhausted

enumerator kEDMA_ChannelStatusMajorLoopHalfCompleteFlag
Major loop half complete flag

enum _edma_error_status_flags
_edma_error_status_flags eDMA channel detail error status flags.

Values:

enumerator kEDMA_ChannelDestinationBusErrorFlag
Bus error on destination address

enumerator kEDMA_ChannelSourceBusErrorFlag
Bus error on the source address

enumerator kEDMA_ChannelScatterGatherErrorFlag
Error on the Scatter/Gather address, not 32byte aligned.

enumerator kEDMA_ChannelNbytesErrorFlag
NBYTES/CITER configuration error

enumerator kEDMA_ChannelDestinationOffsetErrorFlag
Destination offset not aligned with destination size

enumerator kEDMA_ChannelDestinationAddressErrorFlag
Destination address not aligned with destination size

enumerator kEDMA_ChannelSourceOffsetErrorFlag
Source offset not aligned with source size

enumerator kEDMA_ChannelSourceAddressErrorFlag
Source address not aligned with source size

enumerator kEDMA_ChannelErrorChannelFlag
Error channel number of the canceled channel number

enumerator kEDMA_ChannelPriorityErrorFlag
Channel priority is not unique.

enumerator kEDMA_ChannelTransferCanceledFlag
Transfer canceled

enumerator kEDMA_ChannelValidFlag
No error occurred, this bit is 0. Otherwise, it is 1.

enum _edma_arbitration_type
eDMA arbitration type

Values:

enumerator kEDMA_ArbitrationFixedPriority
channel arbitration by fixed priority

enumerator kEDMA_ArbitrationRoundRobin
Channel arbitration by round robin

enum _edma_channel
edma channel index

Values:

enumerator kEDMA_Channel0
EDMA channel 0

enumerator kEDMA_Channel1
EDMA channel 1

enumerator kEDMA_Channel2
EDMA channel 2

enumerator kEDMA_Channel3
EDMA channel 3

enum _edma_channel_transfer_width
eDMA transfer width configuration

Values:

enumerator kEDMA_ChannelTransferWidth8Bits
Source/Destination data transfer width is 1 byte every time

enumerator kEDMA_ChannelTransferWidth16Bits
Source/Destination data transfer width is 2 bytes every time

enumerator kEDMA_ChannelTransferWidth32Bits
Source/Destination data transfer width is 4 bytes every time

enumerator kEDMA_ChannelTransferWidth128Bits
Source/Destination data transfer size is 16 bytes every time

enum _edma_channel_modulo
eDMA channel modulo configuration

The eDMA modulo feature can be used to specify the address range of the source/destination address, it is useful to implement a circular data queue.

Values:

enumerator kEDMA_ChannelModuloDisable
Disable modulo

enumerator kEDMA_ChannelModulo2bytes
Circular buffer size is 2 bytes.

enumerator kEDMA_ChannelModulo4bytes
Circular buffer size is 4 bytes.

enumerator kEDMA_ChannelModulo8bytes
Circular buffer size is 8 bytes.

enumerator kEDMA_ChannelModulo16bytes
Circular buffer size is 16 bytes.

enumerator kEDMA_ChannelModulo32bytes
Circular buffer size is 32 bytes.

enumerator kEDMA_ChannelModulo64bytes
Circular buffer size is 64 bytes.

enumerator kEDMA_ChannelModulo128bytes
Circular buffer size is 128 bytes.

enumerator kEDMA_ChannelModulo256bytes
Circular buffer size is 256 bytes.

enumerator kEDMA_ChannelModulo512bytes
Circular buffer size is 512 bytes.

enumerator kEDMA_ChannelModulo1Kbytes
Circular buffer size is 1 K bytes.

enumerator kEDMA_ChannelModulo2Kbytes
Circular buffer size is 2 K bytes.

enumerator kEDMA_ChannelModulo4Kbytes
Circular buffer size is 4 K bytes.

enumerator kEDMA_ChannelModulo8Kbytes
Circular buffer size is 8 K bytes.

enumerator kEDMA_ChannelModulo16Kbytes
Circular buffer size is 16 K bytes.

enumerator kEDMA_ChannelModulo32Kbytes
Circular buffer size is 32 K bytes.

enumerator kEDMA_ChannelModulo64Kbytes
Circular buffer size is 64 K bytes.

enumerator kEDMA_ChannelModulo128Kbytes
Circular buffer size is 128 K bytes.

enumerator kEDMA_ChannelModulo256Kbytes
Circular buffer size is 256 K bytes.

enumerator kEDMA_ChannelModulo512Kbytes
Circular buffer size is 512 K bytes.

enumerator kEDMA_ChannelModulo1Mbytes
Circular buffer size is 1 M bytes.

enumerator kEDMA_ChannelModulo2Mbytes
Circular buffer size is 2 M bytes.

enumerator kEDMA_ChannelModulo4Mbytes
Circular buffer size is 4 M bytes.

enumerator kEDMA_ChannelModulo8Mbytes
Circular buffer size is 8 M bytes.

enumerator kEDMA_ChannelModulo16Mbytes
Circular buffer size is 16 M bytes.

enumerator kEDMA_ChannelModulo32Mbytes
Circular buffer size is 32 M bytes.

enumerator kEDMA_ChannelModulo64Mbytes
Circular buffer size is 64 M bytes.

enumerator kEDMA_ChannelModulo128Mbytes
Circular buffer size is 128 M bytes.

enumerator kEDMA_ChannelModulo256Mbytes
Circular buffer size is 256 M bytes.

enumerator kEDMA_ChannelModulo512Mbytes
Circular buffer size is 512 M bytes.

enumerator kEDMA_ChannelModulo1Gbytes
Circular buffer size is 1 G bytes.

enumerator kEDMA_ChannelModulo2Gbytes
Circular buffer size is 2 G bytes.

enum _edma_channel_bandwidth
edma channel Bandwidth control

Generally, as the eDMA processes the minor loop, it continuously generates read/write sequences until the minor count is exhausted. This bandwidth field forces the eDMA to stall after the completion of each read/write access to control the bus request bandwidth.

The default configuration is kEDMA_BandwidthStallNone.

Values:

enumerator kEDMA_ChannelBandwidthStallNone
No eDMA engine stalls.

enumerator kEDMA_ChannelBandwidthStall4Cycle
eDMA engine stalls for 4 cycles after each read/write.

enumerator kEDMA_ChannelBandwidthStall8Cycle
eDMA engine stalls for 8 cycles after each read/write.

typedef enum *_edma_channel_transfer_type* edma_channel_transfer_type_t
eDMA transfer type

typedef enum *_edma_arbitration_type* edma_arbitration_type_t
eDMA arbitration type

typedef enum *_edma_channel* edma_channel_t
edma channel index

typedef enum *_edma_channel_transfer_width* edma_channel_transfer_width_t
eDMA transfer width configuration

typedef enum *_edma_channel_modulo* edma_channel_modulo_t
eDMA channel modulo configuration

The eDMA modulo feature can be used to specify the address range of the source/destination address, it is useful to implement a circular data queue.

typedef enum *_edma_channel_bandwidth* edma_channel_bandwidth_t

edma channel Bandwidth control

Generally, as the eDMA processes the minor loop, it continuously generates read/write sequences until the minor count is exhausted. This bandwidth field forces the eDMA to stall after the completion of each read/write access to control the bus request bandwidth.

The default configuration is kEDMA_BandwidthStallNone.

typedef struct *_edma_channel_Preemption_config* edma_channel_Preemption_config_t

eDMA channel priority configuration, useful to the fixed priority arbitration type

typedef struct *_edma_channel_tcd* edma_channel_tcd_t

edma channel software tcd definition

typedef struct *_edma_channel_transfer_config* edma_channel_transfer_config_t

edma channel transfer configuration

The transfer configuration structure support full feature configuration of the transfer control descriptor.

1.To perform a simple transfer, below members should be initialized at least .u32SrcAddr - source address .u32DstAddr - destination address .eSrcWidthOfEachTransfer - data width of source address .eDstWidthOfEachTransfer - data width of destination address, normally it should be as same as eSrcWidthOfEachTransfer .u32BytesEachRequest - bytes to be transferred in each DMA request .u32TotalBytes - total bytes to be transferred .i16SrcOffsetOfEachTransfer - offset value in bytes unit to be applied to source address as each source read is completed .i16DstOffsetOfEachTransfer - offset value in bytes unit to be applied to destination address as each destination write is completed bEnableChannelRequest - channel request can be enabled together with transfer configure submission

2.The transfer configuration structure also support advance feature: Programmable source/destination address range(MODULO) Programmable minor loop offset Programmable major loop offset Programmable channel chain feature Programmable channel transfer control descriptor link feature

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Note: User should pay attention to the transfer size alignment limitation

a. the u32BytesEachRequest should align with the eSrcWidthOfEachTransfer and the eDstWidthOfEachTransfer that is to say u32BytesEachRequest % eSrcWidthOfEachTransfer should be 0

b. the i16SrcOffsetOfEachTransfer and i16DstOffsetOfEachTransfer must be aligne with transfer width

c. the u32TotalBytes should align with the u32BytesEachRequest

d. the u32SrcAddr should align with the eSrcWidthOfEachTransfer

e. the u32DstAddr should align with the eDstWidthOfEachTransfer

f. the u32SrcAddr should align with eSrcAddrModulo if modulo feature is enabled

g. the u32DstAddr should align with eDstAddrModulo if modulo feature is enabled If anyone of above condition can not be satisfied, the edma interfaces will generate assert error.

---

typedef struct *_edma_config* edma_config_t

edma configuration structure

This structure target for whole edma module configurations.

typedef struct *_edma_handle* edma_handle_t
handler for eDMA

typedef void (*edma_transfer_callback_t)(*edma_handle_t* *psHandle, void *pUserData, bool bTransferDone, uint32_t u32Tcds)
Define callback function for eDMA.

This callback function is called in the EDMA interrupt handler function. In normal mode, running into callback function means the transfer users need is done. In scatter gather mode, run into callback function means a transfer control block (tcd) is finished. Not all transfer finished, users can get the finished tcd numbers using interface EDMA_GetUnusedTCDNumber.

Param handle
EDMA handle pointer, users shall not touch the values inside.

Param userData
The callback user parameter pointer. Users can use this parameter to involve things users need to change in EDMA callback function.

Param transferDone
If the current loaded transfer done. In normal mode it means if all transfer done. In scatter gather mode, this parameter shows is the current transfer block in EDMA register is done. As the load of core is different, it will be different if the new tcd loaded into EDMA registers while this callback called. If true, it always means new tcd still not loaded into registers, while false means new tcd already loaded into registers.

Param tcds
How many tcds are done from the last callback. This parameter only used in scatter gather mode. It tells user how many tcds are finished between the last callback and this.

EDMA_ENTER_CRITICAL_SECTION()
edma transactional tcd pool resource protection lock definition Application should overwrite below two macros if multi task trying to access the same channel.

EDMA_LEAVE_CRITICAL_SECTION()

struct _edma_channel_Preemption_config
#include <fsl_edma.h> eDMA channel priority configuration, useful to the fixed priority arbitration type

Public Members

bool bSuspendedByHighPriorityChannel
a channel can be suspended by other channel with higher priority

bool bSuspendLowPriorityChannel
a channel can suspend other channel with low priority

uint8_t u8ChannelPriority
Channel priority

struct _edma_channel_transfer_config
#include <fsl_edma.h> edma channel transfer configuration

The transfer configuration structure support full feature configuration of the transfer control descriptor.

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2.The transfer configuration structure also support advance feature: Programmable source/destination address range(MODULO) Programmable minor loop offset Programmable major loop offset Programmable channel chain feature Programmable channel transfer control descriptor link feature

---

Note: User should pay attention to the transfer size alignment limitation

a. the u32BytesEachRequest should align with the eSrcWidthOfEachTransfer and the eDstWidthOfEachTransfer that is to say u32BytesEachRequest % eSrcWidthOfEachTransfer should be 0
b. the i16SrcOffsetOfEachTransfer and i16DstOffsetOfEachTransfer must be aligne with transfer width
c. the u32TotalBytes should align with the u32BytesEachRequest
d. the u32SrcAddr should align with the eSrcWidthOfEachTransfer
e. the u32DstAddr should align with the eDstWidthOfEachTransfer
f. the u32SrcAddr should align with eSrcAddrModulo if modulo feature is enabled
g. the u32DstAddr should align with eDstAddrModulo if modulo feature is enabled If anyone of above condition can not be satisfied, the edma interfaces will generate assert error.

Public Members

uint32_t u32SrcAddr
: source address

uint32_t u32DstAddr
: destination address

edma_channel_transfer_width_t eSrcWidthOfEachTransfer
: source width of each transfer

edma_channel_transfer_width_t eDstWidthOfEachTransfer
: destination width of each transfer

uint32_t u32BytesEachMinorLoop
: bytes in each minor loop or each request range: 1 - (2^30 -1) when minor loop mapping is enabled range: 1 - (2^10 - 1) when minor loop mapping is enabled and source or dest minor loop offset is enabled range: 1 - (2^32 - 1) when minor loop mapping is disabled

uint16_t u16MinorLoopCountsEachMajorLoop
: minor loop counts in each major loop, should be 1 at least for each transfer range: (0 - (2^15 - 1)) when minor loop channel link is disabled range: (0 - (2^9 - 1)) when minor loop channel link is enabled total bytes in a transfer = u16MinorLoopCountsEachMajorLoop * u32BytesEachMinorLoop

uint16_t u16EnabledInterruptMask
: channel interrupt to enable, can be OR'ed value of _edma_channel_interrupt_enable

int16_t i16SrcOffsetOfEachTransfer
: Sign-extended offset value in byte unit applied to the current source address to form the next-state value as each source read is completed

edma_channel_modulo_t eSrcAddrModulo
: source circular data queue range

int32_t i32SrcMajorLoopOffset
: source major loop offset

int16_t i16DstOffsetOfEachTransfer
: Sign-extended offset value in byte unit applied to the current destination address to form the next-state value as each destination write is completed.

edma_channel_modulo_t eDstAddrModulo
: destination circular data queue range

int32_t i32DstMajorLoopOffset
: destination major loop offset

bool bEnableSrcMinorLoopOffset
: enable source minor loop offset

bool bEnableDstMinorLoopOffset
: enable dest minor loop offset

int32_t i32MinorLoopOffset
: burst offset, the offset will be applied after minor loop update

bool bEnableChannelMajorLoopLink
: channel link when major loop complete

edma_channel_t eMajorLoopLinkChannel
: major loop link channel number

bool bEnableChannelMinorLoopLink
: channel link when minor loop complete

edma_channel_t eMinorLoopLinkChannel
: minor loop link channel number

edma_channel_bandwidth_t eChannelBandWidth
: channel bandwidth

bool bDisableRequestAfterMajorLoopComplete
: the channel's ERQ bit can be cleared after the major loop complete automatically

bool bEnableChannelRequest
: enable the channel request signal

edma_channel_tcd_t *psLinkTCD
: pointer to the link transfer control descriptor

struct _edma_channel_tcd

#include <fsl_edma.h> eDMA software Transfer control descriptor structure.

This structure is same as eDMA hardware channel TCD registers, user doesn't need to understand the structures, since eDMA driver will responsible for configure it.

The software TCD is useful to configure a software TCD which is linked by the channel hardware TCD to have scatter/gather feature without using transactional interface.

Public Members

__IO uint32_t u32SADDR
SADDR register, used to save source address

__IO uint16_t u16SOFF
SOFF register, offset bytes added to source address every transfer

__IO uint16_t u16ATTR
ATTR register, source/destination transfer size and modulo

__IO uint32_t u32NBYTES
Nbytes register, minor loop length in bytes

__IO uint32_t u32SLAST
SLAST register, adjustment value added to the source address at the completion of the major loop

__IO uint32_t u32DADDR
DADDR register, used for destination address

__IO uint16_t u16DOFF
DOFF register, offset bytes added to destination address every transfer

__IO uint16_t u16CITER
CITER register, current minor loop numbers, for unfinished minor loop.

__IO uint32_t u32DLAST_SGA
DLASTSGA register, next tcd address used in scatter-gather mode

__IO uint16_t u16CSR
CSR register, for TCD control status

__IO uint16_t u16BITER
BITER register, begin minor loop count.

struct _edma_config
#include <fsl_edma.h> edma configuration structure

This structure target for whole edma module configurations.

Public Members

bool bEnableContinuousLinkMode
Enable (true) continuous link mode. Upon minor loop completion, the channel activates again if that channel has a minor loop channel link enabled and the link channel is itself.

bool bEnableHaltOnError
Enable (true) transfer halt on error. Any error causes the HALT bit to set. Subsequently, all service requests are ignored until the HALT bit is cleared.

bool bEnableDmaInDebugMode
Enable(true) eDMA debug mode. When in debug mode, the eDMA stalls the start of a new channel. Executing channels are allowed to complete.

bool bEnableMinorLoopMapping
TCDn.word2 is redefined to include individual enable fields, an offset field, and the NBYTES field. The individual enable fields allow the minor loop offset to be applied to the source address, the destination address, or both. The NBYTES field is reduced when either offset is enabled

edma_arbitration_type_t eArbitrationType
Enable (true) round robin channel arbitration method or fixed priority arbitration is used for channel selection

edma_channel_Preemption_config_t sChannelPreemptionConfig[1]
channel preemption configuration

edma_channel_transfer_config_t *psChannelTransferConfig[1]
channel transfer configuration pointer

struct _edma_handle
#include <fsl_edma.h> eDMA transfer handle structure

Public Members

edma_transfer_callback_t pfCallback
Callback function for major count exhausted.

void *pUserData
Callback function parameter.

DMA_Type *psBase
eDMA peripheral base address.

edma_channel_tcd_t *psTcdPool
Pointer to memory stored TCDs.

edma_channel_t eChannel
eDMA channel number.

volatile uint8_t u8Header
The first TCD index. Should point to the next TCD to be loaded into the eDMA engine.

volatile uint8_t u8Tail
The last TCD index. Should point to the next TCD to be stored into the memory pool.

volatile uint8_t u8TcdUsed
The number of used TCD slots. Should reflect the number of TCDs can be used/loaded in the memory.

volatile uint8_t u8TcdSize
The total number of TCD slots in the queue.

2.22 The Driver Change Log

2.23 EDMA Peripheral and Driver Overview

2.24 EVTG: Event Generator Driver

void EVTG_Init(EVTG_Type *base, *evtg_index_t* eEvtgIndex, *evtg_config_t* *psConfig)
Initialize EVTG with a user configuration structure.

Parameters

- base – EVTG base address.
- eEvtgIndex – EVTG instance index.

- psConfig – EVTG initial configuration structure pointer.

static inline void EVTG_GetDefaultConfig(*evtg_config_t* *psConfig, *evtg_flipflop_mode_t* eFlipflopMode)

Loads default values to the EVTG configuration structure.

The purpose of this API is to initialize the configuration structure to default value for EVTG_Init() to use. The Flip-Flop can be configured as Bypass mode, RS trigger mode, T-FF mode, D-FF mode, JK-FF mode, Latch mode. Please check RM INTC chapter for more details.

Parameters

- psConfig – EVTG initial configuration structure pointer.
- eFlipflopMode – EVTG flip flop mode. see @ ref _evtg_flipflop_mode

static inline void EVTG_ForceFlipflopInitOutput(EVTG_Type *base, *evtg_index_t* eEvtgIndex, *evtg_flipflop_init_output_t* eFlipflopInitOutputValue)

Force Flip-flop initial output value to be presented on flip-flop positive output.

Parameters

- base – EVTG base address.
- eEvtgIndex – EVTG instance index.
- eFlipflopInitOutputValue – EVTG flip-flop initial output control. see evtg_flipflop_init_output_t

static inline void EVTG_SetProductTermInput(EVTG_Type *base, *evtg_index_t* eEvtgIndex, *evtg_aoi_index_t* eAOIIndex, *evtg_aoi_product_term_t* eProductTerm, *evtg_input_index_t* eInputIndex, *evtg_aoi_input_config_t* eInput)

Configure each input value of AOI product term. Each selected input term in each product term can be configured to produce a logical 0 or 1 or pass the true or complement of the selected event input. Adapt to some simple aoi expressions.

Parameters

- base – EVTG base address.
- eEvtgIndex – EVTG instance index.
- eAOIIndex – EVTG AOI index. see enum ref evtg_aoi_index_t
- eProductTerm – EVTG product term index.
- eInputIndex – EVTG input index.
- eInput – EVTG input configuration with enum evtg_aoi_input_config_t.

void EVTG_ConfigAOIProductTerm(EVTG_Type *base, *evtg_index_t* eEvtgIndex, *evtg_aoi_index_t* eAOIIndex, *evtg_aoi_product_term_t* eProductTerm, *evtg_aoi_product_term_config_t* *psProductTermConfig)

Configure AOI product term by initializing the product term configuration structure.

Parameters

- base – EVTG base address.
- eEvtgIndex – EVTG instance index.
- eAOIIndex – EVTG AOI index. see enum evtg_aoi_index_t
- eProductTerm – EVTG AOI product term index.

- psProductTermConfig – Pointer to EVTG product term configuration structure. see ref _evtg_aoi_product_term_config

FSL_EVTG_DRIVER_VERSION
EVTG driver version.

enum _evtg_index
EVTG instance index.

Values:

enumerator kEVTG_Index0
EVTG instance index 0.

enumerator kEVTG_Index1
EVTG instance index 1.

enumerator kEVTG_Index2
EVTG instance index 2.

enumerator kEVTG_Index3
EVTG instance index 3.

enum _evtg_input_index
EVTG input index.

Values:

enumerator kEVTG_InputA
EVTG input A.

enumerator kEVTG_InputB
EVTG input B.

enumerator kEVTG_InputC
EVTG input C.

enumerator kEVTG_InputD
EVTG input D.

enum _evtg_aoi_index
EVTG AOI index.

Values:

enumerator kEVTG_AOI0
EVTG AOI index 0.

enumerator kEVTG_AOI1
EVTG AOI index 1.

enum _evtg_aoi_product_term
EVTG AOI product term index.

Values:

enumerator kEVTG_ProductTerm0
EVTG AOI product term index 0.

enumerator kEVTG_ProductTerm1
EVTG AOI product term index 1.

enumerator kEVTG_ProductTerm2
EVTG AOI product term index 2.

enumerator kEVTG_ProductTerm3
EVTG AOI product term index 3.

enum _evtg_aoi_input_config
EVTG input configuration.

Values:

enumerator kEVTG_Input_LogicZero
Force input in product term to a logical zero.

enumerator kEVTG_Input_DirectPass
Pass input in product term.

enumerator kEVTG_Input_Complement
Complement input in product term.

enumerator kEVTG_Input_LogicOne
Force input in product term to a logical one.

enum _evtg_aoi_outfilter_count
EVTG AOI Output Filter Sample Count.

Values:

enumerator kEVTG_AOIOutFilter_SampleCount3
EVTG AOI output filter sample count is 3.

enumerator kEVTG_AOIOutFilter_SampleCount4
EVTG AOI output filter sample count is 4.

enumerator kEVTG_AOIOutFilter_SampleCount5
EVTG AOI output filter sample count is 5.

enumerator kEVTG_AOIOutFilter_SampleCount6
EVTG AOI output filter sample count is 6.

enumerator kEVTG_AOIOutFilter_SampleCount7
EVTG AOI output filter sample count is 7.

enumerator kEVTG_AOIOutFilter_SampleCount8
EVTG AOI output filter sample count is 8.

enumerator kEVTG_AOIOutFilter_SampleCount9
EVTG AOI output filter sample count is 9.

enumerator kEVTG_AOIOutFilter_SampleCount10
EVTG AOI output filter sample count is 10.

enum _evtg_outfdbk_override_input
EVTG output feedback override control mode. When FF is configured as JK-FF mode, need EVTG_OUTA feedback to EVTG input and replace one of the four inputs.

Values:

enumerator kEVTG_Output_OverrideInputA
Replace input A.

enumerator kEVTG_Output_OverrideInputB
Replace input B.

enumerator kEVTG_Output_OverrideInputC
Replace input C.

enumerator kEVTG_Output_OverrideInputD
Replace input D.

enum _evtg_flipflop_mode
EVTG flip flop mode configuration.

Values:

enumerator kEVTG_FFMode_Bypass
Bypass mode (default).In this mode, user can choose to enable or disable input sync logic and filter function.

enumerator kEVTG_FFMode_RSTrigger
RS trigger mode. In this mode, user can choose to enable or disable input sync logic and filter function.

enumerator kEVTG_FFMode_TFF
T-FF mode. In this mode, input sync or filter has to be enabled to remove the possible glitch.

enumerator kEVTG_FFMode_DFF
D-FF mode. In this mode, input sync or filter has to be enabled to remove the possible glitch.

enumerator kEVTG_FFMode_JKFF
JK-FF mode. In this mode, input sync or filter has to be enabled to remove the possible glitch.

enumerator kEVTG_FFMode_Latch
Latch mode. In this mode, input sync or filter has to be enabled to remove the possible glitch.

enum _evtg_flipflop_initoutput
EVTG flip-flop initial value.

Values:

enumerator kEVTG_FF_InitOut0
Configure the positive output of flip-flop as 0.

enumerator kEVTG_FF_InitOut1
Configure the positive output of flip-flop as 1.

typedef enum *_evtg_index* evtg_index_t
EVTG instance index.

typedef enum *_evtg_input_index* evtg_input_index_t
EVTG input index.

typedef enum *_evtg_aoi_index* evtg_aoi_index_t
EVTG AOI index.

typedef enum *_evtg_aoi_product_term* evtg_aoi_product_term_t
EVTG AOI product term index.

typedef enum *_evtg_aoi_input_config* evtg_aoi_input_config_t
EVTG input configuration.

typedef enum *_evtg_aoi_outfilter_count* evtg_aoi_outfilter_count_t
EVTG AOI Output Filter Sample Count.

typedef enum *_evtg_outfdbk_override_input* evtg_outfdbk_override_input_t

EVTG output feedback override control mode. When FF is configured as JK-FF mode, need EVTG_OUTA feedback to EVTG input and replace one of the four inputs.

typedef enum *_evtg_flipflop_mode* evtg_flipflop_mode_t

EVTG flip flop mode configuration.

typedef enum *_evtg_flipflop_initoutput* evtg_flipflop_init_output_t

EVTG flip-flop initial value.

typedef struct *_evtg_aoi_outfilter_config* evtg_aoi_outfilter_config_t

The structure for configuring an AOI output filter sample.

AOI output filter sample count represent the number of consecutive samples that must agree prior to the AOI output filter accepting an transition. AOI output filter sample period represent the sampling period (in IP bus clock cycles) of the AOI output signals. Each AOI output is sampled multiple times at the rate specified by this period.

For the modes with Filter function enabled, filter delay is "(FILT_CNT + 3) x FILT_PER + 2".

typedef struct *_evtg_aoi_product_term_config* evtg_aoi_product_term_config_t

The structure for configuring an AOI product term.

typedef struct *_evtg_aoi_config* evtg_aoi_config_t

EVTG AOI configuration structure.

typedef struct *_evtg_config* evtg_config_t

EVTG configuration covering all configurable fields.

struct _evtg_aoi_outfilter_config

#include <fsl_evtg.h> The structure for configuring an AOI output filter sample.

AOI output filter sample count represent the number of consecutive samples that must agree prior to the AOI output filter accepting an transition. AOI output filter sample period represent the sampling period (in IP bus clock cycles) of the AOI output signals. Each AOI output is sampled multiple times at the rate specified by this period.

For the modes with Filter function enabled, filter delay is "(FILT_CNT + 3) x FILT_PER + 2".

Public Members

evtg_aoi_outfilter_count_t eSampleCount

EVTG AOI output filter sample count. refer to evtg_aoi_outfilter_count_t.

uint8_t u8SamplePeriod

EVTG AOI output filter sample period, within 0~255. If sample period value is 0x00 (default), then the input filter is bypassed.

struct _evtg_aoi_product_term_config

#include <fsl_evtg.h> The structure for configuring an AOI product term.

Public Members

evtg_aoi_input_config_t eAInput

Input A configuration.

evtg_aoi_input_config_t eBInput

Input B configuration.

evtg_aoi_input_config_t eCInput

Input C configuration.

evtg_aoi_input_config_t eDInput
Input D configuration.

struct _evtg_aoi_config
#include <fsl_evtg.h> EVTG AOI configuration structure.

Public Members

evtg_aoi_outfilter_config_t sAOIOutFilterConfig
EVTG AOI output filter sample configuration structure.

evtg_aoi_product_term_config_t sProductTerm0
Configure AOI product term0.

evtg_aoi_product_term_config_t sProductTerm1
Configure AOI product term1.

evtg_aoi_product_term_config_t sProductTerm2
Configure AOI product term2.

evtg_aoi_product_term_config_t sProductTerm3
Configure AOI product term3.

struct _evtg_config
#include <fsl_evtg.h> EVTG configuration covering all configurable fields.

Public Members

bool bEnableInputASync
Enable/Disable EVTG A input synchronous with bus clk.

bool bEnableInputBSync
Enable/Disable EVTG B input synchronous with bus clk.

bool bEnableInputCSync
Enable/Disable EVTG C input synchronous with bus clk.

bool bEnableInputDSync
Enable/Disable EVTG D input synchronous with bus clk.

evtg_outfdbk_override_input_t eOutfdbkOverideinput
EVTG output feedback to EVTG input and replace one of the four inputs.

evtg_flipflop_mode_t eFlipflopMode
Flip-Flop can be configured as one of Bypass mode, RS trigger mode, T-FF mode, D-FF mode, JK-FF mode, Latch mode.

bool bEnableFlipflopInitOutput
Flip-flop initial output value enable/disable.

evtg_flipflop_init_output_t eFlipflopInitOutputValue
Flip-flop initial output value configuration.

evtg_aoi_config_t sAOI0Config
Configure EVTG AOI0.

evtg_aoi_config_t sAOI1Config
Configure EVTG AOI1.

2.25 The Driver Change Log

2.26 EVTG Peripheral and Driver Overview

2.27 EWM: External Watchdog Monitor Driver

void EWM_Init(EWM_Type *base, const *ewm_config_t* *psConfig)

Initializes the EWM peripheral.

This function is used to initialize the EWM. After calling, the EWM runs immediately according to the configuration.

This is an example.

```
ewm_config_t psConfig;
EWM_GetDefaultConfig(&psConfig);
psConfig.compareHighValue = 0xAAU;
EWM_Init(ewm_base,&psConfig);
```

Note: Except for the interrupt enable control bit, other control bits and registers are write once after a CPU reset. Modifying them more than once generates a bus transfer error.

Parameters

- base – EWM peripheral base address
- psConfig – The configuration of the EWM

void EWM_Deinit(EWM_Type *base)

Deinitializes the EWM peripheral.

This function is used to shut down the EWM.

Parameters

- base – EWM peripheral base address

void EWM_GetDefaultConfig(*ewm_config_t* *psConfig)

Initializes the EWM configuration structure.

This function initializes the EWM configuration structure to default values. The default values are as follows.

```
ewmConfig->bEnableEWM = true;
ewmConfig->bEnableEWMInput = false;
ewmConfig->eInputAssertState = kEWM_EwmInZeroAssert;
ewmConfig->bEnableInterrupt = false;
ewmConfig->eClockSource = kEWM_LpoClockSource0;
ewmConfig->u8ClockDivder = 0;
ewmConfig->u8CompareLowValue = 0;
ewmConfig->u8CompareHighValue = 0xFEU;
```

See also:

ewm_config_t

Parameters

- psConfig – Pointer to the EWM configuration structure.

static inline void EWM_EnableInterrupt(EWM_Type *base)

Enables the EWM interrupt.

This function enables the EWM interrupt.

Parameters

- base – EWM peripheral base address

static inline void EWM_DisableInterrupt(EWM_Type *base)

Disables the EWM interrupt.

This function disables the EWM interrupt.

Parameters

- base – EWM peripheral base address

void EWM_Refresh(EWM_Type *base)

Services the EWM.

This function resets the EWM counter to zero.

Parameters

- base – EWM peripheral base address

FSL_EWM_DRIVER_VERSION

EWM driver version.

enum _ewm_input_assert_state

Assert pin voltage configuration.

Values:

enumerator kEWM_EwmInZeroAssert

EWM-in assert with low-voltage logic

enumerator kEWM_EwmInOneAssert

EWM-in assert with high-voltage logic

typedef enum *_ewm_input_assert_state* ewm_input_assert_state_t

Assert pin voltage configuration.

typedef struct *_ewm_config* ewm_config_t

Data structure for EWM configuration.

This structure is used to configure the EWM.

struct _ewm_config

#include <fsl_ewm.h> Data structure for EWM configuration.

This structure is used to configure the EWM.

Public Members

uint8_t bEnableEWM

Enable EWM module

uint8_t bEnableEWMInput

Enable EWM_in input

uint8_t bEnableInterrupt

Enable EWM interrupt

ewm_input_assert_state_t eInputAssertState
EWM_in signal assertion state select

ewm_lpo_clock_source_t eClockSource
Clock source select

uint8_t u8ClockDivder
EWM counter clock is clockSource/(clockDivder+1)

uint8_t u8CompareLowValue
Compare low-register value

uint8_t u8CompareHighValue
Compare high-register value, maximum setting is 0xFE

2.28 The Driver Change Log

2.29 EWM Peripheral and Driver Overview

2.30 Flash Driver

enum _flash_driver_version_constants
Flash driver version for ROM.

Values:

enumerator kFLASH_DriverVersionName
Flash driver version name.

enumerator kFLASH_DriverVersionMajor
Major flash driver version.

enumerator kFLASH_DriverVersionMinor
Minor flash driver version.

enumerator kFLASH_DriverVersionBugfix
Bugfix for flash driver version.

enum _flash_driver_api_keys
Enumeration for FLASH driver API keys.

Note: The resulting value is built with a byte order such that the string being readable in expected order when viewed in a hex editor, if the value is treated as a 32-bit little endian value.

Values:

enumerator kFLASH_ApiEraseKey

enum _flash_read_resource_opt
Enumeration for the two possible options of flash read resource command.

Values:

enumerator kFLASH_ResourceOptionFlashIfr
Select code for Program flash 0 IFR, Program flash swap 0 IFR, Data flash 0 IFR

enumerator kFLASH_ResourceOptionVersionId
Select code for the version ID

enum _flash_margin_value
Enumeration for supported FTFx margin levels.

Values:

enumerator kFLASH_MarginValueNormal
Use the 'normal' read level for 1s.

enumerator kFLASH_MarginValueUser
Apply the 'User' margin to the normal read-1 level.

enumerator kFLASH_MarginValueFactory
Apply the 'Factory' margin to the normal read-1 level.

enumerator kFLASH_MarginValueInvalid
Not real margin level, Used to determine the range of valid margin level.

enum _flash_security_state
Enumeration for the three possible FTFx security states.

Values:

enumerator kFLASH_SecurityStateNotSecure
Flash is not secure.

enumerator kFLASH_SecurityStateBackdoorEnabled
Flash backdoor is enabled.

enumerator kFLASH_SecurityStateBackdoorDisabled
Flash backdoor is disabled.

enum _flash_swap_control_opt
Enumeration for the possible options of Swap control commands.

Values:

enumerator kFLASH_SwapControlOptionIntializeSystem
An option used to initialize the Swap system

enumerator kFLASH_SwapControlOptionSetInUpdateState
An option used to set the Swap in an update state

enumerator kFLASH_SwapControlOptionSetInCompleteState
An option used to set the Swap in a complete state

enumerator kFLASH_SwapControlOptionReportStatus
An option used to report the Swap status

enumerator kFLASH_SwapControlOptionDisableSystem
An option used to disable the Swap status

enum _flash_swap_state
Enumeration for the possible flash Swap status.

Values:

enumerator kFLASH_SwapStateUninitialized
Flash Swap system is in an uninitialized state.

enumerator kFLASH_SwapStateReady
Flash Swap system is in a ready state.

enumerator kFLASH_SwapStateUpdate
Flash Swap system is in an update state.

enumerator kFLASH_SwapStateUpdateErased
Flash Swap system is in an updateErased state.

enumerator kFLASH_SwapStateComplete
Flash Swap system is in a complete state.

enumerator kFLASH_SwapStateDisabled
Flash Swap system is in a disabled state.

enum _flash_swap_block_status
Enumeration for the possible flash Swap block status.

Values:

enumerator kFLASH_SwapBlockStatusLowerHalfProgramBlocksAtZero
Swap block status is that lower half program block at zero.

enumerator kFLASH_SwapBlockStatusUpperHalfProgramBlocksAtZero
Swap block status is that upper half program block at zero.

enum _flash_memory_type
Enumeration for FTFx memory type.

Values:

enumerator kFLASH_MemTypePflash

enumerator kFLASH_MemTypeFlexnvm

enum _flash_property_tag
Enumeration for various flash properties.

Values:

enumerator kFLASH_PropertyPflashSectorSize
Pflash sector size property.

enumerator kFLASH_PropertyPflashTotalSize
Pflash total size property.

enumerator kFLASH_PropertyPflashBlockSize
Pflash block size property.

enumerator kFLASH_PropertyPflashBlockCount
Pflash block count property.

enumerator kFLASH_PropertyPflashBlockBaseAddr
Pflash block base address property.

enumerator kFLASH_PropertyVersion

enum _flash_status
FTFx driver status codes.

Values:

enumerator kStatus_FLASH_Success
API is executed successfully

enumerator kStatus_FLASH_InvalidArgument
Invalid argument

enumerator kStatus_FLASH_SizeError
Error size

enumerator kStatus_FLASH_AlignmentError
Parameter is not aligned with the specified baseline

enumerator kStatus_FLASH_AddressError
Address is out of range

enumerator kStatus_FLASH_AccessError
Invalid instruction codes and out-of bound addresses

enumerator kStatus_FLASH_ProtectionViolation
The program/erase operation is requested to execute on protected areas

enumerator kStatus_FLASH_CommandFailure
Run-time error during command execution.

enumerator kStatus_FLASH_UnknownProperty
Unknown property.

enumerator kStatus_FLASH_EraseKeyError
API erase key is invalid.

enumerator kStatus_FLASH_CommandNotSupported
Flash API is not supported.

enumerator kStatus_FLASH_SwapSystemNotInUninitialized
Swap system is not in an uninitialzed state.

enumerator kStatus_FLASH_SwapIndicatorAddressError
The swap indicator address is invalid.

enumerator kStatus_FLASH_ReadOnlyProperty
The flash property is read-only.

enumerator kStatus_FLASH_InvalidPropertyValue
The flash property value is out of range.

enumerator kStatus_FLASH_InvalidSpeculationOption
The option of flash prefetch speculation is invalid.

typedef union *_standard_version* standard_version_t

typedef enum *_flash_read_resource_opt* flash_read_resource_opt_t
Enumeration for the two possible options of flash read resource command.

typedef enum *_flash_margin_value* flash_margin_value_t
Enumeration for supported FTFx margin levels.

typedef enum *_flash_security_state* flash_security_state_t
Enumeration for the three possible FTFx security states.

typedef enum *_flash_swap_control_opt* flash_swap_control_opt_t
Enumeration for the possible options of Swap control commands.

typedef enum *_flash_swap_state* flash_swap_state_t
Enumeration for the possible flash Swap status.

typedef enum *_flash_swap_block_status* flash_swap_block_status_t
Enumeration for the possible flash Swap block status.

typedef struct *_flash_swap_state_config* flash_swap_state_config_t
    Flash Swap information.

typedef struct *_flash_special_mem* flash_spec_mem_t
    ftfx special memory access information.

typedef struct *_flash_mem_desc_t* flash_mem_desc_t
    Flash memory descriptor.

typedef struct *_flash_ops_config* flash_ops_config_t
    Active FTFx information for the current operation.

typedef struct *_flash_ifr_desc* flash_ifr_desc_t
    Flash IFR memory descriptor.

typedef struct *_ftfx_config* ftfx_config_t
    Flash driver state information.

    An instance of this structure is allocated by the user of the flash driver and passed into each of the driver APIs.

typedef struct *_flash_config* flash_config_t

typedef enum *_flash_property_tag* flash_property_tag_t
    Enumeration for various flash properties.

FSL_FLASH_DRIVER_VERSION
    Flash driver version for SDK.

FSL_FLASH_DRIVER_VERSION_ROM
    Flash driver version for ROM.

MAKE_STATUS(group, code)
    Construct a status code value from a group and code number.

FTFx_FLASH_COUNT
    Flash driver state information.

    An instance of this structure is allocated by the user of the flash driver and passed into each of the driver APIs.

flash_status_t FLASH_Init(*flash_config_t* *config)
    Initializes the global flash properties structure members.

    This function checks and initializes the Flash module for the other Flash APIs.

    Parameters

    - config – Pointer to the storage for the driver runtime state.

    Return values

    - kStatus_FLASH_Success – API was executed successfully.
    - kStatus_FLASH_InvalidArgument – An invalid argument is provided.

flash_status_t FLASH_GetProperty(*flash_config_t* *config, *flash_property_tag_t* whichProperty, uint32_t *value)
    Returns the desired flash property.

    Parameters

    - config – A pointer to the storage for the driver runtime state.
    - whichProperty – The desired property from the list of properties in enum flash_property_tag_t

- value – A pointer to the value returned for the desired flash property.

Return values

- kStatus_FLASH_Success – API was executed successfully; the flash property was stored to value.
- kStatus_FLASH_InvalidArgument – An invalid argument is provided.
- kStatus_FLASH_UnknownProperty – An unknown property tag.

flash_status_t FLASH_Erase(*flash_config_t* *config, uint32_t start, uint32_t lengthInBytes, uint32_t key)

Erases the flash sectors encompassed by parameters passed into function.

This function erases the appropriate number of flash sectors based on the desired start address and length.

Parameters

- config – The pointer to the storage for the driver runtime state.
- start – The start address of the desired flash memory to be erased. The start address does not need to be sector-aligned but must be phrase-aligned (64 bits).
- lengthInBytes – The length, given in bytes (not words or long-words) to be erased. Must be phrase-aligned (64 bits).
- key – The value used to validate all flash erase APIs. Use kFLASH_ApiEraseKey here.

Return values

- kStatus_FLASH_Success – API was executed successfully.
- kStatus_FLASH_InvalidArgument – An invalid argument is provided.
- kStatus_FLASH_AlignmentError – The parameter is not aligned with the specified baseline.
- kStatus_FLASH_AddressError – The address is out of range.
- kStatus_FLASH_EraseKeyError – The API erase key is invalid.
- kStatus_FLASH_AccessError – Invalid instruction codes and out-of bounds addresses.
- kStatus_FLASH_ProtectionViolation – The program/erase operation is requested to execute on protected areas.
- kStatus_FLASH_CommandFailure – Run-time error during the command execution.

flash_status_t FLASH_EraseAll(*flash_config_t* *config, uint32_t key)

Erases entire flash, after done flash is on security status.

Parameters

- config – Pointer to the storage for the driver runtime state.
- key – A value used to validate all flash erase APIs. Use kFLASH_ApiEraseKey here.

Return values

- kStatus_FLASH_Success – API was executed successfully.
- kStatus_FLASH_InvalidArgument – An invalid argument is provided.
- kStatus_FLASH_EraseKeyError – API erase key is invalid.

- kStatus_FLASH_AccessError – Invalid instruction codes and out-of bounds addresses.
- kStatus_FLASH_ProtectionViolation – The program/erase operation is requested to execute on protected areas.
- kStatus_FLASH_CommandFailure – Run-time error during command execution.

flash_status_t FLASH_EraseAllUnsecure(*flash_config_t* *config, uint32_t key)

Erases the entire flash, after done flash is on unsecurity status.

Parameters

- config – Pointer to the storage for the driver runtime state.
- key – A value used to validate all flash erase APIs. Use kFLASH_ApiEraseKey here.

Return values

- kStatus_FLASH_Success – API was executed successfully.
- kStatus_FLASH_InvalidArgument – An invalid argument is provided.
- kStatus_FLASH_EraseKeyError – API erase key is invalid.
- kStatus_FLASH_AccessError – Invalid instruction codes and out-of bounds addresses.
- kStatus_FLASH_ProtectionViolation – The program/erase operation is requested to execute on protected areas.
- kStatus_FLASH_CommandFailure – Run-time error during command execution.

flash_status_t FLASH_Program(*flash_config_t* *config, uint32_t start, uint8_t *src, uint32_t lengthInBytes)

Programs flash with data at locations passed in through parameters via the Program Section command.

This function programs the flash memory with the desired data for a given flash area as determined by the start address and length.

Parameters

- config – A pointer to the storage for the driver runtime state.
- start – The start address of the desired flash memory to be programmed. Must be phrase-aligned (64 bits).
- src – A pointer to the source buffer of data that is to be programmed into the flash.
- lengthInBytes – The length, given in bytes (not words or long-words), to be programmed. Must be phrase-aligned (64 bits).

Return values

- kStatus_FLASH_Success – API was executed successfully.
- kStatus_FLASH_InvalidArgument – An invalid argument is provided.
- kStatus_FLASH_AlignmentError – Parameter is not aligned with specified baseline.
- kStatus_FLASH_AddressError – Address is out of range.
- kStatus_FLASH_AccessError – Invalid instruction codes and out-of bounds addresses.

- kStatus_FLASH_ProtectionViolation – The program/erase operation is requested to execute on protected areas.
- kStatus_FLASH_CommandFailure – Run-time error during command execution.

flash_status_t FLASH_ProgramOnce(*ftfx_config_t* *config, uint32_t index, uint8_t *src, uint32_t lengthInBytes)

Programs Program Once Field through parameters.

This function programs the Program Once Field with the desired data for a given flash area as determined by the index and length.

Parameters

- config – A pointer to the storage for the driver runtime state.
- index – The index indicating which area of the Program Once Field to be programmed.Index is 0~7.
- src – A pointer to the source buffer of data that is to be programmed into the Program Once Field.
- lengthInBytes – The length, given in bytes (not words or long-words), to be programmed. Must be phrase-aligned (64 bits). This value is ignored, it's always 8 bytes that are written into specified IFR area.

Return values

- kStatus_FLASH_Success – API was executed successfully.
- kStatus_FLASH_InvalidArgument – An invalid argument is provided.
- kStatus_FLASH_AccessError – Invalid instruction codes and out-of bounds addresses.
- kStatus_FLASH_ProtectionViolation – The program/erase operation is requested to execute on protected areas.
- kStatus_FLASH_CommandFailure – Run-time error during the command execution.

flash_status_t FLASH_VerifyErase(*flash_config_t* *config, uint32_t start, uint32_t lengthInBytes, *flash_margin_value_t* margin)

Verifies an erasure of the desired flash area at a specified margin level.

This function checks the appropriate number of flash sectors based on the desired start address and length to check whether the flash is erased to the specified read margin level.

Parameters

- config – A pointer to the storage for the driver runtime state.
- start – The start address of the desired flash memory to be verified. The start address does not need to be sector-aligned but must be phrase-aligned (64 bits).
- lengthInBytes – The length, given in bytes (not words or long-words), to be verified. Must be phrase-aligned (64 bits).
- margin – Read margin choice. Choose from the members in flash_margin_value_t.

Return values

- kStatus_FLASH_Success – API was executed successfully.
- kStatus_FLASH_InvalidArgument – An invalid argument is provided.

- kStatus_FLASH_AlignmentError – Parameter is not aligned with specified baseline.
- kStatus_FLASH_AddressError – Address is out of range.
- kStatus_FLASH_AccessError – Invalid instruction codes and out-of bounds addresses.
- kStatus_FLASH_ProtectionViolation – The program/erase operation is requested to execute on protected areas.
- kStatus_FLASH_CommandFailure – Run-time error during the command execution.

flash_status_t FLASH_VerifyEraseAll(*flash_config_t* *config, *flash_margin_value_t* margin)

Verifies erasure of the entire flash at a specified margin level.

This function checks whether the flash is erased to the specified read margin level.

Parameters

- config – A pointer to the storage for the driver runtime state.
- margin – Read margin choice. Choose from the members in flash_margin_value_t.

Return values

- kStatus_FLASH_Success – API was executed successfully.
- kStatus_FLASH_InvalidArgument – An invalid argument is provided.
- kStatus_FLASH_AccessError – Invalid instruction codes and out-of bounds addresses.
- kStatus_FLASH_ProtectionViolation – The program/erase operation is requested to execute on protected areas.
- kStatus_FLASH_CommandFailure – Run-time error during the command execution.

flash_status_t FLASH_VerifyProgram(*flash_config_t* *config, uint32_t start, uint32_t lengthInBytes, const uint8_t *expectedData, *flash_margin_value_t* margin, uint32_t *failedAddress, uint32_t *failedData)

Verifies programming of the desired flash area at a specified margin level.

This function verifies the data programed in the flash memory using the Flash Program Check Command and compares it to the expected data for a given flash area as determined by the start address and length.

Parameters

- config – A pointer to the storage for the driver runtime state.
- start – The start address of the desired flash memory to be verified. Must be longword-aligned (32 bits).
- lengthInBytes – The length, given in bytes (not words or long-words), to be verified. Must be longword-aligned (32 bits).
- expectedData – A pointer to the expected data that is to be verified against.
- margin – Read margin choice. Choose from the members in flash_margin_value_t. "kFLASH_MarginValueNormal" is not for this command.
- failedAddress – A pointer to the returned failing address, which is used by PGMCHK command. So it's always longword-aligned.

- failedData – A pointer to the returned failing data. Some derivatives do not include failed data as part of the FCCOBx registers. In this case, zeros are returned upon failure.

Return values

- kStatus_FLASH_Success – API was executed successfully.
- kStatus_FLASH_InvalidArgument – An invalid argument is provided.
- kStatus_FLASH_AlignmentError – Parameter is not aligned with specified baseline.
- kStatus_FLASH_AddressError – Address is out of range.
- kStatus_FLASH_AccessError – Invalid instruction codes and out-of bounds addresses.
- kStatus_FLASH_ProtectionViolation – The program/erase operation is requested to execute on protected areas.
- kStatus_FLASH_CommandFailure – Run-time error during the command execution.

flash_status_t FLASH_GetSecurityState(*flash_config_t* *config, *flash_security_state_t* *state)

Returns the security state via the pointer passed into the function.

This function retrieves the current flash security status, including the security enabling state and the backdoor key enabling state.

Parameters

- config – A pointer to storage for the driver runtime state.
- state – A pointer to the value returned for the current security status code: one of the members in flash_security_state_t.

Return values

- kStatus_FLASH_Success – API was executed successfully.
- kStatus_FLASH_InvalidArgument – An invalid argument is provided.

flash_status_t FLASH_SecurityBypass(*flash_config_t* *config, const uint8_t *backdoorKey)

Allows users to bypass security with a backdoor key.

If the MCU is in secured state, this function unsecures the MCU by comparing the provided backdoor key with ones in the flash configuration field.

Parameters

- config – A pointer to the storage for the driver runtime state.
- backdoorKey – A pointer to the user buffer containing the backdoor key.

Return values

- kStatus_FLASH_Success – API was executed successfully.
- kStatus_FLASH_InvalidArgument – An invalid argument is provided.
- kStatus_FLASH_AccessError – Invalid instruction codes and out-of bounds addresses.
- kStatus_FLASH_ProtectionViolation – The program/erase operation is requested to execute on protected areas.
- kStatus_FLASH_CommandFailure – Run-time error during the command execution.

flash_status_t FLASH_ReadOnce(*ftfx_config_t* *config, uint32_t index, uint8_t *dst, uint32_t lengthInBytes)

Reads the Program Once Field through parameters.

This function reads the read once feild with given index and length.

Parameters

- config – A pointer to the storage for the driver runtime state.
- index – The index indicating the area of program once field to be read. Index is 0~7.
- dst – A pointer to the destination buffer of data that is used to store data to be read.
- lengthInBytes – The length, given in bytes (not words or long-words), to be programmed. This value is ignored, it's always 8 bytes that are read out from the specified IFR area.

Return values

- kStatus_FLASH_Success – API was executed successfully.
- kStatus_FLASH_InvalidArgument – An invalid argument is provided.
- kStatus_FLASH_AccessError – Invalid instruction codes and out-of bounds addresses.
- kStatus_FLASH_ProtectionViolation – The program/erase operation is requested to execute on protected areas.
- kStatus_FLASH_CommandFailure – Run-time error during the command execution.

flash_status_t FLASH_ReadResource(*flash_config_t* *config, uint32_t start, uint8_t *dst, uint32_t lengthInBytes, *flash_read_resource_opt_t* option)

Reads the resource with data at locations passed in through parameters.

This function reads the flash memory with the desired location for a given flash area as determined by the start address and length.

Parameters

- config – A pointer to the storage for the driver runtime state.
- start – The start address of the desired flash memory resource to be read. Must be phrase-aligned (64 bits).
- dst – A pointer to the destination buffer of data that is used to store data to be read.
- lengthInBytes – The length, given in bytes (not words or long-words), to be read. Must be phrase-aligned (64 bits). When option is "kFLASH_ResourceOptionFlashIfr", lengthInBytes can't be larger than 64. When option is "kFLASH_ResourceOptionVersionId", lengthInBytes should be set to 8.
- option – The resource option which indicates which area should be read back. Choose from "kFLASH_ResourceOptionFlashIfr" and "kFLASH_ResourceOptionVersionId".

Return values

- kStatus_FLASH_Success – API was executed successfully.
- kStatus_FLASH_InvalidArgument – An invalid argument is provided.

- kStatus_FLASH_AlignmentError – Parameter is not aligned with the specified baseline.
- kStatus_FLASH_AccessError – Invalid instruction codes and out-of bounds addresses.
- kStatus_FLASH_ProtectionViolation – The program/erase operation is requested to execute on protected areas.
- kStatus_FLASH_CommandFailure – Run-time error during the command execution.

flash_status_t FLASH_Swap(*flash_config_t* *config, uint32_t address, uint8_t isSetEnable)

Swaps the lower half flash with the higher half flash.

Parameters

- config – A pointer to the storage for the driver runtime state.
- address – Address used to configure the flash swap function
- isSetEnable – The possible option used to configure the Flash Swap function or check the flash Swap status.

Return values

- kStatus_FLASH_Success – API was executed successfully.
- kStatus_FLASH_InvalidArgument – An invalid argument is provided.
- kStatus_FLASH_AlignmentError – Parameter is not aligned with specified baseline.
- kStatus_FLASH_SwapIndicatorAddressError – Swap indicator address is invalid.
- kStatus_FLASH_AccessError – Invalid instruction codes and out-of bounds addresses.
- kStatus_FLASH_ProtectionViolation – The program/erase operation is requested to execute on protected areas.
- kStatus_FLASH_CommandFailure – Run-time error during command execution.
- kStatus_FLASH_SwapSystemNotInUninitialized – Swap system is not in an uninitialzed state.

typedef int flash_status_t

uint8_t bugfix

uint8_t minor

uint8_t major

char name

struct *_standard_version* B

uint32_t version

flash_swap_state_t flashSwapState

The current Swap system status.

flash_swap_block_status_t currentSwapBlockStatus

The current Swap block status.

flash_swap_block_status_t nextSwapBlockStatus
    The next Swap block status.

uint32_t base
    Base address of flash special memory.

uint32_t size
    size of flash special memory.

uint32_t count
    flash special memory count.

uint8_t type
    Type of flash block.

uint8_t index
    Index of flash block.

uint8_t reserved[2]

uint32_t isIndBlock

uint32_t hasIndPfsizeReg

uint32_t hasProtControl

uint32_t hasIndProtReg

uint32_t hasXaccControl

uint32_t hasIndXaccReg

uint32_t ___pad0___

uint32_t ProtRegBits

struct *_flash_mem_desc_t* feature

uint32_t blockBase
    A base address of the flash block

uint32_t totalSize
    The size of the flash block.

uint32_t sectorSize
    The size in bytes of a sector of flash.

uint32_t blockCount
    A number of flash blocks.

flash_spec_mem_t accessSegmentMem

flash_spec_mem_t protectRegionMem

uint32_t convertedAddress
    A converted address for the current flash type.

uint8_t sectorCmd

uint8_t sectionCmd

uint8_t resourceCmd

uint8_t checkCmd

uint8_t swapCtrlCmd

uint8_t blockWriteUnitSize

uint8_t reserved[2]

struct *_flash_ops_config* addrAligment

uint32_t has4ByteIdxSupport

uint32_t has8ByteIdxSupport

uint32_t ___pad0___

struct *_flash_ifr_desc* feature

uint8_t versionIdStart

uint8_t versionIdSize

uint16_t ifrMemSize

uint32_t pflashIfrStart

uint32_t dflashIfrStart

uint32_t pflashSwapIfrStart

struct *_flash_ifr_desc* resRange

uint16_t mix8byteIdxStart

uint16_t mix8byteIdxEnd

struct *_flash_ifr_desc* idxInfo

flash_mem_desc_t flashDesc

flash_ops_config_t opsConfig

uint32_t flexramBlockBase
    The base address of the FlexRAM/acceleration RAM

uint32_t flexramTotalSize
    The size of the FlexRAM/acceleration RAM

uint16_t eepromTotalSize
    The size of EEPROM area which was partitioned from FlexRAM

uint16_t reserved

uint32_t *runCmdFuncAddr
    An buffer point to the flash execute-in-RAM function.

flash_ifr_desc_t ifrDesc

ftfx_config_t ftfxConfig[1]

uint32_t dummy[1]

uint8_t byte[4]

union __standard__version
    #include <fsl_flash.h>

struct _flash_swap_state_config
    #include <fsl_flash.h> Flash Swap information.

struct _flash_special_mem
    #include <fsl_flash.h> ftfx special memory access information.

struct _flash_mem_desc_t
    #include <fsl_flash.h> Flash memory descriptor.

struct _flash_ops_config
    #include <fsl_flash.h> Active FTFx information for the current operation.

struct _flash_ifr_desc
    #include <fsl_flash.h> Flash IFR memory descriptor.

struct _ftfx_config
    #include <fsl_flash.h> Flash driver state information.

    An instance of this structure is allocated by the user of the flash driver and passed into each of the driver APIs.

struct _flash_config
    #include <fsl_flash.h>

union UNION_Type_aligned_for_longword
    #include <fsl_flash.h>

struct B

struct feature

struct addrAligment

struct feature

struct resRange

struct idxInfo

2.31 Driver Change Log

2.32 FlexCAN Driver

void FLEXCAN_Init(CAN_Type *base, const *flexcan_config_t* *psConfig)
    Initializes a FlexCAN instance with classic / FD mode supported.

    This function initializes the FlexCAN module with user-defined settings. User can call the FELXCAN_GetDefaultConfig function an starting point for the needed init configuration structure.

    Note: If user want to initialize the peripheral in CAN FD mode, user can call the FLEXCAN_GetFDDefaultConfig to get the flexcan_fd_config_t and assign the address of the data structure to the member psFDConfig of flexcan_config_t

    Parameters

    - base – FlexCAN peripheral base address.
    - psConfig – Pointer to the user-defined configuration structure.

void FLEXCAN_Deinit(CAN_Type *base)

De-initializes a FlexCAN instance.

This function disables the FlexCAN module clock and sets all register values to the reset value.

Parameters

- base – FlexCAN peripheral base address.

void FLEXCAN_GetDefaultConfig(*flexcan_config_t* *psConfig, uint32_t u32ClkFreqHz)

Gets the default configuration structure.

This API does not provide specific classic CAN bit timing configuration values (sTimingConfig), but set bEnableTimingCalc to true by default, and it will make FLEXCAN_Init() calculate and configure bit timing parameters based on the frequency of the peripheral (u32ClkFreqHz) and classic CAN bit rate (u32BaudRateBps).

```
psConfig->bEnableTimingCalc          = true;
psConfig->u32ClkFreqHz               = u32ClkFreqHz;
psConfig->eClkSrc                    = kFLEXCAN_ClkSrc0;
psConfig->u32BaudRateBps             = 500000U;
psConfig->u8MaxMsgBufNum             = 16;
psConfig->bEnableLoopBack            = false;
psConfig->bEnableTimerSync           = true;
psConfig->bEnableSelfWakeup          = false;
psConfig->eWakeupSrc                 = kFLEXCAN_WakeupSrcUnfiltered;
psConfig->bEnableIndividMask         = false;
psConfig->bDisableSelfReception      = false;
psConfig->bEnableListenOnlyMode      = false;
psConfig->bEnableDoze                = false;
psConfig->psFDConfig = NULL;
```

Note: By default, CAN FD mode is disabled and not configured.

Parameters

- psConfig – Pointer to the FlexCAN configuration structure.
- u32ClkFreqHz – Flexcan peripheral clock

void FLEXCAN_GetFDDefaultConfig(*flexcan_config_t* *psConfig, *flexcan_fd_config_t* *psFDConfig)

Gets the default configuration structure for Flexcan FD mode.

The function provided the default value of the data structure as code below

```
psConfig->u32BaudRateBps             = 2000000U;
psConfig->eMsgSize                   = kFLEXCAN_64BperMB;
psConfig->bEnableTxDelayCompensation = true;
psConfig->bEnableBitRateSwitch       = true;
```

Parameters

- psConfig – Pointer to the FlexCAN configuration structure.
- psFDConfig – Pointer to FD configuration structure.

void FLEXCAN_EnterFreezeMode(CAN_Type *base)

Enter FlexCAN Freeze Mode.

This function makes the FlexCAN work under Freeze Mode.

Parameters

- base – FlexCAN peripheral base address.

void FLEXCAN_ExitFreezeMode(CAN_Type *base)

Exit FlexCAN Freeze Mode.

This function makes the FlexCAN leave Freeze Mode.

Parameters

- base – FlexCAN peripheral base address.

bool FLEXCAN_CalculateImprovedTimingValuesWithCBT(*flexcan_timing_config_t* *psTimingConfig, uint32_t u32IdealSp, uint32_t u32BaudRateBps, uint32_t u32SrcClkHz)

Calculates the improved timing values by specific baud rates for classical CAN (use CBT register)

Note: The CBT register support 8 ~ 129 time quanta

Parameters

- psTimingConfig – Pointer to the FlexCAN timing configuration structure.
- u32IdealSp – The desired sample point, unit is one thousandth. (like 875, 800, 750).
- u32BaudRateBps – The classical CAN speed in bps defined by user.
- u32SrcClkHz – The Source clock data speed in bps.

Returns

TRUE if timing configuration found, FALSE if failed to find configuration

bool FLEXCAN_FDCalculateImprovedTimingValues(*flexcan_timing_config_t* *psTimingConfig, *flexcan_timing_config_t* *psFDTimingConfig, uint32_t u32BaudRateBps, uint32_t u32FDBaudRateBps, uint32_t u32SrcClkHz)

Calculates the improved timing values by specific baudrates for CANFD.

Parameters

- psTimingConfig – Pointer to the FlexCAN timing configuration structure.
- psFDTimingConfig – Pointer to the FlexCAN FD timing configuration structure.
- u32BaudRateBps – The CANFD bus control speed in bps defined by user.
- u32FDBaudRateBps – The CANFD bus data speed in bps defined by user.
- u32SrcClkHz – The Source clock data speed in bps.

Returns

TRUE if timing configuration found, FALSE if failed to find configuration

bool FLEXCAN_CalculateImprovedTimingValues(*flexcan_timing_config_t* *psTimingConfig, uint32_t u32BaudRateBps, uint32_t u32SrcClkHz)

Calculates the improved timing values by specific baud rates for classical CAN (use CTRL1 register)

Note: The CTRL1 register support 8 ~ 25 time quanta

Parameters

- psTimingConfig – Pointer to the FlexCAN timing configuration structure.
- u32BaudRateBps – The classical CAN speed in bps defined by user.
- u32SrcClkHz – The Source clock data speed in bps.

Returns
TRUE if timing configuration found, FALSE if failed to find configuration

status_t FLEXCAN_SetFDBaudRate(CAN_Type *base, uint32_t u32SrcClkHz, uint32_t u32BaudRateBps, uint32_t u32FDBaudRateBps)

Set Baud Rate of FlexCAN FD mode.

This function set the baud rate of FlexCAN FD frame.

Parameters

- base – FlexCAN peripheral base address.
- u32SrcClkHz – Source Clock in Hz.
- u32BaudRateBps – Frame Baud Rate in Bps.
- u32FDBaudRateBps – FD frame Baud Rate in Bps.

Return values

- kStatus_Success – Set baud rate success.
- kStatus_Fail – Set baud rate fail.

void FLEXCAN_SetFDTimingConfig(CAN_Type *base, const *flexcan_timing_config_t* *psConfig)

Sets the FlexCAN FD protocol timing characteristic.

This function gives user settings to CAN bus timing characteristic. The function is for an experienced user. For less experienced users, call the FLEXCAN_Init() and fill the baud rate field with a desired value. This provides the default timing characteristics to the module.

Note that calling FLEXCAN_SetFDTimingConfig() overrides the baud rate set in FLEXCAN_Init().

Parameters

- base – FlexCAN peripheral base address.
- psConfig – Pointer to the timing configuration structure.

status_t FLEXCAN_SetBaudRate(CAN_Type *base, uint32_t u32SrcClkHz, uint32_t u32BaudRateBps)

Set Baud Rate of FlexCAN classic mode.

This function calculates the improved timing values base on specific baud rates and sets these values in timing register (CTRL1/CBT).

Parameters

- base – FlexCAN peripheral base address.
- u32SrcClkHz – Source Clock in Hz.
- u32BaudRateBps – Desired classic CAN Baud Rate in Bps.

Return values

- kStatus_Success – Set baud rate success.

- kStatus_Fail – Set baud rate fail.

void FLEXCAN_SetTimingConfig(CAN_Type *base, const *flexcan_timing_config_t* *psConfig)

Sets the FlexCAN protocol timing characteristic.

This function gives user settings to classic CAN timing characteristic. The function is for an experienced user. For less experienced users, call the FLEXCAN_GetDefaultConfig and FLEXCAN_Init() to fill the baud rate field with auto-calculates values (base on the default baud rate). Users also can call FLEXCAN_SetBaudRate() to set auto-calculates timing values base on the desired baud rate.

Note: that calling FLEXCAN_SetTimingConfig() overrides the baud rate set in FLEXCAN_Init() or FLEXCAN_SetBaudRate().

Parameters

- base – FlexCAN peripheral base address.
- psConfig – Pointer to the timing configuration structure.

void FLEXCAN_SetRxMbGlobalMask(CAN_Type *base, uint32_t u32RecMsgBufs)

Sets the FlexCAN receive message buffer global mask.

This function sets the global mask for the FlexCAN message buffer in a matching process. The configuration is only effective when the Rx individual mask is disabled in the FLEXCAN_Init().

Parameters

- base – FlexCAN peripheral base address.
- u32RecMsgBufs – Rx Message Buffer Global Mask value.

void FLEXCAN_SetRxFifoGlobalMask(CAN_Type *base, uint32_t u32RecFifos)

Sets the FlexCAN receive FIFO global mask.

This function sets the global mask for FlexCAN FIFO in a matching process.

Parameters

- base – FlexCAN peripheral base address.
- u32RecFifos – Rx Fifo Global Mask value.

void FLEXCAN_SetRxIndividualMask(CAN_Type *base, uint8_t u8MaskIdx, uint32_t u32Mask)

Sets the FlexCAN receive individual mask.

This function sets the individual mask for the FlexCAN matching process. The configuration is only effective when the Rx individual mask is enabled in the FLEXCAN_Init(). If the Rx FIFO is disabled, the individual mask is applied to the corresponding Message Buffer. If the Rx FIFO is enabled, the individual mask for Rx FIFO occupied Message Buffer is applied to the Rx Filter with the same index. Note that only the first 32 individual masks can be used as the Rx FIFO filter mask.

Parameters

- base – FlexCAN peripheral base address.
- u8MaskIdx – The Index of individual Mask.
- u32Mask – Rx Individual Mask value.

void FLEXCAN_SetTxMbConfig(CAN_Type *base, uint8_t u8MsgBufIdx, bool bEnable)

Configures a FlexCAN transmit message buffer.

This function aborts the previous transmission, cleans the Message Buffer, and configures it as a Transmit Message Buffer.

Parameters

- base – FlexCAN peripheral base address.
- u8MsgBufIdx – The Message Buffer index.
- bEnable – Enable/disable Tx Message Buffer.
  - true: Enable Tx Message Buffer.
  - false: Disable Tx Message Buffer.

void FLEXCAN_SetFDTxMbConfig(CAN_Type *base, uint8_t u8MsgBufIdx, bool bEnable)

Configures a FlexCAN transmit message buffer.

This function aborts the previous transmission, cleans the Message Buffer, and configures it as a Transmit Message Buffer.

Parameters

- base – FlexCAN peripheral base address.
- u8MsgBufIdx – The Message Buffer index.
- bEnable – Enable/disable Tx Message Buffer.
  - true: Enable Tx Message Buffer.
  - false: Disable Tx Message Buffer.

void FLEXCAN_SetRxMbConfig(CAN_Type *base, uint8_t u8MsgBufIdx, const *flexcan_rx_mb_config_t* *psRxMsgBufConfig, bool bEnable)

Configures a FlexCAN Receive Message Buffer.

This function cleans a FlexCAN build-in Message Buffer and configures it as a Receive Message Buffer.

Parameters

- base – FlexCAN peripheral base address.
- u8MsgBufIdx – The Message Buffer index.
- psRxMsgBufConfig – Pointer to the FlexCAN Message Buffer configuration structure.
- bEnable – Enable/disable Rx Message Buffer.
  - true: Enable Rx Message Buffer.
  - false: Disable Rx Message Buffer.

void FLEXCAN_SetFDRxMbConfig(CAN_Type *base, uint8_t u8MsgBufIdx, const *flexcan_rx_mb_config_t* *psRxMsgBufConfig, bool bEnable)

Configures a FlexCAN Receive Message Buffer.

This function cleans a FlexCAN build-in Message Buffer and configures it as a Receive Message Buffer.

Parameters

- base – FlexCAN peripheral base address.
- u8MsgBufIdx – The Message Buffer index.
- psRxMsgBufConfig – Pointer to the FlexCAN Message Buffer configuration structure.
- bEnable – Enable/disable Rx Message Buffer.
  - true: Enable Rx Message Buffer.
  - false: Disable Rx Message Buffer.

void FLEXCAN_SetRxFifoConfig(CAN_Type *base, const *flexcan_rx_fifo_config_t* *psRxFifoConfig, bool bEnable)

Configures the FlexCAN Rx FIFO.

This function configures the Rx FIFO with given Rx FIFO configuration.

Parameters

- base – FlexCAN peripheral base address.
- psRxFifoConfig – Pointer to the FlexCAN Rx FIFO configuration structure.
- bEnable – Enable/disable Rx FIFO.
  - true: Enable Rx FIFO.
  - false: Disable Rx FIFO.

static inline uint32_t FLEXCAN_GetStatusFlags(CAN_Type *base)

Gets the FlexCAN module interrupt flags.

This function gets all FlexCAN status flags. The flags are returned as the logical OR value of the enumerators _flexcan_status_flags. To check the specific status, compare the return value with enumerators in _flexcan_status_flags.

Parameters

- base – FlexCAN peripheral base address.

Returns

FlexCAN status flags which are ORed by the enumerators in the _flexcan_status_flags.

static inline void FLEXCAN_ClearStatusFlags(CAN_Type *base, uint32_t u32StatusFlags)

Clears status flags with the provided mask.

This function clears the FlexCAN status flags with a provided mask. An automatically cleared flag can't be cleared by this function.

Parameters

- base – FlexCAN peripheral base address.
- u32StatusFlags – The status flags to be cleared, it is logical OR value of _flexcan_status_flags.

static inline void FLEXCAN_GetBusErrCount(CAN_Type *base, uint8_t *pu8TxErrBuf, uint8_t *pu8RxErrBuf)

Gets the FlexCAN Bus Error Counter value.

This function gets the FlexCAN Bus Error Counter value for both Tx and Rx direction. These values may be needed in the upper layer error handling.

Parameters

- base – FlexCAN peripheral base address.
- pu8TxErrBuf – Buffer to store Tx Error Counter value.
- pu8RxErrBuf – Buffer to store Rx Error Counter value.

static inline uint64_t FLEXCAN_GetMbStatusFlags(CAN_Type *base, uint64_t mask)

Gets the FlexCAN Message Buffer interrupt flags.

This function gets the interrupt flags of a given Message Buffers.

Parameters

- base – FlexCAN peripheral base address.
- mask – The ORed FlexCAN Message Buffer mask.

Returns
The status of given Message Buffers.

static inline void FLEXCAN_ClearMbStatusFlags(CAN_Type *base, uint64_t mask)
Clears the FlexCAN Message Buffer interrupt flags.

This function clears the interrupt flags of a given Message Buffers.

Parameters
- base – FlexCAN peripheral base address.
- mask – The ORed FlexCAN Message Buffer mask.

static inline void FLEXCAN_EnableInterrupts(CAN_Type *base, uint32_t u32InterruptFlags)
Enables FlexCAN interrupts according to the provided mask.

This function enables the FlexCAN interrupts according to the provided mask. The mask is a logical OR of enumeration members, see _flexcan_interrupt_enable.

Parameters
- base – FlexCAN peripheral base address.
- u32InterruptFlags – The interrupts to enable. Logical OR of _flexcan_interrupt_enable.

static inline void FLEXCAN_DisableInterrupts(CAN_Type *base, uint32_t u32InterruptFlags)
Disables FlexCAN interrupts according to the provided mask.

This function disables the FlexCAN interrupts according to the provided mask. The mask is a logical OR of enumeration members, see _flexcan_interrupt_enable.

Parameters
- base – FlexCAN peripheral base address.
- u32InterruptFlags – The interrupts to disable. Logical OR of _flexcan_interrupt_enable.

static inline void FLEXCAN_EnableMbInterrupts(CAN_Type *base, uint64_t mask)
Enables FlexCAN Message Buffer interrupts.

This function enables the interrupts of given Message Buffers.

Parameters
- base – FlexCAN peripheral base address.
- mask – The ORed FlexCAN Message Buffer mask.

static inline void FLEXCAN_DisableMbInterrupts(CAN_Type *base, uint64_t mask)
Disables FlexCAN Message Buffer interrupts.

This function disables the interrupts of given Message Buffers.

Parameters
- base – FlexCAN peripheral base address.
- mask – The ORed FlexCAN Message Buffer mask.

void FLEXCAN_EnableRxFifoDMA(CAN_Type *base, bool bEnable)
Enables or disables the FlexCAN Rx FIFO DMA request.

This function enables or disables the DMA feature of FlexCAN build-in Rx FIFO.

Parameters
- base – FlexCAN peripheral base address.
- bEnable – true to enable, false to disable.

static inline uint32_t FLEXCAN_GetRxFifoHeadAddr(CAN_Type *base)

Gets the Rx FIFO Head address.

This function returns the FlexCAN Rx FIFO Head address, which is mainly used for the DMA/eDMA use case.

Parameters

- base – FlexCAN peripheral base address.

Returns

FlexCAN Rx FIFO Head address.

static inline void FLEXCAN_Enable(CAN_Type *base, bool bEnable)

Enables or disables the FlexCAN module operation.

This function enables or disables the FlexCAN module.

Parameters

- base – FlexCAN base pointer.
- bEnable – true to enable, false to disable.

status_t FLEXCAN_WriteTxMb(CAN_Type *base, uint8_t u8MsgBufIdx, const *flexcan_frame_t* *psTxFrame)

Writes a classic CAN frame to the Transmit Message Buffer.

This function writes a classic CAN frame to the specified Transmit Message Buffer and changes the Message Buffer state to start CAN Message transmit. After that the function returns immediately.

Parameters

- base – FlexCAN peripheral base address.
- u8MsgBufIdx – The FlexCAN Message Buffer index.
- psTxFrame – Pointer to CAN message frame to be sent.

Return values

- kStatus_Success – - Write Tx Message Buffer Successfully.
- kStatus_Fail – - Tx Message Buffer is currently in use.

status_t FLEXCAN_ReadRxMb(CAN_Type *base, uint8_t u8MsgBufIdx, *flexcan_frame_t* *psRxFrame)

Reads a classic CAN frame from Receive Message Buffer.

This function reads a classic CAN frame from a specified Receive Message Buffer. The function fills a receive CAN message frame structure with just received data and activates the Message Buffer again. The function returns immediately.

Parameters

- base – FlexCAN peripheral base address.
- u8MsgBufIdx – The FlexCAN Message Buffer index.
- psRxFrame – Pointer to CAN message frame structure for reception.

Return values

- kStatus_Success – - Rx Message Buffer is full and has been read successfully.
- kStatus_FLEXCAN_RxOverflow – - Rx Message Buffer is already overflowed and has been read successfully.
- kStatus_Fail – - Rx Message Buffer is empty.

status_t FLEXCAN_ReadRxFifo(CAN_Type *base, *flexcan_frame_t* *psRxFrame)

Reads a FlexCAN Message from Rx FIFO.

This function reads a CAN message from the FlexCAN build-in Rx FIFO.

Parameters

- base – FlexCAN peripheral base address.
- psRxFrame – Pointer to CAN message frame structure for reception.

Return values

- kStatus_Success – - Read Message from Rx FIFO successfully.
- kStatus_Fail – - Rx FIFO is not enabled.

status_t FLEXCAN_WriteFDTxMb(CAN_Type *base, uint8_t u8MsgBufIdx, const *flexcan_fd_frame_t* *psTxFrame)

Writes a CAN frame to the Transmit Message Buffer.

This function writes a CAN FD frame or classic CAN frame to the specified Transmit Message Buffer and changes the Message Buffer state to start CAN FD Message transmit. After that the function returns immediately.

Parameters

- base – FlexCAN peripheral base address.
- u8MsgBufIdx – The FlexCAN FD Message Buffer index.
- psTxFrame – Pointer to CAN FD message frame to be sent.

Return values

- kStatus_Success – - Write Tx Message Buffer Successfully.
- kStatus_Fail – - Tx Message Buffer is currently in use.

status_t FLEXCAN_ReadFDRxMb(CAN_Type *base, uint8_t u8MsgBufIdx, *flexcan_fd_frame_t* *psRxFrame)

Reads a CAN frame from Receive Message Buffer.

This function reads a CAN FD frame or classic CAN frame from a specified Receive Message Buffer. The function fills a receive CAN FD message frame structure with just received data and activates the Message Buffer again. The function returns immediately.

Parameters

- base – FlexCAN peripheral base address.
- u8MsgBufIdx – The FlexCAN FD Message Buffer index.
- psRxFrame – Pointer to CAN FD message frame structure for reception.

Return values

- kStatus_Success – - Rx Message Buffer is full and has been read successfully.
- kStatus_FLEXCAN_RxOverflow – - Rx Message Buffer is already overflowed and has been read successfully.
- kStatus_Fail – - Rx Message Buffer is empty.

status_t FLEXCAN_TransferSendBlocking(CAN_Type *base, uint8_t u8MsgBufIdx, *flexcan_frame_t* *psTxFrame)

Performs a polling send transaction on the CAN bus.

Note that a transfer handle does not need to be created before calling this API.

Parameters

- base – FlexCAN peripheral base pointer.
- u8MsgBufIdx – The FlexCAN Message Buffer index.
- psTxFrame – Pointer to CAN message frame to be sent.

Return values

- kStatus_Success – - Write Tx Message Buffer Successfully.
- kStatus_Fail – - Tx Message Buffer is currently in use.

status_t FLEXCAN_TransferReceiveBlocking(CAN_Type *base, uint8_t u8MsgBufIdx, *flexcan_frame_t* *psRxFrame)

Performs a polling receive transaction on the CAN bus.

Note that a transfer handle does not need to be created before calling this API.

Parameters

- base – FlexCAN peripheral base pointer.
- u8MsgBufIdx – The FlexCAN Message Buffer index.
- psRxFrame – Pointer to CAN message frame structure for reception.

Return values

- kStatus_Success – - Rx Message Buffer is full and has been read successfully.
- kStatus_FLEXCAN_RxOverflow – - Rx Message Buffer is already overflowed and has been read successfully.
- kStatus_Fail – - Rx Message Buffer is empty.

status_t FLEXCAN_TransferReceiveFifoBlocking(CAN_Type *base, *flexcan_frame_t* *psRxFrame)

Performs a polling receive transaction from Rx FIFO on the CAN bus.

Note that a transfer handle does not need to be created before calling this API.

Parameters

- base – FlexCAN peripheral base pointer.
- psRxFrame – Pointer to CAN message frame structure for reception.

Return values

- kStatus_Success – - Read Message from Rx FIFO successfully.
- kStatus_Fail – - Rx FIFO is not enabled.

status_t FLEXCAN_TransferFDSendBlocking(CAN_Type *base, uint8_t u8MsgBufIdx, *flexcan_fd_frame_t* *psTxFrame)

Performs a polling send transaction on the CAN bus.

Note that a transfer handle does not need to be created before calling this API.

Parameters

- base – FlexCAN peripheral base pointer.
- u8MsgBufIdx – The FlexCAN FD Message Buffer index.
- psTxFrame – Pointer to CAN FD message frame to be sent.

Return values

- kStatus_Success – - Write Tx Message Buffer Successfully.
- kStatus_Fail – - Tx Message Buffer is currently in use.

status_t FLEXCAN_TransferFDReceiveBlocking(CAN_Type *base, uint8_t u8MsgBufIdx, *flexcan_fd_frame_t* *psRxFrame)

Performs a polling receive transaction on the CAN bus.

Note that a transfer handle does not need to be created before calling this API.

Parameters

- base – FlexCAN peripheral base pointer.
- u8MsgBufIdx – The FlexCAN FD Message Buffer index.
- psRxFrame – Pointer to CAN FD message frame structure for reception.

Return values

- kStatus_Success – - Rx Message Buffer is full and has been read successfully.
- kStatus_FLEXCAN_RxOverflow – - Rx Message Buffer is already overflowed and has been read successfully.
- kStatus_Fail – - Rx Message Buffer is empty.

void FLEXCAN_TransferCreateHandle(CAN_Type *base, *flexcan_handle_t* *psHandle, *flexcan_transfer_callback_t* pfCallback, void *pUserData)

Initializes the FlexCAN handle.

This function initializes the FlexCAN handle, which can be used for other FlexCAN transactional APIs. Usually, for a specified FlexCAN instance, call this API once to get the initialized handle.

Parameters

- base – FlexCAN peripheral base address.
- psHandle – FlexCAN handle pointer.
- pfCallback – The callback function.
- pUserData – The parameter of the callback function.

status_t FLEXCAN_TransferSendNonBlocking(*flexcan_handle_t* *psHandle, *flexcan_mb_transfer_t* *psMsgBufXfer)

Sends a message using IRQ.

This function sends a message using IRQ. This is a non-blocking function, which returns right away. When messages have been sent out, the send callback function is called.

Parameters

- psHandle – FlexCAN handle pointer.
- psMsgBufXfer – FlexCAN Message Buffer transfer structure. See the flexcan_mb_transfer_t.

Return values

- kStatus_Success – Start Tx Message Buffer sending process successfully.
- kStatus_Fail – Write Tx Message Buffer failed.
- kStatus_FLEXCAN_TxBusy – Tx Message Buffer is in use.

status_t FLEXCAN_TransferReceiveNonBlocking(*flexcan_handle_t* *psHandle, *flexcan_mb_transfer_t* *psMsgBufXfer)

Receives a message using IRQ.

This function receives a message using IRQ. This is non-blocking function, which returns right away. When the message has been received, the receive callback function is called.

Parameters

- psHandle – FlexCAN handle pointer.
- psMsgBufXfer – FlexCAN Message Buffer transfer structure. See the flexcan_mb_transfer_t.

Return values

- kStatus_Success – - Start Rx Message Buffer receiving process successfully.
- kStatus_FLEXCAN_RxBusy – - Rx Message Buffer is in use.

status_t FLEXCAN_TransferReceiveFifoNonBlocking(*flexcan_handle_t* *psHandle, *flexcan_fifo_transfer_t* *psFifoXfer)

Receives a message from Rx FIFO using IRQ.

This function receives a message using IRQ. This is a non-blocking function, which returns right away. When all messages have been received, the receive callback function is called.

Parameters

- psHandle – FlexCAN handle pointer.
- psFifoXfer – FlexCAN Rx FIFO transfer structure. See the flexcan_fifo_transfer_t.

Return values

- kStatus_Success – - Start Rx FIFO receiving process successfully.
- kStatus_FLEXCAN_RxFifoBusy – - Rx FIFO is currently in use.

uint32_t FLEXCAN_GetTimeStamp(*flexcan_handle_t* *psHandle, uint8_t u8MsgBufIdx)

Gets the detail index of Mailbox's Timestamp by handle.

Then function can only be used when calling non-blocking Data transfer (TX/RX) API, After TX/RX data transfer done (User can get the status by handler's callback function), we can get the detail index of Mailbox's timestamp by handle, Detail non-blocking data transfer API (TX/RX) contain. -FLEXCAN_TransferSendNonBlocking -FLEXCAN_TransferFDSendNonBlocking -FLEXCAN_TransferReceiveNonBlocking -FLEXCAN_TransferFDReceiveNonBlocking -FLEXCAN_TransferReceiveFifoNonBlocking

Parameters

- psHandle – FlexCAN handle pointer.
- u8MsgBufIdx – The FlexCAN FD Message Buffer index.

Return values

the – index of mailbox 's timestamp stored in the handle.

void FLEXCAN_TransferAbortSend(*flexcan_handle_t* *psHandle, uint8_t u8MsgBufIdx)

Aborts the interrupt driven message send process.

This function aborts the interrupt driven message send process.

Parameters

- psHandle – FlexCAN handle pointer.
- u8MsgBufIdx – The FlexCAN Message Buffer index.

void FLEXCAN_TransferAbortReceive(*flexcan_handle_t* *psHandle, uint8_t u8MsgBufIdx)

Aborts the interrupt driven message receive process.

This function aborts the interrupt driven message receive process.

Parameters

- psHandle – FlexCAN handle pointer.
- u8MsgBufIdx – The FlexCAN Message Buffer index.

void FLEXCAN_TransferAbortReceiveFifo(*flexcan_handle_t* *psHandle)

Aborts the interrupt driven message receive from Rx FIFO process.

This function aborts the interrupt driven message receive from Rx FIFO process.

Parameters

- psHandle – FlexCAN handle pointer.

void FLEXCAN_TransferHandleIRQ(*flexcan_handle_t* *psHandle)

FlexCAN IRQ handle function.

This function handles the FlexCAN Error, the Message Buffer, and the Rx FIFO IRQ request.

Parameters

- psHandle – FlexCAN handle pointer.

status_t FLEXCAN_TransferFDSendNonBlocking(*flexcan_handle_t* *psHandle, *flexcan_mb_transfer_t* *psMsgBufXfer)

Sends a message using IRQ.

This function sends a message (classic CAN frame or CAN FD frame) using IRQ. This is a non-blocking function, which returns right away. When messages have been sent out, the send callback function is called.

Parameters

- psHandle – FlexCAN handle pointer.
- psMsgBufXfer – FlexCAN FD Message Buffer transfer structure. See the flexcan_mb_transfer_t.

Return values

- kStatus_Success – Start Tx Message Buffer sending process successfully.
- kStatus_Fail – Write Tx Message Buffer failed.
- kStatus_FLEXCAN_TxBusy – Tx Message Buffer is in use.

status_t FLEXCAN_TransferFDReceiveNonBlocking(*flexcan_handle_t* *psHandle, *flexcan_mb_transfer_t* *psMsgBufXfer)

Receives a message using IRQ.

This function receives a message using IRQ. This is non-blocking function, which returns right away. When the message has been received, the receive callback function is called.

Parameters

- psHandle – FlexCAN handle pointer.
- psMsgBufXfer – FlexCAN FD Message Buffer transfer structure. See the flexcan_mb_transfer_t.

Return values

- kStatus_Success – - Start Rx Message Buffer receiving process successfully.
- kStatus_FLEXCAN_RxBusy – - Rx Message Buffer is in use.

void FLEXCAN_TransferFDAbortSend(*flexcan_handle_t* *psHandle, uint8_t u8MsgBufIdx)

Aborts the interrupt driven message send process.

This function aborts the interrupt driven message send process.

Parameters

- psHandle – FlexCAN handle pointer.
- u8MsgBufIdx – The FlexCAN FD Message Buffer index.

void FLEXCAN_TransferFDAbortReceive(*flexcan_handle_t* *psHandle, uint8_t u8MsgBufIdx)

Aborts the interrupt driven message receive process.

This function aborts the interrupt driven message receive process.

Parameters

- psHandle – FlexCAN handle pointer.
- u8MsgBufIdx – The FlexCAN FD Message Buffer index.

FSL_FLEXCAN_DRIVER_VERSION

FlexCAN driver version.

FlexCAN transfer status codes, used by bus operation APIs and transactional APIs as return value to indicate the current status as the API's execution result, or used in the callback to indicate transfer results.

Values:

enumerator kStatus_FLEXCAN_TxBusy

Tx Message Buffer is Busy.

enumerator kStatus_FLEXCAN_TxIdle

Tx Message Buffer is Idle.

enumerator kStatus_FLEXCAN_TxSwitchToRx

Remote Message is send out and Message buffer changed to Receive one.

enumerator kStatus_FLEXCAN_RxBusy

Rx Message Buffer is Busy.

enumerator kStatus_FLEXCAN_RxIdle

Rx Message Buffer is Idle.

enumerator kStatus_FLEXCAN_RxOverflow

Rx Message Buffer is Overflowed.

enumerator kStatus_FLEXCAN_RxFifoBusy

Rx Message FIFO is Busy.

enumerator kStatus_FLEXCAN_RxFifoIdle

Rx Message FIFO is Idle.

enumerator kStatus_FLEXCAN_RxFifoOverflow

Rx Message FIFO is overflowed.

enumerator kStatus_FLEXCAN_RxFifoWarning

Rx Message FIFO is almost overflowed.

enumerator kStatus_FLEXCAN_ErrorStatus

FlexCAN Module Error and Status.

enumerator kStatus_FLEXCAN_WakeUp

FlexCAN is waken up from STOP mode.

enumerator kStatus_FLEXCAN_UnHandled

UnHadled Interrupt asserted.

enumerator kStatus_FLEXCAN_RxRemote

Rx Remote Message Received in Mail box.

enum _flexcan_frame_format
FlexCAN frame format.

Values:

enumerator kFLEXCAN_FrameFormatStandard
Standard frame format attribute.

enumerator kFLEXCAN_FrameFormatExtend
Extend frame format attribute.

enum _flexcan_frame_type
FlexCAN frame type.

Values:

enumerator kFLEXCAN_FrameTypeData
Data frame type attribute.

enumerator kFLEXCAN_FrameTypeRemote
Remote frame type attribute.

enum _flexcan_clock_source
FlexCAN clock source.

Note: The user must ensure the protocol engine clock tolerance according to the CAN Protocol standard (ISO 11898-1).

Values:

enumerator kFLEXCAN_ClkSrc0
FlexCAN Protocol Engine clock selected by user as SRC == 0.

enumerator kFLEXCAN_ClkSrc1
FlexCAN Protocol Engine clock selected by user as SRC == 1.

enum _flexcan_wake_up_source
FlexCAN wake up source.

Values:

enumerator kFLEXCAN_WakeupSrcUnfiltered
FlexCAN uses unfiltered Rx input to detect edge.

enumerator kFLEXCAN_WakeupSrcFiltered
FlexCAN uses filtered Rx input to detect edge.

enum _flexcan_rx_fifo_filter_type
FlexCAN Rx Fifo Filter type.

Values:

enumerator kFLEXCAN_RxFifoFilterTypeA
One full ID (standard and extended) per ID Filter element.

enumerator kFLEXCAN_RxFifoFilterTypeB
Two full standard IDs or two partial 14-bit ID slices per ID Filter Table element.

enumerator kFLEXCAN_RxFifoFilterTypeC
Four partial 8-bit Standard or extended ID slices per ID Filter Table element.

enumerator kFLEXCAN_RxFifoFilterTypeD
All frames rejected.

enum _flexcan_mb_size
FlexCAN Message Buffer Data Size.

Values:

enumerator kFLEXCAN_8BperMB
Selects 8 bytes per Message Buffer.

enumerator kFLEXCAN_16BperMB
Selects 16 bytes per Message Buffer.

enumerator kFLEXCAN_32BperMB
Selects 32 bytes per Message Buffer.

enumerator kFLEXCAN_64BperMB
Selects 64 bytes per Message Buffer.

enum _flexcan_rx_fifo_priority
FlexCAN Rx FIFO priority.

The matching process starts from the Rx MB(or Rx FIFO) with higher priority. If no MB(or Rx FIFO filter) is satisfied, the matching process goes on with the Rx FIFO(or Rx MB) with lower priority.

Values:

enumerator kFLEXCAN_RxFifoPriorityLow
Matching process start from Rx Message Buffer first.

enumerator kFLEXCAN_RxFifoPriorityHigh
Matching process start from Rx FIFO first.

enum _flexcan_interrupt_enable
FlexCAN interrupt configuration structure, default settings all disabled.

This structure contains the settings for all of the FlexCAN Module interrupt configurations. Note: FlexCAN Message Buffers and Rx FIFO have their own interrupts.

Values:

enumerator kFLEXCAN_BusOffInterruptEnable
Bus Off interrupt.

enumerator kFLEXCAN_ErrorInterruptEnable
Error interrupt.

enumerator kFLEXCAN_RxWarningInterruptEnable
Rx Warning interrupt.

enumerator kFLEXCAN_TxWarningInterruptEnable
Tx Warning interrupt.

enumerator kFLEXCAN_WakeUpInterruptEnable
Wake Up interrupt.

enumerator kFLEXCAN_AllInterruptEnable

enum _flexcan_status_flags
FlexCAN status flags.

This provides constants for the FlexCAN status flags for use in the FlexCAN functions. Note: The CPU read action will clears all error flag in kFLEXCAN_ErrorFlag.

Values:

enumerator kFLEXCAN_FDStuffingError
Stuffing Error.

enumerator kFLEXCAN_FDFormError
Form Error.

enumerator kFLEXCAN_FDCrcError
Cyclic Redundancy Check Error.

enumerator kFLEXCAN_FDBit0Error
Unable to send dominant bit.

enumerator kFLEXCAN_FDBit1Error
Unable to send recessive bit.

enumerator kFLEXCAN_StuffingError
Stuffing Error.

enumerator kFLEXCAN_FormError
Form Error.

enumerator kFLEXCAN_CrcError
Cyclic Redundancy Check Error.

enumerator kFLEXCAN_AckError
Received no ACK on transmission.

enumerator kFLEXCAN_Bit0Error
Unable to send dominant bit.

enumerator kFLEXCAN_Bit1Error
Unable to send recessive bit.

enumerator kFLEXCAN_ErrorFlag
All FlexCAN read clear Error Status.

enumerator kFLEXCAN_FDErrorIntFlag
FD frames Error Interrupt Flag.

enumerator kFLEXCAN_BusoffDoneIntFlag
Bus Off Done Interrupt Flag.

enumerator kFLEXCAN_OverrunError
Error Overrun Status.

enumerator kFLEXCAN_TxWarningIntFlag
Tx Warning Interrupt Flag.

enumerator kFLEXCAN_RxWarningIntFlag
Rx Warning Interrupt Flag.

enumerator kFLEXCAN_BusOffIntFlag
Bus Off Interrupt Flag.

enumerator kFLEXCAN_ErrorIntFlag
Error Interrupt Flag.

enumerator kFLEXCAN_WakeUpIntFlag
Wake-Up Interrupt Flag.

enumerator kFLEXCAN_SynchFlag
CAN Synchronization Status Flag.

enumerator kFLEXCAN_TxErrorWarningFlag
Tx Error Warning Status Flag.

enumerator kFLEXCAN_RxErrorWarningFlag
Rx Error Warning Status Flag.

enumerator kFLEXCAN_IdleFlag
CAN IDLE Status Flag.

enumerator kFLEXCAN_FaultConfinementFlag
Fault Confinement Status Flag.

enumerator kFLEXCAN_TransmittingFlag
FlexCAN In Transmission Status Flag.

enumerator kFLEXCAN_ReceivingFlag
FlexCAN In Reception Status Flag.

enumerator kFLEXCAN_StatusAllFlags
All status/interrupt flags which are write clearable.

enum _flexcan_mb_flags
FlexCAN Rx FIFO status flags.

The FlexCAN Rx FIFO Status enumerations are used to determine the status of the Rx FIFO. Because Rx FIFO occupy the MB0 ~ MB7 (Rx Fifo filter also occupies more Message Buffer space), Rx FIFO status flags are mapped to the corresponding Message Buffer status flags.

Values:

enumerator kFLEXCAN_RxFifoOverflowFlag
Rx FIFO overflow flag.

enumerator kFLEXCAN_RxFifoWarningFlag
Rx FIFO almost full flag.

enumerator kFLEXCAN_RxFifoFrameAvlFlag
Frames available in Rx FIFO flag.

typedef enum *_flexcan_frame_format* flexcan_frame_format_t
FlexCAN frame format.

typedef enum *_flexcan_frame_type* flexcan_frame_type_t
FlexCAN frame type.

typedef enum *_flexcan_clock_source* flexcan_clock_source_t
FlexCAN clock source.

Note: The user must ensure the protocol engine clock tolerance according to the CAN Protocol standard (ISO 11898-1).

typedef enum *_flexcan_wake_up_source* flexcan_wake_up_source_t
FlexCAN wake up source.

typedef enum *_flexcan_rx_fifo_filter_type* flexcan_rx_fifo_filter_type_t
FlexCAN Rx Fifo Filter type.

typedef enum *_flexcan_mb_size* flexcan_mb_size_t
FlexCAN Message Buffer Data Size.

typedef enum *_flexcan_rx_fifo_priority* flexcan_rx_fifo_priority_t

FlexCAN Rx FIFO priority.

The matching process starts from the Rx MB(or Rx FIFO) with higher priority. If no MB(or Rx FIFO filter) is satisfied, the matching process goes on with the Rx FIFO(or Rx MB) with lower priority.

typedef struct *_flexcan_frame* flexcan_frame_t

FlexCAN message frame structure.

typedef struct *_flexcan_fd_frame* flexcan_fd_frame_t

CAN FD message frame structure.

Note: This structure can contain a CAN FD frame (bitEdl equal 1) or classic CAN frame (bitEdl equal 0).

---

typedef struct *_flexcan_timing_config* flexcan_timing_config_t

FlexCAN protocol timing characteristic configuration structure.

typedef struct *_flexcan_fd_config* flexcan_fd_config_t

Configuration for the Flexcan CAN FD mode. It only cover FD related parts.

It is used as member of flexcan_config_t to do the CAN FD specific init on init this peripheral.

typedef struct *_flexcan_config* flexcan_config_t

FlexCAN module configuration structure.

typedef struct *_flexcan_rx_mb_config* flexcan_rx_mb_config_t

FlexCAN Receive Message Buffer configuration structure.

This structure is used as the parameter of FLEXCAN_SetRxMbConfig() function. The FLEXCAN_SetRxMbConfig() function is used to configure FlexCAN Receive Message Buffer. The function abort previous receiving process, clean the Message Buffer and activate the Rx Message Buffer using given Message Buffer setting.

typedef struct *_flexcan_rx_fifo_config* flexcan_rx_fifo_config_t

FlexCAN Rx FIFO configuration structure.

typedef struct *_flexcan_mb_transfer* flexcan_mb_transfer_t

FlexCAN Message Buffer transfer.

typedef struct *_flexcan_fifo_transfer* flexcan_fifo_transfer_t

FlexCAN Rx FIFO transfer.

typedef struct *_flexcan_handle* flexcan_handle_t

FlexCAN handle structure definition. .

typedef void (*flexcan_transfer_callback_t)(*flexcan_handle_t* *psHandle, *status_t* status, uint32_t result, void *pUserData)

FlexCAN transfer callback function.

The FlexCAN transfer callback returns a value from the underlying layer. If the status equals to kStatus_FLEXCAN_ErrorStatus, the result parameter is the Content of FlexCAN status register which can be used to get the working status(or error status) of FlexCAN module. If the status equals to other FlexCAN Message Buffer transfer status, the result is the index of Message Buffer that generate transfer event. If the status equals to other FlexCAN Message Buffer transfer status, the result is meaningless and should be Ignored.

uint32_t FLEXCAN_GetInstance(CAN_Type *base)

Get the FlexCAN instance from peripheral base address.

Parameters

- base – FlexCAN peripheral base address.

Returns
FlexCAN instance.

FLEXCAN_WAIT_TIMEOUT

DLC_LENGTH_DECODE(dlc)
FlexCAN frame length helper macro.

FLEXCAN_ID_STD(id)
FlexCAN Frame ID helper macro.

Standard Frame ID helper macro.

FLEXCAN_ID_EXT(id)
Extend Frame ID helper macro.

FLEXCAN_RX_MB_STD_MASK(id, rtr, ide)
FlexCAN Rx Message Buffer Mask helper macro.

Standard Rx Message Buffer Mask helper macro.

FLEXCAN_RX_MB_EXT_MASK(id, rtr, ide)
Extend Rx Message Buffer Mask helper macro.

FLEXCAN_RX_FIFO_STD_MASK_TYPE_A(id, rtr, ide)
FlexCAN Rx FIFO Mask helper macro.

Standard Rx FIFO Mask helper macro Type A helper macro.

FLEXCAN_RX_FIFO_STD_MASK_TYPE_B_HIGH(id, rtr, ide)
Standard Rx FIFO Mask helper macro Type B upper part helper macro.

FLEXCAN_RX_FIFO_STD_MASK_TYPE_B_LOW(id, rtr, ide)
Standard Rx FIFO Mask helper macro Type B lower part helper macro.

FLEXCAN_RX_FIFO_STD_MASK_TYPE_C_HIGH(id)
Standard Rx FIFO Mask helper macro Type C upper part helper macro.

FLEXCAN_RX_FIFO_STD_MASK_TYPE_C_MID_HIGH(id)
Standard Rx FIFO Mask helper macro Type C mid-upper part helper macro.

FLEXCAN_RX_FIFO_STD_MASK_TYPE_C_MID_LOW(id)
Standard Rx FIFO Mask helper macro Type C mid-lower part helper macro.

FLEXCAN_RX_FIFO_STD_MASK_TYPE_C_LOW(id)
Standard Rx FIFO Mask helper macro Type C lower part helper macro.

FLEXCAN_RX_FIFO_EXT_MASK_TYPE_A(id, rtr, ide)
Extend Rx FIFO Mask helper macro Type A helper macro.

FLEXCAN_RX_FIFO_EXT_MASK_TYPE_B_HIGH(id, rtr, ide)
Extend Rx FIFO Mask helper macro Type B upper part helper macro.

FLEXCAN_RX_FIFO_EXT_MASK_TYPE_B_LOW(id, rtr, ide)
Extend Rx FIFO Mask helper macro Type B lower part helper macro.

FLEXCAN_RX_FIFO_EXT_MASK_TYPE_C_HIGH(id)
Extend Rx FIFO Mask helper macro Type C upper part helper macro.

FLEXCAN_RX_FIFO_EXT_MASK_TYPE_C_MID_HIGH(id)
Extend Rx FIFO Mask helper macro Type C mid-upper part helper macro.

FLEXCAN_RX_FIFO_EXT_MASK_TYPE_C_MID_LOW(id)
Extend Rx FIFO Mask helper macro Type C mid-lower part helper macro.

FLEXCAN_RX_FIFO_EXT_MASK_TYPE_C_LOW(id)
Extend Rx FIFO Mask helper macro Type C lower part helper macro.

FLEXCAN_RX_FIFO_STD_FILTER_TYPE_A(id, rtr, ide)
FlexCAN Rx FIFO Filter helper macro.

Standard Rx FIFO Filter helper macro Type A helper macro.

FLEXCAN_RX_FIFO_STD_FILTER_TYPE_B_HIGH(id, rtr, ide)
Standard Rx FIFO Filter helper macro Type B upper part helper macro.

FLEXCAN_RX_FIFO_STD_FILTER_TYPE_B_LOW(id, rtr, ide)
Standard Rx FIFO Filter helper macro Type B lower part helper macro.

FLEXCAN_RX_FIFO_STD_FILTER_TYPE_C_HIGH(id)
Standard Rx FIFO Filter helper macro Type C upper part helper macro.

FLEXCAN_RX_FIFO_STD_FILTER_TYPE_C_MID_HIGH(id)
Standard Rx FIFO Filter helper macro Type C mid-upper part helper macro.

FLEXCAN_RX_FIFO_STD_FILTER_TYPE_C_MID_LOW(id)
Standard Rx FIFO Filter helper macro Type C mid-lower part helper macro.

FLEXCAN_RX_FIFO_STD_FILTER_TYPE_C_LOW(id)
Standard Rx FIFO Filter helper macro Type C lower part helper macro.

FLEXCAN_RX_FIFO_EXT_FILTER_TYPE_A(id, rtr, ide)
Extend Rx FIFO Filter helper macro Type A helper macro.

FLEXCAN_RX_FIFO_EXT_FILTER_TYPE_B_HIGH(id, rtr, ide)
Extend Rx FIFO Filter helper macro Type B upper part helper macro.

FLEXCAN_RX_FIFO_EXT_FILTER_TYPE_B_LOW(id, rtr, ide)
Extend Rx FIFO Filter helper macro Type B lower part helper macro.

FLEXCAN_RX_FIFO_EXT_FILTER_TYPE_C_HIGH(id)
Extend Rx FIFO Filter helper macro Type C upper part helper macro.

FLEXCAN_RX_FIFO_EXT_FILTER_TYPE_C_MID_HIGH(id)
Extend Rx FIFO Filter helper macro Type C mid-upper part helper macro.

FLEXCAN_RX_FIFO_EXT_FILTER_TYPE_C_MID_LOW(id)
Extend Rx FIFO Filter helper macro Type C mid-lower part helper macro.

FLEXCAN_RX_FIFO_EXT_FILTER_TYPE_C_LOW(id)
Extend Rx FIFO Filter helper macro Type C lower part helper macro.

struct _flexcan_frame
#include <fsl_flexcan.h> FlexCAN message frame structure.

struct _flexcan_fd_frame
#include <fsl_flexcan.h> CAN FD message frame structure.

Note: This structure can contain a CAN FD frame (bitEdl equal 1) or classic CAN frame (bitEdl equal 0).

struct _flexcan_timing_config
#include <fsl_flexcan.h> FlexCAN protocol timing characteristic configuration structure.

Public Members

uint16_t u16PreDivider
    Clock Pre-scaler Division Factor.

uint8_t u8RJumpWidth
    Re-sync Jump Width.

uint8_t u8PhaseSeg1
    Phase Segment 1.

uint8_t u8PhaseSeg2
    Phase Segment 2.

uint8_t u8PropSeg
    Propagation Segment.

struct _flexcan_fd_config
#include <fsl_flexcan.h> Configuration for the Flexcan CAN FD mode. It only cover FD related parts.

It is used as member of flexcan_config_t to do the CAN FD specific init on init this peripheral.

struct _flexcan_config
#include <fsl_flexcan.h> FlexCAN module configuration structure.

Public Members

bool bEnableTimingCalc
    Enable or Disable the bit timing calculation in FLEXCAN_Init() API.

uint32_t u32BaudRateBps
    FlexCAN baud rate in bps (for classical CAN or CANFD nominal phase). Only meaningful when the bEnableTimingCalc is true.

uint32_t u32ClkFreqHz
    FlexCAN peripheral clock frequency in HZ. Only meaningful when the bEnableTimingCalc is true.

flexcan_timing_config_t sTimingConfig
    Protocol timing configuration. Only meaningful when the bEnableTimingCalc is false.

flexcan_clock_source_t eClkSrc
    Clock source for FlexCAN Protocol Engine.

uint8_t u8MaxMsgBufNum
    The maximum number of Message Buffers used by user.

bool bEnableIndividMask
    Enable or Disable Rx Individual Mask.

flexcan_wake_up_source_t eWakeupSrc
    Wake up source selection.

bool bEnableSelfWakeup
    Enable or Disable Self Wakeup Mode.

bool bEnableLoopBack
    Enable or Disable Loop Back Self Test Mode.

bool bEnableTimerSync
    Enable or Disable Timer Synchronization.

bool bDisableSelfReception

Enable or Disable Self Reflection.

bool bEnableListenOnlyMode

Enable or Disable Listen Only Mode.

bool bEnableDoze

Enable or Disable Doze Mode.

struct _flexcan_rx_mb_config

#include <fsl_flexcan.h> FlexCAN Receive Message Buffer configuration structure.

This structure is used as the parameter of FLEXCAN_SetRxMbConfig() function. The FLEXCAN_SetRxMbConfig() function is used to configure FlexCAN Receive Message Buffer. The function abort previous receiving process, clean the Message Buffer and activate the Rx Message Buffer using given Message Buffer setting.

Public Members

uint32_t u32Id

CAN Message Buffer Frame Identifier, should be set using FLEXCAN_ID_EXT() or FLEXCAN_ID_STD() macro.

flexcan_frame_format_t eFormat

CAN Frame Identifier format(Standard of Extend).

flexcan_frame_type_t eType

CAN Frame Type(Data or Remote).

struct _flexcan_rx_fifo_config

#include <fsl_flexcan.h> FlexCAN Rx FIFO configuration structure.

Public Members

uint32_t *pu32IdFilterTable

Pointer to the FlexCAN Rx FIFO identifier filter table.

uint8_t u8IdFilterNum

The quantity of filter elements.

flexcan_rx_fifo_filter_type_t eIdFilterType

The FlexCAN Rx FIFO Filter type.

flexcan_rx_fifo_priority_t ePriority

The FlexCAN Rx FIFO receive priority.

struct _flexcan_mb_transfer

#include <fsl_flexcan.h> FlexCAN Message Buffer transfer.

Public Members

flexcan_frame_t *psFrame

The buffer of CAN Message to be transfer.

uint8_t u8MsgBufIdx

The index of Message buffer used to transfer Message.

struct _flexcan_fifo_transfer

#include <fsl_flexcan.h> FlexCAN Rx FIFO transfer.

Public Members

flexcan_frame_t *psFrame
    The buffer of CAN Message to be received from Rx FIFO.

struct _flexcan_handle
    #include <fsl_flexcan.h> FlexCAN handle structure.

Public Members

flexcan_transfer_callback_t pfCallback
    Callback function.

void *pUserData
    FlexCAN callback function parameter.

flexcan_fd_frame_t *volatile psFDMbFrameBufs[CAN_WORD1_COUNT]
    The buffer for received data from Message Buffers.

flexcan_frame_t *volatile psRxFifoFrameBuf
    The buffer for received data from Rx FIFO.

volatile uint8_t u8MsgBufStates[CAN_WORD1_COUNT]
    Message Buffer transfer state.

volatile uint8_t u8RxFifoState
    Rx FIFO transfer state.

volatile uint32_t u32TimeStamps[CAN_WORD1_COUNT]
    Mailbox transfer timestamp.

struct __unnamed10__

Public Members

uint32_t bitsTimestamp
    FlexCAN internal Free-Running Counter Time Stamp.

uint32_t bitsLength
    CAN frame payload length in bytes(Range: 0~8).

uint32_t bitType
    CAN Frame Type(DATA or REMOTE).

uint32_t bitFormat
    CAN Frame Identifier(STD or EXT format).

uint32_t __pad0__
    Reserved.

uint32_t bitsIdHit
    CAN Rx FIFO filter hit id(This value is only used in Rx FIFO receive mode).

struct __unnamed12__

Public Members

uint32_t bitsId
CAN Frame Identifier, should be set using FLEXCAN_ID_EXT() or FLEXCAN_ID_STD() macro.

uint32_t ___pad0___
Reserved.

union ___unnamed14___

Public Members

struct _flexcan_frame

struct _flexcan_frame

struct ___unnamed16___

Public Members

uint32_t u32DataWord0
CAN Frame payload word0.

uint32_t u32DataWord1
CAN Frame payload word1.

struct ___unnamed18___

Public Members

uint8_t u8DataByte3
CAN Frame payload byte3.

uint8_t u8DataByte2
CAN Frame payload byte2.

uint8_t u8DataByte1
CAN Frame payload byte1.

uint8_t u8DataByte0
CAN Frame payload byte0.

uint8_t u8DataByte7
CAN Frame payload byte7.

uint8_t u8DataByte6
CAN Frame payload byte6.

uint8_t u8DataByte5
CAN Frame payload byte5.

uint8_t u8DataByte4
CAN Frame payload byte4.

struct ___unnamed20___

Public Members

uint32_t bitsTimestamp
FlexCAN internal Free-Running Counter Time Stamp.

uint32_t bitsLength
CAN FD frame data length code (DLC), range see _flexcan_fd_frame_length, When the length <= 8, it equals to the data length in bytes, otherwise the number of valid frame data is not equal to the length value. User can use DLC_LENGTH_DECODE(length) macro to get the number of valid data bytes.

uint32_t bitType
CAN Frame Type(DATA or REMOTE).

uint32_t bitFormat
CAN Frame Identifier(STD or EXT format).

uint32_t bitSrr
Substitute Remote request.

uint32_t bitsCode
Message Buffer Code.

uint32_t bitEsi
Error State Indicator.

uint32_t bitBrs
Bit Rate Switch.

uint32_t bitEdl
Extended Data Length.

struct ___unnamed22___

Public Members

uint32_t bitsId
CAN Frame Identifier, should be set using FLEXCAN_ID_EXT() or FLEXCAN_ID_STD() macro.

uint32_t ___pad0___
Reserved.

union ___unnamed24___

Public Members

struct _flexcan_fd_frame

struct _flexcan_fd_frame

struct ___unnamed26___

Public Members

uint32_t u32DataWord[16]
CAN FD Frame payload, 16 double word maximum.

struct ___unnamed28___

Public Members

uint8_t u8DataByte3
CAN Frame payload byte3.

uint8_t u8DataByte2
CAN Frame payload byte2.

uint8_t u8DataByte1
CAN Frame payload byte1.

uint8_t u8DataByte0
CAN Frame payload byte0.

uint8_t u8DataByte7
CAN Frame payload byte7.

uint8_t u8DataByte6
CAN Frame payload byte6.

uint8_t u8DataByte5
CAN Frame payload byte5.

uint8_t u8DataByte4
CAN Frame payload byte4.

2.33 The Driver Change Log

2.34 FlexCAN Peripheral and Driver Overview

2.35 GPIO: General-Purpose Input/Output Driver

void GPIO_PinInit(GPIO_Type *base, *gpio_pin_t* ePin, const *gpio_config_t* *psConfig)

Initializes a GPIO pin with provided structure gpio_config_t covering all configuration fields.

To initialize the GPIO, define a pin configuration, as either input or output, in the user file. Then, call the GPIO_PinInit() function.

This is function to configure all GPIO Pin configurable fields.

```
gpio_config_t sConfig = {
    .eDirection      = kGPIO_DigitalOutput,
    .eMode           = kGPIO_ModeGpio,
    .eOutMode        = kGPIO_OutputOpenDrain,
    .eSlewRate       = kGPIO_SlewRateFast,
    .eOutLevel       = kGPIO_OutputLow,
    .eDriveStrength = kGPIO_DriveStrengthLow,
    .ePull           = kGPIO_PullDisable,
    .eInterruptMode = kGPIO_InterruptDisable,
}
GPIO_PinInit(GPIOA, kGPIO_Pin1, &psConfig);
```

Note: If GPIO glitch is critical for your application, do not use this API instead using the API in GPIO pin configuration interfaces to do with the glitch during GPIO mode transition in accordance to your board design.

Parameters

- base – GPIO peripheral base pointer (GPIOA, GPIOB, GPIOC, and so on.)
- ePin – GPIO pin identifier. User enumerator provided by gpio_pin_t. Note that not all Pins existed in SoC and user need to check the data sheet.
- psConfig – GPIO pin configuration pointer

static inline void GPIO_PinSetPeripheralMode(GPIO_Type *base, *gpio_pin_t* ePin, *gpio_peripheral_mode_t* eMode)

Configure the GPIO Pin as Peripheral mode or GPIO mode for one pin.

Configure GPIO can be configured as Peripheral mode or GPIO mode for one pin.

Parameters

- base – GPIO peripheral base pointer
- ePin – GPIO pin identifier. User enumerator provided by gpio_pin_t. Note that not all Pins existed in SoC and user need to check the data sheet.
- eMode – Peripheral mode or GPIO mode for this pin. See gpio_peripheral_mode_t

static inline void GPIO_PinSetPeripheralMux(gpio_peripheral_mux_t eMux)

Configure the multiplexing of GPIO pins to different peripheral.

Configure the MUX of GPIO pins to different peripheral functionality.

Note: User still need to call the GPIO_PinSetPeripheralMode.

Parameters

- eMux – GPIO peripheral MUX when configured as peripheral mode.

static inline void GPIO_PinSetDirection(GPIO_Type *base, *gpio_pin_t* ePin, *gpio_direction_t* eDirection)

Configure the GPIO pin as Input or Output for one pin.

Configure the GPIO pin as Input or Output for one pin.

Parameters

- base – GPIO peripheral base pointer
- ePin – GPIO pin identifier. User enumerator provided by gpio_pin_t. Note that not all Pins existed in SoC and user need to check the data sheet.
- eDirection – Direction of GPIO pin. gpio_direction_t

static inline void GPIO_PinSetOutputMode(GPIO_Type *base, *gpio_pin_t* ePin, *gpio_output_mode_t* eOutMode)

Configure GPIO pin output as Push-Pull or Open-Drain for one pin.

Configure GPIO pin output as Push-Pull or Open-Drain. This function applies while pin is configured as output. See gpio_direction_t and API GPIO_PinSetDirection.

Parameters

- base – GPIO peripheral base pointer
- ePin – GPIO pin identifier. User enumerator provided by gpio_pin_t. Note that not all Pins existed in SoC and user need to check the data sheet.
- eOutMode – Push-Pull/Open-Drain output mode. See gpio_output_mode_t.

static inline void GPIO_PinSetDriveStrength(GPIO_Type *base, *gpio_pin_t* ePin, *gpio_output_drive_strength_t* eDriveStrength)

Configure High/Low drive strength when Pin is configured as output for one pin.

Configure High/Low drive strength when Pin is configured as output. See gpio_direction_t and API GPIO_PinSetDirection.

Parameters

- base – GPIO peripheral base pointer
- ePin – GPIO pin identifier. User enumerator provided by gpio_pin_t. Note that not all Pins existed in SoC and user need to check the data sheet.
- eDriveStrength – High/Low driver strength. See gpio_output_drive_strength_t

static inline void GPIO_PinSetSlewRate(GPIO_Type *base, *gpio_pin_t* ePin, *gpio_output_slew_rate_t* eSlewRate)

Configure GPIO pin Fast/Slow slew rate when pin is configured as output.

Configure GPIO pin Fast/Slow slew rate when pin is configured as output. See gpio_direction_t and API GPIO_PinSetDirection.

Parameters

- base – GPIO peripheral base pointer
- ePin – GPIO pin identifier. User enumerator provided by gpio_pin_t. Note that not all Pins existed in SoC and user need to check the data sheet.
- eSlewRate – Fast/Slow slewrate. See gpio_output_slew_rate_t

static inline void GPIO_PinSetPullResistorMode(GPIO_Type *base, *gpio_pin_t* ePin, *gpio_pull_mode_t* ePullMode)

Configure Pull resistor for GPIO pin to Disable/Pull-Up/Pull-Down.

Configure Pull resistor for GPIO pin to Disable/Pull-Up/Pull-Down.

Parameters

- base – GPIO peripheral base pointer
- ePin – GPIO pin identifier. User enumerator provided by gpio_pin_t. Note that not all Pins existed in SoC and user need to check the data sheet.
- ePullMode – Pull Mode as Disable/Pull-Up/Pull-Down. See gpio_pull_mode_t

static inline void GPIO_PinWrite(GPIO_Type *base, *gpio_pin_t* ePin, *gpio_output_level_t* eOutput)

Set GPIO Pin as High/Low voltage level on Output.

Set GPIO Pin as High/Low voltage level on Output.

Parameters

- base – GPIO peripheral base pointer
- ePin – GPIO pin identifier. User enumerator provided by gpio_pin_t. Note that not all Pins existed in SoC and user need to check the data sheet.
- eOutput – Output as High level or Low Level. See gpio_output_level_t.

static inline void GPIO_PortSet(GPIO_Type *base, uint16_t u16Pins)

Set GPIO multiple pins output High voltage level without impact pins.

Set GPIO multiple pins output High voltage level without impact other pins. Multiple pins are configured by OR enumerator from gpio_pin_t

Parameters

- base – GPIO peripheral base pointer
- u16Pins – GPIO pins which is ORed by gpio_pin_t. # kGPIO_Pin0 | kGPIO_Pin3 means Pin 0 and Pin 3.

static inline void GPIO_PinSet(GPIO_Type *base, *gpio_pin_t* ePin)

Output High voltage level for GPIO Pin when configured as Output.

Output High voltage level for GPIO Pin when configured as Output.

Parameters

- base – GPIO peripheral base pointer
- ePin – GPIO pin identifier. User enumerator provided by gpio_pin_t. Note that not all Pins existed in SoC and user need to check the data sheet.

static inline void GPIO_PortClear(GPIO_Type *base, uint16_t u16Pins)

Set GPIO multiple pins belong to same PORT output Low voltage level when these pins are configured as output.

Set GPIO multiple pins belong to same PORT output Low voltage level when these pins are configured as output. Multiple pins are configured by ORing enumerators from gpio_pin_t

Parameters

- base – GPIO peripheral base pointer
- u16Pins – GPIO pins which is ORed by gpio_pin_t. # kGPIO_Pin0 | kGPIO_Pin3 means Pin 0 and Pin 3.

static inline void GPIO_PinClear(GPIO_Type *base, *gpio_pin_t* ePin)

Output Low voltage level for GPIO Pin when configured as Output.

Output Low voltage level for GPIO Pin when configured as Output.

Parameters

- base – GPIO peripheral base pointer
- ePin – GPIO pin identifier. User enumerator provided by gpio_pin_t. Note that not all Pins existed in SoC and user need to check the data sheet.

static inline void GPIO_PortToggle(GPIO_Type *base, uint16_t u16Pins)

Toggle GPIO multiple pins belong to same PORT when these pins are configured as output.

Toggle GPIO multiple pins belong to same PORT when these pins are configured as output. Multiple pins are configured by ORing enumerators from gpio_pin_t

Parameters

- base – GPIO peripheral base pointer
- u16Pins – GPIO pins which is ORed by gpio_pin_t. # kGPIO_Pin0 | kGPIO_Pin3 means Pin 0 and Pin 3.

static inline void GPIO_PinToggle(GPIO_Type *base, *gpio_pin_t* ePin)

Toggle the GPIO output voltage level when configured as Output.

Toggle the GPIO output voltage level when configured as Output.

Note: GPIO peripheral register do not get register to toggle directly. It is implemented by read back the GPIO output level and write to the register with reverted level.

Parameters

- base – GPIO peripheral base pointer
- ePin – GPIO pin identifier. User enumerator provided by gpio_pin_t. Note that not all Pins existed in SoC and user need to check the data sheet.

static inline uint16_t GPIO_PortRead(GPIO_Type *base)

Read High/Low voltage level for multiple GPIO pins from the pin or the data bus.

Read High/Low voltage level for multiple GPIO pins from the pin if the pin is configured as input or the data bus. When the device comes out of reset, GPIO pins are configured as inputs with internal pull disabled. As a result, the reset value of this pin is undefined. For different PORT, the available pins number is different. User need use the return value to OR with the gpio_pin_t to decide whether that pin is logic high or low.

```
if (GPIO_PortRead(GPIOA) & (uint16_t)kGPIO_Pin0)
{
    //GPIOA Pin 0 is High
}
else
{
    //GPIOA Pin 0 is Low
}
```

Parameters

- base – GPIO peripheral base pointer

Returns

Voltage level for multiple GPIO pins from the pin or the data bus.

static inline uint8_t GPIO_PinRead(GPIO_Type *base, *gpio_pin_t* ePin)

Read High/Low voltage level for one GPIO pin from the pin or the data bus.

Read High/Low voltage level from the pin if the pin is configured as input or the data bus.

Note: When the device comes out of reset, GPIO pins are configured as inputs with internal pull disabled. As a result, the reset value of this pin is undefined.

Parameters

- base – GPIO peripheral base pointer
- ePin – GPIO pin identifier. User enumerator provided by gpio_pin_t. Note that not all Pins existed in SoC and user need to check the data sheet.

Return values

- 1 – Voltage level for one GPIO pin from the pin or the data bus is high.
- 0 – Voltage level for one GPIO pin from the pin or the data bus is low.

static inline uint16_t GPIO_PortReadRawData(GPIO_Type *base)

Read Raw voltage high/low level data from the pins or peripheral bus for multiple pins belong to same PORT.

Read Raw voltage high/low level data from the pins or peripheral bus. Values are not clocked and are subject to change at any time. Read several times to ensure a stable value.

The reset value of this register depends on the default PIN state. User need use the return value to OR with the gpio_pin_t to decide whether that pin is logic high or low.

```
if (GPIO_PortReadRawData(GPIOA) & (uint16_t)kGPIO_Pin0)
{
    //GPIOA Pin 0 is High
}
else
{
    //GPIOA Pin 0 is Low
}
```

Parameters

- base – GPIO peripheral base pointer

Returns

Voltage high/low level data from the pins or peripheral bus for multiple pins belong to same PORT.

static inline uint8_t GPIO_PinReadRawData(GPIO_Type *base, *gpio_pin_t* ePin)

Read Raw logic level data from the pins or peripheral bus for one pin.

Read Raw voltage high/low level data from the pins or peripheral bus. Values are not clocked and are subject to change at any time. Read several times to ensure a stable value. The reset value of this register depends on the default PIN state.

Parameters

- base – GPIO peripheral base pointer
- ePin – GPIO pin identifier. User enumerator provided by gpio_pin_t. Note that not all Pins existed in SoC and user need to check the data sheet.

Return values

- 1 – Raw voltage level data from the pins or peripheral bus is high.
- 0 – Raw voltage level data from the pins or peripheral bus is low.

static inline void GPIO_PinSetInterruptConfig(GPIO_Type *base, *gpio_pin_t* ePin, *gpio_interrupt_mode_t* eIntConfig)

Configure GPIO Pin interrupt detection condition.

Configure GPIO Pin interrupt detection condition

Parameters

- base – GPIO peripheral base pointer
- ePin – GPIO pin identifier. User enumerator provided by gpio_pin_t. Note that not all Pins existed in SoC and user need to check the data sheet.
- eIntConfig – Interrupt detection condition for rising edge/down edge or no detection. See gpio_interrupt_mode_t

static inline void GPIO_PortAssertSWInterrupts(GPIO_Type *base, uint16_t u16Pins)

Assert software interrupt for multiple pins belong to same port which will generate interrupt.

This API is only for software testing of a software interrupt capability. When the software interrupt is asserted, an interrupt is generated. The interrupt is generated continually until this software interrupt is de-asserted.

Parameters

- base – GPIO peripheral base pointer

- u16Pins – GPIO pins which is ORed by gpio_pin_t. # kGPIO_Pin0 | kGPIO_Pin3 means Pin 0 and Pin 3.

static inline void GPIO_PortDeassertSWInterrupts(GPIO_Type *base, uint16_t u16Pins)

De-Assert software interrupt for multiple pins belong to same port which will stop generating interrupt.

This API is only for software testing of a software interrupt capability.

Parameters

- base – GPIO peripheral base pointer
- u16Pins – GPIO pins which is ORed by gpio_pin_t. # kGPIO_Pin0 | kGPIO_Pin3 means Pin 0 and Pin 3.

static inline void GPIO_PinAssertSWInterrupt(GPIO_Type *base, *gpio_pin_t* ePin)

Assert software interrupt for one pin which will generate interrupt.

This API is only for software testing of a software interrupt capability. When the software interrupt is asserted, an interrupt is generated. The interrupt is generated continually until this software interrupt is de-asserted.

Parameters

- base – GPIO peripheral base pointer
- ePin – GPIO pin identifier. User enumerator provided by gpio_pin_t. Note that not all Pins existed in SoC and user need to check the data sheet.

static inline void GPIO_PinDeassertSWInterrupt(GPIO_Type *base, *gpio_pin_t* ePin)

De-Assert software interrupt for one pin which will stop generating interrupt.

This API is only for software testing of a software interrupt capability.

Parameters

- base – GPIO peripheral base pointer
- ePin – GPIO pin identifier. User enumerator provided by gpio_pin_t. Note that not all Pins existed in SoC and user need to check the data sheet.

static inline void GPIO_PortEnableInterrupts(GPIO_Type *base, uint16_t u16Pins)

Enable interrupt detection for multiple pins belong to same port.

This API is to enable interrupt detection on rising edge or falling edge.

Parameters

- base – GPIO peripheral base pointer
- u16Pins – GPIO pins which is ORed by gpio_pin_t. # kGPIO_Pin0 | kGPIO_Pin3 means Pin 0 and Pin 3.

static inline void GPIO_PortDisableInterrupts(GPIO_Type *base, uint16_t u16Pins)

Disable interrupt detection for multiple pins belong to same port.

This API is to disable interrupt detection on rising edge or falling edge.

Parameters

- base – GPIO peripheral base pointer
- u16Pins – GPIO pins which is ORed by gpio_pin_t. # kGPIO_Pin0 | kGPIO_Pin3 means Pin 0 and Pin 3.

static inline void GPIO_PinEnableInterrupt(GPIO_Type *base, *gpio_pin_t* ePin)

Enable interrupt detection for one pin.

This API is to enable interrupt detection on rising edge or falling edge.

Parameters

- base – GPIO peripheral base pointer
- ePin – GPIO pin identifier. User enumerator provided by gpio_pin_t. Note that not all Pins existed in SoC and user need to check the data sheet.

static inline void GPIO_PinDisableInterrupt(GPIO_Type *base, *gpio_pin_t* ePin)

Disable interrupt detection for one pin.

This API is to disable interrupt detection on rising edge or falling edge.

Parameters

- base – GPIO peripheral base pointer
- ePin – GPIO pin identifier. User enumerator provided by gpio_pin_t. Note that not all Pins existed in SoC and user need to check the data sheet.

static inline uint16_t GPIO_PortGetInterruptPendingStatusFlags(GPIO_Type *base)

Get interrupt pending status flags all pins belong to same port.

Get interrupt pending status flags for all pins belong to same port. User need to use the gpio_pin_t to OR with the return value, if the result is not 0, this flag is set. otherwise, this flag is not set.

Note: this flags can only be cleared by calling GPIO_PortClearEdgeDetectedStatusFlag if it is caused by edge detected or by calling GPIO_PortEnableSWInterrupt if it is caused by SW interrupt.

```
if (GPIO_PortGetInterruptPendingStatusFlags(GPIOA) & (uint16_t)kGPIO_Pin0)
{
    //Interrupt occurred on GPIOA Pin 0.
}
else
{
    //No Interrupt on GPIOA Pin 0.
}
```

Parameters

- base – GPIO peripheral base pointer

Returns

Interrupt pending status flags all pins belong to same port.

static inline uint16_t GPIO_PinGetInterruptPendingStatusFlags(GPIO_Type *base, *gpio_pin_t* ePin)

Get interrupt pending status flags for one pin.

Get interrupt pending status flags for one pin.

Note: this flags can only be cleared by calling GPIO_PortClearEdgeDetectedStatusFlag if it is caused by edge detected or by calling GPIO_PortEnableSWInterrupt if it is caused by SW interrupt.

Parameters

- base – GPIO peripheral base pointer
- ePin – GPIO pin identifier. User enumerator provided by gpio_pin_t. Note that not all Pins existed in SoC and user need to check the data sheet.

Return values

- 1 – Interrupt occurred.
- 0 – No Interrupt.

static inline uint16_t GPIO_PortGetEdgeDetectedStatusFlags(GPIO_Type *base)

Get Edge detected status flags for all pins belong to same port.

Get edge detected status flags for all pins in the PORT. This status flag can only be detected when interrupt detection is enabled by GPIO_PortEnableInterrupt or GPIO_PinEnableInterrupt.

```
if (GPIO_PortGetEdgeDetectedStatusFlags(GPIOA) & (uint16_t)kGPIO_Pin0)
{
    //An edge detected on GPIOA Pin 0.
}
else
{
    //No edge detected on GPIOA Pin 0.
}
```

Parameters

- base – GPIO peripheral base pointer

Returns

Detected edge status flags for all pins belong to same port.

static inline uint8_t GPIO_PinGetEdgeDetectedStatusFlag(GPIO_Type *base, *gpio_pin_t* ePin)

Get Edge detected status flags for one pin.

Get edge detected status flags for one pin. This status flag can only be detected when interrupt detection is enabled by GPIO_PortEnableInterrupt or GPIO_PinEnableInterrupt.

Parameters

- base – GPIO peripheral base pointer
- ePin – GPIO pin identifier. User enumerator provided by gpio_pin_t. Note that not all Pins existed in SoC and user need to check the data sheet.

Return values

- 1 – An edge detected.
- 0 – No edge detected.

static inline void GPIO_PortClearEdgeDetectedStatusFlags(GPIO_Type *base, uint16_t u16Pins)

Clear Edge detected status flags for multiple pins belong to same port.

Clear Edge Detected status flags for multiple pins belong to same port.

Parameters

- base – GPIO peripheral base pointer
- u16Pins – GPIO pins which is ORed by gpio_pin_t. # kGPIO_Pin0 | kGPIO_Pin3 means Pin 0 and Pin 3.

static inline void GPIO_PinClearEdgeDetectedStatusFlags(GPIO_Type *base, *gpio_pin_t* ePin)

Clear Edge detected status flags for one pin.

Clear Edge Detected status flags for one pin.

Parameters

- base – GPIO peripheral base pointer

- ePin – GPIO pin identifier. User enumerator provided by gpio_pin_t. Note that not all Pins existed in SoC and user need to check the data sheet.

FSL_GPIO_DRIVER_VERSION
GPIO driver version.

enum _gpio_pin
GPIO Pin identifier with each pin get a unique bit thus they can be ORed.

Values:

enumerator kGPIO_Pin0
GPIO PORT Pin 0.

enumerator kGPIO_Pin1
GPIO PORT Pin 1.

enumerator kGPIO_Pin2
GPIO PORT Pin 2.

enumerator kGPIO_Pin3
GPIO PORT Pin 3.

enumerator kGPIO_Pin4
GPIO PORT Pin 4.

enumerator kGPIO_Pin5
GPIO PORT Pin 5.

enumerator kGPIO_Pin6
GPIO PORT Pin 6.

enumerator kGPIO_Pin7
GPIO PORT Pin 7.

enumerator kGPIO_Pin8
GPIO PORT Pin 8.

enumerator kGPIO_Pin9
GPIO PORT Pin 9.

enumerator kGPIO_Pin10
GPIO PORT Pin 10.

enumerator kGPIO_Pin11
GPIO PORT Pin 11.

enumerator kGPIO_Pin12
GPIO PORT Pin 12.

enumerator kGPIO_Pin13
GPIO PORT Pin 13.

enumerator kGPIO_Pin14
GPIO PORT Pin 14.

enumerator kGPIO_Pin15
GPIO PORT Pin 15.

enum _gpio_peripheral_mode
GPIO Pin peripheral/gpio mode option.

Values:

enumerator kGPIO_ModeGpio
Set GPIO pin as GPIO Mode.

enumerator kGPIO_ModePeripheral
Set GPIO pin as Peripheral Mode.

enum _gpio_direction
GPIO Pin input/output direction option.

Values:

enumerator kGPIO_DigitalInput
Set GPIO pin as digital input.

enumerator kGPIO_DigitalOutput
Set GPIO pin as digital output.

enum _gpio_pull_mode
GPIO Pin pull resistor mode option.

Values:

enumerator kGPIO_PullDown
Internal pull-down resistor is enabled.

enumerator kGPIO_PullUp
Internal pull-up resistor is enabled.

enumerator kGPIO_PullDisable
Internal pull-up/down resistor is disabled.

enum _gpio_output_mode
GPIO Pin output mode option.

Values:

enumerator kGPIO_OutputOpenDrain
Open drain output mode.

enumerator kGPIO_OutputPushPull
Push pull output mode.

enum _gpio_output_level
GPIO Pin output High/Low level option.

Values:

enumerator kGPIO_OutputLow
Set GPIO pin output low voltage level.

enumerator kGPIO_OutputHigh
Set GPIO pin output high voltage level.

enum _gpio_output_slew_rate
GPIO Pin output Fast/Slow slew rate option.

Values:

enumerator kGPIO_SlewRateFast
Set GPIO pin output Fast slew rate.

enumerator kGPIO_SlewRateSlow
Set GPIO pin output Slow slew rate.

enum _gpio_output_drive_strength

GPIO Pin output High/Low drive strength option.

Values:

enumerator kGPIO_DriveStrengthLow

Set GPIO pin output Low-drive strength.

enumerator kGPIO_DriveStrengthHigh

Set GPIO pin output High-drive strength.

enum _gpio_interrupt_mode

GPIO Pin interrupt detect option.

Values:

enumerator kGPIO_InterruptRisingEdge

Interrupt on rising edge.

enumerator kGPIO_InterruptFallingEdge

Interrupt on falling edge.

enumerator kGPIO_InterruptDisable

Interrupt is disabled.

typedef enum *_gpio_pin* gpio_pin_t

GPIO Pin identifier with each pin get a unique bit thus they can be ORed.

typedef enum *_gpio_peripheral_mode* gpio_peripheral_mode_t

GPIO Pin peripheral/gpio mode option.

typedef enum *_gpio_direction* gpio_direction_t

GPIO Pin input/output direction option.

typedef enum *_gpio_pull_mode* gpio_pull_mode_t

GPIO Pin pull resistor mode option.

typedef enum *_gpio_output_mode* gpio_output_mode_t

GPIO Pin output mode option.

typedef enum *_gpio_output_level* gpio_output_level_t

GPIO Pin output High/Low level option.

typedef enum *_gpio_output_slew_rate* gpio_output_slew_rate_t

GPIO Pin output Fast/Slow slew rate option.

typedef enum *_gpio_output_drive_strength* gpio_output_drive_strength_t

GPIO Pin output High/Low drive strength option.

typedef enum *_gpio_interrupt_mode* gpio_interrupt_mode_t

GPIO Pin interrupt detect option.

typedef struct *_gpio_config* gpio_config_t

GPIO Pin configuration covering all configurable fields when GPIO is configured in GPIO mode.

GPIO_MUX_ENUM_TO_PORT_INDEX(emux)

Helper MACRO function to extract Port Index. (GPIOA, GPIOB, GPIOC, and so on.) The fields located in bit 8 - bit 11.

GPIO_MUX_ENUM_TO_PIN_INDEX(emux)

Helper MACRO function to extract Pin Index. The fields located in bit 4 - bit 7.

GPIO_MUX_ENUM_TO_REG_VALUE(emux)

Helper MACRO function to extract Pin mux config register value. The fields located in bit 0 - bit 1.

GPIO_MUX_ENUM_TO_PIN_MASK(emux)

Helper MACRO function to extract Pin mux config mask.

GPIO_MUX_ENUM_TO_PIN_VALUE(emux)

Helper MACRO function to extract Pin mux config register value on a GPIO Pin.

struct _gpio_config

#include <fsl_gpio.h> GPIO Pin configuration covering all configurable fields when GPIO is configured in GPIO mode.

Public Members

gpio_direction_t eDirection

GPIO direction, input or output

gpio_peripheral_mode_t eMode

GPIO mode as peripheral or GPIO

gpio_peripheral_mux_t eMux

Set the peripheral type if GPIO is configured as peripheral

gpio_output_mode_t eOutMode

GPIO Open-Drain/Push-Pull output mode.

gpio_output_slew_rate_t eSlewRate

GPIO Fast/Slow slew rate output mode.

gpio_output_level_t eOutLevel

GPIO Output High/Low level.

gpio_output_drive_strength_t eDriveStrength

GPIO output Drive strength High/Low.

gpio_pull_mode_t ePull

GPIO Pull resistor mode configuration.

gpio_interrupt_mode_t eInterruptMode

GPIO interrupt detection condition configuration.

2.36 The Driver Change Log

2.37 GPIO Peripheral and Driver Overview

2.38 I2C: Inter-Integrated Circuit Driver

void I2C_MasterGetDefaultConfig(*i2c_master_config_t* *psMasterConfig, uint32_t u32SrcClockHz)

Sets the I2C master configuration structure to default values.

The purpose of this API is to initialize the configuration structure to default value for I2C_MasterInit to use. Use the unchanged structure in I2C_MasterInit or modify the structure before calling I2C_MasterInit. This is an example:

```
i2c_master_config_t config;
I2C_MasterGetDefaultConfig(&config, 12000000U);
config.u32BaudRateBps = 100000;
I2C_MasterInit(I2C0, &config);
```

Parameters

- psMasterConfig – Pointer to the master configuration structure.
- u32SrcClockHz – The clock source frequency for I2C module.

void I2C_MasterInit(I2C_Type *base, const *i2c_master_config_t* *psMasterConfig)

Initializes the I2C peripheral to operate as master.

This API initialize the I2C module for master operation, including the feature configuration of high drive capacity, doubble buffer, glitch filter, SCL timeout value, stop hold off enable and transfer baudrate. User can also configure whether to enable the module in the function.

The configuration structure can be filled manully or be set with default values by calling I2C_MasterGetDefaultConfig. This is an example.

```
I2C_MasterGetDefaultConfig(&config, 12000000U);
I2C_MasterInit(I2C0, &config);
```

Note: If FSL_SDK_DISABLE_DRIVER_CLOCK_CONTROL is enbaled by user, the init function will not ungate I2C clock source before initialization, to avoid hardfault, user has to manually enable ungate the clock source before calling the API

Parameters

- base – I2C base pointer
- psMasterConfig – Pointer to the master configuration structure

void I2C_MasterDeinit(I2C_Type *base)

De-initializes the I2C peripheral. Call this API to disable the I2C module.

Parameters

- base – I2C base pointer

void I2C_SlaveGetDefaultConfig(*i2c_slave_config_t* *psSlaveConfig, uint16_t u16PrimaryAddress, uint32_t u32SrcClockHz)

Sets the I2C slave configuration structure to default values.

The purpose of this API is to initialize the configuration structure for I2C_SlaveInit to use. Use the unchanged initialized structure in I2C_SlaveInit or modify the structure before calling I2C_SlaveInit. This is an example.

```
i2c_slave_config_t config;
I2C_SlaveGetDefaultConfig(&config, 0x23U, 12000000U);
```

Parameters

- psSlaveConfig – Pointer to the slave configuration structure.
- u16PrimaryAddress – For 7-bit address low 7-bit is used, for 10-bit address low 10-bit is used.
- u32SrcClockHz – The clock source frequency for I2C module.

void I2C_SlaveInit(I2C_Type *base, const *i2c_slave_config_t* *psSlaveConfig)

Initializes the I2C peripheral to operate as slave.

This API initialize the I2C module for slave operation, including the feature configuration of high drive capacity, doubble buffer, glitch filter, SCL timeout value, stop hold off enable, addressing mode, alert response/general call minitoring, auto baudrate control, low power mode wake up, SCL/SDA setup and hold time. User can also configure whether to enable the module in the function.

The configuration structure can be filled manully or be set with default values by calling I2C_SlaveGetDefaultConfig. This is an example.

```
i2c_slave_config_t sConfig;
I2C_SlaveGetDefaultConfig(&sConfig, 12000000U);
sConfig.u8PrimaryAddress = 0x2AU;
I2C_SlaveInit(I2C0, &sConfig);
```

Note: If FSL_SDK_DISABLE_DRIVER_CLOCK_CONTROL is enbaled by user, the init function will not ungate I2C clock source before initialization, to avoid hardfault, user has to manually enable ungate the clock source before calling the API

Parameters

- base – I2C base pointer
- psSlaveConfig – Pointer to the slave configuration structure

static inline void I2C_SlaveDeinit(I2C_Type *base)

De-initializes the I2C peripheral. Call this API to disable the I2C module.

Parameters

- base – I2C base pointer

void I2C_GetDefaultConfig(*i2c_config_t* *psConfig, uint16_t u16PrimaryAddress, uint32_t u32SrcClockHz)

Sets the I2C configuration structure to default values.

The purpose of this API is to initialize the configuration structure for I2C_Init to use. Use the unchanged initialized structure in I2C_Init or modify the structure before calling I2C_Init. This is an example.

```
i2c_config_t config;
I2C_GetDefaultConfig(&config, 0x23U, 12000000U);
```

Parameters

- psConfig – Pointer to the slave configuration structure.
- u16PrimaryAddress – For 7-bit address low 7-bit is used, for 10-bit address low 10-bit is used.
- u32SrcClockHz – The clock source frequency for I2C module.

void I2C_Init(I2C_Type *base, const *i2c_config_t* *psConfig)

Initializes the I2C peripheral.

This API initialize the I2C module, including the feature configuration of high drive capacity, doubble buffer, glitch filter, SCL timeout value, stop hold off enable, addressing mode, alert response/general call minitoring, auto baudrate control, low power mode wake up and baudrate. User can also configure whether to enable the module in the function.

The configuration structure can be filled manully or be set with default values by calling I2C_GetDefaultConfig. This is an example.

```
i2c_config_t sConfig;
I2C_GetDefaultConfig(&sConfig, 0x23U, 12000000U);
I2C_Init(I2C0, &sConfig);
```

Note: If FSL_SDK_DISABLE_DRIVER_CLOCK_CONTROL is enbaled by user, the init function will not ungate I2C clock source before initialization, to avoid hardfault, user has to manually enable ungate the clock source before calling the API

Parameters

- base – I2C base pointer
- psConfig – Pointer to the I2C configuration structure

static inline void I2C_Deinit(I2C_Type *base)

De-initializes the I2C peripheral. Call this API to disable the I2C module.

Parameters

- base – I2C base pointer

uint16_t I2C_MasterGetStatusFlags(I2C_Type *base)

Gets the I2C master hardware status flags.

Parameters

- base – I2C base pointer

Returns

the mask of status flags, can be a single flag or several flags in _i2c_status_flags ORed together.

static inline void I2C_MasterClearStatusFlags(I2C_Type *base, uint16_t u16StatusFlags)

Clears the I2C master status flags.

Parameters

- base – I2C base pointer
- u16StatusFlags – The status flag mask, can be a single flag or several flags in _i2c_status_flags ORed together. These flags among _i2c_status_flags can be cleared:
  - kI2C_StartDetectInterruptFlag (only supported on certain SoCs)
  - kI2C_StopDetectInterruptFlag (only supported on certain SoCs)
  - kI2C_ArbitrationLostInterruptFlag
  - kI2C_InterruptPendingFlag
  - kI2C_RangeAddressMatchInterruptFlag
  - kI2C_AddressAsSlaveInterruptFlag
  - kI2C_SclLowTimeoutFlag
  - kI2C_SdaLowTimeoutInterruptFlag

static inline uint16_t I2C_SlaveGetStatusFlags(I2C_Type *base)

Gets the I2C slave hardware status flags.

Parameters

- base – I2C base pointer

Returns

the mask of status flags, can be a single flag or several flags in _i2c_status_flags ORed together.

static inline void I2C_SlaveClearStatusFlags(I2C_Type *base, uint16_t u16StatusFlags)

Clears the I2C slave status flags.

Parameters

- base – I2C base pointer
- u16StatusFlags – The status flag mask, can be a single flag or several flags in _i2c_status_flags ORed together. These flags among _i2c_status_flags can be cleared:
  - kI2C_StartDetectInterruptFlag (only supported on certain SoCs)
  - kI2C_StopDetectInterruptFlag (only supported on certain SoCs)
  - kI2C_ArbitrationLostInterruptFlag
  - kI2C_InterruptPendingFlag
  - kI2C_RangeAddressMatchInterruptFlag
  - kI2C_AddressAsSlaveInterruptFlag
  - kI2C_SclLowTimeoutFlag
  - kI2C_SdaLowTimeoutInterruptFlag

void I2C_EnableInterrupts(I2C_Type *base, uint8_t u8Interrupts)

Enables I2C interrupt source.

Note: Before enabling kI2C_GlobalInterruptEnable, check kI2C_RangeAddressMatchInterruptFlag and kI2C_AddressAsSlaveInterruptFlag first, because any write operation on C1 will clear these 2 bits.

Parameters

- base – I2C base pointer
- u8Interrupts – The interrupt source mask, can be a single source or several sources in _i2c_interrupt_enable ORed together.

void I2C_DisableInterrupts(I2C_Type *base, uint8_t u8Interrupts)

Disables I2C interrupt source.

Note: Before disabling kI2C_GlobalInterruptEnable, check kI2C_RangeAddressMatchInterruptFlag and kI2C_AddressAsSlaveInterruptFlag first, because any write operation on C1 will clear these 2 bits.

Parameters

- base – I2C base pointer
- u8Interrupts – The interrupt source mask, can be a single source or several sources in _i2c_interrupt_enable ORed together.

uint8_t I2C_GetEnabledInterrupts(I2C_Type *base)
Get all the enabled interrupt sources.

Parameters

- base – I2C base pointer

Returns
The interrupt source mask, can be a single source or several sources in _i2c_interrupt_enable ORed together.

static inline bool I2C_IsMaster(I2C_Type *base)
Returns whether the I2C module is in master mode.

Parameters

- base – I2C base pointer

Returns
True for master mode, false for slave mode.

static inline void I2C_Reset(I2C_Type *base)
Sets the I2C register value to reset value.

Parameters

- base – I2C base pointer

static inline void I2C_Enable(I2C_Type *base, bool bEnable)
Enables or disables the I2C peripheral operation.

Parameters

- base – I2C base pointer
- bEnable – Pass true to enable and false to disable the module.

static inline void I2C_EnableFastAck(I2C_Type *base, bool bEnable)
Enables/Disables fast NACK/ACK feature.

When enbled, writing 0/1 to TXAK generates an ACK/NACK after receiving a data byte, when disabled, writing 0/1 to TXAK generates an ACK/NACK on the following receiving data byte.

Parameters

- base – I2C base pointer
- bEnable – True to enable, false to disable.

static inline void I2C_EnableHighDrive(I2C_Type *base, bool bEnable)
Enables/Disables high drive.

Parameters

- base – I2C base pointer
- bEnable – True to enable, false to disable.

static inline void I2C_EnableStopHold(I2C_Type *base, bool bEnable)
Enables/Disables double buffer.

Parameters

- base – I2C base pointer
- bEnable – True to enable, false to disable.

static inline void I2C_SetTransferDirection(I2C_Type *base, *i2c_data_direction_t* eDataDirection)

Sets I2C module data direction.

Parameters

- base – I2C base pointer
- eDataDirection – kI2C_Write to write data to bus, kI2C_Read to read data from bua

void I2C_SetSclTimeoutValue(I2C_Type *base, uint16_t u16SclTimout_Ms, uint32_t u32SrcClockHz)

brief Sets the I2C SCL timeout value.

After the I2C module is initialized, user can call this function to change the timeout value.

param base I2C base pointer. param u16SclTimout_Ms The SCL timeout value in ms. param u32SrcClockHz I2C peripheral clock frequency in Hz

void I2C_SetGlitchFilter(I2C_Type *base, uint16_t u16GlitchFilter_Ns, uint32_t u32SrcClockHz)

brief Sets the I2C master glitch filter width.

After the I2C module is initialized as master, user can call this function to change the glitch filter width.

param base I2C base pointer. param u16GlitchFilter_Ns The GLitch filter length in nano seconds. param u32SrcClockHz I2C peripheral clock frequency in Hz

static inline void I2C_EnableDMA(I2C_Type *base, bool bEnable)

Enables/disables the I2C DMA request.

Parameters

- base – I2C base pointer
- bEnable – true to enable, false to disable

static inline uint32_t I2C_GetDataRegAddr(I2C_Type *base)

Gets the I2C data register address. This API is used to provide the transfer address for I2C DMA transfer.

Parameters

- base – I2C base pointer

Returns

data register address

static inline void I2C_SlaveEnableAlertResponse(I2C_Type *base, bool bEnable)

Enables/Disables alert response.

When enbled, I2C slave will monitor the bus line, and when alert response address is received address match status flag will be set.

Parameters

- base – I2C base pointer
- bEnable – True to enable, false to disable.

static inline void I2C_SlaveEnableSecondaryAddress(I2C_Type *base, bool bEnable)

Enables/Disables secondary address.

Parameters

- base – I2C base pointer
- bEnable – True to enable, false to disable.

static inline void I2C_SlaveEnableGeneralCall(I2C_Type *base, bool bEnable)

Enables/Disables general call.

Parameters

- base – I2C base pointer
- bEnable – True to enable, false to disable.

static inline void I2C_SlaveEnableWakeUp(I2C_Type *base, bool bEnable)

Enables/Disables slave low power wakeup.

Parameters

- base – I2C base pointer
- bEnable – True to enable, false to disable.

void I2C_SlaveSetAddressingMode(I2C_Type *base, *i2c_slave_address_mode_t* eAddressingMode, uint16_t u16Address, uint8_t u8MaxAddress)

Configure the slave addressing mode.

After the I2C module is initialized as slave, user can call this function to change the configuration of slave addressing mode.

Parameters

- base – I2C base pointer.
- eAddressingMode – The slave addressing mode, single address or range address.
- u16Address – I2C slave address. For 7-bit address low 7-bit is used, for 10-bit address low 10-bit is used.
- u8MaxAddress – The maximum boundary of slave address used in a range address match.

void I2C_MasterSetBaudRate(I2C_Type *base, uint32_t u32BaudRateBps, uint32_t u32SrcClockHz)

Sets the I2C master transfer baud rate.

After the I2C module is initialized as master, user can call this function to change the transfer baud rate.

Parameters

- base – I2C base pointer.
- u32BaudRateBps – the baud rate value in bits-per-second.
- u32SrcClockHz – I2C peripheral clock frequency in Hz

static inline uint8_t I2C_ReadByte(I2C_Type *base)

Reads one byte from data register directly.

Parameters

- base – I2C base pointer

Returns

The data read from data register.

static inline void I2C_WriteByte(I2C_Type *base, uint8_t u8Data)

Writes one byte to the data register directly.

Parameters

- base – I2C base pointer
- u8Data – The byte to write.

static inline void I2C_SendAck(I2C_Type *base, bool bIsAck)

Sends an acknowledge/non-acknowledge signal to the bus on the following receiving byte if SMB[FACK] is cleared, or on the current receiving byte if SMB[FACK] is set.

Parameters

- base – I2C base pointer
- bIsAck – True to send ACK signal, false to send NACK signal

status_t I2C_MasterStart(I2C_Type *base, uint8_t u8Address, *i2c_master_transfer_direction_t* eDirection)

Sends a START signal on the I2C bus then the 7-bit slave address with transmit/receive bit.

This function is used to initiate a new transfer in master mode, by sending a START signal, then the slave address with transmit/receive bit to I2C bus.

Note: The return value of this API only indicates whether the start signal is sent to bus, user has to check kI2C_ArbitrationLostInterruptFlag and kI2C_ReceiveNakFlag using I2C_MasterClearStatusFlags to see if valid slave device is avaliable or the aribitration is lost.

Parameters

- base – I2C base pointer
- u8Address – 7-bit slave device address.
- eDirection – Master transfer directions(transmit/receive).

Return values

- kStatus_I2C_Timeout – Transfer error, timeout happens when waiting for status flags to change.
- kStatus_Success – Successfully send the start signal.
- kStatus_I2C_Busy – Current bus is busy.

status_t I2C_MasterRepeatedStart(I2C_Type *base, uint8_t u8Address, *i2c_master_transfer_direction_t* eDirection)

Sends a repeated START signal, then the 7-bit slave address with transmit/receive bit to I2C bus.

Parameters

- base – I2C peripheral base pointer
- u8Address – 7-bit slave device address.
- eDirection – Master transfer directions(transmit/receive).

Return values

- kStatus_I2C_Timeout – Transfer error, timeout happens when waiting for status flags to change.
- kStatus_Success – Successfully send the start signal.
- kStatus_I2C_Busy – Current bus is busy but not occupied by current I2C master.

status_t I2C_MasterStop(I2C_Type *base)

Sends a STOP signal on the I2C bus.

Parameters

- base – I2C base pointer

Return values

- kStatus_Success – Successfully send the stop signal.
- kStatus_I2C_Timeout – Send stop signal failed, timeout.

status_t I2C_MasterWriteBlocking(I2C_Type *base, const uint8_t *pu8Data, uint16_t txSize, bool bSendStop)

Sends a piece of data to I2C bus in master mode in blocking way.

Call this function when using I2C as master to send certain bytes of data to bus when start signal is already sent. User can specify whether to send a stop siganl after the data. This function uses the blocking way, which means it does not return until all the data is sent to bus and stop signal is successfully issued(if user configures the stop

signal).

Parameters

- base – I2C base pointer.
- pu8Data – The pointer to the data to be transmitted.
- txSize – The length in bytes of the data to be transmitted.
- bSendStop – Whether to send stop signal after the data transfer.

Return values

- kStatus_Success – Successfully complete the data transmission.
- kStatus_I2C_ArbitrationLost – Transfer error, arbitration lost.
- kStatus_I2C_Nak – Transfer error, receive NAK during transfer.
- kStatus_I2C_Timeout – Transfer error, timeout happens when waiting for status flags to change.

status_t I2C_MasterReadBlocking(I2C_Type *base, uint8_t *pu8RxBuff, uint16_t rxSize, bool bSendStop)

Receives a piece of data from I2C bus in master mode in blocking way.

Call this function when using I2C as master to receive certain bytes of data from bus when start signal is already sent. User can specify whether to send a stop siganl after the data. This function uses the blocking way, which means it does not return until all the data has been received and stop signal is successfully issued(if user configures the

stop signal).

Note: If user configures to send stop signal after the data, this function stops the bus before reading the final byte from data register. Without stopping the bus prior to the final read, the bus will issue another read, resulting in garbage data being read into the data register.

Parameters

- base – I2C base pointer.
- pu8RxBuff – The pointer to the data to store the received data.
- rxSize – The length in bytes of the data to be received.
- bSendStop – Whether to send stop signal after the data transfer.

Return values

- kStatus_Success – Successfully complete the data transmission.
- kStatus_I2C_Timeout – Send stop signal failed, timeout.

status_t I2C_SlaveWriteBlocking(I2C_Type *base, const uint8_t *pu8TxBuff, uint16_t txSize)

Sends a piece of data to I2C bus in slave mode in blocking way.

Call this funtion to let I2C slave poll register status until it is addressed, then slave sends txSize of data to bus until all the data has been sent to bus or untill it is nacked.

Parameters

- base – I2C base pointer.
- pu8TxBuff – The pointer to the data to be transferred.
- txSize – The length in bytes of the data to be transferred.

Return values

- kStatus_Success – Successfully complete the data transmission.
- kStatus_I2C_ArbitrationLost – Transfer error, arbitration lost.
- kStatus_I2C_Nak – Transfer error, receive NAK during transfer.
- kStatus_I2C_Timeout – Transfer error, timeout happens when waiting for status flags to change.

status_t I2C_SlaveReadBlocking(I2C_Type *base, uint8_t *pu8RxBuff, uint16_t rxSize)

Receives a piece of data from I2C bus in slave mode in blocking way.

Call this funtion to let I2C slave poll register status until it is addressed, then slave receives rxSize of data until all the data has been received.

Parameters

- base – I2C base pointer.
- pu8RxBuff – The pointer to the data to store the received data.
- rxSize – The length in bytes of the data to be received.

Return values

- kStatus_Success – Successfully complete data receive.
- kStatus_I2C_Timeout – Wait status flag timeout.

status_t I2C_MasterTransferBlocking(I2C_Type *base, *i2c_master_transfer_t* *psTransferConfig)

Performs a master polling transfer on the I2C bus.

Note: The API does not return until the transfer succeeds or fails due to arbitration lost or receiving a NAK.

Parameters

- base – I2C peripheral base address.
- psTransferConfig – Pointer to the transfer configuration structure.

Return values

- kStatus_Success – Successfully complete the data transmission.
- kStatus_I2C_Busy – Previous transmission still not finished.
- kStatus_I2C_Timeout – Transfer error, timeout happens when waiting for status flagsto change.

- kStatus_I2C_ArbitrationLost – Transfer error, arbitration lost.
- kStatus_I2C_Nak – Transfer error, receive NAK during transfer.

void I2C_MasterTransferCreateHandle(I2C_Type *base, *i2c_master_transfer_handle_t* *psHandle, *i2c_master_transfer_callback_t* pfCallback, void *pUserData)

Initializes the I2C master transfer in interrupt way.

This function is responsible for initializig master transfer psHandle, installing user callback, registering master IRQ handling function and opening global interrupt.

Parameters

- base – I2C base pointer.
- psHandle – pointer to i2c_master_transfer_handle_t structure to store the transfer state.
- pfCallback – pointer to user callback function.
- pUserData – User configurable pointer to any data, function, structure etc that user wish to use in the callback

status_t I2C_MasterTransferNonBlocking(*i2c_master_transfer_handle_t* *psHandle, *i2c_master_transfer_t* *psTransferConfig)

Initiates a master transfer on the I2C bus in interrupt way.

Note: Transfer in interrupt way is non-blocking which means this API returns immediately after transfer initiates. User can call I2C_MasterTransferGetCount to get the count of data that master has transmitted/received and check transfer status. If the return status is kStatus_NoTransferInProgress, the transfer is finished. Also if user installs a user callback when calling I2C_MasterTransferCreateHandle before, the callback will be invoked when transfer finishes.

Parameters

- psHandle – pointer to i2c_master_transfer_handle_t structure which stores the transfer state.
- psTransferConfig – Pointer to the transfer configuration structure.

Return values

- kStatus_Success – Successfully start the data transmission.
- kStatus_I2C_Busy – Previous transmission still not finished.
- kStatus_I2C_Timeout – Transfer error, timeout happens when waiting for status flagsto change.

status_t I2C_MasterTransferGetCount(*i2c_master_transfer_handle_t* *psHandle, uint16_t *count)

Gets the master transfer count and status during a interrupt transfer.

Parameters

- psHandle – pointer to i2c_master_transfer_handle_t structure which stores the transfer state.
- count – Pointer to number of bytes transferred so far by the non-blocking transaction.

Return values

- kStatus_InvalidArgument – count is Invalid.
- kStatus_NoTransferInProgress – Curent no transfer is in progress.

- kStatus_Success – Successfully obtained the count.

status_t I2C_MasterTransferAbort(*i2c_master_transfer_handle_t* *psHandle)

Aborts an in-process transfer in interrupt way.

Note: This API can be called at any time after a transfer of interrupt way initiates and before it finishes to abort the transfer early.

Parameters

- psHandle – pointer to i2c_master_transfer_handle_t structure which stores the transfer state

Return values

- kStatus_I2C_Busy – Master lost arbitration, bus is in use by other master.
- kStatus_I2C_Timeout – Transfer error, timeout happens when waiting for status flags to change.
- kStatus_Success – Successfully abort the transfer.

void I2C_SlaveTransferCreateHandle(I2C_Type *base, *i2c_slave_transfer_handle_t* *psHandle, *i2c_slave_transfer_callback_t* pfCallback, void *pUserData)

Initializes the I2C slave transfer in interrupt way.

This function is responsible for initializig slave transfer handle, installing user callback, registering slave IRQ handling function and opening global interrupt.

Parameters

- base – I2C base pointer.
- psHandle – pointer to i2c_slave_transfer_handle_t structure to store the transfer state.
- pfCallback – pointer to user callback function.
- pUserData – User configurable pointer to any data, function, structure etc that user wish to use in the callback

status_t I2C_SlaveTransferNonBlocking(*i2c_slave_transfer_handle_t* *psHandle, *i2c_slave_transfer_t* *psTransferConfig)

Sets I2C slave ready to process bus events.

Call this API to let I2C start monitoring bus events driven by I2C master on bus. When user specified event occurs, callback will be invoked passes event information to the callback.

Note: When kI2C_SlaveOutofTransmitDataEvent and kI2C_SlaveOutofReceiveSpaceEvent occured, slave callback will always be revoked regardless which events user choose to enable. This means user need not configure them in the psTransferConfig. If user wants to enable all the events, use kI2C_SlaveAllEvents for convenience.

Parameters

- psHandle – Pointer to i2c_slave_transfer_handle_t structure which stores the transfer state.
- psTransferConfig – I2C transfer configuration.

Return values

- kStatus_Success – I2C slave set to standby state successfully and ready to process events.

- kStatus_I2C_Busy – I2C slave has already been started on this handle.

status_t I2C_SlaveTransferGetCount(*i2c_slave_transfer_handle_t* *psHandle, uint16_t *count)

Gets how many bytes slave have transferred in curent data buffer.

Parameters

- psHandle – pointer to i2c_slave_transfer_handle_t structure.
- count – Number of bytes slave have transferred after the last start/repeated start.

Return values

- kStatus_InvalidArgument – count is Invalid.
- kStatus_NoTransferInProgress – Curent no transfer is in progress.
- kStatus_Success – Successfully obtained the count.

void I2C_SlaveTransferAbort(*i2c_slave_transfer_handle_t* *psHandle)

Aborts the slave transfer.

Note: This API can be called at any time to stop slave for handling further bus events.

Parameters

- psHandle – pointer to i2c_slave_transfer_handle_t structure which stores the transfer state.

FSL_I2C_DRIVER_VERSION

I2C driver version.

I2C API status codes, used by bus operation APIs and transactional APIs as return value to indicate the bus's current status as the API's execution result, or used in the callback to indicate transfer results.

Values:

enumerator kStatus_I2C_Busy

I2C bus is busy.

enumerator kStatus_I2C_Idle

I2C Bus is idle.

enumerator kStatus_I2C_Nak

I2C detected NACK on bus. When in SMBus mode, this means the receiver nacks transmitter before PEC byte.

enumerator kStatus_I2C_ArbitrationLost

I2C lost arbitration during addressing.

enumerator kStatus_I2C_Timeout

Timeout happens when waiting for status flags to change.

enumerator kStatus_I2C_Addr_Nak

NACK was detected during the address probe.

enumerator kStatus_I2C_Pec_Error

Detected NACK for the PEC byte in transmit, or the received PEC does not match with the calculated CRC.

enum _i2c_status_flags

I2C hardware status flags.

These enumerations can be ORed together to form bit masks. The masks can be used as parameter by I2C_MasterClearStatusFlags and I2C_SlaveClearStatusFlags, or as return value by I2C_MasterGetStatusFlags and I2C_SlaveGetStatusFlags.

Values:

enumerator kI2C_ReceiveNakFlag

I2C reveived none ack flag

enumerator kI2C_InterruptPendingFlag

I2C interrupt pending flag. Byte transfer complete, address match, arbitration lost, start/stop detection and SMBus timeout can all cause this status bit to set. This flag can be cleared.

enumerator kI2C_SlaveTransmitFlag

I2C slave write/read status flag

enumerator kI2C_RangeAddressMatchInterruptFlag

Received address is within address range. This flag can be cleared.

enumerator kI2C_ArbitrationLostInterruptFlag

This flag can be cleared.

enumerator kI2C_BusBusyFlag

I2C bus busy flag.

enumerator kI2C_AddressAsSlaveInterruptFlag

Addressed as slave, including general call, alert response, primary/secondary address and range address match. This flag can be cleared.

enumerator kI2C_ByteTransferCompleteInterruptFlag

I2C trasfer complete flag.

enumerator kI2C_StopDetectInterruptFlag

This flag can be cleared.

enumerator kI2C_StartDetectInterruptFlag

This flag can be cleared.

enumerator kI2C_SclLowTimeoutFlag

I2C SCL signal low timeout flag. This flag can be cleared.

enumerator kI2C_BusIdleFlag

I2C SCL and SDA both high timeout flag indicating bus idle.

enumerator kI2C_SdaLowTimeoutInterruptFlag

I2C SDA signal low timeout flag. This flag can be cleared.

enumerator kI2C_StatusAllFlags

All flags which are clearable.

enum _i2c_interrupt_enable

I2C interrupt enable/disable source.

These enumerations can be ORed together to form bit masks. The masks can be used as parameter by I2C_EnableInterrupts, I2C_DisableInterrupts, or as return value by I2C_GetEnabledInterrupts.

Values:

enumerator kI2C_GlobalInterruptEnable
I2C global interrupt.

enumerator kI2C_StartStopDetectInterruptEnable
I2C start&stop detect interrupt.

enumerator kI2C_SdaLowTimeoutInterruptEnable
I2C SDA low timeout interrupt.

enumerator kI2C_AllInterruptEnable

enum _i2c_slave_address_mode
Slave addressing mode, address match or range address match.

Values:

enumerator kI2C_AddressMatch
7-bit addressing mode.

enumerator kI2C_AddressRangeMatch
Range address match addressing mode.

enumerator kI2C_AddressMatch10bit
10-bit addressing mode.

enum _i2c_data_direction
Peripheral data direction.

Values:

enumerator kI2C_Read
I2C read data from bus.

enumerator kI2C_Write
I2C write data to bus.

enum _i2c_master_transfer_control_flags
I2C master transfer control flags.

These flags can be ORed together to form bit mask. The mask is used to configure master transfer's start/stop condition in i2c_master_transfer_t::u8ControlFlagMask.

Values:

enumerator kI2C_TransferStartStopFlag
A transfer starts with a start signal, stops with a stop signal.

enumerator kI2C_TransferNoStartFlag
A transfer starts without a start signal, only support write only or write+read with no start flag, do not support read only with no start flag.

enumerator kI2C_TransferRepeatedStartFlag
A transfer starts with a repeated start signal.

enumerator kI2C_TransferNoStopFlag
A transfer ends without a stop signal.

enum _i2c_master_transfer_direction
Master transfer direction.

Values:

enumerator kI2C_MasterTransmit
Master transmits data to slave.

enumerator kI2C_MasterReceive

Master receives data from slave.

enum _i2c_slave_transfer_event

Set of slave transfer events.

This enumeration lists all the protocol level events that may happen during slave transfer. They can be used for two related purposes:

a. User can select certain events and combined them by OR operation to form a mask, and use the mask to configure slave transfer configuration stucture i2c_slave_transfer_t::u8EventMask. If any of these selected events happens, driver will alert user by invoking callback.

b. When slave callback is invoked, user has to know which specific event occured. Callback uses slave transfer configuration structure i2c_slave_transfer_t as 2nd parameter, its member i2c_slave_transfer_t::eEvent shows which event just happened.

Values:

enumerator kI2C_SlaveAddressMatchEvent

Slave detects general call or alert response address, or primary/secondary/range address is matched after a start or repeated start.

enumerator kI2C_SlaveOutofTransmitDataEvent

Slave runs out of data to transmit, request a new data buffer.

enumerator kI2C_SlaveOutofReceiveSpaceEvent

Slave runs out of space to store received data, request a new data buffer.

enumerator kI2C_SlaveStartEvent

A start/repeated start was detected.

enumerator kI2C_SlaveCompletionEvent

Slave detects a stop signal, or slave is nacked by master during master-receive, or slave has finished transmit/receive previously configured amount of data.

enumerator kI2C_SlaveGenaralcallEvent

Received the general call address after a start or repeated start.

enumerator kI2C_SlaveAllEvents

A bit mask of all available events.

typedef struct *_i2c_master_config* i2c_master_config_t

I2C master configuration structure.

This structure includes all the master operation needed features, user can configure these features one by one manually, or call I2C_MasterGetDefaultConfig to set the structure to default value. Then, call I2C_MasterInit to initialize I2C module. After initialization, the I2C module can only operate as master. To deinitialize I2C, call I2C_MasterDeinit.

typedef enum *_i2c_slave_address_mode* i2c_slave_address_mode_t

Slave addressing mode, address match or range address match.

typedef struct *_i2c_slave_config* i2c_slave_config_t

I2C slave configuration structure.

This structure includes all the slave operation needed features, user can configure these features one by one manually, or call I2C_SlaveGetDefaultConfig to set the structure to default value. Then, call I2C_SlaveInit to initialize I2C module. After initialization, the I2C module can only operate as slave. To deinitialize I2C, call I2C_SlaveDeinit.

typedef struct *_i2c_config* i2c_config_t

I2C configuration structure.

This structure includes all I2C features, user can configure user can configure these features one by one manually, or call I2C_GetDefaultConfig to set the structure to default value. Then, call I2C_Init to initialize I2C module. To deinitialize I2C, call I2C_Deinit.

typedef enum *_i2c_data_direction* i2c_data_direction_t

Peripheral data direction.

typedef enum *_i2c_master_transfer_direction* i2c_master_transfer_direction_t

Master transfer direction.

typedef struct *_i2c_master_transfer* i2c_master_transfer_t

I2C master transfer configuration structure.

This structure definition includes all the user configurable features, that are used to control single I2C transfer of master mode, in polling way or in interrupt way.

typedef struct *_i2c_master_transfer_handle* i2c_master_transfer_handle_t

Forward declaration of the I2C master transfer handle structure. .

typedef void (*i2c_master_transfer_callback_t)(*i2c_master_transfer_handle_t* *psHandle)

I2C master transfer callback function definition.

Defines the interface of user callback function used in master interrupt transfer. The callback function shall be defined and declared in application level by user. Before starting master transfer by calling I2C_MasterTransferNonBlocking, call I2C_MasterTransferCreateHandle to install the user callback. When master transfer ends successfully or failed due to any event like arbitration lost or nacked by slave, user callback will be invoked by driver. And then user can decide what to do next in the callback according to its parameter completionStatus which indicates how the transfer ends.

Param psHandle
I2C transfer handle, which contains the information of base pointer, completionStatus and user data.

typedef enum *_i2c_slave_transfer_event* i2c_slave_transfer_event_t

Set of slave transfer events.

This enumeration lists all the protocol level events that may happen during slave transfer. They can be used for two related purposes:

a. User can select certain events and combined them by OR operation to form a mask, and use the mask to configure slave transfer configuration stucture i2c_slave_transfer_t::u8EventMask. If any of these selected events happens, driver will alert user by invoking callback.

b. When slave callback is invoked, user has to know which specific event occured. Callback uses slave transfer configuration structure i2c_slave_transfer_t as 2nd parameter, its member i2c_slave_transfer_t::eEvent shows which event just happened.

typedef struct *_i2c_slave_transfer* i2c_slave_transfer_t

I2C slave transfer configuration structure.

Covers slave transfer data buffer pointer, data size and the events user want driver to alert.

Note: Unlike master who controls the transfer flow, slave has to monitor any bus event and change its configuration accordingly. So this slave transfer configuration structure is also used as second parameter of callback, for user to change the transfer configuration in the callback. The read-only member eEvent shows which event occured that causes the callback being invoked.

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typedef struct *_i2c_slave_transfer_handle* i2c_slave_transfer_handle_t

Forward declaration of the I2C slave transfer handle structure. .

typedef void (*i2c_slave_transfer_callback_t)(*i2c_slave_transfer_handle_t* *psHandle)

I2C slave transfer callback function definition.

Defines the interface of slave user callback function. The callback function shall be defined and declared in application level by user. Before calling I2C_SlaveTransferNonBlocking to let I2C slave ready to process bus events, call I2C_SlaveTransferCreateHandle first to install the user callback to slave handle. When I2C slave meets user selected events, callback will be invoked and user can decide the following steps in the callback. All the events that can trigger callback are listed in i2c_slave_transfer_event_t.

Param psHandle

I2C transfer handle, which contains the information of base pointer, completionStatus transfer data, data length and user data.

uint32_t I2C_GetInstance(I2C_Type *base)

Gets instance number for I2C module.

Parameters

- base – I2C base pointer.

Return values

The – number of the instance.

I2C_HAS_STOP_DETECT

I2C_RETRY_TIMES

Retry times when checking status flags.

I2C_SMBUS_ENABLE

Control whether to use SMBus featues.

I2C_MASTER_FACK_CONTROL

Control whether to enable FACK for master read operation in non SMBus tranfer. This is used to lower transfer speed by clock stretch for MCU with FSL_FEATURE_I2C_HAS_DOUBLE_BUFFERING supported and enabled.

I2C_GET_TRANSFER_COMPLETION_STATUS(psHandle)

I2C_GET_TRANSFER_USER_DATA(psHandle)

I2C_GET_SLAVE_TRANSFER_EVENT(psHandle)

I2C_GET_SLAVE_TRANSFER_DATA_POINTER(psHandle)

I2C_GET_SLAVE_TRANSFER_DATASIZE(psHandle)

I2C_GET_SLAVE_TRANSFERRED_COUNT(psHandle)

struct _i2c_master_config

#include <fsl_i2c.h> I2C master configuration structure.

This structure includes all the master operation needed features, user can configure these features one by one manually, or call I2C_MasterGetDefaultConfig to set the structure to default value. Then, call I2C_MasterInit to initialize I2C module. After initialization, the I2C module can only operate as master. To deinitialize I2C, call I2C_MasterDeinit.

Public Members

bool bEnableModule
Enable the I2C peripheral during initialization.

bool bEnableStopHold
Control the stop hold enable. I2C_FLT_SHEN

uint8_t u8GlitchFilterWidth
Control the width of the glitch filter. I2C_FLT_FLT

uint8_t u8Interrupts
Mask of the interrupts to be enabled in the init function.

uint32_t u32BaudRateBps
Baud rate value in bits-per-second. I2C_F_MULT, I2C_F_ICR

uint32_t u32SrcClockHz
The clock source frequency for I2C module.

struct _i2c_slave_config
#include <fsl_i2c.h> I2C slave configuration structure.

This structure includes all the slave operation needed features, user can configure these features one by one manually, or call I2C_SlaveGetDefaultConfig to set the structure to default value. Then, call I2C_SlaveInit to initialize I2C module. After initialization, the I2C module can only operate as slave. To deinitialize I2C, call I2C_SlaveDeinit.

Public Members

bool bEnableModule
Enable the I2C peripheral during initialization.

bool bEnableStopHold
Control the stop hold enable. I2C_FLT_SHEN

uint8_t u8GlitchFilterWidth
Control the width of the glitch filter. I2C_FLT_FLT

bool bEnableWakeUp
Enable/disable waking up MCU from low-power mode. I2C_C1_WUEN

bool bEnableGeneralCall
Enable the general call addressing mode, not affected by address length. General call address is 0x00. I2C_C2_GCAEN

i2c_slave_address_mode_t eAddressingMode
Addressing mode chosen from i2c_slave_address_mode_t. I2C_C2_ADEXT I2C_C2_RMEN

uint16_t bitsPrimaryAddress
Primary Slave address. I2C_A1_AD[7] I2C_C2_AD[3]

uint16_t bitsMaxAddress
The maximum boundary of slave address used in a range address match addressing. In range address match, address greater than primary address and less than or equal to upper address is marked as matched. I2C_RA_RAD[7]

uint8_t u8Interrupts
Mask of the interrupts to be enabled in the init function.

uint32_t u32SclStopHoldTime__ns

the delay from the rising edge of SCL (I2C clock) to the rising edge of SDA (I2C data) while SCL is high (stop condition), SDA hold time and SCL start hold time are also configured according to the SCL stop hold time.

uint32_t u32SrcClockHz

The clock source frequency for I2C module.

struct __i2c__config

#include <fsl_i2c.h> I2C configuration structure.

This structure includes all I2C features, user can configure user can configure these features one by one manually, or call I2C_GetDefaultConfig to set the structure to default value. Then, call I2C_Init to initialize I2C module. To deinitialize I2C, call I2C_Deinit.

Public Members

bool bEnableModule

Enable the I2C peripheral during initialization.

bool bEnableStopHold

Control the stop hold enable. I2C_FLT_SHEN

uint8_t u8GlitchFilterWidth

Control the width of the glitch filter. I2C_FLT_FLT

bool bEnableWakeUp

Enable/disable waking up MCU from low-power mode. I2C_C1_WUEN

bool bEnableGeneralCall

Enable the general call addressing mode, not affected by address length. General call address is 0x00. I2C_C2_GCAEN

i2c_slave_address_mode_t eAddressingMode

Addressing mode chosen from i2c_slave_address_mode_t. I2C_C2_ADEXT I2C_C2_RMEN

uint16_t bitsPrimaryAddress

Primary Slave address. I2C_A1_AD[7] I2C_C2_AD[3]

uint16_t bitsMaxAddress

The maximum boundary of slave address used in a range address match addressing. In range address match, address greater than primary address and less than or equal to upper address is marked as matched. I2C_RA_RAD[7]

uint8_t u8Interrupts

Mask of the interrupts to be enabled in the init function.

uint32_t u32BaudRateBps

Baud rate value in bits-per-second. I2C_F_MULT, I2C_F_ICR

uint32_t u32SrcClockHz

The clock source frequency for I2C module.

struct __i2c__master__transfer

#include <fsl_i2c.h> I2C master transfer configuration structure.

This structure definition includes all the user configurable features, that are used to control single I2C transfer of master mode, in polling way or in interrupt way.

Public Members

uint8_t u8ControlFlagMask
: The transfer flag which controls the transfer start/stop signal, refer _i2c_master_transfer_flags.

uint8_t u8SlaveAddress
: 7-bit slave address.

i2c_master_transfer_direction_t eDirection
: Transfer direction, kI2C_MasterTransmit or kI2C_MasterReceive.

uint8_t *pu8Command
: Pointer to command code.

uint8_t u8CommandSize
: Size of the command code, max value 4.

uint8_t *volatile pu8Data
: Pointer to the send/receive data buffer.

volatile uint16_t u16DataSize
: Transfer size.

struct _i2c_master_transfer_handle

#include <fsl_i2c.h> I2C master transfer handle.

Note: If user wants to use the transactional API to transfer data in interrupt way in master mode, one I2C instance should and can only be allocated one master handle.

Note: The handle is maintained by I2C driver internally, which means the transfer state is retained and user shall not modify its state u8State in application level. If user only wish to use transactional APIs without understanding its machanism, it is not necessary to understand these members.

Public Members

I2C_Type *base
: I2C base pointer to the I2C instance that assigned to this handle.

i2c_master_transfer_t sTransfer
: I2C master transfer structure.

uint16_t u16TransferSize
: Total bytes to be transferred.

uint8_t u8State
: A transfer state maintained during transfer.

i2c_master_transfer_callback_t pfCompletionCallback
: Callback function invoked when the transfer is finished.

status_t completionStatus
: I2C master transfer complete status, indicating how the transfer ends.

void *pUserData
: User configurable pointer to any data, function, structure etc that user wish to use in the callback

struct _i2c_slave_transfer

#include <fsl_i2c.h> I2C slave transfer configuration structure.

Covers slave transfer data buffer pointer, data size and the events user want driver to alert.

Note: Unlike master who controls the transfer flow, slave has to monitor any bus event and change its configuration accordingly. So this slave transfer configuration structure is also used as second parameter of callback, for user to change the transfer configuration in the callback. The read-only member eEvent shows which event occured that causes the callback being invoked.

Public Members

uint8_t u8EventMask

Mask of the events. When these enents occur during transfer driver will alert user using callback.

uint8_t *volatile pu8Data

Pointer to the buffer of data to send, or to store received data.

volatile uint16_t u16DataSize

Transfer size.

i2c_slave_transfer_event_t eEvent

The event that caused the callback being invoked. Read-only.

struct _i2c_slave_transfer_handle

#include <fsl_i2c.h> I2C slave transfer handle.

Note: If user wants to use the transactional API to transfer data in slave mode, one I2C instance should and can only be allocated one handle.

Note: The handle is maintained by I2C driver internally, which means the transfer state is retained and user shall not modify its state u8State in application level. If user only wish to use transactional APIs without understanding its machanism, it is not necessary to understand these members.

Public Members

I2C_Type *base

I2C base pointer to the I2C instance that assigned to this handle.

i2c_slave_transfer_t sTransfer

I2C slave transfer structure.

uint16_t u16TransferredCount

The number of bytes actually transferred for curent data buffer.

uint8_t u8State

A transfer state maintained during transfer.

i2c_slave_transfer_callback_t pfCallback

Callback function invoked at the transfer event.

status_t completionStatus
I2C slave transfer complete status, indicating how the transfer ends, such as kStatus_I2C_Nak indicates the slave was nacked by master before all the data was sent. This parameter is only useful when eEvent is kI2C_SlaveCompletionEvent.

void *pUserData
User configurable pointer to any data, function, structure etc that user wish to use in the callback.

2.39 The Driver Change Log

2.40 I2C_EDMA: EDMA based I2C Driver

void I2C_MasterCreateEDMAHandle(I2C_Type *base, *i2c_master_edma_transfer_handle_t* *psHandle, *i2c_master_edma_transfer_callback_t* pfCallback, void *pUserData, DMA_Type *edmaBase, *edma_channel_t* eEdmaChannel)

Initializes the I2C handle which is used in transactional functions.

Parameters

- base – I2C peripheral base address.
- psHandle – A pointer to the i2c_master_edma_transfer_handle_t structure.
- pfCallback – A pointer to the user callback function.
- pUserData – A user parameter passed to the callback function.
- edmaBase – Edma base address.
- eEdmaChannel – eDMA channel for master transfer.

status_t I2C_MasterTransferEDMA(*i2c_master_edma_transfer_handle_t* *psHandle, *i2c_master_transfer_t* *psTransfer)

Performs a master eDMA non-blocking transfer on the I2C bus.

Parameters

- psHandle – A pointer to the i2c_master_edma_transfer_handle_t structure.
- psTransfer – A pointer to the transfer structure of i2c_master_transfer_t.

Return values

- kStatus_Success – Successfully completed the data transmission.
- kStatus_I2C_Busy – A previous transmission is still not finished.
- kStatus_I2C_Timeout – Transfer error, waits for a signal timeout.
- kStatus_I2C_ArbitrationLost – Transfer error, arbitration lost.
- kStataus_I2C_Nak – Transfer error, receive NAK during transfer.

status_t I2C_MasterTransferGetCountEDMA(*i2c_master_edma_transfer_handle_t* *psHandle, uint16_t *pu16Count)

Gets a master transfer status during the eDMA non-blocking transfer.

Parameters

- psHandle – A pointer to the i2c_master_edma_transfer_handle_t structure.
- pu16Count – A number of bytes transferred by the non-blocking transaction.

void I2C_MasterTransferAbortEDMA(*i2c_master_edma_transfer_handle_t* *psHandle)

Aborts a master eDMA non-blocking transfer early.

Parameters

- psHandle – A pointer to the i2c_master_edma_transfer_handle_t structure.

FSL_I2C_EDMA_DRIVER_VERSION

I2C EDMA driver version.

typedef struct *_i2c_master_edma_transfer_handle* i2c_master_edma_transfer_handle_t

Retry times for waiting flag.

I2C master eDMA handle typedef.

typedef void (*i2c_master_edma_transfer_callback_t)(*i2c_master_edma_transfer_handle_t* *handle)

I2C master eDMA transfer callback typedef.

struct _i2c_master_edma_transfer_handle

#include <fsl_i2c_edma.h> I2C master eDMA transfer structure. This struct address should be sizeof(edma_channel_tcd_t) aligned.

Public Members

edma_channel_tcd_t sTcd

TCD for EDMA transfer.

I2C_Type *base

I2C base pointer to the I2C instance that assigned to this handle.

i2c_master_transfer_t sTransfer

I2C master transfer structure.

uint16_t u16TransferSize

Total bytes to be transferred.

uint8_t u8State

I2C master transfer status.

edma_handle_t sEdmaHandle

The eDMA handler used.

status_t completionStatus

I2C master transfer complete status, indicating how the transfer ends.

i2c_master_edma_transfer_callback_t pfCallback

A callback function called after the eDMA transfer is finished.

void *pUserData

User configurable pointer to any data, function, structure etc that user wish to use in the callback

2.41 I2C Peripheral and Driver Overview

2.42 INTC: Interrupt Controller Driver

static inline void INTC_SetIRQPriorityNum(IRQn_Type eIrq, uint8_t u8PriorityNum)

Disable IRQ or Enable IRQ with priority.

There are similar function in fsl_common:

- EnableIRQWithPriority,
- DisableIRQ,
- EnableIRQ,
- IRQ_SetPriority.

This function is faster and simpler than those in fsl_common. Generally, this function and IRQ functions in fsl_common are either-or, don't use them together for same IRQn type, but feasible that different IRQn type use them simultaneously, for example: It is OK OCCS_IRQn use INTC_SetIRQPriorityLevel, and ADC12_CC1_IRQn use EnableIRQWithPriority. It is NOT OK that OCCS_IRQn use INTC_SetIRQPriorityLevel and EnableIRQWithPriority simultaneously.

Note: Please note a none-zero priority number does directly map to priority level, simple summary is as below, you could check RM INTC chapter for more details.

- Some IPs have priority level 1~3, maps priority number 1 to priority 1, 2 to priority 2, 3 to priority 3.
- Some IPs have priority level 0~2, maps priority number 1 to priority 0, 2 to priority 1, 3 to priority 2.

Parameters

- eIrq – The IRQ number.
- u8PriorityNum – IRQ interrupt priority number.
  - 0: disable IRQ.
  - 1-3: enable IRQ and set its priority, 3 is the highest priority for this IRQ and 1 is the lowest priority.

static inline void INTC_SetVectorBaseAddress(uint32_t u32VectorBaseAddr)

Set the base address vector table. The value in INTC_VBA is used as the upper 13 bits of the interrupt vector VAB[20:0].

Parameters

- u32VectorBaseAddr – Vector table base address. The address requires 256 words (512 bytes) aligned. Take the vector table in MC56F83xxx_Vectors.c as example for how to implement this table.

static inline void INTC_SetFastIRQVectorHandler0(vector_type_t eVector, *fast_irq_handler* pfHandler)

Set the IRQ handler for fast IRQ0. The INTC takes the vector address from the appropriate FIVAL0 and FIVAH0 registers, instead of generating an address that is an offset from the vector base address (VBA).

Parameters

- eVector – The vector number.
- pfHandler – Pointer to the fast IRQ handler function, see fast_irq_handler definition for more info.

static inline void INTC_SetFastIRQVectorHandler1(vector_type_t eVector, *fast_irq_handler* pfHandler)

Set the IRQ handler for fast IRQ1. The INTC takes the vector address from the appropriate FIVAL1 and FIVAH1 registers, instead of generating an address that is an offset from the vector base address (VBA).

Parameters

- eVector – The eVector number.
- pfHandler – Pointer to the fast IRQ handler function, see @ ref fast_irq_handler definition for more info.

static inline uint8_t INTC_GetIRQPermittedPriorityLevel(void)

Get IRQ permitted priority levels. Interrupt exceptions may be nested to allow the servicing of an IRQ with higher priority than the current exception.

The return value indicate the priority level needed for a new IRQ to interrupt the current interrupt being sent to the Core.

Return values

- 0 – Required nested exception priority levels are 0, 1, 2, or 3.
- 1 – Required nested exception priority levels are 1, 2, or 3.
- 2 – Required nested exception priority levels are 2 or 3.
- 3 – Required nested exception priority level is 3.

static inline bool INTC_GetPendingIRQ(vector_type_t eVector)

Check if IRQ is pending for execution. Before the ISR is entered, IRQ is pending. After the ISR is entered, the IRQ is not pending.

Parameters

- eVector – The IRQ vector number.

Return values

True – if interrupt is pending, otherwise return false.

static inline uint16_t INTC_GetLatestRespondedVectorNumber(void)

Get the latest responded IRQ's vector number. It shows the Vector Address Bus used at the time the last IRQ was taken.

Note: Return value of the function call could be different according to where the function call is invoked.

- when called in normal ISR handler, it returns current ISR's vector number defined in vector_type_t.
- when called in fast IRQ handler, it returns the lower address bits of the jump address.
- when called in none ISR handler code, it returns previous responded IRQ vector number defined in vector_type_t or fast IRQ low address bits.

Returns

The latest vector number.

FSL_INTC_DRIVER_VERSION

INTC driver version.

typedef void (*fast_irq_handler)(void)

The handle of the fast irq handler function.

Normally this function should be guarded by: #pragma interrupt fast and #pragma interrupt off.

INTC_DisableIRQ(x)

Macro to disable the IRQ.

INTC_PEND_REG_INDEX(x)

Helper Macro function to extract IRQ pending register index comparing to INTC_IRQP0.

INTC_PEND_BIT_INDEX(x)

Helper Macro function to extract pending IRQs bit index.

INTC_TYPE_REG_INDEX(x)

Helper Macro function to extract IRQ priority register index comparing to INTC_IRP0.

INTC_TYPE_BIT_INDEX(x)

Helper Macro function to extract IRQs priority bit index.

2.43 The Driver Change Log

2.44 INTC Peripheral and Driver Overview

2.45 Common Driver

status_t EnableIRQWithPriority(IRQn_Type irq, uint8_t priNum)

Enable the IRQ, and also set the interrupt priority.

- Some IPs maps 1 to priority 1, 2 to priority 2, 3 to priority 3
- Some IPs maps 1 to priority 0, 2 to priority 1, 3 to priority 2

User should check chip's RM to get its corresponding interrupt priority.

When priNum set as 0, then SDK_DSC_DEFAULT_INT_PRIO is set instead. When priNum set as number larger than 3, then only the 2 LSB take effect, for example, setting priNum to 5 is the same with setting it to 1.

This function configures INTC module, application could call the INTC driver directly for the same purpose.

Note: The parameter priNum is range in 1~3, and its value is **NOT** directly map to interrupt priority.

Parameters

- irq – The IRQ to enable.
- priNum – Priority number set to interrupt controller register. Larger number means higher priority. The allowed range is 1~3, and its value is **NOT** directly map to interrupt priority. In other words, the same priority number means different interrupt priority levels for different IRQ, please check reference manual for the relationship. When pass in 0, then SDK_DSC_DEFAULT_INT_PRIO is set to priority register.

Returns
Currently only returns kStatus_Success, will enhance in the future.

status_t DisableIRQ(IRQn_Type irq)

Disable specific interrupt.

This function configures INTC module, application could call the INTC driver directly for the same purpose.

Parameters

- irq – The IRQ to disable.

Returns
Currently only returns kStatus_Success, will enhance in the future.

status_t EnableIRQ(IRQn_Type irq)

Enable specific interrupt.

The recommended workflow is calling IRQ_SetPriority first, then call EnableIRQ. If IRQ_SetPriority is not called first, then the interrupt is enabled with default priority value SDK_DSC_DEFAULT_INT_PRIO.

Another recommended workflow is calling EnableIRQWithPriority directly, it is the same with calling IRQ_SetPriority + EnableIRQ.

This function configures INTC module, application could call the INTC driver directly for the same purpose.

Parameters

- irq – The IRQ to enable.

Returns
Currently only returns kStatus_Success, will enhance in the future.

status_t IRQ_SetPriority(IRQn_Type irq, uint8_t priNum)

Set the IRQ priority.

- Some IPs maps 1 to priority 1, 2 to priority 2, 3 to priority 3
- Some IPs maps 1 to priority 0, 2 to priority 1, 3 to priority 2

User should check chip's RM to get its corresponding interrupt priority

When priNum set as 0, then SDK_DSC_DEFAULT_INT_PRIO is set instead. When priNum set as number larger than 3, then only the 2 LSB take effect, for example, setting priNum to 5 is the same with setting it to 1.

This function configures INTC module, application could call the INTC driver directly for the same purpose.

Note: The parameter priNum is range in 1~3, and its value is **NOT** directly map to interrupt priority.

Parameters

- irq – The IRQ to set.
- priNum – Priority number set to interrupt controller register. Larger number means higher priority, 0 means disable the interrupt. The allowed range is 0~3, and its value is **NOT** directly map to interrupt priority. In other words, the same priority number means different interrupt priority levels for different IRQ, please check reference manual for the relationship.

Returns
Currently only returns kStatus_Success, will enhance in the future.

FSL_COMMON_DRIVER_VERSION
common driver version.

DEBUG_CONSOLE_DEVICE_TYPE_NONE
No debug console.

DEBUG_CONSOLE_DEVICE_TYPE_UART
Debug console based on UART.

DEBUG_CONSOLE_DEVICE_TYPE_LPUART
Debug console based on LPUART.

DEBUG_CONSOLE_DEVICE_TYPE_LPSCI
Debug console based on LPSCI.

DEBUG_CONSOLE_DEVICE_TYPE_USBCDC
Debug console based on USBCDC.

DEBUG_CONSOLE_DEVICE_TYPE_FLEXCOMM
Debug console based on FLEXCOMM.

DEBUG_CONSOLE_DEVICE_TYPE_IUART
Debug console based on i.MX UART.

DEBUG_CONSOLE_DEVICE_TYPE_VUSART
Debug console based on LPC_VUSART.

DEBUG_CONSOLE_DEVICE_TYPE_MINI_USART
Debug console based on LPC_USART.

DEBUG_CONSOLE_DEVICE_TYPE_SWO
Debug console based on SWO.

DEBUG_CONSOLE_DEVICE_TYPE_QSCI
Debug console based on QSCI.

MIN(a, b)
Computes the minimum of *a* and *b*.

MAX(a, b)
Computes the maximum of *a* and *b*.

UINT16_MAX
Max value of uint16_t type.

UINT32_MAX
Max value of uint32_t type.

MCUX_MASK_INVERT_8(mask)
8-bit mask inversion.

MCUX_MASK_INVERT_16(mask)
16-bit mask inversion.

MCUX_MASK_INVERT_32(mask)
32-bit mask inversion for completeness.

MCUX_REG_WRITE8(reg, value)
8-bit register write macro

MCUX_REG_WRITE16(reg, value)
16-bit register write macro

MCUX_REG_WRITE32(reg, value)
32-bit register write macro

MCUX_REG_READ8(reg)
8-bit register read macro

MCUX_REG_READ16(reg)
16-bit register read macro

MCUX_REG_READ32(reg)
32-bit register read macro

MCUX_REG_BIT_SET8(reg, mask)
8-bit register bit set macro

MCUX_REG_BIT_SET16(reg, mask)
16-bit register bit set macro

MCUX_REG_BIT_SET32(reg, mask)
32-bit register bit set macro

MCUX_REG_BIT_CLEAR8(reg, mask)
8-bit register bit clear macro

MCUX_REG_BIT_CLEAR16(reg, mask)
16-bit register bit clear macro

MCUX_REG_BIT_CLEAR32(reg, mask)
32-bit register bit clear macro

MCUX_REG_BIT_GET8(reg, mask)
8-bit register bit get macro

MCUX_REG_BIT_GET16(reg, mask)
16-bit register bit get macro

MCUX_REG_BIT_GET32(reg, mask)
32-bit register bit get macro

MCUX_REG_MODIFY8(reg, mask, value)
32-bit register read-modify-write macro

MCUX_REG_MODIFY16(reg, mask, value)
16-bit register read-modify-write macro

MCUX_REG_MODIFY32(reg, mask, value)
32-bit register read-modify-write macro

USEC_TO_COUNT(us, clockFreqInHz)
Macro to convert a microsecond period to raw count value

COUNT_TO_USEC(count, clockFreqInHz)
Macro to convert a raw count value to microsecond

MSEC_TO_COUNT(ms, clockFreqInHz)
Macro to convert a millisecond period to raw count value

COUNT_TO_MSEC(count, clockFreqInHz)
Macro to convert a raw count value to millisecond

SDK_ALIGN(var, alignbytes)

Macro to define a variable with alignbytes alignment

AT_NONCACHEABLE_SECTION(var)

AT_NONCACHEABLE_SECTION_ALIGN(var, alignbytes)

AT_NONCACHEABLE_SECTION_INIT(var)

AT_NONCACHEABLE_SECTION_ALIGN_INIT(var, alignbytes)

enum _status_groups

Status group numbers.

Values:

enumerator kStatusGroup_Generic

Group number for generic status codes.

enumerator kStatusGroup_FLASH

Group number for FLASH status codes.

enumerator kStatusGroup_LPSPI

Group number for LPSPI status codes.

enumerator kStatusGroup_FLEXIO_SPI

Group number for FLEXIO SPI status codes.

enumerator kStatusGroup_DSPI

Group number for DSPI status codes.

enumerator kStatusGroup_FLEXIO_UART

Group number for FLEXIO UART status codes.

enumerator kStatusGroup_FLEXIO_I2C

Group number for FLEXIO I2C status codes.

enumerator kStatusGroup_LPI2C

Group number for LPI2C status codes.

enumerator kStatusGroup_UART

Group number for UART status codes.

enumerator kStatusGroup_I2C

Group number for UART status codes.

enumerator kStatusGroup_LPSCI

Group number for LPSCI status codes.

enumerator kStatusGroup_LPUART

Group number for LPUART status codes.

enumerator kStatusGroup_SPI

Group number for SPI status code.

enumerator kStatusGroup_XRDC

Group number for XRDC status code.

enumerator kStatusGroup_SEMA42

Group number for SEMA42 status code.

enumerator kStatusGroup_SDHC

Group number for SDHC status code

enumerator kStatusGroup_SDMMC
Group number for SDMMC status code

enumerator kStatusGroup_SAI
Group number for SAI status code

enumerator kStatusGroup_MCG
Group number for MCG status codes.

enumerator kStatusGroup_SCG
Group number for SCG status codes.

enumerator kStatusGroup_SDSPI
Group number for SDSPI status codes.

enumerator kStatusGroup_FLEXIO_I2S
Group number for FLEXIO I2S status codes

enumerator kStatusGroup_FLEXIO_MCULCD
Group number for FLEXIO LCD status codes

enumerator kStatusGroup_FLASHIAP
Group number for FLASHIAP status codes

enumerator kStatusGroup_FLEXCOMM_I2C
Group number for FLEXCOMM I2C status codes

enumerator kStatusGroup_I2S
Group number for I2S status codes

enumerator kStatusGroup_IUART
Group number for IUART status codes

enumerator kStatusGroup_CSI
Group number for CSI status codes

enumerator kStatusGroup_MIPI_DSI
Group number for MIPI DSI status codes

enumerator kStatusGroup_SDRAMC
Group number for SDRAMC status codes.

enumerator kStatusGroup_POWER
Group number for POWER status codes.

enumerator kStatusGroup_ENET
Group number for ENET status codes.

enumerator kStatusGroup_PHY
Group number for PHY status codes.

enumerator kStatusGroup_TRGMUX
Group number for TRGMUX status codes.

enumerator kStatusGroup_SMARTCARD
Group number for SMARTCARD status codes.

enumerator kStatusGroup_LMEM
Group number for LMEM status codes.

enumerator kStatusGroup_QSPI
Group number for QSPI status codes.

enumerator kStatusGroup_DMA
Group number for DMA status codes.

enumerator kStatusGroup_EDMA
Group number for EDMA status codes.

enumerator kStatusGroup_DMAMGR
Group number for DMAMGR status codes.

enumerator kStatusGroup_FLEXCAN
Group number for FlexCAN status codes.

enumerator kStatusGroup_LTC
Group number for LTC status codes.

enumerator kStatusGroup_FLEXIO_CAMERA
Group number for FLEXIO CAMERA status codes.

enumerator kStatusGroup_LPC_SPI
Group number for LPC_SPI status codes.

enumerator kStatusGroup_LPC_USART
Group number for LPC_USART status codes.

enumerator kStatusGroup_DMIC
Group number for DMIC status codes.

enumerator kStatusGroup_SDIF
Group number for SDIF status codes.

enumerator kStatusGroup_SPIFI
Group number for SPIFI status codes.

enumerator kStatusGroup_OTP
Group number for OTP status codes.

enumerator kStatusGroup_MCAN
Group number for MCAN status codes.

enumerator kStatusGroup_CAAM
Group number for CAAM status codes.

enumerator kStatusGroup_ECSPI
Group number for ECSPI status codes.

enumerator kStatusGroup_USDHC
Group number for USDHC status codes.

enumerator kStatusGroup_LPC_I2C
Group number for LPC_I2C status codes.

enumerator kStatusGroup_DCP
Group number for DCP status codes.

enumerator kStatusGroup_MSCAN
Group number for MSCAN status codes.

enumerator kStatusGroup_ESAI
Group number for ESAI status codes.

enumerator kStatusGroup_FLEXSPI
Group number for FLEXSPI status codes.

enumerator kStatusGroup_MMDC
Group number for MMDC status codes.

enumerator kStatusGroup_PDM
Group number for MIC status codes.

enumerator kStatusGroup_SDMA
Group number for SDMA status codes.

enumerator kStatusGroup_ICS
Group number for ICS status codes.

enumerator kStatusGroup_SPDIF
Group number for SPDIF status codes.

enumerator kStatusGroup_LPC_MINISPI
Group number for LPC_MINISPI status codes.

enumerator kStatusGroup_HASHCRYPT
Group number for Hashcrypt status codes

enumerator kStatusGroup_LPC_SPI_SSP
Group number for LPC_SPI_SSP status codes.

enumerator kStatusGroup_I3C
Group number for I3C status codes

enumerator kStatusGroup_LPC_I2C_1
Group number for LPC_I2C_1 status codes.

enumerator kStatusGroup_NOTIFIER
Group number for NOTIFIER status codes.

enumerator kStatusGroup_DebugConsole
Group number for debug console status codes.

enumerator kStatusGroup_SEMC
Group number for SEMC status codes.

enumerator kStatusGroup_ApplicationRangeStart
Starting number for application groups.

enumerator kStatusGroup_IAP
Group number for IAP status codes

enumerator kStatusGroup_SFA
Group number for SFA status codes

enumerator kStatusGroup_SPC
Group number for SPC status codes.

enumerator kStatusGroup_PUF
Group number for PUF status codes.

enumerator kStatusGroup_TOUCH_PANEL
Group number for touch panel status codes

enumerator kStatusGroup_VBAT
Group number for VBAT status codes

enumerator kStatusGroup_XSPI
Group number for XSPI status codes

enumerator kStatusGroup_PNGDEC
    Group number for PNGDEC status codes

enumerator kStatusGroup_JPEGDEC
    Group number for JPEGDEC status codes

enumerator kStatusGroup_AUDMIX
    Group number for AUDMIX status codes

enumerator kStatusGroup_HAL_GPIO
    Group number for HAL GPIO status codes.

enumerator kStatusGroup_HAL_UART
    Group number for HAL UART status codes.

enumerator kStatusGroup_HAL_TIMER
    Group number for HAL TIMER status codes.

enumerator kStatusGroup_HAL_SPI
    Group number for HAL SPI status codes.

enumerator kStatusGroup_HAL_I2C
    Group number for HAL I2C status codes.

enumerator kStatusGroup_HAL_FLASH
    Group number for HAL FLASH status codes.

enumerator kStatusGroup_HAL_PWM
    Group number for HAL PWM status codes.

enumerator kStatusGroup_HAL_RNG
    Group number for HAL RNG status codes.

enumerator kStatusGroup_HAL_I2S
    Group number for HAL I2S status codes.

enumerator kStatusGroup_HAL_ADC_SENSOR
    Group number for HAL ADC SENSOR status codes.

enumerator kStatusGroup_TIMERMANAGER
    Group number for TiMER MANAGER status codes.

enumerator kStatusGroup_SERIALMANAGER
    Group number for SERIAL MANAGER status codes.

enumerator kStatusGroup_LED
    Group number for LED status codes.

enumerator kStatusGroup_BUTTON
    Group number for BUTTON status codes.

enumerator kStatusGroup_EXTERN_EEPROM
    Group number for EXTERN EEPROM status codes.

enumerator kStatusGroup_SHELL
    Group number for SHELL status codes.

enumerator kStatusGroup_MEM_MANAGER
    Group number for MEM MANAGER status codes.

enumerator kStatusGroup_LIST
    Group number for List status codes.

enumerator kStatusGroup_OSA
Group number for OSA status codes.

enumerator kStatusGroup_COMMON_TASK
Group number for Common task status codes.

enumerator kStatusGroup_MSG
Group number for messaging status codes.

enumerator kStatusGroup_SDK_OCOTP
Group number for OCOTP status codes.

enumerator kStatusGroup_SDK_FLEXSPINOR
Group number for FLEXSPINOR status codes.

enumerator kStatusGroup_CODEC
Group number for codec status codes.

enumerator kStatusGroup_ASRC
Group number for codec status ASRC.

enumerator kStatusGroup_OTFAD
Group number for codec status codes.

enumerator kStatusGroup_SDIOSLV
Group number for SDIOSLV status codes.

enumerator kStatusGroup_MECC
Group number for MECC status codes.

enumerator kStatusGroup_ENET_QOS
Group number for ENET_QOS status codes.

enumerator kStatusGroup_LOG
Group number for LOG status codes.

enumerator kStatusGroup_I3CBUS
Group number for I3CBUS status codes.

enumerator kStatusGroup_QSCI
Group number for QSCI status codes.

enumerator kStatusGroup_ELEMU
Group number for ELEMU status codes.

enumerator kStatusGroup_QUEUEDSPI
Group number for QSPI status codes.

enumerator kStatusGroup_POWER_MANAGER
Group number for POWER_MANAGER status codes.

enumerator kStatusGroup_IPED
Group number for IPED status codes.

enumerator kStatusGroup_ELS_PKC
Group number for ELS PKC status codes.

enumerator kStatusGroup_CSS_PKC
Group number for CSS PKC status codes.

enumerator kStatusGroup_HOSTIF
Group number for HOSTIF status codes.

enumerator kStatusGroup_CLIF
Group number for CLIF status codes.

enumerator kStatusGroup_BMA
Group number for BMA status codes.

enumerator kStatusGroup_NETC
Group number for NETC status codes.

enumerator kStatusGroup_ELE
Group number for ELE status codes.

enumerator kStatusGroup_GLIKEY
Group number for GLIKEY status codes.

enumerator kStatusGroup_AON_POWER
Group number for AON_POWER status codes.

enumerator kStatusGroup_AON_COMMON
Group number for AON_COMMON status codes.

enumerator kStatusGroup_ENDAT3
Group number for ENDAT3 status codes.

enumerator kStatusGroup_HIPERFACE
Group number for HIPERFACE status codes.

enumerator kStatusGroup_NPX
Group number for NPX status codes.

enumerator kStatusGroup_ELA_CSEC
Group number for ELA_CSEC status codes.

enumerator kStatusGroup_FLEXIO_T_FORMAT
Group number for T-format status codes.

enumerator kStatusGroup_FLEXIO_A_FORMAT
Group number for A-format status codes.

enumerator kStatusGroup_LPC_QSPI
Group number for LPC QSPI status codes.

Generic status return codes.

Values:

enumerator kStatus_Success
Generic status for Success.

enumerator kStatus_Fail
Generic status for Fail.

enumerator kStatus_ReadOnly
Generic status for read only failure.

enumerator kStatus_OutOfRange
Generic status for out of range access.

enumerator kStatus_InvalidArgument
Generic status for invalid argument check.

enumerator kStatus_Timeout
Generic status for timeout.

enumerator kStatus_NoTransferInProgress
Generic status for no transfer in progress.

enumerator kStatus_Busy
Generic status for module is busy.

enumerator kStatus_NoData
Generic status for no data is found for the operation.

typedef int32_t status_t
Type used for all status and error return values.

uint8_t bool

void *SDK_Malloc(size_t size, size_t alignbytes)
Allocate memory with given alignment and aligned size.

This is provided to support the dynamically allocated memory used in cache-able region.

Parameters

- size – The length required to malloc.
- alignbytes – The alignment size.

Return values
The – allocated memory.

void SDK_Free(void *ptr)
Free memory.

Parameters

- ptr – The memory to be release.

void SDK_DelayAtLeastUs(uint32_t delayTime_us, uint32_t coreClock_Hz)
Delay at least for some time. Please note that, this API uses while loop for delay, different run-time environments make the time not precise, if precise delay count was needed, please implement a new delay function with hardware timer.

Parameters

- delayTime_us – Delay time in unit of microsecond.
- coreClock_Hz – Core clock frequency with Hz.

static inline uint32_t DisableGlobalIRQ(void)
Disable the global IRQ.

static inline void EnableGlobalIRQ(uint32_t irqSts)
Enable the global IRQ.

static inline bool isIRQAllowed(void)
Check if currently core is able to response IRQ.

void SDK_DelayCoreCycles(uint32_t u32Num)
Delay core cycles. Please note that, this API uses software loop for delay, the actual delayed time depends on core clock frequency, where the function is located (ram or flash), flash clock, possible interrupt.

Parameters

- u32Num – Number of core clock cycle which needs to be delayed.

uint32_t SDK_CovertUsToCount(uint32_t u32Us, uint32_t u32Hz)

Covert us to count with fixed-point calculation.

Note: u32Us must not be greater than 4294

Parameters

- u32Us – Time in us
- u32Hz – Clock frequency in Hz

Returns

The count value

uint32_t SDK_CovertCountToUs(uint32_t u32Count, uint32_t u32Hz)

Covert count to us with fixed-point calculation.

Note: u32Hz must not be greater than 429496729UL(0xFFFFFFFFUL/10UL)

Parameters

- u32Count – Count value
- u32Hz – Clock frequency in Hz

Returns

The us value

uint32_t SDK_CovertMsToCount(uint32_t u32Ms, uint32_t u32Hz)

Covert ms to count with fixed-point calculation.

Note: u32Ms must not be greater than 42949UL @ u32Hz = 100M

Parameters

- u32Ms – Time in us
- u32Hz – Clock frequency in Hz

Returns

The count value

uint32_t SDK_CovertCountToMs(uint32_t u32Count, uint32_t u32Hz)

Covert count to ms with fixed-point calculation.

Note: u32Hz must not be greater than 429496729UL(0xFFFFFFFFUL/10UL)

Parameters

- u32Count – Count value
- u32Hz – Clock frequency in Hz

Returns

The us value

void SDK_DelayAtLeastMs(uint32_t delayTime_ms, uint32_t coreClock_Hz)

Delay at least for some time in millisecond unit. Please note that, this API uses while loop for delay, different run-time environments make the time not precise, if precise delay count was needed, please implement a new delay function with hardware timer.

Parameters

- delayTime_ms – Delay time in unit of millisecond.
- coreClock_Hz – Core clock frequency with Hz.

FSL_DRIVER_TRANSFER_DOUBLE_WEAK_IRQ

Macro to use the default weak IRQ handler in drivers.

MAKE_STATUS(group, code)

Construct a status code value from a group and code number.

MAKE_VERSION(major, minor, bugfix)

Construct the version number for drivers.

The driver version is a 32-bit number, for both 32-bit platforms(such as Cortex M) and 16-bit platforms(such as DSC).

```
| Unused    || Major Version || Minor Version ||  Bug Fix    |
31        25  24           17  16            9  8           0
```

ARRAY_SIZE(x)

Computes the number of elements in an array.

UINT64_H(X)

Macro to get upper 32 bits of a 64-bit value

UINT64_L(X)

Macro to get lower 32 bits of a 64-bit value

SUPPRESS_FALL_THROUGH_WARNING()

For switch case code block, if case section ends without "break;" statement, there wil be fallthrough warning with compiler flag -Wextra or -Wimplicit-fallthrough=n when using armgcc. To suppress this warning, "SUPPRESS_FALL_THROUGH_WARNING();" need to be added at the end of each case section which misses "break;"statement.

true

false

SDK_ISR_EXIT_BARRIER

SDK_DSC_DEFAULT_INT_PRIO

Default DSC interrupt priority number.

SetIRQBasePriority(x)

Set base core IRQ priority, that core will response the interrupt request with priority >= base IRQ priority.

PeriphReadReg(reg)

Read register value.

Example: val = PeriphReadReg(OCCS->OSCTL2);

Parameters

- reg – Register name.

Returns

The value of register.

PeriphWriteReg(reg, data)

Write data to register.

Example: PeriphWriteReg(OCCS->OSCTL2, 0x278U);

Parameters

- reg – Register name.
- data – Data wrote to register.

PeriphSetBits(reg, bitMask)

Set specified bits in register.

Example: PeriphSetBits(OCCS->OSCTL2, 0x12U);

Parameters

- reg – Register name.
- bitMask – Bits mask, set bits will be set in the register.

PeriphClearBits(reg, bitMask)

Clear specified bits in register.

Example: PeriphClearBits(OCCS->OSCTL2, 0x12U);

Parameters

- reg – Register name.
- bitMask – Bits mask, set bits will be cleared in the register.

PeriphInvertBits(reg, bitMask)

Invert specified bits in register.

Example: PeriphInvertBits(OCCS->OSCTL2, 0x12U);

Parameters

- reg – Register name.
- bitMask – Bits mask, set bits will be inverted in the register.

PeriphGetBits(reg, bitMask)

Get specified bits in register.

Example: val = PeriphGetBits(OCCS->OSCTL2, 0x23U);

Parameters

- reg – Register name.
- bitMask – Bits mask, specify the getting bits.

Returns

The value of specified bits.

PeriphWriteBitGroup(reg, bitMask, bitValue)

Write group of bits to register.

Example: PeriphWriteBitGroup(OCCS->DIVBY, OCCS_DIVBY_COD_MASK, OCCS_DIVBY_COD(23U)); PeriphWriteBitGroup(OCCS->DIVBY, OCCS_DIVBY_COD_MASK | OCCS_DIVBY_PLLDB_MASK, \ OCCS_DIVBY_COD(23U) | OCCS_DIVBY_PLLDB(49U));

Parameters

- reg – Register name.
- bitMask – Bits mask, mask of the group of bits.

- bitValue – This value will be written into the bit group specified by parameter bitMask.

PeriphSafeClearFlags(reg, allFlagsMask, flagMask)

Clear (acknowledge) flags which are active-high and are cleared-by-write-one.

This macro is useful when a register is comprised by normal read-write bits and cleared-by-write-one bits. Example: PeriphSafeClearFlags(PWMA->FAULT[0].FSTS, PWM_FSTS_FFLAG_MASK, PWM_FSTS_FFLAG(2));

Parameters

- reg – Register name.
- allFlagsMask – Mask for all flags which are active-high and are cleared-by-write-one.
- flagMask – The selected flags(cleared-by-write-one) which are supposed to be cleared.

PeriphSafeClearBits(reg, allFlagsMask, bitMask)

Clear selected bits without modifying (acknowledge) bit flags which are active-high and are cleared-by-write-one.

This macro is useful when a register is comprised by normal read-write bits and cleared-by-write-one bits. Example: PeriphSafeClearBits(PWMA->FAULT[0].FSTS, PWM_FSTS_FFLAG_MASK, PWM_FSTS_FHALF(2));

Parameters

- reg – Register name.
- allFlagsMask – Mask for all flags which are active-high and are cleared-by-write-one.
- bitMask – The selected bits which are supposed to be cleared.

PeriphSafeSetBits(reg, allFlagsMask, bitMask)

Set selected bits without modifying (acknowledge) bit flags which are active-high and are cleared-by-write-one.

This macro is useful when a register is comprised by normal read-write bits and cleared-by-write-one bits. Example: PeriphSafeSetBits(PWMA->FAULT[0].FSTS, PWM_FSTS_FFLAG_MASK, PWM_FSTS_FHALF(2));

Parameters

- reg – Register name.
- allFlagsMask – Mask for all flags which are active-high and are cleared-by-write-one.
- bitMask – The selected bits which are supposed to be set.

PeriphSafeWriteBitGroup(reg, allFlagsMask, bitMask, bitValue)

Write group of bits without modifying (acknowledge) bit flags which are active-high and are cleared-by-write-one.

This macro is useful when a register is comprised by normal read-write bits and cleared-by-write-one bits. Example: PeriphSafeWriteBitGroup(PWMA->FAULT[0].FSTS, PWM_FSTS_FFLAG_MASK, PWM_FSTS_FHALF_MASK, PWM_FSTS_FHALF(3U)); PeriphSafeWriteBitGroup(PWMA->FAULT[0].FSTS, PWM_FSTS_FFLAG_MASK, PWM_FSTS_FHALF_MASK | PWM_FSTS_FFULL_MASK, \ PWM_FSTS_FHALF(3U) | PWM_FSTS_FFULL(2U));

Parameters

- reg – Register name.

- allFlagsMask – Mask for all flags which are active-high and are cleared-by-write-one.
- bitMask – Bits mask, mask of the group of bits.
- bitValue – This value will be written into the bit group specified by parameter bitMask.

SDK_GET_REGISTER_BYTE_ADDR(ipType, ipBase, regName)

Get IP register byte address with uint32_t type.

This macro is useful when a register byte address is required, especially in SDM mode. Example: SDK_GET_REGISTER_BYTE_ADDR(ADC_Type, ADC, RSLT[0]);

Parameters

- ipType – IP register mapping struct type.
- ipBase – IP instance base pointer, WORD address.
- regName – Member register name of IP register mapping struct.

MSDK_REG_SECURE_ADDR(x)

MSDK_REG_NONSECURE_ADDR(x)

2.46 MCM: Miscellaneous Control Module Driver

static inline *mcm_datapath_width_t* MCM_GetDataPathWidth(MCM_Type *base)

Indicates if the datapath is 32 or 64 bits wide.

Parameters

- base – MCM base address.

Returns

The device's datapath width, please refer to mcm_datapath_width_t.

static inline uint16_t MCM_GetCrossbarSwitchSlaveConfig(MCM_Type *base)

Gets crossbar switch (AXBS) slave configuration that indicates the presence/absence of bus slave connections to the device's crossbar switch.

Parameters

- base – MCM base address.

Returns

Crossbar switch (AXBS) slave configuration, each bit in the return value indicates if there is a corresponding connection to the AXBS slave input port. For example if the result is 0x1, it means a bus slave connection to AXBS input port 0 is present.

static inline uint16_t MCM_GetCrossbarSwitchMasterConfig(MCM_Type *base)

Gets crossbar switch (AXBS) master configuration that indicates the presence/absence of bus master connections to the device's crossbar switch.

Parameters

- base – MCM base address.

Returns

Crossbar switch (AXBS) master configuration, each bit in the return value indicates if there is a corresponding connection to the AXBS master input port. For example if the result is 0x1, it means a bus master connection to AXBS input port 0 is present.

static inline void MCM_ClearFlashControllerCache(MCM_Type *base)

Clears Flash Controller Cache, 1 cycle active.

Parameters

- base – MCM base address.

static inline void MCM_DisableFlashControllerDataCaching(MCM_Type *base, bool bDisable)

Disables/Enables flash controller data caching.

Parameters

- base – MCM peripheral base address.
- bDisable – Used to enable/disable flash controller data caching.
  - **true** Disable flash controller data caching.
  - **false** Enable flash controller data caching.

static inline void MCM_DisableFlashControllerInstructionCaching(MCM_Type *base, bool bDisable)

Disables/Enables flash controller instruction caching.

Parameters

- base – MCM peripheral base address.
- bDisable – Used to enable/disable flash contoller instruction caching.
  - **true** Disable flash controller instruction caching.
  - **false** Enable flash controller instruction caching.

static inline void MCM_DisableFlashControllerCache(MCM_Type *base, bool bDisable)

Disables/Enables flash controller cache.

Parameters

- base – MCM peripheral base address.
- bDisable – Used to enable/disable flash controller cache.
  - **true** Disable flash controller cache.
  - **false** Enable flash controller cache.

static inline void MCM_DisableFlashControllerDataSpeculation(MCM_Type *base, bool bDisable)

Disables/Enables flash controller data speculation.

Parameters

- base – MCM peripheral base address.
- bDisable – Used to enable/disable flash controller data speculation.
  - **true** Disable flash controller data speculation.
  - **false** Enable flash controller data speculation.

static inline void MCM_DisableFlashControllerSpeculation(MCM_Type *base, bool bDisable)

Disables/Enables flash controller speculation.

Parameters

- base – MCM peripheral base address.
- bDisable – Used to enable/disable flash controller speculation.
  - **true** Disable flash controller speculation.
  - **false** Enable flash controller speculation.

static inline void MCM_DisableDSP56800EXCoreInstructions(MCM_Type *base, bool bDisable)

Disables/Enables the instruction support only by DSP56800EX core, the instructions supported only by the DSP56800EX core are the BPSC and 32-bit multiply and MAC instructions.

Parameters

- base – MCM peripheral base address.
- bDisable – Used to enable/disable 32-bit multiply and MAC instructions.
  - **true** BFSC and 32-bit multiply and MAC instructions disabled.
  - **false** BFSC and 32-bit multiply and MAC instructions enabled.

static inline void MCM_DisableCoreReverseCarry(MCM_Type *base, bool bDisable)

Disables/Enables core reverse carry.

Parameters

- base – MCM peripheral base address.
- bDisable – Used to enable/disable reverse carry.
  - **true** Disable bit-reverse addressing mode.
  - **false** Enable bit-reverse addressing mode.

static inline void MCM_DisableDSP56800EXNewShadowRegion(MCM_Type *base, bool bDisable)

Disables/Enables the additional AGU shadow registers on the DSP56800EX core.

Parameters

- base – MCM peripheral base address.
- bDisable – Used to disable/enable the additional AGU shadow register on the DPS core.
  - **true** Only the AGU shadow registers supported by the DSP56800E core are enabled.
  - **false** The additional AGU shadow registers on the DSP56800EX core are also enabled.

static inline void MCM_DisableCoreInstructionBuffer(MCM_Type *base, bool bDisable)

Disables/Enables core instruction buffer.

Parameters

- base – MCM peripheral base address.
- bDisable – Used to disable/enable core longword instruction buffer.
  - **true** Disable core longword instruction buffer.
  - **false** Enable core longword instruction buffer.

static inline void MCM_DisableFlashMemoryControllerStall(MCM_Type *base, bool bDisable)

Disables/Enables the flash memory controller's ability to allow flash memory access to initiate when a flash memory command is executing.

Parameters

- base – MCM peripheral base address.
- bDisable – Used to disable/enable stall logic.
  - **true** Stall logic is disabled. While a flash memory command is executing, an attempted flash memory access causes a bus error.

- **false** Stall logic is disabled. While a flash memory command is executing, a flash memory access can occur without causing a bus error. The flash memory command completes execution, and then the flash memory access occurs.

static inline void MCM_SetAxbsDMAControllerPriority(MCM_Type *base, *mcm_axbs_dma_core_priority_t* ePriority)

Sets the priority of the DMA controller in the AXBS crossbar switch arbitration scheme.

Parameters

- base – MCM base address.
- ePriority – The selected DMA controller priority in Crossbar switch arbitration scheme, please refer to mcm_axbs_dma_core_priority_t.

static inline uint32_t MCM_GetCoreFaultAddr(MCM_Type *base)

Gets the address of the last core access terminated with an error response.

Parameters

- base – MCM base address.

Returns

address of the last core access terminated with an error response.

void MCM_GetCoreFaultAttribute(MCM_Type *base, *mcm_core_fault_attribute_t* *psAttribute)

Gets the processor's attributes of the last faulted core access to the system bus.

Parameters

- base – MCM peripheral base address.
- psAttribute – The pointer of structure mcm_core_fault_attribute_t.

static inline *mcm_last_fault_access_location_t* MCM_GetCoreFaultLocation(MCM_Type *base)

Gets the location of the last captured fault.

Parameters

- base – MCM peripheral base address.

Returns

The location of the last captured fault, please refer to mcm_last_fault_access_location_t.

static inline uint32_t MCM_GetCoreFaultData(MCM_Type *base)

Gets the data associated with the last faulted processor write data access from the device's internal bus.

Parameters

- base – MCM base address.

Returns

The data associated with the last faulted processor write data access.

static inline void MCM_EnableCoreFaultInterrupt(MCM_Type *base, bool bEnable)

Enables/Disables core fault error interrupt.

Parameters

- base – MCM peripheral base address.
- bEnable – Used to enable/disable the core fault error interrupt.
  - **true** Enables core fault error interrupt, so an error interrupt will be generated to the interrupt controller on a faulted system bus cycle.

  - **false** Disables core fault error interrupt, so an error interrupt will not be generated to the interrupt controller on a faulted system bus cycle.

static inline uint8_t MCM_GetCoreFaultStatusFlags(MCM_Type *base)

Gets the core fault error status flags, including core fault error interrupt flag and core fault error data lost flag.

Parameters

- base – MCM peripheral base address.

Returns

The current status flags, should be the OR'ed value of _mcm_status_flags.

static inline void MCM_ClearCoreFaultStatusFlags(MCM_Type *base, uint8_t u8StatusFlags)

Clears the core fault error status flags, including core fault error interrupt flag and core fault error data lost flag.

Parameters

- base – MCM peripheral base address.
- u8StatusFlags – The status flags to be cleared, should be the OR'ed value of _mcm_status_flags.

static inline void MCM_EnableResourceProtection(MCM_Type *base, bool bEnable)

Enables/Disables resource protection.

Parameters

- base – MCM peripheral base address.
- bEnable – Used to enable/disable memory resource protection.
  - **true** Enable memory resource protection.
  - **false** Disable memory resource protection.

static inline void MCM_LockResourceProtectionRegisters(MCM_Type *base)

Locks the value of the resource protection related registers, after locked the registers' value can not be changed until a system reset.

Parameters

- base – MCM peripheral base address.

status_t MCM_SetResourceProtectionConfig(MCM_Type *base, const *mcm_resource_protection_config_t* *psConfig)

Sets the configuration of resource protection, including flash base address, ram base address, etc.

Parameters

- base – MCM peripheral base address.
- psConfig – The pointer of structure mcm_resource_protection_config_t.

Return values

- kStatus_Success – Succeed to setting resource protection related options.
- kStatus_Fail – Fail to set resource protection related options.

static inline uint32_t MCM_GetResourceProtectionIllegalFaultPC(MCM_Type *base)

Gets the 21-bit illegal faulting PC that only for a resource protection fault.

Parameters

- base – MCM peripheral base address.

Returns
The resource protection illegal faulting PC.

static inline bool MCM_IsResourceProtectionIllegalFaultValid(MCM_Type *base)
Indicates whether an resource protection illegal PC fault has occurred.

Parameters
- base – MCM peripheral base address.

Return values
- true – The resource protection illegal PC fault has occurred.
- false – The resource protection illegal PC fault has not occurred.

static inline void MCM_ClearResourceProtectionIllegalFaultValid(MCM_Type *base)
Clears the resource protection illegal fault bit.

Parameters
- base – MCM peripheral base address.

static inline uint32_t MCM_GetResourceProtectionMisalignedFaultPC(MCM_Type *base)
Gets the 21-bit misaligned faulting PC that only for a resource protection fault.

Parameters
- base – MCM peripheral base address.

Returns
The resource protection misaligned faulting PC.

static inline bool MCM_IsResourceProtectionMisalignedFaultValid(MCM_Type *base)
Indicates whether an resource protection misaligned PC fault has occurred.

Parameters
- base – MCM peripheral base address.

Return values
- true – The resource protection misaligned PC fault has occurred.
- false – The resource protection misaligned PC fault has not occurred.

static inline void MCM_ClearResourceProtectionMisalignedFaultValid(MCM_Type *base)
Clears the resource protection misaligned fault bit.

Parameters
- base – MCM peripheral base address.

FSL_MCM_DRIVER_VERSION
MCM driver version.

enum _mcm_status_flags
The enumeration of status flags, including core fault error interrupt flag and core fault error data lost flag.

Values:

enumerator kMCM_CoreFaultErrorInterruptFlag
A bus error has occurred.

enumerator kMCM_CoreFaultErrorDataLostFlag
A bus error has occurred before the previous error condition was cleared.

enum _mcm_datapath_width
The enumeration of datapath width, including 32 bits and 64 bits.

Values:

enumerator kMCM_Datapath32b
Datapath width is 32 bits.

enumerator kMCM_Datapath64b
Datapath width is 64 bits.

enum _mcm_axbs_dma_core_priority
The enumeration of DMA controller priority in the Crossbar switch arbitration scheme.

Values:

enumerator kMCM_AxbsPriorityCoreHigherThanDMA
Fixed-priority arbitration is selected: DSC core has a higher priority than the DMA Controller's priority.

enumerator kMCM_AxbsPriorityCoreDMARoundRobin
Round-robin priority arbitration is selected: DMA Controller and DSC core have equal priority.

enum _mcm_last_fault_access___dir
The enumeration of last faulted core access direction.

Values:

enumerator kMCM_CoreRead
Core read access.

enumerator kMCM_CoreWrite
Core write access.

enum _mcm_last_fault_access_size
The enumeration of last faulted core access size.

Values:

enumerator kMCM_Access8b
Last faulted core access size is 8-bit.

enumerator kMCM_Access16b
Last faulted core access size is 16-bit.

enumerator kMCM_Access32b
Last faulted core access size is 32-bit.

enum _mcm_last_fault_access_type
The enumeration of last faulted core access type.

Values:

enumerator kMCM_AccessInstruction
Last faulted core access is instruction.

enumerator kMCM_AccessData
Last faulted core access is data.

enum _mcm_last_fault_access_location
The enumeration of last captured fault Location.

Values:

enumerator kMCM_ErrOnInstructionBus
Error occurred on M0 (instruction bus).

enumerator kMCM_ErrOnOperandABus
Error occurred on M1 (operand A bus).

enumerator kMCM_ErrOnOperandBBus
Error occurred on M2 (operand B bus).

typedef enum *_mcm_datapath_width* mcm_datapath_width_t
The enumeration of datapath width, including 32 bits and 64 bits.

typedef enum *_mcm_axbs_dma_core_priority* mcm_axbs_dma_core_priority_t
The enumeration of DMA controller priority in the Crossbar switch arbitration scheme.

typedef enum *_mcm_last_fault_access__dir* mcm_last_fault_access_dir_t
The enumeration of last faulted core access direction.

typedef enum *_mcm_last_fault_access_size* mcm_last_fault_access_size_t
The enumeration of last faulted core access size.

typedef enum *_mcm_last_fault_access_type* mcm_last_fault_access_type_t
The enumeration of last faulted core access type.

typedef enum *_mcm_last_fault_access_location* mcm_last_fault_access_location_t
The enumeration of last captured fault Location.

typedef struct *_mcm_core_fault_attribute* mcm_core_fault_attribute_t
The structure of core fault attributes, contains access type, access size, access direction, etc.

typedef struct *_mcm_resource_protection_config* mcm_resource_protection_config_t
The structure of the resource protection config, the set value can be used only when the resource protection is enabled, and this value can be changed only when the resource protection is disabled.

struct _mcm_core_fault_attribute
#include <fsl_mcm.h> The structure of core fault attributes, contains access type, access size, access direction, etc.

Public Members

mcm_last_fault_access_type_t eType
Indicates the last faulted core access type, please refer to mcm_last_fault_access_type_t.

uint8_t bitReserved1
Reserved 1 bit.

bool bBufferable
Indicates if last faulted core access was bufferable.

- **true** Last faulted core access is bufferable.
- **false** Last faulted core access is non-bufferable.

uint8_t bitReserved2
Reserved 1 bit.

mcm_last_fault_access_size_t eSize
Indicates last faulted core access size.

mcm_last_fault_access_dir_t eDirection
Indicates the last faulted core access direction.

struct _mcm_resource_protection_config

#include <fsl_mcm.h> The structure of the resource protection config, the set value can be used only when the resource protection is enabled, and this value can be changed only when the resource protection is disabled.

Public Members

bool bEnableResourceProtection

Enable/Disable resource protection.

- **true** Enable Resource protection.
- **false** Disable Resource protection.

uint8_t u8FlashBaseAddress

Flash base address for user region, supports 4 KB granularity.

uint8_t u8RamBaseAddress

Program RAM base address for user region, support 256 byte granularity.

uint32_t u32BootRomBaseAddress

Boot ROM base address for user region

uint32_t u32ResourceProtectionOtherSP

Resource protection other stack pointer.

2.47 The Driver Change Log

2.48 MCM Peripheral and Driver Overview

2.49 PIT: Periodic Interrupt Timer (PIT) Driver

void PIT_Init(PIT_Type *base, const *pit_config_t* *psConfig)

Ungates the PIT clock, configures the PIT features. The configurations are:

- Clock source selection for PIT module
- Prescaler configuration to the input clock source
- PIT period interval
- PIT slave mode enable/disable
- Interrupt enable/disable
- PIT timer enable/disable
- Preset Polarity positive edge/negative edge

Note: This API should be called at the beginning of the application using the PIT driver and call PIT_StartTimer() API to start PIT timer.

Parameters

- base – PIT peripheral base address

- psConfig – Pointer to the user's PIT config structure

void PIT_Deinit(PIT_Type *base)

Gates the PIT clock and disables the PIT module.

Parameters

- base – PIT peripheral base address

void PIT_GetDefaultConfig(*pit_config_t* *psConfig)

Fill in the PIT config structure with the default settings.

This function initializes the PIT configuration structure to default values.

```
psConfig->eClockSource = kPIT_CountClockSource0;
psConfig->bEnableTimer = false;
psConfig->bEnableSlaveMode = false;
psConfig->ePrescaler = kPIT_PrescalerDivBy1;
psConfig->bEnableInterrupt = false;
psConfig->u32PeriodCount = 0xFFFFFFFFU;
psConfig->bEnableNegativeEdge = false;
psConfig->sPresetFilter.u16FilterSamplePeriod = 0x0U;
psConfig->sPresetFilter.u16FilterSampleCount = 0x0U;
psConfig->sPresetFilter.bFilterClock = true;
psConfig->sPresetFilter.eFilterPrescalerPeripheral = kPIT_PrescalerDivBy1;
psConfig->sSyncSource.u8StretchCount = 0x0U;
psConfig->sSyncSource.eSyncOutSel = kPIT_Syncout_Default;
```

Parameters

- psConfig – Pointer to user's PIT config structure.

static inline void PIT_EnableSlaveMode(PIT_Type *base, bool bEnable)

Enable/Disable PIT slave mode.

Parameters

- base – PIT peripheral base address
- bEnable – enable/disable slave mode

static inline void PIT_SetTimerPrescaler(PIT_Type *base, *pit_prescaler_value_t* ePrescaler)

Sets the PIT clock prescaler.

Parameters

- base – PIT peripheral base address
- ePrescaler – Timer prescaler value

static inline void PIT_SetTimerPeriod(PIT_Type *base, uint32_t u32PeriodCount)

Sets the timer period in units of count.

Timers begin counting from 0 until it reaches the value set by this function, then it generates an interrupt and counter resumes counting from 0 again.

Note: Users can call the utility macros provided in fsl_common.h to convert to ticks.

Parameters

- base – PIT peripheral base address
- u32PeriodCount – Timer period in units of ticks, use macro definition MSEC_TO_COUNT to convert value in ms to count of ticks, the PIT clock rate is source clock divide prescaler.

static inline uint32_t PIT_GetCurrentTimerCount(PIT_Type *base)

Reads the current timer counting value.

This function returns the real-time timer counting value, in a range from 0 to a timer period.

Note: Users can call the utility macros provided in fsl_common.h to convert ticks to usec or msec.

Parameters

- base – PIT peripheral base address

Returns

Current timer counting value in ticks, use macro definition COUNT_TO_MSEC to convert value in ticks to count of millisecond, the PIT clock rate is source clock divide prescaler.

static inline void PIT_StartTimer(PIT_Type *base)

Starts the timer counting.

After calling this function, timers load period value, count down to 0 and then load the respective start value again. Each time a timer reaches 0, it generates a trigger pulse and sets the timeout interrupt flag.

Parameters

- base – PIT peripheral base address

static inline void PIT_StopTimer(PIT_Type *base)

Stops the timer counting.

This function stops timer counting, and the counter remains at or returns to a 0 value.

Parameters

- base – PIT peripheral base address

static inline void PIT_EnableInterrupt(PIT_Type *base)

Enables the PIT interrupts.

Parameters

- base – PIT peripheral base address

static inline void PIT_DisableInterrupt(PIT_Type *base)

Disables the selected PIT interrupts.

Parameters

- base – PIT peripheral base address

static inline uint16_t PIT_GetStatusFlags(PIT_Type *base)

Gets the PIT status flags.

Parameters

- base – PIT peripheral base address

Returns

The status flags. This is the logical OR of members of the enumeration _pit_status_flags

static inline void PIT_ClearStatusFlags(PIT_Type *base)

Clears the PIT status flags.

Parameters

- base – PIT peripheral base address

static inline void PIT_SetPresetFiltConfig(PIT_Type *base, const *pit_config_filt_t* psConfig)

Set FILT configurations.

Parameters

- base – PIT peripheral base address
- psConfig – Pointer to user's PIT FILT config structure

static inline void PIT_SetSyncOutConfig(PIT_Type *base, const *pit_config_ctrl2_t* psConfig)

Set Sync configurations.

Parameters

- base – PIT peripheral base address
- psConfig – Pointer to user's PIT SYNC config structure

FSL_PIT_DRIVER_VERSION

PIT driver version.

enum _pit_prescaler_value

PIT clock prescaler values.

Values:

enumerator kPIT_PrescalerDivBy1

Clock divided by 1

enumerator kPIT_PrescalerDivBy2

Clock divided by 2

enumerator kPIT_PrescalerDivBy4

Clock divided by 4

enumerator kPIT_PrescalerDivBy8

Clock divided by 8

enumerator kPIT_PrescalerDivBy16

Clock divided by 16

enumerator kPIT_PrescalerDivBy32

Clock divided by 32

enumerator kPIT_PrescalerDivBy64

Clock divided by 64

enumerator kPIT_PrescalerDivBy128

Clock divided by 128

enumerator kPIT_PrescalerDivBy256

Clock divided by 256

enumerator kPIT_PrescalerDivBy512

Clock divided by 512

enumerator kPIT_PrescalerDivBy1024

Clock divided by 1024

enumerator kPIT_PrescalerDivBy2048

Clock divided by 2048

enumerator kPIT_PrescalerDivBy4096

Clock divided by 4096

enumerator kPIT_PrescalerDivBy8192
Clock divided by 8192

enumerator kPIT_PrescalerDivBy16384
Clock divided by 16384

enumerator kPIT_PrescalerDivBy32768
Clock divided by 32768

enum _pit_status_flags
List of PIT status flags.

Values:

enumerator kPIT_Timer_RollOverFlag
Timer roll over flag

enum _pit_syncout_mode
List of SYNC_OUT output mode.

Values:

enumerator kPIT_Syncout_Default
SYNC_OUT takes affect when PIT counter equals to the MODULO value (default)

enumerator kPIT_Syncout_Toggle
SYNC_OUT is in toggle mode

typedef enum *_pit_prescaler_value* pit_prescaler_value_t
PIT clock prescaler values.

typedef enum *_pit_syncout_mode* pit_syncout_mode_t
List of SYNC_OUT output mode.

typedef struct *_pit_config_filt* pit_config_filt_t
PIT FILT configuration structure.

This structure holds the configuration settings for the PIT FILT register. To initialize this structure to reasonable defaults, call the PIT_GetDefaultConfig() function and pass a pointer to your config structure instance.

The configuration structure can be made constant so it resides in flash.

typedef struct *_pit_config_ctrl2* pit_config_ctrl2_t
PIT CTRL2 configuration structure.

This structure holds the configuration settings for the PIT CTRL2 register. To initialize this structure to reasonable defaults, call the PIT_GetDefaultConfig() function and pass a pointer to your config structure instance.

The configuration structure can be made constant so it resides in flash.

typedef struct *_pit_config* pit_config_t
PIT configuration structure.

This structure holds the configuration settings for the PIT peripheral. To initialize this structure to reasonable defaults, call the PIT_GetDefaultConfig() function and pass a pointer to your config structure instance.

The configuration structure can be made constant so it resides in flash.

struct _pit_config_filt

#include <fsl_pit.h> PIT FILT configuration structure.

This structure holds the configuration settings for the PIT FILT register. To initialize this structure to reasonable defaults, call the PIT_GetDefaultConfig() function and pass a pointer to your config structure instance.

The configuration structure can be made constant so it resides in flash.

Public Members

bool bFilterClock

Filter Clock Source selection.

pit_prescaler_value_t eFilterPrescalerPeripheral

Sets the peripheral clock prescaler.

uint8_t u16FilterSampleCount

Input Filter Sample Count.

uint8_t u16FilterSamplePeriod

Input Filter Sample Period.

struct _pit_config_ctrl2

#include <fsl_pit.h> PIT CTRL2 configuration structure.

This structure holds the configuration settings for the PIT CTRL2 register. To initialize this structure to reasonable defaults, call the PIT_GetDefaultConfig() function and pass a pointer to your config structure instance.

The configuration structure can be made constant so it resides in flash.

Public Members

uint8_t u8StretchCount

The cycle number to be stretched for SYNC_OUT signal.

pit_syncout_mode_t eSyncOutSel

Select the output mode of SYNC_OUT.

struct _pit_config

#include <fsl_pit.h> PIT configuration structure.

This structure holds the configuration settings for the PIT peripheral. To initialize this structure to reasonable defaults, call the PIT_GetDefaultConfig() function and pass a pointer to your config structure instance.

The configuration structure can be made constant so it resides in flash.

Public Members

pit_prescaler_value_t ePrescaler

Clock prescaler value

bool bEnableInterrupt

Enable PIT Roll-Over Interrupt

bool bEnableSlaveMode

Enable the PIT module in slave mode, in which mode the timer will be triggered by master PIT enable.

bool bEnableTimer
PIT timer enable flag, which is false by default

pit_count_clock_source_t eClockSource
Specify the PIT count clock source

uint32_t u32PeriodCount
Timer period in clock cycles, Use macro definition MSEC_TO_COUNT to convert value in ms to count of ticks, the COP clock rate is source clock divide prescaler.

bool bEnableNegativeEdge
choose the polarity of Preset input.

pit_config_filt_t sPresetFilter
Specify the PIT preset filter source

pit_config_ctrl2_t sSyncSource
Specify the PIT Sync source

2.50 The Driver Change Log

2.51 PIT Peripheral and Driver Overview

2.52 PMC: Power Management Controller Driver

static inline void PMC_SetBandgapTrim(PMC_Type *base, uint8_t u8TrimValue)
Sets the trim value of the bandgap reference in the regulator.

Parameters

- base – PMC peripheral base address.
- u8TrimValue – The bandgap's trim value, ranges from 0 to 15.

static inline void PMC_EnableVoltageReferenceBuffer(PMC_Type *base, bool bEnable)
Enables/Disables a buffer that drivers the 1.2V bandgap reference to the ADC.

If the users want to calibrate the ADC using the 1.2V reference voltage, then the voltage reference buffer should be enabled. When ADC calibration is not being performed, the voltage reference buffer should be disabled to save power.

Parameters

- base – PMC peripheral base address.
- bEnable – Used to control the behaviour of voltage reference buffer.
  - **true** Enable voltage reference buffer.
  - **false** Disable voltage reference buffer.

static inline void PMC_EnableInterrupts(PMC_Type *base, uint16_t u16Interrupts)
Enables the interrups, including 2.2V high voltage interrupt, 2.7V/2.65V high voltage interrupt, 2.2V low voltage interrupt, 2.7V/2.65V low voltage interrupt.

Parameters

- base – PMC peripheral base address.
- u16Interrupts – The interupts to be enabled, should be the OR'ed value of _pmc_interrupt_enable.

static inline void PMC_DisableInterrupts(PMC_Type *base, uint16_t u16Interrupts)

Disables the interrups, including 2.2V high voltage interrupt, 2.7V/2.65V high voltage interrupt, 2.2V low voltage interrupt, 2.7V/2.65V low voltage interrupt.

Parameters

- base – PMC peripheral base address.
- u16Interrupts – The interupts to be disabled, should be the OR'ed value of _pmc_interrupt_enable.

static inline uint16_t PMC_GetStatusFlags(PMC_Type *base)

Gets the status flags of PMC module, such as low voltage interrpt flag, small regulator 2.7 active flag, etc.

Parameters

- base – PMC peripheral base address.

Returns

The status flags of PMC module, should be the OR'ed value of _pmc_status_flags.

static inline void PMC_ClearStatusFlags(PMC_Type *base, uint16_t u16StatusFlags)

Clears the status flags of PMC module, only low voltage interrupt flag, sticky 2.7V/2.65V low voltage flag, and sticky 2.2V low voltage flag can be cleared.

Parameters

- base – PMC peripheral base address.
- u16StatusFlags – The status flags to be cleared, should be the OR'ed value of kPMC_LowVoltageInterruptFlag, and kPMC_Sticky2P7VLowVoltageFlag/kPMC_Sticky2P65VLowVoltageFlag, and kPMC_Sticky2P2VLowVoltageFlag,

static inline void PMC_SetVrefTrim(PMC_Type *base, uint16_t u16TrimValue)

Sets the trim value of the Vref reference in the regulator.

Parameters

- base – PMC peripheral base address.
- u16TrimValue – The Vref's trim value, ranges from 0 to 31.

static inline void PMC_SetVcapTrim(PMC_Type *base, uint16_t u16TrimValue)

Sets the trim value of the Vacp reference in the regulator.

Parameters

- base – PMC peripheral base address.
- u16TrimValue – The Vacp's trim value, ranges from 0 to 15.

FSL_PMC_DRIVER_VERSION

PMC driver version.

enum _pmc_interrupt_enable

The enumeration of PMC voltage detection interrupts.

Values:

enumerator kPMC_2P2VLowVoltageInterruptEnable

If the input supply is currently dropped below the 2.2V level, generate the low voltage interrupt.

enumerator kPMC_2P2VHighVoltageInterruptEnable

If the input supply is currently raised above the 2.2V level, generate the low voltage interrupt.

enumerator kPMC_AllInterruptsEnable

enum _pmc_status_flags

The enumeration of PMC status flags.

Values:

enumerator kPMC_SmallRegulator2P7VActiveFlag

The small regulator 2.7V supply is ready to be used.

enumerator kPMC_LowVoltageInterruptFlag

The low voltage interrupt flag, used to indicate whether the low voltage interrupt is asserted.

enumerator kPMC_Sticky2P2VLowVoltageFlag

Input supply has dropped below the 2.2V threshold. This sticky flag indicates that the input supply dropped below the 2.2V level at some point.

enumerator kPMC_2P2VLowVoltageFlag

Input supply is below the 2.2V threshold.

enumerator kPMC_AllStatusFlags

2.53 The Driver Change Log

2.54 PMC Peripheral and Driver Overview

2.55 eFlexPWM: Enhanced Flexible Pulse Width Modulator Driver

void PWM_Init(PWM_Type *base, const *pwm_config_t* *psConfig)

Initialization PWM module with provided structure pwm_config_t.

This function can initial one or more submodules of the PWM module.

This examples shows how only initial submodule 0 without fault protection channel.

```
pwm_config_t sPwmConfig = {0};
pwm_sm_config_t sPwmSm0Config;
sPwmConfig.psPwmSubmoduleConfig[0] = &sPwmSm0Config;
PWM_GetSmDefaultConfig(&sPwmSm0Config);
PWM_Init(PWM, sPwmConfig);
```

Note: This API should be called at the beginning of the application using the PWM driver.

Parameters

- base – PWM peripheral base address.
- psConfig – Pointer to PWM module configure structure. See pwm_config_t.

void PWM_Deinit(PWM_Type *base)

De-initialization a PWM module.

Parameters

- base – PWM peripheral base address

void PWM_GetSMDefaultConfig(*pwm_sm_config_t* *psConfig)

Gets an default PWM submodule's configuration.

This function fills in the initialization structure member, which can make submodule generate 50% duty cycle center aligned PWM_A/B output.

The default effective values are:

```
psConfig->enableDebugMode = false;
psConfig->enableWaitMode = false;
psConfig->enableRun = false;
psConfig->sCounterConfig.eCountClockSource = kPWM_ClockSrcBusClock;
psConfig->sCounterConfig.eCountClockPrescale = kPWM_ClockPrescaleDivide1;
psConfig->sCounterConfig.eCountInitSource = kPWM_InitOnLocalSync;
psConfig->sReloadConfig.eReloadSignalSelect = kPWM_LocalReloadSignal;
psConfig->sReloadConfig.eLoclReloadEffectTime = kPWM_TakeEffectAtReloadOportunity;
psConfig->sReloadConfig.eLocalReloadOportunity = kPWM_LoadEveryOportunity;
psConfig->sReloadConfig.bEnableFullCycleReloadOportunity = true;
psConfig->sReloadConfig.bEnableHalfCycleReloadOportunity = false;
psConfig->sValRegisterConfig.u16CounterInitialValue = 0xFF00U;
psConfig->sValRegisterConfig.u16ValRegister0 = 0x0U;
psConfig->sValRegisterConfig.u16ValRegister1 = 0x00FFU;
psConfig->sValRegisterConfig.u16ValRegister2 = 0xFF80U;
psConfig->sValRegisterConfig.u16ValRegister3 = 0x80U;
psConfig->sValRegisterConfig.u16ValRegister4 = 0xFF80U;
psConfig->sValRegisterConfig.u16ValRegister5 = 0x80U;
psConfig->sForceConfig.eForceSignalSelect = kPWM_LocalSoftwareForce;
psConfig->sForceConfig.eSoftOutputFor23 = kPWM_SoftwareOutputLow;
psConfig->sForceConfig.eSoftOutputFor45 = kPWM_SoftwareOutputLow;
psConfig->sForceConfig.eForceOutput23 = kPWM_GeneratedPwm;
psConfig->sForceConfig.eForceOutput45 = kPWM_GeneratedPwm;
psConfig->sDeadTimeConfig.eMode = kPWM_Independent;
psConfig->sOutputConfig.ePwmXSignalSelect = kPWM_RawPwmX;
psConfig->sOutputConfig.bEnablePwmxOutput = true;
psConfig->sOutputConfig.bEnablePwmaOutput = true;
psConfig->sOutputConfig.bEnablePwmbOutput = true;
psConfig->sOutputConfig.ePwmxFaultState = kPWM_OutputLowOnFault;
psConfig->sOutputConfig.ePwmaFaultState = kPWM_OutputLowOnFault;
psConfig->sOutputConfig.ePwmbFaultState = kPWM_OutputLowOnFault;
```

Parameters

- psConfig – Pointer to user's PWM submodule config structure. See pwm_sm_config_t.

void PWM_GetFaultProtectionDefaultConfig(*pwm_fault_protection_config_t* *psConfig)

Gets an default fault protection channel's configuration.

The default effective values are:

```
psConfig->sFaultInput[i].eFaultActiveLevel = kPWM_Logic0;
psConfig->sFaultInput[i].bEnableAutoFaultClear = true;
psConfig->sFaultInput[i].bEnableFaultFullCycleRecovery = true;
```

Parameters

- psConfig – Pointer to user's PWM fault protection config structure. See pwm_fault_protection_config_t.

void PWM_SetupSMConfig(PWM_Type *base, *pwm_sm_number_t* eSubModule, const *pwm_sm_config_t* *psConfig)

Sets up the PWM submodule configure.

Parameters

- base – PWM peripheral base address
- eSubModule – PWM submodule number, see pwm_sm_number_t.
- psConfig – Pointer to submodule configure structure, see pwm_sm_config_t.

static inline void PWM_SetupCounterConfig(PWM_Type *base, *pwm_sm_number_t* eSubModule, const *pwm_sm_counter_config_t* *psConfig)

Sets up the PWM submodule counter configure.

Parameters

- base – PWM peripheral base address
- eSubModule – PWM submodule number, see pwm_sm_number_t.
- psConfig – Pointer to submodule counter configure structure, see pwm_sm_counter_config_t.

static inline void PWM_SetCounterInitialValue(PWM_Type *base, *pwm_sm_number_t* eSubModule, uint16_t u16InitialValue)

Sets the PWM submodule counter initial register value.

This function set the INIT register value, the counter will start counting from INIT register value when initial signal assert or software force set. This write value will be loaded into inner set of buffered registers according to reload logic configure.

Parameters

- base – PWM peripheral base address
- eSubModule – PWM submodule number, see pwm_sm_number_t.
- u16InitialValue – The submodule number counter initialize value.

static inline void PWM_SetupReloadLogicConfig(PWM_Type *base, *pwm_sm_number_t* eSubModule, const *pwm_sm_reload_logic_config_t* *psConfig)

Sets up the PWM submodule reload logic configure.

Parameters

- base – PWM peripheral base address.
- eSubModule – PWM submodule number, see pwm_sm_number_t.
- psConfig – Pointer to submodule reload logic configure structure, see pwm_sm_reload_logic_config_t.

void PWM_GetValueConfig(*pwm_sm_value_register_config_t* *psConfig, *pwm_sm_typical_output_mode_t* eTypicalOutputMode, uint16_t u16PwmPeriod, uint16_t u16PwmAPulseWidth, uint16_t u16PwmBPulseWidth)

Update PWM submodule compare value configuration according to the typical output mode.

Parameters

- psConfig – See pwm_sm_config_t.

- eTypicalOutputMode – Typical PWM_A/B output mode. See pwm_sm_typical_output_mode_t.
- u16PwmPeriod – PWM output period value in counter ticks. This value can be got by (main counter clock in Hz) / (wanted PWM signal frequency in Hz).
- u16PwmAPulseWidth – PWM_A pulse width value in counter ticks. Can got by (wanted PWM duty Cycle) * u16PwmPeriod.
- u16PwmBPulseWidth – PWM_B pulse width value in counter ticks. Can got by (wanted PWM duty Cycle) * u16PwmPeriod.

static inline void PWM_SetupValRegisterConfig(PWM_Type *base, *pwm_sm_number_t* eSubModule, const *pwm_sm_value_register_config_t* *psConfig)

Sets up the PWM submodule VALn registers logic configure.

Parameters

- base – PWM peripheral base address.
- eSubModule – PWM submodule number, see pwm_sm_number_t.
- psConfig – Pointer to VALn registers configure structure, see pwm_sm_value_register_config_t.

static inline void PWM_SetValueRegister(PWM_Type *base, *pwm_sm_number_t* eSubModule, *pwm_sm_val_register_t* eRegister, uint16_t u16Value)

Sets the PWM submodule VALn register value.

Note: These write value will be loaded into inner set of buffered registers according to reload logic configure.

Parameters

- base – PWM peripheral base address.
- eSubModule – PWM submodule number, see pwm_sm_number_t.
- eRegister – Value register index (range in 0~5), see pwm_sm_val_register_t.
- u16Value – The value for VALn register.

static inline uint16_t PWM_GetValueRegister(PWM_Type *base, *pwm_sm_number_t* eSubModule, *pwm_sm_val_register_t* eRegister)

Gets the PWM submodule VALn register value.

Parameters

- base – PWM peripheral base address.
- eSubModule – PWM submodule number, see pwm_sm_number_t.
- eRegister – Value register index (range in 0~5), see pwm_sm_val_register_t.

Returns

The VALn register value.

static inline void PWM_SetFracvalRegister(PWM_Type *base, *pwm_sm_number_t* eSubModule, *pwm_sm_fracval_register_t* eRegister, uint16_t u16Value)

Sets the PWM submodule fractional value register value.

Note: These write value will be loaded into inner set of buffered registers according to reload logic configure.

Parameters

- base – PWM peripheral base address.
- eSubModule – PWM submodule number, see pwm_sm_number_t.
- eRegister – Fractional value register index (range in 1~5), see pwm_sm_val_register_t.
- u16Value – The value for FRACVALn register.

static inline uint16_t PWM_GetFracvalRegister(PWM_Type *base, *pwm_sm_number_t* eSubModule, *pwm_sm_fracval_register_t* eRegister)

Sets the PWM submodule fractional value register value.

Parameters

- base – PWM peripheral base address.
- eSubModule – PWM submodule number, see pwm_sm_number_t.
- eRegister – Fractional value register index (range in 1~5), see pwm_sm_fracval_register_t.

Returns

The VALn FRACVALn value.

static inline void PWM_SetValueAndFracRegister(PWM_Type *base, *pwm_sm_number_t* eSubModule, *pwm_sm_fracval_register_t* eRegister, uint32_t u32Value)

Set submodule register VALx and its FRAC value with 32bit access.

Parameters

- base – PWM peripheral base address.
- eSubModule – Submodule ID.
- eRegister – Fractional value register index (range in 1~5), see pwm_sm_fracval_register_t.
- u32Value – 32bit value for VALx and its FRAC. VALx: BIT16~BIT31. FRACVALx: BIT11~BIT15. RESERVED: BIT10~BIT0.

static inline uint32_t PWM_GetValueAndFracRegister(PWM_Type *base, *pwm_sm_number_t* eSubModule, *pwm_sm_fracval_register_t* eRegister)

Get submodule register VALx and its FRAC value with 32bit access.

Parameters

- base – PWM peripheral base address.
- eSubModule – Submodule ID.
- eRegister – Fractional value register index (range in 1~5), see pwm_sm_fracval_register_t.

Returns

The value of submodule register VALx and its FRAC, combined into 32bit. VALx: BIT16~BIT31. FRACVALx: BIT11~BIT15. RESERVED: BIT10~BIT0.

static inline void PWM_SetPwmLdok(PWM_Type *base, uint16_t u16Mask)

Set the PWM LDOK bit on a single or multiple submodules.

Enable this feature can make buffered CTRL[PRSC] and the INIT, FRACVAL and VAL registers values take effect after next local load signal assert. The timing of take effect can be the next PWM reload or immediately. After loading, MCTRL[LDOK] is automatically cleared and need to enable again before the next register updated.

Note: The VALx, FRACVALx,INIT, and CTRL[PRSC] registers of the corresponding submodule cannot be written while the the corresponding MCTRL[LDOK] bit is set.

Parameters

- base – PWM peripheral base address
- u16Mask – PWM submodules to set the LDOK bit, Logical OR of _pwm_sm_enable.

static inline void PWM_ClearPwmLdok(PWM_Type *base, uint16_t u16Mask)

Clear the PWM LDOK bit on a single or multiple submodules.

Parameters

- base – PWM peripheral base address
- u16Mask – PWM submodules to clear the LDOK bit, Logical OR of _pwm_sm_enable.

static inline void PWM_SetupForceLogicConfig(PWM_Type *base, *pwm_sm_number_t* eSubModule, const *pwm_sm_force_logic_config_t* *psConfig)

brief Sets up the PWM submodule force logic configure.

param base PWM peripheral base address. param eSubModule PWM submodule number, see pwm_sm_number_t. param psConfig Poniter to submodule force logic configure structure, see pwm_sm_force_logic_config_t.

static inline void PWM_SetSoftwareForce(PWM_Type *base, *pwm_sm_number_t* eSubModule)

Sets up the PWM Sub-Module to trigger a software FORCE_OUT event.

Note: Only works when the CTRL2[FORCE_SEL] select kPWM_ForceOutOnLocalSoftware.

Parameters

- base – PWM peripheral base address.
- eSubModule – PWM submodule number, see pwm_sm_number_t.

void PWM_SetupDeadtimeConfig(PWM_Type *base, *pwm_sm_number_t* eSubModule, const *pwm_sm_deadtime_logic_config_t* *psConfig)

Sets up the PWM submodule deadtime logic configure.

Parameters

- base – PWM peripheral base address.
- eSubModule – PWM submodule number, see pwm_sm_number_t.
- psConfig – Pointer to deadtime logic configure structure, see pwm_sm_deadtime_logic_config_t.

static inline uint16_t PWM_GetDeadtimeSampleValue(PWM_Type *base, *pwm_sm_number_t* eSubModule)

Get the sampled values of the PWM_X input at the end of each deadtime.

When use PWM_A/B in complementary mode and connect to transistor to controls the output voltage. Need insert deadtime to avoid overlap of conducting interval between the top and bottom transistor. And both transistors in complementary mode are off during deadtime. Then connect the PWM_X input to complementary transistors output, then it sampling input at the end of deadtime 0 for DT[0] and the end of deadtime 1 for DT[1]. Which DT value is not 0 indicates that there is a problem with the corresponding deadtime value. This can help to decide if there need do a deadtime correction for current complementary PWM output.

Parameters

- base – PWM peripheral base address
- eSubModule – PWM submodule number, see pwm_sm_number_t.

Returns

The PWM_X input sampled values.

void PWM_SetupFractionalDelayConfig(PWM_Type *base, *pwm_sm_number_t* eSubModule, const *pwm_sm_fractional_delay_logic_config_t* *psConfig)

Sets up the PWM submodule fractional delay logic configure.

Note: The fractional delay logic can only be used when the IPBus clock is running at 100 MHz.

Parameters

- base – PWM peripheral base address.
- eSubModule – PWM submodule number, see pwm_sm_number_t.
- psConfig – Pointer to fractional delay logic configure structure, see pwm_sm_fractional_delay_logic_config_t.

void PWM_SetupOutputConfig(PWM_Type *base, *pwm_sm_number_t* eSubModule, const *pwm_sm_output_logic_config_t* *psConfig)

Sets up the PWM submodule output logic configure.

Parameters

- base – PWM peripheral base address.
- eSubModule – PWM submodule number, see pwm_sm_number_t.
- psConfig – Pointer to output logic configure structure, see pwm_sm_output_logic_config_t.

static inline void PWM_EnableOutput(PWM_Type *base, uint16_t u16SubModules, *pwm_sm_pwm_out_t* eOutput)

Enables the PWM submodule pin output.

This function handles PWMX_EN/PWMA_EN/PWMB_EN bit filed of OUTEN register, whcih can enable one or more submodule pin in PWMX/A/B.

Parameters

- base – PWM peripheral base address
- u16SubModules – The submodules that enable eOutput output, logical OR of _pwm_sm_enable.

- eOutput – PWM output pin ID, see pwm_sm_pwm_out_t.

static inline void PWM_DisableOutput(PWM_Type *base, uint16_t u16SubModules, *pwm_sm_pwm_out_t* eOutput)

Disables the PWM submodule pin output.

This function handles PWMX_EN/PWMA_EN/PWMB_EN bit filed of OUTEN register, whcih can disable one or more submodule pin in PWMX/A/B.

Parameters

- base – PWM peripheral base address
- u16SubModules – The submodules that disable eOutput output, logical OR of _pwm_sm_enable.
- eOutput – PWM output pin ID, see pwm_sm_pwm_out_t.

static inline void PWM_EnableCombinedOutput(PWM_Type *base, uint16_t u16XSubModules, uint16_t u16ASubModules, uint16_t u16BSubModules)

Enables the PWM pin combination output.

This function handles PWMX_EN/PWMA_EN/PWMB_EN bit filed of OUTEN register at the same time.

Parameters

- base – PWM peripheral base address
- u16XSubModules – The submodules that enable PWMX output, should be logical OR of _pwm_sm_enable.
- u16ASubModules – The submodules that enable PWMA output, should be logical OR of _pwm_sm_enable.
- u16BSubModules – The submodules that enable PWMB output, should be logical OR of _pwm_sm_enable.

static inline void PWM_DisableCombinedOutput(PWM_Type *base, uint16_t u16XSubModules, uint16_t u16ASubModules, uint16_t u16BSubModules)

Disables the PWM pin combination output.

This function handles PWMX_EN/PWMA_EN/PWMB_EN bit filed of OUTEN register at the same time.

Parameters

- base – PWM peripheral base address
- u16XSubModules – The submodules that disable PWMX output, should be logical OR of _pwm_sm_enable.
- u16ASubModules – The submodules that disable PWMA output, should be logical OR of _pwm_sm_enable.
- u16BSubModules – The submodules that disable PWMB output, should be logical OR of _pwm_sm_enable.

static inline void PWM_MaskOutput(PWM_Type *base, uint16_t u16SubModules, *pwm_sm_pwm_out_t* eOutput)

Mask the PWM pin output.

This function handles MASKA/MASKB/MASKX bit filed of MASK register, which can mask one or more submodule pin in PWMX/A/B.

Note: The mask bits is buffered and can be updated until a FORCE_OUT event occurs or a software update command.

Parameters

- base – PWM peripheral base address.
- u16SubModules – The submodules that mask eOutput output, logical OR of _pwm_sm_enable.
- eOutput – PWM output pin ID, see pwm_sm_pwm_out_t.

static inline void PWM_UnmaskOutput(PWM_Type *base, uint16_t u16SubModules, *pwm_sm_pwm_out_t* eOutput)

Unmask the PWM pin output.

This function handles MASKA/MASKB/MASKX bit filed of MASK register, which can mask one or more submodule pin in PWMX/A/B.

Note: The mask bits is buffered and can be updated until a FORCE_OUT event occurs or a software update command.

Parameters

- base – PWM peripheral base address
- u16SubModules – The submodules that unmask eOutput output, logical OR of _pwm_sm_enable.
- eOutput – PWM output pin ID, see pwm_sm_pwm_out_t.

static inline void PWM_MaskCombinedOutput(PWM_Type *base, uint16_t u16XSubModules, uint16_t u16ASubModules, uint16_t u16BSubModules)

Mask the PWM pin combination output.

This function handles MASKA/MASKB/MASKX bit filed of MASK register at the same time.

Note: The mask bits is buffered and can be updated until a FORCE_OUT event occurs or a software update command.

Parameters

- base – PWM peripheral base address
- u16XSubModules – The submodules that mask PWMX output, should be logical OR of _pwm_sm_enable.
- u16ASubModules – The submodules that mask PWMA output, should be logical OR of _pwm_sm_enable.
- u16BSubModules – The submodules that mask PWMB output, should be logical OR of _pwm_sm_enable.

static inline void PWM_UnmaskCombinedOutput(PWM_Type *base, uint16_t u16XSubModules, uint16_t u16ASubModules, uint16_t u16BSubModules)

Unmask the PWM pin combination output.

This function handles MASKA/MASKB/MASKX bit filed of MASK register at the same time.

Note: The mask bits is buffered and can be updated until a FORCE_OUT event occurs or a software update command.

Parameters

- base – PWM peripheral base address
- u16XSubModules – The submodules that unmask PWMX output, should be logical OR of _pwm_sm_enable.
- u16ASubModules – The submodules that unmask PWMA output, should be logical OR of _pwm_sm_enable.
- u16BSubModules – The submodules that unmask PWMB output, should be logical OR of _pwm_sm_enable.

static inline void PWM_UpdateMask(PWM_Type *base, *pwm_sm_number_t* eSubModule)

Update PWM output mask bits immediately with a software command.

Parameters

- base – PWM peripheral base address
- eSubModule – PWM submodule number, see pwm_sm_number_t.

static inline void PWM_EnablePwmRunInDebug(PWM_Type *base, *pwm_sm_number_t* eSubModule, bool bEnable)

Enables/Disables the PWM submodule continue to run while the chip is in DEBUG mode.

Parameters

- base – PWM peripheral base address
- eSubModule – PWM submodule number, see pwm_sm_number_t.
- bEnable – Enable the feature or not.
  - **true** Enable load feature.
  - **false** Disable load feature.

static inline void PWM_EnablePwmRunInWait(PWM_Type *base, *pwm_sm_number_t* eSubModule, bool bEnable)

Enables/Disables the PWM submodule continue to run while the chip is in WAIT mode.

Parameters

- base – PWM peripheral base address
- eSubModule – PWM submodule number, see pwm_sm_number_t.
- bEnable – Enable the feature or not.
  - **true** Enable load feature.
  - **false** Disable load feature.

static inline void PWM_EnableCounters(PWM_Type *base, uint16_t u16Mask)

Starts the PWM submodule counter for a single or multiple submodules.

Sets the Run bit which enables the clocks to the PWM submodule. This function can start multiple submodules at the same time.

Parameters

- base – PWM peripheral base address
- u16Mask – PWM submodules to start run, Logical OR of _pwm_sm_enable.

static inline void PWM_DisableCounters(PWM_Type *base, uint16_t u16Mask)

Stops the PWM counter for a single or multiple submodules.

Clears the Run bit which resets the submodule's counter. This function can stop multiple submodules at the same time.

Parameters

- base – PWM peripheral base address
- u16Mask – PWM submodules to start run, Logical OR of _pwm_sm_enable.

static inline uint16_t PWM_GetCaptureValue(PWM_Type *base, *pwm_sm_number_t* eSubModule, *pwm_sm_input_capture_register_t* eRegister)

Reads PWM submodule input capture value register.

This function read the CVALn register value, stores the value captured from the submodule counter.

Parameters

- base – PWM peripheral base address.
- eSubModule – PWM submodule number, see pwm_sm_number_t.
- eRegister – PWM submodule input capture value register, see pwm_sm_input_capture_register_t.

Returns

The input capture value.

static inline uint16_t PWM_GetCaptureValueCycle(PWM_Type *base, *pwm_sm_number_t* eSubModule, *pwm_sm_input_capture_register_t* eRegister)

Reads PWM submodule input capture value cycle register.

This function read the CVALnCYC register value, stores the cycle number corresponding to the value captured in CVALn. This register is incremented each time the counter is loaded with the INIT value at the end of a PWM modulo cycle.

Parameters

- base – PWM peripheral base address.
- eSubModule – PWM submodule number, see pwm_sm_number_t.
- eRegister – PWM submodule input capture value register, see pwm_sm_input_capture_register_t.

Returns

The input capture register cycle value.

static inline uint16_t PWM_GetCaptureEdgeCounterVaule(PWM_Type *base, *pwm_sm_number_t* eSubModule, *pwm_sm_input_capture_pin_t* eInputPin)

Reads the PWM submodule input capture logic edge counter value.

Each input capture logic has a edge counter, which counts both the rising and falling edges of the input capture signal and it compare signal can select as input capture trigger source.

Parameters

- base – PWM peripheral base address.
- eSubModule – PWM submodule number, see pwm_sm_number_t.

- eInputPin – PWM submodule input capture pin number, see pwm_sm_input_capture_pin_t.

void PWM_SetupInputCaptureConfig(PWM_Type *base, *pwm_sm_number_t* eSubModule, *pwm_sm_input_capture_pin_t* eInputPin, const *pwm_sm_input_capture_config_t* *psConfig)

Sets up the PWM submodule input capture configure.

Each PWM submodule has 3 pins that can be configured for use as input capture pins. This function sets up the capture parameters for each pin and enables the input capture operation.

Parameters

- base – PWM peripheral base address.
- eSubModule – PWM submodule number, see pwm_sm_number_t.
- eInputPin – PWM submodule input capture pin number, see pwm_sm_input_capture_pin_t.
- psConfig – Pointer to input capture configure structure, see pwm_sm_input_capture_config_t.

static inline void PWM_EnableInputCapture(PWM_Type *base, *pwm_sm_number_t* eSubModule, *pwm_sm_input_capture_pin_t* eInputPin)

Enables the PWM submodule input capture operation.

Enables input capture operation will start the input capture process. The enable bit is self-cleared when in one shot mode and one or more of the enabled capture circuits has had a capture event.

Parameters

- base – PWM peripheral base address.
- eSubModule – PWM submodule number, see pwm_sm_number_t.
- eInputPin – PWM submodule input capture pin number, see pwm_sm_input_capture_pin_t.

static inline void PWM_DisableInputCapture(PWM_Type *base, *pwm_sm_number_t* eSubModule, *pwm_sm_input_capture_pin_t* eInputPin)

Disables the PWM submodule input capture operation.

The enable bit can be cleared at any time to disable input capture operation.

Parameters

- base – PWM peripheral base address.
- eSubModule – PWM submodule number, see pwm_sm_number_t.
- eInputPin – PWM submodule input capture pin number, see pwm_sm_input_capture_pin_t.

static inline uint16_t PWM_GetInputValue(PWM_Type *base, *pwm_sm_number_t* eSubModule, *pwm_sm_input_capture_pin_t* eInputPin)

Get the logic value currently being driven into the PWM inputs.

Parameters

- base – PWM peripheral base address
- eSubModule – PWM submodule number, see pwm_sm_number_t.
- eInputPin – PWM submodule input capture pin number, see pwm_sm_input_capture_pin_t.

Returns
The PWM submodule input capture pin logic value.

void PWM_SetupFaultProtectionConfig(PWM_Type *base, *pwm_fault_protection_channel_t* eFaultProtection, const *pwm_fault_protection_config_t* *psConfig)

Sets up the PWM fault protection channel configure.

Parameters

- base – PWM peripheral base address.
- eFaultProtection – PWM fault protection channel number, see pwm_fault_protection_channel_t.
- psConfig – Pointer to fault protection channel configure structure, see pwm_fault_protection_config_t.

static inline void PWM_SetupSMFaultInputMapping(PWM_Type *base, *pwm_sm_number_t* eSubModule, *pwm_sm_pwm_out_t* ePwmOutput, const *pwm_sm_fault_input_mapping_t* *psMapping)

Mapping fault protection channel fault input status to PWM submodule output,.

Note: Each PWM output can be mapping anyone or more fault inputs. The mapped fault protection channel inputs can disable PWM output.

Parameters

- base – PWM peripheral base address.
- eSubModule – PWM submodule number, see pwm_sm_number_t.
- ePwmOutput – PWM submodule output, see pwm_sm_pwm_out_t.
- psMapping – The fault input disable mapping structure, see pwm_sm_fault_input_mapping_t.

void PWM_SetupDmaConfig(PWM_Type *base, *pwm_sm_number_t* eSubModule, const *pwm_sm_dma_config_t* *psConfig)

Sets up the PWM submodule DMA configure.

Parameters

- base – PWM peripheral base address.
- eSubModule – PWM submodule number, see pwm_sm_number_t.
- psConfig – Pointer to PWM submodule DMA configure, see pwm_sm_dma_config_t.

static inline void PWM_SetEnabledCaptureDmaSource(PWM_Type *base, *pwm_sm_number_t* eSubModule, *pwm_sm_capture_dma_source_t* eCaptureDmaSource)

Select the trigger source for enabled capture FIFOs DMA read request.

Note: This function only can be used when the bEnableCaptureDMA be true.

Parameters

- base – PWM peripheral base address.
- eSubModule – PWM submodule number, see pwm_sm_number_t.
- eCaptureDmaSource – The PWM DMA capture source.

static inline void PWM_EnableSMInterrupts(PWM_Type *base, *pwm_sm_number_t* eSubModule, uint16_t u16Mask)

Enables the PWM submodule interrupts according to a provided mask.

This examples shows how to enable VAL 0 compare interrupt and VAL 1 compare interrupt.

```
PWM_EnableSMInterrupts(PWM, kPWM_SubModule0, kPWM_CompareVal0InterruptEnable |
kPWM_CompareVal1InterruptEnable);
```

Parameters

- base – PWM peripheral base address
- eSubModule – PWM submodule number, see pwm_sm_number_t.
- u16Mask – The PWM submodule interrupts to enable. Logical OR of _pwm_sm_interrupt_enable.

static inline void PWM_DisbaleSMInterrupts(PWM_Type *base, *pwm_sm_number_t* eSubModule, uint16_t u16Mask)

Disables the PWM submodule interrupts according to a provided mask.

This examples shows how to disable VAL 0 compare interrupt and VAL 1 compare interrupt.

```
PWM_DisbaleSMInterrupts(PWM, kPWM_SubModule0, kPWM_CompareVal0InterruptEnable |
kPWM_CompareVal1InterruptEnable);
```

Parameters

- base – PWM peripheral base address
- eSubModule – PWM submodule number, see pwm_sm_number_t.
- u16Mask – The PWM submodule interrupts to enable. Logical OR of _pwm_sm_interrupt_enable.

static inline void PWM_EnableFaultInterrupts(PWM_Type *base, *pwm_fault_protection_channel_t* eFaultProtection, uint16_t u16Mask)

Enables the PWM fault protection channel interrupt according to a provided mask.

This examples shows how to enable fault pin 0 interrupt and fault pin 1 interrupt.

```
PWM_EnableFaultInterrupts(PWM, kPWM_FaultProtection0, kPWM_Fault0InterruptEnable |
kPWM_Fault1InterruptEnable);
```

Parameters

- base – PWM peripheral base address
- eFaultProtection – PWM fault protection channel number, see pwm_fault_protection_channel_t.
- u16Mask – The PWM fault protection channel interrupts to enable. Logical OR of _pwm_fault_protection_interrupt_enable.

static inline void PWM_DisableFaultInterrupts(PWM_Type *base, *pwm_fault_protection_channel_t* eFaultProtection, uint16_t u16Mask)

Disables the PWM fault protection channel interrupt according to a provided mask.

This examples shows how to disable fault pin 0 interrupt and fault pin 1 interrupt.

```
PWM_DisableFaultInterrupts(PWM, kPWM_FaultProtection0, kPWM_Fault0InterruptEnable |
kPWM_Fault1InterruptEnable);
```

Parameters

- base – PWM peripheral base address
- eFaultProtection – PWM fault protection channel number, see pwm_fault_protection_channel_t.
- u16Mask – The PWM fault protection channel interrupts to disable. Logical OR of _pwm_fault_protection_interrupt_enable.

static inline uint16_t PWM_GetSMStatusFlags(PWM_Type *base, *pwm_sm_number_t* eSubModule)

Gets the PWM submodule status flags.

This examples shows how to check whether the submodule VAL0 compare flag set.

```
if((PWM_GetSMStatusFlags(PWM, kPWM_SubModule0) & kPWM_CompareVal0Flag) != 0U)
{
    ...
}
```

Parameters

- base – PWM peripheral base address
- eSubModule – PWM submodule number, see pwm_sm_number_t.

Returns

The PWM submodule status flags. This is the logical OR of pwm_sm_status_flags_t.

static inline void PWM_ClearSMStatusFlags(PWM_Type *base, *pwm_sm_number_t* eSubModule, uint16_t u16Mask)

Clears the PWM submodule status flags.

This examples shows how to clear the submodule VAL0 compare flag.

```
PWM_ClearSMStatusFlags(PWM, kPWM_SubModule0, kPWM_CompareVal0Flag);
```

Note: The kPWM_RegUpdatedFlag can't be cleared by software.

Parameters

- base – PWM peripheral base address
- eSubModule – PWM submodule number, see pwm_sm_number_t.
- u16Mask – The status flags to clear. This is the logical OR of pwm_sm_status_flags_t.

static inline uint16_t PWM_GetFaultStatusFlags(PWM_Type *base, *pwm_fault_protection_channel_t* eFaultProtection)

Gets the PWM fault protection status flags.

This examples shows how to check whether the fault protection channel fault input pin 0 set.

```
if((PWM_GetFaultStatusFlags(PWM, kPWM_FaultProtection0) & kPWM_FaultPin0Flag) != 0U)
{
    ...
}
```

Parameters

- base – PWM peripheral base address
- eFaultProtection – PWM fault protection channel number, see pwm_fault_protection_channel_t.

Returns

The PWM fault protection channel status flags. This is the logical OR of _pwm_fault_protection_status_flags.

static inline void PWM_ClearFaultStatusFlags(PWM_Type *base, *pwm_fault_protection_channel_t* eFaultProtection, uint16_t u16Mask)

Clears the PWM fault protection status flags according to a provided mask.

This examples shows how to clear the fault protection channel fault 0 flag.

```
PWM_ClearFaultStatusFlags(PWM, kPWM_FaultProtection0, kPWM_Fault0Flag);
```

Note: The kPWM_FaultPin0ActiveFlag ~ kPWM_FaultPin3ActiveFlag can't be cleared by software.

Parameters

- base – PWM peripheral base address
- eFaultProtection – PWM fault protection channel number, see pwm_fault_protection_channel_t.
- u16Mask – The PWM fault protection status flags to be clear. Logical OR of _pwm_fault_protection_status_flags.

FSL_PWM_DRIVER_VERSION

PWM driver version.

enum _pwm_sm_number

The enumeration for PWM submodule number.

Values:

enumerator kPWM_SubModule0

PWM Submodule 0

enumerator kPWM_SubModule1

PWM Submodule 1

enumerator kPWM_SubModule2

PWM Submodule 2

enumerator kPWM_SubModule3
PWM Submodule 3

enum _pwm_sm_enable
The enumeration for PWM submodule enable.

Values:

enumerator kPWM_SubModule0Enable
PWM Submodule 0 enable.

enumerator kPWM_SubModule1Enable
PWM Submodule 1 enable.

enumerator kPWM_SubModule2Enable
PWM Submodule 2 enable.

enumerator kPWM_SubModule3Enable
PWM Submodule 3 enable.

enumerator kPWM_ALLSubModuleEnable

enum _pwm_sm_count_clock_source
The enumeration for PWM submodule clock source.

Values:

enumerator kPWM_ClockSrcBusClock
The IPBus clock is used as the source clock

enumerator kPWM_ClockSrcExternalClock
EXT_CLK is used as the source clock

enumerator kPWM_ClockSrcSubmodule0Clock
Clock of the submodule 0 (AUX_CLK) is used as the source clock

enum _pwm_sm_count_clock_prescaler
The enumeration for PWM submodule prescaler factor selection for clock source.

Values:

enumerator kPWM_ClockPrescaleDivide1
PWM submodule clock frequency = fclk/1

enumerator kPWM_ClockPrescaleDivide2
PWM submodule clock frequency = fclk/2

enumerator kPWM_ClockPrescaleDivide4
PWM submodule clock frequency = fclk/4

enumerator kPWM_ClockPrescaleDivide8
PWM submodule clock frequency = fclk/8

enumerator kPWM_ClockPrescaleDivide16
PWM submodule clock frequency = fclk/16

enumerator kPWM_ClockPrescaleDivide32
PWM submodule clock frequency = fclk/32

enumerator kPWM_ClockPrescaleDivide64
PWM submodule clock frequency = fclk/64

enumerator kPWM_ClockPrescaleDivide128
PWM submodule clock frequency = fclk/128

enum _pwm_sm_count_init_source
The enumeration for PWM submodule counter initialization options.

Values:

enumerator kPWM_InitOnLocalSync
Local sync causes initialization

enumerator kPWM_InitOnMasterReload
Master reload from submodule 0 causes initialization

enumerator kPWM_InitOnMasterSync
Master sync from submodule 0 causes initialization

enumerator kPWM_InitOnExtSync
EXT_SYNC causes initialization

enum _pwm_ml2_stretch_count_clock_prescaler
The enumeration for PWM stretch IPBus clock count prescaler for mux0_trig/mux1_trig/out0_trig/out1_trig/pwma_trig/pwmb_trig.

Values:

enumerator kPWM_StretchIPBusClockPrescaler1
Stretch count is zero, no stretch.

enumerator kPWM_StretchIPBusClockPrescaler2
Stretch mux0_trig/mux1_trig/out0_trig/out1_trig/pwma_trig/pwmb_trig for 2 IPBus clock period.

enumerator kPWM_StretchIPBusClockPrescaler4
Stretch mux0_trig/mux1_trig/out0_trig/out1_trig/pwma_trig/pwmb_trig for 4 IPBus clock period.

enumerator kPWM_StretchIPBusClockPrescaler8
Stretch mux0_trig/mux1_trig/out0_trig/out1_trig/pwma_trig/pwmb_trig for 8 IPBus clock period.

enum _pwm_sm_reload_signal_select
The enumeration for PWM submodule local reload take effect timing.

Values:

enumerator kPWM_LocalReloadSignal
The local RELOAD signal is used to reload buffered-registers.

enumerator kPWM_MasterReloadSignal
The master RELOAD signal (from submodule 0) is used to reload buffered-registers (should not be used in submodule 0).

enum _pwm_sm_local_reload_effect_timing
The enumeration for PWM submodule local reload take effect timing.

Values:

enumerator kPWM_TakeEffectAtReloadOportunity
Buffered-registers reload after one/more reload opportunities, and a load opportunity can generate on a PWM half or/and full cycle.

enumerator kPWM_TakeEffectImmediately
Buffered-registers reload with new values as soon as MCTRL[LDOK] bit is set when choose local reload.

enum _pwm_sm_local_reload_oportunity

The enumeration for PWM submodule reload opportunities selection under kPWM_ReloadWithLocalReloadOportunity.

Values:

enumerator kPWM_LoadEveryOportunity

Every PWM submodule reload opportunity

enumerator kPWM_LoadEvery2Oportunity

Every 2 PWM submodule reload opportunities

enumerator kPWM_LoadEvery3Oportunity

Every 3 PWM submodule reload opportunities

enumerator kPWM_LoadEvery4Oportunity

Every 4 PWM submodule reload opportunities

enumerator kPWM_LoadEvery5Oportunity

Every 5 PWM submodule reload opportunities

enumerator kPWM_LoadEvery6Oportunity

Every 6 PWM submodule reload opportunities

enumerator kPWM_LoadEvery7Oportunity

Every 7 PWM submodule reload opportunities

enumerator kPWM_LoadEvery8Oportunity

Every 8 PWM submodule reload opportunities

enumerator kPWM_LoadEvery9Oportunity

Every 9 PWM submodule reload opportunities

enumerator kPWM_LoadEvery10Oportunity

Every 10 PWM submodule reload opportunities

enumerator kPWM_LoadEvery11Oportunity

Every 11 PWM submodule reload opportunities

enumerator kPWM_LoadEvery12Oportunity

Every 12 PWM submodule reload opportunities

enumerator kPWM_LoadEvery13Oportunity

Every 13 PWM submodule reload opportunities

enumerator kPWM_LoadEvery14Oportunity

Every 14 PWM submodule reload opportunities

enumerator kPWM_LoadEvery15Oportunity

Every 15 PWM submodule reload opportunities

enumerator kPWM_LoadEvery16Oportunity

Every 16 PWM submodule reload opportunities

enum _pwm_sm_val_compare_mode

The enumeration for PWM submodule VALn register compare mode.

Values:

enumerator kPWM_CompareOnEqual

The VALn registers and the PWM counter are compared using an “equal to” method.

enumerator kPWM_CompareOnEqualOrGreater

The VALn registers and the PWM counter are compared using an “equal to or greater than” method.

enum _pwm_sm_val_register

The enumeration for PWM submodule VAL registers.

Values:

enumerator kPWM_VAL0

PWM submodule value register 0.

enumerator kPWM_VAL1

PWM submodule value register 1.

enumerator kPWM_VAL2

PWM submodule value register 2.

enumerator kPWM_VAL3

PWM submodule value register 3.

enumerator kPWM_VAL4

PWM submodule value register 4.

enumerator kPWM_VAL5

PWM submodule value register 5.

enum _pwm_sm_force_signal_select

The enumeration for PWM submodule FORCE_OUT source which can trigger force logic output update.

Values:

enumerator kPWM_LocalSoftwareForce

The local software force signal CTRL2[FORCE] is used to force updates.

enumerator kPWM_MasterSoftwareForce

The master software force signal from submodule 0 is used to force updates.

enumerator kPWM_LocalReloadForce

The local reload signal from this submodule is used to force updates without regard to the state of LDOK.

enumerator kPWM_MasterReloadForce

The master reload signal from submodule 0 is used to force updates if LDOK is set, should not be used in submodule 0.

enumerator kPWM_LocalSyncForce

The local sync (VAL1 match event) signal from this submodule is used to force updates.

enumerator kPWM_MasterSyncForce

The master sync signal from submodule0 is used to force updates.

enumerator kPWM_ExternalForceForce

The external force signal EXT_FORCE, from outside the PWM module causes updates.

enumerator kPWM_ExternalSyncForce

The external sync signal EXT_SYNC, from outside the PWM module causes updates.

enum _pwm_sm_force_deadtime_source

The enumeration for PWM submodule force out logic output (PWM23 and PWM45) source, which will transfer to output logic when a FORCE_OUT signal is asserted.

Values:

enumerator kPWM_GeneratedPwm

Generated PWM signal is used as the deadtime logic output.

enumerator kPWM_InvertedGeneratedPwm

Inverted PWM signal is used as the deadtime logic output.

enumerator kPWM_SoftwareControlValue

Software controlled value is used as the deadtime logic output.

enumerator kPWM_UseExternal

PWM_EXTA signal is used as the deadtime logic output.

enum _pwm_sm_force_software_output_value

The enumeration for PWM submodule software controlled force out signal value.

Values:

enumerator kPWM_SoftwareOutputLow

A logic 0 is supplied to the deadtime generator when chose Software controlled value as output source.

enumerator kPWM_SoftwareOutputHigh

A logic 1 is supplied to the deadtime generator when chose Software controlled value as output source.

enum _pwm_sm_deadtime_logic_mode

The enumeration for PWM submodule deadtime logic mode, which decide how the deadtime logic process the force logic output signal.

Values:

enumerator kPWM_Independent

The PWMA (PWM23) and PWMB (PWM45) signal from force logic transfer to output logic independent.

enumerator kPWM_IndependentWithDoubleSwitchPwm

The PWMA (PWM23) and PWMB (PWM45) signals from force logic will XOR first, then the XOR signal transfer to output logic independent.

enumerator kPWM_IndependentWithSplitDoubleSwitchPwm

The PWMA (PWM23) and PWMB (PWM45) signals from force_out logic will XOR first, then the XOR signal transfer to output logic independent.

enumerator kPWM_ComplementaryWithPwmA

The PWMA (PWM23) signal from force logic will transfer to output logic with complementary mode.

enumerator kPWM_ComplementaryWithPwmB

The PWMB (PWM45) signal from force logic will transfer to output logic with complementary mode.

enumerator kPWM_ComplementaryWithDoubleSwitchPwm

The PWMA (PWM23) and PWMB (PWM45) signals from force logic will XOR first, then the XOR signal transfer to output logic with complementary mode.

enum _pwm_sm_fracval_register
The enumeration for PWM submodule FRACVAL registers.

Values:

enumerator kPWM_FRACVAL1
PWM submodule fractional value register 1.

enumerator kPWM_FRACVAL2
PWM submodule fractional value register 2.

enumerator kPWM_FRACVAL3
PWM submodule fractional value register 3.

enumerator kPWM_FRACVAL4
PWM submodule fractional value register 4.

enumerator kPWM_FRACVAL5
PWM submodule fractional value register 5.

enum _pwm_sm_mux_trigger_source
The enumeration for PWM submodule output logic final trigger output port signal.

Values:

enumerator kPWM_ActualCompareEvent
Route the PWM_OUT_TRIG signal (OR of VALx compare signal) to the mux trigger output port.

enumerator kPWM_PwmOutput
Route the PWM output (after polarity/mask/enable control) to the mux trigger output port.

enum _pwm_sm_pwm_output_on_fault
The enumeration for PWM submodule output logic PWM output fault status.

Values:

enumerator kPWM_OutputLowOnFault
The output is forced to logic 0 state prior to consideration of output polarity/mask/enable control during fault conditions and STOP mode.

enumerator kPWM_OutputHighOnFault
The output is forced to logic 1 state prior to consideration of output polarity/mask/enable control during fault conditions and STOP mode.

enumerator kPWM_OutputTristatedOnFault
The output status be tristated during fault conditions and STOP mode.

enum _pwm_sm_pwmx_signal_select
The enumeration for PWM submodule output logic PwmX signal input source (before output polarity/mask/enable control).

Values:

enumerator kPWM_RawPwmX
The PWM_X source is raw Pwm01_fractional_delay signal.

enumerator kPWM_DoubleSwitch
The PWM_X source is Pwm23_fractional_delay XOR Pwm23_fractional_delay signal.

enum _pwm_sm_pwm_out
The enumeration for PWM submodule PWM output.

Values:

enumerator kPWM_PwmX
    The PWM output PWM_X.

enumerator kPWM_PwmB
    The PWM output PWM_B.

enumerator kPWM_PwmA
    The PWM output PWM_A.

enum _pwm_sm_input_capture_pin
The enumeration for PWM submodule input capture pins.

Values:

enumerator kPWM_InputCapturePwmX
    The input capture pin PwmX, need disable PwmX output when enable input capture.

enumerator kPWM_InputCapturePwmA
    The input capture pin PwmA, need disable PwmA output when enable input capture.

enumerator kPWM_InputCapturePwmB
    The input capture pin PwmB, need disable PwmB output when enable input capture.

enum _pwm_sm_input_capture_source
The enumeration for PWM submodule input capture source.

Values:

enumerator kPWM_RawInput
    The capture source is the raw input signal.

enumerator kPWM_InputEdgeCounter
    The capture source is edge counter which counts rising and falling edges on the raw input signal.

enum _pwm_sm_input_capture_edge
The enumeration for PWM submodule input capture edge when choose raw input as capture source.

Values:

enumerator kPWM_Noedge
    Disabled capture on source falling/falling edge.

enumerator kPWM_FallingEdge
    Enable input capture, and capture on source falling edge when chose the raw input signal as capture source.

enumerator kPWM_RisingEdge
    Enable input capture, and capture on source rising edge when chose the raw input signal as capture source.

enumerator kPWM_RiseAndFallEdge
    Enable input capture, and capture on source rising or falling edge when chose the raw input signal as capture source.

enum _pwm_sm_input_capture_register
The enumeration for PWM submodule input capture value register.

Values:

enumerator kPWM_InpCaptureVal0
    Stores the value captured from the submodule counter when the PWM_X circuitry 0 logic capture occurs.

enumerator kPWM_InpCaptureVal1

Stores the value captured from the submodule counter when the PWM_X circuitry 1 logic capture occurs.

enumerator kPWM_InpCaptureVal2

Stores the value captured from the submodule counter when the PWM_A circuitry 0 logic capture occurs.

enumerator kPWM_InpCaptureVal3

Stores the value captured from the submodule counter when the PWM_A circuitry 1 logic capture occurs.

enumerator kPWM_InpCaptureVal4

Stores the value captured from the submodule counter when the PWM_B circuitry 0 logic capture occurs.

enumerator kPWM_InpCaptureVal5

Stores the value captured from the submodule counter when the PWM_B circuitry 1 logic capture occurs.

enum _pwm_sm_input_capture_filter_count

The enumeration for input filter count Represent the number of consecutive samples that must agree prior to the input filter accepting an input transition.

Values:

enumerator kPWM_InputCaptureFilterCount3Samples

3 samples.

enumerator kPWM_InputCaptureFilterCount4Samples

4 samples.

enumerator kPWM_InputCaptureFilterCount5Samples

5 samples.

enumerator kPWM_InputCaptureFilterCount6Samples

6 samples.

enumerator kPWM_InputCaptureFilterCount7Samples

7 samples.

enumerator kPWM_InputCaptureFilterCount8Samples

8 samples.

enumerator kPWM_InputCaptureFilterCount9Samples

9 samples.

enumerator kPWM_InputCaptureFilterCount10Samples

10 samples.

enum _pwm_sm_capture_dma_source

The enumeration for the source which can trigger the DMA read requests for the capture FIFOs.

Values:

enumerator kPWM_FIFOWatermarksORDma

Selected FIFO watermarks are OR'ed together to sets the read DMA request.

enumerator kPWM_FIFOWatermarksANDDma

Selected FIFO watermarks are AND'ed together to sets the read DMA request.

enumerator kPWM_LocalSyncDma
A local sync (VAL1 match event) sets the read DMA request.

enumerator kPWM_LocalReloadDma
A local reload (STS[RF] being set) sets the read DMA request.

enum _pwm_sm_interrupt_enable
The enumeration for PWM submodule interrupt enable.

Values:

enumerator kPWM_CompareVal0InterruptEnable
PWM submodule VAL0 compare interrupt.

enumerator kPWM_CompareVal1InterruptEnable
PWM submodule VAL1 compare interrupt.

enumerator kPWM_CompareVal2InterruptEnable
PWM submodule VAL2 compare interrupt.

enumerator kPWM_CompareVal3InterruptEnable
PWM submodule VAL3 compare interrupt.

enumerator kPWM_CompareVal4InterruptEnable
PWM submodule VAL4 compare interrupt.

enumerator kPWM_CompareVal5InterruptEnable
PWM submodule VAL5 compare interrupt.

enumerator kPWM_CaptureX0InterruptEnable
PWM submodule capture X0 interrupt.

enumerator kPWM_CaptureX1InterruptEnable
PWM submodule capture X1 interrupt.

enumerator kPWM_CaptureB0InterruptEnable
PWM submodule capture B0 interrupt.

enumerator kPWM_CaptureB1InterruptEnable
PWM submodule capture B1 interrupt.

enumerator kPWM_CaptureA0InterruptEnable
PWM submodule capture A0 interrupt.

enumerator kPWM_CaptureA1InterruptEnable
PWM submodule capture A1 interrupt.

enumerator kPWM_ReloadInterruptEnable
PWM submodule reload interrupt.

enumerator kPWM_ReloadErrorInterruptEnable
PWM submodule reload error interrupt.

enumerator kPWM_ALLSubModuleInterruptEnable

enum _pwm_sm_status_flags
The enumeration for PWM submodule status flags.

Values:

enumerator kPWM_CompareVal0Flag
PWM submodule VAL0 compare flag.

enumerator kPWM_CompareVal1Flag
PWM submodule VAL1 compare flag.

enumerator kPWM_CompareVal2Flag
PWM submodule VAL2 compare flag.

enumerator kPWM_CompareVal3Flag
PWM submodule VAL3 compare flag.

enumerator kPWM_CompareVal4Flag
PWM submodule VAL4 compare flag.

enumerator kPWM_CompareVal5Flag
PWM submodule VAL5 compare flag.

enumerator kPWM_CaptureX0Flag
PWM submodule capture X0 flag.

enumerator kPWM_CaptureX1Flag
PWM submodule capture X1 flag.

enumerator kPWM_CaptureB0Flag
PWM submodule capture B0 flag.

enumerator kPWM_CaptureB1Flag
PWM submodule capture B1 flag.

enumerator kPWM_CaptureA0Flag
PWM submodule capture A0 flag.

enumerator kPWM_CaptureA1Flag
PWM submodule capture A1 flag.

enumerator kPWM_ReloadFlag
PWM submodule reload flag.

enumerator kPWM_ReloadErrorFlag
PWM submodule reload error flag.

enumerator kPWM_RegUpdatedFlag
PWM submodule registers updated flag.

enumerator kPWM_ALLSMStatusFlags

enum _pwm_sm_typical_output_mode
The enumeration for some PWM submodule PWM_A/B typical output mode.

Values:

enumerator kPWM_SignedCenterAligned
Center-aligned PWM with signed compare value.

enumerator kPWM_CenterAligned
Center-aligned PWM with unsigned compare value.

enumerator kPWM_SignedEdgeAligned
Edge-aligned PWM with signed compare value.

enumerator kPWM_EdgeAligned
Edge-aligned PWM with signed compare value.

enum _pwm_fault_protection_channel
The enumeration for PWM fault protection channel number.

Values:

enumerator kPWM_FaultProtection0
PWM fault protection channel 0

enum _pwm_fault_protection_interrupt_enable
The enumeration for PWM module fault protection channel interrupt enable.

Values:

enumerator kPWM_Fault0InterruptEnable
Fault protection channel fault 0 interrupt

enumerator kPWM_Fault1InterruptEnable
Fault protection channel fault 1 interrupt

enumerator kPWM_Fault2InterruptEnable
Fault protection channel fault 2 interrupt

enumerator kPWM_Fault3InterruptEnable
Fault protection channel fault 3 interrupt

enumerator kPWM_ALLfaultInterruptEnable

enum _pwm_fault_protection_status_flags
The enumeration for PWM module fault protection status flags.

Values:

enumerator kPWM_Fault0Flag
Fault protection channel fault 0 flag, set within two CPU cycles after a transition to active on the fault input pin 0.

enumerator kPWM_Fault1Flag
Fault protection channel fault 1 flag, set within two CPU cycles after a transition to active on the fault input pin 1.

enumerator kPWM_Fault2Flag
Fault protection channel fault 2 flag, set within two CPU cycles after a transition to active on the fault input pin 2.

enumerator kPWM_Fault3Flag
Fault protection channel fault 3 flag, set within two CPU cycles after a transition to active on the fault input pin 3.

enumerator kPWM_FaultPin0ActiveFlag
Fault protection channel fault input pin 0 active flag.

enumerator kPWM_FaultPin1ActiveFlag
Fault protection channel fault input pin 1 active flag.

enumerator kPWM_FaultPin2ActiveFlag
Fault protection channel fault input pin 2 active flag.

enumerator kPWM_FaultPin3ActiveFlag
Fault protection channel fault input pin 3 active flag.

enumerator kPWM_ALLFaultStatusFlags

enum _pwm_fault_active_level
: The enumeration for PWM fault protection channel number.

  Values:

  enumerator kPWM_Logic0
  : A logic 0 on the fault input indicates a fault condition.

  enumerator kPWM_Logic1
  : A logic 0 on the fault input indicates a fault condition.

typedef enum *_pwm_sm_number* pwm_sm_number_t
: The enumeration for PWM submodule number.

typedef enum *_pwm_sm_count_clock_source* pwm_sm_count_clock_source_t
: The enumeration for PWM submodule clock source.

typedef enum *_pwm_sm_count_clock_prescaler* pwm_sm_count_clock_prescaler_t
: The enumeration for PWM submodule prescaler factor selection for clock source.

typedef enum *_pwm_sm_count_init_source* pwm_sm_count_init_source_t
: The enumeration for PWM submodule counter initialization options.

typedef enum *_pwm_ml2_stretch_count_clock_prescaler* pwm_ml2_stretch_count_clock_prescaler_t
: The enumeration for PWM stretch IPBus clock count prescaler for mux0_trig/mux1_trig/out0_trig/out1_trig/pwma_trig/pwmb_trig.

typedef struct *_pwm_sm_counter_config* pwm_sm_counter_config_t
: The structure for configuring PWM submodule counter logic.

typedef enum *_pwm_sm_reload_signal_select* pwm_sm_reload_signal_select_t
: The enumeration for PWM submodule local reload take effect timing.

typedef enum *_pwm_sm_local_reload_effect_timing* pwm_sm_local_reload_effect_timing_t
: The enumeration for PWM submodule local reload take effect timing.

typedef enum *_pwm_sm_local_reload_oportunity* pwm_sm_local_reload_oportunity_t
: The enumeration for PWM submodule reload opportunities selection under kPWM_ReloadWithLocalReloadOportunity.

typedef struct *_pwm_sm_reload_logic_config* pwm_sm_reload_logic_config_t
: The structure for configuring PWM submodule reload logic.

typedef enum *_pwm_sm_val_compare_mode* pwm_sm_val_compare_mode_t
: The enumeration for PWM submodule VALn register compare mode.

typedef enum *_pwm_sm_val_register* pwm_sm_val_register_t
: The enumeration for PWM submodule VAL registers.

typedef struct *_pwm_sm_value_register_config* pwm_sm_value_register_config_t
: The structure for configuring PWM submodule value registers.

typedef enum *_pwm_sm_force_signal_select* pwm_sm_force_signal_select_t
: The enumeration for PWM submodule FORCE_OUT source which can trigger force logic output update.

typedef enum *_pwm_sm_force_deadtime_source* pwm_sm_force_deadtime_source_t
: The enumeration for PWM submodule force out logic output (PWM23 and PWM45) source, which will transfer to output logic when a FORCE_OUT signal is asserted.

typedef enum *_pwm_sm_force_software_output_value* pwm_sm_force_software_output_value_t
: The enumeration for PWM submodule software controlled force out signal value.

typedef struct *_pwm_sm_force_logic_config* pwm_sm_force_logic_config_t
    The structure for configuring PWM submodule force logic.

typedef enum *_pwm_sm_deadtime_logic_mode* pwm_sm_deadtime_logic_mode_t
    The enumeration for PWM submodule deadtime logic mode, which decide how the deadtime logic process the force logic output signal.

typedef struct *_pwm_sm_deadtime_value* pwm_sm_deadtime_value_t
    The structure of the inserted dead time value, applies only to KPWM_Complementaryxxx mode.

typedef struct *_pwm_sm_deadtime_logic_config* pwm_sm_deadtime_logic_config_t
    The structure for configuring PWM submodule force out logic, works on the deadtime logic output.

typedef enum *_pwm_sm_fracval_register* pwm_sm_fracval_register_t
    The enumeration for PWM submodule FRACVAL registers.

typedef struct *_pwm_sm_fractional_delay_logic_config* pwm_sm_fractional_delay_logic_config_t
    The structure for configuring PWM submodule fractional delay logic, works on the deadtime logic output.

typedef enum *_pwm_sm_mux_trigger_source* pwm_sm_mux_trigger_source_t
    The enumeration for PWM submodule output logic final trigger output port signal.

typedef enum *_pwm_sm_pwm_output_on_fault* pwm_sm_pwm_output_on_fault_t
    The enumeration for PWM submodule output logic PWM output fault status.

typedef enum *_pwm_sm_pwmx_signal_select* pwm_sm_pwmx_signal_select_t
    The enumeration for PWM submodule output logic PwmX signal input source (before output polarity/mask/enable control).

typedef enum *_pwm_sm_pwm_out* pwm_sm_pwm_out_t
    The enumeration for PWM submodule PWM output.

typedef struct *_pwm_sm_output_logic_config_t* pwm_sm_output_logic_config_t
    The structure for configuring PWM submodule output logic.

typedef enum *_pwm_sm_input_capture_pin* pwm_sm_input_capture_pin_t
    The enumeration for PWM submodule input capture pins.

typedef enum *_pwm_sm_input_capture_source* pwm_sm_input_capture_source_t
    The enumeration for PWM submodule input capture source.

typedef enum *_pwm_sm_input_capture_edge* pwm_sm_input_capture_edge_t
    The enumeration for PWM submodule input capture edge when choose raw input as capture source.

typedef enum *_pwm_sm_input_capture_register* pwm_sm_input_capture_register_t
    The enumeration for PWM submodule input capture value register.

typedef enum *_pwm_sm_input_capture_filter_count* pwm_sm_input_capture_filter_count_t
    The enumeration for input filter count Represent the number of consecutive samples that must agree prior to the input filter accepting an input transition.

typedef struct *_pwm_sm_input_capture_config* pwm_sm_input_capture_config_t
    The structure for configuring PWM submodule input capture logic.

    Note: When choosing kPWM_InputEdgeCounter as circuit 0/1 capture source, the eCircuit0CaptureEdge and eCircuit1CaptureEdge selected trigger edge will be ignored, but still need place a value other than kPWM_Noedge in either or both of the eCaptureCircuit0 and/or CaptureCircuit1 fields in order to enable one or both of the capture registers.

typedef enum *_pwm_sm_capture_dma_source* pwm_sm_capture_dma_source_t

The enumeration for the source which can trigger the DMA read requests for the capture FIFOs.

typedef struct *_pwm_sm_capture_dma_config* pwm_sm_capture_dma_config_t

The structure for configuring PWM submodule read capture DMA.

typedef struct *_pwm_sm_dma_config* pwm_sm_dma_config_t

The structure for configuring PWM submodule DMA.

typedef struct *_pwm_sm_fault_input_mapping* pwm_sm_fault_input_mapping_t

The enumeration for PWM submodule output fault enable mask for one fault protection channel.

The structure for configuring PWM submodule fault input disable mapping.

Note: The channel 0 input 0 and channel 1 input 0 are different pins.

Note: Each PWM output can be mapping anyone or more fault inputs. The mapped fault protection channel inputs can disable PWM output.

typedef enum *_pwm_sm_status_flags* pwm_sm_status_flags_t

The enumeration for PWM submodule status flags.

typedef enum *_pwm_sm_typical_output_mode* pwm_sm_typical_output_mode_t

The enumeration for some PWM submodule PWM_A/B typical output mode.

typedef struct *_pwm_sm_config* pwm_sm_config_t

PWM submodule config structure.

This structure holds the configuration settings for the PWM peripheral. To initialize this structure to reasonable defaults, call the PWM_GetDefaultConfig() function and pass a pointer to your config structure instance.

typedef enum *_pwm_fault_protection_channel* pwm_fault_protection_channel_t

The enumeration for PWM fault protection channel number.

typedef enum *_pwm_fault_active_level* pwm_fault_input_active_level_t

The enumeration for PWM fault protection channel number.

typedef struct *_pwm_fault_protection_input_config* pwm_fault_protection_input_config_t

typedef struct *_pwm_fault_protection_config* pwm_fault_protection_config_t

The structure for configuring PWM fault protection channel, a PWM module can have multiple fault protection channels, PWM sub-module can choose to mapping any one or more fault input from fault protection channels.

typedef struct *_pwm_config* pwm_config_t

PWM module config structure which contain submodule config structure pointers and fault protection filter config structure pointers.

Note: Need use submodule structure address to init the structure pointers, when the submodule or fault protection structure pointers is NULL, it will be ignored by PWM_Init API. This can save stack space when only one or two submodules are used.

struct _pwm_sm_counter_config

#include <fsl_pwm.h> The structure for configuring PWM submodule counter logic.

Public Members

pwm_sm_count_clock_source_t eCountClockSource

Configures PWM submodule counter clock source.

pwm_sm_count_clock_prescaler_t eCountClockPrescaler

Configures PWM submodule counter clock source prescaler.

pwm_sm_count_init_source_t eCountInitSource

Configures PWM submodule counter initial source.

bool bEnableForceInitial

Enable force-controlled initialization. The assert FORCE_OUT signal can to initialize the counter without regard to the selected initial source.

uint16_t u16PhaseDelayValue

Defines the delay from the master sync signal of submodule 0 to this submodule counter (the unit of delay is the PWM clock cycle), only works when chose kPWM_InitOnMasterSync as initial source.

struct _pwm_sm_reload_logic_config

#include <fsl_pwm.h> The structure for configuring PWM submodule reload logic.

Public Members

pwm_sm_reload_signal_select_t eReloadSignalSelect

Configures PWM submodule RELOAD signal source to be local reload signal or master reload signal.

pwm_sm_local_reload_effect_timing_t eLoclReloadEffectTime

Configures PWM submodule local reload signal effective timing when choose it as RELOAD signal source.

bool bEnableFullCycleReloadOportunity

Enable generate a reload opportunity on PWM half cycle (count from INIT value to VAL0).

bool bEnableHalfCycleReloadOportunity

Enable generate a reload opportunity on PWM full cycle (count from INIT value to VAL1).

pwm_sm_local_reload_oportunity_t eLocalReloadOportunity

Configures PWM submodule reload frequency when using local reload opportunities mode .

struct _pwm_sm_value_register_config

#include <fsl_pwm.h> The structure for configuring PWM submodule value registers.

Public Members

uint16_t u16CounterInitialValue
Configures PWM submodule counter initial value.

uint16_t u16ValRegister0
Configures PWM submodule value register 0 (VAL0) value.

uint16_t u16ValRegister1
Configures PWM submodule value register 1 (VAL1) value.

uint16_t u16ValRegister2
Configures PWM submodule value register 2 (VAL2) value.

uint16_t u16ValRegister3
Configures PWM submodule value register 3 (VAL3) value.

uint16_t u16ValRegister4
Configures PWM submodule value register 4 (VAL4) value.

uint16_t u16ValRegister5
Configures PWM submodule value register 5 (VAL5) value.

struct _pwm_sm_force_logic_config
#include <fsl_pwm.h> The structure for configuring PWM submodule force logic.

Public Members

uint8_t bitPWM23OutputInitialVaule
Configures PWM submodule compare output x (PwmX) initial value.

uint8_t bitPWM45OutputInitialVaule
Configures PWM submodule compare output A (PwmA) initial value.

uint8_t bitPWMXOutputInitialVaule
Configures PWM submodule compare output B (PwmB) initial value.

pwm_sm_force_signal_select_t eForceSignalSelect
Configures PWM submodule force out select update trigger source.

pwm_sm_force_software_output_value_t eSoftOutputFor23
Configures PWM submodule force out PwmA value when select software as output source.

pwm_sm_force_software_output_value_t eSoftOutputFor45
Configures PWM submodule force out PwmB value when select software as output source.

pwm_sm_force_deadtime_source_t eForceOutput23
Configures the source of Pwm23, which will be force to deadtime logic.

pwm_sm_force_deadtime_source_t eForceOutput45
Configures the source of Pwm45, which will be force to deadtime logic.

struct _pwm_sm_deadtime_value
#include <fsl_pwm.h> The structure of the inserted dead time value, applies only to KPWM_Complementaryxxx mode.

struct _pwm_sm_deadtime_logic_config
#include <fsl_pwm.h> The structure for configuring PWM submodule force out logic, works on the deadtime logic output.

Public Members

pwm_sm_deadtime_logic_mode_t eMode

The mode in which Deadtime logic process the force logic output signal.

pwm_sm_deadtime_value_t sDeadTimeValue0

Control the deadtime during 0 to 1 transitions of the PWM_23 output (assuming normal polarity). When disable fractional delays, the maximum value is 0x7FF which represents 2047 cycles of IP bus cycles. When enable fractional delays, the maximum value is 0xFFFF which represents 2047 31/32 cycles cycles of IP bus cycles.

pwm_sm_deadtime_value_t sDeadTimeValue1

Control the deadtime during 0 to 1 transitions of the PWM_45 output (assuming normal polarity). When disable fractional delays, the maximum value is 0x7FF which represents 2047 cycles of IP bus cycles. When enable fractional delays, the maximum value is 0xFFFF which represents 2047 31/32 cycles cycles of IP bus cycles.

struct _pwm_sm_fractional_delay_logic_config

#include <fsl_pwm.h> The structure for configuring PWM submodule fractional delay logic, works on the deadtime logic output.

Public Members

uint8_t bitsFracValue1

Configures PWM submodule compare register VAL1 fractional delay value, the unit is 1/32 IP bus clock.

bool bEnableVal1FractionalDelay

Enable the fractional delay feature of bitsFracValue1.

uint8_t bitsFracValue2

Configures PWM submodule compare register VAL2 fractional delay value, the unit is 1/32 IP bus clock.

uint8_t bitsFracValue3

Configures PWM submodule compare register VAL3 fractional delay value, the unit is 1/32 IP bus clock.

bool bEnableVal23FractionalDelay

Enable the fractional delay feature of bitsFracValue2 and bitsFracValue3.

uint8_t bitsFracValue4

Configures PWM submodule compare register VAL4 fractional delay value, the unit is 1/32 IP bus clock.

uint8_t bitsFracValue5

Configures PWM submodule compare register VAL5 fractional delay value, the unit is 1/32 IP bus clock.

bool bEnableVal45FractionalDelay

Enable the fractional delay feature of bitsFracValue4 and bitsFracValue5.

struct _pwm_sm_output_logic_config_t

#include <fsl_pwm.h> The structure for configuring PWM submodule output logic.

Public Members

bool bVal0TriggerEnable

Enable VAL0 register compare event trigger.

bool bVal1TriggerEnable
Enable VAL1 register compare event trigger.

bool bVal2TriggerEnable
Enable VAL2 register compare event trigger.

bool bVal3TriggerEnable
Enable VAL3 register compare event trigger.

bool bVal4TriggerEnable
Enable VAL4 register compare event trigger.

bool bVal5TriggerEnable
Enable VAL5 register compare event trigger.

bool bEnableTriggerPostScaler
True : Trigger outputs are generated only during the final PWM period prior to a reload opportunity, false : Trigger outputs are generated during every PWM period. Configures PWM submodule mux trigger output signal 0 source.

pwm_sm_mux_trigger_source_t eMuxTrigger0
Configures PWM submodule mux trigger output signal 1 source.

pwm_sm_mux_trigger_source_t eMuxTrigger1
Configures PWM submodule PWM_X output source (before polarity/mask/enable control).

bool bInvertPwmxOutput
True : invert PWM_X output, false : no invert PWM_X output.

bool bInvertPwmaOutput
True : invert PWM_A output, false : no invert PWM_A output.

bool bInvertPwmbOutput
True : invert PWM_B output, false : no invert PWM_B output.

bool bMaskPwmxOutput
True : PWM_X output masked, false : PWM_X output normal. Mask bit is buffered, and take effect until FORCE_OUT event or software update command.

bool bMaskPwmaOutput
True : PWM_A output masked, false : PWM_A output normal. Mask bit is buffered, and take effect until FORCE_OUT event or software update command.

bool bMaskPwmbOutput
True : PWM_B output masked, false : PWM_B output normal. Mask bit is buffered, and take effect until FORCE_OUT event or software update command.

bool bEnablePwmxOutput
True : Enable PWM_X output. false : PWM_X is disabled and output is tristated.

bool bEnablePwmaOutput
True : Enable PWM_A output. false : PWM_A is disabled and output is tristated.

bool bEnablePwmbOutput
True : Enable PWM_B output. false : PWM_B is disabled and output is tristated. Configures PWM submodule PWM_X output during fault status (only works when fault status enable).

pwm_sm_pwm_output_on_fault_t ePwmxFaultState
Configures PWM submodule PWM_A output during fault status (only works when fault status enable).

pwm_sm_pwm_output_on_fault_t ePwmaFaultState

Configures PWM submodule PWM_B output during fault status (only works when fault status enable).

struct _pwm_sm_input_capture_config

#include <fsl_pwm.h> The structure for configuring PWM submodule input capture logic.

Note: When choosing kPWM_InputEdgeCounter as circuit 0/1 capture source, the eCircuit0CaptureEdge and eCircuit1CaptureEdge selected trigger edge will be ignored, but still need place a value other than kPWM_Noedge in either or both of the eCaptureCircuit0 and/or CaptureCircuit1 fields in order to enable one or both of the capture registers.

Public Members

bool bEnableInputCapture

True: enable the input capture process, false : disable the input capture process.

pwm_sm_input_capture_source_t eInCaptureSource

Configures capture circuit 0/1 input source

pwm_sm_input_capture_edge_t eCircuit0CaptureEdge

Configures which edge causes a capture for capture circuit 0 , will be ignore when use edge counter as capture source.

pwm_sm_input_capture_edge_t eCircuit1CaptureEdge

Configures which edge causes a capture for capture circuit 1 , will be ignore when use edge counter as capture source.

bool bEnableOneShotCapture

True: Enable one-shot capture mode, the bEnableInputCapture will self-cleared when one or more of the enabled capture circuits has had a capture event; false: Capture circuit 0/1 will perform capture continue;

uint8_t bitsCaptureFifoWatermark

Watermark level for circuit 0/1 capture FIFO. The capture flags in the status register will set if the word count in the circuit 0/1 capture FIFO is greater than this watermark level

uint8_t u8EdgeCounterCompareValue

Edge counter compare value, used only if edge counter is used as capture circuit 0/1 input source

uint8_t u8FilterPeriod

Sampling period (in IPBus clock cycles) of the input filter, set to 0 to bypass the filter.

pwm_sm_input_capture_filter_count_t eFilterCount

Filter sample count.

struct _pwm_sm_capture_dma_config

#include <fsl_pwm.h> The structure for configuring PWM submodule read capture DMA.

Public Members

bool bEnableCaptureDMA

Enables DMA read requests for the Capture FIFOs.

pwm_sm_capture_dma_source_t eCaptureDMASource

Select the source to enables DMA read requests for the Capture FIFOs. Will be ignored when bEnableCaptureDMA be false.

struct _pwm_sm_dma_config

#include <fsl_pwm.h> The structure for configuring PWM submodule DMA.

Public Members

bool bEnableWriteValDMA

STS[RF] set enables DMA write requests for VALx and FRACVALx registers.

bool bEnableReadCaptureX0DMA

STS[CFX0] set enables DMA read requests for Capture X0 FIFO. And X0 FIFO watermark is selected for sCaptureDma pwm_sm_capture_dma_config_t.

bool bEnableReadCaptureX1DMA

STS[CFX1] set enables DMA read requests for Capture X1 FIFO. And X1 FIFO watermark is selected for sCaptureDma pwm_sm_capture_dma_config_t.

bool bEnableReadCaptureA0DMA

STS[CFA0] set enables DMA read requests for Capture A0 FIFO. And A0 FIFO watermark is selected for sCaptureDma pwm_sm_capture_dma_config_t.

bool bEnableReadCaptureA1DMA

STS[CFA1] set enables DMA read requests for Capture A1 FIFO. And A1 FIFO watermark is selected for sCaptureDma pwm_sm_capture_dma_config_t.

bool bEnableReadCaptureB0DMA

STS[CFB0] set enables DMA read requests for Capture B0 FIFO. And B0 FIFO watermark is selected for sCaptureDma pwm_sm_capture_dma_config_t.

bool bEnableReadCaptureB1DMA

STS[CFB1] set enables DMA read requests for Capture B1 FIFO. And B1 FIFO watermark is selected for sCaptureDma pwm_sm_capture_dma_config_t.

pwm_sm_capture_dma_config_t sCaptureDma

DMA read requests for the capture FIFOs configure.

struct _pwm_sm_fault_input_mapping

#include <fsl_pwm.h> The enumeration for PWM submodule output fault enable mask for one fault protection channel.

The structure for configuring PWM submodule fault input disable mapping.

Note: The channel 0 input 0 and channel 1 input 0 are different pins.

Note: Each PWM output can be mapping anyone or more fault inputs. The mapped fault protection channel inputs can disable PWM output.

Public Members

bool bFaultInput0Mapping

Mapping fault input 0 (from fault protection channel 0) to PWM output.

bool bFaultInput1Mapping
Mapping fault input 1 (from fault protection channel 0) to PWM output.

bool bFaultInput2Mapping
Mapping fault input 2 (from fault protection channel 0) to PWM output.

bool bFaultInput3Mapping
Mapping fault input 3 (from fault protection channel 0) to PWM output.

bool bFaultInput4Mapping
Mapping fault input 4 (from fault protection channel 1) to PWM output.

bool bFaultInput5Mapping
Mapping fault input 5 (from fault protection channel 1) to PWM output.

bool bFaultInput6Mapping
Mapping fault input 6 (from fault protection channel 1) to PWM output.

bool bFaultInput7Mapping
Mapping fault input 7 (from fault protection channel 1) to PWM output.

struct _pwm_sm_config
#include <fsl_pwm.h> PWM submodule config structure.

This structure holds the configuration settings for the PWM peripheral. To initialize this structure to reasonable defaults, call the PWM_GetDefaultConfig() function and pass a pointer to your config structure instance.

Public Members

bool enableDebugMode
true: PWM continues to run in debug mode; false: PWM is paused in debug mode.

bool enableWaitMode
true: PWM continues to run in WAIT mode; false: PWM is paused in WAIT mode.

bool enableRun
true: PWM submodule is enabled; false: PWM submodule is disabled. Configures submodule value registers compare mode, only can be written one time.

pwm_sm_counter_config_t sCounterConfig
Submodule counter logic config.

pwm_sm_reload_logic_config_t sReloadConfig
Submodule reload control logic config.

pwm_sm_value_register_config_t sValRegisterConfig
Submodule value registers config.

pwm_sm_force_logic_config_t sForceConfig
Submodule force out logic config.

pwm_sm_deadtime_logic_config_t sDeadTimeConfig
Submodule deadtime logic config.

pwm_sm_fractional_delay_logic_config_t sFracDelayConfig
Submodule fractional logic config.

pwm_sm_output_logic_config_t sOutputConfig
Submodule output logic config.

pwm_sm_input_capture_config_t sInCaptureConfig[3]

Submodule input capture config for PWM_X/A/B pins.

pwm_sm_dma_config_t sDMAConfig

Submodule DMA config. PWM_X output fault input mapping, determines which fault inputs can disable PWM_X output.

pwm_sm_fault_input_mapping_t sPwmXFaultInputMapping

PWM_A output fault input mapping, determines which fault inputs can disable PWM_A output.

pwm_sm_fault_input_mapping_t sPwmAFaultInputMapping

PWM_B output fault input mapping, determines which fault inputs can disable PWM_B output.

pwm_sm_fault_input_mapping_t sPwmBFaultInputMapping

Submodule interrupt enable mask, logic OR of _pwm_sm_interrupt_enable.

pwm_ml2_stretch_count_clock_prescaler_t eStrBusClock

PWM stretch IPBus clock count prescaler.

struct _pwm_fault_protection_input_config

#include <fsl_pwm.h>

Public Members

pwm_fault_input_active_level_t eFaultActiveLevel

Select the active logic level of the fault input.

bool bEnableAutoFaultClear

True : Enable automatic fault clearing, fault recovery (PWM outputs can re-enable) occurs when FSTS[FFPINx] is clear , false : Use manual fault clearing, fault recovery (PWM outputs can re-enable) occurs when FSTS[FFLAGx] is manual clear (and FSTS[FFPINx] is clear).

bool bEnableManualFaultClearSafeMode

True : fault recovery (PWM outputs can re-enable) occurs when FSTS[FFLAGx] is manual clear and FSTS[FFPINx] is clear, false : fault recovery (PWM outputs can re-enable) occurs when FSTS[FFLAGx] is manual clear.

bool bEnableFaultFullCycleRecovery

Enable full cycle fault recovery, which make PWM outputs are re-enabled at the start of a half cycle after fault recovery occurs.

bool bEnableFaultHalfCycleRecovery

Enable half cycle fault recovery, which make PWM outputs are re-enabled at the start of a half cycle after fault recovery occurs.

bool bEnableFaultNoCombinationalPath

True : The fault inputs are combined with the filtered and latched fault signals to disable the PWM outputs , false : the filtered and latched fault signals are used to disable the PWM outputs.

bool bEnableFaultInterrupt

Enable the fault input interrupt.

struct _pwm_fault_protection_config

#include <fsl_pwm.h> The structure for configuring PWM fault protection channel, a PWM module can have multiple fault protection channels, PWM sub-module can choose to mapping any one or more fault input from fault protection channels.

Public Members

bool bEnableFaultGlitchStretch

Fault Glitch Stretch Enable: A logic 1 means that input fault signals will be stretched to at least 2 IPBus clock cycles.

uint8_t bitsFaultFilterCount

Configures PWM fault protection channel fault filter count.

uint8_t u8FaultFilterPeriod

Configures PWM fault protection channel fault filter period, value of 0 will bypass the filter.

struct _pwm_config

#include <fsl_pwm.h> PWM module config structure which contain submodule config structure pointers and fault protection filter config structure pointers.

Note: Need use submodule structure address to init the structure pointers, when the submodule or fault protection structure pointers is NULL, it will be ignored by PWM_Init API. This can save stack space when only one or two submodules are used.

Public Members

pwm_sm_config_t *psPwmSubmoduleConfig[1]

< PWM submodule config. PWM fault protection channel config, will take effect for all submodules.

2.56 The Driver Change Log

2.57 eFlexPWM Peripheral and Driver Overview

2.58 QSCI: Queued Serial Communications Interface Driver

void QSCI_GetDefaultConfig(*qsci_config_t* *psConfig, uint32_t u32BaudRateBps, uint32_t u32SrcClockHz)

Sets the QSCI configuration structure to default values.

The purpose of this API is to initialize the configuration structure to default value for QSCI_Init to use. Use the unchanged structure in QSCI_Init or modify the structure before calling QSCI_Init. This is an example:

```
qsci_config_t sConfig;
QSCI_GetDefaultConfig(&sConfig, 115200, 12000000U);
QSCI_Init(QSCI0, &config);
```

Parameters

- psConfig – Pointer to configuration structure.
- u32BaudRateBps – Baudrate setting.
- u32SrcClockHz – The clock source frequency for QSCI module.

status_t QSCI_Init(QSCI_Type *base, *qsci_config_t* *psConfig)

Initializes the QSCI instance with a user configuration structure.

This function configures the QSCI module with the customed settings. User can configure the configuration structure manually or get the default configuration by using the QSCI_GetDefaultConfig function. The example below shows how to use this API to configure QSCI.

```
qsci_config_t sConfig;
QSCI_GetDefaultConfig(&sConfig, 115200, 12000000U);
QSCI_Init(QSCI0, &sConfig);
```

Parameters

- base – QSCI peripheral base address.
- psConfig – Pointer to the user-defined configuration structure.

Return values

- kStatus_QSCI_BaudrateNotSupport – Baudrate is not supported in the current clock source.
- kStatus_Success – Set baudrate succeeded.

void QSCI_Deinit(QSCI_Type *base)

Deinitializes a QSCI instance.

This function waits for transmiting complete, then disables TX and RX.

Parameters

- base – QSCI peripheral base address.

static inline uint16_t QSCI_GetStatusFlags(QSCI_Type *base)

Gets QSCI hardware status flags.

Parameters

- base – QSCI peripheral base address.

Returns

QSCI status flags, can be a single flag or several flags in _qsci_status_flags combined by OR.

void QSCI_ClearStatusFlags(QSCI_Type *base, uint16_t u16StatusFlags)

Clears QSCI status flags.

This function clears QSCI status flags. Members in kQSCI_Group0Flags can't be cleared by this function, they are cleared or set by hardware.

Parameters

- base – QSCI peripheral base address.
- u16StatusFlags – The status flag mask, can be a single flag or several flags in _qsci_status_flags combined by OR.

void QSCI_EnableInterrupts(QSCI_Type *base, uint8_t u8Interrupts)

Enables QSCI interrupts according to the provided mask.

This function enables the QSCI interrupts according to the provided mask. The mask is a logical OR of enumeration members in _qsci_interrupt_enable.

Parameters

- base – QSCI peripheral base address.

- u8Interrupts – The interrupt source mask, can be a single source or several sources in _qsci_interrupt_enable combined by OR.

void QSCI_DisableInterrupts(QSCI_Type *base, uint8_t u8Interrupts)

Disables QSCI interrupts according to the provided mask.

This function disables the QSCI interrupts according to the provided mask. The mask is a logical OR of enumeration members in _qsci_interrupt_enable.

Parameters

- base – QSCI peripheral base address.
- u8Interrupts – The interrupt source mask, can be a single source or several sources in _qsci_interrupt_enable combined by OR.

uint8_t QSCI_GetEnabledInterrupts(QSCI_Type *base)

Gets the enabled QSCI interrupts.

This function gets the enabled QSCI interrupts. The enabled interrupts are returned as the logical OR value of the enumerators _qsci_interrupt_enable.

Parameters

- base – QSCI peripheral base address.

Returns

The interrupt source mask, can be a single source or several sources in _qsci_interrupt_enable combined by OR.

static inline void QSCI_Reset(QSCI_Type *base)

Sets the QSCI register value to reset value.

Parameters

- base – QSCI peripheral base address.

static inline void QSCI_EnableTx(QSCI_Type *base, bool bEnable)

Enables or disables the QSCI transmitter.

This function enables or disables the QSCI transmitter.

Parameters

- base – QSCI peripheral base address.
- bEnable – True to enable, false to disable.

static inline void QSCI_EnableRx(QSCI_Type *base, bool bEnable)

Enables or disables the QSCI receiver.

This function enables or disables the QSCI receiver.

Parameters

- base – QSCI peripheral base address.
- bEnable – True to enable, false to disable.

static inline void QSCI_EnableStopInWait(QSCI_Type *base, bool bEnable)

Enables/disables stop in wait.

Parameters

- base – QSCI peripheral base address.
- bEnable – true to enable, QSCI stops working in wait mode, false to disable, QSCI keeps working in wait mode

static inline void QSCI_Enable9bitMode(QSCI_Type *base, bool bEnable)

Enables/Disables 9-bit data mode for QSCI.

Parameters

- base – QSCI peripheral base address.
- bEnable – true to enable, false to disable.

static inline void QSCI_EnableStandbyMode(QSCI_Type *base, bool bEnable)

Enables/Disables standby mode.

When QSCI is in standby mode, further receiver interrupt requests are inhibited waiting to be wake up. The wakeup mode can be configured by QSCI_SetWakeupMode. Hardware wakes the receiver by automatically disabling standby.

Parameters

- base – QSCI peripheral base address.
- bEnable – true to enable, false to disable.

static inline void QSCI_EnableLINSlaveMode(QSCI_Type *base, bool bEnable)

Enable/Disable LIN slave mode.

If enabled QSCI is in LIN slave mode. When break is detected, the baudrate register is automatically adjusted to match the value measured from the sync character that follows.

Parameters

- base – QSCI peripheral base address.
- bEnable – true to enable, false to disable.

static inline void QSCI_EnableStopHold(QSCI_Type *base, bool bEnable)

Enable/Disable stop mode hold off.

When enabled, if chip level stop mode occurs and transmiter or receiver is still busy, QSCI will hold off stop mode until both transmiter and receiver are idle.

Parameters

- base – QSCI peripheral base address.
- bEnable – true to enable, false to disable.

static inline void QSCI_SetTransferMode(QSCI_Type *base, *qsci_transfer_mode_t* eTransferMode)

Sets the QSCI transfer mode.

Parameters

- base – QSCI peripheral base address.
- eTransferMode – The QSCI tx/rx loop mode, kQSCI_Normal to use normal transfer, kQSCI_LoopInternal to let internal tx feed back to rx, kQSCI_SingleWire to use single wire mode using tx pin as tx and rx.

static inline void QSCI_SetWakeupMode(QSCI_Type *base, *qsci_wakeup_mode_t* eWakeupMode)

Sets wakeup mode for QSCI.

Parameters

- base – QSCI peripheral base address.
- eWakeupMode – Wakeup mode, kQSCI_WakeupOnIdleLine or kQSCI_WakeupOnAddressMark.

static inline void QSCI_SetPolarityMode(QSCI_Type *base, *qsci_polarity_mode_t* ePolarityMode)

Sets polarity mode for QSCI.

Parameters

- base – QSCI peripheral base address.
- ePolarityMode – Polarity mode, kQSCI_PolarityNormal or kQSCI_PolarityInvert.

static inline void QSCI_SetParityMode(QSCI_Type *base, *qsci_parity_mode_t* eParityMode)

Sets parity mode for QSCI.

Parameters

- base – QSCI peripheral base address.
- eParityMode – Polarity mode, kQSCI_ParityDisabled, kQSCI_ParityEven or kQSCI_ParityOdd.

status_t QSCI_SetBaudRate(QSCI_Type *base, uint32_t u32BaudRateBps, uint32_t u32SrcClockHz)

Sets the QSCI instance baud rate.

This function configures the QSCI module baud rate. This function can be used to update QSCI module baud rate after the QSCI module is initialized by the QSCI_Init.

Parameters

- base – QSCI peripheral base address.
- u32BaudRateBps – QSCI baudrate to be set.
- u32SrcClockHz – QSCI clock source frequency in Hz.

Return values

- kStatus_QSCI_BaudrateNotSupport – Baudrate is not supported in the current clock source.
- kStatus_Success – Set baudrate succeeded.

static inline void QSCI_EnableFifo(QSCI_Type *base, bool bEnable)

Enables/Disables transmitter/receiver FIFO.

Parameters

- base – QSCI peripheral base address.
- bEnable – true to enable, false to disable.

static inline void QSCI_SetTxWaterMark(QSCI_Type *base, *qsci_tx_water_t* eTxFifoWatermark)

Sets transmitter watermark.

Parameters

- base – QSCI peripheral base address.
- eTxFifoWatermark – Tx water mark level.

static inline void QSCI_SetRxWaterMark(QSCI_Type *base, *qsci_rx_water_t* eRxFifoWatermark)

Sets receiver watermark.

Parameters

- base – QSCI peripheral base address.
- eRxFifoWatermark – Rx water mark level.

static inline void QSCI_EnableTxDMA(QSCI_Type *base, bool bEnable)

Enables or disables the QSCI transmitter DMA request.

This function enables or disables CTRL2[TDE], to generate the DMA requests when Tx data register is empty.

Parameters

- base – QSCI peripheral base address.
- bEnable – True to enable, false to disable.

static inline void QSCI_EnableRxDMA(QSCI_Type *base, bool bEnable)

Enables or disables the QSCI receiver DMA request.

This function enables or disables CTRL2[RDE], to generate DMA requests when receiver data register is full.

Parameters

- base – QSCI peripheral base address.
- bEnable – True to enable, false to disable.

static inline uint32_t QSCI_GetDataRegisterAddress(QSCI_Type *base)

Gets the QSCI data register byte address.

This function returns the QSCI data register address, which is mainly used by DMA/eDMA.

Parameters

- base – QSCI peripheral base address.

Returns

QSCI data register byte addresses which are used both by the transmitter and the receiver.

static inline void QSCI_WriteByte(QSCI_Type *base, uint8_t u8Data)

Writes to the TX register.

This function writes data to the TX register directly. The upper layer must ensure that the TX register is empty or TX FIFO has room before calling this function.

Parameters

- base – QSCI peripheral base address.
- u8Data – The byte to write.

static inline void QSCI_SendAddress(QSCI_Type *base, uint8_t u8Address)

Sends an address frame in 9-bit data mode.

Parameters

- base – QSCI peripheral base address.
- u8Address – QSCI slave address.

static inline uint8_t QSCI_ReadByte(QSCI_Type *base)

Reads the RX register directly.

This function reads data from the RX register directly. The upper layer must ensure that the RX register is full or that the TX FIFO has data before calling this function.

Parameters

- base – QSCI peripheral base address.

Returns

The byte read from QSCI data register.

void QSCI_WriteBlocking(QSCI_Type *base, const uint8_t *pu8Data, uint32_t u32Length)

Writes TX register using a blocking method.

This function polls the TX register, waits TX register to be empty or TX FIFO have room then writes data to the TX buffer.

Parameters

- base – QSCI peripheral base address.
- pu8Data – Start address of the data to write.
- u32Length – Size of the data to write.

status_t QSCI_ReadBlocking(QSCI_Type *base, uint8_t *pu8Data, uint32_t u32Length)

Reads RX data register using a blocking method.

This function polls the RX register, waits RX register to be full or RX FIFO have data, then reads data from the RX register.

Parameters

- base – QSCI peripheral base address.
- pu8Data – Start address of the buffer to store the received data.
- u32Length – Size of the buffer.

Return values

- kStatus_Fail – Receiver error occurred while receiving data.
- kStatus_QSCI_RxHardwareOverrun – Receiver overrun occurred while receiving data
- kStatus_QSCI_NoiseError – Noise error occurred while receiving data
- kStatus_QSCI_FramingError – error occurred while receiving data
- kStatus_QSCI_ParityError – Parity error occurred while receiving data
- kStatus_Success – Successfully received all data.

static inline void QSCI_SendBreak(QSCI_Type *base)

Sends one break character (10 or 11 bits of zeroes).

Parameters

- base – QSCI peripheral base address.

void QSCI_TransferCreateHandle(QSCI_Type *base, *qsci_transfer_handle_t* *psHandle, *qsci_transfer_callback_t* pfCallback, void *pUserData)

Initializes the QSCI handle.

This function initializes the QSCI handle which can be used for other QSCI transactional APIs. Usually, for a specified QSCI instance, call this API once to get the initialized handle.

Parameters

- base – QSCI peripheral base address.
- psHandle – QSCI handle pointer.
- pfCallback – The callback function.
- pUserData – The parameter of the callback function.

void QSCI_TransferStartRingBuffer(*qsci_transfer_handle_t* *psHandle, uint8_t *pu8RxRingBuffer, uint16_t u16RxRingBufferSize)

Sets up the RX ring buffer.

This function sets up the RX ring buffer to a specific QSCI handle.

When the RX ring buffer is used, data received are stored into the ring buffer even when the user doesn't call the QSCI_TransferReceiveNonBlocking() API. If data is already received in the ring buffer, the user can get the received data from the ring buffer directly.

Note: When using the RX ring buffer, one byte is reserved for internal use. In other words, if ringBufferSize is 32, only 31 bytes are used for saving data.

Parameters

- psHandle – QSCI handle pointer.
- pu8RxRingBuffer – Start address of the ring buffer for background receiving. Pass NULL to disable the ring buffer.
- u16RxRingBufferSize – Size of the ring buffer.

void QSCI_TransferStopRingBuffer(*qsci_transfer_handle_t* *psHandle)

Aborts the background transfer and uninstalls the ring buffer.

This function aborts the background transfer and uninstalls the ring buffer.

Parameters

- psHandle – QSCI handle pointer.

uint16_t QSCI_TransferGetRxRingBufferLength(*qsci_transfer_handle_t* *psHandle)

Get the ring buffer valid data length.

Parameters

- psHandle – QSCI handle pointer.

Returns

Valid data length in ring buffer.

status_t QSCI_TransferSendNonBlocking(*qsci_transfer_handle_t* *psHandle, *qsci_transfer_t* *psTransfer)

Transmits a buffer of data using the interrupt method.

This function sends data using an interrupt method. This is a non-blocking function, which returns directly without waiting for all data to be written to the TX register. When all data is sent out, the QSCI driver calls the callback function and passes the kStatus_QSCI_TxIdle as status parameter.

Parameters

- psHandle – QSCI handle pointer.
- psTransfer – QSCI transfer structure. See qsci_transfer_t.

Return values

- kStatus_Success – Successfully start the data transmission.
- kStatus_QSCI_TxBusy – Previous transmission still not finished; data not all written to TX register yet.

void QSCI_TransferAbortSend(*qsci_transfer_handle_t* *psHandle)

Aborts the interrupt-driven data transmit.

This function aborts the interrupt-driven data sending. The user can get the remainBytes to find out how many bytes are not sent out.

Parameters

- psHandle – QSCI handle pointer.

status_t QSCI_TransferGetSendCount(*qsci_transfer_handle_t* *psHandle, uint32_t *pu32Count)

Gets the number of bytes sent out to bus.

This function gets the number of bytes sent out to bus by using the interrupt method.

Parameters

- psHandle – QSCI handle pointer.
- pu32Count – Send bytes count.

Return values

- kStatus_NoTransferInProgress – No send in progress.
- kStatus_Success – Get successfully through the parameter count;

status_t QSCI_TransferReceiveNonBlocking(*qsci_transfer_handle_t* *psHandle, *qsci_transfer_t* *psTransfer, uint32_t *pu32ReceivedBytes)

Receives a buffer of data using an interrupt method.

This function receives data using an interrupt method. This is a non-blocking function, which returns without waiting for all data to be received. If the RX ring buffer is used and not empty, the data in the ring buffer is copied and the parameter pu32ReceivedBytes shows how many bytes are copied from the ring buffer. After copying, if the data in the ring buffer is not enough to read, the receive request is saved by the QSCI driver. When the new data arrives, the receive request is serviced first. When all data is received, the QSCI driver notifies the upper layer through a callback function and passes the status parameter kStatus_QSCI_RxIdle. For example, the upper layer needs 10 bytes but there are only 5 bytes in the ring buffer. The 5 bytes are copied to the psTransfer->data and this function returns with the parameter pu32ReceivedBytes set to 5. For the left 5 bytes, newly arrived data is saved from the psTransfer->data[5]. When 5 bytes are received, the QSCI driver notifies the upper layer. If the RX ring buffer is not enabled, this function enables the RX and RX interrupt to receive data to the psTransfer->data. When all data is received, the upper layer is notified.

Parameters

- psHandle – QSCI handle pointer.
- psTransfer – QSCI transfer structure, see qsci_transfer_t.
- pu32ReceivedBytes – Bytes received from the ring buffer directly.

Return values

- kStatus_Success – Successfully queue the transfer into transmit queue.
- kStatus_QSCI_RxBusy – Previous receive request is not finished.

void QSCI_TransferAbortReceive(*qsci_transfer_handle_t* *psHandle)

Aborts the interrupt-driven data receiving.

This function aborts the interrupt-driven data receiving. The user can get the remainBytes to know how many bytes are not received yet.

Parameters

- psHandle – QSCI handle pointer.

status_t QSCI_TransferGetReceivedCount(*qsci_transfer_handle_t* *psHandle, uint32_t *pu32Count)

Gets the number of bytes that have been received.

This function gets the number of bytes that have been received.

Parameters

- psHandle – QSCI handle pointer.
- pu32Count – Receive bytes count.

Return values

- kStatus_NoTransferInProgress – No receive in progress.
- kStatus_InvalidArgument – Parameter is invalid.
- kStatus_Success – Get successfully through the parameter pu32Count;

FSL_QSCI_DRIVER_VERSION

QSCI driver version.

Status codes for the QSCI driver.

Values:

enumerator kStatus_QSCI_TxBusy

Transmitter is busy.

enumerator kStatus_QSCI_RxBusy

Receiver is busy.

enumerator kStatus_QSCI_TxIdle

Transmitter is idle.

enumerator kStatus_QSCI_RxIdle

Receiver is idle.

enumerator kStatus_QSCI_FlagCannotClearManually

Status flag can’t be manually cleared.

enumerator kStatus_QSCI_RxRingBufferOverrun

QSCI RX software ring buffer overrun.

enumerator kStatus_QSCI_RxHardwareOverrun

QSCI receiver hardware overrun.

enumerator kStatus_QSCI_NoiseError

QSCI noise error.

enumerator kStatus_QSCI_FramingError

QSCI framing error.

enumerator kStatus_QSCI_ParityError

QSCI parity error.

enumerator kStatus_QSCI_BaudrateNotSupport

Baudrate is not supported in current clock source

enumerator kStatus_QSCI_IdleLineDetected

QSCI IDLE line detected.

enumerator kStatus_QSCI_Timeout

Timeout happens when waiting for status flags to change.

enum _qsci_status_flags

QSCI hardware status flags.

These enumerations can be ORed together to form bit masks.

Values:

enumerator kQSCI_TxDataRegEmptyFlag

TX data register empty flag.

enumerator kQSCI_TxIdleFlag

Transmission idle flag.

enumerator kQSCI_RxDataRegFullFlag

RX data register full flag.

enumerator kQSCI_RxIdleLineFlag

Rx Idle line flag.

enumerator kQSCI_RxOverrunFlag

RX overrun flag.

enumerator kQSCI_RxNoiseFlag

RX detect noise on Rx input.

enumerator kQSCI_RxFrameErrorFlag

Rx frame error flag, sets if logic 0 was detected for stop bit

enumerator kQSCI_RxParityErrorFlag

Rx parity error if parity enabled, sets upon parity error detection

enumerator kQSCI_RxInputEdgeFlag

RX pin active edge interrupt flag, sets when active edge detected

enumerator kQSCI_LINSyncErrorFlag

Only for LIN mode.

enumerator kQSCI_TxDMARequestFlag

Tx DMA request is ongoing.

enumerator kQSCI_RxDMARequestFlag

Rx DMA request is ongoing.

enumerator kQSCI_RxActiveFlag

enumerator kQSCI_Group0Flags

Members in kQSCI_Group0Flags can't be cleared by QSCI_ClearStatusFlags, they are handled by HW.

enumerator kQSCI_Group1Flags

Whole kQSCI_Group1Flags will be cleared if trying to clear any member in kQSCI_Group1Flags or kQSCI_Group2Flags in the mask.

enumerator kQSCI_Group2Flags

Member in kQSCI_Group2Flags can be cleared individually

enumerator kQSCI_StatusAllFlags

enum _qsci_interrupt_enable

QSCI interrupt enable/disable source.

These enumerations can be ORed together to form bit masks.

Values:

enumerator kQSCI_TxEmptyInterruptEnable
Transmit data register empty interrupt.

enumerator kQSCI_TxIdleInterruptEnable
Transmission idle interrupt.

enumerator kQSCI_RxFullInterruptEnable
Receive data register full interrupt.

enumerator kQSCI_RxErrorInterruptEnable
Receive error interrupt.

enumerator kQSCI_RxInputEdgeInterruptEnable
Receive input edge interrupt.

enumerator kQSCI_RxIdleLineInterruptEnable
Receive idle interrupt.

enumerator kQSCI_AllInterruptEnable

enum _qsci_transfer_mode
QSCI transmiter/receiver loop mode.

Values:

enumerator kQSCI_Normal
Normal mode, 2 signal pins, no loop.

enumerator kQSCI_LoopInternal
Loop mode with internal TXD fed back to RXD.

enumerator kQSCI_SingleWire
Use tx pin as input and output half-duplex transfer.

enum _qsci_data_bit_mode
QSCI data bit count.

Values:

enumerator kQSCI_Data8Bit
1 start bit, 8 data bit, 1 stop bit

enumerator kQSCI_Data9Bit
1 start bit, 9 data bit, 1 stop bit. This mode actually is not supported yet in driver.

enum _qsci_wakeup_mode
QSCI wakeup mode.

Values:

enumerator kQSCI_WakeupOnIdleLine
Idle condition wakes the QSCI module.

enumerator kQSCI_WakeupOnAddressMark
Address mark wakes the QSCI module.

enum _qsci_polarity_mode
QSCI signal polarity mode.

Values:

enumerator kQSCI_PolarityNormal
Normal mode, no inversion.

enumerator kQSCI_PolarityInvert
Invert transmit and receive data bits.

enum _qsci_parity_mode
QSCI parity mode.

Values:

enumerator kQSCI_ParityDisabled
Parity disabled

enumerator kQSCI_ParityEven
Parity enabled, type even, bit setting: PE|PT = 10

enumerator kQSCI_ParityOdd
Parity enabled, type odd, bit setting: PE|PT = 11

enum _qsci_tx_water
QSCI transmitter watermark level.

Values:

enumerator kQSCI_TxWater0Word
Tx interrupt sets when tx fifo empty.

enumerator kQSCI_TxWater1Word
Tx interrupt sets when tx fifo has 1 or few word.

enumerator kQSCI_TxWater2Word
Tx interrupt sets when tx fifo has 2 or few words.

enumerator kQSCI_TxWater3Word
Tx interrupt sets when tx fifo not full.

enum _qsci_rx_water
QSCI receiver watermark level.

Values:

enumerator kQSCI_RxWater1Word
Rx interrupt sets when rx fifo not empty.

enumerator kQSCI_RxWater2Word
Rx interrupt sets when rx fifo has at least 1 word.

enumerator kQSCI_RxWater3Word
Rx interrupt sets when rx fifo has at least 2 words.

enumerator kQSCI_RxWater4Word
Rx interrupt sets when rx fifo full.

typedef enum *_qsci_transfer_mode* qsci_transfer_mode_t
QSCI transmiter/receiver loop mode.

typedef enum *_qsci_data_bit_mode* qsci_data_bit_mode_t
QSCI data bit count.

typedef enum *_qsci_wakeup_mode* qsci_wakeup_mode_t
QSCI wakeup mode.

typedef enum *_qsci_polarity_mode* qsci_polarity_mode_t
QSCI signal polarity mode.

typedef enum *_qsci_parity_mode* qsci_parity_mode_t
QSCI parity mode.

typedef enum *_qsci_tx_water* qsci_tx_water_t
QSCI transmitter watermark level.

typedef enum *_qsci_rx_water* qsci_rx_water_t
QSCI receiver watermark level.

typedef struct *_qsci_config* qsci_config_t
QSCI configuration structure.

typedef struct *_qsci_transfer_handle_t* qsci_transfer_handle_t
Forward declaration of the handle typedef .

typedef void (*qsci_transfer_callback_t)(*qsci_transfer_handle_t* *psHandle)
QSCI interrupt transfer callback function definition.

Defines the interface of user callback function used in QSCI interrupt transfer using transactional APIs. The callback function shall be defined and declared in application level by user. Before starting QSCI transmiting or receiving by calling QSCI_TransferSendNonBlocking or QSCI_TransferReceiveNonBlocking, call QSCI_TransferCreateHandle to install the user callback. When the transmiting or receiving ends or any bus error like hardware overrun occurs, user callback will be invoked by driver.

Param psHandle
Transfer handle that contains bus status, user data.

typedef struct *_qsci_transfer* qsci_transfer_t
QSCI transfer structure.

typedef void (*qsci_isr_t)(void *handle)

qsci_isr_t s_pfQsciIsr

void *s_psQsciHandles[]

IRQn_Type const s_eQsciTXIdleIRQs[]

uint16_t QSCI_GetInstance(QSCI_Type *base)
Get the QSCI instance from peripheral base address.

Parameters

- base – QSCI peripheral base address.

Returns
QSCI instance.

void QSCI_DriverIRQHandler(uint32_t instance)
QSCI driver IRQ handler common entry.

This function provides the common IRQ request entry for QSCI.

Parameters

- instance – QSCI instance.

QSCI_RETRY_TIMES
Retry times when checking status flags.

QSCI_GET_BUS_STATUS(psHandle)
Macros to be used inside user callback.

QSCI_GET_TRANSFER_USER_DATA(psHandle)

struct _qsci_config
#include <fsl_qsci.h> QSCI configuration structure.

Public Members

qsci_transfer_mode_t eTransferMode
Transmitter/receiver loop mode.

bool bStopInWaitEnable
Enable/disable module stops working in wait mode.

qsci_data_bit_mode_t eDataBitMode
Number of data bits.

qsci_wakeup_mode_t eWakeupMode
Receiver wakeup mode, idle line or addressmark.

qsci_polarity_mode_t ePolarityMode
Polarity of transmit/receive data.

qsci_parity_mode_t eParityMode
Parity mode, disabled (default), even, odd.

bool bEnableStopHold
Control the stop hold enable.

bool bEnableTx
Enable TX

bool bEnableRx
Enable RX

bool bEnableFifo
Enable Tx/Rx FIFO

bool bEnableTxDMA
Enable Tx DMA

bool bEnableRxDMA
Enable Rx DMA

qsci_tx_water_t eTxFifoWatermark
TX FIFO watermark

qsci_rx_water_t eRxFifoWatermark
RX FIFO watermark

uint8_t u8Interrupts
Mask of QSCI interrupt sources to enable.

uint32_t u32BaudRateBps
QSCI baud rate

uint32_t u32SrcClockHz
The clock source frequency for QSCI module.

struct _qsci_transfer_handle_t
#include <fsl_qsci.h> QSCI transfer handle.

Note: If user wants to use the transactional API to transfer data in interrupt way, one QSCI instance should and can only be allocated one handle.

Note: The handle is maintained by QSCI driver internally, which means the transfer state is retained and user shall not modify its state u8TxState or u8RxState in application level. If user only wish to use transactional APIs without understanding its machanism, it is not necessary to understand these members.

Public Members

QSCI_Type *base
: QSCI base pointer to the instance belongs to this handle.

uint8_t *pu8TxData
: Address of remaining data to send.

volatile uint32_t u32TxRemainingSize
: Size of the remaining data to send.

uint32_t u32TxDataSize
: Size of the data to send out.

uint8_t *pu8RxData
: Address of remaining data to receive.

volatile uint32_t u32RxRemainingSize
: Size of the remaining data to receive.

uint32_t u32RxDataSize
: Size of the data to receive.

uint8_t *pu8RxRingBuffer
: Start address of the receiver ring buffer.

uint16_t u16RxRingBufferSize
: Size of the ring buffer.

volatile uint16_t u16RxRingBufferHead
: Index for the driver to store received data into ring buffer.

volatile uint16_t u16RxRingBufferTail
: Index for the user to get data from the ring buffer.

qsci_transfer_callback_t pfCallback
: Callback function.

void *pUserData
: QSCI callback function parameter.

volatile uint8_t u8TxState
: TX transfer state.

volatile uint8_t u8RxState
: RX transfer state

status_t busStatus
: QSCI bus status.

struct _qsci_transfer
: *#include <fsl_qsci.h>* QSCI transfer structure.

Public Members

uint8_t *pu8Data

The buffer pointer of data to be transferred.

uint32_t u32DataSize

The byte count to be transferred.

2.59 The Driver Change Log

2.60 QSCI_EDMA: EDMA based QSCI Driver

void QSCI_TransferCreateHandleEDMA(QSCI_Type *base, *qsci_edma_transfer_handle_t* *psHandle, *qsci_edma_transfer_callback_t* pfCallback, void *pUserData, DMA_Type *edmaBase, *edma_channel_t* eEdmaTxChannel, *edma_channel_t* eEdmaRxChannel)

Initializes the QSCI edma handle.

This function initializes the QSCI edma handle which can be used for other QSCI transactional APIs. Usually, for a specified QSCI instance, call this API once to get the initialized handle.

Parameters

- base – QSCI peripheral base address.
- psHandle – Pointer to qsci_edma_transfer_handle_t structure.
- pfCallback – Callback function.
- pUserData – User data.
- edmaBase – Edma base address.
- eEdmaTxChannel – eDMA channel for TX transfer.
- eEdmaRxChannel – eDMA channel for RX transfer.

status_t QSCI_TransferSendEDMA(*qsci_edma_transfer_handle_t* *psHandle, *qsci_transfer_t* *psTransfer)

Initiate data transmit using EDMA.

This function initiates a data transmit process using eDMA. This is a non-blocking function, which returns right away. When all the data is sent, the send callback function is called.

Parameters

- psHandle – QSCI handle pointer.
- psTransfer – QSCI eDMA transfer structure. See qsci_transfer_t.

Return values

- kStatus_Success – if succeed, others failed.
- kStatus_QSCI_TxBusy – Previous transfer on going.
- kStatus_InvalidArgument – Invalid argument.

status_t QSCI_TransferReceiveEDMA(*qsci_edma_transfer_handle_t* *psHandle, *qsci_transfer_t* *psTransfer)

Initiate data receive using EDMA.

This function initiates a data receive process using eDMA. This is a non-blocking function, which returns right away. When all the data is received, the receive callback function is called.

Parameters

- psHandle – Pointer to qsci_edma_transfer_handle_t structure.
- psTransfer – QSCI eDMA transfer structure, see qsci_transfer_t.

Return values

- kStatus_Success – if succeed, others fail.
- kStatus_QSCI_RxBusy – Previous transfer ongoing.
- kStatus_InvalidArgument – Invalid argument.

void QSCI_TransferAbortSendEDMA(*qsci_edma_transfer_handle_t* *psHandle)

Aborts the data transmit process using EDMA.

Parameters

- psHandle – Pointer to qsci_edma_transfer_handle_t structure.

void QSCI_TransferAbortReceiveEDMA(*qsci_edma_transfer_handle_t* *psHandle)

Aborts the data receive process using EDMA.

Parameters

- psHandle – Pointer to qsci_edma_transfer_handle_t structure.

status_t QSCI_TransferGetReceivedCountEDMA(*qsci_edma_transfer_handle_t* *psHandle, uint32_t *pu32Count)

Gets the number of received bytes.

This function gets the number of received bytes.

Parameters

- psHandle – QSCI handle pointer.
- pu32Count – Receive bytes count.

Return values

- kStatus_NoTransferInProgress – No receive in progress.
- kStatus_Success – Get successfully through the parameter count;

status_t QSCI_TransferGetSendCountEDMA(*qsci_edma_transfer_handle_t* *psHandle, uint32_t *pu32Count)

Gets the number of bytes written to the QSCI TX register.

This function gets the number of bytes written to the QSCI TX register by DMA.

Parameters

- psHandle – QSCI handle pointer.
- pu32Count – Send bytes count.

Return values

- kStatus_NoTransferInProgress – No send in progress.
- kStatus_Success – Get successfully through the parameter count;

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QSCI EDMA driver version.

typedef struct *_qsci_edma_transfer_handle* qsci_edma_transfer_handle_t

Forward declaration of the qsci edma handle typedef. .

typedef void (*qsci_edma_transfer_callback_t)(*qsci_edma_transfer_handle_t* *psHandle)

QSCI edma transfer callback function definition.

Defines the interface of user callback function used in QSCI edma transfer using transactional APIs. The callback function shall be defined and declared in application level by user. Before starting QSCI transmiting or receiving by calling QSCI_TransferSendEDMA or QSCI_TransferReceiveEDMA, call QSCI_TransferCreateHandleEDMA to install the user callback. When the transmiting or receiving ends, user callback will be invoked by driver.

Param psHandle
Transfer handle that contains bus status, user data.

struct _qsci_edma_transfer_handle

#include <fsl_qsci_edma.h> QSCI edma transfer handle.

This struct address should be sizeof(edma_channel_tcd_t) aligned.

Note: If user wants to use the transactional API to transfer data in edma way, one QSCI instance should and can only be allocated one handle.

Note: The handle is maintained by QSCI driver internally, which means the transfer state is retained and user shall not modify its state u8TxState or u8RxState in application level. If user only wish to use transactional APIs without understanding its machanism, it is not necessary to understand these members.

Public Members

edma_channel_tcd_t sTxTcd

TCD for EDMA TX transfer.

edma_channel_tcd_t sRxTcd

TCD for EDMA RX transfer.

QSCI_Type *base

Pointer to the QSCI base that belongs to this handle.

qsci_edma_transfer_callback_t pfCallback

Callback function.

uint32_t u32RxDataSizeAll

Size of the data to receive.

uint32_t u32TxDataSizeAll

Size of the data to send out.

edma_handle_t sTxEdmaHandle

The eDMA TX channel used.

edma_handle_t sRxEdmaHandle

The eDMA RX channel used.

volatile uint8_t u8TxState
TX transfer state.

volatile uint8_t u8RxState
RX transfer state

status_t busStatus
QSCI bus status.

void *pUserData
User configurable pointer to any data, function, structure etc that user wish to use in the callback

2.61 QSCI Peripheral and Driver Overview

2.62 QSPI: Queued SPI Driver

void QSPI_MasterInit(QSPI_Type *base, const *qspi_master_config_t* *psConfig)
Initializes the QUEUEDSPI as Master.

Use helpher function QSPI_MasterGetDefaultConfig to get ready-to-use structure.

Parameters

- base – QUEUEDSPI peripheral address.
- psConfig – Pointer to the structure qspi_master_config_t.

void QSPI_MasterGetDefaultConfig(*qspi_master_config_t* *psConfig, uint32_t u32ClockFreqHz)
Helper function to create ready-to-user maste init structure.

The purpose of this API is to get the configuration structure initialized for the QSPI_MasterInit. Users may use the initialized structure unchanged in the QSPI_MasterInit or modify the structure before calling the QSPI_MasterInit. Example:

```
qspi_master_config_t sMasterConfig;
QSPI_MasterGetDefaultConfig(&sMasterConfig);
```

The default values are: Example:

```
// Parameter provided by user
psConfig->u32BaudRateBps = u32BaudRateBps;
psConfig->u32ClockFrequencyHz = u32ClockFreqHz;
psConfig->eDataWidth = eDataWidth;

// Default configuration
psConfig->eClkPolarity = kQSPI_ClockPolarityActiveRisingEdge;
psConfig->eClkPhase = kQSPI_ClockPhaseSlaveSelectHighBetweenWords;
psConfig->eShiftDirection = kQSPI_MsbFirst;
psConfig->u16DelayBetweenFrameInCLK = 1U;
psConfig->bEnableWiredOrMode = false;
psConfig->bEnableModeFault = false;
psConfig->u8DmaEnableFlags = 0U;    // Disable TX/RX Dma
psConfig->bEnableFIFO = false;
psConfig->bEnableStopModeHoldOff = false;
psConfig->u8Interrupts = 0U;
psConfig->bEnableModule = false;
@todo To be added
```

Parameters

- psConfig – pointer to qspi_master_config_t structure.
- u32ClockFreqHz – Peripheral clock frequency in Hz

void QSPI_SlaveInit(QSPI_Type *base, const *qspi_slave_config_t* *psConfig)

Initializes the QUEUEDSPI as slave.

Use helpher function QSPI_SlaveGetDefaultConfig to get ready-to-use structure.

Parameters

- base – QUEUEDSPI peripheral address.
- psConfig – Pointer to the structure qspi_slave_config_t.

void QSPI_SlaveGetDefaultConfig(*qspi_slave_config_t* *psConfig)

Set the qspi_slave_config_t structure to default values.

The purpose of this API is to get the configuration structure initialized for the QSPI_SlaveInit. Users may use the initialized structure unchanged in the QSPI_SlaveInit or modify the structure before calling the QSPI_SlaveInit. Example:

```
qspi_slave_config_t slaveConfig;
QSPI_SlaveGetDefaultConfig(&slaveConfig);
```

The default values are: Example:

```
@todo
```

Parameters

- psConfig – Pointer to the qspi_slave_config_t structure.

void QSPI_Deinit(QSPI_Type *base)

De-initialize the QUEUEDSPI peripheral for either Master or Slave.

Parameters

- base – QUEUEDSPI peripheral address.

static inline void QSPI_EnableInterrupts(QSPI_Type *base, uint8_t u8Interrupts)

Enable one or multiple interrupts.

This function enable one or multiple interrupts.

Note: for TX and RX requests, while enabling the interrupt request the DMA request will be disabled as well. Do not use this API while QUEUEDSPI is in running state.

Parameters

- base – QUEUEDSPI peripheral address.
- u8Interrupts – The interrupt mask which is ORed by the _qspi_interrupt_enable.

static inline void QSPI_DisableInterrupts(QSPI_Type *base, uint8_t u8Interrupts)

Disable one or multiple interrupts.

This function

Parameters

- base – QUEUEDSPI peripheral address.
- u8Interrupts – The interrupt mask which is ORed by the _qspi_interrupt_enable.

static inline void QSPI_EnableDMA(QSPI_Type *base, uint8_t u8DmaFlags)

Enable one or multiple DMA.

Note that if the DMA is enabled for Transmit or Receive, make sure the interurpt is disabled for Transmit or Receive.

Parameters

- base – QUEUEDSPI peripheral address.
- u8DmaFlags – DMA Flags ORed from _qspi_dma_enable_flags.

static inline void QSPI_DisableDMA(QSPI_Type *base, uint8_t u8DmaFlags)

Enable one or multiple DMA.

Note that if the DMA is enabled for Transmit or Receive, make sure the interurpt is disabled for Transmit or Receive.

Parameters

- base – QUEUEDSPI peripheral address.
- u8DmaFlags – DMA Flags ORed from _qspi_dma_enable_flags.

static inline uint32_t QSPI_GetTxRegisterAddress(QSPI_Type *base)

Get the QUEUEDSPI transmit data register address for the DMA operation.

Parameters

- base – QUEUEDSPI peripheral address.

Returns

The QUEUEDSPI master PUSHR data register address.

static inline uint32_t QSPI_GetRxRegisterAddress(QSPI_Type *base)

Get the QUEUEDSPI receive data register address for the DMA operation.

Parameters

- base – QUEUEDSPI peripheral address.

Returns

The QUEUEDSPI POPR data register address.

static inline uint16_t QSPI_GetStatusFlags(QSPI_Type *base)

Get the QUEUEDSPI status flag state.

Parameters

- base – QUEUEDSPI peripheral address.

Returns

QUEUEDSPI status.

static inline void QSPI_ClearStatusFlags(QSPI_Type *base, uint16_t u16StatusFlags)

Clear the status flag only for the mode fault.

Clear the status flag only for mode fault.

Note: only kQSPI_ModeFaultFlag can be cleared by this API.

Parameters

- base – QUEUEDSPI peripheral address.
- u16StatusFlags – status flags ORed from _qspi_status_flags

static inline void QSPI_Enable(QSPI_Type *base, bool bEnable)

Enable or disable the QUEUEDSPI peripheral.

Parameters

- base – QUEUEDSPI peripheral address.
- bEnable – true to enable module, otherwise disable module

uint32_t QSPI_MasterSetBaudRate(QSPI_Type *base, uint32_t u32BaudRateBps, uint32_t u32SrcClockHz)

Set the QUEUEDSPI baud rate in bits-per-second.

This function takes in the desired baud rate, calculates the nearest possible baud rate, and returns the calculated baud rate in bits-per-second.

Parameters

- base – QUEUEDSPI peripheral address.
- u32BaudRateBps – The desired baud rate in bits-per-second.
- u32SrcClockHz – Module source input clock in Hertz.

Returns

The actual calculated baud rate.

static inline void QSPI_SetMasterSlaveMode(QSPI_Type *base, *qspi_master_slave_mode_t* eMode)

Set the QUEUEDSPI as master or slave.

Parameters

- base – QUEUEDSPI peripheral address.
- eMode – Mode setting of type qspi_master_slave_mode_t.

static inline bool QSPI_IsMaster(QSPI_Type *base)

Return whether the QUEUEDSPI module is in master mode.

Parameters

- base – QUEUEDSPI peripheral address.

Returns

Returns true if the module is in master mode or false if the module is in slave mode.

static inline void QSPI_SetDataShiftOrder(QSPI_Type *base, *qspi_data_shift_direction_t* eDataShiftOrder)

Set Data Shift Order as MSB first or LSB first.

Parameters

- base – QUEUEDSPI peripheral address.
- eDataShiftOrder – MSB or LSB first from qspi_data_shift_direction_t

static inline void QSPI_EnableModeFault(QSPI_Type *base, bool bEnable)

Enable/Disable mode fault detection.

If enable, allows the kQSPI_ModeFaultFlag flag to be set. If the kQSPI_ModeFaultFlag flag is set, disable the Mod detection does not clear the flag. If the mod detection is disabled, the level of the SS_B pin does not affect the operation of an enabled SPI configured as a master. If configured as a master and mod fault detection is enabled, a transaction in progress will stop if SS_B goes low. For an enabled SPI configured as a slave, having this feature disabled only prevents the flag from being set. It does not affect any other part of SPI operation

Parameters

- base – QUEUEDSPI peripheral address.
- bEnable – true to enable Mode Fault detection, false to disable

static inline void QSPI_SetClockPolarity(QSPI_Type *base, *qspi_clock_polarity_t* ePolarity)

Set clock polarity.

Note: module shall be disabled before change the polarity by calling QSPI_Enable.

Parameters

- base – QUEUEDSPI peripheral address.
- ePolarity – clock polarity option

static inline void QSPI_SetClockPhase(QSPI_Type *base, *qspi_clock_phase_t* eClockPhase)

Set clock phase.

Configure whether get the Slave Select signal toggle high during 2 data frames. Get the SS toggle high between data frames will lead to SPI to be trigged with transaction for the falling edge of SS signal. Otherwise, the data transaction is started on the first active SCLK edge.

Note: module shall be disabled before change the polarity by calling QSPI_Enable.

Note: Do not use kQSPI_ClockPhaseSlaveSelectHighBetweenWords in DMA mode.

Parameters

- base – QUEUEDSPI peripheral address.
- eClockPhase – Option for clock phase

static inline void QSPI_EnableWiredORMode(QSPI_Type *base, bool bEnable)

Enable/Disable Wired OR mode for SPI pins which means open-drain when enabled and push-pull when disabled.

Parameters

- base – QUEUEDSPI peripheral address.
- bEnable – true to configure SPI pins as open-drain, false to configure as push-pull

static inline void QSPI_SetTransactionDataSize(QSPI_Type *base, *qspi_data_width_t* eDataWidth)

Set the transaction data width.

Parameters

- base – QUEUEDSPI peripheral address.
- eDataWidth – datawidth for bits in each data frame.

static inline void QSPI_MasterSetWaitDelay(QSPI_Type *base, uint16_t u16WaitDelayInPeriClockCount)

For master mode, set wait delay in clock cycle with delay is set value + 1 peripheral bus clock.

This controls the time between data transactions in master mode. Delay will not be added if no word is waiting for transmitting.

Parameters

- base – QUEUEDSPI peripheral address.
- u16WaitDelayInPeriClockCount – Clock count for the delay during data frames

static inline void QSPI_EnableStopModeHoldOff(QSPI_Type *base, bool bEnable)

Enable/Disable hold off entry to stop mode is a word is being transmitted/received for Master Mode.

When enabled, this bit allows the SPI module to hold off entry to chip level stop mode if a word is being transmitted or received. Stop mode will be entered after the SPI finishes transmitting/receiving. This bit does not allow the SPI to wake the chip from stop mode in any way. The SHEN bit can only delay the entry into stop mode. This bit should not be set in slave mode because the state of SS_B (which would be controlled by an external master device) may cause the logic to hold off stop mode entry forever.

Parameters

- base – QUEUEDSPI peripheral address.
- bEnable – true to enable hold-off entrying stop mode if there is transmitting/receiving

uint32_t QSPI_GetInstance(QSPI_Type *base)

Helper function exported for QSPI DMA driver.

Get the instance index from the base address. User need not understand this function.

Parameters

- base – QUEUEDSPI peripheral address.

Returns

uint32_t Index of the peripheral instance for given base address.

static inline *qspi_ss_data_logic_level_t* QSPI_MasterGetSlaveSelectLogicLevel(QSPI_Type *base)

For master mode, get the SS_B input logic level while true means drive High and false means drive Low.

Get the value to drive on the SS_B pin. This bit is disabled when SSB_AUTO=1 or SSB_STRB=1. Only apply for Master mode.

Parameters

- base – QUEUEDSPI peripheral address.

Returns

true SS_B input level High

Returns

false SS_B input level Low

static inline void QSPI_MasterSetSlaveSelectLogicLevel(QSPI_Type *base, *qspi_ss_data_logic_level_t* eLogicLevel)

for master mode, drive Slave Select pin logic high or low

This feature is disabled if Slave Select automatic mode is enabled or Slave Select Strobe feature is enabled

Parameters

- base – QUEUEDSPI peripheral address.
- eLogicLevel – logic level

static inline void QSPI_MasterEnableSlaveSelectOpenDrainMode(QSPI_Type *base, bool bEnable)

For master mode, Enable open drain in SSB pad pin.

Enable it means SS_B is configured for high and low drive. This mode is generally used in single master systems. Disable it means SS_B is configured as an open drain pin (only drives low output level). This mode is useful for multiple master systems

Parameters

- base – QUEUEDSPI peripheral address.
- bEnable – Enable/Disable option.

static inline void QSPI_MasterEnableSlaveSelectAutomaticMode(QSPI_Type *base, bool bEnable)

For master mode, Enable/Disable Slave Select pin automatic mode.

Parameters

- base – QUEUEDSPI peripheral address.
- bEnable – Enable/Disable option.

static inline void QSPI_SetSlaveSelectDirection(QSPI_Type *base, *qspi_ss_direction_t* eDirection)

Set Input/Output mode for SSB signal.

Parameters

- base – QUEUEDSPI peripheral address.
- eDirection – options from qspi_ss_direction_t

static inline void QSPI_MasterEnableSlaveSelectStrobe(QSPI_Type *base, bool bEnable)

For master, set strobe mode for SSB signal.

If enabled, Slave select pulse high during data frames irrespective of Clock Phase configuration

Parameters

- base – QUEUEDSPI peripheral address.
- bEnable – Enable/Disable option.

static inline void QSPI_EnableSlaveSelectOverride(QSPI_Type *base, bool bEnable)

Enable / Disable SSB signal from Master/Slave configuration or GPIO pin state.

Parameters

- base – QUEUEDSPI peripheral address.
- bEnable – Enable/Disable option.

void QSPI_SetDummyData(QSPI_Type *base, uint8_t u8DummyData)

Set up the dummy data used when there is not transmit data provided.

Parameters

- base – QUEUEDSPI peripheral address.
- u8DummyData – Data to be transferred when tx buffer is NULL.

uint8_t QSPI_GetDummyData(QSPI_Type *base)

Get the dummy data for each peripheral.

Parameters

- base – QUEUEDSPI peripheral base address.

static inline void QSPI_WriteData(QSPI_Type *base, uint16_t data)

Write data into the transmit data register without polling the status of shifting.

Parameters

- base – QUEUEDSPI peripheral address.
- data – The data to send.

static inline uint16_t QSPI_ReadData(QSPI_Type *base)

Read data from the receive data register.

Parameters

- base – QUEUEDSPI peripheral address.

Returns

The data from the receive data register.

static inline void QSPI_EnableFifo(QSPI_Type *base, bool bEnable)

Enable or disable the QUEUEDSPI FIFOs.

This function allows the caller to disable or enable the TX and RX FIFOs together.

Parameters

- base – QUEUEDSPI peripheral address.
- bEnable – Pass true to enable, pass false to disable

static inline uint16_t QSPI_GetTxFIFOCount(QSPI_Type *base)

Get TX FIFO level.

This function gets how many words are in the TX FIFO.

Parameters

- base – QUEUEDSPI peripheral address.

Returns

TX FIFO word count.

static inline uint16_t QSPI_GetRxFIFOCount(QSPI_Type *base)

Get RX FIFO level.

This function gets how many words are in the RX FIFO.

Parameters

- base – QUEUEDSPI peripheral address.

Returns

RX FIFO word count.

static inline void QSPI_SetFifoWatermarks(QSPI_Type *base, uint16_t txWatermark, uint16_t rxWatermark)

Set the transmit and receive FIFO watermark values.

Parameters

- base – QUEUEDSPI peripheral address.
- txWatermark – The TX FIFO watermark value. Refer to qspi_txfifo_watermark_t for available values.
- rxWatermark – The RX FIFO watermark value. Refer to qspi_rxfifo_watermark_t for available values.

static inline void QSPI_GetFifoWatermarks(QSPI_Type *base, uint8_t *pu8TxWatermark, uint8_t *pu8RxWatermark)

Get the transmit and receive FIFO watermark values.

Parameters

- base – QUEUEDSPI peripheral address.
- pu8TxWatermark – The TX FIFO watermark value.
- pu8RxWatermark – The RX FIFO watermark value.

static inline void QSPI_EmptyRxFifo(QSPI_Type *base)

Empty the QUEUEDSPI RX FIFO.

Parameters

- base – QUEUEDSPI peripheral address.

void QSPI_MasterTransferCreateHandle(QSPI_Type *base, *qspi_master_transfer_handle_t* *psHandle, *qspi_master_transfer_callback_t* pfCallback, void *pUserData)

Initialize the QUEUEDSPI master handle.

This function initializes the QUEUEDSPI handle, which can be used for other QUEUEDSPI transactional APIs. Usually, for a specified QUEUEDSPI instance, call this API once to get the initialized handle.

Note: If only use the QSPI_MasterTransferBlocking, this API is not necessary be called.

Parameters

- base – QUEUEDSPI peripheral address.
- psHandle – QUEUEDSPI handle pointer to qspi_master_transfer_handle_t.
- pfCallback – QUEUEDSPI callback.
- pUserData – Callback function parameter.

status_t QSPI_MasterTransferBlocking(QSPI_Type *base, *qspi_transfer_t* *psXfer)

Polling method of QUEUEDSPI master transfer.

This function transfers data using a polling method for master. This is a blocking function, which does not return until all transfers have been completed.

Parameters

- base – QUEUEDSPI peripheral address.
- psXfer – Pointer to the qspi_transfer_t structure.

Returns

status of status_t.

status_t QSPI_MasterTransferNonBlocking(*qspi_master_transfer_handle_t* *psHandle, *qspi_transfer_t* *psXfer)

Interrupt method of QUEUEDSPI master transfer.

This function transfers data using interrupts for master. This is a non-blocking function, which returns right away. When all data is transferred, the callback function is called.

Parameters

- psHandle – QUEUEDSPI handle pointer to qspi_master_transfer_handle_t.
- psXfer – Pointer to the qspi_transfer_t structure.

Returns
status of status_t.

status_t QSPI_MasterTransferGetCount(*qspi_master_transfer_handle_t* *psHandle, uint16_t *pu16Count)

Get the master transfer count.

Parameters

- psHandle – QUEUEDSPI handle pointer to qspi_master_transfer_handle_t.
- pu16Count – The number of bytes transferred by using the non-blocking transaction.

Returns
status of status_t.

void QSPI_MasterTransferAbort(*qspi_master_transfer_handle_t* *psHandle)

Abort a transfer that uses interrupts for master.

Parameters

- psHandle – QUEUEDSPI handle pointer to qspi_master_transfer_handle_t.

void QSPI_MasterTransferHandleIRQ(*qspi_master_transfer_handle_t* *psHandle)

QUEUEDSPI Master IRQ handler function.

This function processes the QUEUEDSPI transmit and receive IRQ.

Parameters

- psHandle – QUEUEDSPI handle pointer to qspi_master_transfer_handle_t.

void QSPI_SlaveTransferCreateHandle(QSPI_Type *base, *qspi_slave_transfer_handle_t* *psHandle, *qspi_slave_transfer_callback_t* pfCallback, void *pUserData)

Initialize the QUEUEDSPI slave handle.

This function initializes the QUEUEDSPI handle, which can be used for other QUEUEDSPI transactional APIs. Usually, for a specified QUEUEDSPI instance, call this API once to get the initialized handle.

Parameters

- base – QUEUEDSPI peripheral base address.
- psHandle – QUEUEDSPI handle pointer to the qspi_slave_transfer_handle_t.
- pfCallback – QUEUEDSPI callback.
- pUserData – Callback function parameter.

status_t QSPI_SlaveTransferNonBlocking(*qspi_slave_transfer_handle_t* *psHandle, *qspi_transfer_t* *psXfer)

Interrupt driven method of QUEUEDSPI slave transfer with completion will be notified by registered callback.

This function transfers data using interrupts for slave. This is a non-blocking function, which returns right away. When all data is transferred, the callback function is called.

Parameters

- psHandle – Pointer to the qspi_slave_transfer_handle_t structure which stores the transfer state.
- psXfer – Pointer to the qspi_transfer_t structure.

Returns
status of status_t.

status_t QSPI_SlaveTransferGetCount(*qspi_slave_transfer_handle_t* *psHandle, uint16_t *pu16Count)

Get the slave transfer count already transmitted/received.

Parameters

- psHandle – Pointer to the qspi_slave_transfer_handle_t structure which stores the transfer state.
- pu16Count – The number of bytes transferred by using the non-blocking transaction.

Returns

status of status_t.

void QSPI_SlaveTransferAbort(*qspi_slave_transfer_handle_t* *psHandle)

Abort a transaction.

Parameters

- psHandle – Pointer to the qspi_slave_transfer_handle_t structure which stores the transfer state.

void QSPI_SlaveTransferHandleIRQ(*qspi_slave_transfer_handle_t* *psHandle)

QUEUEDSPI slave IRQ handler function.

This function processes the QUEUEDSPI transmit and receive IRQ.

Parameters

- psHandle – Pointer to the qspi_slave_transfer_handle_t structure which stores the transfer state.

FSL_QSPI_DRIVER_VERSION

QSPI driver version.

QSPI_TRANSFER_GET_BASE(handle)

Extract Base Address from handle for master or slave handle.

QSPI_TRANSFER_GET_USER_DATA(handle)

Extract user data from handle for master or slave handle.

Status return code for the QUEUEDSPI driver. Only used in transactional layer in this driver.

.

Values:

enumerator kStatus_QSPI_Busy

QUEUEDSPI transfer is busy.

enumerator kStatus_QSPI_Error

QUEUEDSPI driver error.

enumerator kStatus_QSPI_Idle

QUEUEDSPI is idle.

enumerator kStatus_QSPI_OutOfRange

QUEUEDSPI transfer out of range.

enum _qspi_status_flags

QUEUEDSPI peripheral status flags.

Values:

enumerator kQSPI_TxEmptyFlag
Transmitter Empty Flag.

enumerator kQSPI_ModeFaultFlag
Mode Fault Flag.

enumerator kQSPI_RxOverflowFlag
Receiver Overflow Flag.

enumerator kQSPI_RxFullFlag
Receiver Full Flag.

enumerator kQSPI_AllStatusFlags

enum _qspi_interrupt_enable
QUEUEDSPI interrupt source.

Values:

enumerator kQSPI_TxInterruptEnable
SPTE interrupt enable.

enumerator kQSPI_RxInterruptEnable
SPRF interrupt enable.

enumerator kQSPI_RxOverFlowInterruptEnable
Bus error interrupt enable.

enumerator kQSPI_AllInterrupts

enum _qspi_ss_direction
options for Slave Select (SSB) signal direction.

Values:

enumerator kQSPI_SlaveSelectDirectionInput
SSB signal as input for slave mode or master mode with Mode fault enabled.

enumerator kQSPI_SlaveSelectDIrectionOutput
SSB signal as output.

enum _qspi_ss_data_logic_level
logical level for Slave Select (SSB) signal data

Values:

enumerator kQSPI_SlaveSelectLogicLow
Slave select logic level low

enumerator kQSPI_SlaveSelectLogicHigh
Slave select logic level high

enum _qspi_txfifo_watermark
QUEUEDSPI Transmit FIFO watermark settings.

Values:

enumerator kQSPI_TxFifoWatermarkEmpty
Transmit interrupt active when Tx FIFO is empty

enumerator kQSPI_TxFifoWatermarkOneWord
Transmit interrupt active when Tx FIFO has one or fewer words available

enumerator kQSPI_TxFifoWatermarkTwoWord
Transmit interrupt active when Tx FIFO has two or fewer words available

enumerator kQSPI_TxFifoWatermarkThreeWord
Transmit interrupt active when Tx FIFO has three or fewer words available

enum _qspi_rxfifo_watermark
QUEUEDSPI Receive FIFO watermark settings.

Values:

enumerator kQSPI_RxFifoWatermarkOneWord
Receive interrupt active when Rx FIFO has at least one word used

enumerator kQSPI_RxFifoWatermarkTwoWord
Receive interrupt active when Rx FIFO has at least two words used

enumerator kQSPI_RxFifoWatermarkThreeWord
Receive interrupt active when Rx FIFO has at least three words used

enumerator kQSPI_RxFifowatermarkFull
Receive interrupt active when Rx FIFO is full

enum _qspi_data_width
Transfer data width in each frame.

Values:

enumerator kQSPI_Data2Bits
2 bits data width

enumerator kQSPI_Data3Bits
3 bits data width

enumerator kQSPI_Data4Bits
4 bits data width

enumerator kQSPI_Data5Bits
5 bits data width

enumerator kQSPI_Data6Bits
6 bits data width

enumerator kQSPI_Data7Bits
7 bits data width

enumerator kQSPI_Data8Bits
8 bits data width

enumerator kQSPI_Data9Bits
9 bits data width

enumerator kQSPI_Data10Bits
10 bits data width

enumerator kQSPI_Data11Bits
11 bits data width

enumerator kQSPI_Data12Bits
12 bits data width

enumerator kQSPI_Data13Bits
13 bits data width

enumerator kQSPI_Data14Bits
14 bits data width

enumerator kQSPI_Data15Bits
15 bits data width

enumerator kQSPI_Data16Bits
16 bits data width

enum _qspi_dma_enable_flags
QUEUEDSPI DMA configuration for Transmit and Receive.

Values:

enumerator kQSPI_DmaRx
Receive DMA Enable Flag.

enumerator kQSPI_DmaTx
Transmit DMA Enable Flag.

enum _qspi_master_slave_mode
QUEUEDSPI master or slave mode configuration.

Values:

enumerator kQSPI_Slave
QUEUEDSPI peripheral operates in slave mode.

enumerator kQSPI_Master
QUEUEDSPI peripheral operates in master mode.

enum _qspi_clock_polarity
QUEUEDSPI clock polarity configuration.

Values:

enumerator kQSPI_ClockPolarityActiveRisingEdge
CPOL=0. Active-high QUEUEDSPI clock (idles low), rising edge of SCLK starts transaction.

enumerator kQSPI_ClockPolarityActiveFallingEdge
CPOL=1. Active-low QUEUEDSPI clock (idles high), falling edge of SCLK starts transaction.

enum _qspi_clock_phase
QUEUEDSPI clock phase configuration.

Values:

enumerator kQSPI_ClockPhaseSlaveSelectHighBetweenWords
CPHA=0, Slave Select toggle high during data frames.

enumerator kQSPI_ClockPhaseSlaveSelectLowBetweenWords
CPHA=1, Slave Select keep low during data frames.

enum _qspi_data_shift_direction
QUEUEDSPI data shifter direction options for a given CTAR.

Values:

enumerator kQSPI_MsbFirst
Data transfers start with most significant bit.

enumerator kQSPI_LsbFirst
Data transfers start with least significant bit.

enum _qspi_pcs_polarity_config
QUEUEDSPI Peripheral Chip Select Polarity configuration.

Values:

enumerator kQSPI_PcsActiveHigh
Pcs Active High (idles low).

enumerator kQSPI_PcsActiveLow
Pcs Active Low (idles high).

enum _qspi_master_transfer_flag
transaction layer configuration options for each transaction

Values:

enumerator kQSPI_MasterPCSContinous
Indicates whether the PCS signal de-asserts during transfer between frames, note this flag should not be used when CPHA is 0.

enumerator kQSPI_MasterActiveAfterTransfer
Indicates whether the PCS signal is active after the last frame transfer, note 1. this flag should not be used when CPHA is 0, 2. this flag can only be used when kQSPI_MasterPCSContinous is used.

enum _qspi_transfer_state
QUEUEDSPI transfer state, used internally for transactional layer.

Values:

enumerator kQSPI_Idle
Nothing in the transmitter/receiver.

enumerator kQSPI_Busy
Transfer queue is not finished.

enumerator kQSPI_Error
Transfer error.

typedef enum *_qspi_ss_direction* qspi_ss_direction_t
options for Slave Select (SSB) signal direction.

typedef enum *_qspi_ss_data_logic_level* qspi_ss_data_logic_level_t
logical level for Slave Select (SSB) signal data

typedef enum *_qspi_txfifo_watermark* qspi_txfifo_watermark_t
QUEUEDSPI Transmit FIFO watermark settings.

typedef enum *_qspi_rxfifo_watermark* qspi_rxfifo_watermark_t
QUEUEDSPI Receive FIFO watermark settings.

typedef enum *_qspi_data_width* qspi_data_width_t
Transfer data width in each frame.

typedef enum *_qspi_master_slave_mode* qspi_master_slave_mode_t
QUEUEDSPI master or slave mode configuration.

typedef enum *_qspi_clock_polarity* qspi_clock_polarity_t
QUEUEDSPI clock polarity configuration.

typedef enum *_qspi_clock_phase* qspi_clock_phase_t
QUEUEDSPI clock phase configuration.

typedef enum *_qspi_data_shift_direction* qspi_data_shift_direction_t
    QUEUEDSPI data shifter direction options for a given CTAR.

typedef struct *_qspi_master_config* qspi_master_config_t
    QUEUEDSPI master configuration structure with all master configuration fields covered.

typedef struct *_qspi_slave_config* qspi_slave_config_t
    QUEUEDSPI slave configuration structure with all slave configuration fields covered.

typedef enum *_qspi_pcs_polarity_config* qspi_pcs_polarity_config_t
    QUEUEDSPI Peripheral Chip Select Polarity configuration.

typedef struct *_qspi_transfer* qspi_transfer_t
    QUEUEDSPI master/slave transfer structure.

typedef struct *_qspi_master_handle* qspi_master_transfer_handle_t
    Forward declaration of the _qspi_master_handle typedefs. .

typedef void (*qspi_master_transfer_callback_t)(*qspi_master_transfer_handle_t* *psHandle, *status_t* eCompletionStatus, void *pUserData)
    Completion callback function pointer type.

Param base
QUEUEDSPI peripheral address.

Param psHandle
Pointer to the handle for the QUEUEDSPI master.

Param eCompletionStatus
Success or error code describing whether the transfer completed.

Param pUserData
Arbitrary pointer-dataSized value passed from the application.

typedef struct *_qspi_master_handle* qspi_slave_transfer_handle_t
    Forward declaration of the _qspi_master_handle typedefs. .

typedef void (*qspi_slave_transfer_callback_t)(*qspi_slave_transfer_handle_t* *psHandle, *status_t* eCompletionStatus, void *pUserData)
    Completion callback function pointer type.

Param base
QUEUEDSPI peripheral address.

Param handle
Pointer to the handle for the QUEUEDSPI slave.

Param status
Success or error code describing whether the transfer completed.

Param pUserData
Arbitrary pointer-dataSized value passed from the application.

void QSPI_DriverIRQHandler(uint32_t instance)
    QSPI driver IRQ handler common entry.

    This function provides the common IRQ request entry for QSPI.

Parameters

- instance – QSPI instance.

QSPI_DUMMY_DATA
    User Configuraiton item dummy data filled into Output signal if there is no Tx data.

    Dummy data used for Tx if there is no txData.

struct _qspi_master_config

#include <fsl_queued_spi.h> QUEUEDSPI master configuration structure with all master configuration fields covered.

Public Members

uint32_t u32BaudRateBps
: Baud Rate for QUEUEDSPI.

qspi_data_width_t eDataWidth
: Data width in SPI transfer

qspi_clock_polarity_t eClkPolarity
: Clock polarity.

qspi_clock_phase_t eClkPhase
: Clock phase.

qspi_data_shift_direction_t eShiftDirection
: MSB or LSB data shift direction.

bool bEnableWiredOrMode
: SPI pin configuration, when enabled the SPI pins are configured as open-drain drivers with the pull-ups disabled.

bool bEnableModeFault
: Enable/Disable mode fault detect for Slave Select Signal

bool bEnableStrobe
: Enable/Disable strobe between data frames irrespective of clock pahse setting

bool bEnableSlaveSelAutoMode
: Enable/Disable Slave Select Auto mode.

bool bEnableSlaveSelOpenDrain
: Enable the open-drain mode of SPI Pins, otherwise Push-Pull

uint16_t u16DelayBetweenFrameInCLK
: The delay between frame.

bool bEnableFIFO
: Enable / Disable FIFO for Transmit/Receive

qspi_txfifo_watermark_t eTxFIFOWatermark
: Watermark config for Transmit FIFO

qspi_txfifo_watermark_t eRxFIFOWatermark
: Watermark config for Receive FIFO

bool bEnableModule
: Enable / Disable module

uint8_t u8Interrupts
: Interrupt enabled ORed from _qspi_interrupt_enable

uint8_t u8DmaEnableFlags
: Configure DMA Enable/Disable for Transmit/Receive

struct _qspi_slave_config

#include <fsl_queued_spi.h> QUEUEDSPI slave configuration structure with all slave configuration fields covered.

Public Members

qspi_data_width_t eDataWidth
Data width in SPI transfer

qspi_clock_polarity_t eClkPolarity
Clock polarity.

qspi_clock_phase_t eClkPhase
Clock phase.

qspi_data_shift_direction_t eShiftDirection
MSB or LSB data shift direction.

bool bEnableWiredOrMode
SPI pin configuration, when enabled the SPI pins are configured as open-drain drivers with the pull-ups disabled.

bool bEnableModeFault
Enable/Disable mode fault detect for Slave Select Signal

bool bEnableSlaveSelOverride
Enable/Disble override Slave Select (SS) singal with Master/Slave Mode config

bool bEnableFIFO
Enable / Disable FIFO for Transmit/Receive

qspi_txfifo_watermark_t eTxFIFOWatermark
Watermark config for Transmit FIFO

qspi_txfifo_watermark_t eRxFIFOWatermark
Watermark config for Receive FIFO

bool bEnableModule
Enable/Disable Module

uint8_t u8DmaEnableFlags
Configure DMA Enable/Disable for Transmit/Receive

struct _qspi_transfer
#include <fsl_queued_spi.h> QUEUEDSPI master/slave transfer structure.

Public Members

void *pTxData
Transmit buffer.

void *pRxData
Receive buffer.

volatile uint16_t u16DataSize
Transfer bytes.

uint8_t u8ConfigFlags
Transfer configuration flags; set from _qspi_master_transfer_flag. This is not used in slave transfer.

struct _qspi_master_handle
#include <fsl_queued_spi.h> QUEUEDSPI master transfer handle structure used for transactional API.

Public Members

QSPI_Type *base
: Base address for the QSPI peripheral

qspi_data_width_t eDataWidth
: The desired number of bits per frame.

volatile bool bIsPcsActiveAfterTransfer
: Indicates whether the PCS signal is active after the last frame transfer, This is not used in slave transfer.

uint8_t *volatile pu8TxData
: Send buffer.

uint8_t *volatile pu8RxData
: Receive buffer.

volatile uint16_t u16RemainingSendByteCount
: A number of bytes remaining to send.

volatile uint16_t u16RemainingReceiveByteCount
: A number of bytes remaining to receive.

uint16_t u16TotalByteCount
: A number of transfer bytes

volatile uint8_t u8State
: QUEUEDSPI transfer state, see _qspi_transfer_state.

qspi_master_transfer_callback_t pfCallback
: Completion callback.

void *pUserData
: Callback user data.

volatile uint16_t u16ErrorCount
: Error count for slave transfer, this is not used in master transfer.

2.63 QSPI Peripheral and Driver Overview

2.64 QSPI_EDMA: EDMA based QSPI Driver

FSL_QSPI_EDMA_DRIVER_VERSION
: QSPI EDMA driver version.

typedef struct *_qspi_master_edma_handle* qspi_master_edma_handle_t
: Forward declaration of the _qspi_master_edma_handle typedefs.

typedef struct *_qspi_master_edma_handle* qspi_slave_edma_handle_t
: Forward declaration of the _qspi_master_edma_handle typedefs.

typedef void (*qspi_edma_transfer_callback_t)(*qspi_master_edma_handle_t* *psHandle, *status_t* eCompletionStatus, void *pUserData)
: Completion callback function pointer type.

Param base
: QUEUEDSPI peripheral base address.

Param psHandle
Pointer to the handle for the QUEUEDSPI master.

Param eCompletionStatus
Success or error code describing whether the transfer completed.

Param pUserData
Arbitrary pointer-dataSized value passed from the application.

void QSPI_MasterTransferCreateHandleEDMA(QSPI_Type *base, *qspi_master_edma_handle_t* *psHandle, *qspi_edma_transfer_callback_t* pfCallback, void *pUserData, DMA_Type *psEdmaBase, *edma_channel_t* eEdmaTxChannel, *edma_channel_t* eEdmaRxChannel)

Initialize the QUEUEDSPI master EDMA handle.

This function initializes the QUEUEDSPI EDMA master handle which can be used for QUEUEDSPI EDMA master transactional APIs. Usually, for a specified QUEUEDSPI instance, call this API once to get the initialized handle.

Parameters

- base – QUEUEDSPI peripheral base address.
- psHandle – QUEUEDSPI handle pointer to qspi_master_edma_handle_t.
- pfCallback – QUEUEDSPI callback.
- pUserData – callback function parameter.
- psEdmaBase – base address for the EDMA
- eEdmaTxChannel – Channel of the EDMA used for QSPI Tx
- eEdmaRxChannel – Channel of the EDMA used for QSPI Rx

status_t QSPI_MasterTransferEDMA(*qspi_master_edma_handle_t* *psHandle, *qspi_transfer_t* *psXfer)

EDMA method of QUEUEDSPI master transfer.

This function transfers data using EDMA. This is a non-blocking function, which returns right away. When all data is transferred, the callback function is called.

Note: : The transfer data size should be even, if the transfer data width is larger than 8.

Parameters

- psHandle – pointer to qspi_master_edma_handle_t structure which stores the transfer state.
- psXfer – pointer to qspi_transfer_t structure.

Returns
status of status_t.

status_t QSPI_MasterTransferGetCountEDMA(*qspi_master_edma_handle_t* *psHandle, uint16_t *pu16Count)

Get the master EDMA transfer count.

Parameters

- psHandle – Pointer to the qspi_master_edma_handle_t structure which stores the transfer state.
- pu16Count – The number of bytes transferred by using the EDMA transaction.

Returns
status of status_t.

void QSPI_MasterTransferAbortEDMA(*qspi_master_edma_handle_t* *psHandle)

Abort a transfer that uses EDMA for master.

Parameters

- psHandle – Pointer to the qspi_master_edma_handle_t structure which stores the transfer state.

void QSPI_SlaveTransferCreateHandleEDMA(QSPI_Type *base, *qspi_slave_edma_handle_t* *psHandle, *qspi_edma_transfer_callback_t* pfCallback, void *pUserData, DMA_Type *psEdmaBase, *edma_channel_t* eEdmaTxChannel, *edma_channel_t* eEdmaRxChannel)

Initialize the QUEUEDSPI slave EDMA handle.

This function initializes the QUEUEDSPI EDMA handle which can be used for other QUEUEDSPI transactional APIs. Usually, for a specified QUEUEDSPI instance, call this API once to get the initialized handle.

Parameters

- base – QUEUEDSPI peripheral base address.
- psHandle – QUEUEDSPI handle pointer to qspi_slave_edma_handle_t.
- pfCallback – QUEUEDSPI callback.
- pUserData – callback function parameter.
- psEdmaBase – base address for the EDMA
- eEdmaTxChannel – Channel of the EDMA used for QSPI Tx
- eEdmaRxChannel – Channel of the EDMA used for QSPI Rx

status_t QSPI_SlaveTransferEDMA(*qspi_slave_edma_handle_t* *psHandle, *qspi_transfer_t* *psXfer)

EDMA method of QUEUEDSPI slave transfer.

This function transfers data using EDMA. This is a non-blocking function, which returns right away. When all data is transferred, the callback function is called.

Note: : The transfer data size should be even if the transfer data width is larger than 8.

Parameters

- psHandle – pointer to qspi_slave_edma_handle_t structure which stores the transfer state.
- psXfer – pointer to qspi_transfer_t structure.

Returns
status of status_t.

status_t QSPI_SlaveTransferGetCountEDMA(*qspi_slave_edma_handle_t* *psHandle, uint16_t *pu16Count)

Get the slave EDMA transfer count.

Parameters

- psHandle – Pointer to the qspi_slave_edma_handle_t structure which stores the transfer state.

- pu16Count – The number of bytes transferred by using the EDMA transaction.

Returns
status of status_t.

void QSPI_SlaveTransferAbortEDMA(*qspi_slave_edma_handle_t* *psHandle)

Abort a transfer that uses EDMA for slave.

Parameters

- psHandle – Pointer to the qspi_slave_edma_handle_t structure which stores the transfer state.

struct _qspi_master_edma_handle

#include <fsl_queued_spi_edma.h> QUEUEDSPI master EDMA transfer handle structure used for transactional API. This struct should be sizeof(edma_channel_tcd_t) aligned.

Public Members

QSPI_Type *base

Base address of the QSPI Peripheral

volatile uint8_t u8State

QUEUEDSPI transfer state , defined in _qspi_transfer_state.

uint16_t u16TotalByteCount

A number of transfer bytes.

qspi_data_width_t eDataWidth

The desired number of bits per frame.

uint16_t u16TxDummyData

Used if txData is NULL.

uint16_t u16RxDummyData

Used if rxData is NULL.

edma_handle_t sTxHandle

edma_handle_t handle point used for transmitting data.

edma_handle_t sRxHandle

edma_handle_t handle point used for receiving data.

bool bIsTxInProgress

Indicates whether the transmit is in progress.

bool bIsRxInProgress

Indicates whether the receive is in progress.

qspi_edma_transfer_callback_t pfCallback

Completion callback.

void *pUserData

Callback user data.

volatile bool bIsPcsActiveAfterTransfer

Indicates whether the PCS signal is active after the last frame transfer, This is not used in slave transfer.

2.65 QTMR: Quad Timer Driver

void QTMR_Init(TMR_Type *base, const *qtmr_config_t* *psConfig)

Initialization Quad Timer module with provided structure.

This function can initial one or more channels of the Quad Timer module.

This examples shows how only initial channel 0.

```
qtmr_config_t sConfig = {0};
qtmr_channel_config_t sChannel0Config;
sConfig.psChannelConfig[0] = &sChannel0Config;
QTMR_GetChannelDefaultConfig(&sChannel0Config);
QTMR_Init(QTMR, sConfig);
```

Note: This API should be called at the beginning of the application using the Quad Timer module.

Parameters

- base – Quad Timer peripheral base address.
- psConfig – Pointer to user's Quad Timer config structure. See qtmr_config_t.

void QTMR_Deinit(TMR_Type *base)

De-initialization Quad Timer module.

Parameters

- base – Quad Timer peripheral base address.

void QTMR_GetChannelDefaultConfig(*qtmr_channel_config_t* *psConfig)

Gets an available pre-defined options for Quad Timer channel module's configuration.

This function initializes the channel configuration structure with a free run 16bit timer work setting. The default values are:

```
psConfig->sInputConfig.ePrimarySource = kQTMR_PrimarySrcIPBusClockDivide2;
psConfig->sInputConfig.eSecondarySource = kQTMR_SecondarySrcInputPin0;
psConfig->sInputConfig.eSecondarySourceCaptureMode = kQTMR_SecondarySrcCaptureNoCapture;
psConfig->sInputConfig.bEnableSecondarySrcFaultFunction = false;
psConfig->sInputConfig.eEnableInputInvert = false;
psConfig->sCountConfig.eCountMode = kQTMR_CountPrimarySrcRiseEdge;
psConfig->sCountConfig.eCountLength = kQTMR_CountLengthUntilRollOver;
psConfig->sCountConfig.eCountDir = kQTMR_CountDirectionUp;
psConfig->sCountConfig.eCountTimes = kQTMR_CountTimesRepeat;
psConfig->sCountConfig.eCountLoadMode = kQTMR_CountLoadNormal;
psConfig->sCountConfig.eCountPreload1 = kQTMR_CountPreloadNoLoad;
psConfig->sCountConfig.eCountPreload2 = kQTMR_CountPreloadNoLoad;
psConfig->sOutputConfig.eOutputMode = kQTMR_OutputAssertWhenCountActive;
psConfig->sOutputConfig.eOutputValueOnForce = kQTMR_OutputValueClearOnForce;
psConfig->sOutputConfig.bEnableOutputInvert = false;
psConfig->sOutputConfig.bEnableSwForceOutput = false;
psConfig->sOutputConfig.bEnableOutputPin = false;
psConfig->sCooperationConfig.bEnableMasterReInit = false;
psConfig->sCooperationConfig.bEnableMasterForceOFLAG = false;
psConfig->sCooperationConfig.bEnableMasterMode = false;
psConfig->eDebugMode = kQTMR_DebugRunNormal;
psConfig->u16EnabledInterruptMask = 0x0U;
psConfig->u16EnabledDMAMask = 0x0U;
psConfig->u16Comp1 = 0x0U;
```

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```
psConfig->u16Comp2 = 0x0U;
psConfig->u16Comp1Preload = 0x0U;
psConfig->u16Comp1Preload = 0x0U;
psConfig->u16Load = 0x0U;
psConfig->u16Count = 0x0U;
psConfig->bEnableChannel = false;
```

Parameters

- psConfig – Pointer to user's Quad Timer channel config structure. See qtmr_channel_config_t.

void QTMR_SetupChannleConfig(TMR_Type *base, *qtmr_channel_number_t* eChannelNumber, const *qtmr_channel_config_t* *psConfig)

Setup a Quad Timer channel with provided structure.

Parameters

- base – Quad Timer peripheral base address.
- eChannelNumber – Quad Timer channel number. See qtmr_channel_number_t.
- psConfig – Pointer to user's Quad Timer channel config structure. See qtmr_channel_config_t.

static inline void QTMR_SetPrimaryCountSource(TMR_Type *base, *qtmr_channel_number_t* eChannelNumber, *qtmr_channel_primary_count_source_t* ePrimarySource)

Sets primary input source.

This function select the primary input source, it can select from "input pin 0~3", "channel output

0~3" and "IP bus clock prescaler".

Parameters

- base – Quad Timer peripheral base address.
- eChannelNumber – Quad Timer channel number. See qtmr_channel_number_t.
- ePrimarySource – The primary input source. See qtmr_channel_primary_count_source_t.

static inline void QTMR_SetSecondaryCountSource(TMR_Type *base, *qtmr_channel_number_t* eChannelNumber, *qtmr_channel_secondary_count_source_t* source)

Sets secondary input source.

This function select the secondary input source, it can select from "input pin 0~3".

Parameters

- base – Quad Timer peripheral base address.
- eChannelNumber – Quad Timer channel number. See qtmr_channel_number_t.

- source – The Secondary input source. See qtmr_channel_secondary_count_source_t.

void QTMR_SetSecondarySourceInputCaptureMode(TMR_Type *base, *qtmr_channel_number_t* eChannelNumber, *qtmr_channel_secondary_source_capture_mode_t* eCaptureMode)

Sets secondary input capture mode.

This function select the capture mode for secondary input, it can select from "disable capture", "capture on

rising/falling edge" and "capture on both edges". Need enable capture mode when input edge interrupt is needed.

Parameters

- base – Quad Timer peripheral base address.
- eChannelNumber – Quad Timer channel number. See qtmr_channel_number_t.
- eCaptureMode – The capture mode of secondary input. See qtmr_channel_secondary_source_capture_mode_t.

static inline void QTMR_EnableSecondarySourceFault(TMR_Type *base, *qtmr_channel_number_t* eChannelNumber, bool bEnable)

Enables/Disables secondary input source signal fault feature.

Enable fault feature will make secondary input acts as a fault signal so that the channel output signal (OFLAG) is cleared when the secondary input is set.

Parameters

- base – Quad Timer peripheral base address.
- eChannelNumber – Quad Timer channel number. See qtmr_channel_number_t.
- bEnable – Enable the feature or not.
  - **true** Enable secondary source fault feature.
  - **false** Disable secondary source fault feature.

static inline void QTMR_EnableInputInvert(TMR_Type *base, *qtmr_channel_number_t* eChannelNumber, bool bEnable)

Enables/Disables input pin signal polarity invert feature.

This function enables/disables input pin signal polarity invert feature.

Note: Invert feature only affects "input pin 0~3", and acts on the channel input node, not the input pin, so it only affect current channel and not share by other channel

---

Parameters

- base – Quad Timer peripheral base address.
- eChannelNumber – Quad Timer channel number. See qtmr_channel_number_t.
- bEnable – Enable the feature or not.
  - **true** Invert input pin signal polarity.

- **false** No invert for input pin signal polarity.

static inline void QTMR_SetInputFilter(TMR_Type *base, *qtmr_input_pin_t* ePin, uint8_t u8Count, uint8_t u8Period)

Sets input filter for one input pin.

Sets input filter if the input signal is noisy.

Note: The input filter acts on the input pin directly, so the input filter config will affect all channels that select this input pin as source. Turning on the input filter(setting FILT_PER to a non-zero value) introduces a latency of (((u8Count + 3) x u8Period) + 2) IP bus clock periods.

Parameters

- base – Quad Timer peripheral base address.
- ePin – Quad Timer input pin number. See qtmr_input_pin_t.
- u8Count – Range is 0~7, represent the number of consecutive samples that must agree prior to the input filter accepting an input transition. Actual consecutive samples numbers is (u8Count + 3).
- u8Period – Represent the sampling period (in IP bus clock cycles) of the input pin signals. Each input is sampled multiple times at the rate specified by this field. If u8Period is 0, then the input pin filter is bypassed.

static inline uint16_t QTMR_GetInputPinValueInSecondarySource(TMR_Type *base, *qtmr_channel_number_t* eChannelNumber)

Gets the external input signal value selected via the secondary input source.

This function read the value of the secondary input source, the input pin IPS and filtering have been applied to the read back value.

Parameters

- base – Quad Timer peripheral base address.
- eChannelNumber – Quad Timer channel number. See qtmr_channel_number_t.

Returns

The state of the current state of the external input pin selected via the secondary count source after application of IPS and filtering.

void QTMR_SetCountMode(TMR_Type *base, *qtmr_channel_number_t* eChannelNumber, *qtmr_channel_count_mode_t* eCountMode)

Sets channel count mode.

This function select channel basic count mode which trigger by primary input or/and secondary input events.

Parameters

- base – Quad Timer peripheral base address.
- eChannelNumber – Quad Timer channel number. See qtmr_channel_number_t.
- eCountMode – The mode of operation for the count. See qtmr_channel_count_mode_t.

static inline void QTMR_SetCountLength(TMR_Type *base, *qtmr_channel_number_t* eChannelNumber, *qtmr_channel_count_length_t* eLength)

Sets channel count length.

This function select channel single count length from "until roll over" or "until compare". "until roll over" means count until 0xFFFF, "until compare" means count until reach COMP1 (for count up) or COMP2 (for count up) value (unless the output signal is in alternating compare mode, this mode make channel use COMP1 and COMP2 alternately).

Parameters

- base – Quad Timer peripheral base address.
- eChannelNumber – Quad Timer channel number. See qtmr_channel_number_t.
- eLength – The channel count length. See qtmr_channel_count_length_t.

static inline void QTMR_SetCountDirection(TMR_Type *base, *qtmr_channel_number_t* eChannelNumber, *qtmr_channel_count_direction_t* eDirection)

Sets channel count direction.

This function select channel count direction from "count up" or "count down". Under normal count mode, this function decide the count direction directly, when chose "secondary specifies direction" count mode, count direction decide by "the secondary input level" XOR with "the function selection".

Parameters

- base – Quad Timer peripheral base address.
- eChannelNumber – Quad Timer channel number. See qtmr_channel_number_t.
- eDirection – The channel count direction. See qtmr_channel_count_direction_t.

static inline *qtmr_channel_count_direction_t* QTMR_GetCountDirection(TMR_Type *base, *qtmr_channel_number_t* eChannelNumber)

Gets channel count direction.

This function read the channel count direction of the last count during quadrature encoded count mode.

Parameters

- base – Quad Timer peripheral base address.
- eChannelNumber – Quad Timer channel number. See qtmr_channel_number_t.

Returns

The direction of the last count. Value see qtmr_channel_count_direction_t.

static inline void QTMR_SetCountTimes(TMR_Type *base, *qtmr_channel_number_t* eChannelNumber, *qtmr_channel_count_times_t* eTimes)

Sets channel count times.

This function select channel count times from "once" or "repeatedly". If select "once" with "until compare", channel will stop when reach COMP1 (for count up) or COMP2 (for count up) (unless the output signal is in alternating compare mode, this mode will make channel reaching COMP1, re-initializes then count reaching COMP2, and then stops).

Parameters

- base – Quad Timer peripheral base address.
- eChannelNumber – Quad Timer channel number. See qtmr_channel_number_t.
- eTimes – The channel count times. See qtmr_channel_count_times_t.

static inline void QTMR_SetCountLoadMode(TMR_Type *base, *qtmr_channel_number_t* eChannelNumber, *qtmr_channel_count_load_mode_t* eLoadMode)

Sets channel count load mode.

This function select channel count re-initialized load mode from "normal" or "alternative". "normal" means channel counter re-initialized from LOAD register when compare event, "alternative" means channel counter can re-initialized from LOAD (count up) or CMPLD2 (count down) when compare event.

Parameters

- base – Quad Timer peripheral base address.
- eChannelNumber – Quad Timer channel number. See qtmr_channel_number_t.
- eLoadMode – The channel count load mode. See qtmr_channel_count_load_mode_t.

static inline void QTMR_SetCompare1PreloadControl(TMR_Type *base, *qtmr_channel_number_t* eChannelNumber, *qtmr_channel_count_preload_mode_t* ePreloadMode)

Sets channel preload mode for compare register 1.

This function select channel preload mode for compare register 1. Default the COMP1 register never preload, when enabled, the COMP1 can preload from CMPLD1 register when COMP1 or COMP2 compare event.

Parameters

- base – Quad Timer peripheral base address.
- eChannelNumber – Quad Timer channel number. See qtmr_channel_number_t.
- ePreloadMode – The compare register 1 preload mode. See qtmr_channel_count_preload_mode_t.

static inline void QTMR_SetCompare2PreloadControl(TMR_Type *base, *qtmr_channel_number_t* eChannelNumber, *qtmr_channel_count_preload_mode_t* ePreloadMode)

Sets channel preload mode for compare register 2.

This function select channel preload mode for compare register 2. Default the COMP2 register never preload, when enabled, the COMP2 can preload from CMPLD2 register when COMP1 or COMP2 compare event.

Parameters

- base – Quad Timer peripheral base address.
- eChannelNumber – Quad Timer channel number. See qtmr_channel_number_t.
- ePreloadMode – The compare register 2 preload mode. See qtmr_channel_count_preload_mode_t.

static inline void QTMR_SetCompare1PreloadValue(TMR_Type *base, *qtmr_channel_number_t* eChannelNumber, uint16_t u16Comp1Preload)

Sets channel compare register 1 preload register value.

This function set the CMPLD1 register value. The COMP1 can preload from CMPLD1 register when preload mode is not "never preload".

Parameters

- base – Quad Timer peripheral base address.
- eChannelNumber – Quad Timer channel number. See qtmr_channel_number_t.
- u16Comp1Preload – Value for Channel compare register 1 preload register.

static inline void QTMR_SetCompare2PreloadValue(TMR_Type *base, *qtmr_channel_number_t* eChannelNumber, uint16_t u16Comp2Preload)

Sets channel compare register 2 preload register value.

This function set the CMPLD2 register value. The COMP2 can preload from CMPLD2 register when preload mode is not "never preload".

Parameters

- base – Quad Timer peripheral base address.
- eChannelNumber – Quad Timer channel number. See qtmr_channel_number_t.
- u16Comp2Preload – Value for Channel compare register 2 preload register.

static inline void QTMR_SetLoadValue(TMR_Type *base, *qtmr_channel_number_t* eChannelNumber, uint16_t u16Load)

Sets channel load register value.

This function set the LOAD register value. The channel will re-initialize the counter value with this register after counter compare or overflow event.

Parameters

- base – Quad Timer peripheral base address.
- eChannelNumber – Quad Timer channel number. See qtmr_channel_number_t.
- u16Load – Value used to initialize the counter after counter compare or overflow event.

static inline void QTMR_SetCompare1Value(TMR_Type *base, *qtmr_channel_number_t* eChannelNumber, uint16_t u16Comp1)

Sets channel count compare register 1.

This function set the COMP1 register value. It use to trigger compare event in count up mode or alternating compare mode.

Parameters

- base – Quad Timer peripheral base address.
- eChannelNumber – Quad Timer channel number. See qtmr_channel_number_t.
- u16Comp1 – Value for Channel compare register 1.

static inline void QTMR_SetCompare2Value(TMR_Type *base, *qtmr_channel_number_t* eChannelNumber, uint16_t u16Comp2)

Sets channel count compare register 2.

This function set the COMP2 register value. It use to trigger compare event in count down mode or alternating compare mode.

Parameters

- base – Quad Timer peripheral base address.
- eChannelNumber – Quad Timer channel number. See qtmr_channel_number_t.
- u16Comp2 – Value for Channel compare register 2.

static inline uint16_t QTMR_ReadCaptureValue(TMR_Type *base, *qtmr_channel_number_t* eChannelNumber)

Gets channel capture register value.

This function read the CAPT register value, which store the real-time channel counter value when input capture event.

Parameters

- base – Quad Timer peripheral base address.
- eChannelNumber – Quad Timer channel number. See qtmr_channel_number_t.

Returns

The value captured from the channel counter.

static inline uint16_t QTMR_GetHoldValue(TMR_Type *base, *qtmr_channel_number_t* eChannelNumber)

Gets channel hold register value.

This function read the HOLD register value, which stores the channel counter's values of specific channels whenever any of the four channels within a module is read.

Parameters

- base – Quad Timer peripheral base address.
- eChannelNumber – Quad Timer channel number. See qtmr_channel_number_t.

Returns

The channel counter value when any read operation occurs.

static inline void QTMR_SetCounterValue(TMR_Type *base, *qtmr_channel_number_t* eChannelNumber, uint16_t u16Count)

Sets channel counter register value.

This function set the CNTR register value, the channel will start counting based on this value.

Parameters

- base – Quad Timer peripheral base address.
- eChannelNumber – Quad Timer channel number. See qtmr_channel_number_t.
- u16Count – The channel counter initialize value.

static inline uint16_t QTMR_GetCounterValue(TMR_Type *base, *qtmr_channel_number_t* eChannelNumber)

Reads channel counter register value.

This function read the CNTR register value, which stores the channel real-time channel counting value. This read operation will trigger HOLD register update.

Note: User can call the utility macros provided in fsl_common.h to convert ticks to usec or msec.

Parameters

- base – Quad Timer peripheral base address.
- eChannelNumber – Quad Timer channel number. See qtmr_channel_number_t.

Returns

The real-time channel counter value.

static inline void QTMR_SetOutputMode(TMR_Type *base, *qtmr_channel_number_t* eChannelNumber, *qtmr_channel_output_mode_t* eOutputMode)

Sets Channel output signal (OFLAG) work mode.

This function select channel output signal (OFLAG) work mode base on different channel event.

Parameters

- base – Quad Timer peripheral base address.
- eChannelNumber – Quad Timer channel number. See qtmr_channel_number_t.
- eOutputMode – The mode of operation for the OFLAG output signal. See qtmr_channel_output_mode_t.

static inline void QTMR_SetOutputValueOnForce(TMR_Type *base, *qtmr_channel_number_t* eChannelNumber, *qtmr_channel_output_value_on_force_t* eValue)

Sets the value of output signal when a force event occurs.

This function config the value of output signal when a force event occurs. Force events can be a software command or compare event from a master channel.

Parameters

- base – Quad Timer peripheral base address.
- eChannelNumber – Quad Timer channel number. See qtmr_channel_number_t.
- eValue – The value of output signal when force event occur. See qtmr_channel_output_value_on_force_t.

static inline void QTMR_EnableOutputInvert(TMR_Type *base, *qtmr_channel_number_t* eChannelNumber, bool bEnable)

Enables/Disables output signal polarity invert feature.

This function enables/disables the invert feature of output signal (OFLAG).

Parameters

- base – Quad Timer peripheral base address.

- eChannelNumber – Quad Timer channel number. See qtmr_channel_number_t.
- bEnable – Enable the feature or not.
  - **true** Invert output signal polarity.
  - **false** No invert for output signal polarity.

static inline void QTMR_EnableSwForceOutput(TMR_Type *base, *qtmr_channel_number_t* eChannelNumber)

Enables software triggers a FORCE command to output signal.

This function uses a software command to trigger force event, which can force the current value of SCTRL[VAL] bit to be written to the OFLAG output.

Note: This function can be called only if the counter is disabled.

```
QTMR_SetOutputValueOnForce(QTMR, kQTMR_Channel0, kQTMR_OutputValueSetOnForce);
QTMR_EnableSwForceOutput(QTMR, kQTMR_Channel0);
```

Parameters

- base – Quad Timer peripheral base address.
- eChannelNumber – Quad Timer channel number. See qtmr_channel_number_t.

static inline void QTMR_EnableOutputPin(TMR_Type *base, *qtmr_channel_number_t* eChannelNumber, bool bEnable)

Enables/Disables output signal (OFLAG) drive on the external pin feature.

This function enables/disables output signal (OFLAG) drive on the external pin feature.

Parameters

- base – Quad Timer peripheral base address.
- eChannelNumber – Quad Timer channel number. See qtmr_channel_number_t.
- bEnable – Enable the feature or not.
  - **true** The output signal is driven on the external pin.
  - **false** The external pin is configured as an input.

static inline void QTMR_EnableMasterMode(TMR_Type *base, *qtmr_channel_number_t* eChannelNumber, bool bEnable)

Enables/Disables channel master mode.

This function enables/disables channel master mode.

Note: Master channel can broadcast compare event to all channels within the module to re-initialize channel and/or force channel output signal.

Parameters

- base – Quad Timer peripheral base address.
- eChannelNumber – Quad Timer channel number. See qtmr_channel_number_t.
- bEnable – Enable the feature or not.

- **true** Enables channel master mode.
- **false** Disables channel master mode.

static inline void QTMR_EnableMasterForceOFLAG(TMR_Type *base, *qtmr_channel_number_t* eChannelNumber, bool bEnable)

Enables/Disables force the channel output signal (OFLAG) state by master channel compare event.

This function enables/disables the compare event from master channel within the same module to force the state of this channel OFLAG output signal.

Parameters

- base – Quad Timer peripheral base address.
- eChannelNumber – Quad Timer channel number. See qtmr_channel_number_t.
- bEnable – Enable the feature or not.
  - **true** Enables OFLAG state to be forced by master channel compare event.
  - **false** Disables OFLAG state to be forced by master channel compare event.

static inline void QTMR_EnableMasterReInit(TMR_Type *base, *qtmr_channel_number_t* eChannelNumber, bool bEnable)

Enables/Disables channel be re-initialized by master channel compare event feature.

This function enables/disables the compare event from master channel within the same module to force the re-initialization of this channel.

Parameters

- base – Quad Timer peripheral base address.
- eChannelNumber – Quad Timer channel number. See qtmr_channel_number_t.
- bEnable – Enable the feature or not.
  - **true** Enables channel be re-initialized by master channel compare event.
  - **false** Disables channel be re-initialized by master channel compare event.

static inline void QTMR_EnableDma(TMR_Type *base, *qtmr_channel_number_t* eChannelNumber, uint16_t u16Mask)

Enables the Quad Timer DMA request according to a provided mask.

This function enables the Quad Timer DMA request according to a provided mask. The mask is a logical OR of enumerators members. See _qtmr_channel_dma_enable. This examples shows how to enable compare 1 register preload DMA request and compare 2 register preload DMA request.

```
QTMR_EnableDma((QTMR, kQTMR_Channel0,kQTMR_Compare1PreloadDmaEnable | kQTMR_
↪Compare2PreloadDmaEnable);
```

Parameters

- base – Quad Timer peripheral base address.
- eChannelNumber – Quad Timer channel number. See qtmr_channel_number_t.

- u16Mask – The QTMR DMA requests to enable. Logical OR of _qtmr_channel_dma_enable.

static inline void QTMR_DisableDma(TMR_Type *base, *qtmr_channel_number_t* eChannelNumber, uint16_t u16Mask)

Disables the Quad Timer DMA request according to a provided mask.

This function disables the Quad Timer DMA request according to a provided mask. The mask is a logical OR of enumerators members. See _qtmr_channel_dma_enable. This examples shows how to disable compare 1 register preload DMA request and compare 2 register preload DMA request.

```
QTMR_DisableDma((QTMR, kQTMR_Channel0, kQTMR_Compare1PreloadDmaEnable | kQTMR_
→Compare2PreloadDmaEnable);
```

Parameters

- base – Quad Timer peripheral base address.
- eChannelNumber – Quad Timer channel number. See qtmr_channel_number_t.
- u16Mask – The QTMR DMA requests to disable. Logical OR of _qtmr_channel_dma_enable.

static inline void QTMR_EnableInterrupts(TMR_Type *base, *qtmr_channel_number_t* eChannelNumber, uint16_t u16Mask)

Enables the Quad Timer interrupts according to a provided mask.

This function enables the Quad Timer interrupts according to a provided mask. The mask is a logical OR of enumerators members. See _qtmr_channel_interrupt_enable. This examples shows how to enable compare 1 interrupt and compare 2 interrupt.

```
QTMR_EnableInterrupts((QTMR, kQTMR_Channel0, kQTMR_Compare1InterruptEnable |␣
→kQTMR_Compare2InterruptEnable);
```

Parameters

- base – Quad Timer peripheral base address.
- eChannelNumber – Quad Timer channel number. See qtmr_channel_number_t.
- u16Mask – The QTMR DMA interrupts to enable. Logical OR of _qtmr_channel_interrupt_enable.

static inline void QTMR_DisableInterrupts(TMR_Type *base, *qtmr_channel_number_t* eChannelNumber, uint16_t u16Mask)

Disables the Quad Timer interrupts according to a provided mask.

This function disables the Quad Timer interrupts according to a provided mask. The mask is a logical OR of enumerators members. See _qtmr_channel_interrupt_enable. This examples shows how to disable compare 1 interrupt and compare 2 interrupt.

```
QTMR_DisableInterrupts((QTMR, kQTMR_Channel0, kQTMR_Compare1InterruptEnable |␣
→kQTMR_Compare2InterruptEnable);
```

Parameters

- base – Quad Timer peripheral base address.
- eChannelNumber – Quad Timer channel number. See qtmr_channel_number_t.

- u16Mask – The QTMR DMA interrupts to disable. Logical OR of _qtmr_channel_interrupt_enable.

static inline uint16_t QTMR_GetStatusFlags(TMR_Type *base, *qtmr_channel_number_t* eChannelNumber)

Gets the Quad Timer status flags.

This function gets all QTMR channel status flags. The flags are returned as the logical OR value of the enumerators _qtmr_channel_status_flags. To check for a specific status, compare the return value with enumerators in the _qtmr_channel_status_flags. For example, to check whether the compare flag set.

```
if((QTMR_GetStatusFlags(QTMR, kQTMR_Channel0) & kQTMR_CompareFlag) != 0U)
{
    ...
}
```

Parameters

- base – Quad Timer peripheral base address.
- eChannelNumber – Quad Timer channel number. See qtmr_channel_number_t.

Returns

The QTMR status flags which is the logical OR of the enumerators _qtmr_channel_status_flags.

static inline void QTMR_ClearStatusFlags(TMR_Type *base, *qtmr_channel_number_t* eChannelNumber, uint16_t u16Mask)

Clears the Quad Timer status flags.

This function clears QTMR channel status flags with a provide mask. The mask is a logical OR of enumerators _qtmr_channel_status_flags. This examples shows how to clear compare 1 flag and compare 2 flag.

```
QTMR_ClearStatusFlags((QTMR, kQTMR_Channel0, kQTMR_Compare1Flag | kQTMR_
↪Compare2Flag);
```

Parameters

- base – Quad Timer peripheral base address
- eChannelNumber – Quad Timer channel number. See qtmr_channel_number_t
- u16Mask – The QTMR status flags to clear. Logical OR of _qtmr_channel_status_flags

static inline void QTMR_SetDebugActions(TMR_Type *base, *qtmr_channel_number_t* eChannelNumber, *qtmr_channel_debug_action_t* eDebugMode)

Sets channel debug actions.

This function selects the certain actions which will perform when the chip entering debug mode.

Parameters

- base – Quad Timer peripheral base address.
- eChannelNumber – Quad Timer channel number. See qtmr_channel_number_t.

- eDebugMode – The Quad Timer channel actions in response to the chip entering debug mode. See qtmr_channel_debug_action_t.

static inline void QTMR_EnableChannels(TMR_Type *base, uint16_t u16Mask)

Enables the Quad Timer channels according to a provided mask.

This function enables the Quad Timer channels according to a provided mask. The mask is a logical OR of enumerators _qtmr_channel_enable. This examples shows how to enable channel 0 and channel 1.

```
QTMR_EnableChannels(QTMR, kQTMR_Channel0Enable | kQTMR_Channel1Enable);
```

Note: If one channel has effective count mode, it will start its counter as soon as the channel be enabled.

Parameters

- base – Quad Timer peripheral base address.
- u16Mask – The QTMR channels to enable. Logical OR of _qtmr_channel_enable.

static inline void QTMR_DisableChannels(TMR_Type *base, uint16_t u16Mask)

Disables the Quad Timer channels according to a provided mask.

This function disables the Quad Timer channels according to a provided mask. The mask is a logical OR of enumerators _qtmr_channel_enable. This examples shows how to disable channel 0 and channel 1.

```
QTMR_DisableChannels(QTMR, kQTMR_Channel0Enable | kQTMR_Channel1Enable);
```

Parameters

- base – Quad Timer peripheral base address.
- u16Mask – The QTMR channels to enable. Logical OR of _qtmr_channel_enable.

static inline uint32_t TMR_GetCaptureRegAddr(TMR_Type *base, *qtmr_channel_number_t* nChannel)

Gets the TMR capture register address. This API is used to provide the transfer address for TMR capture transfer.

Parameters

- base – TMR base pointer
- nChannel – Quad Timer channel number. See qtmr_channel_number_t.

Returns

capture register address

FSL_QTMR_DRIVER_VERSION

QTMR driver version.

enum _qtmr_input_pin

The enumeration for Quad Timer module input pin source.

Values:

enumerator kQTMR_InputPin0

Quad Timer input pin 0.

enumerator kQTMR_InputPin1
Quad Timer input pin 1.

enumerator kQTMR_InputPin2
Quad Timer input pin 2.

enumerator kQTMR_InputPin3
Quad Timer input pin 3.

enum _qtmr_channel_number
The enumeration for Quad Timer module channel number.

Values:

enumerator kQTMR_Channel0
Quad Timer Channel 0.

enumerator kQTMR_Channel1
Quad Timer Channel 1.

enumerator kQTMR_Channel2
Quad Timer Channel 2.

enumerator kQTMR_Channel3
Quad Timer Channel 3.

enum _qtmr_channel_primary_count_source
The enumeration for Quad Timer channel primary input source.

Values:

enumerator kQTMR_PrimarySrcInputPin0
Quad Timer input pin 0.

enumerator kQTMR_PrimarySrcInputPin1
Quad Timer input pin 1.

enumerator kQTMR_PrimarySrcInputPin2
Quad Timer input pin 2.

enumerator kQTMR_PrimarySrcInputPin3
Quad Timer input pin 3.

enumerator kQTMR_PrimarySrcChannel0Output
Quad Timer channel 0 output.

enumerator kQTMR_PrimarySrcChannel1Output
Quad Timer channel 1 output.

enumerator kQTMR_PrimarySrcChannel2Output
Quad Timer channel 2 output.

enumerator kQTMR_PrimarySrcChannel3Output
Quad Timer channel 3 output.

enumerator kQTMR_PrimarySrcIPBusClockDivide1
IP bus clock divide by 1.

enumerator kQTMR_PrimarySrcIPBusClockDivide2
IP bus clock divide by 2.

enumerator kQTMR_PrimarySrcIPBusClockDivide4
IP bus clock divide by 4.

enumerator kQTMR_PrimarySrcIPBusClockDivide8
IP bus clock divide by 8.

enumerator kQTMR_PrimarySrcIPBusClockDivide16
IP bus clock divide by 16.

enumerator kQTMR_PrimarySrcIPBusClockDivide32
IP bus clock divide by 32.

enumerator kQTMR_PrimarySrcIPBusClockDivide64
IP bus clock divide by 64.

enumerator kQTMR_PrimarySrcIPBusClockDivide128
IP bus clock divide by 128.

enum _qtmr_channel_secondary_count_source
The enumeration for Quad Timer channel secondary input source.

Values:

enumerator kQTMR_SecondarySrcInputPin0
Quad Timer input pin 0.

enumerator kQTMR_SecondarySrcInputPin1
Quad Timer input pin 1.

enumerator kQTMR_SecondarySrcInputPin2
Quad Timer input pin 2.

enumerator kQTMR_SecondarySrcInputPin3
Quad Timer input pin 3.

enum _qtmr_channel_secondary_source_capture_mode
The enumeration for Quad Timer channel secondary input source capture mode.

Values:

enumerator kQTMR_SecondarySrcCaptureNoCapture
Secondary source capture is disabled.

enumerator kQTMR_SecondarySrcCaptureRisingEdge
Secondary source capture on rising edge.

enumerator kQTMR_SecondarySrcCaptureFallingEdge
Secondary source capture on falling edge.

enumerator kQTMR_SecondarySrcCaptureRisingAndFallingEdge
Secondary source capture on both edges.

enumerator kQTMR_SecondarySrcCaptureRisingEdgeWithReload
Secondary source capture on rising edge while cause the channel to be reloaded.

enumerator kQTMR_SecondarySrcCaptureFallingEdgeWithReload
Secondary source capture on falling edge while cause the channel to be reloaded.

enumerator kQTMR_SecondarySrcCaptureRisingAndFallingEdgeWithReload
Secondary source capture on both edges while cause the channel to be reloaded.

enum _qtmr_channel_count_mode
The enumeration for Quad Timer channel count mode.

When "channel output 0~3" or "IP bus clock prescaler" is chosen, active edge is the rising edge. When "input pin 0~3" is chosen, active edge and active level is determined by input invert feature (IPS). Disable input invert feature means active edge is rising edge, active level is high level, enable input invert feature means active edge is falling edge, active level is low level.

Values:

enumerator kQTMR_CountNoOperation

No operation.

enumerator kQTMR_CountPrimarySrcRiseEdge

Count active edge of primary input source.

enumerator kQTMR_CountPrimarySrcRiseAndFallEdge

Count rising and falling edges of primary input source.

enumerator kQTMR_CountPrimarySrcRiseEdgeSecondarySrcInHigh

Count active edge of primary input source when secondary input is at a active level.

enumerator kQTMR_CountPrimarySecondarySrcInQuadDecode

Quadrature count mode, uses primary and secondary sources.

enumerator kQTMR_CountPrimarySrcRiseEdgeSecondarySrcDir

Count active edge of primary input source; secondary input source specifies count direction.

enumerator kQTMR_CountPrimarySrcRiseEdgeSecondarySrcRiseEdgeTrig

The active edge of secondary input source triggers count active edge of primary input source, and the channel counter will stop upon receiving a second trigger event while it's still counting from the first trigger event.

enumerator kQTMR_CountCascadeWithOtherChannel

Cascaded count mode, the channel will count as compare events occur in the selected source chennel (use a special high-speed signal path rather than the OFLAG output signal). The active edge of secondary input source triggers count active edge of primary input source, and the channel counter will re-initialized upon receiving a second trigger event while it's still counting from the first trigger event.

enumerator kQTMR_CountPrimarySrcRiseEdgeSecondarySrcRiseEdgeTrigWithReInit

enum _qtmr_channel_count_length

The enumeration for Quad Timer channel count length.

Values:

enumerator kQTMR_CountLengthUntilRollOver

Count until roll over at $FFFF.

enumerator kQTMR_CountLengthUntilCompare

Count until compare.

enum _qtmr_channel_count_direction

The enumeration for Quad Timer channel count direction.

Values:

enumerator kQTMR_CountDirectionUp

Count direction up.

enumerator kQTMR_CountDirectionDown

Count direction down.

enum _qtmr_channel_count_times

The enumeration for Quad Timer channel count times.

Values:

enumerator kQTMR_CountTimesRepeat

Count repeatedly.

enumerator kQTMR_CountTimesOnce

Count time once.

enum _qtmr_channel_count_load_mode

The enumeration for Quad Timer channel count load mode.

Values:

enumerator kQTMR_CountLoadNormal

Count can be re-initialized only with the LOAD register when match event occurs.

enumerator kQTMR_CountLoadAlternative

Channel can be re-initialized with the LOAD register when count up and a match with COMP1 occurs, or with CMPLD2 register when count down and a match with COMP2 occurs.

enum _qtmr_channel_count_preload_mode

The enumeration for Quad Timer channel COMP1 & COMP2 preload mode.

Values:

enumerator kQTMR_CountPreloadNoLoad

Not load CMPLDn into COMPn register when compare event occurs.

enumerator kQTMR_CountPreloadOnComp1CompareEvent

Load CMPLDn register into COMPn when occurs a successful comparison of channel counter value and the COMP1 register.

enumerator kQTMR_CountPreloadOnComp2CompareEvent

Load CMPLDn register into COMPn when occurs a successful comparison of channel counter value and the COMP2 register.

enum _qtmr_channel_output_mode

The enumeration for Quad Timer channel output signal (OFLAG signal) work mode.

Values:

enumerator kQTMR_OutputAssertWhenCountActive

OFLAG output assert while counter is active.

enumerator kQTMR_OutputClearOnCompare

OFLAG output clear on successful compare.

enumerator kQTMR_OutputSetOnCompare

OFLAG output set on successful compare.

enumerator kQTMR_OutputToggleOnCompare

OFLAG output toggle on successful compare.

enumerator kQTMR_OutputToggleOnAltCompareReg

OFLAG output toggle using alternating compare registers.

enumerator kQTMR_OutputSetOnComareClearOnSecSrcActiveEdge

OFLAG output set on compare, clear on secondary source input edge.

enumerator kQTMR_OutputSetOnCompareClearOnCountRoll

OFLAG output set on compare, clear on counter rollover.

enumerator kQTMR_OutputGateClockOutWhenCountActive

OFLAG output gated while count is active.

enum _qtmr_qtmr_channel_output_value_on_force
The enumeration for Quad Timer channel output signal (OFLAG) value on force event occur.

Values:

enumerator kQTMR_OutputValueClearOnForce
OFLAG output clear (low) when software triggers a FORCE command or master channel force the OFLAG (EEOF need set).

enumerator kQTMR_OutputValueSetOnForce
OFLAG output set (high) when software triggers a FORCE command or master channel force the OFLAG (EEOF need set).

enum _qtmr_channel_debug_action
The enumeration for Quad Timer channel run options when the chip entering debug mode.

Values:

enumerator kQTMR_DebugRunNormal
Continue with normal operation.

enumerator kQTMR_DebugHaltCounter
Halt counter.

enumerator kQTMR_DebugForceOutToZero
Force output to logic 0.

enumerator kQTMR_DebugHaltCountForceOutZero
Halt counter and force output to logic 0.

enum _qtmr_channel_interrupt_enable
The enumeration for Quad Timer channel interrupts.

Values:

enumerator kQTMR_CompareInterruptEnable
Compare interrupt.

enumerator kQTMR_Compare1InterruptEnable
Compare 1 interrupt.

enumerator kQTMR_Compare2InterruptEnable
Compare 2 interrupt.

enumerator kQTMR_OverflowInterruptEnable
Timer overflow interrupt.

enumerator kQTMR_EdgeInterruptEnable
Input edge interrupt.

enumerator kQTMR_ALLInterruptEnable

enum _qtmr_channel_status_flags
The enumeration for Quad Timer channel work status.

Values:

enumerator kQTMR_CompareFlag
Compare flag.

enumerator kQTMR_Compare1Flag
Compare 1 flag.

enumerator kQTMR_Compare2Flag
Compare 2 flag.

enumerator kQTMR_OverflowFlag
Timer overflow flag.

enumerator kQTMR_EdgeFlag
Input edge flag.

enumerator kQTMR_StatusAllFlags

enum _qtmr_channel_enable
The enumeration for Quad Timer channel enable.

Values:

enumerator kQTMR_Channel0Enable
Channel 0 enable.

enumerator kQTMR_Channel1Enable
Channel 1 enable.

enumerator kQTMR_Channel2Enable
Channel 2 enable.

enumerator kQTMR_Channel3Enable
Channel 3 enable.

enumerator kQTMR_ALLChannelEnable

enum _qtmr_channel_dma_enable
The enumeration for Quad Timer channel DMA trigger source.

Values:

enumerator kQTMR_InputEdgeFlagDmaEnable
Input edge flag setting will trigger DMA read request for CAPT register.

enumerator kQTMR_Compare1PreloadDmaEnable
Channel load CMPLD1 register into COMP1 will trigger DMA write request for CMPLD1.

enumerator kQTMR_Compare2PreloadDmaEnable
Channel load CMPLD2 register into COMP2 will trigger DMA write request for CMPLD2.

enumerator kQTMR_AllDMAEnable

typedef enum *_qtmr_input_pin* qtmr_input_pin_t
The enumeration for Quad Timer module input pin source.

typedef enum *_qtmr_channel_number* qtmr_channel_number_t
The enumeration for Quad Timer module channel number.

typedef enum *_qtmr_channel_primary_count_source* qtmr_channel_primary_count_source_t
The enumeration for Quad Timer channel primary input source.

typedef enum *_qtmr_channel_secondary_count_source* qtmr_channel_secondary_count_source_t
The enumeration for Quad Timer channel secondary input source.

typedef enum *_qtmr_channel_secondary_source_capture_mode* qtmr_channel_secondary_source_capture_mode_t
The enumeration for Quad Timer channel secondary input source capture mode.

typedef enum *_qtmr_channel_count_mode* qtmr_channel_count_mode_t
The enumeration for Quad Timer channel count mode.

When "channel output 0~3" or "IP bus clock prescaler" is chosen, active edge is the rising edge. When "input pin 0~3" is chosen, active edge and active level is determined by input invert feature (IPS). Disable input invert feature means active edge is rising edge, active level is high level, enable input invert feature means active edge is falling edge, active level is low level.

typedef enum *_qtmr_channel_count_length* qtmr_channel_count_length_t
The enumeration for Quad Timer channel count length.

typedef enum *_qtmr_channel_count_direction* qtmr_channel_count_direction_t
The enumeration for Quad Timer channel count direction.

typedef enum *_qtmr_channel_count_times* qtmr_channel_count_times_t
The enumeration for Quad Timer channel count times.

typedef enum *_qtmr_channel_count_load_mode* qtmr_channel_count_load_mode_t
The enumeration for Quad Timer channel count load mode.

typedef enum *_qtmr_channel_count_preload_mode* qtmr_channel_count_preload_mode_t
The enumeration for Quad Timer channel COMP1 & COMP2 preload mode.

typedef enum *_qtmr_channel_output_mode* qtmr_channel_output_mode_t
The enumeration for Quad Timer channel output signal (OFLAG signal) work mode.

typedef enum *_qtmr_qtmr_channel_output_value_on_force* qtmr_channel_output_value_on_force_t
The enumeration for Quad Timer channel output signal (OFLAG) value on force event occur.

typedef enum *_qtmr_channel_debug_action* qtmr_channel_debug_action_t
The enumeration for Quad Timer channel run options when the chip entering debug mode.

typedef struct *_qtmr_channel_input_config* qtmr_channel_input_config_t
The structure for configuring Quad Timer channel input signal.

typedef struct *_qtmr_channel_count_config* qtmr_channel_count_config_t
The structure for configuring Quad Timer channel counting behaviors.

typedef struct *_qtmr_channel_output_config* qtmr_channel_output_config_t
The structure for configuring Quad Timer channel output signal (OFLAG).

typedef struct *_qtmr_channel_cooperation_config* qtmr_channel_cooperation_config_t
The structure for configuring Quad Timer channel cooperation mode with other channels.

typedef struct *_qtmr_channel_config* qtmr_channel_config_t
Quad Timer channel configuration covering all channel configurable fields.

typedef struct *_qtmr_input_pin_filter_config* qtmr_input_pin_filter_config_t
The structure for configuring Quad Timer module input pin filter.

typedef struct *_qtmr_config* qtmr_config_t
Quad Timer module configuration which contain channel config structure pointers and input pin filter config structure pointers.

Note: Need use channel structure address to init the structure pointers, when the channel or input pin structure pointers is NULL, it will be ignored by QTMR_Init API. This can save stack space when only one or two channels are used.

struct _qtmr_channel_input_config
#include <fsl_qtmr.h> The structure for configuring Quad Timer channel input signal.

Public Members

qtmr_channel_primary_count_source_t ePrimarySource
    Specify the primary input source.

qtmr_channel_secondary_count_source_t eSecondarySource
    Specify the secondary input source.

bool bEnableSecondarySrcFaultFunction
    true: The selected secondary input acts as a fault signal which can clear the channel output signal when it is set, false: Fault function disabled.

bool eEnableInputInvert
    true: Invert input signal value when select input pin as primary or/and secondary input source false: no operation.

struct _qtmr_channel_count_config
    #include <fsl_qtmr.h> The structure for configuring Quad Timer channel counting behaviors.

Public Members

qtmr_channel_count_mode_t eCountMode
    Configures channel count mode.

qtmr_channel_count_length_t eCountLength
    Configures channel count length.

qtmr_channel_count_direction_t eCountDir
    Configures channel count direction.

qtmr_channel_count_times_t eCountTimes
    Configures channel count times.

qtmr_channel_count_load_mode_t eCountLoadMode
    Configures channel count load mode.

struct _qtmr_channel_output_config
    #include <fsl_qtmr.h> The structure for configuring Quad Timer channel output signal (OFLAG).

Public Members

qtmr_channel_output_mode_t eOutputMode
    Configures channel output signal work mode.

qtmr_channel_output_value_on_force_t eOutputValueOnForce
    The value of output signal when force event occur.

bool bEnableOutputInvert
    True: the polarity of output signal will be inverted, false: The output signal is not inverted.

bool bEnableSwForceOutput
    True: forces the current value of eOFLAGValueOnForce to output signal. false: no operation.

bool bEnableOutputPin
    True: the output signal is driven on the external pin. false: the external pin is configured as an input.

struct _qtmr_channel_cooperation_config

#include <fsl_qtmr.h> The structure for configuring Quad Timer channel cooperation mode with other channels.

Public Members

bool bEnableMasterReInit

true: Master channel within the module can re-initialize this channel when it has a compare event, false: no operation.

bool bEnableMasterForceOFLAG

true: Master channel within the module can force this channel OFLAG signal when it has a compare event, false: no operation.

bool bEnableMasterMode

true: This channel is configured as mater channel, it can broadcast compare event to all channels within the module to re-initialize channel and/or force channel output signal, false: no operation.

struct _qtmr_channel_config

#include <fsl_qtmr.h> Quad Timer channel configuration covering all channel configurable fields.

Public Members

qtmr_channel_input_config_t sInputConfig

Configures channel input signal.

qtmr_channel_count_config_t sCountConfig

Configures channel count work mode.

qtmr_channel_output_config_t sOutputConfig

Configures channel output signal (OFLAG) work mode.

qtmr_channel_debug_action_t eDebugMode

Configures channel operation in chip debug mode.

uint16_t u16EnabledInterruptMask

The mask of the interrupts to be enabled, should be the OR'ed of _qtmr_channel_interrupt_enable.

uint16_t u16EnabledDMAMask

The mask of the interrupts to be enabled, should be the OR'ed of _qtmr_channel_dma_enable.

uint16_t u16Comp1

Value for Channel compare register 1.

uint16_t u16Comp2

Value for Channel compare register 2.

uint16_t u16Comp1Preload

Value for Channel compare 1 preload register.

uint16_t u16Comp2Preload

Value for Channel compare 2 preload register.

uint16_t u16Load

Value for Channel load register.

uint16_t u16Count

Value for Channel counter value register.

bool bEnableChannel

True: enable the channel prescaler (if it is being used) and counter false: disable channel.

struct _qtmr_input_pin_filter_config

#include <fsl_qtmr.h> The structure for configuring Quad Timer module input pin filter.

Public Members

uint8_t u8Period

Value for input filter sample period.

uint8_t u8Count

Value for input filter sample count (sample count = count +3).

struct _qtmr_config

#include <fsl_qtmr.h> Quad Timer module configuration which contain channel config structure pointers and input pin filter config structure pointers.

Note: Need use channel structure address to init the structure pointers, when the channel or input pin structure pointers is NULL, it will be ignored by QTMR_Init API. This can save stack space when only one or two channels are used.

2.66 The Driver Change Log

2.67 QTMR Peripheral and Driver Overview

2.68 The Driver Change Log

2.69 SIM: System Integration Module Driver

FSL_SIM_DRIVER_VERSION

SIM driver version.

2.70 The Driver Change Log

static inline void SIM_SetWaitModeOperation(SIM_Type *base, *sim_wait_mode_operation_t* eOperation)

Sets the operation of wait mode, enable/disable the entry of wait mode.

Parameters

- base – SIM peripheral base address.
- eOperation – Used to enable/disable the wait mode, please refer to sim_wait_mode_operation_t.

static inline void SIM_SetStopModeOperation(SIM_Type *base, *sim_stop_mode_operation_t* eOperation)

Sets the operation of stop mode, enable/disable the entry of stop mode.

Parameters

- base – SIM peripheral base address.
- eOperation – Used to enable/disable the stop mode, please refer to sim_stop_mode_operation_t.

static inline void SIM_EnterLPMode(SIM_Type *base)

Enters into LPMode when the advanced power mode is enabled(register FOPT[1] bit is set).

Note: Please make sure the power mode register is not set as write protected before invoking this function.

Note: This function is useful only when the FTFE module's FOPT[0] bit is set(advanced power mode is enabled).

Parameters

- base – SIM peripheral base address.

static inline void SIM_ExitLPMode(SIM_Type *base)

Exits from LPMode when the advanced power mode is enabled(register FOPT[1] bit is set).

Note: Please make sure the power mode register is not set as write protected before invoking this function.

Note: This function is useful only when the FTFE module's FOPT[0] bit is set(advanced power mode is enabled).

Parameters

- base – SIM peripheral base address.

static inline void SIM_EnterVLPMode(SIM_Type *base)

Enters into VLPMode when the advanced power mode is enabled(register FOPT[1] bit is set).

Note: Please make sure the power mode register is not set as write protected before invoking this function. If both set to enter LPMode and VLPMode, the VLPMode has higher priority.

Note: This function is useful only when the FTFE module's FOPT[0] bit is set(advanced power mode is enabled).

Parameters

- base – SIM peripheral base address.

static inline void SIM_ExitVLPMode(SIM_Type *base)

Exits from VLPMode when the advanced power mode is enabled(register FOPT[1] bit is set).

Note: Please make sure the power mode register is not set as write protected before invoking this function.

Note: This function is useful only when the FTFE module's FOPT[0] bit is set(advanced power mode is enabled).

Parameters

- base – SIM peripheral base address.

static inline bool SIM_IsInLPMode(SIM_Type *base)

Indicates whether the chip is in LPMode when the advanced power mode is enabled(register FOPT[1] bit is set).

Note: This function is useful only when the FTFE module's FOPT[0] bit is set(advanced power mode is enabled).

Parameters

- base – SIM peripheral base address.

Return values

- true – The chip is in LPMode.
- false – The chip is not in LPMode.

static inline bool SIM_IsInVLPMode(SIM_Type *base)

Indicates whether the chip is in VLPMode when the advanced power mode is enabled(register FOPT[1] bit is set).

Note: This function is useful only when the FTFE module's FOPT[0] bit is set(advanced power mode is enabled).

Parameters

- base – SIM peripheral base address.

Return values

- true – The chip is in VLPMode.
- false – The chip is not in VLPMode.

static inline void SIM_TriggerSoftwareReset(SIM_Type *base)

Triggers the software reset for device.

Parameters

- base – SIM base address.

static inline uint16_t SIM_GetResetStatusFlags(SIM_Type *base)

Gets the cause of the most recent reset.

Note: At any given time, the only one reset source is indicated. When multiple reset source assert simultaneously, the reset source with the highest precedence is indicated. The precedence from highest to lowest is POR, external reset, COP loss of reference reset, COP CPU time-out reset, software reset, COP window time-out reset. The POR is always set during a power-on reset. However, POR is cleared and the external reset is set if the external reset pin is asserted or remains asserted after the power-on reset has de-asserted.

Parameters

- base – SIM peripheral base address.

Returns

The current reset status flags, should be the OR'ed value of _sim_reset_status_flags.

static inline void SIM_TriggerPeripheralSoftwareReset(SIM_Type *base, sim_swReset_peri_index_t ePeriIndex)

Triggers the software reset of specific peripheral.

Parameters

- base – SIM peripheral base address.
- ePeriIndex – The index of the peripheral to be reset.

static inline void SIM_EnableResetPadCellInputFilter(SIM_Type *base, bool bEnable)

Enables/Disables the input filter on external reset padcell.

If the input filter is enabled, the filter will remove transient signals on the input at the expense of an increased input delay.

Note: If the input filter is enabled, the filter will affect all input functions supported by that padcell, including GPIO.

Parameters

- base – SIM peripheral base address.
- bEnable – Used to control the behaviour of input filter.
  - **true** Enable the input filter on external input padcell.
  - **false** Disable the input filter on external input padcell.

static inline void SIM_SetInternalPeriInput(SIM_Type *base, sim_internal_peri_index_t eIndex, sim_internal_peri_input_t eInput)

Sets internal peripheral inputs, some peripheral inputs have the ability to be connected to either XBAR outputs or GPIO.

Parameters

- base – SIM base address.
- eIndex – The internal peripherals that supply multi-inputs.
- eInput – The specific input that connected to the selected internal peripheral.

static inline void SIM_SetXbarInputPWMSelection(SIM_Type *base, sim_xbar_input_pwm_index_t eIndex, sim_xbar_input_pwm_selection_t eSelection)

Selects the Xbar input from PWMA and PWMB.

Parameters

- base – SIM base address.
- eIndex – SIM PWM select register field index.
- eSelection – Xbar input pwm selection.

static inline void SIM_SetXbarInputAdcTmrSelection(SIM_Type *base, sim_xbar_input_adc_tmr_index_t eIndex, sim_xbar_input_adc_tmr_selection_t eSelection)

Selects the Xbar input from ADC and TMR A/B.

Parameters

- base – SIM base address.
- eIndex – SIM ADC and TMR select register field index.
- eSelection – Xbar input ADC and TMR selection.

static inline void SIM_SetSmallRegulator1P2VControlMode(SIM_Type *base, *sim_small_regulator_1P2V_control_mode_t* eControlMode)

Sets the control mode of small regulator 1.2V supply, the available control modes are normal mode, standby mode, etc.

Note: This function is useful only when the flash module's FOPT[0] bit is 0.

Parameters

- base – SIM peripheral base address.
- eControlMode – The control mode to be set, please refer to sim_small_regulator_1P2V_control_mode_t.

static inline void SIM_SetSmallRegulator2P7VControlMode(SIM_Type *base, *sim_small_regulator_2P7V_control_mode_t* eControlMode)

Sets the control mode of small regulator 2.7 supply, the available control modes are normal mode, standby mode, etc.

Note: This function is useful only when the flash module's FOPT[0] bit is 0.

Parameters

- base – SIM peripheral base address.
- eControlMode – THe control mode to be set, please refer to sim_small_regulator_2P7V_control_mode_t.

static inline void SIM_SetLargeRegulatorControlMode(SIM_Type *base, *sim_large_regulator_control_mode_t* eControlMode)

Sets the control mode of large regulator, the available control mode are normal mode, standby mode, etc.

Note: This function is useful only when the flash module's FOPT[0] bit is 0.

Parameters

- base – SIM peripheral base address.
- eControlMode – The control mode to be set, please refer to sim_large_regulator_control_mode_t.

static inline void SIM_SetRegisterProtectionMode(SIM_Type *base, *sim_write_protection_module_t* eModule, *sim_write_protection_mode_t* eMode)

Sets the write protection mode of the selected register.

Parameters

- base – SIM peripheral base address.
- eModule – The module to be set, please refer to sim_write_protection_module_t.
- eMode – The specific write protection mode to be set, please refer to sim_write_protection_mode_t.

static inline uint32_t SIM_GetJTAGID(SIM_Type *base)

Gets JTAG ID, the JTAG ID is 32bits width.

Parameters

- base – SIM base address.

Returns

The 32bits width JTAG ID.

static inline uint8_t SIM_GetPMCBandgapTrim(SIM_Type *base)

Gets the trim vlaue of the bandgap inside the PMC module, the available range is 0 to 15.

Parameters

- base – SIM peripheral base address.

Returns

The trim value of PMC's bandgap, ranges from 0 to 15.

static inline uint16_t SIM_Get200KHzROSCFreqTrim(SIM_Type *base)

Gets the trim value of 200KHz Relaxation Osillator Frequency, the available range is 0 to 511.

Parameters

- base – SIM peripheral base address.

Returns

The trim value of 200 khz Relaxation Oscillator frequency, ranges from 0 to 511.

static inline void SIM_SetIOShortAddressValue(SIM_Type *base, uint32_t u32IOShortAddressValue)

Sets the I/O short address location value which specifies the memory referenced through the I/O short address mode.

The I/O short address mode allows the instrution to specify the lower 6 bits of the address. And the upper 18 bits of the address can be controlled by invoking this function.

Note: The pipeline delay between setting the related register set and using short I/O addrssing with the new value is five cycles.

Parameters

- base – SIM base address.
- u32IOShortAddressValue – The value of I/O short address location, this address value should be 24 bits width.

static inline uint16_t SIM_GetSoftwareControlData(SIM_Type *base, sim_software_contrl_register_index_t eIndex)

Gets the software control data by the software control register index.

Parameters

- base – SIM base address.
- eIndex – SIM software control register index.

Returns

Software control registers value.

static inline void SIM_SetSoftwareControlData(SIM_Type *base, sim_software_contrl_register_index_t eIndex, uint16_t u16Value)

Sets the software control data by the software contorl register index, the data is for general-purpose use by software.

Parameters

- base – SIM base address.
- eIndex – SIM software control register index.
- u16Value – Software control registers value.

static inline void SIM_SetOnCEClockOperationMode(SIM_Type *base, *sim_onceclk_operation_mode_t* eOperationMode)

Sets the operation mode of the OnCE clock, the available operation modes are always enabled and enabled when the core TAP is enabled.

Parameters

- base – SIM peripheral base address.
- eOperationMode – The operation mode of OnCE clock, please refer to sim_onceclk_operation_mode_t.

static inline void SIM_SetDMAOperationMode(SIM_Type *base, *sim_dma_operation_mode_t* eOperationMode)

Sets the operation mode of DMA, such as disabled, enabled in run mode only, etc.

Parameters

- base – SIM peripheral base address.
- eOperationMode – The operation mode to be set, please refer to sim_dma_operation_mode_t.

static inline *sim_boot_mode_t* SIM_GetBootMode(SIM_Type *base)

Gets the device's boot mode, the available boot modes are ROM boot and NVM flash boot.

Parameters

- base – SIM peripheral base address.

Returns

The device's boot mode, please refer to sim_boot_mode_t.

static inline void SIM_EnableADCScanControlReorder(SIM_Type *base, bool bEnable)

Enables/Disables the ADC scan control register reorder feature.

Parameters

- base – SIM peripheral base address.
- bEnable – Used to control the ADC scan control register reorder feature.
  - **true** Enable the re-ordering of ADC scan control bits.
  - **false** ADC scan control register works in normal order.

static inline void SIM_SetMasterPIT(SIM_Type *base, *sim_master_pit_selection_t* eMasterPit)

Sets master programmable interval timer.

Parameters

- base – SIM peripheral base address.
- eMasterPit – The master PIT to be selected, please refer to sim_master_pit_selection_t.

static inline void SIM_SetBootOverRide(SIM_Type *base, sim_boot_override_mode_t eMode)

Sets the boot over ride mode, this API can be used to determine the boot option in the next reset excluding POR.

Parameters

- base – SIM peripheral base address.
- eMode – THe boot over ride mode.

enum _sim_reset_status_flags

The enumeration of system reset status flags, such as power on reset, software reset, etc.

Values:

enumerator kSIM_PowerONResetFlag

The Power on reset caused the most recent reset.

enumerator kSIM_ExternalResetFlag

The external reset caused the most recent reset, that means the external reset pin was asserted or remained asserted after the power-on reset de-asserted.

enumerator kSIM_COPLossOfReferenceResetFlag

The computer operating properly module signaled a PLL loss of reference clock reset caused the most recent reset.

enumerator kSIM_COPCPUTimeOutResetFlag

The computer operating properly module signaled a CPU time-out reset caused the most recent reset.

enumerator kSIM_SofwareResetFlag

The previous system reset occurred as a result of a software reset

enumerator kSIM_COPWindowTimeOutResetFlag

The previous system reset occurred as a result of a cop_window reset.

enum _sim_stop_mode_operation

The enumeration of stop mode operation can be used to enable/disable stop mode enter.

Values:

enumerator kSIM_STOPInstrutionEnterStopMode

Stop mode is entered when the DSC core executes a STOP instruction.

enumerator kSIM_STOPInstrutionNotEnterStopMode
The DSC core STOP instruction does not cause entry into stop mode.

enumerator kSIM_STOPInstrutionEnterStopModeWriteProtect
Stop mode is entered when the DSC core executes a STOP instruction, and the realted register bit field is write protected until the next reset.

enumerator kSIM_STOPInstructionNotEnterStopModeWriteProtect
The DSC core STOP instruction does not cause entry into stop mode, and the related register bit field is write protected until the next reset.

enum _sim_wait_mode_operation
The enumeration of wait mode operation can be used to enable/disable wait mode enter.

Values:

enumerator kSIM_WAITInstrutionEnterWaitMode
Wait mode is entered when the DSC core executes a WAIT instruction.

enumerator kSIM_WAITInstrutionNotEnterWaitMode
The DSC core WAIT instruction does not cause entry into wait mode.

enumerator kSIM_WAITInstrutionEnterWaitModeWriteProtect
Wait mode is entered when the DSC core executes a WAIT instruction, and the realted register bit field is write protected until the next reset.

enumerator kSIM_WAITInstructionNotEnterWaitModeWriteProtect
The DSC core WAIT instruction does not cause entry into wait mode, and the related register bit field is write protected until the next reset.

enum _sim_onceclk_operation_mode
The enumeration of OnCE clock operation mode, such as enabled when core TAP is enabled and always enabled.

Values:

enumerator kSIM_OnCEClkEnabledWhenCoreTapEnabled
The OnCE clock to the DSC core is enabled when the core TAP is enabled.

enumerator kSIM_OnCEClkAlwaysEnabled
The OnCE clock to the DSC core is always enabled.

enum _sim_dma_operation_mode
The enumeration of dma operation mode, this enumeration can be used to disable/enable DMA module in different power modes.

Values:

enumerator kSIM_DMADisable
DMA module is disabled.

enumerator kSIM_DMAEnableAtRunModeOnly
DMA module is enabled in run mode only.

enumerator kSIM_DMAEnableAtRunModeWaitMode
DMA module is enabled in run and wait modes only.

enumerator kSIM_DMAEnableAtAllPowerModes
DMA module is enabled in all power modes.

enumerator kSIM_DMADisableWriteProtect
DMA module is disabled and the related register bit field is write protected until the next reset.

enumerator kSIM_DMAEnableAtRunModeOnlyWriteProtect

DMA module is enabled in run mode only and the related bit field is write protected until the next reset.

enumerator kSIM_DMAEnableAtRunModeWaitModeWriteProtect

DMA module is enabled in run and wait modes only and the related register bit field is write protected until the next reset.

enumerator kSIM_DMAEnableAtAllPowerModesWriteProtect

DMA module is enabled in all low power modes and the related register bit field is write protected until the next reset.

enum _sim_boot_mode

The enumeration of device's boot mode, including ROM boot and NVM flash boot.

Values:

enumerator kSIM_BootFromNVMFlash

Indicates the chip is boot from NVM Flash.

enumerator kSIM_BootFromROM

Indicates the chip is boot from ROM.

enum _sim_small_regulator_1P2V_control_mode

The enumeration of small regualtor 1P2V control mode, such as normal mode and standby mode.

Values:

enumerator kSIM_SmallRegulator1P2VInNormalMode

Small regulator 1.2V supply placed in normal mode.

enumerator kSIM_SmallRegulator1P2VInStandbyMode

Small regulator 1.2V supply placed in standby mode.

enumerator kSIM_SmallRegulator1P2VInNormalModeWriteProtect

Small regulator 1.2V supply placed in nomal mode, and the related register bit field is write protected until the next reset.

enumerator kSIM_SmallRegulator1P2VInStandbyModeWriteProtect

Small regulator 1.2V supply placed in standby mode, and the related register bit field is write protected until the next reset.

enum _sim_small_regulator_2P7V_control_mode

The enumeration of small regulator 2P7V control mode, such as normal mode, standby mode, powerdown mode, etc.

Values:

enumerator kSIM_SmallRegulator2P7VInNormalMode

Small regulator 2.7V supply placed in normal mode.

enumerator kSIM_SmallRegulator2P7VInStandbyMode

Small regulator 2.7V supply placed in standby mode.

enumerator kSIM_SmallRegulator2P7VInPowerdownMode

Small regulator 2.7V supply placed in powerdown mode.

enumerator kSIM_SmallRegulator2P7VInNormalModeWriteProtect

Small regulator 2.7V supply placed in normal mode and the related bit field is write protected until chip reset.

enumerator kSIM_SmallRegulator2P7VInStandbyModeWriteProtect

Small regulator 2.7V supply placed in standby mode and the related bit field is write protected until chip reset.

enumerator kSIM_SmallRegulator2P7VInPowerdownModeWriteProtect

Small regulator placed in powerdown mode and the related bit field is write protected until chip reset.

enum _sim_large_regulator_control_mode

The enumeration of large regulator contorl mode, such as normal mode, standby mode.

Values:

enumerator kSIM_LargeRegulatorInNormalMode

Large regulator placed in normal mode.

enumerator kSIM_LargeRegulatorInStandbyMode

Large regulator placed in standby mode.

enumerator kSIM_LargeRegulatorInNormalModeWriteProtect

Large regulator placed in normal mode, and the related register bit field is write protected until chip reset.

enumerator kSIM_LargeRegulatorInStandbyModeWriteProtect

Large regulator placed in standby mode, and the related register bit field is write protected until chip reset.

enum _sim_write_protection_module

The enumeration of modules that support various protection mode.

Values:

enumerator kSIM_GPIOInternalPeripheralSelectProtection

Used to control the protection mode GPSn and IPSn registers in the SIM, all XBAR, EVTG, GPIOn_PER, GPIOn_PPMODE, GPIOn_DRIVE.

enumerator kSIM_PeripheralClockEnableProtection

Used to control the protection mode of PCEn, SDn, PSWRn, and PCR register.

enumerator kSIM_GPIOPortDProtection

Used to control the protection mode of GPIO_D_PER, GPIO_D_PPMODE, and GPIO_D_DRIVE register.

enumerator kSIM_PowerModeControlWriteProtection

Used to control the protection mode of the PWRMODE register.

enum _sim_write_protection_mode

The enumeration of write protection mode, such as write protection off, write protection on, etc.

Values:

enumerator kSIM_WriteProtectionOff

Write protection off.

enumerator kSIM_WriteProtectionOn

Write protection on.

enumerator kSIM_WriteProtectionOffAndLocked

Write protection off and locked until chip reset.

enumerator kSIM_WriteProtectionOnAndLocked

Write protection on and locked until chip reset.

enum _sim_lpi2c_trigger_selection

The enumeration of lpi2c trigger selection, including slave trigger and master trigger.

Values:

enumerator kSIM_Lpi2cSlaveTrigger

Selects slave trigger.

enumerator kSIM_Lpi2cMasterTrigger

Selects master trigger.

enum _sim_master_pit_selection

The enumeration of master pit.

Values:

enumerator kSIM_PIT0MasterPIT1Slave

PIT0 is master PIT and PIT1 is slave PIT.

enumerator kSIM_PIT1MasterPIT0Slave

PIT0 is master PIT and PIT1 is slave PIT.

typedef enum *_sim_stop_mode_operation* sim_stop_mode_operation_t

The enumeration of stop mode operation can be used to enable/disable stop mode enter.

typedef enum *_sim_wait_mode_operation* sim_wait_mode_operation_t

The enumeration of wait mode operation can be used to enable/disable wait mode enter.

typedef enum *_sim_onceclk_operation_mode* sim_onceclk_operation_mode_t

The enumeration of OnCE clock operation mode, such as enabled when core TAP is enabled and always enabled.

typedef enum *_sim_dma_operation_mode* sim_dma_operation_mode_t

The enumeration of dma operation mode, this enumeration can be used to disable/enable DMA module in different power modes.

typedef enum *_sim_boot_mode* sim_boot_mode_t

The enumeration of device's boot mode, including ROM boot and NVM flash boot.

typedef enum *_sim_small_regulator_1P2V_control_mode* sim_small_regulator_1P2V_control_mode_t

The enumeration of small regualtor 1P2V control mode, such as normal mode and standby mode.

typedef enum *_sim_small_regulator_2P7V_control_mode* sim_small_regulator_2P7V_control_mode_t

The enumeration of small regulator 2P7V control mode, such as normal mode, standby mode, powerdown mode, etc.

typedef enum *_sim_large_regulator_control_mode* sim_large_regulator_control_mode_t

The enumeration of large regulator contorl mode, such as normal mode, standby mode.

typedef enum *_sim_write_protection_module* sim_write_protection_module_t

The enumeration of modules that support various protection mode.

typedef enum *_sim_write_protection_mode* sim_write_protection_mode_t

The enumeration of write protection mode, such as write protection off, write protection on, etc.

typedef enum *_sim_lpi2c_trigger_selection* sim_lpi2c_trigger_selection_t

The enumeration of lpi2c trigger selection, including slave trigger and master trigger.

typedef enum *_sim_master_pit_selection* sim_master_pit_selection_t
    The enumeration of master pit.

FSL_COMPONENT_ID

SIM_RESET_STATUS_MASK
    The macro of REST status bit field mask.

SIM_PWR_SR27_CONTROL_MODE_MASK
    The definition of the short regulator control mode bit field mask.

SIM_PWR_SR27_CONTROL_MODE_SHIFT
    The definition of the short regulator control mode bit field shift.

SIM_PWR_SR27_CONTROL_MODE(x)
    The macro that can be used to set the bit field of PWR register's short regulator bit field.

SIM_PROT_BIT_FIELD_MASK(moduleName)
    The definition of the PORT register bit filed mask.

SIM_PORT_SET_MODE_PROTECTION_MODE(moduleName, protectionMode)
    The macro that can be used to set module's protection mode.

2.71 SIM Peripheral and Driver Overview

2.72 XBAR: Inter-Peripheral Crossbar Switch Driver

void XBARA_Init(XBARA_Type *base)
    Initializes the XBARA module.

    This function un-gates the XBARA clock.

    Parameters

    - base – XBARA peripheral address.

void XBARA_Deinit(XBARA_Type *base)
    Shuts down the XBARA module.

    This function disables XBARA clock.

    Parameters

    - base – XBARA peripheral address.

static inline void XBARA_SetSignalsConnection(XBARA_Type *base, xbar_input_signal_t eInput, xbar_output_signal_t eOutput)
    Sets a connection between the selected XBARA_IN[*] input and the XBARA_OUT[*] output signal.

    This function connects the XBARA input to the selected XBARA output. If more than one XBARA module is available, only the inputs and outputs from the same module can be connected.

    Example:

```
XBARA_SetSignalsConnection(XBARA, kXBARA_InputPIT_TRG0, kXBARA_
↪OutputDMAMUX18);
```

    Parameters

- base – XBARA peripheral address.
- eInput – XBARA input signal.
- eOutput – XBARA output signal.

static inline void XBARA_SetActiveEdgeDetectMode(XBARA_Type *base, xbar_output_signal_t eOutput, *xbara_active_edge_t* eActiveEdgeMode)

Sets active edge detection mode for the XBARA_OUT[*] output signal.

Parameters

- base – XBARA peripheral address.
- eOutput – XBARA output signal.
- eActiveEdgeMode – Active edge mode.

static inline void XBARA_SetInterruptDMARequestMode(XBARA_Type *base, xbar_output_signal_t eOutput, *xbara_request_t* eRequest)

Sets DMA, Interrupt or disabled request generation mode for the XBARA_OUT[*] output signal.

Parameters

- base – XBARA peripheral address.
- eOutput – XBARA output signal.
- eRequest – Request type.

void XBARA_SetOutputSignalConfig(XBARA_Type *base, xbar_output_signal_t eOutput, const *xbara_control_config_t* *psControlConfig)

Configures the XBARA output signal edge detection and interrupt/dma featues.

This function configures an XBARA control register. The active edge detection and the DMA/IRQ function on the corresponding XBARA output can be set.

Example:

```
xbara_control_config_t userConfig;
userConfig.activeEdge = kXBARA_EdgeRising;
userConfig.requestType = kXBARA_RequestInterruptEnable;
XBARA_SetOutputSignalConfig(XBARA, kXBARA_OutputDMAMUX18, &userConfig);
```

Note: Only a subset of the XBARA output signal can be called with this API. On debug mode code will check whether the output signal eOutput satisfy the requirement.

Parameters

- base – XBARA peripheral address.
- eOutput – XBARA output number.
- psControlConfig – Pointer to structure that keeps configuration of control register.

uint16_t XBARA_GetStatusFlags(XBARA_Type *base)

Gets the active edge detection status for all XBAR output signal supporting this feature.

This function gets the active edge detect status of all XBARA_OUTs. If the active edge occurs, the return value is asserted. When the interrupt or the DMA functionality is enabled for the XBARA_OUTx, this field is 1 when the interrupt or DMA request is asserted and 0 when the interrupt or DMA request has been cleared.

Parameters

- base – XBARA peripheral address.

Returns

ORed value from all status flag from xbara_status_flag_t.

static inline void XBARA_ClearStatusFlags(XBARA_Type *base, uint16_t u16Flags)

Clear the edge detection status flags of relative mask.

Parameters

- base – XBARA peripheral address.
- u16Flags – status flags composed from ORed xbara_status_flag_t indicating flags to be cleared.

FSL_XBAR_DRIVER_VERSION

XBAR driver version.

enum _xbara_active_edge

XBARA active edge for detection.

Values:

enumerator kXBARA_EdgeNone

Edge detection status bit never asserts.

enumerator kXBARA_EdgeRising

Edge detection status bit asserts on rising edges.

enumerator kXBARA_EdgeFalling

Edge detection status bit asserts on falling edges.

enumerator kXBARA_EdgeRisingAndFalling

Edge detection status bit asserts on rising and falling edges.

enum _xbara_request

XBARA DMA and interrupt configurations. Note it only apply for a subset of XBARA output signal.

Values:

enumerator kXBARA_RequestDisable

Interrupt and DMA are disabled.

enumerator kXBARA_RequestDMAEnable

DMA enabled, interrupt disabled.

enumerator kXBARA_RequestInterruptEnable

Interrupt enabled, DMA disabled.

enum _xbara_status_flag

XBARA status flags.

This provides constants for the XBARA status flags for use in the XBARA functions. The enumerator value is designed to make sure Flags in same register can be created with register value to write/read register.

Values:

enumerator kXBARA_EdgeDetectionOut0Flag

XBAR_OUT0 active edge interrupt flag, sets when active edge detected.

enumerator kXBARA_EdgeDetectionOut1Flag
XBAR_OUT1 active edge interrupt flag, sets when active edge detected.

enumerator kXBARA_EdgeDetectionOut2Flag
XBAR_OUT2 active edge interrupt flag, sets when active edge detected.

enumerator kXBARA_EdgeDetectionOut3Flag
XBAR_OUT3 active edge interrupt flag, sets when active edge detected.

enumerator kXBARA_AllStatusFlags

typedef enum *_xbara_active_edge* xbara_active_edge_t
XBARA active edge for detection.

typedef enum *_xbara_request* xbara_request_t
XBARA DMA and interrupt configurations. Note it only apply for a subset of XBARA output signal.

typedef enum *_xbara_status_flag* xbara_status_flag_t
XBARA status flags.

This provides constants for the XBARA status flags for use in the XBARA functions. The enumerator value is designed to make sure Flags in same register can be created with register value to write/read register.

typedef struct *_xbara_control_config* xbara_control_config_t
Defines the configuration structure of the XBARA control register.

This structure keeps the configuration of XBARA control register for one output. Control registers are available only for a few outputs. Not every XBARA module has control registers.

XBARA_SELx(base, output)
Macro function to extract the XBAR select register address for a given xbar output signal.

XBARA_CTRLx(base, output)
Macro function to extract the XBAR Ctrl register address for a given xbar output signal.

XBARA_SELx_SELn_SHIFT(output)
Macro function to get SELn field shift in XBARA_SELx register for a given output signal.

XBARA_SELx_SELn_MASK(output)
Macro function to get SELn field mask in XBARA_SELx register for a given output signal.

XBARA_SELx_SELn(output, input_signal)
Macro function to create SELn field value in XBARA_SELx register for given output signal and input signal value input_signal, see xbar_input_signal_t.

XBARA_CTRLx_DIENn_MASK(output)
Macro function to get DIENn field mask in XBARA_CTRLx register for a given output signal.

XBARA_CTRLx_DIENn_SHIFT(output)
Macro function to get DIENn field shift in XBARA_CTRLx register for a given output signal.

XBARA_CTRLx_DIENn(output, x)
Macro function to create DIENn field value in XBARA_CTRLx register for given output signal and DMA/Interrupt mode x, see xbara_request_t.

XBARA_CTRLx_EDGEn_MASK(output)
Macro function to get EDGEn field mask in XBARA_CTRLx register for a given output signal.

XBARA_CTRLx_EDGEn_SHIFT(output)
Macro function to get EDGEn field shift in XBARA_CTRLx register for a given output signal.

XBARA_CTRLx_EDGEn(output, x)

Macro function to create EDGEn field value in XBARA_CTRLx register for given output signal and edge mode x, see xbara_active_edge_t.

XBARA_CTRLx_STS_MASK

Macro value for the Status bits in CTRL register.

struct _xbara_control_config

#include <fsl_xbara.h> Defines the configuration structure of the XBARA control register.

This structure keeps the configuration of XBARA control register for one output. Control registers are available only for a few outputs. Not every XBARA module has control registers.

Public Members

xbara_active_edge_t eActiveEdge

Active edge to be detected.

xbara_request_t eRequestType

Selects DMA/Interrupt request.

2.73 The Driver Change Log

2.74 XBAR Peripheral and Driver Overview

Chapter 3

Middleware

Chapter 4

RTOS

4.1 FreeRTOS

4.1.1 FreeRTOS kernel

Open source RTOS kernel for small devices.

FreeRTOS kernel for MCUXpresso SDK Readme

FreeRTOS kernel for MCUXpresso SDK ChangeLog

FreeRTOS kernel Readme

4.1.2 FreeRTOS drivers

This is set of NXP provided FreeRTOS reentrant bus drivers.

4.1.3 backoffalgorithm

Algorithm for calculating exponential backoff with jitter for network retry attempts.

Readme

4.1.4 corehttp

C language HTTP client library designed for embedded platforms.

4.1.5 corejson

JSON parser.

Readme

4.1.6 coremqtt

MQTT publish/subscribe messaging library.

4.1.7 corepkcs11

PKCS #11 key management library.

Readme

4.1.8 freertos-plus-tcp

Open source RTOS FreeRTOS Plus TCP.

Readme