

# **MCUXpresso SDK Release Notes**

## **Supporting MKV10Z64/128, MKV11Z64/128, and HVP-KV11Z75M**



# Contents

<b>Chapter 1 Overview.....</b>	<b>3</b>
<b>Chapter 2 MCUXpresso SDK.....</b>	<b>4</b>
<b>Chapter 3 Development tools.....</b>	<b>5</b>
<b>Chapter 4 Supported development systems.....</b>	<b>6</b>
<b>Chapter 5 Release contents.....</b>	<b>7</b>
<b>Chapter 6 MCUXpresso SDK release package.....</b>	<b>8</b>
<b>Chapter 7 MISRA compliance.....</b>	<b>9</b>
<b>Chapter 8 Known issues.....</b>	<b>11</b>

# Chapter 1

## Overview

The MCUXpresso Software Development Kit (SDK) is a collection of software enablement for Microcontrollers that includes peripheral drivers, high-level stacks including other middleware packages, and integrated RTOS support for FreeRTOS™ OS. In addition to the base enablement, the MCUXpresso SDK is augmented with demo applications and driver example projects, and API documentation to help the customers quickly leverage the support of the MCUXpresso SDK.

For more details about MCUXpresso SDK, see the MCUXpresso SDK homepage [MCUXpresso-SDK: Software Development Kit](#).

---

### NOTE

See the attached Change Logs section at the end of this document to reference the device-specific driver logs, middleware logs, and RTOS log.

---

## Chapter 2

# MCUXpresso SDK

As part of the MCUXpresso software and tools, MCUXpresso SDK is the evolution of Kinetis SDK v2.x.x, includes support for both LPC and i.MX System-on-Chips (SoC). The same drivers, APIs, and middleware are still available with support for Kinetis, LPC, 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 have 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 for easy cloning of existing SDK examples and demos, allowing users to easily leverage the existing software examples provided by the SDK for their own projects.

---

### NOTE

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.

---

# Chapter 3

## Development tools

The MCUXpresso SDK was compiled and tested with these development tools:

- IAR Embedded Workbench for Arm version 8.32.3
- MDK-Arm Microcontroller Development Kit (Keil)<sup>®</sup> 5.27
- Makefiles support with GCC revision 8-2018-q4-major GCC8 from Arm Embedded
- MCUXpresso IDE v11.0.0

## Chapter 4

# Supported development systems

This release supports boards and devices listed in this table. Boards and devices in boldface were tested in this release:

**Table 1. Supported MCU devices and development boards**

Development boards	MCU devices
<b>TWR-KV11Z75M, FRDM-KV11Z, HVP-KV11Z75M</b>	<b>MKV11Z128VLH7</b> , MKV11Z64VLH7, MKV11Z128VLC7, MKV11Z64VLC7, MKV11Z128VFM7, MKV11Z64VFM7, MKV11Z128VLF7, MKV11Z64VLF7, MKV10Z128VLH7, MKV10Z64VLH7, MKV10Z128VLC7, MKV10Z64VLC7, MKV10Z128VFM7, MKV10Z64VFM7, MKV10Z128VLF7, MKV10Z64VLF7, MKV11Z128VLF7

# Chapter 5

## Release contents

This table provides an overview of the MCUXpresso SDK release package contents and locations.

**Table 2. Release contents**

<b>Deliverable</b>	<b>Location</b>
Boards	<install_dir>/boards
TinyCBOR	<install_dir>/rtos/amazon-freertos/lib/third_party/tinycbor
Demo applications	<install_dir>/boards/<board_name>/demo_apps
Driver examples	<install_dir>/boards/<board_name>/driver_examples
Cortex Microcontroller Software Interface Standard (CMSIS) driver examples	<install_dir>/boards/<board_name>/cmsis_driver_examples
RTOS examples	<install_dir>/boards/<board_name>/rtos_examples
Documentation	<install_dir>/docs
Middleware	<install_dir>/middleware
Driver, SoC header files, extension header files and feature header files, utilities	<install_dir>/devices/<device_name>
CMSIS Arm Cortex <sup>®</sup> -M header files, DSP library source	<install_dir>/CMSIS
Peripheral Drivers	<install_dir>/devices/<device_name>/drivers
CMSIS drivers	<install_dir>/devices/<device_name>/cmsis_drivers
Utilities such as debug console	<install_dir>/devices/<device_name>/utilities
RTOS Kernel Code	<install_dir>/rtos
Tools	<install_dir>/tools
segger_systemview	<install_dir>/boards/<board>/rtos_examples/visualization/freertos_segger_sysview
percepio_snapshot	<install_dir>/boards/<board>/rtos_examples/visualization/freertos_percepio_snapshot

# Chapter 6

## MCUXpresso SDK release package

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

### 6.1 Device support

The device folder contains all available software enablement for the specific System-on-Chip (SoC) subfamily. This folder includes clock-specific implementation, device register header file, device register feature header file, CMSIS derived device SVD, and the system configuration source files. Included with the standard SoC support are folders containing peripheral drivers, toolchain support, and a simple debug console.

The device-specific header files provide a direct access to the MCU peripheral registers. The device header file provides an overall SoC memory mapped register definition. In addition to the overall device memory mapped header file, the MCUXpresso SDK also includes the feature header file for each peripheral instantiated on the SoC.

The toolchain folder contains the startup code and linker files for each supported toolchain. The startup code is a CMSIScompliant startup that efficiently transfers the code execution to the main() function.

#### 6.1.1 Board support

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

#### 6.1.2 Demo applications 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.

### 6.2 Middleware

#### 6.2.1 RTOS

The MCUXpresso SDK is integrated with FreeRTOS OS.

#### 6.2.2 CMSIS

The MCUXpresso SDK is shipped with the standard CMSIS development pack, including the prebuilt libraries.



# Chapter 7

## MISRA compliance

All MCUXpresso SDK drivers and USB stack comply to MISRA 2012 rules with the following exceptions.

**Table 3. MISRA exceptions**

Exception Rules	Description
Rule 5.1	External identifiers shall be distinct.
Rule 5.4	Macro identifiers shall be distinct.
Rule 21.1	#define and #undef shall not be used on a reserved identifier or reserved macro name.
Rule 21.2	A reserved identifier or macro name shall not be declared.
Directive 4.4	Sections of code should not be "commented out".
Directive 4.5	Identifiers in the same name space with overlapping visibility should be typographically unambiguous.
Directive 4.6	Typedefs that indicate size and signedness should be used in place of the basic numerical types.
Directive 4.8	If a pointer to a structure or union is never dereferenced within a translation unit, then the implementation of the object should be hidden.
Directive 4.9	A function should be used in preference to a function-like macro where they are interchangeable.
Directive 4.13	Functions which are designed to provide operations on a resource should be called in an appropriate sequence.
Rule 1.2	Language extensions should not be used.
Rule 2.3	A project should not contain unused type declarations.
Rule 2.4	A project should not contain unused tag declarations.
Rule 2.5	A project should not contain unused macro declarations.
Rule 2.6	A function should not contain unused label declarations.
Rule 2.7	There should be no unused parameters in functions.
Rule 4.2	Trigraphs should not be used.
Rule 5.9	Identifiers that define objects or functions with internal linkage should be unique.
Rule 8.7	Functions and objects should not be defined with external linkage if they are referenced in only one translation unit.
Rule 8.9	An object should be defined at block scope if its identifier only appears in a single function.
Rule 8.11	When an array with external linkage is declared, its size should be explicitly specified.

*Table continues on the next page...*

**Table 3. MISRA exceptions (continued)**

Rule 8.13	A pointer should point to a const-qualified type whenever possible.
Rule 10.5	The value of an expression should not be cast to an inappropriate essential type.
Rule 11.4	A conversion should not be performed between a pointer to object and an integer type.
Rule 11.5	A conversion should not be performed from pointer to void into pointer to object.
Rule 12.1	The precedence of operators within expressions should be made explicit.
Rule 12.3	The comma operator should not be used.
Rule 12.4	Evaluation of constant expressions should not lead to unsigned integer wrap-around.
Rule 13.3	A full expression containing an increment (++) or decrement (--) operator should have no other potential side effects other than that caused by the increment or decrement operator.
Rule 15.4	There should be no more than one break or go to statement used to terminate any iteration statement.
Rule 17.5	The function argument corresponding to a parameter declared to have an array type shall have an appropriate number of elements.
Rule 17.8	A function parameter should not be modified.
Rule 19.2	The union keyword should not be used.
Rule 20.1	#include directives should only be preceded by preprocessor directives or comments.
Rule 20.10	The #and ## preprocessor operators should not be used.
Rule 21.12	The exception handling features of <fenv.h> should not be used. .

## Chapter 8

### Known issues

#### 8.1 Maximum file path length in Windows 7<sup>®</sup> operating system

Windows 7 operating system imposes a 260 character maximum length for file paths. When installing the MCUXpresso SDK, place it in a directory close to the root to prevent file paths from exceeding the maximum character length specified by the Windows operating system. The recommended location is the C:\nxp folder.

#### 8.2 USBFS controller issue

Because of the USBFS controller design issues, the USB host suspend/resume demos (usb\_suspend\_resume\_host\_hid\_mouse) of the full speed controller do not support the low speed device directly.

#### 8.3 USB PID issue

Because the PID of all USB device examples is updated, uninstall the device drivers and then reinstall when the device (with new PID) is plugged in the first time.

#### 8.4 Create new project without board template

The following components should be selected at the same time when creating a new project without using a board template, including serial\_manager, serial\_manager\_uart, debug\_console, and one UART adapter (lpuart\_adapter for LPUART IP, uart\_adapter for UART IP, lpsci\_adapter for LPSCI IP, etc).

#### 8.5 New Project Wizard compile failure

The following components request the user to manually select other components that they depend on to pass the compile. These components depend on several components, and the New Project Wizard (NPW) is not able to decide which one is needed by the user.

##### NOTE

"xxx" means core variants like cm0plus, cm33, cm4, cm33\_nodsp.

**Components:** Assert, assert\_cm0plus, assert\_xxx, assert\_lite, baremetal, button, codec\_i2c, codec\_i2c\_xxx, debug\_console, debug\_console\_xxx, debug\_console\_lite, dialog7212, led, misc\_utilities, panic, serial\_manager, serial\_manager\_xxx, serial\_manager\_swo, serial\_manager\_swo\_xxx, serial\_manager\_uart, serial\_manager\_uart\_xxx, serial\_manager\_usb\_cdc, serial\_manager\_usb\_cdc\_xxx, sgtl\_adapter, sgtl5000, shell, shell\_xxx, timer\_manager, wm8904, wm8904\_xxx, wm8904\_adapter, wm8904\_adapter\_xxx, wm8960, wm8960\_adapter, xip\_device.

---

# **MCUXpresso SDK Release Notes Supporting MKV10Z64/128, MKV11Z64/128, and HVP-KV11Z75M**

**Change Logs**

# Contents

<b>Driver Change Log</b>	<b>1</b>
ADC16 . . . . .	1
CMP . . . . .	1
CRC . . . . .	1
DAC . . . . .	1
DMAMUX . . . . .	2
DSPI . . . . .	2
EDMA . . . . .	3
EWM . . . . .	5
FLASH . . . . .	5
FLEXCAN . . . . .	6
FTM . . . . .	7
GPIO . . . . .	8
I2C . . . . .	9
LLWU . . . . .	10
LPTMR . . . . .	11
MMDVQS . . . . .	11
PDB . . . . .	11
PMC . . . . .	12
PORT . . . . .	12
RCM . . . . .	12

# Contents

Title	Page Number
<b>SIM</b> . . . . .	<b>12</b>
<b>SMC</b> . . . . .	<b>13</b>
<b>UART</b> . . . . .	<b>13</b>
<b>WDOG</b> . . . . .	<b>14</b>
<b>CLOCK</b> . . . . .	<b>14</b>
<b>Middleware Change Log</b>	<b>16</b>
<b>DMA_MANAGER</b> . . . . .	<b>16</b>
<b>FatFs for MCUXpresso SDK</b> . . . . .	<b>16</b>
<b>SDMMC</b> . . . . .	<b>16</b>
<b>SDIO</b> . . . . .	<b>19</b>
<b>SDSPI</b> . . . . .	<b>20</b>
<b>RTOS Change Log</b>	<b>21</b>
<b>FreeRTOS for MCUXpresso SDK.</b> . . . . .	<b>21</b>

# 1 Driver Change Log

## ADC16

The current ADC16 driver version is 2.0.2.

- 2.0.2
  - Used conversion control feature macro instead of that in IO map.
- 2.0.1
  - Bug fix:
    - \* Fixed MISRA-2012 rules.
      - Rule 16.4, 10.1, 13.2, 14.4, 17.7.
- 2.0.0
  - Initial version

## CMP

The current CMP driver version is 2.0.1.

- 2.0.1
  - Bug Fix:
    - \* Fix MISRA-2012 rules.
      - Rule 14.4, rule 10.3, rule 10.1, rule 10.4, rule 17.7.
- 2.0.0
  - Initial version.

## CRC

The current CRC driver version is 2.0.1.

- 2.0.1
  - Bug fix:
    - \* DATA and DATALL macro definition moved from header file to source file.
- 2.0.0
  - Initial version.

## DAC

The current DAC driver version is 2.0.1.

- 2.0.1
  - Bug fix:
    - \* Moved the default DAC\_Enable(..., true) from DAC\_Init() to the application code so users

can enable the DAC's output.

## 2.0.0

- Initial version.

## DMAMUX

The current DMAMUX driver version is 2.0.3.

- 2.0.3
  - Fixed the issue for MISRA-2012 check.
    - \* Fixed rule 10.4, rule 10.3.
- 2.0.2
  - New feature:
    - \* Added an always-on enable feature to a DMA channel for ULP1 DMAMUX support.
- 2.0.1
  - Bug fix:
    - \* Fixed build warning while setting the DMA request source in DMAMUX\_SetSource-Change issue by changing the type of the parameter source from uint8\_t to uint32\_t.
- 2.0.0
  - Initial version.

## DSPI

The current dspi driver version is 2.2.1.

- 2.2.1
  - Bug Fix:
    - \* Fix the bug for double excution of transfer complete callback in master interrupt transfer mode. In the interrupt routine, the DSPI interrupt may meet the situation of the interrupt pending by itself while receiveing the last frame, adding check the transfer state to excute the callback fuction.
    - \* Fix the wrong logic in DSPI\_SetFifoEnable().
  - MISRA C-2012 issue fixed.
    - \* Fixed rule contain: rule-12.1, rule-17.7, rule-16.4, rule-14.4, rule-10.4, rule-10.8, rule-10.3, rule-10.1, rule-10.6, rule-13.5, rule-11.3, rule-13.2, rule-8.3, rule-8.5.
- 2.2.0
  - New features:
    - \* Added gasket feature for SPI EDMA driver, which reduces one channel used in the EDMA master transfer. With this feature support, only two channels are needed. For example, if the gasket feature is supported, we could use the DSPI\_MasterTransferCreateHandleEDMA function like below: DSPI\_MasterTransferCreateHandleEDMA(EXAMPLE\_DSPI\_MASTER\_BASEADDR, &g\_dspi\_edma\_m\_handle, DSPI\_MasterUserCallback, &userData, &dspiEdmaMasterRxRegToRxDataHandle, NULL, &dspi-



- EdmaMasterIntermediaryToTxRegHandle);
  - \* Added dummy data setup API to allow users to configure the dummy data to be transferred.
  - \* Added new APIs for half-duplex transfer function. Users can send and receive data by one API in the polling/interrupt/EDMA way, and users can choose to either transmit first or receive first. Additionally, the PCS pin can be configured as assert status in transmission (between transmit and receive) by setting the isPcsAssertInTransfer to true.
- 2.1.4
  - Bug fix:
    - \* DSPI EDMA driver: The DSPI instance that has separated so the DMA request source can now transfer up to 32767 Bytes data in one DSPI\_MasterTransferEDMA() transfer.
- 2.1.3
  - Bug fix:
    - \* DSPI EDMA driver can no longer support the case that the transfer data size is odd, but the bitsPerFrame is greater than 8.
  - Optimization:
    - \* Added #ifndef/#endif to allow users to change the default TX value at compile time.
- 2.1.2
  - Bug fix:
    - \* DSPI\_MasterTransferBlocking function would hang in some corner cases (for example, some cases with bitsPerFrame is 4,6 and kDSPI\_MasterPcsContinuous transfer mode).
- 2.1.1
  - Bug fix:
    - \* Set the EOQ (End Of Queue) bit to TRUE for the last transfer in transactional APIs.
- 2.1.0
  - New features:
    - \* Added Transfer prefix in transactional APIs.

## EDMA

The current eDMA driver version is 2.1.8.

- 2.1.8
  - Bug fix:
    - \* Fixed wrong channel preemption base address used in EDMA\_SetChannelPreemption-Config api that will cause channel preemption register cannot configure correctly.
- 2.1.7
  - Bug fix:
    - \* Fixed wrong transfer size setting
      - Add 8 bytes transfer configuration and feature for RT series
      - Add feature to support 16 bytes transfer for Kinetis
    - \* Fixed the issue that EDMA\_HandleIRQ will go to incorrect branch When TCD is not used and callback function is not registered.
- 2.1.6

- Bug fix:
  - \* Fixed KW3X MISRA Issue.
    - Rule 14.4, 10.8, 10.4, 10.7, 10.1, 10.3, 13.5, 13.2.
- Improvements:
  - \* Clear IRQ handler that not available for specific platform with macro FSL\_FEATURE\_EDMA\_MODULE\_CHANNEL\_IRQ\_ENTRY\_SHARED\_OFFSET.
- 2.1.5
  - Improvements:
    - \* Improve EDMA IRQ handler to support half interrupt feature.
- 2.1.4
  - Bug fix:
    - \* Clear enabled request, status during EDMA\_Init for the case that EDMA is halted before reinitialization.
- 2.1.3
  - Bug fix:
    - \* Add clear DONE bit in IRQ handler to avoid overwrite TCD issue.
    - \* Optimize above solution for the case that transfer request occurs in callback.
- 2.1.2
  - Improvements:
    - \* Added interface to get next TCD address.
    - \* Added interface to get the unused TCD number.
- 2.1.1
  - Improvements:
    - \* Added documentation for eDMA data flow when scatter/gather is implemented for the EDMA\_HandleIRQ API.
    - \* Updated and corrected some related comments in the EDMA\_HandleIRQ API and edma\_handle\_t struct.
- 2.1.0
  - Improvements:
    - \* Changed the EDMA\_GetRemainingBytes API into EDMA\_GetRemainingMajorLoopCount due to eDMA IP limitation (see API comments/note for further details).
- 2.0.5
  - Improvements:
    - \* Added pubweak DriverIRQHandler for K32H844P (16 channels shared).
- 2.0.4
  - Improvements:
    - \* Added support for SoCs with multiple eDMA instances.
    - \* Added pubweak DriverIRQHandler for KL28T DMA1 and MCIMX7U5\_M4.
- 2.0.3
  - Bug fix:
    - \* Fixed the incorrect pubweak IRQHandler name issue, which causes re-definition build errors when client sets his/her own IRQHandler, by changing the 32-channel IRQHandler name to DriverIRQHandler.
- 2.0.2
  - Bug fix:

- \* Fixed incorrect minorLoopBytes type definition in \_edma\_transfer\_config struct, and defined minorLoopBytes as uint32\_t instead of uint16\_t.
- 2.0.1
  - Bug fix:
    - \* Fixed the eDMA callback issue (which did not check valid status) in EDMA\_HandleIRQ API.
- 2.0.0
  - Initial version.

## **EWM**

The current EWM driver version is 2.0.1.

- 2.0.1
  - Fixed EWM\_Deinit hard fault issue.
- 2.0.0
  - Initial version.

## **FLASH**

The current FLASH driver version is 3.0.0.

- 3.0.0
  - Improvements:
    - \* Reorganized FTFx flash driver source file.
    - \* Extracted flash cache driver from FTFx driver.
    - \* Extracted FLEXNVM flash driver from FTFx driver.
- 2.3.1
  - Bug fix:
    - \* Unified flash IFR design from K3.
    - \* New encoding rule for K3 flash size.
- 2.3.0
  - New features:
    - \* Added support for device with LP flash (K3S/G).
    - \* Added flash prefetch speculation APIs.
  - Improvements:
    - \* Refined flash\_cache\_clear function.
    - \* Reorganized the member of flash\_config\_t structure.
- 2.2.0
  - New features:
    - \* Supported FTFL device in FLASH\_Swap API.
    - \* Supported various PFLASH start addresses.
    - \* Added support for KV58 in cache clear function.
    - \* Added support for device with secondary flash (KW40).

- Bug fix:
  - \* Compiled execute-in-ram functions as PIC binary code for driver use.
  - \* Added missed FLEXRAM properties.
  - \* Fixed unaligned variable issue for execute-in-ram function code array.
- 2.1.0
  - Improvements:
    - \* Updated coding style to align with KSDK 2.0.
    - \* Different alignment size support for PFLASH and FLEXNVM.
    - \* Improved the implementation of execute-in-ram functions.
- 2.0.0
  - Initial version.

## **FLEXCAN**

The current FLEXCAN driver version is 2.4.0.

- 2.4.0
  - MISRA C-2012 issue check.
    - \* Fixed rule contain: rule-12.1, rule-17.7, rule-16.4, rule-11.9, rule-8.4, rule-14.4, rule-10.8, rule-10.4, rule-10.3, rule-10.7, rule-10.1, rule-11.6, rule-13.5, rule-11.3, rule-8.3, rule-12.2. rule-16.1.
  - Improvements:
    - \* fix issue for [FlexCAN] RemoteRequest UT Case run fail
    - \* Implementation all TX and RX transferring Timestamp used in FlexCAN demos
    - \* fix issue for UT Test Fail for CANFD payload size changed from 64BperMB to 8PerMB
    - \* Implementation for Update released CAN-FD capable products to same driver support, improve baud rate API
  - Bug fixes:
    - \* CANFD transfer data fail when use bus baudrate 30Khz
    - \* fix issue ERR009595 not follow the ERRATA document.
    - \* fix code error for ERR006032 work around solution
    - \* fix Coverity issue BAD\_SHIFT in FLEXCAN
    - \* fix Repo build warning issue for variable no initial.
- 2.3.2
  - Improvements:
    - \* Implementation for ERR005959.
    - \* Implementation for ERR005829.
    - \* Implementation for ERR006032.
- 2.3.1
  - Bug fixes:
    - \* Adding correct handle when kStatus\_FLEXCAN\_TxSwitchToRx comming.
- 2.3.0
  - Improvements:
    - \* Added self-wakeup support from STOP mode in the interrupt handling.

- 2.2.3
  - Bug fix:
    - \* Fixed CANFD data phase's bit rate not set as expected.
- 2.2.2
  - Improvements:
    - \* Added a time stamp feature and enabled it in the interrupt\_transfer example.
- 2.2.1
  - Improvements:
    - \* Separated CANFD initialization API.
    - \* In the interrupt handling, fixed the issue that the user cannot use the normal CAN API when FD is present.
- 2.2.0
  - Improvements:
    - \* Added FSL\_FEATURE\_FLEXCAN\_HAS\_SUPPORT\_ENGINE\_CLK\_SEL\_REMOVE feature to support SoCs without CAN Engine Clock selection in FlexCAN module.
    - \* Added FlexCAN Serial Clock Operation to support i.MX SoCs.
- 2.1.0
  - Bug fixes:
    - \* Fixed incorrect function name spelling of FLEXCAN\_XXX()
    - \* Moved Freeze Enable/Disable setting from FLEXCAN\_Enter/ExitFreezeMode() to FLEXCAN\_Init();
    - \* Fixed incorrect helper macro values.
  - Other changes:
    - \* Hid FLEXCAN\_Reset() from user.
    - \* Used NDEBUG macro to wrap FLEXCAN\_IsMbOccupied() function instead of DEBUG macro.
- 2.0.0
  - Initial version.

## FTM

The current FTM driver version is 2.1.1.

- 2.1.1 <<<<<< Updated upstream

### - Fix Coverity interger handing issue that the right operand of a left bit shift statement

- Fixed coverity integer handing issue where the right operand of a left bit shift statement

Stashed changes

should not be a negative value. This appears in FTM\_SetReloadPoints().

2.1.0

- New feature:
  - Add a new API FTM\_SetupPwmMode() to allow the user to set the channel match value in units of timer ticks. New configure structure called ftm\_chnl\_pwm\_config\_param\_t was added to configure the channel's PWM parameters. This API is similar with FTM\_SetupPwm() API, but the new API will not set the timer period(MOD value), it will be useful for users to set the PWM parameters without changing the timer period.
- Bug fixes:
  - Add feature macro to enable/disable the external trigger source configuration.

#### 2.0.4

- Features:
  - Added to enable DMA transfer with new API:
    - \* FTM\_EnableDmaTransfer()

#### 2.0.3

- Bug fixes:
  - Updated the FTM driver to enable fault input after configuring polarity.

#### 2.0.2

- Features:
  - Added support to Quad Decoder feature with new APIs:
    - \* FTM\_GetQuadDecoderFlags()
    - \* FTM\_SetQuadDecoderModuloValue()
    - \* FTM\_GetQuadDecoderCounterValue()
    - \* FTM\_ClearQuadDecoderCounterValue()

#### 2.0.1

- Bug fixes:
  - Updated the FTM driver to fix write to ELSA and ELSB bits.
  - FTM combine mode: set the COMBINE bit before writing to CnV register.

#### 2.0.0

- Initial version.

## GPIO

The current driver version is 2.3.2.

- 2.3.2
  - Fix the issue for MISRA-2012 check.
    - \* Fixed rule 3.1, 10.1, 8.6, 10.6, 10.3.
- 2.3.1:
  - Remove deprecated APIs.
- 2.3.0:
  - New feature:

- \* Update the driver code to adapt the case of interrupt configurations in GPIO module. New APIs were added to configure the GPIO interrupt settings if the module has this feature on it.
- 2.2.1:
  - API interface changes:
    - \* Refined naming of API while keep all original APIs by marking them as deprecated. Original API will be removed in next release. The main change is update API with prefix of `_PinXXX()` and `_PortXXX`.
- 2.1.1:
  - API interface changes:
    - \* Added API for the check attribute bytes.
- 2.1.0:
  - API interface changes:
    - \* Added "pins" or "pin" to some APIs' names.
    - \* Renamed "`_PinConfigure`" to "`GPIO_PinInit`".

## I2C

The current I2C driver version is 2.0.7.

- 2.0.7
  - Fix the issue for MISRA-2012 check.
    - \* Fixed rule 11.9 ,15.7 ,14.4 ,10.4 ,10.8 ,10.3, 10.1, 10.6, 13.5, 11.3, 13.2, 17.7, 5.7, 8.3, 8.5, 11.1, 16.1.
  - Improvements:
    - \* Added `I2C_MASTER_FACK_CONTROL` macro to enable FACK control for master transfer receive flow when IP support double buffer, then master could hold the SCL by manually set TX AK/NAK during data transfer.
  - Fix coverity issue of unchecked return value in `I2C_RTOS_Transfer`.
  - Bug fix:
    - \* Fix variable redefine issue by moving `i2cBases` from `fsl_i2c.h` to `fsl_i2c.c`.
- 2.0.6
  - Bug fix:
    - \* Fixed the issue that I2C Master transfer APIs(blocking/non-blocking) does not support the situation that master transfer with subaddress and transfer data size zero, which means no data follows by the subaddress.
- 2.0.5
  - Improvements:
    - \* Added `I2C_WATI_TIMEOUT` macro to allow the user to specify the timeout times for waiting flags in functional API and blocking transfer API.
- 2.0.4
  - Bug fixes:
    - \* Added proper handle for transfer config flag `kI2C_TransferNoStartFlag` to support transmit with `kI2C_TransferNoStartFlag` flag. Only supports write only or write+read

with no start flag, does not support read only with no start flag.

- 2.0.3
  - Bug fixes:
    - \* Removed enableHighDrive member in the master/slave configuration structure because the operation to HDRS bit is useless, user needs to use DSE bit in port register to configure the high drive capability.
    - \* Added reset registers operation in I2C\_MasterInit and I2C\_SlaveInit APIs. Fixed issue where I2C could not switch between master and slave mode.
    - \* Improved slave IRQ handler to handle the corner case that stop flag and address match flag come synchronously.
- 2.0.2
  - Bug fixes:
    - \* Fixed issue in master receive and slave transmit mode with no stop flag. The master could not succeed to start next transfer because the master could not send out re-start signal.
    - \* Fixed data transfer out of order issue due to memory barrier
    - \* Added hold time configuration for slave. By leaving the SCL divider and MULT reset values when configure to slave mode, the setup and hold time of the slave is then reduced outside of spec for lower baudrates. This can cause intermittent arbitration loss on the master side.
  - New features:
    - \* Added address nak event for master.
    - \* Added general call event for slave.
- 2.0.1
  - New features:
    - \* Added double buffer enable configuration for Socs which have the DFEN bit in S2 register.
    - \* Added flexible transmit/receive buffer size support in I2C\_SlaveHandleIRQ.
    - \* Added start flag clear, address match, and release bus operation in I2C\_SlaveWrite/-ReadBlocking API.
  - Bug fix:
    - \* Changed the kI2C\_SlaveRepeatedStartEvent to kI2C\_SlaveStartEvent.

## LLWU

The current LLWU driver version is 2.0.2.

- 2.0.2
  - Optimization:
    - \* Corrected driver function LLWU\_SetResetPinMode parameter name.
  - Bug fix:
    - \* Fixed MISRA-2012 rules.
      - Rule 14.4, 10.8, 10.4, 10.3.
- 2.0.1



- Miscellaneous changes:
    - \* Updates for KL8x.
- 2.0.0
  - Initial version.

## **LPTMR**

The current LPTMR driver version is 2.0.2.

- 2.0.2
  - Bug fix:
    - \* Fixed MISRA-2012 issues.
      - Rule 10.1.
- 2.0.1
  - Driver update:
    - \* Updated the LPTMR driver to support 32-bit CNR and CMR registers in some devices.
- 2.0.0
  - Initial version.

## **MMDVSQ**

The current MMDVSQ driver version is 2.0.2.

- 2.0.2
  - Bug fix:
    - \* Fixed MMDVSQ\_GetExecutionStatus function get execution status wrong.
- 2.0.1
  - Other changes:
    - \* Changed name of MMDVSQ\_GetDivideRemainder and MMDVSQ\_GetDivide-Quotient functions.
- 2.0.0
  - Initial version.

## **PDB**

The current PDB driver version is 2.0.2.

- 2.0.2
  - Improvement:
    - \* Used macros in feature file instead of that in IO map.
- 2.0.1
  - Changed PDB register base array to const.
- 2.0.0
  - Initial version.

## **PMC**

The current PMC driver version is 2.0.1.

- 2.0.1
  - Fixed MISRA issue.
    - \* Rule 10.8, rule 10.3.
- 2.0.0
  - Initial version.

## **PORT**

The current PORT driver version is 2.1.0.

- 2.1.0
  - New feature:
    - \* Updated the driver code to adapt the case of the interrupt configurations in GPIO module. Will move the pin configuration APIs to GPIO module.
- 2.0.2
  - Miscellaneous changes:
    - \* Added feature guard macros in the driver.
- 2.0.1
  - Miscellaneous changes:
    - \* Added "const" in function parameter.
    - \* Updated some enumeration variables' names.

## **RCM**

The current RCM driver version is 2.0.2.

- 2.0.2
  - Fixed MISRA issue.
    - \* Rule 10.8, rule 10.1, rule 13.2, rule 3.1.
- 2.0.1
  - [KPSDK-10249] Fixed kRCM\_SourceSw bit shift issue.
- 2.0.0
  - Initial version.

## **SIM**

The current SIM driver version is 2.1.0.

- 2.1.0
  - Added new APIs of SIM\_GetRfAddr() and SIM\_EnableSystickClock().
- 2.0.0

- Initial version.

## SMC

The current SMC driver version is 2.0.5.

- 2.0.5
  - Fixed issue for MISRA-2012 check.
    - \* Fixed rule 15.7, rule 14.4, rule 10.3, rule 10.1, rule 10.4.
- 2.0.4
  - When entering stop modes, use RAM function for the flash synchronize issue. Application should make sure that, the RW data of fsl\_smc.c is located in memory region which is not powered off in stop modes.
- 2.0.3
  - Added APIs SMC\_PreEnterStopModes, SMC\_PreEnterWaitModes, SMC\_PostExitWaitModes, and SMC\_PostExitStopModes.
- 2.0.2
  - Bug fix:
    - \* Added DSB before WFI, add ISB after WFI.
  - Miscellaneous changes:
    - \* Updated SMC\_SetPowerModeVlwp implementation.
- 2.0.1
  - Miscellaneous changes:
    - \* Updated for KL8x.
- 2.0.0
  - Initial version.

## UART

The current UART driver version is 2.1.6.

- 2.1.6
  - Fixed repeated reading status register issue while dealing the IRQ routine.
- 2.1.5
  - Added hardware flow control function support.
  - Added idle line detected feature in UART\_TransferNonBlocking function. If an idle line is detected, a callback is triggered with status kStatus\_UART\_IdleLineDetected returned. This feature may be useful when the number of received bytes is less than the expected receive data size. Before triggering the callback, data in the FIFO is read out (if it has FIFO), and all interrupts are not disabled except if the receive data size reaches 0.
  - Enabled the RX FIFO watermark function. With the idle line detected feature enabled, you can set the watermark value to whatever you want (should not be bigger than the RX FIFO size). Data is then received and a callback is triggered when data receive ends.
- 2.1.4

- Changed parameter type in UART\_RTOS\_Init() struct rtos\_uart\_config -> uart\_rtos\_config\_t.
- Bug fixed:
  - \* Disabled UART receive interrupt instead of disable all NVIC when read data from ring buffer. Because with ring buffer is used, receive nonblocking disables all NVIC interrupts to protect the ring buffer. This has a negative effect to other IPS which are using interrupt.
- 2.1.3
  - Added RX framing error and parity error status check when use interrupt transfer.
- 2.1.2
  - Fixed baud rate fine adjust bug to make the computed baud rate more accurately.
- 2.1.1
  - Removed needless check of event flags and assert in UART\_RTOS\_Receive.
  - Waited always for RX event flag in UART\_RTOS\_Receive.
- 2.1.0
  - Added transactional API.
- 2.0.0
  - Initial version.

## WDOG

The current WDOG driver version is 2.0.0.

- 2.0.0
  - Initial version.

## CLOCK

Current CLOCK driver version is 2.2.2

- 2.2.2
  - Fix the issue for MISRA-2012 check.
    - \* Fixed rule 10.4, rule 10.1, rule 10.6, rule 13.5, rule 10.8.
  - Bug Fix:
    - \* Fix incorrect External Oscillator Configuration sequence and ensure oscillator configuration be executed before it be enabled.
- 2.2.1
  - Bug Fix:
    - \* Fix the issue that MCG could not switch to FEE/FBE/PBE modes when OSCERCLK clock not enabled.
- 2.2.0
  - New Features:
    - \* [KPSDK-9157] Update CLOCK\_SetFeiMode/CLOCK\_SetFbiMode/CLOCK\_BootToFeiMode() to support set MCG\_C4[DMX32]=1 in FEI/FBI modes.

- Bug Fix:
    - \* Update IP\_CLOCKS array, remove unused gates and add missing gates.
- 2.1.0
  - Other Changes:
    - \* Merge fsl\_mcg and fsl\_osc into fsl\_clock.
- 2.0.0
  - Initial version.

## 2 Middleware Change Log

### DMA\_MANAGER

The current DMA\_MANAGER driver version is 2.1.0.

- 2.1.0
  - Updated DMA manager interface to support dynamic configuration of the managed area. This is used for a platform with multiple cores.
- 2.0.0
  - Initial version.

### FatFs for MCUXpresso SDK

The current version is FatFs R0.13b\_rev0.

- R0.13b\_rev0
  - Upgraded to version 0.13b
- R0.13a\_rev0
  - Upgraded to version 0.13a. Added patch ff\_13a\_p1.diff.
- R0.12c\_rev1
  - Added NAND disk support.
- R0.12c\_rev0
  - Upgraded to version 0.12c and applied patches ff\_12c\_p1.diff and ff\_12c\_p2.diff.
- R0.12b\_rev0
  - Upgraded to version 0.12b.
- R0.11a
  - Added glue functions for low-level drivers (SDHC, SDSPI, RAM, MMC). Modified diskio.c.
  - Added RTOS wrappers to make FatFs thread safe. Modified syscall.c.
  - Renamed ffconf.h to ffconf\_template.h. Each application should contain its own ffconf.h.
  - Included ffconf.h into diskio.c to enable the selection of physical disk from ffconf.h by macro definition.
  - Conditional compilation of physical disk interfaces in diskio.c.

### SDMMC

The current driver version is 2.2.11.

- 2.2.11
  - Bug fixes:
    - \* Fixed NULL pointer dereference issue when calling function SDMMCHOST\_Card-DetectInit in host adaptor layer.
    - \* Fixed logical dead code issue in SDMMC\_SwitchToVoltage function.

- 2.2.10
  - Bug fixes:
    - \* Added NULL pointer check for USDHC FreeRTOS adaptor transfer complete. callback.
    - \* Added event value check for all the FreeRTOS event to fix program hang when a card event occurs before created.
- 2.2.9
  - Improvements:
    - \* Added NULL pointer check for sdmmchostcard\_usr\_param\_t member CD in card detect callback to avoid memory corruption.
    - \* Added card voltage switch function in sdmmhostcard\_usr\_param\_t to allow application register card signal line voltage switch function.
  - Bug fixes:
    - \* Fixed host FreeRTOS adaptor and polling adaptor, where they cannot detect card insert bug for USDHC.
    - \* Fixed SDHC host layer build issue and typo issue.
- 2.2.8
  - Improvement:
    - \* Updated SDMMC to support SDIO interrupt.
- 2.2.7
  - Bug fixes:
    - \* Fixed MDK 66-D warning.
- 2.2.6
  - Improvements:
    - \* Removed some SoC-specific header files from porting layer.
    - \* Saved MMC OCR registers while sending CMD1 with argument 0.
  - Bug fixes:
    - \* Added MMC\_PowerOn function in which there is delay function after powerup SD Card. Otherwise, the card may init fail.
- 2.2.5
  - New features:
    - \* Added SD\_ReadStatus API to get 512-bit SD status.
    - \* Added error log support in SD Card functions.
    - \* Added SDMMC\_ENABLE\_SOFTWARE\_TUNING to enable/disable software tuning. It is disabled by default.
    - \* Added error procedure in the transfer function to improve stability.
    - \* Removed deprecated GPIO API in host layer.
- 2.2.4
  - Bug fix:
    - \* Fixed DDR mode data sequence miss issue, which is caused by NIBBLE\_POS.
  - New features:
    - \* Increased g\_sdmmc 512 Bytes to improve performance when application uses a non-word align data buffer address.
    - \* Used OCR access mode bits to determine the MMC Card high capacity flag.
    - \* Enabled auto CMD12 for SD read/write.
    - \* Disabled DDR mode frequency multiply by 2.

- 2.2.3
  - Bug fix:
    - \* Added response check for send operation condition command. If not checked, the card may occasionally init fail.
- 2.2.2
  - Moved set card detect priority operation before enable IRQ.
- 2.2.1
  - New features:
    - \* Improved MMC Boot feature.
    - \* Kept SD\_Init/SDIO\_Init function for forward compatibility.
- 2.2.0
  - New features:
    - \* Separated the SD/MMC/SDIO init API to xxx\_CardInit/xxx\_HostInit.
    - \* Allowed user register card detect callback, select card detect type, and determine the card detect timeout value.
    - \* Allowed user register the power on/off function, and determine the power on/off delay time.
    - \* SD\_Init/SDIO\_Init is deprecated in the next version.
    - \* Added write complete wait operation for MMC\_Write to fix command timeout issue.
- 2.1.6
  - Enhanced SD IO default driver strength.
- 2.1.5
  - Fixed coverity issue.
  - Fixed SD v1.x card write fail issue. It was caused by the block length set error.
- 2.1.4
  - Miscellaneous:
    - \* Added Host reset function for card re-initialization.
    - \* Added Host\_ErrorRecovery function for host error recovery procedure.
    - \* Added cache maintain operation
    - \* Added HOST\_CARD\_INSERT\_CD\_LEVEL to improve compatibility.
  - Bug fix:
    - \* Fixed card cannot detect dynamically.
- 2.1.3
  - Bug fix:
    - \* Non high-speed sdcard init fail at switch to high speed.
  - Miscellaneous:
    - \* Optimized tuning/mmc switch voltage/mmc select power class/mmc select timing function.
    - \* Added strobe dll for mmc HS400 mode.
    - \* Added Delay for SDCard power up.
- 2.1.2
  - New features:
    - \* Added fsl\_host.h to provide prototype to adapt different controller IPs(SDHC/SDIF).
    - \* Added adaptor code in SDMMC/Port folder to adapt different host controller IPs with different. transfer modes(interrupt/polling/freertos). Application includes a different



- adaptor code to make application more simple.
- \* Adaptor code provides HOST\_Init/HOST\_Deinit/CardInsertDetect. APIs to do host controller initialize and transfer function configuration. SDMMC card stack uses adaptor code inside stack to wait card insert and configure host when calling card init APIs (SD\_Init/MMC\_Init/SDIO\_Init).
- \* This change requires the user to include host adaptor code into the application. If not changed, link errors saying it cannot find the definition of HOST\_Init/HOST\_Deinit/CardInsertDetect appear.
- New features: Improved SDMMC to support SD v3.0 and eMMC v5.0.
- Bug fix:
  - \* Fixed incorrect comparison between count and length in MMC\_ReadBlocks/MMC\_WriteBlocks.
- 2.1.1
  - Bug fix:
    - \* Fixed the block range boundary error when transferring data to MMC card.
    - \* Fixed the bit mask error in the SD card switch to high speed function.
  - Other changes:
    - \* Added error code to indicate that SDHC ADMA1 transfer type is not supported yet.
    - \* Optimized the SD card initialization function.
- 2.1.0
  - Bug fix:
    - \* Changed callback mechanism when sending a command.
    - \* Fixed low performance issue when transferring data.
  - Other changes:
    - \* Changed the name of some error codes returned by internal function.
    - \* Merged all host related attributes to one structure.
    - \* Optimize the function of setting maximum data bus width for MMC card.

## SDIO

The current driver version is 2.2.11.

- 2.2.11
  - Bug fix:
    - \* Added check card async interrupt capability in function SDIO\_GetCardCapability.
    - \* Fixed OUT OF BOUNDS access in function SDIO\_IO\_Transfer.
- 2.2.10
  - Bug fix:
    - \* Fixed SDIO card driver get wrong IO number when the card IO number is bigger than 2.
  - New feature:
    - \* Added SDIO 3.0 support.
    - \* Added API SDIO\_IO\_RW\_Direct for direct read/write card register access.
- 2.2.9

- Improvement:
  - \* Added API SDIO\_SetIOIRQHandler/SDIO\_HandlePendingIOInterrupt to handle multi IO pending IRQ.
- 2.2.8
  - Improvement:
    - \* Updates SDMMC to support SDIO interrupt.
    - \* Added API SDIO\_GetPendingInterrupt to get the pending IO interrupt.
- 2.2.7
  - Bug fix:
    - \* Fixed MDK 66-D warning.
- 2.2.6
  - New features:
    - \* Added a unified transfer interface for SDIO.
  - Bug fix:
    - \* Wrong pointer address used by SDMMC\_HOST\_Init.
- 2.1.5
  - Bug fix:
    - \* Improved SDIO card init sequence and added retry option for SDIO\_SwitchToHigh-Speed function.
- 2.1.4
  - Miscellaneous:
    - \* Added Go\_Idle function for SDIO card.
- 2.0.0
  - Initial version.

## **SDSPI**

The current SDSPI driver version is 2.1.4.

- 2.1.4
  - Bug fix:
    - \* Fixed MDK 66-D warning.
- 2.1.3
  - Improved SDSPI code size and performance.
- 2.0.0
  - Initial version.

### 3 RTOS Change Log

#### FreeRTOS for MCUXpresso SDK.

The current version is Amazon-FreeRTOS 1.4.0 Original package is available at [github.-com/aws/amazon-freertos](https://github.com/aws/amazon-freertos).

- 1.4.7\_rev0
  - New features:
    - \* Add optional allocation scheme heap\_useNewlib.c by D. Nadler.
    - \* Enable task aware debugging for cm33 platforms
    - \* Move tickless implementation to application layer
  - Other changes:
    - \* Fix other build warnings, errors
- 1.4.6\_rev0
  - New features:
    - \* Update support of CM33 port with Trustzone, MPU, FPU support
    - \* Add support for AWS test for Cypress WiFi
    - \* Use lwip netif api to avoid lwIP raw API calls outside of tcpip thread in aws\_wifi.c
  - Other changes:
    - \* Fix issues with mflash driver
    - \* Fix other build warnings, errors
- 1.4.0\_rev1
  - New features:
    - \* Add implementation of vTaskEndScheduler for CM0 GCC port.
    - \* Support for CM33, CM33F architectures based on CM3, CM4F ports
- 1.4.0\_rev0
  - New features:
    - \* Support for pkcs11 for several platforms, secure element host library under pkcs11/portable/nxp folder
    - \* Lwip, wifi\_qca support for secure\_sockets in secure\_sockets/portable/nxp folder
    - \* Flash driver support for several platforms in third\_party/mcu\_vendor/nxp folder
    - \* Generic support for aws\_wifi under wifi/portable/nxp/common folder
  - Other changes:
    - \* Fix several build warnings, errors

Updates applied to FreeRTOS kernel up to version 10.0.0 (up to Amazon - FreeRTOS merge). New kernel related changes will be described in section above as part of AWS package.

- 9.0.0\_rev3
  - New features:
    - \* Tickless idle mode support for Cortex-A7. Add fsl\_tickless\_epit.c and fsl\_tickless\_generic.h in portable/IAR/ARM\_CA9 folder.
    - \* Enabled float context saving in IAR for Cortex-A7. Added configUSE\_TASK\_FPU\_SUPPORT macros. Modified port.c and portmacro.h in portable/IAR/ARM\_CA9 folder.

- Other changes:
  - \* Transformed ARM\_CM core specific tickless low power support into generic form under freertos/Source/portable/low\_power\_tickless/.
- 9.0.0\_rev2
  - New features:
    - \* Enabled MCUXpresso thread aware debugging. Add freertos\_tasks\_c\_additions.h and configINCLUDE\_FREERTOS\_TASK\_C\_ADDITIONS\_H and configFRTOS\_MEMORY\_SCHEME macros.
- 9.0.0\_rev1
  - New features:
    - \* Enabled -flt0 optimization in GCC by adding **attribute((used))** for vTaskSwitchContext.
    - \* Enabled KDS Task Aware Debugger. Apply FreeRTOS patch to enable configRECORD\_STACK\_HIGH\_ADDRESS macro. Modified files are task.c and FreeRTOS.h.
- 9.0.0\_rev0
  - New features:
    - \* Example freertos\_sem\_static.
    - \* Static allocation support RTOS driver wrappers.
  - Other changes:
    - \* Tickless idle rework. Support for different timers is in separated files (fsl\_tickless\_systick.c, fsl\_tickless\_lptmr.c).
    - \* Removed configuration option configSYSTICK\_USE\_LOW\_POWER\_TIMER. Low power timer is now selected by linking of appropriate file fsl\_tickless\_lptmr.c.
    - \* Removed configOVERRIDE\_DEFAULT\_TICK\_CONFIGURATION in RVDS port. Use of **attribute((weak))** is the preferred solution. Not same as \_weak!
- 8.2.3
  - New features:
    - \* Tickless idle mode support.
    - \* Added template application for Kinetis Expert (KEx) tool (template\_application).
  - Other changes:
    - \* Folder structure reduction. Keep only Kinetis related parts.

## How To Reach Us

### Home Page:

[nxp.com](http://nxp.com)

### Web Support:

[nxp.com/support](http://nxp.com/support)

Information in this document is provided solely to enable system and software implementers to use NXP products. There are no express or implied copyright licenses granted hereunder to design or fabricate any integrated circuits based on the information in this document. NXP reserves the right to make changes without further notice to any products herein.

NXP makes no warranty, representation, or guarantee regarding the suitability of its products for any particular purpose, nor does NXP assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation consequential or incidental damages. "Typical" parameters that may be provided in NXP data sheets and/or specifications can and do vary in different applications, and actual performance may vary over time. All operating parameters, including "typicals," must be validated for each customer application by customer's technical experts. NXP does not convey any license under its patent rights nor the rights of others. NXP sells products pursuant to standard terms and conditions of sale, which can be found at the following address: [nxp.com/SalesTermsandConditions](http://nxp.com/SalesTermsandConditions).

While NXP has implemented advanced security features, all products may be subject to unidentified vulnerabilities. Customers are responsible for the design and operation of their applications and products to reduce the effect of these vulnerabilities on customer's applications and products, and NXP accepts no liability for any vulnerability that is discovered. Customers should implement appropriate design and operating safeguards to minimize the risks associated with their applications and products.

NXP, the NXP logo, NXP SECURE CONNECTIONS FOR A SMARTER WORLD, COOLFLUX, EMBRACE, GREENCHIP, HITAG, I2C BUS, ICODE, JCOP, LIFE VIBES, MIFARE, MIFARE CLASSIC, MIFARE DESFire, MIFARE PLUS, MIFARE FLEX, MANTIS, MIFARE ULTRALIGHT, MIFARE4MOBILE, MIGLO, NTAG, ROADLINK, SMARTLX, SMARTMX, STARPLUG, TOPFET, TRENCHMOS, UCODE, Freescale, the Freescale logo, Altivec, C-5, CodeTEST, CodeWarrior, ColdFire, ColdFire+, C-Ware, the Energy Efficient Solutions logo, Kinetis, Layerscape, MagniV, mobileGT, PEG, PowerQUICC, Processor Expert, QorIQ, QorIQ Qonverge, Ready Play, SafeAssure, the SafeAssure logo, StarCore, Symphony, VortiQa, Vybrid, Airfast, BeeKit, BeeStack, CoreNet, Flexis, MXC, Platform in a Package, QUICC Engine, SMARTMOS, Tower, TurboLink, and UMEMS are trademarks of NXP B.V. All other product or service names are the property of their respective owners. AMBA, Arm, Arm7, Arm7TDMI, Arm9, Arm11, Artisan, big.LITTLE, Cordio, CoreLink, CoreSight, Cortex, DesignStart, DynamIQ, Jazelle, Keil, Mali, Mbed, Mbed Enabled, NEON, POP, RealView, SecurCore, Socrates, Thumb, TrustZone, ULINK, ULINK2, ULINK-ME, ULINK-PLUS, ULINKpro,  $\mu$ Vision, Versatile are trademarks or registered trademarks of Arm Limited (or its subsidiaries) in the US and/or elsewhere. The related technology may be protected by any or all of patents, copyrights, designs and trade secrets. All rights reserved. Oracle and Java are registered trademarks of Oracle and/or its affiliates. The Power Architecture and Power.org word marks and the Power and Power.org logos and related marks are trademarks and service marks licensed by Power.org.

© NXP B.V. 2019.

All rights reserved.

For more information, please visit: <http://www.nxp.com>

For sales office addresses, please send an email to: [salesaddresses@nxp.com](mailto:salesaddresses@nxp.com)

Date of release: 06/2019

Document identifier: MCUXSDKKV11RN

