

# MCUXpresso SDK Release Notes Supporting EVKB-IMXRT1050

## Contents

## 1 Overview

The MCUXpresso Software Development Kit (SDK) is a collection of software enablement for Microcontrollers that includes peripheral drivers, high-level stacks including USB and lwIP, integration with WolfSSL and mbed TLS cryptography libraries, other middleware packages, such as multicore support and FatFs, 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 the latest version of this and other MCUXpresso SDK documents, 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.

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## 2 MCUXpresso SDK



## Development tools

As part of the MCUXpresso software and tools, MCUXpressoSDK is the evolution of Kinetis SDK v2.3.0, 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, a new 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 FSL 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.

## 3 Development tools

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

- IAR Embedded Workbench for Arm version 8.22.2
- MDK-Arm Microcontroller Development Kit (Keil)<sup>®</sup> 5.24a
- Makefiles support with GCC revision 7-2017-q4-major from Arm Embedded
- MCUXpresso IDE v10.2.0

## 4 Supported development systems

This release supports boards and devices listed in this table.

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

Development boards	MCU devices
EVKB-IMXRT1050	MIMXRT1052DVL6B, MIMXRT1052CVL5B, MIMXRT1051DVL6B, MIMXRT1051CVL5B

## 5 Release contents

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

**Table 2. Release contents**

Deliverable	Location
Boards	<install_dir>/boards
Demo applications	<install_dir>/boards/<board_name>/demo_apps
CMSIS driver examples	<install_dir>/boards/<board_name>/cmsis_driver_examples
Driver examples	<install_dir>/boards/<board_name>/driver_examples
RTOS examples	<install_dir>/boards/<board_name>/rtos_examples

*Table continues on the next page...*

**Table 2. Release contents (continued)**

EMWIN examples	<install_dir>/boards/<board_name>/emwin_examples
USB demo applications	<install_dir>/boards/<board_name>/usb_examples
Documentation	<install_dir>/docs
Middleware	<install_dir>/middleware
USB Documentation	<install_dir>/docs/usb
lwIP Documentation	<install_dir>/docs/lwip
SDMMC card driver	<install_dir>/middleware/sdmmc
lwIP stack	<install_dir>/middleware/lwip
USB stack	<install_dir>/middleware/usb
Driver, SoC header files, extension header files and feature header files, utilities	<install_dir>/devices/<device_name>
Cortex Microcontroller Software Interface Standard (CMSIS) ARM Cortex®-M header files, DSP library source	<install_dir>/CMSIS
Peripheral Drivers	<install_dir>/devices/<device_name>/drivers
Utilities such as debug console	<install_dir>/devices/<device_name>/utilities
RTOS Kernel Code	<install_dir>/rtos
Tools	<install_dir>/tools

## 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 CMSIS-compliant 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.

The RTOS and middleware folders each contain examples demonstrating the use of the included source.

## 6.2 Middleware

### 6.2.1 USB stack

See the *MCUXpresso SDK USB Stack User's Guide* (document MCUXSDKUSBSUG) for more information.

#### 6.2.1.1 Peripheral devices tested with the USB Host stack

This table provides a list of USB devices tested with the USB Host stack.

**Table 3. Peripheral devices**

Device type	Device
USB HUB	BELKIN F5U233 BELKIN F5U304 BELKIN F5U307 BELKIN F4U040 UNITEK Y-2151 Z-TEK ZK032A HYUNDAI HY-HB608
USB flash drive	ADATA C008 32 GB ADATA S102 8 G ADATA S102 16 G Verbatim STORE N GO USB Device 8 G Kingston DataTraveler DT101 G2 SanDisk Cruzer Blade 8 GB Unisplendour 1 G Imation 2 GB V-mux 2 GB Sanmina-SCI 128 M

*Table continues on the next page...*

**Table 3. Peripheral devices (continued)**

	Corporate Express 1 G TOSHIBA THUHYBS-008G 8 G Transcend JF700 8 G Netac U903 16 G SSK SFD205 8 GB Rex 4 GB SAMSUNG USB3.0 16GB
USB card reader/adapter	SSK TF adapter Kawau Multi Card Reader Kawau TF adapter Kawau SDHC card
USB Mouse	DELL MS111-P DELL M066U0A DELL MUAVDEL8 TARGUS AMU76AP DELL MD56U0 DELL MS111-T RAPOO M110
USB Keyboard	DELL SK8135 DELL SK8115

## 6.2.2 TCP/IP stack

The lwIP TCP/IP stack is pre-integrated with MCUXpresso SDK and runs on top of the MCUXpresso SDK Ethernet driver with Ethernet-capable devices/boards. For details, see the *lwIP TCP/IP Stack and MCUXpresso SDK Integration User's Guide* (document MCUXSDKLWIPUG).

## 6.2.3 Security libraries

The MCUXpresso SDK is integrated with mbedTLS and wolfSSL libraries. The integration demonstrates hardware acceleration of various cryptography algorithms and random number generation. The packages are available through separate add-on packages at [mcuxpresso.nxp.com](http://mcuxpresso.nxp.com), Optional Middleware section.

## 6.2.4 RTOS

The MCUXpresso SDK is integrated with FreeRTOS OS.

## 6.2.5 CMSIS

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

## 7 MISRA compliance

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

**Table 4. MISRA exceptions**

Exception Rules	Description
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	Typedef that indicate size and signedness should be used in place of the basic numerical type.
Directive 4.8	If a pointer to a structure or union is never dereferenced within a transaction unit then the implementation of the object should hidden.
Directive 4.9	A function should be used in preference to a function like macro where they are interchangeable.
Directive 4.10	Precautions shall be taken in order to prevent the contents of a header file being included more than once.
Directive 4.11	The validity of values passed to library functions shall be checked.
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 2.7	There should be no unused parameters in functions.
Rule 3.1	The character sequences /* and // shall not be used within a comment.
Rule 5.1	External identifiers shall distinct.
Rule 5.3	A identifier declared in an inner scope shall not hide an identifier declared in an outer scope.
Rule 5.7	A tag name shall be a unique identifier.
Rule 5.9	Identifiers that define objects or functions with external linkage shall be unique.
Rule 8.13	A pointer should point to a const-qualified type whenever possible.
Rule 8.3	All declarations of an object or function shall use the same names and type qualifiers.
Rule 8.6	An identifier with external linage shall have exactly one external definition.
Rule 8.7	Octal constants shall not be used.
Rule 8.9	A object should be defined at block scope if its identified only appears in a single function.

*Table continues on the next page...*

**Table 4. MISRA exceptions (continued)**

Rule 10.1	Operands shall not be of an inappropriate essential type.
Rule 10.3	The value of an expression shall not be assigned to an object with a narrower essential type of a different essential type category.
Rule 10.4	Both operands of an operator in which the usual arithmetic conversions are performed shall have the same essential type category.
Rule 10.5	The value of an expression should not be cast to an inappropriate essential type.
Rule 10.6	The value of a composite expression shall not be assigned to an object with wider essential type.
Rule 10.7	If a composite expression is used as one operand of an operator in which the usual arithmetic conversions are performed then the other operand shall not have wider essential type.
Rule 10.8	The value of a composite expression shall not be cast to a different essential type category or a wider essential type.
Rule 11.1	Conversions shall not be performed between a pointer to a function and any other type.
Rule 11.3	A case shall not be performed between a pointer to object type and a pointer to a different object 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 11.6	A cast shall not be performed between pointer to void and an arithmetic type.
Rule 12.1	The precedence of operators within expressions should be made explicit.
Rule 12.2	The right hand operator of a shift operator shall lie in the range zero to one less than the width in bits of the essential type of the left hand operand.
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 13.5	The right hand operand of a logical && or    operator shall not contain persistent side effects.
Rule 14.2	A for loop shall be well formed.
Rule 14.4	The controlling expressions of an statement and the controlling expression of an iteration-statement shall have essentially Boolean type.
Rule 15.5	A function should have a single point of exit at the end.
Rule 16.1	All switch statements shall be well-formed.
Rule 17.7	The feature of <stdarg.h> shall not be used.
Rule 18.4	The +, -, += and -= operators should not be applied to an expression of pointer type.
Rule 19.2	The union keyword should not be used.

*Table continues on the next page...*

**Table 4. MISRA exceptions (continued)**

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 21.1	#define and #undef shall not be used on a reserved identifier or reserved macro name.

## 8 Known issues

### 8.1 Maximum file path length in Windows® 7 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 WDOG power down counter

The power down counter is not disabled in current SDK examples. This means it will cause a problem when GPIO\_B1\_13 is configured to WDOG\_B because it will shut down the power of DCDC\_3v3 on the EVK board. Therefore, if GPIO\_B1\_13 needs to be configured to WDOG\_B, the bit PDE in WMCR needs to be cleared in 16 s after reset. This issue will be fixed in the next SDK release.



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# **MCUXpresso SDK Release Notes Supporting EVKB-IMXRT1050**

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# **1 Driver Change Log**

## **ADC**

The current ADC driver version is 2.0.0.

- 2.0.0
  - Initial version.

## **ADC\_ETC**

The current ADC\_ETC driver version is 2.0.0.

- 2.0.0
  - Initial version.

## **AIPSTZ**

The current AIPSTZ driver version is 2.0.0.

- 2.0.0
  - Initial version.

## **AOI**

The current AOI driver version is 2.0.0.

- 2.0.0
  - Initial version.

## **BEE**

The current BEE driver version is 2.0.0.

- 2.0.0
  - Initial version.

## **CACHE**

The current CACHE driver version is 2.0.1.

- 2.0.1
  - Fixed cache size issue in L2CACHE\_GetDefaultConfig API.

- 2.0.0
  - Initial version.

## **CMP**

The current CMP driver version is 2.0.0.

- 2.0.0
  - Initial version.

## **CSI**

The current PXP driver version is 2.0.0.

- 2.0.0
  - Initial version.

## **DCDC**

The current DCDC driver version is 2.0.0.

- 2.0.0
  - Initial version.

## **DMAMUX**

The current DMAMUX driver version is 2.0.2.

- 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.

## **EDMA**

The current eDMA driver version is 2.1.2.

- 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 wrong 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.

## **ELCDIF**

The current ELCDIF driver version is 2.0.0.

- 2.0.0
  - Initial version.



## ENET

The current ENET driver version is 2.2.3.

- 2.2.3
  - Improved data buffer cache maintenance in the ENET driver.
- 2.2.2
  - Added the APIs for extended multi-ring support.
  - Added the AVB configure API for extended AVB feature support.
- 2.2.1
  - Changed the input data pointer attribute to const in ENET\_SendFrame().
- 2.1.1
  - Added the extended MDIO IEEE802.3 Clause 45 MDIO format SMI command APIs.
  - Added the extended interrupt coalescing feature.
  - Combined all storage operations in the ENET\_Init to ENET\_SetHandler API.
- 2.0.1
  - Bug fix:
    - \* Used direct transmit busy check when doing data transmit.
  - Miscellaneous changes:
    - \* Updated IRQ handler work flow.
    - \* Changed the TX/RX interrupt macro from kENET\_RxByteInterrupt to kENET\_RxBufferInterrupt, from kENET\_TxByteInterrupt to kENET\_TxBufferInterrupt.
    - \* Deleted unnecessary parameters in ENET handler.
- 2.0.0
  - Initial version.

## EWM

The current EWM driver version is 2.0.1.

- 2.0.1
  - Fixed EWM\_Deinit hardfault issue.
- 2.0.0
  - Initial version.

## FLEXCAN

The current FLEXCAN driver version is 2.2.0.

- 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 wrong function name spelling: FLEXCAN\_XXX() -> FLEXCAN\_XXX();
  - \* Moved Freeze Enable/Disable setting from FLEXCAN\_Enter/ExitFreezeMode() to FLEXCAN\_Init();
  - \* Fixed wrong helper macro values.
- Other changes:
  - \* Hid FLEXCAN\_Reset() to user.
  - \* Used NDEBUG macro to wrap FLEXCAN\_IsMbOccupied() function instead of DEBUG macro.
- 2.0.0
  - Initial version.

## **FLEXRAM**

The current FLEXRAM driver version is 2.0.2.

- 2.0.2
  - Updated driver due to Reference Manual update.
- 2.0.1
  - Fixed MISRA issue.
- 2.0.0
  - Initial version.

## **FLEXIO**

The current FLEXIO driver version is 2.0.2.

- 2.0.2:
  - Improvements:
    - \* Split FlexIO component which combines all flexio/flexio\_uart/flexio\_i2c/flexio\_i2s drivers into several components. FlexIO component, flexio\_uart component, flexio\_i2c\_master component, and flexio\_i2s component.
- 2.0.1
  - Bug fix:
    - \* Fix the Dozen mode configuration error in FLEXIO\_Init API. For enableInDoze = true, the configuration should be 0; for enableInDoze = false, the configuration should be 1.

## **FLEXIO\_UART**

The current FLEXIO\_UART driver version is 2.1.4.

- 2.1.4
  - Unify component full name to FLEXIO UART(DMA/EDMA) Driver
- 2.1.3

- Bug fixes: The following modifications support FlexIO using multiple instances.
  - \* Removed FLEXIO\_Reset API in module Init APIs.
  - \* Updated module Deinit APIs to reset the shifter/timer config instead of disable module and disable clock.
  - \* Updated module Enable APIs to only support enable operation.
- 2.1.2
  - Bug fixes:
    - \* Fixed the transfer count calculation issue in FLEXIO\_UART\_TransferGetReceiveCount, FLEXIO\_UART\_TransferGetSendCount, FLEXIO\_UART\_TransferGetReceiveCountDMA, FLEXIO\_UART\_TransferGetSendCountDMA, FLEXIO\_UART\_TransferGetReceiveCountEDMA and FLEXIO\_UART\_TransferGetSendCountEDMA
    - \* Fixed the Dozen mode configuration error in FLEXIO\_UART\_Init API. For enableInDoze = true, the configuration should be 0; for enableInDoze = false, the configuration should be 1.
    - \* Reported error when set baudrate too low and FLEXIO cannot reach that baudrate.
    - \* Disabled FLEXIO\_UART receive interrupt instead of disable all NVIC when read data from ring buffer. Because ring buffer is used, receive nonblocking disables all NVIC interrupts to protect the ring buffer. This has negative effects on other IPS which are using interrupt.
- 2.1.1
  - Bug fixes:
    - \* Changed the API name FLEXIO\_UART\_StopRingBuffer to FLEXIO\_UART\_TransferStopRingBuffer to align with the definition in C file.
- 2.1.0
  - New features:
    - \* Added Transfer prefix in transactional APIs.
    - \* Added txSize/rxSize in handle structure to record the transfer size.
  - Bug fixes:
    - \* Added error handle to handle the data count is zero or data buffer is NULL situation.

## FLEXIO\_I2C

The current FLEXIO\_I2C driver version is 2.1.5.

- 2.1.5
  - Unify component full name to FLEXIO I2C Driver
- 2.1.4
  - Bug fixes: The following modifications support FlexIO using multiple instances.
    - \* Removed FLEXIO\_Reset API in module Init APIs.
    - \* Updated module Deinit APIs to reset the shifter/timer config instead of disable module and disable clock.
    - \* Updated module Enable APIs to only support enable operation.
- 2.1.3
  - Changed the prototype of FLEXIO\_I2C\_MasterInit to return kStatus\_Success if initialization

successfully and return `kStatus_InvalidArgument` if " $(\text{srcClock\_Hz} / \text{masterConfig->baudRate\_Bps}) / 2 - 1$ " exceeds `0xFFU`.

- 2.1.2
  - Fixed the FLEXIO I2C issue where the master cannot receive data from I2C slave in high baudrate.
  - Fixed the FLEXIO I2C issue where the master cannot receive NAK when master sends non-existent addr.
  - Fixed the FLEXIO I2C issue where the master cannot get transfer count successfully.
  - Fixed the FLEXIO I2C issue where the master cannot receive data successfully when sending data first.
  - Fixed the Dozen mode configuration error in `FLEXIO_I2C_MasterInit` API. For `enableInDoze = true`, the configuration should be 0; for `enableInDoze = false`, the configuration should be 1.
  - Fixed the `FLEXIO_I2C_MasterTransferBlocking` API calls `FLEXIO_I2C_MasterTransferCreateHandle` issue. This leads the `s_flexioHandle/s_flexioIsr/s_flexioType` variable written. Then, if calling `FLEXIO_I2C_MasterTransferBlocking` API multiple times, the `s_flexioHandle/s_flexioIsr/s_flexioType` variable cannot be written anymore due to it being out of range. This leads to the following: NonBlocking transfer APIs cannot work due to register IRQ failed.
- 2.1.1
  - Bug fixes:
    - \* Implemented the `FLEXIO_I2C_MasterTransferBlocking` API which defined in header file but has no implementation in the C file.
- 2.1.0
  - New features:
    - \* Added Transfer prefix in transactional APIs.
    - \* Added `transferSize` in handle structure to record the transfer size.

## **FLEXIO\_SPI**

The current FLEXIO\_SPI driver version is 2.1.3.

- 2.1.3
  - Unify component full name to FLEXIO SPI(DMA/EDMA) Driver
- 2.1.2
  - Bug fixes: The following modification support FlexIO using multiple instances.
    - \* Removed `FLEXIO_Reset` API in module Init APIs.
    - \* Updated module Deinit APIs to reset the shifter/timer config instead of disable module and disable clock.
    - \* Updated module Enable APIs to only support enable operation.
- 2.1.1
  - Bug fixes:
    - \* Fixed bug where FLEXIO SPI transfer data is in 16 bit per frame mode with eDMA.
    - \* Fixed bug where FLEXIO SPI transfer data is in 16 bit per frame and direction is Lsbfirst mode with eDMA and interrupt.

- \* Fixed the Dozen mode configuration error in FLEXIO\_SPI\_MasterInit/FLEXIO\_SPI\_SlaveInit API. For enableInDoze = true, the configuration should be 0; for enableInDoze = false, the configuration should be 1.
- Optimization:
  - \* Added #ifndef/#endif to allow user to change the default tx value at compile time.
- 2.1.0
  - New features:
    - \* Added Transfer prefix in transactional APIs.
    - \* Added transferSize in handle structure to record the transfer size.
  - Bug fixes:
    - \* Fixed the error register address return for 16-bit data write in FLEXIO\_SPI\_GetTxData-RegisterAddress.
    - \* Provided independent IRQHandler/transfer APIs for Master and slave to fix the baudrate limit issue.

## **FLEXIO\_I2S**

The current FLEXIO\_I2S driver version is 2.1.4.

- 2.1.4
  - Unify component full name to FLEXIO I2S(DMA/EDMA) Driver
- 2.1.3
  - Bug fixes: The following modifications support FlexIO using multiple instances.
    - \* Removed FLEXIO\_Reset API in module Init APIs.
    - \* Updated module Deinit APIs to reset the shifter/timer config instead of disable module and disable clock.
    - \* Updated module Enable APIs to only support enable operation.
- 2.1.2
  - New features:
    - \* Added configure items for all pin polarity and data valid polarity.
    - \* Added default configure for pin polarity and data valid polarity.
- 2.1.1
  - Bug fixes:
    - \* Fixed FlexIO I2S RX data read error and eDMA address error.
    - \* Fix FlexIO I2S slave timer compare setting error.
- 2.1.0
  - New features:
    - \* Added Transfer prefix in transactional APIs.
    - \* Added transferSize in handle structure to record the transfer size.

## **FLEXIO\_MCU\_LCD**

The current FLEXIO\_MCU\_LCD driver version is 2.0.2.

- 2.0.2
  - Unify component full name to FLEXIO\_MCU\_LCD(EDMA) Driver
- 2.0.1
  - Bug fixes: The following modification to support FlexIO using multiple instances.
    - \* Removed FLEXIO\_Reset API in module Init APIs.
    - \* Updated module Deinit APIs to reset the shifter/timer config instead of disable module and disable clock.
    - \* Updated module Enable APIs to only support enable operation.
- 2.0.0
  - Initial version.

## **FLEXIO\_CAMERA**

The current FLEXIO\_CAMERA driver version is 2.1.2.

- 2.1.2
  - Unify component full name to FLEXIO CAMERA(EDMA) Driver
- 2.1.1
  - Bug fixes: The following modifications support FlexIO using multiple instances.
    - \* Removed FLEXIO\_Reset API in module Init APIs.
    - \* Updated module Deinit APIs to reset the shifter/timer config instead of disable module and disable clock.
    - \* Updated module Enable APIs to only support enable operation.
- 2.1.0
  - New features:
    - \* Added Transfer prefix in transactional APIs.

## **FLEXSPI**

The current FLEXSPI driver version is 2.0.2.

- 2.0.2
  - New features:
    - \* Supports DQS write mask enable/disable feature during set FLEXSPI configuration.
    - \* Provides new API FLEXSPI\_TransferUpdateSizeEDMA for user to update eDMA transfer size(SSIZE/DSIZE) per DMA transfer.
  - Bug fixes:
    - \* Fixed FLEXSPI\_Init invalid operation to enable AHB bus Read Access to IP RX FIFO issue.
    - \* Fixed FLEXSPI\_Init incorrect operation to configure IP TX FIFO watermark issue.
- 2.0.1
  - Bug fixes:
    - \* Fixed the flag clear issue and AHB read Command index configuration issue in FLEXSPI\_SetFlashConfig.

- \* Updated FLEXSPI\_UpdateLUT function to update LUT table from any index instead of previous command index.
- \* Added bus idle wait in FLEXSPI\_SetFlashConfig and FLEXSPI\_UpdateLUT to ensure bus is idle before any change to FlexSPI controller.
- \* Updated interrupt API FLEXSPI\_TransferNonBlocking and interrupt handle flow FLEXSPI\_TransferHandleIRQ.
- \* Updated eDMA API FLEXSPI\_TransferEDMA.
- 2.0.0
  - Initial version.

## **GPC**

The current GPC driver version is 2.0.0.

- 2.0.0
  - Initial version.

## **GPIO**

The current GPIO driver version is 2.0.1.

- 2.0.1:
  - API interface changes:
    - \* Refined naming of API while keeping all original APIs, marking them as deprecated. Original API will be removed in next release. The mainin change is update API with prefix of `_PinXXX()` and `_PorortXXX`.
- 2.0.0
  - Initial version.

## **GPT**

The current GPT driver version is 2.0.0.

- 2.0.0
  - Initial version.

## **KPP**

The current KPP driver version is 2.0.0.

- 2.0.0
  - Initial version.

## LPI2C

The current LPI2C driver version is 2.1.5.

- 2.1.5
  - Bug fix:
    - \* Extended the Driver IRQ handler to support LPI2C4 and change to use ARRAY\_SIZE(k-Lpi2cBases) instead of FEATURE COUNT to decide the array size for handle pointer array.
    - \* 2.1.4
  - Bug fix:
    - \* Fixed the LPI2C\_MasterTransferEDMA receive issue when LPI2C share same request source for TX/RX DMA request. In the previous way the API uses scatter gather method, handle command transfer first, then handles the linked TCD which preset with the receive data transfer. The issue is that TX DMA request and RX DMA request are both enabled, when DMA finished the first command TCD transfer and handled the receive data TCD, the TX DMA request still happens due to TX FIFO empty. This results the RX DMA transfer starts, without waiting on the expected RX DMA request. Fix the issue by enabling IntMajor interrupt for the command TCD and checking if there is a linked TCD to disable the TX DMA request in LPI2C\_MasterEDMACallback API.
- 2.1.3
  - Improvement:
    - \* Added LPI2C\_WATI\_TIMEOUT macro to allow the user to specify the timeout times for waiting flags in functional API and blocking transfer API.
    - \* Added LPI2C\_MasterTransferBlocking API.
- 2.1.2
  - Bug fix:
    - \* In LPI2C\_SlaveTransferHandleIRQ, reset the slave status to idle when stop flag is detected.
- 2.1.1
  - Bug fix:
    - \* Disabled auto stop feature in eDMA driver. Previously, the autostop feature was enabled at transfer when transferring with stop flag. If the previous transfer was without stop flag, because the auto stop feature is enabled, then when starting a new transfer with stop flag, the stop flag sends before starting the new transfer, and the start flag cannot successfully send, so the transfer can not start.
    - \* Changed default slave configuration with address stall false.
- 2.1.0
  - API name change:
    - \* LPI2C\_MasterTransferCreateHandle -> LPI2C\_MasterCreateHandle.
    - \* LPI2C\_MasterTransferGetCount -> LPI2C\_MasterGetTransferCount.
    - \* LPI2C\_MasterTransferAbort -> LPI2C\_MasterAbortTransfer.
    - \* LPI2C\_MasterTransferHandleIRQ -> LPI2C\_MasterHandleInterrupt.
    - \* LPI2C\_SlaveTransferCreateHandle -> LPI2C\_SlaveCreateHandle.
    - \* LPI2C\_SlaveTransferGetCount -> LPI2C\_SlaveGetTransferCount.
    - \* LPI2C\_SlaveTransferAbort -> LPI2C\_SlaveAbortTransfer.



- \* LPI2C\_SlaveTransferHandleIRQ -> LPI2C\_SlaveHandleInterrupt.
- 2.0.0
  - Initial version.

## **LPSPI**

The current LPSPI driver version is 2.0.2.

- 2.0.2
  - New feature:
    - \* Added dummy data setup API to allow users to configure the dummy data to be transferred.
    - \* Enabled the 3-wire mode, SIN and SOUT pins can be configured as input/output pin.
- 2.0.1
  - Bug fix:
    - \* The clock source should be divided by PRESCALE setting in LPSPI\_MasterSetDelayTimes function.
    - \* Fixed the bug that LPSPI\_MasterTransferBlocking function would hang in some corner cases.
  - Optimization:
    - \* Added #ifndef/#endif to allow user to change the default TX value at compile time.
- 2.0.0
  - Initial version.

## **LPUART**

The current LPUART driver version is 2.2.5.

- 2.2.5
  - Do not set or clear the TIE/RIE bits when using LPUART\_EnableTxDMA() and LPUART\_EnableRxDMA().

### 2.2.4

- Added hardware flow control function support.
- Added idle line detected feature in LPUART\_TransferNonBlocking function. If an idle line was detected, a callback is triggered with status kStatus\_LPUART\_IdleLineDetected returned. This feature may be useful when the received Bytes is less than the expected receive data size. Before triggering the callback, data in the FIFO (if has FIFO) is read out, and all interrupts will not be 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 be less than the RX FIFO size). Data is received and a callback is triggered when data receive is end.

### 2.2.3

- Changed parameter type in LPUART\_RTOS\_Init() struct rtos\_lpuart\_config -> lpuart\_rtos\_config\_t.
- Bug fix:
  - Disabled LPUART receive interrupt instead of disabling all NVIC when read data from ring buffer. Because the 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 the interrupt.

### 2.2.2

- Added software reset feature support.
- Added software reset API to LPUART\_Init().

### 2.2.1

- Added separate RX,TX IRQ number support.

### 2.2.0

- Added 7 data bits and MSB support.

### 2.1.1

- Removed needless check of event flags and assert in LPUART\_RTOS\_Receive.
- Always wait for RX event flag in LPUART\_RTOS\_Receive.

### 2.1.0

- Update transactional APIs.

## PIT

The current PIT driver version is 2.0.0.

- 2.0.0
  - Initial version.

## PMU

The current PMU driver version is 2.1.0.

- 2.1.0
  - Added feature macros for low power control APIs to support to conditional compile.
  - Renamed "PMU\_2P1EnablePullDown" to "PMU\_2P5EnablePullDown"
- 2.0.0
  - Initial version.

## PWM

The current PWM driver version is 2.0.0.

- 2.0.0
  - Initial version.

## **PXP**

The current PXP driver version is 2.0.0.

- 2.0.0
  - Initial version.

## **RTWDOG**

The current RTWDOG driver version is 2.0.0.

- 2.0.0
  - Initial version.

## **QTMR**

The current QTMR driver version is 2.0.0.

- 2.0.0
  - Initial version.

## **SAI**

The current SAI driver version is 2.1.4.

-2.1.4

- New feature:
  - Added API to enable/disable auto FIFO error recovery in platforms that support this feature.
  - Added API to set data packing feature in platform which support this feature.

2.1.3

- New feature:
  - Added feature to make I2S frame sync length configurable according to bitWidth.

2.1.2

- Bug fix:
  - Added 24-bit support for SAI eDMA transfer. All data shall be 32 bits for send/receive, as eDMA cannot directly handle 3 Byte transfer.

2.1.1

- Optimization:

- Reduced code size while not using transactional API.

### 2.1.0

- API name change:
  - SAI\_GetSendRemainingBytes -> SAI\_GetSentCount.
  - SAI\_GetReceiveRemainingBytes -> SAI\_GetReceivedCount.
  - All transactional API name add "Transfer" prefix.
  - All transactional API use base and handle as input parameter.
  - Unify the parameter names.
- Bug fix:
  - Fixed WLC bug while reading TCSR/RCSR registers.
  - Fixed MOE enable flow issue, move MOE enable after MICS settings in SAI\_TxInit/SAI\_Rx-Init.

### 2.0.0

- Initial version.

## SEMC

The current SEMC driver version is 2.0.2.

- 2.0.2
  - Changed semc nand configuration structure and verify semc nand related APIs.
  - Added extended semc clock enable
- 2.0.1
  - Fixed data size mask configure in SEMC\_ConfigureIPCommand API.
  - Updated the command mode in IP command type.
- 2.0.0
  - Initial version.

## SPDIF

The current SPDIF driver version is 2.0.0.

- 2.0.0
  - Initial version.

## SRC

The current SRC driver version is 2.0.0.

- 2.0.0
  - Initial version.

## TSC

The current TSC driver version is 2.0.0.

- 2.0.0
  - Initial version.
  - This module was first developed on I.MX 6ULL.

## USDHC

The current USDHC driver version is 2.2.3.

- 2.2.3
  - Fixed issue where AMDA did not disable with DMAEN clear.
  - Improved set clock function to check the output frequency range.
  - Dynamic set SDCLKFS during DDR enable or disable.
- 2.2.2
  - Improved read transfer cache maintain operation, combined clean and invalidated into one function.
- 2.2.1
  - Disabled the invalidate cache operation for tuning.
- 2.2.0
  - Improved USDHC to support mmc boot feature.
- 2.1.3
  - Fixed MISRA issue.
- 2.1.2
  - Fixed Coverity issue.
  - Added base address and userData parameter for all callback function.
- 2.1.1
  - Added cache maintain operation.
  - Added timeout status check for the DATA transfer which ignore error.
  - Added feature macro for SDR50/SDR104 mode.
  - Removed useless IRQ handler for different platform.
- 2.1.0
  - Intergrated tuning into transfer function.
  - Added strobe DLL feature.
  - Added enableAutoCommand23 in data structure.
  - Removed enable card clock function due to controller will handle the clock on/off.
- 2.0.0
  - Initial version.

## WDOG

The current WDOG driver version is 2.0.0.

- 2.0.0
  - Initial version.

## **XBARA**

The current XBARA driver version is 2.0.3.

- 2.0.3
  - Bug fixes:
    - \* Corrected configuration for function XBAR\_SetOutputSignalConfig.

2.0.2

- Other changes:
  - Changed array clock name.

2.0.1

- Bug fixes:
  - Fixed w1c bits for XBARA\_SetOutputSignalConfig function.

2.0.0

- Initial version.

## **XBARB**

The current XBARB driver version is 2.0.1.

- 2.0.1
  - Bug fixes:
    - \* Corrected XBARB\_SetSignalsConnection function.
  - Other changes:
    - \* Changed array clock name.

2.0.0

- Initial version.

## **CLOCK**

The current CLOCK driver version is 2.1.2.

- 2.1.2
  - Minor fixes.
- 2.0.0
  - initial version.

## **IOMUXC**

The current IOMUXC driver version is 2.0.0.

- 2.0.0
  - initial version.

## **XIP**

The current XIP driver version is 2.0.1.

- 2.0.1
  - Structure adjustment:
    - \* Moved fsl\_flexspi\_nor\_config.c/h to board folder.
- 2.0.0
  - Initial version.

## 2 Middleware Change Log

### emWin library

The current version is 5.38a.

### FatFs for MCUXpresso SDK

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

- R0.13a\_rev0
  - Upgraded to version 0.13a. Added patch ff\_13a\_p1.diff.
- R0.12c\_rev1
  - Add 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.

### LigJpeg for MCUXpresso SDK

The current version is LigJpeg 9b. The following are changes that were integrated with SDK:

1. In libjpeg/inc/jinclude.h line 88-96, map JFREAD and JFWRITE to FATFS f\_read and f\_write
2. In libjpeg/inc/jmorecfg.h line 397-406, change RGB color offset.
3. In libjpeg/src/jerror.c line 79-81, don't call function exit.

### lwIP for MCUXpresso SDK

The current version of lwIP is based on lwIP 2.0.3.

- 2.0.3\_rev1
  - New features:
    - \* Ported lwIP 2.0.3 (2017-09-15, SHA-1: 92f23d6ca0971a32f2085b9480e738d34174417b) to KSDK 2.0.0.



- 2.0.2\_rev1
  - New features:
    - \* Ported lwIP 2.0.2 (2017-03-13, SHA-1: c0862d60746e2d1ceae69af4c6f24e469570ecef) to KSDK 2.0.0.
- 2.0.0\_rev3
  - New features:
    - \* Ported lwIP 2.0.0 (2016-11-10, SHA-1: 216bf89491815029aa15463a18744afa04df58fe) to KSDK 2.0.0.
- 2.0.0\_rev2
  - New features:
    - \* Ported lwIP 2.0.0 RC2 (2016-08-08, SHA-1: b1dfd00f9233d124514a36a8c8606990016f2ad4) to KSDK 2.0.0.
- 2.0.0\_rev1
  - New features:
    - \* Ported lwIP 2.0.0 RC0 (2016-05-26) to KSDK 2.0.0.
    - \* Changed lwIP bare-metal examples to use poll-driven approach instead of interrupt-driven one.
- 1.4.1\_rev2
  - New features:
    - \* Enabled critical sections in lwIP.
  - Bug fixes:
    - \* Fixed default lwIP packet-buffer size to be able to accept a maximum size frame from the ENET driver.
    - \* Fixed possible drop of multi-frame packets during transmission.
- 1.4.1\_rev1
  - New features:
    - \* Ported lwIP 1.4.1 to KSDK 2.0.0.

## **mbedTLS for MCUXpresso SDK**

The current version of mbedTLS is based on mbedTLS 2.6.0 released 2017-Aug-10.

- 2.6.0\_rev1
  - Bug fixes:
    - \* ksdk\_mbedtls.c bignum functions now read sign of input mbedtls\_mpi at beginning of functions to properly support in place computations (when output bignum is the same as one of input bignums). Affected functions: mbedtls\_mpi\_mul\_mpi(), mbedtls\_mpi\_mod\_mpi(), ecp\_mul\_comb().
- 2.6.0
  - New features:
    - \* Ported mbedTLS 2.6.0 to KSDK.
    - \* Added MBEDTLS\_FREESCALE\_FREERTOS\_CALLOC\_ALT to allow alternate implementation of pvPortCalloc() when using .c.
- 2.5.1\_rev1

- New features:
  - \* Added support for DCP driver.
- 2.5.1
  - New features:
    - \* Ported mbedTLS 2.5.1 to KSDK.
- 2.4.2\_rev2
  - New features:
    - \* Added Curve25519 support for CAU3.
    - \* Added MBEDTLS\_ECP\_MUL\_MXZ\_ALT configuration parameter enabling overloading of ecp\_mul\_mxz().
- 2.4.2\_rev1
  - New features:
    - \* Added support for CAU3 driver.
    - \* Added new files:
      - \* .c - contains regular software implementation of DES algorithm with added MBEDTLS\_DES3\_SETKEY\_DEC\_ALT and MBEDTLS\_DES3\_SETKEY\_ENC\_ALT config parameters.
      - \* .h - contains modified mbedtls\_des\_context and mbedtls\_des3\_context structures.
      - \* Added MBEDTLS\_DES3\_SETKEY\_DEC\_ALT configuration parameter enabling reloading of mbedtls\_des3\_set2key\_dec() and mbedtls\_des3\_set3key\_dec().
      - \* Added MBEDTLS\_DES3\_SETKEY\_ENC\_ALT configuration parameter enabling reloading of mbedtls\_des3\_set2key\_enc() and mbedtls\_des3\_set3key\_enc().
- 2.4.2
  - New features:
    - \* Ported mbedTLS 2.4.2 to KSDK 2.0.0.
    - \* Added CRYPTO\_InitHardware() function.
    - \* Added new file:
      - .h - contains declaration of CRYPTO\_InitHardware() function and should be included in applications.
- 2.3.0\_rev1
  - New features:
    - \* Added support for CAAM driver.
    - \* In LTC-specific wrapper, allocate temporary integers from heap in one large block.
- 2.3.0
  - New features:
    - \* Ported mbedTLS 2.3.0 to KSDK 2.0.0.

## 2.2.1

- New features:
  - Ported mbedTLS 2.2.1 to KSDK 2.0.0.
  - Added support of MMCAU cryptographic acceleration module. Accelerated MD5, SHA, AES, and DES.
  - Added support of LTC cryptographic acceleration module. Accelerated AES, DES, and PKHA.
  - Added new files:

- .c - alternative implementation of cryptographic algorithm functions using LTC and MMCAU module drivers.
- .h - configuration settings used by mbedTLS KSDK bare metal examples.
- Added mbedTLS KSDK bare-metal examples:
  - \* <board name> - KSDK mbedTLS benchmark application.
  - \* <board name> - KSDK mbedTLS self-test application.
- Added MBEDTLS\_GCM\_CRYPT\_ALT configuration parameter enabling reloading of mbedtls\_gcm\_crypt\_and\_tag().
- Added MBEDTLS\_ECP\_MUL\_COMB\_ALT to enable alternate implementation of ecp\_mul\_comb().
- Added MBEDTLS\_ECP\_ADD\_ALT configuration parameter enabling reloading of ecp\_add().
- Added MBEDTLS\_DES\_SETKEY\_DEC\_ALT configuration parameter enabling reloading of mbedtls\_des\_setkey\_dec(), mbedtls\_des3\_set2key\_dec() and mbedtls\_des3\_set3key\_dec().
- Added MBEDTLS\_DES\_SETKEY\_ENC\_ALT configuration parameter enabling reloading of mbedtls\_des\_setkey\_enc(), mbedtls\_des3\_set2key\_enc() and mbedtls\_des3\_set3key\_enc().
- Added MBEDTLS\_DES\_CRYPT\_CBC\_ALT configuration parameter enabling reloading of mbedtls\_des\_crypt\_cbc().
- Added MBEDTLS\_DES3\_CRYPT\_CBC\_ALT configuration parameter enabling reloading of mbedtls\_des3\_crypt\_cbc().
- Added MBEDTLS\_AES\_CRYPT\_CBC\_ALT configuration parameter enabling reloading of mbedtls\_aes\_crypt\_cbc().
- Added MBEDTLS\_AES\_CRYPT\_CTR\_ALT configuration parameter enabling reloading of mbedtls\_aes\_crypt\_ctr().
- Added MBEDTLS\_CCM\_CRYPT\_ALT configuration parameter enabling reloading of mbedtls\_ccm\_encrypt\_and\_tag() and mbedtls\_ccm\_auth\_decrypt().
- Added MBEDTLS\_MPI\_ADD\_ABS\_ALT configuration parameter enabling reloading of mbedtls\_mpi\_add\_abs().
- Added MBEDTLS\_MPI\_SUB\_ABS\_ALT configuration parameter enabling reloading of mbedtls\_mpi\_sub\_abs().
- Added MBEDTLS\_MPI\_EXP\_MOD\_ALT configuration parameter enabling reloading of mbedtls\_mpi\_exp\_mod().
- Added MBEDTLS\_MPI\_MUL\_MPI\_ALT configuration parameter enabling reloading of mbedtls\_mpi\_mul\_mpi().
- Added MBEDTLS\_MPI\_MOD\_MPI\_ALT configuration parameter enabling reloading of mbedtls\_mpi\_mod\_mpi().
- Added MBEDTLS\_MPI\_GCD\_ALT configuration parameter enabling reloading of mbedtls\_mpi\_gcd().
- Added MBEDTLS\_MPI\_INV\_MOD\_ALT configuration parameter enabling reloading of mbedtls\_mpi\_inv\_mod().
- Added MBEDTLS\_MPI\_IS\_PRIME\_ALT configuration parameter enabling reloading of mbedtls\_mpi\_is\_prime().
- Added encrypt/decrypt mode to mbedtls\_des\_context and mbedtls\_des3\_context structure.
- Added carriage return ” for mbedtls\_printf() in self test functions.

## SDMMC

The current driver version is 2.2.4.

- 2.2.4
  - Bug fix:
    - \* Fixed DDR mode data sequence miss issue, which is caused by NIBBLE\_POS.
  - New features:
    - \* Increased g\_sdmmc 512byte to improve the performance when application use a non-word align data buffer address.
    - \* Used OCR access mode bits to determine the mmccard high capacity flag.
    - \* Enabled auto cmd12 for SD read/write.
    - \* Disabled DDR mode frequency multiply by 2.
- 2.2.3
  - Bug fix:
    - \* Added reponse 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.
    - \* Keep 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 will be 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.
  - Improved SDIO card init sequence and add retry option for SDIO\_SwitchToHighSpeed function.
- 2.1.4
  - Miscellaneous:
    - \* Added Host reset function for card re-initialization.
    - \* Added Go\_Idle function for SDIO card.
    - \* 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 sdc card 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 wrong 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:
    - \* Change the callback mechanism when sending a command.
    - \* Fix the performance low 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.

## USB stack for MCUXpresso SDK

The current version of USB stack is 2.0.1.

- 2.0.1
  - Bug fix:
    - \* fixed some USB issues.
    - \* Change the audio codec interfaces.
- 2.0.0
  - New features:
    - \* PTN5110N support.
  - Bug fix:
    - \* Added some comments, fixed some minor USB issues.
- 1.9.0
  - New features:
    - \* Examples:
      - usb\_pd\_alt\_mode\_dp\_host
- 1.8.2
  - Updated license.
- 1.8.1
  - Bug fix:
    - \* Verified some hardware issues, support aruba\_flashless.
- 1.8.0
  - New features:
    - \* Examples:
      - usb\_device\_composite\_cdc\_vcom\_cdc\_vcom
      - usb\_device\_composite\_hid\_audio\_unified
      - usb\_pd\_sink\_battery
      - Changed usb\_pd\_battery to usb\_pd\_charger\_battery.

Bug fix:

- Code cleaned up, removed some irrelevant code.

1.7.0

- New features:
  - USB PD stack support.
- Examples
  - usb\_pd
  - usb\_pd\_battery
  - usb\_pd\_source\_charger

1.6.3

- Bug fix: -IP3511\_HS driver control transfer sequence issue, enabled 3511 ip cv test.

1.6.2

- New features:

- Multi instance support.

#### 1.6.1

- New features:
  - Changed the struct variable address method for device\_video\_virtual\_camera and host\_phdc\_manager.

#### 1.6.0

- New features:
  - Supported Device Charger Detect feature on usb\_device\_hid\_mouse.

#### 1.5.0

- New features:
  - Supported controllers
    - \* OHCI (Full Speed, Host mode)
    - \* IP3516 (High Speed, Host mode)
    - \* IP3511 (High Speed, Device mode)
  - Examples:
    - \* usb\_lpm\_device\_hid\_mouse
    - \* usb\_lpm\_device\_hid\_mouse\_lite
    - \* usb\_lpm\_host\_hid\_mouse

#### 1.4.0

- New features:
  - Examples:
    - \* usb\_device\_hid\_mouse/freertos\_static
    - \* usb\_suspend\_resume\_device\_hid\_mouse\_lite

#### 1.3.0

- New features:
  - Supported roles
    - \* OTG
  - Supported classes
    - \* CDC RNDIS
  - Examples
    - \* usb\_otg\_hid\_mouse
    - \* usb\_device\_cdc\_vnic
    - \* usb\_suspend\_resume\_device\_hid\_mouse
    - \* usb\_suspend\_resume\_host\_hid\_mouse

#### 1.2.0

- New features:
  - Supported controllers
    - \* LPC IP3511 (Full Speed, Device mode)

#### 1.1.0

- Bug fix:
  - Fixed some issues in USB certification.
  - Changed VID and Manufacturer string to NXP.
- New features:
  - Supported classes
    - \* Printer
  - Examples:
    - \* `usb_device_composite_cdc_msc_sdcard`
    - \* `usb_device_printer_virtual_plain_text`
    - \* `usb_host_printer_plain_text`

### 1.0.1

- Bug fix:
  - Improved the efficiency of device audio speaker by changing the transfer mode from interrupt to DMA, thus providing the ability to eliminate the periodic noise.

### 1.0.0

- New features:
  - Supported roles
    - \* Device
    - \* Host
  - Supported controllers:
    - \* KHCI (Full Speed)
    - \* EHCI (High Speed)
  - Supported classes:
    - \* AUDIO
    - \* CCID
    - \* CDC
    - \* HID
    - \* MSC
    - \* PHDC
    - \* VIDEO
  - Examples:
    - \* `usb_device_audio_generator`
    - \* `usb_device_audio_speaker`
    - \* `usb_device_ccid_smart_card`
    - \* `usb_device_cdc_vcom`
    - \* `usb_device_cdc_vnic`
    - \* `usb_device_composite_cdc_msc`
    - \* `usb_device_composite_hid_audio`
    - \* `usb_device_composite_hid_mouse_hid_keyboard`
    - \* `usb_device_hid_generic`
    - \* `usb_device_hid_mouse`
    - \* `usb_device_msc_ramdisk`
    - \* `usb_device_msc_sdcard`



- \* usb\_device\_phdc\_weighscale
- \* usb\_device\_video\_flexio\_ov7670
- \* usb\_device\_video\_virtual\_camera
- \* usb\_host\_audio\_speaker
- \* usb\_host\_cdc
- \* usb\_host\_hid\_generic
- \* usb\_host\_hid\_mouse
- \* usb\_host\_hid\_mouse\_keyboard
- \* usb\_host\_msd\_command
- \* usb\_host\_msd\_fatfs
- \* usb\_host\_phdc\_manager
- \* usb\_keyboard2mouse
- \* usb\_pin\_detect\_hid\_mouse

## **QCA WiFi**

The current version is 2.0.0.

- 2.0.0
  - Initial version.
    - \* Added QCA WiFi, ported from SDK 1.3, synchronized with latest MQX Qualcomm v3.-3.5.
  - Known issues:
    - \* Low power mode may not work, require further investigation.
    - \* DHCP request requires some timeout to retrieve valid data.

## **wolfSSL**

The current version is 3.9.8\_rev3, based on Release 3.9.8 of wolfSSL.

- 3.9.8\_rev3
  - New features:
    - \* Added support for DCP driver.
- 3.9.8\_rev2
  - New features:
    - \* Added support for CAU3 driver.
- 3.9.8\_rev1
  - New features:
    - \* Added support for CAAM driver.
    - \* Added FREESCALE\_ALT macros.
- 3.9.8
  - New features:
    - \* Added support for AES and SHA acceleration modules of LPC devices. Accelerates AES and SHA wolfSSL modules.

- \* LTC acceleration for AES CBC now updates IV.
- Bug fixes:
  - \* Fixed K8x/KL8x LTC RSA sign when FREESCALE\_LTC\_TFM\_RSA\_4096\_ENABLE macro is enabled.
- 3.9.0
  - New features:
    - \* Added more LTC public key acceleration (curve25519, ed25519 and RSA4096).
    - \* FREESCALE\_LTC\_TFM\_RSA\_4096\_ENABLE macro added to enable RSA4096 on K8x/KL8x LTC.
    - \* LTC\_MAX\_ECC\_BITS increased to 384 to enable ECC-384 curve acceleration on LTC.
    - \* FREESCALE\_LTC\_SHA added for KL8x SHA-1 and SHA-256 hardware acceleration.
  - Other changes:
    - \* wolfSSL/wolfcrypt/settings.h is changed to remove unused macros and add support for KSDK 2.0.
    - \* LTC public key acceleration is implemented in separate source file ksdk\_port.h and ksdk\_port.c
- 3.8.0
  - New features:
    - \* Added support for LTC hardware acceleration module. Accelerates AES, 3DES, TFM module (modular integer arithmetic) and ECC wolfSSL modules.
    - \* Added support for random number generator modules TRNG and RNGA.
  - Other changes:
    - \* The MMCAU acceleration now uses "fsl\_mmcau.h" instead of "cau\_api.h".
    - \* In DSA, wc\_dsaSign() changed to repeat wc\_RNG\_GenerateBlock() until k is less than q.
    - \* wolfSSL/wolfcrypt/settings.h is changed to remove unused macros and add support for KSDK 2.0.
    - \* In wolfcrypt/src/asn.c, ksdk\_time(time\_t) changed to extern, to be defined by application.

## 3 RTOS Change Log

### FreeRTOS for MCUXpresso SDK

The current version is FreeRTOS 9.0.0. Original package is available at [freertos.org](http://freertos.org).

- 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`.
- 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 `configFRRTOS_MEMORY_SCHEME` macros.
- 9.0.0\_rev1
  - New features:
    - \* Enabled `-fto` 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 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.

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