Freescale Semiconductor, Inc.
Release Notes

Document Number: KSDK120RN
Rev. 0, 04/2015

Kinetis SDK v.1.2.0 Release Notes

1 Overview

These are the release notes for the Freescale Kinetis Software Development Kit (SDK) 1.2.0. The core of the Kinetis SDK is a set of drivers architected in two layers: the Hardware Abstraction Layer (HAL) and the Peripheral Driver Layer.

The HAL abstracts the hardware register accesses into a set of stateless functional primitives which provide the building blocks for high-level Peripheral Drivers or applications. The Peripheral Driver Layer implements use-case driven drivers by utilizing one or more HAL layer components, system services, and possibly other Peripheral Drivers.

The Kinetis SDK includes a set of example applications demonstrating the use of the Peripheral Drivers and other integrated software modules such as a Real-Time Operating System (RTOS) through an RTOS abstraction layer. The Kinetis SDK also integrates middleware such as the Freescale USB stack to provide an easy-to-use Software Development Kit for Kinetis microcontroller (MCU) product families.

Contents

For the latest version of this and other Kinetis SDK documents, see the Kinetis SDK homepage www.freescale.com/ksdk.

2 What Is New

These are the new features for Kinetis SDK 1.2.0:

- Added device family support:

Table 1. Added device families

Added Devices		
MK10D10	MK66F18	MKL34Z4
MK11DA5	MKL02Z4	MKL36Z4
MK20D10	MKL14Z4	MKL43Z4
MK21DA5	MKL15Z4	MKV40F15
MK21FA12	MKL16Z4	MKV43F15
MK26F18	MKL17Z4	MKV44F15
MK30D10	MKL17Z644	MKV45F15
MK40D10	MKL24Z4	MKV46F15
MK50D10	MKL25Z4	MKW01Z4
MK51D10	MKL26Z4	MKW21D5
MK52D10	MKL27Z4	MKW22D5
MK53D10	MKL27Z644	MKW24D5
MK65F18	MKL33Z4	MK24F12
MK63F12		

- Added Peripheral support:
  - AOI
  - ENC
  - FLEXBUS
  - FLEXIO
  - LMEM
  - VREF
  - XBAR

- PWM

3 Development Tools

The Kinetis SDK 1.2.0 was compiled and tested with these development tools:

- Kinetis Design Studio IDE v3.0
- IAR Embedded Workbench for ARM® version 7.40.2
- MDK-ARM Microcontroller Development Kit (Keil)® 5.14
- Makefiles support with GCC revision 4.8-2014-q3-update from ARM Embedded
- Atollic® TrueSTUDIO® 5.3.0

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 2. Supported MCU devices and development boards

Development boards	Kinetis MCU devices
FRDM-KL03Z (Rev. B1)	MKL03Z8VFG4, MKL03Z16VFG4, MKL03Z32VFG4, MKL03Z32CAF4R, MKL03Z8VFK4, MKL03Z16VFK4, **MKL03Z32VFK4**
TWR-K22F120M (Rev. C) **FRDM-K22F (Rev. D)**	MK22FN512VDC12, MK22FN512VLL12, **MK22FN512VLH12**, MK22FN512VMP12, MK22FN512CAP12, MK02FN128VLH10, MK02FN128VLF10, MK02FN128VFM10, MK02FN64VFM10, MK02FN64VLF10, MK02FN64VLH10 MK22FN128CAH12, MK22FN128VDC10, MK22FN128VLH10, MK22FN128VLL10 MK22FN128VMP10, MK22FN256CAH12 MK22FN256VDC12, MK22FN256VLH12, MK22FN256VLL12, MK22FN256VMP12
TWR-KV31F120M (Rev. B)	**MKV31F512VLL12**, MKV31F512VLH12, MKV30F128VFM10, MKV30F128VLF10, MKV30F128VLH10, MKV30F64VFM10, MKV30F64VLF10, MKV30F64VLH10, MKV31F128VLH10, MKV31F128VLL10, MKV31F256VLH12, MKV31F256VLL12
TWR-K24F120M (Rev. A)	**MK24FN256VDC12**
TWR-K64F120M (Rev. B1) **FRDM-K64F (Rev. C)**	MK24FN1M0VDC12, MK24FN1M0VLL12, MK24FN1M0VLQ12, MK63FN1M0VLQ12, MK63FN1M0VMD12, MK64FN1M0VDC12, **MK64FN1M0VLL12**, MK64FN1M0VLQ12, **MK64FN1M0VMD12**, MK64FX512VDC12, MK64FX512VLL12, MK64FX512VLQ12, MK64FX512VMD12
TWR-KV10Z32 (Rev. B3)	**MKV10Z32VLF7**, MKV10Z32VLC7, MKV10Z32VFM7, MKV10Z16VLF7, MKV10Z16VLC7, MKV10Z16VFM7

TWR-K60D100M (Rev. B)	MK10DN512VLK10, MK10DN512VLL10, MK10DN512VLQ10, MK10DN512VMC10, MK10DN512VMD10, MK10DX128VLQ10, MK10DX128VMD10, MK10DX256VLQ10, MK10DX256VMD10, MK20DN512VLK10, MK20DN512VLL10, MK20DN512VLQ10, MK20DN512VMC10, MK20DN512VMD10, MK20DX128VLQ10, MK20DX128VMD10, MK20DX256VLK10, MK20DX256VLQ10, MK20DX256VMC10, MK20DX256VMD10, MK20DX256VLL10, MK30DN512VLK10, MK30DN512VLL10, MK30DN512VLQ10, MK30DN512VMC10, MK30DN512VMD10, MK30DX128VLQ10, MK30DX128VMD10, MK30DX256VLQ10, MK30DX256VMD10, MK40DN512VLK10, MK40DN512VLL10, MK40DN512VLQ10, MK40DN512VMC10, MK40DN512VMD10, MK40DX128VLQ10, MK40DX128VMD10, MK40DX256VLQ10, MK40DX256VMD10, MK50DN512CLL10, MK50DN512CLQ10, MK50DN512CMC10, MK50DN512CMD10, MK50DX256CLK10, MK50DX256CLL10, MK50DX256CMC10, MK50DX256CMD10, MK51DN256CLQ10, MK51DN256CMD10, MK51DN512CLL10, MK51DN512CLQ10, MK51DN512CMC10, MK51DN512CMD10, MK51DX256CLK10, MK51DX256CLL10, MK51DX256CMC10, MK52DN512CLQ10, MK52DN512CMD10, MK53DN512CLQ10, MK53DN512CMD10, MK53DX256CLQ10, MK53DX256CMD10, MK60DN256VLL10, MK60DN256VLQ10, MK60DN256VMC10, MK60DN256VMD10, MK60DN512VLL10, MK60DN512VLQ10, MK60DN512VMC10, **MK60DN512VMD10**, MK60DX256VLL10, MK60DX256VLQ10, MK60DX256VMC10, MK60DX256VMD10
FRDM-KL46Z (Rev. C)	MKL16Z256VLH4, MKL16Z256VMP4, MKL26Z256VLH4, MKL26Z256VMP4, MKL26Z128VLL4, MKL26Z256VLL4, MKL26Z128VMC4, MKL26Z256VMC4, MKL34Z64VLH4, MKL34Z64VLL4, MKL36Z64VLH4, MKL36Z128VLH4, MKL36Z256VLH4, MKL36Z256VMP4, MKL36Z64VLL4, MKL36Z128VLL4, MKL36Z256VLL4, MKL36Z128VMC4, MKL36Z256VMC4, MKL46Z128VLH4, MKL46Z256VLH4, MKL46Z256VMP4, MKL46Z128VLL4, **MKL46Z256VLL4**, MKL46Z128VMC4, MKL46Z256VMC4
TWR-K21D50M (Rev. B)	MK11DN512AVLK5, MK11DN512AVMC5, MK11DX128AVLK5, MK11DX128AVMC5, MK11DX256AVLK5, MK11DX256AVMC5, MK21DN512AVLK5, **MK21DN512AVMC5**, MK21DX128AVLK5, MK21DX128AVMC5, MK21DX256AVLK5, MK21DX256AVMC5
TWR-K21F120M (Rev. A)	MK21FN1M0AVLQ12, **MK21FN1M0AVMC12**, MK21FN1M0AVMD12, MK21FX512AVLQ12, MK21FX512AVMC12, MK21FX512AVMD12

TWR-KW24D512 (Rev. C) **USB-KW24D512 (Rev. A3)** **FRDM-KW24 (Rev. X1)**	MKW21D256VHA5, MKW21D512VHA5, MKW22D512VHA5, **MKW24D512VHA5**
TWR-KV46F150M (Rev. C)	MKV40F128VLH15, MKV40F256VLH15, MKV40F64VLH15, MKV43F128VLH15, MKV43F64VLH15, MKV44F128VLH15, MKV44F64VLH15, MKV45F128VLH15, MKV45F256VLH15, MKV46F128VLH15, MKV46F256VLH15, MKV40F128VLL15, MKV40F256VLL15, MKV43F128VLL15, MKV44F128VLL15, MKV45F128VLL15, MKV45F256VLL15, MKV46F128VLL15, **MKV46F256VLL15**
FRDM-KL43Z (Rev. A) **TWR-KL43Z48M (Rev. C)**	MKL17Z128VFM4, MKL17Z256VFM4, MKL17Z128VFT4, MKL17Z256VFT4, MKL17Z128VLH4, MKL17Z256VLH4, MKL17Z128VMP4, MKL17Z256VMP4, MKL27Z128VFM4, MKL27Z256VFM4, MKL27Z128VFT4, MKL27Z256VFT4, MKL27Z128VLH4, MKL27Z256VLH4, MKL27Z128VMP4, MKL27Z256VMP4, MKL33Z128VLH4, MKL33Z256VLH4, MKL33Z128VMP4, MKL33Z256VMP4, MKL43Z128VLH4, **MKL43Z256VLH4**, MKL43Z128VMP4, MKL43Z256VMP4
FRDM-KL27Z (Rev. A)	MKL17Z32VFM4, MKL17Z64VFM4, MKL17Z32VDA4, MKL17Z64VDA4, MKL17Z32VFT4, MKL17Z64VFT4, MKL17Z32VMP4, MKL17Z64VMP4, MKL17Z32VLH4, MKL17Z64VLH4, MKL27Z32VFM4, MKL27Z64VFM4, MKL27Z32VDA4, MKL27Z64VDA4, MKL27Z32VFT4, MKL27Z64VFT4, MKL27Z32VMP4, MKL27Z64VMP4, MKL27Z32VLH4, **MKL27Z64VLH4**
TWR-K65F180M (Rev. C)	MK26FN2M0VMD18, MK26FN2M0VLQ18,MK26FN2M0CAC18, MK26FN2M0VMI18, MK65FN2M0CAC18, **MK65FN2M0VMI18**, MK65FX1M0VMI18, MK65FX1M0CAC18, MK66FN2M0VLQ18, MK66FN2M0VMD18, MK66FX1M0VLQ18, MK66FX1M0VMD18
FRDM-KL02Z (Rev. B)	MKL02Z8VFG4, MKL02Z16VFG4, MKL02Z32VFG4, MKL02Z32CAF4, MKL02Z16VFK4, MKL02Z32VFK4, MKL02Z16VFM4, **MKL02Z32VFM4**
FRDM-KL25Z (Rev. F)	MKL14Z32VFM4, MKL14Z64VFM4, MKL14Z32VFT4, MKL14Z64VFT4, MKL14Z32VLH4, MKL14Z64VLH4, MKL14Z32VLK4, MKL14Z64VLK4, MKL15Z32VFM4, MKL15Z64VFM4, MKL15Z128VFM4, MKL15Z128CAD4, MKL15Z32VFT4, MKL15Z64VFT4, MKL15Z128VFT4, MKL15Z32VLH4, MKL15Z64VLH4, MKL15Z128VLH4, MKL15Z32VLK4, MKL15Z64VLK4, MKL15Z128VLK4, MKL24Z32VFM4, MKL24Z64VFM4, MKL24Z32VFT4, MKL24Z64VFT4, MKL24Z32VLH4, MKL24Z64VLH4, MKL24Z32VLK4, MKL24Z64VLK4, MKL25Z32VFM4, MKL25Z64VFM4, MKL25Z128VFM4, MKL25Z32VFT4, MKL25Z64VFT4, MKL25Z128VFT4, MKL25Z32VLH4, MKL25Z64VLH4, MKL25Z128VLH4, MKL25Z32VLK4, MKL25Z64VLK4, **MKL25Z128VLK4**
MRB-KW019032NA (Rev. D) **MRB-KW019032JA (Rev. B)** **MRB-KW019032EU (Rev. D)**	**MKW01Z128CHN4**

FRDM-KL26Z (Rev. B)	MKL16Z32VFM4, MKL16Z64VFM4, MKL16Z128VFM4, MKL16Z32VFT4, MKL16Z64VFT4, MKL16Z128VFT4, MKL16Z32VLH4, MKL16Z64VLH4, MKL16Z128VLH4, MKL26Z32VFM4, MKL26Z64VFM4, MKL26Z128VFM4, MKL26Z128CAL4, MKL26Z32VFT4, MKL26Z64VFT4, MKL26Z128VFT4, MKL26Z32VLH4, MKL26Z64VLH4, **MKL26Z128VLH4**

5 Release Contents

This table describes the release contents.

Table 3. Release Contents

Deliverable	Location
Examples	<install_dir>/examples/...
Demo applications	<install_dir>/examples/<board_name>/demo_apps/…
USB demo applications	<install_dir>/examples/<board_name>/demo_apps/usb/…
Driver examples	<install_dir>/examples/<board_name>/driver_examples/...
Documentation	<install_dir>/doc/...
MQX Documentation	<install_dir>/doc/rtos/mqx/...
USB Documentation	<install_dir>/doc/usb/...
MQX RTCS Documentation	<install_dir>/doc/tcpip/mqx_rtcs/...
lwIP Documentation	<install_dir>/doc/tcpip/lwip/...
MQX MFS Documentation	<install_dir>/doc/filesystem/mqx_mfs/...
Projects to build libraries	<install_dir>/lib/...
Middleware	<install_dir>/middleware/...
TCP/IP stacks	<install_dir>/middleware/tcpip/...
File System	<install_dir>/middleware/filesystem/...
Driver library, startup code and utilities	<install_dir>/platform/...
Cortex Microcontroller Software Interface Standard (CMSIS) ARM Cortex®-M header files, DSP library source	<install_dir>/platform/CMSIS/…
Composite drivers for SD-card and Soundcard support	<install_dir>/platform/composite/...
Linker control files for each supported tool chain	<install_dir>/platform/devices/<soc_name>/linker/…
SoC header files, Extension header files and feature header files	<install_dir>/platform/devices/<device_name>/include
CMSIS-compliant startup code	<install_dir>/platform/ devices/<soc_name>/startup/…
Peripheral Drivers	<install_dir>/platform/drivers/…
Hardware Abstraction Layer	<install_dir>/platform/hal/…
OS Abstraction for Bare Metal and RTOS	<install_dir>/platform/osa/…
System Services such as clock manager, interrupt manager, unified hardware timer, and low power manager	<install_dir>/platform/system/…
Utilities such as debug console	<install_dir>/platform/utilities/…
RTOS Kernel Code, RTOS abstraction implementations, and RTOS kernel folders	<install_dir>/rtos/...
A Processor Expert service pack and cmake toolchain files.	<install_dir>/tools
USB stack and USB projects to build libraries	<install_dir>/usb/...
Utilities such as shell	<install_dir>/utilities/...

Compared to KSDK 1.1.0 release, the main folder structure changes are listed below:

- SOC header files, extension header files, feature header files are moved from <install_dir>/platform/CMSIS/Inclulde/device/<soc_name> to <install_dir>/platform/device/<soc_name>/Include.
- Linker files are moved from <install_dir>/platform/linker/<soc_name> to <install_dir>/platform/device/<soc_name>/linker.
- startup codes are moved from <install_dir>/platform/startup/<soc_name> to <install_dir>/platform/device/<soc_name>/startup.
- board configuration files are moved from <install_dir>/boards/<board_name> to <install_dir>/examples/<board_name>.
- demo projects are moved from <install_dir>/demos to <install_dir>/examples/<board_name>/demo_apps.
- <install_dir>/filesystem and <install_dir>/tcpip are moved to <install_dir>/middleware.
- usb projects are moved from <install_dir>/usb/example to <install_dir>/examples/<board_name>/demo_apps/usb.

6 Kinetis SDK Release Overview

The Kinetis SDK is intended for use with Freescale's Kinetis MCU product family based on the ARM® Cortex-M series architectures. The release consists of:

- Kinetis MCU platform support
- Demo applications/Driver examples
- The FatFs FAT File System
- USB Host and Device OTG stacks
- lwIP TCP/IP networking stack
- RTOS support components
- Documentation (Kinetis SDK API Reference Manual and various user's guides)

6.1 Kinetis MCU platform support

The Kinetis SDK platform directory contains the startup code, operating system abstraction, system services, driver libraries for peripherals, header files, linker files, and utilities such as the debug console implementation.

6.1.1 Startup code

The Kinetis SDK includes simple CMSIS compliant startup code for the supported Kinetis MCUs which efficiently deliver the code execution to the `main()` function. An application can either include the startup code directly in the project build environment or include a prebuilt startup code library for a cleaner project build environment.

6.1.2 Operating system abstraction

The drivers are designed to work with or without an operating system through the Operating System Abstraction layer (OSA). The OSA defines a common set of services that abstract most of the OS kernel functionalities. The OSA either maps an OSA service to the target OS function, or implements the service when no OS is used (bare metal) or when the service does not exist in the target OS. The Kinetis SDK implements the OSA for Freescale MQX™ RTOS, FreeRTOS, µC/OS-II, µC/OS-III, and for OS-less "bare metal" usage. The bare metal OSA implementation is selected as the default option.

6.1.3 System Services

The system services contain a set of software entities that can be used either by the Peripheral Drivers or with the HAL to build either Peripheral Drivers or an application directly. The system services include the interrupt manager, clock manager, low power manager, and the unified hardware timer interface.

6.1.4 Driver library

The Kinetis SDK provides a set of drivers for the Kinetis MCU product family on-chip peripherals. The drivers are designed and implemented around the peripheral hardware blocks rather than for a specific Kinetis MCU, and work with or without an OS through the OS Abstraction layer. The drivers are architected into two layers: the Hardware Abstraction Layer and the Peripheral Driver Layer.

The HAL is designed to abstract hardware register accesses into functional accesses. It is stateless and is intended to cover the entire hardware functionality.

The Peripheral Drivers are built on top of the HAL to provide a set of easy-to-use interfaces that handle high-level data and stateful transactions. They are designed for the most common use cases identified for the underlying hardware block and are reasonably efficient in terms of memory and performance. They are written in C language and can be easily ported from product to product as they are designed to be initialized at runtime based on the driver configuration passed in by the user. In most cases, the Peripheral Drivers can be used as is. However, if the Peripheral Driver does not address a particular target use case, it can either be modified/enhanced or completely rewritten to meet the target functionality and other requirements. In this case, the existing Peripheral Driver can be used as a reference to build a custom driver based on the HAL. For more details, see the *Architectural Overview* chapter in the *Kinetis SDK API Reference Manual*.

Detailed implementation of hardware peripheral functionality, for both the HAL and Peripheral Driver, is implemented in stages. For example, the current version of the UART driver does not support modem control and smart card features. Likewise, the current version of the I2C driver does not support the SMBUS feature. The features which are missing from the current driver versions may be implemented in future releases.

6.1.5 Header files

The Kinetis SDK devices directory contains device-specific header files which provide direct access to the Kinetis MCU peripheral registers. Each supported Kinetis MCU device in the Kinetis SDK has an overall System-on-Chip (SoC) memory-mapped header file. In addition to the overall SoC memory-mapped header file, the Kinetis SDK includes extension header files and feature header files for each peripheral instantiated on the Kinetis MCU. Along with the SoC header files, peripheral extension header files, and feature header files the Kinetis SDK CMSIS directory includes common CMSIS header files for the ARM Cortex-M core and DSP library from the ARM CMSIS version 4.2 release.

6.1.6 Linker files

The Kinetis SDK devices directory contains linker control files (or simply linker files) for each supported tool chain and Kinetis MCU device.

6.1.7 Utilities

The utilities directory contains useful software utilities such as a debug console.

6.2 Demo applications

The demo applications demonstrate the usage of the driver libraries and other integrated software solutions on supported development systems. For details, see the *Kinetis SDK v. 1.2 Demo Applications User's Guide* (document KSDK12DEMOUG).

6.3 Driver examples

The driver examples demonstrate configuring drivers by passing configuration data to the API functions. For details, see the *Kinetis SDK v.1.2 Demo Applications User's Guide* (document KSDK12DEMOUG).

6.4 Other integrated software solutions

The Kinetis SDK is designed for easy integration with other software solutions such as OS kernels, USB stack, TCP/IP stack, and file systems.

6.4.1 USB stack

A Freescale USB stack is integrated with the Kinetis SDK and was tested both with and without an OS through the OS abstraction layer. For details, see the *Integration of the USB Stack and Kinetis SDK*.

6.4.2 TCP/IP stack

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

6.4.3 File System

A FAT file system is integrated with Kinetis SDK and can be used to access either the SD card or the USB memory stick when the SD card driver or the USB Mass Storage Device class implementation is used.

6.4.4 RTOS

The Kinetis SDK is pre-integrated with Freescale MQX RTOS, FreeRTOS, µC/OS-II, and µC/OS-III. OS abstraction layers are implemented for these RTOSes.

7 Known Issues

7.1 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 Kinetis 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:\Freescale folder.

7.2 No spaces in the Kinetis SDK installation

The Freescale MQX RTOS build uses batch files, which do not work when there are spaces in the file path.

7.3 USB HUB power supply

The external power supply of the USB HUB must be provided before it can be used. This is the result of the development board which is not designed to power a USB HUB and the devices connected to the HUB. Therefore, the external USB HUB that is connected to the development board should have its own power supply.

7.4 USB audio noise on the TWR-K22F120M, TWR-K21D50M, TWR-K21F120M, and TWR-K24F120M Tower System modules

A noise occurs when running the USB audio example on the TWR-K22F120M, TWR-K21D50M, TWR-K21F120M, and TWR-K24F120M Tower System modules as a result of poor clock accuracy of the CSTCE8M00G55-R0 crystal oscillator.

7.5 cdc_serial/OTG example on KSDK MQX RTOS

Follow these steps to run the host cdc_serial/OTG example on the KSDK MQX RTOS.

1. Add two lines to the rtos\mqx\config\mcu\<soc_name>\mqx_sdk_config.h

```
#define BSPCFG_ENABLE_IO_SUBSYSTEM    (0)
#define printf              debug_printf
```

2. Re-compile all libraries, such as mqx_<board_name>, mqx_stdlib_<board_name>, ksdk_mqx_lib, and usbh_sdk_<board_name>_mqx.

7.6 HS USB device MSD demo issue

If the SD card is used as the storage medium, the functionality of USB might not work correctly if the USB hot plug action is performed while transferring files.

7.7 Trimming the Clock in software initialization for TWR-K24D512 board with the P24K9V N62J1N42H SoC embedded

Run the clock trimming for the TWR-K24D512 Tower System module with the P24K8V N62J1N42H SoC embedded.

7.8 FOPT programming for the FRDM-KL43Z board

For the FRDM-KL43Z board, program a new FOPT value to the Flash to ensure that SoC boots from Flash. To enable the FOPT programming for IAR projects, provide the "--enable_config_write" parameter for the Flash loader and save it as a new .board file. The FlashKLxx256ROM_with_config_write_enabled.board file in <install_dir>/examples/frdmkl43z is created for this purpose for all FRDM-KL43Z projects.

7.9 Project sets (WSD files) are not supported for all projects

WSD files are used for importing project sets in the KDS IDE. WSD files are only supported for MQX RTOS projects.

8 Revision History

This table summarizes revisions to this document.

Revision History		
Revision number	**Date**	**Substantial changes**
0	04/2015	Kinetis SDK 1.2.0 release

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Document Number: KSDK120RN
Rev. 0
04/2015