

# Kinetis SDK v.1.3.0 Release Notes for KV4x Derivatives

## 1 Overview

These are the release notes for the Freescale Kinetis Software Development Kit (SDK) v.1.3.0 supporting MKV42, MKV44, and MKV46 derivatives with 256 KB, 128 KB and 64 KB of flash memory. 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.

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For the latest version of this and other Kinetis SDK documents, see the Kinetis SDK homepage [www.freescale.com/ksdk](http://www.freescale.com/ksdk).

## 2 What is new

These are the new features for Kinetis SDK v.1.3.0:

- Added device family support:

**Table 1. Added device families**

Added Devices		
MKV42F16	MKV44F16	MKV46F16

- MQX™ RTOS support for the TWR-KV46F150M Freescale Tower System module

### 3 Development tools

The Kinetis SDK 1.3.0 was compiled and tested with these development tools:

- Kinetis Design Studio IDE v3.0
- IAR Embedded Workbench for ARM<sup>®</sup> version 7.40.5
- MDK-ARM Microcontroller Development Kit (Keil)<sup>®</sup> 5.15
- Makefiles support with GCC revision 4.9-2015-q1-update from ARM Embedded

## 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
<b>TWR-KV46F150M (Rev. C)</b>	<b>MKV46F256VLL16</b> , MKV46F256VLH16, MKV46F128VLH16, MKV46F128VLL16, MKV44F256VLH16, MKV44F128VLF16, MKV44F256VLL16, MKV44F128VLH16, MKV44F128VLL16, MKV44F64VLH16, MKV44F64VLF16, MKV42F256VLH16, MKV42F256VLL16, MKV42F128VLF16, MKV42F128VLH16, MKV42F128VLL16, MKV42F64VLH16, MKV42F64VLF16

## 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/...
Driver examples	<install_dir>/examples/<board_name>/driver_examples/...
Documentation	<install_dir>/doc/...
USB Documentation	<install_dir>/doc/usb/...
Projects to build libraries	<install_dir>/lib/...
Middleware	<install_dir>/middleware/...
TCP/IP stacks	<install_dir>/middleware/tcpip/...
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/...

Compared to KSDK v.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/Include/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`.

## 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
- RTOS (FreeRTOS,  $\mu$ C/OS-II,  $\mu$ C/OS-III, MQX 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,  $\mu$ C/OS-II,  $\mu$ C/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* (document KSDK13KV4XAPIRM).

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. 1.3 Demo Applications User's Guide* (document KSDK13KV4XDEMOUG).

## 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.1.3 Demo Applications User's Guide* (document KSDK13KV4XDEMOUG).

## 6.4 Other integrated software solutions

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

### 6.4.1 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.

### 6.4.2 RTOS

The Kinetis SDK is pre-integrated with Freescale MQX RTOS, FreeRTOS,  $\mu$ C/OS-II, and  $\mu$ C/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 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.

## 7.4 Patch description

Patch Name	Description
Keil.Kinetis_KVxx_DFP.1.5.0.pack	Patch KVxx for Keil $\mu$ Vision v5.15

## 7.5 Applying patches

The patch for MKV46F256xxx16 does not provide support for all compilers now, so you will need to wait for the patch version for it. Install the MKV46F256xxx15 to temporarily replace MKV46F256xxx16 and to apply a patch for Keil  $\mu$ Vision v5.15. These patches can be obtained from [www.keil.com/dd2/pack/](http://www.keil.com/dd2/pack/).

## 7.6 J-Link software version

To program MKV4x derivatives (TWR-KV46F150M Tower System module), ensure that SEGGER J-Link software version 5.02a or higher is installed from [www.segger.com/jlink-software.html](http://www.segger.com/jlink-software.html).

## 7.7 FreeRTOS with Collect runtime statistics, Visualization and tracing, and Statistics formatting functions

If FreeRTOS is used with Collect runtime statistics, Visualization and tracing, and Statistics formatting functions features, then the build fails because of missing Utility.h and Utility.c. The workaround for this issue is to download Utility.h and Utility.c from [https://github.com/ErichStyger/mcuoneclipse/tree/master/Examples/KDS/FRDM-K64F120M/Lab\\_KSD\\_K\\_FreeRTOS/Sources](https://github.com/ErichStyger/mcuoneclipse/tree/master/Examples/KDS/FRDM-K64F120M/Lab_KSD_K_FreeRTOS/Sources). Install Utility.h into <install\_dir>/rtos/FreeRTOS/include/ and Utility.c into <install\_dir>/rtos/FreeRTOS/src/.

## 8 Installation instructions

### 8.1 Installation guide

Run the installer for Freescale Kinetis SDK v.1.3.0 KV4x to install MQX RTOS.

### 8.2 Build procedure

For build procedures, see the *Getting Started with Kinetis Software Development Kit (KSDK) v.1.3 for KV4x Derivatives* (document KSDK13KV4XGSUG).

### 8.3 Jumper settings

These are the jumper settings for TWR-KV46F150M Tower System module standalone operation:

- J20 default ON
- J21 default NOT SHUNT
- J512 default at 1-2 position when powering the OpenSDA MCU. BOOTLOADER mode can be selected, and at 2-3 position when OpenSDA when MCU is not powered, the “Reset” button can be used.
- Set all other Jumpers to open.

## 9 Revision history

This table summarizes revisions to this document.

<b>Revision history</b>		
<b>Revision number</b>	<b>Date</b>	<b>Substantive changes</b>
0	10/2015	Initial release

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