

TU0777
Tutorial
Designing SmartFusion with Keil



Power Matters.™

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1 Revision History

The revision history describes the changes that were implemented in the document. The changes are listed by revision, starting with the most current publication.

1.1 Revision 2.0

The entire document is rewritten based on the latest Keil Microcontroller Development Kit (MDK-ARM).

1.2 Revision 1.0

Revision 1.0 was the first publication of this document.

2 Designing SmartFusion with Keil

Microsemi's SmartFusion® FPGA SoC is supported by Keil's latest release of MDK-ARM. For Keil development, ARM7, ARM9, ARM Cortex-M0, Cortex-M0+, and Cortex-M1 processors; Cortex-M3, Cortex-M4, Cortex-M7, Cortex-M23, Cortex-M33, SC000, and SC300 microcontrollers are used. These tools are easy to learn and use, yet powerful enough for the most demanding embedded applications.

2.1 Microcontroller Development Kit

The Keil Microcontroller Development Kit (MDK-ARM) for ARM includes the following:

- *µVision* IDE, debugger, and flash programmer
- *ARM* compiler 5 and compiler 6 are developed based on LLVM framework, and support C, C++, or assembly language. Compiler 5 and compiler 6 are compatible with the source code written for *GCC*.
- *MicroLib* highly optimized run-time library
- CoreSight serial wire viewer (SWV)
- Keil *RTX* deterministic real-time operating system (included with the complete source code). This full feature RTOS has a BSD license. RTX v5 has an Apache 2.0 license. For more information, see https://github.com/ARM-software/CMSIS_5
- Dynamic Syntax Checking on C/C++ source lines
- *Compiler Safety Certification Kit*
- TÜV certification, SIL3 (IEC 61508), and ASILD (ISO 26262)
- MISRA C/C++ support using *PC-Lint*
- Two kernel aware windows in *µVision*, which gets updated in real time
- Debug adapters: ULINK2, ULINKpro, CMSIS-DAP, and J-Link
- Keil technical support for one year (renewable)
- Affordable perpetual and term licensing
- Support for Microsemi ARM7, Cortex-M1, and Cortex-M3. 8051 is supported with PK51, which also uses *µVision*

2.2 Serial Wire Viewer

Serial Wire Viewer displays PC samples, exceptions (including interrupts), data writes, ITM, CPU counters, and a timestamp. SWV does not steal any CPU cycles, is non-intrusive, and does not require stubs in your source code. SWV works with a ULINK2, ULINK-ME, ULINKpro or J-Link.

If you are new to Keil tools, you can begin with the evaluation version (MDK-Lite and then upgrade to the MDK-Essential, MDK-Plus or MDK-Professional edition. For existing users of Keil MDK-ARM, SmartFusion devices are supported in version 4.0 or later.

2.3 Keil Microcontroller Development Kit for Cortex-M Processors

- MDK-Lite (Evaluation version) 32 K Code and Data Limit – \$0
- MDK-Essential for all Cortex-M series processors – unlimited code limit
- MDK-Plus MiddleWare Level 1– ARM7, ARM9, Cortex-M, and SecureCore
- MDK-Professional MiddleWare Level 2. For more information, see www.keil.com/mdk5/version520.

Note: MDK-Lite does not require a license to use. The addition of a valid license turns MDK-Lite into a commercial version. To support Keil MiddleWare on SmartFusion requires the creation of CMSIS-Drivers. For more information, see www.keil.com/CMSIS.

SmartFusion debugging requires a USB-JTAG adapter or debug probe. ULINK2, ULINKPro, and ULINK-ME support SmartFusion devices.

2.3.1 Design Examples for SmartFusion Using Keil Software

There are multiple design examples and tutorials available for SmartFusion designers using the Keil design environment.

- The MDK-ARM software includes basic examples such as blinky for customer use.
- The Firmware Catalog included as part of the Microsemi Libero Integrated Design Environment (IDE) tools allows for the generation of sample code for any peripheral in the device, exported specifically for the Keil design environment.
- For the evaluation and development kits, published tutorials describe how to use the Keil design environment for complete SmartFusion designs.