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FM4-176L-S6E2CC-ETH

FM4 Starter Kit Guide

Doc. No. 002-09367 Rev. *B

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1. Introduction

The FM4-176L-S6E2CC-ETH Starter Kit provides a low-cost solution to quickly start development on an Arm® Cortex®-M4 microcontroller. The board features peripheral devices to demonstrate the features of the FM4 S6E2CC microcontroller. It also has an Arduino-compatible interface to connect with shields, making application development options limitless. The FM4 S6E2CC microcontroller comes pre-programmed with an interactive application to test all of the on-board features using a virtual communication port to send message prompts, input test parameters, and output test results.

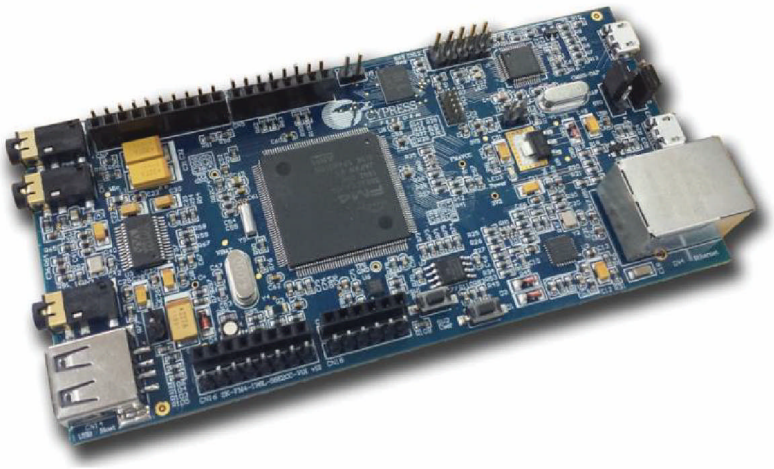
This document is the guide for the FM4-176L-S6E2CC-ETH starter kit. It provides a hardware description for the kit and software development resources for application development.

This document covers S6E2CC of the starter kit:

- FM4-176L-S6E2CC-ETH

Kit Features:

Feature	FM4-176L-S6E2CC-ETH
FM4 Family S6E2CC MCU	✓
CMSIS-DAP JTAG adapter	✓
Ethernet RJ45 (IEEE802.3)	✓
USB device interface	✓
USB host interface	✓
32Mbit quad SPI flash memory	✓
16Mbit external SRAM memory	✓
Stereo codec	✓
RGB LED	✓
Acceleration sensor	✓
Phototransistor	✓
User button	✓
Arduino-compatible interface	✓
10-pin JTAG interface	✓



CN7 – Arduino shield
CN9 – Arduino shield
CN13
CN1 - JTAG
CN12 - Multicon
LED 1- 3 (power cmsis-dap)
CN5 – Headphone jack
CN11 – Microphone jack
Q3 – Phototransistor
CN6 – Line-in jack
LED4 RGB
CN2 – USB for CMSIS-DAP
J3 & J4
CN3 – USB Device
CN4 – Ethernet
J2 – MD0
SW1 – Reset (INITX)
CN8 – Arduino shield
CN10 – Arduino shield
SW2 – Pushbutton

1.1 Target products

This starter kit document supports evaluating features on these products:

Series	Product Number (not including package suffix)
S6E2CC Series	S6E2CC8, S6E2CC9, S6E2CC
S6E2C1 Series	S6E2C18, S6E2C19, S6E2C1A
S6E2C2 Series	S6E2C28, S6E2C29, S6E2C2A
S6E2C3 Series	S6E2C38, S6E2C39, S6E2C3A
S6E2C4 Series	S6E2C48, S6E2C49, S6E2C4A
S6E2C5 Series	S6E2C58, S6E2C59, S6E2C5A

2. How to Use the FM4-176L-S6E2CC-ETH

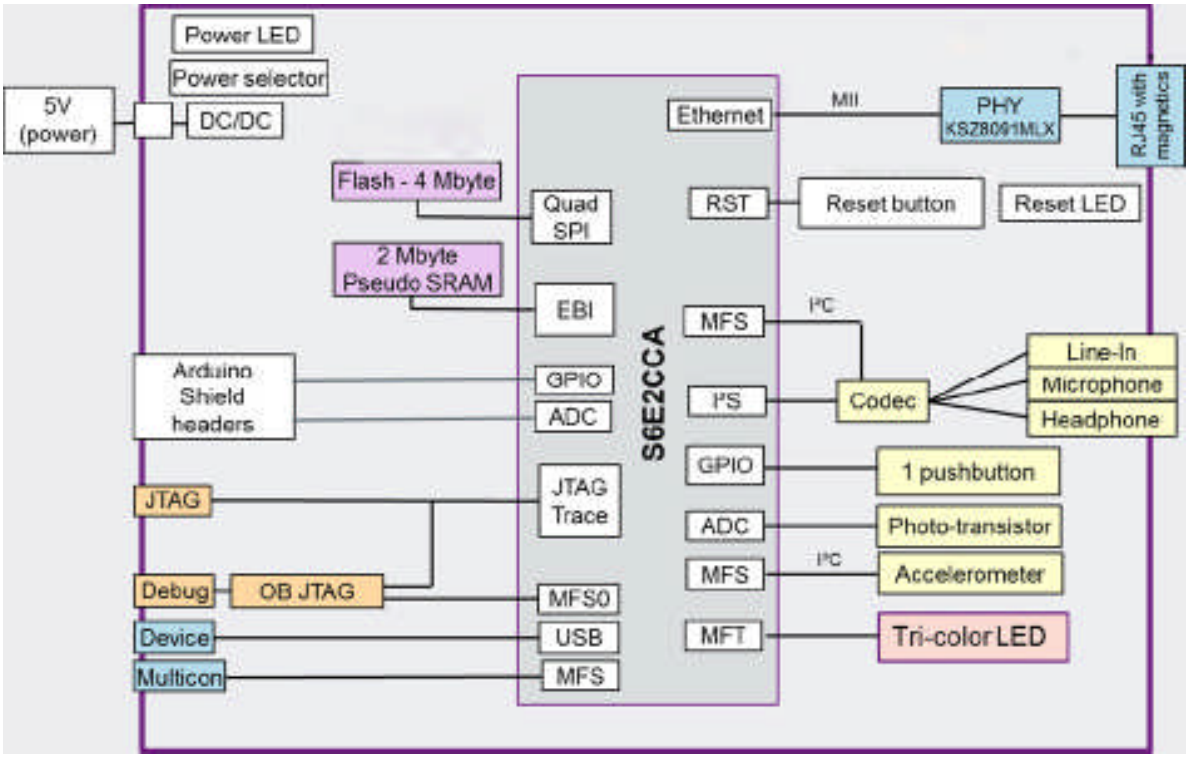
To initially start with the FM4-176L-S6E2CC-ETH starter kit, you should follow the Quick Start Guide. This will guide you through the initial steps of powering the board and running the preprogrammed demonstrations.

To begin actual development, the software resources are found on the product page for the FM4-176L-S6E2CC-ETH Starter Kit. Within the software resources are all the components needed for application development on the S6E2CC device and programming tools.

3. Hardware Description

The FM4-176L-S6E2CC-ETH starter kit includes an S6E2CC device, a CMSIS-DAP JTAG emulator, and external devices to interface to the on-chip peripherals of the S6E2CC device.

This section provides information on how to operate these external devices and how to interface with the S6E2CC device.



3.1 MCU and Base Level Components of the Hardware

This section contains information on the MCU, Arduino interface, user button and user LED, and the Multicon interface.

3.1.1 MCU

The S6E2CC device is part of the 32-bit, general-purpose series based on the ARM Cortex-M4 processor core with 2 MB flash memory and 256 KB SRAM. The series, which features DSP and floating point (FPU) functions, covers the highest end of the product range. The S6E2CC Series has an I^2S port for communication with an audio codec and an external memory bus to interface with system SRAM. Standard peripheral functions such as timers, ADCs, DACs, and communication and display interfaces are also included.

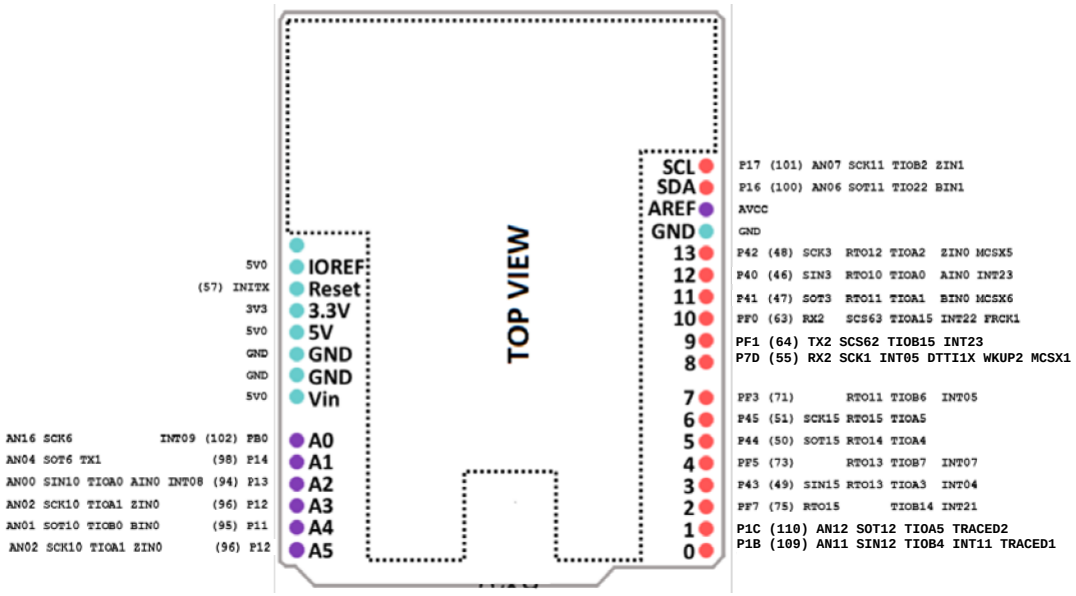
The S6E2CC device on the FM4-176L-S6E2CC-ETH starter kit board is factory programmed with a board test application that checks peripherals. For full details of how to run the board test application, refer to the Quick Start Guide.

3.1.2 Arduino Interface

The following table and figure show the interconnects provided for the standard Uno3 Arduino Shields. The table is useful for planning your design and pin usage. The figure after the table is useful for debugging the interface.

Important note: Although the IOREF is connected to 5 V, the FM4-176L-S6E2CC-ETH is a 3V3 system that has to be considered while connecting external hardware.

Pin No.	Pin Name	Arduino I/F	Arduino Connector designation	Multicon
1	VCC			
46	P40/**SIN3_1**/RTO10_0/TIOA0_0/AIN0_0/INT23_0/MCSX7_0	MISO	CN7-5	CN12-7
47	P41/**SOT3_1**/RTO11_0/TIOA1_0/BIN0_0/MCSX6_0	MOSI	CN7-4	CN12-2
48	P42/**SCK3_1**/RTO12_0/TIOA2_0/ZIN0_0/MCSX5_0	CLK	CN7-6	CN12-1
49	P43/SIN15_0/**RTO13_0**/TIOA3_0/**INT04_0**/MCSX4_0	PWM/INT	CN9-4	CN12-6
50	P44/SOT15_0/**RTO14_0**/TIOA4_0/MCSX3_0	PWM	CN9-6	CN12-8
51	P45/SCK15_0/**RTO15_0**/TIOA5_0/MCSX2_0	PWM	CN9-7	
55	**P7D**/SCK1_1/RX2_0/DTTI1X_0/INT05_0/WKUP2/MCSX1_0	IO	CN7-1	
57	INITX	RESET	CN8-6	
63	**PF0/SCS63_0**/RX2_1/FRCK1_1/TIOA15_1/INT22_1	SS	CN7-3	CN12-5
64	PF1/SCS62_0/TX2_1/**TIOB15_1**/INT23_1	PWM	CN7-2	
71	**PF3**/RTO11_1/TIOB6_1/INT05_1/MCASX_0	IO	CN9-8	
73	**PF5**/RTO13_1/TIOB7_1/INT07_1/MCSX8_0	IO	CN9-5	
75	PF7/RTO15_1/TIOB14_1/**INT21_1**/MSDCLK_0	INT	CN9-3	
94	P10/**AN00**/SIN10_0/TIOA0_2/AIN0_2/INT08_0	A3	CN10-3	
95	P11/**AN01/SOT10_0**/TIOB0_2/BIN0_2	A4/SDA10	CN10-2	
96	P12/**AN02/SCK10_0**/TIOA1_2/ZIN0_2	A5/SCL10	CN10-1	
97	P13/**AN03**/SIN6_1/RX1_1/INT25_1	A2	CN10-4	
98	P14/**AN04/SOT6_1**/TX1_1	A1/SDA6	CN10-5	
100	P16/AN06/**SOT11_0**/TIOA2_2/BIN1_2	SDA11	CN7-9	
101	P17/AN07/**SCK11_0**/TIOB2_2/ZIN1_2	SCL11	CN7-10	
102	PB0/AN16/**SCK6_1**/TIOA9_1	A0/SCL6	CN10-6	
109	P1B/AN11/**SIN12_0**/TIOB4_2/INT11_0/TRACED1	RX	CN9-1	
110	P1C/AN12/**SOT12_0**/TIOA5_2/TRACED2	TX	CN9-2	



3.1.3 User Button and User LED

There is a user button and a user tri-color (RGB) LED on the FM4-176L-S6E2CC-ETH starter kit board.

Port	MCU Pin Number	External Device
P20/NMIX	128	SW2 – User Button
P1A	108	LED4 – Red
PB2	104	LED4 – Green
P18	106	LED4 – Blue
INITX	57	SW1 – MCU Reset

3.1.4 Multicon Interface

The Multicon interface, CN12, is a 2x5 pin connector interface that brings the appropriate signals for UART, SPI, and I^2C interfacing off board. A simple 10-pin cable can be used to route the serial signals and power to a secondary board or system. Pins 9 and 10 connect to an extra connector, CN13, to provide another optional off board connection point.

For additional detail, refer to the schematic.

3.2 Codec, SRAM, and Ethernet

The FM4-176L-S6E2CC-ETH kit provides an I2S audio codec, SRAM and Ethernet connectivity.

3.2.1 Codec

The WM8731 (U3) codec is connected to the I^2S and I^2C peripheral interfaces of the S6E2CC. The codec is a low-power stereo with an integrated headphone driver. It offers the unique ability to independently program the ADC and DAC sample rates from a single clock source. The respective sample rates from the clock source are on signals ADCLRC and DACLRC.

The analog switch SN74LVC1G3157DBVR (U4) controls the clock selection to interface to the ADCLRC or DACLRC for transmission. The default status of the analog switch SN74LVC1G3157DBVR (U4) is the DAC (B2) connected to the I^2S module interface of the S6E2CC device. To connect the ADC (B1) to I^2S module interface of the S6E2CC device, set the S signal to low.

There is a microphone jack, a headphone jack, and a line-in jack connected to the codec for specific application use options.

- CN11 is a microphone jack
- CN5 is a headphone jack
- CN6 is a line-in jack

For additional detail, refer to the schematic. The I^2C address is 0x1A.

3.2.2 SRAM

The CY62147EV30LL-45B2XI (U5) is a 2 MB SRAM connected to the external bus interface of the S6E2CC device. The connection to the SRAM uses 20 address lines, 16 data lines, and 6 control lines.

For additional detail, refer to the schematic.

3.2.3 Ethernet

The Ethernet interface of the S6E2CC is connected to an Ethernet circuit consisting of a PHY and RJ45 to enable full Ethernet application development. The KSZ8091 is a single-supply 10Base-T/100Base-TX Ethernet PHY for transmission and reception of data and supports twisted pair (UTP). The J00-0045NL (CN4) is a standard 10/100.

Base-TX RJ45 connector with integrated magnetics that is IEEE 802.3 compliant.

For additional detail, refer to the schematic.

3.3 Programming and Debug Options

3.3.1 CMSIS-DAP

The Cortex Microcontroller Software Interface Standard – Debug Access Port (CMSIS-DAP) provides an on-board JTAG emulator to enable programming and debugging of the S6E2CC device. The CMSIS-DAP is supported by all major IDEs. See the list in Section 4.4. The CMSIS-DAP also provides a virtual communication port that connects to the UART0 of the S6E2CC device.

The CMSIS-DAP module provides power to the FM4-176L-S6E2CC-ETH starter kit board via the CN2 connector when J4 is in 1-2 position. The CMSIS-DAP firmware solution supports full JTAG configuration and a two-wire connection to the Serial Wire Debug (SWD) interface.

The CMSIS-DAP firmware can be updated with new revisions when necessary. For step-by-step instructions of updating the CMSIS-DAP firmware, see Support Software download cmsisdap_fw_update.zip.

3.3.2 JTAG

The FM4-176L-S6E2CC-ETH starter kit board has the option to populate the CN1 to connect an external JTAG emulator from a third party vendor. CN1 is a standard ARM 10-pin Cortex debug pinout.

For more information on standard ARM debug pin outs, go to infocenter.arm.com.

3.3.3 USB Direct

USB Direct is a method to program the S6E2CC device via USB interface by invoking an internal ROM bootloader. The required USB Direct programmer can be downloaded online from www.cypress.com. The tool communicates with the ROM bootloader through a graphical user interface. The Flash USB Direct Programmer can program, erase, and verify memory contents of the S6E2CC device

To invoke the internal ROM boot loader, see the table below for jumper settings.

Jumper and Position	Pin Number	Pin Function
J2 closed	85	MD0 – mode pin
J3 2-3 position	172	P60 – port to select USB or UART boot method.
J4 2-3 position	N/A	Power board via USB CN3

After all jumpers have been positioned properly, connect a USB cable between CN3 and PC. The ROM bootloader will be invoked when MD0 and P60 are high level through a reset or power on. See 4.3.2 Program with USB Direct Programmer and ROM Bootloader for step by step instructions.

3.4 Additional Board Features

This section describes the USB device, acceleration sensor, and phototransistor features that are on the FM4-176L-S6E2CC-ETH starter kit board.

3.4.1 USB

Connector CN3 is a micro-B connector that interfaces to the USB0 peripheral of the S6E2CC device to enable development of USB device applications. Transistor MMC8550 is used to force a termination of the USB communications.

Connector CN14 is a USB type-A socket that interfaces to the USB1 peripheral of the S6E2CC device to enable development of USB host applications. A USB power switch and overcurrent protection is implemented by U4 (AP2141), using the GPIO P32 (pin 125) and INT24_1 (pin 107).

For additional detail, refer to the schematic.

3.4.2 Acceleration Sensor

The KXCJK is a low power tri-axis accelerometer that interfaces to the I^2C peripheral of the S6E2CC device. The KXCJK features user-selectable g-force range and output data rate and configurable resolution. The I^2C address is 0x0E.

3.4.3 Light Sensor

PT11-21C/L41/TR8 is a phototransistor in a miniature SMD package that can be used for applications as an opto-electronic switch, video, and infrared-applied system. PT11-21C/L41/TR8 (Q3) interfaces to the S6E2CC device via the analog module at pin 103, AN17.

4. Software Development

This section contains information for the software resources that are available to support the S6E2CC device and FM4-176L-S6E2CC-ETH starter kit.

4.1 Source Code

The software resources provided with the FM4-176L-S6E2CC-ETH starter kit includes:

- Peripheral Driver Library (PDL) with API driver functions
- Prebuilt templates with PDL integrated for IAR, ARM/Keil, and Atollic
- Examples to demonstrate use of all S6E2CC device peripherals
- Examples to demonstrate the FM4-176L-S6E2CC-ETH starter kit features and target applications

The Peripheral Driver Library (PDL) API set is a full suite of pre-written functions to initialize and operate the on-chip peripherals. The examples in the PDL folder demonstrate the APIs being used to initialize, set the mode, and configure each peripheral.

4.2 Tool Options

The S6E2CC series is supported by several 3rd party tool vendors, and you have the option to select your preferred vendor. For demonstrating examples, main IDEs are supported by having a prebuilt template and examples with the PDL integrated. The main.c and pdl_user.h of any example can be copied and pasted into the source folder, and then opened and compiled for immediate use in any one of these IDEs:

- ARM/Keil uVision Integrated Development Environment
- IAR Embedded Workbench for ARM
- Atollic GCC Compiler
- iSytem winIDEA open

Download evaluation versions of these tools from the vendors' websites. A full license may necessary to build or debug some of the examples. For detailed information on using the tools, see the documentation in the tool chain help section or on the website of the tool supplier.

4.3 Using the Example Software in the Template with PDL

This section is to provide step by step guide to programming an example into the S6E2CC device on the FM4-176L-S6E2CC-ETH Starter Kit using two of the methods in 3.3 .

- CMSIS-DAP JTAG emulator with IDE
- USB Direct Programmer with internal ROM boot loader

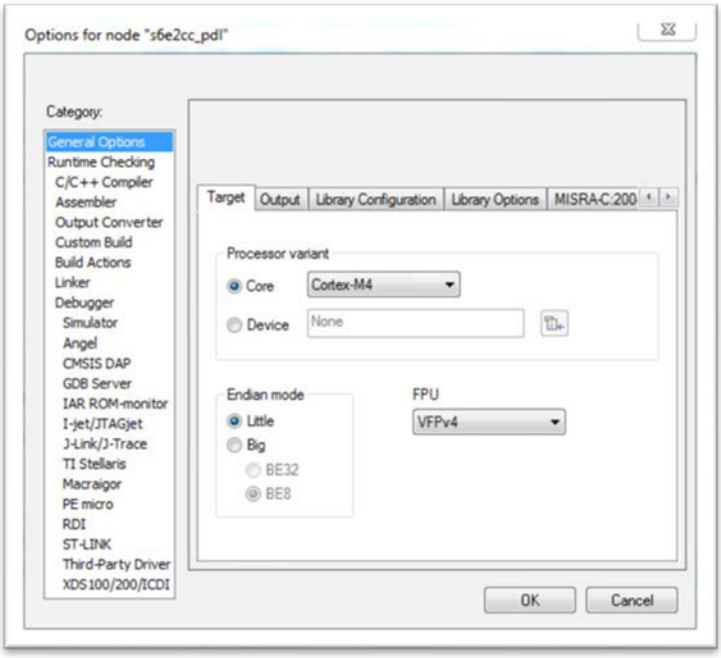
4.3.1 Program with CMSIS-DAP JTAG Emulator using the IDE from IAR

The following section describes how to setup the CMSIS-DAP debugger within the IAR Embedded Workbench.

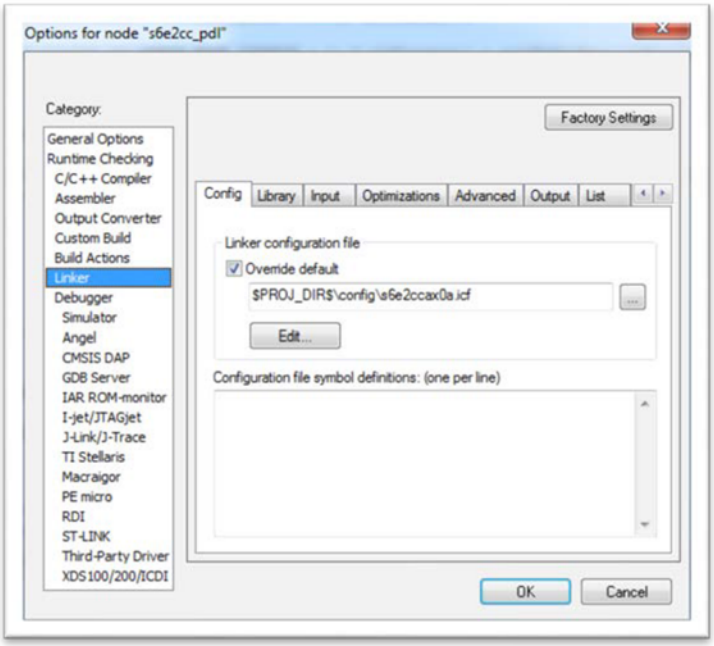
Select Project/Options and ensure that the project settings are as shown in steps 1 to 4. If they are not, change it to be the same as shown by browsing to the correct file within the project template.

Note: All necessary linker and programming algorithm files exist within template.

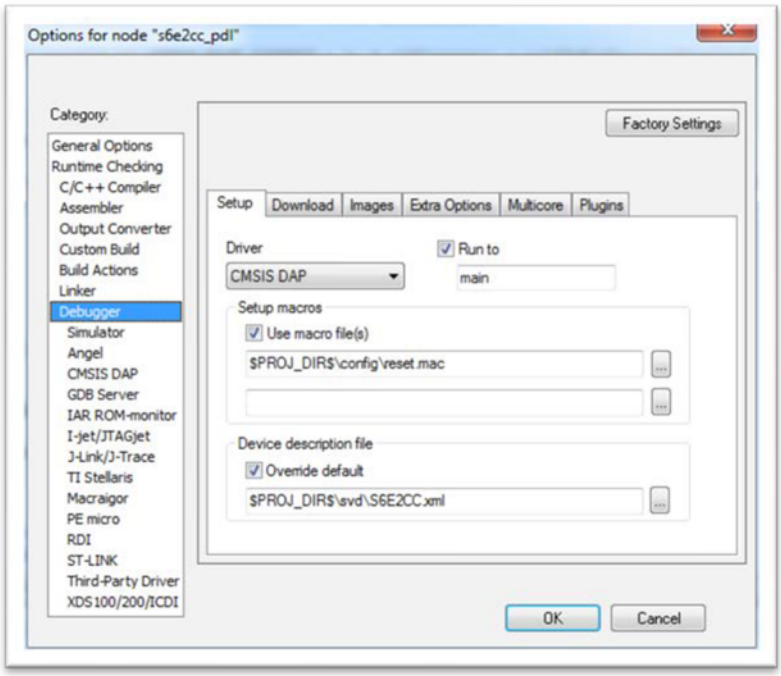
1. General Options:



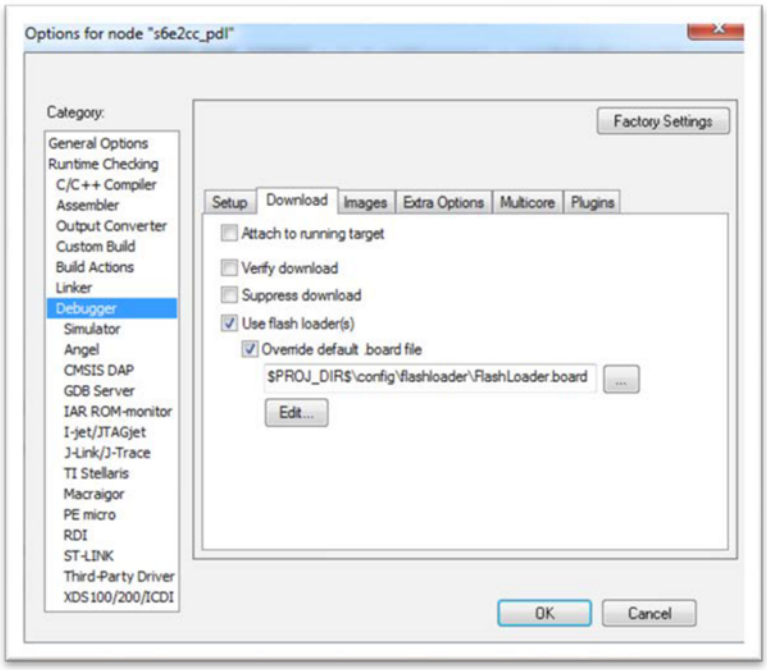
2. Linker



3. Debugger, Setup



4. Debugger, Download



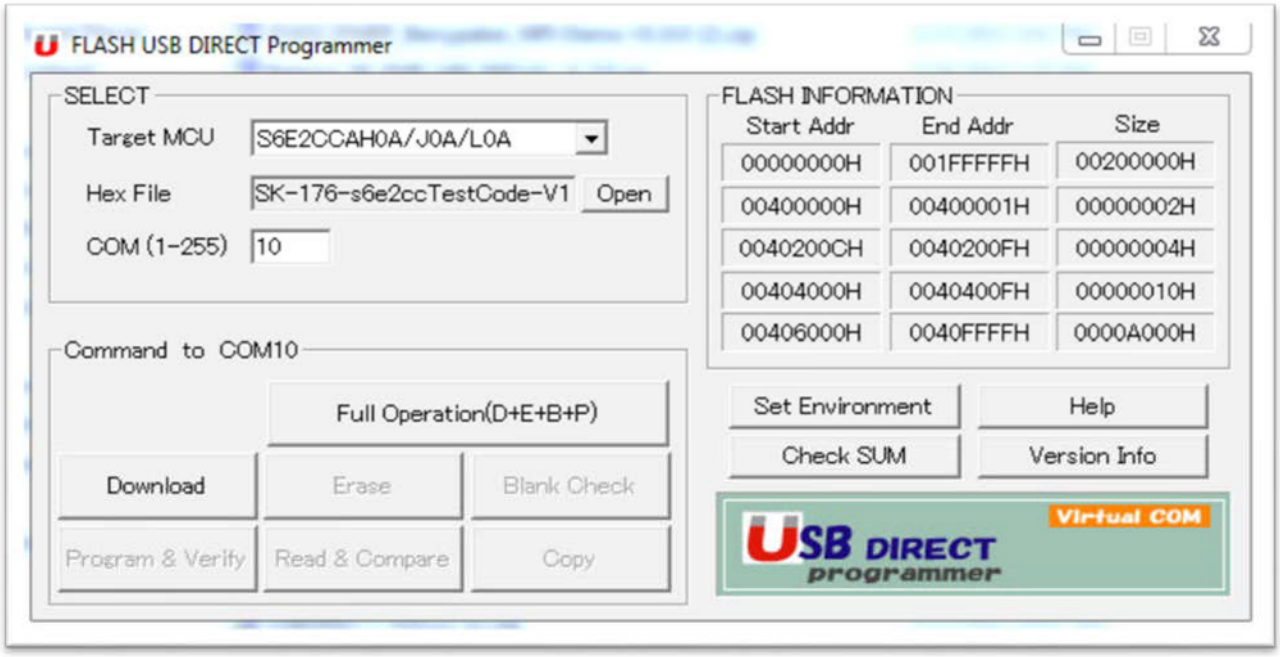
5. Connect the FM4-176L-S6E2CC-ETH via CN2 to the PC.
6. Within IAR Embedded Workbench use Download and Debug ( ).
7. This will connect to the target MCU via JTAG, download the program and enter the debug session. The debugger will halt at main.c.
8. Proceed debugging your project now as usual.

4.3.2 Program with USB Direct Programmer and ROM Bootloader

Follow the step-by-step instructions to program the binary of the board test program.

1. Open the Flash USB Direct Programmer GUI
2. Set the parameters as shown here:
   a. Target MCU: Using pull down menu, select “S6E2CCH0A/J0A/L0A”.
   b. Hex File: Click the Open button and navigate to your project’s *.srec or *.hex file.
   c. COM (1-256): Type in the COM port number that the PC enumerated with when connected to the board. There are two ways to get this information:
      I. Through Windows, navigate through “Control Panel” -> “Device Manager” -> “Ports (COM & LPT)”. You should see “USBVCOM(COMxx)” under the ports list.
      II. Pressing the RESET button (SW1) on the board will force the PC to re-enumerate and message window will temporarily pop up with the COM port number. You should see a message like this “USBVCOM (COMxx) [USB]”.

   Note: If the COM port does not appear to be active, please check that the jumper J2 is in place and that *CN3 is used for the USB connection.*
3. Configuration should look like the figure below.



4. Click on Full Operation (D+E+B+P) button. This will download a flash programming algorithm into the SRAM of the S6E2CC target MCU, erase and program the device.
5. Follow the prompts to reset the device as needed to complete the programming process.
6. A popup window will indicate that the Hex File (*.srec/*.hex) is successfully programmed.
7. To run the code, remove jumper J2 and press the reset button.

Revision History

Document Revision History

Document Title: FM4-176L-S6E2CC-ETH, FM4 Starter Kit Guide Document Number: 002-09367				
Revision	**ECN No.**	**Issue Date**	**Origin of Change**	**Description of Change**
**	–	03/26/2015	HOWE	Initial release.
*A	5815398	7/13/2017	HOWE	Migrated Spansion Document from FM4_AN709-00010-1v1-E to Cypress format .
*B	6035956	01/17/2018	HOWE	Changing document category from Application Note to Kit Guide and publishing to Web with fixes.