FM4 S6E2H-Series

Starter Kit Guide

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1. Introduction

Thank you for your interest in the FM4-120L-S6E2HG FM4 S6E2H-Series Starter Kit. The FM4 S6E2H-Series Starter Kit enables customers to evaluate and develop projects using the FM4 device family. Flexible MCU 4 (FM4) is a portfolio of high-performance ARM® Cortex®-M4 MCUs that includes hardware support for digital signal processing and floating-point operations, designed for safety-critical, industrial systems and home appliance applications. There are multiple series of device families in this portfolio. The S6E2C-Series, S6E2H-Series and S6E2G-Series are few of the prominent series of device families. This kit uses a device from the S6E2H-Series.

Devices in the S6E2H-Series are highly integrated 32-bit microcontrollers with high performance at a competitive cost. This series is based on the ARM® Cortex®-M4 processor, including floating point instructions, with on-chip flash memory and SRAM. The series has peripherals such as motor control timers, A/D converters, and communications interfaces like CAN, UART, CSIO, I2C and LIN. The S6E2H-Series of FM4 devices offers up to a 160-MHz CPU, 512 Kbytes Main Flash, 32 Kbytes Work Flash, 64KB SRAM, 100 GPIOs, 24 digital peripherals and 2 analog peripherals.

The FM4 S6E2H-Series Starter Kit routes all pins out, which provides limitless options for application development. It is intended to aid the customer to evaluate the featured peripherals of the S6E2H-Series. In order to properly enable our customers, the FM4 S6E2H-Series Starter Kit is aligned to our low cost development systems, aligning this kit with our successful line of Starter Kits in form, price and flexibility.

1.1 Kit Contents

The FM4 S6E2H-Series Starter Kit contains the following, as shown in Figure 1-1.

- FM4 S6E2H-Series Starter board
- USB Standard-A to Micro-B cable
- Quick Start Guide

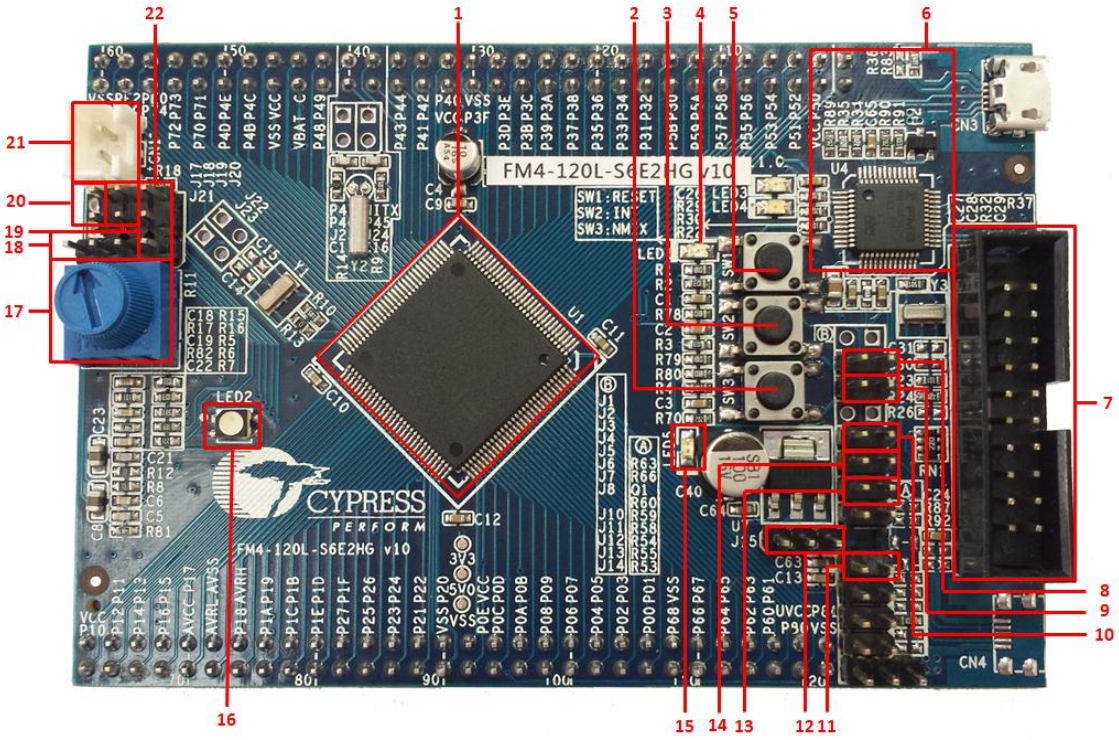
Figure 1-1: Kit Contents



Inspect the contents of the kit; if you find any part missing, contact your nearest Cypress sales office for help: www.cypress.com/support.

1.2 Board Details

Figure 1-2: FM4 S6E2H-Series Starter Kit Markup



1. Cypress FM4 MCU S6E2HG6A0J
2. Non-Maskable Interrupt pin (NMIX) switch (SW3)
3. User button (SW2)
4. Reset LED
5. Reset button
6. MB9AF312K Programmer and Debugger (CMSIS-DAP)
7. 20-pin JTAG interface (CN2)
8. VBUS selection jumper for CMSIS-DAP (J2)
9. Programmer and debugger enable jumper (J3)
10. Programming mode jumper of MB9AF312K (J5)
11. Jumper to connect SW3 to NMIX (J10)
12. On-board voltage select (J15)
13. Select power from CMSIS-DAP (J7)
14. Select power from peripheral (J6)
15. Power supply LED
16. RGB LED
17. Potentiometer (R11)
18. Jumper for Pin56 multifunction select (J21)
19. Jumper to connect S6E2HG SIN0 to CMSIS-DAP (J19)
20. Programming mode (MD0) jumper of S6E2HG (J18)
21. Battery connector (CN1)
22. Jumper to connect S6E2HG SOT0 to CMSIS-DAP (J20)

1.3 Jumper and Connector

Table 1-1: Connector Description

Connector	Description
CN1	Battery connector
CN2	20-pin JTAG interface
CN3	USB port of CMSIS-DAP
CN5	SD card interface

Table 1-2: Jumper Description

Jumper	Function	Setting
J2	VBUS detection of CMSIS-DAP Used for VBUS detection function (pin 60) of MB9AF312K on board	Open: For on-board voltage is 3.3V
		Closed: For on-board voltage is 5.0V
J3	Programmer and Debugger select	Open: Enable CMSIS-DAP unit
		Closed: Disable CMSIS-DAP unit
J5	Pull down the MD0 of MB9AF312K	Open: Run mode
		Closed: Serial programming mode
J6, J7, J8	Power supply source select Select only one power source!	Closed J6: Powered by peripheral at J16
		Closed J7: Powered by CN3 (USB port of CMSIS-DAP)
		Closed J8: Powered by CN2 (20-pin JTAG interface)
J10	SW3 connect	Open: SW3 is disconnected from the S6E2HG
		Closed: SW3 is connected to the S6E2HG
J15	On-board voltage select	Pin1 to Pin2: Sets MCU voltage at 3.3V Pin 2 to Pin3: Sets MCU voltage at 5V
J18	Pull down the MD0 of S6E2HG	Open: Run mode
		Closed: Serial programming mode
J19	CMSIS-DAP virtual COM connect	Open: SIN0_0 is disconnected from CMSIS-DAP
		Closed: SIN0_0 is connected with CMSIS-DAP
J20	CMSIS-DAP virtual COM connect	Pin1 to Pin2: SOT0_0 is connected with CMSIS-DAP
		Pin2 to Pin3: Pull down the P22 of MB9AF312K
J21	MD1/PE0 function select	Pin1 to Pin2: Pull down MD1 (Programming-Mode)
		Pin2 to Pin3: PE0 drives the blue LED

1.4 Getting Started

This guide will help you get started with the FM4 S6E2H-Series Starter Kit:

- The Installation and Test Operation chapter describes the kit installation and test operation. This includes the CMSIS-DAP driver to enable the CMSIS-DAP debugger, Serial Port Viewer Tool to view the serial port communication, Flash MCU programmer and Flash USB Direct programmer to program the hex files on the device.
- The Hardware chapter describes the major features of the FM4 S6E2H-Series Starter Kit and functionalities such as CMSIS-DAP debugger, RGB LED, and buttons.
- The Software Development chapter describes the available software resources and tools, and how to create a project based on the Peripheral Driver Library (PDL).
- The Appendix provides the kit schematics, and the bill of materials (BOM).

1.5 Additional Learning Resources

Cypress provides a wealth of data at www.cypress.com to help you to select the right MCU device for your design, and quickly and effectively integrate the device into your design. The following is an abbreviated list for FM4 family resources:

- **Overview**: S6E2H-Series fact sheet
- **Device Selector** : Microcontroller Select Guide
- **Datasheets**: S6E2H-Series datasheet and Handling precautions.
- **FM4 Peripheral Manual**: Main Section, Communication Macro Section, Analog Macro Section, Timer Section.

The documents listed above can be accessed from the kit's webpage at www.cypress.com/FM4-120L-S6E2HG.

1.6 Technical Support

For assistance, visit Cypress Support or contact customer support at +1(800) 541-4736 Ext. 2 (in the USA) or +1(408) 943-2600 Ext. 2 (International).

1.7 Acronyms

Table 1-3. Acronyms Used in this Document

Acronym	Description
ADC	Analog-to-Digital Converter
CMSIS-DAP	Debug Access Port
GPIO	General Purpose Input/Output
I2C	Inter-Integrated Circuit
IDE	Integrated Development Environment
LDO	Low Drop Out (voltage regulator)
LED	Light-Emitting Diode
INT	Interuppt
RGB	Red Green Blue
JTAG	Joint Test Action Group
MFS	Multi Function Serial
PDL	Peripheral Driver Library
SWD	Serial Wire Debug
UART	Universal Asynchronous Receiver Transmitter
USB	Universal Serial Bus

2. Installation and Test Operation

This chapter describes the steps to install the software tools on a PC for using the FM4 S6E2H-Series Starter Kit. After successful installation, the user can run pre-programmed test code on the device.

2.1 Install Software

Follow the steps below to install the FM4 S6E2H-Series Starter Kit software:

1. Download the FM4 S6E2H-Series Starter Kit installer from the webpage www.cypress.com/FM4-120L-S6E2HG. The Kit software is available for download in three formats.
   - **FM4 S6E2H-Series Starter Kit Complete Setup**: This installation package contains the files related to the kit, including the Documentation, Hardware, Firmware, Software tools and drivers. However, it does not include the Windows Installer or Microsoft .NET framework packages. If these packages are not installed on your computer, the installer directs you to download and install them from the Internet.
   - **FM4 S6E2H-Series Starter Kit Only**: This executable file installs only the kit contents, which include kit code examples, hardware files, and user documents. This package can be used if all the software prerequisites (listed in step 7) are already installed on your PC.
   - **FM4 S6E2H-Series Starter Kit DVD ISO**: This file is a complete package, stored in a DVD-ROM image format, which you can use to create a DVD or extract using an ISO extraction program such as WinZip® or WinRAR. The file can also be mounted like a virtual CD/DVD using virtual drive programs such as Virtual CloneDrive and MagicISO. This file includes all the required software, utilities, drivers, hardware files, and user documents.
2. If you have downloaded the ISO file, mount it as a virtual drive. Extract the ISO contents if you do not have a virtual drive to mount the ISO file. Double-click **cyautorun.exe** in the root directory of the extracted content or the mounted ISO if “Autorun from CD/DVD” is not enabled on the PC. The installation window will appear automatically.

   Note: If you are using the “Kit Complete Setup” or “Kit Only” package, then go to step 4 for installation.

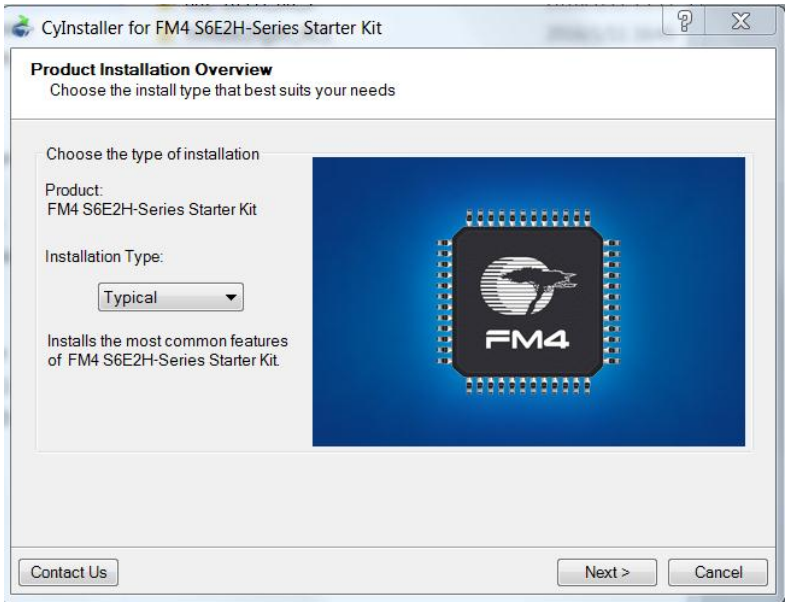
3. Click **Install FM4-120L-S6E2HG** to start the kit installation, shown as Figure 2-1.

Figure 2-1: Kit Installation Window



4. Select the folder in which you want to install this package or use the default folder and click **Next**.
5. Choose the **Typical**, **Custom**, or **Complete** installation type (select **'Typical'** if you do not know which one to select) in the Product Installation Overview window, as shown in Figure 2-2. Click **Next** after you select the installation type.

Figure 2-2: Product Installation Overview

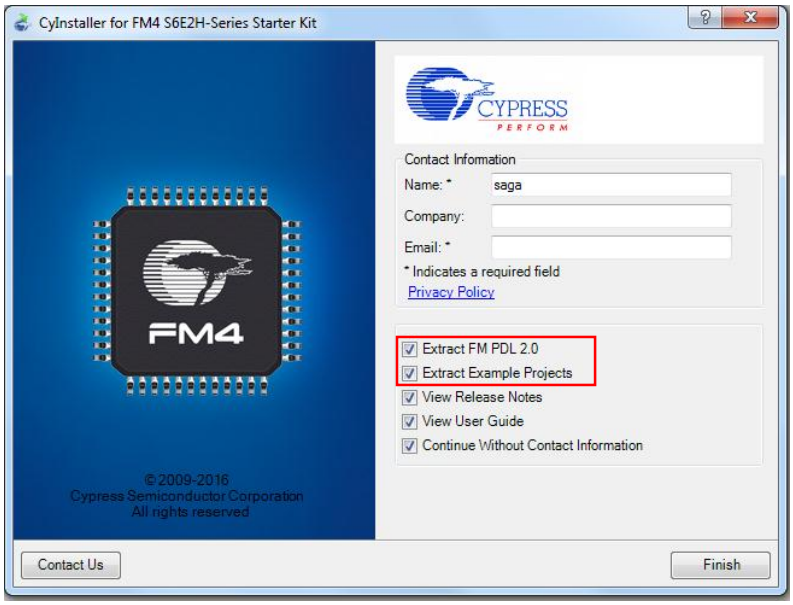


6. Read the License agreement and select **I accept the terms in the license agreement** to continue with installation.

7. When you click **Next**, the FM4 S6E2H-Series Starter Kit installer automatically installs the required software, if it is not present on your PC. Following are the required software and driver:
   - FM Universal Peripheral Driver Library (PDL)
   - Serial Port Viewer
   - FLASH USB DIRECT Programmer
   - FLASH MCU Programmer
   - CMSIS-DAP driver
8. When the installation begins, a list of packages appears on the installation page. A green check mark appears next to each package after successful installation.
9. If you are an un-registered user either enter your contact information or select the check box **Continue without Contact Information**. If you are a registered user, then the installation procedure will not request you to enter the contact information. Click **Finish** to complete the kit installation.

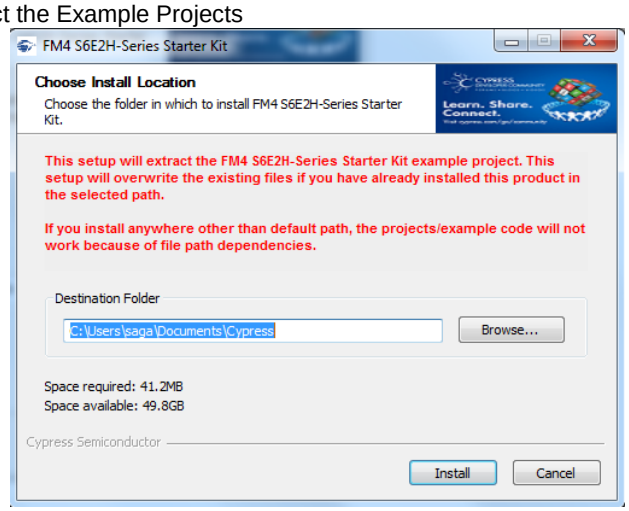
   Note: Ensure that the check boxes **Extract Example Projects** and **Extract FM PDL 2.0** are selected.

Figure 2-3: Launch the Contents



10. View the documents and select the folder in which you want to extract the FM Peripheral Driver Library (PDL) and example projects or leave it as default. Click **Install**.

Figure 2-4: Extract the Example Projects



11. Click **Close** to finish the extraction.

After the installation is complete, the documents and hardware files are available at the following default location:

Windows OS (64-bit): C:\Program Files (x86)\Cypress
\FM4 S6E2H-Series Starter Kit

Windows OS (32-bit): C:\Program Files\Cypress\FM4 S6E2H-Series Starter Kit

The Peripheral Driver Library (PDL) will be extracted to this default directory:
`C:\Users\<User Name>\My Documents\Cypress\FM_PDL_2.0.1`

And, the example projects will be extracted to this default directory:
`C:\Users\<User Name>\My Documents\Cypress`
`\FM4 S6E2H-Series Starter Kit_Ver01`

In the rest of the document, the following directory is termed as <User_Directory>:
`C:\Users\<User Name>\My Documents\Cypress`

2.2 Uninstall Software

The software can be uninstalled using one of the following methods:

- Go to **Start** > **All Programs** > **Cypress** > **Cypress Update Manager** and select the **Uninstall** button that corresponds to the kit software.
- Go to Start > Control Panel > Programs and Features for Windows 7 or Add/Remove Programs for Windows XP; select the Uninstall button.

Note: Uninstalling the Kit software will not remove the FM PDL 2.0 and FM4 S6E2H Series Starter Kit Example Projects from <User_Directory>.

2.3 Test Operation

The FM4 S6E2H-Series Starter Kit has been pre-programmed with a test demo code, which helps you to test all on-board features. The Motorola s-record file, *tp_fm4-120l-s6e2hg.srec*, is provided in the following directory and can be programmed on the MCU by using the FLASH MCU Programmer.

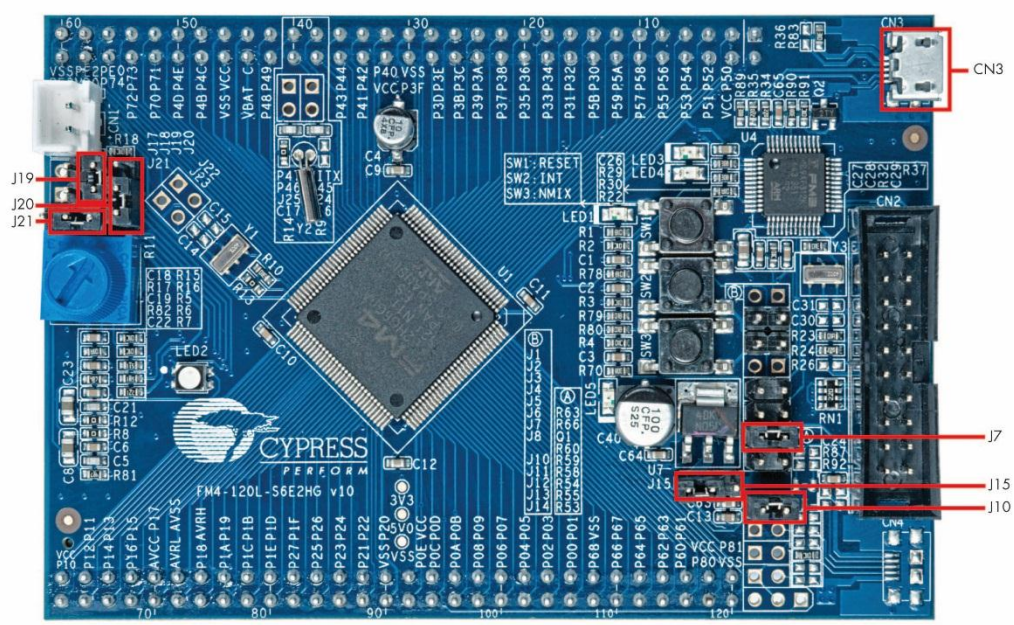
```
<User_Directory>:\FM4 S6E2H-Series Starter Kit_Ver01\Firmware
\Demo Projects\Test_Demo_Code
```

2.3.1 Run the Test Demo

Follow the instructions to run the test demo code.

1. Ensure the jumpers J7, J10 and J19 are closed. Close Pin 1 and Pin 2 of J15 and J20. Close Pin2 and Pin3 of J21 and connect CN3 to a PC using the USB cable provided.

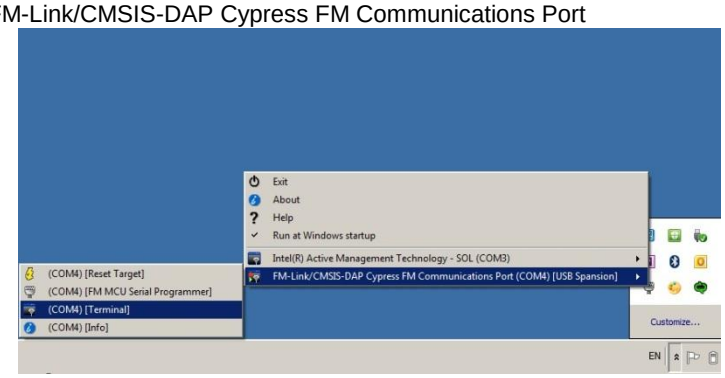
Figure 2-5: Power the Board from CN3



2. Ensure the power LED (LED5) is on and the LED3 blinks with a breathing effect. The RGB LED (LED2) will alternately flash red, green, and blue.
3. If not already launched, then launch the Serial Port Viewer from the start menu under **All Programs** > **Cypress** > **Serial Port Viewer**.

5. Click on the Serial Port Viewer icon in the task bar and select the **FM-Link/CMSIS-DAP Cypress FM Communications Port**.

Figure 2-6: FM-Link/CMSIS-DAP Cypress FM Communications Port



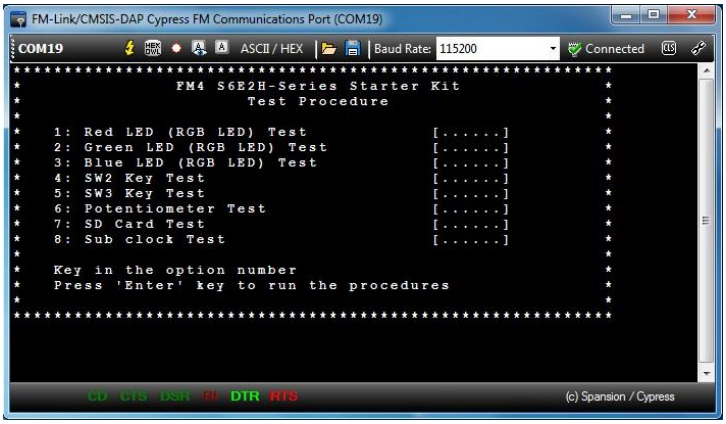
6. Select the baud rate **115200**, and click the **Disconnect** button to connect the board.

Figure 2-7: Select the Baud Rate



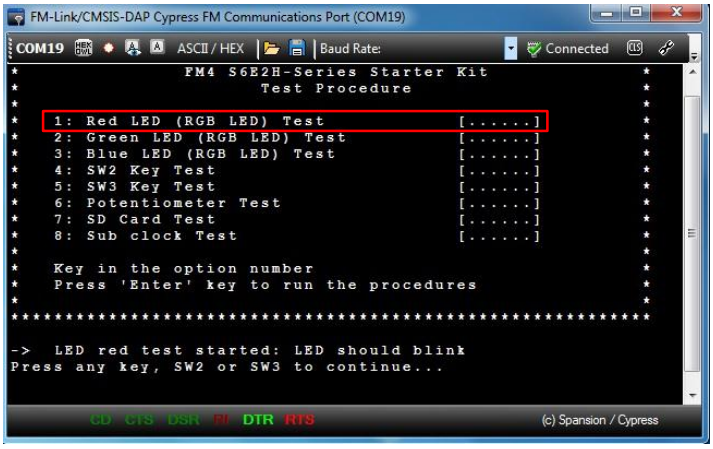
7. Press the **Enter** key on your keyboard to run the test procedure. Key in the option number to run the test and press the **Enter** key to complete the test.

Figure 2-8: Test Procedure



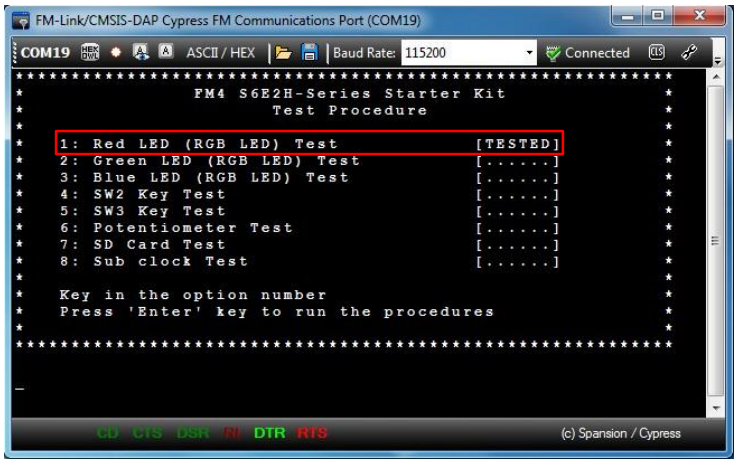
8. For example, key in **1** to test the Red LED.

Figure 2-9: Red LED Test-1



9. Press the **Enter** key to complete the Red LED test. The terminal window will display **TESTED**.

Figure 2-10: Red LED Test-2

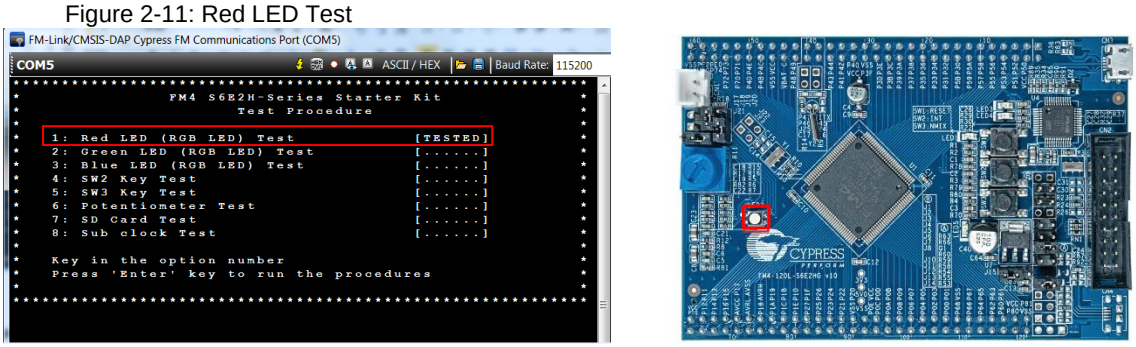


2.3.2 Test Procedure Explanation

This section explains the test procedure. This test procedure is based on the Serial Port Viewer. The user has to key-in the test procedure number displayed on the menu to run the test procedures and then press the **Enter** key on the PC to complete the test. The firmware on the board will run the test procedure and display the results. There are eight test procedures. A short description of each test procedure is given below:

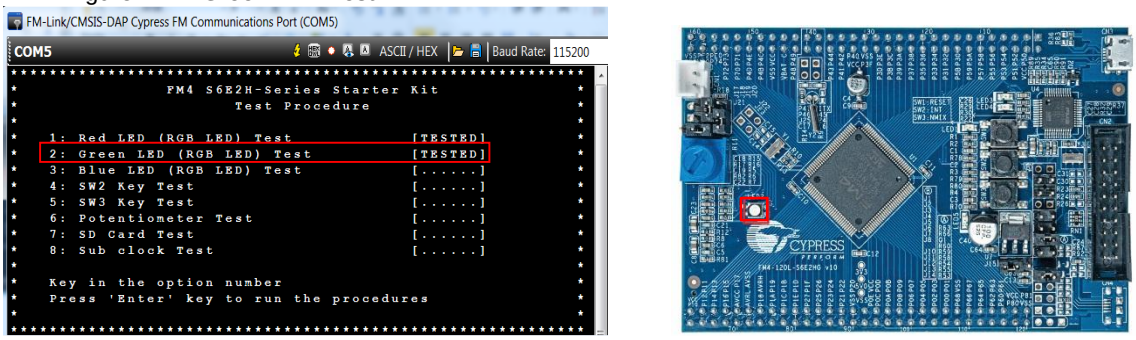
- **Red LED (RGB LED) Test**: This procedure will test whether red LED works normally. Key in **1** to run the test procedure and the red LED will blink. Then press the **Enter** key on the PC to complete the test and **TESTED** will be displayed next to the test.

Figure 2-11: Red LED Test



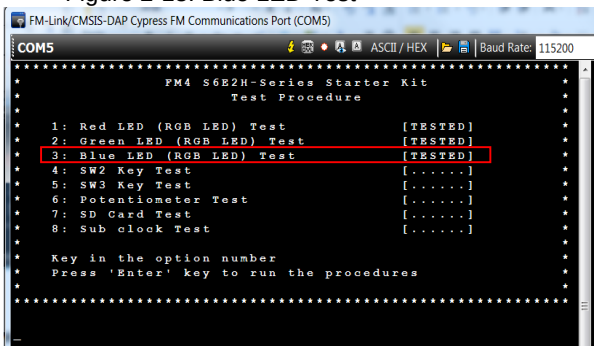
- **Green LED (RGB LED) Test**: This procedure will test whether green LED works normally. Key in **2** to run the test procedure and the green LED will blink. Then press the **Enter** key on the PC to complete the test and **TESTED** will be displayed in the console.

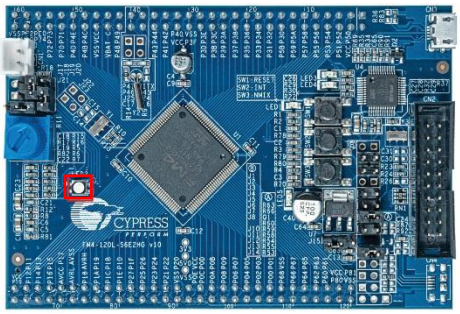
Figure 2-12: Green LED Test



- **Blue LED (RGB LED) Test**: This procedure will test whether blue LED works normally. Key in **3** to run the test procedure and the blue LED will blink. Then press the **Enter** key on the PC to complete the test. **TESTED** will be displayed as shown in Figure 2-13.

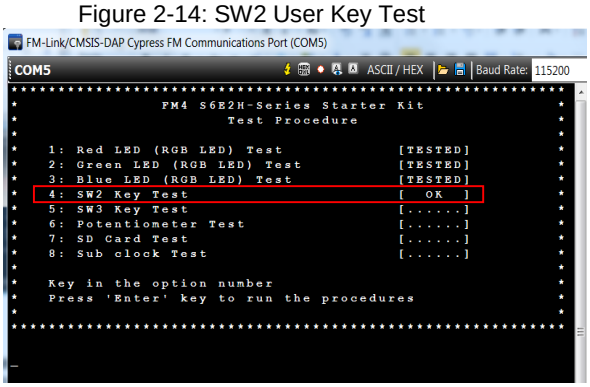
Figure 2-13: Blue LED Test

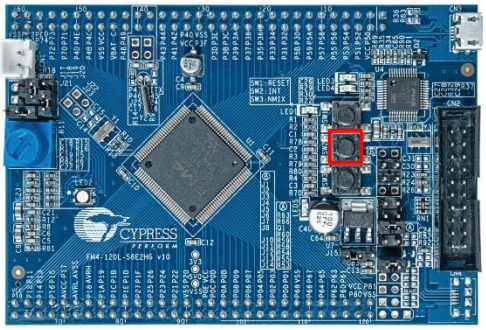




- **SW2 User Key Test**: This procedure is to test switch SW2. Key in **4**, and then press SW2 on the starter board. The RGB LED (LED2) will glow green while SW2 is held down. Release SW2 and press the **Enter** key to complete the test. It will display **OK.**

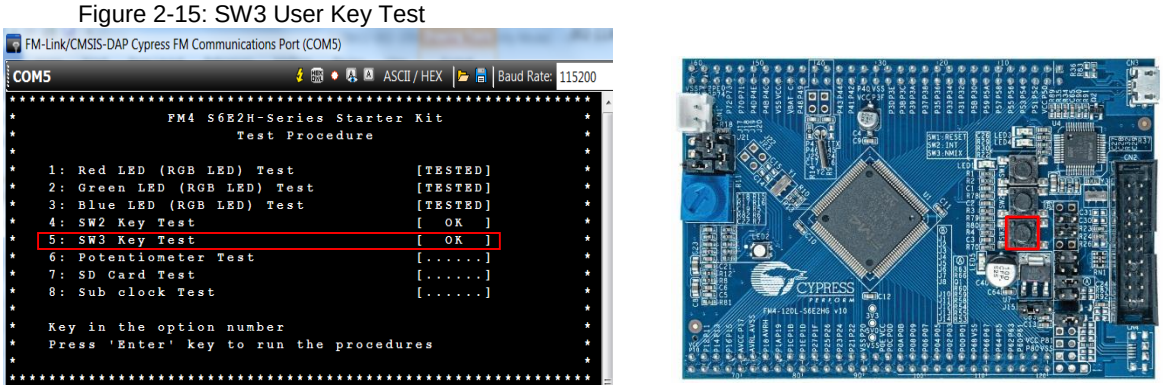
Figure 2-14: SW2 User Key Test





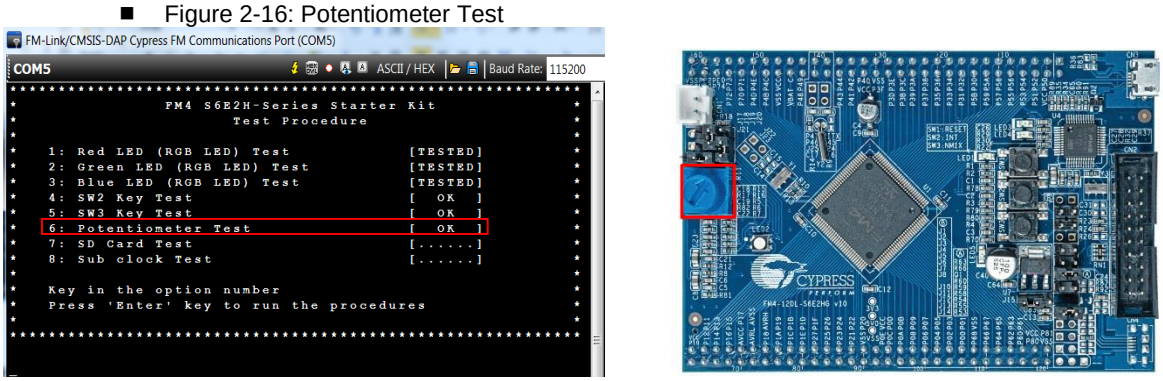
- **SW3 User Key Test**: This procedure is to test switch SW3. Key in **5**, and then press SW3 on the starter board. The RGB LED (LED2) will glow green while SW3 is held down. Release SW3 and press **Enter** to complete the test. It will display **OK.**

Figure 2-15: SW3 User Key Test



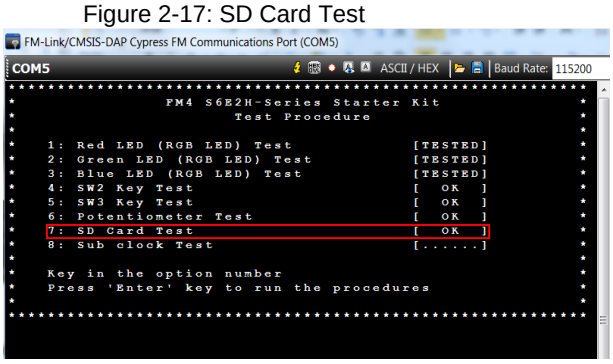
- **Potentiometer Test**: This procedure tests the potentiometer. Key in **6** and "Turn Pot clockwise/anti-clockwise" appear in the serial port viewer window depending on the potentiometer's (R11) current position. When the potentiometer is turned clockwise from the min to the max position, RGB LED (LED2) color changes from red to green to blue. When turned anticlockwise, LED color varies from blue to green to red.

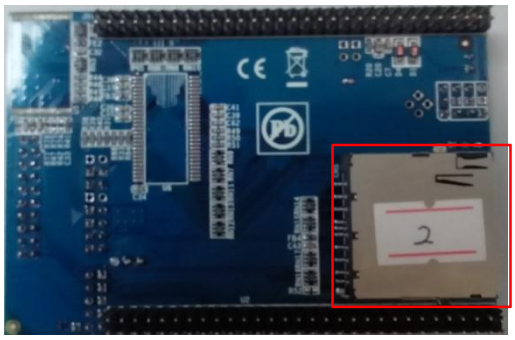
- Figure 2-16: Potentiometer Test



- **SD Card Test**: This procedure tests the SD Card. Key in **7** and press the **Enter** key. If an SD Card is found in the SD card slot (CN5) and read successfully, the console will display **OK**. If an SD Card is not found in the slot, the console will display **Fail.**

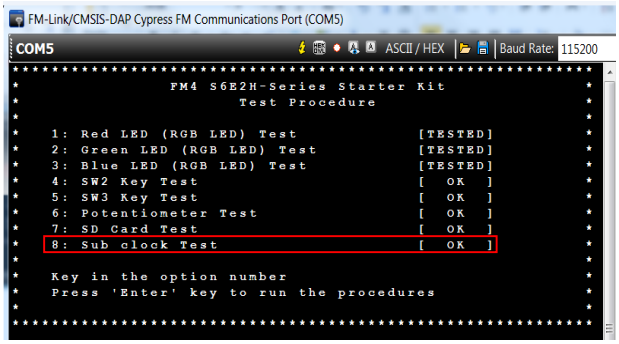
Figure 2-17: SD Card Test

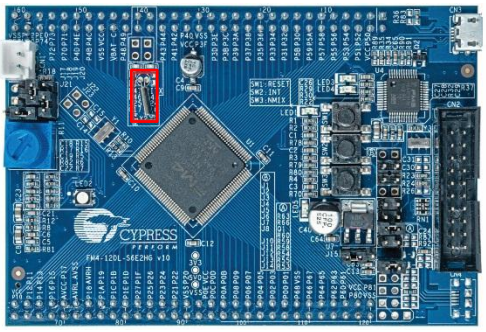




- **Sub Clock Test**: This procedure will test whether the sub clock is at 32.768 KHz or not. Key in **8** and press the **Enter** key, the main routine will shift the system clock to the sub clock, and then shift back to main clock after the sub clock is confirmed to be running at 32.768 KHz. It displays **OK** if the sub clock is running at 32.768 KHz otherwise it will display **Fail.**

Figure 2-18: Sub Clock Test





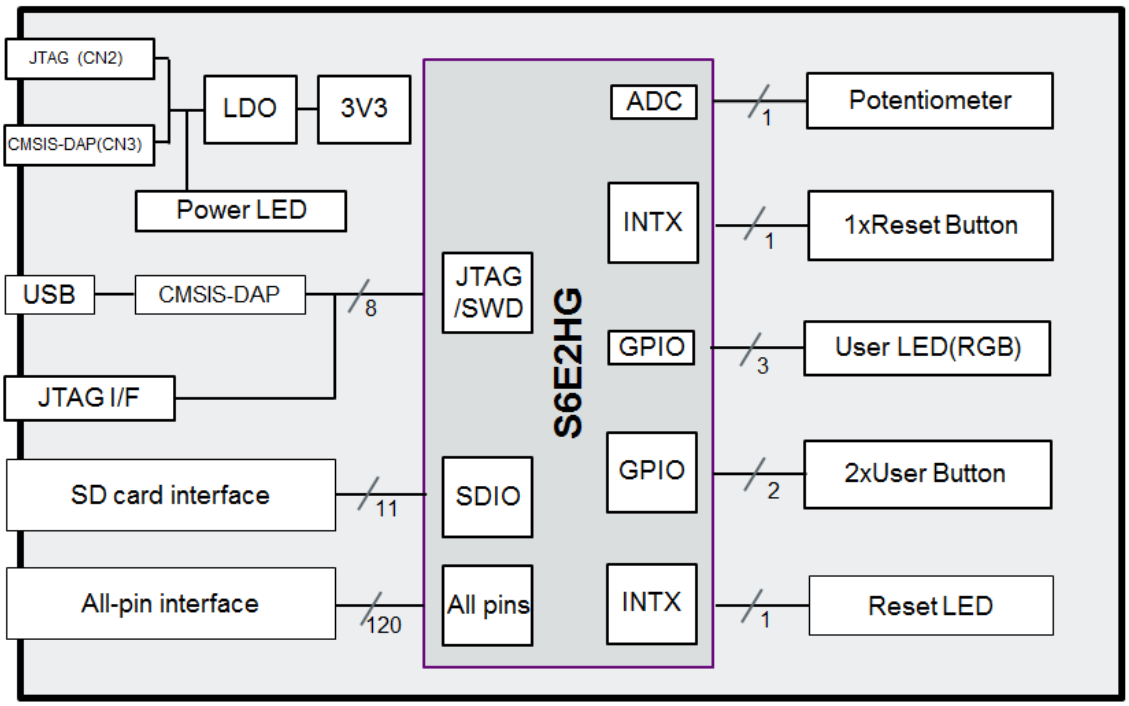
3. Hardware

This chapter describes the features and hardware details of the FM4 S6E2H-Series Starter Kit.

3.1 System Block Diagram

Figure 3-1 shows the block diagram of the FM4 S6E2H-Series Starter Kit.

Figure 3-1: System Block Diagram



3.2 Hardware Features

- Cypress FM4 S6E2HG MCU
- On-board ICE (CMSIS-DAP compatible)
- SD card interface
- All pins interface
- Reset LED
- Potentiometer
- RGB LED
- User buttons to generate interrupt (INT) and Non-Maskable interrupt (NMIX)

- Reset button
- 20-pin JTAG interface
- Selectable on-board voltage (3.3 V or 5.0 V)

3.3 Hardware Details

3.3.1 FM4 Series MCU

The FM4 S6E2HG MCU is a family of highly integrated 32-bit microcontrollers dedicated for high performance embedded controllers at competitive price.

This series is based on the ARM® Cortex®-M4 processor with on-chip flash memory and SRAM, and has peripherals such as motor control timers, A/D converters, and communication interfaces like CAN, UART, CSIO, I^2C, and LIN.

3.3.2 User Button and LED

The FM4 S6E2H-Series Starter Kit features two user buttons and a 3-color LED. The LED and switches are connected to the S6E2HG MCU device via pins listed in Table 3-1.

Table 3-1: Button and LED

Pin Number	Port	Peripherals	External Device
108	P68	SCK3_0,TIOB7_2, INT00_2	SW2
116	P60	SCK5_0,TIOA2_2,NMIX,MRDY_0,WKUP0	SW3
82	P27	TIOA6_2, INT02_2, RTO05_1	LED2 – Red
22	P38	INITX	LED2 – Green
56	PE0	MD1	LED2 – Blue

Pin 56 is used to drive the blue LED; it is also connected to MD1 pin which is used for the serial programming mode setting. Jumper J21 can be used to switch the functions. Table 3-2 shows the configuration.

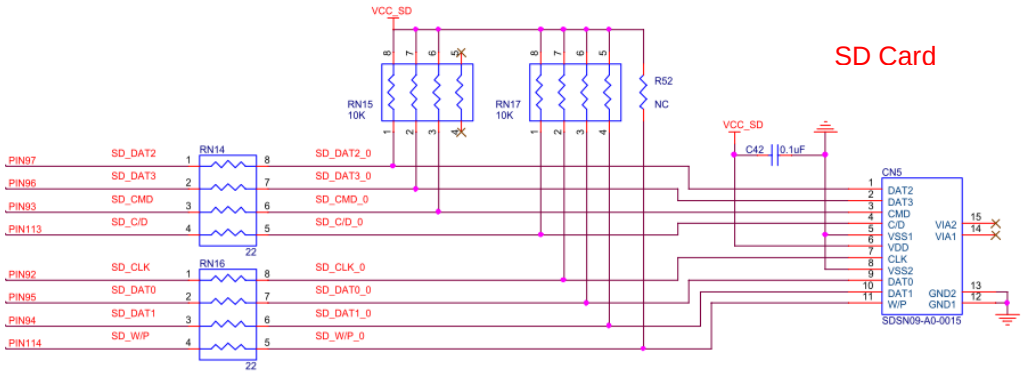
Table 3-2: J21 Configuration

Jumper-J21	Port	Function
Close 2~3	PE0	Drive the blue LED
Close 1~2	MD1	Serial programming mode

3.3.3 SD Card Interface

CN5 is an SD card interface connected with the SDIO macro of the S6E2HG device. This SD card interface supports full function of the SDIO including data transmission, card detection and write protection.

Figure 3-2: SD Card Circuit



The pin arrangement of the SD card is shown in Figure 3-3.

Figure 3-3: Pin Arrangement of SD Card Interface

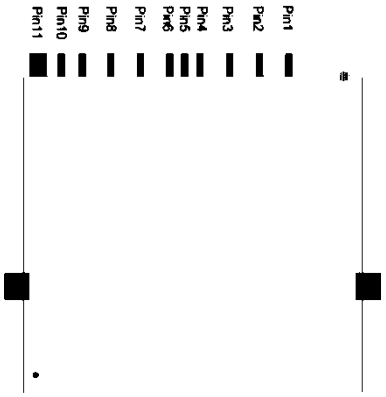


Table 3-3 shows the signals of the SD card interface.

Table 3-3: Signals of SD Card Interface

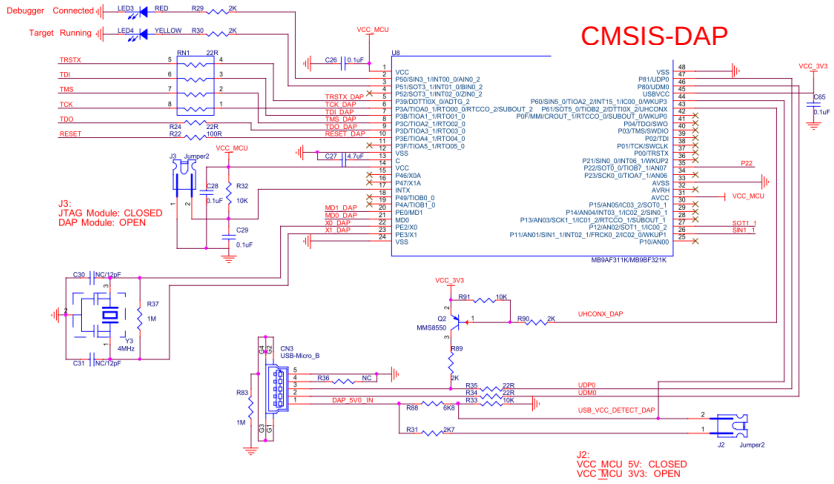
Pin No.	Pin Name	Type	Description
1	DAT2	I/O	Data
2	DAT3	I/O	Data
3	CMD	I/O	Data
4	C/D	I/O	Card detect
5	VSS1	power	Power supply ground
6	VDD	power	Power supply
7	CLK	I	Clock
8	VSS2	power	Power supply ground
9	DAT0	I/O	Data
10	DAT1	I/O	Data
11	W/P	O	Write protect detect

3.3.4 CMSIS-DAP

The FM4 S6E2H-Series Starter Kit features an on-board CMSIS-DAP module to enable programming and debugging of the FM4 S6E2HG MCU. The CMSIS-DAP firmware solution supports full JTAG configuration and a two-wire Serial Wire Debug (SWD) interface.

The CMSIS-DAP module can also power the FM4 S6E2H-Series Starter kit via the CN3 connector.

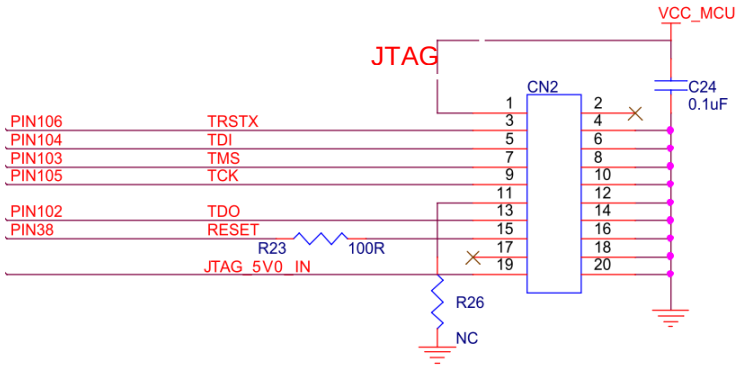
Figure 3-4: CMSIS-DAP Circuit



3.3.5 JTAG

The FM4 S6E2H-Series Starter Kit provides an interface, CN2, to connect an external programmer for programming the FM4 S6E2HG MCU or for connecting a third-party debugging tool. CN2 is a standard ARM 0.1'' 10*2-pin Cortex debug connector.

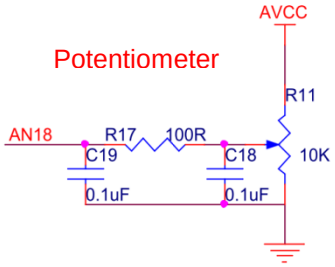
Figure 3-5: 10-pin JTAG I/F



3.3.6 Potentiometer

The FM4 S6E2H-Series Starter Kit has a potentiometer with resistance value ranging from 0 to 10 kΩ. The middle terminal is connected to the ADC channel AN18.

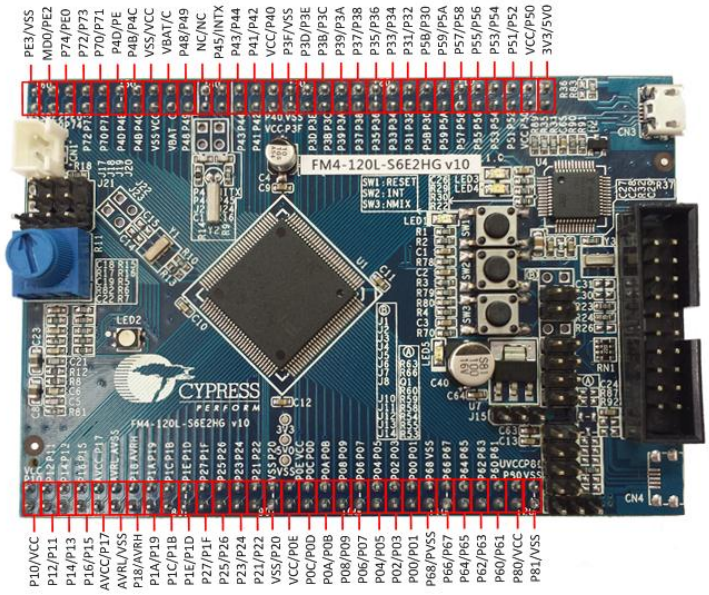
Figure 3-6: Potentiometer



3.3.7 Expansion Port

The FM4 S6E2H-Series Starter Kit provides two sets of expansion ports which route all the MCU pins. The user can access all pins of the S6E2HG device from these ports. Figure 3-7 shows the details.

Figure 3-7: Expansion Port



4. Software Development

This chapter provides information about the available software resources supporting the S6E2HG device and FM4 S6E2H-Series Starter kit.

4.1 Tool Options

The FM4 S6E2H-Series is supported by several third party tools/IDEs, and the user can choose their preferred tool for development. Any one of below listed IDEs can used for opening and building the example projects packaged with this kit:

- IAR Embedded Workbench for ARM
- Keil ARM RealView® Microcontroller Development System

Download evaluation versions of these tools from the vendor's website. A full license may be required to build or debug some of the example projects. For detailed information on using the tools, see the documentation in the Help section of the tool chain or the website of the tool's supplier.

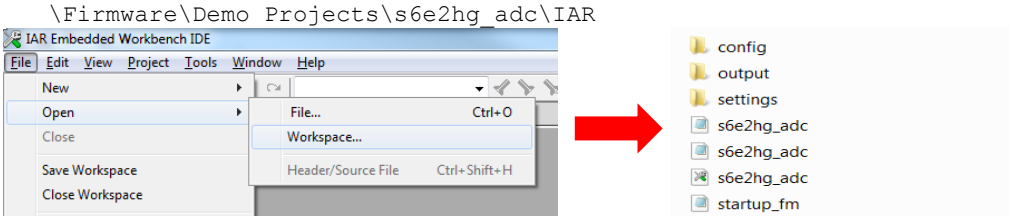
4.1.1 Build an Example Project with IAR IDE

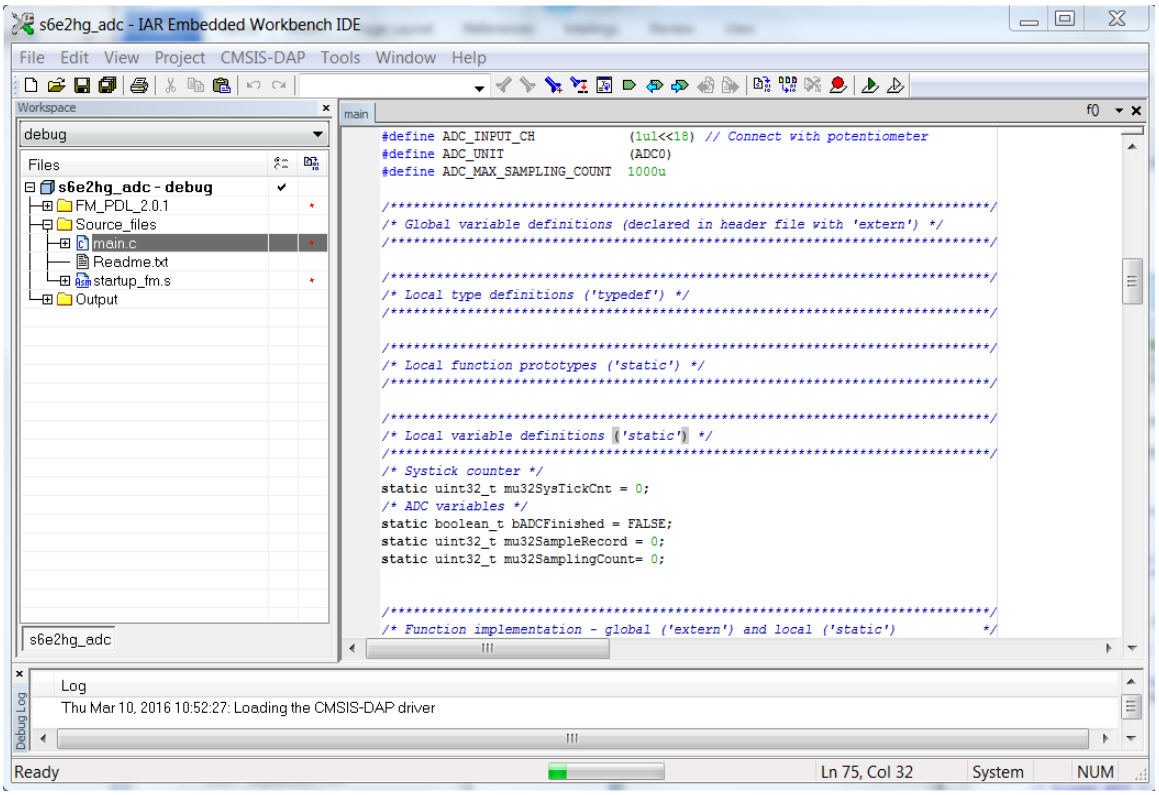
The following steps describe how to open, build, and run an example project in the IAR IDE.

The *s6e2hg_adc* is one example project that is available after a successful installation.

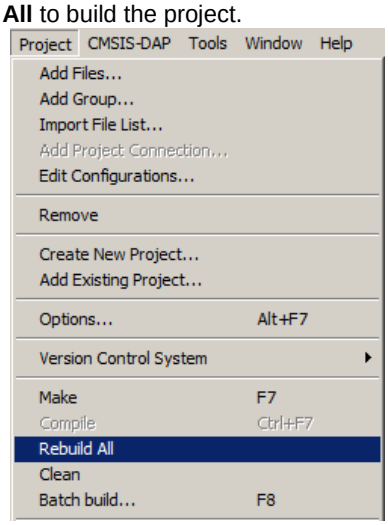
1. Launch IAR Embedded Workbench IDE V7.40.5.9739 (or later).

2. Click **File** > **Open** > **Workspace** and select the workspace file *s6e2hg_adc.eww* from `<User_Directory>:\ FM4 S6E2H-Series Starter Kit_Ver01 \Firmware\Demo Projects\s6e2hg_adc\IAR`





3. Click **Project** > **Rebuild All** to build the project.



4. Make sure the jumpers on the FM4 S6E2H-Series Starter board are placed according to Table 4-1.

Table 4-1: Debugging Jumper Settings

Jumper	Position	Description
J2	Open	Sets MB9AF312K to 3.3V.
J3	Open	Sets MB9AF312K (CMSIS-DAP) in run mode. Power from CMSIS-DAP (CN3)
J7	Closed	Sets S6E2HG (CMSIS-DAP) in run mode.
J10	Closed	Sets SW3 user button connected.
J15	Pin1 to Pin2	Sets S6E2HG to 3.3V.
J19	Close	CMSIS-DAP virtual COM connection
J20	Pin1 to Pin2	CMSIS-DAP virtual COM connection
J21	Pin2 to Pin3	PE0 drives blue LED

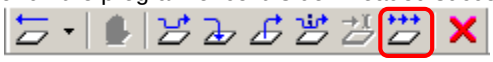
5. Connect the USB cable to the CN3 port.
6. Observe that Power LED (LED5) is glowing green.
7. Click the **Download and Debug** icon in the tool bar, use Shortcut **Crtl+D,** or choose **Project** > **Download and Debug** to start downloading and debugging.



Note: When downloading the code example into the board, if you get a following warning: "Skipping flash loading pass because there is no data in the designated range: 0x200C0000-0x200C7FFF", you can safely ignore it.

The S6E2HG processor includes two banks of flash, the main flash and a smaller work flash at address 0x200C0000. The code examples do not use the work flash. However, the debugger memory map includes the work flash, as it should. In effect, the IAR IDE tells you the code example doesn't use the work flash. That's correct, and not a problem.

8. Click the **Run** icon to run the program once it is downloaded successfully.



Refer to the Example Projects section for more details on example projects.

9. Click the **Stop** icon to stop the program.



For more information about the IAR Embedded Workbench IDE, please click **Help** from within the tool.

4.1.2 Build an Example Project with Keil µVision IDE

The following steps describe how to open, build and run an example project in Keil µVision IDE.

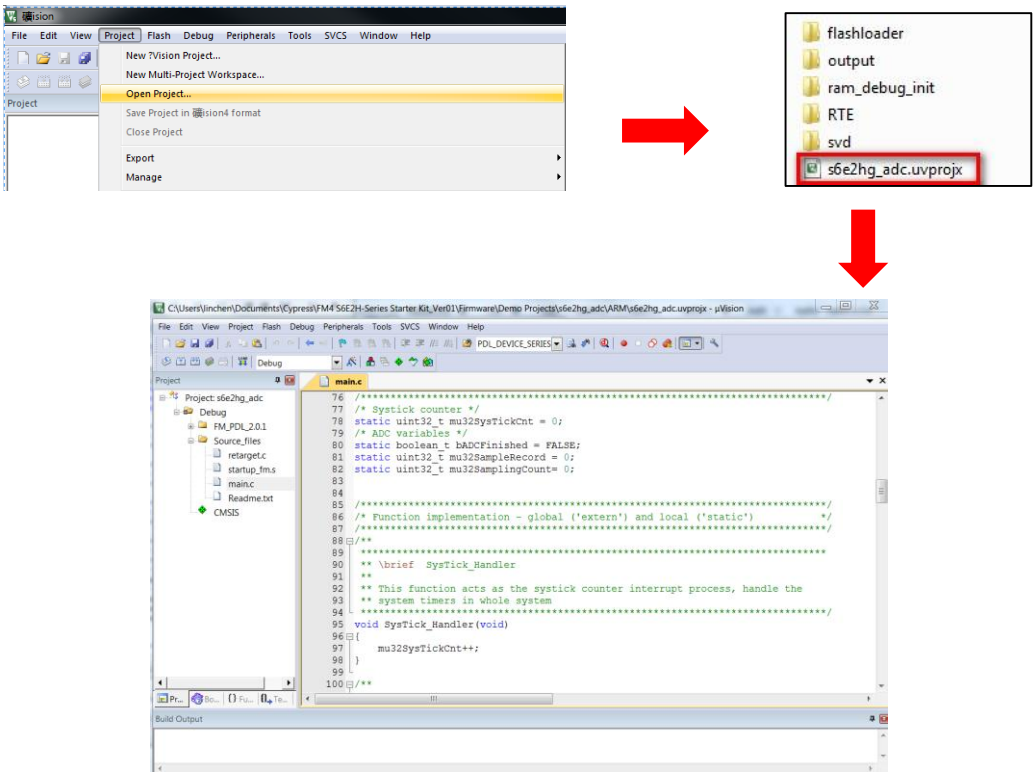
Before doing this, please check the availability of the flash loader file of the S6E2HG device (*S6E2HG4X0A.FLM & S6E2HG6X0A.FLM*) in this directory:

`<Keil_Install_Directory>:\ARM\flash.`

If the flash loader files are not there, copy them to the above folder from:
`<User_Directory>:\FM4 S6E2H-Series Starter Kit_Ver01\Firmware \Demo Projects\<Project>\ARM\flashloader\`

The *s6e2hg_adc* is one example project that is available after a successful installation.

1. Launch Keil µVision IDE v5.16a (or later).
2. Click **Project** > **Open Project** and select the workspace file *s6e2hg_dac.uvprojx* from `<User_Directory>:\FM4 S6E2H-Series Starter Kit_Ver01\Firmware \Demo Projects\s6e2hg_adc\ARM`.



3. Click the **Build** icon to build this project.



4. Make sure the jumpers on the FM4 S6E2HG-Series Starter board are placed according to Table 4-2.

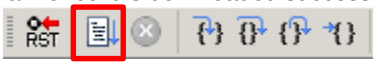
Table 4-2: Debugging Jumper Settings

Jumper	Position	Description
J2	Open	Sets MB9AF312K to 3.3V.
J3	Open	Sets MB9AF312K (CMSIS-DAP) in run mode. Power from CMSIS-DAP (CN2)
J7	Closed	Sets S6E2HG in run mode.
J10	Closed	Sets S6E2HG user module
J15	Pin1 to Pin2	Sets S6E2HG to 3.3V.
J19	Closed	CMSIS-DAP virtual COM connection
J20	Pin1 to Pin2	CMSIS-DAP virtual COM connection
J21	Pin2 to Pin3	PE0 drives blue LED

5. Connect the USB cable to the CN3 port.
6. Observe that Power LED (LED5) is glowing green.
7. Click the **Debug** icon, use shortcut **Crtl+F5,** or choose **Debug** > **Start/Stop Debug Session** to start downloading and debugging.



8. Click **Run** to run the program once it is downloaded successfully.



9. Click **Stop** to stop the program when you want.



For more information about the Keil µVision IDE, please click **Help** from within the tool.

4.2 Example Projects

The FM4 S6E2H-Series Starter Kit includes twelve example projects to help the user get a quick start with the S6E2HG device. The example projects are located in this directory:

```
<User_Directory>:\FM4 S6E2H-Series Starter Kit_Ver01\Firmware
\Demo Projects
```

These examples listed in the Table 4-3 are based on the Peripheral Driver Library (PDL). The PDL provides APIs for initializing and operating on-chip peripherals. PDL documentation is available at:

```
<User_Directory>:\FM_PDL_2.0.1\doc
```

Use either IAR Embedded Workbench v7.40.5.9739 (or later) or Keil µVision IDE v5.16a (or later) to open these example projects.

Table 4-3: Example Projects

#	Projects	Title/Description
1	s6e2hg_adc	Title: Analog-to-Digital Converter Description: This project demonstrates the analog to digital conversion of the S6E2HG device. This example sets the ADC to channel 18 in single conversion mode with interrupt enabled. ADC channel 18 is connected to a potentiometer. The conversion is started using a software trigger. When an ADC conversion is completed, the interrupt callback function is called, it reads the result data and prints it to UART0. Refer to section AD Converter for details.
2	s6e2hg_bt_pwm	Title: Base Timer Description: This project demonstrates the base timer operation of the S6E2HG device. This project configures a base timer in PWM mode to generate a PWM sequence. The PWM outputs from TIOA6_2 which drives the red LED of LED2. The PWM duty cycle is updated every 1ms by another base timer to produce a breathing LED effect.
3	s6e2hg_dma	Title: Direct Memory Access (DMA) Description: This project demonstrates DMA operation of the S6E2HG device. This example shows how to use DMA for software block transfer. In this example DMA channel 0 is used to transfer the contents of an array to another array using software block transfer. After the transfer a callback function is executed, which sets a DMA operation finished flag. Refer to section Direct Memory Access (DMA) for details.
4	s6e2hg_ext_int	Title: External Interrupt Description: This project demonstrates the external interrupt operation of the S6E2HG device. SW2 key press is detected by the external interrupt. Pressing the SW2 key on the board will change the color of RGB LED (LED2) from red to green to blue.
5	s6e2hg_flash	Title: Flash Write Description: This project demonstrates the flash writing operation of the S6E2HG device. A specific set of four values each of four bytes in size will be written into a specific address location in the flash memory. Refer to section Flash Write for the details.

#	Projects	Title/Description
6	s6e2hg_gpio	Title: GPIO Description: This project demonstrates the GPIO operations of the S6E2HG device by driving an LED. Pin P38 sinks current from the green LED of the RGB LED (LED2). Pin P38 will output a pulse sequence to blink the LED continuously.
7	s6e2hg_mfs_uart	Title: Multi-function Serial Interface Description: This project demonstrates the UART communication of the S6E2HG device. This program enables the MFS0 as a UART to communicate with the CMSIS-DAP. The CMSIS-DAP serves as the bridge between the MCU and the PC. Refer to section UART Communication for details.
8	s6e2hg_mft_frt	Title: Multi-function Timer Description: This project demonstrates the multi-function timer (MFT) operation of the S6E2HG device. This example demonstrates the access of FRT (Free Run Timer) in Up/Down-count mode with peak/zero match interrupt. The blue LED (RGB LED2) will turn on/off when peak/zero match interrupt occurs.
9	s6e2hg_rtc	Title: Real Time Clock Description: This project demonstrates the RTC operation of the S6E2HG device. The program enables the RTC in calendar mode, and sends out the current calendar data through UART0. The calendar starts from 2015/9/30 23:59:01 Wednesday. The calendar data will be displayed in the Serial Port Viewer window. When time reaches "2015-10-01 00:00:00", the Serial Port Viewer window displays ‘alarm occurs’ message, and at the same time, RGB LED2 starts blinking. A new time "2015-10-01 09:30:00" is set.
10	s6e2hg_sleep_mode	Title: Sleep Mode Description: This project demonstrates the sleep mode operation of the S6E2HG device. The MCU will enter sleep mode after blinking the green LED five times. It can be woken up by pressing SW3. After wakeup, the green LED will turn on. Refer to section Sleep Mode for the details.
11	s6e2hg_sw_wdt	Title: Software Watchdog Description: This project demonstrates the operation of the S6E2HG watchdog by considering two different situations when the watchdog is enabled: a) when the watchdog is fed and b) when the watchdog is not fed. If the watchdog is enabled and is fed in time, the program will run normally, and the RGB LED will blink green. If the watchdog is enabled and not fed in time, the device will reset, and the green LED will remain ON continuously. Refer to section Software Watchdog for the details.
12	s6e2hg_wc	Title: Watch Timer Description: This project demonstrates the Watch Timer function of the S6E2HG device. The Watch Timer generates an interrupt every second. In the interrupt service routine, pin P38 will drive the RGB LED (LED2) to blink green.

4.2.1 AD Converter

4.2.1.1 Project Description

This project demonstrates the Analog-to-Digital conversion of the S6E2HG device. This example sets the ADC channel 18 in single conversion mode with interrupt enabled. ADC channel 18 is connected to a potentiometer. The conversion is started using a software trigger. When ADC conversion is completed, the interrupt callback function is called, it reads the result data and prints it to UART0.

4.2.1.2 Hardware Connection

No specific hardware connections are required for this project. All connections are hardwired on the board.

4.2.1.3 Verify Output

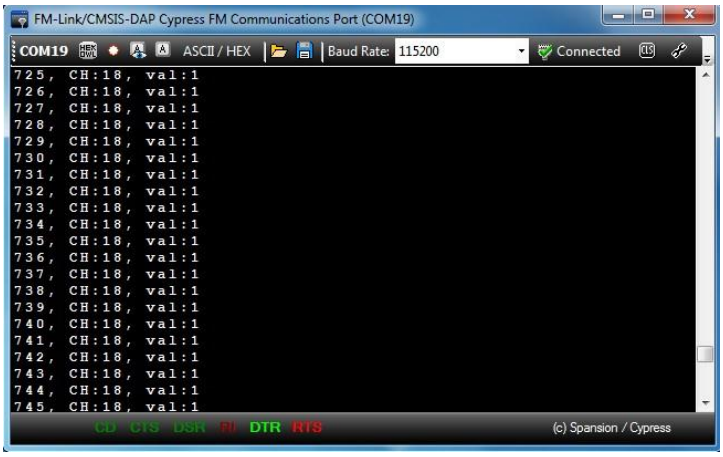
1. Power the FM4 S6E2HG-Series Starter board from CN3 using a USB cable, refer to Figure 2-5.
2. Open the project file in IAR Embedded Workbench or Keil µVision IDE from the following directory on your PC:
   ```
   IAR project: <User_Directory>:
   \FM4 S6E2H-Series Starter Kit_Ver01\Firmware
   \Demo Projects\s6e2hg_adc\IAR\s6e2hg_adc.eww.
   Keil project: <User_Directory>:
   \FM4 S6E2H-Series Starter Kit_Ver01\Firmware
   \Demo Projects\s6e2hg_adc\ARM\s6e2hg_adc.uvprojx.
   ```
3. Build the project and download the code into the S6E2HG device.
4. Run the Serial Port Viewer, set the baud rate as **115200**, and click the **Disconnected** button to connect the board with PC, as described in section Run the Test Demo.

Figure 4-1: Select the Baud Rate



5. Run the program and the ADC value will be displayed in the Serial Port Viewer window.

Figure 4-2: ADC value



6. Turn the potentiometer, the ADC values will change accordingly.

4.2.2 Direct Memory Access (DMA)

4.2.2.1 Project Description

This project demonstrates DMA operation of the S6E2HG device. The program configures DMA to move the data from *au32SourceData* (source array) to *au32DestinationData* (destination array), and then compares the content of the arrays to verify the data.

4.2.2.2 Hardware Connection

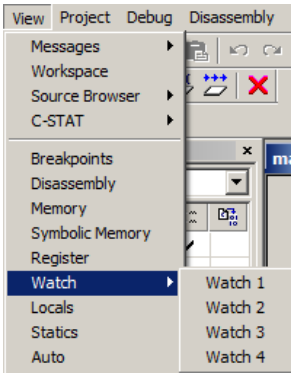
No specific hardware connections are required for this project. All connections are hardwired on the board.

4.2.2.3 Verify Output

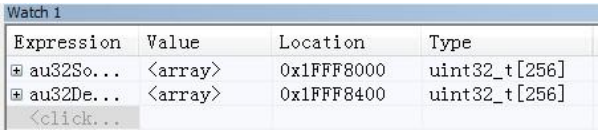
4.2.2.3.1 Instructions for IAR Embedded Workbench

1. Power the FM4 S6E2H-Series Starter board from CN3 using a USB cable, refer to Figure 2-5.
2. Open the project file in IAR Embedded Workbench from the following directory on your PC:
   `IAR project: <User_Directory>:`
   `\FM4 S6E2H-Series Starter Kit_Ver01\Firmware`
   `\Demo Projects\s6e2hg_dma\IAR\s6e2hg_dma.eww.`
3. Build the project and download the code into the S6E2HG device.

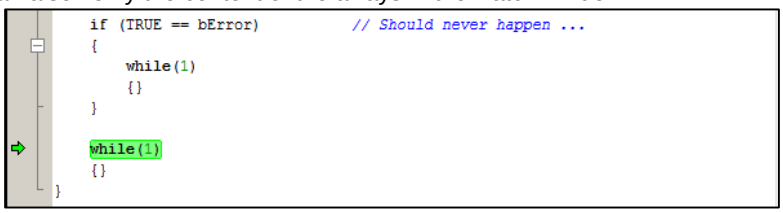
4. Open Watch1 window from **View**-> **Watch**.



5. Add the arrays *au32SourceData* and *au32DestinationData* in Watch1 window.



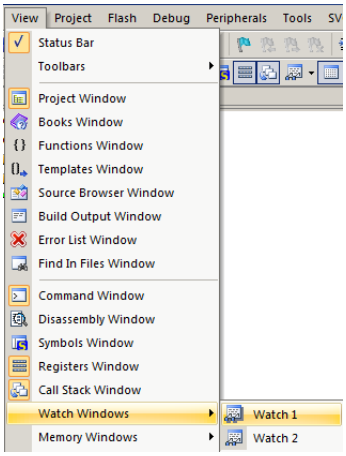
6. Run the program for a while (>10 seconds).
7. Stop the program and check the arrays mentioned above. The Program Counter (PC) will stop at the routine as shown below which means the content of the arrays are the same. You can also verify the content of the arrays in the watch window.



4.2.2.3.2 *Instructions for Keil µVision IDE*

1. Power the FM4 S6E2H-Series Starter board from CN3 using a USB cable, refer to Figure 2-5.
2. Open the project *s6e2hg_dma* in Keil µVision IDE from the following directory on your PC:
   `Keil project: <User_Directory>:`
   `\FM4 S6E2H-Series Starter Kit_Ver01\Firmware`
   `\Demo Projects\s6e2hg_dma\ARM\s6e2hg_dma.uvprojx.`
3. Build the project and download the code into the S6E2HG device.

4. Open Watch1 window from **View**->**Watch Windows**.



5. Add the arrays *au32SourceData* and *au32DestinationData* in Watch1 window.

Watch 1

Name	Value	Type
au32SourceData	0x20038014 au32SourceData	unsigned int[256]
au32DestinationData	0x20038414 au32DestinationData	unsigned int[256]
<Enter expression>		

6. Run the program for a while (>10 seconds).
7. Stop the program and check the arrays mentioned above. The Program Counter (PC) will stop at the routine as shown below which means the content of the arrays are the same. You can also verify the content of the arrays in the watch window.

```
180     if (TRUE == bError)          // Should never happen ...
181     {
182         while(1)
183         {}
184     }
185
186     while(1)
187     {}
188 }
```

4.2.3 Flash Write

4.2.3.1 Project Description

This project demonstrates the flash writing operation of the S6E2HG device. A specific set of four values each of four bytes in size will be written into a specific address location in the flash memory.

4.2.3.2 Hardware Connection

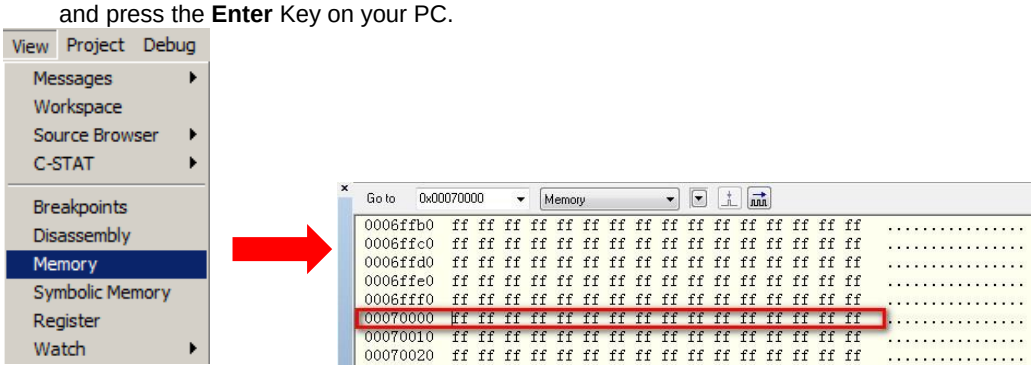
No specific hardware connections are required for this project. All connections are hardwired on the board.

4.2.3.3 Verify Output

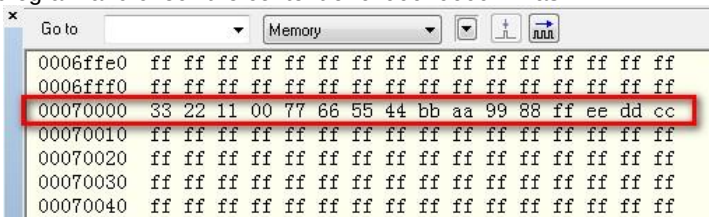
4.2.3.3.1 Instructions for IAR Embedded Workbench

1. Power the FM4 S6E2H-Series Starter board from CN3 using a USB cable, refer to Figure 2-5.

2. Open the project file in IAR Embedded Workbench from the following directory on your PC:
   `IAR project: <User_Directory>:`
   `\FM4 S6E2H-Series Starter Kit_Ver01\Firmware`
   `\Demo Projects\s6e2hg_flash\IAR\s6e2hg_flash.eww.`
3. Build the project and download the code into the S6E2HG device.
4. Open the memory window from the **View** > **Memory**. Enter 0x00070000 in the **Go to** table and press the **Enter** Key on your PC.



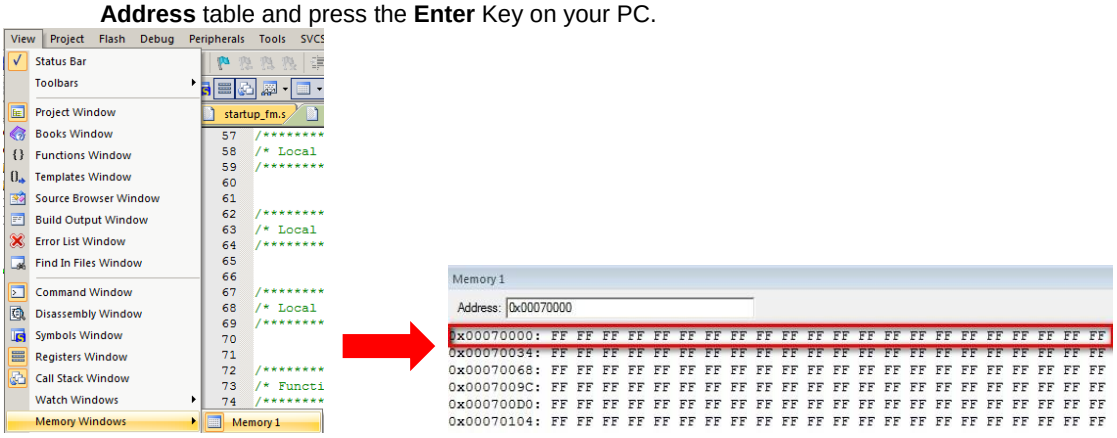
5. Run the program for a while (>10 seconds).
6. Stop the program and check the content of 0x00070000 in flash.



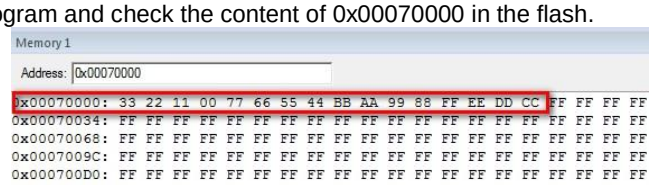
4.2.3.3.2 Instructions for Keil µVision IDE

1. Power the FM4 S6E2H-Series Starter board from CN3 using a USB cable, refer to Figure 2-5.
2. Open the project *s6e2hg_flash* in Keil µVision IDE from the following directory on your PC:
   `Keil project: <User_Directory>:`
   `\FM4 S6E2H-Series Starter Kit_Ver01\Firmware`
   `\Demo Projects\s6e2hg_flash\ARM\s6e2hg_flash.uvprojx.`
3. Build the project and download the code into the S6E2HG device.

4. Open the Memory1 window from the **View** > **Memory Windows**. Enter 0x00070000 in the **Address** table and press the **Enter** Key on your PC.



5. Run the program for a while (>10 seconds).
6. Stop the program and check the content of 0x00070000 in the flash.



4.2.4 UART Communication

4.2.4.1 Project Description

This project demonstrates the UART communication of the S6E2HG device. This program enables the MFS0 as a UART to communicate with the CMSIS-DAP. The CMSIS-DAP serves as the bridge between the MCU and the PC.

4.2.4.2 Hardware Connection

No specific hardware connections are required for this project. All connections are hardwired on the board.

4.2.4.3 Verify Output

1. Power the FM4 S6E2H-Series Starter board from CN3 using a USB cable, refer to Figure 2-5.
2. Open the project file in IAR Embedded Workbench or Keil µVision IDE from the following directory on your PC:

   ```
   IAR project: <User_Directory>:
   \FM4 S6E2H-Series Starter Kit_Ver01\Firmware
   \Demo Projects\s6e2hg_mfs_uart\IAR\s6e2hg_mfs_uart.eww.
   Keil project:<User_Directory>:
   \FM4 S6E2H-Series Starter Kit_Ver01\Firmware
   \Demo Projects\s6e2hg_mfs_uart\ARM\s6e2hg_mfs_uart.uvprojx.
   ```

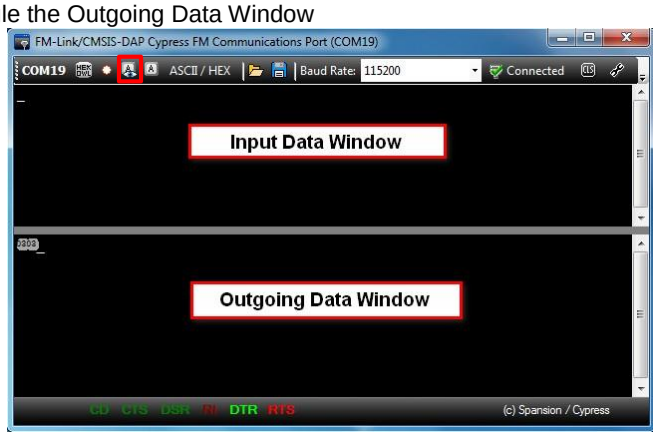
3. Build the project and download the code into the S6E2HG device.
4. Run the program.
5. Run the Serial Port Viewer, set the baud rate as **115200**, and click the **Disconnected** button to connect the board with the PC, as described in section Run the Test Demo.

Figure 4-3: Select the Baud Rate



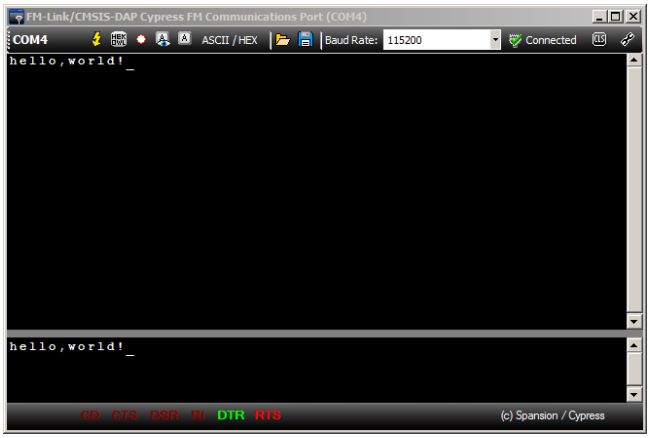
6. Click the Toggle Outgoing Data Window button.

Figure 4-4: Toggle the Outgoing Data Window



7. Key in any characters in the Outgoing Data Window, the same characters will be echoed in the Input Data Window.

Figure 4-5: Echo Test



4.2.5 Sleep Mode

4.2.5.1 Project Description

This project demonstrates the sleep mode operation of the S6E2HG device. The MCU will enter sleep mode after blinking the green LED 5 times. It can be woken up by pressing the SW3 key. After wakeup, the green LED will turn on.

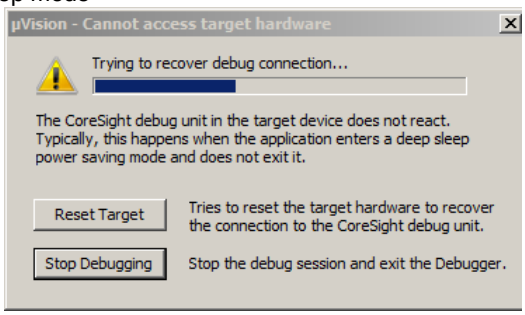
4.2.5.2 Hardware Connection

No specific hardware connections are required for this project. All connections are hardwired on the board.

4.2.5.3 Verify Output

1. Power the FM4 S6E2G-Series Starter board from CN3 using a USB cable, refer to Figure 2-5.
2. Open the project file in IAR Embedded Workbench or Keil µVision IDE from the following directory on your PC:
   ```
   IAR project: <User_Directory>:
   \FM4 S6E2H-Series Starter Kit_Ver01\Firmware
   \Demo Projects\s6e2hg_sleep_mode\IAR\s6e2hg_sleep_mode.eww.
   Keil project: <User_Directory>:
   \FM4 S6E2H-Series Starter Kit_Ver01\Firmware
   \Demo Projects\s6e2hg_sleep_mode\ARM\s6e2hg_sleep_mode.uvprojx.
   ```
3. Build the project and download the code into the S6E2HG device.
4. Run the program.
5. The RGB LED (LED2) will blink 5 times (green color), and then the MCU enters sleep mode.

Figure 4-6: MCU in sleep mode



6. Press the SW3 key to wake up the MCU.
7. The RGB LED (LED2) will glow with green color.

4.2.6 Software Watchdog

4.2.6.1 Project Description

This project is to demonstrate the operation of the S6E2HG watchdog. The project demonstrates two different situations: when the watchdog is fed and when the watchdog is not fed.

If the watchdog is enabled and the watchdog is fed in time, the program will run properly, and the RGB LED (LED2) will blink green.

If the watchdog is enabled, but not fed in time, the chip will reset, and the green LED will remain glowing.

4.2.6.2 Hardware Connection

No specific hardware connections are required for this project. All connections are hardwired on the board.

4.2.6.3 Verify Output

1. Power the FM4 S6E2H-Series Starter board from CN3 using a USB cable, refer to Figure 2-5.
2. Open the project file in IAR Embedded Workbench or Keil µVision IDE from the following directory on your PC:
   ```
   IAR project: <User_Directory>:
   \FM4 S6E2H-Series Starter Kit_Ver01\Firmware
   \Demo Projects\s6e2hg_st_wdt\IAR\s6e2hg_st_wdt.eww.
   Keil project: <User_Directory>:
   \FM4 S6E2H-Series Starter Kit_Ver01\Firmware
   \Demo Projects\s6e2hg_st_wdt\ARM\s6e2hg_st_wdt.uvprojx.
   ```
3. Build the project and download the code into the S6E2HG device.
4. Run the program.
5. The RGB LED (LED2) will blink green.
6. Stop the program, comment out the line of *Swwdg_Feed();* in *main.c*, and click **File** > **Save**

   ```
   static void WdgSwCallback(void)
   {
       //Shield "Swwdg_Feed()"
       //Swwdg_Feed();   // Clear Irq and Reset Timer
       ++u8CountWdg;
       if (TRUE != FM_SWWDT->WDOGRIS_f.RIS) // If the watchdog interrupt flag had
       {
           SetLed(u8CountWdg);
       }
   }
   ```

7. Repeat steps 3 to 4.
8. The RGB LED (LED2) will glow green but will not blink.

4.3 Flash Programming

This section describes how to program the S6E2HG MCU using the FLASH MCU Programmer and how to program the CMSIS-DAP device using the FLASH USB DIRECT Programmer.

4.3.1 Programming the S6E2HG using the FLASH MCU Programmer

1. The FLASH MCU Programmer gets installed on your PC as part the Kit installer. Follow Install Software to install the kit.
2. Make sure the jumpers on the FM4 S6E2H-Series Starter board are placed according to Table 4-4.

Table 4-4: Jumper Settings for S6E2HG programming using FLASH MCU Programmer

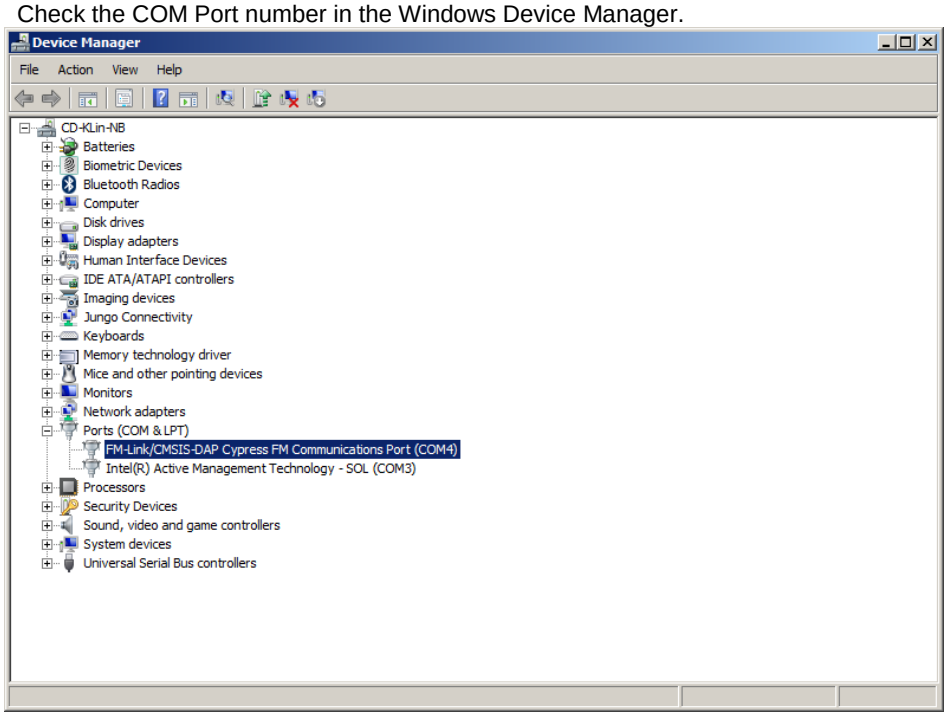
Jumper	Position	Description
J2	Open	Sets MB9AF312K to 3.3V.
J3	Open	Enable MB9AF312K CMSIS-DAP for debugging and programming purpose.

Jumper	Position	Description
J5	Open	Sets MB9AF312K (CMSIS-DAP) in run mode.
J7	Closed	Selects CMSIS-DAP as power source.
J10	Open	Sets S6E2HG in programming mode
J15	Pin1 to Pin2	Sets S6E2HG to 3.3V.
J18	Closed	Sets S6E2HG in programming mode
J19	Closed	CMSIS-DAP virtual COM connection (SIN0 to pin 21 of MB9AF312K)
J20	Pin1 to Pin2	CMSIS-DAP virtual COM connection (SOT0 to pin 20 of MB9AF312K)
J21	Pin1 to Pin2	Sets the PE0 pin to MD1 mode

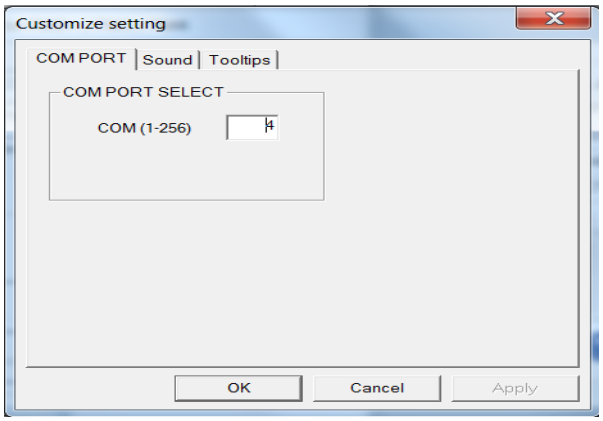
3. Connect the USB cable to the CN3 port.
4. Observe that the Power LED (LED5) is glowing green.
5. Launch the FLASH MCU Programmer from Windows

   Start **Menu** > **All Programs** > **Cypress** > **FLASH MCU Programmer** > **FM0+ FM3 FM4**
6. Select **Target MCU** as S6E2HG6G/E/F.
7. Set Crystal Frequency to 4MHz.
8. Select the Motorola-S format file or Intel-HEX format file to be programmed to FLASH memory in the MCU.

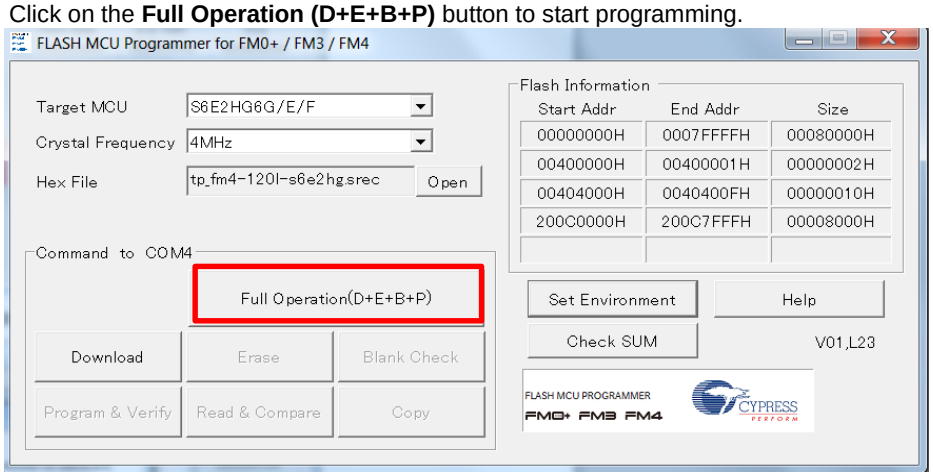
   Note: The HEX file selected in this example is the Test Demo firmware.
9. Check the COM Port number in the Windows Device Manager.



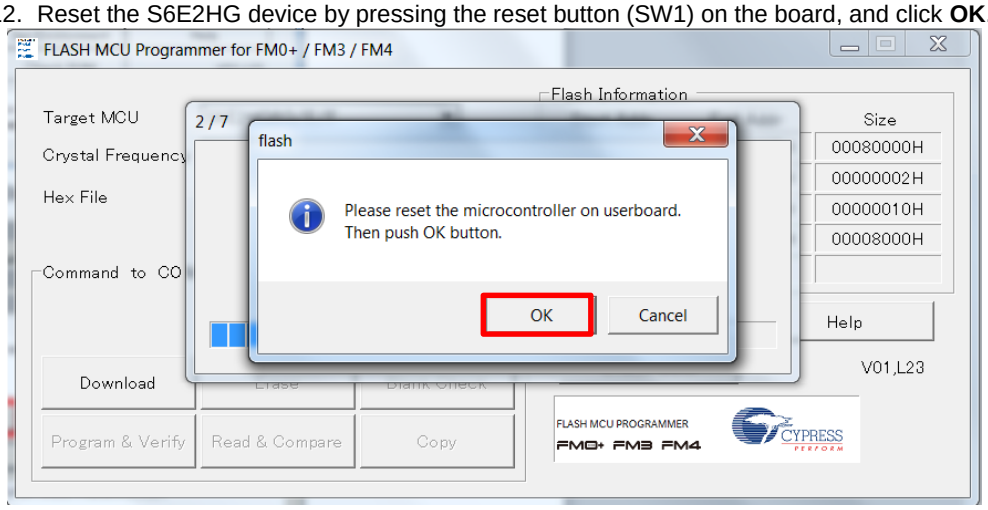
10. Enter the Virtual COM Port listed in the Ports of Windows Device Manager in **COM** box in the Customize setting window (This window appears when the **Set Environment** button is clicked).



11. Click on the **Full Operation (D+E+B+P)** button to start programming.



12. Reset the S6E2HG device by pressing the reset button (SW1) on the board, and click **OK**.



Note: Please click on **Help** for any issues or errors encountered during programming.

4.3.2 Programming the CMSIS-DAP (MB9AF312K) Device Using the FLASH USB DIRECT Programmer

By default, the latest CMSIS-DAP firmware is programmed on the MB9AF312K. It is not required for the user to re-program firmware again before running the CMSIS-DAP debugger. Follow the steps below to update the firmware, if needed.

1. The FLASH USB DIRECT Programmer gets installed on your PC as part the kit installer.
2. Make sure the jumpers on the FM4 S6E2H-Series Starter board are placed according to Table 4-5.

Table 4-5: Programming Jumper Settings for CMSIS-DAP programming

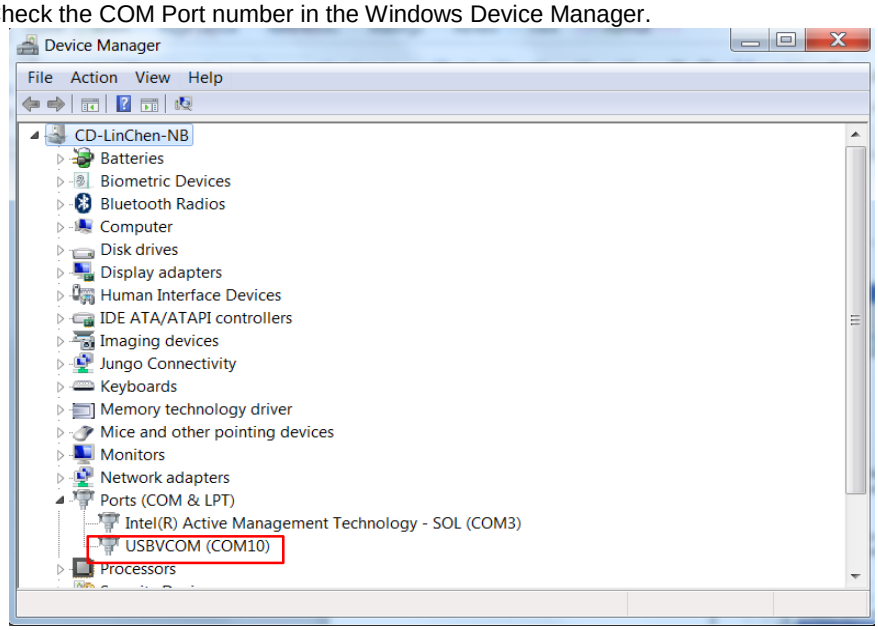
Jumper	Position	Description
J2	Open	Sets MB9AF312K to 3.3V.
J3	Open	Enable MB9AF312K CMSIS-DAP for programming and debugging purpose.
J5	Closed	Sets MB9AF312K (CMSIS-DAP) in programmer mode.
J7	Closed	Selects CMSIS-DAP as power source.
J10	Closed	Sets S6E2HG in programming mode
J15	Pin1 to Pin2	Sets S6E2HG to 3.3V.
J18	Open	Sets S6E2HG in run mode
J19	Closed	CMSIS-DAP virtual COM connection (SIN0 to pin 21 of MB9AF312K)
J20	Pin1 to Pin2	CMSIS-DAP virtual COM connection (SOT0 to pin 20 of MB9AF312K)
J21	Pin2 to Pin3	Sets pin PE0 to drive the LED

3. Connect the USB cable to the CN3 port.
4. Observe that the Power LED (LED5) is glowing green.
5. Launch the FLASH USB DIRECT Programmer from Windows

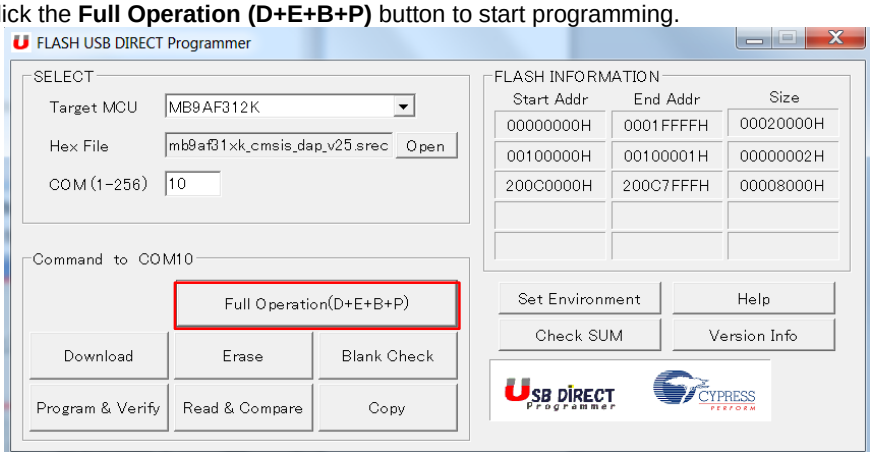
   Start Menu > **All Programs** > **Cypress** > **FLASH USB DIRECT Programmer** > **USBDirect**
6. Select the Target MCU as MB9AF312K.
7. Select the Motorola-S format file or Intel-HEX format file to be programmed on MB9AF312K. The hex file is included in the following directory:

   `<User_Directory>:`
   `\FM4 S6E2H-Series Starter Kit_Ver01\Firmware\CMSIS-DAP`

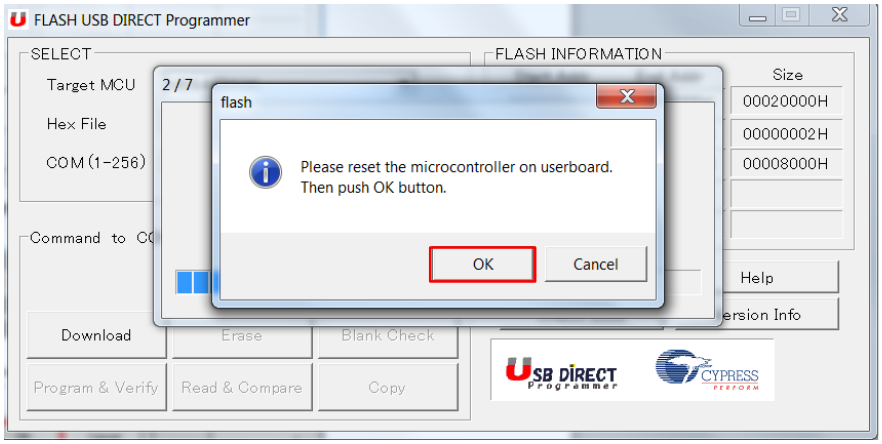
8. Check the COM Port number in the Windows Device Manager.



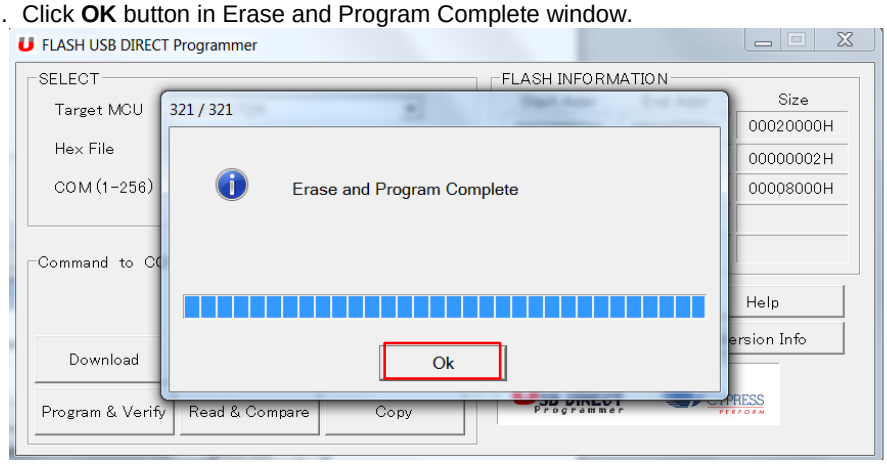
9. Enter the Virtual COM Port listed in the Ports of Device Manager in the **COM** box.
10. Click the **Full Operation (D+E+B+P)** button to start programming.



11. Reset the CMSIS-DAP microcontroller by removing and reconnecting the USB cable, and click **OK**.



12. Click **OK** button in Erase and Program Complete window.



Note: Please click on **Help** for any issues or errors encountered during programming.

A. Appendix

A.1 Schematic

Figure A-1. MCU

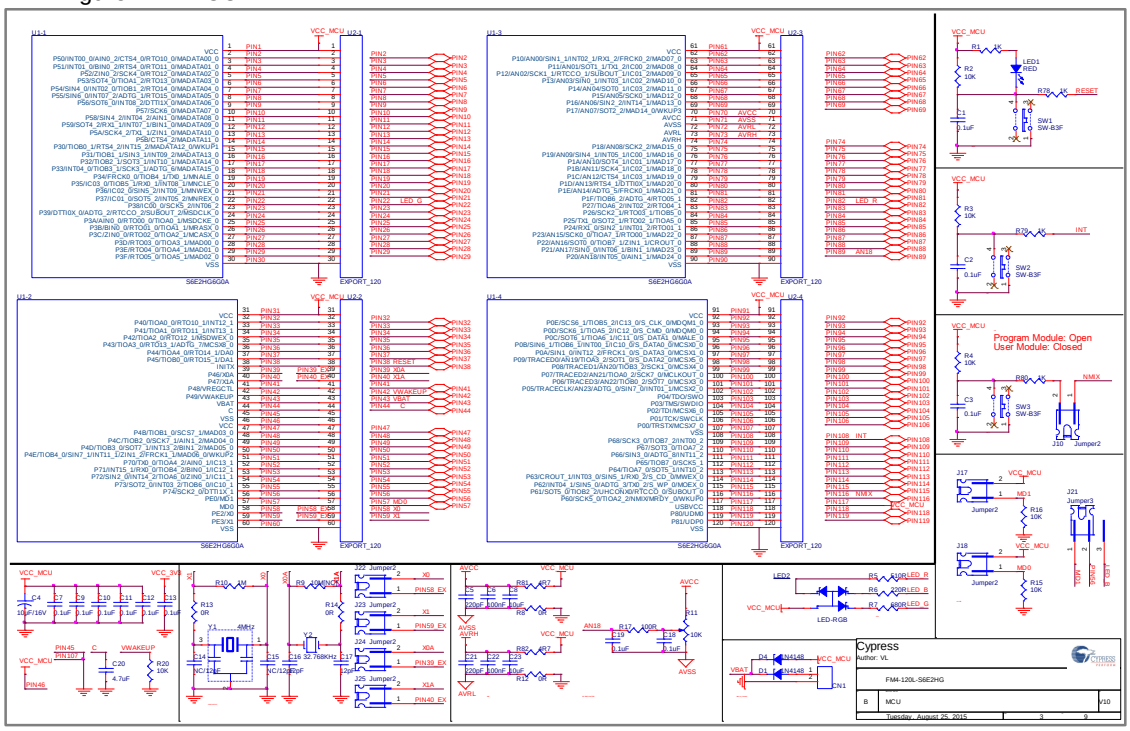


Figure A-2. CMSIS-DAP & JTAG

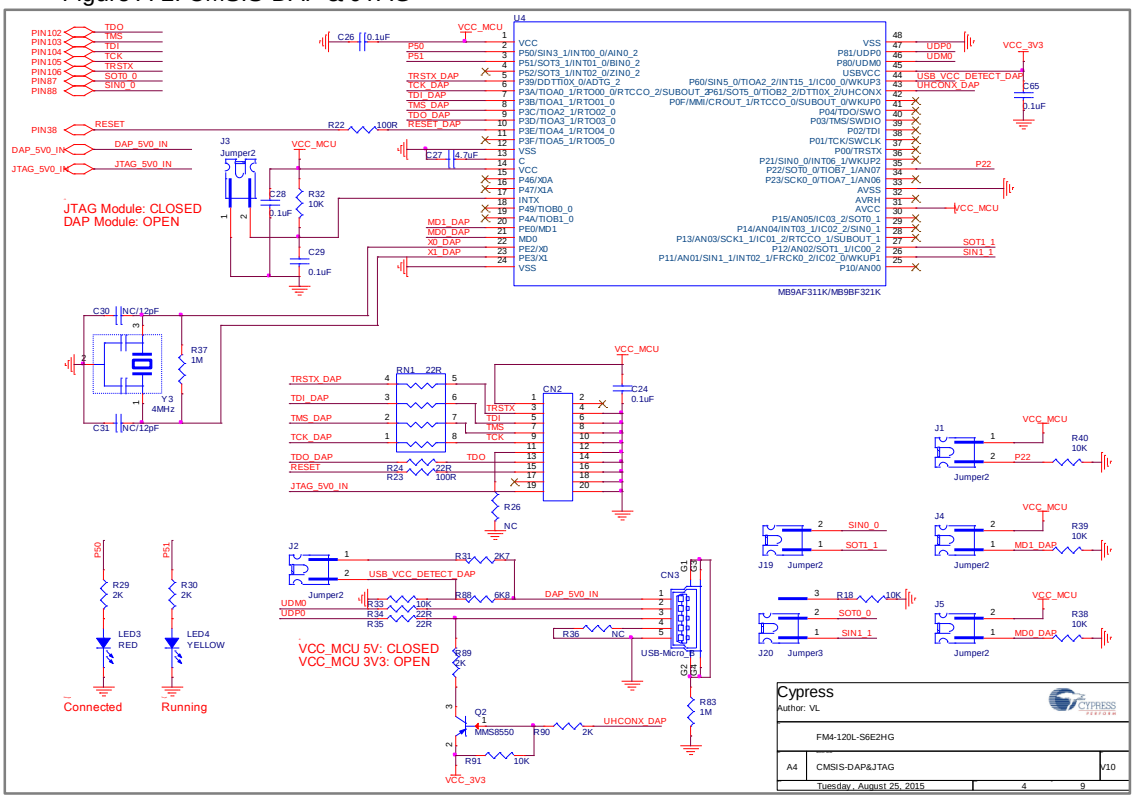


Figure A-3. SD Card Interface

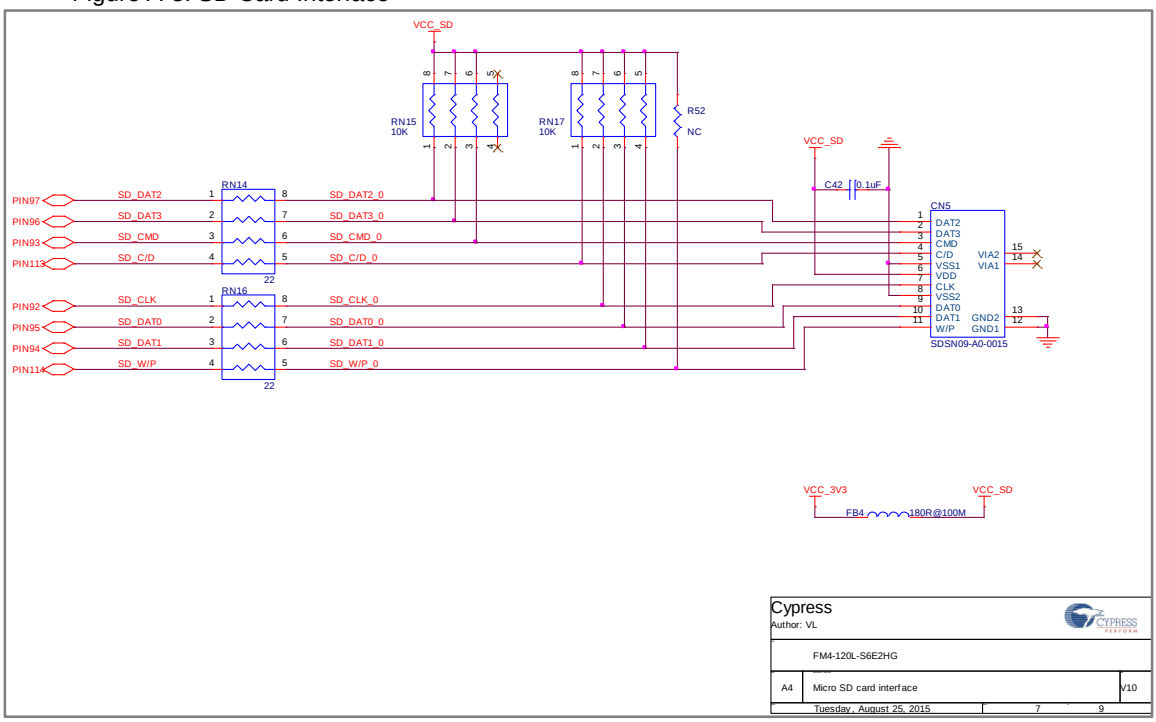


Figure A-4. NAND Flash (NOT MOUNTED)

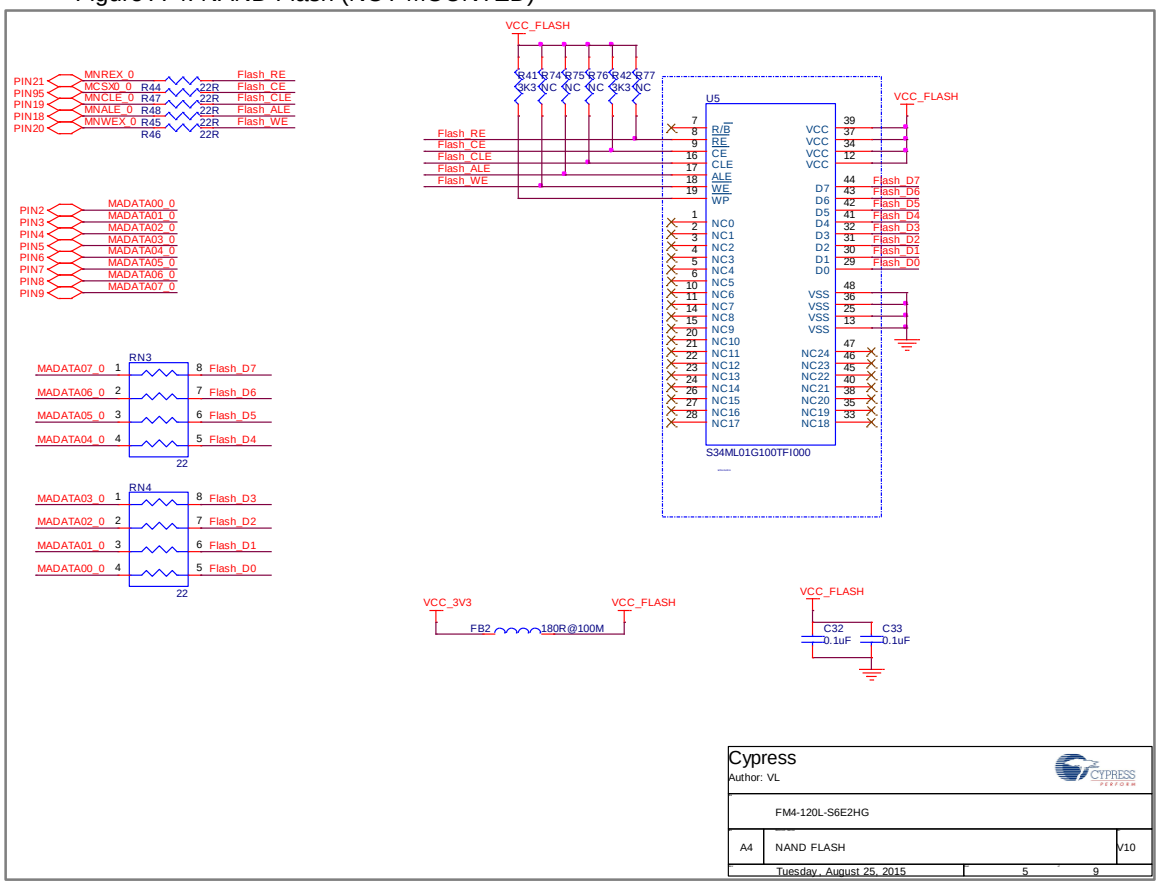


Figure A-5. SDRAM (NOT MOUNTED)

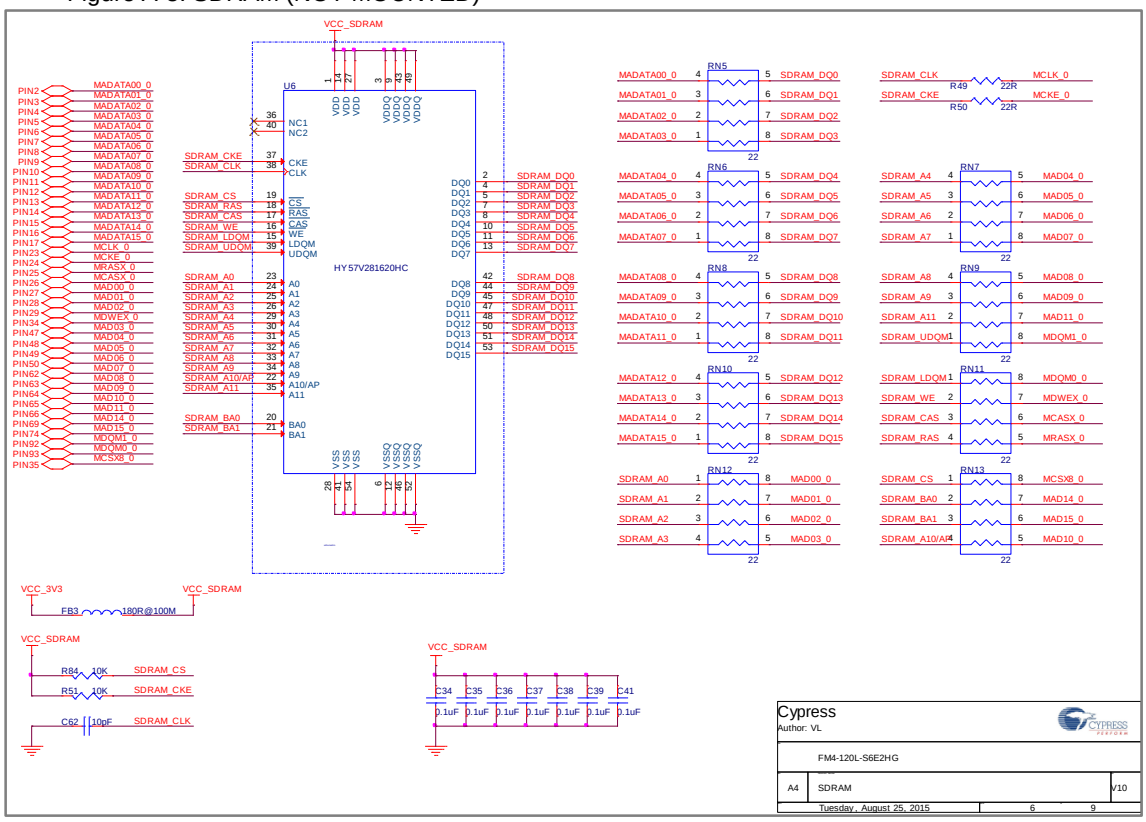


Figure A-6: USB (NOT MOUNTED)

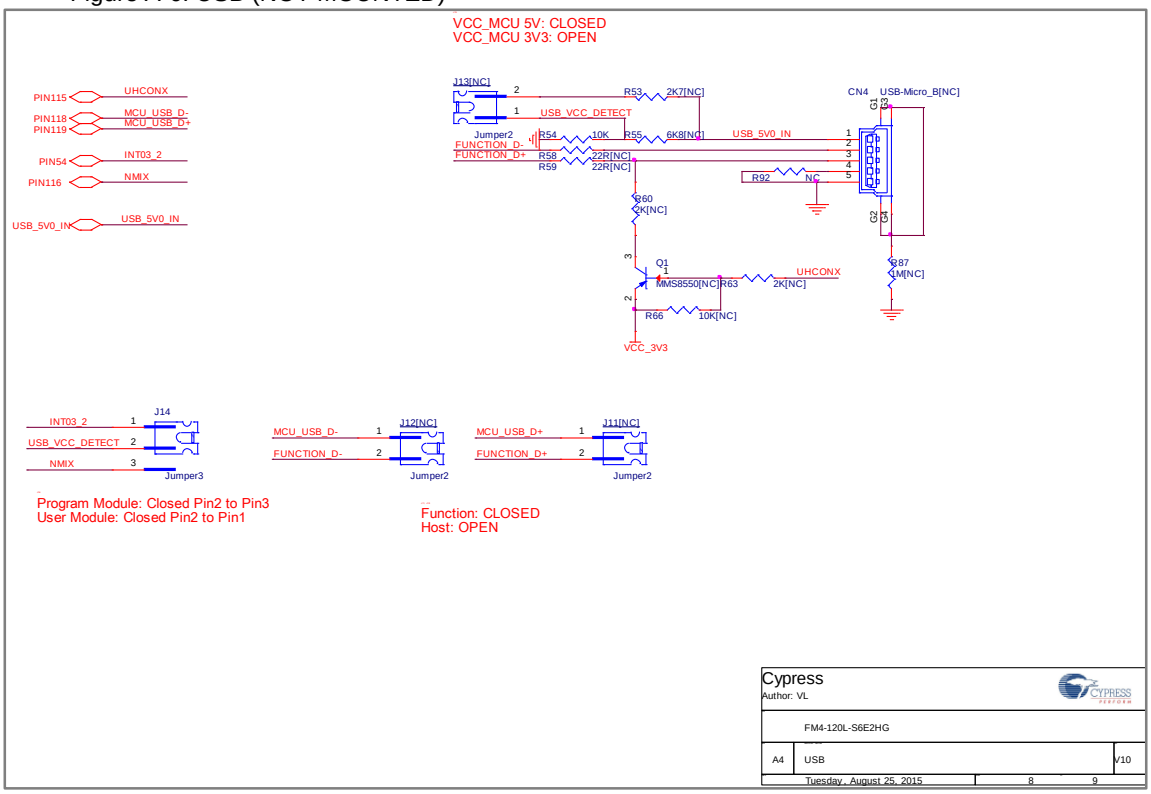
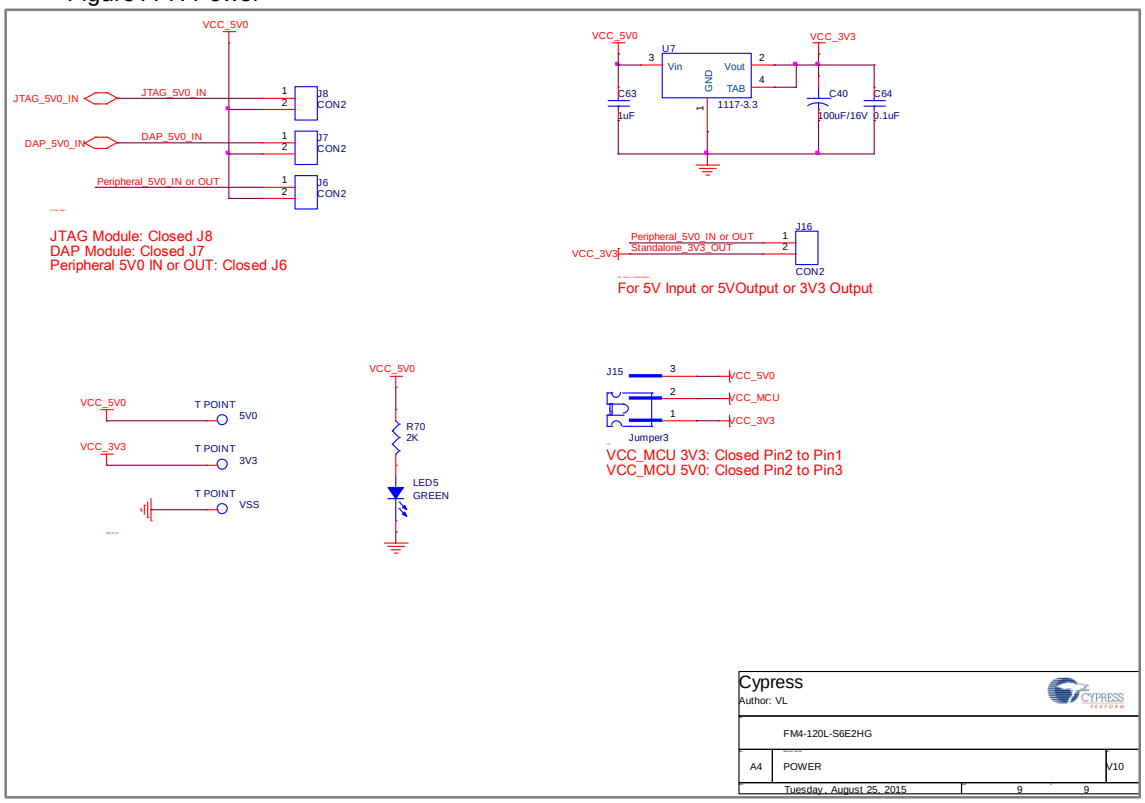


Figure A-7: Power



A.2 Bill of Materials

Item	Qty	Reference	Value	Description	Mfg	Mfg part number
1	1	CN1	2.54mm, 2pin,Wall	2.54mm, 2pin connector	AIMO	2285-0106ANGO01
2	1	CN2	2.54mm, 10*2pin,Wall	2.54mm,10*2pin IDC connector	AIMO	2285-0110ANGO01
3	1	CN3	10118192-0001LF	Micro USB type B	FCI	10118192-0001LF
4	4	CN5	SDSN09-A0-0015	SD card interface	PROCONN	SDSN09-A0-0015
5	10	J2, J3, J5, J6, J7, J8, J16, J10, J18, J19	Pin header,1*2pin,dip	2.54mm, 2pin header	AIMO	1225-1102ANGOS11.501
6	3	J15, J20, J21	Pin header,1*3pin,dip	2.54mm, 3pin header	AVX	1225-1103ANGOS11.501
7	1	U2-1, U2-2	Pin header,30*2pin,dip	2.54mm,30*2pin header	AIMO	1225-11060ANGOS11.501
8	27	C1, C2, C3, C7, C9, C10, C11, C12, C13, C18, C19, C24, C26, C28, C29, C32, C33, C34, C35, C36, C37, C38, C39, C41, C42, C64, C65	0.1uF	Ceramic Capacitor	YAGEO	CC0603KRX5R8BB104
9	4	C5, C21	220pF	Ceramic Capacitor	YAGEO	CC0603JRNPO9BN221
10	2	C6, C22	100nF	Ceramic Capacitor	YAGEO	CC0603KRX5R8BB104
11	0	C14, C15, C30, C31	NC/12pF	Ceramic Capacitor	YAGEO	CC0603KKX5R8BB120
12	2	C16, C17	12pF	Ceramic Capacitor	YAGEO	CC0603JRNPO9BN120
13	1	C62	10pF	Ceramic Capacitor	YAGEO	CC0805KKX5R8BB100
14	1	C63	1uF	Ceramic Capacitor	YAGEO	CC0603KKX5R8BB105
15	2	C20, C27	4.7uF	Ceramic Capacitor	YAGEO	CC0603KKX5R8BB475
16	2	C8, C23	10uF	Ceramic Capacitor	YAGEO	CC0603KKX5R8BB106
17	1	C4	10uF/16V	Electrolytic Capacitor	Panasonic	EEE-FK1C100R
18	1	C40	100uF/16V	Electrolytic Capacitor	Panasonic	EEE-1CA101WP
19	14	RN1, RN3, RN4, RN5, RN6, RN7, RN8, RN9, RN10, RN11, RN12, RN13, RN14, RN16	22R	Resister Array	BOURNS	652-CAT16-220J4LF
20	2	RN15, RN17	10K	Resister Array	BOURNS	652-CAT16-103J4LF

Item	Qty	Reference	Value	Description	Mfg	Mfg part number
21	4	R1, R78, R79, R80	1K	Resister	YAGEO	RC0603FR-071KL
22	14	R2, R4, R15, R16, R18, R20, R38, R39, R40, R33, R51, R54, R84, R91	10K	Resister	YAGEO	RC0603FR-0710KL
23	1	R5	510R	Resister	YAGEO	RC0603FR-07510RL
24	1	R6	680R	Resister	YAGEO	RC0603FR-07680RL
25	1	R7	220R	Resister	YAGEO	RC0603FR-07220RL
26	4	R8, R12, R13, R14	0R	Resister	YAGEO	RC0603FR-070RL
27	3	R10, R37, R83	1M	Resister	YAGEO	RC0603FR-070RL
28	3	R17, R22, R23	100R	Resister	YAGEO	RC0603FR-071ML
29	10	R24, R34, R35, R44, R45, R46, R47, R48, R49, R50	22R	Resister	YAGEO	RC0603FR-0722RL
30	5	R29, R30, R70, R89, R90	2K	Resister	YAGEO	RC0603FR-072KL
31	1	R31	2K7	Resister	YAGEO	RC0603FR-072K7L
32	0	R26, R36, R52, R74, R75, R76, R77, R92	NC	Resister	YAGEO	RC0603FR-070RL
33	2	R41, R42	3K3	Resister	YAGEO	RC0603FR-073K3L
34	1	R55, R88	6K8	Resister	YAGEO	RC0603FR-076K8L
35	2	R81, R82	4R7	Resister	YAGEO	RC0603FR-074R7L
36	2	R3, R32	10K	Resister	YAGEO	RC0603FR-0710KL
37	1	R11	3386P-1-103T	Potentiometer	BOURNS	3386P-1-103T
38	1	LED4	LED YELLOW	Yellow LED,0805,SMT	OSRAM	LY R976-PS-36
39	1	LED5	LED GREEN	Green LED,0805,SMT	OSRAM	LG R971-KN-1
40	2	LED1, LED3	LED RED	Red LED,0805,SMT	OSRAM	LH R974-LP-1
41	1	LED2	CLV1A-FKB-CJ1M1F1BB7R4S3	RGB LED,SMT	Cree	CLV1A-FKB-CJ1M1F1BB7R4S3
42	2	D1, D4	DL4148	Rectifier Diode	MMC	DL4148
43	3	FB2, FB3, FB4	MPZ1608S101AT	Ferrite Bead	TDK	MPZ1608S101AT
44	1	Q2	MMS8550-H-TP	NPN transistor	MMC	MMS8550-H-TP

Item	Qty	Reference	Value	Description	Mfg	Mfg part number
45	3	SW1, SW2, SW3	ELTSM-62KR-H-T/R	Push-button,6*6*5mm, SMT	Jinling	ELTSM-62KR-H-T/R
46	1	U1	S6E2HG6G0A GV20000	MCU,176LQFP,0.5mm pitch	Cypress	S6E2HG6G0A GV20000
47	1	U4	MB9BF312K	MCU,64LQFP,0.5mm pitch	Cypress	MB9BF312KPMC
48	1	U7	LM1117IMPX-3.3/NOPB	Regulator	TI	LM1117IMPX-3.3/NOPB
49	2	Y1, Y3	CSTCR4M00G15L99-*0	Ceramic Resonator, 4M, 1000ppm	Murata	CSTCR4M00G15L99-*0
50	1	Y2	QRA-32768A20125B	Crystal,32.768K,206	Wisdom	QRA-32768A20125B

Revision History

Document Revision History

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Revision	**ECN Number**	**Issue Date**	**Origin of Change**	**Description of Change**
**	5179566	03/24/2016	CCTA	Initial revision.