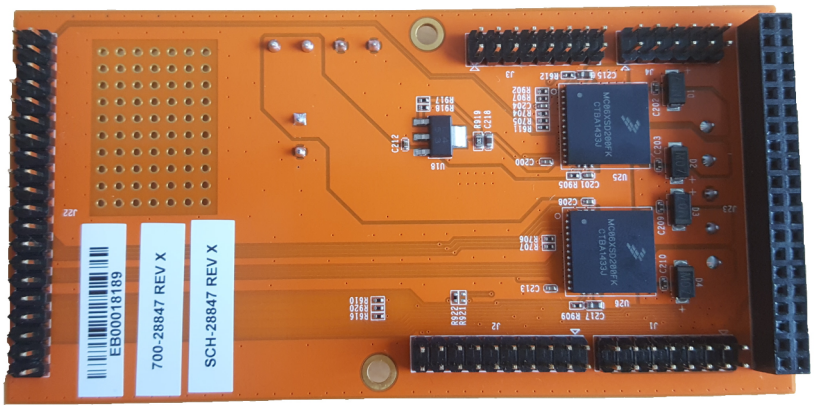
KTFRDMMC36XSDEVBUG

FRDM-MC36XSD-EVB evaluation board

Rev. 1.0 — 30 August 2016 User guide

1 FRDM-MC36XSD-EVB



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3 Overview of the FRDM-MC36XSD-EVB development environment

The FRDM-MC36XSD-EVB provides an evaluation platform for developing systems based on NXP's MC06XSD200 dual high-side switch device. DC components—such as brushed motors, light bulbs and fans—can be connected to the board as part of the development environment. Designers access the functionality of the on-board MC06XSD200 through a software interface on a host PC. Communication between the PC and the FRDM-MC36XSD-EVB is managed by a companion board connected to the evaluation board. There are three possible options in selecting the type of companion board and the corresponding software interface.

Option 1—The FRDM-KL25Z and CodeWarrior

This option uses NXP's FRDM-KL25Z board attached to the FRDM-MC36XSD-EVB through the Arduino™ connectors on each board. In this configuration, the KL25Z serves primarily as an SPI communication link between the evaluation board and the host PC. The software interface is through NXP's CodeWarrior IDE (Integrated Design Environment) and the CodeWarrior 36VeXtremeSwitch component. A CodeWarrior example project, available as a .zip file on NXP's website, incorporates the 36eXtremeSwitch component and demonstrates a typical CodeWarrior implementation using the FRDM-MC36XSD-EVB. Designers can connect components to the evaluation board and modify the code in the example to suit their development needs.

Option 2—Raspberry Pi and Python

With this option, the Raspberry Pi 2 Model B multi-functional board is attached to the FRDM-MC36XSD-EVB through the GPIO connectors on each board. The designer downloads a microcode image of the Raspberry Pi operating system from NXP's website and flashes the image to the Raspberry Pi SD memory card. This image incorporates all the drivers and support required to interact with the FRDM-MC36XSD-EVB. Raspberry Pi's USB and HDMI ports provide connectivity to a keyboard, mouse and monitor, which allows users to access the operating system and execute Python code to interact with the evaluation board and the components connected to it. A Python source code demo, included in the image downloaded from NXP's website, can be modified to fit the designer's needs.

Option 3—RIoTboard and Python

This option is similar to Option 2, with the RIoTboard serving as the companion board. Both boards are linked through their respective GPIO connectors. NXP's website provides a control program image that the designer downloads and flashes to the RIoTboard's memory. The RIoTboard connects to a host PC through a USB port. The designer activates a terminal emulator on the host PC and executes Python code to interact with the evaluation board and its connected components. Python source code for this option is included in the image downloaded from NXP's website.

4 Getting started

4.1 Kit contents/packing list

The FRDM-MC36XSD-EVB contents include:

- Assembled and tested evaluation board/module in anti-static bag
- Quick start guide

4.2 Jump start

NXP's analog product development boards provide an easy-to-use platform for evaluating NXP products. The boards support a range of analog, mixed-signal and power solutions. They incorporate monolithic ICs and system-in-package devices that use proven high-volume SMARTMOS technology. NXP products offer longer battery life, a smaller form factor, reduced component counts, lower cost and improved performance in powering state of the art systems.

1. Go to http://www.nxp.com/FRDM-MC36XSD-EVB.
2. Review your Tools Summary Page.
3. Locate and click:

4. Download the documents, software and other information.

Once the files are downloaded, review the user guide in the bundle. The user guide includes setup instructions, BOM and schematics. Jump start bundles are available on each tool summary page with the most relevant and current information. The information includes everything needed for design.

4.3 Required equipment

This kit requires the following items:

- 3/16" blade screwdriver for connecting the cables
- DC power supply: 5.0 V to 36 V with up to 20 A current handling capability, depending on motor requirements
- Typical loads (DC motor, bulbs, power resistors or inductive load with 20 A and 36 V max operation)
- One of the following hardware for SPI communication, configuration and control:
  - FRDM-KL25Z Freedom Development Platform
  - Raspberry Pi 2 Model B
  - RIoTboard

This board is also compatible with Arduino™ Uno and Leonardo but no drivers are provided for this hardware.

4.4 System requirements

The kit requires the following to function properly with the software:

- USB enabled computer running Windows XP or newer

5 Getting to know the hardware

5.1 Board overview

The FRDM-MC36XSD-EVB evaluation kit exercises all the functions of the MC06XSD200 device. It features two devices for a total of four power outputs that can be connected in parallel 2-by-2.

The board can be used in conjunction either with a FRDM-KL25Z board (connected to a PC's USB port) or with RIoTboard or Raspberry Pi.

Configuration, control and status monitoring of both MC06XSD200 is accomplished by using the board's SPI communication capabilities or, alternatively, by configuring the GPIO pins as direct input pins.

5.2 Board features

The FRDM-MC36XSD-EVB board supports evaluation of all the functionality available on NXP's MC06XSD200. The board features the following:

- Four configurable power outputs with current, voltage and overtemperature protection
- Power connectors to control various types of external loads
- 3.3 V voltage regulator
- Solder paste area reserved for soldering in additional components
- Freewheeling diodes on all power channels
- 220 µF tank capacitor on supply terminal to help to maintain voltage during current inrush

5.3 Block diagram

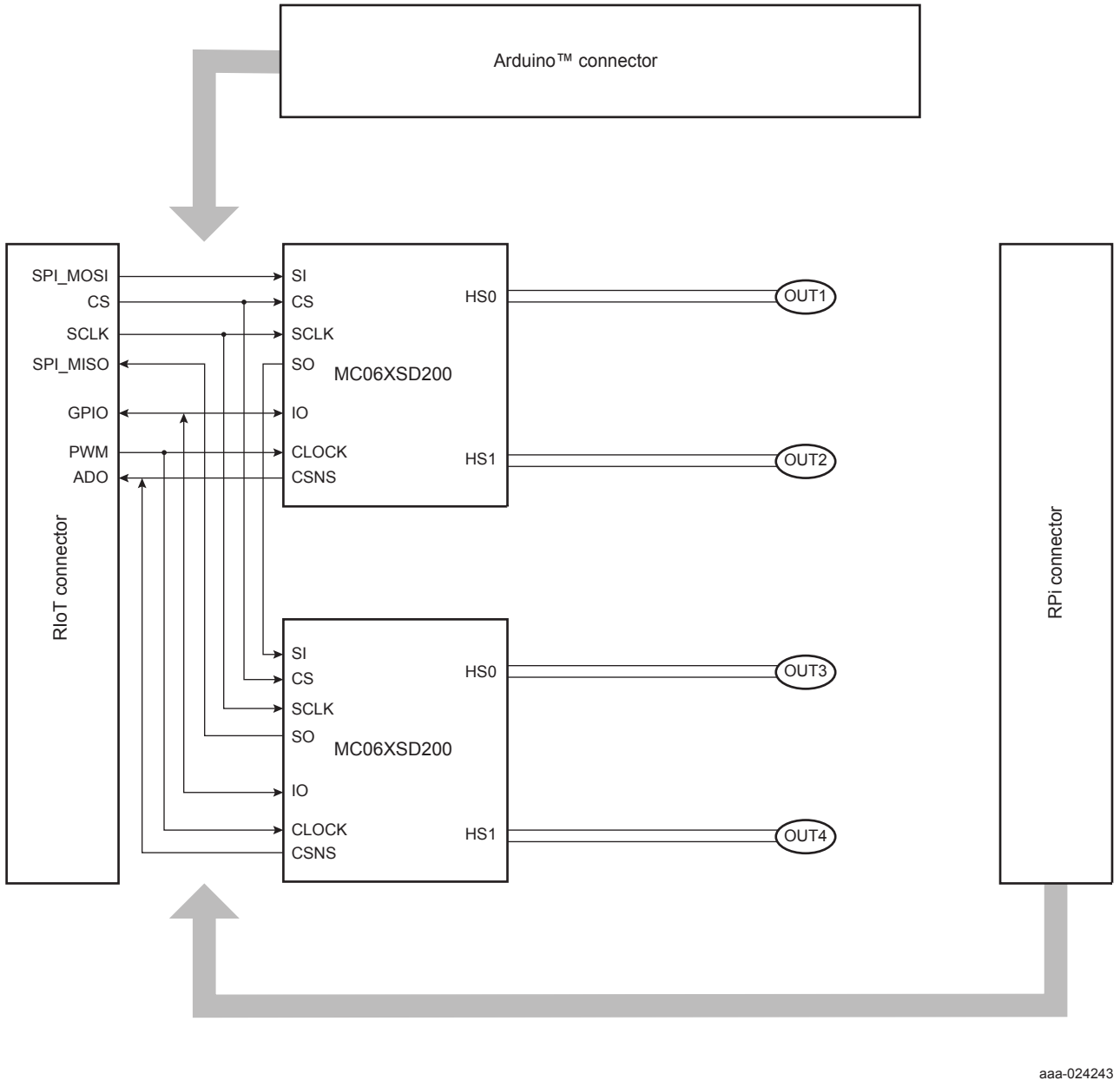


Figure 1. Block diagram

5.4 Device features

This evaluation board features the following NXP product:

Table 1. Device features

Device	Description	Features
MC06XSD200	The MC06XSD200 is a dual High-side Switch Power IC, enhanced with SPI configuration, protection and diagnostic capabilities	• Up to 12 A steady-state current per channel • Separate bulb and DC motor latched overcurrent handling • Sleep mode with minimal supply current (< 10 µA @ 24 V) • Individually programmable internal/external PWM clock signals • Overcurrent, short-circuit, and overtemperature protection with programmable auto-retry functions • Accurate temperature and current sensing • Open-load detection (channel in OFF and ON state), also for LED applications (7.0 mA typ.) • Normal operating range: 8.0 - 36 V, extended range: 6.0 - 58 V • 3.3 V and 5.0 V compatible 16-bit SPI port for device control, configuration and diagnostics at rates up to 8.0 MHz

For more details on the MC06XSD200, refer to the datasheet: http://www.nxp.com/files/analog/doc/data_sheet/MC06XSD200.pdf

5.5 Application diagram

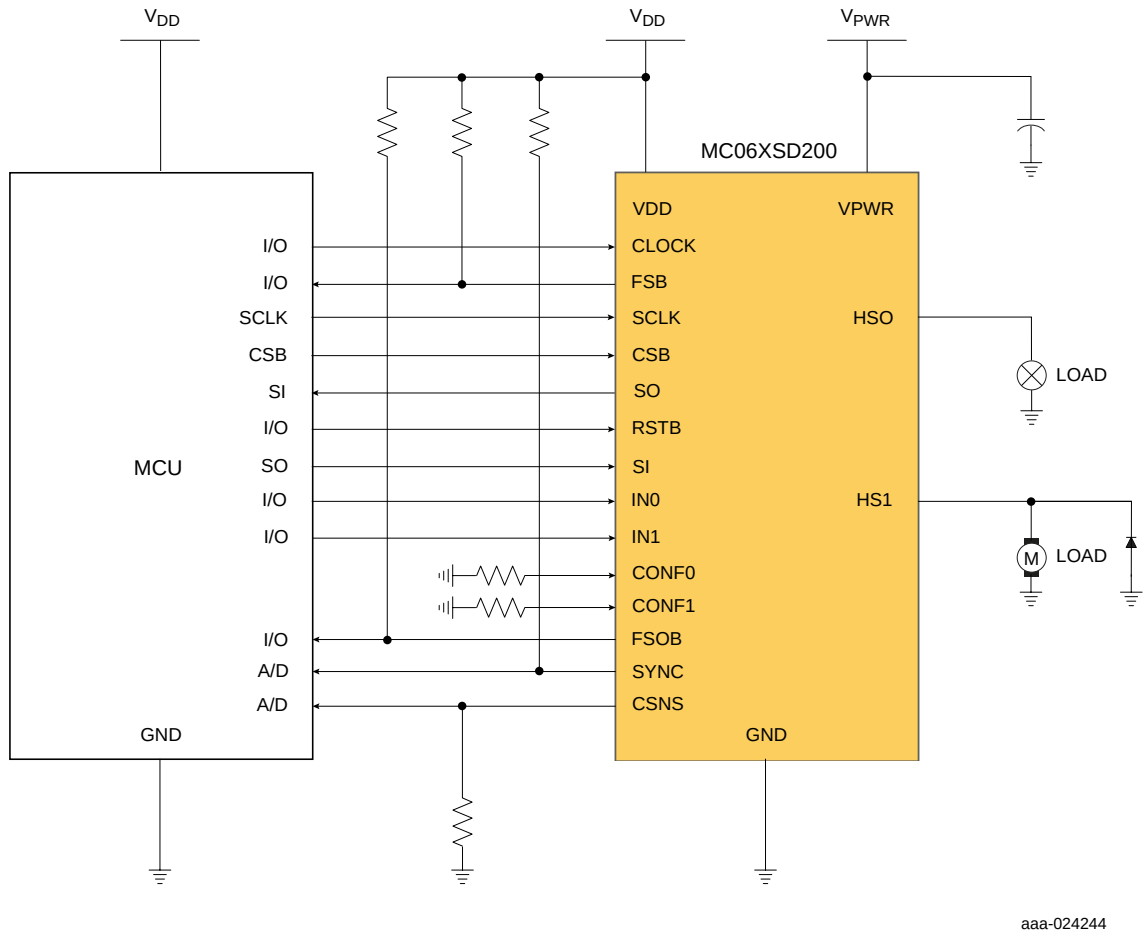


Figure 2. Application diagram

5.6 Internal block diagram

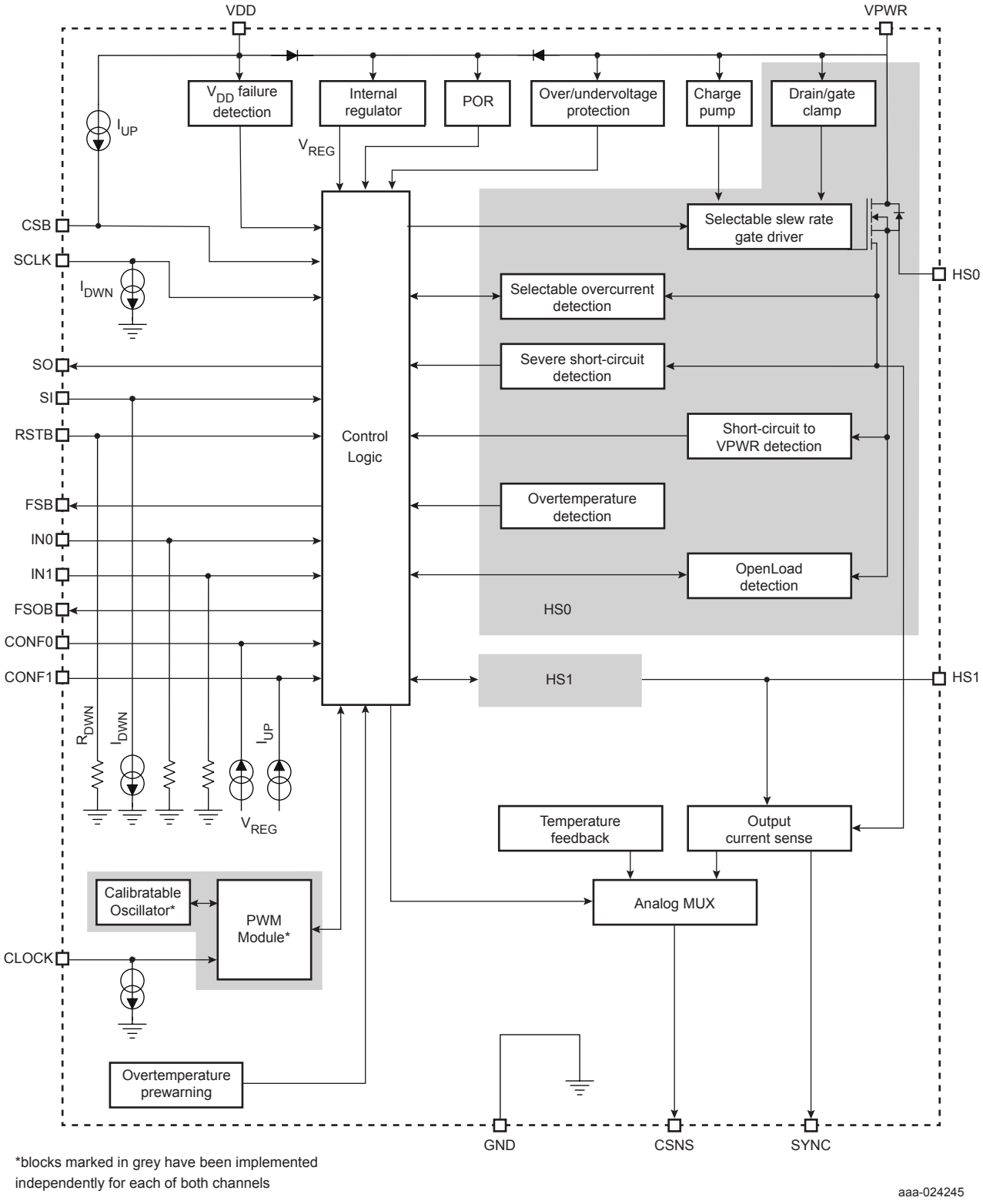


Figure 3. Internal block diagram

5.7 Overcurrent protection management

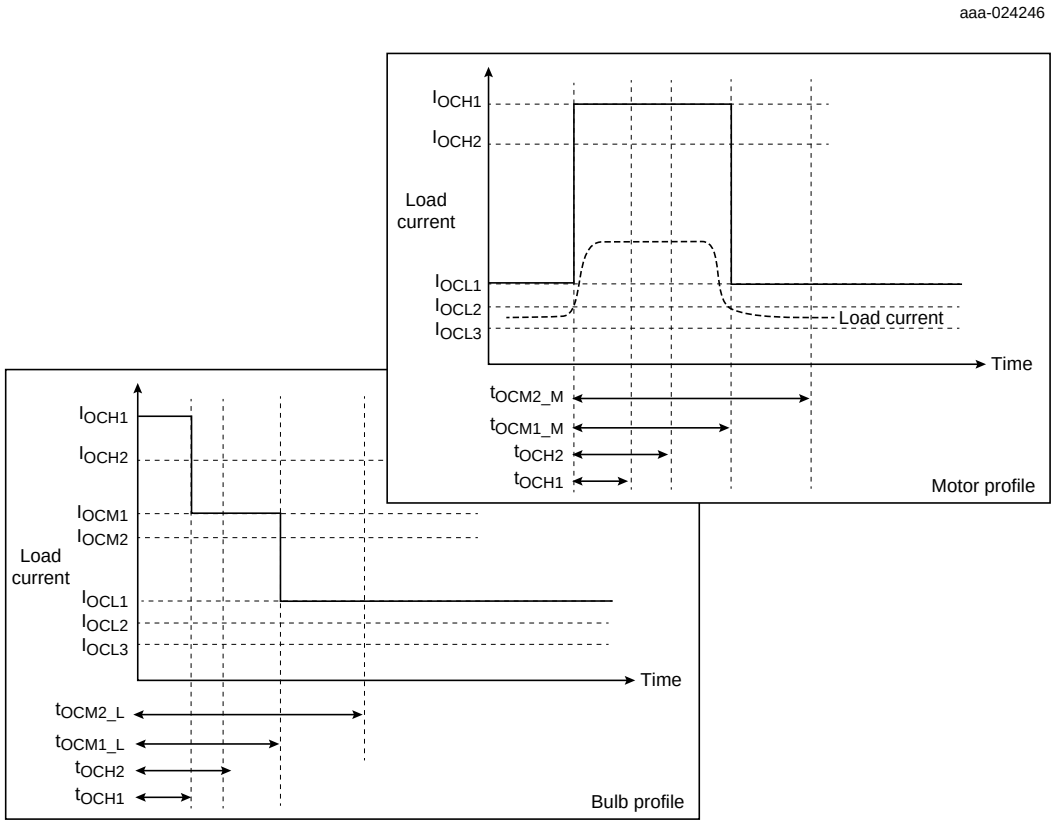


Figure 4. Overcurrent protection management

5.8 Board description

Figure 5 and Table 2 show the main elements on the FRDM-MC36XSD-EVB board.

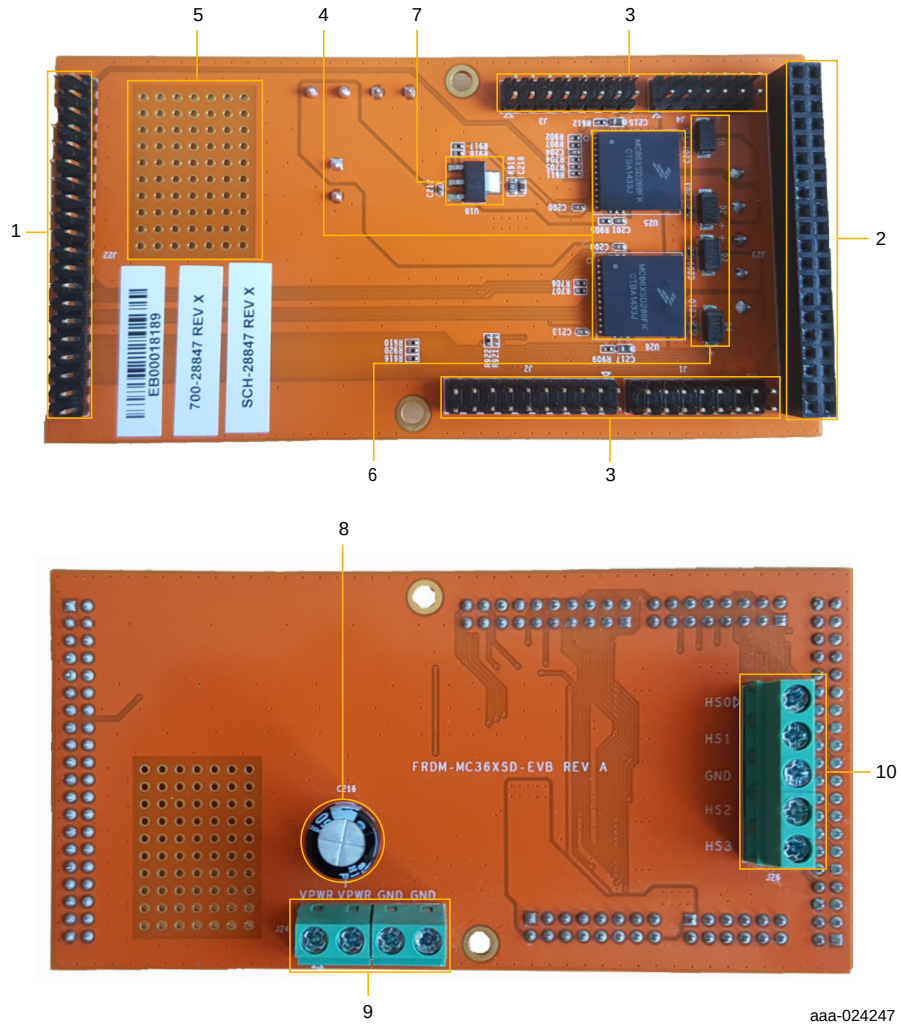


Figure 5. Board description

Table 2. Board description

Number	Name	Description
1	RIoTboard connector	Header male 2x20 pins for RIoTboard (J22)
2	Raspberry Pi connector	Header female 2x20 pins for Raspberry Pi (J23)
3	Arduino™ connectors	Male connectors for FRDM-KL25Z or Arduino™ board
4	2 × MC06XSD200	Dual high-side smart power switches
5	Solder area	5x7 holes solder paste area for external components
6	Power diodes	Freewheeling diodes for inductive loads
7	3.3 V regulator	3.3 V supply for V_{DD}
8	220 µF capacitor	Supply tank capacitor to support inrush currents

Number	Name	Description
9	Supply connector	Power connection for V_{PWR} and Ground
10	Outputs connectors	Power connection for Outputs HS0..3 of both devices and Ground

5.8.1 Input signal definitions

The following input signals control the outputs or functions inside the circuit.

Table 3. Input signal definitions

Input name	Description
GPIO0..3	Logic input to control the output state of HS0..3
MOSI	Master out slave input for the SPI
CSB	Chip select bar input for the SPI
SCLK	Clock for the SPI
RSTB	Reset of devices. Active low
CLOCK	External clock for PWM

5.8.2 Output signal definitions

In addition to driving a load, the FRDM-MC36XSD-EVB provides analog output for real time current monitoring and uses the following output signals to reflect the fault and device status.

Table 4. Output signal definitions

Output name	Description
FSB	Open drain active low status flag output to indicate fault
FSOB	Open drain active low fail-safe output
MISO	Master in slave out output for the SPI
CSNS	Analog monitoring of output current and ICs temperature
SYNC	Trigger signal for measurements on CSNS pin
HS0..3	Power outputs of both devices

5.9 Screw terminal connections

The board has the following screw terminal connections to connect the power supply and the load.

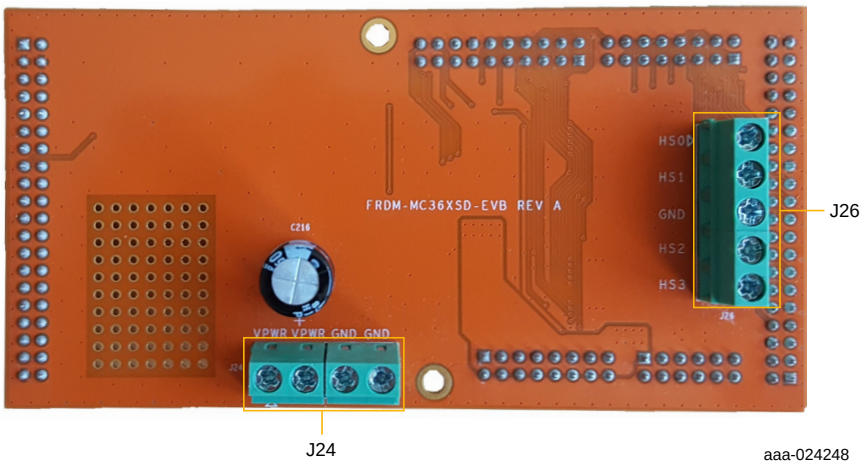


Figure 6. Screw terminal locations

Table 5. Screw terminal connections

Screw terminal name	Description
J24	Power supply connector for the 2 x MC06XSD200
J26	Output connector to connect load for both outputs of both devices (HS0…3) to ground

6 Operating with the FRDM-KL25Z and CodeWarrior

NXP's Freedom development platform is a set of software and hardware tools that provide an ideal platform for the rapid prototyping of microcontroller- based applications. The FRDM-KL25Z board is a key component of the development platform.

The board features a Kinetis L Series microcontroller, the industry's first microcontroller built on the ARM® Cortex™ –M0+ core. It makes use of the USB, the built in LEDs and the I/O ports available with NXP's Kinetis KL2x family of microcontrollers. When used in conjunction with other Freedom evaluation boards, the FRDM-KL25Z controls SPI communication between the evaluation board and a PC. It permits the user to regulate the power outputs and implement the features of the device on the evaluation board.

The FRDM-KL25Z also monitors the SPI registers, thereby facilitating the use of safety and advanced diagnostic functions.

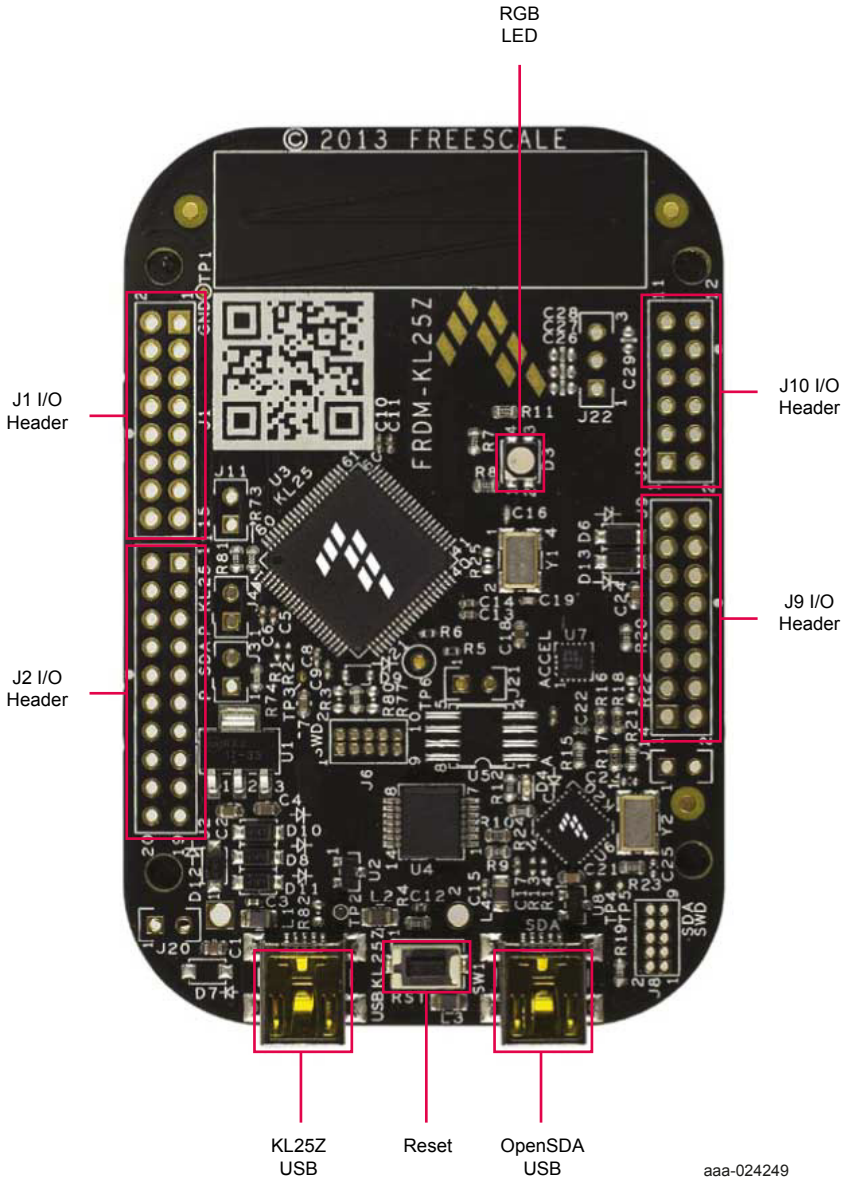


Figure 7. FRDM-KL25Z

6.1 Connecting the Freedom KL25Z to the FRDM-MC36XSD-EVB

The FRDM-MC36XSD-EVB connects to the FRDM-KL25Z using the four dual row Arduino™ R3 connectors on the bottom of the board.

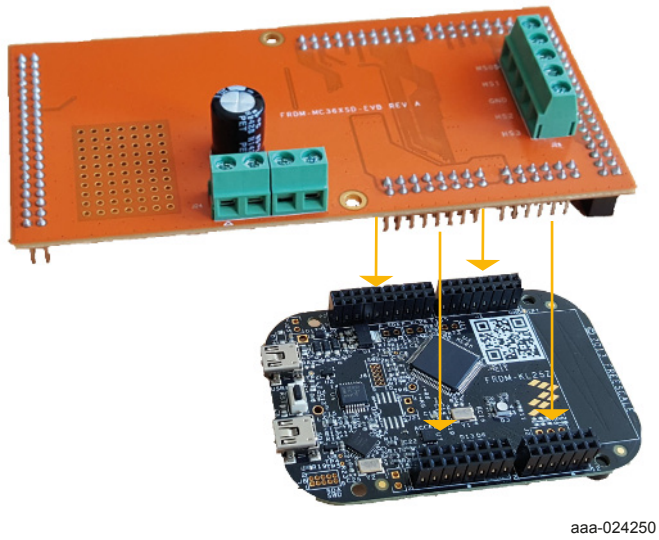


Figure 8. Connecting the FRDM-MC36XSD-EVB to the FRDM-KL25Z

Table 6. FRDM-MC36XSD-EVB to FRDM-KL25Z

Header	Pin	FRDM-KL25Z hardware name	FRDM-MC36XSD-EVB hardware name	Description
J1	1	PTC7	N/C	No connection
	2	PTA1	N/C	No connection
	3	PTC0	N/C	No connection
	4	PTA2	N/C	No connection
	5	PTC3	N/C	No connection
	6	PTD4	GPIO3	IN3 signal for HS0
	7	PTC4	N/C	No connection
	8	PTA12	GPIO2	IN2 signal for HS1
	9	PTC5	N/C	No connection
	10	PTA4	GPIO0	IN0 signal for HS3
	11	PTC6	N/C	No connection
	12	PTA5	GPIO1	IN1 signal for HS2
	13	PTC10	N/C	No connection
	14	PTC8	FSOB_C	Fail-safe output
	15	PTC11	N/C	No connection
	16	PTC9	FSB	Fault status to report faults
J2	1	PTC12	N/C	No connection
	2	PTA13	RSTB	Reset

Header	Pin	FRDM-KL25Z hardware name	FRDM-MC36XSD-EVB hardware name	Description
	3	PTC13	N/C	No connection
	4	PTD5	CLOCK	Input clock
	5	PTC16	N/C	No connection
	6	PTD0	SPI_CS	Chip select bar pin
	7	PTC17	N/C	No connection
	8	PTD2	SPI_MOSI	Master Output, Slave Input
	9	PTA16	N/C	No Connection
	10	PTD3	SPI_MISO	Master Input, Slave Output
	11	PTA17	N/C	No connection
	12	PTD1	SPI_CLK	Clock for SPI
	13	PTE31	N/C	No connection
	14	GND	GND	Gnd
	15	NC	N/C	No connection
	16	VREFH	N/C	No connection
	17	PTD6	CSNS	Current/temp sense reporting
	18	PTE0	CSNS	Current/temp sense reporting
	19	PTD7	N/C	No connection
	20	PTE1	SYNC	Synchronization signal for CSNS

6.2 Configuring the hardware

The FRDM-MC36XSD-EVB consists of four power high-side channels driven through a parallel and SPI interface. The two devices on board are daisy chained. The board can be configured for use with a FRDM-KL25Z board and the 36VeXtremeSwitch Processor Expert component.

Note: *When using the FRDM-MC36XSD-EVB, make sure that the maximum supply voltage (VPWR) stays within the 5.0 V to 36 V range. Operating outside this range may cause damage to the board.*

To configure the FRDM-MC36XSD-EVB for use with the FRDM-KL25Z and CodeWarrior, do the following:

1. Connect the FRDM-MC36XSD-EVB to the FRDM-KL25Z using the Arduino™ connectors on each board.
2. Connect the USB cable (not supplied with the kit) between the PC and the USB port labeled **SDA** on the FRDM-KL25Z board.
3. With the power switched off, attach the DC power supply to the VBAT and GND screw connector terminal (J24) on the evaluation board.
4. Connect the load to the screw terminal (J26).

Figure 9 illustrates the hardware configuration using a FRDM-KL25Z.

For more details on setup of the FRDM-KL25Z, refer to the FRDM-KL25Z tool summary page at http://www.nxp.com/FRDM-KL25Z or the material at http://www.element14.com/community/docs/DOC-49219

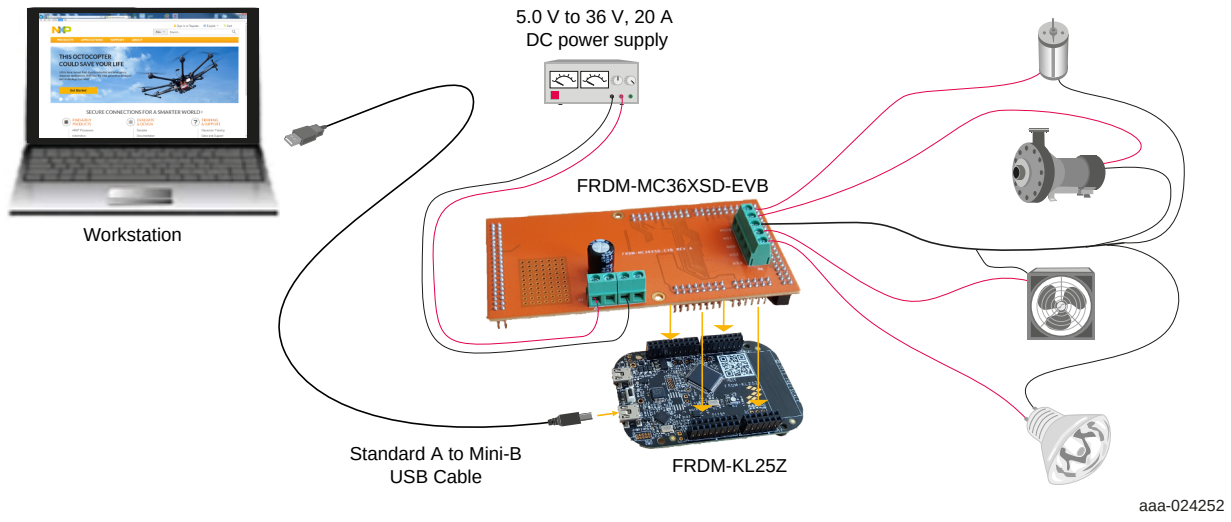


Figure 9. FRDM-MC36XSD-EVB configured for use with a FRDM-KL25Z board

6.3 Setting up the software

The software user interface for the FRDM-MC36XSD-EVB board is provided by NXP's CodeWarrior IDE (integrated development environment). A software component—36VeXtremeSwitch—imported into CodeWarrior as part of a project, contains the low-level drivers required to configure the FRDM-MC36XSD-EVB development environment and control the on-board device.

Prior to using the FRDM-MC36XSD-EVB in an evaluation environment, the user must do the following:

1. Download and install CodeWarrior 10.6 or higher onto the PC. To download CodeWarrior, go to the following website: http://www.nxp.com/CodeWarrior.
2. Go to the Tool Summary Page at http://www.nxp.com/FRDM-MC36XSD-EVB and click on the **Jump Start** icon. Locate and download the zip file named **FRDM-MC36XSDEVB-Demo.zip**. This file contains an example project that incorporates the 36VeXtremeSwitch component. Unzip this file into the computer that has CodeWarrior installed.

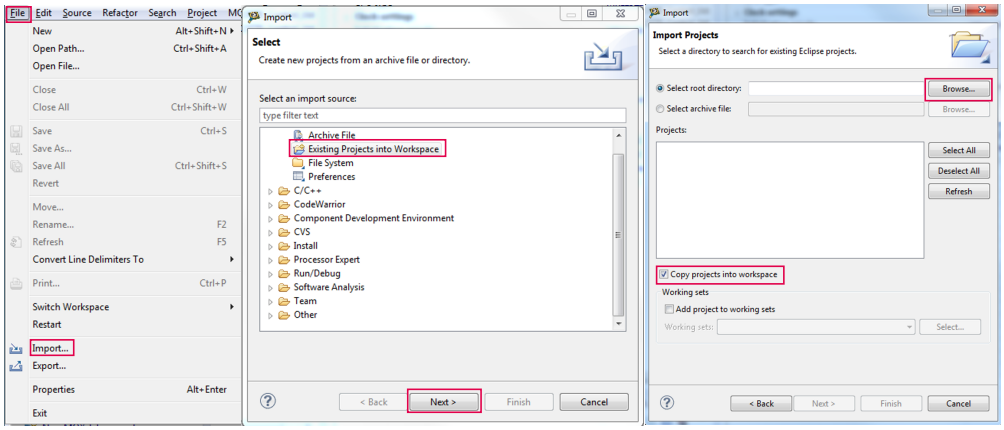
For more details on importing a project and configuring CodeWarrior with the 36VeXtremeSwitch component, refer to the TWR-MC36XSDEVB User Guide.

6.4 Importing a project example into CodeWarrior

This section describes the high-level flow for importing and using an example project related to the FRDM-MC36XSD-EVB. The example file is included in the zip file downloaded in Section 6.3 "Setting up the software".

The steps provided below offer only a cursory overview of the process. For more detailed information, see TWR-MC36XSDEVB User Guide.

1. With a Standard A /Mini B USB cable, connect the Standard A plug into the PC and the Mini-B plug into the **SDA** port on the FRDM-KL25Z.
2. Open CodeWarrior on the computer.
3. From the CodeWarrior menu bar, select File>>Import.
4. In the **Select** window, click **Existing Projects into Workspace**, then click **Next**.



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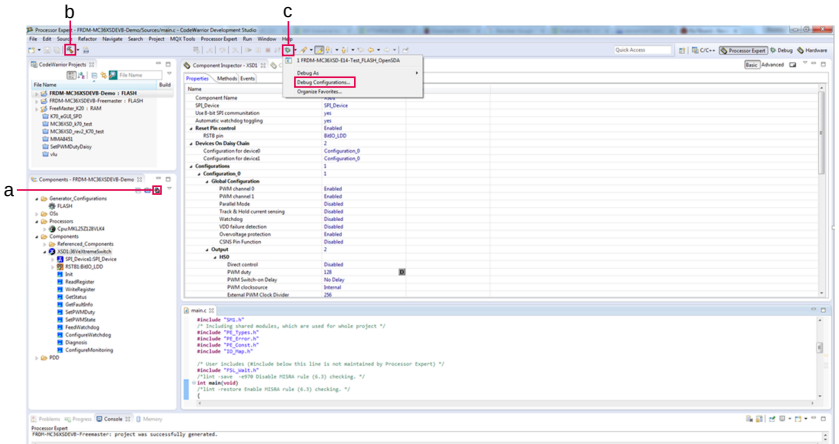
5. In the **Import Projects** window, assure that the **Select root directory** option is selected. In the corresponding box, select the FRDM-MC36XSDEVB-Demo project downloaded in Section 6.3 "Setting up the software". Then click **Finish**. With the demo project open in CodeWarrior, do the following:
   a. In the CodeWarrior Components panel, click on the **Generate Processor Expert** code icon.
   b. In the CodeWarrior menu bar, click on the **Build** icon.
   c. From the **Debug** menu, click **Debug Configurations**. Locate and select the file FRDM-MC36XSDEVB-Demo_FLASH_OpenSDA. Then click the **Debug** button.



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This example project toggles the different outputs at 1 Hz frequency. The user can modify main.c to customize the code, use some of the functions listed under the XSD1:36VeXtremeSwitch component or configure the different properties set during initialization.

7 Operating with Raspberry Pi and Python

The Raspberry Pi is a multifunctional board designed as an educational tool. It features a Broadcom BCM2836 SoC (quad-core ARM Cortex-A7), VideoCore IV GPU, and 1 GB of RAM (Model B). It also includes four USB ports, an HDMI port, and a 10/100 Ethernet controller.

Figure 10. Raspberry Pi board

The Raspberry Pi has an easy access 40-pin GPIO I/O header (2x20, 0.1” Center).

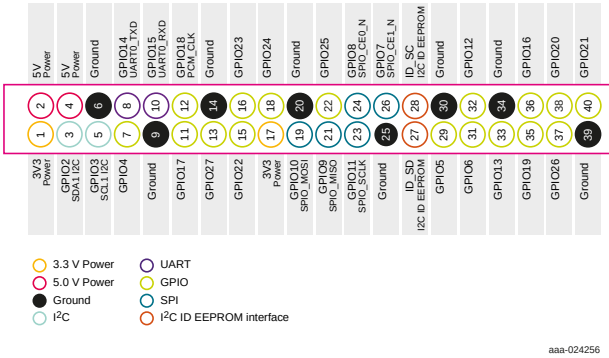

Figure 11. Pinouts of I/O headers on Raspberry Pi

7.1 Connecting Raspberry Pi to the FRDM-MC36XSD-EVB

To connect the FRDM-MC36XSD-EVB, align the connector J8 on the evaluation board with the GPIO pins on Raspberry Pi. Then mount the evaluation board to the Raspberry Pi board.

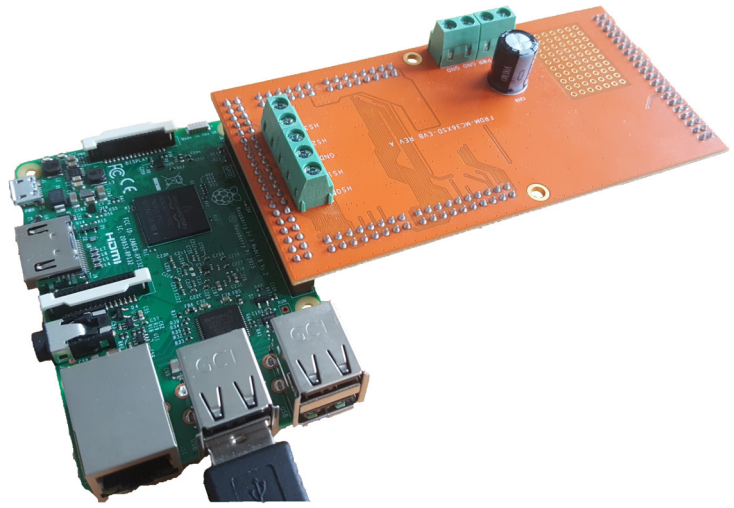

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Figure 12. FRDM-MC36XSD-EVB connection to Raspberry Pi

Table 7. Connecting the Raspberry Pi to the board

Raspberry Pi			FRDM-MC36XSD-EVB			
Header	**Pin**	**Hardware name**	**Header**	**Pin**	**Hardware name**	**Description**
J8	1	3V3	J23	1	—	No connection
	2	5V		2	—	No connection
	3	GPIO2		3	—	No connection
	4	5V		4	—	No connection
	5	GPIO3		5	—	No connection
	6	GND		6	GND	Gnd
	7	GPIO4		7	—	No connection
	8	GPIO14		8	GPIO3	IN3 signal for HS0
	9	GND		9	GND	Gnd
	10	GPIO15		10	GPIO2	IN2 signal for HS1
	11	GPIO17		11	RSTB	Reset
	12	GPIO18		12	GPIO0	IN0 signal for HS3
	13	GPIO27		13	SYNC	Synchronization signal for CSNS
	14	GND		14	GND	Fail-safe output
	15	GPIO22		15	—	No connection
	16	GPIO23		16	GPIO1	IN1 signal for HS2
	17	3V3		17	—	No connection
	18	GPIO24		18	FSOB_C	Fail-safe output
	19	GPIO10	J23	19	SPI_MOSI	Master Output, Slave Input
	20	GND		20	GND	Gnd

Raspberry Pi			FRDM-MC36XSD-EVB			
Header	Pin	Hardware name	Header	Pin	Hardware name	Description
	21	GPIO9		21	SPI_MISO	Master Input, Slave Output
	22	GPIO25		22	FSB	Fault status to report faults
	23	GPIO11		23	SPI_CLK	Clock for SPI
	24	GPIO8		24	SPI_CS	Chip select bar pin
	25	GND		25	GND	Gnd
	26	GPIO7		26	—	No connection
	27	ID_SD		27	—	No connection
	28	ID_SC		28	—	No connection
	29	GPIO5		29	—	No connection
	30	GND		30	GND	Gnd
	31	GPIO6		31	—	No connection
	32	GPIO12		32	CLOCK	Input clock
	33	GPIO13		33	—	No connection
	34	GND		34	GND	Gnd
	35	GPIO19		35	—	No connection
	36	GPIO16		36	—	No connection
	37	GPIO26		37	—	No connection
	38	GPIO20		38	—	No connection
	39	GND		39	GND	No connection
	40	GPIO21		40	—	No connection

7.2 Configuring the hardware with Raspberry Pi

With the FRDM-MC36XSD-EVB mounted to the Raspberry Pi board as described in Section 7.1 "Connecting Raspberry Pi to the FRDM-MC36XSD-EVB", make the following connections:

On the FRDM-MC36XSD-EVB:

1. Connect 5.0 V to 36 V DC power supply to connector J24.
2. Connect up to four loads to connector J26.

On the Raspberry Pi board:

1. Connect an HDMI-compatible monitor to the HDMI port.
2. Connect the USB mouse and keyboard to one of the USB connectors.
3. Connect a 5.0 V 2.0 A power supply to the Micro-USB Power port.

Figure 13 illustrates the hardware configuration with the Raspberry Pi board.

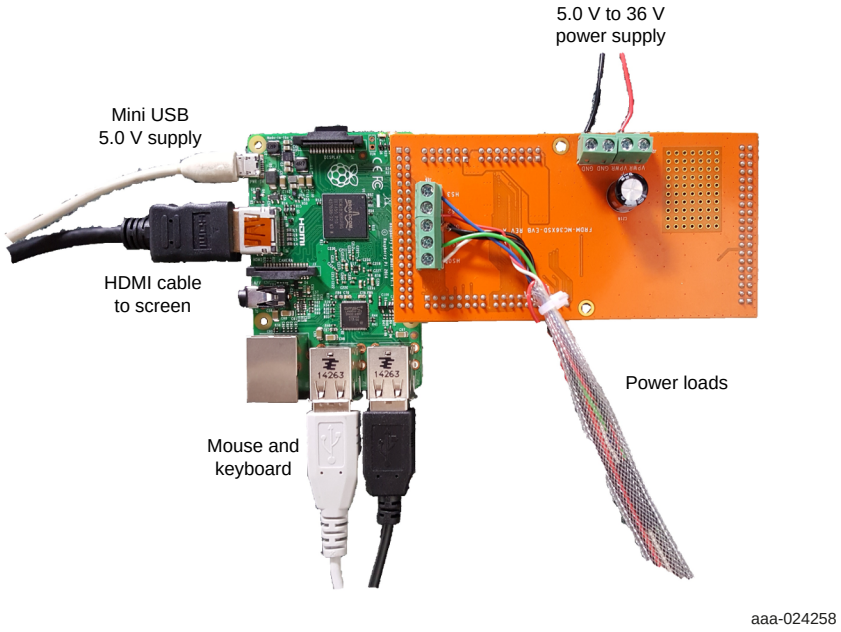

Figure 13. FRDM-MC36XSD-EVB configured for use with Raspberry Pi board

7.3 Setting up the Raspberry Pi software

The procedure for setting up the software that supports using the FRDM-MC36XSD-EVB with a Raspberry Pi 2 Model B board is as follows:

1. Got to the Tool Summary Page at http://www.nxp.com/FRDM-MC36XSD-EVB and click on the **Jump Start** icon. Locate and download the zip file named **Rpi_save_HSSwitch_20160121.zip**. This file contains a microcode image of the Raspbian operating system and a Python demo file that illustrates the functionality of the FRDM-MC36XSD-EVB with Raspberry Pi.
2. Unzip the file. The resulting image file appears with the name **Rpi_save_HSSwitch_20160121.img**.
3. Flash the image to an 8 GB SD card. To flash the image, follow the instructions at: https://www.raspberrypi.org/documentation/installation/installing-images/
4. Insert the SD card into the Raspberry Pi SD slot (located on the back of the board). Power up the board by inserting a powered USB cable into the Micro USB port on the Raspberry Pi.
5. If a login is required, use: Username = **Pi** Password = **raspberry**.

Open a terminal window and enter the following command to run the Python code: **sudo python Highside_switch.py**

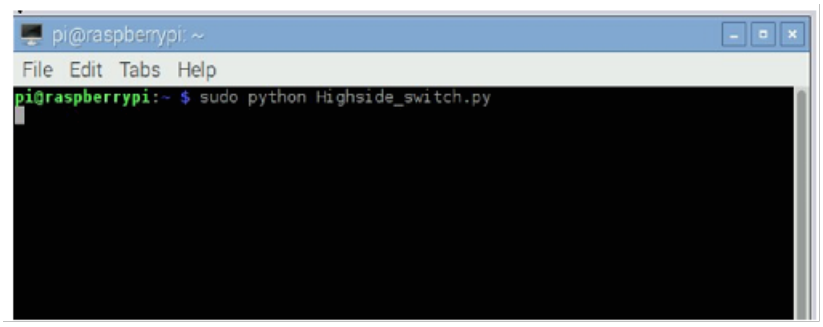

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Figure 14. Raspberry Pi Terminal and launch command

A turn On/Off demo sequence on the different outputs HS0..3 is launched.

The Python code is located at /home/Pi/Highside_switch.py and can be edited to accommodate the user's requirements.

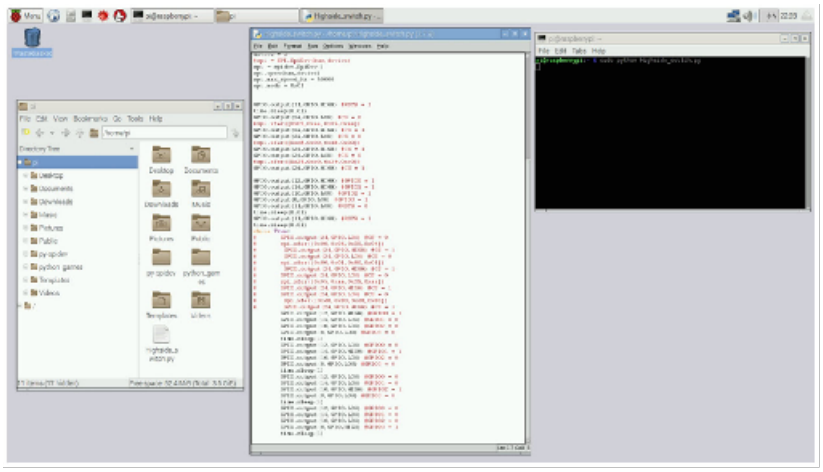

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Figure 15. Raspberry Pi dashboard

8 Operating with the RIoTboard

The RIoTboard is based on the i.MX 6Solo processor from NXP and integrates all the functionality of this multimedia application processor. The board supports a wide range of internet devices, such as game consoles and navigation devices. It offers a variety of I/O options, including four Standard A USB ports, one Mini USB port, an Ethernet port and a 40-pin GPIO expansion port. For more details on RIoTBoard, go to https://www.element14.com/community/docs/DOC-74480/l/riot-board-starter-kit

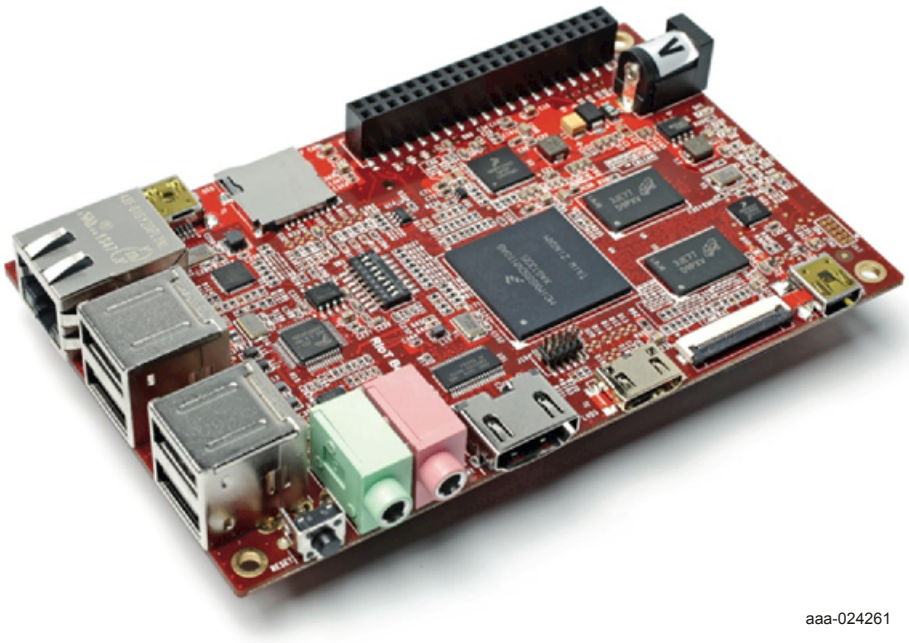


Figure 16. RIoTboard

8.1 Connecting RIoTboard to the FRDM-MC36XSD-EVB

To connect the FRDM-MC36XSD-EVB to a RIoTboard, mount the GPIO header (J13) on the FRDM-MC36XSD-EVB to the RIoTboard.

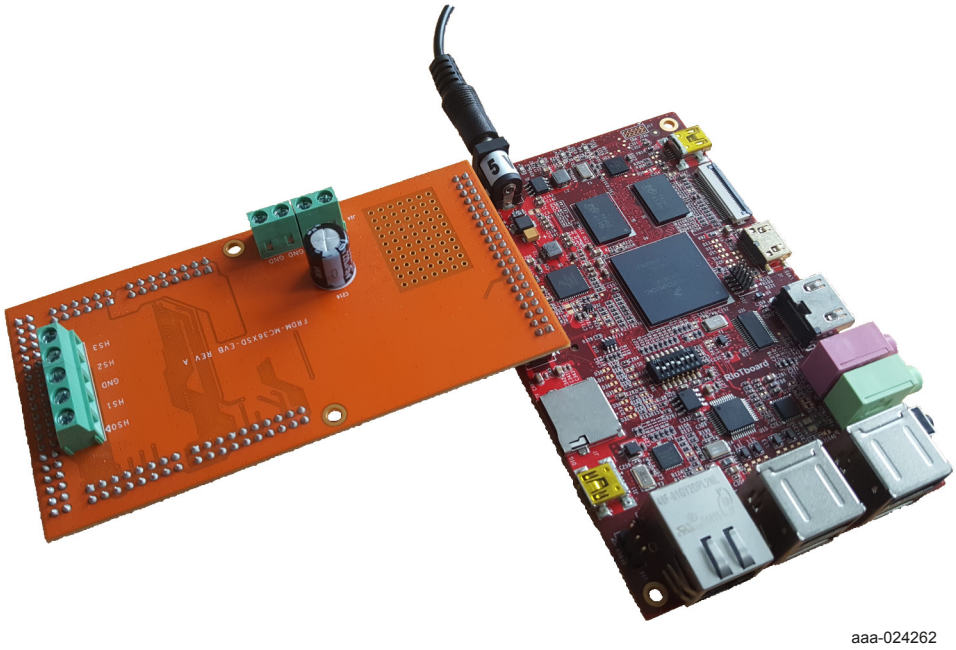


Figure 17. FRDM-MC36XSD-EVB connection to RIotBoard

Table 8. FRDM-MC36XSD-EVB to RIoTboard connections

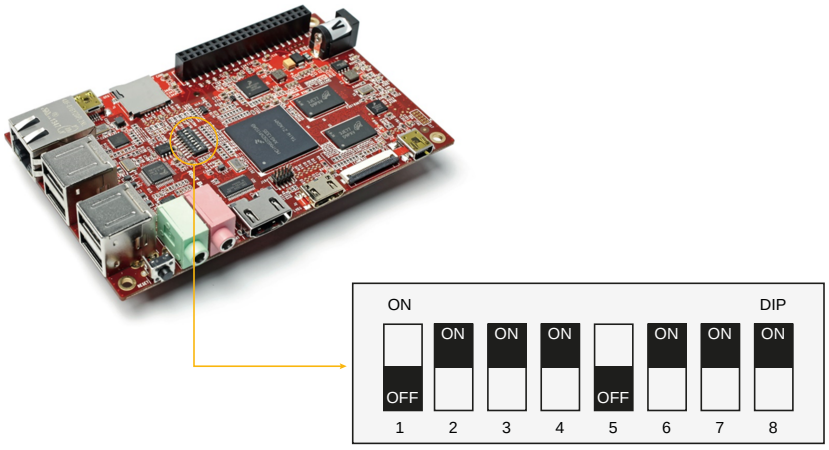
RIoTboard			FRDM-MC36XSD-EVB			
Header	**Pin**	**Hardware name**	**Header**	**Pin**	**Hardware name**	**Description**
J13	1	VDD_NVCC	J22	1	—	No connection
	2	5VIN		2	—	No connection
	3	GND		3	Gnd	Gnd
	4	GND		4	Gnd	Gnd
	5	GPIO4_16		5	GPIO0	IN0 signal for HS3
	6	CSPI3_CLK		6	SPI_CLK	Clock for SPI
	7	GPIO4_17		7	GPIO1	IN1 signal for HS2
	8	CSPI3_MOSI		8	SPI_MOSI	Master Output, Slave Input
	9	GPIO4_18		9	FSOB_C	Fail-safe output
	10	CSPI3_MISO		10	SPI_MISO	Master Input, Slave Output
	11	GPIO4_19		11	FSB	Fault status to report faults
	12	CSPI3_CS0		12	SPI_CS	Chip select bar pin
	13	CSPI3_CS1		13	GPIO2	IN2 signal for HS1
	14	CSPI2_CS1		14	GPIO3	IN3 signal for HS0
	15	GPIO4_31		15	RSTB	Reset
	16	CSPI2_MOSI		16	SYNC	Synchronization signal for CSNS
	17	GPIO5_05		17	—	No connection
	18	CSPI2_MISO		18	—	No connection

RIoTboard			FRDM-MC36XSD-EVB			
Header	Pin	Hardware name	Header	Pin	Hardware name	Description
	19	GPIO5_06		19	—	No connection
	20	CSPI2_CS0		20	—	No connection
	21	GPIO5_07		21	—	No connection
	22	CSPI2_CLK		22	—	No connection
	23	GPIO5_08		23	—	No connection
	24	UART3_RXD		24	—	No connection
	25	GPIO4_26		25	—	No connection
	26	UART3_TXD		26	—	No connection
	27	GPIO4_27		27	—	No connection
	28	UART4_RXD		28	—	No connection
	29	CSPI3_RDY		29	—	No connection
	30	UART4_TXD		30	—	No connection
	31	I2C3_SCL		31	—	No connection
	32	UART5_RXD		32	—	No connection
	33	I2C3_SDA		33	—	No connection
	34	UART5_TXD		34	—	No connection
	35	I2C4_SCL		35	—	No connection
	36	PWM1		36	—	No connection
	37	I2C4_SDA		37	—	No connection
	38	PWM2		38	—	No connection
	39	GND		39	Gnd	Gnd
	40	PWM3		40	CLOCK	Input clock

8.2 Setting up the RIoTboard software

The procedure for setting up the software that supports using the FRDM-MC36XSD-EVB with a RIoTboard is as follows:

1. Go to the Tool Summary Page at http://www.nxp.com/FRDM-MC36XSD-EVB and click on the **Jump Start** icon. Locate and download the zip file named **tools_SVN2487(2016-1-22).zip**. Unzip the file to a location on the host PC.
2. Connect a 5.0 V DC power supply to the RIoTboard.
3. Connect one end of a Mini USB cable to the USB OTG interface on the RIoTboard. Connect the other end of the cable to the host PC.
4. Power down the board and set the boot switch (SW1) on the RIoTboard to serial download mode, as shown below:



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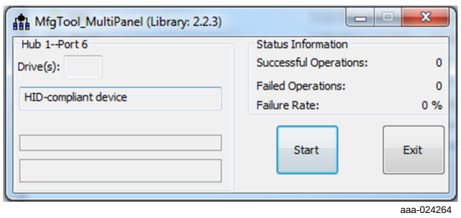
5. Click on the tools_SVN2487(2016-1-22) folder (extracted in Step 1) and open the folder **Mfgtools-Rel-4.1.0_130816_MX6DL_UPDATER**. Locate and activate **MfgTools2.exe**, then power up the RIoTboard.
6. Click **Start** in the following window; when download process is done, click **Stop** to finish.



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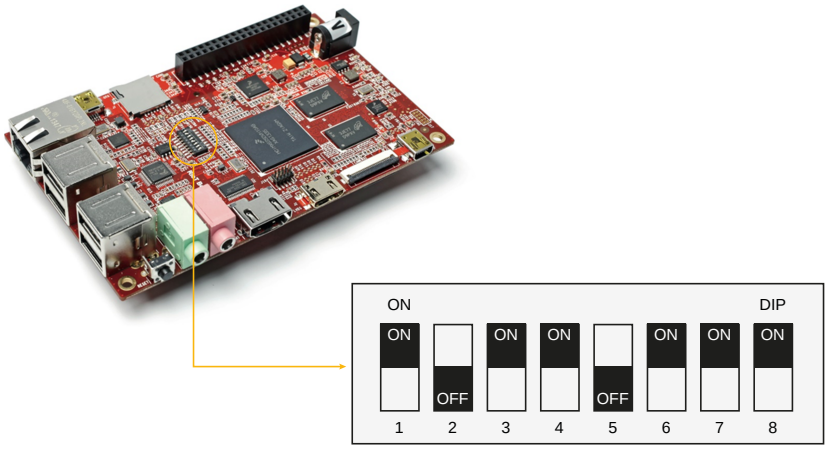
7. Power off the RIoTboard and set the boot switches (SW1) to eMMC boot mode, as shown below:



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8. Boot the RIotBoard and open a terminal window. Enter the following command:
   root@linaro-ubuntu-desktop:~# **python source/Highside_switch.py driver_test**

The results and driven output appear as follows :

```
Init gpio for Highside switch
Set gpio direction
RSTB = 1
GPIO0 = 1
Init Highside Switch driver
GPIO1 = 1
GPIO2 = 1
GPIO3 = 1
GPIO0 = 0
GPIO1 = 1
GPIO2 = 1
GPIO3 = 1
GPIO0 = 1
GPIO1 = 0
GPIO2 = 1
GPIO3 = 1
```

The file **Highside_switch.py** can be edited for specific usage.

9 Schematics, board layout and bill of materials

FRDM-MC36XSD-EVB board schematics, board layout and bill of materials are available in the download tab of the FRDM-MC36XSD-EVB Tool summary page at the following URL: www.nxp.com/FRDM-MC36XSD-EVB

10 References

The following are URLs related to NXP products and application solutions:

NXP.com support pages	Description	URL
FRDM-MC36XSD-EVB	Tool summary page	www.nxp.com/FRDM-MC36XSD-EVB
FRDM-KL25Z	Tool summary page	www.nxp.com/FRDM-KL25Z
MC06XSD200	Product summary page	http://www.nxp.com/MC36XSD

11 Contact information

Visit http://www.nxp.com/support for a list of phone numbers within your region.
Visit http://www.nxp.com/warranty to submit a request for tool warranty.

12 Revision history

Revision	Date	Description of changes
1.0	8/2016	Initial release

13 Legal information

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