SmartFusion2 DMPM Kit

Quickstart Guide

Overview

Microsemi's **SmartFusion®2 Digital Mixed-Signal Power Management Daughter Card Kit** builds on the SmartFusion DMPM kit by utilizing SmartFusion2 FPGA's ability to manage up to 64 channels of both analog and digital point-of-loads. The SF2-DMPM Daughter Board provides a bench top demonstration and development platform for Microsemi's SmartFusion2 MPM reference design, which incorporates eight digital regulators (controlled and monitored through the PMBus) in addition to eight Microsemi analog regulators, which are monitored through an external ADC. It includes a PMBus header for I^2C communication, which can be evaluated using the included USB-I^2C module. The SF2-DMPM-KIT connects to the SF2-DEV-KIT through the FMC header.

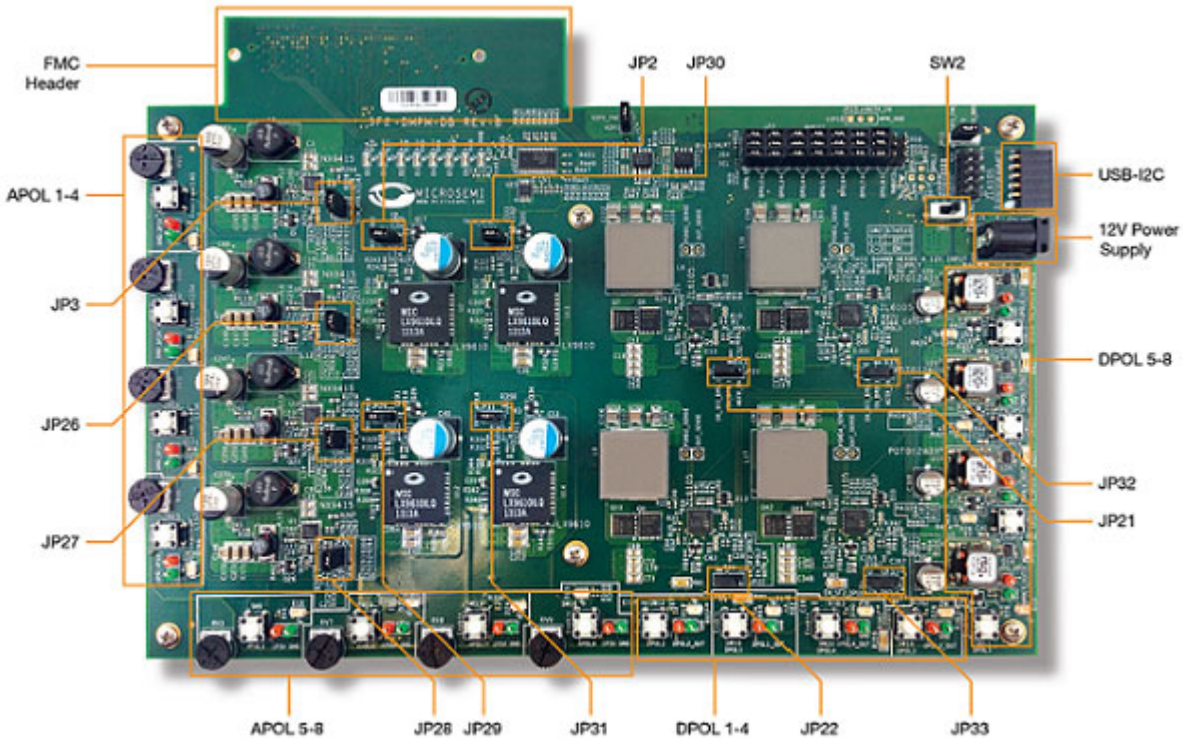

***Figure 1* • SF2 DMPM Daughter Board to SF2 Development Kit Through Their Respective FMC Connectors**

Kit Contents – SF2-DMPM-KIT

Table 1 • **SF2-DMPM Daughter Board Kit Contents**

Quantity	Description
1	SF2-DMPM Daughter Card
1	12 V, 5 A AC Power Adapter
1	Any Plug to Grounded 3 pin UK/Hong Kong Plug Adapter
1	Enhanced USB I^2C Module
1	USB CABLE A-B 3'
50	Mini Jumpers
1	SF2-DMPM-Kit Quickstart Card

Kit Contents – SF2-DEV-KIT

Table 2 • **SF2-DEV-KIT Contents**

Quantity	Description
1	SmartFusion2 Development Board with M2S050T-FGG896
1	12 V, 6 A AC Power Adapter
1	FlashPro4 Programmer
1	USB A to MicroB Cable
1	USB MicroA to A Cable
50	USB A to Mini-B Cable
1	PCI Edge Card Ribbon Cable

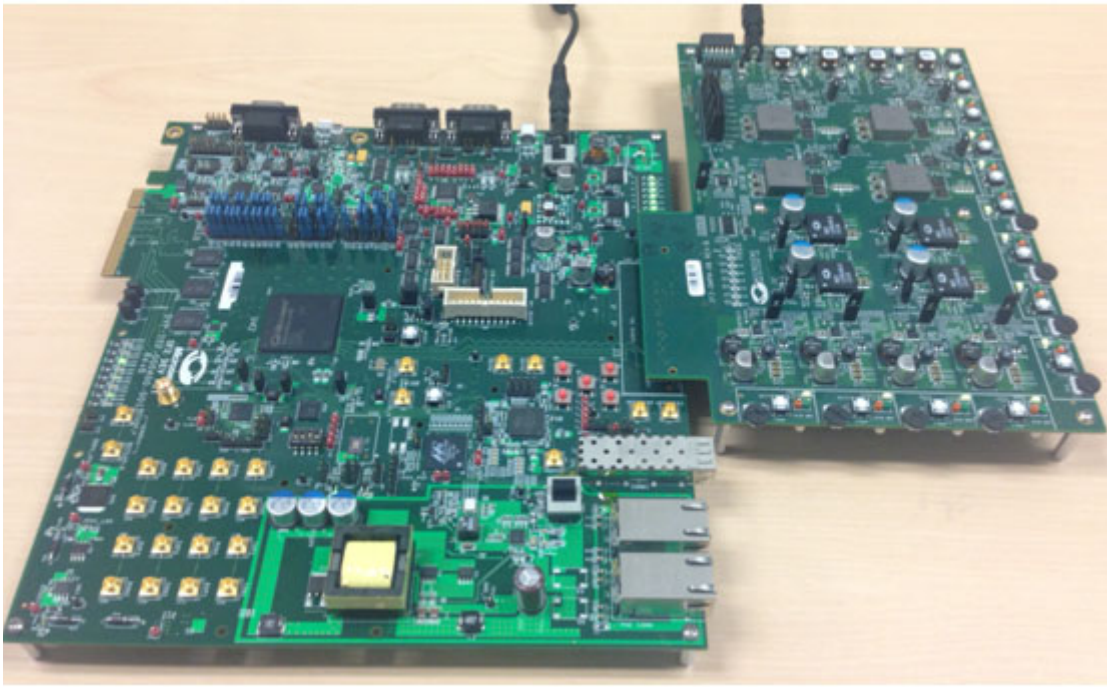

Figure 2 • **SF2-DMPM Daughter Board with the SmartFusion2 Development Kit Board**

Using the MPM

Installation

For installation, use the MPM v6.1 GUI Installation File:

http://soc.microsemi.com/download/rsc/?f=SmartFusion2_DMPM_GUI_DF.

Run the installer and follow the installation wizard instructions. By default, the MPM installs into the *C:\Microsemi\SF2_MPM_RefDesign_v6.1* folder and this is the recommended location for it. In particular, avoid installing it in a folder that is very deeply nested or has a very long path name. Otherwise, some tools may encounter problems accessing files with names longer than 259 characters*.

Once installed, the MPM adds the following options to the Windows start menu:

Start

All Programs

- Microsemi SmartFusion2 MPM Reference Design v6.1
  - Browse Design Files
    Opens in Windows Explorer the folder containing the MPM Libero®SoC hardware and SoftConsole firmware projects
  - MPM GUI
    Runs the MPM GUI
  - Uninstall
    Uninstalls the MPM

Hardware Setup

This section explains how to prepare the hardware for programming the MPM reference design and running the default demonstration.

You will need the following:

- SmartFusion2 Development Kit Board:
  http://www.microsemi.com/products/fpga-soc/design-resources/dev-kits/smartfusion2/smartfusion2-development-kit
- SF2 Digital MPM Daughter Board (SF2-DMPM-DB):
  http://www.microsemi.com/products/fpga-soc/design-resources/dev-kits/smartfusion2/smartfusion2-dmpm-kit
- Devantech/Robot Electronics USB-ISS communications module:
  http://robot-electronics.co.uk/acatalog/USB_I2C.html

**See the Microsoft MSDN article for more on path length issues:http://msdn.microsoft.com/en-us/library/aa365247.aspx.*

SmartFusion2 Development Kit Setup

The following jumper settings are required on the SmartFusion2 Dev-Kit to route the signals required for the DMPM board to the FMC connector. Due to the number of jumpers needed, we have provided pictures of the jumpers as well as the list of pins.

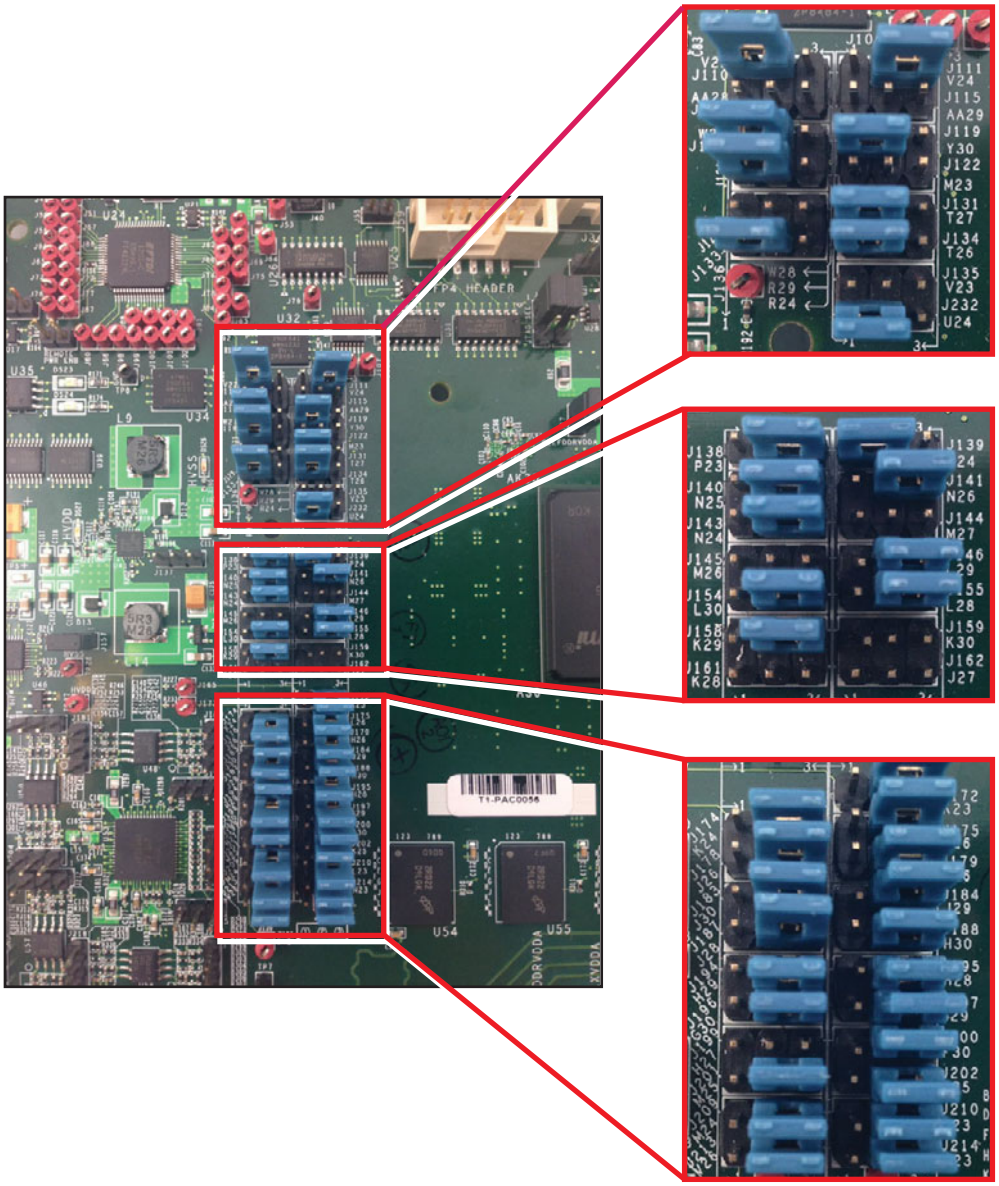

***Figure 3* • SmartFusion2 Development Kit Setup**

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Table 3 • **List of Jumpers Needed on the SF2-DEV-KIT**

J174 pins 2 and 3 jumpered	J172 pins 2 and 3 jumpered	J184 pins 2 and 3 jumpered
J175 pins 2 and 3 jumpered	J179 pins 2 and 3 jumpered	J195 pins 2 and 3 jumpered
J200 pins 2 and 3 jumpered	J194 pins 2 and 3 jumpered	J202 pins 2 and 3 jumpered
J210 pins 2 and 3 jumpered	J201 pins 2 and 3 jumpered	J209 pins 2 and 3 jumpered
J155 pins 2 and 3 jumpered	J146 pins 2 and 3 jumpered	J140 pins 2 and 3 jumpered
J138 pins 2 and 3 jumpered	J158 pins 2 and 3 jumpered	J154 pins 2 and 3 jumpered
J143 pins 2 and 3 jumpered	J141 pins 2 and 3 jumpered	J111 pins 2 and 3 jumpered
J133 pins 2 and 3 jumpered	J214 pins 2 and 3 jumpered	J213 pins 2 and 3 jumpered
J178 pins 2 and 3 jumpered	J188 pins 2 and 3 jumpered	J187 pins 2 and 3 jumpered
J197 pins 2 and 3 jumpered	J196 pins 2 and 3 jumpered	J183 pins 2 and 3 jumpered

The DIP switch SW10 is used to provide four of the MPM inputs and also to select optional operational modes for MPM.

The default settings for SW10 are:

SW10.1 - ON
SW10.2 - ON
SW10.3 - ON
SW10.4 - ON

Figure 4 • **SF2-Dev-Kit SW10**

SW10.1 selects whether the MPM initiates an auto-shutdown when an APOL goes to OV2 or UV2.

When SW10.1 is OFF, the MPM does not initiate an auto-shutdown

When SW10.1 is ON, the MPM will initiate an auto-shutdown.

SW10.2 selects whether the MPM reloads the configuration in eNMV with known good values on power up.

When SW10.2 is OFF, the MPM does not reload the last known good configuration in eNVM

When SW10.2 is ON, the MPM reloads the last good configuration values in eNVM on power up.

SW10.3 selects whether the DEADTIME parameter for DPOL 1-4 is configurable or not.

When SW10.3 is OFF, DEADTIME is not set by the MPM and will have either the default values as defined in the ZL6105 documentation; if the DPOL had just been powered up or the last value set by the MPM and if the DPOL has not been power cycled since the last write to DEADTIME.

When SW10.3 is ON, DEADTIME will be selected by SW10.4

SW10.4 selects the DEADTIME configuration value for DPOL1-4.

When SW10.4 is OFF, the MPM will select a DEADTIME of 40nS

When SW10.4 is ON, the MPM will select a DEADTIME of 24nS

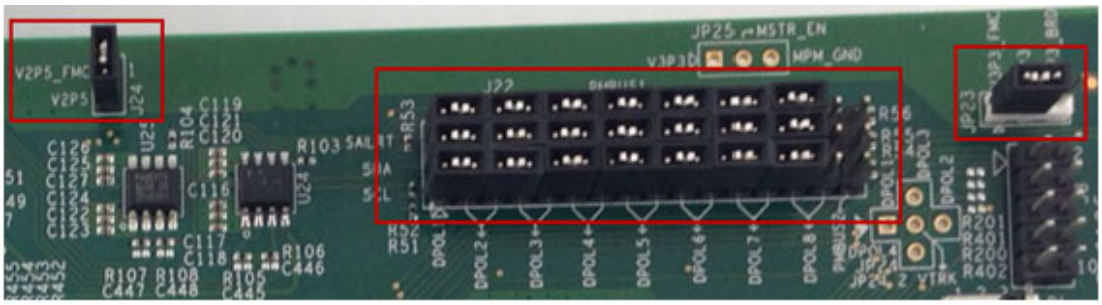

***Figure 5* • SF2-DMPM-DB I^{2}C Jumpers**

JP23 should have pins 1 and 2 jumpered and J24 should be jumpered to provide 3.3 V and 2.5 V supplies to the SF2-DMPM-DB board from the FMC connector.

J22 should have 7 x 3 jumpers installed as shown in Figure 5 above, to link the eight DPOLs to PMBUS1. The last pair of pins labeled PMBUS2 are unjumpered.

For the APOLs on the SF2-DMPM-DB JP3, JP26, JP27, JP28, JP2, JP29, JP30, and JP31 must be jumpered to enable trimming, refer to Figure 6.

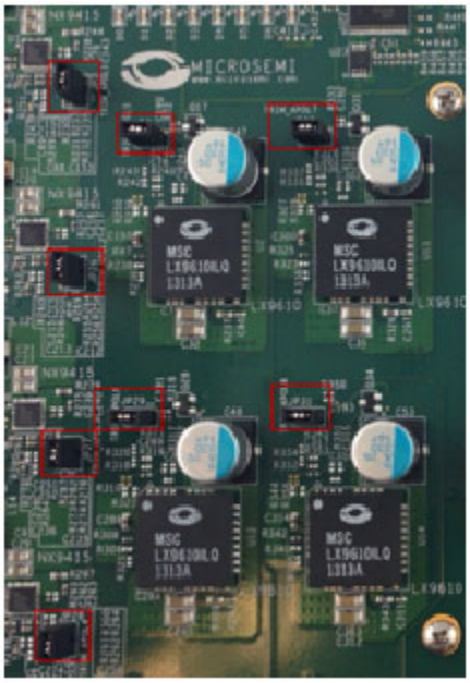

***Figure 6* • APOLs Jumpered to Enable Trimming**

For the DPOLs on the SF2-DMPM-DB board JP21, JP22, JP32, and JP33 must be jumpered on pins 1 and 2 to route the regulator enables of the first four DPOLs to the FMC connector, refer to Figure 7.

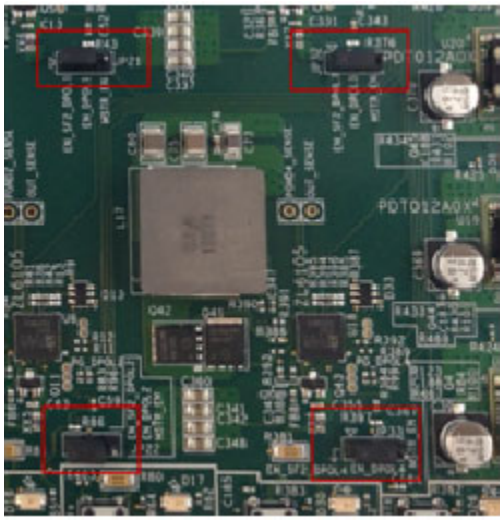

***Figure 7* • DPOLs to the FMC Connector**

Programming the MPM

The first time you use the MPM, you need to use the MPM GUI to program the MPM design to the target hardware.

- For the SmartFusion2 Development Kit Board:
  - Connect the **12 V/6 A** power supply to the **J18 12 V INPUT SUPPLY** connector
  - Connect **FlashPro4 programmer** to the **J59 – FP4 Header**
  - Connect a **mini USB cable** between your PC and the FlashPro4
  - Power the board on using **SW7**
- To run the MPM GUI:
  - Select **Data** > **FlashPro** > **Choose STAPL template** and select the appropriate STAPL file for your target hardware from the *C:\Microsemi\SF2_MPM_RefDesign_v6.1\template* folder.*
  - Select **Data** > **FlashPro** > **FlashPro Setup** and browse to select the FlashPro software executable in your Libero SoC v11 or later installation.
  - Select **Data** > **FlashPro** > **Write NVM & Fabric** and the MPM GUI will launch FlashPro and program the full design (MSS configuration, MPM firmware, MPM configuration data in ENVM along with the FPGA fabric logic) to the target hardware. You will see a Command Shell “DOS Box” appear reporting progress. When prompted you can close this. At this stage the MPM target should be programmed with the MPM reference design.
- Power off the **SmartFusion2 Development board** by flipping **SW7** to **OFF** and disconnecting the USB cable and power supply cables
- Connect the **SF2-DMPM-DB** to the **SmartFusion2 Development Kit** board by connecting their respective FMC connectors
- Connect the **12 V/5 A** power supply to the **SF2-DMPM-DB J1 12 V DC IN** connector
- Reconnect the power cable to the **SmartFusion2 Development Kit** and turn **SW7** to **ON**
- Power the **SF2-DMPM-DB** on by using **SW2**
- Reset the **SmartFusion2 Development** board by pressing **SW9 RESET**

Note: **The power up order is important and it is advised to reset the system using SW9 on the SmartFusion2 Development Kit after powering up.**

**See the Microsoft MSDN article for more on path length issues:http://msdn.microsoft.com/en-us/library/aa365247.aspx.*

The MPM Reference Design Demo

Without the MPM GUI

Once the MPM reference design has been programmed to the target hardware, the demo can be viewed even without the MPM GUI by using SW3 on the Dev-Kit to initiate power-up and power-down sequences and observing the current state of the MPM on the Dev-Kit LEDs.

The central button (SW3) is used to start the MPM sequencing. If the MPM system is off, pressing SW3 starts sequencing the POLs up. If the MPM system is fully started, pressing SW3 starts sequencing the POLs down.

The remaining push buttons are connected to the MPM inputs and can be used to demonstrate the input functionality:

SW1 is connected to MPM input 1.

SW2 is connected to MPM input 2.

SW4 is connected to MPM input 3.

SW5 is connected to MPM input 4.

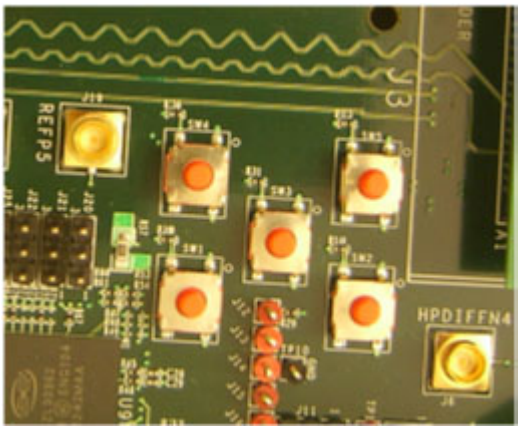

***Figure 8* • SF2-Dev-Kit SW1 to SW5**

The first four of the eight LEDs on the Dev-Kit are used to display the current state-of-the-MPM systems as follows:

LED 1 – ON when MPM is in the off state.

LED 2 – ON when MPM is sequencing power up.

LED 3 – ON when all POLs have sequenced on.

LED 4 – ON when MPM is sequencing power down.

LEDs 5 to 7 – are currently toggled by mpm_threshold_task(), mpm_i2c_slave_task() every time they run and provide a visual indication of the MPM activity.

LED 8 – pulses once if there is a PMBus I^2C timeout and twice if there is a PMBus error, which provides a useful oscilloscope or logic analyzer trigger signal when debugging issues on the PMBus.

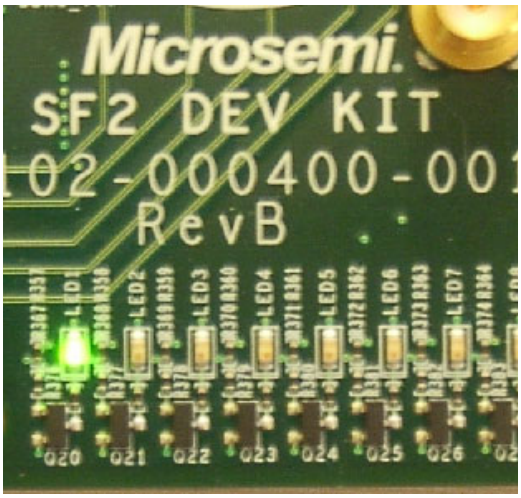

***Figure 9* • SF2-Dev-Kit LEDs**

Table 4 • **MPM Status Description**

Status	Description
Stopped	Power-off sequencing is successful and the MPM is idle. None of the following are active: channel threshold monitoring, output flag generation, and open or closed trimming. The channel voltages can be read in any state.
Starting	Executing power-on sequencing during which open-loop trimming (if applicable), channel threshold monitoring, and output flag generation are active.
Started	Power sequencing is successful; the MPM is now active and reading the channel voltages on-demand, monitoring channel thresholds, executing closed-loop trimming (if applicable), and generating output flags.
Stopping	Executing power-off sequencing before closed-loop trimming (if applicable) is switched off but the channel threshold monitoring and output flag generation remains operational.

The DIP Switch SW10, is used to provide another four of the MPM inputs and also to select optional operational modes for the MPM, refer to Figure 10.

SW10.1 is connected to MPM input 5.
SW10.2 is connected to MPM input 6.
SW10.3 is connected to MPM input 7.
SW10.4 is connected to MPM input 8.

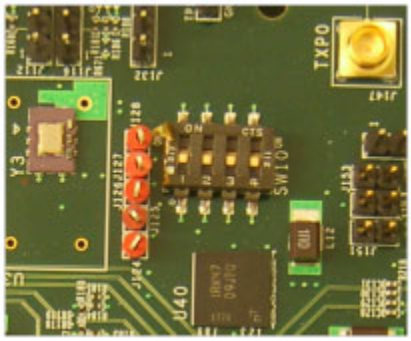

Figure 10 • **SF2-Dev-Kit SW10**

The eight LEDs on the DMPM Board display the state of the first eight MPM outputs, refer to Figure 11. With the default configuration, these LEDs represent the state of the first eight APOLs. When an LED is ON, the corresponding APOL is in a non-nominal state. When an LED is OFF, the corresponding APOL is in a non-nominal state. This is useful when sequencing the APOLs, as you can adjust the POT for a channel until it enters the nominal state by watching for the corresponding LED to turn off.

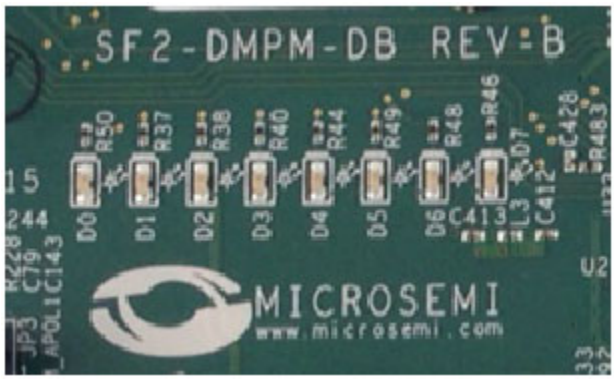

Figure 11 • **SF2-DMPM-DB LEDs**

If you press SW3 to initiate power-up sequencing, the MPM state changes to Starting and you can see the various regulator enabled LEDs on the SF2-DMPM-DB turning on in sequence. If the status does not change to Started and the power-on sequence restarts, you can adjust the voltage of the individual APOL channels via the associated potentiometers to complete the sequencing. If open-loop trimming is enabled, the open-loop trim pin voltage will only achieve nominal value if the potentiometer is suitably adjusted.

When power sequencing has completed and all regulators have reached nominal voltage, the status changes to Started and APOL closed-loop trimming is also enabled, if applicable. Closed-loop trimming keeps the APOL channel output voltage at the nominal value specified in the GUI, even when the potentiometer is adjusted. You can disable trimming by removing the Trim jumper for a given regulator. The following list shows which jumper configures which APOL:

Table 5 • **MPM Status Description**

Jumper	APOL
JP3	1
JP26	2
JP27	3
JP28	4
JP2	5
JP29	6
JP30	7
JP31	8

Removing one of these jumpers disables closed-loop trimming for the associated APOL therefore, the output voltage can be varied using the potentiometer for that channel. Reinstalling the jumper reactivates closed-loop trimming and brings it back to nominal.

Running the Demo Design With the MPM GUI

I²C Setup

Use the MPM GUI to connect to the MPM target via I²C with the included Devantech/Robot Electronics USB-ISS communications module. Ensure that the USB-ISS Power Link has a jumper removed for 3.3 V operations for compatibility with the MPM target.

Remove Jumper on the USB-I2C Module, as shown in Figure 12.

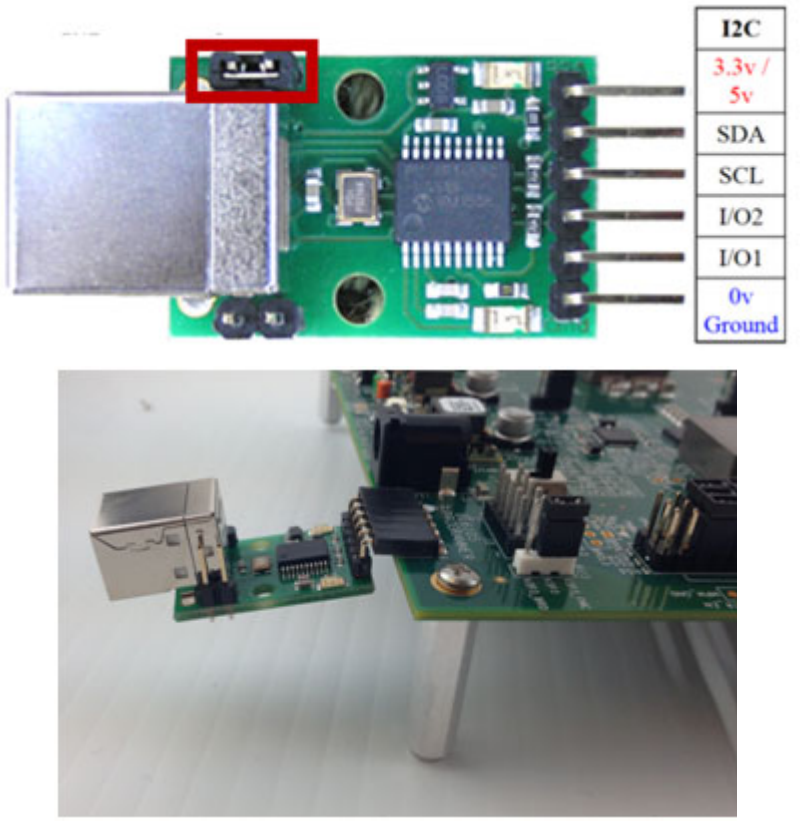

***Figure 12* • SF2-DMPM-DB Rev B Slave I²C Connection**

The SF2-DMPM-DB Rev B boards have a dedicated connector for the Devantech USB Adaptor (J25).

Use the included standard USB A/B cable to connect the USB-ISS to your PC. Install the drivers that are bundled with the MPM GUI in the *C:\Microsemi\SF2_MPM_RefDesign_v6.1\Devantech_USB-ISS_drivers* folder.

After installing the drivers, and plugging the USB-ISS module into a spare USB port, find which COM port it has been assigned to. This will vary from system-to-system depending on how many COM ports you currently have installed. To find out where it is, right-click on your **Computer desktop** icon and select **Properties** > **Device Manager**. Scroll down and open the **Ports (COM & LPT)** tab. The USB serial port C**OM5** is listed, as shown in Figure 13 on page 12.

If you want to change the COM port number—just right click on it, select **properties > advanced > Port Settings > COMport number** from the available list. The COM port default settings are sufficient.

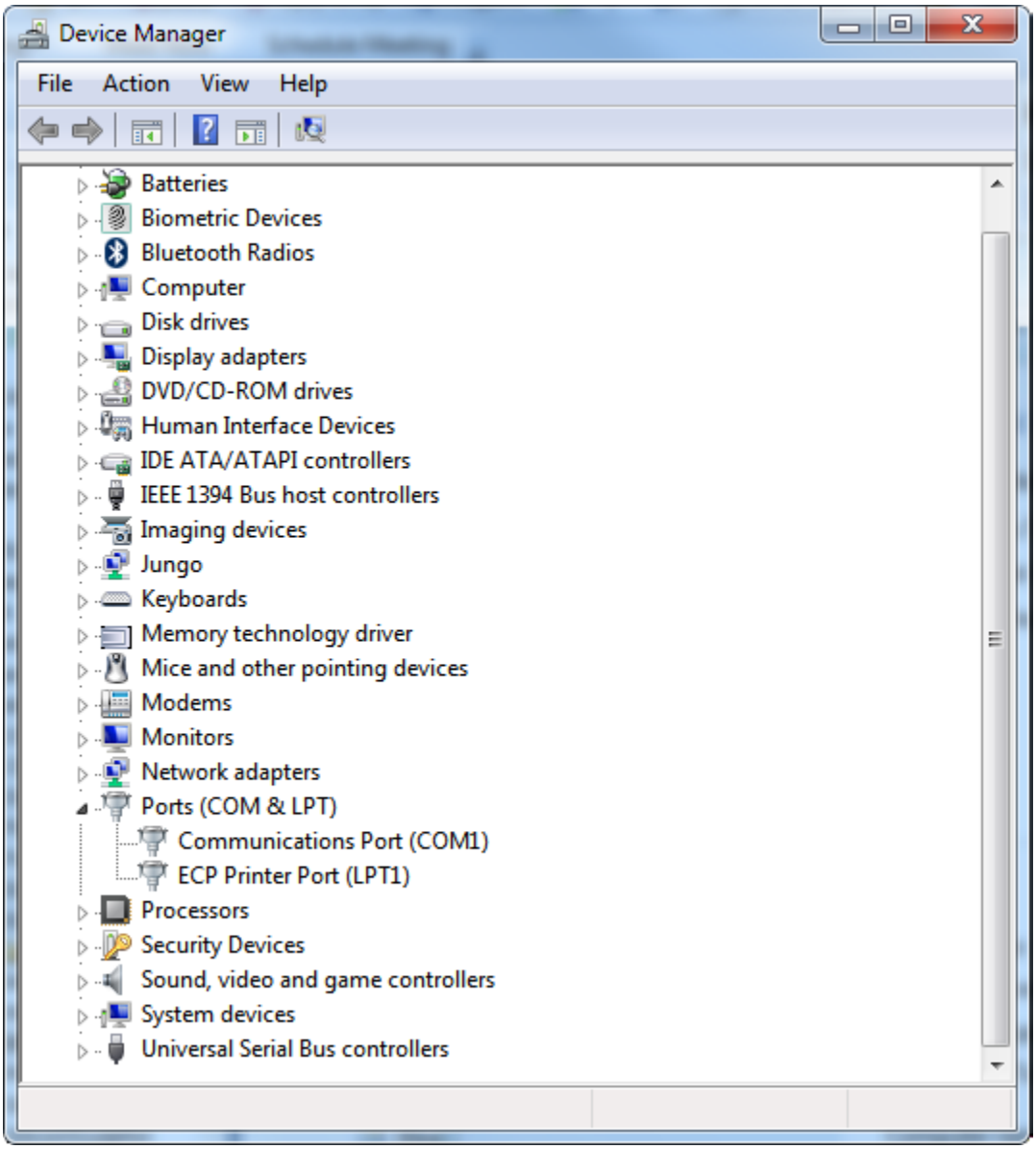

Figure 13 **• Device Manager**

Note the COM port assigned to the USB-ISS communications module. Run the MPM GUI, select **Data > PC > TestI2C Dongle**. Select the **USB-ISS COM** port from the **Communications > Port** drop-down list. Select **Test Dongle** from the **Activity > Action** drop-down list and click the **Go** button**.** If the test is successful then you should see the following as shown in Figure 14, in the **Status** text box**.**

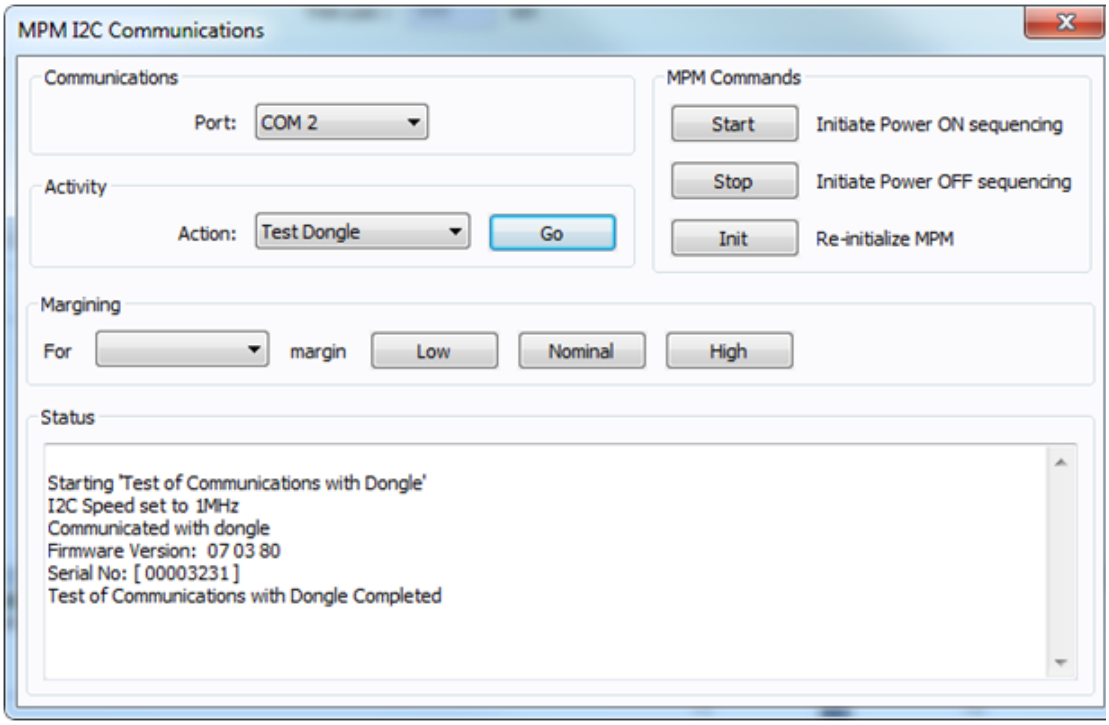

***Figure 14* • Devantech Robot Electronics USB ISS**

The MPM reference design demo can be exercised using the MPM GUI communicating with the MPM target I^2C slave via the Devantech/Robot Electronics USB-ISS I^2C communications module. Ensure that the USB-ISS hardware and drivers are installed, configured, and working as described.

The default I2C slave address for the MPM is 100 (decimal). All menu options under **Data > I2C** launch the **MPM I2C** Communications dialog with different default settings. Refer to Figure 15 for an example: **Data > I2C > Monitor Values ON/OFF**.

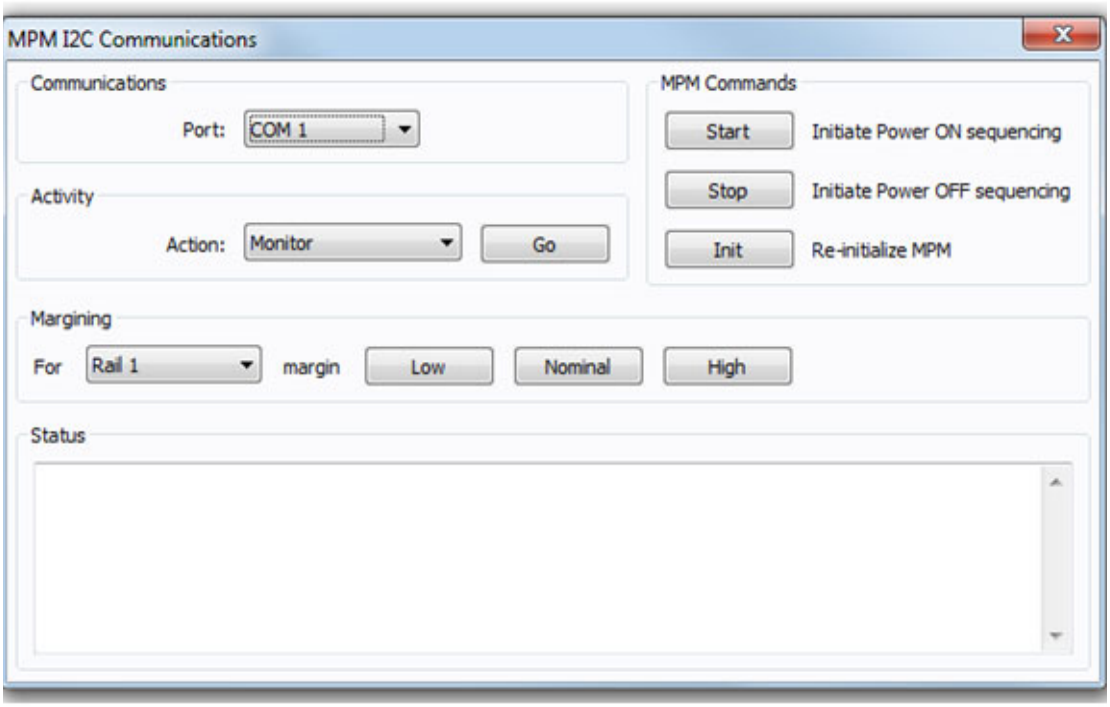

***Figure 15* • MPM I2C Communications Dialog**

Click the **Activity** > **Go** button to check that the MPM GUI communications with the USB-ISS works. If not, ensure that all hardware, driver, and software configurations are correct.

Once the MPM GUI communications with the USB-ISS device are working, select **Find I2C Address** from the **Activity** > **Action** drop-down and click the **Activity** > **Go** button. For the default configuration with the MPM I2C slave address 100, you should see:

```
Starting Looking for I2C Address
I2C Speed set to 1MHz
Trying I2C Address of 100
Success
```

If the **Find I2C Address** option is not used to dynamically scan for the MPM slave address then the GUI will by default try to use the I2C address specified under **Misc > Management Interface I2C > I2C Address**.

Once the GUI communication with the USB-ISS and the MPM target I2C slave has been established, it is possible to use the various other options in the MPM I2C Communications dialog to interact with the target:

- Activity
  - **Test Dongle**: Tests communication with the USB-ISS dongle only. The USB-ISS does not need to be connected to the MPM target.
  - **Find I2C Address**: Dynamically scans to search for the MPM I2C slave address.
  - **Read**: Reads the configuration settings from the target through the I2C and populates the MPM GUI settings using them.
  - **Write**: Writes the configuration settings in the MPM GUI to the MPM target through the I2C. These settings will take effect the next time the MPM is reinitialized (in stopped mode) and then re-started. Note you can **Read**, reconfigure the MPM configuration settings and **Write** in order to change the configuration of the MPM target.
  - **Monitor**: Enters monitoring mode so that the GUI can display live updates of the target state using the Meters and Memory Map views.
  - **Go/Stop**: Click the Go button to run the chosen activity. While running, the Go button changes to the Stop button and can be pressed to prematurely terminate the active activity.

- MPM Commands
  - **Start**: Initiates power on sequencing, which is the same as pressing SW3 when the MPM is in the stopped mode. No effect if the MPM is already started.
  - **Stop**: Initiates power off sequencing, which is the same as pressing SW3 when the MPM is in the started mode. No effect if the MPM is already stopped. Note that you can start the MPM using the GUI and stop it using SW3 and vice versa.
  - **Init**: Re-initializes the MPM—such as, reloads the latest MPM configuration data from ENVM. This only works when the MPM is in stopped mode—no effect otherwise.
- Margining
  - **For**: Select the channel/rail to which the following margining command will be applied.
  - **Margin**: The **Low**, **Nominal,** and **High** buttons cause the selected channel/rail to margin to its low, nominal, or high set voltage. No effect if the MPM is not started or the relevant channel is not available.
- Status
  - Displays information about the progress and status of the most recent activity, command, or margining operation.

Software and Licensing

The SmartFusion2 Development Kit is supported by Libero® System-on-Chip (SoC) software v11.0 and later. SoftConsole software IDE and FlashPro software tools can be used for software design and debug. SmartFusion2 is also supported by Keil™ and IAR® Systems software, which can be installed separately. Refer to the *SmartFusion2 Development Kit User's Guide* for more information.

Software releases:http://www.microsemi.com/products/fpga-soc/design-resources/design-software/libero-soc#overview

Keil and IAR information: http://www.microsemi.com/products/fpga-soc/design-resources/design-software/embedded-ecosystem

Libero SoC software requires a valid Gold, Platinum, or standalone Libero license. If you need a new license, select FREE Libero SoC Gold license and request a new one from your Microsemi Customer Portal account. This license supports all the tools for designing with the SmartFusion2 family and associated development kits.

License updates: http://www.microsemi.com/products/fpga-soc/design-resources/licensing

Documentation Resources

For further kit information, including user's guide, tutorial, and full design examples, refer to the SmartFusion2 DMPM Kit page:

Documentation: http://www.microsemi.com/products/fpga-soc/design-resources/dev-kits/smartfusion2/smartfusion2-dmpm-kit

As new demos and tutorials become available, they will be posted on the SmartFusion2 DMPM Kit webpage. Microsemi recommends that you sign up for Product Updates to be notified when new material is available. You can sign up for product updates from your Microsemi Customer Portal account.

Product updates: http://soc.microsemi.com/Portal/DPortal.aspx?v=1

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