

KITPF3000FRDMEVM Board for PF3000 Evaluation and PF3001 Emulation

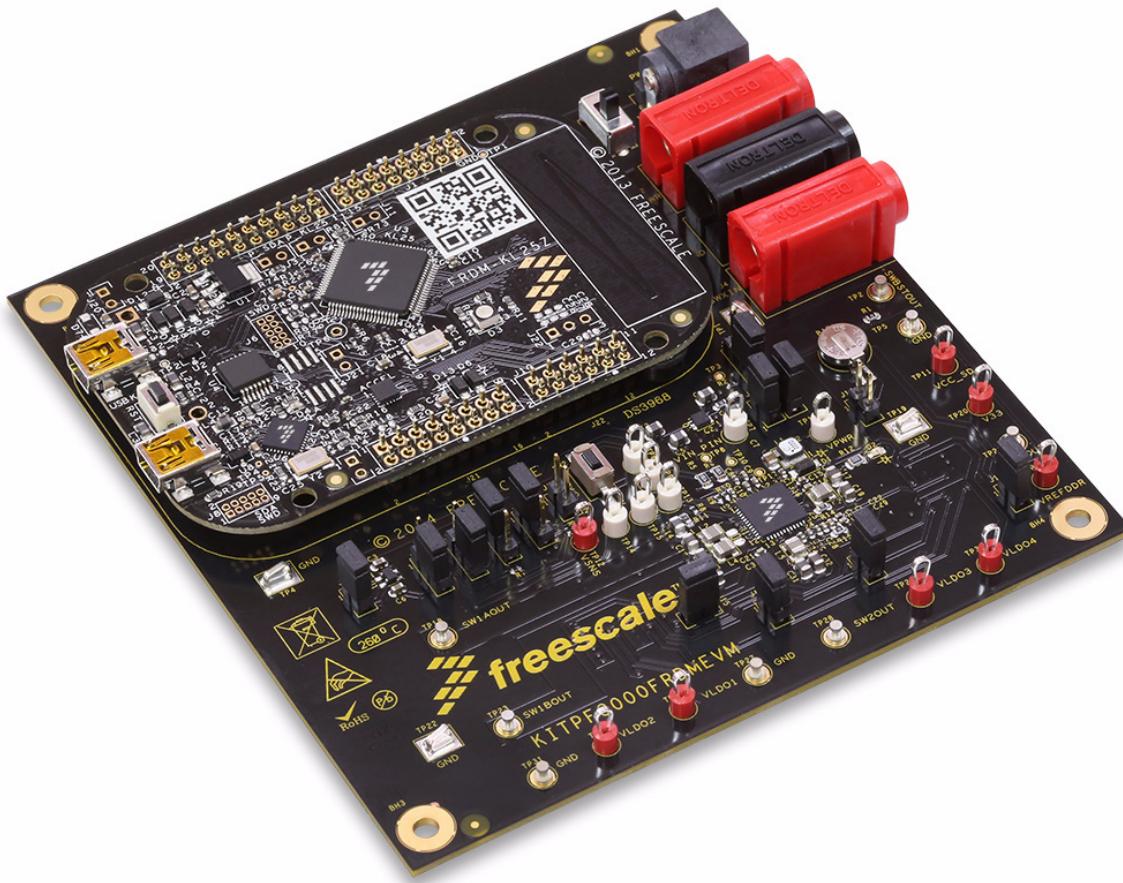


Figure 1. KITPF3000FRDMEVM

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1

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Freescale provides the enclosed product(s) under the following conditions:

This evaluation kit is intended for use of ENGINEERING DEVELOPMENT OR EVALUATION PURPOSES ONLY. It is provided as a sample IC pre-soldered to a printed circuit board to make it easier to access inputs, outputs, and supply terminals. This evaluation kit may be used with any development system or other source of I/O signals by simply connecting it to the host MCU or computer board via off-the-shelf cables. Final device in an application will be heavily dependent on proper printed circuit board layout and heat sinking design as well as attention to supply filtering, transient suppression, and I/O signal quality.

The goods provided may not be complete in terms of required design, marketing, and or manufacturing related protective considerations, including product safety measures typically found in the end product incorporating the goods. Due to the open construction of the product, it is the user's responsibility to take any and all appropriate precautions with regard to electrostatic discharge. In order to minimize risks associated with the customers applications, adequate design and operating safeguards must be provided by the customer to minimize inherent or procedural hazards. For any safety concerns, contact Freescale sales and technical support services.

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2 Getting Started

2.1 Kit Contents/Packing List

The KITPF3000FRDMEVM contents include:

- Assembled and tested KITPF3000FRDMEVM evaluation board
- Firmware loaded FRDM-KL25Z board (mounted to the evaluation board)
- Quick Start Guide
- USB to Mini-USB Cable
- Warranty card

2.2 Jump Start

Freescale's analog product development boards help to easily evaluate Freescale products. These tools support analog mixed signal and power solutions including monolithic ICs using proven high-volume SMARTMOS mixed signal technology, and system-in-package devices utilizing power, SMARTMOS and MCU dies. Freescale products enable longer battery life, smaller form factor, component count reduction, ease of design, lower system cost and improved performance in powering state of the art systems.

- Go to www.freescale.com/KITPF3000FRDMEVM
- Review your Tool Summary Page
- Look for



Jump Start Your Design

- Download documents, software, and other information

Once the files are downloaded, review the user guide in the bundle. Jump start bundles with current versions of all relevant information are available on each tool summary page. The information in the bundles includes everything you need to begin designing.

2.3 Required Equipment and Software

To use this kit, you need:

- 5.0 V power supply wall adaptor or lab power supply with 3.0 V to 5.0 V at 3.0 A capability
- KITPF3000GUI installed on a PC running Windows 7, XP, Vista or 8 (32-bit or 64-bit)
- KITPF3001GUI installed on a PC running Windows 7, XP, Vista or 8 (32-bit or 64-bit) to emulate the PF3001
- Optional voltmeters to measure regulator outputs
- Optional oscilloscope

2.4 System Requirements

The kit requires the following:

- USB-enabled PC with Windows® XP or higher

3 Getting to Know the Hardware

3.1 Board Overview

The KITPF3000FRDMEVM Evaluation Board (EVB) is an easy-to-use circuit board allowing the user to exercise all the functions of the PF3000 and PF3001 Power Management IC. This board can be used to emulate the PF3001.

A FRDM-KL25Z is mounted to the EVB as an integral component. The FRDM-KL25Z serves as an interface between the KITPF3000GUI and the PF3000 or between the PF3001GUI and the PF3001. Analog-to-Digital Convertors (ADCs) in the FRDM-KL25Z monitor the regulator voltages through the GUI.

3.2 Board Features

The board features are as follows:

- PF3000 and PF3001 Power Management IC
- Input supply using wall adaptor or lab power supply through banana jacks
- Integrated FRDM-KL25Z as communication link between the EVB and a PC
- Two 1 Amp E-Loads with configurable current

3.3 Device Features

This evaluation board features the following Freescale products:

Table 1. PF3000 Features

Device	Description	Features
PF3000	Power Management Integrated Circuit (PMIC) for i.MX Series & i.MX 6 SL/SX	<ul style="list-style-type: none">• Four adjustable high efficiency buck regulators: 1.75 A, 1.5 A, 1.25 A, 1.0 A• 5.0 V, 600 mA boost regulator with PFM or Auto mode• Six adjustable general purpose linear regulators• Input voltage range: 2.8 V to 4.5 V or 3.7 V to 5.5 V⁽¹⁾• OTP (One Time Programmable) memory for device configuration
PF3001	Power Management Integrated Circuit (PMIC) for i.MX 7 and i.MX 6 SoloLite/SoloX/UltraLite Processors	<ul style="list-style-type: none">• Three adjustable high efficiency buck regulators: 2.75 A, 1.25 A, 1.5 A• Six adjustable general purpose linear regulators• Input voltage range: 2.8 V to 4.5 V or 3.7 V to 5.5 V⁽¹⁾

Notes:

1. Minimum start-up voltage is 3.1 V

3.4 Board Description

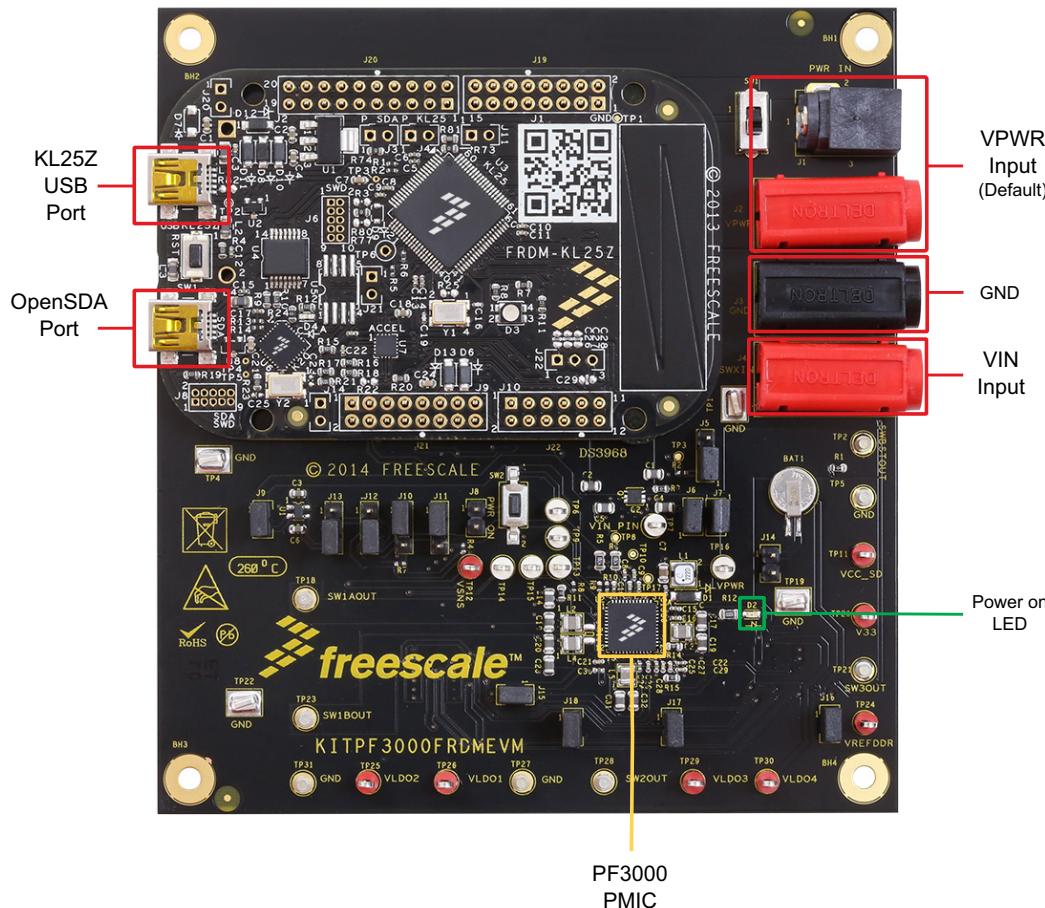


Figure 2. Board Description

Table 2. Board Description

Name	Description
VPWR input (J1 and J2)	3.7 V to 5.5 V Supply input (Default). Use only when SW1 is in position 1 (VPWR path). This connector is shorted to GND when SW1 is in position 2 (VIN path)
GND (J3)	Board Ground
VIN Input (J4)	2.8 V ⁽²⁾ to 4.5 V Supply input. Use only when SW1 in position 2 (VIN path)
KL25Z USB port (USBKL25Z)	USB communication port. Connect this port to your computer to use the GUI software
OpenSDA Port (SDA)	Reserved for downloading firmware to the FRDM-KL25Z
Power On LED (D2)	This LED indicates the PF3000 is powered (the LED is connected to the V33 output)
PF3000 PMIC	PF3000 Power Management IC

Notes:

2. Minimum start-up voltage is 3.1 V

3.5 Device Description

The PF3000 device populated on KITPF3000FRDMEVM features the A1 OTP. See [Figure 3](#).

Table 3. Start-up Configuration⁽³⁾

Registers	Value
Default I ² C Address	0x08
VSNVS_VOLT	3.0 V
SW1A_VOLT	1.10 V
SW1A_SEQ	1
SW1B_VOLT	1.0 V
SW1B_SEQ	1
SW2_VOLT	1.8 V
SW2_SEQ	2
SW3_VOLT	1.35 V
SW3_SEQ	5
SWBST_VOLT	5.0 V
SWBST_SEQ	OFF
VLDO1_VOLT	1.8 V
VLDO1_SEQ	4
VLDO2_VOLT	1.5 V
VLDO2_SEQ	4
VLDO3_VOLT	3.3 V
VLDO3_SEQ	3
VLDO4_VOLT	3.3 V
VLDO4_SEQ	3
V33_VOLT	3.3 V
V33_SEQ	3
VCC_SD_VOLT	3.3 V/1.85 V
VCC_SD_SEQ	4
PU CONFIG, SEQ_CLK_SPEED	2000 µs
PU CONFIG, SWDVS_CLK	12.5 mV/µs
PU CONFIG, PWRON	Level sensitive
SW1A/B CONFIG	SW1A, SW1B Independent Mode, 2.0 MHz
SW2 CONFIG	2.0 MHz
SW3 CONFIG	2.0 MHz
PG EN	RESETBMCU in Default Mode

Notes:

- This table specifies the default output voltage of the LDOs and SWx after start-up and/ or when the LDOs and SWx are enabled. VREFDDR_SEQ is internally fixed to be same as SW3_SEQ. VCC_SD voltage depends on the state of the SD_VSEL pin.

3.6 Jumper and Switch Definitions

Figure 3 shows the location of jumpers and switches on the KITPF3000FRDMEVM evaluation board. Table 4 describes the function and settings for each jumper and switch. (Default settings are shown in bold.)

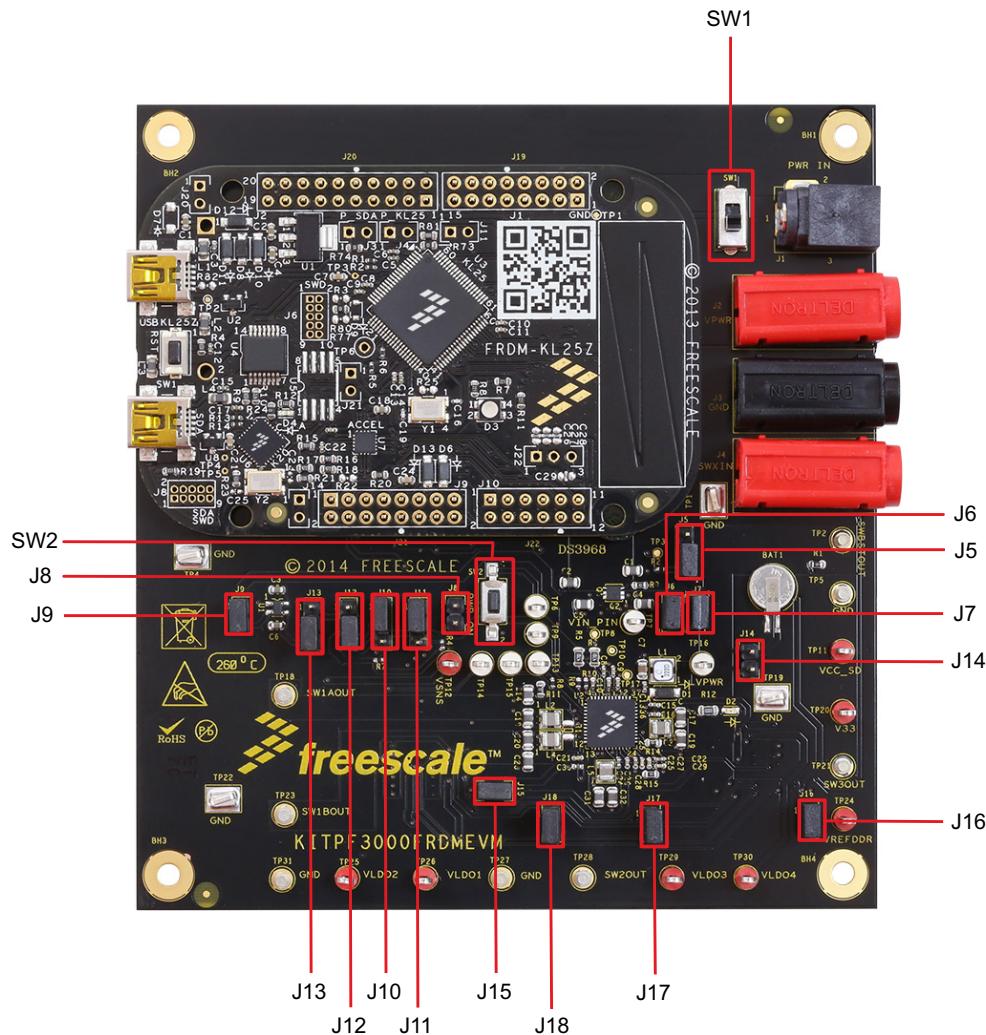


Figure 3. Jumper and Switch Locations⁽⁶⁾

Table 4. Jumper and Switch Definitions

Jumper/Switch	Description	Setting	Connection
SW1	VPWR Path	1-2	Connect a 3.7 V to 5.5 V supply either through banana jacks J2 (positive) and J3 (ground) or through wall adaptor via J1 connector
	VIN Path	2-3 ⁽⁵⁾	Connect a 2.8 V ⁽⁴⁾ to 4.5 V supply via J4 (positive) and J3 (ground)
SW2	PWRON to GND	Open	Connects PWRON to GND when pushed
J5	VDOTP Path	1-2	Connects VDDOTP to VCOREDIG (load from default values)
		2-3	Connects VDDOTP to GND (load from fuses/Try-before-buy)
J6	VIN supply to VIN pin	Closed	Connects VIN supply to VIN pin
J7	SWBST output to ADC mux	Closed	Connects SWBST output to ADC mux
J8	PWRON to GND	Open	Connects PWRON to GND
J9	VIN supply to 3.3 V LDO regulators	Closed	Connects VIN supply to the 3.3V LDO regulator
J10	STANDBY pin to logic	1-2	Connects STANDBY pin to logic low (ON Mode)
		2-3	Connects STANDBY pin to logic high (Standby Mode)
J11	SD_VSEL pin to logic	1-2	Connects SD_VSEL pin to logic low (Selects VCC_SD = 2.85 V to 3.30 V)
		2-3	Connects SD_VSEL pin to logic high (Selects VCC_SD = 1.8 V to 1.85 V)
J12	Pull-up voltage for logic input pins	1-2	Uses VSNVS as pull up voltage for logic input pins
		2-3	Uses VDDIO as pull up voltage for logic input pins
J13	VDDIO voltage source	1-2	Uses on-board discrete LDO as VDDIO voltage
		2-3	Uses SW2 output as VDDIO voltage
J14	Coin cell to LICELL pin	Closed	Connects coin cell to LICELL pin
J15	VIN supply to VLDO1IN pin	Closed	Connects VIN supply to VLDO1IN pin.
J16	VIN supply to analog mux	Closed	Connects VIN supply to the analog mux - part of the ADC circuitry using the FRDM-KL25Z board
J17	VIN supply to VLDO32IN pin	Closed	Connects VIN supply to VLDO34IN pin
J18	SW2 output to VLDO2IN pin	Closed	Connects SW2 output to VLDO2IN pin
J24 ⁽⁶⁾	E-load channel A	Closed	Enables E-load channel A. Use GUI to set the current
J25 ⁽⁶⁾	E-load channel B	Closed	Enables E-load channel B. Use GUI to set the current

Notes:

4. Minimum start-up voltage is 3.1 V
5. The 5.0 V input is provided by default (VPWR path.) To switch to the VIN path, first remove the glue from the SW1 switch, set it to the 2-3 position, then connect the 3.1 V to 4.5 V supply to J4 and J3.

CAUTION

Using the SW1 in the 2-3 position will short J2 to ground (VPWR path). When using the VPWR path (J2 and J3), make sure SW1 stays in the 1-2 position to avoid a supply short.

6. Board displayed in [Figure 3](#) is Revision A. Hence, some jumpers in later revisions do not appear in the illustration.

4 Installing the Software and Setting up the Hardware

4.1 Installing PF3000GUI on your Computer

1. Download PF3000GUI.zip from
https://www.freescale.com/webapp/sps/site/prod_summary.jsp?code=KITPF3000FRDMEVM.
2. Extract all the files to C:/Freescale/PF3000GUI or any other desired folder on your PC.
3. Run setup.exe and click on "Install" in the dialog box in [Figure 4](#).



Figure 4. Install Dialog Box

4. The GUI installation is complete and the window shown in [Figure 5](#) appears. Do not click on anything until the board is plugged in.

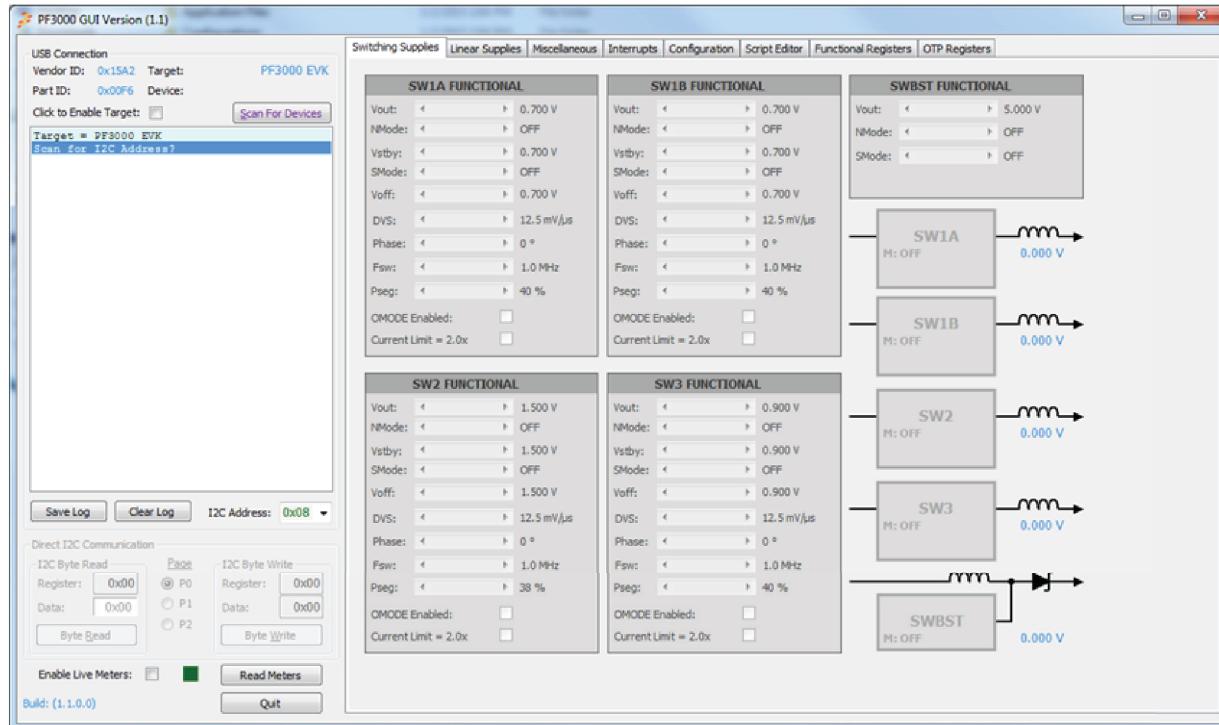


Figure 5. Installation Confirmation

4.2 Installing PF3001GUI on your Computer

1. Download PF3001GUI.zip from
https://www.freescale.com/webapp/sps/site/prod_summary.jsp?code=KITPF3000FRDMEVM.
2. Extract all the files to C:/Freescale/PF3001GUI or any other desired folder on your PC.
3. Run setup.exe and click on "Install" in the dialog box in [Figure 6](#).

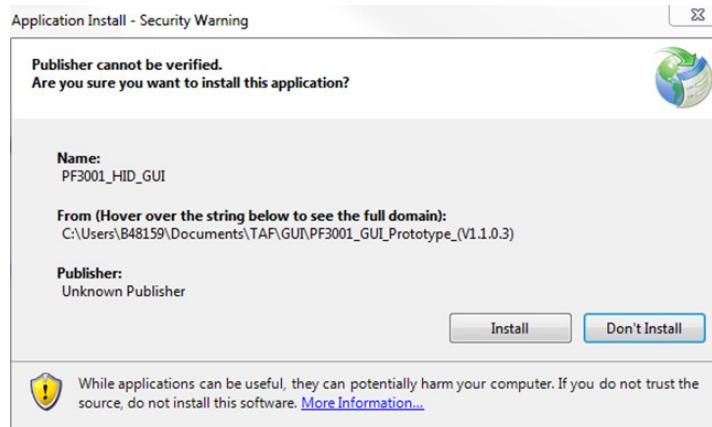


Figure 6. Install Dialog Box

4. The GUI installation is complete and the window shown in [Figure 7](#) appears. Do not click on anything until the board is plugged in.

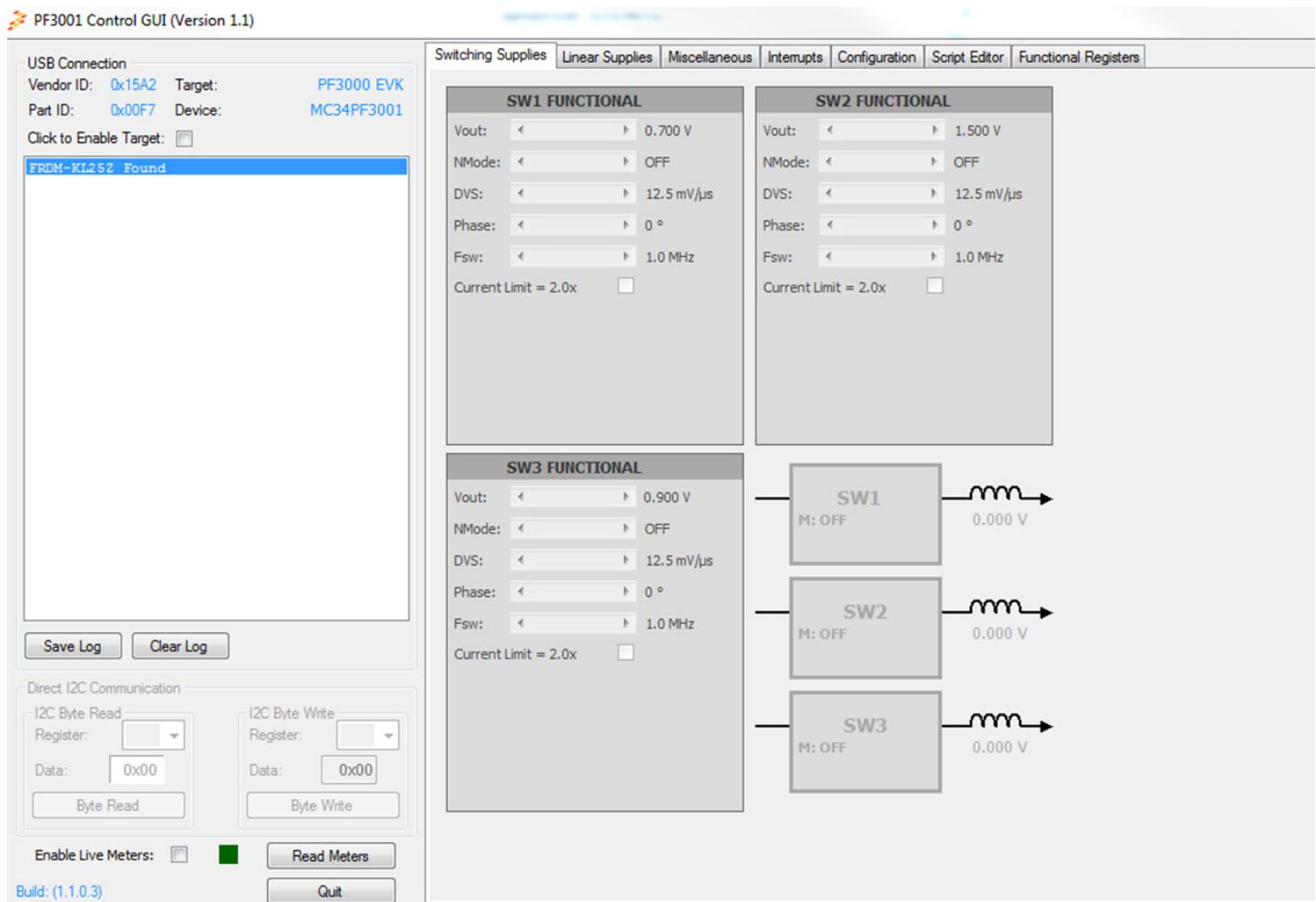


Figure 7. Installation Confirmation

4.3 Configuring the Hardware and using the GUI for Control and Monitoring

1. Apply input voltage to the board: use a 5.0 V supply connected to J2 (+) and J3 (-).
2. Plug the mini-USB side of the mini-USB to USB cable into the KL25Z USB port on the FRDM-KL25Z board and the other end to an available USB port on the PC as shown in [Figure 8](#).

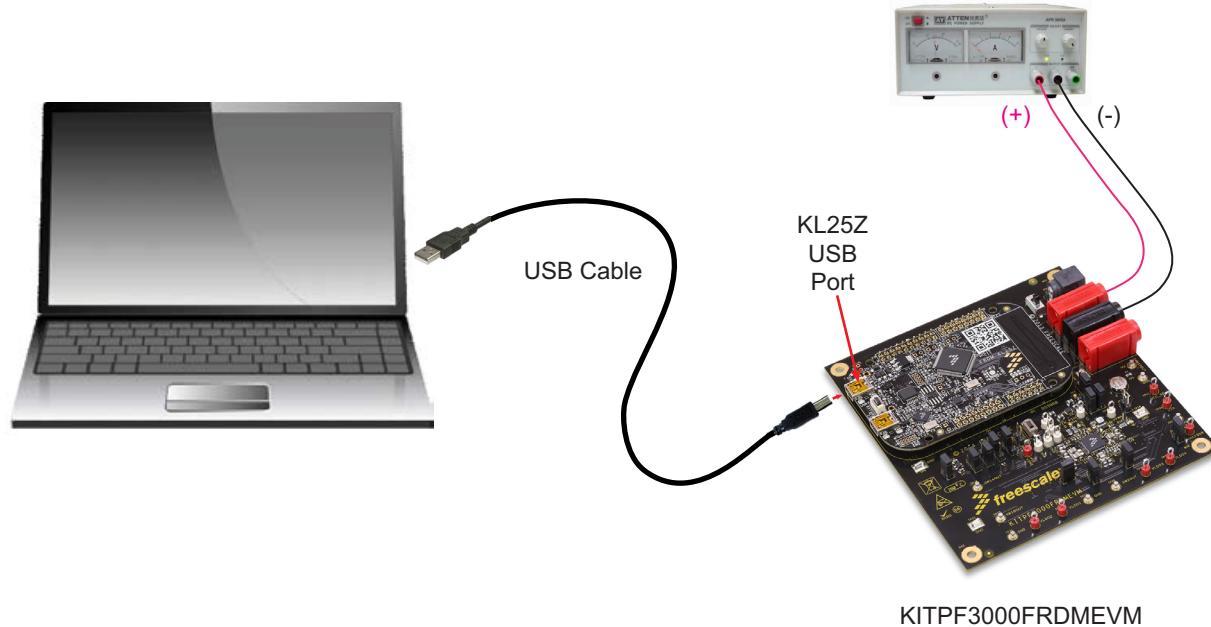


Figure 8. Hardware Configuration

3. Windows will automatically install the necessary drivers. Wait for this to complete.
4. In the PF3000 GUI or PF3001 GUI window, click on the "Scan For Devices" button in the top-left portion. A confirmation message that a valid device is available is logged (see [Figure 9](#)).

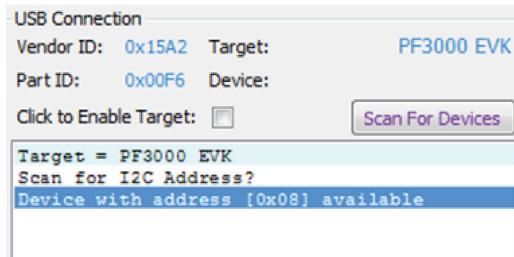


Figure 9. Confirmation of Available Device

5. Enable the communication by clicking the "Click to Enable Target" check box. You will immediately see the window turn from grey to color. The green LED on the FRDM-KL25Z also turns on.
6. The GUI installation and hardware setup is now complete.

To emulate the PF3001, follow the procedure in [Section 5](#) for the hardware modification details.

4.4 Understanding and Using the GUI

4.4.1 GUI Structure for PF3000

Figure 10 shows the different components of the GUI.

To enable the volt meters on the board, click on the "Read Meters" button located in the bottom left of the window. The output of the meters is displayed in the right side of the window. Clicking the "Enable Live Meters" button enables continuous polling of the meters.

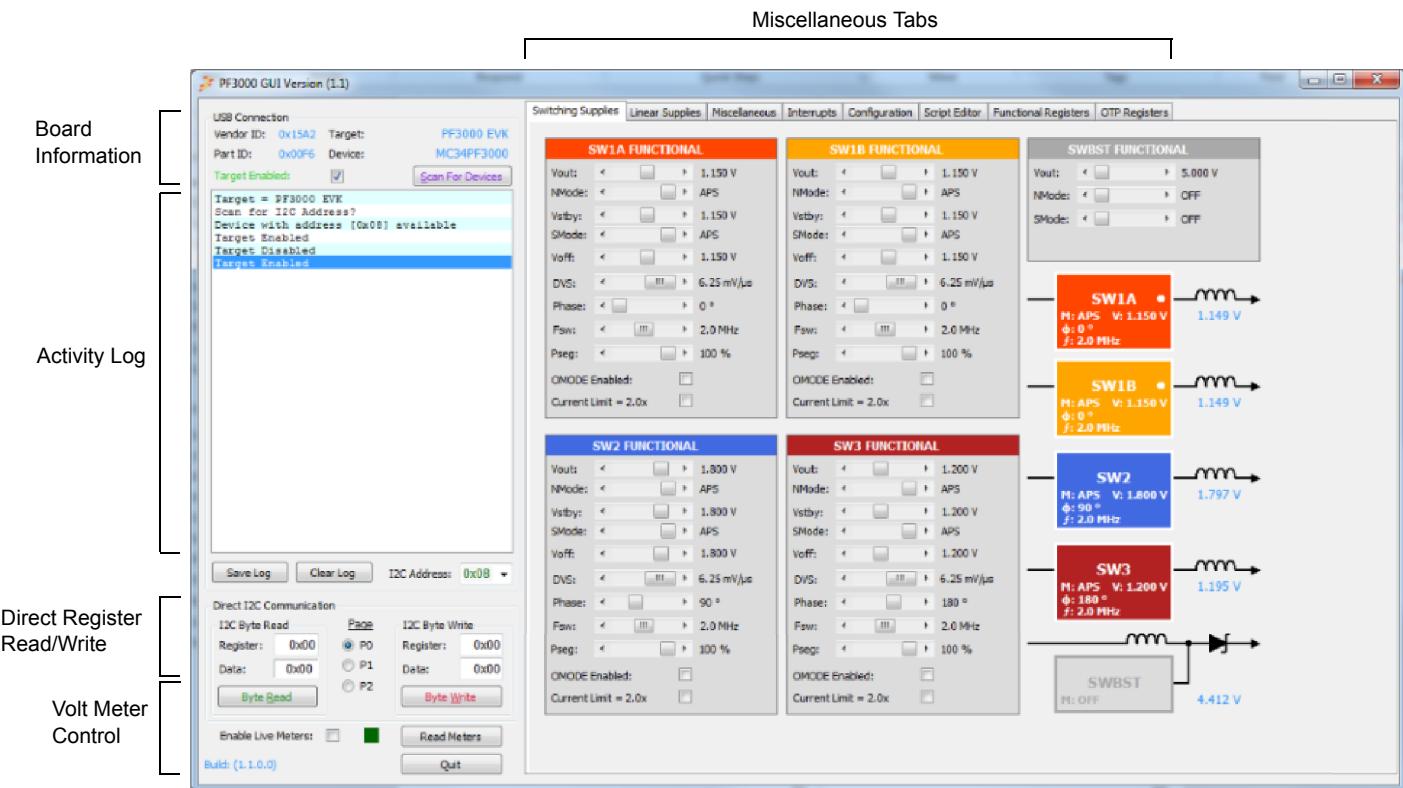


Figure 10. PF3000 GUI Main Window

You are encouraged to explore the different tables, buttons and sliders in the various tabs of the GUI.

4.4.2 Try-Before-Buy Mode using the “Configuration” Tab

The PF3000FRDMPEVM comes with a PF3000 device whose OTP memory is pre-programmed. The PF3000 allows the user to override the OTP memory using the "Try-Before-Buy" mode.

To use this mode, go to the "Configuration" tab and click on the "Enter TBB Mode" button in the top-right of the window. Use the drop down options to change the voltage, sequence and configuration of the regulators. Click the "Update" button after all the desired options are selected.

To restart the PF3000 using the selected configuration, click on the "Restart PMIC" button. Alternatively, you can toggle the PWRON button to initiate the startup. The startup sequence can be monitored on an oscilloscope and will match this selection in the "Configuration" tab.

To measure voltages, use either a stand-alone meter or the on-board meters available in the GUI.

Use the "Save Configuration" and "Load Configuration" buttons to save the configuration for later use.

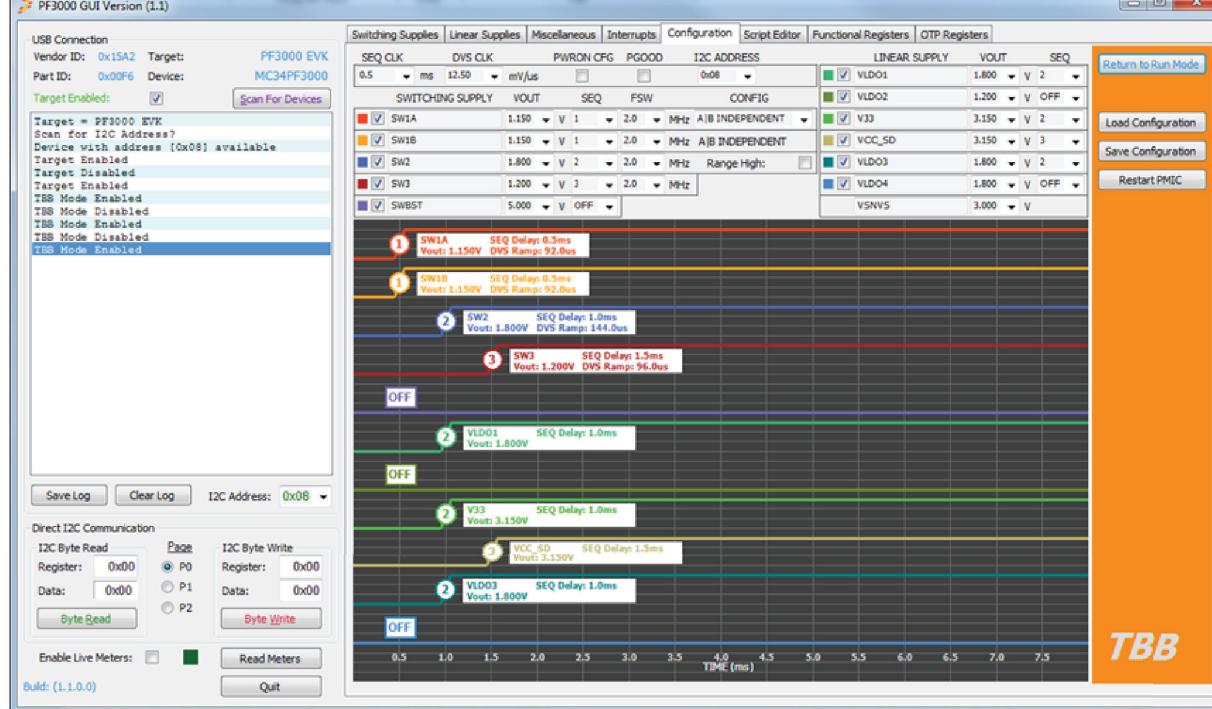


Figure 11. Try-Before-Buy Window

4.4.3 GUI Structure for PF3001

Figure 12 shows the different components of the GUI.

To enable the volt meters on the board, click on the "Read Meters" button located in the bottom left of the window. The output of the meters is displayed in the right side of the window. Clicking the "Enable Live Meters" button enables continuous polling of the meters.

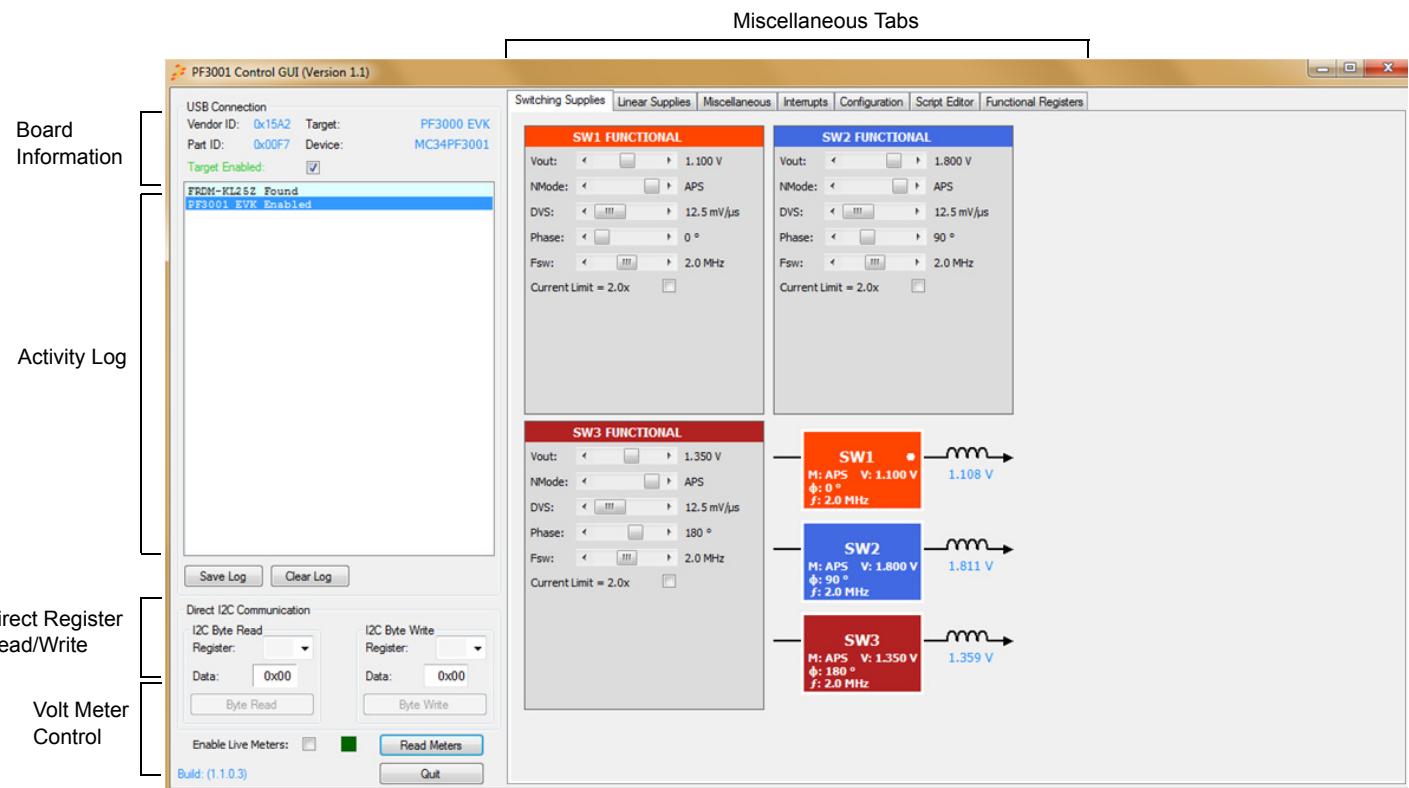


Figure 12. PF3001 GUI Main Window

You are encouraged to explore the different tables, buttons, and sliders in the various tabs of the GUI.

5 How to Emulate the PF3001

To emulate the PF3001:

1. Add a 0 Ohm resistor R13 and remove L4 as shown in [Figure 13](#).

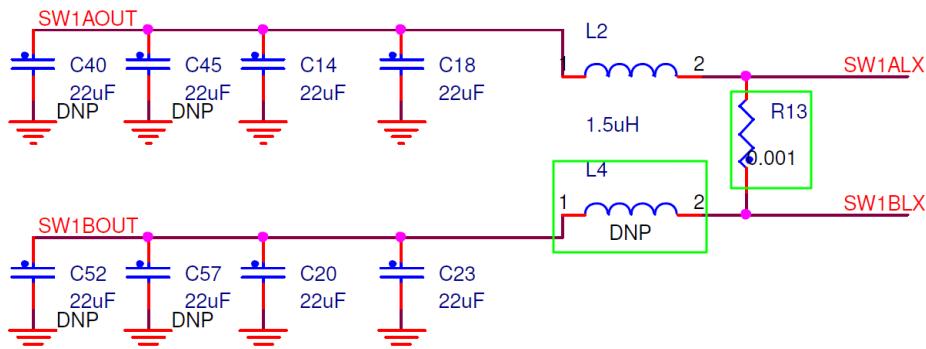


Figure 13. Schematic Change for PF3001

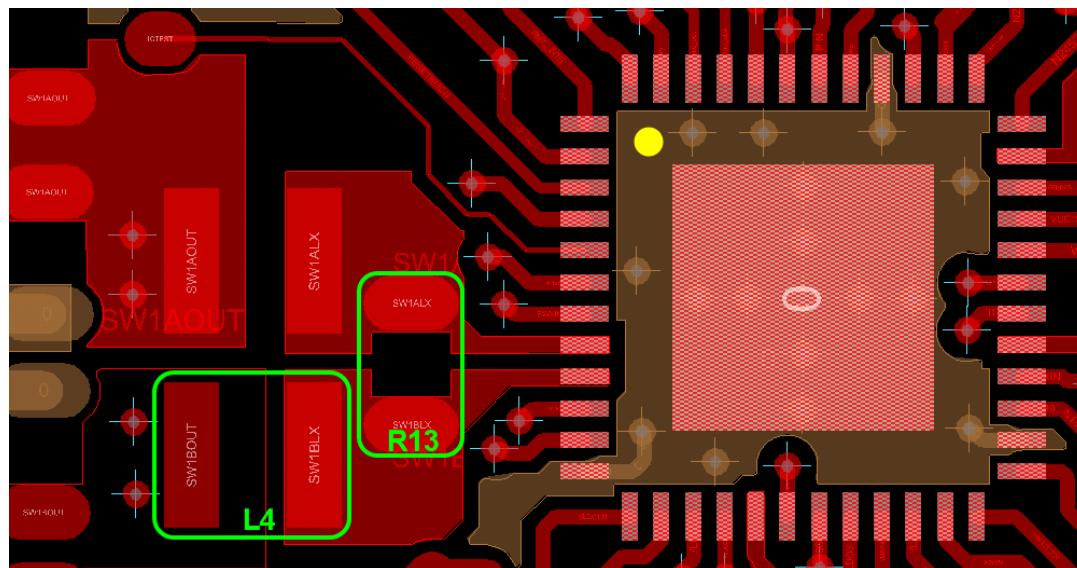


Figure 14. Layout Change for PF3001

2. Make sure the Jumper J5 is connected as shown in [Figure 15](#).

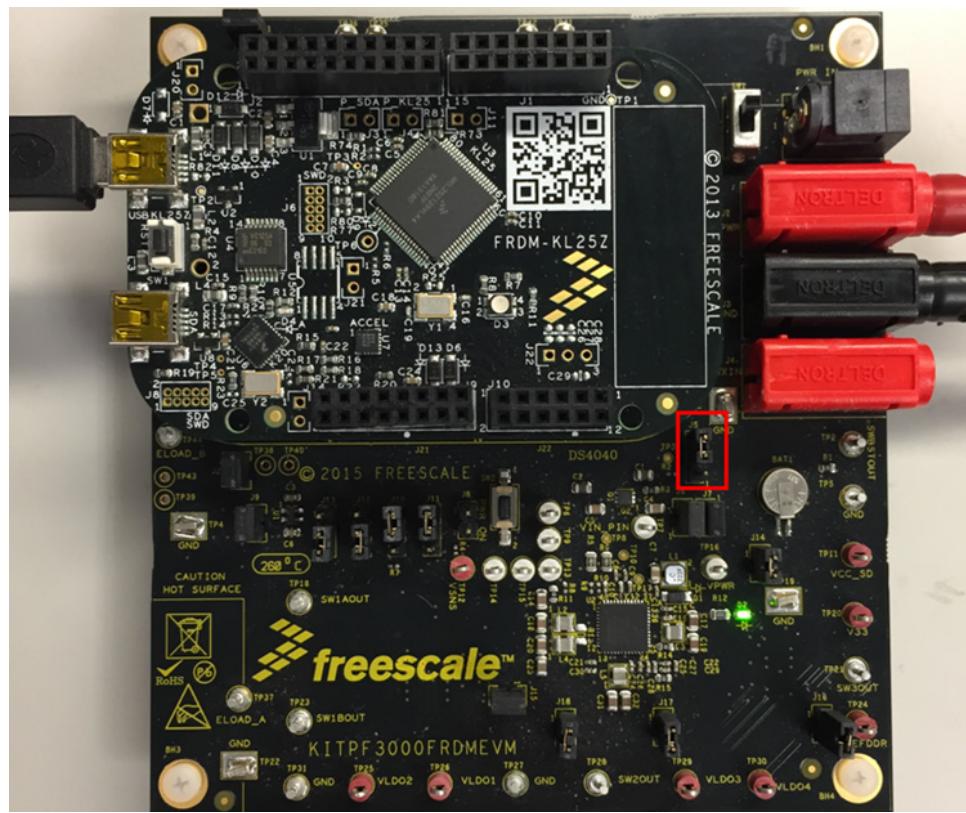


Figure 15. J5 TBB Jumper Connection

3. Download and use the PF3001GUI.

6 Schematics, Board Layout and Bill of Materials

Schematics, Board Layout and Bill of Materials

KITPF3000FRDMEVM board schematics, board layout, and bill of materials are available in the Download section of the KITPF3000FRDMEVM Product Summary page at the following url:

http://www.freescale.com/webapp/sps/site/prod_summary.jsp?code=KITPF3000FRDMEVM

7 References

Following are URLs where you can obtain information on related Freescale products and application solutions:

Freescale.com Support Pages	Description	URL
KITPF3000FRDMEVM	Tool Summary Page	http://www.freescale.com/webapp/sps/site/prod_summary.jsp?code=KITPF3000FRDMEVM
	Schematic, BOM, Board Layout	http://www.freescale.com/webapp/sps/site/prod_summary.jsp?code=KITPF3000FRDMEVM (Download Section)
PF3000	Product Summary Page	http://www.freescale.com/webapp/sps/site/prod_summary.jsp?code=PF3000
PF3001	Product Summary Page	http://www.freescale.com/webapp/sps/site/prod_summary.jsp?code=PF3001
FRDM-KL25Z	Freescale Freedom Development Platform	http://www.freescale.com/webapp/sps/site/prod_summary.jsp?code=FRDM-KL25Z

7.1 Support

Visit www.freescale.com/support for a list of phone numbers within your region.

7.2 Warranty

Visit www.freescale.com/warranty to submit a request for tool warranty.

8 Revision History

Revision	Date	Description of Changes
1.0	5/2015	<ul style="list-style-type: none">Initial releaseAdded caution to note (5) in Table 4
		<ul style="list-style-type: none">Added Section 4.2Added Section 4.4.3Added Section 5
2.0	8/2015	

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