UM11526

KITFS5600FRDMEVM evaluation board

Rev. 1 — 25 May 2021 User manual

Document information

Information	Content
Keywords	FS5600, controller, FET
Abstract	The KITFS5600FRDMEVM is a hardware evaluation tool that allows performance test of the FS5600.

1 Revision history

Revision history

Rev	Date	Description
v.1	20210525	• Initial version

2 Introduction

The FS5600 integrates a 36 V DC-DC controller with external FETs and a 36 V DC-DC converter with internal FETs. In addition, it offers functional safety features such as independent voltage monitors, windowed watchdog timer, I/O monitoring via ERRMON and FCCU and built-in self-test. This document covers connecting the hardware, installing the software and tools, configuring the environment and using the kit.

This document is the user guide for the KITFS5600FRDMEVM evaluation board. This document is intended for the engineers involved in the evaluation, design, implementation, and validation of FS5600.

3 Finding kit resources and information on the NXP web site

NXP Semiconductors provides online resources for this evaluation board and its supported device(s) on http://www.nxp.com.

The information page for KITFS5600FRDMEVM evaluation board is at http://www.nxp.com/KITFS5600FRDMEVM. The information page provides overview information, documentation, software and tools, parametrics, ordering information and a **Getting Started** tab. The **Getting Started** tab provides quick-reference information applicable to using the KITFS5600FRDMEVM evaluation board, including the downloadable assets referenced in this document.

3.1 Collaborate in the NXP community

The NXP community is for sharing ideas and tips, ask and answer technical questions, and receive input on just about any embedded design topic.

The NXP community is at http://community.nxp.com.

4 Getting ready

Working with the KITFS5600FRDMEVM requires the kit contents, additional hardware and a Windows PC workstation with installed software.

4.1 Kit contents

- Assembled and tested evaluation board in an anti-static bag
- FRDM-K82F Freedom Development Platform
- Quick Start Guide

4.2 Additional hardware

In addition to the kit contents, the following hardware is necessary or beneficial when working with this kit.

- Power supply with a range upto 40 V
- Oscilloscope
- Voltmeter

4.3 Windows PC workstation

This evaluation board requires a Windows PC workstation. Meeting these minimum specifications should produce great results when working with this evaluation board.

- USB-enabled computer with Windows 7 or Windows 10

4.4 Software

Installing software is necessary to work with this evaluation board. All listed software is available on the evaluation board's information page at http://www.nxp.com/KITFS5600FRDMEVM.

5 Getting to know the hardware

5.1 Kit overview

The KITFS5600FRDMEVM is a hardware evaluation tool that allows performance test of the FS5600.

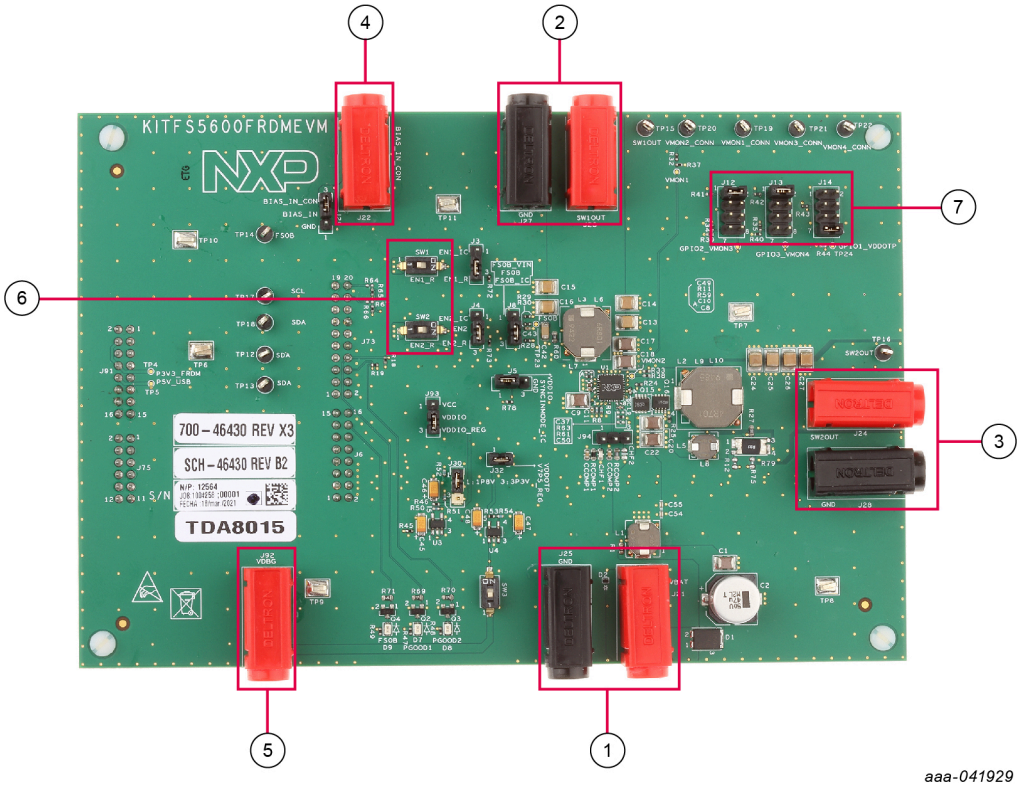
An Emulation mode is possible to test different OTP configurations as needed. Different inductors and MOSFETs are included in the kit to allow the user to try different switching frequencies.

5.1.1 KITFS5600FRDMEVM features

- VBAT power supply connectors
- SW1 output capability up to 3.5 A (internal MOSFET)
- SW2 output capability up to 15 A (external MOSFET)
- EN1/2 switches
- PGOOD1/2 status indicators
- FS0B external safety pin
- LEDs that indicate signal or regulator status
- Emulation mode capabilities
- USB connection and GUI for register access, OTP emulation and programming

5.2 Kit featured components

Figure 1 identifies important components on the board.



1. VBAT connector
2. SW1 output
3. SW2 output
4. BIAS_IN input
5. Debug voltage input
6. EN1 and EN2 switches
7. GPIO1/2/3 option selection

Figure 1. Evaluation board featured component locations

5.2.1 Jumpers

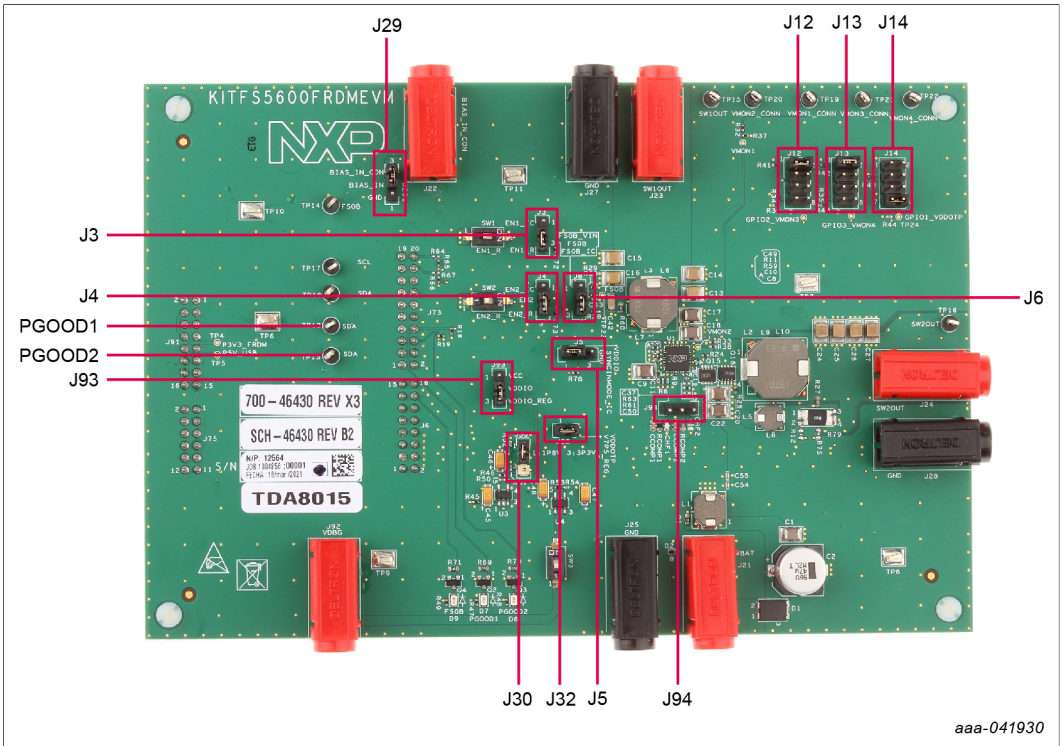


Figure 2. Evaluation board jumper/switch locations

Table 1. Evaluation board jumper/switch descriptions

Name	Default	Description
J3	2-3 shorted	Controls EN1 source • 1-2 shorted → From Freedom board • 2-3 shorted → From onboard switch
J4	2−3 shorted	Controls EN2 source • 1-2 shorted → From Freedom board • 2-3 shorted → From onboard switch
J5	1−2 shorted	MODE logic level control • 1-2 → Ground • 2-3 → VDDIO
J8	2−3 shorted	FS0B pull up source • 1-2 → VIN • 2-3 → VDDIO
J12	1−2 shorted	GPIO2/VMON3 selection • 1-2 → GPO2 • 3-4 → FCCU1 • 5-6 → Ground • 7-8 → VMON3
J13	1−2 shorted	GPIO3/VMON4 selection • 1-2 → GPO3 • 3-4 → FCCU2 • 5-6 → ERRMON2 • 7-8 → VMON4

Table 1. Evaluation board jumper/switch descriptions...*continued*

Name	Default	Description
J14	7−8 shorted	GPIO1 selection • 1-2 → Floating • 3-4 → GPO1 • 5-6 → ERRMON1 • 7-8 → VDDOTP (for debug and development)
J29	1−2 shorted	BIAS_IN selection • 1-2 → Connect to ground • 2-3 → BIAS_IN connected to J22. Apply 5.0 V on J22.
J30	1−2 shorted	VDDIO voltage selection • 1-2 → 1.8 V • 2-3 → 3.3 V
J32	1−2 shorted	VDDOTP Debug Selection • Closed → Apply debug voltage to VDDOTP • Open → Do not apply VDDOTP
J93	2−3 shorted	Select the source for VDDIO • 1-2 shorted → VCC • 2-3 shorted → LDO on board (see J30 for voltage selection)
J94	1−2 shorted	SW2 compensation selection • 1-2 → 450 kHz operation • 2-3 → 2.2 MHz operation

5.3 Schematic, board layout and bill of materials

The schematic, board layout and bill of materials for the KITFS5600FRDMEVM evaluation board are available at http://www.nxp.com/KITFS5600FRDMEVM.

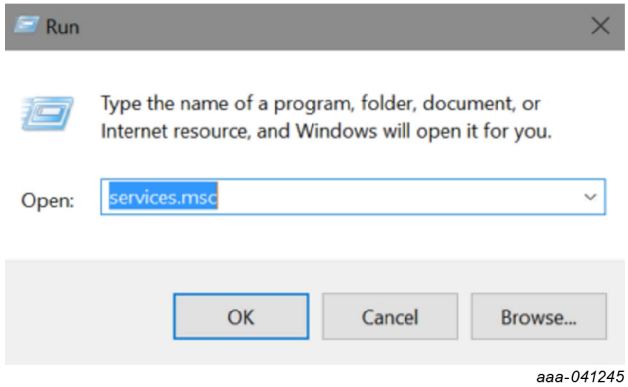
6 Installing and configuring software and tools

6.1 GUI installation

Unzip the **NXPGUI_PR_x** into any desired location. Find the **NXP_GUI_x.x-Setup** from the GUI folder inside the package and run it to install the GUI in any desired location.

6.2 Freedom board firmware update

For Windows 10, disable the storage services: run services.msc; double-click on the storage service from the list and press the Stop button.



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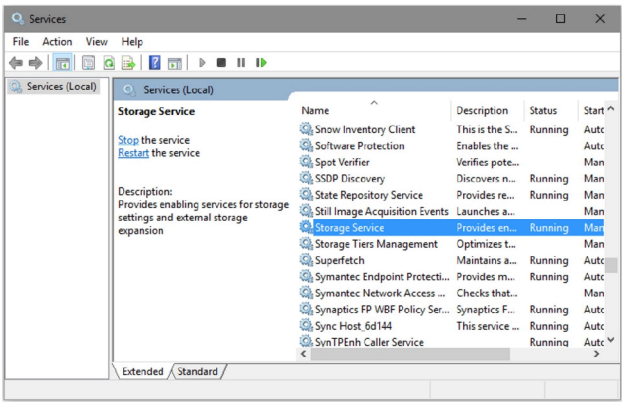

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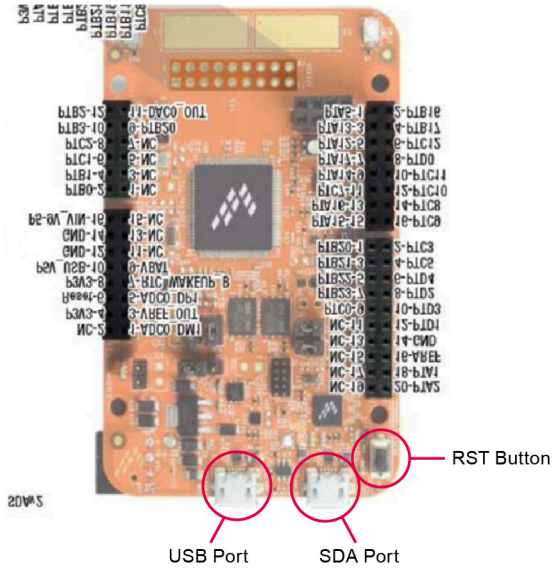
1. Press the RST push button on the Freedom board and connect the USB cable into the SDA port (J5) on the Freedom board.



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2. If a new “BOOTLOADER” device appears on the left pane of the File explorer:
   a. Drag and drop the downloaded file “0244_k20dx_bootloader_update_0x8000.bin” into the BOOTLOADER drive. Make sure to allow enough time for the firmware to be saved in the Bootloader.
   b. Disconnect and reconnect the USB cable into the SDA port (this time WITHOUT pressing the RST push button).
   c. Drag and drop the file “k20dx_frdmk82f_if_crc_legacy_0x8000.bin” from the package (MCU folder) into the MAINTENANCE drive.
   Note:
   *Make sure to allow enough time for the firmware to be saved in the Bootloader. The device should change to **FRDM_K82FD**.*
3. Skip 2a if MAINTENANCE appears in the File Explorer instead of BOOTLOADER. Follow 2b and 2c instead.
4. Locate the file “**nxp-gui-fw-frdmk82f-usb_hid-fs5600_xxx.bin**” from the package (MCU folder) and drag and drop the file into the FRDM_K82FD device.

5. Freedom board Firmware is successfully loaded. Disconnect and reconnect the USB cable into the USB port. Open the previously installed NXPGUI. The “Start” button on the top-left corner must be activated.
6. If only the NXPGUI firmware needs to be updated, then start from step 4 above. The PC detects **FRDM_K82FD**.

7 Configuring the hardware for startup

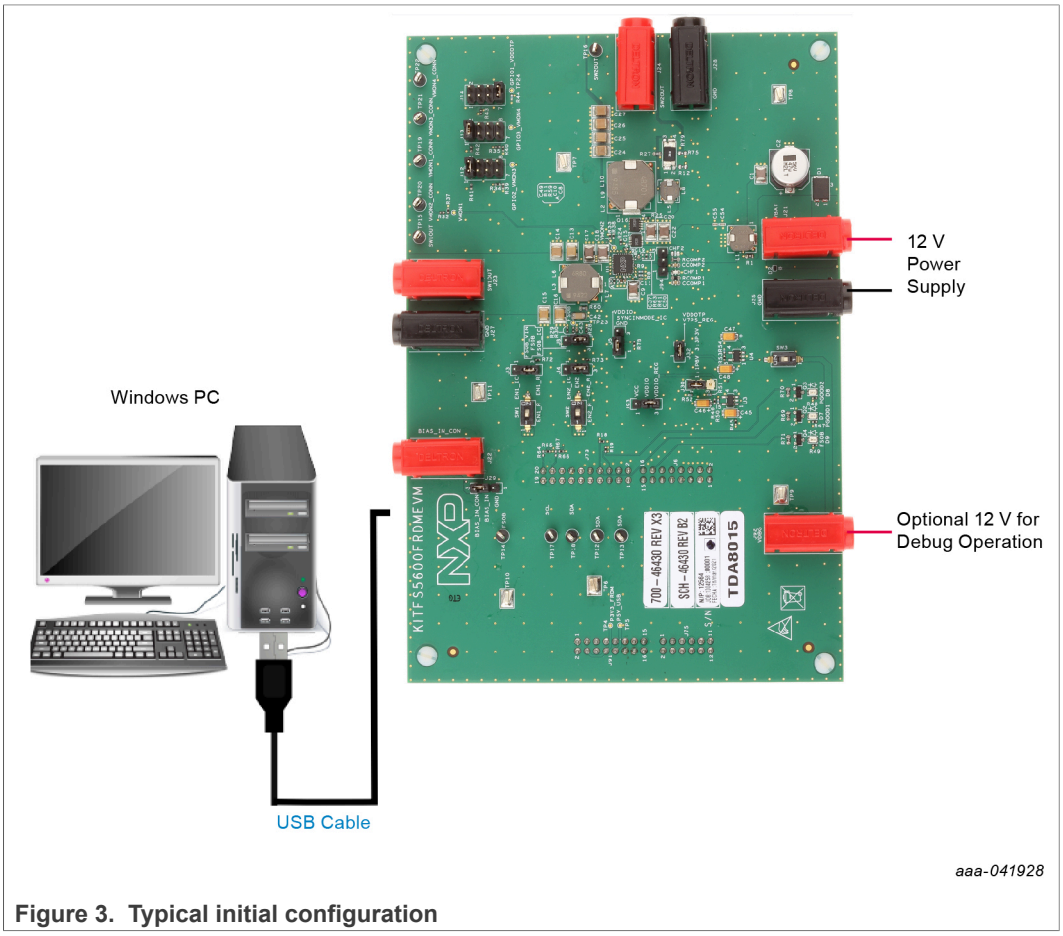


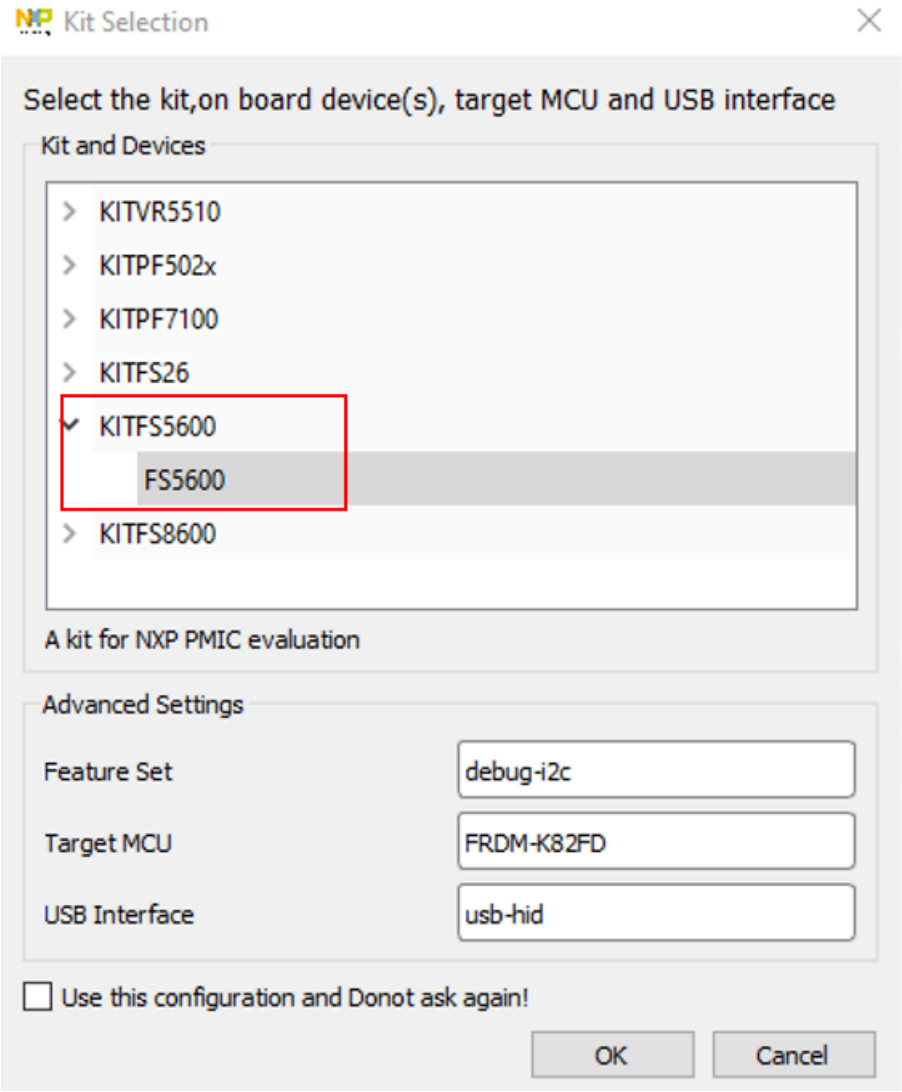
Figure 3. Typical initial configuration

Figure 3 presents a typical hardware configuration incorporating the development board, power supply and Windows PC workstation.

To configure the hardware and workstation as illustrated in Figure 3, complete the following procedure:

1. Ensure that jumpers are in the default positions as shown in Section 5.2.1 "Jumpers".
2. With the USB cable connected to the PC and the USB port in the freedom board K82F, apply power to the evaluation board by applying 12 V between J21 and J25.
3. Press **Reset** on the Freedom board to make sure that the board is recognized.
4. Run the installed **NXPGUI** application from the Start menu or the installation folder.

5. A configuration window is displayed. Select the kit type and the device silicon version, and then click **OK**.



6. Click **Start** to enable the connection to the device. Once the device is connected properly, the “Start” button is activated and the system is ready for operation.

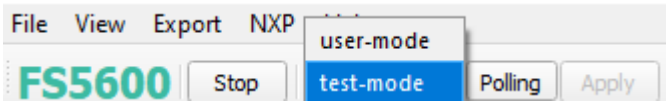
7. If the NXPGUI does not recognize the FRDM-K82F board or if the **Start** button does not get activated, then it is possible that the interface is broken. In this case, reprogramming of the FRDM board can be attempted.

8 Using the KITFS5600FRDMEVM evaluation board

This section summarizes the overall setup. Detailed description is provided in the following sections.

8.1 Modifying the mirror registers on the fly

1. Make sure that the part is turned On with EN1 or EN2 high.
2. Move jumper J14 to 7-8 position.
3. Move switch SW3 to ON position.
4. Apply 12 V to J92.
5. Enter **Test Mode** in the GUI using the drop-down list, and then click **Apply**.



6. The mirror registers can be modified using the appropriate tab in the GUI anytime the part is On.
7. The user can create a script using the OTP tab by using the Export menu to automate some actions.

8.2 Starting up with a known configuration

With EN1 = EN2 = 0, apply VBAT.

1. Move jumper J14 to 7-8 position.
2. Move switch SW3 to On position.
3. Apply 12 V at J92.
4. Apply EN1 or EN2 = High.
5. The state machine of FS5600 stops in a debug state to allow the user to configure the mirror registers. The mirror registers can be configured in this state using the GUI either by running a script, or individually modifying them.
6. After configuring the mirror registers as needed, move SW3 to Off position. The FS5600 powers up with the configured register settings.

9 References

[1] **KITFS5600FRDMEVM** — detailed information on this board, including documentation, downloads, and software and tools
http://www.nxp.com/KITFS5600FRDMEVM

[2] **FS5600** — product information on FS5600, Automotive Dual Buck Regulator and Controller with Voltage Monitors and Watchdog Timer
http://www.nxp.com/FS5600

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