UM11482

KITPF7100FRDMPGM evaluation board

Rev. 1 — 24 September 2020 User guide

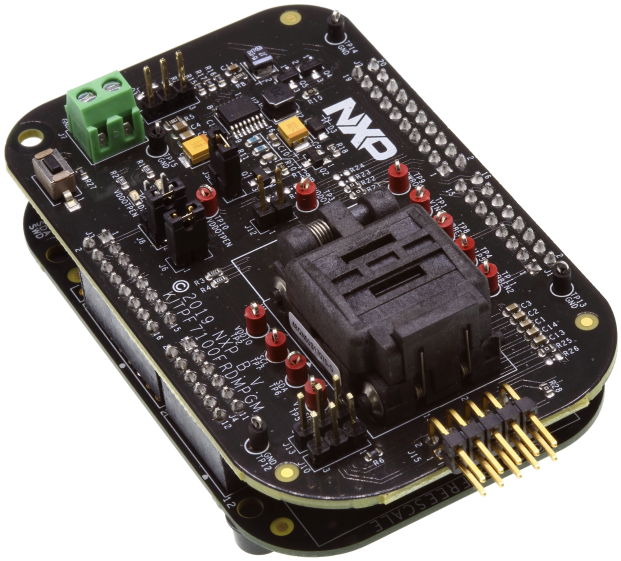

Figure 1. KITPF7100FRDMPGM

Important Notice

NXP 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 board 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. This evaluation board is not a Reference Design and is not intended to represent a final design recommendation for any particular application. 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.

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1 Introduction

This document is the user guide for the KITPF7100FRDMPGM evaluation board, intended for the engineers involved in the evaluation, design, implementation, and validation of multichannel power management integrated circuit PF7100.

The scope of this document is to provide the user with information to evaluate the multichannel power management integrated circuit PF7100. This document covers connecting the hardware, installing the software and tools, configuring the environment and using the kit.

The customer evaluation board provides full access to all the features in the PF7100 device.

2 Finding kit resources and information on the NXP web site

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

The information page for evaluation boards are at https://www.nxp.com/KITPF7100FRDMPGM. 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 these evaluation boards, including the downloadable assets referenced in this document.

2.1 Collaborate in the NXP community

The NXP community is for sharing ideas and tips, asking and answering technical questions, and receiving input on just about any embedded design topic.

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

3 Getting ready

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

3.1 Kit contents

- Assembled and tested evaluation board and preprogrammed FRDM-KL25Z microcontroller board in an antistatic bag
- USB-STD A to USB-B-mini cable
- Quick Start Guide

3.2 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, Windows 8, or Windows 10

3.3 Software

Installing software is necessary to work with this evaluation board.

Software package NXP_GUI_PR_revision.zip contains:

- KL25Z firmware files
- PF7100 NXPGUI Setup
- OTP mirror register read script

4 Getting to know the hardware

The NXP OTP programming boards provide an easy-to-use platform for programming the default configuration of the NXP PF7100 power management products. The boards support all voltages and signals needed for OTP programming.

4.1 Kit overview

The KITPF7100FRDMPGM is a programming board featuring a 48-pin QFN socket for PF7100 PMICs. The kit integrates all hardware needed to program the OTP registers in the PMIC.

The KITPF7100FRDMPGM integrates a communication bridge based on the FRDM-KL25Z freedom board to communicate with the NXPGUI software interface to program the OTP configuration.

4.1.1 Evaluation board features

Programming socket

- Clamshell 48-pin QFN socket

System features

- 5.0 V operating input voltage range (from USB connector)
- Integrated boost converted to supply VDDOTP programming voltage
- USB to I^2C communication via the FRDM-KL25Z interface
- Inline programming interface connector

4.1.2 Schematics

The board layout and bill of materials for the KITPF7100FRDMPGM are available at www.nxp.com/KITPF7100FRDMPGM.

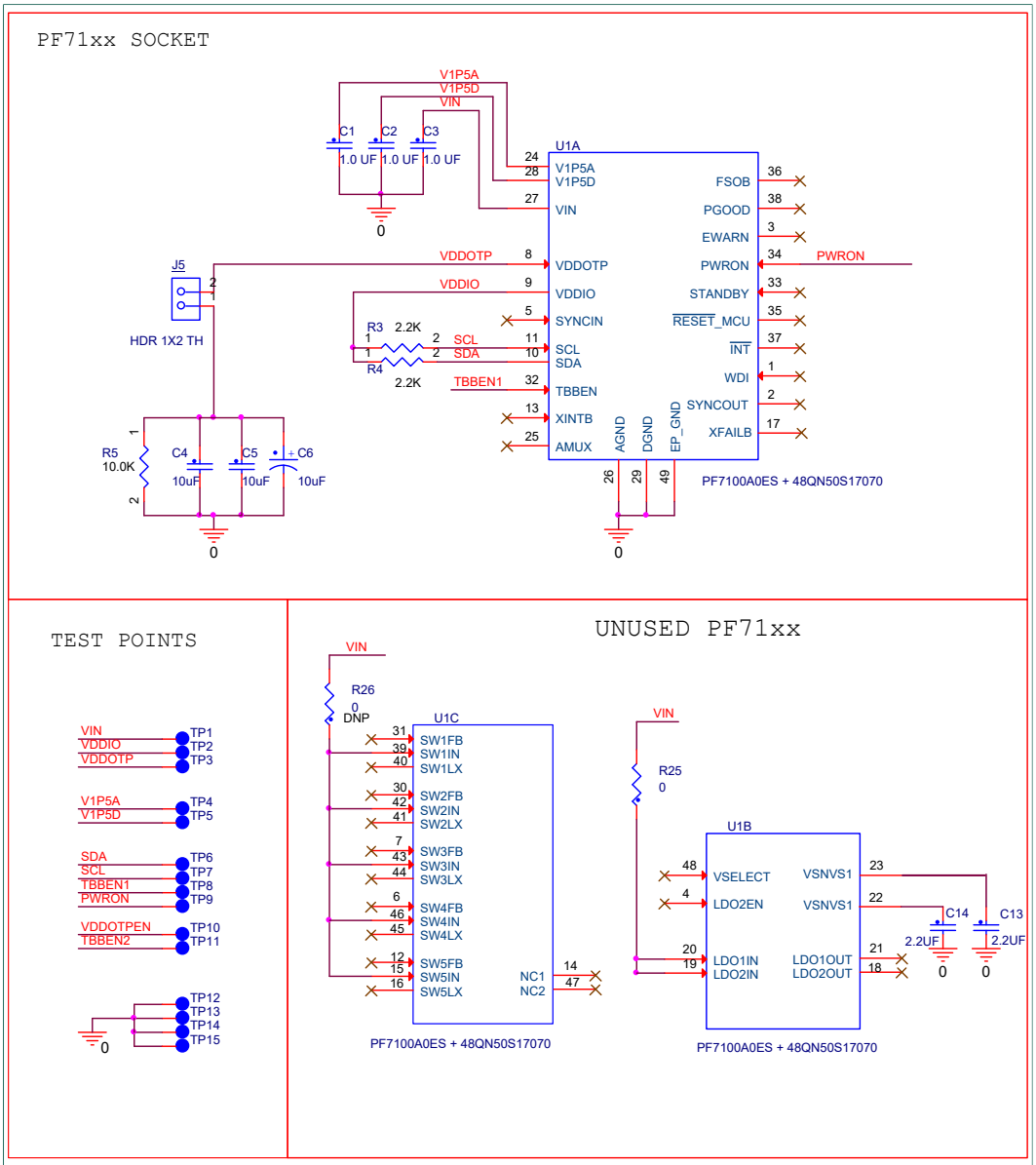


Figure 2. PMIC socket connections

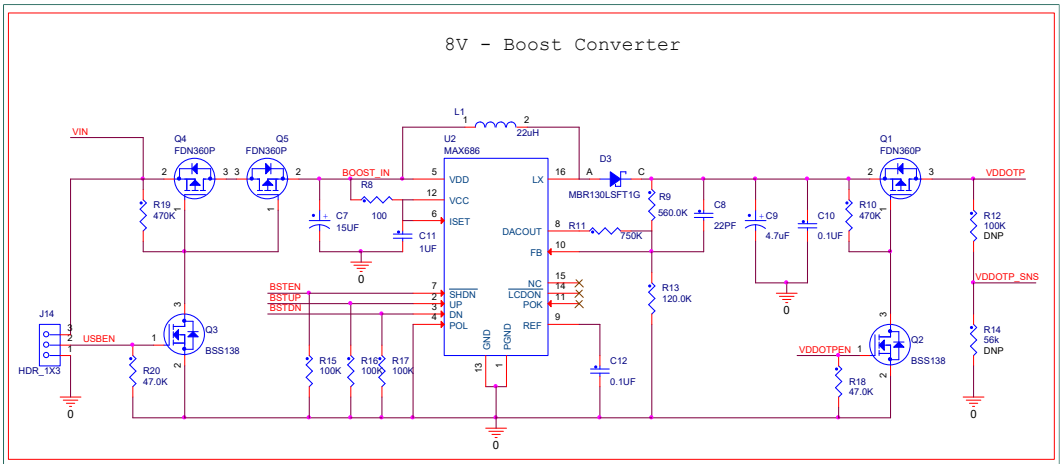


Figure 3. VDDOTP boost converter

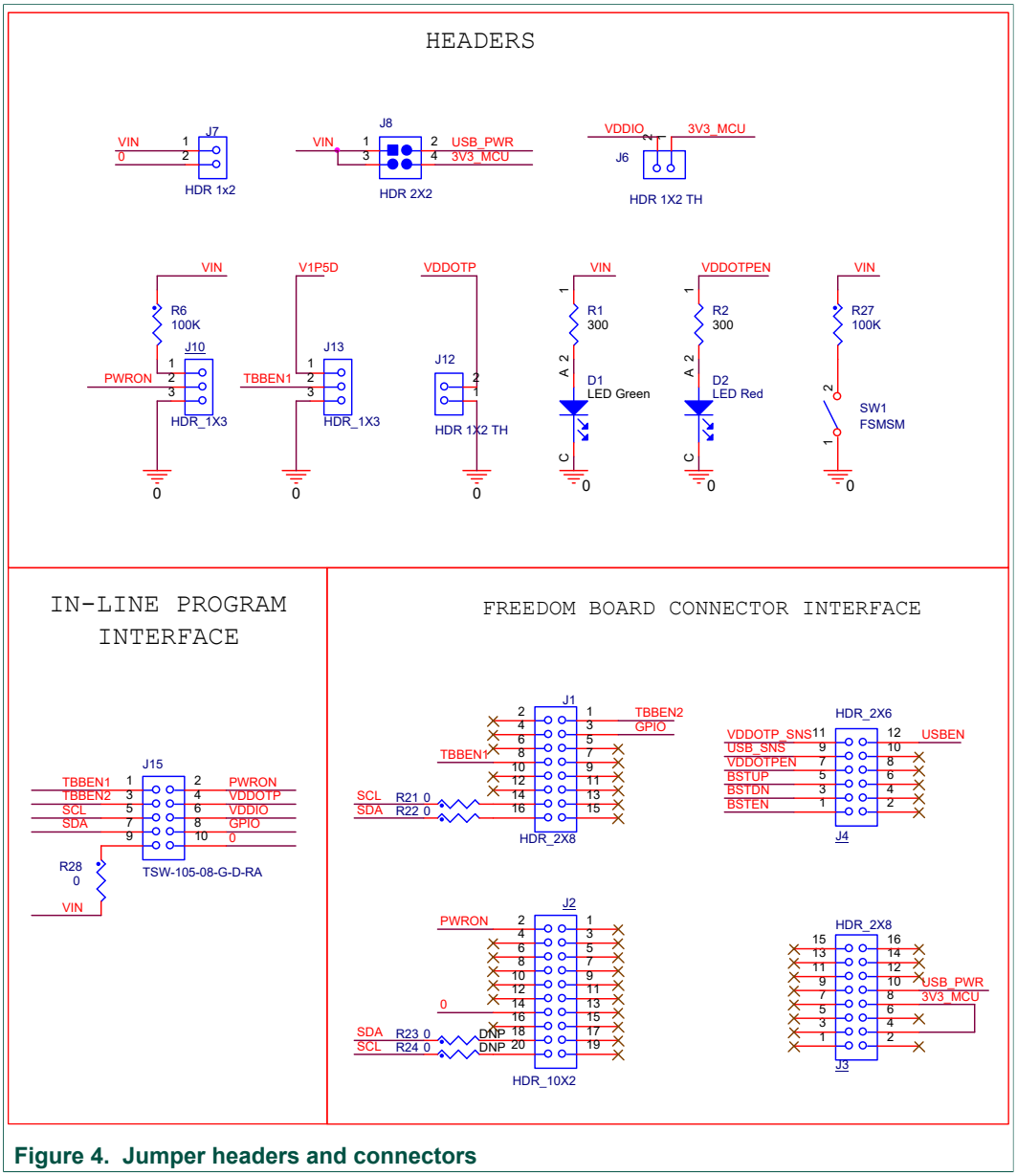
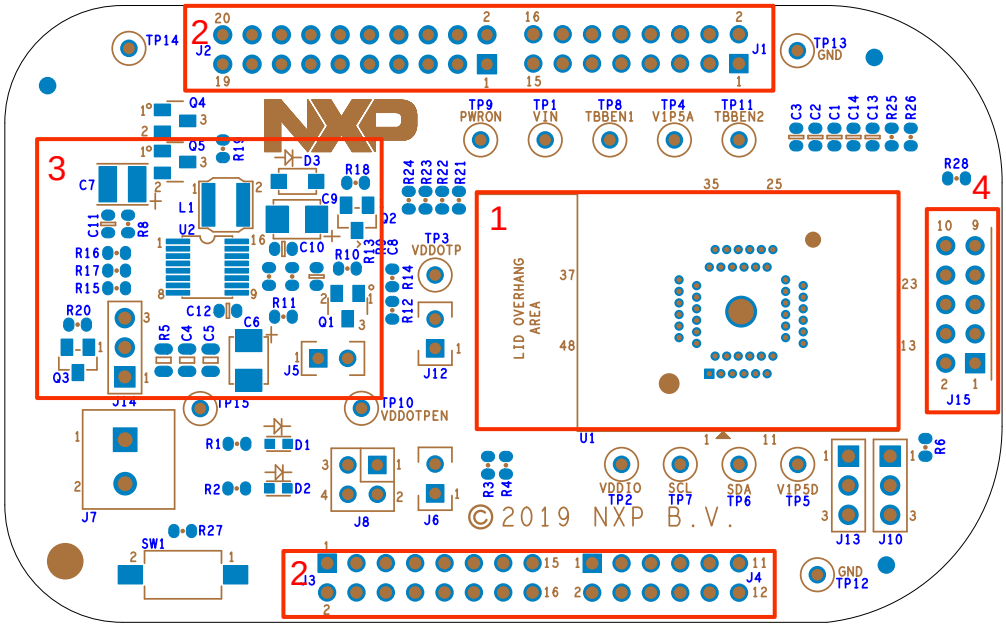


Figure 4. Jumper headers and connectors

4.2 Kit featured components

Figure 5 identifies important components on the board.



1. QFN 48-pin Socket
2. Freedom board interface connectors
3. 7.5 V Boost converter
4. Inline programming connector

Figure 5. Evaluation board featured component locations

4.3 Default jumper configurations

Table 1. Evaluation board jumper descriptions

Name	Default	Description
J7	Disconnected	External VIN supply
J14	Open	Force VIN for the boost converter • 1-2: disconnect VIN from the boost converter • 2-3: force VIN to supply the boost converter • Open: allow the MCU to control the boost input voltage supply
J8	1-2 Shorted	KITPF7100FRDMPGM input supply selection • 1-2 shorted: select USB 5 V from FRDM-KL25Z as input • 3-4 shorted: select 3.3 V from FRDM-KL25Z as input
J5	Shorted	Filter capacitors for VDDOTP pin
J6	Shorted	Force VDDIO supply to 3.3 V from FRDM-KL25Z
J10	Open	PWRON voltage selection • 1-2 shorted: force PWRON high • 2-3 shorted: force PWRON low • Open: allows MCU to control PWRON pin
J13	Open	TBBEN voltage selection • 1-2 shorted: force TBBEN high • 2-3 shorted: force TBBEN low • Open: allows MCU to control TBBEN pin
J12	Open	Force VDDOTP to ground
J1, J2, J3, J4	—	Freedom board interface

Name	Default	Description
J15	Shorted	Inline programming connector

4.4 Test points

The following test points provide access to various signals to and from the board.

Table 2. Evaluation board test point descriptions

Name (label)	Signal name	Description
Ground test points		
TP12, TP13, TP14, TP15	GND	Ground plane test points
Digital I/O signal		
TP1	VIN	Connected to pin 27 (VIN) on socket
TP2	VDDIO	Connected to pin 9 (VDDIO) on socket
TP3	VDDOTP	Connected to pin 8 (VDDOTP) on socket
TP4	V1P5A	Connected to pin 24 (V1P5A) on socket
TP5	V1P5D	Connected to pin 28 (V1P5D) on socket
TP6	SDA	Connected to pin 10 (SDA) on PMIC. Main system I^2C bus
TP7	SCL	Connected to pin 11 (SCL) on PMIC. Main system I^2C bus.
TP8	TBBEN1	Connected to pin 32 (TBBEN) on socket
TP9	PWRON	Connected to pin 34 (PWRON) on socket
TP10	VDDOTPEN	Connected to VDDOTP enable FET on the boost converter block
TP11	TBBEN2	Connected to pin 3 (TBBEN2) on the inline programming connector; provided to support dual PMIC programming when doing inline programming

4.5 Inline programming interface configuration

In order to provide connectivity for programming of a PF7100 device on a target board, a set of jumper wires has been provided.

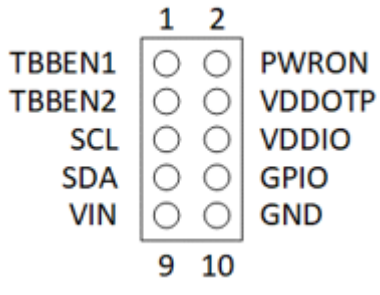


Figure 6. Inline programming interface connector

For systems that require inline programming capabilities, the following circuits should be provided in order to be able to interface with the KITPF7100FRDMPGM programming board via the interface connector.

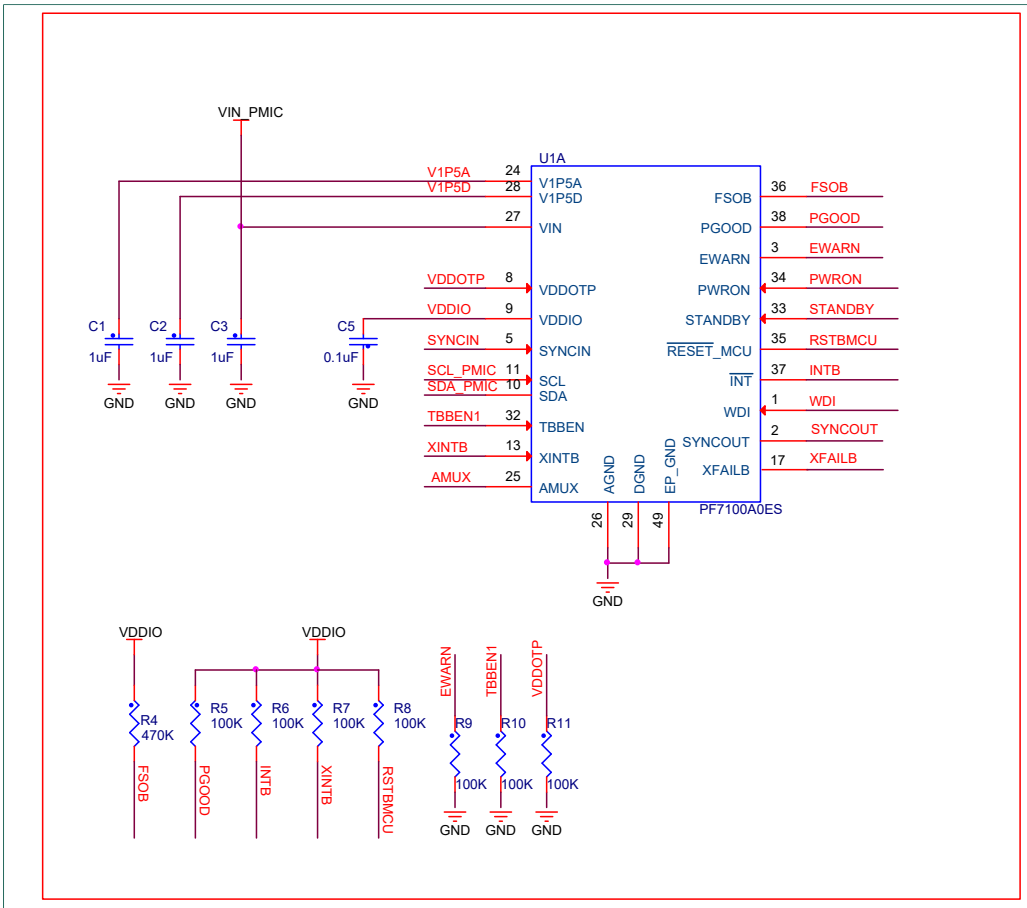


Figure 7. PMIC control signals

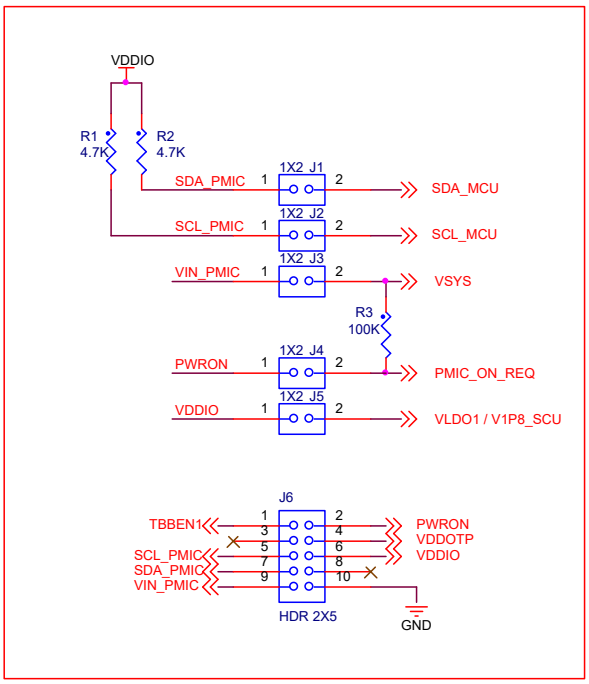


Figure 8. Programming interface

Notes:

- *Inline programming interface connector may require mirror signals, depending on the cable configuration used to connect with the KITPF7100FRDMPGM programmer.*
- *The configuration signal might require isolation from the main system in order to allow proper communication with the PMIC during the OTP programming procedure. Such isolation may be achieved via 1x2 pin header, 0 Ω resistor or a dip switch array.*
- *TBBEN2 and GPIO pins in KITPF7100FRDMPGM interface connector are intended for advance system configuration. Connection is optional as needed.*
- *Make sure to use a connector cable that is eight inches or shorter to communicate between the KITPF7100FRDMPGM and the target board.*

5 Software and firmware preparation

5.1 Installing NXPGUI on your computer

The KITPF7100FRDMPGM can use the NXPGUI for any of the PF7100 devices. Prior to the installation of the NXPGUI software and performing device firmware updates (if needed), download and unzip the NXP_GUI_PR_version.zip file to any desired location.

Open and run the NXP_GUI_version_Setup.exe file from the unzipped package. This installs the NXPGUI software in the system. Install it in a local destination folder.

The installation package is available at www.nxp.com/KITPF7100FRDMPGM.

5.2 Updating the PF7100 NXPGUI firmware

The FRDM-KL25Z freedom board is used to operate as a communication bridge to interface the NXPGUI with the PMIC and other I^2C devices. The firmware is organized in three levels:

1. At the first level, the SDA uses the BOOTLOADER to operate as the main path to flash the functional code of the SDA processor. The BOOTLOADER is preprogrammed on the FRDM-KL25Z freedom boards and cannot be reflashed, to avoid permanent damage to the Freedom board.
2. At the second level, the SDA provides a *firmware loader* for quick drag-and-drop update of the KL25Z MCU firmware.
3. At the third level, the KL25Z MCU provides the NXPGUI firmware. This firmware converts the USB communication into MCU instructions to control digital I/Os, as well as I^2C communication to the PMIC.

If the FRDM-KL25Z is not loaded with the correct firmware to support a future software upgrade, the firmware can be updated in few simple steps.

Note: *The following firmware updates are optional and can be skipped if the firmware is up-to-date.*

5.2.1 Flashing the FRDM-KL25Z firmware loader

- This step is optional and should be performed only if the FRDM_KL25Z driver does not appear when the SDA port is connected. Press the push button on the Freedom board and connect the USB cable into the SDA port on the Freedom board. A new BOOTLOADER device should appear on the left pane of the file explorer.

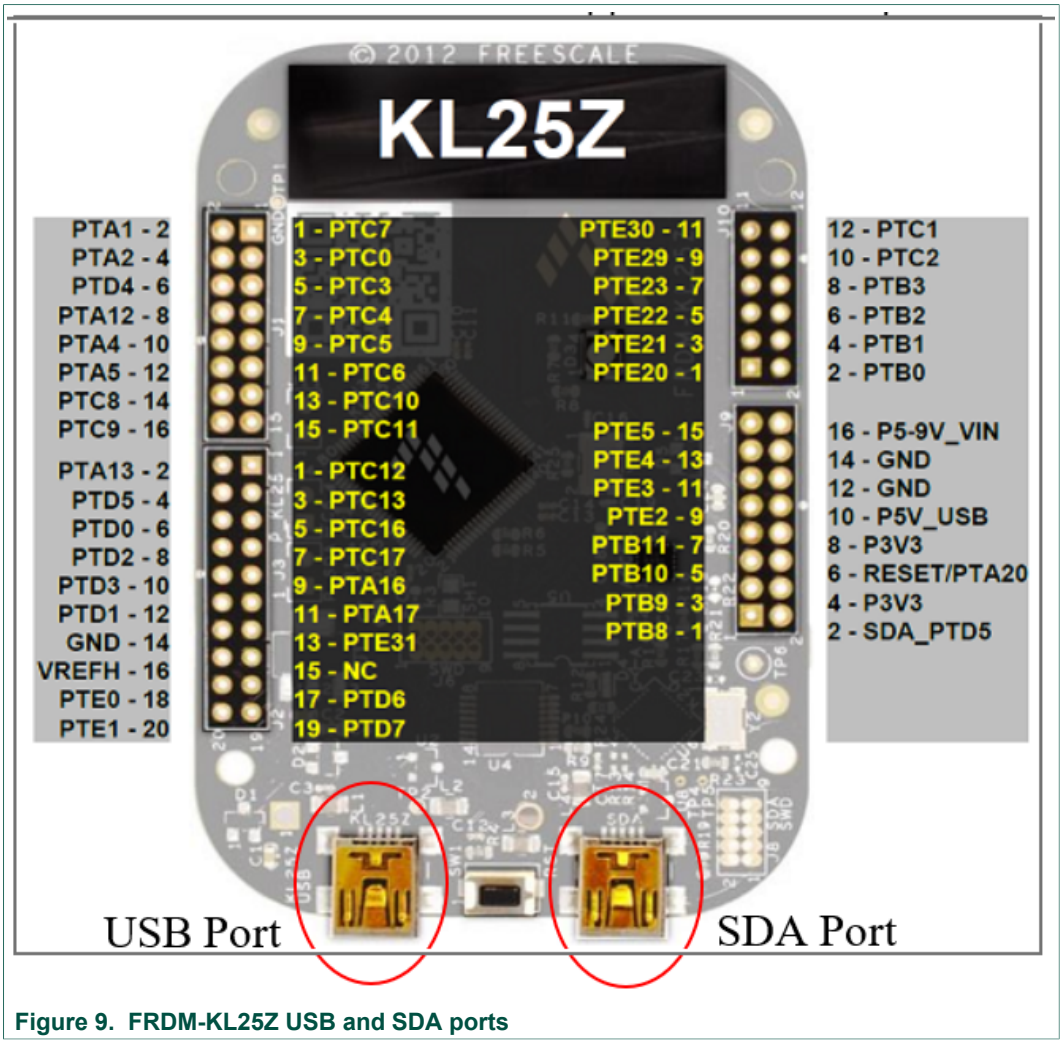


Figure 9. FRDM-KL25Z USB and SDA ports

- The file, *MSD-DEBUG-FRDM-KL25Z_Pemicro_v118.SDA*, should be located in the *KL25Z firmware* folder. Drag and drop this file into the BOOTLOADER drive.
- Disconnect and reconnect the USB cable into the SDA port (this time without pressing the push button). A new device called *FRDM_KL25Z* is installed on the PC.

5.2.2 Flashing the NXPGUI firmware

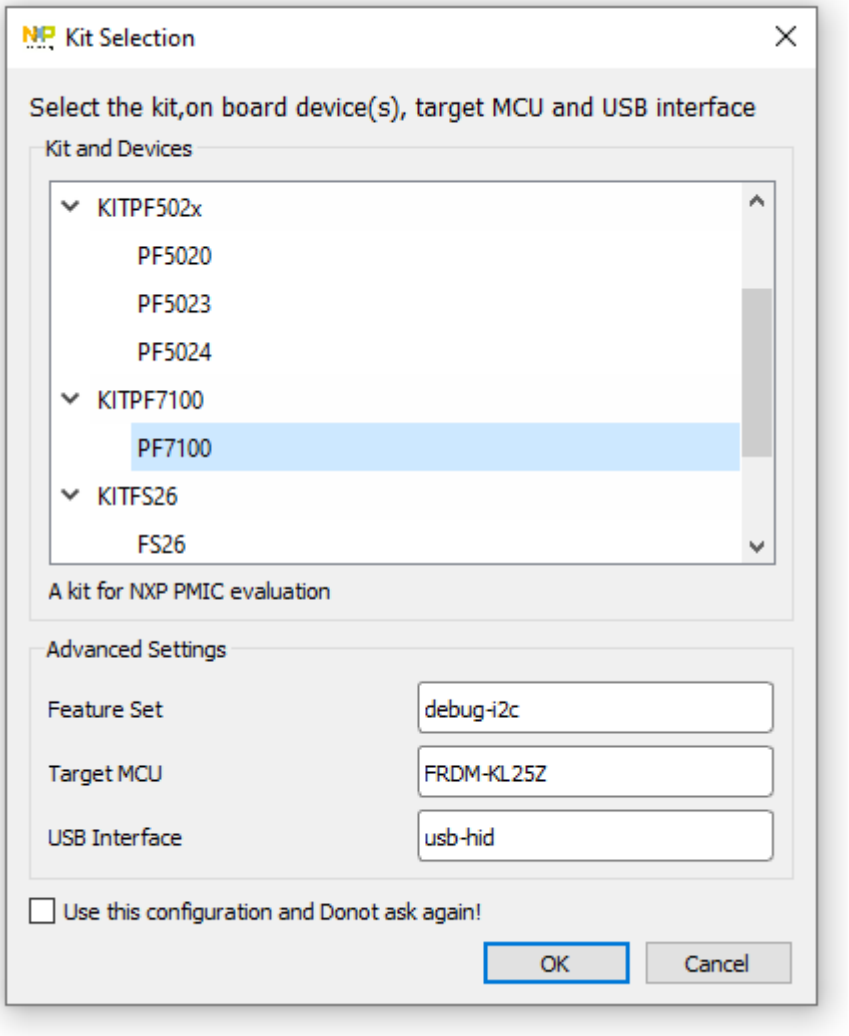
If a new software or silicon release requires a firmware update on the FRDM-KL25Z freedom board, use the following steps to upgrade or downgrade the firmware of the freedom board as needed. Note that this procedure is needed only to update the firmware and may be skipped if no change is needed.

- Connect the USB cable in the SDA port (without holding the push button). The PC installs a new device called FRDM_KL25Z.
- Locate the ".bin" NXPGUI driver to be installed, for example *nxp-gui-fw-frdmkl25z-usb_hid-pf7100_version.bin* and drag and drop the file into the FRDM_KL25Z driver.
- Freedom board firmware is successfully loaded.

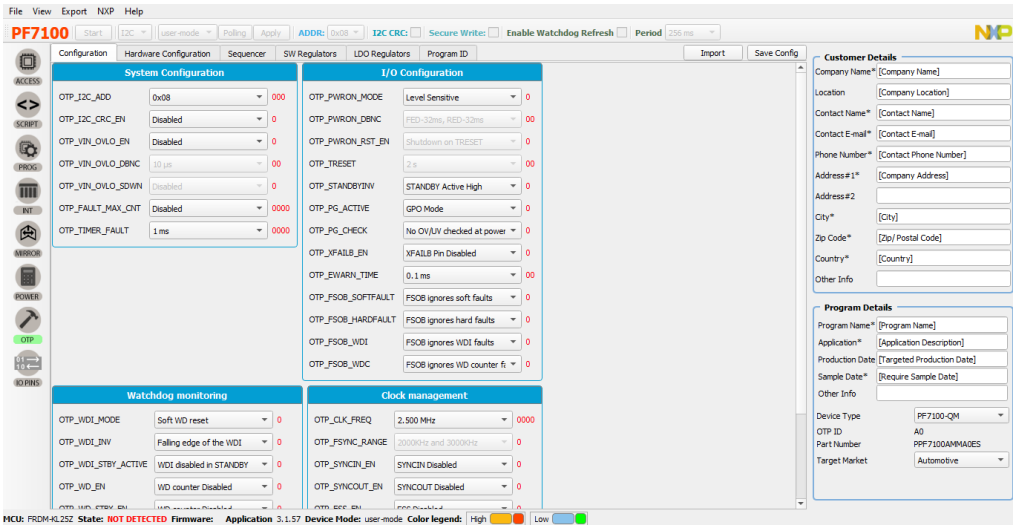
6 Programming OTP configuration on the PF7100 PMIC

6.1 Launch NXPGUI to generate an OTP script

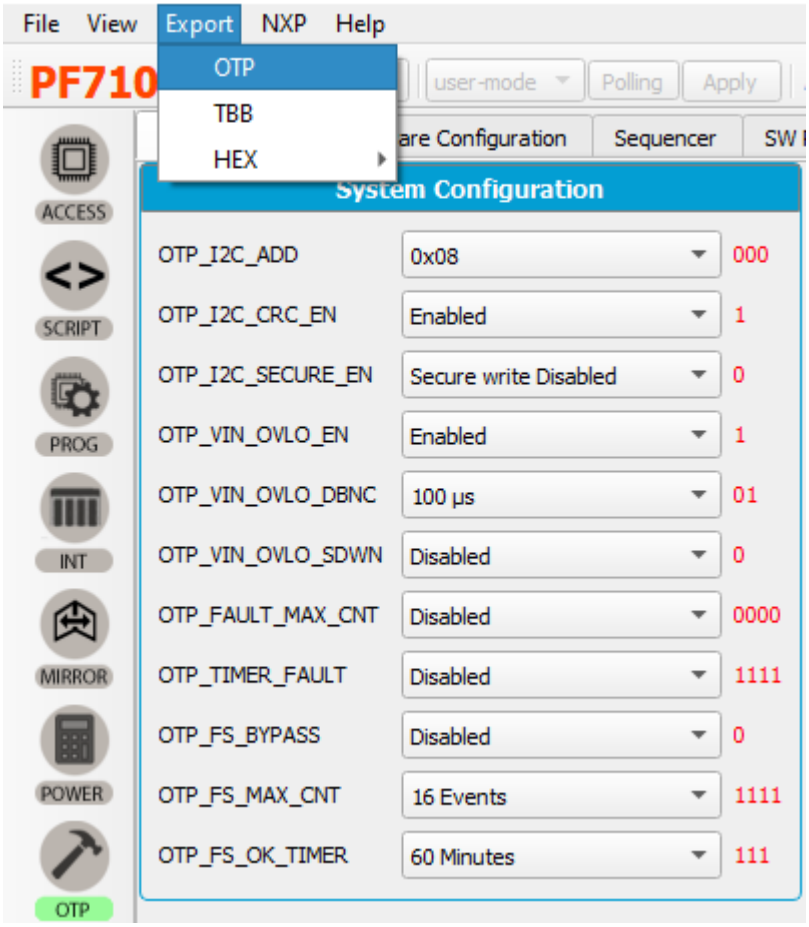
1. Open the NXPGUI application from the installation folder or from the Start menu to start the application.
2. The NXPGUI launcher is displayed with a list of possible configurations to load the NXPGUI. Select the appropriate option for the device and silicon revision to be used. If the device revision populated on the KITPF7100FRDMPGM is not available in the list, please contact your NXP representative to obtain the latest software update suitable for your device. Click OK to launch the NXPGUI.



3. Set the desired OTP configuration using the OTP tab panel. If there is a predefined OTP configuration script, the user can load it by clicking on the Import button.



4. Select **OTP** from the **Export** tab in the menu and save the generated OTP file (.txt) to a known location with a desired filename.



5. The script for OTP programming is ready.

6.2 Connect the board

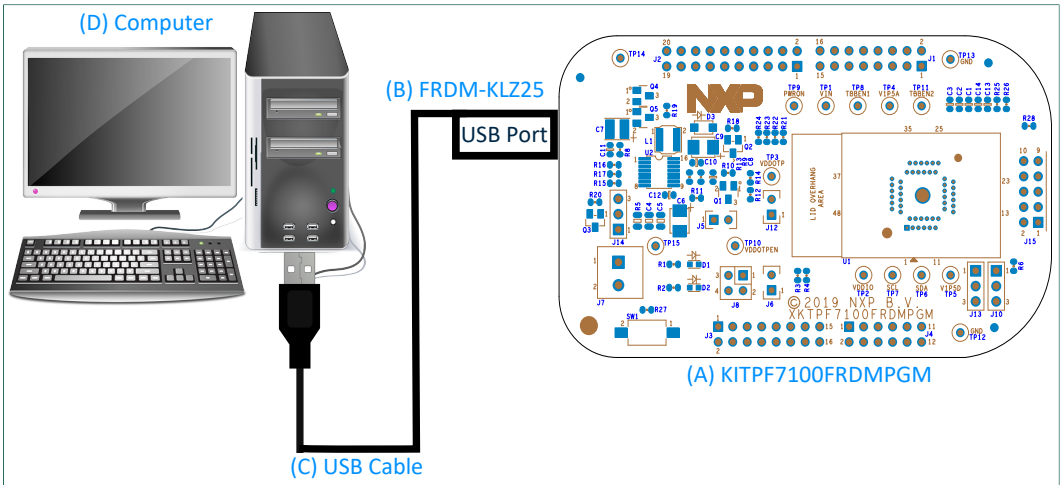
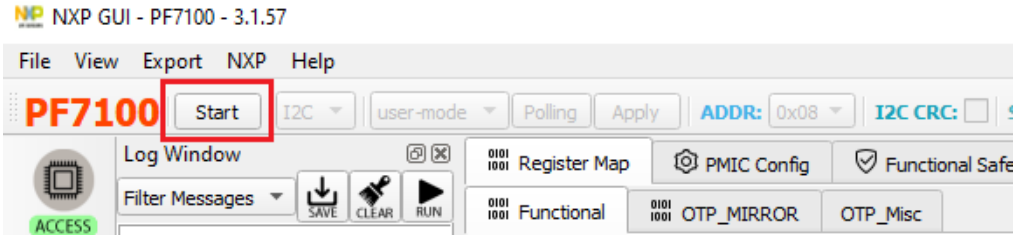


Figure 10. Evaluation board setup

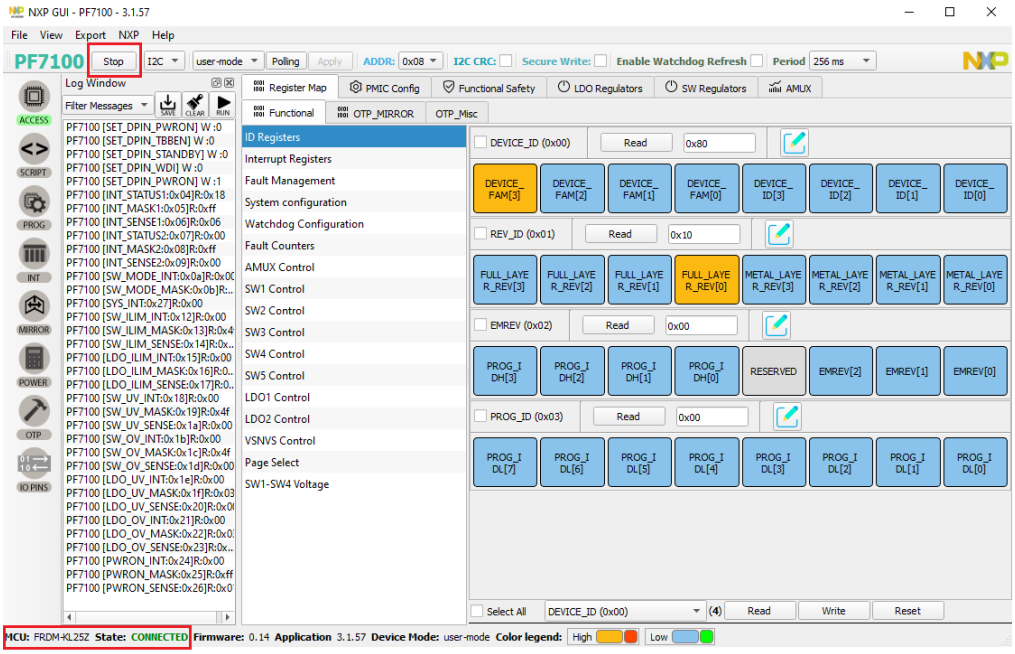
Figure 10 presents a typical hardware configuration incorporating the development board and a Windows PC workstation.

To configure the hardware and workstation, complete the following procedure:

1. Connect the KITPF7100FRDMPGM board to the top of the Freedom KL25Z board.
   - For standalone chip programming, introduce a PF7100 QFN device in the socket (ensure pin 1 is properly aligned).
   - For inline programming, connect the interface connector to the system board and ensure VIN power is provided either from the programmer or at the system board. Ensure the SCL and SDA pins are connected only to the PMIC and isolated from the system bus. This configuration avoids the unpowered system from pulling the signal up or down, causing communication problems.
2. Connect the USB cable from the PC to the USB port on the Freedom board.
   - The green LED should light up.
3. The USB-HID connection will automatically search for the KITPF7100FRDMPGM, if a valid board is connected. This is displayed by the active Start button on the top-left corner of the GUI, then click **Start** to create a connection.



The Start button changes to a Stop button after it is clicked. The device status can be read from the bottom-left corner of the NXPGUI.



4. If the board is properly recognized, press the Reset button on the Freedom board.

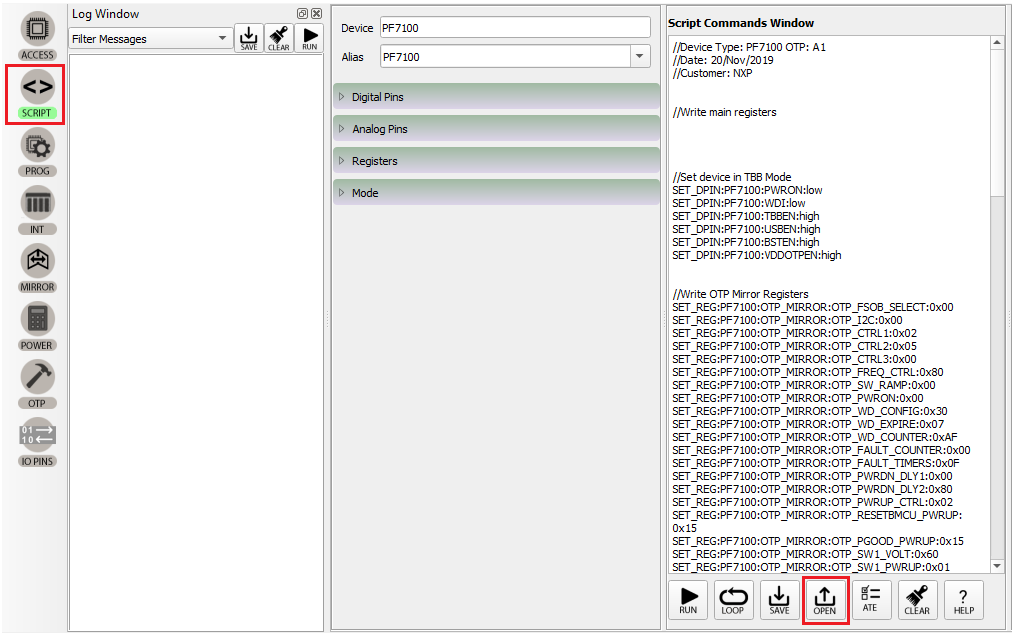
Once the device is connected, the system is ready to perform the OTP programming.

6.3 Load OTP script to program the device

There are two ways to program the PF7100 device with NXPGUI: using the **SCRIPT** tab or the **PROG** tab. The following sections introduce these two methods.

6.3.1 Program the device with SCRIPT tab

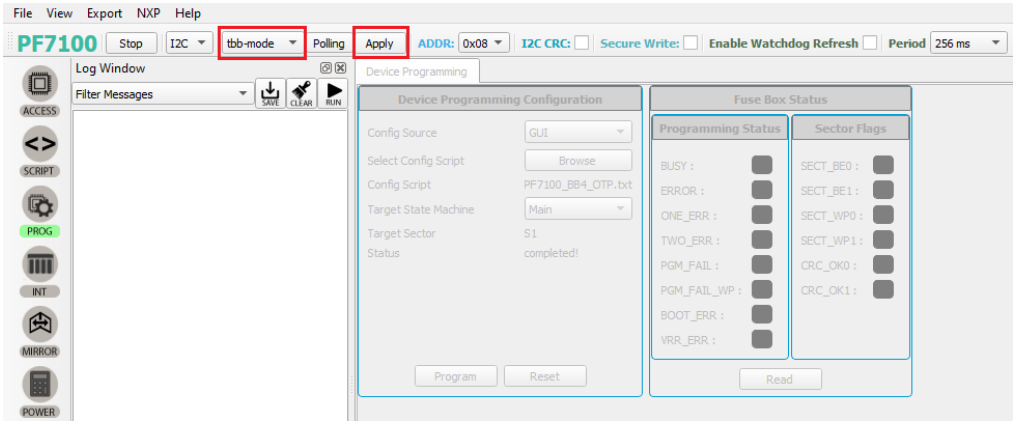
1. To begin the OTP configuration on the PMIC with the **SCRIPT** tab, select the **SCRIPT** tab and open the OTP script generated by the **OTP** Tab.



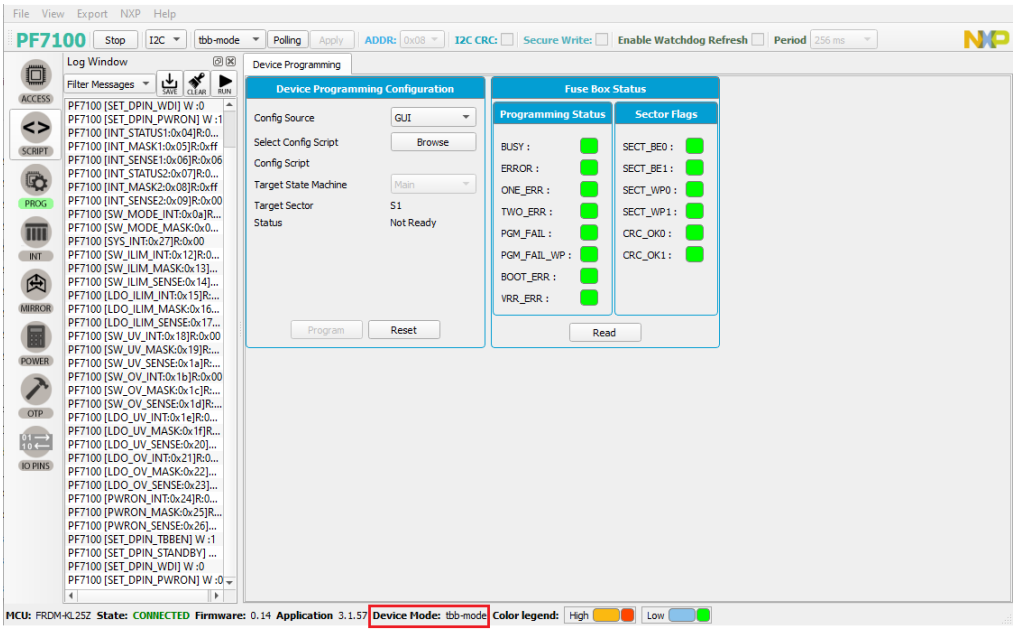
2. Click the RUN button at the bottom of the **Script Commands Window**. Wait for the NXPGUI to finish the burning sequence.
3. To verify proper configuration of the device, stop the communication with the device, disconnect and reconnect the USB cable, and establish connection with the board again (this process is needed to ensure the PMIC has a complete power cycle and the new OTP configuration is loaded in the Mirror registers).
4. Click **OPEN** to load the PF7100_A0_Read_Mirror_Registers.txt file provided in the NXP_GUI_PR_version folder. Click the **RUN** button. The log is displayed in the **Script Results Window**.
5. The first command provides the device ID
   - PF7100 Auto QM = 0x80
   - PF7100 Auto ASILB = 0x88
6. The last two commands verify the proper programing of the Mirror register sector status. If SECT_STATUS = 0x3F & FSTATUS = 0x00, the part is programmed correctly.
7. All other lines output the programmed value of the Mirror registers.

6.3.2 Program the device with PROG tab

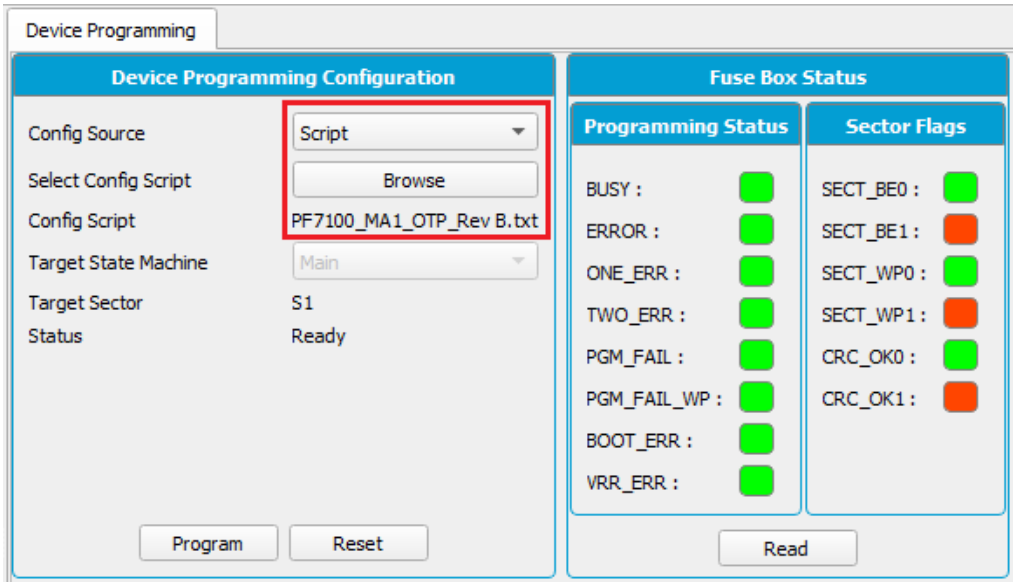
1. To begin the OTP configuration on the PMIC with PROG tab, the PF7100 must first run in TBB mode. Select the tbb-mode in main menu and click the **Apply** button.



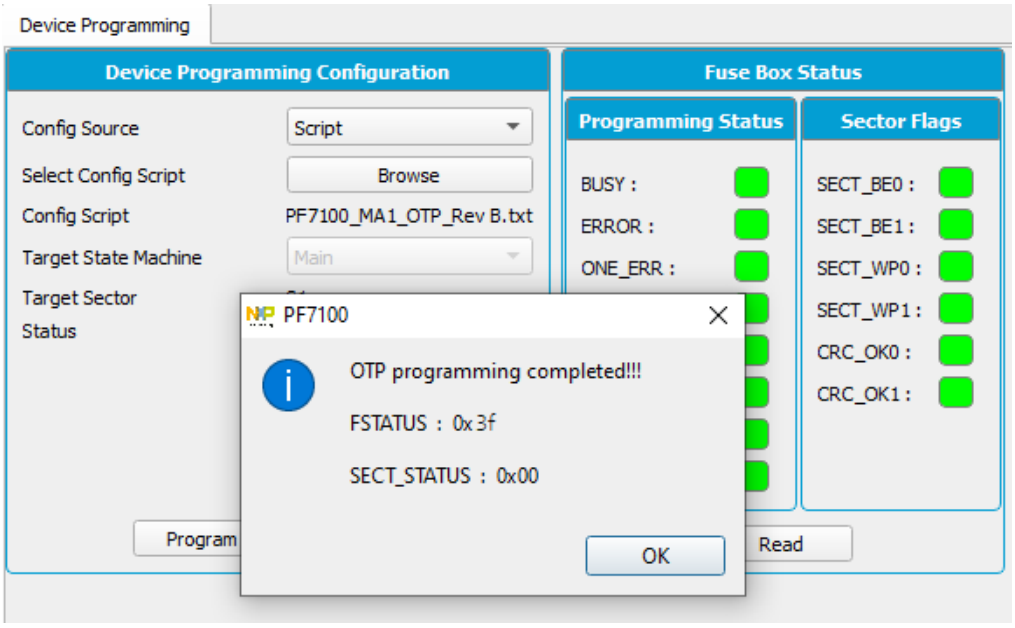
The PROG panel turns becomes active on TBB mode. The device status flags on the bottom bar indicates the device's current mode.



2. Go to the **PROG** tab, select the Config Source as **Script**, and click **Browse** to load the OTP script. The selected OTP script title shows up on the panel.



3. Click the **Program** button and wait for the NXPGUI to finish the burning sequence. A pop-up window appears if the OTP programming is done.



4. To verify proper configuration of the device, stop the communication with the device, disconnect and reconnect the USB cable, and establish connection with the board again. This process ensures the PMIC has a complete power cycle and the new OTP configuration is loaded in the Mirror registers).
5. Go to **SCRIPT** tab, click **OPEN** to load the PF7100_A0_Read_Mirror_Registers.txt provided in the NXP_GUI_PR_version folder. Click **RUN**. The log prints out in the Script Results Window.
6. The first command provides the device ID
   - PF7100 Auto QM = 0x8

- PF7100 Auto ASILB = 0x88

7. The last two commands verify the proper programing of the Mirror register sector status. If SECT_STATUS = 0x3F & FSTATUS = 0x00, the part is programmed correctly.
8. All other lines output the programmed value of the Mirror registers.

7 References

[1] **KITPF7100FRDMPGM** — detailed information on this board, including documentation, downloads, and software and tools
http://www.nxp.com/KITPF7100FRDMPGM

[2] **PF7100** — product information on Multichannel power management integrated circuit
http://www.nxp.com/PF7100

8 Revision history

Revision history

Rev	Date	Description
v.1	20200925	Initial release

9 Legal information

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