*User's Guide*

# ***TPS257XX-Q1-GUI Configuration Guide***

TEXAS INSTRUMENTS


**ABSTRACT**

This document provides guidance regarding the configurable parameters for the TPS2576x-Q1 and TPS2577x-Q1 USB power delivery (PD) controller device family. Use this guide when configuring the TPS2576x-Q1 and TPS2577x-Q1 devices using the TPS257xx-Q1-GUI configuration tool (referred to as *GUI* throughout this document) available at *TPS257XX-Q1-GUI*.


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## 1 Introduction

The TPS2576x-Q1 and TPS2577x-Q1 device family is user-configurable and can support a wide range of operational modes to meet specific use-case requirements. This programmable flexibility enables the same hardware design to support different requirements without changes to the physical hardware. Hardware system design of the TPS25762Q1EVM and TPS25772Q1EVM include connection of an EEPROM memory to the TPS2576x-Q1 or TPS2577x-Q1 device through an I2C interface.

Application-specific device configuration and programming can be accomplished using the TPS257XX-Q1-GUI. This graphical user interface tool is configurable based on user requirements and generates corresponding binary files that can be downloaded into the EEPROM through an I2C interface. The GUI inherently supports the ability to update hardware using a USB endpoint connection, a mode typically used post-production once hardware has been deployed.

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**Note**

Some graphics contained in this document can differ slightly from the current version of the GUI available from dev.ti.com because regular maintenance releases can occur ahead of updates to this guide.

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# 2 Getting Started

## 2.1 Related Documents

- Texas Instruments, *TPS25762-Q1 Automotive Single USB Type-C® Power Delivery Controller with Buck-Boost Regulator* data sheet
- Texas Instruments, *TPS25772-Q1 Automotive Dual USB Type-C® Power Delivery Controller with Buck-Boost Regulator* data sheet
- Texas Instruments, *TPS25762/72-Q1 EVM User's Guide*
- Texas Instruments, *TPS2576x/TPS2577x-Q1 Source Power Policy Management* application note

## 2.2 Hardware

The TI TPS2576x-Q1 and TPS2577x-Q1 devices and corresponding hardware evaluation modules (EVMs) can be used with this GUI configuration tool:

- TPS25762Q1EVM-146
- TPS25772Q1EVM-149
- TPS25772Q1EVM-150

## 2.3 Software

The following software packages are required to use the GUI configuration tool:

- TPS257xx-Q1 Firmware Package (*Request access from the GUI tool page. Use link below.*)
- TPS257xx-Q1 Configuration GUI

The GUI software is available in the Gallery at dev.ti.com. Run the software from a web browser using Google Chrome® browser, Firefox®, or Microsoft® Edge. The TI Cloud Agent must be installed as a browser extension to enable USB port connection to the EVM. When the application is launched, instructions appear for installing the TI Cloud Agent.

The GUI software can also be run natively on the PC. If this is desired, the GUI application and GUI Composer Runtime package is installed. To install, click on the downwards-facing arrow inside the application dashboard listed in the Gallery to access the links for download. After selecting the correct operating system, open the installer and follow the prompts to install the programs.

## 2.4 GUI Installation and Launch

Launch the GUI tool either through a web browser or locally as a desktop application following these steps:

- Navigate to *TPS257XX-Q1-GUI* using a supported web browser
- Click the *Evaluate in the cloud* button
- A new tab opens with the application launched

If the TI Cloud Agent is not already installed, instructions appear for installing the required software.

To download and install the application locally on the PC follow these steps:

- Navigate to *TPS257XX-Q1-GUI* using a supported web browser
- Click the *Download* button
- If required, select the application dashboard that has the correct tool displayed
- Click on the downwards-facing arrow on the bottom left side of the dashboard, and look towards the top set of links that appear. Select the operating system, and open the installer.
- Once the installer is open, follow the directions to install the GUI application

The TPS257xx-Q1-GUI application configuration tool provides users with the following capabilities:

- Generate application configuration settings in a binary file format
- Load configuration settings to the onboard EEPROM of the EVM
- Load configuration settings to an EVM (or custom hardware) along with security keys using the USB Type-C® port
- Save configuration settings in JSON format locally for future use

# 3 Application Configuration Overview

After launching the GUI and selecting *Quick Start*, the user is prompted to select a device variant using the "Choose a device" drop-down menu.

After selecting the device and clicking *SELECT* in the *Start Configuration* box, the *Advanced Configuration* page appears (the *Simple Configuration* menu is recommended for new users and can be selected from the left sidebar.). Using these input fields, the application can be configured based on system requirements by selecting the desired sub-system tabs in the GUI.

Once the application is configured, the firmware is ready to be downloaded into the system hardware.

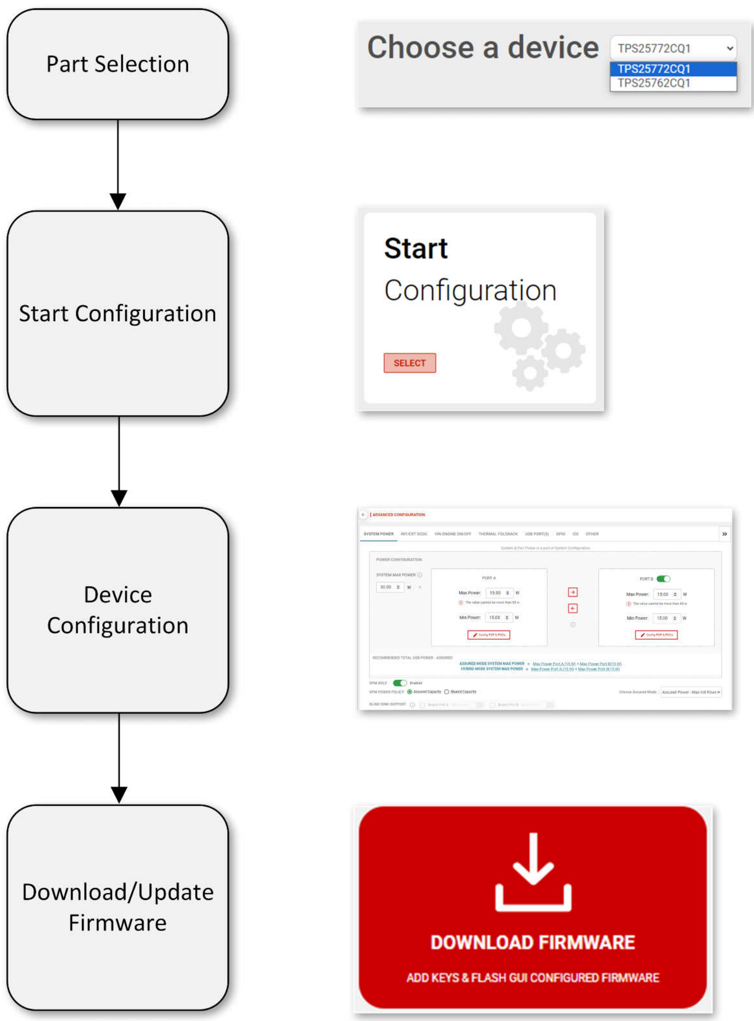


**Figure 3-1. Typical GUI Flow**

## 3.1 Creating a New Application Configuration

Starting from the initial GUI landing page, the following steps outline how to begin creating a new application configuration:

1. Click *Quick Start*
2. Click the dropdown menu next to *Choose a Device* to select device variant
3. Click *SELECT* in the *Start Configuration* box (the *Advanced Configuration* page appears)
4. Configure each module accordingly per system requirements, navigate using the the desired sub-system tabs
5. After configuration is complete, click the *SAVE CONFIGURATION* button to save the setup as a JSON file to reload the settings in a future GUI session

## 3.2 Loading a Saved Configuration

The TPS257XX-Q1-GUI supports the ability to load a previously saved configuration file. The file is saved as a .JSON file and can be loaded as described in the following list, starting from the initial GUI landing page:

1. Click *Quick Start*.
2. Click the *OPEN CONFIGURATION* button (upper right of the GUI screen).
3. Two options are presented:
    a. *SAVE OLD CONFIGURATION*: this saves the current application configuration settings (if any) to a new JSON file
    b. *LOAD NEW CONFIGURATION*: This opens a navigation window to select an existing JSON file
4. Click *LOAD NEW CONFIGURATION* and navigate to the desired JSON file. If the selected JSON file was generated using a previous version of the GUI, previous settings may not update as expected (click *Help*, located at the top of the GUI next to *Options*, then *Release Notes* for information on GUI versions and compatible firmware).
5. Once loaded, the *Simple Configuration* page appears containing the restored application configuration settings.
6. Make any desired changes accordingly per system requirements, navigate using the button string graphic and the *NEXT* button in the GUI.
7. After configuration is complete, click the *SAVE CONFIGURATION* button to save the setup as a new JSON file.

# 4 Configuration Parameters

## 4.1 USB Port Configuration Module

USB Port A-specific parameters (and Port B when using a dual port controller device) are configured in this module.

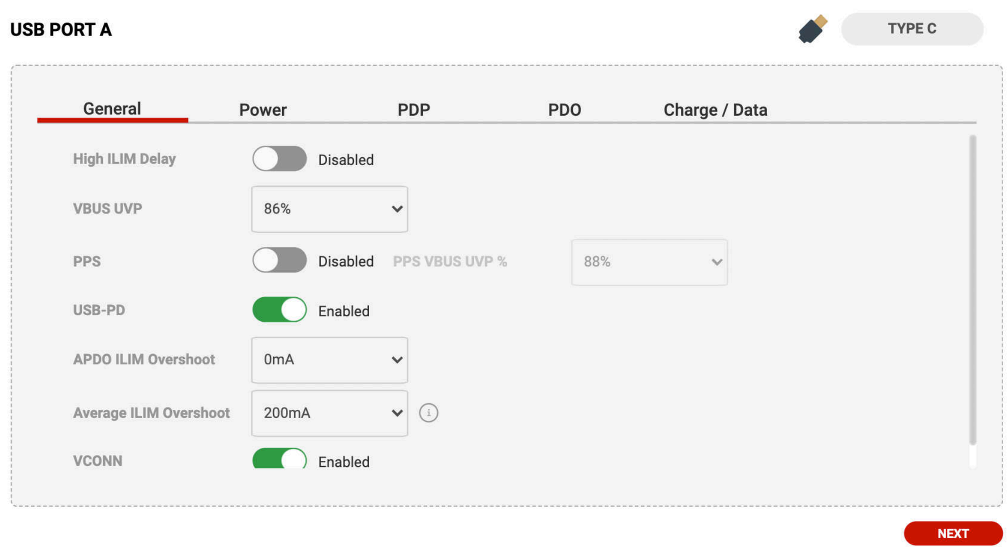


**Figure 4-1. USB Port Configuration Module**

| | |
|---|---|
| **General** | General parameters such as current limit delay, VBUS undervoltage protection, programmable power supply enable or disable, and USB PD enable or disable are configurable in this page. |
| **Power** | Total system USB power and port-specific power parameters are configurable in this page. This page works in conjunction with the PDP and PDO page. |
| **PDP** | PDPs are auto-generated based on power settings defined in the Power page. The PDPs can be modified in this page. |
| **PDO** | PDOs are auto-generated based on power settings defined in the Power and PDP pages. The PDOs can be modified in this page. |
| **Charge / Data** | USB Fast charge mode can be enabled or disabled with different charging modes selectable in this page. |

**USB PORT B** When using a dual-port controller device, the Port B module page is available. When Port B is selected, an option is available to enable or disable Port B. If disabled, only Port A is active and the dual-port device operates in single-port mode. Disabling of the Port affects other parameters such as total VBUS power, port power, and SPM-related system configuration. These parameters can be re-configured for correct operation of the device when disabled.

## 4.2 I2C Configuration

I2C parameters are configurable in this page. Fixed parameters are also shown for user information purposes.

TVSP CONFIG preference is determined by I2C target address setting. The target system hardware must have a matching TVSP configuration, otherwise it is possible the device does not function.

## 4.3 Internal DCDC

Internal DCDC parameters are configurable in this page. Fixed parameters are also shown for user information purposes. The inductor value chosen must match actual inductor values configured in the target system hardware.

## 4.4 GPIO Configuration

GPIO parameters are configurable in this page. Fixed values for each GPIO are shown for user information purposes. If GPIO is a fixed value, the pin configuration is not re-configurable. For example, in TPS25772-Q1, GPIO 0 and GPIO 1 are fixed as PB_CC1 and PB_CC2 for Port B USB Type-C PD communication purposes.

## 4.5 External DCDC

External DCDC parameters are configurable in this page (applies only for two-port device selection, for example, TPS25772-Q1) for either the TPS55288-Q1 or TPS55289-Q1 buck-boost converters. OCP Delay can be configured. Other external DCDC parameters are pre-configured for the best Port B operation and shown for user information purposes.

## 4.6 System Configuration

System operational level parameters are configurable in this page. There are four categories of the configuration group in this module: System Power Management, Device IDs, Thermal Foldback, and VIN Engine ON/OFF.

### 4.6.1 System Power Management

System Power Management (SPM) parameters can be configured in this page. Three SPM policies available:

- Assured Power - Maximum Init Power
  - Initially allocates maximum power per port without power sharing
- Assured Power - Minimum Init Power
  - Initially allocates minimum power per port without power sharing
- Shared Capacity - Fair Share Power Policy
  - Enables power sharing between ports (only applicable in a two port system)
  - When selected, an option to enable or disable blind sink support is active.
  - When blind sink support is enabled, an additional option to enable or disable "Max Power" is active. This will enable the charging port to offer max power to the sink regardless of behavior.

This feature works in conjunction with the configured port power parameters.

For more information regarding SPM, see the *TPS2576x/TPS2577x-Q1 Source Power Policy Management*.

### 4.6.2 Device IDs

Device IDs can be configured in this page. For test purposes, the fields can be left at their default values. Vendor IDs, XIDs, and Product IDs are unique IDs assigned by the USB Implementers Forum. See usb.org for more information about obtaining IDs.

### 4.6.3 Thermal Foldback

Thermal foldback related parameters can be configured in this page. Thermal foldback allows the system to reduce power when defined device thermal thresholds are reached, helping to automatically manage power versus temperature system requirements.

Thermal phase is monitored via the *NTC* device pin (GPIO5) with a thermistor resistor network as described in Figure 4-2. Only positive voltage slope (from lowest to highest temperature) is supported with NTC or PTC thermistor configurations.

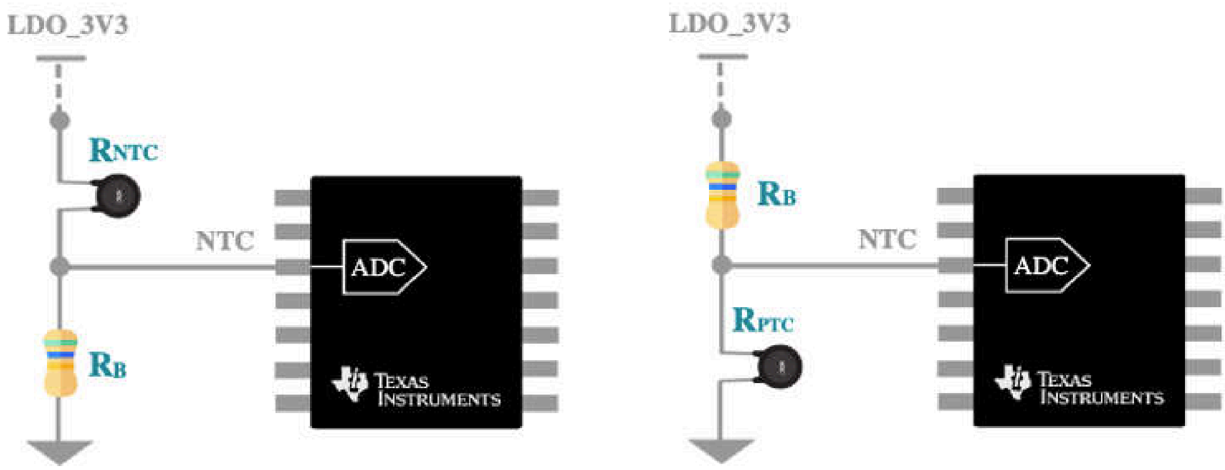


**Figure 4-2. Thermistor Implementation Options: NTC and PTC Circuit Diagrams**

PHASE 1 is the first thermal foldback phase followed by PHASE 2 and finally PHASE 3. Voltage thresholds must be configured from lowest to highest temperature starting from PHASE 1. Input voltage levels can be calculated based upon the type of thermistor and external resistor values used in the target system hardware design. See the thermistor data sheet for voltage input calculations applicable for each phase as required for the given application operation. When enabled in the GUI, one of two provided preset values can be selected:

PRESET1 is based upon an NTC with $R_B$ = 3 kΩ and $R_{NTC}$ = 47 kΩ.

**Table 4-1. PRESET1 (47 kΩ $R_{NTC}$ With $R_B$ = 3 kΩ)**

| Voltage Threshold | Voltage/Temp |
|---|---|
| Phase 1 $V_{TH}$F | 0.392 V (40°C) |
| Phase 1 $V_{TH}$R | 0.574 V (50°C) |
| Phase 2 $V_{TH}$F | 0.686 V (55°C) |
| Phase 2 $V_{TH}$R | 0.938 V (65°C) |
| Phase 3 $V_{TH}$F | 1.078 V (70°C) |
| Phase 3 $V_{TH}$R | 1.386 V (80°C) |

PRESET2 is based upon a PTC (TMP61) with $R_B$ = 10 kΩ.

**Table 4-2. PRESET2 - $R_{PTC}$(TMP61) With $R_B$ = 10 kΩ**

| Voltage Threshold | Voltage/Temp |
|---|---|
| Phase 1 $V_{TH}$F | 1.82 V (40°C) |
| Phase 1 $V_{TH}$R | 1.876 V (50°C) |
| Phase 2 $V_{TH}$F | 1.904 V (55°C) |
| Phase 2 $V_{TH}$R | 1.96 V (65°C) |
| Phase 3 $V_{TH}$F | 1.988 V (70°C) |
| Phase 3 $V_{TH}$R | 2.03 V (80°C) |

The CUSTOM option is available to allow up to 6 PHASES and for user-defined setpoints based on voltage and temperature relationships for other thermistor resistor network designs.

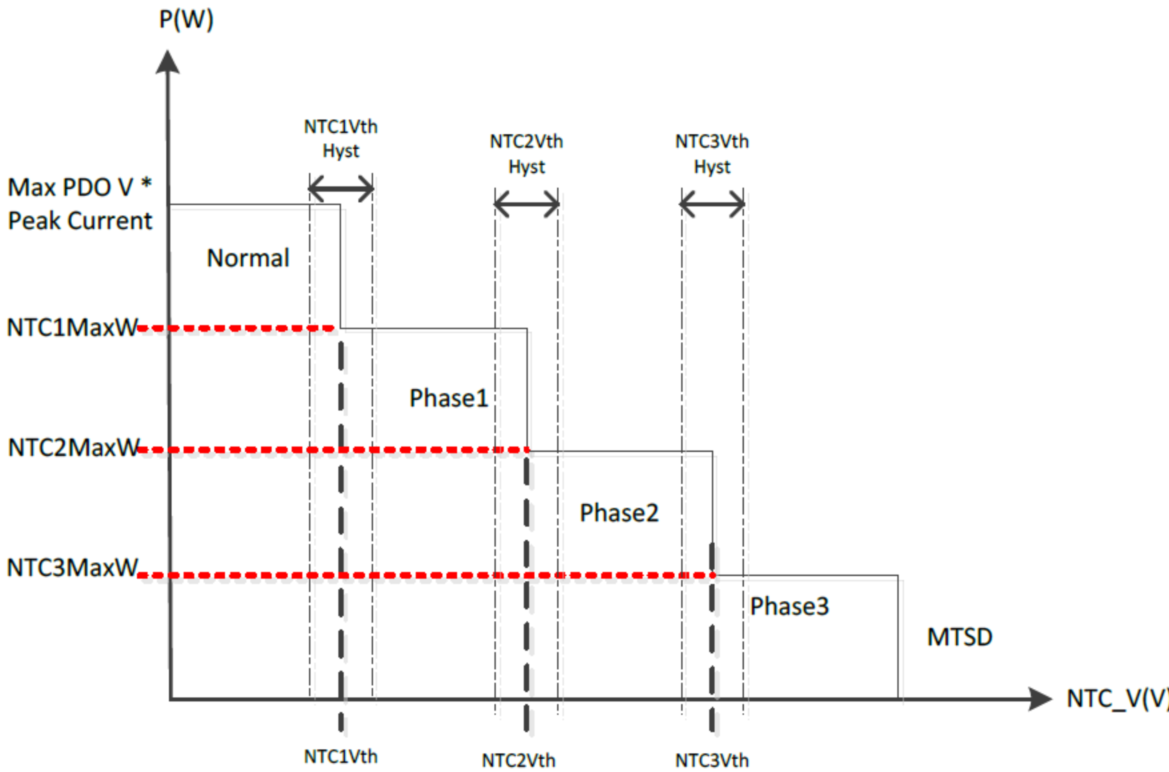


**Figure 4-3. Thermal Foldback Phase vs Maximum Port Power**

Maximum power for each phase is a configurable total port power output for each thermal foldback phase. Program the maximum power relative to the total VBUS power. Note that if maximum power for a given thermal foldback phase is less than the user-defined total minimum port power (sum of minimum port power in dual port systems), the ports are disabled upon entry into the corresponding thermal foldback phase.

Dual port example:

- Total USB VBUS Power = 100 W
- VBUS Port A maximum power = 60 W and VBUS Port B maximum power = 60 W
- VBUS Port A minimum power = 15 W and VBUS Port B minimum power = 15 W
- Maximum power for PHASE1 = 60 W
  - Once this phase is entered, the total USB VBUS power is reduced to 60 W total for ALL ports
- Maximum power for PHASE2 = 30 W
  - Once this phase is entered, total USB VBUS power is reduced to 30 W total for ALL ports
- Maximum power for PHASE3 = 15 W
  - Once this phase is entered, the total USB VBUS power is reduced to 15 W total for ALL ports which is less than the sum of the minimum power of each port (15 W + 15 W = 30 W). In this scenario, the maximum foldback power configured can meet the minimum 15-W requirement of a single port resulting in one port being disabled.

### 4.6.4 VIN Engine On or Off

VIN Engine On or Off power level parameters are configurable in this page.

The TPS257xx-Q1 family supports autonomous power transition dependent upon the $V_{IN}$ (for example, $V_{BATT}$) voltage level per the diagram shown in Figure 4-4.

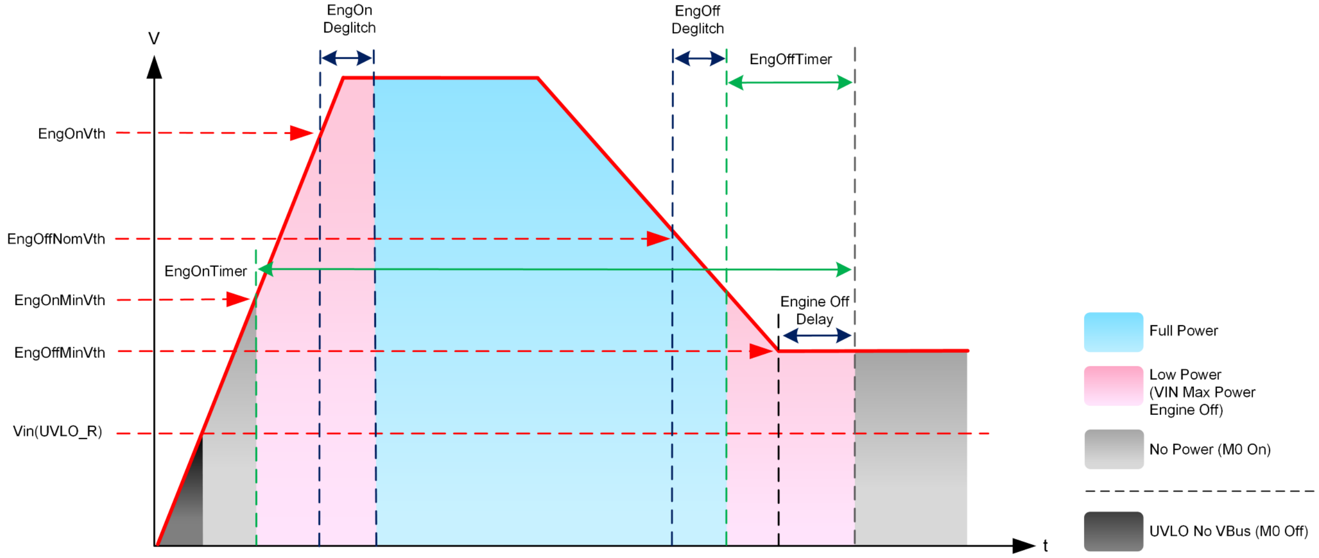


**Figure 4-4. Engine On/Off Controls and Power Mode Operation**

The Engine On/Off voltage thresholds must be configured in sequential order (highest to lowest): EngOnVth (full power) > EngOffNomVth (low power) > EngOnMinVth (low power) > EngOffMinVth (disabled).

Maximum power for the low-power phase is a configurable total port power output. Program maximum power relative to total VBUS power.

Dual port example:

- Total USB VBUS Power = 100 W
- VBUS Port A maximum power = 60 W and VBUS Port B maximum power = 60 W
- VBUS Port A minimum power = 15 W and VBUS Port B minimum power = 15 W
- Maximum power for low power = 30 W:
  - Once the $V_{IN}$ level falls below the EngOffNomVth setpoint, the total USB VBUS power is reduced to 30 W total for all ports.

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**Note**

If the maximum power for low power is less than the total minimum port power (the sum of the minimum port power for ports) ports are disabled upon entry into the low-power phase.

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### 4.7 Advanced Configuration

While the *Simple Configuration* controls can satisfy the device configuration requirements for most systems, additional controls for some modules are available in the *Advanced Configuration GUI* page. Initial configuration of the device is done via the *Simple Configuration* page followed by the *Custom Configuration* page which can be used to configure or override specific parameters.

Custom configurations options are accessed via the *ADVANCED CONFIGURATION* button at the bottom of the *Simple Configuration Summary* page or by clicking the button directly from the side toolbar in the GUI.

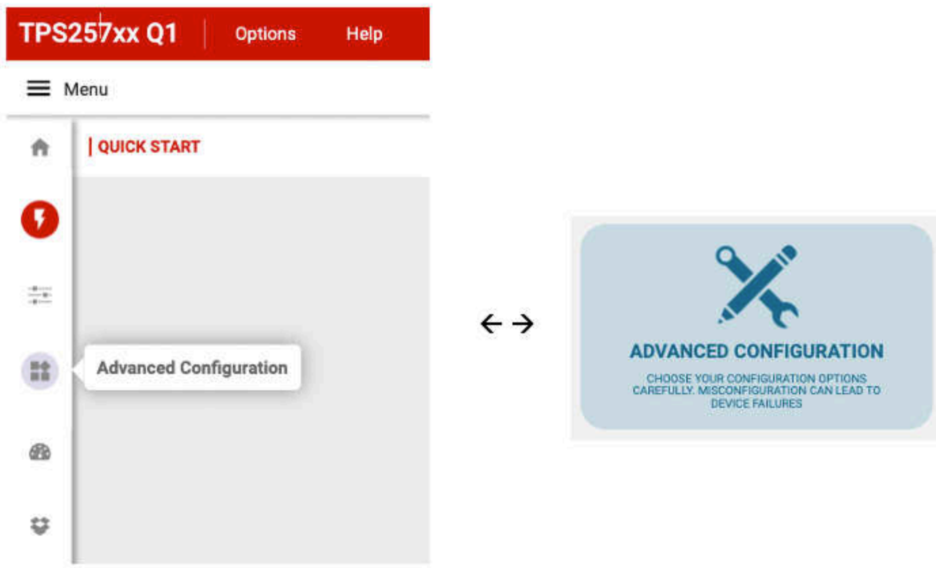


**Figure 4-5. Accessing the Advanced Configuration Page**

## 5 Application Configuration Download

Once the desired configuration is completed in the GUI, the binary file used to program the TPS257xx-Q1 device can be generated. This binary file is then downloaded to the hardware by one of two transport mechanisms:

1. Direct programming of the binary image into onboard EEPROM using I2C:
   a. This mode is the default method used during development
   b. Programming using the built-in connections on the TPS257xx-Q1 EVM using the onboard TIVA MCU or directly using an external programming tool such as the Total Phase Aardvark I2C/SPI Host Adapter (see Section 5.4)
   c. This method of programming is required to load the production-ready binary image into a blank EEPROM device during production
2. Secure programming of the binary image into onboard EEPROM using USB:
   a. This mode is accessed using the TPS257xx-Q1-GUI for post-production field updates of custom hardware (can also be used during development).
   b. The TPS257xx-Q1 device must be powered up into *Firmware Update* mode (FWUP), configuring Port A as a USB endpoint connection
   c. The binary image is programmed into EEPROM by the TPS257xx-Q1 device after verification of matching keys between the binary image and previously-programmed EEPROM image at production

Version control can be embedded manually to a GUI-generated binary file to uniquely identify and track changes. For more details, See Appendix A.

The following sections describe the methods used to load the custom application configuration onto the hardware.

## 5.1 Firmware Download Procedure

Firmware download is supported by the GUI and accessed when clicking the *Download Firmware* button from the *Simple* or *Advanced* configuration pages.

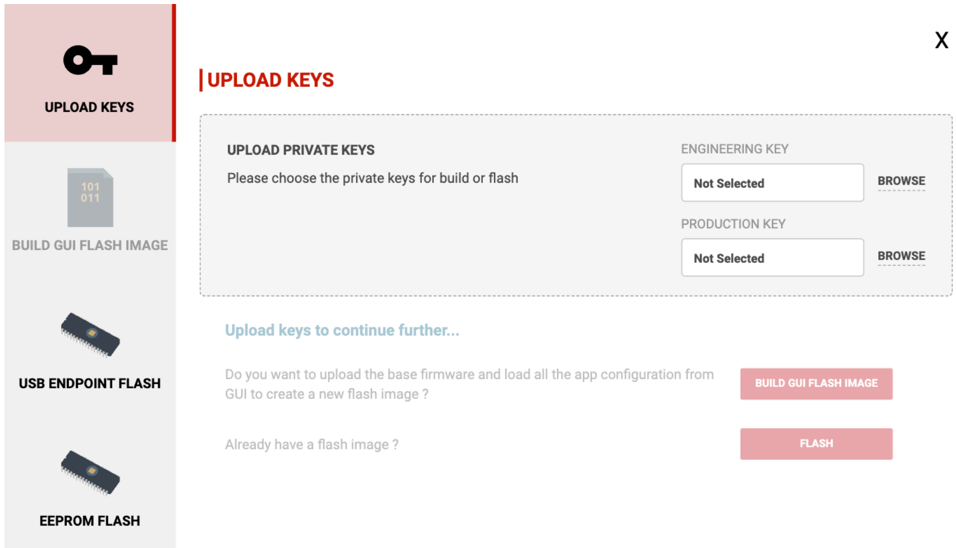


**Figure 5-1. GUI Firmware Download Page**

From this page, the user can load TI-provided development keys or private keys. The binary image can then be generated and saved or directly loaded into hardware using the I2C or USB endpoint methods detailed in Section 5.1.1.1 and Section 5.1.1.2.

### 5.1.1 Key Upload and Binary File Generation

To create the configuration binary file, first select the private keys for use in the GUI. Default keys are provided in the TPS257xx-Q1 Firmware Package and can be used for evaluation purposes. Customer-specific private keys can also be selected (this is recommended before building and deploying a final production binary image). Upload the desired secure private keys in the *UPLOAD PRIVATE KEYS* window.

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**Note**

TI provides a set of keys for development purposes only. The end user is responsible for creating a secure set of private keys to generate binaries for final production.

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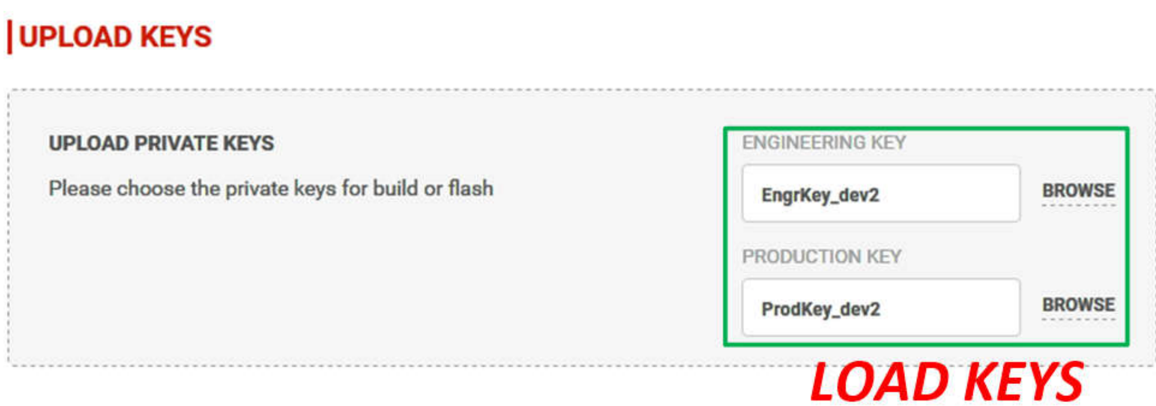


**Figure 5-2. Loading Keys**

After uploading the keys, the user has the following options:

1. Select *BUILD GUI FLASH IMAGE* to build and save a binary file using the current configuration as defined within the GUI
2. Select *FLASH* which skips the build step and allows the user to select an existing binary file

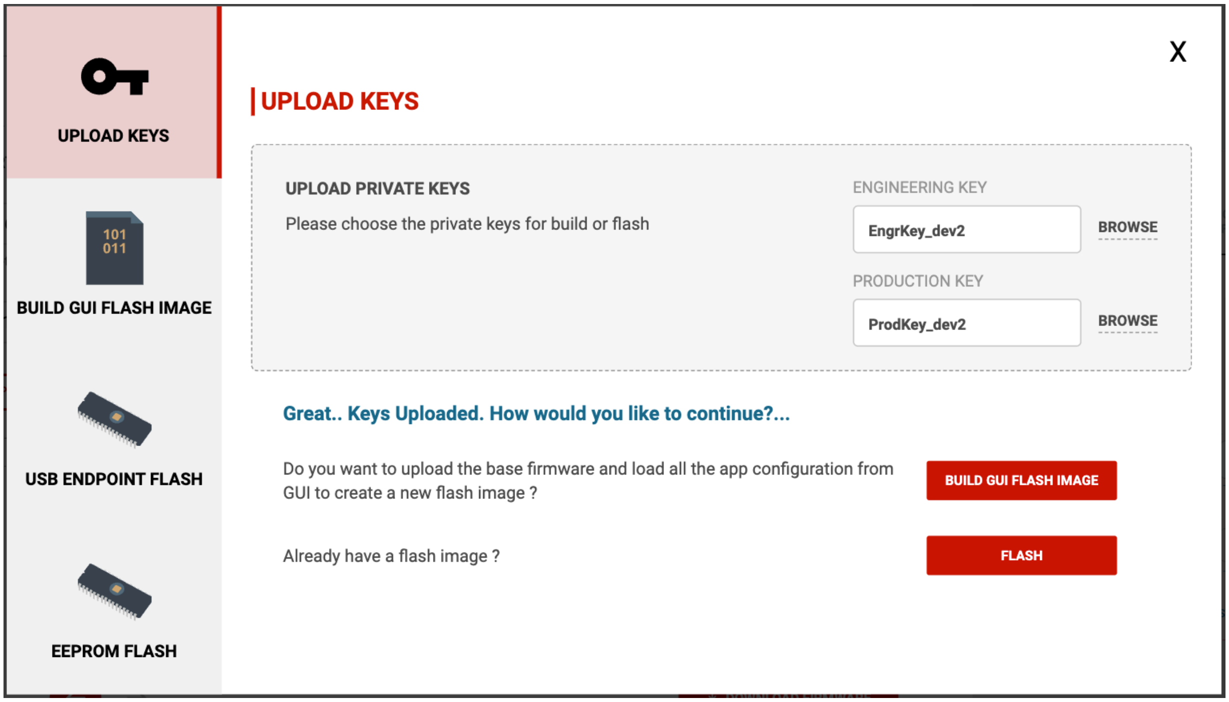


**Figure 5-3. Upload Keys Page**

If the desired binary file is already available, the file can be uploaded using one of two interface methods as described in Section 5.1.1.1 or Section 5.1.1.2 by clicking the *FLASH* button. If a new binary file needs to be built, click the *BUILD GUI FLASH IMAGE* button and follow the next steps described.

In the *BUILD GUI FLASH IMAGE* window, the user has the option to select the base firmware image binary - this file is provided from TI when the firmware release package is installed. A valid base firmware image must be selected or the device does not operate correctly (click *Help*, located at the top of the GUI next to *Options*, then *Release Notes* for information on GUI versions and compatible firmware). Next, select *Production Key* when uploading newer application configuration versions as needed. Alternatively, select *Engineering Key* when reverting to previous versions.

Figure 5-4 shows the selection of the engineering or production key.

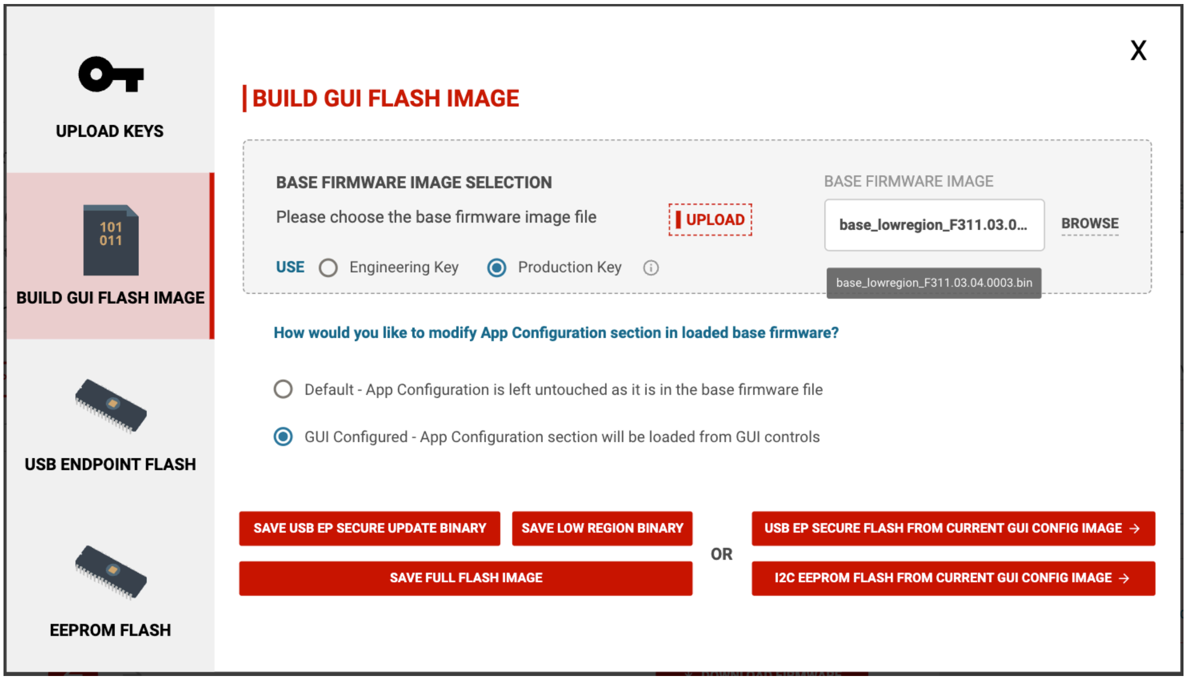


**Figure 5-4. BUILD GUI FLASH IMAGE Page**

After loading the base firmware image, the application configuration binary can be saved in three formats:

1. The first format option is *SAVE FULL FLASH IMAGE*.


   Save in this format for update using I2C directly to the EEPROM. This is the method used to program a blank EEPROM and can be done using the TIVA USB interface designed on the EVM from TI or directly using an EEPROM programmer such as the Total Phase Aardvark programming tool. In both cases the binary image is loaded into the EEPROM device using an I2C interface.

   **Note**

   This method is required to create the initial image used to program a blank EEPROM device.

2. The second format option is *SAVE USB EP SECURE UPDATE BINARY*.


   Save in this format for update via the USB Endpoint connection method. In this mode the PC is connected to the USB-C charger port ("Port A" for dual-port implementations) with the corresponding boot setting on power up or reset as described in the TPS25762/72-Q1 EVM User's Guide. The binary image is transferred over USB to the TPS257xx-Q1 device and then into the EEPROM device using I2C. Only images built with a valid private key that matches the image previously programmed into the EEPROM transfer successfully.

Once the desired binary format is saved, the file can then be selected from the *USB ENDPOINT FLASH* or *EEPROM FLASH* pages and programmed to the EEPROM in hardware.

**Note**

It is also possible to directly create the binary image and transition to the *USB ENDPOINT FLASH* or *EEPROM FLASH* pages to load the binary ***without*** saving the generated file. Loading without saving can be done for each format by selecting the *USB EP SECURE FLASH FROM CURRENT GUI CONFIG IMAGE* or *I2C EEPROM FLASH FROM CURRENT GUI CONFIG IMAGE* buttons. Selecting either button automatically creates the image and selects the image for download in the respective *FLASH* page without saving the image locally.

Section 5.1.1.1 and Section 5.1.1.2 describe the process to load the binary image into hardware using USB end point or I2C.

A third format option is *SAVE LOW REGION BINARY*.


Selecting this option opens a menu to save the application configuration as a low region binary or a C header file (see Figure 5-5) that is intended to be used for the device's MCU/HUB Boot Mode. For more information regarding this boot mode, see the *TPS257x-Q1/77x-Q1 Firmware Update with a Host*.

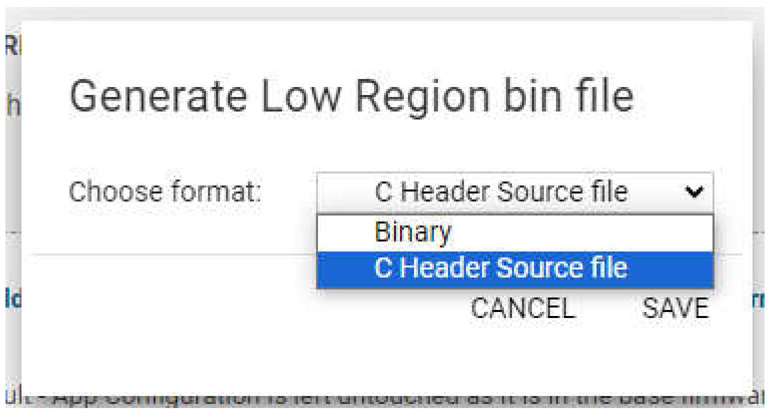


**Figure 5-5. Generating a Low Region Bin as a C Header File**

#### *5.1.1.1 Firmware Update: USB Endpoint*

In the *USB ENDPOINT FLASH* window, the selected USB EP binary image is loaded by USB connection to the TPS257xx-Q1 device to program the EEPROM.

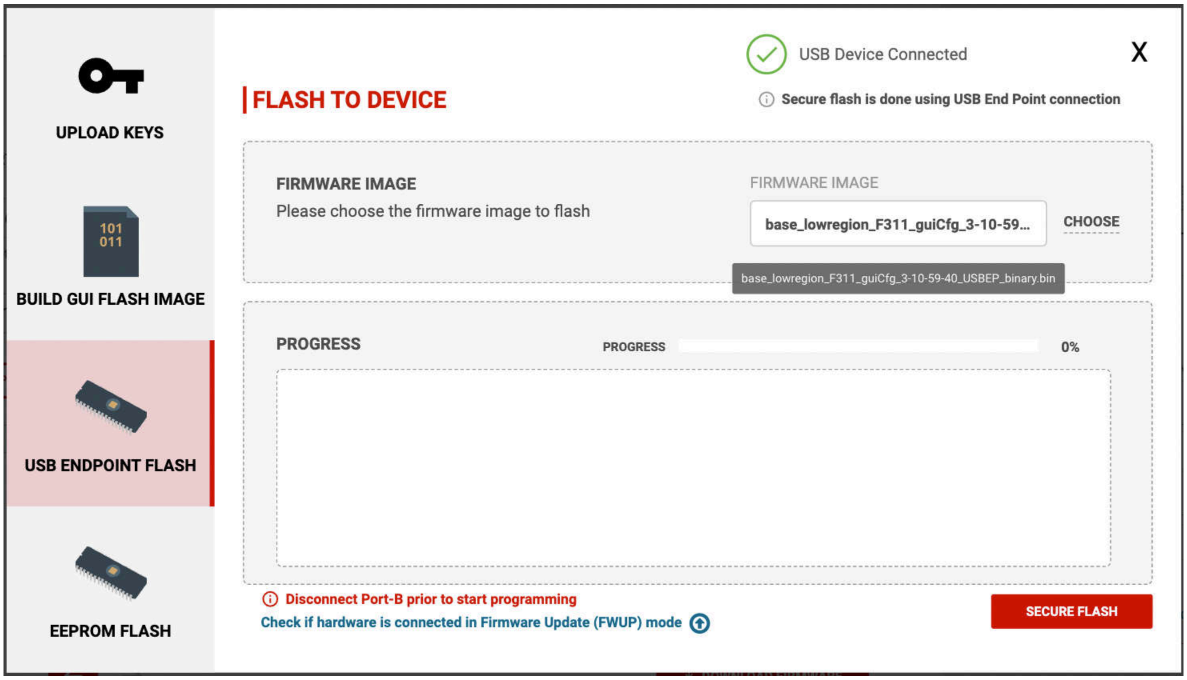


**Figure 5-6. USB ENDPOINT FLASH Page**

Prior to initiating the download by selecting *SECURE FLASH*, verify the TPS257xx-Q1 device is booted into *Firmware Update* mode (for example, *FWUP* mode). This can be accomplished by making sure the TVSP pin is configured in hardware for FWUP operation. To program the EEPROM integrated on the TPS257xx-Q1 EVM, populate the TVSP jumper accordingly and power the device. Once in FWUP mode, connect the PC to the device using the USB Type-C charging port.

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**Note**

In a dual-port system, use *Port A* for the USB endpoint connection and make sure the other port is not connected during the firmware update process.

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Once connected, the device appears under device manager as *TPS DMC Family* and the GUI indicates *USB Device Connected* status upon a successful connection. Figure 5-7 shows the successful connection image.

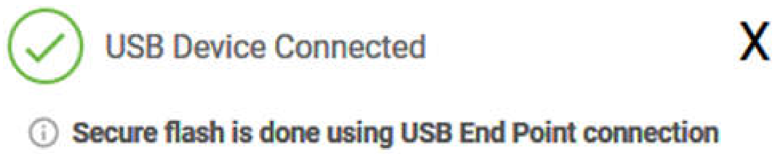



**Figure 5-7. USB Endpoint Connection Status**

Once a proper connection is established with the target device in FWUP mode, start the update using the *SECURE FLASH* button. Progress is shown in the GUI until completion.

Once the firmware update is complete, the message *Secure update completed successfully* is returned and the cable can be disconnected.

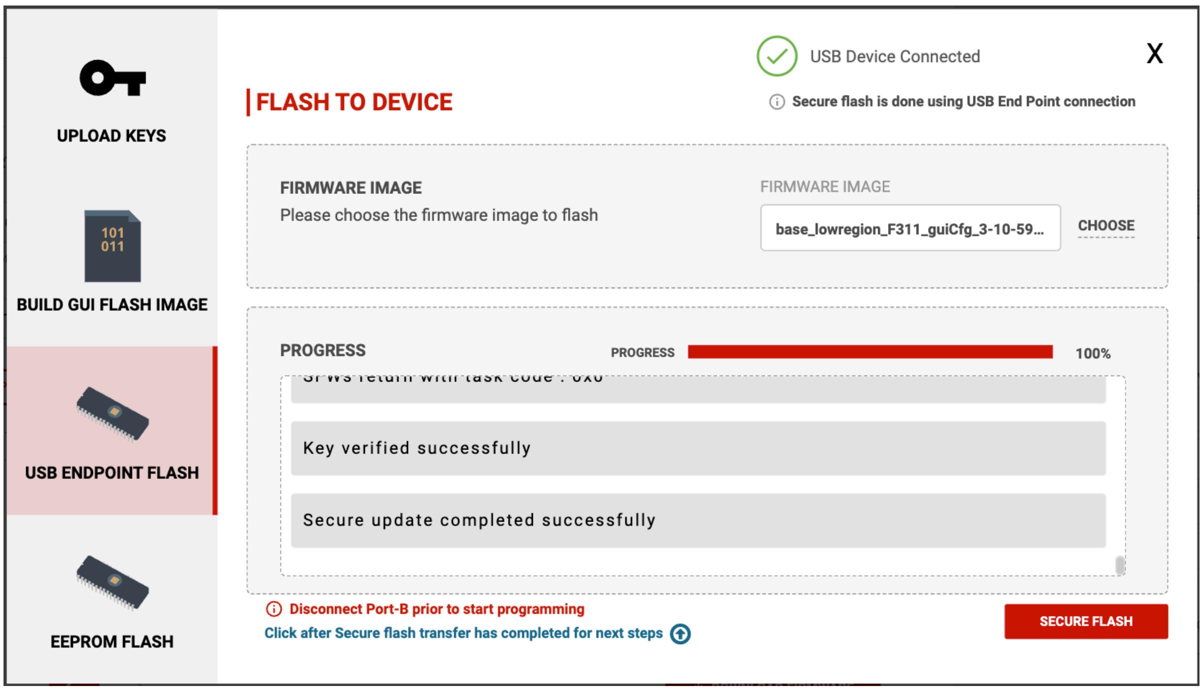



**Figure 5-8. SECURE FLASH - Complete**

Release the TPS257xx-Q1 device from FWUP mode by changing the TVSP setting followed by a power cycle or device reset.

#### 5.1.1.2 Firmware Update: I2C

In the *EEPROM FLASH* window (see Figure 5-9), the selected low region or full flash binary image is programed into the EEPROM by direct I2C connection.

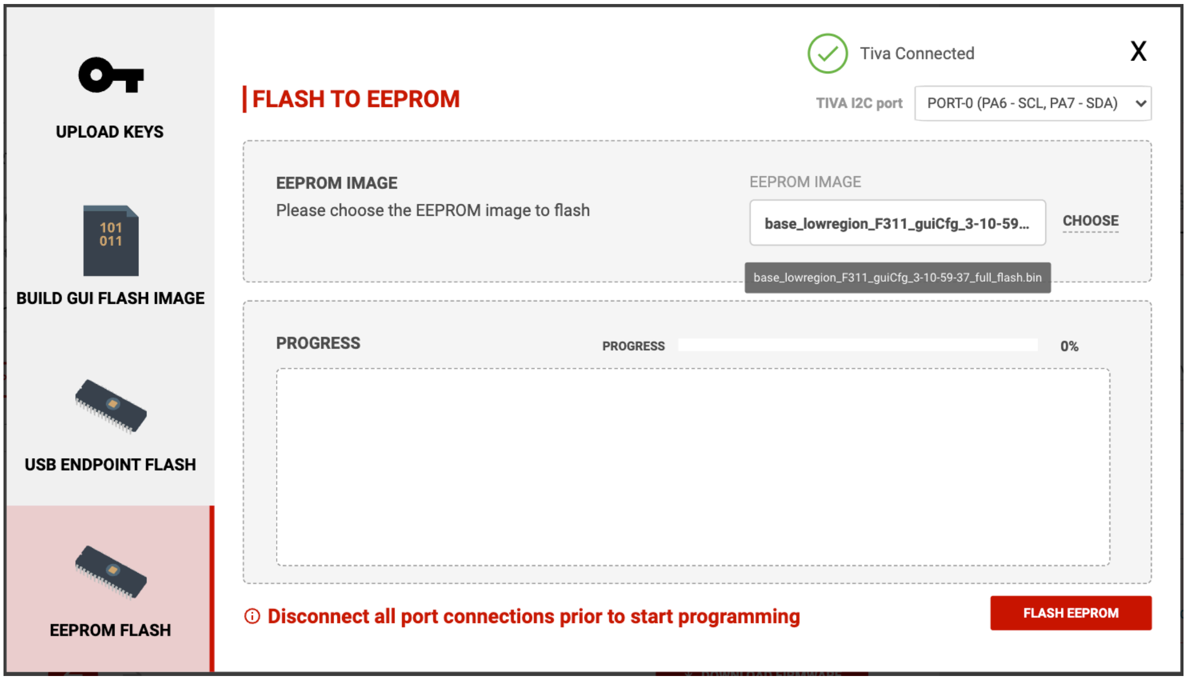



**Figure 5-9. EEPROM FLASH Page**

When evaluating using the EVM from TI, using this method programs the system EEPROM through the USB connection to the onboard TIVA microcontroller. Ensure that the correct serial port is configured if the TIVA USB connection cannot be established (see Figure 6-4). In addition, any I2C-capable programming tool can be used to program a saved binary file generated by the TPS257xx-Q1-GUI tool. This is the method used in custom-built hardware when programming the EEPROM via I2C.

Once the I2C connection is established and the desired binary file is chosen in the *EEPROM IMAGE* field, selecting the *FLASH EEPROM* button downloads the binary image. Progress is displayed in the GUI until the update is completed.

**Note**

Disconnect all USB-C devices from ports prior to programming the EEPROM. All ports must remain disconnected during programming.

## 5.2 Secure Firmware Update

TPS257xx-Q1 devices support secure firmware updates over USB using the previously-described USB endpoint method. The secure firmware update makes sure that only the binary image signed with the correct set of keys can be used to reprogram the EEPROM device. The GUI and firmware use the SHA-256 algorithm to hash and sign the binary image with RSA-PSS generated keys. A set of private and public key pairs can be generated using RSA-PSS for end-customer (OEM) development and production purposes.

During end-product production, initial programming of the EEPROM must be performed using I2C with the *Full Flash* binary image built with the desired set of keys. Field updates can then be done using the TPS257XX-Q1-GUI tool over a USB connection to the primary charging port with the *USB EP* binary image that was built with the same set of keys. The customer-specific private keys must be kept secure and need to be loaded at the time of USB field update to reprogram the device; otherwise, the secure firmware update process does not complete.

## 5.3 Optional USB Driver Installation

The computer OS system must be able to connect as a USB endpoint to use the USB endpoint firmware update capability. Install a generic libusb-win32 USB device driver to connect to the USB endpoint of the TPS257xx-Q1 device. This connection can be accomplished by downloading a driver installation tool such as Zadig.

Complete the following after installing Zadig:

1. Connect Port A of the device to be programmed to a PC. Make sure the TVSP pin is configured for FWUP mode.
2. Download then run the Zadig executable, then choose the libusb-win32 option (see Figure 5-10).

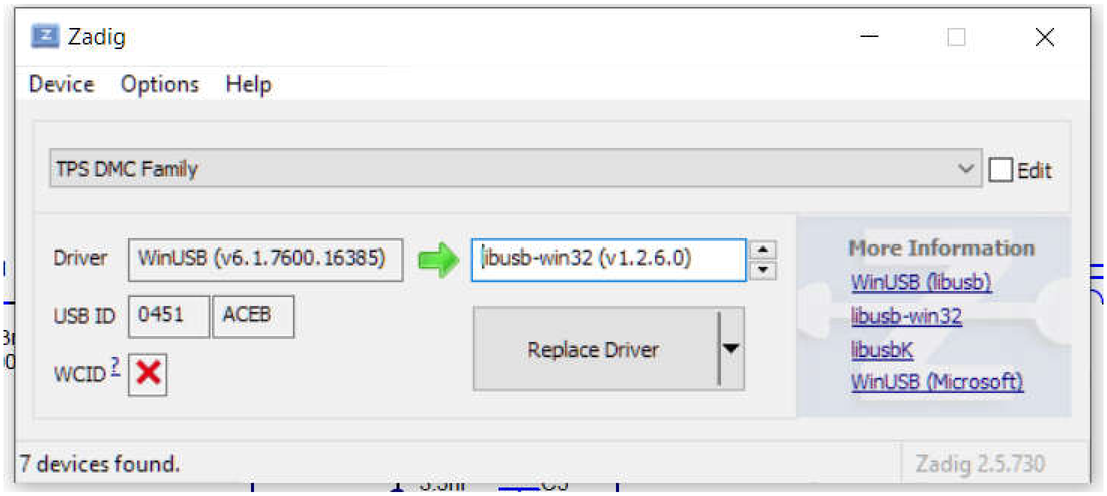



**Figure 5-10. Zadig USB Driver Installer Dialog Window**

Once enumerated correctly, the device end-point enumerates in the device manager as Figure 5-11 shows.


**Figure 5-11. PC Device Connection Status**

Some PC systems operate with the *WINUSB vs LIBUSB* driver. If the *LIBUSB error* is received upon USB EP firmware update connection, update the PC driver with the WINUSB driver, then reboot the computer system. The WINUSB driver can be installed with the Zadig tool by choosing the winusb option instead of libusb.


**Figure 5-12. Connection Error Message**

## 5.4 Direct EEPROM Programming

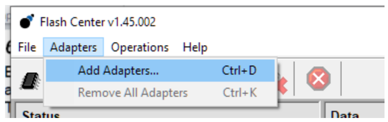
The EEPROM device can be programmed with the *Full Flash* binary file generated using the GUI with a valid set of keys as detailed in Section 5.1.1. While the EEPROM on the TPS257xx-Q1 EVM can be programmed using the onboard TIVA MCU, it is also possible to use a standard EEPROM programmer interfaced with the proper pins on the EVM. Use of an EEPROM programmer can also be used when programming the EEPROM of a custom hardware design. This is required for the initial programming of a blank EEPROM.

For example, EEPROM programming can be done using the Total Phase™Aardvark I2C/SPI™ Host Adapter. The following steps are required to use the programmer:

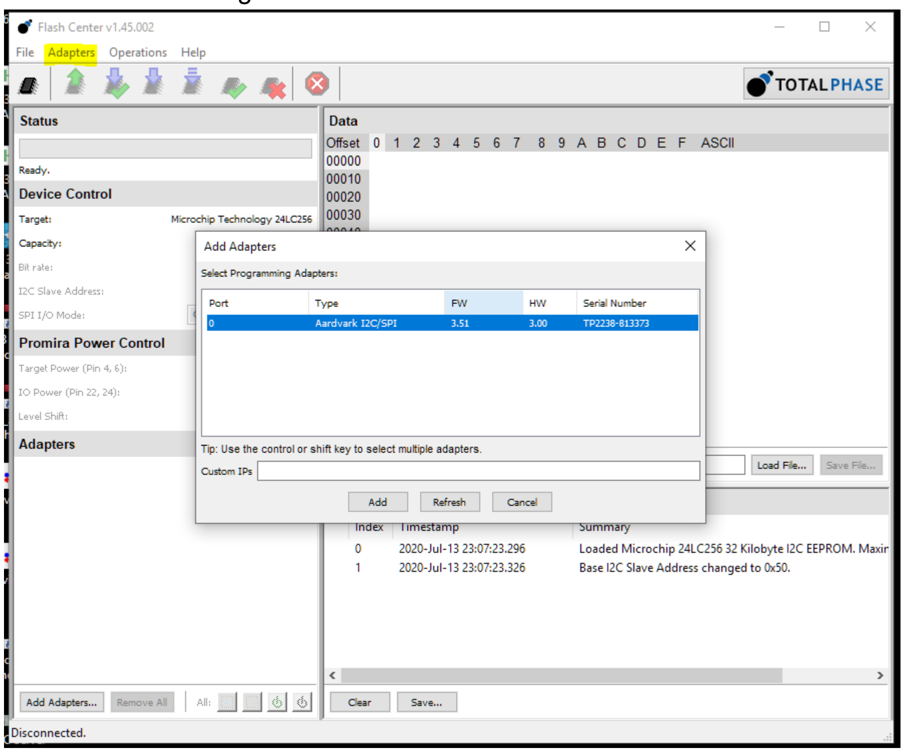
1. Install the Total Phase Flash Center Software
2. Connect Aardvark I2C/SPI Host adapter to the PC
3. Install the USB driver for the Aardvark I2C/SPI Host Adapter

Once setup is completed, use the following steps to program the EEPROM:

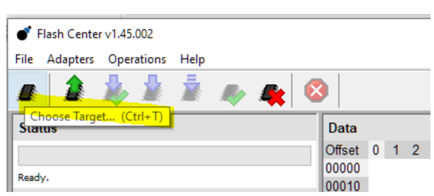
1. Disconnect all devices from the TPS257xx-Q1 device USB charge ports. All USB ports must remain disconnected throughout the programming process.
2. Invoke the *Flash Center* Software
3. Select: *Adapters > Add Adapters*



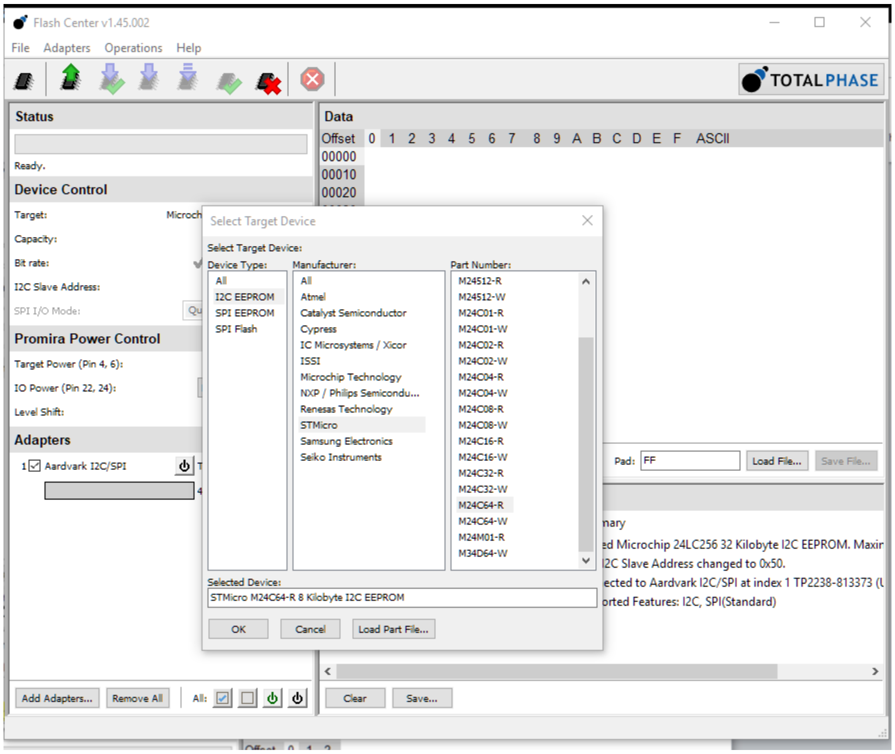

4. *Add Adapters* leads to the following screen. Click the *Add* button



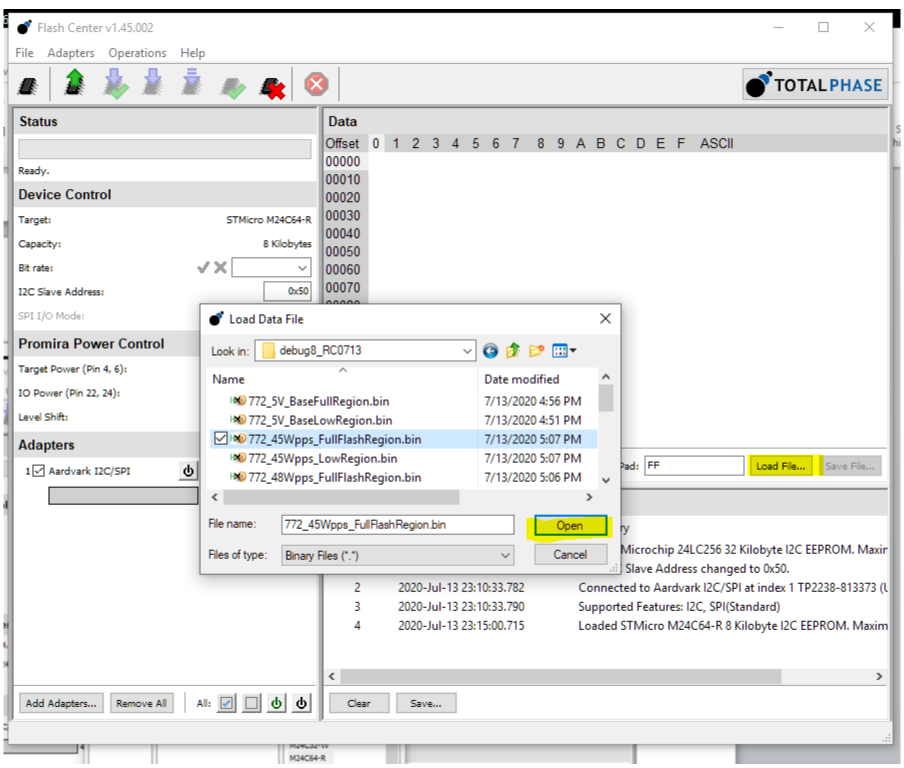

5. Click the *Choose Target* icon



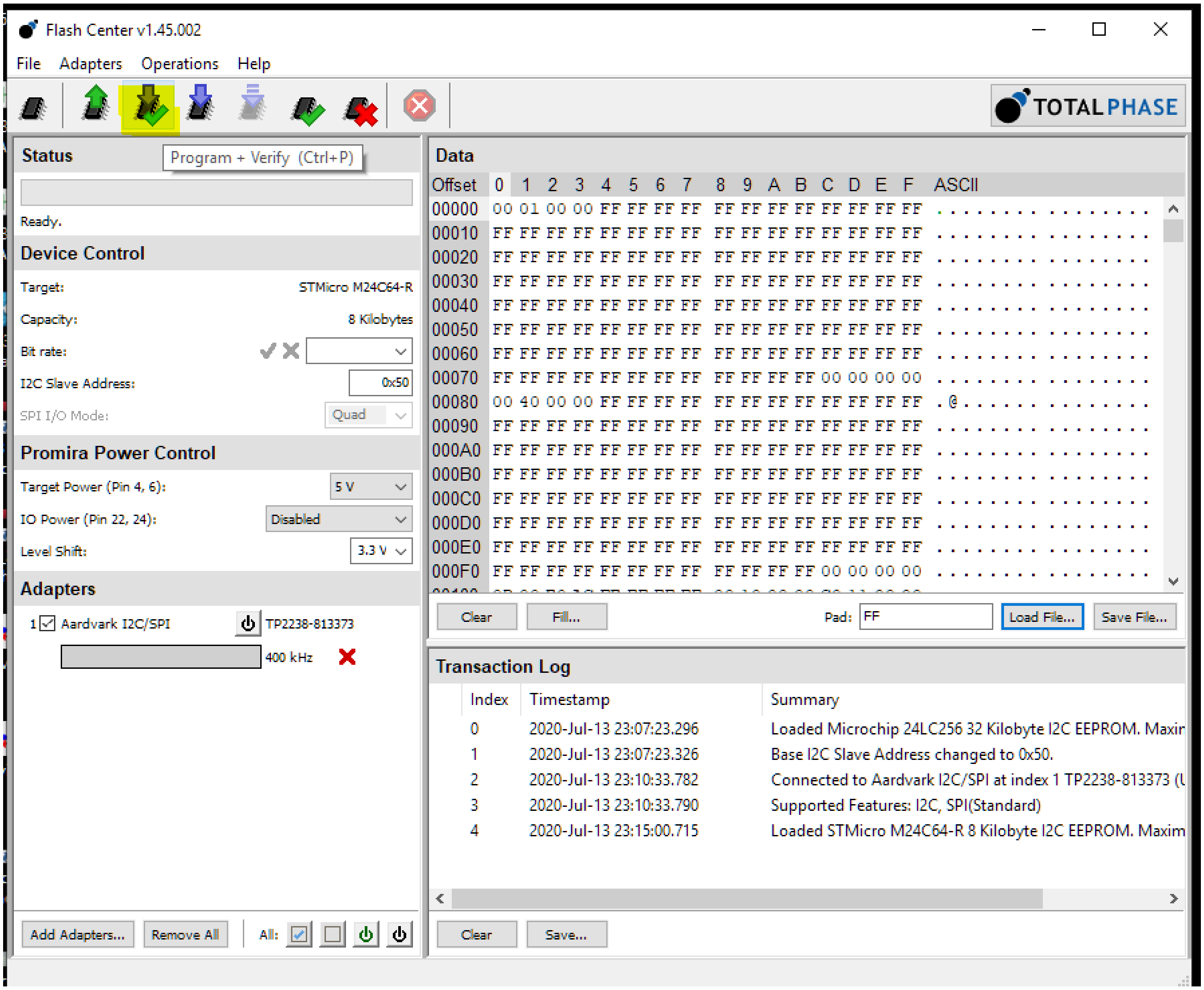
6. Choose the target device to be programmed. If the part number for the device is not shown, choose a target device with the same memory capacity.




7. Select *Load File* > *Open* and navigate to the *Full Flash* binary example file provided by TI or a custom binary file created with the GUI.



8. Select *Program and Verify*



## 5.5 SSH Key Generation

Creating RSA Keys using ssh-keygen. SSH key pairs can be generated using the following command lines:

1. `mkdir keys`
2. `ssh-keygen -t rsa -b 3072 -m PEM -f keys/rsa3072engr`
3. `ssh-keygen -t rsa -b 3072 -m PEM -f keys/rsa3072prod`

```
$ ssh-keygen -t rsa -b 3072 -m PEM -f keys/rsa3072engr1
Generating public/private rsa key pair.
Enter passphrase (empty for no passphrase):
Enter same passphrase again:
Your identification has been saved in keys/rsa3072engr1.
Your public key has been saved in keys/rsa3072engr1.pub.
The key fingerprint is:
SHA256:3BlcJTFvQlXFgP7BRH2PSzstnkKpYe8HrkVVkvV+eHo a0214798@lta0214798
The key's randomart image is:
+---[RSA 3072]----+
|            ***B*|
|         . o.+oo=|
|          o..o+.+|
|       . . o.+=o.|
|        S o .+.=+|
|          o.+ *oo|
|         . *.o.+E|
|          ..+ +. |
|          .o.o   |
+----[SHA256]-----+
```

**Figure 5-13. Git Bash Key Generation - *Engineering***

```
$ ssh-keygen -t rsa -b 3072 -m PEM -f keys/rsa3072prod1
Generating public/private rsa key pair.
Enter passphrase (empty for no passphrase):
Enter same passphrase again:
Your identification has been saved in keys/rsa3072prod1.
Your public key has been saved in keys/rsa3072prod1.pub.
The key fingerprint is:
SHA256:L9ZMEfwykZ7WXrX7Iz3cdKRx6wsKDFxwsFPTh2s+w6I a0214798@lta0214798
The key's randomart image is:
+---[RSA 3072]----+
|       o.=o..    |
|        = =+ .  .|
|       o o.=o  ..|
|      . o *+o o.o|
|       oS.=+ . =o|
|        o* =. .oo|
|        +o= o.+.+|
|       E .. ...*o|
|          .   ..+|
+----[SHA256]-----+
```

**Figure 5-14. Git Bash Key Generation - *Production***

Generated keys are found in the *keys* directory created via the `mkdir keys` command.

```
$ dir keys
rsa3072engr      rsa3072engr1      rsa3072prod      rsa3072prod1
rsa3072engr.pub  rsa3072engr1.pub  rsa3072prod.pub  rsa3072prod1.pub
```

**Figure 5-15. Generated Keys**

For a Microsoft® Windows® PC, *Git installation with SSH* can be necessary to generate keys as instructed in this section.

To install Git:

1. Download and initiate the *Git installer*.
2. When prompted, accept the default components by clicking the *Next* button.
3. Choose the default text editor. If you have Notepad++™ installed, select Notepad++ and click the *Next* button.
4. Select *Use Git from the Windows Command Prompt* and click the *Next* button.
5. Select *Use OpenSSL library* and click the *Next* button.
6. Select *Checkout Windows-style, commit Unix-style line endings* and click the *Next* button.
7. Select *Use MinTTY* (The default terminal of mYSYS2) and click the *Next* button.
8. Accept the default extra option configuration by clicking the *Install* button.
9. When the installation completes, restart Windows, if needed.

To launch GitBash:

1. Invoke the command line window: `cmd.exe`.
2. Run `bash.exe` from the Git installation folder: (that is, C:\Program Files\Git\bin)

## 6 Telemetry

The EVM supports device communication over USB to the integrated TIVA MCU. Connect the USB cable to the micro USB port of the EVM as shown in Figure 6-1. In addition to allowing EEPROM programming over I2C, the USB connection also provides a data and control communication path between the EVM and PC. Using the USB interface, the user has control over the following actions:

- Device reset
- I2C port configuration
- Telemetry data detailing the operational status of the charging ports
- Device status

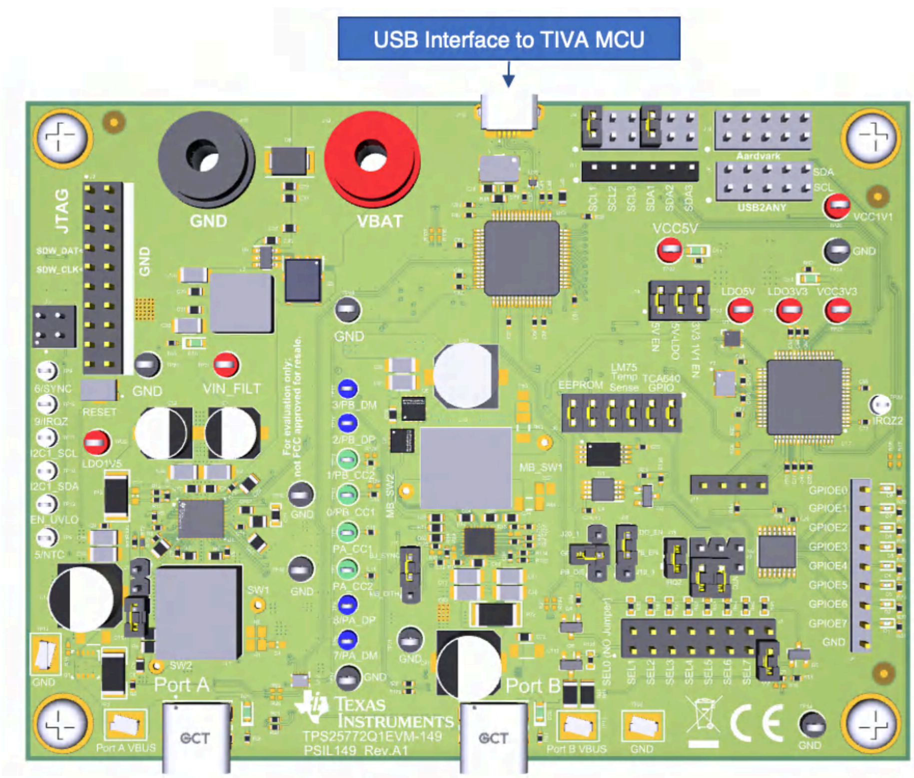



**Figure 6-1. TIVA USB Port Connection**

The connection status is indicated in the bottom left corner of TPS257XX-Q1-GUI, see Figure 6-2 and Figure 6-3. The status icon can also be used to connect or disconnect the TIVA USB port by clicking the icon. If not connected, click the icon to establish connection.

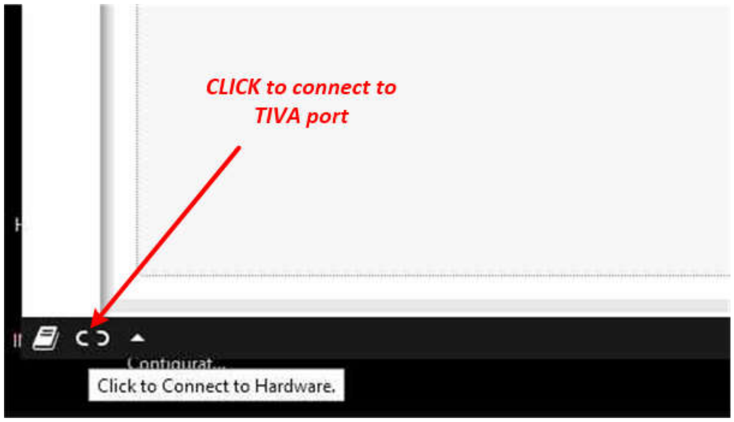



**Figure 6-2. TIVA USB Disconnected**

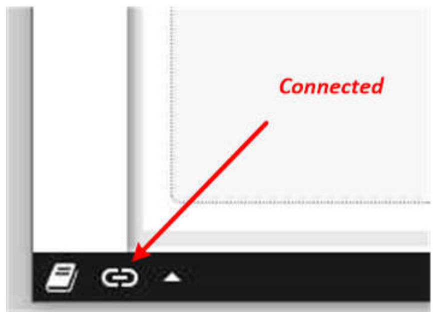



**Figure 6-3. TIVA USB Connected**

If the connection cannot be established, check the serial port configuration in the control at the upper left of the GUI, see Figure 6-4.

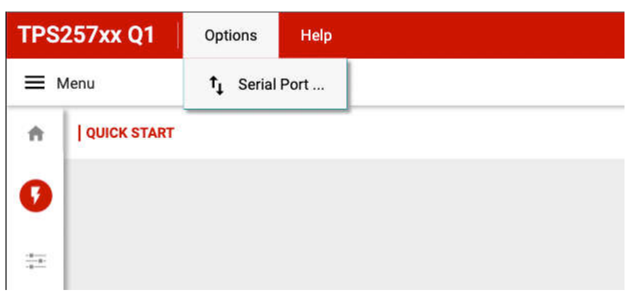



**Figure 6-4. GUI Communication Port Menu**

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**Note**

When the I2C1 port is used for device communication (default), data cannot be read or written real-time as intended due to continuous bus traffic between I2C controller and connected target peripheral devices in hardware. Alternatively, when the I2C2 port is used for device communication, corresponding GPIOs (GPIO2 and GPIO3) must be configured as I2C_SCL2 and I2C_SDA2. (For dual-port devices, GPIO2 and GPIO3 are configured as Port B D+ and Port B D– and therefore are not intended to be used for I2C communication.)

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The telemetry view in the GUI is selected by clicking the *Device Communication* button in the sidebar, see Figure 6-5.

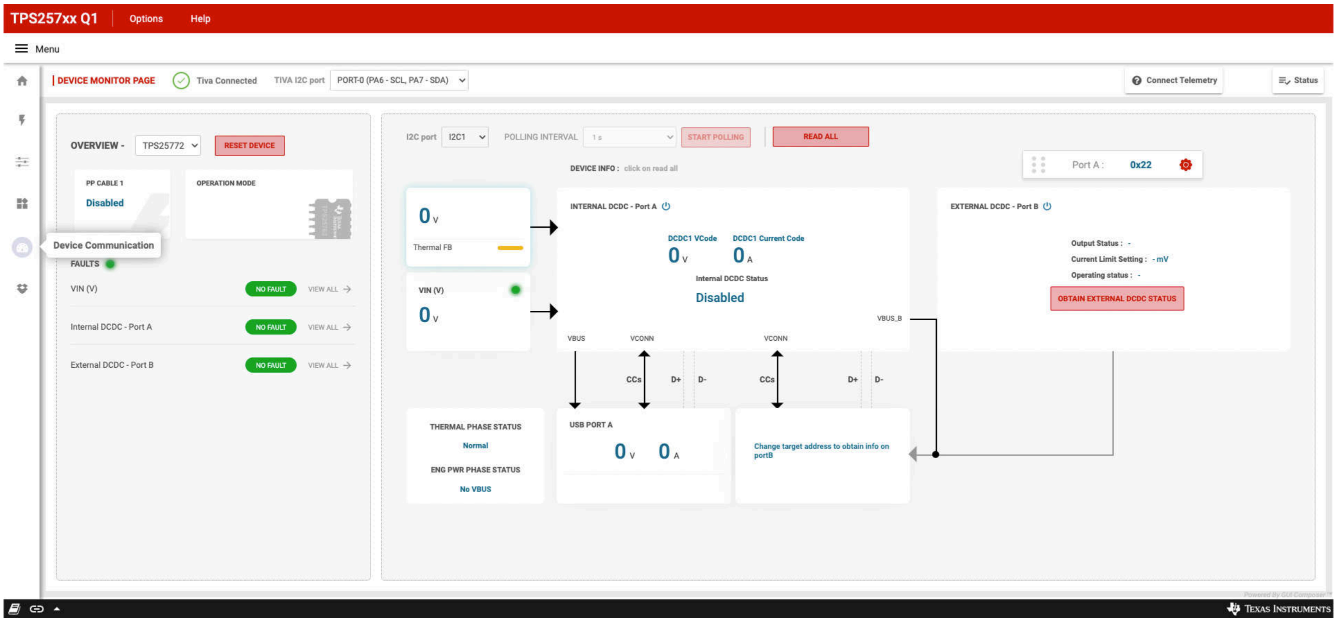


**Figure 6-5. TPS257xx-Q1 Telemetry Interface**

Make sure the correct target address is selected to access device telemetry information. The address is determined by the TVSP pin configuration as described in the device-specific data sheet. The target address is 0x22 or 0x23 for Port A and 0x26 or 0x27 for Port B (on a dual-port device). Only one port status can be read at a time.

The GUI provides Port A and Port B target address selection controls to align with the hardware configuration, see Figure 6-6.

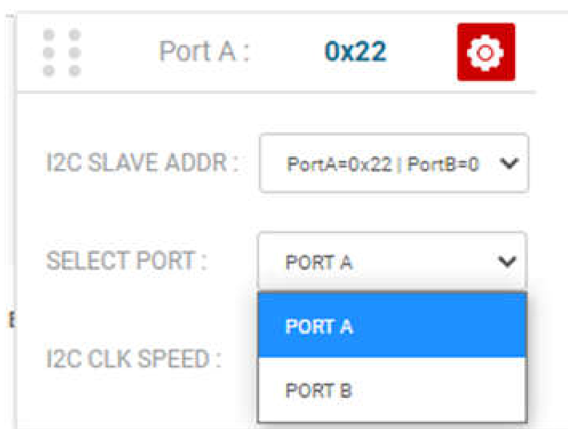


**Figure 6-6. Telemetry Port Configuration**

In addition to the main telemetry information, clicking the *Status* button in the upper right of the GUI page opens the quick status window displaying additional information about the port charging status when the *READ ALL* button is selected, see Figure 6-7.

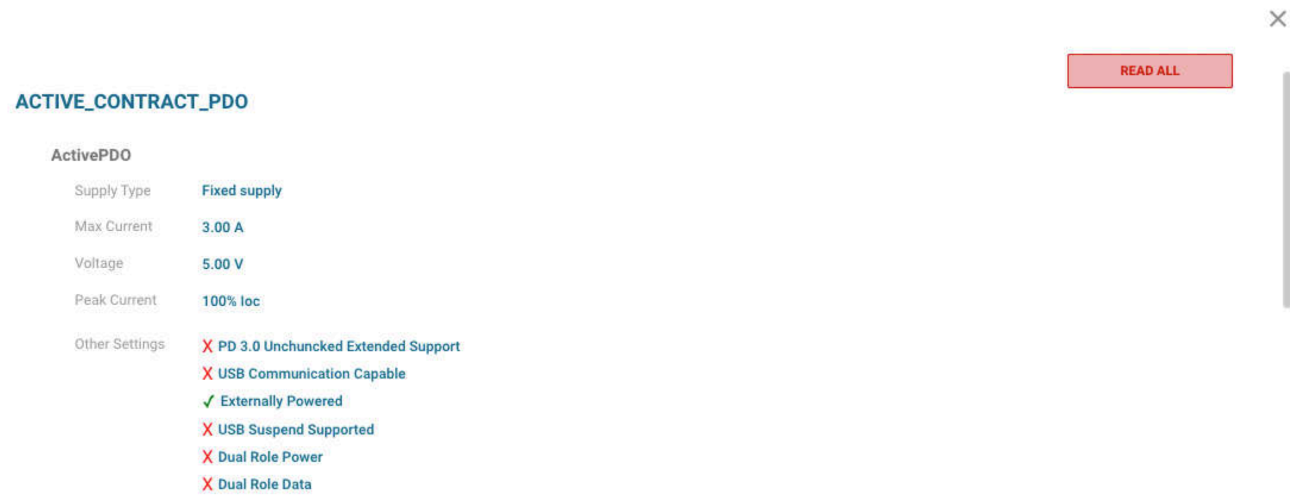


**Figure 6-7. Telemetry *Status* View**

# A TPS257xx-Q1 GUI Feature - CUSTOM ID (Version Control)

There are two ways to version control a GUI-generated binary file. The first method is automatically implemented when a binary is generated, as covered in Section 5, and a timestamp will be included within the file name. In some cases, however, it is desirable to be able to uniquely identify a binary file that is loaded into an EEPROM using an EEPROM reader such as an Aardvark adapter (see Section 5.4). This can be done by integrating a user-defined version control to the binary file using the CUSTOM ID feature on the OTHER tab from the *Advanced Configuration GUI* page (see Figure A-1).

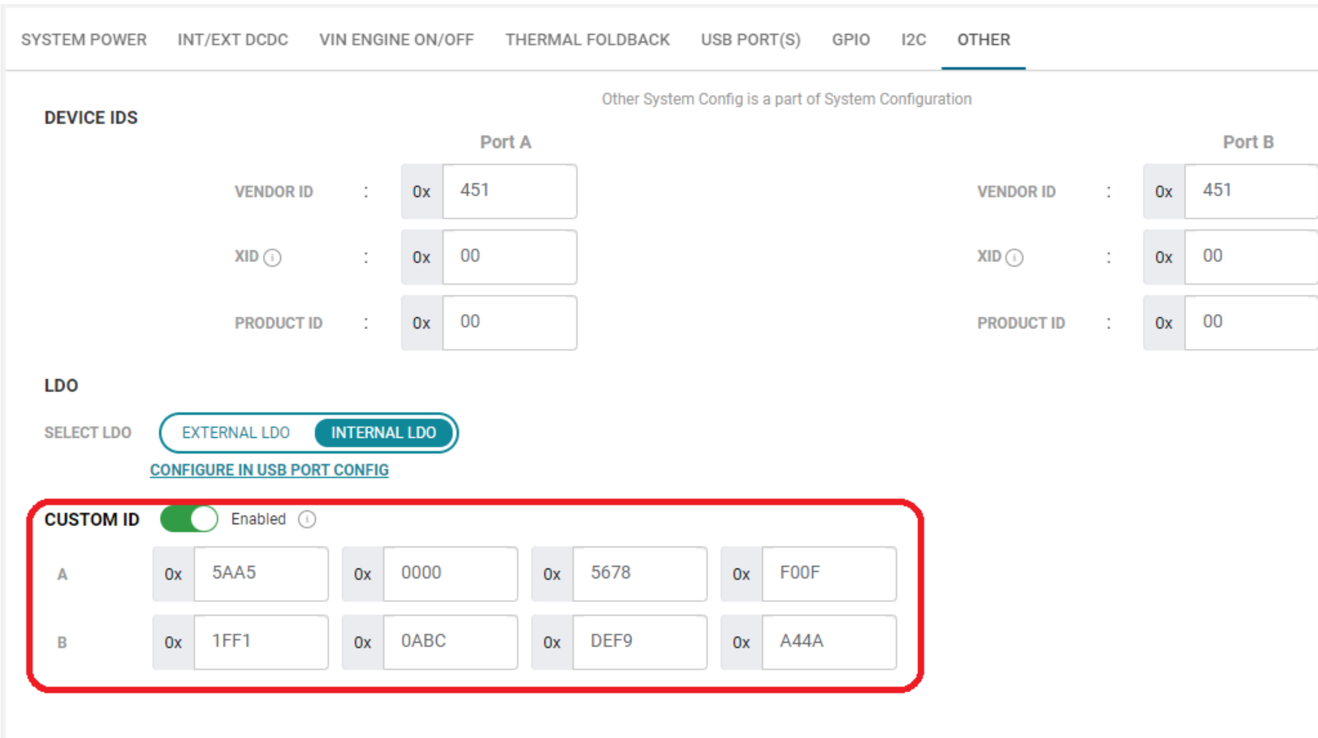


**Figure A-1. CUSTOM ID Menu**

The CUSTOM ID feature is disabled by default. By enabling it, custom-defined values can be added to four input boxes per port. A 16-bit value can be entered in each box represented in hexidecimal format, so values up to 8 bytes for TPS25762-Q1 ("A" field only) and 16 bytes for TPS25772-Q1 ("A+B" fields) are possible.

Figure A-2 shows a comparison of two binary output files with the CUSTOM ID feature disabled and enabled. The same "A" and "B" field data entries from Figure A-1 are highlighted in the CUSTOM ID enabled binary shown below. Note that the custom-defined values in the binary are assembled least significant byte first.


**Figure A-2. Binary Files with CUSTOM ID Enabled vs. Disabled**

The byte position of the CUSTOM ID data may vary in the binary file depending on how the device features are configured. The "A" field data entry and "B" field data entry are preceded with their respective headers that are always the same (see Figure A-3); the header for the "A" field is 04 06 00 07 and the header for the "B" field is 40 06 00 07. Searching for the header within the binary file will allow for easy identification of the CUSTOM ID data.

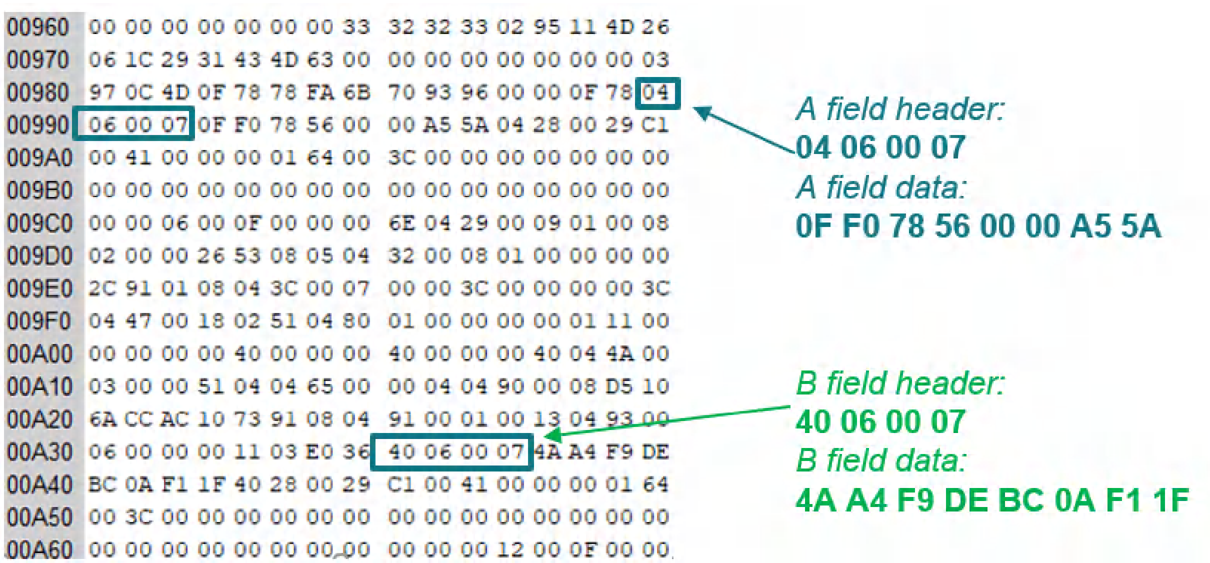


**Figure A-3. CUSTOM ID Data Headers**

Although a binary file is time stamped in the file name when it is generated using the GUI, the CUSTOM ID feature is a more reliable way to embed a custom revision/version identifier. It is integrated into the binary file generation and it can be read out of the EEPROM directly for verification purposes.

## Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

| Changes from Revision A (August 2023) to Revision B (February 2024) | Page |
|---|---|
| • Updated Section 3. Updated to show the "Choose device" selection in the new GUI v1.4.0 | 4 |
| • Updated Section 3.1. Updated steps to reflect GUI v1.4.0 | 4 |
| • Updated Section 3.2. Added instruction to view the GUI's Release Notes to check GUI versions and compatible FW. | 5 |
| • Updated Section 4.5 | 6 |
| • Updated Section 5.1.1. Added instruction to view the GUI's Release Notes to check GUI versions and compatible FW. | 11 |