

TPS6598x Configuration Import Guide

ABSTRACT

This import guide describes how to extract a user's application configurations from an existing TPS6598x device. The extracted application configurations can be reused with later versions of firmware using the TPS6598x Application Customization Tool which enables users to get more features and bug fixes while still retaining their application configuration.

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1 Getting Started

1.1 Purpose and Scope

This document describes how to port old TPS6598x firmware images to a newer firmware image, while retaining the user's custom configurations. Many of the old TPS6598x firmware images built using the TPS6598x Configuration Tool are older firmware versions which are depreciating. These older firmware images are not compatible with the newer TPS6598x Configuration Tool versions and therefore users cannot update them to make use of the latest firmware images.

To enable users to retain their configurations and use the latest versions of the firmware available, a new tool is being introduced by Texas Instruments known as TPS6598x Application Customization Tool. This tool can be used to customize and generate firmware images that can be loaded onto a TPS6598x device. This application report describes the procedure to update and configure a user's TPS6598x firmware images by importing application configuration settings from the user's TPS6598x device.

Details regarding each configuration setting are not within the scope of this guide. For information on which settings to choose for the user's application, refer to *TPS65982 and TPS65986 Firmware User's Guide* (SLVUAH7).

1.2 Hardware

The following is a list of the required hardware. Different hardware is required depending on the selected adapter. See Section 4 for figures of each hardware setup.

- Windows-based PC with at least one USB2.0 (or later) port
- TPS6598x-EVM or user's custom board with TPS6598x
- Barrel-jack laptop-charger power-supply AC adapter (DC 20-V Output)
- TotalPhase Aardvark I²C/SPI Host Adapter (referred to simply as Aardvark) + USB Standard-A to Standard-B cable
- FTDI-based adapter board + USB micro-B to A cable

This application report describes how to write and read the firmware image using the TPS65982-EVM and Aardvark. For more information on acquiring the Aardvark HW or installing Aardvark drivers, refer to the TotalPhase website. To use these steps with a custom board, make the required hardware changes to bring out the SPI and I²C pins from the board to the Aardvark or FTDI-based adapter board. For information on using jumper wires to connect the TPS65982-EVM to the Aardvark or using the stand-alone TotalPhase SPI Flash update software, refer to the TPS65982-EVM User's Guide.

1.3 Software

The required software packages are the TPS6598x Host Interface Tool and the TPS6598x Application Customization Tool (SLVUAR8).

Follow the installation instructions from the respective user guides to install each tool. Ensure that the drivers are installed by the Windows system automatically on connection of Aardvark or FTDI-based adapter board for the first time. The TPS6598x Host Interface Tool may not function correctly if the Aardvark or FTDI drivers are installed properly in the Windows system.



2 Hardware Preparation and Flashing TPS6598x Firmware Image

2.1 Hardware Preparation

Figure 1 shows the hardware setup that should be used. Connect the Aardvark pins to the correct pins of the two 20-pin connectors J2 and J3 connectors on the backside of TPS6598x-EVM. If a BoosterPack or other FTDI-based adapter board is used with two 20-pin connectors that match the TPS65982-EVM, ensure proper orientation of the two boards based on the barrel-jack connector of the TPS6598x-EVM being positioned near pin 1 of both J2 and J3.



Figure 1. Aardvark Wired to SPI Pins of TPS65982-EVM (Top view of J2 and J3)

Now connect a USB cable to the Aardvark and Windows PC with the appropriate plug ends. Also connect the powered barrel-jack laptop charger to TPS6598x-EVM.

2.1.1 Custom Board Setup

This section describes the steps to use a custom TPS65982 board to import the configuration settings using an Aardvark or FTDI-based adapter board. The Aardvark or an FTDI-based adapter uses I²C and SPI lines to read and write registers in the TPS6598x device, and to burn the firmware and configuration image to the SPI flash.

If the custom board is used instead of TPS65982-EVM (shown in this document), the user must re-map the I²C and SPI pins on the custom board to a header or custom connector. Table 1 lists the I²C and SPI pins on the TPS65982-EVM.



Hardware Preparation and Flashing TPS6598x Firmware Image

Table 1. I²C and SPI Pins on TPS65982-EVM

Net Name	Header Pin Number	Header Designator
I ² C Pins		
I2C_SDA1	Pin 20	J2
I2C_SCL1	Pin 18	J2
I2C_IRQ1Z	Pin 16	J2
SPI Pins		
SPI_MOSI	Pin 11	J3
SPI_MISO	Pin 13	J3
SPI_CSZ	Pin 17	J3
SPI_CLK	Pin 14	J2
GND Pins		
GND	Pin 3	J2
GND	Pin 1	J3

2.2 Flashing Old TPS6598x Firmware Image

The user can skip this step if the old firmware images are already flashed to the TPS6598x-EVM or the custom board. To flash an old firmware image to TPS6598x-EVM or the custom board, use the steps in this section.

2.2.1 Configuration for FTDI or Aardvark Interface to the TPS65982

To configure the tool for FTDI or Aardvark, use the following steps:

- Step 1. Open the TPS6598x Host Interface Tool GUI (also known as TPS6598x Utilities GUI).
- Step 2. Follow the instructions provided in TPS6598x Utilities User Guide (SLVA701) to configure the tool to work with the FTDI-based adapter or Aardvark.
- Step 3. Upon successful configuration, a confirmation appears as shown in Figure 2.
- Step 4. The register mode return value can be either APP or BOOT depending upon whether a valid firmware existed on the TPS6598x-EVM.

TPS6598x Host Interface To	Host Interface Tools	About
Welcome Configure	USB to I2C/SPI Adapter Configuration	
Host Interface FW Update	USB to I2C/SPI Adapter Device I2C Address	FTDI 0x38 Kbps 100 Mbps 8
Update Register List	I2C Port SPI Port	Port 1 Port 0
Command List	Test Configuration Settings Connection Results: Successful Interface Open	
Reset Connection	Attempt to read Mode Register succeeded Mode Register returns: APP Hardware CONNECTED 12C Scanner	ISTRUMENTS

Figure 2. Successful Configuration for FTDI

NOTE: The PC should automatically detect an Aardvark when adding the adapter; however, if the PC does recognize the Aardvark, download the Aardvark drivers from Total Phase and follow the installation prompts.

2.2.2 SPI Firmware Update

The user should flash the old firmware that has the custom configurations using the SPI firmware update procedure. Refer to the TPS6598x Utilities User Guide to successfully update the firmware on the TPS6598x-EVM. Upon a successful update, a confirmation message is displayed as shown in Figure 3.



TPS65982 Host Interface Tools TPS65982 Host Interface Tools About Welcome SPI Flash Update Configure Abort Flash Update **12C FW** Updating flash image in progress... Update Erasing 1M Flash SPI FW Update Flashing Image **Register List** Command Verifying Image List Flash verification succeeded Texas Instruments Reset Connection Hardware CONNECTED 12C Scanner

Figure 3. Successful SPI Flash Update

After successfully flashing the TPS6598x device, disconnect/re-connect the barrel-jack adapter or press the Reset button on the TPS65982-EVM (S3) to load the newly installed firmware image on the SPI flash IC. When using an FTDI-based adapter, disconnect the barrel-jack and micro-USB cable for a few seconds before reconnecting back as the FTDI pins may latch on to the states of the adapter unless power is completely removed.

3 Using the TPS6598x Application Customization Tool

Now the TPS6598x board is running the application which contains the user's custom configurations and a firmware for controlling the TPS6598x device. The objective is to update this application which contains the latest firmware available but still containing the user's custom configuration. For this purpose, use the new TPS6598x Application Customization tool. This tool is used to customize and generate firmware images that can be loaded onto TPS6598x devices. The Application Customization Tool is capable of loading firmware settings from a TPS6598x at run time over a USB to I²C adapter (an Aardvark or FTDI-based adapter).

The user guide of the TPS6598x Application Customization tool (SLVUAR8) describes the installation procedure and the complete process of using TI-provided firmware projects to create usable firmware. To instal the tool, use the steps listed in the user's guide.

This tool includes TI-provided projects, which are firmware templates that contain configuration settings that are specific to various applications. These projects are to be used as a starting point in generating or adopting custom firmware.

NOTE: Projects have a varying level of configurability depending on the application and therefore TI recommends selecting a project that matches with the user's intended device and application.

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3.1 Starting a New Project

When starting a new project, users typically open default templates (.tpl), which are provided by Texas Instruments. The default images cover the primary use cases for TPS6598x applications.

To load and use one of the TI projects, use the following steps:

- 1. Click the *File* menu and then select *New Project*. The next window displayed allows the user to browse, select, and open a default project (see Figure 4).
- 2. Select the appropriate .tpl project file for the application then click the OK button.



Figure 4. Project Files

The user now sees additional functionality, depending on the project that is loaded. In Figure 5, for example, the user now the following is displayed:

- The TPS65982 Intel Apex Creek, version 2.4 project has been loaded to the tool.
- The low-region firmware image has been loaded as shown in the *Firmware Base Image* section of the *General Settings* tab.
- The available configurable settings within the *Global and Device Settings* tab, which are described in the respective firmware user's guide for the selected TPS6598x device.
- Billboarding information is now configurable in the String Table section of the General Settings tab.



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<u>D</u> evice <u>V</u> iew <u>H</u> elp							
General Settings Global Device Settings Device Settings (0xff)							
TPS65982 Application Customiza	ition Tool	TPS65982 Intel legacy TBT, version 2.4					
Firmware Base Image (Low-region binary file)							
Change File tps65982_01.07.09_lowregin	on.bin						
Device Initialization Chain							
Number of Connected Devices: 1 -							
Device Device Selection Bitfield							
Device		Device Selection Bitfield					
Device Device 1		Device Selection Bitfield					
Device 1 String Table		Device Selection Bitfield					
Device 1 String Table Name		Device Selection Bitfield Oxff					
Device 1 String Table Name 1 Serial Number	UNKNOW	Device Selection Bitfield Oxff String N					
Device 1 Device 1 String Table String Table 1 Serial Number 2 Product	UNKNOW	Device Selection Bitfield Oxff String N N N					
Device 1 Device 1 String Table I Serial Number 2 Product 3 Manufacturer		Device Selection Bitfield Oxff String N N N N N N N N N N N N N N N N N N N					
Device 1 Device 1 String Table I Serial Number Product Mame Amulacturer Billboard URL		Device Selection Bitfield Oxff String N N N N N N N N N N N N N N N N N N					
Device 1 Device 1 String Table I Serial Number 2 Product 3 Manufacturer 4 Billboard URL 5 Thunderbolt Billboard Msg		Device Selection Bitfield Oxff String N N N N N N N N N N N N N N N N N N N					
Device 1 Device 1 String Table String Table I Serial Number 2 Product 3 Manufacturer 4 Billboard URL 5 Thunderbolt Billboard Msg 6 DisplayPort Billboard Msg		Device Selection Bitfield Oxff String N N N N N N N N N N N N N					
Device 1 Device 1 String Table I Serial Number Product Manufacturer Billboard URL Thunderbolt Billboard Msg DisplayPort Billboard Msg Device D		Device Selection Bitfield Oxff String N N N N N N N N N N N N N					
Device 1 Device 1 String Table I Serial Number Product Manufacturer Billboard URL Thunderbolt Billboard Msg DisplayPort Billboard Msg		Device Selection Bitfield Oxff String N N N N N N N N N N N N N					

Figure 5. TPS6598x Application Customization Tool With Intel Legacy Thunderbolt Project

3.2 Device Settings

After creating a new project from the default templates for the intended application and device, all default device configurations values are available in the *Device Settings* tab as shown in Figure 6.

Each of the configuration values can be viewed by selecting the appropriate vertical tabs (on the left-hand side of the GUI) in the *Device Settings* tab. The *Raw view* tab provides the raw values embedded in the configuration registers.

Customiza	ation Tool			TPS65982 Intel legacy TBT, version 2.4
Raw View				
Device	Register	Offset	Length	Value
Oxff	0x16	0	7	0x2000000
Oxff	0x17	0	7	0x2000008
Oxff	0x20	0	1	0x0
Oxff	0x28	0	15	0xd86ea00e36203f038a
Oxff	0x29	0	4	0x1005010
Oxff	0x32	0	31	0x401912c000000
Oxff	0x33	0	57	p0000000000000000000000000000000000000
Oxff	0x38	0	12	0x18087
Oxff	0x47	0	49	000000000000003800000000000000006c00808704
Oxff	0x51	0	7	0x1001c4600
Oxff	0x52	0	7	0x10003
Oxff	0x54	0	3	0x0
Oxff	0x5c	0	64	000000000000000010000001000000000000380318
Oxff	0x5d	0	40	0x0
Oxff	0x5e	0	28	4321444d4321444d4321000000000003f0e400300318
Oxff	0x70	0	2	0x300
	Customiza Raw View Device Dxff Dxff Dxff Dxff Dxff Dxff Dxff Dxf	Customization Tool Register Device Register Device 0x16 Device 0x20 Device 0x32 Device 0x33 Device 0x51 Device 0x52 Device 0x54 Device 0x52 Device 0x54 Device 0x54 Device 0x54 Device 0x54 Device 0x56 Device 0x56	Customization Tool Register Offset Device Register Offset \xff 0x16 0 \xff 0x17 0 \xff 0x20 0 \xff 0x28 0 \xff 0x32 0 \xff 0x33 0 \xff 0x34 0 \xff 0x51 0 \xff 0x52 0 \xff 0x54 0 \xff 0x52 0	Customization Tool Register Offset Length Device Register Offset Length Mrf 0x16 0 7 Mrf 0x17 0 1 Mrf 0x20 0 1 Mrf 0x28 0 15 Mrf 0x32 0 31 Mrf 0x33 0 57 Mrf 0x47 0 49 Mrf 0x51 0 3 Mrf 0x52 0 4 Mrf 0x54 0 3 Mrf 0x56 0 4 Mrf 0x56 0 4

Figure 6. TPS6598x Default Device Settings

Older firmware versions included configurations for the *Miscellaneous Configuration* and *GPIO Event Map* within the firmware code and not in the configuration structure area. But newer firmware, which uses the TPS6598x Application Customization Tool, does not include the *Miscellaneous Configuration* and *GPIO Event Map* within the firmware code. The user must save these values before importing device settings from a running board.

To save GPIO Event Map, save the value of register 0x5c to a notepad program (see Figure 7).

To save *Miscellaneous Configuration*, copy the value of register 0x5e to a notepad program (see Figure 7).





Figure 7. Saving GPIO Event Map and Miscellaneous Configuration Values

3.3 Importing Configuration Settings from a TPS6598x

Now that the base device settings are loaded in the TPS6598x Application Customization tool, import the device and firmware settings from a TPS6598x-EVM at run-time.

NOTE: This function is extracting the contents of each register directly and placing in the device settings on the tool. Therefore, only import device settings to a project that is for the associated device. For example, if the contents of a TPS65982 device are imported into a TPS65983 project, the contents will not be placed appropriately.

To perform the import function, use the following the steps:

- 1. Connect the barrel-jack connector to the TPS6598x-EVM and connect the Aardvark to Windows PC using a USB Micro-B to A cable.
- 2. Click the Device menu and then select Import Settings from Device.
- 3. Select the appropriate USB to I²C adapter (FTDI or Aardvark), I²C address, and device settings tab to place the settings.
- 4. (Optional) Click the *Test Read (Mode Register 0x3):* button to ensure proper device connection. If *APP* is displayed next to this button, the TPS6598x device has loaded the application firmware.



Dytho	onw		9	X
USB t	o I2C Adapter:	FTDI		•
I2C A	ddress:	0x38		
Test	Read (Mode Reg	ister 0x3):	APP	
Impor	t Settings To:			
G	lobal Device Sett	ngs Tab		
0 D	evice Settings (0)	ff) Tab		
		ОК	Cance	el

Figure 8. Import Device Settings Window

5. Select *Device Settings* tab and click the *OK* button to import the device settings. If successful, a window is displayed which indicates a successful import of device settings (see Figure 9).

🔳 Impo	ort From Device
1	Successful Import from Device to: Device Settings (0xff) Tab
	ОК

Figure 9. Successful Device Settings Import

The configuration settings from the device are now viewable in the Device Settings tab that was selected.

In the *Device Settings* tab, the registers 0x5c and 0x5e values are blank. Ensure that the *Miscellaneous Configuration* values and *GPIO Event Map* values are restored. To restore the *GPIO Event Map* values, copy the saved values to the 0x5c register in the *Raw View* section of the GUI. To restore the *Miscellaneous Configuration* values, copy the saved values to register 0x5e in the *Raw View* section of the GUI.

The user can now save the low-region binary file which can be flashed onto the TPS6598x device using the TPS6598x Utilities Tool. The user can also save the modified project (.pjt), which contains the updated configuration.

neral Settings Global Dev	ice Settings	Device Settings ((0xff)		
TPS65982 Application	n Customiza	ation Tool			TPS65982 Intel legacy TBT, version 2.4
nterrupt Mask for I2C1	Raw View				
system Power State	Device	Register	Offset	Length	Value
ystem Configuration	Oxff	0x16	0	7	0x2000000
ransmit Source Capabilities	Oxff	0x17	0	7	0x2000008
ransmit Sink Capabilities Iternate Mode Entry Queue	Oxff	0x20	0	1	0x0
ransmit Identity Data Object	Oxff	0x28	0	15	0xd86ea00c36083f0398
tel VID Config Register	Oxff	0x29	0	4	0x1005010
exas Instruments VID Config PIO Event Map	Oxff	0x32	0	31	0x3c12c0401912c000000
liscellaneous Configuration	Oxff	0x33	0	57	0x45f6403c000640440003c0700001905a01
aw View	Oxff	0x38	0	12	0x18087
	Oxff	0x47	0	49	00000000000000380000000000000006c00808704
	Oxff	0x51	0	7	0x1001c4600
	Oxff	0x52	0	7	0x10003
	Oxff	0x54	0	3	0x0
	Oxff	0x5c	0	64	000000000000000100000010000000000000000
	Oxff	0x5d	0	40	0x0
	Oxff	0x5e	0	28	4321444d4321444d4321000000000003f0e40030031
	Oxff	0x70	0	2	0x300

Figure 10. Imported TPS6598x Custom Device Settings

4 Sanity Check

This section describes how to perform a basic sanity check after the firmware on the custom board has been upgraded with the configuration. Performing this check is a good idea because any change in the configuration can alter the performance of the firmware.

Using a USB PD protocol analyzer, such as the Teledyne Lecroy, is best to perform this check.

4.1 System Setup

Figure 11 shows the system setup. The TPS65982-EVM mounted on a custom FTDI-based adapter board on the left-side of Figure 11 is referred to as the *Docking Station* system. The TPS65982-EVM along with an Aardvark or a custom FTDI-based adapter board on the right-side of Figure 11 is referred to as the *Notebook* system. The *Docking Station* is connected to a barrel-jack connector. The *Docking Station* system is the one which is intended to be upgraded to the latest firmware.





Figure 11. Setup for Basic Sanity Check

The *Docking Station* and *Notebook* systems are connected through the Teledyne Lecroy analyzer as shown in Figure 11. Connect the Teledyne Lecroy analyzer to a Windows PC using a Type-C to A cable.

4.2 Power-Delivery Contract Analysis

This section describes how to analyze the PD contract and PD messages using the Teledyne Lecroy analyzer. To use the Teledyne Lecroy analyzer, the user should have installed the Mercury T2/T2C USB protocol suite which is available on the Teledyne website (teledyne.com). The user can use any other Protocol analyzer as well.

To analyze whether all configuration settings were imported correctly from the old firmware, review the PD-contract establishment and alternate-mode negotiation using PD messages under two scenarios. The first scenario uses the old firmware code with the setup shown in Figure 11.. The second scenario uses the new firmware code with the setup shown in Figure 11.

To start the PD-contract analysis, follow the following steps:

- Step 1. Disconnect the USB Type-C cable from the *Notebook* system and the barrel-jack adapter from the *Docking Station* system.
- Step 2. Start the USB protocol suite and check whether the power and status LEDs are glowing.
- Step 3. Connect the barrel-jack adapter.
- Step 4. Start recording of the PD contract using the USB protocol suite.
- Step 5. Connect the USB Type-C cable to the Notebook system.



Sanity Check

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Step 6. Wait for some time and then stop recording in the USB protocol suite.

The user should now able to see the PD-contract establishment messages being exchanged by the source and sink as shown in Figure 12. The user can now also see the device searching and entering alternate modes if enabled.



Figure 12. PD-Contract Establishment Messages

NOTE: The PD messages and contract negotiation depends upon the user-configuration settings in the firmware. The messages shown in Figure 12 should be considered as an example only. These messages will differ depending upon the configuration settings on the user's board.

Save this exchange and repeat this exercise with the newer firmware and imported configuration settings on the *Docking Station* system. The user should be able to see the same PD contracts being established and similar messaging and negotiations occurring as in the earlier case.



Page

Revision History

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

Changes from Original (June 2016) to A Revision

• Deleted references to the USB2MANY board and replaced them with Aardvark or FTDI-based adapter	2
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