

TSC4270 Evaluation Module



Figure 1. TSC4270 Evaluation Module

This user's guide describes the characteristics, operation, and use of the TSC4270 evaluation module (EVM). The TSC4270EVM is an evaluation fixture for the TSC4270, a touch screen controller (TSC) for capacitive touch panels. A complete circuit description, schematic diagram, and bill of materials are included.

The following related documents are available for download through the Texas Instruments web site at <http://www.ti.com>.

Table 1. EVM-Related Device Data Sheets

Device	Literature Number
TSC4270	Data sheet available on request
LM3S3748	See LM3S3748 for the latest documentation
LM4F120	See LM4F120 for the latest documentation

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1 EVM Overview

1.1 Features

The TSC4270EVM main features include:

- Full-featured evaluation board for the [TSC4270](#) capacitive touch screen controller (TSC)
- Digital interface for use with external processors
- Easy-to-use evaluation software for computers with Microsoft Windows® operating systems
- USB-powered (with optional power supply)
- Complete control of board settings

The TSC4270EVM is a complete evaluation kit. This kit combines the TSC4270EVM daughterboard with the Stellaris microcontroller-based TSC4270 EVM motherboard and evaluation software for use with a personal computer (PC).

The TSC4270EVM motherboard allows the TSC4270EVM daughterboard to be connected to the computer using an available USB port. This manual shows how to use the TSC4270EVM motherboard as part of the TSC4270 evaluation module kit, but does not provide technical details about the TSC4270EVM motherboard itself.

This manual covers the operation of the TSC4270EVM. Throughout this document, the terms *TSC4270EVM*, *evaluation board*, *evaluation module*, and *EVM* are synonymous with the TSC4270 evaluation module, and the abbreviation of graphical user interface (GUI) is synonymous with the TSC4270 GUI software.

1.2 Introduction

The TSC4270EVM can assist in the process of system prototyping, and firmware and software development around the TSC4270 device.

The EVM allows for easy access to the TSC4270 with a user-specified host processor and software in order to direct evaluation on the TSC4270 performance and operating characteristics. The EVM is a complete evaluation and demonstration package for use with a personal computer equipped with a Microsoft Windows XP® or Windows 7® operating system.

The TSC4270EVM-PDK includes the following items:

1. TSC4270EVM daughterboard
2. TSC4270EVM motherboard
3. Capacitive touch screen panel from Truly Semiconductor, installed on supporting fixture (see [Figure 1](#))
4. Evaluation-software and related documentation (downloaded from <ftp://ftp.ti.com/pub/evm-pdk/TSC4270/>)

2 Hardware Overview

2.1 Analog Interface

The TSC4270 supports a 33-wire capacitive touch screen. A 36-pin FPC/FFC connector J1 (part number FH12-36S-0.5SH) is installed on the TSC4270EVM daughterboard, and provides a direct connection to a corresponding 36-pin flat cable from the capacitive touch screen.

[Table 2](#) details the pinout of 36-pin connector J1 on a TSC4270EVM daughterboard and also shows the suggested connection to the provided 20-row by 12-column capacitive touch screen panel.

Table 2. Analog Connection Through 36-Pin Connector J1

Pin Number	TSC4270		20 × 12 Screen
J1.1	GND		GND
J1.2	Pin 2	R8	Panel row 19
J1.3	Pin 2	R7	Panel row 18
J1.4	Pin 2	R6	Panel row 17
J1.5	Pin 2	R5	Panel row 16
J1.6	Pin 2	R4	Panel row 15
J1.7	Pin 30	R3	Panel row 14
J1.8	Pin 31	R2	Panel row 13
J1.9	Pin 32	R1	Panel row 12
J1.10	Pin 33	R0	Panel row 11
J1.11	GND		GND
J1.12	Pin 37	C13 / R2	Panel column 11
J1.13	Pin 38	C12	Panel column 10
J1.14	Pin 39	C11	Panel column 9
J1.15	Pin 40	C10	Panel column 8
J1.16	Pin 41	C9	Panel column 7
J1.17	Pin 42	C8	Panel column 6
J1.18	Pin 43	C7	Panel column 5
J1.19	Pin 44	C6	Panel column 4
J1.20	Pin 45	C5	Panel column 3
J1.21	Pin 46	C4	Panel column 2
J1.22	Pin 47	C3	Panel column 1
J1.23	Pin 48	C2	Panel column 0
J1.24	GND		
J1.25	Pin 1	R19 / C1	Panel row 10
J1.26	Pin 2	R18 / C0	Panel row 9
J1.27	Pin 3	R9	Panel row 8
J1.28	Pin 4	R10	Panel row 7
J1.29	Pin 5	R11	Panel row 6
J1.30	Pin 6	R12	Panel row 5
J1.31	Pin 7	R13	Panel row 4
J1.32	Pin 8	R14	Panel row 3
J1.33	Pin 9	R15	Panel row 2
J1.34	Pin 10	R16	Panel row 1
J1.35	Pin 11	R17	Panel row 0
J1.36	GND		GND

2.2 Digital Interface

The TSC4270 EVM is designed to easily interface with multiple control platforms. A convenient 24-pin socket J2 (Samtec SSM-124-X-SV) is installed on the TSC4270EVM daughterboard, and provides an interface to digital signals between the TSC4270 device and the Stellaris LM3S3748 microprocessor on the TSC4270EVM motherboard.

Table 3. Pinout for Digital Interface P2

Pin	Name	Description
J2.1	DUT SCL	I ² C™ bus serial clock
J2.2	DUT SDA	I ² C bus serial data line
J2.3 to J2.6	Unused	Unused
J2.7	DUT+1p8V	+1.8 V power supply to the TSC4270 device
J2.8	GND	Ground
J2.9	DUT+3p3V	+3.3 V power supply to the TSC4270 device
J2.10	GND	Ground
J2.11	Stellaris+3p3V	+3.3 V power supply to the Stellaris device
J2.12	Unused	Unused
J2.13	DUT $\overline{\text{RST}}$	TSC4270 reset, active low
J2.14	DUT $\overline{\text{IRQ}}$	TSC4270 interrupt, active low
J2.15 to J2.20	Unused	Unused
J2.21	DUT $\overline{\text{CS}}$	SPI™ bus chip selection, active low
J2.22	DUT MISO	SPI bus master-in-slave-out data line
J2.23	DUT MOSI	SPI bus master-out-slave-in data line
J2.24	DUT SCLK	SPI bus sync clock

2.3 DUT and MCO Printed Circuit Boards (PCBs)

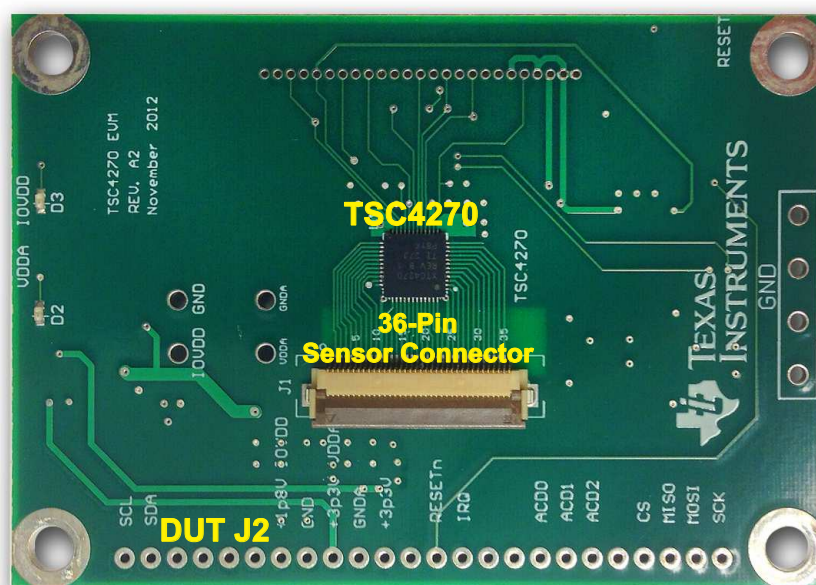


Figure 2. TSC4270 DUT Board, Top View

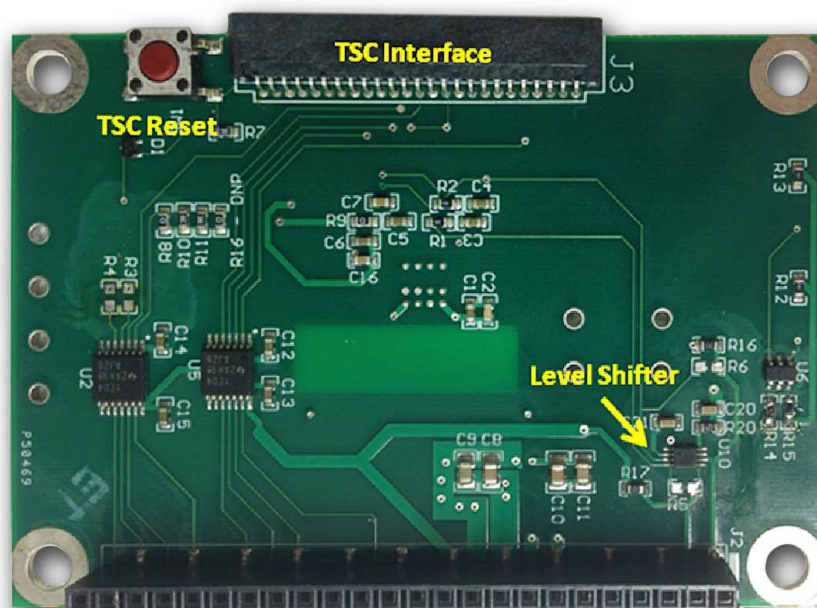


Figure 3. TSC4270 DUT Board, Bottom View

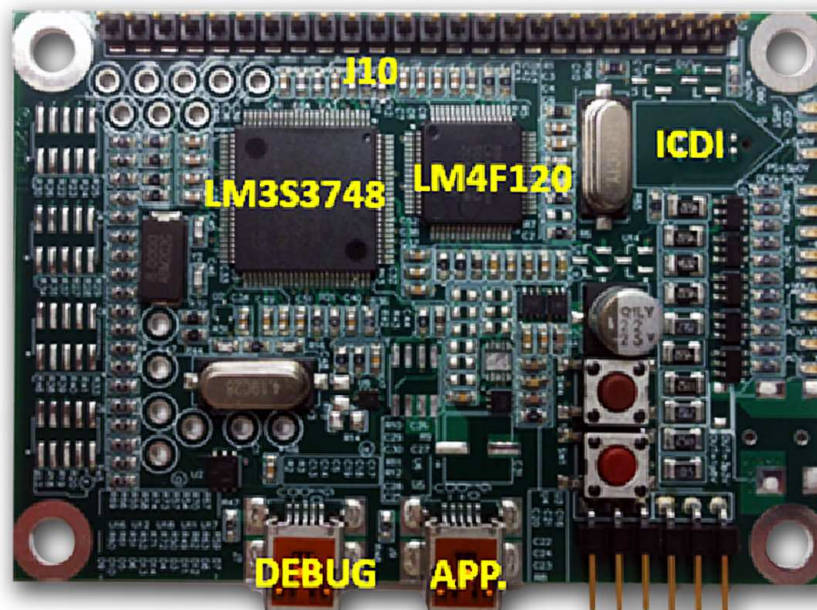


Figure 4. Stellaris Motherboard

3 Power Supply

The power supplies to the TSC4270EVM kit are derived from the USB connected to your PC. On the TSC4270EVM motherboard, the +5.0-V power from the USB is regulated by linear regulators U3, U4, and U5. These regulators generate +3.3 VDC to provide power supplies to the Stellaris microprocessors and other circuitry on the TSC4270EVM motherboard, and also generate +3.3 VDC and +1.8 VDC to provide power-supplies to the TSC4270 on the TSC4270EVM daughterboard.

As shown in [Table 3](#), the +3.3 VDC and +1.8 VDC power supplies are provided to the TSC4270EVM daughterboard through connector J2.

4 Installation

4.1 Hardware Description

The following items are provided in the hardware packet.

1. One TSC4270EVM daughterboard printed circuit board (PCB).
2. One TSC4270EVM motherboard PCB.
3. One TRULY Semiconductor, 20 × 12 channel capacitive touch screen, assembled on a fixture.
4. One USB connection cable.
5. TSC4270EVM-PDK evaluation software and related documentation (download from <ftp://ftp.ti.com/pub/evm-pdk/TSC4270/>).

Items 1, 2, and 3 arrive preassembled, as shown in [Figure 1](#). Installing the EVM software, is described in the following section.

4.2 Software Installation

The USB driver installation has to be carried out before running the GUI software.

1. Based on the PC specifications, download the latest TSC4270EVM-PDK software package from <ftp://ftp.ti.com/pub/evm-pdk/TSC4270/>.
2. Extract the software package to the local hard drive.
3. Prerequisites before installation:
 - (a) .NET Framework v4.0 or higher (<ftp://ftp.ti.com/pub/evm-pdk/TSC4270/>).
 - (b) Visual C++ redistributable 2010 or higher (<ftp://ftp.ti.com/pub/evm-pdk/TSC4270/>).

4. Install the USB driver:
 - (a) Plug the USB mini 5-wire cable from the PC to the application USB port shown in [Figure 5](#).



Figure 5. Highlighted Application USB Port on the TSC4270EVM

- (b) Ignore or cancel the Windows automatic driver installation.
- (c) Navigate to `TSC4270\TSC4270_Dependencies\libusb-win32-bin-1.2.6.0\bin` in the unzipped folder.
- (d) Run `inf-wizard.exe`.
- (e) Click **Next**, as shown in [Figure 6](#)

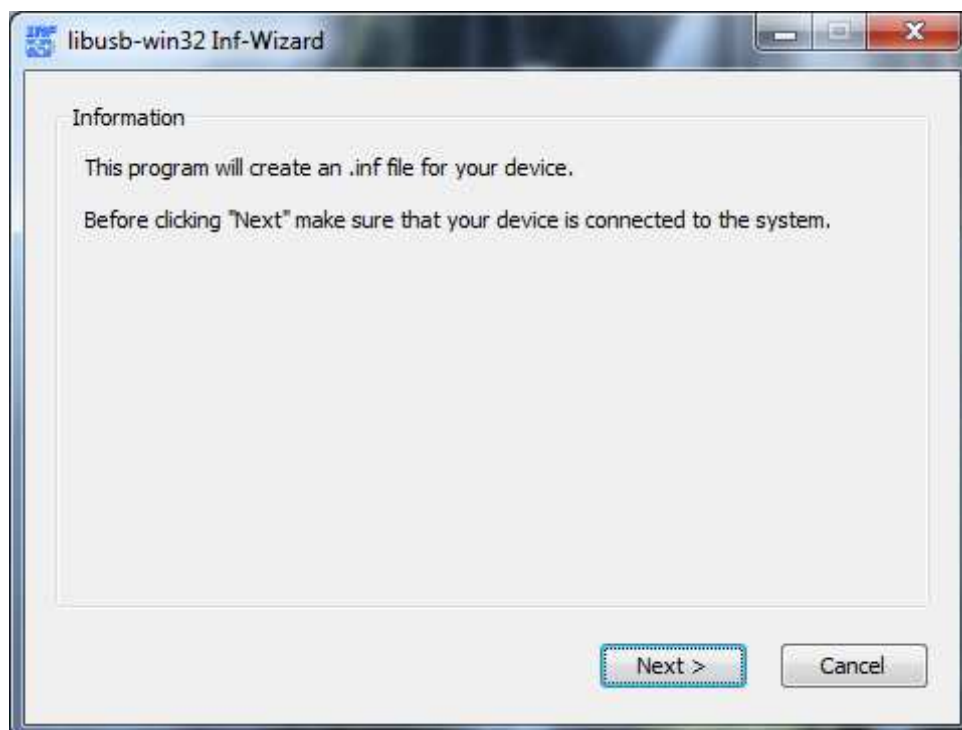


Figure 6. Inf-Wizard Startup Window

- (f) Select the TSC device with Vendor ID = 0x1CBE, and Product ID = 0x0003, and click *Next*, as shown in [Figure 7](#)

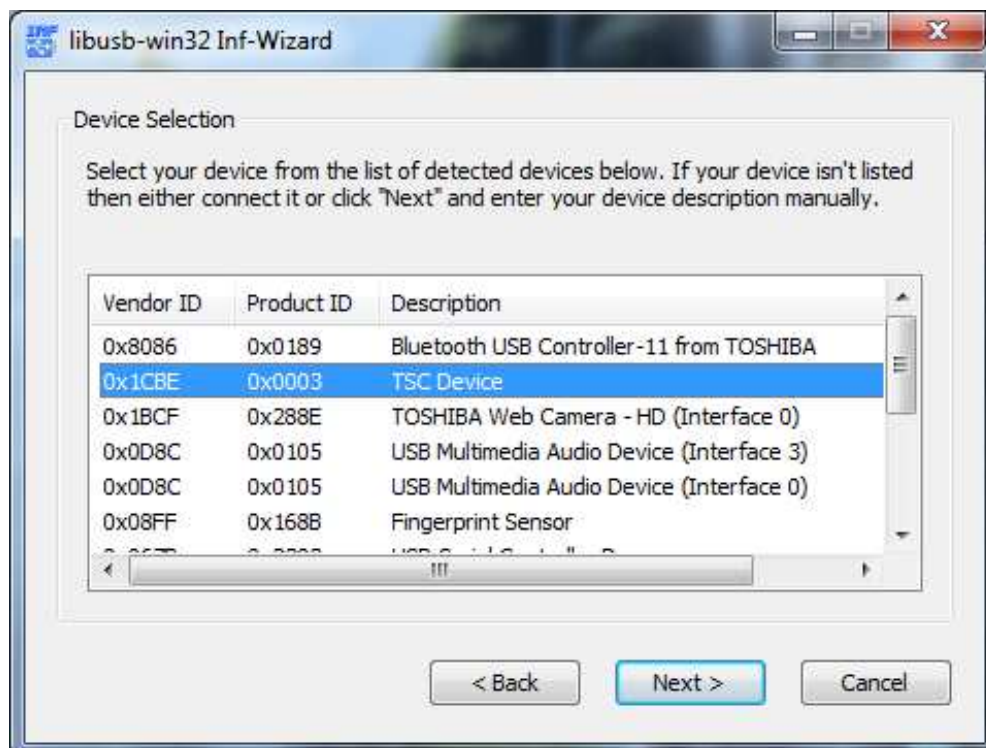


Figure 7. Inf-Wizard Device Selection

- (g) Click *Next*, as shown in [Figure 8](#).

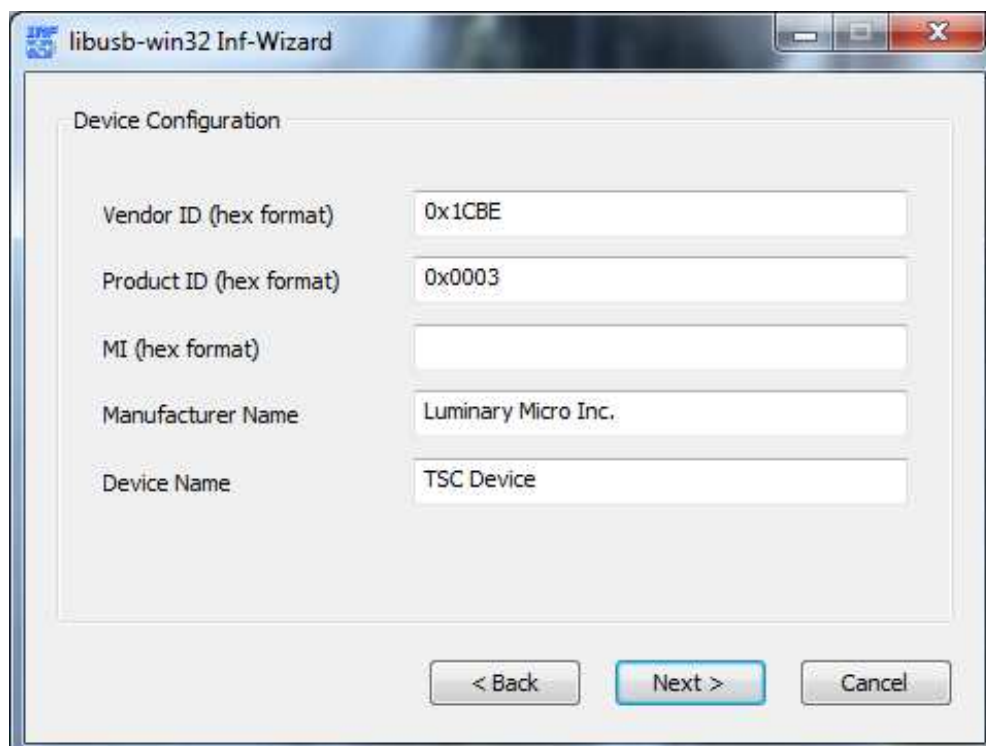


Figure 8. Inf-Wizard Device Configuration

- (h) Select a location on the local hard disk and click **Save**, as shown in [Figure 9](#).

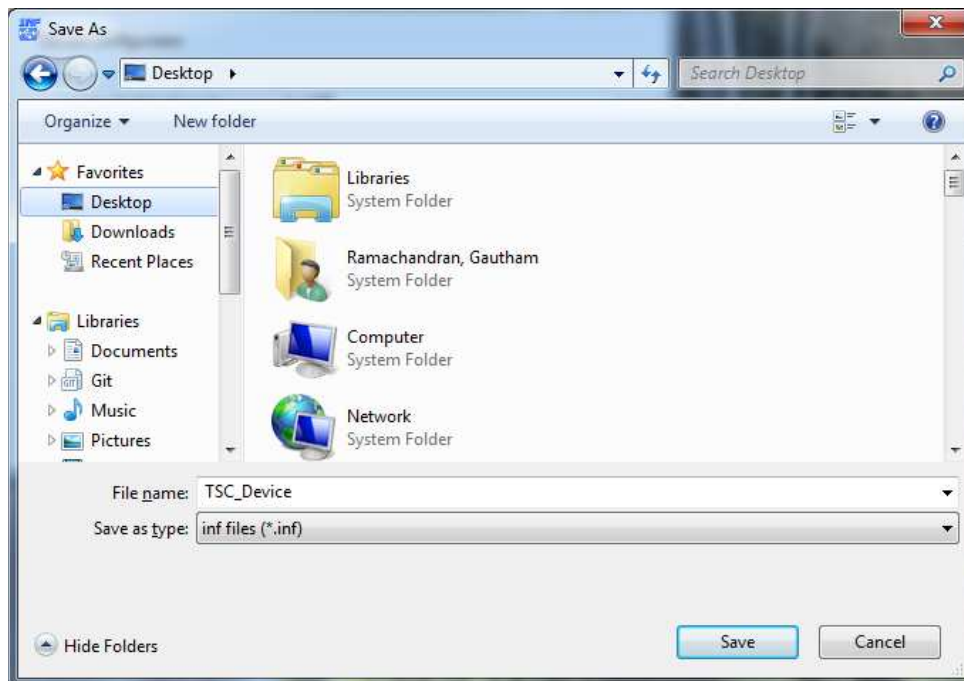


Figure 9. Inf-Wizard File Save Prompt

- (i) Click **Install Now...**, as shown in [Figure 10](#). After installation, unplug the device, and then plug it back in.

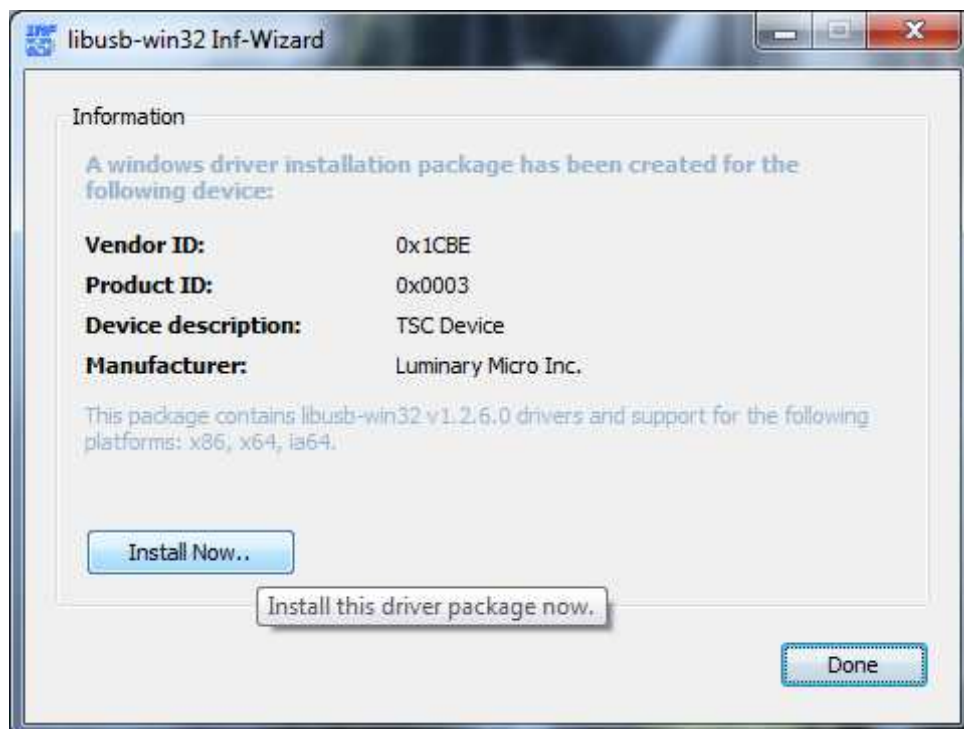


Figure 10. Inf-Wizard Installation Prompt

- (j) If the window shown in [Figure 11](#) appears, click **Install this driver software anyway**.



Figure 11. Driver Installer Authentication

- (k) Optional verification: navigate to the Windows Control Panel and open the Device Manager. If installation was successful, *libusb-win32* device and *TSC* device is visible in the tree.
5. Plug in the EVM and run the *TSC 4270 EVM Application.exe* file from the project folder.

5 Operation

The following sections of this user guide provide information on operating the TSC4270EVM.

5.1 Quick Start

After both hardware and software installation processes have been successfully completed, connect the USB cable from the PC to the TSC4270EVM motherboard (J9 on the motherboard).

As configured at the factory, the TSC4270EVM motherboard is powered from the USB interface. Therefore, an external power supply is not required. Upon USB connection, the green indicator LEDs on the TSC4270EVM motherboard light up, and the +3.3 V and +1.8 V LEDs on the daughterboard also light up.

After the TSC4270EVM is powered on, launch the *TSC4270 EVM Application.exe* file. The software should automatically find the TSC4270EVM, and the GUI startup screen appears, as shown in [Figure 12](#).

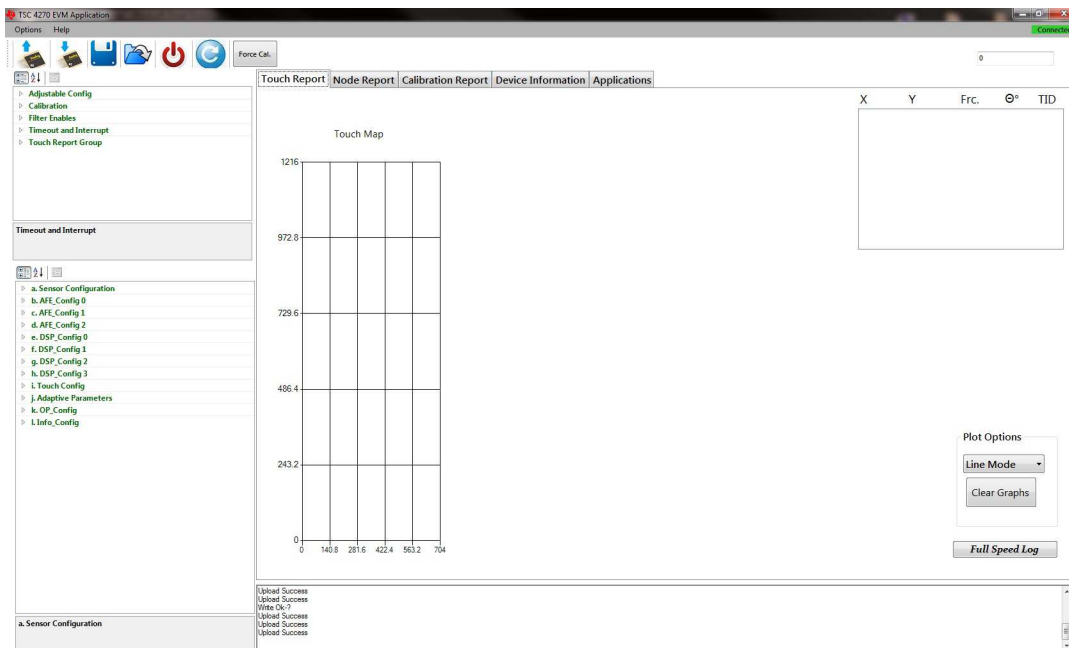


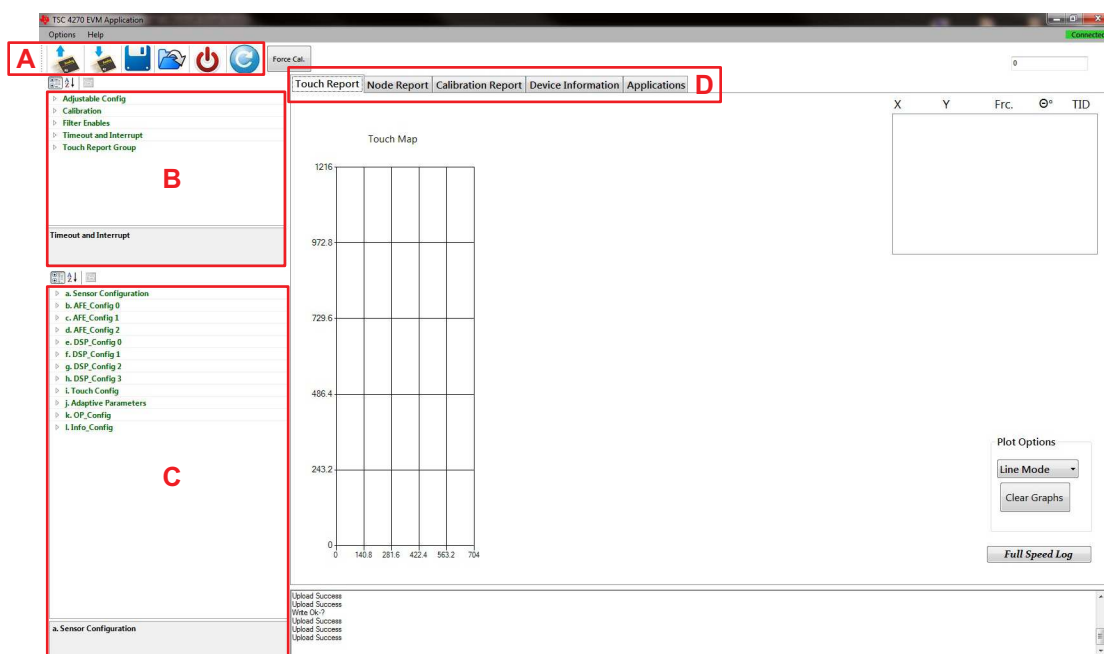
Figure 12. GUI Startup Screen

5.2 GUI Operation

After plugging the EVM into a USB port and starting the TSC4270EVM-PDK software, the GUI is displayed, as shown in [Figure 12](#). Use the TSC4270EVM GUI to test different functions of the TSC4270. There are five main tabs in the GUI:

1. Touch Report
2. Node Report
3. Calibration Report
4. Device Information
5. Applications

These tabs are described later in this document. After a successful enumeration of the hardware EVM by the GUI, the startup screen is displayed, as shown in [Figure 13](#). The main regions of the GUI map are shown in [Figure 13](#).



- A Button menu.
- B Runtime configuration grid.
- C Tunable flash parameters grid.
- D Tabs for user control.

Figure 13. GUI Block Description

5.2.1 Button Menu

The button menu is shown in [Figure 14](#).



Figure 14. Button Menu

The individual buttons are described as follows:

- (i) *Upload run-time parameters from TSC*: This button gets the current run-time parameters (that is, filter enables, report rate, and more from the TSC) and populates it on the runtime configuration grid from [Figure 13](#).
- (ii) *Download run-time parameters to TSC*: This button flashes the TSC with the values set in the runtime configuration to the TSC4270.
- (iii) *Save run-time parameters to disk*: This button saves the configuration from the runtime configuration to an XML file on your hard drive.
- (iv) *Load run-time parameters from disk*: This button loads the configuration from an XML file on your hard drive to the runtime configuration.
- (v) *Reset TSC*: This button issues a hardware reset to the TSC. Note that any run-time configuration changes are erased and set to default values.
- (vi) *Reload GUI*: This button cancels any changes made, and reloads the GUI in case an error occurs during operation. Unplug the EVM before pressing this button.

5.2.2 Options Menu

The options drop-down menu contains the following items:

1. *Upload flash parameters from TSC*: This menu item retrieves the current tunable flash parameters from the TSC and populates it in the tunable flash parameters grid, as shown in [Figure 13](#). A window pops up asking for the Service Key provided by Texas Instruments. The keyboard shortcut is Ctrl+U.
2. *Download flash parameters to TSC*: This item downloads the current tunable flash parameters from the tunable flash parameters grid to the TSC. A window pops up asking for the service key provided by Texas Instruments. The keyboard shortcut is Ctrl+D.
3. *Save flash parameters to disk*: This item writes all the items from the tunable flash parameters grid to an xml file for later use.
4. *Load flash parameters from disk*: This item uploads an xml file to the tunable flash parameters grid. This file can be altered and flashed to the TSC, if needed.
5. *Load flash image*: This item flashes the firmware on the TSC after mass erasing the device. To complete this action, enter the provided service key and ISP key in the subsequent popup window. The keyboard shortcut is Ctrl+F.
6. *Exit*: This item shuts down the program. Keyboard shortcut is Ctrl+Q.

5.2.3 Adjusting the Settings

The TSC4270 behavior can be adjusted by changing the values of the the runtime configuration grid and the tunable flash parameters grid and writing it to the TSC4270.

5.2.3.1 Runtime Configuration Grid

Use the runtime configuration grid to adjust the TSC4270 dynamic settings that do not require to change the state of the TSC4270. Permitted operations include changing the report rate and turning the filters on or off. This operation does not require service or ISP keys. After changing the values, the TSC4270 must be updated with the current settings from the grid by clicking button *ii* shown in Figure 14. Also, button *i* retrieves the current settings present in the TSC4270 and populates the settings on the runtime configuration grid. The settings of this grid can be reverted to default values by using the *Reset* button on the GUI, or by pressing the reset switch on the TSC4270EVM device.

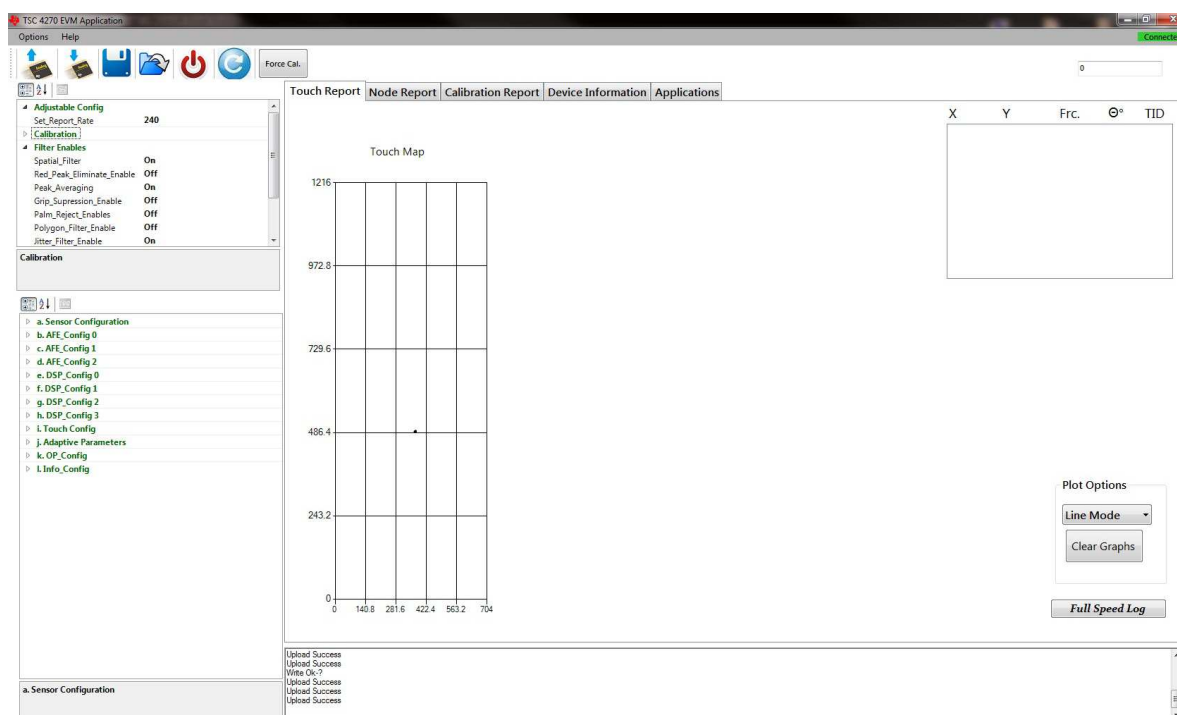


Figure 15. Runtime Configuration Grid, Expanded View

5.2.3.2 Tunable Flash Parameters Grid

Use the tunable flash parameters grid to adjust the flash parameters of the TSC4270. Changing the tunable flash parameters grid affects the behavior of the TSC4270. Uploading flash parameters requires the service keys that are entered in the window that appears when selecting *Download Flash Parameters to TSC* from the Options menu. Parameters such as sensor configuration and AFE settings are adjustable using the tunable flash parameters grid.

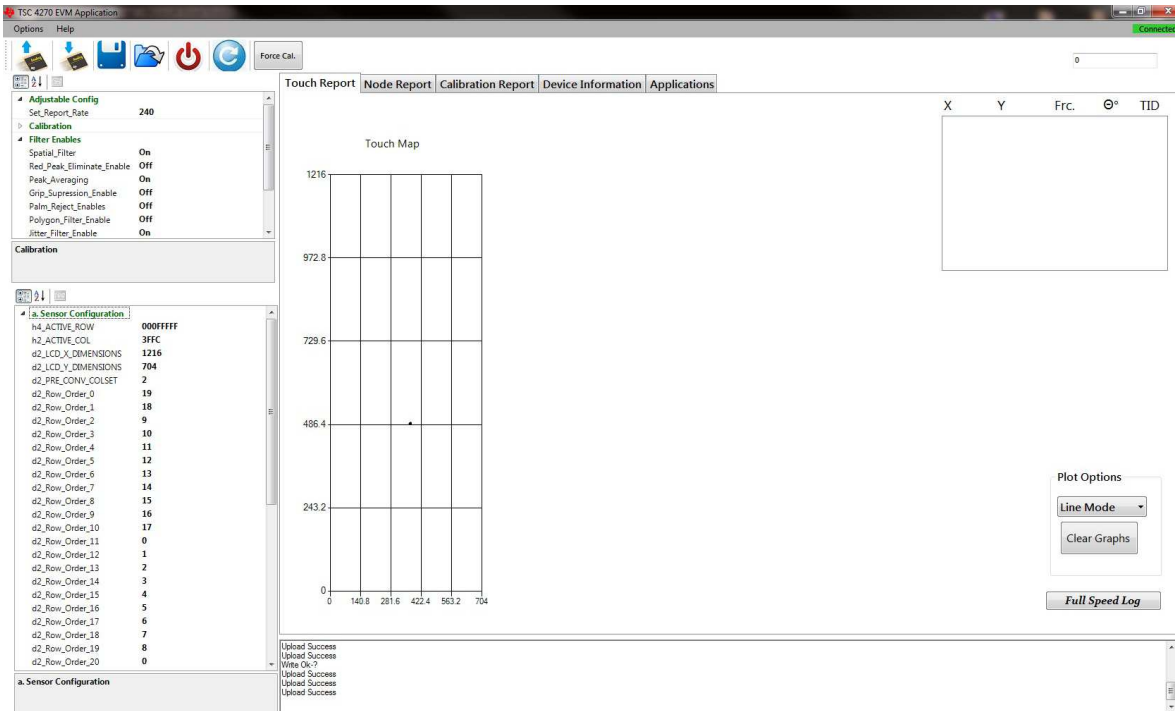


Figure 16. Tunable Flash Parameters Grid, Expanded View

5.2.4 Touch Report Tab

The default startup tab of the EVM GUI is the *Touch Report* tab. This tab consists of a touch map that can be used to visualize finger and palm touches on the panel. [Figure 17](#) shows the three available plotting options:

- (i) Line Mode: For continuous drawing and linearity tests (keyboard shortcut: press 1).
- (ii) Instant Mode: For visualizing real run-time fingers and finger motion on the panel (keyboard shortcut: press 2).
- (iii) Dot Mode: History-enabled tracking of finger coordinates (keyboard shortcut: press 3).

NOTE: Use the number keys on the upper left side of your keyboard for keyboard shortcuts. The keyboard shortcuts do not work when using the numpad.

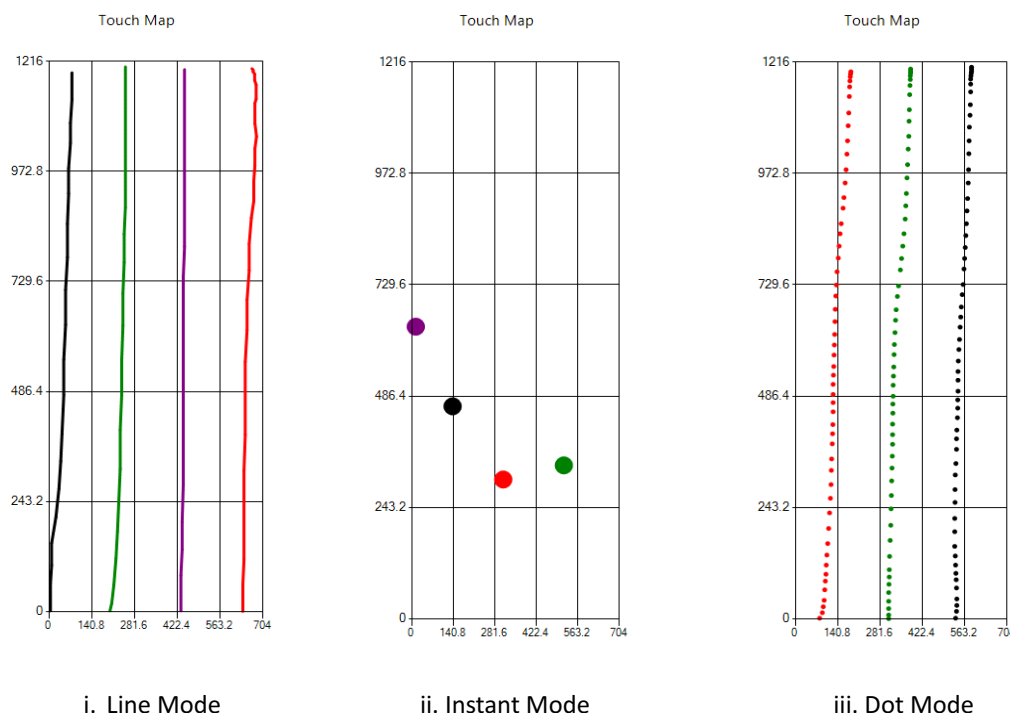


Figure 17. Plot Options Available on Touch Report Tab

There is also a real-time list of the finger X and Y coordinates, force, and touch ID.

The *Full Speed Log* button is a feature where the TSC finger output is logged into a comma-separated variable (csv) file at the report rate of the TSC.

5.2.5 Node Report Tab

The second tab is the *Node Report* tab, as shown in [Figure 18](#). Select this tab to retrieve the current run-time configuration from the TSC and to change back the bit selection on the run-time parameters to request the TSC to generate node reports. The Node Report tab requires a finger or an object on the panel to generate node reports, unless the Cont_Read Enable register from the runtime configuration grid is turned on.

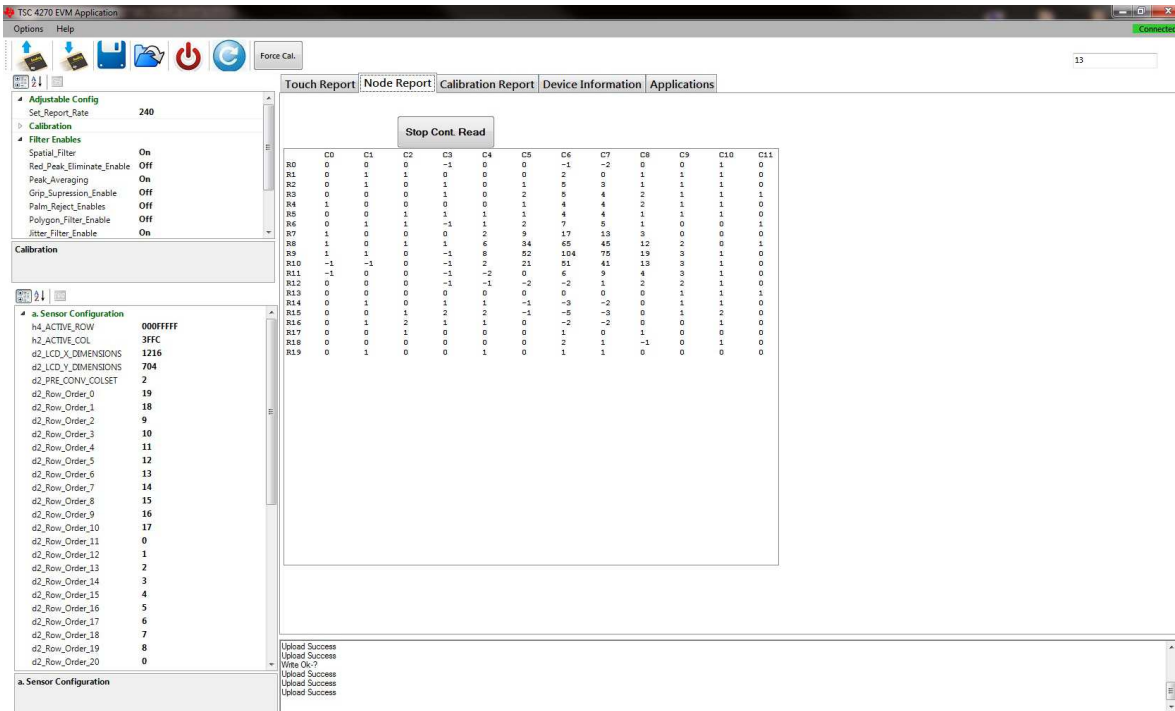


Figure 18. Node Reports from the TSC When a Finger is Present on Panel

5.2.6 Calibration Report Tab

The *Get Cal Data* button in the *Calibration Report* tab retrieves the current TSC calibration data and displays it as shown in [Figure 19](#).

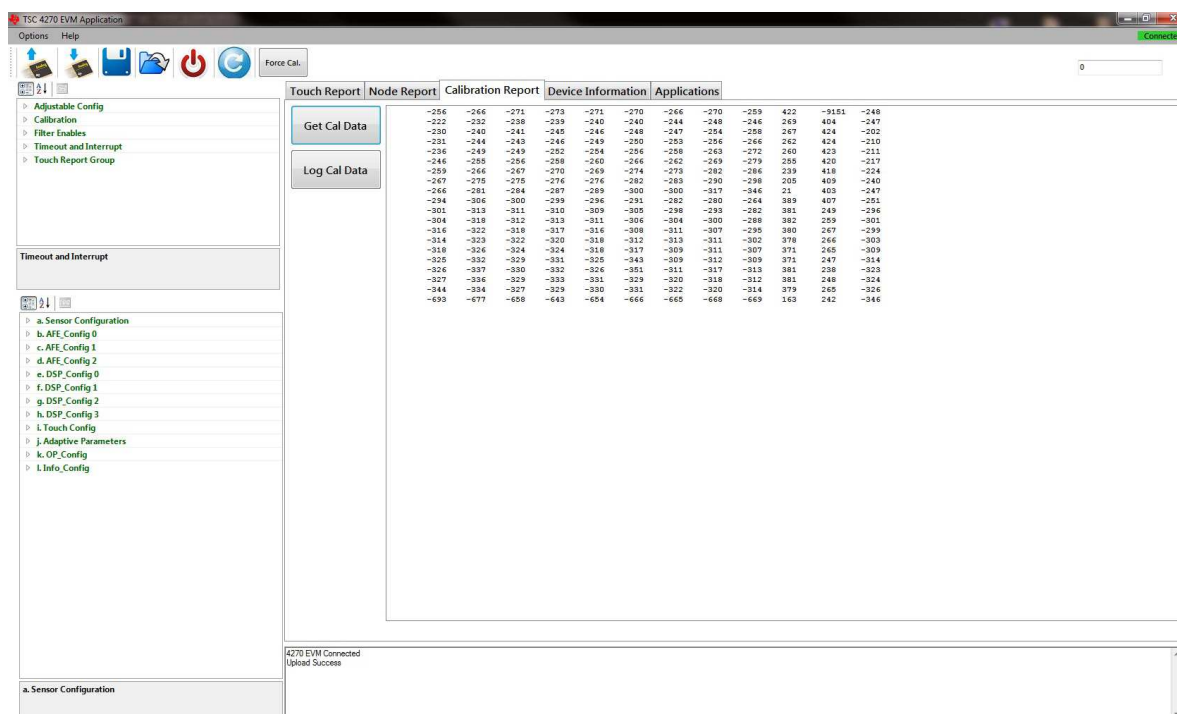


Figure 19. Calibration Data

The *Log Cal Data* button writes the current calibration value into a csv file.

5.2.7 Device Information Tab

The *Device Information* tab retrieves the current configuration, firmware ID, and other device-specific information, as shown in [Figure 20](#). This tab also shows the mapping of all the keyboard shortcuts available in the EVM GUI. The *Copy to Clipboard* button copies the information displayed in the box and enables the information to be sent to the developer in case of issues.

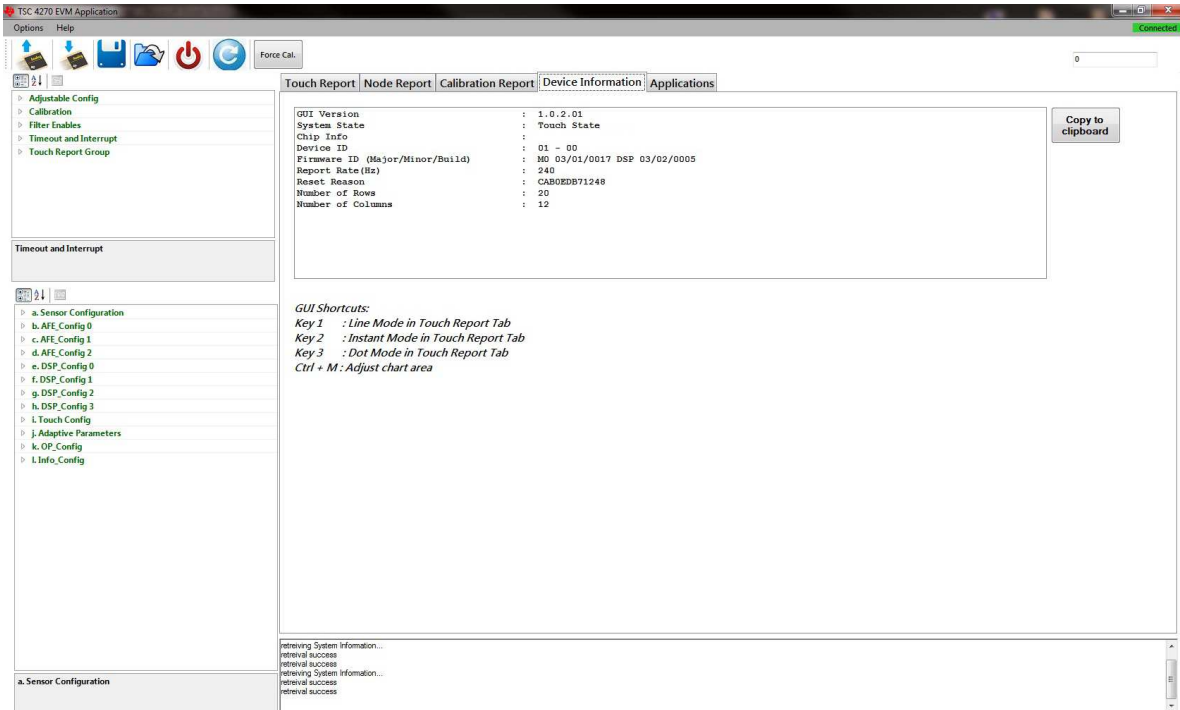


Figure 20. Device Information

5.2.8 Applications Tab

Currently, there are four different applications in the EVM GUI. Switch between multiple applications by turning the App. Selector Knob, as shown in [Figure 21](#).

5.2.8.1 Sense Force Application

The sense force application is used to demonstrate the force exerted by a finger on the panel. The deflections in the force meter are proportional to the touch force on the panel. By adjusting the threshold slider, control over the plot in the graph is achieved. Note that the sense force application supports one-finger drawing only.

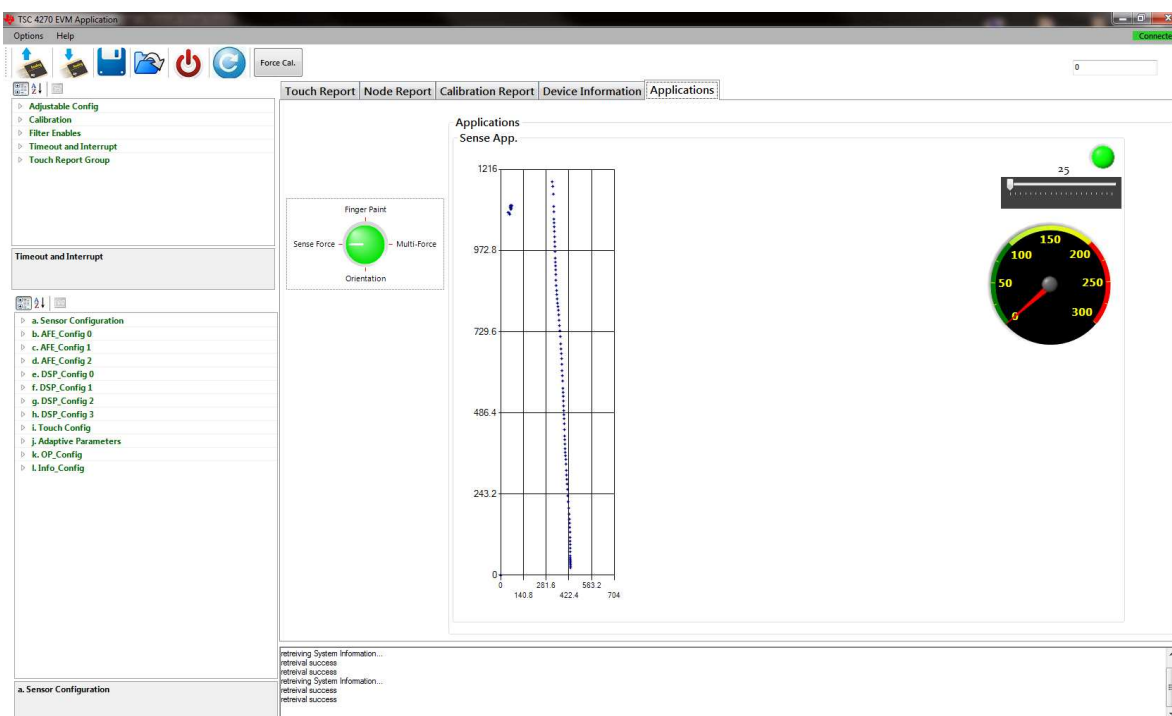


Figure 21. Sense Force Application

5.2.8.2 Finger Paint Application

The finger paint application is used to differentiate between the draw of a light stroke and a heavy stroke, as shown in Figure 22. The thickness of the line is dependent on the touch force intensity. Note that the finger paint application supports one-finger drawing only.

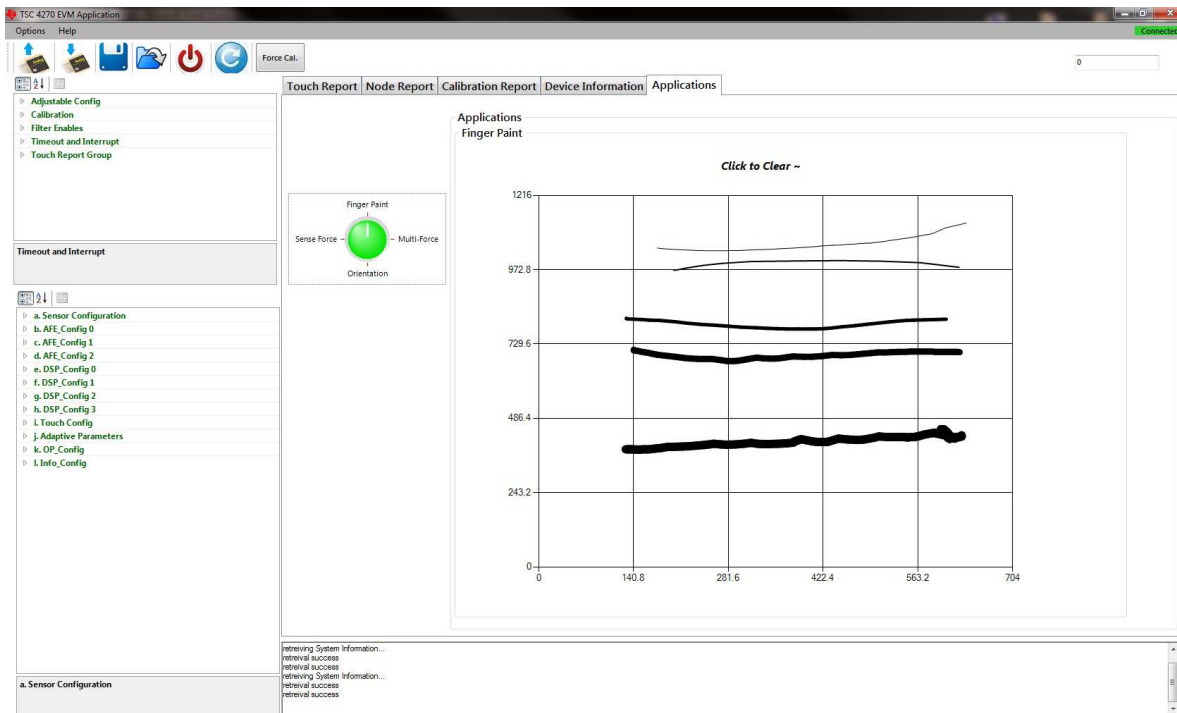


Figure 22. Finger Paint Application

5.2.8.3 Multi-Force Application

Multi-Force application demonstrates the force numbers of all the ten fingers on the panel, as shown in Figure 23. Ten-finger support included in multi-force application.

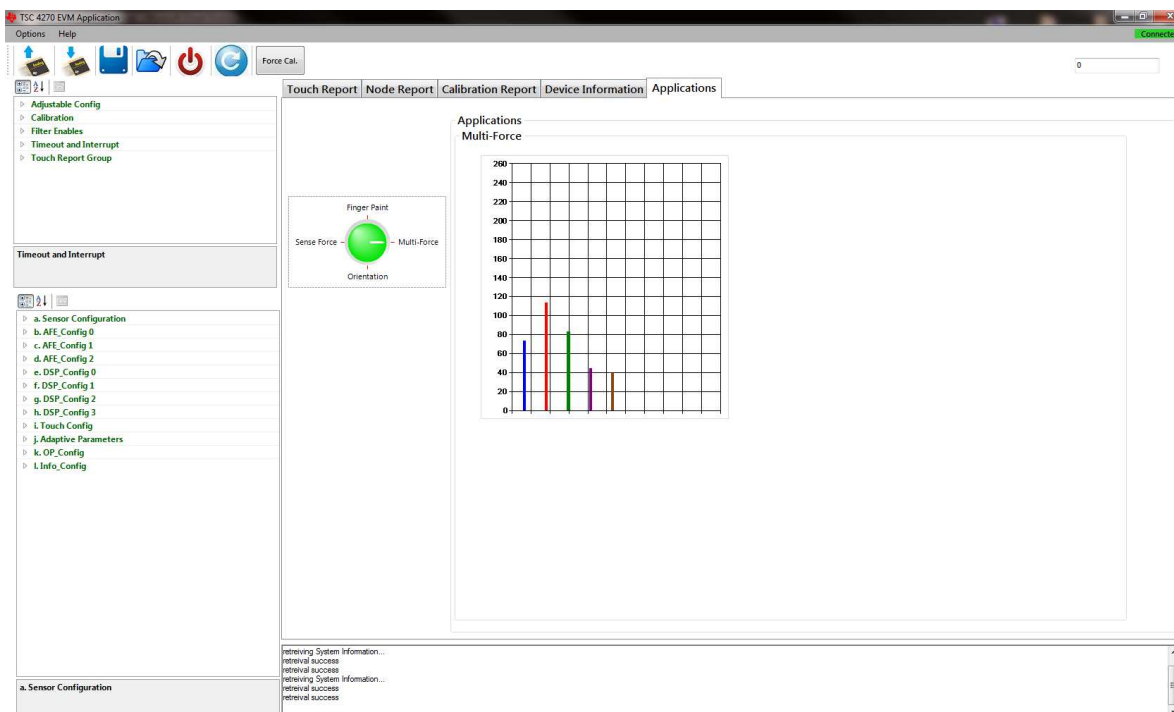


Figure 23. Force Values of Fingers

5.2.8.4 Orientation Application

With this application, the orientation of each finger in degrees is obtained by the TSC. Orientation lies between (0,180), as shown in [Figure 24](#). This application supports only one-finger orientation.

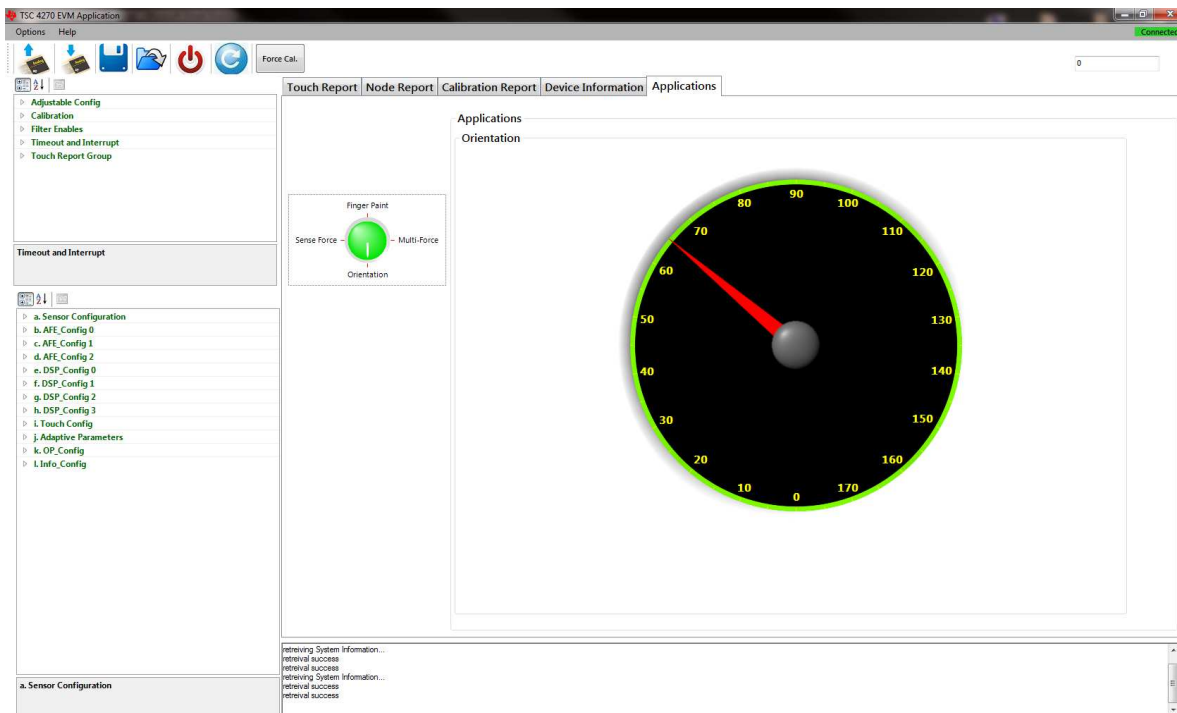


Figure 24. Orientation Plot

6 Bill of Materials

Table 4 and Table 5 contain a complete bill of materials for the modular TSC4270EVM daughterboard and motherboard, respectively.

Table 4. TSC4270EVM Daughterboard Bill of Materials

Ref Des	Description	Part Number	Manufacturer
U2, U5	4-Bit Bidirectional Voltage-Level Translator	TXB0104	Texas Instruments Inc
U6	50V DUAL NPN SILICON LOW SATURATION SWITCHING TRANSISTOR	ZXTD09N50DE6	Diodes Inc
D1	Diode, Schottky 30mA 30V Low IR	MA3J741	Panasonic
C8, C10	CAP, CERM, 10uF, 10V, +/-10%, X7R, 0805	GRM21BR71A106KE51L	MuRata
C2, C20, C21	CAP, CERM, 0.1uF, 16V, +/-5%, X7R, 0603	0603YC104JAT2A	AVX
C9, C11	CAP, CERM, 0.1uF, 16V, +/-10%, X7R, 0805	GRM219R71C104KA01D	MuRata
C1, C3, C4, C5, C6, C12, C13, C14, C15	CAP, CERM, 2.2uF, 10V, +/-10%, X5R, 0603	C0603C225K8PACTU	Kemet
R14	RES, 11.5k ohm, 1%, 0.1W, 0603	CRCW060311K5FKEA	Vishay-Dale
R1, R2, R12, R13	RES, 1.00k ohm, 1%, 0.1W, 0603	CRCW06031K00FKEA	Vishay-Dale
C7, C16	CAP, CERM, 0.1uF, 50V, +/-10%, X7R, 0603	C1608X7R1H104K	TDK
R16, R17	RES, 2.2k ohm, 5%, 0.1W, 0603	CRCW06032K20JNEA	Vishay-Dale
R7, R10, R11	RES, 20.0k ohm, 1%, 0.1W, 0603	RC0603FR-0720KL	Yageo America
R20	RES, 220k ohm, 1%, 0.1W, 0603	RC0603FR-07220KL	Yageo America
R9	RES, 0 ohm, 5%, 0.1W, 0603	RC0603JR-070RL	Yageo America
R15	RES, 27k ohm, 5%, 0.1W, 0603	RC0603JR-0727KL	Yageo America
J2		SSM-124-X-SV	Samtec
U1		TSC4270	Texas Instruments
J3	Connector, 0.050", 25-Pin, Samtec	TFM-125-01-L-S-RA	Samtec
D2, D3	Green LED 0603 SMD	L29K	LG
U10	PCA9306DCU	PCA9306DCU	Texas Instruments
SW1	SPST-NO	SW416-ND	Omron
J1	Touch Sensor Connector	FH12-36S-0.5SH	Hirose
R3, R4, R5, R6, R8, R18, TP1, TP2, TP3, TP4, TP5, TP6, TP7, TP8	Uninstalled	DNI	N/A

Table 5. TSC4270EVM Motherboard Bill of Materials

Ref Des	Description	Part Number	Manufacturer
J10	Cut From TSW-150-07-G-S	TSW-124-07-G-S	Samtec
J7, J9	USB 2.0 Type Mini-B Connector	548190572	Molex Inc
U11, U12, U16, U17, U18	50V DUAL NPN SILICON LOW SATURATION SWITCHING TRANSISTOR	ZXTD09N50DE6TA	Diodes Inc
U3	1.8V 250mA LDO Regulator	TPS73418DRVT	Texas Instruments Inc.
U4, U5	3.3V 250mA LDO Regulator	TPS73433DRVR	Texas Instruments Inc.
Y1	16MHz Crystal	HCM49-16.000MABJ-UT	Citizen
C15	CAP, AL, 150uF, 10V, +/-20%, 0.021 ohm, SMD	EMVY250ADA220MF55G	Nippon Chemi-Con
C1, C35, C36, C37, C38, C39, C40, C41, C42, C44, C49, C51, C52, C53	CAP, CERM, 0.1uF, 25V, +/-10%, X7R, 0603	C0603X104K3RACTU	Kemet
C3, C4, C5, C6, C7, C11, C12, C33, C34, C50	CAP, CERM, 0.01uF, 50V, +/-10%, X7R, 0603	C0603X103K5RACTU	Kemet
C14, C17, C20, C24	CAP, CERM, 2.2uF, 16V, +/-10%, X5R, 0603	GRM188R61C225KE15D	MuRata
C9, C10, C45, C46	CAP, CERM, 10pF, 50V, +/-5%, C0G/NP0, 0603	06035A100JAT2A	AVX
R44	RES, 1.00Meg ohm, 1%, 0.1W, 0603	CRCW06031M00FKEA	Vishay-Dale
R1	RES, 330 ohm, 5%, 0.1W, 0603	CRCW0603330RJNEA	Vishay-Dale

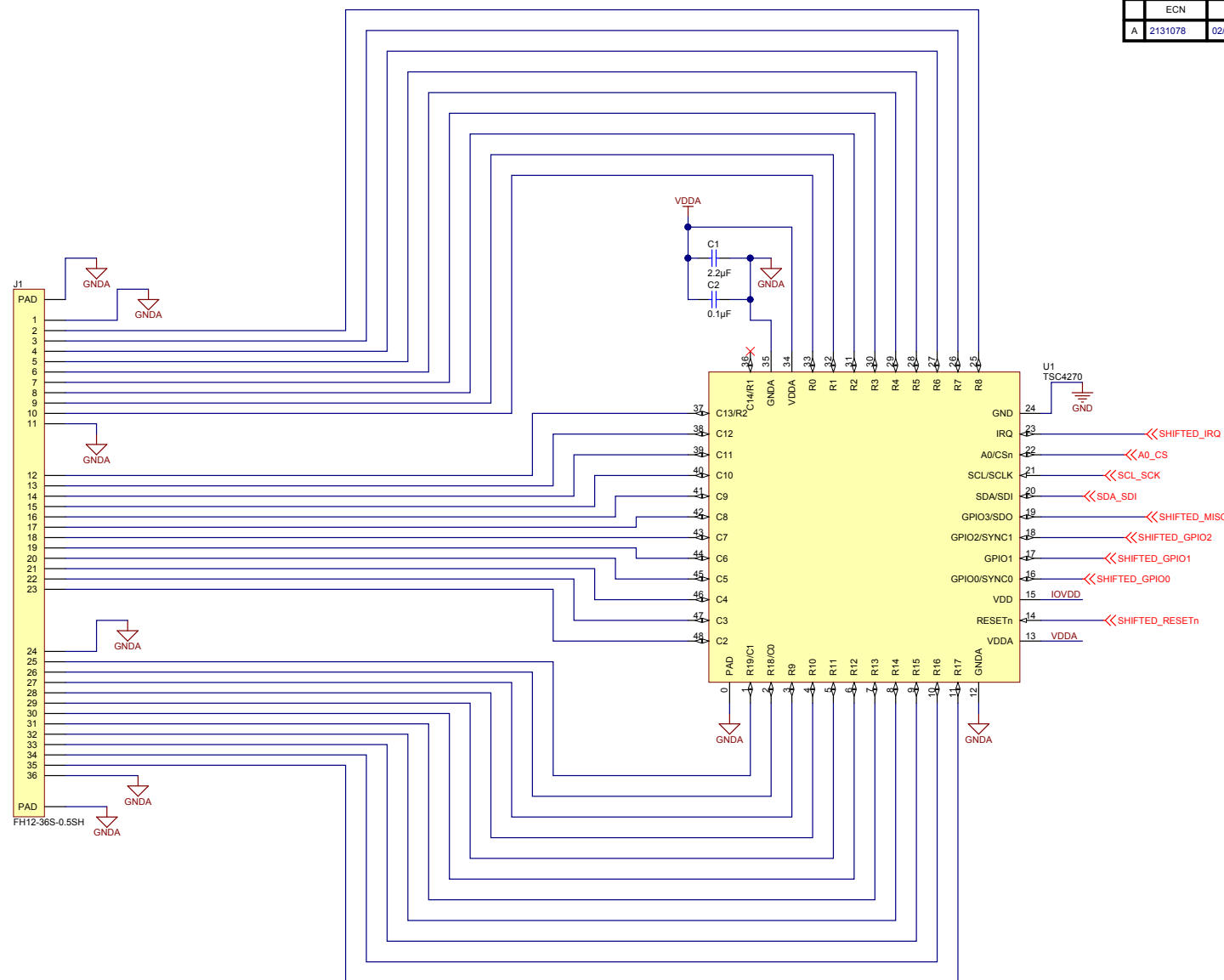
Table 5. TSC4270EVM Motherboard Bill of Materials (continued)

Ref Des	Description	Part Number	Manufacturer
C8, C13, C32, C43, C54	CAP, CERM, 1uF, 16V, +/-10%, X5R, 0603	C0603C105K4PACTU	Kemet
C47, C48	CAP, CERM, 27pF, 50V, +/-5%, C0G/NP0, 0603	06035A270JAT2A	AVX
R2, R3, R4, R5, R6, R42	RES, 10.0k ohm, 1%, 0.1W, 0603	CRCW060310K0FKEA	Vishay-Dale
R7, R43	RES, 100 ohm, 1%, 0.1W, 0603	CRCW0603100RFKEA	Vishay-Dale
R8, R13	RES, 100k ohm, 1%, 0.1W, 0603	CRCW0603100KFKEA	Vishay-Dale
R56, R65	RES, 7.32k ohm, 1%, 0.1W, 0603	CRCW06037K32FKEA	Vishay-Dale
C55	CAP, CERM, 0.01uF, 50V, +/-5%, X7R, 0603	C0603C103J5RACTU	Kemet
C16, C19, C22, C23	CAP, CERM, 0.1uF, 50V, +/-10%, X7R, 0603	GRM188R71H104KA93D	MuRata
C18, C21, C25	CAP, CERM, 0.01uF, 50V, +/-10%, X7R, 0603	GRM188R71H103KA01D	MuRata
R17, R18, R19, R20, R31, R32, R64	RES, 1.0k ohm, 5%, 0.1W, 0603	CRCW06031K00JNEA	Vishay-Dale
R58, R66	RES, 11.5k ohm, 1%, 0.25W, 1206	RC1206FR-0711K5L	Yageo America
R55, R73	RES, 27.0k ohm, 1%, 0.25W, 1206	RC1206FR-0727KL	Yageo America
R54, R57, R67, R70, R74	RES, 45.3k ohm, 1%, 0.25W, 1206	RC1206FR-0745K3L	Yageo America
R69	RES, 5.10k ohm, 1%, 0.25W, 1206	RC1206FR-075K1L	Yageo America
R36	RES, 9.10k ohm, 1%, 0.1W, 0603	RC0603FR-079K1L	Yageo America
R16, R21, R22, R23, R24, R25, R26, R27, R28, R29, R30, R33, R34, R35, R37, R38, R39, R40, R41, R45, R46, R47, R48	RES, 0 ohm, 5%, 0.1W, 0603	ERJ-3GEY0R00V	Panasonic
R49, R50, R51, R52, R53, R59, R60, R61, R62, R63, R71, R72	RES, 165 ohm, 1%, 0.1W, 0603	RC0603FR-07165RL	Yageo America
Y2	Crystal, 8MHz, 18pF	535-10870-1-ND	Abracon Corp
Y3	Crystal, 4.194304MHz	300-8529-1-ND	Citizen
U9	ESD Protected, High-Speed USB 2.0 1:2 Multiplexer Switch	TS3USB221ARSER	Texas Instruments Inc.
U2	ESD-Protection Array for High-Speed Data Interface	TPD2E001DRSR	Texas Instruments Inc.
D3, D4, D5, D6, D9, D10, D11, D12, D13, D14	Green LED 0603 SMD	SML-310MTT86	Rohm Semiconductor
SW2, SW3	Jumper, 3 Pos, Right Angle	3M9468-ND	3M
SW1, SW4	Off-Mom Tactile Switch	PTS645SK43SMTRLFS	C & K Components
D7, D8	Red LED 0603 SMD	SML-310VTT86	Rohm Semiconductor
U1	Stellaris In-Circuit Debug Interface	LM4F120	Texas Instruments Inc.
U8	Stellaris Microcontroller	LM3S3748	Texas Instruments Inc.
C2, C26, C27, C28, C29, C30, C31, D1, D2, J2, J3, J4, J5, J6, R9, R10, R11, R12, R14, R15, TP1, TP2, TP3, TP4, TP5, TP6, TP7, TP8, TP9, TP10, TP11, TP12, TP13, TP14, TP15, U6, U7, U10, U13, U14, U15	Uninstalled	DNI	N/A

7 Schematics

The schematics for the TSC4270EVM are appended to this data sheet.

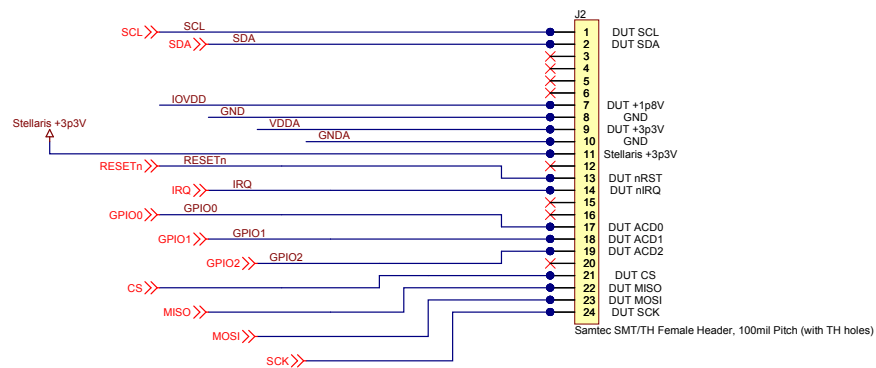
Revision History			
	ECN	Date	Notes
A	2131078	02/13/2013	Initial Release



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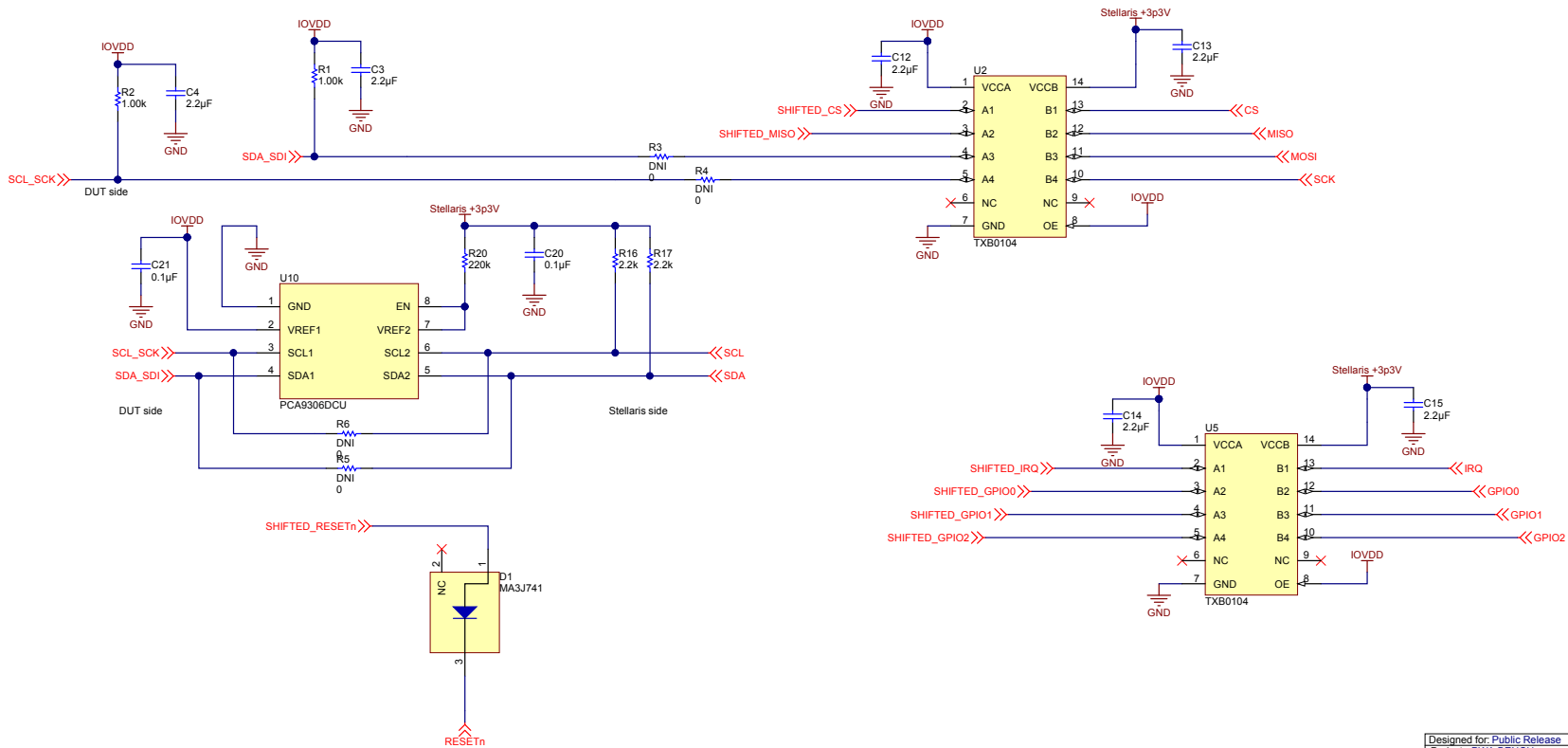
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Project: PWA.BENCH. EVALUATION BOARD. TSC4270	
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Size: C	Schematic: 6569514
Assembly Variant: [No Variations]	
File: 1 TSC4270.SchDoc	
Contact: http://www.fti.com/support	





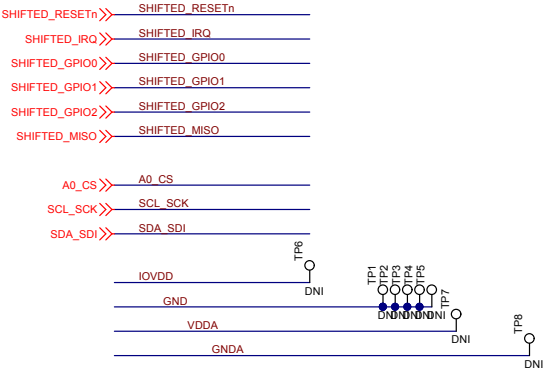
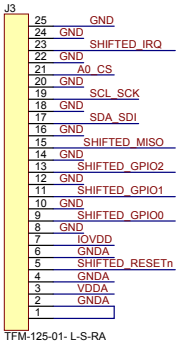
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Designed for: Public Release	Mod. Date: 3/13/2013
Project: PWA.BENCH,	
EVALUATION BOARD,	
TSC4270	
Sheet Title: DUT Connector	Sheet: 2 of 5
Size: C	Schematic: 6569514
Assembly Variant: [No Variations]	Rev: A
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Contact: http://www.ti.com/support	



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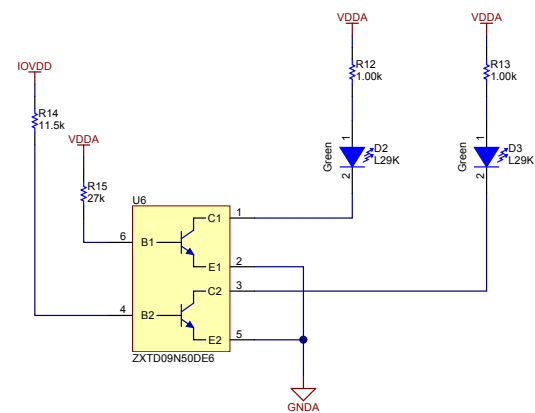
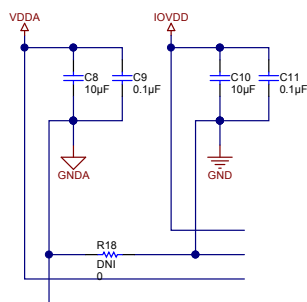
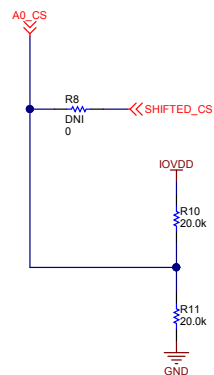
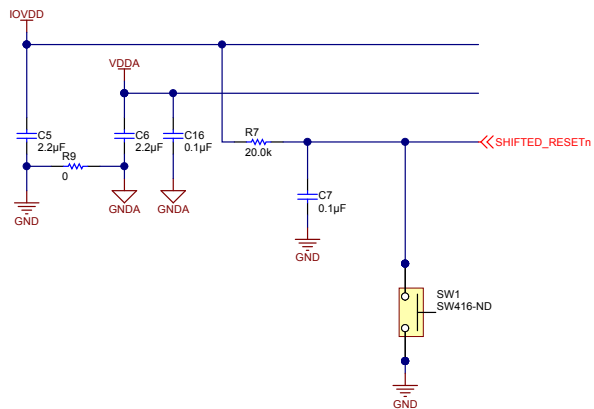
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Project: PWA_BENCH,	
EVALUATION BOARD,	
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Contact: http://www.ti.com/support	



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Designed for: Public Release	Mod. Date: 3/13/2013
Project: PWA.BENCH,	
EVALUATION BOARD,	
TSC4270	
Sheet Title: Test Points	Sheet: 4 of 5
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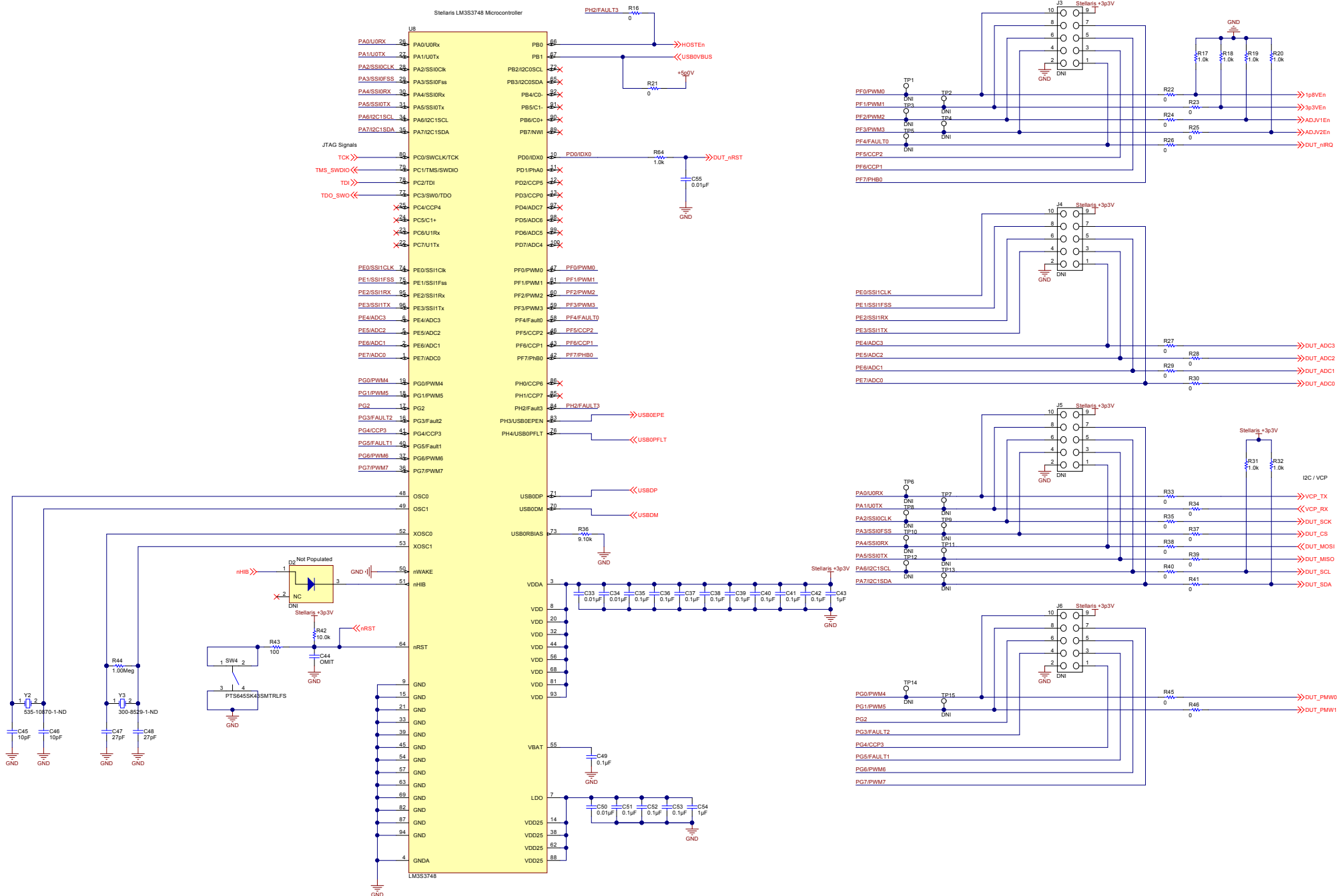


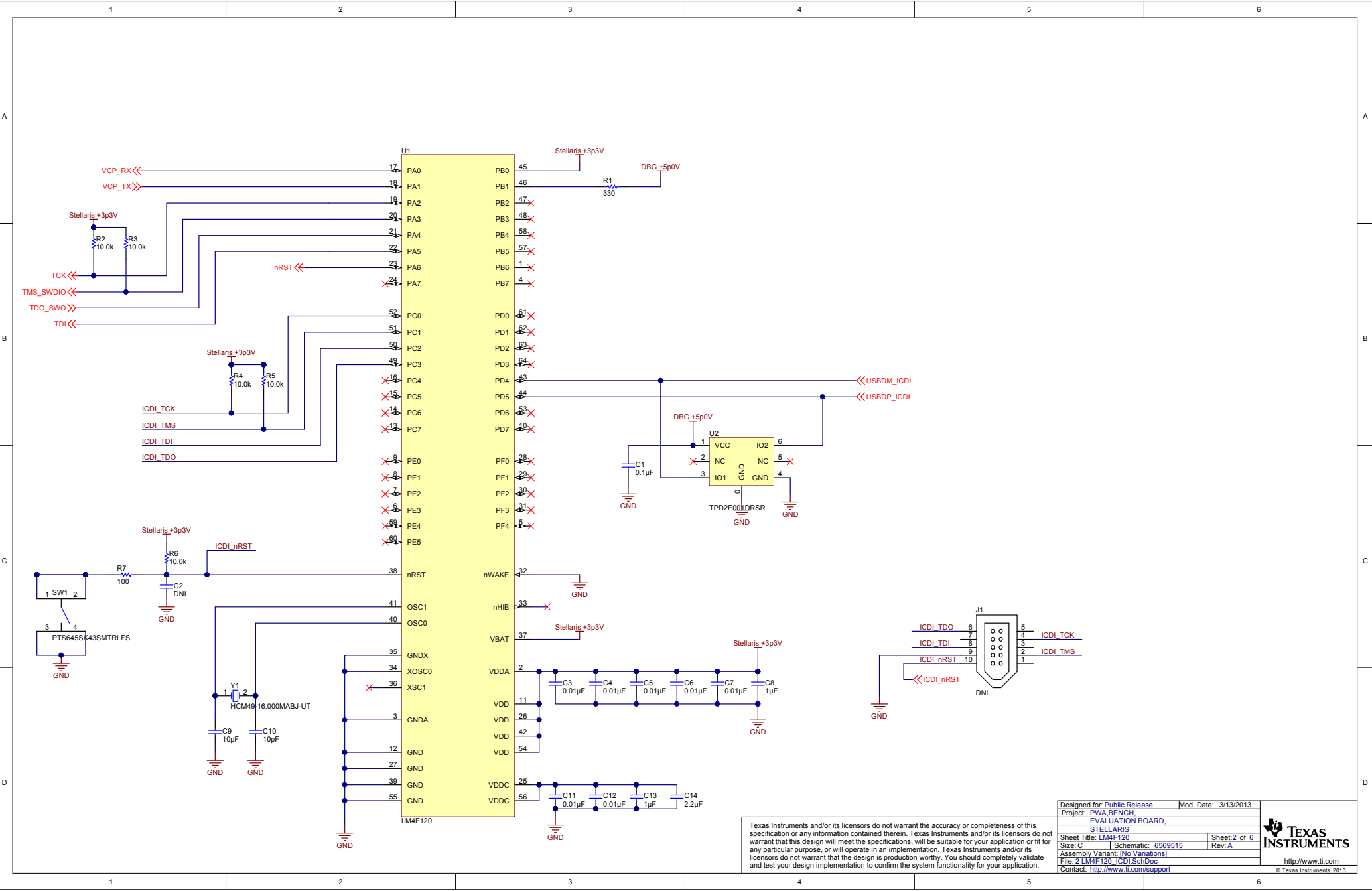


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Project: PWA_BENCH,	
EVALUATION BOARD,	
TS:4270	
Sheet Title: Power	Sheet: 5 of 5
Size: C	Schematic: 6569514
Assembly Variant: (No Variations)	Rev: A
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Revision History		
ECN	Date	Notes
A	2131079	02/13/2013 Initial Release

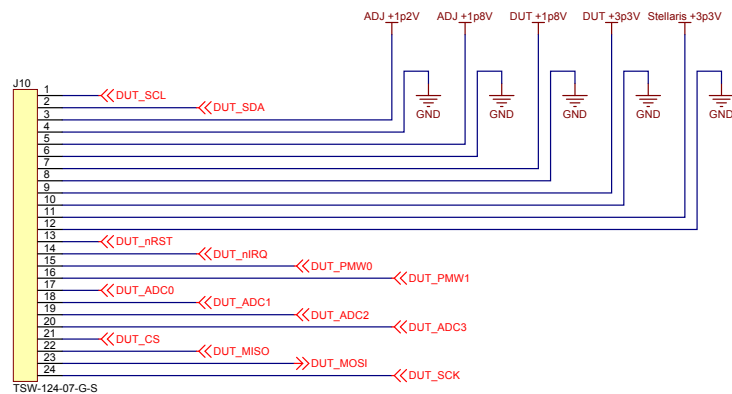




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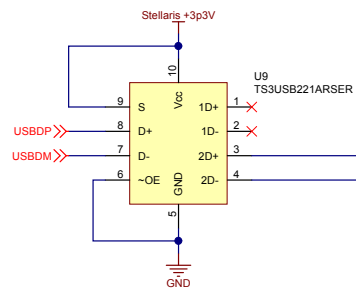
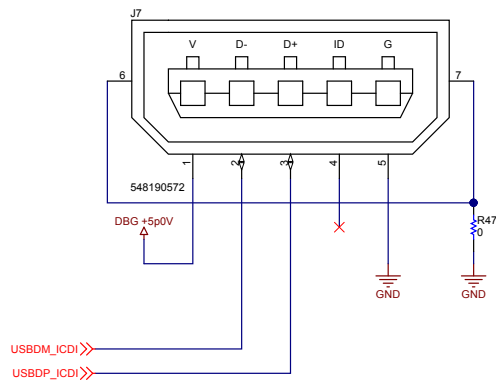
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Project: PWA.BENCH,	
EVALUATION BOARD,	
STELLARIS	
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Size: C	Schematic: 6569515
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Assembly Variant: [No Variations]	
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Contact: http://www.ti.com/support	





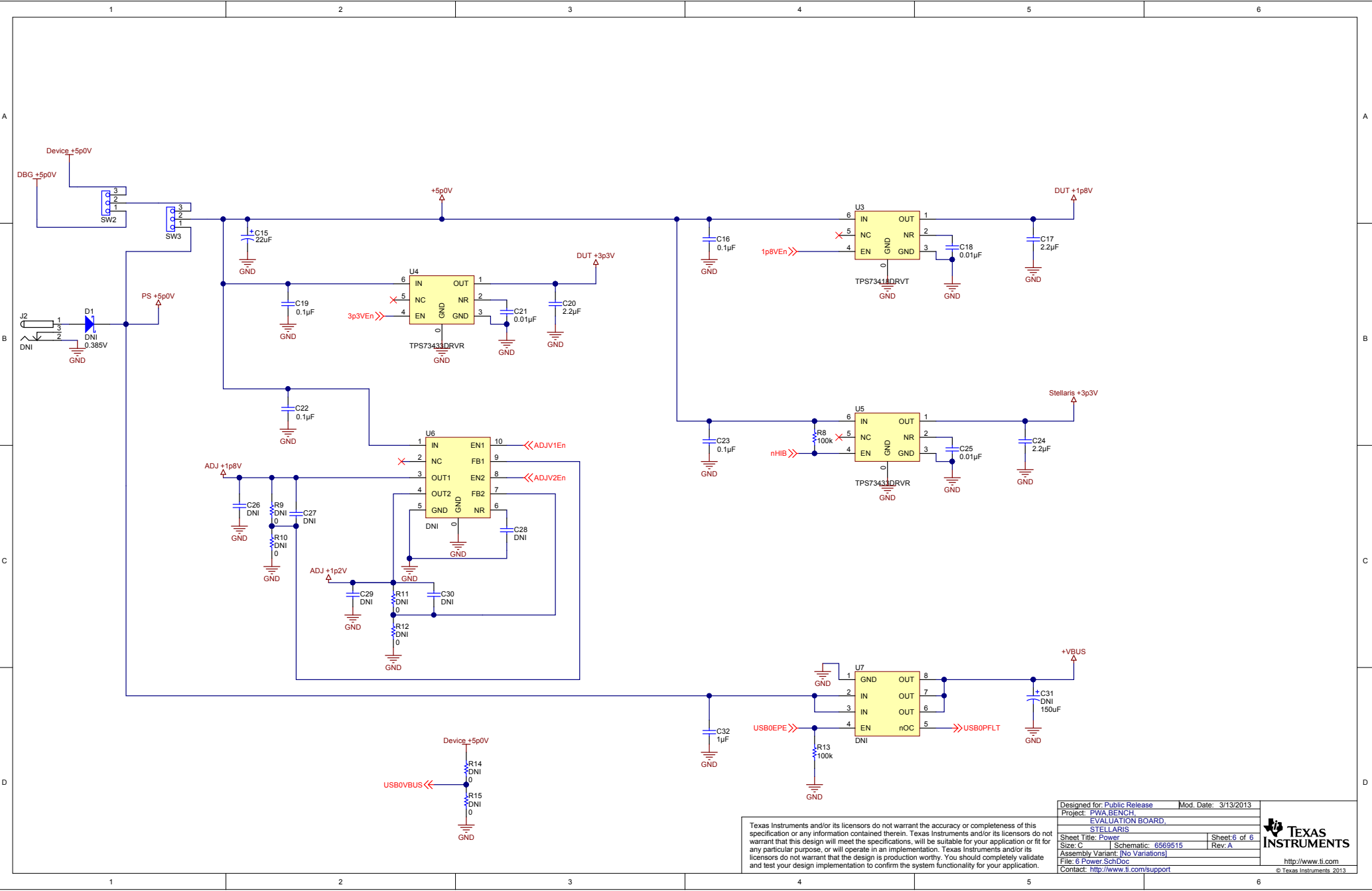
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Designed for: Public Release	Mod. Date: 3/13/2013
Project: PWA.BENCH,	
EVALUATION BOARD,	
STELLARIS	
Sheet Title: TSP Connections	Sheet: 3 of 6
Size: C	Schematic: 6569515
Assembly Variant: [No Variations]	Rev: A
File: 3 DUT_Signals.SchDoc	
Contact: http://www.ti.com/support	



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Designed for: Public Release	Mod. Date: 3/13/2013
Project: PWA BENCH,	
EVALUATION BOARD,	
STELLARIS	
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Contact: http://www.ti.com/support	



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Designed for: Public Release	Mod. Date: 3/13/2013
Project: PWA.BENCH,	
EVALUATION BOARD,	
STELLARIS	
Sheet Title: Power	Sheet: 6 of 6
Size: C	Schematic: 6569515
Assembly Variant: [No Variations]	Rev: A
File: 6 Power.SchDoc	
Contact: http://www.ti.com/support	



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Texas Instruments (TI) provides the enclosed Evaluation Board/Kit/Module (EVM) under the following conditions:

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REGULATORY COMPLIANCE INFORMATION

As noted in the EVM User's Guide and/or EVM itself, this EVM and/or accompanying hardware may or may not be subject to the Federal Communications Commission (FCC) and Industry Canada (IC) rules.

For EVMs **not** subject to the above rules, this evaluation board/kit/module is intended for use for ENGINEERING DEVELOPMENT, DEMONSTRATION OR EVALUATION PURPOSES ONLY and is not considered by TI to be a finished end product fit for general consumer use. It generates, uses, and can radiate radio frequency energy and has not been tested for compliance with the limits of computing devices pursuant to part 15 of FCC or ICES-003 rules, which are designed to provide reasonable protection against radio frequency interference. Operation of the equipment may cause interference with radio communications, in which case the user at his own expense will be required to take whatever measures may be required to correct this interference.

General Statement for EVMs including a radio

User Power/Frequency Use Obligations: This radio is intended for development/professional use only in legally allocated frequency and power limits. Any use of radio frequencies and/or power availability of this EVM and its development application(s) must comply with local laws governing radio spectrum allocation and power limits for this evaluation module. It is the user's sole responsibility to only operate this radio in legally acceptable frequency space and within legally mandated power limitations. Any exceptions to this are strictly prohibited and unauthorized by Texas Instruments unless user has obtained appropriate experimental/development licenses from local regulatory authorities, which is responsibility of user including its acceptable authorization.

For EVMs annotated as FCC – FEDERAL COMMUNICATIONS COMMISSION Part 15 Compliant

Caution

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

FCC Interference Statement for Class A EVM devices

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

FCC Interference Statement for Class B EVM devices

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

For EVMs annotated as IC – INDUSTRY CANADA Compliant

This Class A or B digital apparatus complies with Canadian ICES-003.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Concerning EVMs including radio transmitters

This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Concerning EVMs including detachable antennas

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication.

This radio transmitter has been approved by Industry Canada to operate with the antenna types listed in the user guide with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Cet appareil numérique de la classe A ou B est conforme à la norme NMB-003 du Canada.

Les changements ou les modifications pas expressément approuvés par la partie responsable de la conformité ont pu vider l'autorité de l'utilisateur pour actionner l'équipement.

Concernant les EVMs avec appareils radio

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Concernant les EVMs avec antennes détachables

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante.

Le présent émetteur radio a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés dans le manuel d'usage et ayant un gain admissible maximal et l'impédance requise pour chaque type d'antenne. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.

【Important Notice for Users of this Product in Japan】

This development kit is NOT certified as Confirming to Technical Regulations of Radio Law of Japan

If you use this product in Japan, you are required by Radio Law of Japan to follow the instructions below with respect to this product:

1. Use this product in a shielded room or any other test facility as defined in the notification #173 issued by Ministry of Internal Affairs and Communications on March 28, 2006, based on Sub-section 1.1 of Article 6 of the Ministry's Rule for Enforcement of Radio Law of Japan,
2. Use this product only after you obtained the license of Test Radio Station as provided in Radio Law of Japan with respect to this product, or
3. Use of this product only after you obtained the Technical Regulations Conformity Certification as provided in Radio Law of Japan with respect to this product. Also, please do not transfer this product, unless you give the same notice above to the transferee. Please note that if you could not follow the instructions above, you will be subject to penalties of Radio Law of Japan.

Texas Instruments Japan Limited
(address) 24-1, Nishi-Shinjuku 6 chome, Shinjuku-ku, Tokyo, Japan

<http://www.tij.co.jp>

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日本テキサス・インスツルメンツ株式会社

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Your Sole Responsibility and Risk. You acknowledge, represent and agree that:

1. You have unique knowledge concerning Federal, State and local regulatory requirements (including but not limited to Food and Drug Administration regulations, if applicable) which relate to your products and which relate to your use (and/or that of your employees, affiliates, contractors or designees) of the EVM for evaluation, testing and other purposes.
2. You have full and exclusive responsibility to assure the safety and compliance of your products with all such laws and other applicable regulatory requirements, and also to assure the safety of any activities to be conducted by you and/or your employees, affiliates, contractors or designees, using the EVM. Further, you are responsible to assure that any interfaces (electronic and/or mechanical) between the EVM and any human body are designed with suitable isolation and means to safely limit accessible leakage currents to minimize the risk of electrical shock hazard.
3. You will employ reasonable safeguards to ensure that your use of the EVM will not result in any property damage, injury or death, even if the EVM should fail to perform as described or expected.
4. You will take care of proper disposal and recycling of the EVM's electronic components and packing materials.

Certain Instructions. It is important to operate this EVM within TI's recommended specifications and environmental considerations per the user guidelines. Exceeding the specified EVM ratings (including but not limited to input and output voltage, current, power, and environmental ranges) may cause property damage, personal injury or death. If there are questions concerning these ratings please contact a TI field representative prior to connecting interface electronics including input power and intended loads. Any loads applied outside of the specified output range may result in unintended and/or inaccurate operation and/or possible permanent damage to the EVM and/or interface electronics. Please consult the EVM User's Guide prior to connecting any load to the EVM output. If there is uncertainty as to the load specification, please contact a TI field representative. During normal operation, some circuit components may have case temperatures greater than 60°C as long as the input and output are maintained at a normal ambient operating temperature. These components include but are not limited to linear regulators, switching transistors, pass transistors, and current sense resistors which can be identified using the EVM schematic located in the EVM User's Guide. When placing measurement probes near these devices during normal operation, please be aware that these devices may be very warm to the touch. As with all electronic evaluation tools, only qualified personnel knowledgeable in electronic measurement and diagnostics normally found in development environments should use these EVMs.

Agreement to Defend, Indemnify and Hold Harmless. You agree to defend, indemnify and hold TI, its licensors and their representatives harmless from and against any and all claims, damages, losses, expenses, costs and liabilities (collectively, "Claims") arising out of or in connection with any use of the EVM that is not in accordance with the terms of the agreement. This obligation shall apply whether Claims arise under law of tort or contract or any other legal theory, and even if the EVM fails to perform as described or expected.

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