EVM User's Guide: TPS26750AEVM

TPS26750A Evaluation Module

Description

The TPS26750AEVM evaluation module evaluates USB-PD for sink-only, source-only, or DRP use in both SPR and EPR operations. TPS26750AEVM can operate without power, as a source, sink, or DRP device with up to 48V at 5A (240W), supporting battery-charging applications per the USB-PD specification.

Get Started

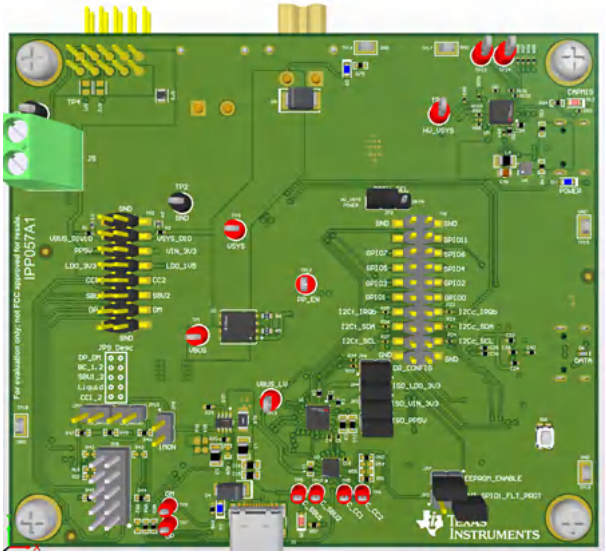
1. Order the TPS26750AEVM, a highly integrated USB Type-C® and USB PD controller evaluation module (EVM)
2. Read the TPS26750AEVM user's guide
3. Start development with the application customization tool
4. Refer to the datasheet, technical reference manual, and the E2E™ forums for questions and support

Features

- Up to 240W (48V/5A) source and sink applications
- Easy-to-use GUI with pre-configured firmware to configure voltage ranges, charging protocols, and all aspects of the attached TPS26750A USB-PD controller
- Multiple test points and headers for quick and easy debug signals such as VBUS, CCx, and ADCINx lines

Applications

- Battery pack for cordless power tool
- Power bank
- Retail automation and payment
- Wireless speakers
- Cordless vacuum cleaner
- Personal or portable electronics
- Medical and healthcare



TPS26750AEVM

1 Evaluation Module Overview

1.1 Introduction

The TPS26750AEVM is a full-featured evaluation module used to evaluate the TPS26750A USB-PD controller. This board contains everything necessary to evaluate USB-PD applications capable of EPR in either a source, sink, or dual-role power (DPR) application. A pre-flashed embedded microcontroller is included on the board that allows for easy communication and programming of the EEPROM attached to the TPS26750A device, eliminating the need for an external programmer or debugger. A full-fledged GUI is provided to interact with the device and includes functions such as initial configuration, exporting programming and patch artifacts, and reading diagnostic or fault information from the TPS26750A device on-the-fly.

1.2 Kit Contents

- TPS26750AEVM evaluation module
- Interposer board to allow for power connection with the BQ25756EVM
- Ribbon cable to allow for signal connection with the BQ25756EVM
- EVM disclaimer read me

1.3 Specification

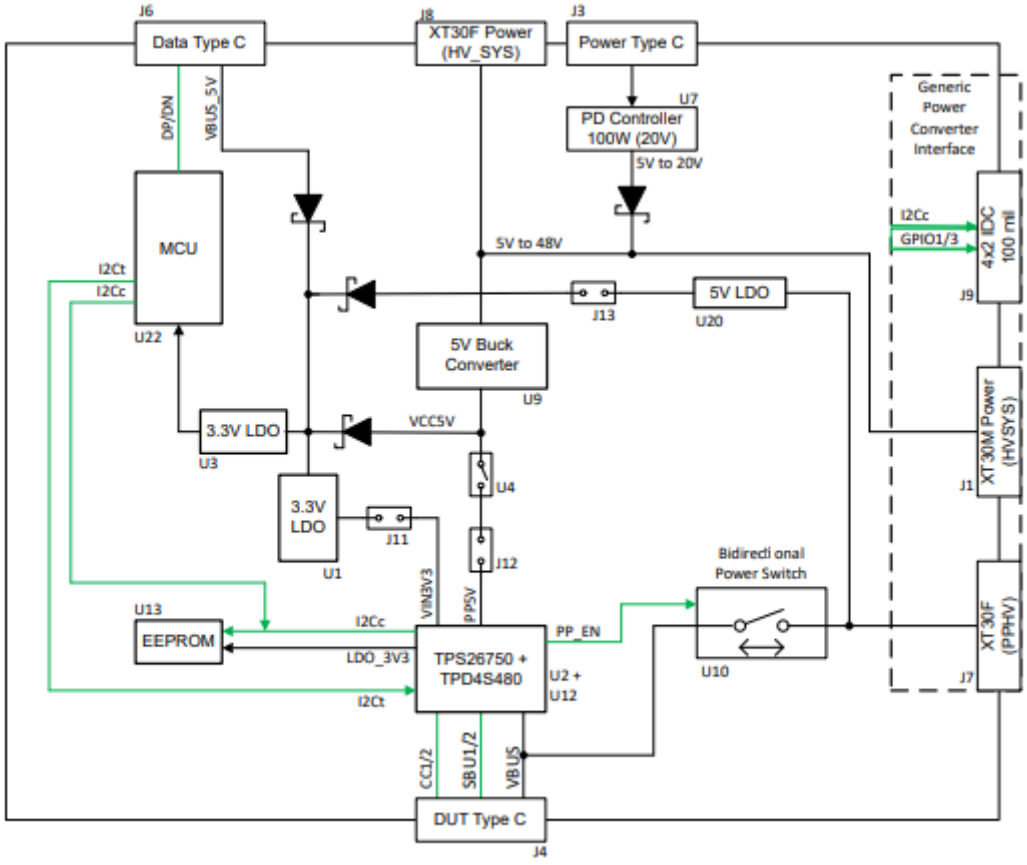


Figure 1-1. TPS26750AEVM Block Diagram

1.4 Device Information

The TPS26750A device is a single-port USB controller capable of extended power range (EPR) with a wide range of applications and features, including the ability to sink, source, and act as a DRP device up to 240W. Through an online configuration tool, the device can be customized to support a variety of both I2C and GPIO events. The device is meant to be a full-featured solution that has the ability to run a full USB-PD stack with no custom firmware development required by the user.

The TPS26750AEVM evaluation module includes several devices for complete evaluation of voltage protection, power topology, and current sensing. An additional TPS26750A PD controller for barrel-jack replacement can power the device without the immediate need for a bench power supply. For more details on each of the devices on the TPS26750AEVM evaluation module, see Table 1-1.

The TPS26750AEVM PD controller is configurable through the web-based GUI for application specific requirements, architectures, and power roles and data roles. The GUI tool offers an additional firmware configuration to integrate control for select battery charger products which is optional.

Table 1-1. Devices on TPS26750AEVM

Designator	Device Name	Description
U1	TPS26750ASRSMR	USB Type-C® EPR dual role power PD controller
U2	TPD4S201	20V port protection with short to VBUS protection
U5	TPS25730A	USB Type-C® sink-only PD controller, DC barrel jack replacement

2 Hardware

2.1 Power Requirements

For a standalone PD evaluation, the main power supply for the TPS26750AEVM evaluation module is through the USB Type-C® sink-only port (J7), which accepts a 45W USB Type-C PD source (15V to 20V). If the USB Type-C® adapter is not capable of a minimum of 15V, then the TPS26750AEVM evaluation module does not power on properly. Alternatively, the EVM can also be powered on from an external bench supply connected to the VSYS screw terminal (J5), with the bench supply providing a voltage range of 15V-48V. The TPS26750AEVM evaluation module can also be powered directly through a USB Type-C® connector (J1) to simulate the TPS26750A device in a dead battery scenario. When the TPS26750AEVM evaluation module is powered only through port J1, the EVM acts as sink only (unable to source unless the VSYS screw terminal is powered on). For a battery charging application, the TPS26750AEVM pairs with a select battery charger EVM to simulate a battery charging system. Specifically, the BQ25756EVM evaluation module is the EVM that is compatible with the extended power range (EPR) and can source or sink up to 48V at 5A (240W). A special interposer board and ribbon cable are provided to allow the BQ25756EVM and TPS26750AEVM to seamlessly connect and communicate with each other.

2.2 Setup

Out of the box, the TPS26750AEVM evaluation module is configured for a default configuration of 15W (5V/3A) source and 100W (20V/5A) sink power. When different configurations are required, use the application customization tool to create a configuration or load a different configuration template. Refer to the GUI user guide for detailed instructions on using the application customization tool.

To use the device in a standalone operation, connect either of the following:

- A USB-PD power supply with a minimum wattage capability of 45W to J7
- An external power supply of up to 48V to the VSYS screw terminal (J5)

The device can also act in dead battery mode by connecting a USB Type-C® cable to J1.

To connect the BQ25756EVM evaluation module to the device, the interposer board provided must be connected in between the TPS26750AEVM and BQ25756EVM evaluation modules. An example of how to connect the two boards together can be seen in Figure 2-1.

Follow the instructions to connect the two boards:

1. Unscrew the terminal screws on J1 and J3 of the BQ25756EVM evaluation module.
2. Insert the interposer board taking care to fully insert the leads before screwing down the terminals.
3. Line up the interposer board with the TPS26750AEVM evaluation module.
4. Push the contacts into place until the contacts make a secure connection.

Note

The boards are on slightly different vertical planes.

5. Attach one side of the provided ribbon cable to J8 of the BQ25756EVM evaluation module.
6. Attach the other side of the provided ribbon cable to J3 of the TPS26750AEVM evaluation module.

Note

Pins 1 and 2 of the J3 connection point on the TPS26750AEVM evaluation module (the pins closest to the drill hole of the board) are not connected to the ribbon cable.

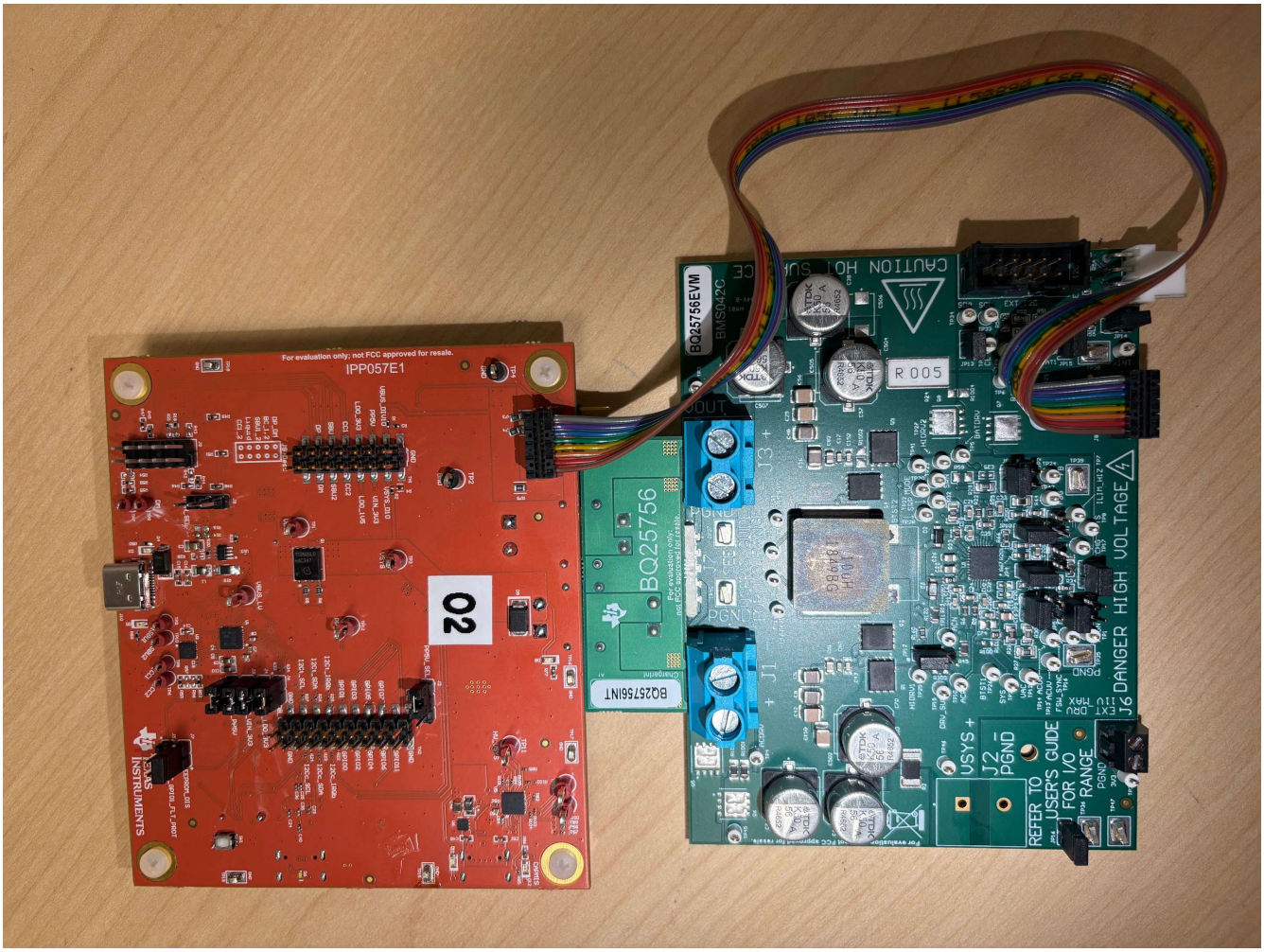


Figure 2-1. BQ25756EVM and TPS26750AEVM Connected

Note

The figure uses a different revision of the TPS26750AEVM evaluation module, with slightly different net names; however, the electrical connections are identical.

2.3 Jumper Information

The jumper information is clearly marked on the board with functional descriptions. A table of all of the configuration jumpers, as well as a descriptions, can be found in Table 2-1.

Table 2-1. Jumper Information

Jumper Designator	Pin Description
JP1	Isolation for PP5V. Allows for current measurement.
JP2	Selects where PP5V is sourced from, either: • The high voltage node from the battery charger • The USB Type-C® connector or the 5V rail of the MCU
JP3	Isolation for VIN_3V3. Allows for current measurement.
JP4	Isolation for LDO_3V3. Allows for current measurement.
JP5	Connects the /FLT output of the TPD4S201RUKR to GPIO1 to allow for event mapping of a fault input.

Table 2-1. Jumper Information (continued)

Jumper Designator	Pin Description
JP6	Configures dead battery mode of the PD controller. Keep jumper on for SafeMode Remove jumper for AlwaysEnableSink.
JP7	I2Cc data line between the PD controller and EEPROM. Remove jumper to disable I2C configuration load from EEPROM (PD remains in PTCH).
JP8	Used for current monitoring input of the TPS26750A device.
JP9	Select which pins to use for liquid detection (CCx or SBUx).
JP10	LD1 resistor divider is connected to GPIO0 for ADC measurement.
JP11	LD2 resistor divider is connected to GPIO2 for ADC measurement.

2.4 LED Information

Table 2-2. LED Information

Designator	Description
D3	Blue LED that shows when the USB Type-C® is connected to the TPS26750A Type-C port (J1).
D5	Red LED that shows when a fault is asserted by the TPD4S480RUKR protection device sitting in front of the main USB Type-C® port (J1).
D6	White LED that shows when the USB Type-C® is connected to the data Type-C port (J4).
D9	Blue LED that shows when power is provided from the BQ device using the XT30 connector (J6).
D11	Blue LED that shows when the USB Type-C® is connected to the barrel jack replacement port (J7).
D12	Red LED that shows a capability mismatch when an attached source is not providing enough power to the sink, but only to the Type-C port.

2.5 Test Points

Table 2-3. Test Point Information

Net Label	Description
TP1	PD controller VBUS voltage reference.
TP2	Ground reference for EVM, this GND is placed close to VBUS.
TP3	PD controller VSYS voltage reference (updated terminology from previous PPHV label to match the S variant).
TP4	Ground reference for EVM placed close to VSYS.
TP5	Connector side of the CC1 of PD controller, located between the TPD4S480RUKR device and the USB-C or USB PD port.
TP6	Connector side of the CC2 of PD controller, located between the TPD4S480RUKR device and the USB-C or USB PD port.
TP7	Connector side of the DP of PD controller, located between the TPD4S480RUKR device and the USB-C or USB PD port.
TP8	Connector side of the DM of PD controller, located between the TPD4S480RUKR device and the USB-C or USB PD port.
TP9	Connector side of the SBU1 of PD controller, located between the TPD4S480RUKR device and the USB-C or USB PD port.
TP10	Connector side of the SBU2 of PD controller, located between the TPD4S480RUKR device and the USB-C or USB PD port.
TP11	System voltage connection that from the BQ device that feeds the DC-DC converter to distribute to lower voltage rails.
TP12	Connected to power path enable input of eFuse that controls high voltage power path on VBUS

Table 2-3. Test Point Information (continued)

Net Label	Description
TP13	Connected to the TPD4S480RUKR device, which is used for lower voltage monitoring.
TP14	Connected to the NFET gate of the main power path to enable for VBUS.
TP15 through TP19	Ground references.
TP20 to TP21	Test points for the sense resistor used for low-side current sensing.
TP22	Power good signal of the LM76005 DC-DC.
TP23 and TP24	I2Ct_SCL and I2Ct_SDA lines (respectively) of the TPS26750A device.

2.6 Switches and Push Buttons

Table 2-4. Switch and Push Button Information

Designator	Description
S1	Push-button to assert the RST signal of the PICO microcontroller. When pressed, the RST pin goes low.

3 Software

3.1 Software Description

The required software is available at the TI Gallery, and is run from the web browser, provided that the web browser used is Google Chrome®, Firefox®®, or Safari ®®. The TI Cloud Agent must also be installed as a browser extension on the PC if use of this software is desired. When the application is launched, instructions appear for installing the TI Cloud Agent. The software can also be run natively on the PC. If running the software natively on the PC is desired, then the GUI Composer Runtime must be installed natively. To install the GUI Composer Runtime, click on the downward-facing arrow inside one of the applications listed in the TI Gallery, and look toward the bottom set of links that appear. After selecting the native operating system, open the installer and follow the prompts to install the program. For more information on how to install and utilize the GUI with the TPS26750AEVM evaluation module, see the GUI user guide.

4 Hardware Design Files

4.1 Schematics

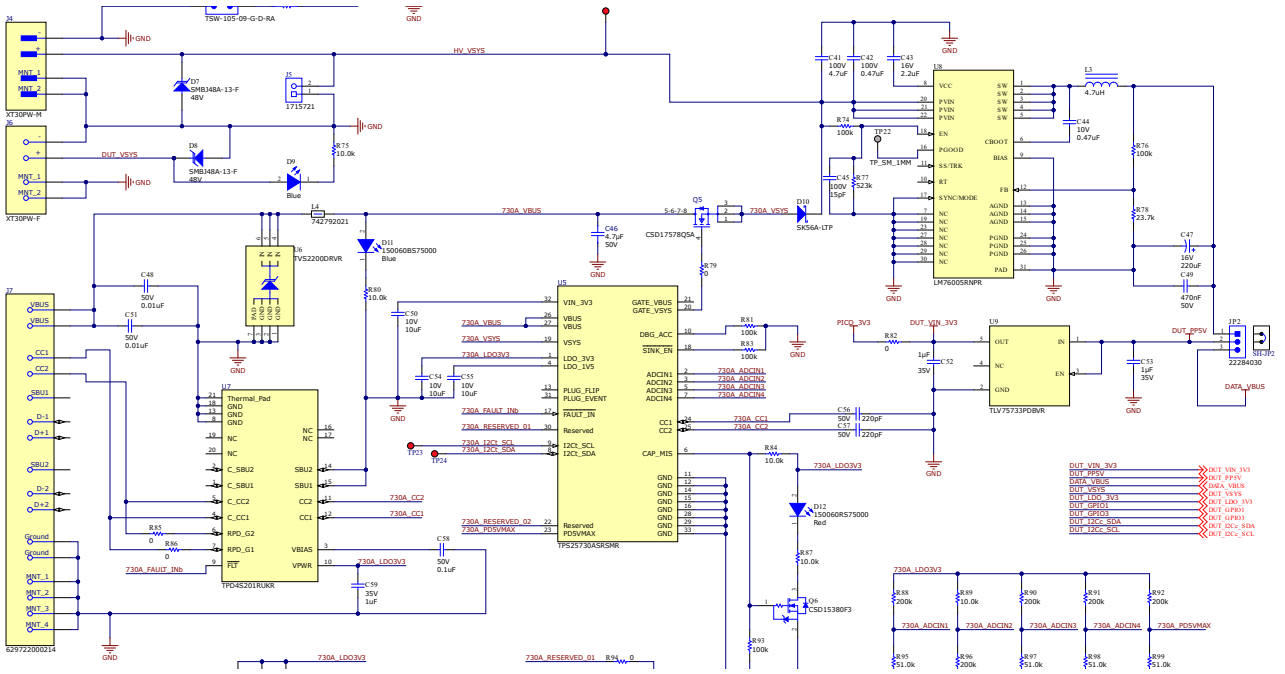


Figure 4-1. Power Path Schematic

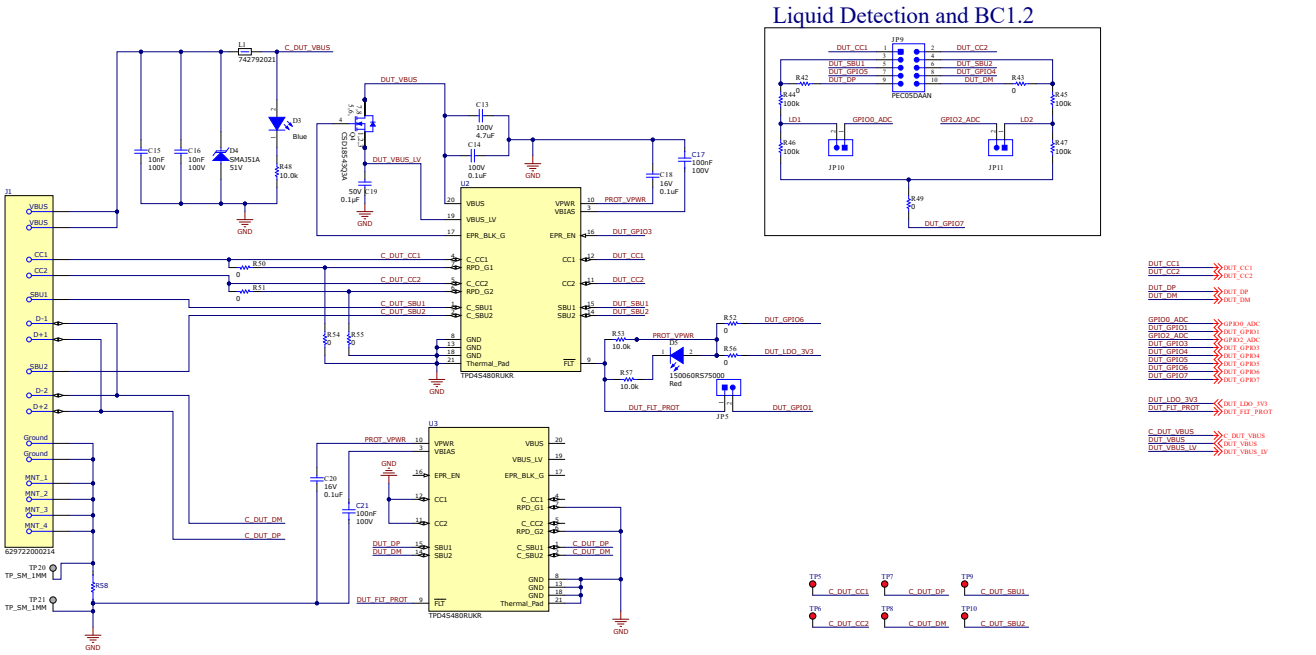


Figure 4-2. Protection Schematic

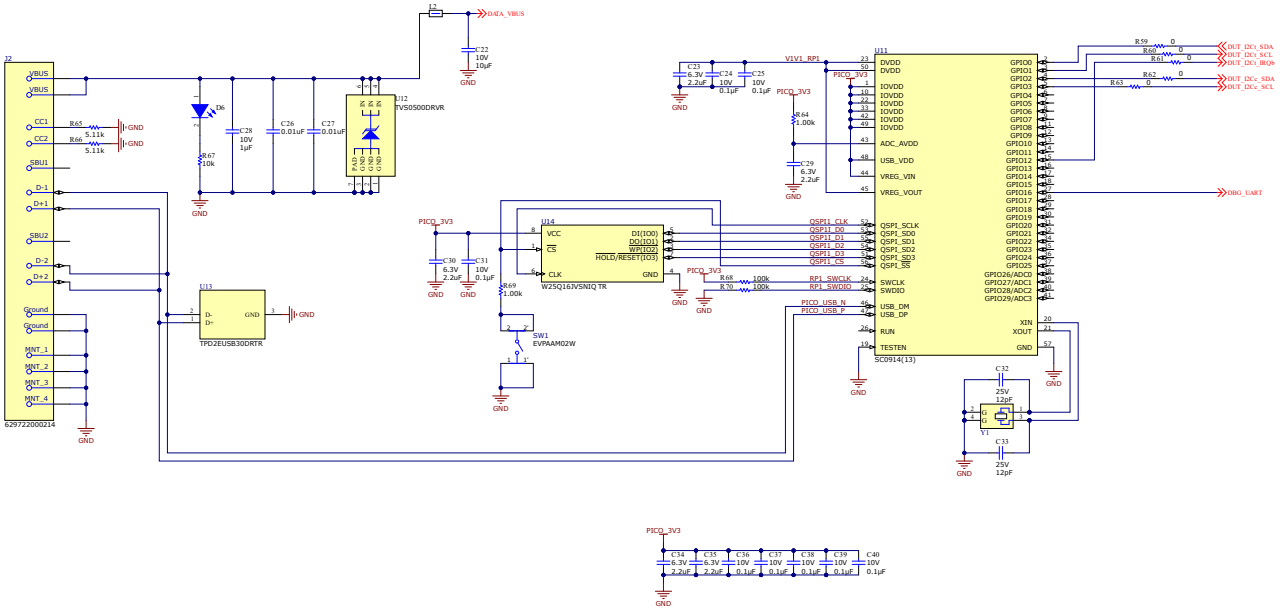


Figure 4-3. MCU Schematic

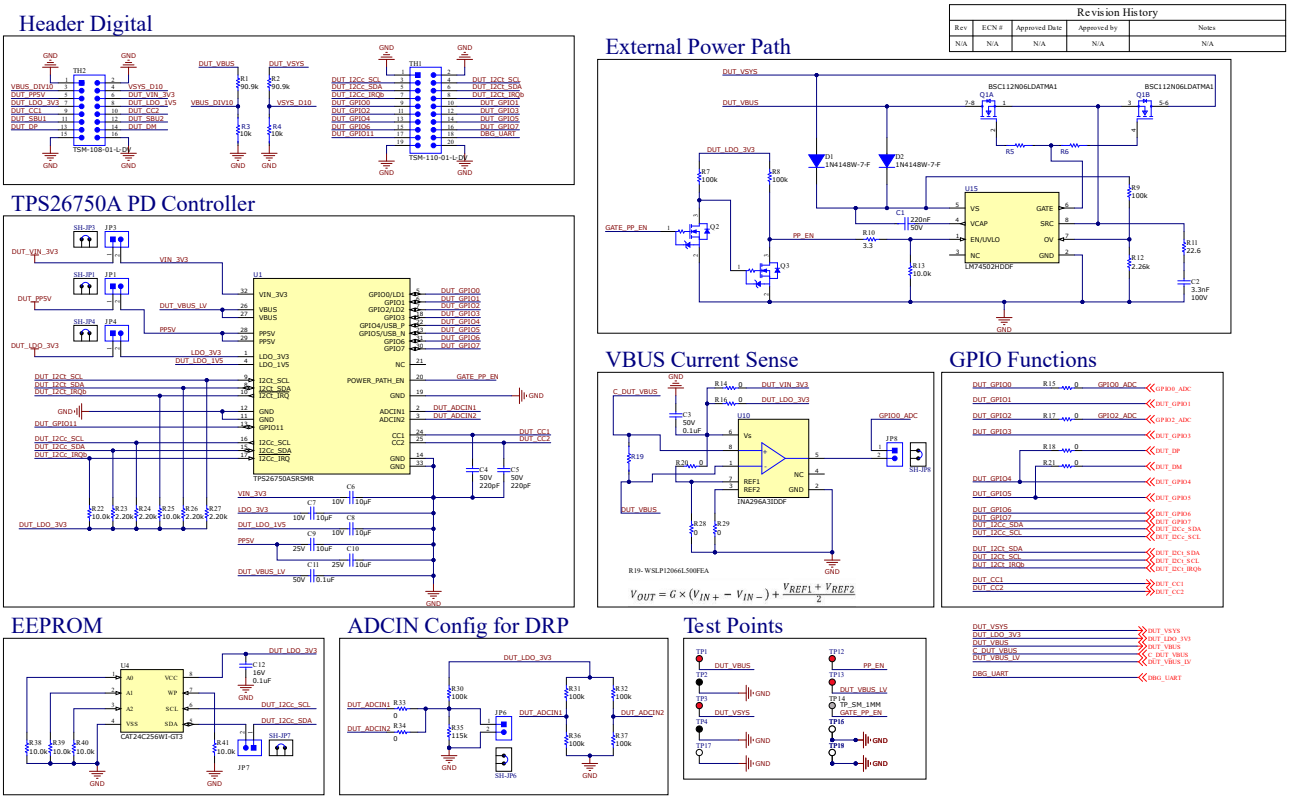


Figure 4-4. USB-PD Schematic

4.2 PCB Layouts

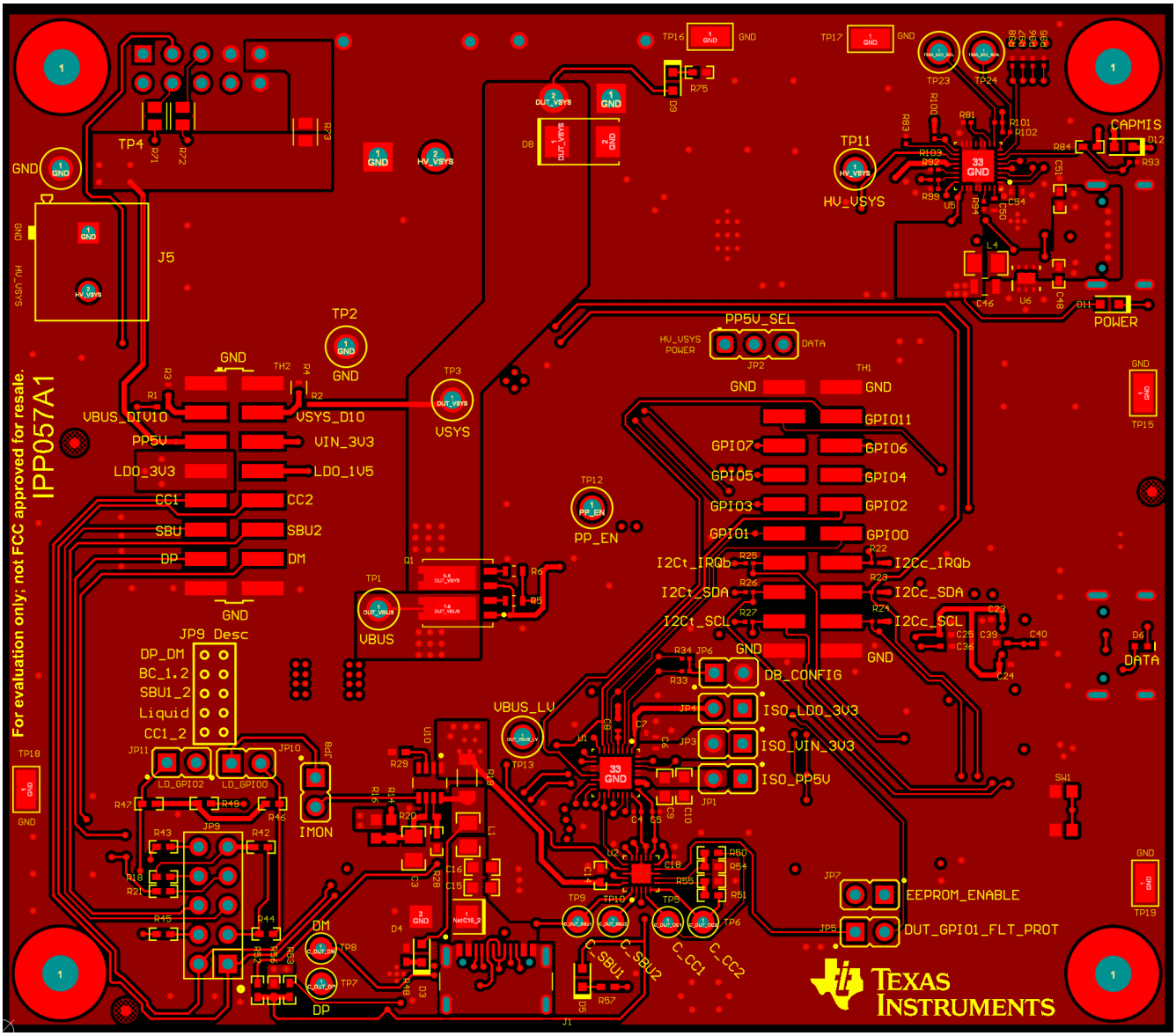


Figure 4-5. Top Layer

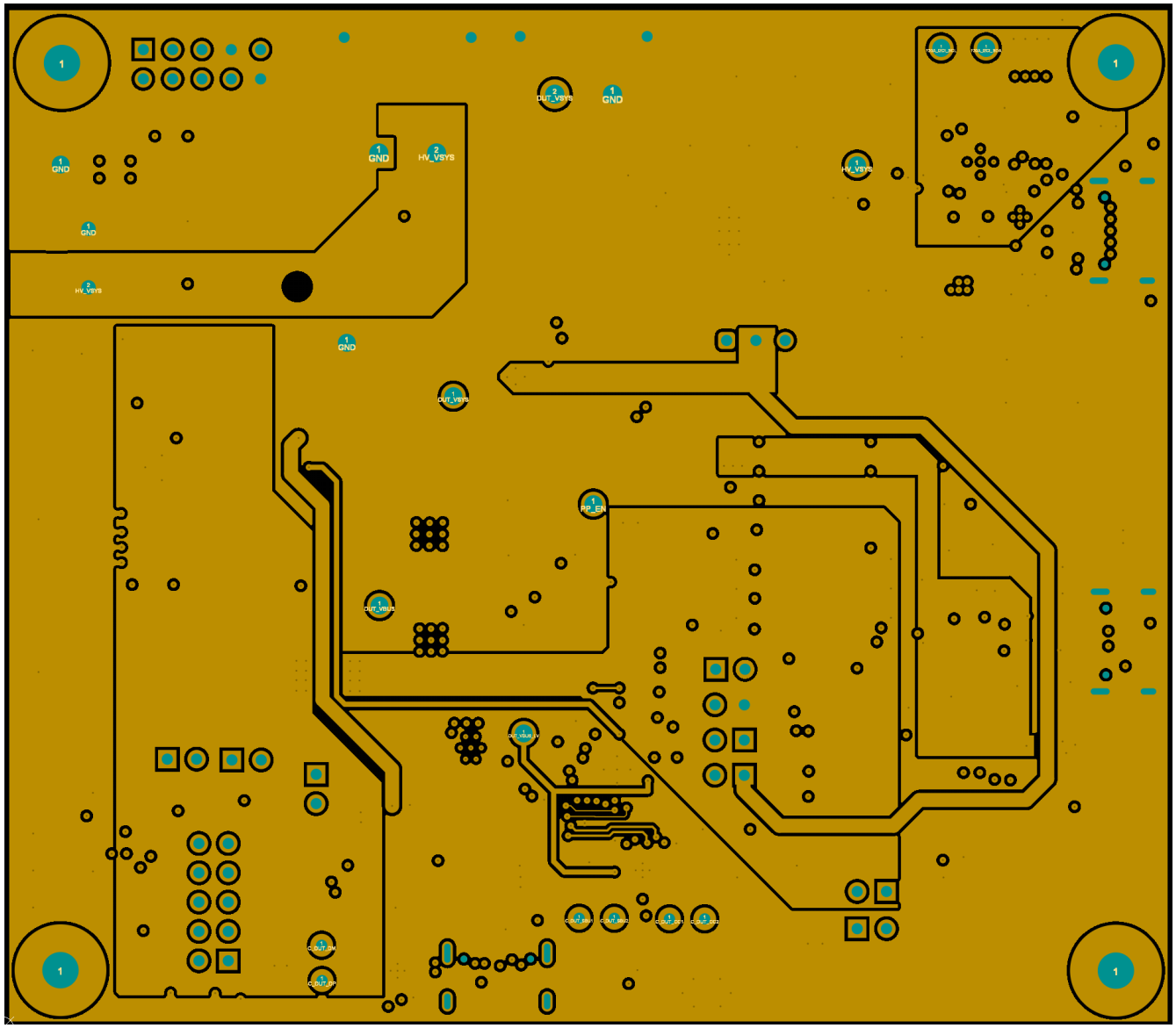


Figure 4-6. Power Layer

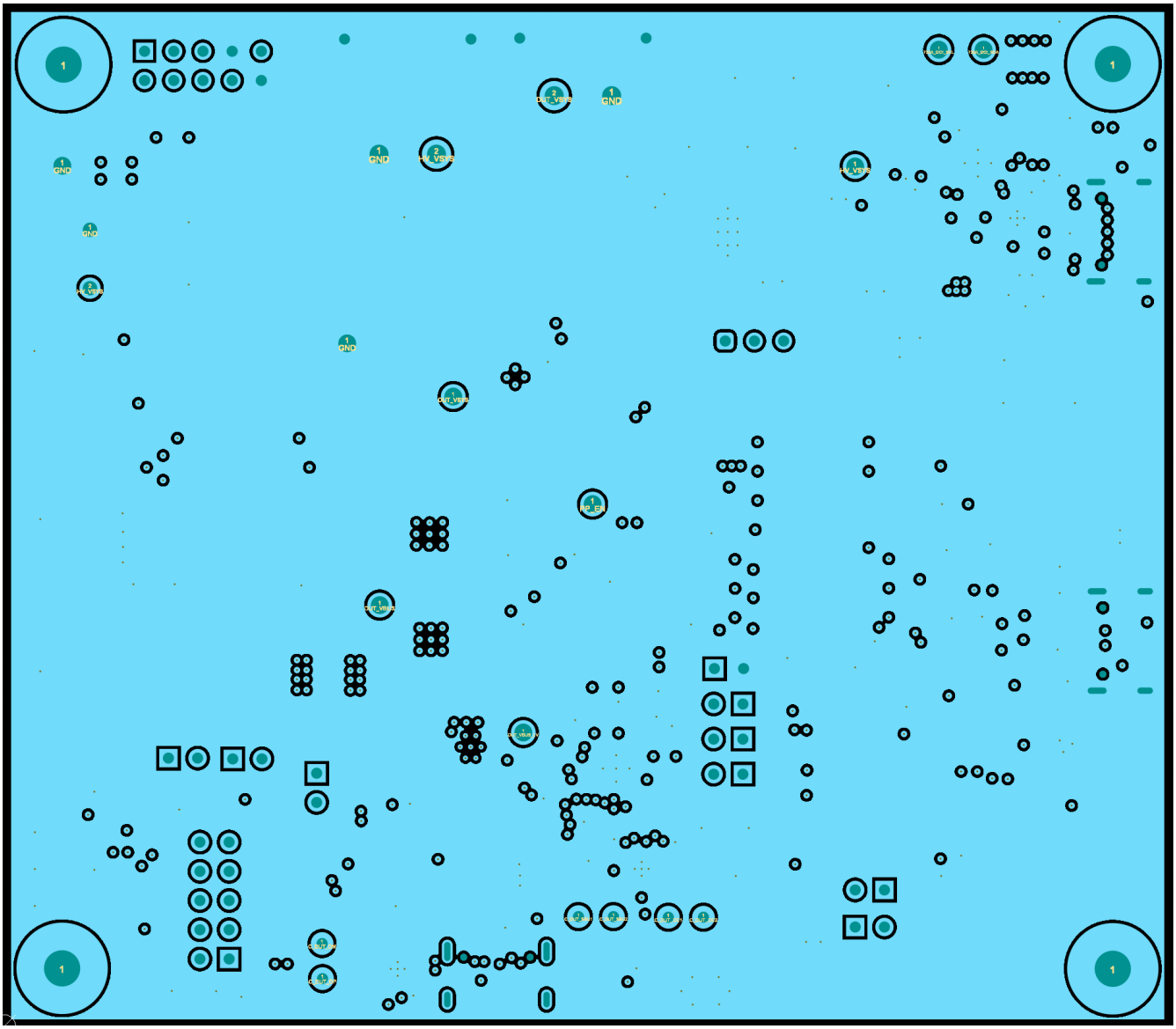


Figure 4-7. Ground Layer

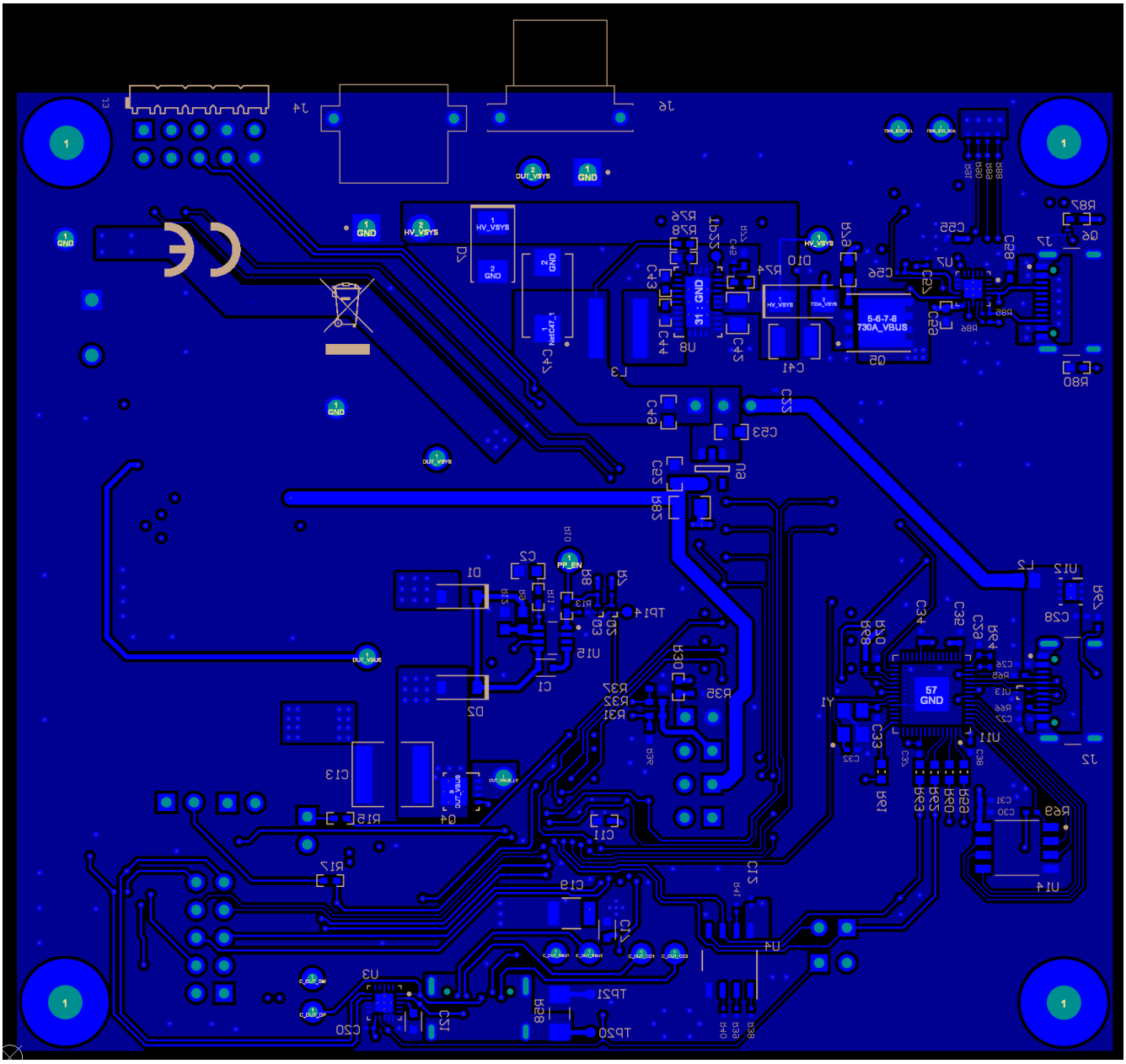


Figure 4-8. Bottom Layer

4.3 Bill of Materials (BOM)

Table 4-1. TPS26750AEVM Bill of Materials

Designator	Description	PartNumber	Manufacturer
C1	Cap Ceramic 0.22µF 50V X7R 10% Pad SMD 0603 Soft Termination +125°C Automotive T/R	GCJ188R71H224KA01D	Murata
C2	CAP, CERM, 3300pF, 100V, ±10%, X7R, AEC-Q200 Grade 1, 0603	GCM188R72A332KA37D	MuRata
C3	CAP, CERM, 0.1µF, 50V, ±20%, X5R, 0805	C2012X5R1H104M085AA	TDK
C4, C5, C56, C57	CAP, CERM, 220pF, 50V, ±10%, X7R, AEC-Q200 Grade 1, 0201	CGA1A2X7R1H221K030BA	TDK
C6, C7, C8	CAP, CERM, 10µF, 10V, ±20%, X5R, 0402	CC0402MRX5R6BB106	Yageo
C9, C10	CAP, CERM, 10µF, 25V, ±20%, X5R, 0603	GRM188R61E106MA73D	MuRata
C11, C58	CAP, CERM, 0.1µF, 50V, ±10%, X5R, 0402	C1005X5R1H104K050BB	TDK
C12, C18, C20	CAP, CERM, 0.1µF, 16V, ±10%, X5R, 0201	GRM033C71C104KE14D	MuRata
C13	CAP, CERM, 4.7µF, 100V, ±20%, X7R, 2220	C5750X7R2A475M230KA	TDK
C14	CAP, CERM, 0.1 uF, 100 V, ±10%, X5R, 0402	GRM155R62A104KE14D	MuRata
C15, C16	CAP, CERM, 0.01µF, 100V, ±10%, X7R, 0603	C0603X103K1RACTU	Kemet
C17, C21	Cap Ceramic 100nF 100V X7R 10% SMD 0603 125°C Paper T/R	06031C104K4T2A	KYOCERA AVX
C19	CAP, CERM, 0.1µF, 50V, ±5%, C0G/NP0, 1210	C3225C0G1H104J250AA	TDK
C22	CAP, CERM, 10µF, 10V, ±20%, X5R, 0402	0402ZD106MAT2A	AVX
C23, C29, C30, C34, C35	CAP, CERM, 2.2µF, 6.3V, ±20%, X5R, 0402	JMK105BJ225MV-F	Taiyo Yuden
C24, C25, C31, C36, C37, C38, C39, C40	CAP, CERM, 0.1µF, 10V, +/-10%, X7R, AEC-Q200 Grade 1, 0402	C0402C104K8RACAUTO	Kemet
C26, C27, C48, C51	CAP, CERM, 0.01µF, 50V, ±5%, X7R, 0402	C0402C103J5RACTU	Kemet
C28	CAP, CERM, 1µF, 10V, ±20%, X5R, 0402	CC0402MRX5R6BB105	Yageo America
C32, C33	CAP, CERM, 12pF, 25V, ±5%, C0G/NP0, 0402	GRM1555C1E120JA01D	MuRata
C41	CAP, CERM, 4.7µF, 100V, ±10%, X7S, 1210	C3225X7S2A475K200AE	TDK
C42	CAP, CERM, 0.47µF, 100V, ±10%, X7S, 0805	C2012X7S2A474K125AB	TDK
C43	CAP, CERM, 2.2µF, 16V, ±10%, X6S, 0402	C1005X6S1C225K050BC	TDK
C44	CAP, CERM, 0.47µF, 10V, ±10%, X5R, 0402	GRM155R61A474KE15D	MuRata
C45	CAP, CERM, 15pF, 100V, ±5%, C0G/NP0, 0201	GRM0335C2A150JA01D	MuRata
C46	Chip Multilayer Ceramic Capacitors for General Purpose, 0805, 4.7µF, X7R, 15%, 10%, 50V	GRM21BZ71H475KE15L	Murata
C47	CAP, TA, 220µF, 16V, ±20%, 0.1Ω, SMD	TPSE227M016R0100	AVX
C49	CAP, CERM, 0.47µF, 50V, ±10%, X7R, 0603	C1608X7R1H474K080AC	TDK
C50, C54, C55	CAP, CERM, 10µF, 10V, ±20%, X5R, 0402	CL05A106MP5NUNC	Samsung Electro-Mechanics
C52, C53	CAP, CERM, 1µF, 35V, ±10%, X7R, AEC-Q200 Grade 1, 0603	CGA3E1X7R1V105K080AC	TDK
C59	CAP, CERM, 1µF, 35V, ±10%, X5R, 0402	GRM155R6YA105KE11D	MuRata
D1, D2	Diode, Ultrafast, 100V, 0.15A, SOD-123	1N4148W-7-F	Diodes Inc.

Table 4-1. TPS26750AEVM Bill of Materials (continued)

Designator	Description	PartNumber	Manufacturer
D3, D9, D11	LED, Blue, SMD	150060BS75000	Wurth Elektronik
D4	Diode, TVS, Uni, 51V, 82.4Vc, 400W, 4.9A, SMA	SMAJ51A	Littelfuse
D5, D12	LED, Red, SMD	150060RS75000	Wurth Elektronik
D6	LED, White, SMD	LW QH8G-Q2S2-3K5L-1	OSRAM
D7, D8	Diode, TVS, Uni, 48V, 77.4Vc, SMB	SMBJ48A-13-F	Diodes Inc.
D10	Diode, Schottky, 60V, 5A, SMA	SK56A-LTP	Micro Commercial Components
H1, H2, H3, H4	Machine Screw, Round, #4-40 x 1/4, Nylon, Philips panhead	NY PMS 440 0025 PH	B&F Fastener Supply
H5, H6, H7, H8	Standoff, Hex, 0.5"L #4-40 Nylon	1902C	Keystone
J1, J2, J7	Connector USB 2.0 Type C Horizontal SMT	6.29722E+11	Wurth Electronics
J3	Header, 2.54mm, 5x2, Gold, R/A, TH	TSW-105-09-G-D-RA	Samtec
J4	Socket, DC supply, XT30, male, PIN: 2, on PCBs, THT, yellow, 15A, 500V	XT30PW-M	Amass
J5	Terminal Block, 5.08mm, 2x1, TH	1715721	Phoenix Contact
J6	Socket, DC supply, XT30, female, PIN: 2, on PCBs, THT, yellow, 15A	XT30PW-F	Amass
JP1, JP3, JP4, JP5, JP6, JP7, JP8, JP10, JP11	Header, 100mil, 2x1, Gold, TH	PBC02SAAN	Sullins Connector Solutions
JP2	Header, 2.54mm, 3x1, Tin, TH	22284030	Molex
JP9	Header, 100mil, 5x2, Tin, TH	PEC05DAAN	Sullins Connector Solutions
L1, L2, L4	Ferrite Bead, 22Ω at 100MHz, 6A, 0805	742792021	Wurth Elektronik
L3	Inductor, Shielded, Composite, 4.7µH, 10.5A, 0.0144Ω, AEC-Q200 Grade 1, SMD	XAL6060-472MEB	Coilcraft
Q1	MOSFET Array 2 N-Channel (Dual) 60V 20A (Tc) 65W (Tc) Surface Mount PG-TDSON-8-4	BSC112N06LDATMA1	Infineon
Q2, Q3	MOSFET, N-CH, 30V, 3A, YJJ0003A (PICOSTAR-3)	CSD17484F4T	Texas Instruments
Q4	MOSFET, N-CH, 60V, 35A, DNH0008A (VSONP-8)	CSD18543Q3A	Texas Instruments
Q5	MOSFET N-Channel 30V 25A (Ta) 3.1W (Ta), 42W (Tc) Surface Mount 8-VSONP (5x6)	CSD17578Q5A	Texas Instruments
Q6	MOSFET, N-CH, 20V, 0.5A, YJM0003A (PICOSTAR-3)	CSD15380F3	Texas Instruments
R1, R2	RES, 90.9k, 1%, 0.063W, AEC-Q200 Grade 0, 0402	CRCW040290K9FKED	Vishay-Dale
R3, R4	10kΩ ±1% 0.063W, 1/16W Chip Resistor 0402 (1005 Metric) Thick Film	CRCW040210K0FKEDC	Vishay
R5, R6	CRCW Series 0603 0.1W 0Ω Jumper Surface Mount Thick Film Chip Resistor	CRCW06030000Z0EAC	Vishay
R7, R8	RES, 100k, 1%, 0.05W, 0201	RC0201FR-07100KL	Yageo America
R9	RES, 100k, 0.5%, 0.1W, 0603	RT0603DRE07100KL	Yageo America
R10	RES, 3.3, 5%, 0.063 W, AEC-Q200 Grade 0, 0402	CRCW04023R30JNED	Vishay-Dale
R11	RES, 22.6, 1%, 0.063W, AEC-Q200 Grade 0, 0402	CRCW040222R6FKED	Vishay-Dale
R12	RES, 2.26k, 1%, 0.1W, 0603	M55342K12B2E26T	TT Electronics/IRC

Table 4-1. TPS26750AEVM Bill of Materials (continued)

Designator	Description	PartNumber	Manufacturer
R15, R17, R20, R29, R49, R50, R51, R56	RES, 0, 5%, 0.063W, AEC-Q200 Grade 0, 0402	CRCW04020000Z0ED	Vishay-Dale
R19	12mΩ ±1% 0.5W, 1/2W Chip Resistor 1206 (3216 Metric) Current Sense Thick Film	RL1206FR-7W0R012L	YAGEO
R22, R25, R38, R39, R40, R41	RES, 10.0k, 1%, 0.05W, 0201	CRCW020110K0FKED	Vishay-Dale
R23, R24, R26, R27, R101, R102	RES, 2.20k, 1%, 0.05W, 0201	CRCW02012K20FKED	Vishay-Dale
R30	RES, 100k, 1%, 0.1W, 0402	ERJ-2RKF1003X	Panasonic
R33, R34, R85, R86, R94, R103	RES, 0, 5%, 0.05W, 0201	CRCW02010000Z0ED	Vishay-Dale
R35	RES, 115k, 1%, 0.063W, 0402	RC0402FR-07115KL	Yageo America
R44, R45, R46, R47	RES, 100k, 1%, 0.063W, 0402	RC1005F104CS	Samsung Electro-Mechanics
R48, R75, R80, R84, R87	RES, 10.0k, 1%, 0.063W, AEC-Q200 Grade 0, 0402	CRCW040210K0FKED	Vishay-Dale
R53, R57	RES, 10.0k, 1%, 0625W, 0402	RT0402BRD0710KL	Yageo America
R58	6.5mΩ ±1% 1W Chip Resistor 1206 (3216 Metric) Anti-Sulfur, Automotive AEC-Q200, Current Sense, Moisture Resistant, Pulse Withstanding Metal Element	WSLP12066L500FEA	Vishay
R59, R60, R61, R62, R63	RES, 0, 5%, 0.1W, AEC-Q200 Grade 0, 0603	CRCW06030000Z0EA	Vishay-Dale
R64, R69	RES, 1.00k, 1%, 0.0625W, 0402	RC0402FR-071KL	Yageo America
R65	RES, 5.11k, 1%, 0.063W, AEC-Q200 Grade 0, 0402	CRCW04025K11FKED	Vishay-Dale
R68, R70	RES, 100k, 1%, 0.0625W, 0402	RC0402FR-07100KL	Yageo America
R73	0Ω Jumper Chip Resistor 0805 (2012 Metric) Metal Element	WSL080500000ZEA9	Vishay
R74, R76	RES, 100k, 1%, 0.063W, AEC-Q200 Grade 0, 0402	CRCW0402100KFKED	Vishay-Dale
R77	RES, 523k, 1%, 0.063W, AEC-Q200 Grade 0, 0402	CRCW0402523KFKED	Vishay-Dale
R78	RES, 23.7k, 1%, 0.1W, AEC-Q200 Grade 0, 0402	ERJ-2RKF2372X	Panasonic
R79	RES, 0, 5%, 0.1W, AEC-Q200 Grade 0, 0603	ERJ-3GEY0R00V	Panasonic
R81, R83, R93	RES, 100k, 1%, 0.05W, 0201	RC0201FS-7D100KL	Yageo America
R82	RES, 0, 5%, 0.125W, AEC-Q200 Grade 0, 0805	ERJ-6GEY0R00V	Panasonic
R88, R90, R91, R96	RES, 200k, 1%, 0.05W, 0201	CRCW0201200KFKED	Vishay-Dale
R89, R100	RES, 10.0k, 1%, 0.05W, 0201	RC0201FR-0710KL	Yageo America
R95, R97, R98, R99	RES, 51.0k, 1%, 0.05W, 0201	RC0201FR-0751KL	Yageo America
SH-JP1, SH-JP2, SH-JP3, SH-JP4, SH-JP6, SH-JP7, SH-JP8	Shunt, 100mil, Flash Gold, Black	SPC02SYAN	Sullins Connector Solutions
SW1	SWITCH TACTILE SPST-NO 0.02A 15V	EVPAAM02W	Panasonic
TH1	Header, 2.54mm, 10x2, Gold, SMT	TSM-110-01-L-DV	Samtec
TH2	Header, 2.54mm, 8x2, Gold, SMT	TSM-108-01-L-DV	Samtec
TP1, TP3	Test Point, Compact, Red, TH	5005	Keystone Electronics
TP2, TP4	Test Point, Compact, Black, TH	5006	Keystone Electronics
TP5, TP6, TP7, TP8, TP9, TP10	Test Point, Miniature, Red, TH	5000	Keystone Electronics
TP11, TP12, TP13, TP23, TP24	Test Point, Multipurpose, Red, TH	5010	Keystone Electronics
TP15, TP16, TP17, TP18, TP19	Test Point, Miniature, SMT	5015	Keystone Electronics

Table 4-1. TPS26750AEVM Bill of Materials (continued)

Designator	Description	PartNumber	Manufacturer
U1	TPS26750ASRSMR	TPS26750ASRSMR	Texas Instruments
U2, U3	USB Type-C® 48V EPR Port Protector: Short-to-VBUS Overvoltage and IEC ESD Protection	TPD4S480RUKR	Texas Instruments
U4	256kb I2C CMOS Serial EEPROM, SOIC-8	CAT24C256WI-GT3	ON Semiconductor
U5	USB Type-C® and USB PD Controller With Integrated Power Switches Optimized for Power Applications	TPS25730ASRSMR	Texas Instruments
U6	22V Precision Surge Protection Clamp, DRV0006A (WSON-6)	TVS2200DRVR	Texas Instruments
U7	USB Type-C® 28V SPR Port Protector: Short-to-VBUS Overvoltage and IEC ESD Protection	TPD4S201RUKR	Texas Instruments
U8	3.5V to 60V 5A Synchronous Step-Down Voltage Regulator, RNP0030A (WQFN-30)	LM76005RNPR	Texas Instruments
U9	500mA, Low IQ, Small Size, Low Dropout Regulator, DBV0005A (SOT-23-5)	TLV75733PDBVR	Texas Instruments
U10	-4V to 110V, Bidirectional, 1-MHz, 5V/µs, Ultra-Precise Current Sense Amplifier, SOT23-8	INA296A3IDDF	Texas Instruments
U11	ARM® Cortex®-M0+ - Microcontroller IC 32-Bit Dual-Core 133MHz External Program Memory 56-QFN (7x7)	SC0914(13)	Raspberry Pi
U12	5-V Precision Surge Protection Clamp, DRV0006A (WSON-6)	TVS0500DRVR	Texas Instruments
U13	ESD Solution for Super-Speed (6 Gbps) USB 3.0 Interface, 2 Channels, -40 to +85°C, 3-pin SOT (DRT), Green (Rohs & No Sb/Br)	TPD2EUSB30DRTR	Texas Instruments
U14	NOR Flash Serial (SPI, Dual SPI, Quad SPI) 3V/3.3V 16M-bit 2M x 8 6ns 8-Pin SOIC N T/R	W25Q16JVSNIQ TR	Winbond
U15	Low IQ High Side Switch Controller With Reverse Polarity and Overvoltage Protection	LM74502HDDF	Texas Instruments
Y1	Crystal, 12MHz, 30ppm, SMD	7M-12.000MAHE-T	TXC Corporation
FID1, FID2, FID3	Fiducial mark. There is nothing to buy or mount.	N/A	N/A
R13	RES, 10.0k, 1%, 0.05W, 0201	RC0201FS-7D10KL	Yageo America
R14, R16	RES, 0, 5%, 0.125W, 0603	MCT06030Z0000ZP500	Vishay/Beyschlag
R18, R21, R28, R42, R43, R52, R54, R55	RES, 0, 5%, 0.063W, AEC-Q200 Grade 0, 0402	CRCW04020000Z0ED	Vishay-Dale
R31, R32, R36, R37	RES, 100k, 1%, 0.1W, 0402	ERJ-2RKF1003X	Panasonic
R66	RES, 5.11k, 1%, 0.063W, AEC-Q200 Grade 0, 0402	CRCW04025K11FKED	Vishay-Dale
R67	RES, 10k, 5%, 0.063W, AEC-Q200 Grade 0, 0402	CRCW040210K0JNED	Vishay-Dale
R71, R72	0Ω Jumper Chip Resistor 0805 (2012 Metric) Metal Element	WSL080500000ZEA9	Vishay
R92	RES, 200k, 1%, 0.05W, 0201	CRCW0201200KFKED	Vishay-Dale

5 Additional Information

5.1 Known Hardware or Software Issues

- The current sense circuitry is currently not populated and will be revised at a later date once support is added in the GUI configuration tool

5.2 Trademarks

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2 *Limited Warranty and Related Remedies/Disclaimers*:

   2.1 These terms do not apply to Software. The warranty, if any, for Software is covered in the applicable Software License Agreement.

   2.2 TI warrants that the TI EVM will conform to TI's published specifications for ninety (90) days after the date TI delivers such EVM to User. Notwithstanding the foregoing, TI shall not be liable for a nonconforming EVM if (a) the nonconformity was caused by neglect, misuse or mistreatment by an entity other than TI, including improper installation or testing, or for any EVMs that have been altered or modified in any way by an entity other than TI, (b) the nonconformity resulted from User's design, specifications or instructions for such EVMs or improper system design, or (c) User has not paid on time. Testing and other quality control techniques are used to the extent TI deems necessary. TI does not test all parameters of each EVM. User's claims against TI under this Section 2 are void if User fails to notify TI of any apparent defects in the EVMs within ten (10) business days after delivery, or of any hidden defects with ten (10) business days after the defect has been detected.

   2.3 TI's sole liability shall be at its option to repair or replace EVMs that fail to conform to the warranty set forth above, or credit User's account for such EVM. TI's liability under this warranty shall be limited to EVMs that are returned during the warranty period to the address designated by TI and that are determined by TI not to conform to such warranty. If TI elects to repair or replace such EVM, TI shall have a reasonable time to repair such EVM or provide replacements. Repaired EVMs shall be warranted for the remainder of the original warranty period. Replaced EVMs shall be warranted for a new full ninety (90) day warranty period.

WARNING

Evaluation Kits are intended solely for use by technically qualified, professional electronics experts who are familiar with the dangers and application risks associated with handling electrical mechanical components, systems, and subsystems.

User shall operate the Evaluation Kit within TI’s recommended guidelines and any applicable legal or environmental requirements as well as reasonable and customary safeguards. Failure to set up and/or operate the Evaluation Kit within TI’s recommended guidelines may result in personal injury or death or property damage. Proper set up entails following TI’s instructions for electrical ratings of interface circuits such as input, output and electrical loads.

NOTE:

EXPOSURE TO ELECTROSTATIC DISCHARGE (ESD) MAY CAUSE DEGREDATION OR FAILURE OF THE EVALUATION KIT; TI RECOMMENDS STORAGE OF THE EVALUATION KIT IN A PROTECTIVE ESD BAG.

3 *Regulatory Notices:*

3.1 *United States*

3.1.1 *Notice applicable to EVMs not FCC-Approved:*

FCC NOTICE: This kit is designed to allow product developers to evaluate electronic components, circuitry, or software associated with the kit to determine whether to incorporate such items in a finished product and software developers to write software applications for use with the end product. This kit is not a finished product and when assembled may not be resold or otherwise marketed unless all required FCC equipment authorizations are first obtained. Operation is subject to the condition that this product not cause harmful interference to licensed radio stations and that this product accept harmful interference. Unless the assembled kit is designed to operate under part 15, part 18 or part 95 of this chapter, the operator of the kit must operate under the authority of an FCC license holder or must secure an experimental authorization under part 5 of this chapter.

3.1.2 *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

NOTE: 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

NOTE: 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.*

3.2 *Canada*

3.2.1 *For EVMs issued with an Industry Canada Certificate of Conformance to RSS-210 or RSS-247*

Concerning EVMs Including Radio Transmitters:

This device complies with Industry Canada license-exempt RSSs. 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.

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.

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.

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

3.3 *Japan*

3.3.1 *Notice for EVMs delivered in Japan:* Please see http://www.tij.co.jp/lsds/ti_ja/general/eStore/notice_01.page 日本国内に輸入される評価用キット、ボードについては、次のところをご覧ください。

https://www.ti.com/ja-jp/legal/notice-for-evaluation-kits-delivered-in-japan.html

3.3.2 *Notice for Users of EVMs Considered "Radio Frequency Products" in Japan:* EVMs entering Japan may not be certified by TI as conforming to Technical Regulations of Radio Law of Japan.

If User uses EVMs in Japan, not certified to Technical Regulations of Radio Law of Japan, User is required to follow the instructions set forth by Radio Law of Japan, which includes, but is not limited to, the instructions below with respect to EVMs (which for the avoidance of doubt are stated strictly for convenience and should be verified by User):

1. Use EVMs 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 EVMs only after User obtains the license of Test Radio Station as provided in Radio Law of Japan with respect to EVMs, or
3. Use of EVMs only after User obtains the Technical Regulations Conformity Certification as provided in Radio Law of Japan with respect to EVMs. Also, do not transfer EVMs, unless User gives the same notice above to the transferee. Please note that if User does not follow the instructions above, User will be subject to penalties of Radio Law of Japan.

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3.4 *European Union*

3.4.1 *For EVMs subject to EU Directive 2014/30/EU (Electromagnetic Compatibility Directive)*:

This is a class A product intended for use in environments other than domestic environments that are connected to a low-voltage power-supply network that supplies buildings used for domestic purposes. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

4 *EVM Use Restrictions and Warnings:*

4.1 EVMS ARE NOT FOR USE IN FUNCTIONAL SAFETY AND/OR SAFETY CRITICAL EVALUATIONS, INCLUDING BUT NOT LIMITED TO EVALUATIONS OF LIFE SUPPORT APPLICATIONS.

4.2 User must read and apply the user guide and other available documentation provided by TI regarding the EVM prior to handling or using the EVM, including without limitation any warning or restriction notices. The notices contain important safety information related to, for example, temperatures and voltages.

4.3 *Safety-Related Warnings and Restrictions:*

4.3.1 User shall operate the EVM within TI's recommended specifications and environmental considerations stated in the user guide, other available documentation provided by TI, and any other applicable requirements and employ reasonable and customary safeguards. Exceeding the specified performance ratings and specifications (including but not limited to input and output voltage, current, power, and environmental ranges) for the EVM may cause personal injury or death, or property damage. If there are questions concerning performance ratings and specifications, User should 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 also result in unintended and/or inaccurate operation and/or possible permanent damage to the EVM and/or interface electronics. Please consult the EVM user 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, even with the inputs and outputs kept within the specified allowable ranges, some circuit components may have elevated case temperatures. These components include but are not limited to linear regulators, switching transistors, pass transistors, current sense resistors, and heat sinks, which can be identified using the information in the associated documentation. When working with the EVM, please be aware that the EVM may become very warm.

4.3.2 EVMs are intended solely for use by technically qualified, professional electronics experts who are familiar with the dangers and application risks associated with handling electrical mechanical components, systems, and subsystems. User assumes all responsibility and liability for proper and safe handling and use of the EVM by User or its employees, affiliates, contractors or designees. User assumes all responsibility and liability to ensure 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. User assumes all responsibility and liability for any improper or unsafe handling or use of the EVM by User or its employees, affiliates, contractors or designees.

4.4 User assumes all responsibility and liability to determine whether the EVM is subject to any applicable international, federal, state, or local laws and regulations related to User's handling and use of the EVM and, if applicable, User assumes all responsibility and liability for compliance in all respects with such laws and regulations. User assumes all responsibility and liability for proper disposal and recycling of the EVM consistent with all applicable international, federal, state, and local requirements.

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   8.2 *Specific Limitations.* IN NO EVENT SHALL TI'S AGGREGATE LIABILITY FROM ANY USE OF AN EVM PROVIDED HEREUNDER, INCLUDING FROM ANY WARRANTY, INDEMITY OR OTHER OBLIGATION ARISING OUT OF OR IN CONNECTION WITH THESE TERMS, , EXCEED THE TOTAL AMOUNT PAID TO TI BY USER FOR THE PARTICULAR EVM(S) AT ISSUE DURING THE PRIOR TWELVE (12) MONTHS WITH RESPECT TO WHICH LOSSES OR DAMAGES ARE CLAIMED. THE EXISTENCE OF MORE THAN ONE CLAIM SHALL NOT ENLARGE OR EXTEND THIS LIMIT.

9. *Return Policy.* Except as otherwise provided, TI does not offer any refunds, returns, or exchanges. Furthermore, no return of EVM(s) will be accepted if the package has been opened and no return of the EVM(s) will be accepted if they are damaged or otherwise not in a resalable condition. If User feels it has been incorrectly charged for the EVM(s) it ordered or that delivery violates the applicable order, User should contact TI. All refunds will be made in full within thirty (30) working days from the return of the components(s), excluding any postage or packaging costs.

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