EVM User's Guide: TPS25772Q1EVM-CD-150

TPS25772-Q1 USB PD + USB 2.0 Evaluation Module

Description

The TPS25772Q1EVM-CD-150 is designed to evaluate the TPS25772-Q1 for USB Type-C® and Power Delivery (PD) applications. This EVM supports dual PD charging ports + USB 2.0 and comes with three other variants: single port charging with DisplayPort™ over USB-C® (DP Alt Mode) (TPS25763Q1EVM), single port charging only (TPS25762DQ1EVM), and dual ports charging only (TPS25772DQ1EVM). The EVM integrates a TIVA microcontroller and HUB IC, enabling online debugging, online EEPROM updates, and dual ports USB 2.0 data support.

Device configuration settings are selected through an intuitive Application Customization Tool in the form of a graphical user interface (TPS257XX-Q1-GUI), reducing much of the complexity associated with competitive USB-PD designs.

Get Started

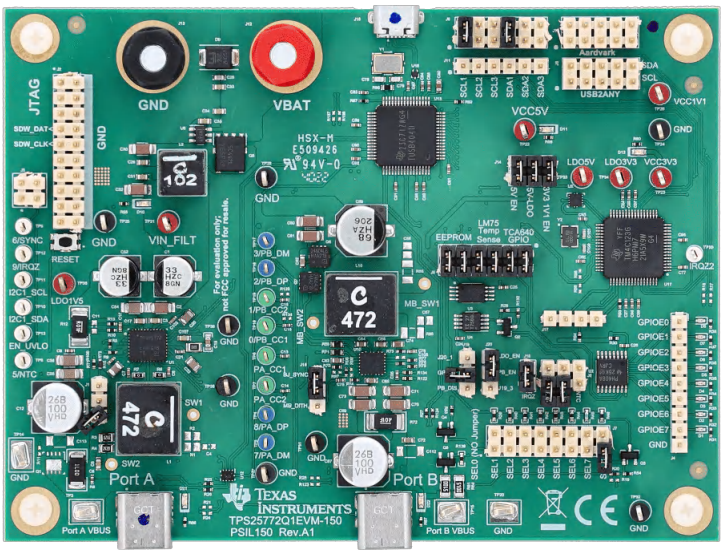
1. Read this TPS25772Q1EVM-CD-150 user's guide
2. Start development with the Graphical User Interface (TPS257XX-Q1-GUI)
3. Refer to the TPS25772-Q1 data sheet or E2E for questions and support

Features

- TPS25772-Q1: USB-IF certification with PPS, TID: 9161
- Charging up to 65W on Port A
- Supports 65W charging on Port B with the TPS55288-Q1
- Easy-to-use GUI with preconfigured firmware to configure device
- VBUS and CCx test points for both Type-C ports to monitor PD traffic
- MCU for EEPROM programming and system telemetry
- Jumper configuration of all system configurable pins

Applications

- Automotive USB Charging
- Automotive Media Hub
- Automotive Head Unit
- Automotive Rear Seat Entertainment



TPS25772Q1EVM-CD-150

1 Evaluation Module Overview

1.1 Introduction

The TPS25772Q1EVM-CD-150 is an evaluation module for the TPS25772-Q1, a highly integrated USB Type-C Power Delivery (PD) controller for use in dual-port USB PD applications including charging (up to 65W per port) as well as USB 2.0 data. The TPS25772Q1EVM-CD-150 is a board designed to enable easy application configuration development using the Graphical User Interface (TPS257XX-Q1-GUI) and USB PD evaluation for the TPS25772-Q1 device.

The EVM is customizable through the TPS257XX-Q1-GUI. Additionally, the EVM is equipped with Aardvark connector to I2C interfaces and USB Micro-B interface and USB2ANY interface for debugging and development.

This user's guide describes how the TPS25772Q1EVM-CD-150 can be used to test PD functions as well as USB data. This document includes descriptions of how to use the EVM, contents, schematics, printed circuit board (PCB) layouts, and bill of materials (BOM). Throughout this document the terms evaluation board, evaluation module, and EVM are synonymous with the TPS25772Q1EVM-CD-150.

1.2 Kit Contents

The EVM Kit contains the TPS25772Q1EVM-CD-150.

1.3 Specification

The block diagram for the TPS25772Q1EVM-CD-150 is shown in Figure 1-1.

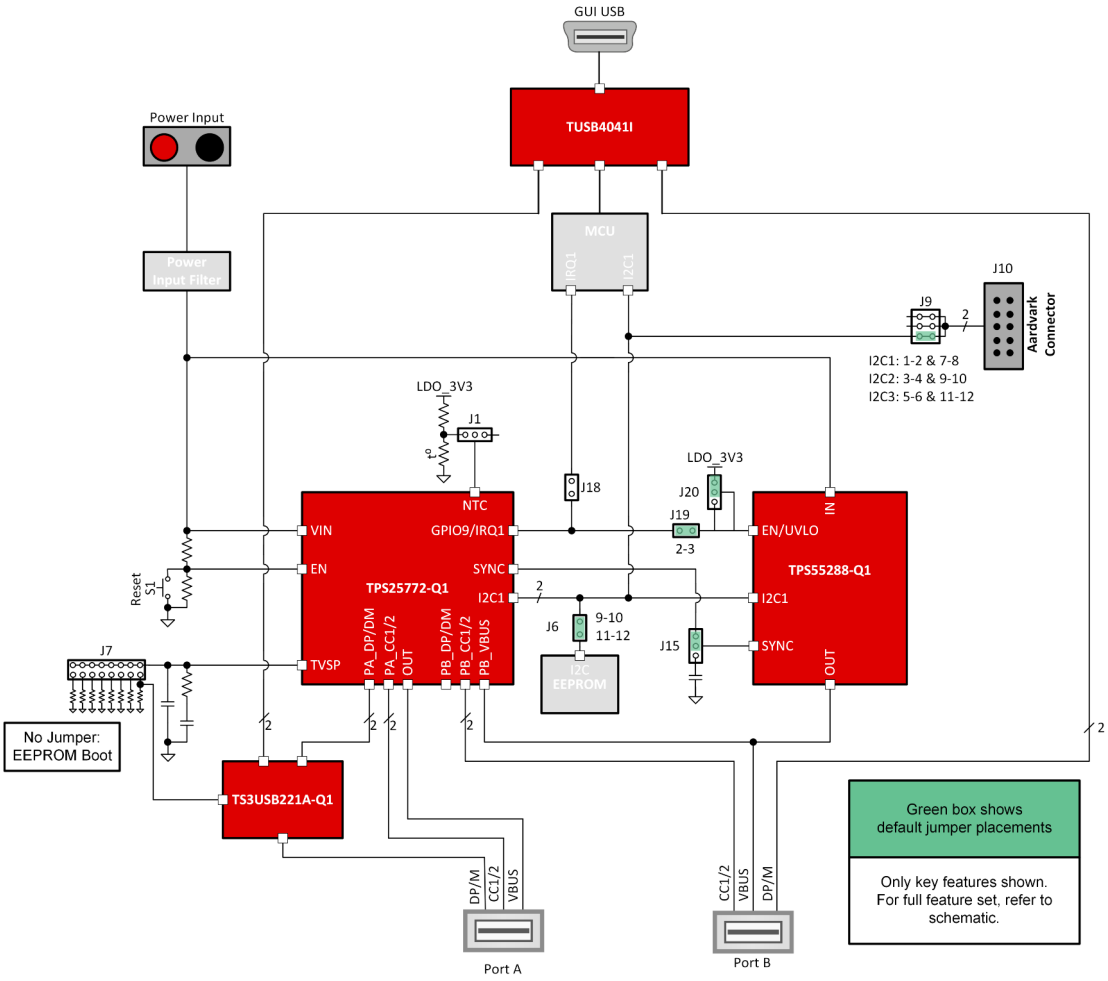


Figure 1-1. EVM Simplified Block Diagram

1.4 Device Information

The purpose of the TPS25772Q1EVM-CD-150 is to showcase the hardware and firmware capabilities of the TPS25772-Q1 device. The other components on the board are populated for testing and support of the main device.

The TPS25772-Q1 implements intelligent System Power Management (SPM) to maximize delivered USB power while protecting the system from automotive battery transient and over-temperature conditions.

Note

All figures and references in this document apply to RevA1 and RevB. TPS25772-Q1 C version is on RevA1 and TPS25772-Q1 D version is on RevB.

2 Hardware

2.1 EVM Operation

Connections to achieve EVM operation:

- Connect approx. 5.5V-18V DC power supply to the power input banana connectors.
- Connect micro Type-B USB connector to PC to use GUI to program EEPROM.
- Aardvark connector to program EEPROM or observe I2C traffic between TPS25772-Q1 and TPS55288-Q1 during operation.
- Port A and Port B Type-C connectors are provided to connect to Power Delivery or Type-C sink devices or test equipment.

2.2 Setup

Items required for Operation

- TPS25772-Q1 Automotive Dual USB Type-C® Power Delivery Controller with BuckBoost Regulator data sheet
- TPS257XX-Q1-GUI
- Approx. 5.5V-18V DC power supply
- Type-C cables (1 per port)
- Each port needs a UFP (sink) or UFP emulator for operation
- USB Type-A to USB micro-B cable
- Notebook with USB 2.0 capabilities

Figure 2-1 shows how to power and set up the TPS25772Q1EVM-CD-150 for evaluation and testing.

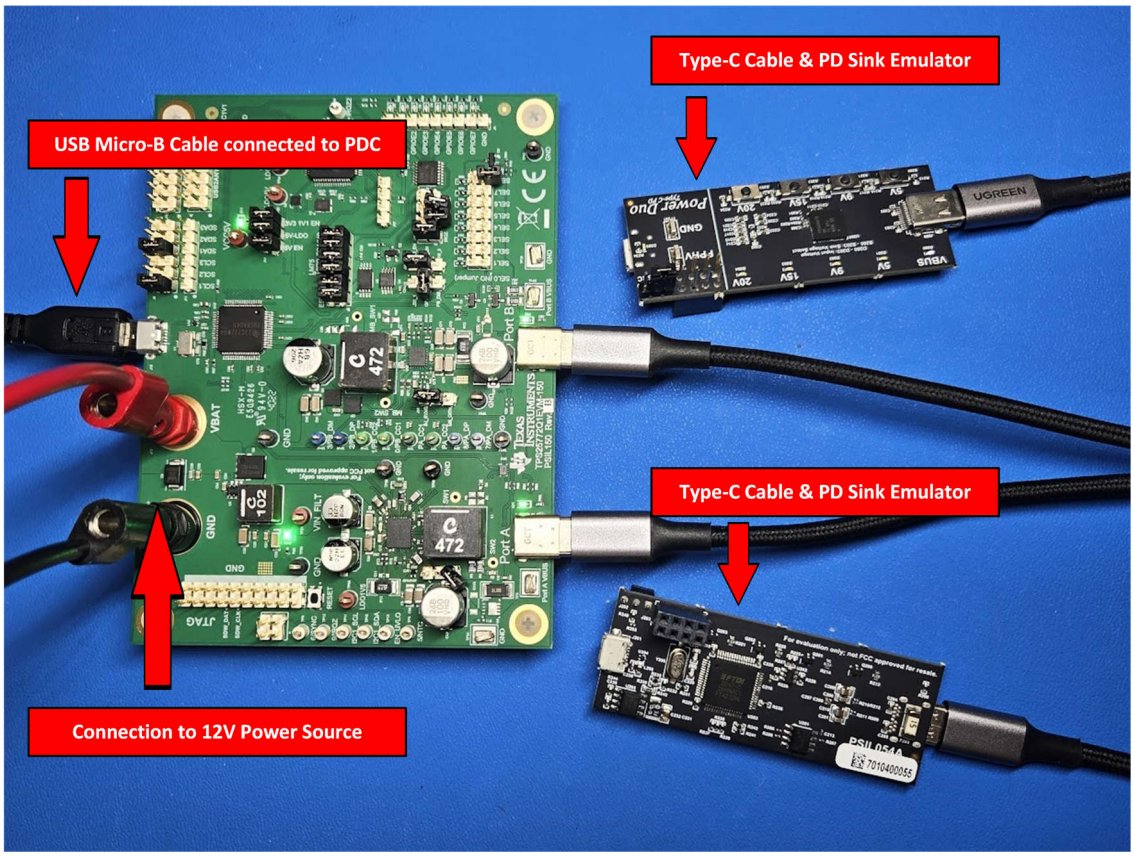


Figure 2-1. EVM Connections

2.3 Jumper and Connector Descriptions

2.3.1 Jumper Settings

This section goes over the jumper settings of the EVM. To reference the default jumper configurations, see Table 2-1.

Table 2-1. TPS25772Q1EVM-CD-150 Configuration for Basic Operation

Jumper	Connection	Description
J1	Jumper not installed	NTC not connected to onboard PTC or I2C digital potentiometer
J6	Jumpers installed between pins 9-10 and 11-12	PCB EEPROM connected to the TPS25772-Q1 via I2C1
J7	Jumper not installed	TPS25772-Q1 configured to boot from EEPROM
J9	Jumpers installed between pins 1-2 and 7-8	I2C1 connected to the Aardvark connector (J10)
J15	Jumper installed between pins 2-3	SYNC pin of TPS25772-Q1 connected to the TPS55288-Q1
J18	Installed	IRQ1 Connected to MCU used by GUI
J19	Not installed	GPIO9/IRQ1 not connected to TPS55288-Q1
J20	Jumper installed between pins 2-3	TPS55288-Q1 enabled when the TPS25772-Q1 is powered

TVSP Selection

The J7 jumper selects the Boot Mode and I2C address for the TPS25772-Q1. The TVSP Selection headers and jumper settings are shown in Figure 2-2 and described in Table 2-2 below.

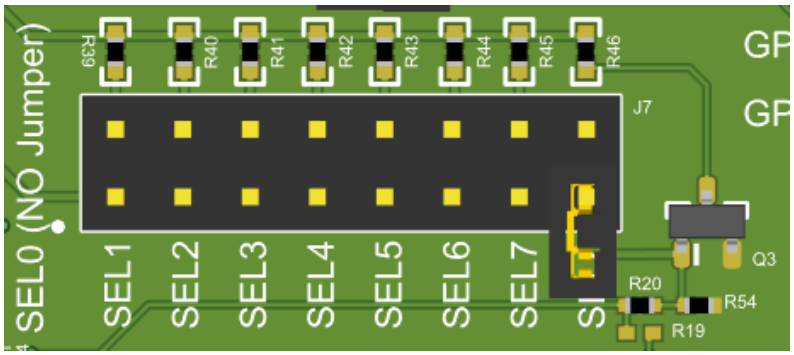


Figure 2-2. J7 TVSP Header Block

See the *SYNC(i) Frequency Ranges* table in the TPS25772-Q1 Automotive Dual USB Type-C® Power Delivery Controller with BuckBoost Regulator data sheet for TVSP Selection Description.

Table 2-2. J7 TVSP Jumper Settings

Pins	Name	Logic Level	Boot Mode
Open	SEL0	3.3V	EEPROM Boot and 22h/26h I2C address
1-2	SEL1	3.3V	External HUB/MCU Boot and 23h/27h I2C address
3-4	SEL2	1.8V	EEPROM Boot and 22h/26h I2C address
5-6	SEL3	1.8V	External HUB/MCU Boot and 23h/27h I2C address
7-8	SEL4	3.3V	EEPROM Boot and 23h/27h I2C address
9-10	SEL5	3.3V	External HUB/MCU Boot and 22h/26h I2C address
11-12	SEL6	1.8V	EEPROM Boot and 23h/27h I2C address
13-14	SEL7	1.8V	External HUB/MCU Boot and 22h/26h I2C address
15-16(1)	SEL8	3.3V	Firmware update mode

(1) Shorting pins 15 and 16 also routes the USB 2.0 data signals of Port A to the J16 Micro Type-B USB connector. For more details, see Section 2.3.2.

Power Supply Control

The J14 jumpers can be used to choose the VCONN source and enable external 5V, 3.3V and 1.1V auxiliary power. The 3.3V and 1.1V voltages supply power to the USB HUB and MCU. To make sure the EVM has full function, TI recommends to connect all pins. The power supply control headers and jumper settings are shown in Figure 2-3 and described in Table 2-3.

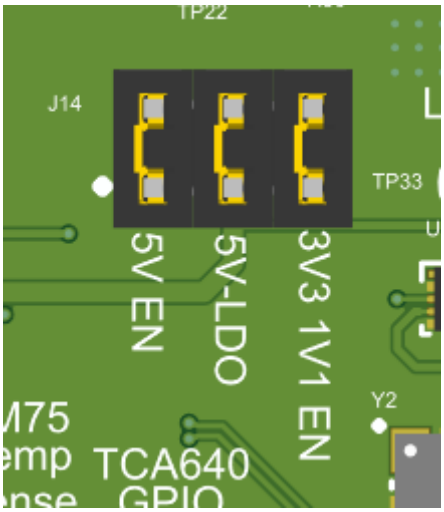


Figure 2-3. J14 Power Supply Control Headers

Table 2-3. J14 Power Supply Control Jumper Settings

Pins	Label	Description
1-2	5V EN	Enable buck regulator (U7) to generate VCC5V
3-4	5V-LDO	Connect LDO_5V (pin 21 of TPS25771-Q1) to VCC5V
5-6	3V3 1V1 EN	Enable the LDOs (U8 & U9) to generate VCC3V3 and VCC1V1 for Hub (U13) and MCU (U17)

I2C Connection Settings

The J6 jumpers expand the I2C1 connections of TPS25772-Q1 and can connect to the GPIO expander, I2C temperature sensor and EEPROM. Since the I2C1 bus can support multiple targets, TI recommends to connect all pins. The I2C Connection headers and jumper settings are shown in Figure 2-4 and described in Table 2-4.

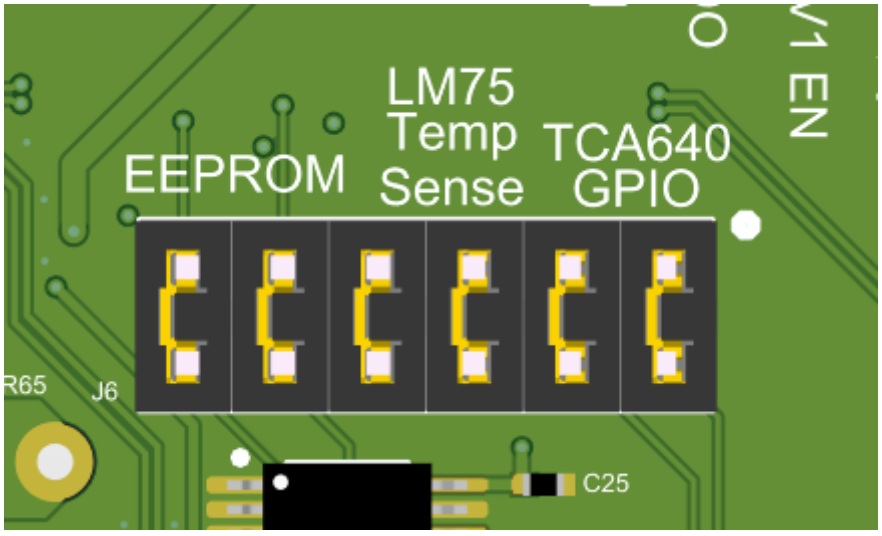


Figure 2-4. J6 I2C Connection Header Block

Table 2-4. J6 I2C Connection Jumper Settings

Pins	Label	Description
1-2 and 3-4	TCA640 GPIO	Connect the I2C1 bus of theTPS25772-Q1 to the TCA640 GPIO expander (J4)
4-5 and 7-8	LM75 Temp Sense	Connect the TPS25772-Q1's I2C1 bus to the LM75 temperature sensor (U4)
9-10 and 10-11	EEPROM	Connect the I2C1 bus of the TPS25772-Q1 to the EEPROM (U3)

TPS55288-Q1 Configuration Jumpers

The J15, J18, J19, and J20 jumpers can be used to select the TPS55288-Q1's configuration settings and the GPIO9 signal path of theTPS25772-Q1. The Power Supply Control headers and jumper settings are shown in Figure 2-5 and described in Table 2-5, Table 2-6, Table 2-7, and Table 2-8.

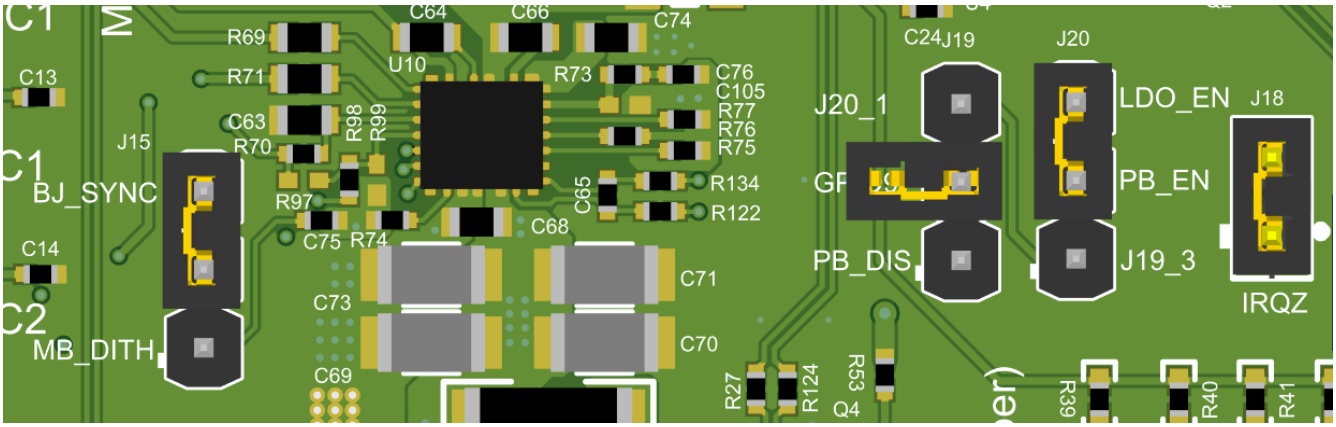


Figure 2-5. J15, J18, J19, and J20: TPS55288-Q1 Headers

Table 2-5. J15: SYNC/Dither Selection Jumper Settings

Pins	Description/Label
1-2	Connect C75 capacitor to the DITH/SYNC pin of the TPS55288-Q1 to set a dithering frequency
2-3	Connect the SYNC pin of the TPS25772-Q1 to the DITH/SYNC pin of the TPS55288-Q1

Table 2-6. J18:GPIO9 Connection to IRQZ Pin of MCU

Pins	Description/Label
1-2	Connect GPIO9 of TPS25772-Q1 to the IRQ1 pin of the MCU
Open	Disconnect GPIO9 of TPS25772-Q1 from the IRQ1 pin of the MCU

Table 2-7. J19: GPIO9 Connection with TPS55288-Q1

Pins	Description/Label
1-2	Connect GPIO9 of TPS25772-Q1 to N-FET (Q8) gate to discharge Port B VBUS
2-3	Connect to route GPIO9 of TPS25772-Q1 to the J20 header

Table 2-8. J20:TPS55288-Q1 Enable Selection Jumper Settings

Pins	Description/Label
1-2	Connect GPIO9 of TPS25772-Q1 to the EN pin of the TPS55288-Q1
2-3	Connect LDO_3V3 of TPS25772-Q1 to the EN pin of the TPS55288-Q1
Open	Leave open to connect the EN pin of the TPS55288-Q1 to a resistor divider from VIN. The R97 and R99 resistors are DNP by default

NTC Selection Jumper

The J1 header is used to verify the Thermal Foldback function. The NTC pin detects the voltage of an external NTC circuit and can be connected to a thermistor (NTC or PTC) divider or NTC_VAR. NTC_VAR is the output of TPL0102 (U5), which is a I2C digital potentiometer. The divider footprints allow the use of either PTC or NTC resistors to match what is used in the system represented. Another option is to remove the jumper and directly connect pin 2 of the J1 header to an external voltage. This combination is used to test the Thermal Foldback function. The thermistor assembled on the EVM is a positive temperature coefficient (PTC). The NTC Selection header and jumper settings are shown in Figure 2-6 and described in Table 2-9 below.

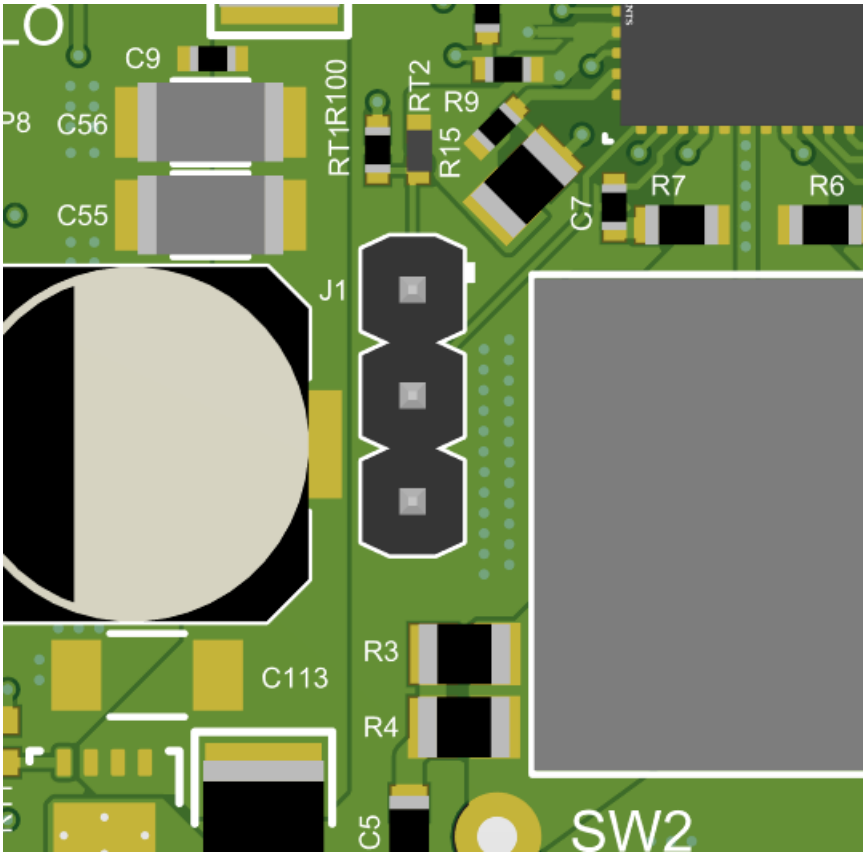


Figure 2-6. J1 NTC Selection Header

Table 2-9. J1 NTC Selection Jumper Settings

Pins	Label	Description
1-2	NTC	Connect PTC resistors to TPS25772-Q1 NTC pin
2-3	NTC VAR	Connect the I2C digital potentiometer to the NTC pin

TMP75B-Q1 Alert Connection Jumper

The J5 jumper can be used to select and route either the IRQ or NTC pin of the TPS25772-Q1to the Alert pin of the TMP75B-Q1. The TMP75B-Q1 Alert Connection headers and jumper settings are shown in Figure 2-7 and described in Table 2-10.

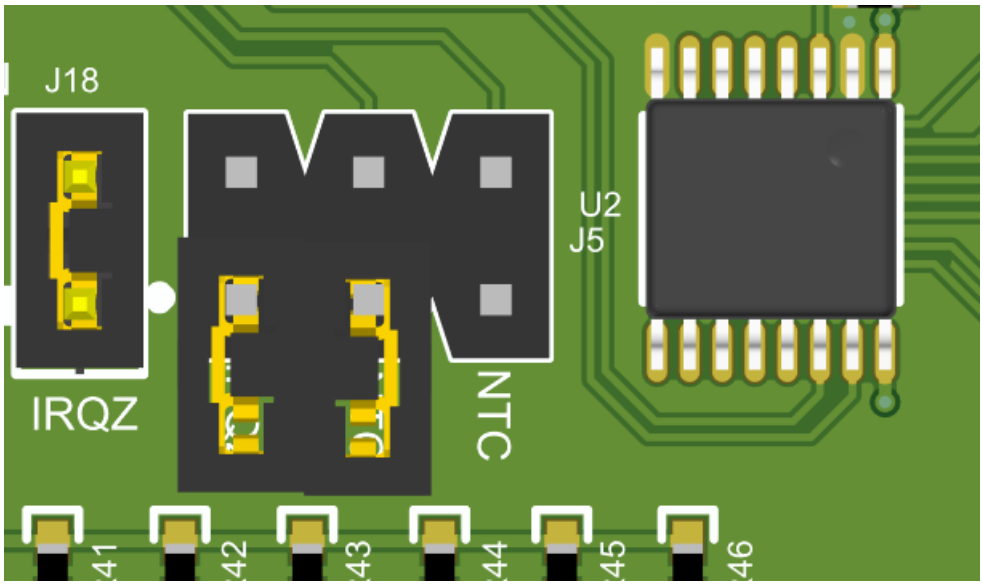


Figure 2-7. J5 TMP75B-Q1 Alert Connection Header

Table 2-10. J5 TMP75BQ1 Alert Connection Jumper Settings

Pins	Label	Description
1-2	IRQ	Connect the Alert pin (active low) of TMP75B-Q1 to the IRQ pin (GPIO9 of TPS25772-Q1)
3-4	NTC	Connect the Alert pin (active low) of TMP75B-Q1 to the NTC pin of TPS25772-Q1
5-6	NTC	Connect the inverted (active high) Alert pin of TMP75B-Q1 to the NTC pin of TPS25772-Q1

2.3.2 USB 2.0 Data

The D+ and D- signals of Port A can either be routed to the Micro-B USB receptacle or to the TPS25772-Q1 using U12, the TS3USB221 USB Multiplexer. Pulling the Select pin low of the MUX connects the USB 2.0 data from the Port A Type-C receptacle to the Micro-B receptacle via the U13 TUSB4041I HUB. Pulling the Select pin high of the MUX connects the USB data from the Type-C receptacle of the Port A to the TPS25772-Q1.

See the *USB_SEL* signal connected to the J7 TVSP Selection header and the Q3 MOSFET in Figure 4-4 and the Select pin of the U12 MUX in Figure 4-5. By shorting pins 15 and 16 on the J7 TVSP header (and configuring the TPS25772-Q1 to boot in Firmware Update Mode), *USB_SEL* is high and connect the USB data from the Port A Type-C receptacle to the PA_DP and PA_DM pins of the TPS25772-Q1. By removing the jumper across pins 15 and 16 from J7, *USB_SEL* is low and connect the USB data from the Port A Type-C receptacle to the Micro-B receptacle.

The D+ and D- signals of Port B are directly connected to the Micro-B receptacle via the U13 HUB.

2.3.3 Aardvark Connector

The J10 connector allows the Total Phase Aardvark to connect directly to the EVM. The connector and signal assignment are shown in Figure 2-8 and described in Table 2-11.

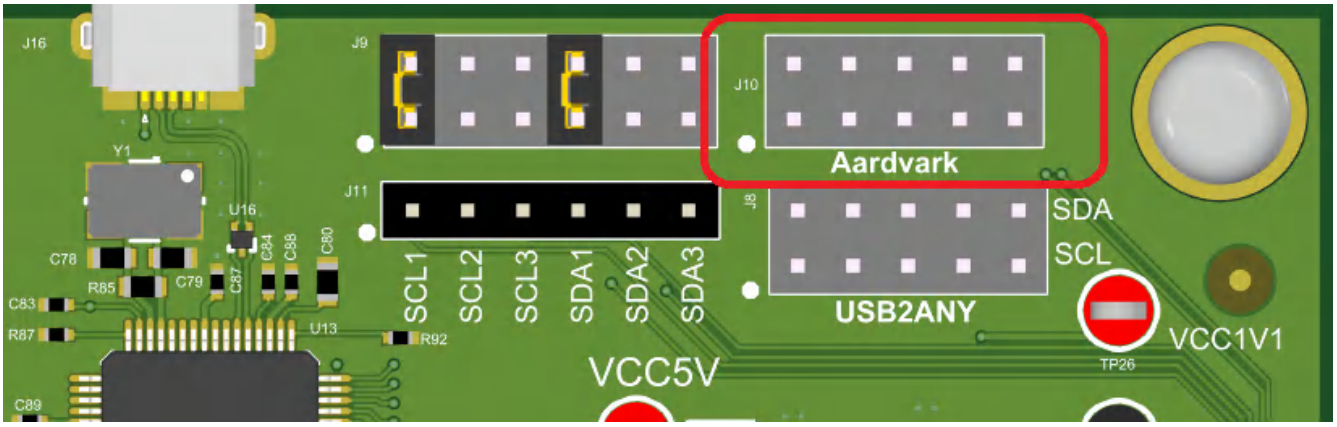


Figure 2-8. J10 Aardvark Connector

Table 2-11. J10 Aardvark Connector Pin Assignment

Pin Number	Pin/Jumper			Description
1	J9	1:2	I2C_SCL1	Select between the three possible I2C_SCL connections on the EVM. I2C1 is connected to the I2C controller of the TPS25772-Q1
		3:4	I2C_SCL2	
		5:6	I2C_SCL3	
2	GND			Ground reference
3	J9	7:8	I2C_SDA1	Select between the 3 possible I2C_SDA connections on the EVM. I2C1 is connected to the I2C controller of the TPS25772-Q1
		9:10	I2C_SDA2	
		11:12	I2C_SDA3	
4	Aard1_5V			5V supply from the Aardvark connection. Not used on the EVM, but present for potential use in debug.
5	N.C.			No connection
6	Aard1_5V			5V supply from the Aardvark connection. Not used on the EVM, but present for potential use in debug.
7	N.C.			No connection
8	N.C.			No connection
9	N.C.			No connection
10	GND			Ground reference

2.3.4 USB2ANY

The J8 connector provides an interface with the USB2ANY adapter when using a PC and GUI. The J8 connector is shown in Figure 2-9 below.

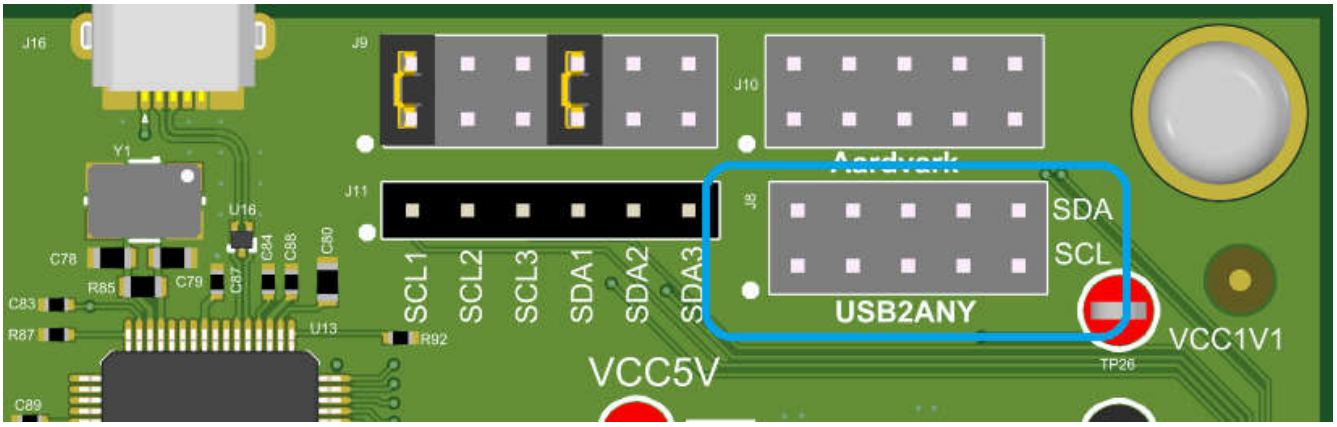


Figure 2-9. J8 USB2ANY Connector

2.4 Push Buttons

The TPS25772-Q1 can be reset using the RESET momentary button. The RESET button is shown in Figure 2-10 below.

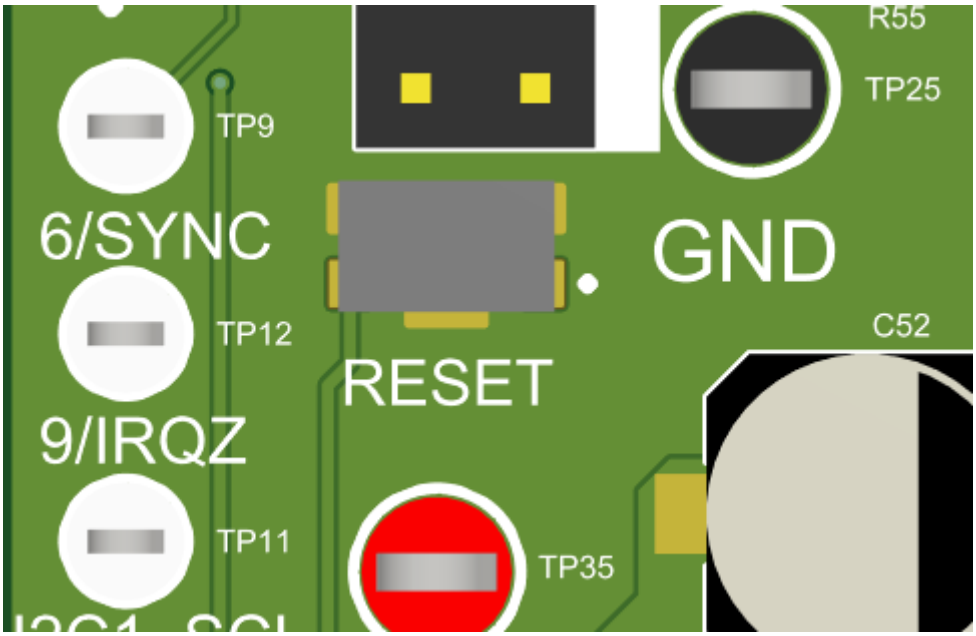


Figure 2-10. Reset Button

3 Software

3.1 Web GUI Link

The TPS25772-Q1 device is configured using the TPS257XX-Q1-GUI graphical user interface. The TPS257XX-Q1-GUI Configuration Guide describes the features of the GUI and the process to program the resulting configuration into the EEPROM connected to the TPS25772-Q1.

4 Hardware Design Files

4.1 Schematics

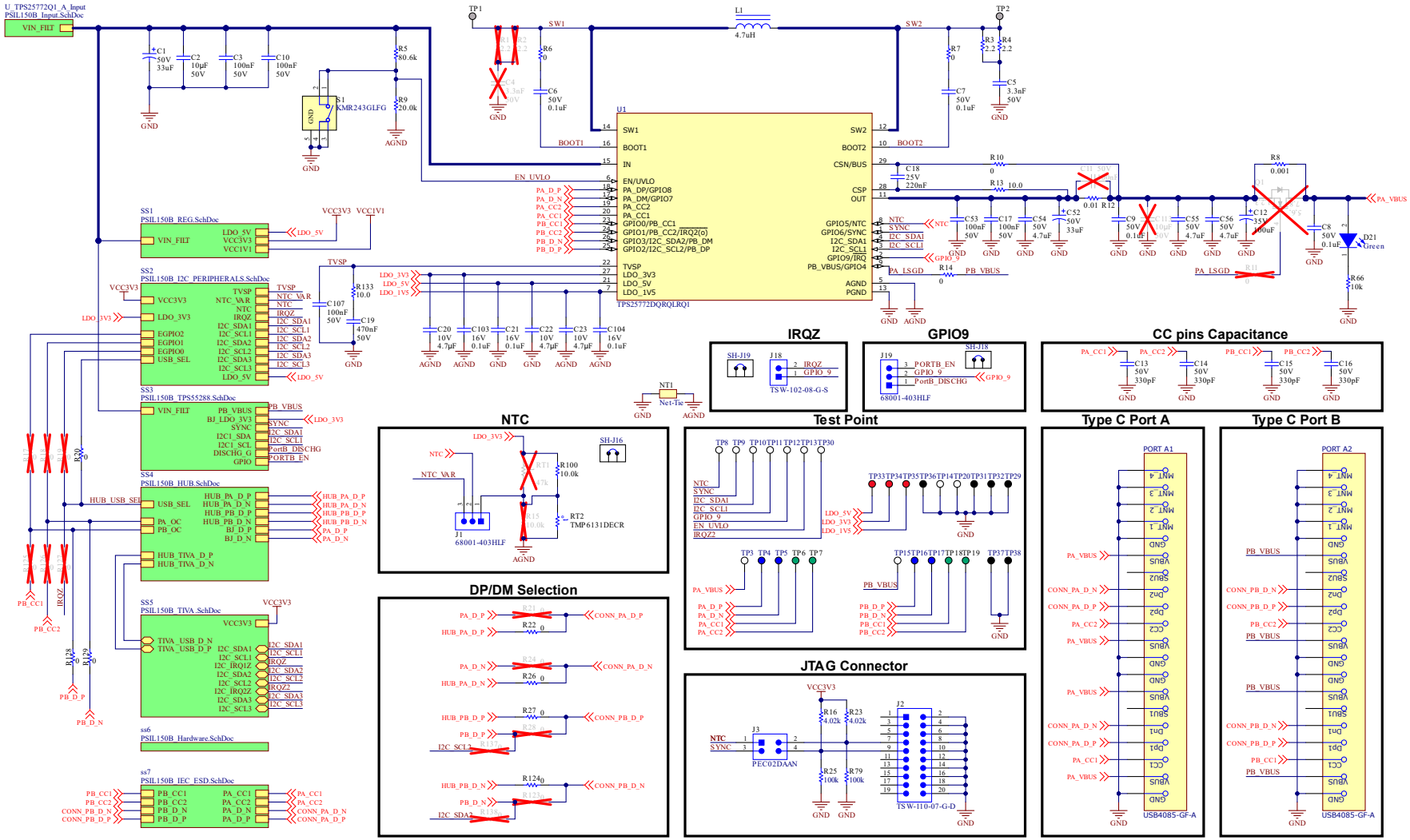


Figure 4-1. EVM Top Level Schematic

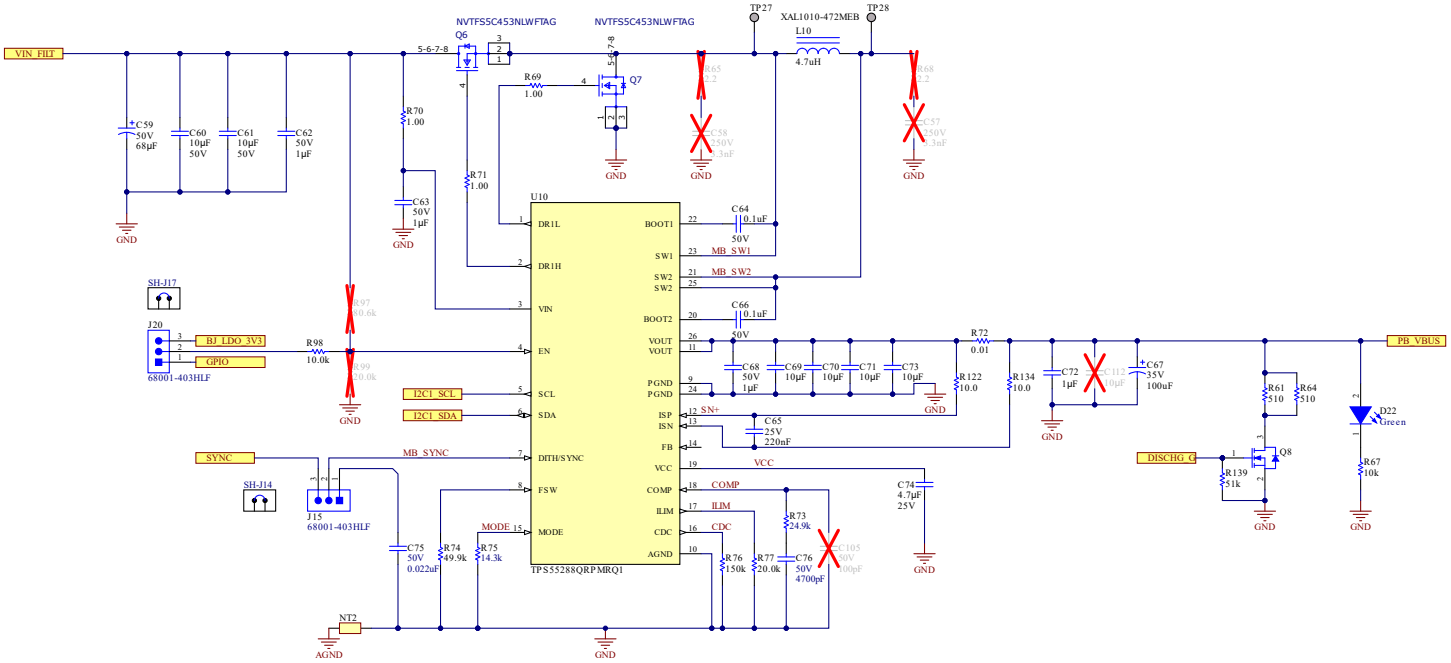


Figure 4-2. TPS55288-Q1 Schematic

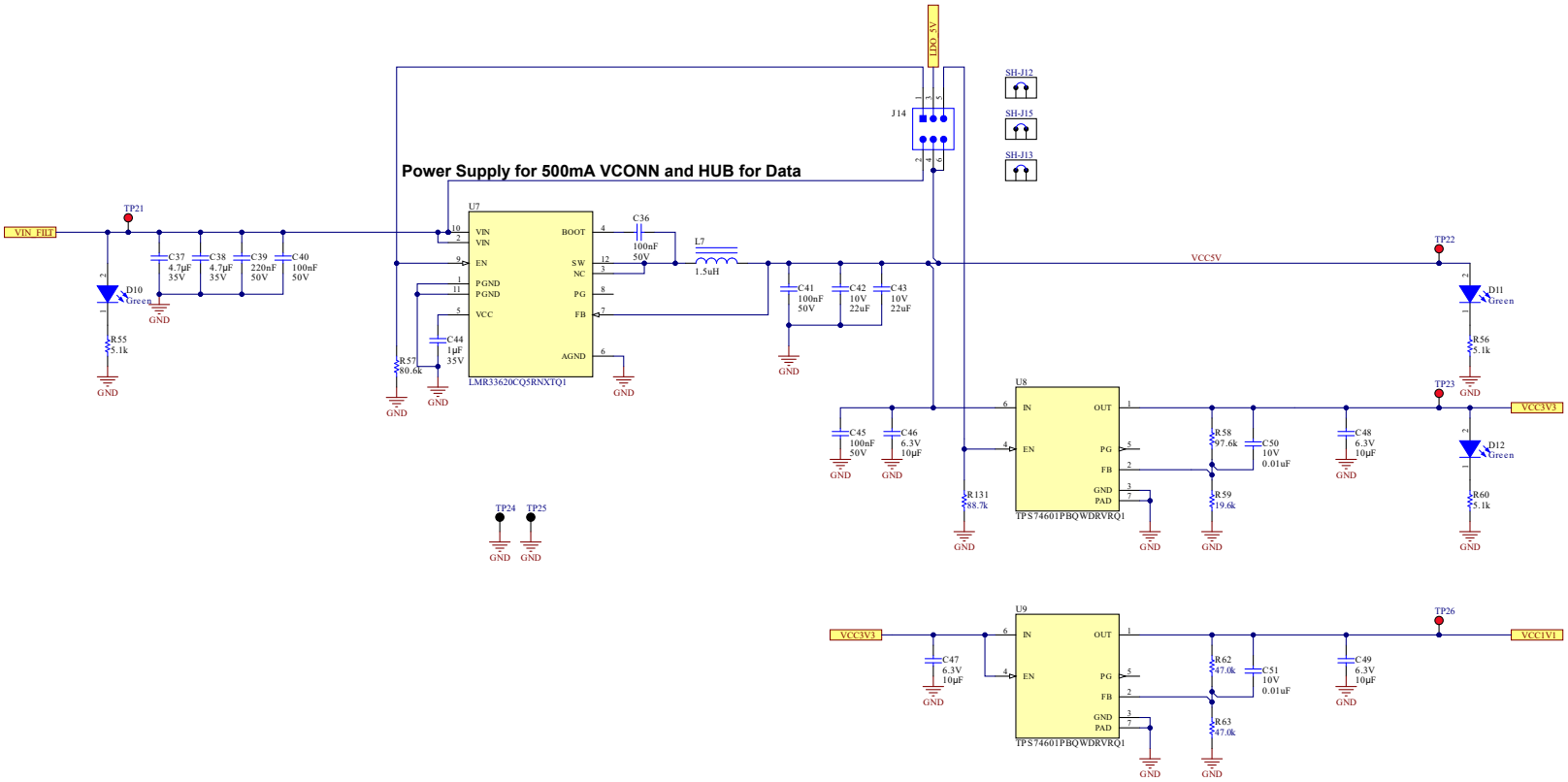


Figure 4-3. EVM Power System

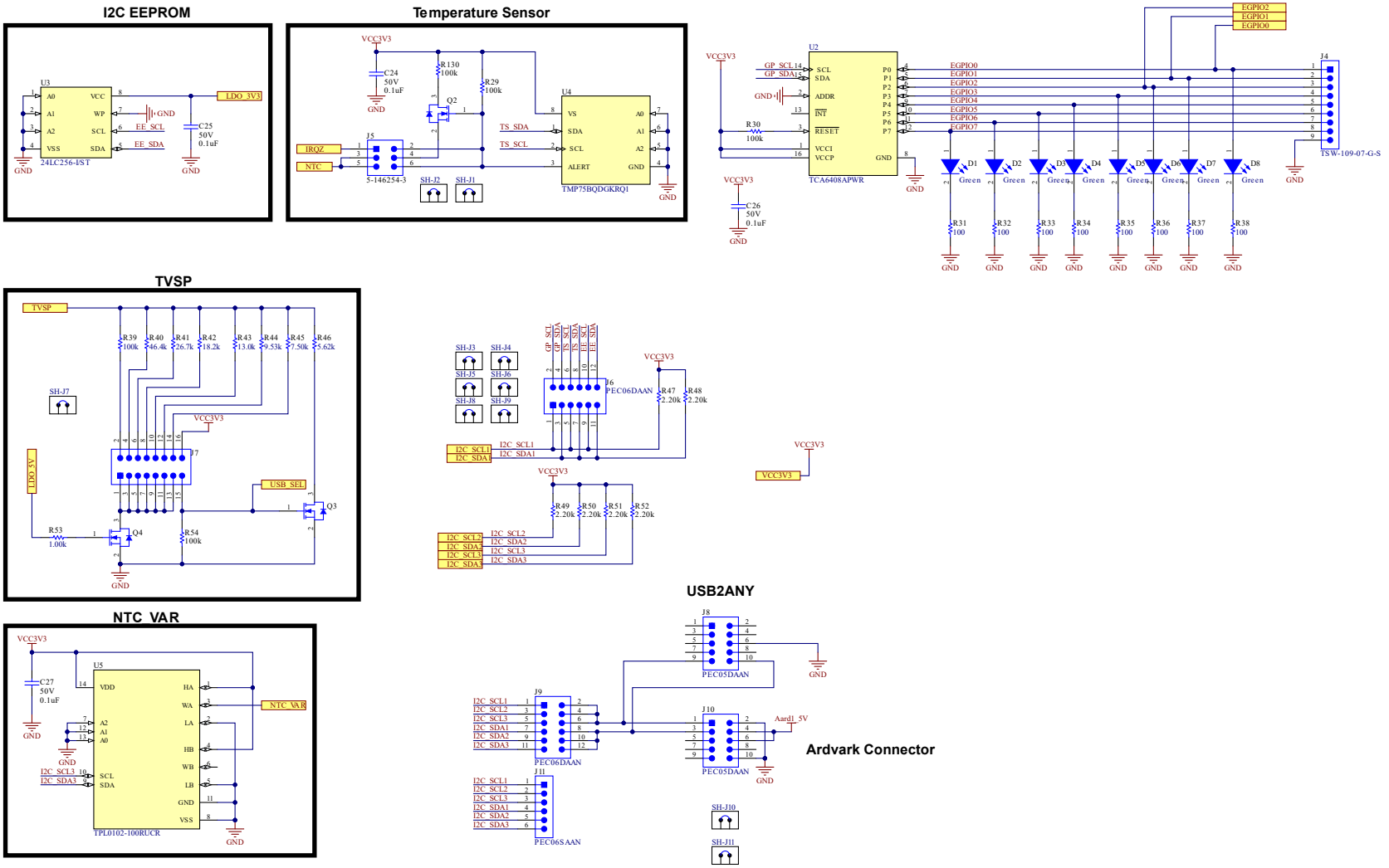


Figure 4-4. TPS25772-Q1 Schematic Peripherals

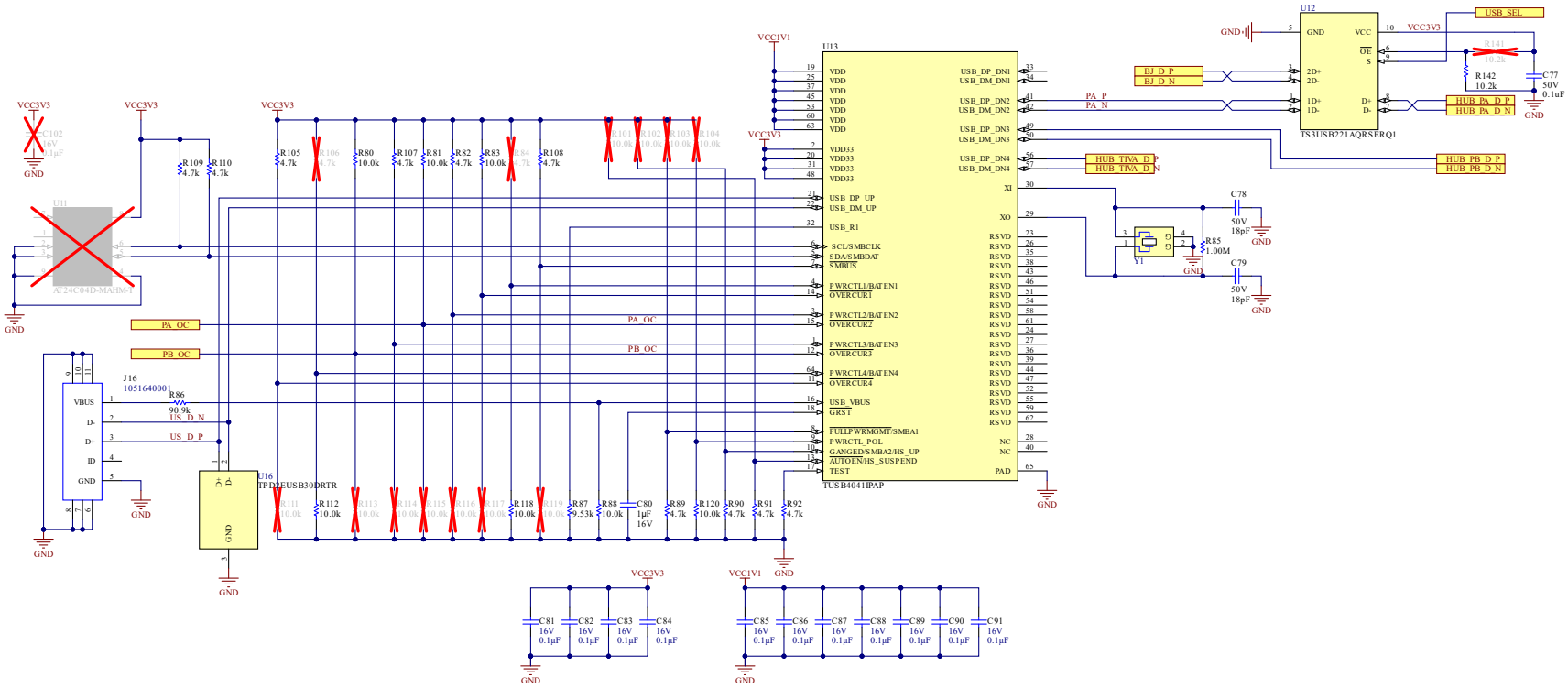


Figure 4-5. USB HUB

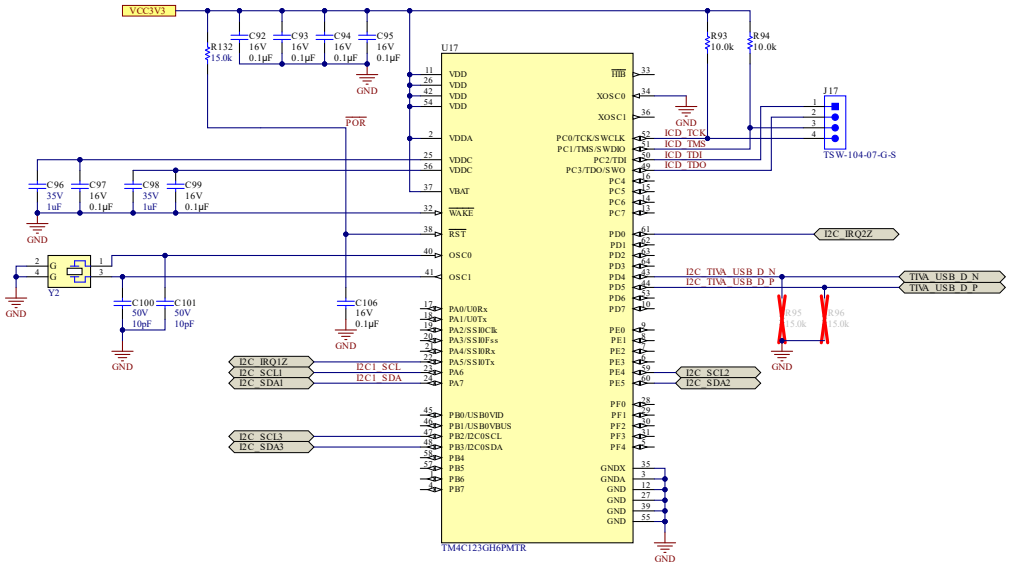


Figure 4-6. TIVA USB 2 I2C MCU

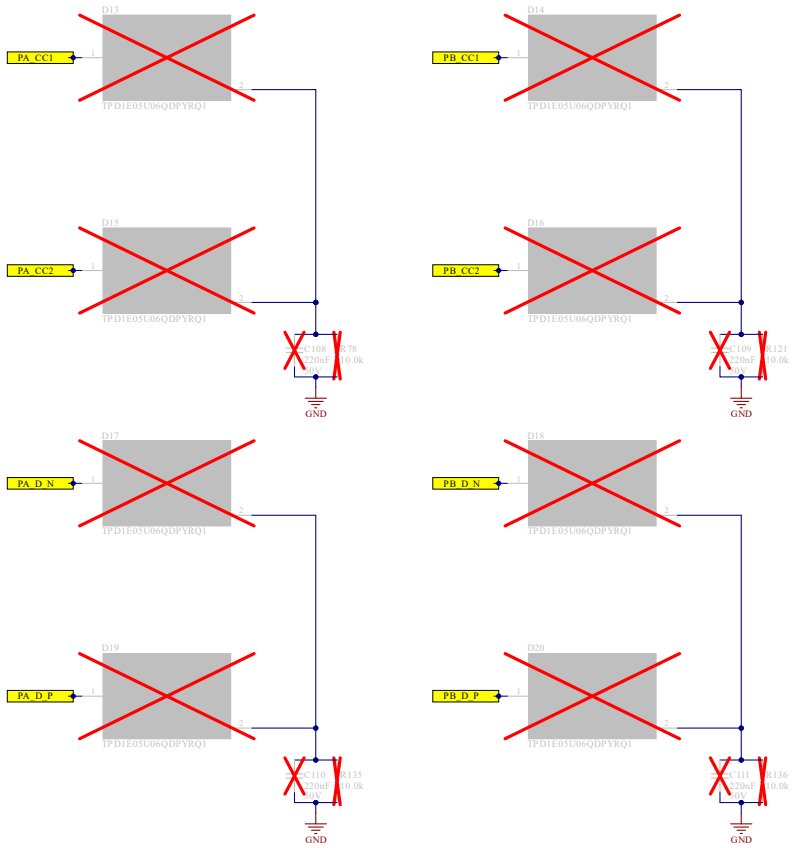


Figure 4-7. EVM IEC ESD Protection

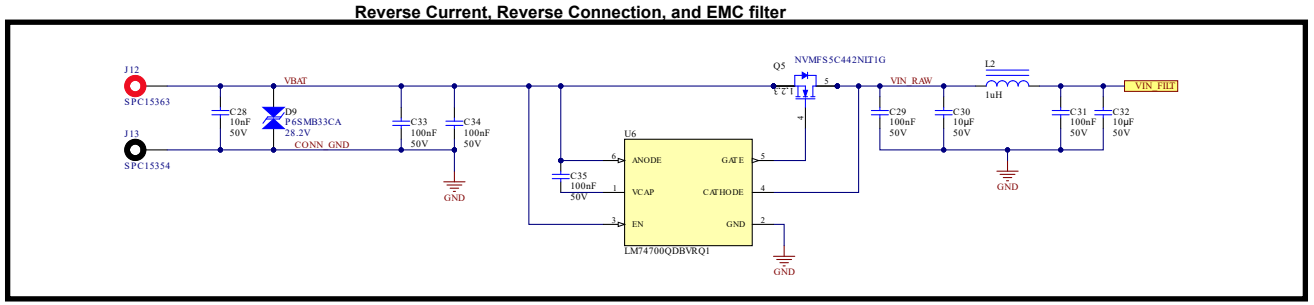


Figure 4-8. EVM 12V Input and EMC Power Filter

4.2 PCB Layouts

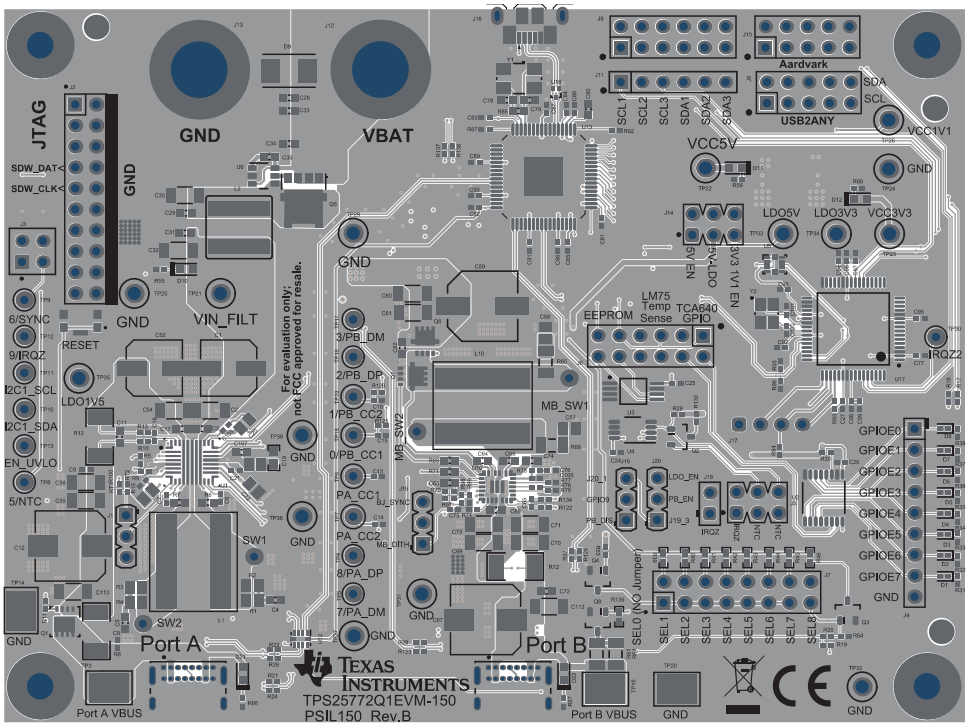


Figure 4-9. Top View Composite View

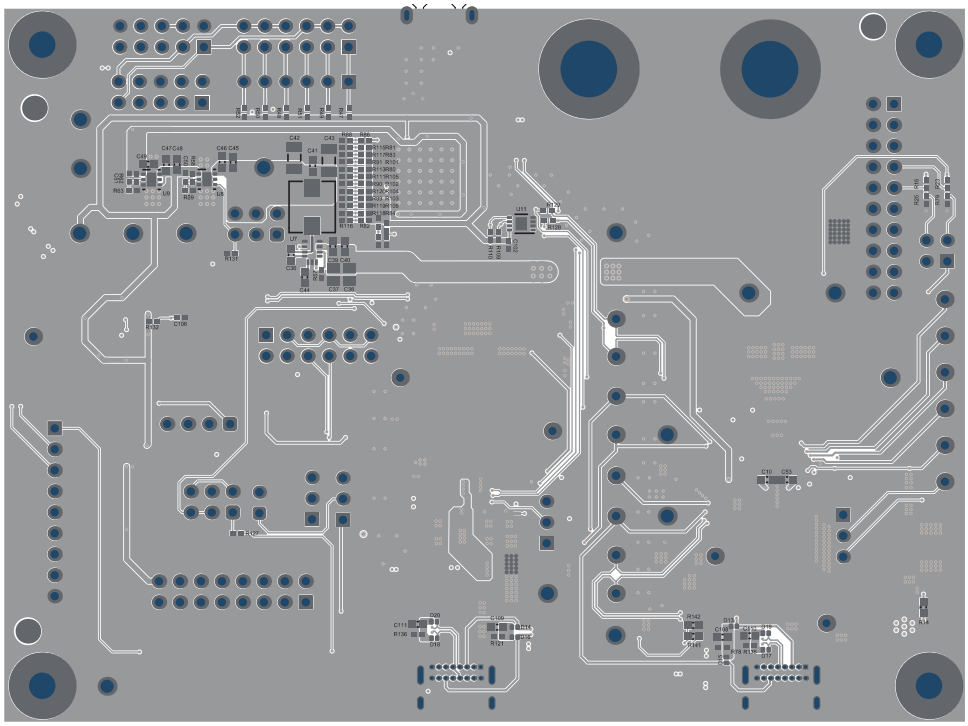


Figure 4-10. Bottom View Composite View

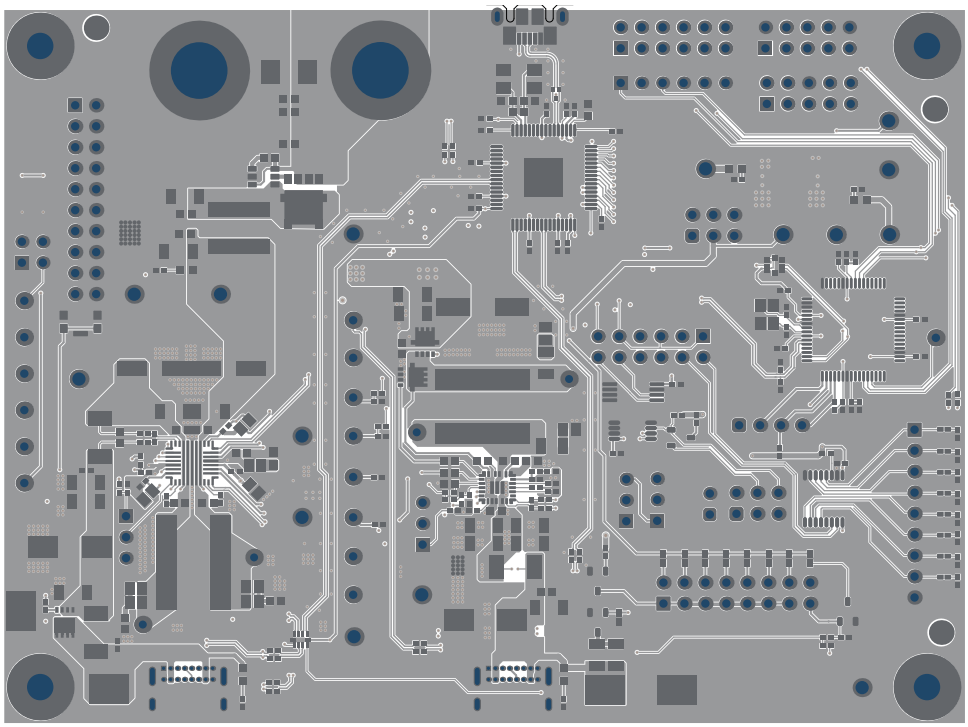


Figure 4-11. Top Solder Mask

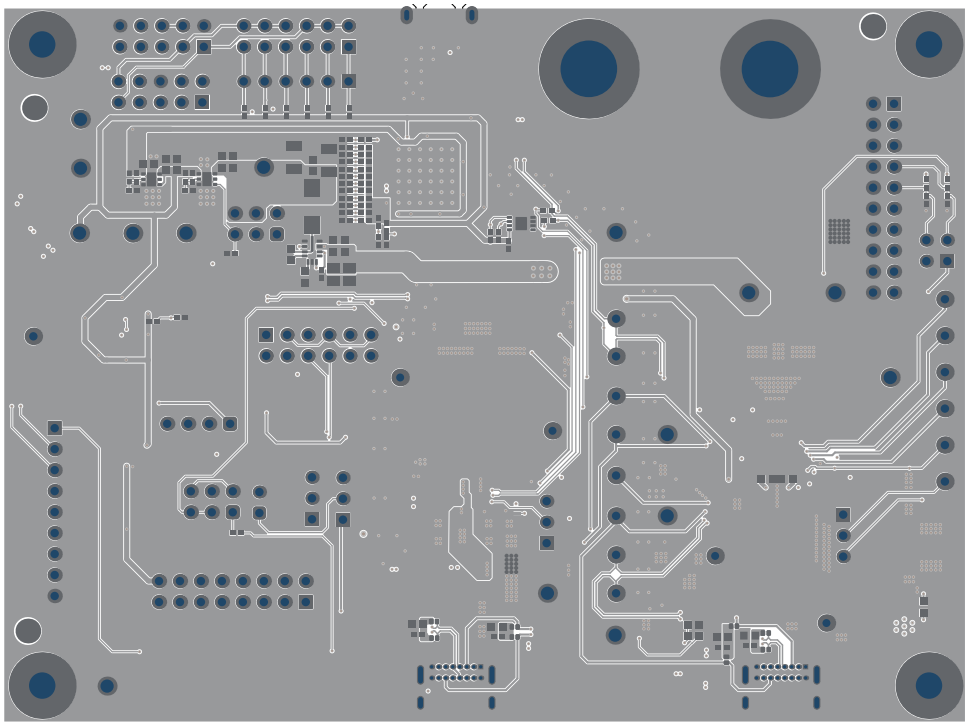


Figure 4-12. Bottom Solder Mask

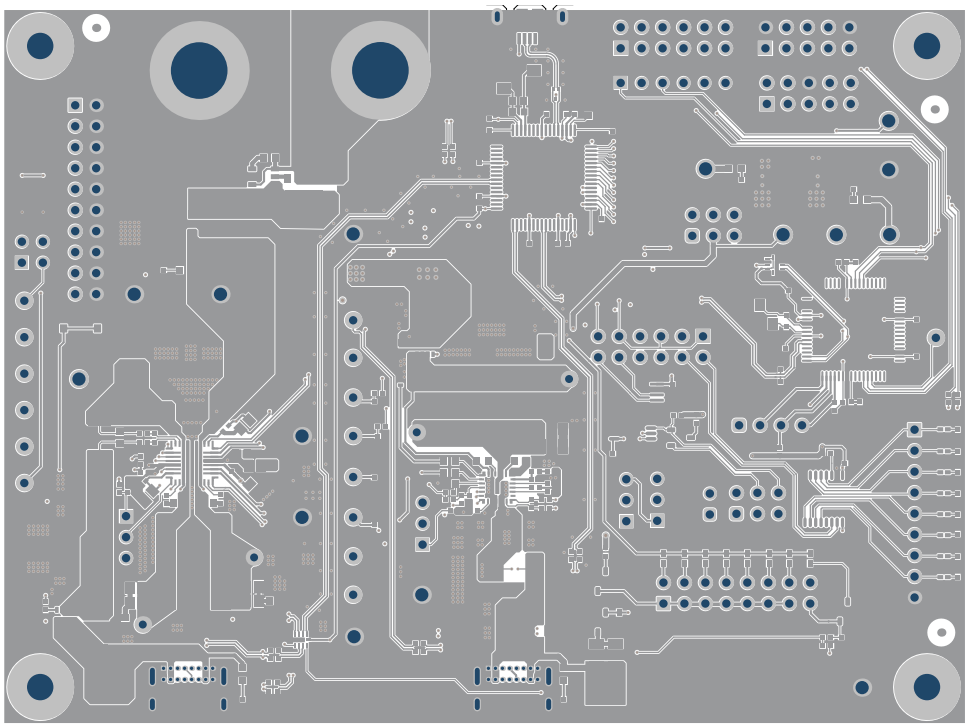


Figure 4-13. Top Layer(1)

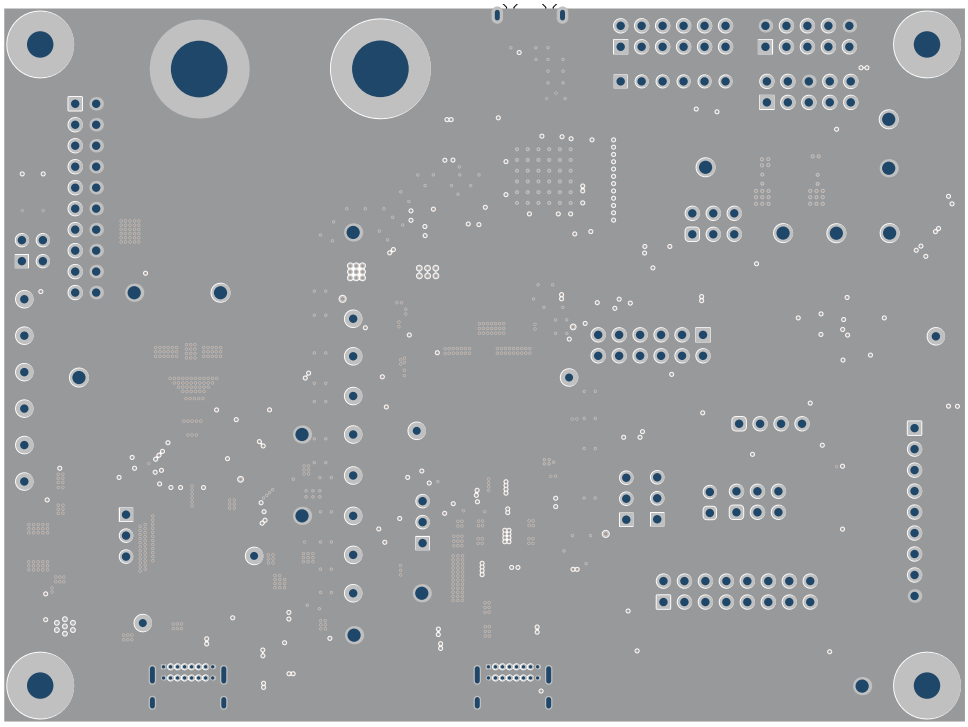


Figure 4-14. Signal Layer(2)

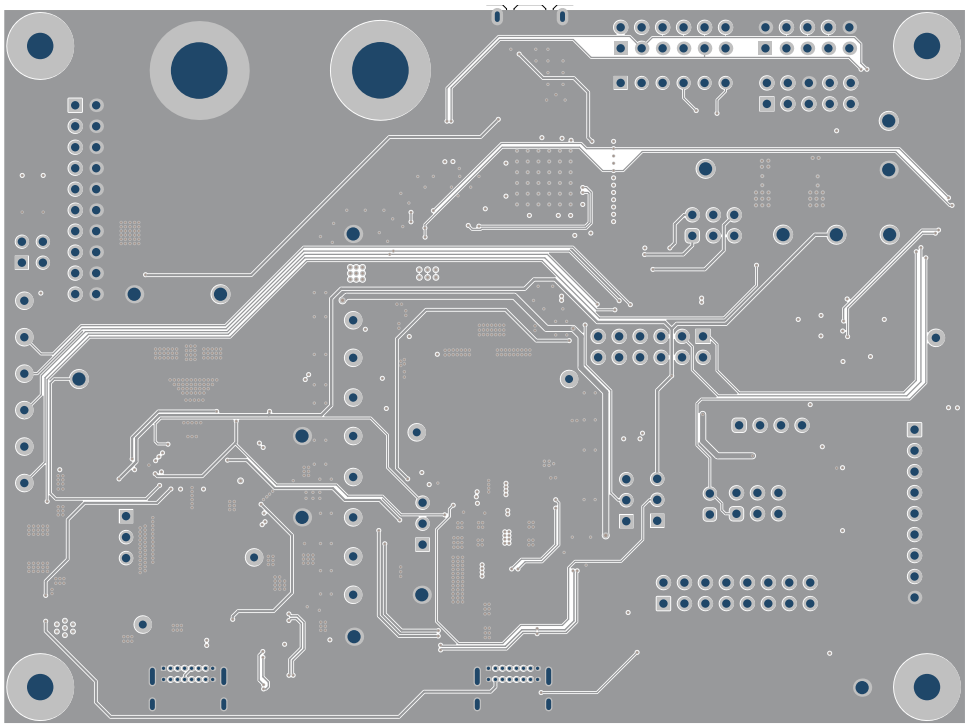


Figure 4-15. Signal Layer(3)

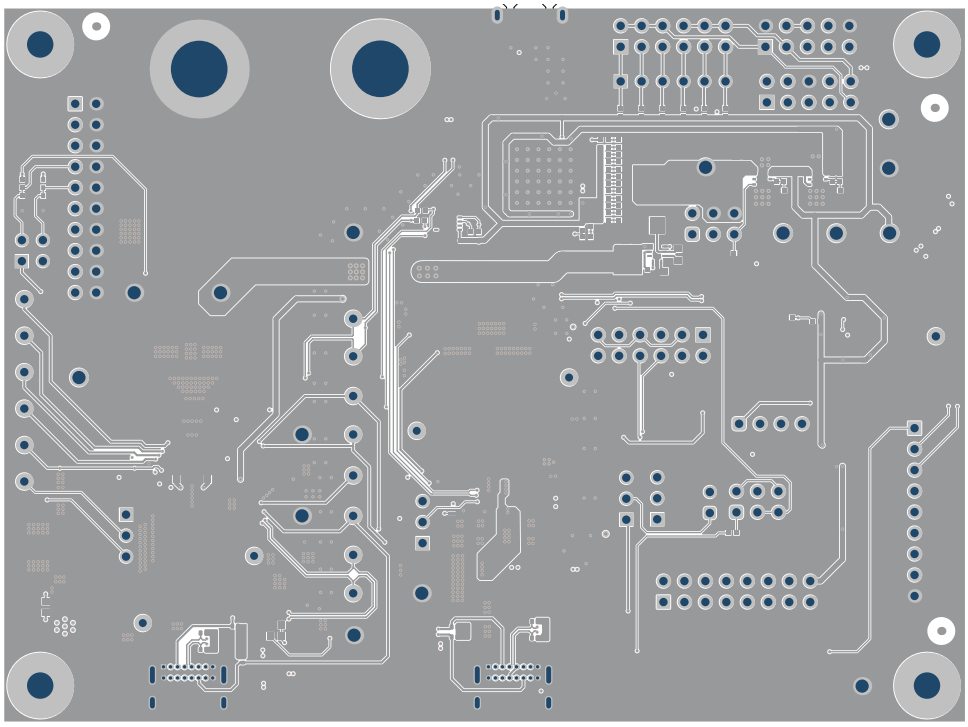


Figure 4-16. Bottom Layer (4)

4.3 Bill of Materials (BOM)

The bill of materials for the TPS25772Q1EVM-CD-150 is listed in Table 4-1.

Table 4-1. TPS25772Q1EVM-CD-150 Bill of Materials

Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer	Alternate Part Number	Alternate Manufacturer
!PCB1	1		Printed Circuit Board		PSIL150	Any		
C1, C52	2	33uF	CAP, Polymer Hybrid, 33uF, 50V, +/- 20%, 40 ohm, 6.3x7.7 SMD	6.3x7.7	EEH-ZC1H330XP	Panasonic		
C2, C30, C32, C60, C61, C69, C70, C71, C73	9	10uF	CAP, CERM, 10µF, 50V,+/- 10%, X7R, AEC-Q200 Grade 1, 1206	1206	CGA5L1X7R1H106K160AC	TDK		
C3, C10, C17, C36, C40, C41, C45, C53, C107	9	0.1uF	CAP, CERM, 0.1uF, 50V, +/- 10%, X7R, AEC-Q200 Grade 1, 0603	603	CGA3E2X7R1H104K080AA	TDK		
C5	1	3300pF	CAP, CERM, 3300pF, 50V,+/- 10%, X7R, 0603	603	8.85012E+11	Wurth Elektronik		
C6, C7, C8, C9, C24, C25, C26, C27, C77	9	0.1uF	CAP, CERM, 0.1uF, 50V, +/- 10%, X7R, AEC-Q200 Grade 1, 0402	402	CGA2B3X7R1H104K050BB	TDK		
C12	1	100uF	CAP, Polymer Hybrid, 100uF, 35V, +/- 20%, 27 mohm, 8x10 SMD	8x10	EEH-ZC1V101P	Panasonic		
C13, C14, C15, C16	4	330pF	CAP, CERM, 330pF, 50V, +/- 10%, X7R, 0402	402	GRM155R71H331KA01D	MuRata		
C18, C65	2	0.22uF	CAP, CERM, 0.22uF, 25V, +/- 20%, X5R, 0402	402	C1005X5R1E224M050BC	TDK		
C19	1	0.47uF	CAP, CERM, 0.47uF, 50V, +/- 10%, X7R, 0603	603	C1608X7R1H474K080AC	TDK		
C20, C22, C23	3	4.7uF	CAP, CERM, 4.7µF, 10V,+/- 10%, X7R, AEC-Q200 Grade 1, 0805	805	CGA4J3X7R1A475K125AB	TDK		
C21, C103, C104	3	0.1uF	CAP, CERM, 0.1uF, 16V, +/- 10%, X7R, 0402	402	0402YC104KAT2A	AVX		
C28	1	0.01uF	CAP, CERM, 0.01uF, 50V, +/- 10%, X7R, AEC-Q200 Grade 1, 0603	603	GCM188R71H103KA37D	MuRata		
C29, C31, C33, C34, C35	5	0.1uF	CAP, CERM, 0.1µF, 50V,+/- 10%, X7R, AEC-Q200 Grade 1, 0603	603	06035C104KAZ2A	AVX		
C37, C38	2	4.7uF	CAP, CERM, 4.7uF, 35V, +/- 10%, X7R, AEC-Q200 Grade 1, 0805	805	CGA4J1X7R1V475K125AC	TDK		
C39	1	0.22uF	CAP, CERM, 0.22µF, 50V,+/- 10%, X7R, AEC-Q200 Grade 1, 0603	603	GCJ188R71H224KA01D	MuRata		
C42, C43	2	22uF	CAP, CERM, 22uF, 10V, +/- 10%, X7R, AEC-Q200 Grade 1, 1206	1206	GCM31CR71A226KE02L	MuRata		

Table 4-1. TPS25772Q1EVM-CD-150 Bill of Materials (continued)

Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer	Alternate Part Number	Alternate Manufacturer
C44	1	1uF	CAP, CERM, 1uF, 35V, +/- 10%, X7R, AEC-Q200 Grade 1, 0603	603	CGA3E1X7R1V105K080AC	TDK		
C46, C47, C48, C49	4	10uF	CAP, CERM, 10µF, 6.3V,+/- 20%, X7R, 0603	603	CL10B106MQ8NRNC	Samsung Electro-Mechanics		
C50, C51	2	0.01uF	CAP, CERM, 0.01uF, 10V, +/- 10%, X5R, 0402	402	GRM155R61A103KA01D	MuRata		
C54, C55, C56	3	4.7uF	CAP, CERM, 4.7uF, 50V, +/- 10%, X7R, 1206	1206	C3216X7R1H475K160AC	TDK		
C59	1	68uF	CAP, Aluminum Polymer, 68µF, 50V,+/- 20%, 0.03 ohm, AEC-Q200 Grade 0, D8xL10.2mm SMD	D8xL10.2mm	EEH-ZE1H680V	Panasonic		
C62, C63, C68, C72	4	1uF	CAP, CERM, 1µF, 50V,+/- 20%, X5R, AEC-Q200 Grade 3, 0603	603	CGA3E3X5R1H105M080AB	TDK		
C64, C66	2	0.1uF	CAP, CERM, 0.1uF, 50V, +/- 10%, X7R, 0603	603	GCM188R71H104KA57D	MuRata		
C67	1	100uF	CAP, Polymer Hybrid, 100uF, 35V, +/- 20%, 27 ohm, 8x10 SMD	8x10	EEH-ZC1V101P	Panasonic		
C74	1	4.7uF	CAP, CERM, 4.7µF, 25V,+/- 10%, X6S, AEC-Q200 Grade 2, 0603	603	GRT188C81E475KE13D	MuRata		
C75	1	0.022uF	CAP, CERM, 0.022 uF, 50V, +/- 10%, X7R, AEC-Q200 Grade 1, 0402	402	CGA2B3X7R1H223K050BB	TDK		
C76	1	4700pF	CAP, CERM, 4700pF, 50V, +/- 10%, X7R, AEC-Q200 Grade 1, 0402	402	GCM155R71H472KA37D	MuRata		
C78, C79	2	18pF	CAP, CERM, 18pF, 50V, +/- 5%, C0G/NP0, 0603	603	GRM1885C1H180JA01D	MuRata		
C80	1	1uF	CAP, CERM, 1µF, 16V,+/- 10%, X7R, AEC-Q200 Grade 1, 0603	603	EMK107B7105KAHT	Taiyo Yuden		
C81, C82, C83, C84, C85, C86, C87, C88, C89, C90, C91, C92, C93, C94, C95, C97, C99, C106	18	0.1uF	CAP, CERM, 0.1µF, 16V,+/- 5%, X7R, AEC-Q200 Grade 1, 0402	402	GCM155R71C104JA55D	MuRata		
C96, C98	2	1uF	CAP, CERM, 1uF, 35V, +/- 10%, X5R, 0402	402	C1005X5R1V105K050BC	TDK		
C100, C101	2	10pF	CAP, CERM, 10pF, 50V, +/- 5%, C0G/NP0, 0402	402	500R07S100JV4T	Johanson Technology		
D1, D2, D3, D4, D5, D6, D7, D8	8	Green	LED, Green, SMD	402	APHHS1005CGCK	Kingbright		

Table 4-1. TPS25772Q1EVM-CD-150 Bill of Materials (continued)

Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer	Alternate Part Number	Alternate Manufacturer
D9	1	28.2V	Diode, TVS, Bi, 22V, 35.5 Vc, AEC-Q101, SMC	SMB	P6SMB33CA	Littelfuse		
D10, D11, D12, D21, D22	5	Green	LED, Green, SMD	LED_0603	150060GS75000	Wurth Elektronik		
H1, H2, H3, H4	4		Machine Screw, Round, #4-40 x 1/4, Nylon, Philips panhead	Screw	NY PMS 440 0025 PH	B&F Fastener Supply		
H5, H6, H7, H8	4		Standoff, Hex, 0.5"L #4-40 Nylon	Standoff	1902C	Keystone		
J1, J15, J19, J20	4		Header, 2.54mm, 3x1, Tin, TH	Header, 2.54mm, 3x1, TH	68001-403HLF	FCI		
J2	1		Header, 100mil, 10x2, Gold, TH	10x2 Header	TSW-110-07-G-D	Samtec		
J3	1		Header, 100mil, 2x2, Tin, TH	Header, 2x2, 2.54mm, TH	PEC02DAAN	Sullins Connector Solutions		
J4	1		Header, 100mil, 9x1, Gold, TH	9x1 Header	TSW-109-07-G-S	Samtec		
J5, J14	2		Header, 100mil, 3x2, Tin, TH	Header, 100mil, 3x2, TH	5-146254-3	TE Connectivity		
J6, J9	2		Header, 100mil, 6x2, Tin, TH	Header, 6x2, 100mil, Tin	PEC06DAAN	Sullins Connector Solutions		
J7	1		Header, 100mil, 8x2, Gold, TH	8x2 Header	TSW-108-07-G-D	Samtec		
J8, J10	2		Header, 100mil, 5x2, Tin, TH	Header, 5x2, 100mil, Tin	PEC05DAAN	Sullins Connector Solutions		
J11	1		Header, 100mil, 6x1, Tin, TH	TH, 6-Leads, Body 608x100mil, Pitch 100mil	PEC06SAAN	Sullins Connector Solutions		
J12	1		BANANA JACK, SOLDER LUG, RED, TH	Red Insulated Banana Jack	SPC15363	Tenma		
J13	1		BANANA JACK, SOLDER LUG, BLACK, TH	Black Insulated Banana Jack	SPC15354	Tenma		
J16	1		Receptacle, USB 2.0, Micro B, 5 Position, R/A, SMT	Receptacle, USB 2.0, Micro B, 5 Pos, 0.65mm Pitch, R/A, SMT	1051640001	Molex		
J17	1		Header, 100mil, 4x1, Gold, TH	4x1 Header	TSW-104-07-G-S	Samtec		
J18	1		Header, 2.54mm, 2x1, Gold, TH	Header, 2.54mm, 2x1, TH	TSW-102-08-G-S	Samtec		
L1, L10	2	4.7uH	Inductor, Shielded, Composite, 4.7uH, 24A, 0.01 ohm, SMD	Inductor, 11.3x10x10mm	XAL1010-472MEB	Coilcraft		
L2	1	1uH	Inductor, Shielded, Composite, 1uH, 25A, 0.00255 ohm, SMD	7.2x7x7.5mm	XAL7070-102MEB	Coilcraft		

Table 4-1. TPS25772Q1EVM-CD-150 Bill of Materials (continued)

Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer	Alternate Part Number	Alternate Manufacturer
L7	1	1.5uH	Inductor, Shielded, Ferrite, 1.5uH, 6A, 0.025 ohm, SMD	Inductor, 5.7x2.8x5.2mm	SRP5030T-1R5M	Bourns		
PORT A1, PORT A2	2		USB - C (Type - C) USB 2.0 Receptacle Connector 16 Position Through Hole, Right Angle	PTH_USB-C	USB4085-GF-A	Global Connector Technology		
Q2	1	60V	MOSFET, N-CH, 60V, 0.115A, AEC-Q101, SOT-23	SOT-23	2N7002Q-7-F	Diodes Inc.		None
Q3, Q4, Q8	3	60V	MOSFET, N-CH, 60V, 0.24A, SOT-23	SOT-23	2N7002E-T1-E3	Vishay-Siliconix		None
Q5	1	40V	MOSFET, N-CH, 40V, 27A, AEC-Q101, DFN5 5x6mm	DFN5 5x6mm	NVMFS5C442NLT1G	ON Semiconductor		None
Q6, Q7	2		N-Channel 40V 107A (Tc) 68W (Tc) Surface Mount 8-WDFN (3.3x3.3)	WDFN8	NVTFS5C453NLWFTAG	ON Semiconductor		
R3, R4	2	2.2	RES, 2.2, 5%, 0.125 W, AEC-Q200 Grade 0, 0805	805	ERJ-6GEYJ2R2V	Panasonic		
R5, R57	2	80.6k	RES, 80.6 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	402	CRCW040280K6FKED	Vishay-Dale		
R6, R7, R14	3	0	RES, 0, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	603	RMCF0603ZT0R00	Stackpole Electronics Inc		
R8	1	0.001	RES, 0.001, 1%, 1 W, 2010	2010	PMR50HZPFV1L00	Rohm		
R9	1	20.0k	RES, 20.0 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	402	CRCW040220K0FKED	Vishay-Dale		
R10, R20, R22, R26, R27, R124, R128, R129	8	0	RES, 0, 5%, 0.063 W, AEC-Q200 Grade 0, 0402	402	CRCW04020000Z0ED	Vishay-Dale		
R12, R72	2	0.01	RES, 0.01, 1%, 1 W, 2010	2010	WSL2010R0100FEA18	Vishay-Dale		
R13, R122, R134	3	10	RES, 10.0, 1%, 0.063 W, 0402	402	CRCW040210R0FKED	Vishay-Dale		
R16, R23	2	4.02k	RES, 4.02 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	402	CRCW04024K02FKED	Vishay-Dale		
R25, R29, R30, R54, R79, R130	6	100k	RES, 100 k, 1%, 0.0625 W, AEC-Q200 Grade 0, 0402	402	AC0402FR-07100KL	Yageo America		
R31, R32, R33, R34, R35, R36, R37, R38	8	100	RES, 100, 1%, 0.063 W, 0402	402	MCR01MZPF1000	Rohm		
R39	1	100k	RES, 100 k, 1%, 0.0625 W, 0402	402	RC0402FR-07100KL	Yageo America		
R40	1	46.4k	RES, 46.4 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	402	CRCW040246K4FKED	Vishay-Dale		

Table 4-1. TPS25772Q1EVM-CD-150 Bill of Materials (continued)

Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer	Alternate Part Number	Alternate Manufacturer
R41	1	26.7k	RES, 26.7 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	402	CRCW040226K7FKED	Vishay-Dale		
R42	1	18.2k	RES, 18.2 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	402	CRCW040218K2FKED	Vishay-Dale		
R43	1	13.0k	RES, 13.0 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	402	CRCW040213K0FKED	Vishay-Dale		
R44, R87	2	9.53k	RES, 9.53 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	402	CRCW04029K53FKED	Vishay-Dale		
R45	1	7.50k	RES, 7.50 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	402	CRCW04027K50FKED	Vishay-Dale		
R46	1	5.62k	RES, 5.62 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	402	CRCW04025K62FKED	Vishay-Dale		
R47, R48, R49, R50, R51, R52	6	2.20k	RES, 2.20 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	402	RMCF0402FT2K20	Stackpole Electronics Inc		
R53	1	1.00k	RES, 1.00 k, 1%, 0.063 W, 0402	402	MCR01MZPF1001	Rohm		
R55, R56, R60	3	5.1k	RES, 5.1 k, 5%, 0.063 W, AEC-Q200 Grade 0, 0402	402	CRCW04025K10JNED	Vishay-Dale		
R58	1	97.6k	RES, 97.6 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	402	CRCW040297K6FKED	Vishay-Dale		
R59	1	19.6k	RES, 19.6 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	402	CRCW040219K6FKED	Vishay-Dale		
R61, R64	2	510	RES, 510, 5%, 0.25 W, 1206	1206	CRCW1206510RJNEA	Vishay-Dale		
R62, R63	2	47.0k	RES, 47.0 k, 1%, 0.0625 W, 0402	402	RC0402FR-0747KL	Yageo America		
R66, R67	2	10k	RES, 10 k, 5%, 0.1 W, AEC-Q200 Grade 0, 0402	402	ERJ-2GEJ103X	Panasonic		
R69, R71	2	1	RES, 1.00, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	603	CRCW06031R00FKEA	Vishay-Dale		
R70	1	1	RES, 1.00, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	402	CRCW04021R00FKED	Vishay-Dale		
R73	1	24.9k	RES, 24.9 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	402	CRCW040224K9FKED	Vishay-Dale		
R74	1	49.9k	RES, 49.9 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	402	CRCW040249K9FKED	Vishay-Dale		
R75	1	14.3k	RES, 14.3 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	402	CRCW040214K3FKED	Vishay-Dale		
R76	1	150k	RES, 150 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	402	CRCW0402150KFKED	Vishay-Dale		
R77	1	20.0k	RES, 20.0 k, 1%, 0.063 W, 0402	402	CRCW040220K0FKED	Vishay-Dale		

Table 4-1. TPS25772Q1EVM-CD-150 Bill of Materials (continued)

Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer	Alternate Part Number	Alternate Manufacturer
R80, R81, R83, R88, R93, R94, R98, R100, R112, R118, R120	11	10.0k	RES, 10.0 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	402	AC0402FR-0710KL	Yageo America		
R82, R89, R90, R91, R92, R105, R107, R108, R109, R110	10	4.7k	RES, 4.7 k, 5%, 0.063 W, AEC-Q200 Grade 0, 0402	402	CRCW04024K70JNED	Vishay-Dale		
R85	1	1.00Meg	RES, 1.00M, 1%, 0.1W, AEC-Q200 Grade 0, 0603	603	CRCW06031M00FKEA	Vishay-Dale		
R86	1	90.9k	RES, 90.9 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	402	CRCW040290K9FKED	Vishay-Dale		
R131	1	88.7k	RES, 88.7 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	402	CRCW040288K7FKED	Vishay-Dale		
R132	1	15.0k	RES, 15.0 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	402	CRCW040215K0FKED	Vishay-Dale		
R133	1	10	RES, 10.0, 1%, 0.25 W, 0805	805	RNCP0805FTD10R0	Stackpole Electronics Inc		
R139	1	51k	RES, 51 k, 5%, 0.063 W, AEC-Q200 Grade 0, 0402	402	CRCW040251K0JNED	Vishay-Dale		
R142	1	10.2k	RES, 10.2 k, 1%, 0.1 W, 0603	603	RC0603FR-0710K2L	Yageo		
RT2	1		Thermistor, DEC0002A (X1SON-2)	DEC0002A	TMP6131DECR	Texas Instruments	TMP6131DECT	Texas Instruments
S1	1		Switch, SPST-NO, Off-Mom, 0.01A, 32 VDC, SMD	4.2x2.8mm	KMR243GLFG	C&K Components		
SH-J1, SH-J2, SH-J3, SH-J4, SH-J5, SH-J6, SH-J7, SH-J8, SH-J9, SH-J10, SH-J11, SH-J12, SH-J13, SH-J14, SH-J15, SH-J16, SH-J17, SH-J18, SH-J19	19	1x2	Shunt, 100mil, Gold plated, Black	Shunt	SNT-100-BK-G	Samtec	969102-0000-DA	3M
TP3, TP14, TP15, TP20	4		Test Point, Compact, SMT	Testpoint_Keystone_Compact	5016	Keystone		
TP4, TP5, TP16, TP17	4		Test Point, Miniature, Blue, TH	Blue Miniature Test point	5117	Keystone		

Table 4-1. TPS25772Q1EVM-CD-150 Bill of Materials (continued)

Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer	Alternate Part Number	Alternate Manufacturer
TP6, TP7, TP18, TP19	4		Test Point, Miniature, Green, TH	Green Miniature Test point	5116	Keystone		
TP8, TP9, TP10, TP11, TP12, TP13, TP30	7		Test Point, Miniature, White, TH	White Miniature Test point	5002	Keystone		
TP21, TP22, TP23, TP26, TP33, TP34, TP35	7		Test Point, Compact, Red, TH	Red Compact Test point	5005	Keystone		
TP24, TP25, TP29, TP31, TP32, TP36, TP37, TP38	8		Test Point, Compact, Black, TH	Black Compact Test point	5006	Keystone		
U1	1		Automotive Dual USB Type-C® Power Delivery Controller with BuckBoost Regulator	VQFN-HR29	TPS25772DQRQLRQ1	Texas Instruments		
U2	1		Low-Voltage 8-Bit I2C and SMBus I/O Expander, 1.65 to 5.5V, -40 to 85 degC, 16-pin TSSOP (PW), Green (RoHS & no Sb/Br)	PW0016A	TCA6408APWR	Texas Instruments		
U3	1		256K I2C CMOS Serial EEPROM, TSSOP-8	TSSOP-8	24LC256-I/ST	Microchip		
U4	1		Automotive Grade, 1.4V-Capable Temperature Sensor with I2C/ SMBus Interface in LM75 Pinout, DGK0008A (VSSOP-8)	DGK0008A	TMP75BQDGKRQ1	Texas Instruments	TMP75BQDGKTQ1	Texas Instruments
U5	1		256-Taps Dual-Channel Digital Potentiometer With I2C Interface and Nonvolatile Memory, RUC0014A (X2QFN-14)	RUC0014A	TPL0102-100RUCR	Texas Instruments		Texas Instruments
U6	1		Low Iq Always ON Smart Diode Controller, DBV0006A (SOT-23-6)	DBV0006A	LM74700QDBVRQ1	Texas Instruments	LM74700QDBVTQ1	Texas Instruments
U7	1		Automotive 3.8V to 36V 2A Synchronous Step-Down Voltage Regulator, RNX0012B (VQFN-HR-12)	RNX0012B	LMR33620CQ5RNXTQ1	Texas Instruments	LMR33620CQ5RNXRQ1	Texas Instruments
U8, U9	2		1A LDO With Power-Good, DRV0006A (WSON-6)	DRV0006A	TPS74601PBQWDRVRQ1	Texas Instruments		Texas Instruments
U10	1		36V, 16A Buck-Boost Converter, RPM0026A (VQFN-HR-26)	RPM0026A	TPS55288QRPMRQ1	Texas Instruments		Texas Instruments

Table 4-1. TPS25772Q1EVM-CD-150 Bill of Materials (continued)

Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer	Alternate Part Number	Alternate Manufacturer
U12	1		Automotive Catalog ESD Protected, High-Speed USB 2.0 (480Mbps) 1:2 Multiplexer / Demultiplexer Switch, 16 ohm RON, 2.5 to 3.3V, -40 to 125 degC, 10-Pin UQFN (RSE), Green (RoHS & no Sb/Br)	RSE0010A	TS3USB221AQRSERQ1	Texas Instruments		
U13	1		Four-Port High-Speed 480Mbps USB 2.0 Hub, PAP0064K (HTQFP-64)	PAP0064K	TUSB4041IPAP	Texas Instruments	TUSB4041IPAPR	Texas Instruments
U16	1		ESD Solution for Super-Speed (6Gbps) USB 3.0 Interface, 2 Channels, -40 to +85 degC, 3-pin SOT (DRT), Green (Rohs ad No Sb/Br)	DRT0003A	TPD2EUSB30DRTR	Texas Instruments		
U17	1		Tiva C Series Microcontroller, 256 KB Flash, 32 KB SRAM, 12 Bit, 12 Channels, -40 to 105 degC, 64-Pin LQFP (PM), Green (RoHS & no Sb/Br), Tape and Reel	PM0064A	TM4C123GH6PMTR	Texas Instruments		
Y1	1		Crystal, 24MHz, 30ppm, 20pF, SMD	5x3.2mm	ECS-240-20-30B-AEN-TR	ECS Inc.		
Y2	1		Crystal, 16MHz, 8pF, SMD	3.2x0.75x2.5mm	NX3225GA-16.000M-STD-CRG-1	NDK		
C4	0	3300pF	CAP, CERM, 3300pF, 50V,+/- 10%, X7R, 0603	603	8.85012E+11	Wurth Elektronik		
C11	0	0.1uF	CAP, CERM, 0.1uF, 50V, +/- 10%, X7R, AEC-Q200 Grade 1, 0603	603	CGA3E2X7R1H104K080AA	TDK		
C57, C58	0	3300pF	CAP, CERM, 3300pF, 250V,+/- 10%, X7R, AEC-Q200 Grade 1, 0805	805	GCJ21AR72E332KXJ1D	MuRata		
C102	0	0.1uF	CAP, CERM, 0.1µF, 16V,+/- 5%, X7R, AEC-Q200 Grade 1, 0402	402	GCM155R71C104JA55D	MuRata		
C105	0	100pF	CAP, CERM, 100pF, 50V, +/- 1%, C0G/NP0, 0402	402	04025A101FAT2A	AVX		
C108, C109, C110, C111	0	0.22uF	CAP, CERM, 0.22µF, 50V,+/- 10%, X7R, AEC-Q200 Grade 1, 0603	603	GCJ188R71H224KA01D	MuRata		
C112, C113	0	10uF	CAP, CERM, 10µF, 50V,+/- 10%, X7R, AEC-Q200 Grade 1, 1206	1206	CGA5L1X7R1H106K160AC	TDK		
D13, D14, D15, D16, D17, D18, D19, D20	0		Automotive 1-Channel Ultra-Low-Capacitance IEC ESD Protection Diode, DPY0002A (X1SON-2)	DPY0002A	TPD1E05U06QDPYRQ1	Texas Instruments	TPD1E05U06QDPYTQ1	Texas Instruments
Q1	0	30V	MOSFET, N-CH, 30V, 60A, DQG0008A (VSON-CLIP-8)	DQG0008A	CSD17575Q3	Texas Instruments		None

Table 4-1. TPS25772Q1EVM-CD-150 Bill of Materials (continued)

Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer	Alternate Part Number	Alternate Manufacturer
R1, R2	0	2.2	RES, 2.2, 5%, 0.125 W, AEC-Q200 Grade 0, 0805	805	ERJ-6GEYJ2R2V	Panasonic		
R11	0	0	RES, 0, 5%, 0.063 W, 0402	402	RC0402JR-070RL	Yageo America		
R15, R78, R101, R102, R103, R104, R111, R113, R114, R115, R116, R117, R119, R121, R135, R136	0	10.0k	RES, 10.0 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	402	AC0402FR-0710KL	Yageo America		
R17, R18, R19, R21, R24, R28, R123, R125, R126, R127, R137, R138	0	0	RES, 0, 5%, 0.063 W, AEC-Q200 Grade 0, 0402	402	CRCW04020000Z0ED	Vishay-Dale		
R65, R68	0	2.2	RES, 2.2, 5%, 0.25 W, AEC-Q200 Grade 0, 1206	1206	CRCW12062R20JNEA	Vishay-Dale		
R84, R106	0	4.7k	RES, 4.7 k, 5%, 0.063 W, AEC-Q200 Grade 0, 0402	402	CRCW04024K70JNED	Vishay-Dale		
R95, R96	0	15.0k	RES, 15.0 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	402	CRCW040215K0FKED	Vishay-Dale		
R97	0	80.6k	RES, 80.6 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	402	CRCW040280K6FKED	Vishay-Dale		
R99	0	20.0k	RES, 20.0 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	402	CRCW040220K0FKED	Vishay-Dale		
R141	0	10.2k	RES, 10.2 k, 1%, 0.1 W, 0603	603	RC0603FR-0710K2L	Yageo		
RT1	0	47k	Thermistor NTC, 47k ohm, 5%, 0402	402	NCP15WL473J03RC	MuRata		
U11	0		EEPROM 4KBIT 1MHZ,8UDFN	UDFN-8	AT24C04D-MAHM-T	Atmel		

5 Additional Information

5.1 Trademarks

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6 Revision History

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

Changes from Revision * (August 2024) to Revision A (September 2024)	Page
• Updated document status from private to public	1
• Updated document title for clarity	1

STANDARD TERMS FOR EVALUATION MODULES

1. *Delivery:* TI delivers TI evaluation boards, kits, or modules, including any accompanying demonstration software, components, and/or documentation which may be provided together or separately (collectively, an “EVM” or “EVMs”) to the User (“User”) in accordance with the terms set forth herein. User's acceptance of the EVM is expressly subject to the following terms.

   1.1 EVMs are intended solely for product or software developers for use in a research and development setting to facilitate feasibility evaluation, experimentation, or scientific analysis of TI semiconductors products. EVMs have no direct function and are not finished products. EVMs shall not be directly or indirectly assembled as a part or subassembly in any finished product. For clarification, any software or software tools provided with the EVM (“Software”) shall not be subject to the terms and conditions set forth herein but rather shall be subject to the applicable terms that accompany such Software

   1.2 EVMs are not intended for consumer or household use. EVMs may not be sold, sublicensed, leased, rented, loaned, assigned, or otherwise distributed for commercial purposes by Users, in whole or in part, or used in any finished product or production system.

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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2. 実験局の免許を取得後ご使用いただく。
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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.

5. *Accuracy of Information:* To the extent TI provides information on the availability and function of EVMs, TI attempts to be as accurate as possible. However, TI does not warrant the accuracy of EVM descriptions, EVM availability or other information on its websites as accurate, complete, reliable, current, or error-free.

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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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