



Description

The TPS26742EQ1EVM is designed to evaluate the TPS26742E-Q1 IC for USB Type-C® and Power Delivery (PD) applications. This EVM supports dual port PD charging and comes with three other variants: single port charging with DisplayPort™ over USB-C™ (DP Alt Mode)

The EVM integrates a microcontroller, enabling online debugging and online Flash updates.

Device configuration settings are selected through an intuitive Application Customization Tool in the form of a graphical user interface ([TPS267XX-Q1-GUI](#)), reducing much of the complexity associated with competitive USB-PD designs.

Get Started

1. Order the TPS26742EQ1EVM.
2. Order 2 LM251772EVM-PD
 - a. Other EVMs/daughter cards will become available in the future
3. Read this TPS26742EQ1EVM user's guide (this document)
4. Start development with the graphical user interface ([TPS267XX-Q1-GUI](#))

5. Refer to the data sheet or E2E for questions and support

Features

- Charging up to 240W on Port A and port B
 - 240W with LM251772EVM-PD
- Supported VIN is 6V to 48V
- GUI([TPS267XX-Q1-GUI](#))
- VBUS and CCx test points for both Type-C ports to monitor PD traffic
- MCU for Flash programming and system telemetry
- Jumper selection for PP5V source
- Jumper to allow for future EVM boards that support voltages up to 50V
- I2C address update via Jumper
- All GPIO pins available on headers
 - PP5V from TPS26742EQ1
 - PP5V from Data Type C
 - PP5V generated from VIN using onboard Buck converter

Applications

- Automotive USB charging
- Automotive media hub
- Automotive head unit
- Automotive rear seat entertainment

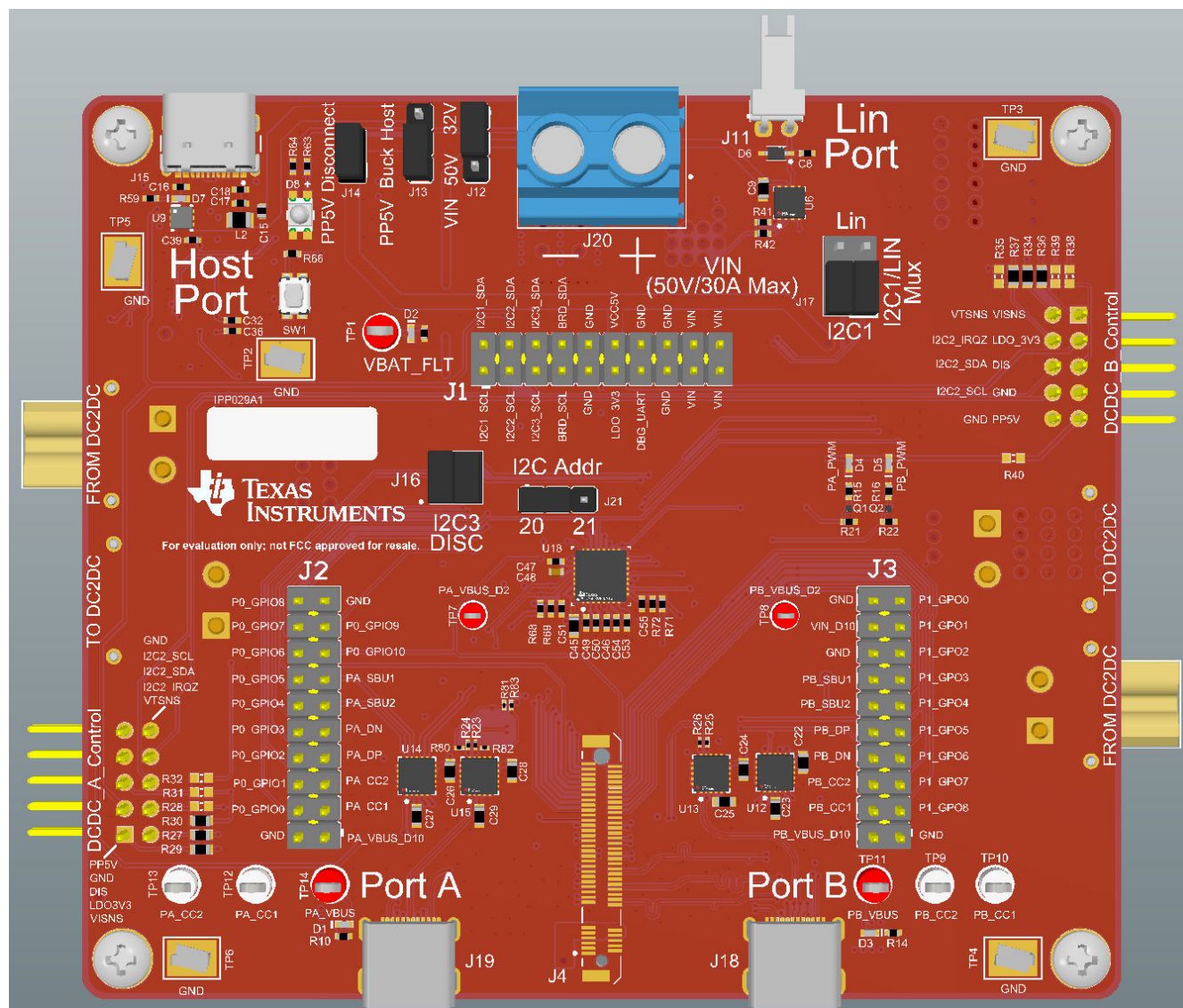


Figure 1-1. TPS26742EQ1EVM

1 Evaluation Module Overview

1.1 Introduction

This user's guide describes how the TPS26742EQ1EVM can be used to test PD functions.

The TPS26742E-Q1 is a dual port USB PD controller that has integrated flash and the ability to control external DC2DC converters and display port re-timers and switches

The EVM is customizable by using the ([TPS267XX-Q1-GUI](#).) to control an on board MCU through a type C connector

Additionally, the EVM is equipped with 100 mil connectors to I2C interfaces and all GPIO pins supported by the TPS26742E-Q1 device

1.2 Kit Contents

The EVM Kit contains the TPS2674EQ1 EVM.

1.3 Specification

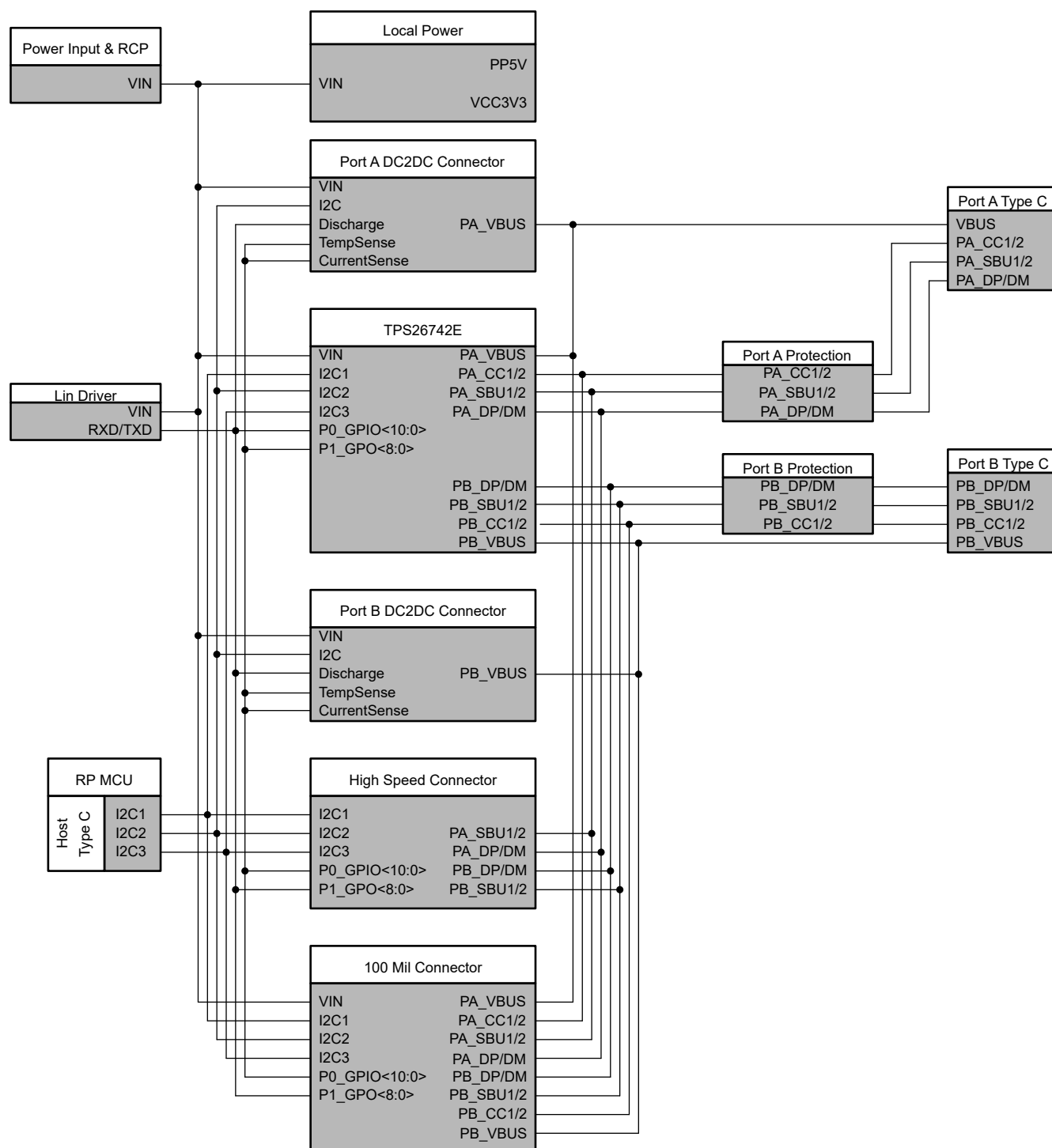


Figure 1-1. EVM Simplified Block Diagram

1.4 Device Information

The TPS26742E-Q1 is a dual port Type-C controller that can interface with 2 external DC2DC converters and support up to 240W per port of power delivery.

The TPS26742E-Q1 implements intelligent system power management (SPM) to maximize delivered USB power while protecting the system from automotive battery transient and over-temperature conditions.

2 Hardware

2.1 Power Requirements

The TPS26742EQ1EVM is designed to support 2 different voltage ranges that need to be configured by placing the provide shunt on J12. When the EVM is packaged, a shunt will will be installed between pins 1 and 2 to set the voltage range to the lower range of 6V to 32V.

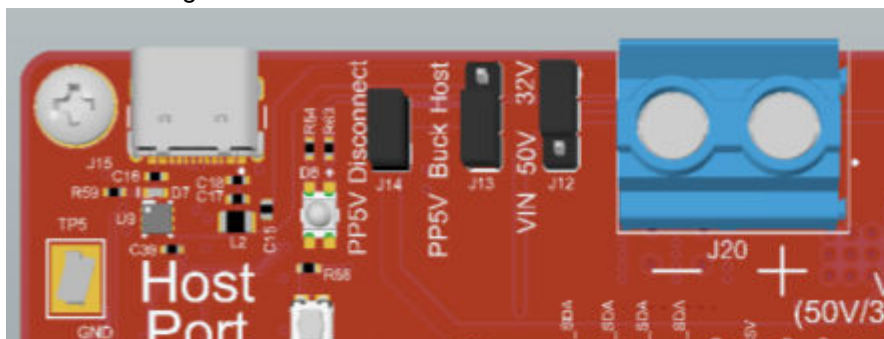


Figure 2-1. EVM Power Connectors

Table 2-1. Jumper J12 Configuration

Jumper J12	Vin Voltage Range
Pins 1 and 2	6V to 32V
Pins 2 and 3	6V to 50V

The TPS26742E-Q1 EVM supports a sustained DC current of 30A. This requirement sets the input current that the external power supply needs to provide to the EVM and needs to be considered when testing the output PDO voltage and current. The table below shows the voltage that will cause the input current to the EVM to hit the 30A maximum for common dual port maximum USB Type C PD output PDO powers.

Table 2-2. Minimum Input Voltage for power delivery (30A input Current)

Power Delivered to Type C connector	Input Voltage
100W to both port A and port B	6.67V
140W to both port A and port B	9.34V
180W to both port A and port B	12V
240W to both port A and port B	16V

2.2 Setup

The TPS26742EQ1EVM requires the connection of additional EVMs (Daughter Cards) in order to operate normally. This connection option allows many different DC2DC converters to be connected to the EVM for evaluation.

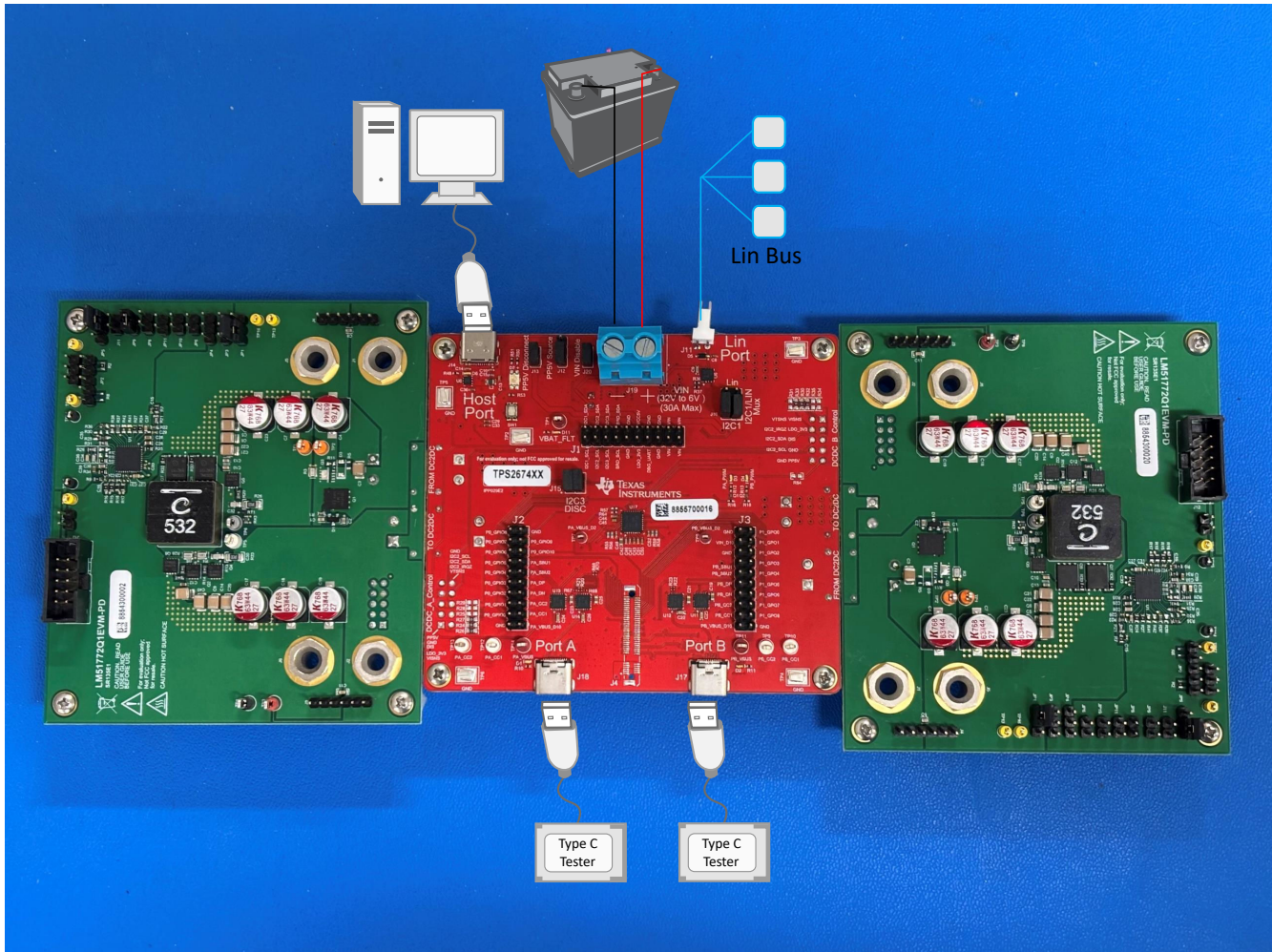
Daughter cards for the BQ25758Q1/BQ25758BQ1, LM55288, LM55289, LM72650Q1, and LM72680Q1 are under development.

System Implemented with LM251772EVM-PD

- Prepare the TPS26742EQ1 EVM
 - Verify that a shunt is installed between pins 1 and 2 of J12 to select the 6V to 32V input voltage range
 - Verify that a shunt is installed on J14 to connect the VCC5V pin of the TPS26742EQ2 IC to the 5V PCB buck to support VCONN for Type C PD power greater than 60W
- Prepare LM251772EVM-PD daughter cards
 - Verify that a shunt is installed between pins 2 and 3 of JP5
 - Verify that a shunt is installed on JP9 if daughter card connected to port A and not installed for port B

- c. Verify that a shunt is installed between pins 1 and 2 of JP1
 - d. Verify that all other jumpers are open
3. Connect the 3 boards together as shown below
 - 4.

Figure 2-2. Setup With LM251772-Q1 EVM



5. Connect a 5.5V-32V DC power supply to J20, the blue 2 pin screw terminal connector. This power supply must meet the input power requirements of the combined type C output ports and TPS26742EQ1EVM
6. Connect Host MCU to a laptop or PC using the host type C port if planning to update the firmware using the GUI.
7. Attach a Lin bus controller to the Lin Bus connector if planning to use :om
8. Connect Port A and/or Port B Type-C connectors a type-C sink devices or test equipment.

2.3 Header Information

Headers J1, J2, and J3 are provided to observe or control all interfaces supported by the TPS26742EQ1 device. The pin connects for the headers are clearly labeled in silk screen.

All signals on these jumpers are voltage ranged to support a 5V digitizer

- J2 provides PA_VBUS divided by 10 and buffered by on OPAMP to support connection of a digitizer with a 5V range
- J3 provides VIN and PB_VBUS divided by 10 and buffered by on OPAMP to support connection of a digitizer with a 5V range
- All other signals on J1, J2, and J3 are clearly labeled on the silk screen

2.4 Jumper Information

Table 2-3. Jumper Connections

Jumper	Shunt Connection		Description
J12	1-2 Installed	VIN up to 6V to 32V	Select the input voltage of the EVM. When the 50V VIN range is selected, the Lin interface cannot be used
	2-3 Installed	VIN up to 6V to 50V	
J13	1-2 Installed	TPS26772EQ1 5V connected to Host Type C VBUS	Select the source of the 5V Vcc voltage.
	2-3 Installed	PP5V supplied from EVM 5V supply	
J14	Open	Disconnect EVM 5V Power rail from PP5V	TPS26742EQ1 power selection
	Installed	Connect EVM 5V to PP5V of TPS26742EQ1	
J16	1-3 Installed and 2-4 Installed	I2C3 connected the RP MCU with pull-ups	I2C3 Disconnect
J17	Open	P0_GPIO5 and P0_GPIO6	GPIO Selected
	1-3 Installed and 2-4 Installed	P0_GPIO5 connected to I2C1_SDA and P0_GPIO6 connected to I2C1_SCL	I2C1 Selected
	3-5 Installed and 4-6 Installed	P0_GPIO5 connected to LIN_RXD and P0_GPIO6 connected to LIN_TXDX	Lin Driver Selected
J21	1-2 Installed	Address: 0x20	I2C Host Interface Address Selection
	2-3 Installed	Address: 0x21	

2.5 Interfaces

Generic DC2DC Interface

In order to support multiple DC2DC converters as well as support future devices, a generic DC2DC interface is provided

The interface is comprised of 3 connectors and all 3 connectors are mounted on the bottom side of the PCB

Table 2-4. Connector Definition

Connection Purpose	PD DVM	Daughter Card	Pins	
Input Voltage	XT30PW-M	XT30PW-F	Pin 1	GND
			Pin 2	VIN
Output Voltage	XT30PW-F	XT30PW-M	Pin 1	GND
			Pin 2	VBUS

Table 2-4. Connector Definition (continued)

Connection Purpose	PD DVM	Daughter Card	Pins	
Digital Signals	5x2 100 mil Right Angle Header	5x2 100 mil right Angle Receptacle	Pin1	Voltage Proportional to Current sensor or power Switch Enable
			Pin2	PTC/NTC temperature sensor
			Pin 3	3.3V LDO from PD Controller
			Pin 4	SYNC signal from TPS26742E-Q1 controller or IRQZ signal to TPS26742E-Q1
			Pin 5	Discharge Control or PWM signal from TPS26742E-Q1
			Pin 6	I2C2_SDA from TPS26742E-Q1
			Pin 7	GND
			Pin 8	I2C2_SCL from TPS26742E-Q1
			Pin 9	PP5V connection to TPS26742E-Q1
			Pin 10	GND

PD EVM

Daughter
Card

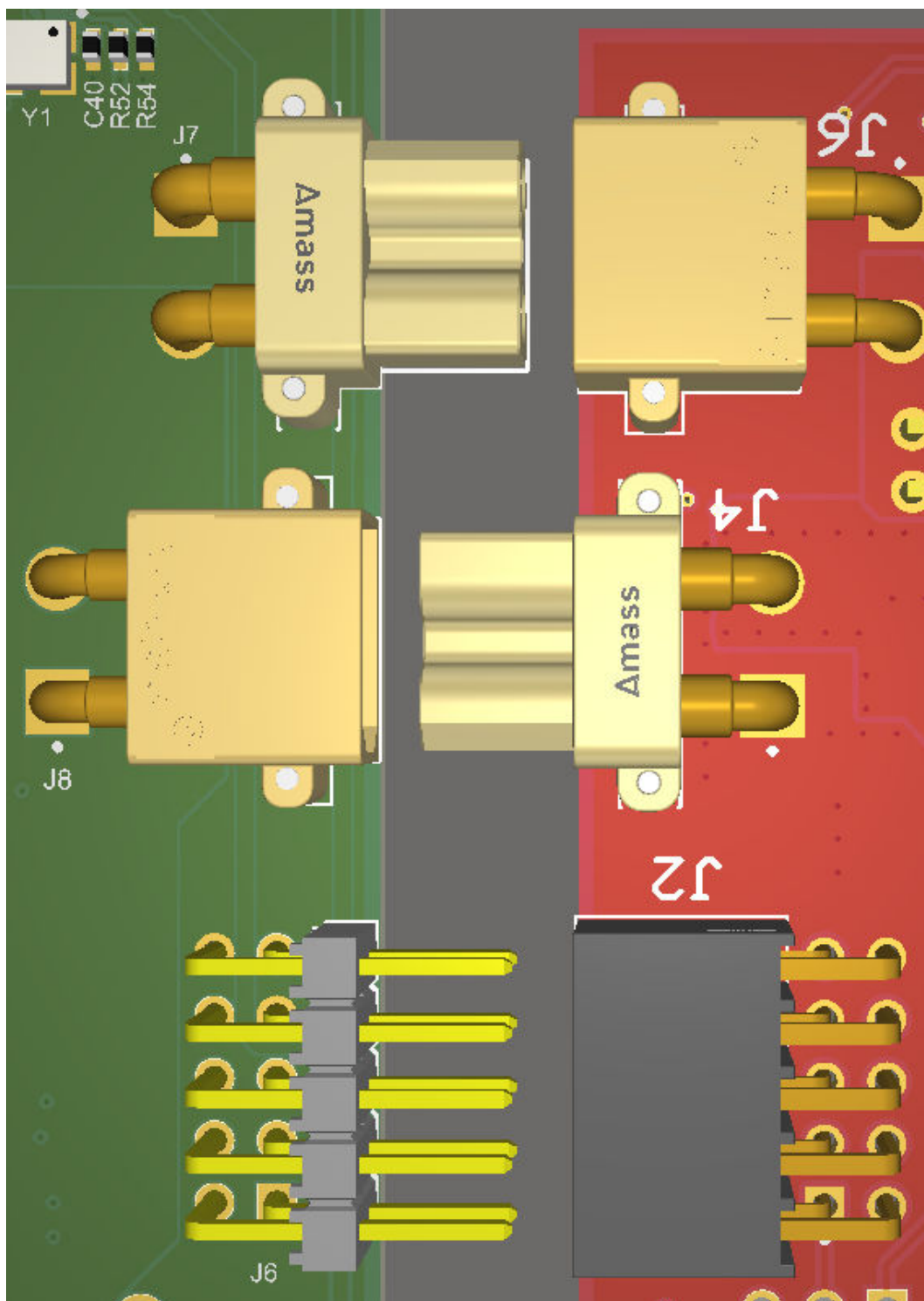


Figure 2-3. 3D View of Connection

2x5 100mil
RA Socket

XT30PW-F

XT30PW-M

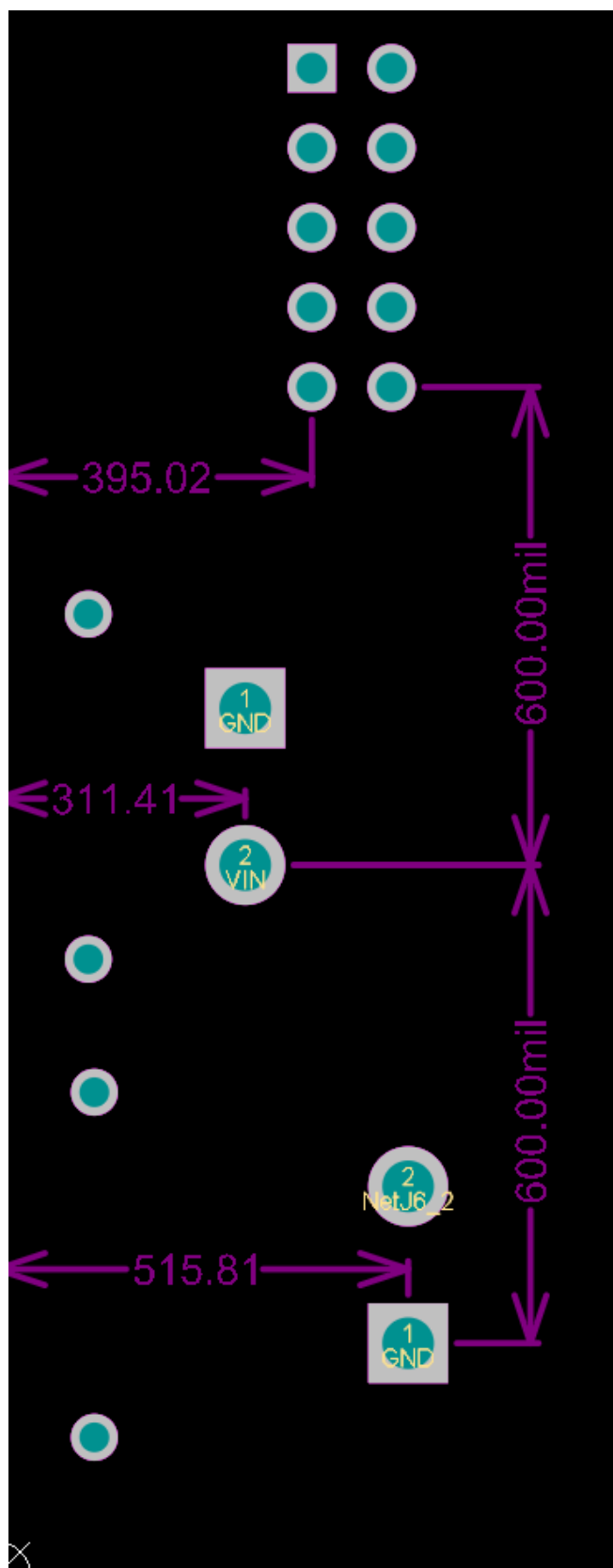


Figure 2-4. Placement Measurements

3 Hardware Design Files

3.1 Schematics

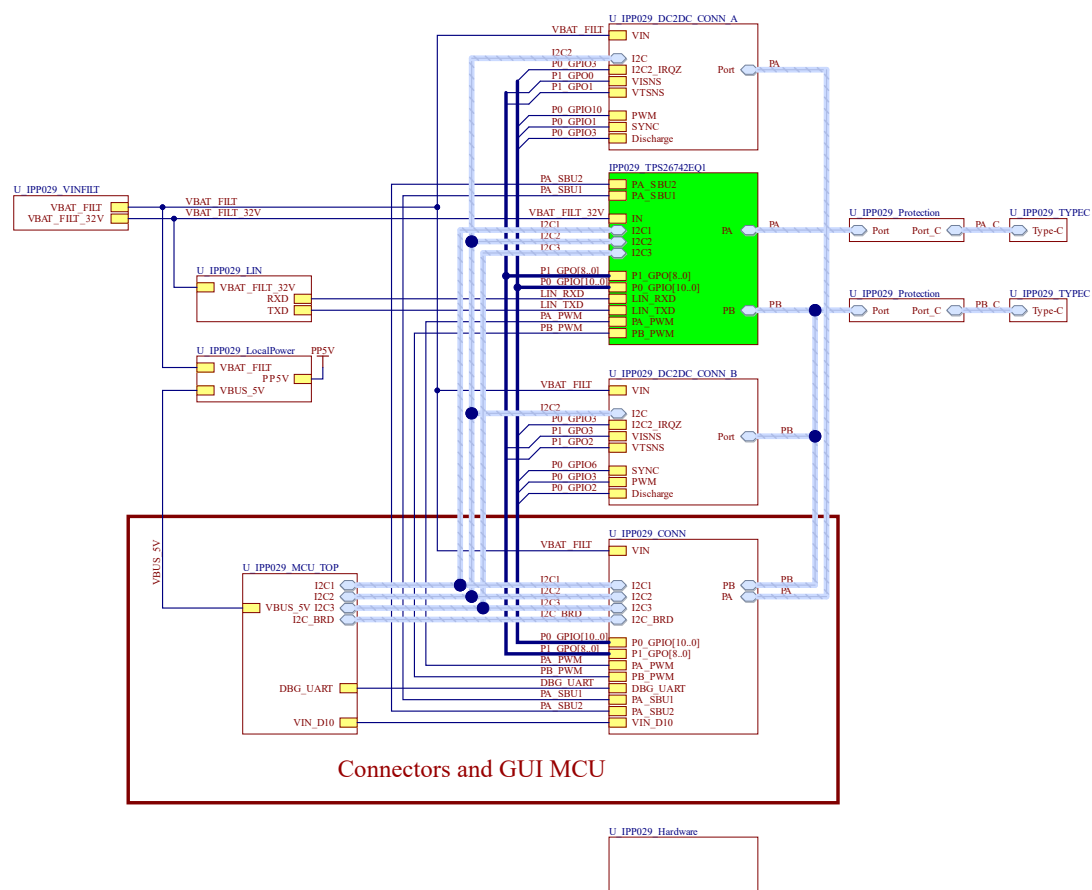


Figure 3-1. EVM Top Level Schematic (Block Diagram)

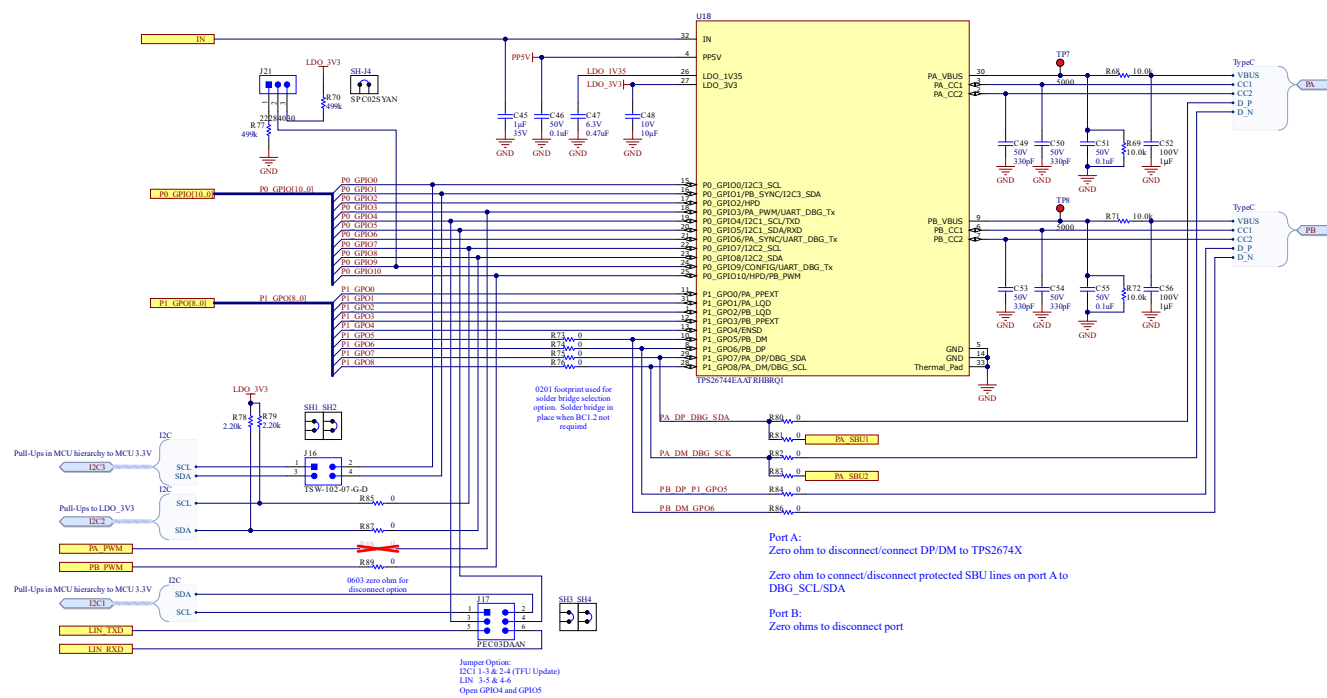


Figure 3-2. TPS26742EQ1 Schematic

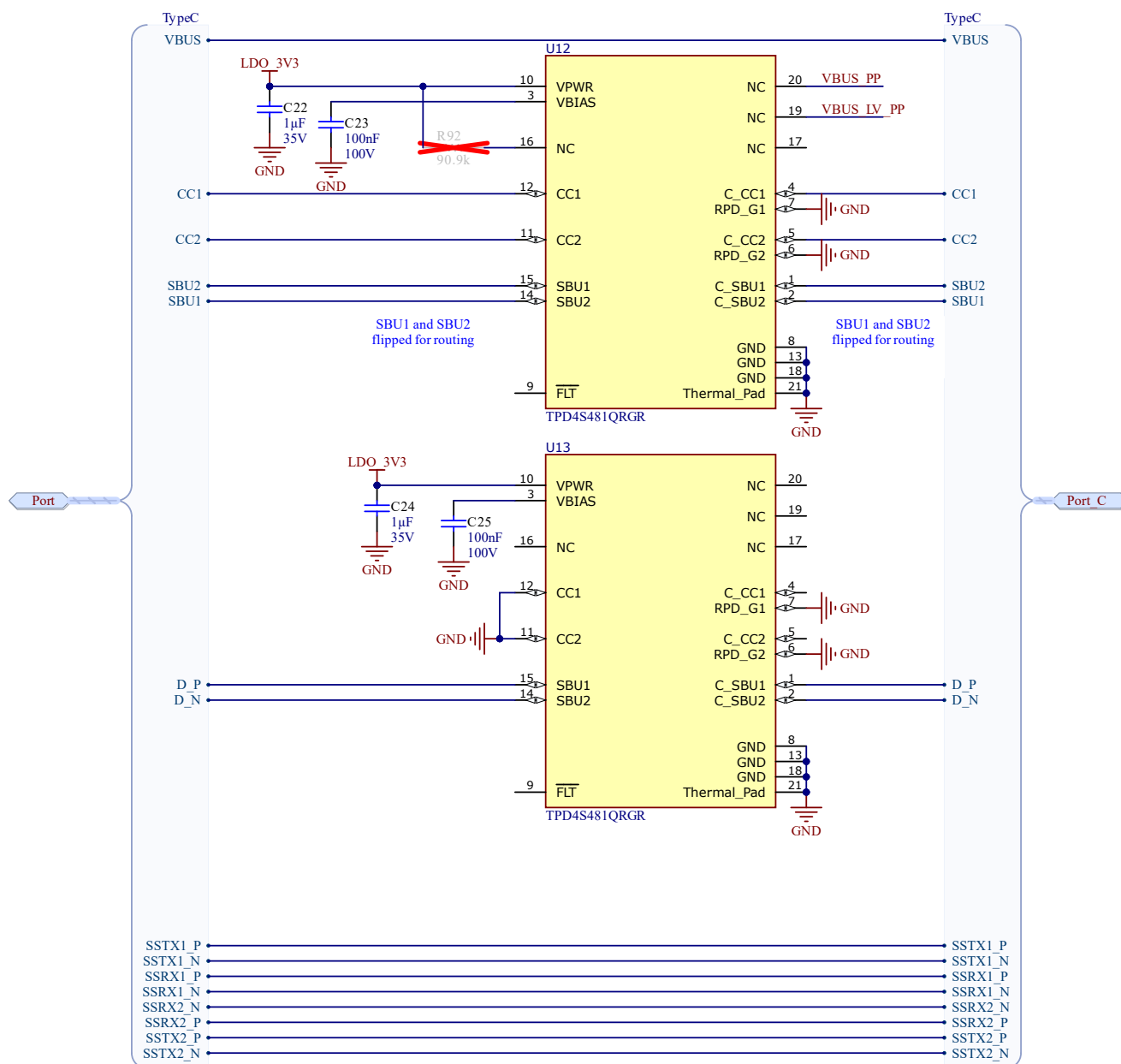


Figure 3-3. Type C Port Protection

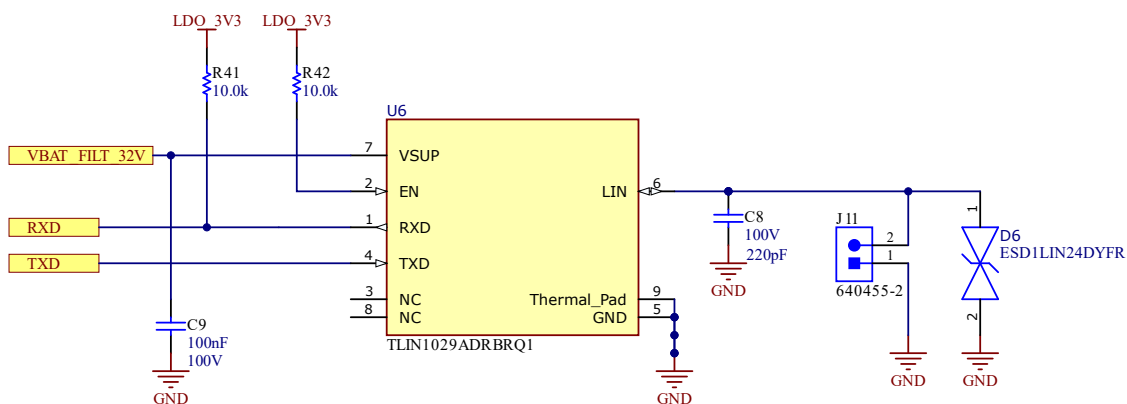


Figure 3-4. Lin Driver



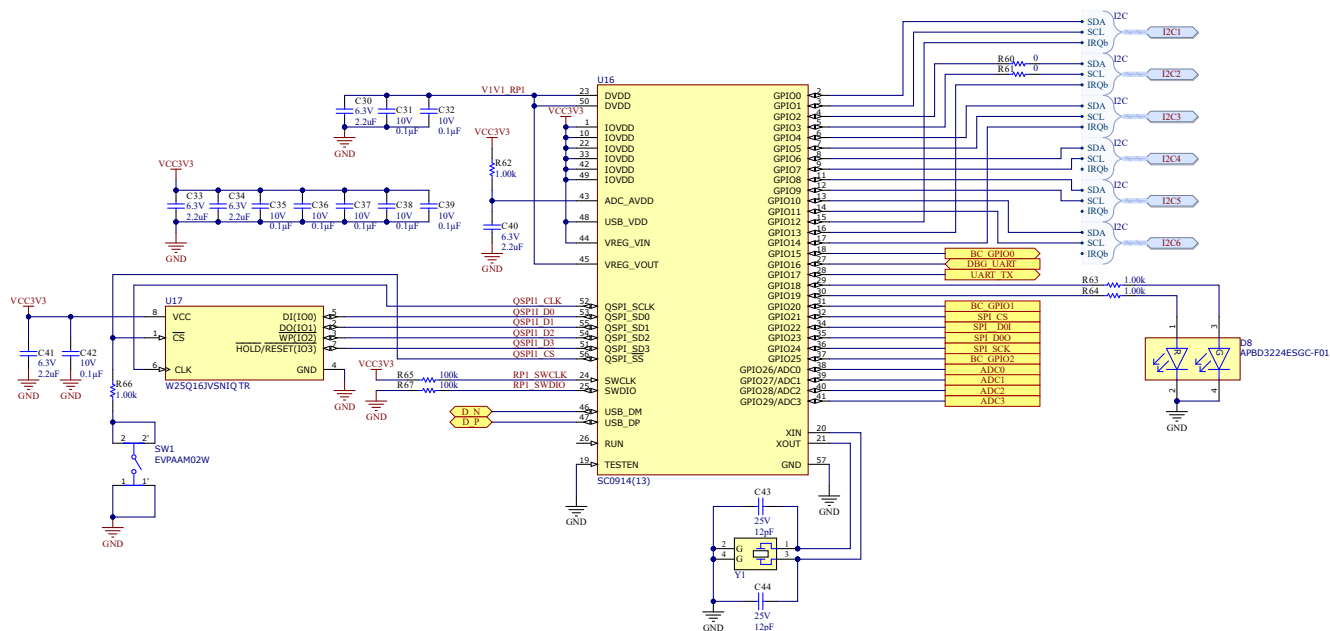


Figure 3-7. MCU

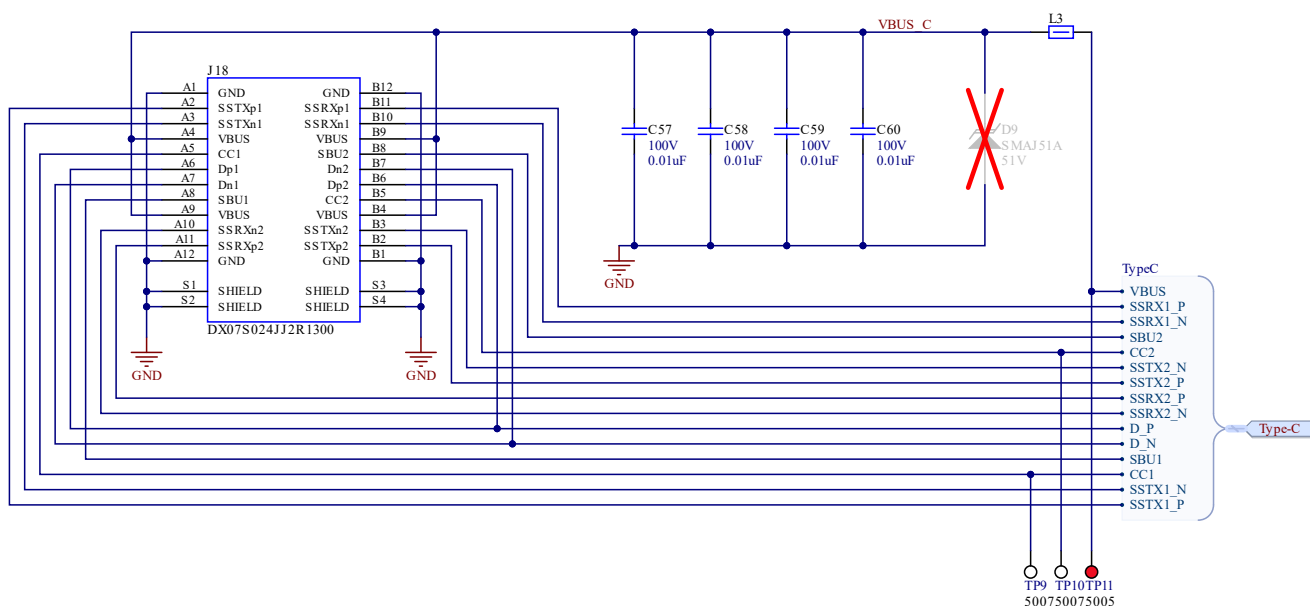


Figure 3-8. Type C connector

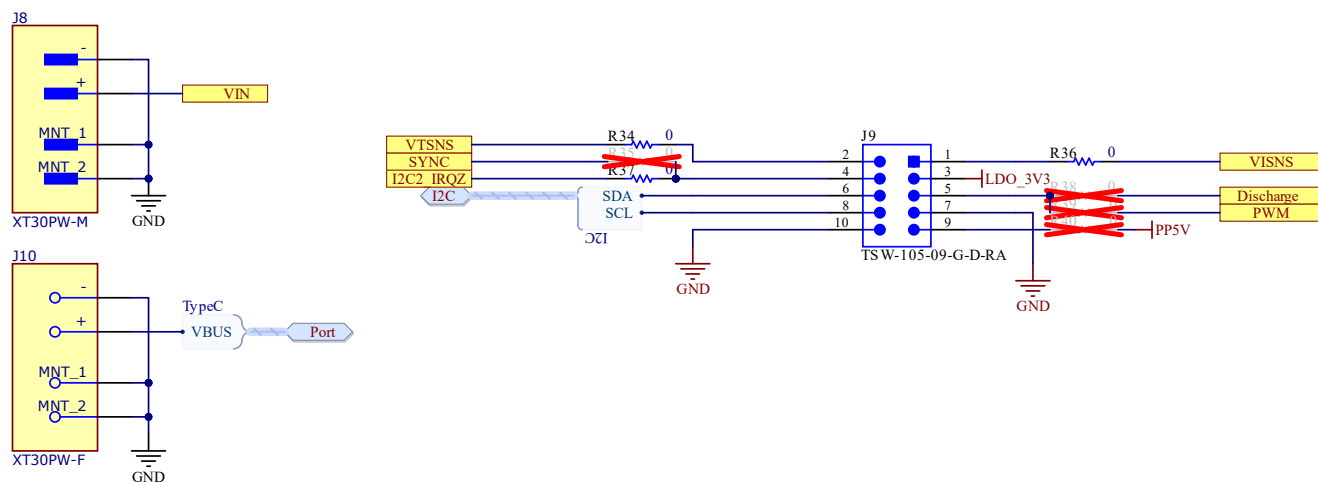


Figure 3-9. Generic DC2DC Connector

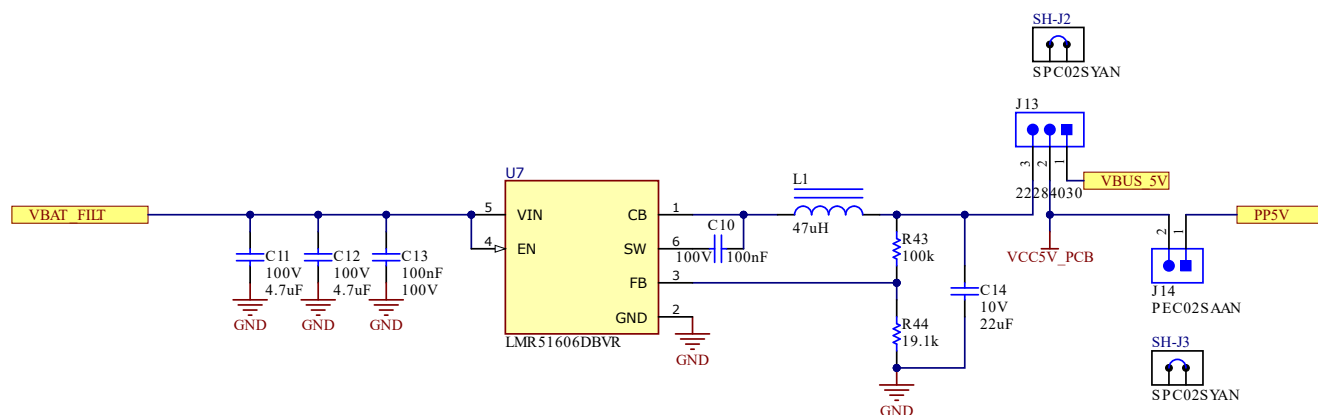
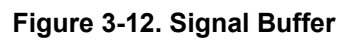


Figure 3-10. Local Power



3.2 PCB Layouts

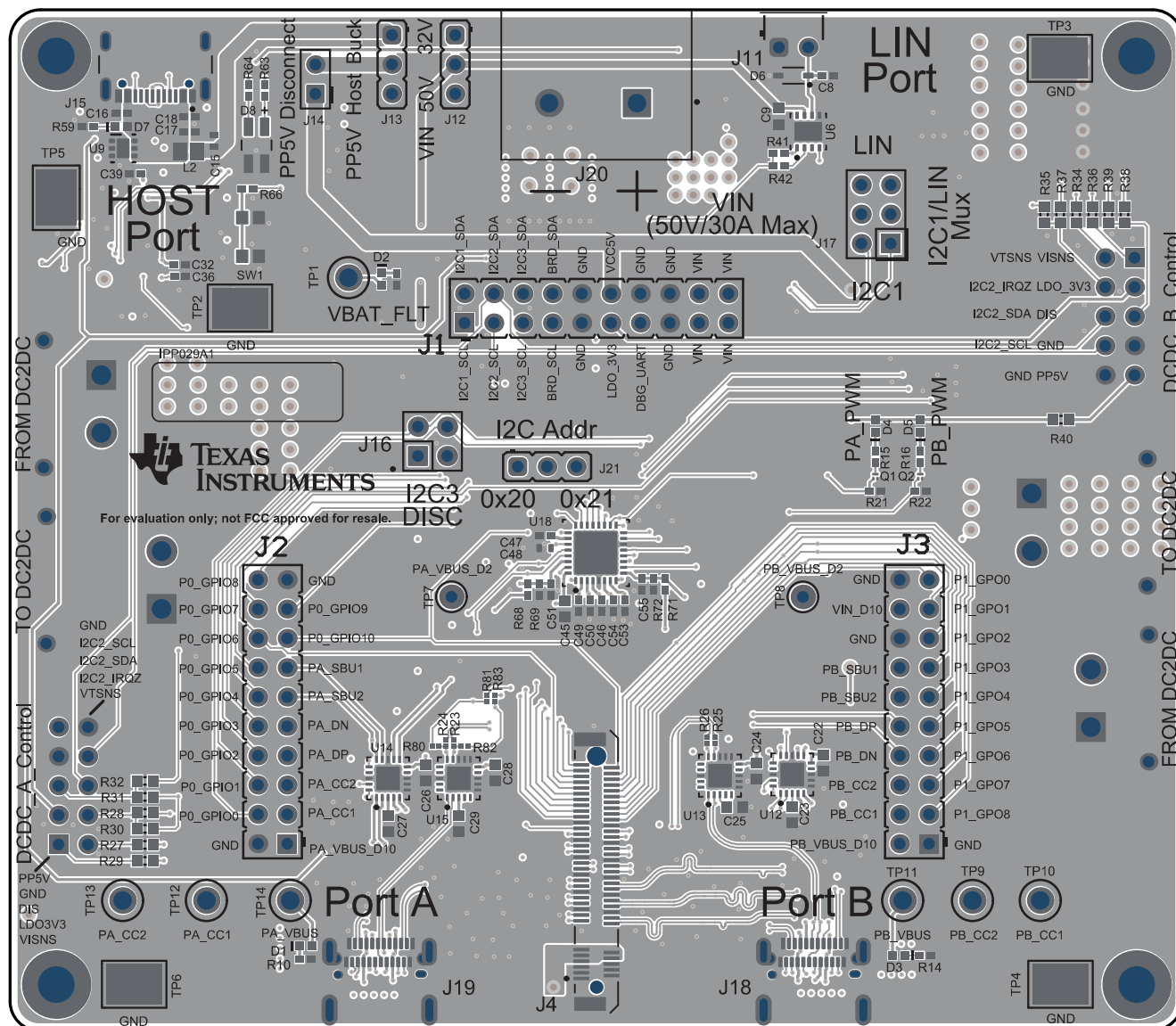


Figure 3-13. Top Layer Composite

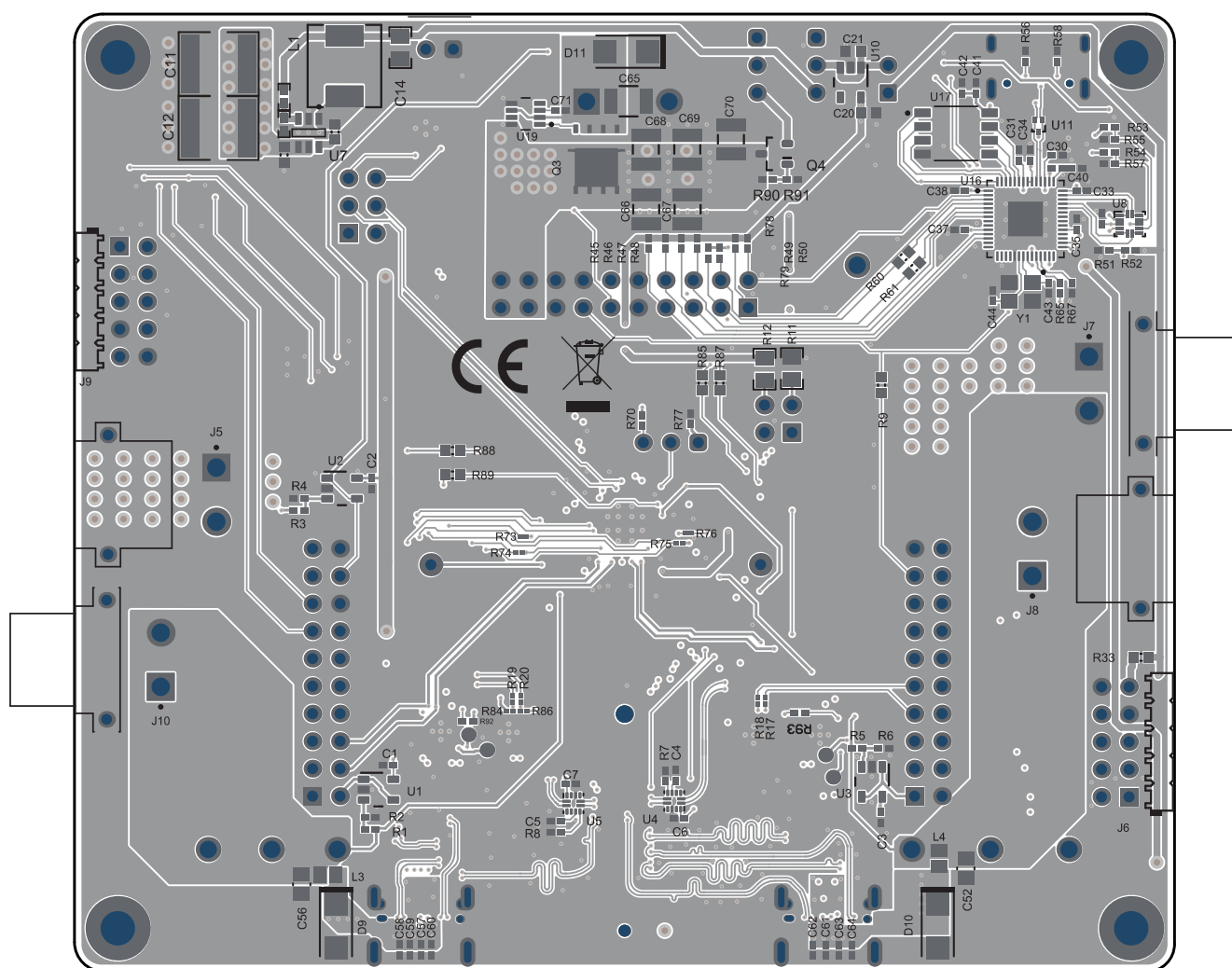


Figure 3-14. Bottom Layer Composite

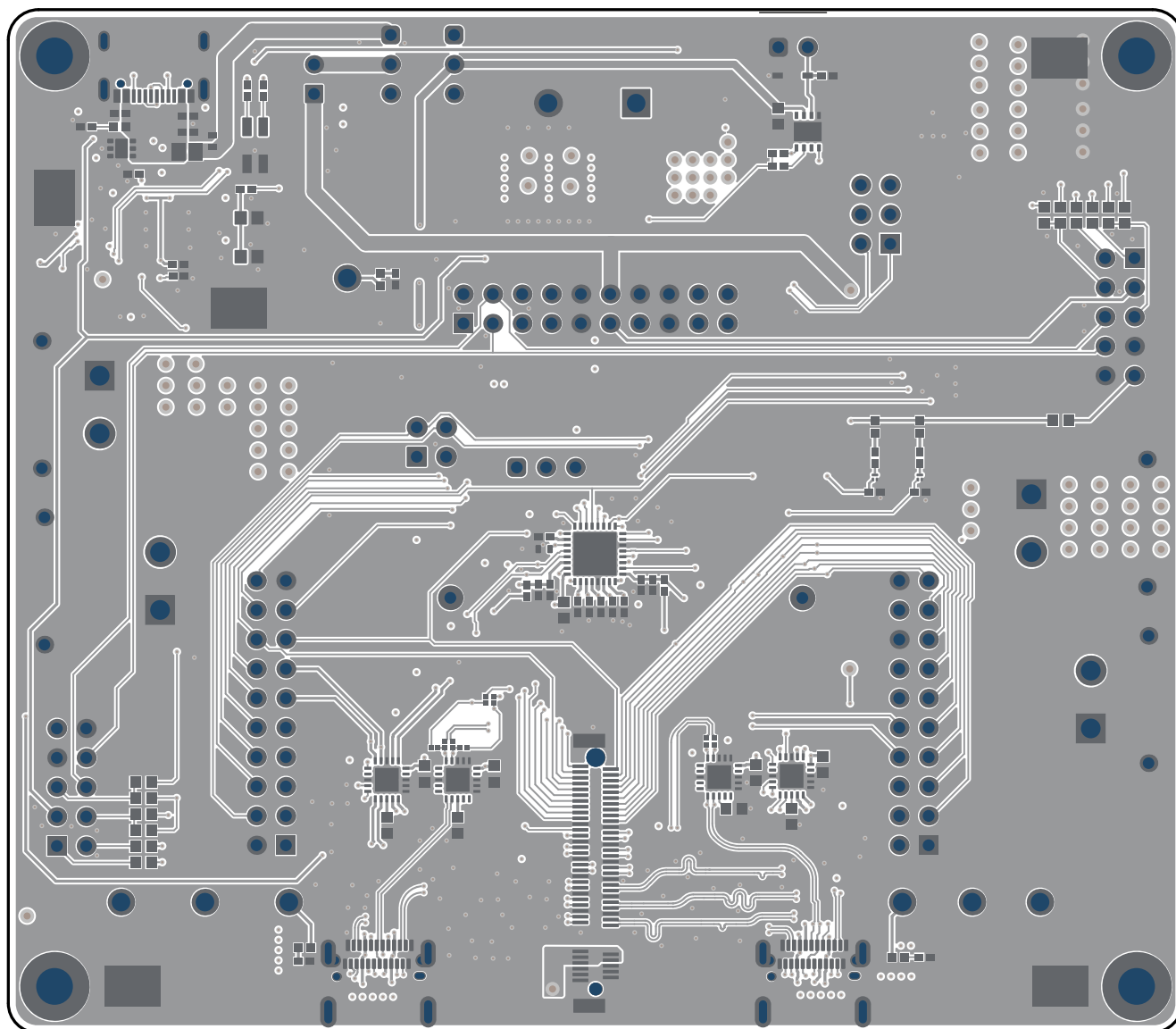


Figure 3-15. Top Layer Mask

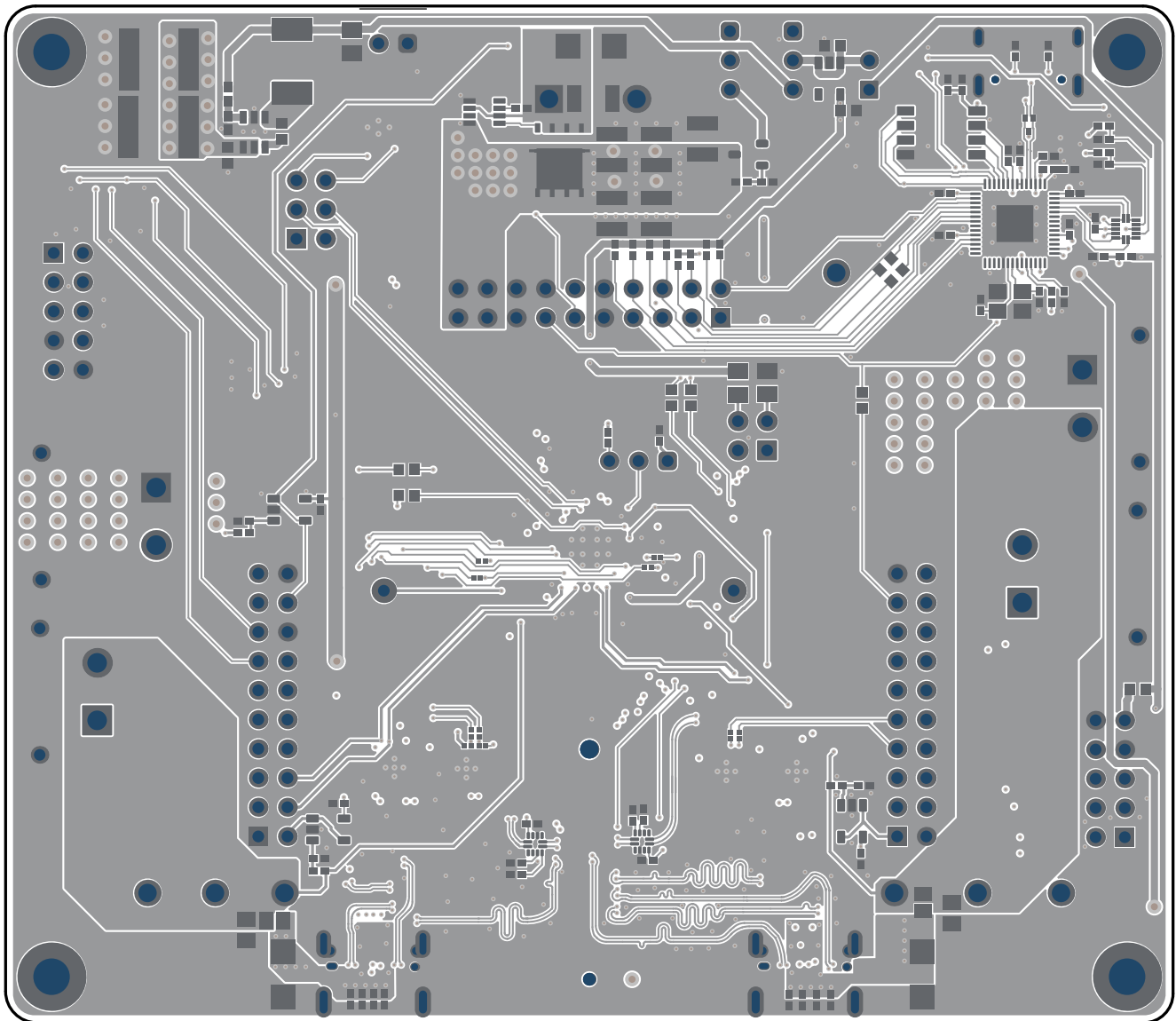


Figure 3-16. Bottom Layer Mask

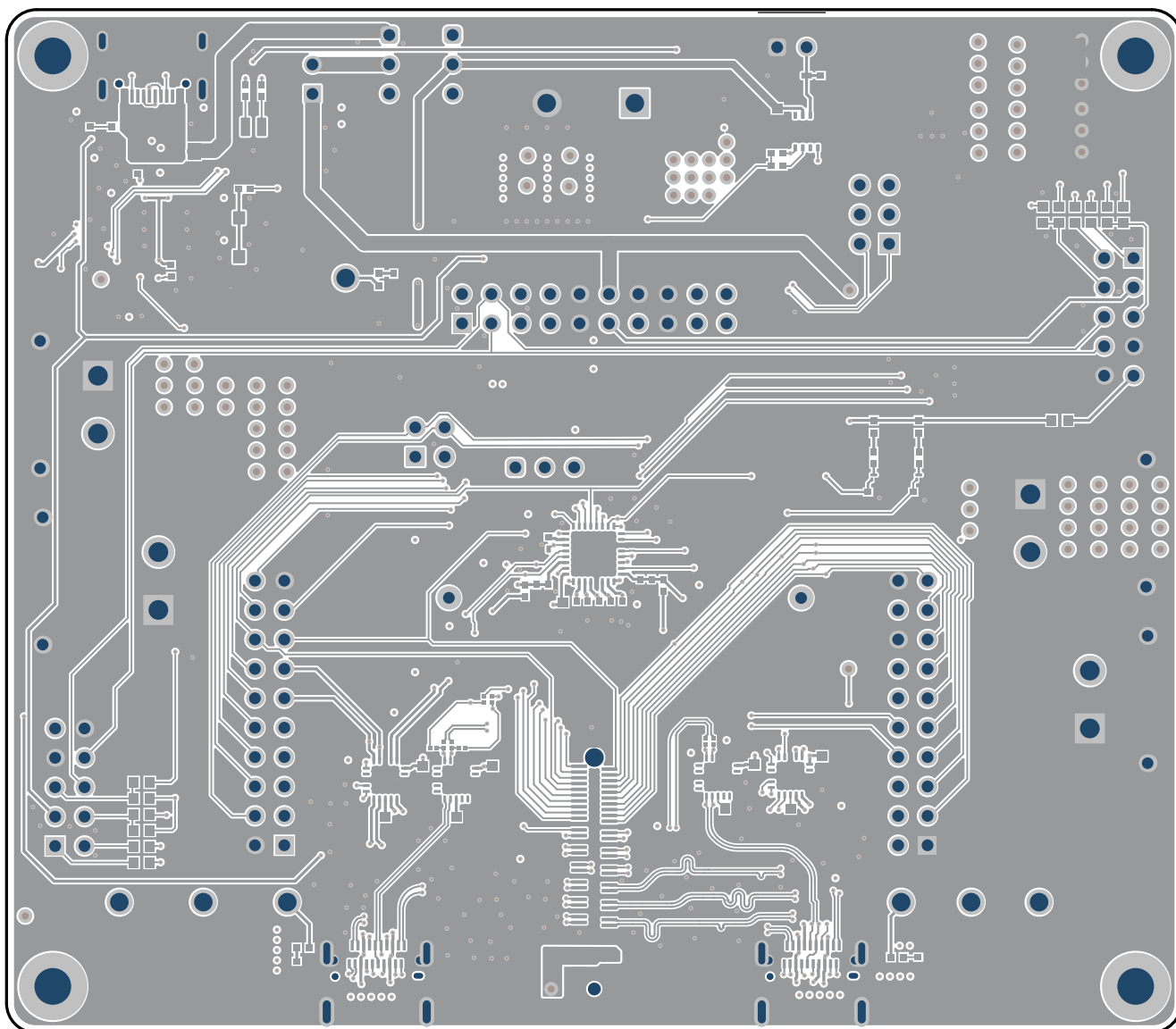


Figure 3-17. Top Layer

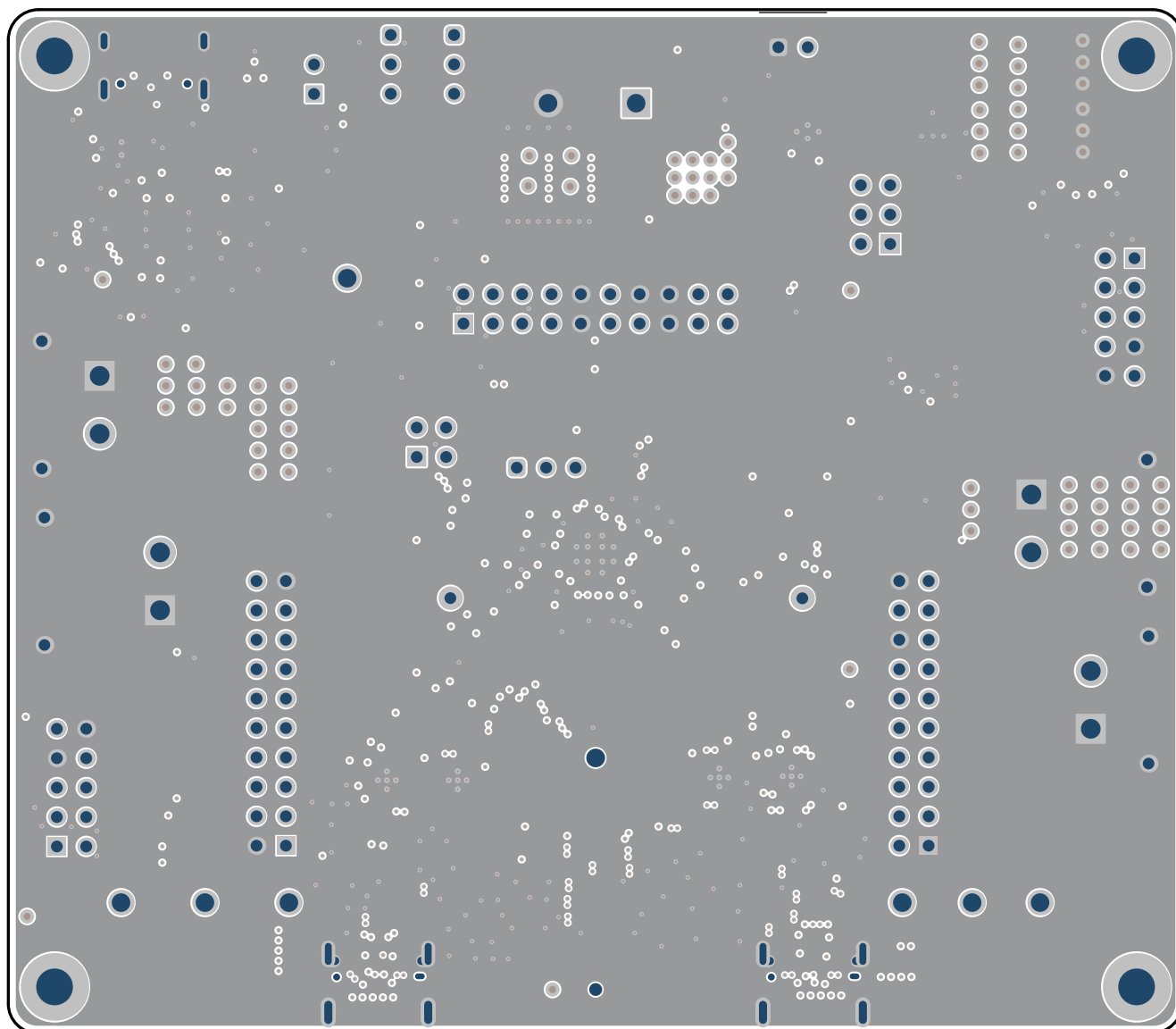


Figure 3-18. Layer 2 (GND)

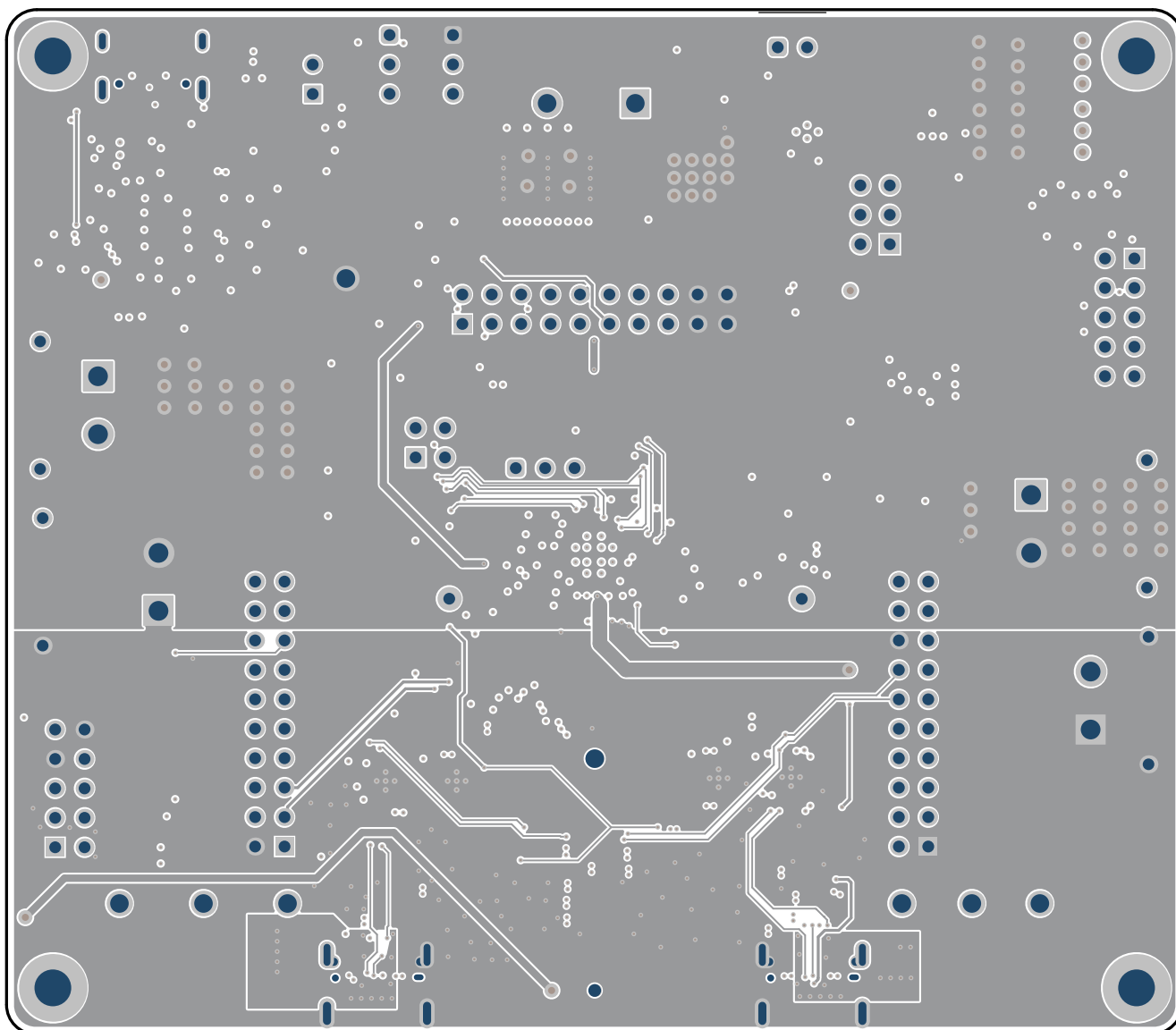


Figure 3-19. Layer 3 (SIG)

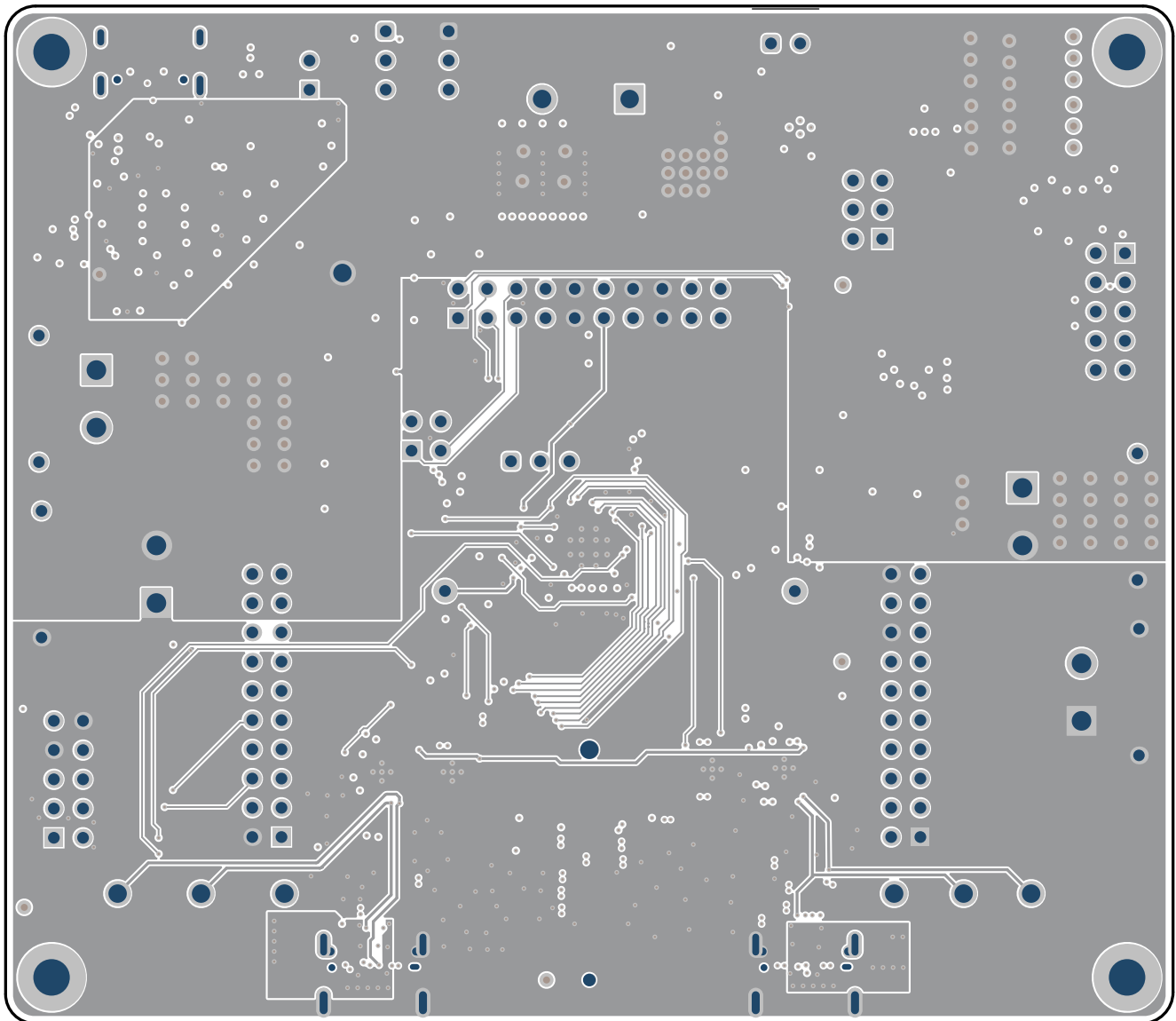


Figure 3-20. Layer 4 (SIG)

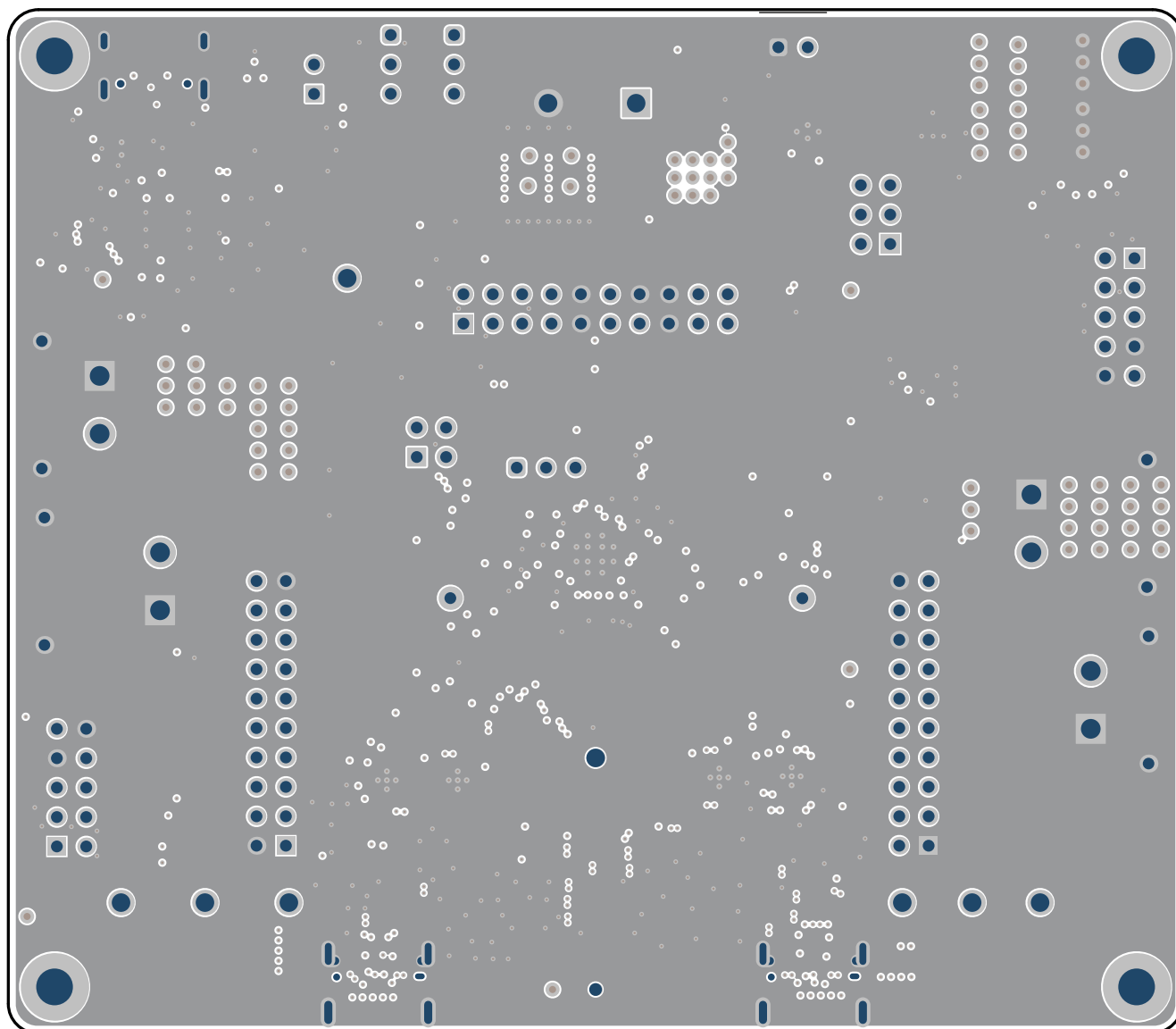


Figure 3-21. Layer 5 (GND)

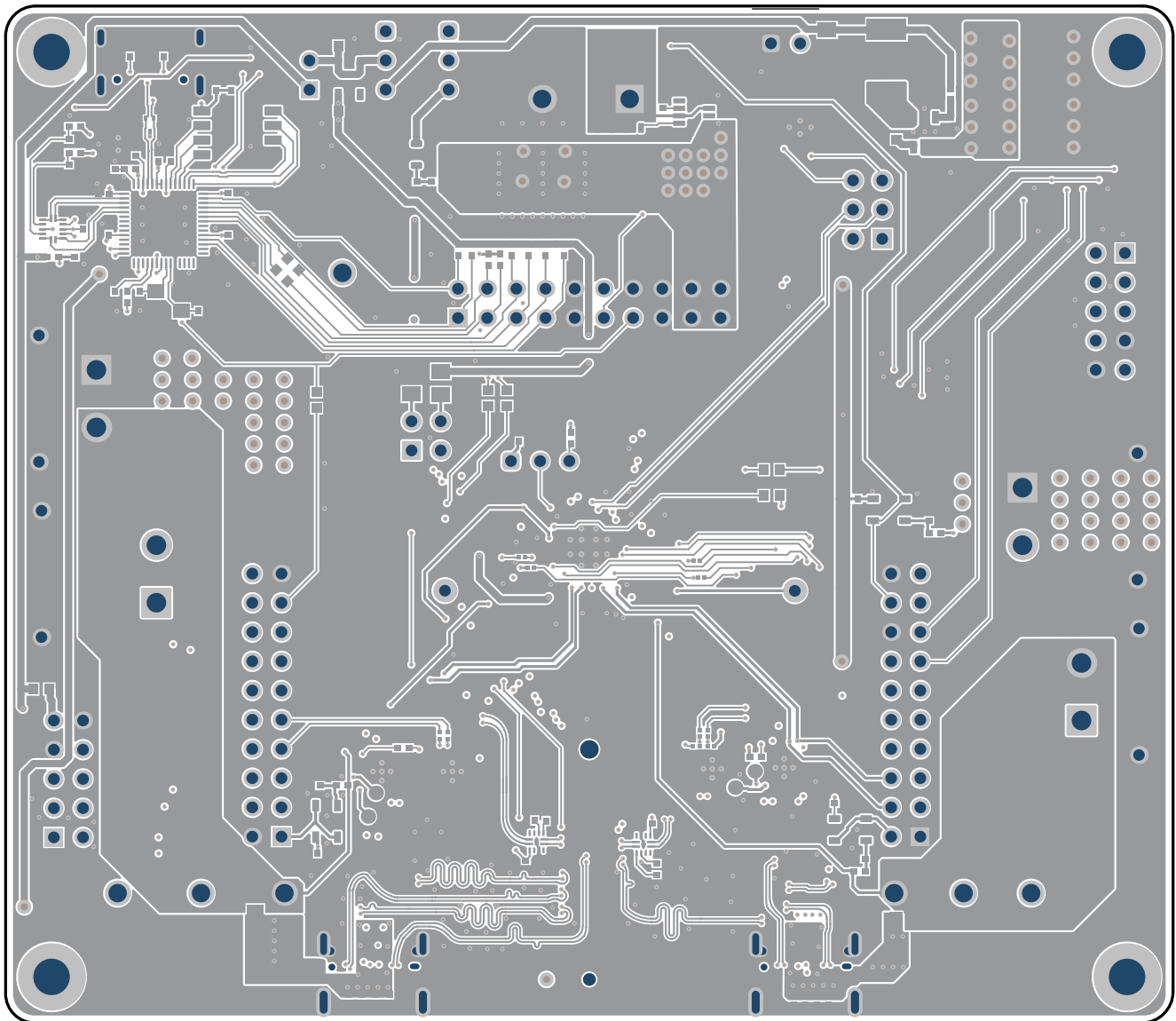
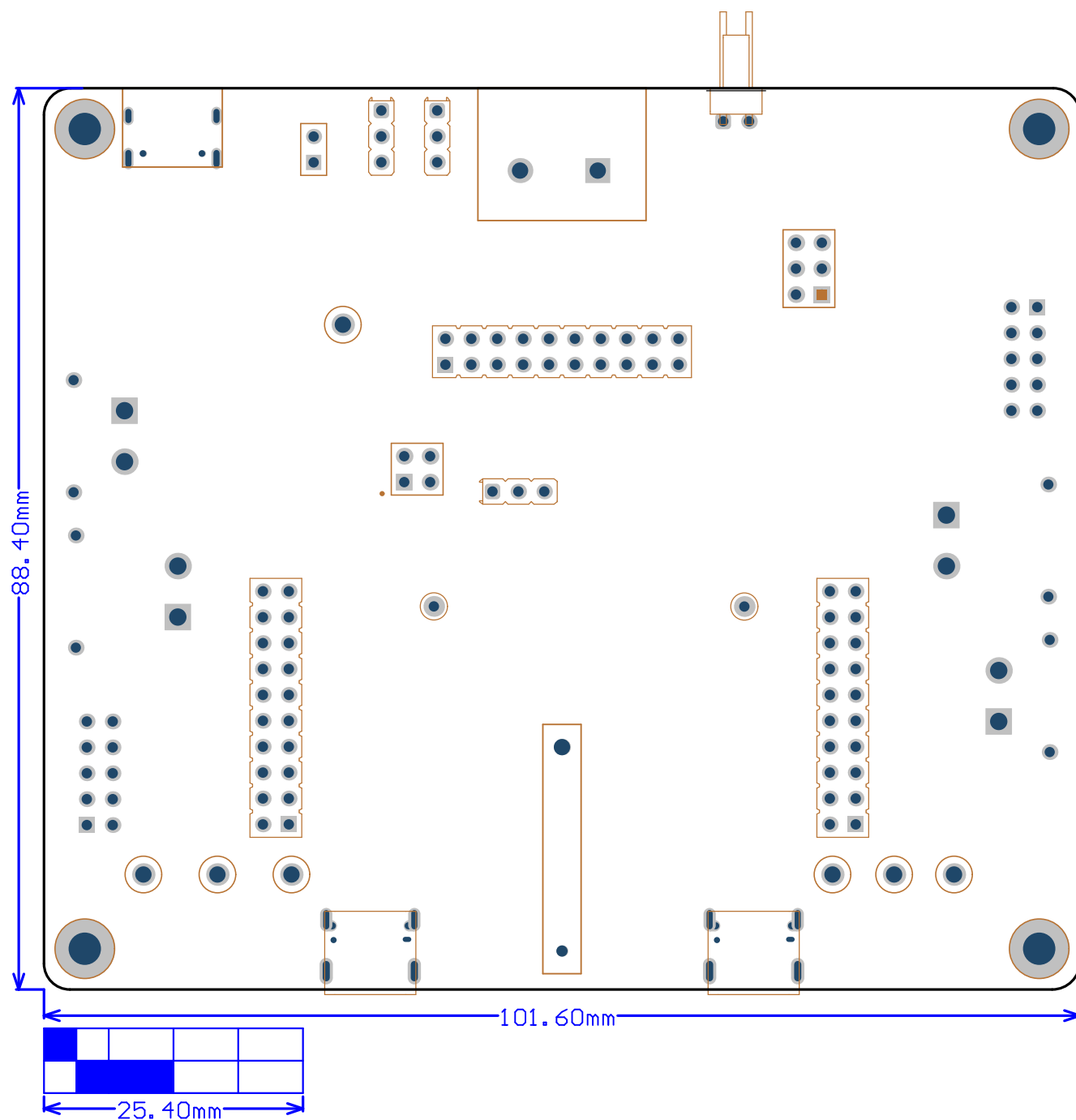


Figure 3-22. Bottom Layer

**Figure 3-23. Board Level Dimensions**

3.3 Bill of Materials (BOM)

Designator	Quantity	Value	Description	Package Reference	Part Number
!PCB1	1		Printed Circuit Board		IPP029
C1, C2, C3, C19, C31, C32, C35, C36, C37, C38, C39, C42	12	0.1uF	CAP, CERM, 0.1μF, 10V, +/- 10%, X7R, AEC-Q200 Grade 1, 0402	0402	C0402C104K8RACA
C4, C5, C6, C7, C46, C51, C55	7	0.1uF	CAP, CERM, 0.1uF, 50V, +/- 20%, X7R, AEC-Q200 Grade 1, 0402	0402	CGA2B3X7R1H104M
C8	1	220pF	CAP, CERM, 220pF, 100V, +/- 10%, X7R, 0402	0402	GRM155R72A221KA
C9, C10, C13, C23, C25, C27, C29	7	0.1uF	CAP, CERM, 0.1uF, 100V, +/- 10%, X7R, 0603	0603	GRM188R72A104KA
C11, C12	2	4.7uF	CAP, CERM, 4.7uF, 100V, +/- 20%, X7R, 2220	2220	C5750X7R2A475M23
C14	1	22uF	CAP, CERM, 22uF, 10V, +/- 20%, X5R, 0805	0805	GRM21BR61A226ME
C15	1	10uF	CAP, CERM, 10μF, 10V, +/- 20%, X5R, 0402	0402	0402ZD106MAT2A
C16, C17	2	0.01uF	CAP, CERM, 0.01uF, 50V, +/- 5%, X7R, 0402	0402	C0402C103J5RACTU
C18	1	1uF	CAP, CERM, 1μF, 10V, +/- 20%, X5R, 0402	0402	CC0402MRX5R6BB1
C20, C21, C22, C24, C26, C28, C45	7	1uF	CAP, CERM, 1uF, 35V, +/- 10%, X7R, AEC-Q200 Grade 1, 0603	0603	CGA3E1X7R1V105K
C30, C33, C34, C40, C41	5	2.2uF	CAP, CERM, 2.2uF, 6.3V, +/- 20%, X5R, 0402	0402	JMK105BJ225MV-F
C43, C44	2	12pF	CAP, CERM, 12pF, 25V, +/- 5%, C0G/NP0, 0402	0402	GRM1555C1E120JA
C47	1	0.47uF	CAP, CERM, 0.47uF, 6.3V, +/- 10%, X6S, 0402	0402	GRM155C80J474KE
C48	1	10uF	CAP, CERM, 10μF, 10V, +/- 20%, X5R, 0402	0402	CL05A106MP8NUB8
C49, C50, C53, C54	4	330pF	CAP, CERM, 330pF, 50V, +/- 10%, X7R, AEC-Q200 Grade 1, 0402	0402	CGA2B2X7R1H331K
C52, C56	2	1uF	CAP, CERM, 1μF, 100V, +/- 10%, X7R, AEC-Q200 Grade 1, 0805	0805	KAF21KR72A105KU
C57, C58, C59, C60, C61, C62, C63, C64	8	0.01uF	CAP, CERM, 0.01uF, 100V, +/- 10%, X7S, AEC-Q200 Grade 1, 0402	0402	CGA2B3X7S2A103K
C65	1	4.7uF	CAP, CERM, 4.7uF, 50V, +/- 10%, X7R, AEC-Q200 Grade 1, 1210	1210	CGA6P3X7R1H475K
C66, C67, C68, C69, C70	5	10uF	CAP, CERM, 10uF, 50V, +/- 10%, X7R, AEC-Q200 Grade 1, 1210	1210	UMJ325KB7106KMH
C71	1	2.2uF	CAP, CERM, 2.2μF, 16V, +/- 20%, X6S, AEC-Q200 Grade 2, 0402	0402	GRT155C81C225ME
D1, D2, D3, D4, D5, D7	6	White	LED, White, SMD	0402, White	LW QH8G-Q2S2-3K5

D6	1		24V, 1-Channel ESD Protection Diode	SOD323	ESD1LIN24DYFR
D8	1		LED Bi-Color Green/Red 565nm/627nm 4-Pin Chip LED T/R	SMT_LED_3MM2_2MM4	APBD3224ESGC-F0
D11	1	54V	Diode, TVS, Bi, 54 V, 87.1 Vc, 400 W, 4.6A, SMA (non-polarized)	SMA (non-polarized)	SMAJ54CA
H1, H2, H3, H4	4		Hex Standoff Threaded #4-40 Nylon 0.750" (19.05mm) 3/4" Natural	HEX_STANDOFF	1902D_Ndrill
H5, H6, H7, H8	4		MACHINE SCREW PAN PHILLIPS 4-40	Machine Screw, 4-40, 1/4 inch	PMSSS 440 0025 PH
J1, J2, J3	3		Header, 10x2, 2.54mm, Tin, TH	Header, 10x2, 2.54mm, Tin, TH	TSW-110-07-T-D
J5, J8	2		Socket, DC supply, XT30, male, PIN: 2, on PCBs, THT, yellow, 15A, 500V	CONN_PLUG2	XT30PW-M
J6, J9	2		Header, 2.54mm, 5x2, Gold, R/A, TH	Header, 2.54mm, 5x2, R/A, TH	TSW-105-09-G-D-RA
J7, J10	2		Socket, DC supply, XT30, female, PIN: 2, on PCBs, THT, yellow, 15A	CONN_SOCKET_DC2	XT30PW-F
J11	1		Header, 2.54mm, 2x1, R/A, Tin, TH	Header, 2.54mm, 2x1, R/A, TH	640455-2
J12, J13, J21	3		Header, 2.54mm, 3x1, Tin, TH	Header, 2.54mm, 3x1, Tin, TH	22284030
J14	1		Header, 100mil, 2x1, Tin, TH	Header, 2 PIN, 100mil, Tin	PEC02SAAN
J15	1		Connector USB 2.0 Type C Horizontal SMT	CONN_USB	6.29722E+11
J16	1		Header, 100mil, 2x2, Gold, TH	2x2 Header	TSW-102-07-G-D
J17	1		Header, 100mil, 3x2, Tin, TH	3x2 Header	PEC03DAAN
J18, J19	2		Receptacle, USB 3.1 Type C, R/A, Gold, SMT	Receptacle, USB 3.1 Type C, R/A, SMT	DX07S024JJ2R1300
J20	1		2 Position Wire to Board Terminal Block Horizontal with Board 0.300" (7.62mm) Through Hole	TERM_CONN	TB005-762-02BE
L1	1	47uH	Inductor, Shielded, Ferrite, 47uH, 1.6A, 0.366ohm, SMD	Inductor, 7.2x4x6.5mm	SRP6540-470M
L2, L3, L4	3	22 ohm	Ferrite Bead, 22 ohm @ 100 MHz, 6A, 0805	0805	742792021
LBL1	1		Thermal Transfer Printable Labels, 0.650" W x 0.200" H - 10,000 per roll	PCB Label 0.650 x 0.200 inch	THT-14-423-10
Q1, Q2	2	12V	MOSFET, N-CH, 12V, 3.6A, YJM0003A (PICOSTAR-3)	YJM0003A	CSD13380F3
Q3	1	60V	MOSFET, N-CH, 60V, 100A, DNK0008A (VSON-CLIP-8)	DNK0008A	CSD18540Q5B
Q4	1	60 V	Transistor, NPN, 60V, 0.9A, SOT-23	SOT-23	PBSS4160T
R1, R3, R5, R51, R52, R53, R54, R55, R57	9	90.9k	RES, 90.9 k, 1%, 0.1W, AEC-Q200 Grade 0, 0402	0402	ERJ-2RKF9092X
R2, R4, R6	3	10.2k	RES, 10.2 k, 1%, 0.063W, AEC-Q200 Grade 0, 0402	0402	CRCW040210K2FKE
R7, R8, R70, R77	4	499k	RES, 499 k, 1%, 0.063W, AEC-Q200 Grade 0, 0402	0402	CRCW0402499KFKE

R9, R27, R29, R30, R33, R34, R36, R37, R60, R61, R85, R87, R89	13	0	RES, 0, 5%, 0.1W, AEC-Q200 Grade 0, 0603	0603	CRCW06030000Z0E
R10, R13, R14, R15, R16, R59	6	10k	RES, 10 k, 5%, 0.063W, AEC-Q200 Grade 0, 0402	0402	CRCW040210K0JNE
R17, R18, R19, R20, R23, R24, R25, R26, R73, R74, R75, R76, R80, R81, R82, R83, R84, R86	18	0	RES, 0, 5%, 0.05W, AEC-Q200 Grade 1, 0201	0201	ERJ-1GE0R00C
R21, R22	2	100k	RES, 100 k, 1%, 0.063W, AEC-Q200 Grade 0, 0402	0402	CRCW0402100KFKE
R41, R42	2	10.0k	RES, 10.0 k, 0.1%, 0.1W, AEC-Q200 Grade 0, 0402	0402	MCS0402MD1002BE
R43	1	100k	RES, 100 k, 1%, 0.063W, AEC-Q200 Grade 0, 0402	0402	RMCF0402FT100K
R44	1	19.1k	RES, 19.1 k, 1%, 0.063W, AEC-Q200 Grade 0, 0402	0402	CRCW040219K1FKE
R45, R46, R47, R48, R49, R50, R78, R79	8	2.20k	RES, 2.20 k, 1%, 0.063W, AEC-Q200 Grade 0, 0402	0402	CRCW04022K20FKE
R56, R58	2	5.11k	RES, 5.11 k, 1%, 0.063W, AEC-Q200 Grade 0, 0402	0402	CRCW04025K11FKE
R62, R63, R64, R66	4	1.00k	RES, 1.00 k, 1%, 0.0625W, 0402	0402	RC0402FR-071KL
R65, R67	2	100k	RES, 100 k, 1%, 0.0625W, 0402	0402	RC0402FR-07100KL
R68, R69, R71, R72, R90, R91	6	10.0k	RES, 10.0 k, 1%, 0.063W, AEC-Q200 Grade 0, 0402	0402	RK73H1ETTP1002F
SH1, SH2, SH3, SH4, SH-J1, SH-J2, SH-J3, SH-J4	8	1x2	Shunt, 100mil, Flash Gold, Black	Closed Top 100mil Shunt	SPC02SYAN
SW1	1		SWITCH TACTILE SPST-NO 0.02A 15V	SMT_SW_3MM5_2MM9	EVPAAM02W
TP1, TP11, TP14	3		Test Point, Compact, Red, TH	Red Compact Testpoint	5005
TP2, TP3, TP4, TP5, TP6	5		Test Point, Compact, SMT	Testpoint_Keystone_Compact	5016
TP7, TP8	2		Test Point, Miniature, Red, TH	Red Miniature Testpoint	5000
TP9, TP10, TP12, TP13	4		Test Point, Compact, White, TH	White Compact Testpoint	5007
U1, U2, U3	3		10-MHz, RRIO, CMOS Operational Amplifier for Cost-Sensitive Systems, DBV0005A (SOT-23-5)	DBV0005A	TLV9061IDBVR
U4, U5	2		USB High Speed Signal Conditioner, RWB0012A (X2QFN-12)	RWB0012A	TUSB211QRWBRQ1
U6	1		LIN Transceiver with Integrated Vreg 20kBd Automotive 8-Pin VSON EP T/R	VSON8	TLIN1029ADRBRQ1

U7	1		SIMPLE SWITCHER 4V to 65V, 0.6A Buck Converter, SOT23-6	SOT23-6	LMR51606DBVR
U8	1		10-MHz, RRIO, CMOS Operational Amplifiers for Cost-Sensitive Systems, RUC0014A (X2QFN-14)	RUC0014A	TLV9064IRUCR
U9	1		5-V Precision Surge Protection Clamp, DRV0006A (WSON-6)	DRV0006A	TVS0500DRVR
U10	1		Automotive capacitor-free 300-mA LDO regulator with foldback current limit for portable devices, DBV0005A (SOT-23-5)	DBV0005A	TLV73333PQDBVRQ
U11	1		ESD Solution for Super-Speed (6 Gbps) USB 3.0 Interface, 2 Channels, -40 to +85 degC, 3-pin SOT (DRT), Green (Rohs & No Sb/Br)	DRT0003A	TPD2EUSB30DRTR
U12, U13, U14, U15	4		USB Type-C® 48V EPR Port Protector: Short-to-VBUS Overvoltage and IEC ESD Protection	VQFN20	TPD4S481QRGR
U16	1		ARM® Cortex®-M0+ - Microcontroller IC 32-Bit Dual-Core 133MHz External Program Memory 56-QFN (7x7)	QFN56	SC0914(13)
U17	1		NOR Flash Serial (SPI, Dual SPI, Quad SPI) 3V/3.3V 16M-bit 2M x 8 6ns 8-Pin SOIC N T/R	SOIC8	W25Q16JVSNIQ TR
U18	1		Automotive Dual-Port USB Type-C® PD Controller with 240W EPR and DisplayPort™ over USB Type-C	VQFN32	TPS26744EAATRHB
U19	1		Low IQ Reverse Battery Protection Ideal Diode Controller with Integrated VDS Clamp	SOT23-8	LM74701QDDFQ1
Y1	1		Crystal, 12MHz, 30 ppm, SMD	3.20x0.70x2.50mm	7M-12.000MAHE-T
D9, D10	0	51V	Diode, TVS, Uni, 51 V, 82.4 Vc, 400 W, 4.9 A, SMA	SMA	SMAJ51A
J4	0		PCIe® M.2 Gen 3 and Gen 4 Card Edge Connectors	PCI_CONN_67P	MDT350B01001VT
R11, R12	0	100k	RES, 100 k, 1%, 0.125W, AEC-Q200 Grade 0, 0805	0805	ERJ-6ENF1003V
R28, R31, R32, R35, R38, R39, R40, R88	0	0	RES, 0, 5%, 0.1W, AEC-Q200 Grade 0, 0603	0603	CRCW06030000Z0E

4 Additional Information

4.1 Known Hardware or Software Issues

The silk screen for D11 is backwards and shows the Anode/Cathode incorrectly. The diode is properly placed on the PADS, so no change is required for functionality, but if the diode is replaced, it needs to be installed upside down

4.2 Trademarks

All trademarks are the property of their respective owners.

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

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