RT1716 Type-C Port Controller Evaluation Board

General Description

The RT1716WSC is a USB Type-C controller that complies with the latest USB Type-C and PD standards. This document explains the function and use of the RT1716WSC evaluation board (EVB), and provides information to enable operation, modification of the evaluation board and circuit to suit individual requirements.

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Performance Specification Summary

Summary of the RT1716WSC Evaluation Board performance specificiaiton is provided in Table 1. The ambient temperature is 25°C.

Table 1. RT1716WSC Evaluation Board Performance Specification Summary

Specification	Test Conditions	Min	Typ	Max	Unit
Input Voltage at DC Jack		--	12	--	V
Vbus Output Current		--	--	3	A
Vbus Output Voltage		--	5	--	V
Vbus Input Voltage		5	--	12	V

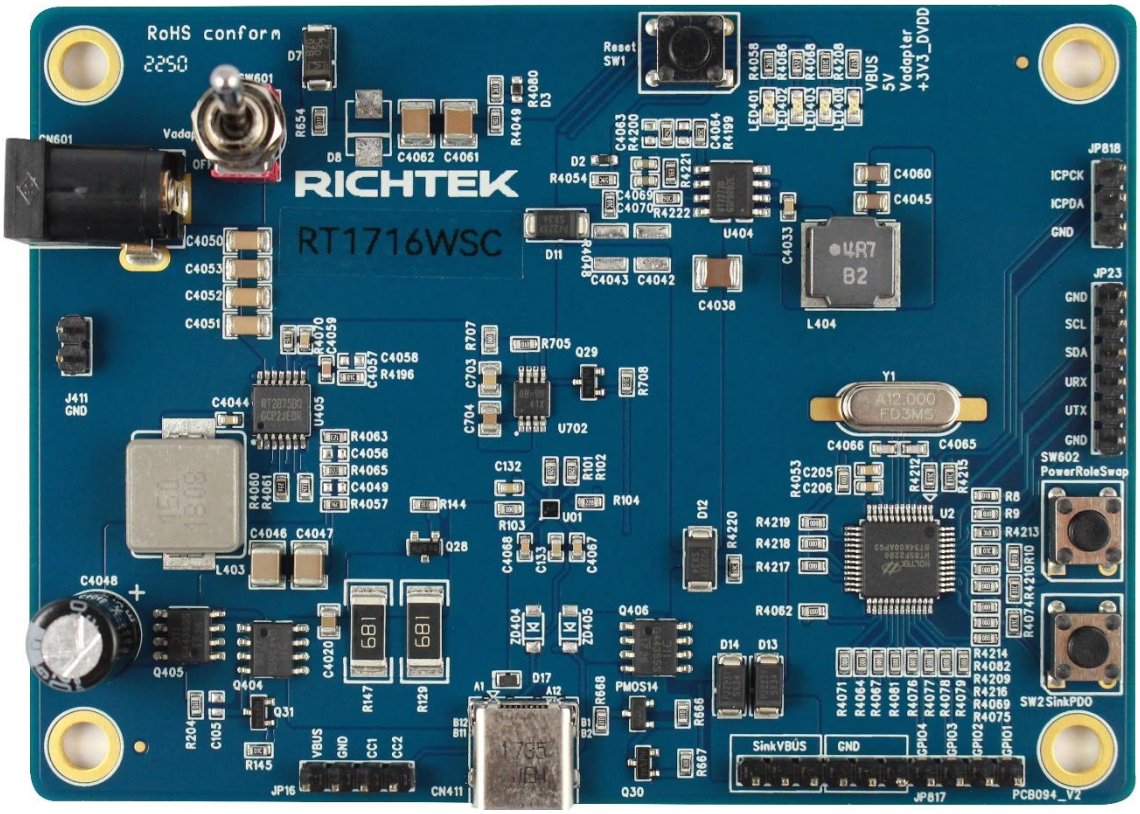
Power-up Procedure

The RT1716 supports DRP and Dead battery mode in this evaluation board. The followings explain the functions.

1. Insert 12V adapter and turn on the toggle switch. The 5V adapter and +3V3_DVDD LEDs wll light up. CC1 and CC2 will start DRP toggling.
2. If the RT1716 is attached as source, ie CC present Rp, source path will be on and output 5V at VBUS.
   Pressing “PowerRoleSwap” button will execute power role swap. If sink side accepts, source path will be off, the RT1716 will swap to sink, sink path will be on, and there will be 5V at SinkVBUS.
   After the RT1716 swaps to sink, pressing “SinkPDO” button will ask next PDO (PD_Object) from port partner.
3. If the RT1716 is attached as sink, ie CC present Rd, sink path will be on and there will be 5V at SinkVBUS.
   Pressing “SinkPDO” button will ask next PDO (PD_Object) from port partner.
   Pressing “PowerRoleSwap” button will execute power role swap. If source side accepts, sink path will be off, the RT1716 will swap to source, source path will be on, and there will be 5V at VBUS.
4. If 12V adapter is not inserted, CC1 and CC2 will present Rd. If source is inserted into Type-C receptacle, the whole EVB will be active. The sink path will be on and there will be 5V at SinkVBUS.
   Pressing “SinkPDO” button will ask next PDO (PD_Object) from port partner.
   Pressing “PowerRoleSwap” button will not execute power role swap because there is no adapter power.
   Pressing “Reset” button will reset +3V3_DVDD. MCU and the RT1716 will be reseted.

Detailed Description of Hardware

Headers Description and Placement



Carefully inspect all the components used in the EVB according to the following Bill of Materials table, and then make sure all the components are undamaged and correctly installed. If there is any missing or damaged component, which may occur during transportation, please contact our distributors or e-mail us at evb_service@richtek.com.

Test Points

The EVB is provided with the test points and pin names listed in the table below.

Test Point/ Pin Name	Function
VBUS	5V as the RT1716 is souorce. 5V to 20V as the RT1716 is sink.
CC1	CC1 is used to establish and manage the Source-to-Sink connection.
CC2	CC2 is used to establish and manage the Source-to-Sink connection.
GND	Ground.
SinkVBUS	As the RT1716 is sink, sink path will turn on. The RT1716 will get power from port partner for system applications.
GPIO1~4	These four pins are used to control other functions in system for user.

Test Point/ Pin Name	Function
UTX/URX	These two pins are used to trace log of MCU.
SDA/SCL	These two pins are I^2C communication between the RT1716 and MCU.
ICPDA/ICPCK	These two pins are used to programming MCU.

Bill of Materials

Reference	Count	Part Number	Value	Description	Package	Manufacturer
C132, C133	2	0603X105K250CT	1μF	Capacitor, Ceramic, 25V/X5R	0603	WALSIN
C205, C206, C4033, C4044, C4059	5	0603B104K500CT	0.1μF	Capacitor, Ceramic, 50V, X7R	0603	WALSIN
C703	1	0805B224K250CT	0.22μF	Capacitor, Ceramic, 25V, X7R	0805	WALSIN
C704	1	0805B105K250CT	1μF	Capacitor, Ceramic, 25V, X7R	0805	WALSIN
C4020	1	0805B105K500CT	1μF	Capacitor, Ceramic, 50V, X7R	0805	WALSIN
C4038, C4061, C4062	3	GRM32ER71H106KA12L	10μF	Capacitor, Ceramic, 50V, X7R	1210	MURATA
C4045, C4060	2	0805X226M250CT	22μF	Capacitor, Ceramic, 25V, X5R	0805	WALSIN
C4046, C4047	2	GRM32E61E226KE15L	22μF	Capacitor, Ceramic, 25V, X5R	1210	MURATA
C4048	1	35YXG220MEFC8X16	220μF	Capacitor, Ceramic, 35V	8x16x3.5mm	RUBYCON
C4050, C4051, C4052, C4053	4	GRM31CR61H106KA12L	10μF	Capacitor, Ceramic, 50V, X5R	1206	MURATA
C4057	1	0603B682K500CT	6.8nF	Capacitor, Ceramic, 50V, X7R	0603	WALSIN
C4065, C4066	2	0603N100J500CT	10pF	Capacitor, Ceramic, 50V, NPO	0603	WALSIN
C4067, C4068	2	0603B471K500CT	470pF	Capacitor, Ceramic, 50V, X7R	0603	WALSIN
C4069, C4070	2	0603B272K500CT	2.7nF	Capacitor, Ceramic, 50V, X7R	0603	WALSIN
CN411	1	121U-3CST-09CR	USB TYPE-C 3.1	USB TYPE-C 3.1	9.87x9.75mm	JEM
CN601	1		DC POWER JACK	DC POWER JACK	14.4x8.7mm	
D2, D3	2	MM5Z2V7	3.3V	Zener Diode	SOD523	SECOS
D7	1	BZG05C27	27V	Zener Diode	SMA/DO-214AC	VISHAY
D8	1	SMBJ24CA	SMBJ24CA	TVS Diodes SMBJ24CA	SMB/DO-214AA	FAIRCHILD
D11, D12, D13, D14	4	SX34	40V/3A	Schottky Diode	SMA/DO-214AC	PANJIT
D17	1	AZ4520-01F	25.5V	ESD Diode	1.6x1.0mm	Amazing

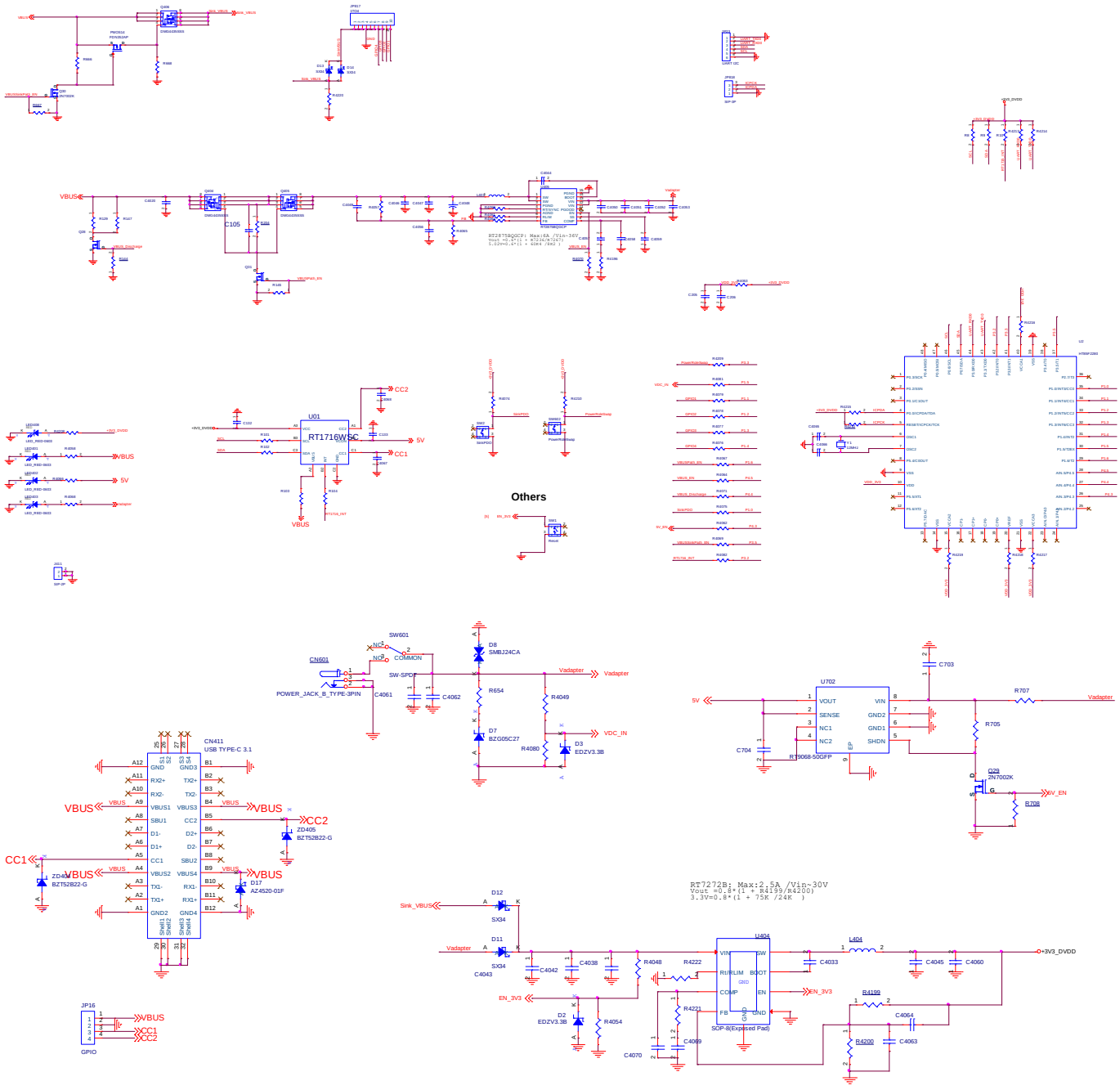
Reference	Count	Part Number	Value	Description	Package	Manufacturer
L403	1	M10A1509MT-C	15µH	Inductor, 6A	11x10x3.8mm	Nichtek
L404	1	NR8040T4R7N	4.7µH	Inductor, 4.7A	8x8x4.2mm	TAIYO YUDEN
LED401, LED402, LED403, LED408	4	LNL-191SUR	LED_RED	LED_RED-0603	0603	LighTop
PMOS14	1	FDN352AP	FDN352AP	PMOS	SOT-23-3/ TO-236	FAIRCHILD
Q28, Q29, Q30, Q31	4	2N7002K	2N7002K	NMOS	SOT-23	PANJIT
Q404, Q405, Q406	3	DMG4435SSS	DMG4435SSS	PMOS	SOIC-8	DIODES
R8, R9, R10	3	RTT031001FTP	1k	Resistor, Chip, 1/10W, 1%	0603	RALEC
R101, R102, R104	3	WR06X22R0FTL	22	Resistor, Chip, 1/10W, 1%	0603	WALSIN
R103, R707, R4053, R4062, R4064, R4067, R4069, R4071, R4075, R4076, R4077, R4078, R4079, R4081, R4082, R4209, R4216, R4217, R4218, R4219	20	WR06X000 PTL	0	Resistor, Chip, 1/10W, 1%	0603	WALSIN
R129, R147	2	3520680RJT	680	Resistor, Chip, 1W, 5%	2512	TE Connectivity
R144, R708, R4070	3	WR06X1004FTL	1M	Resistor, Chip, 1/10W, 1%	0603	WALSIN

Reference	Count	Part Number	Value	Description	Package	Manufacturer
R145, R4048, R4058, R4068, R4074, R4080, R4196, R4210, R4212, R4213, R4214, R4215	12	WR06X1002FTL	10k	Resistor, Chip, 1/10W, 1%	0603	WALSIN
R204, R666, R668, R705	4	WR06X1003FTL	100k	Resistor, Chip, 1/10W, 1%	0603	WALSIN
R654	1	WR06W1R00FTL	1	Resistor, Chip, 1/10W, 1%	0603	WALSIN
R667	1	WR06X2001FTL	2k	Resistor, Chip, 1/10W, 1%	0603	WALSIN
R4049	1	WR06X3002FTL	30k	Resistor, Chip, 1/10W, 1%	0603	WALSIN
R4054	1	WR06X4022FTL	40.2k	Resistor, Chip, 1/10W, 1%	0603	WALSIN
R4057	1	WR06X6204FTL	60.4k	Resistor, Chip, 1/10W, 1%	0603	WALSIN
R4060	1	RTT031693FTP	169k	Resistor, Chip, 1/10W, 1%	0603	RALEC
R4061	1	WR06X4702FTL	47k	Resistor, Chip, 1/10W, 1%	0603	WALSIN
R4063	1	WR06X1202FTL	12k	Resistor, Chip, 1/10W, 1%	0603	WALSIN
R4065	1	WR06X8201FTL	8.2k	Resistor, Chip, 1/10W, 1%	0603	WALSIN
R4066, R4208	2	WR06X5101FTL	5.1k	Resistor, Chip, 1/10W, 1%	0603	WALSIN
R4199	1	WR06X7502FTL	75k	Resistor, Chip, 1/10W, 1%	0603	WALSIN
R4200	1	WR06X2402FTL	24k	Resistor, Chip, 1/10W, 1%	0603	WALSIN
R4220	1	RTT035112FTP	51.1k	Resistor, Chip, 1/10W, 1%	0603	RALEC
R4221	1	WR06X1602FTL	16k	Resistor, Chip, 1/10W, 1%	0603	WALSIN
R4222	1	WR06X8452FTL	84.5k	Resistor, Chip, 1/10W, 1%	0603	WALSIN
U01	1	RT1716WSC	RT1716	Type-C Port Controller	WL-CSP-8B 1.38x1.34 (BSC)	RICHTEK
U2	1	HT85F2280	HT85F2280	MCU	LQFP7_48L	HOLTEK

Reference	Count	Part Number	Value	Description	Package	Manufacturer
U404	1	RT7272BGSP	RT7272B	Buck Converter	SOP-8 (Exposed Pad)	RICHTEK
U405	1	RT2875BQGCP	RT2875B	Buck Converter	TSSOP-14 (Exposed Pad)	RICHTEK
U702	1	RT9068-50GFP	RT9068	LDO	MSOP-8	RICHTEK
Y1	1	49S-012000-FX6B01	12MHz	Oscillator	HC-49S	AKER
ZD404, ZD405	2	BZT52B22-G	22V	Zener Diode	SOD-123	VISHAY

Typical Applications

EVB Schematic Diagram



1. The capacitance values of the input and output capacitors will influence the input and output voltage ripple.
2. MLCC capacitors have degrading capacitance at DC bias voltage, and especially smaller size MLCC capacitors will have much lower capacitance.

Evaluation Board Layout

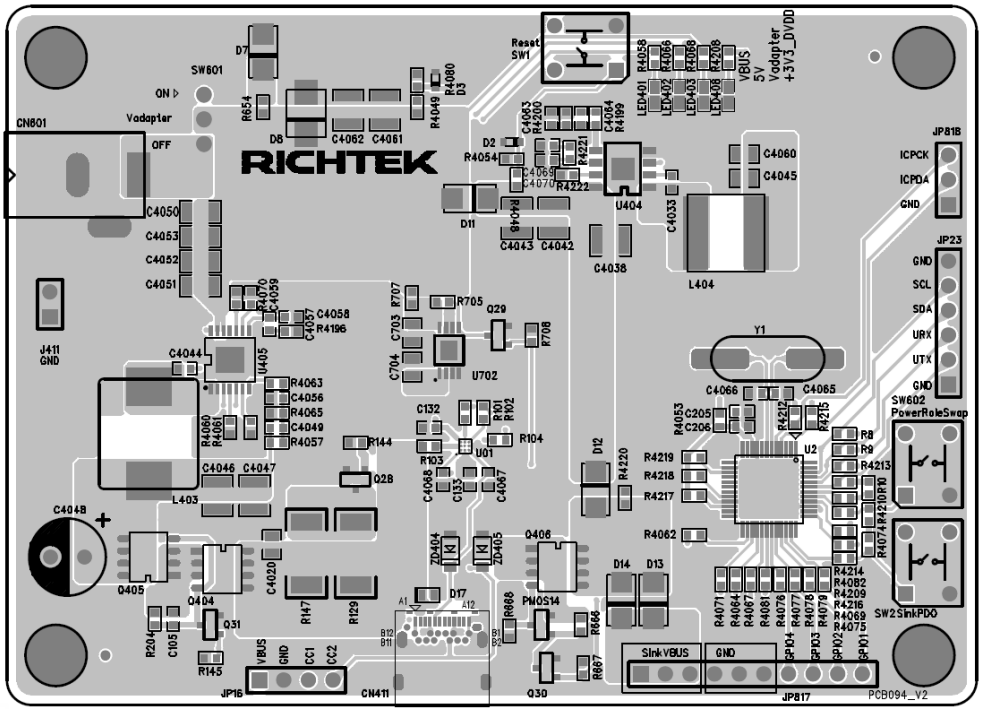


Figure 1. Top View (1st layer)

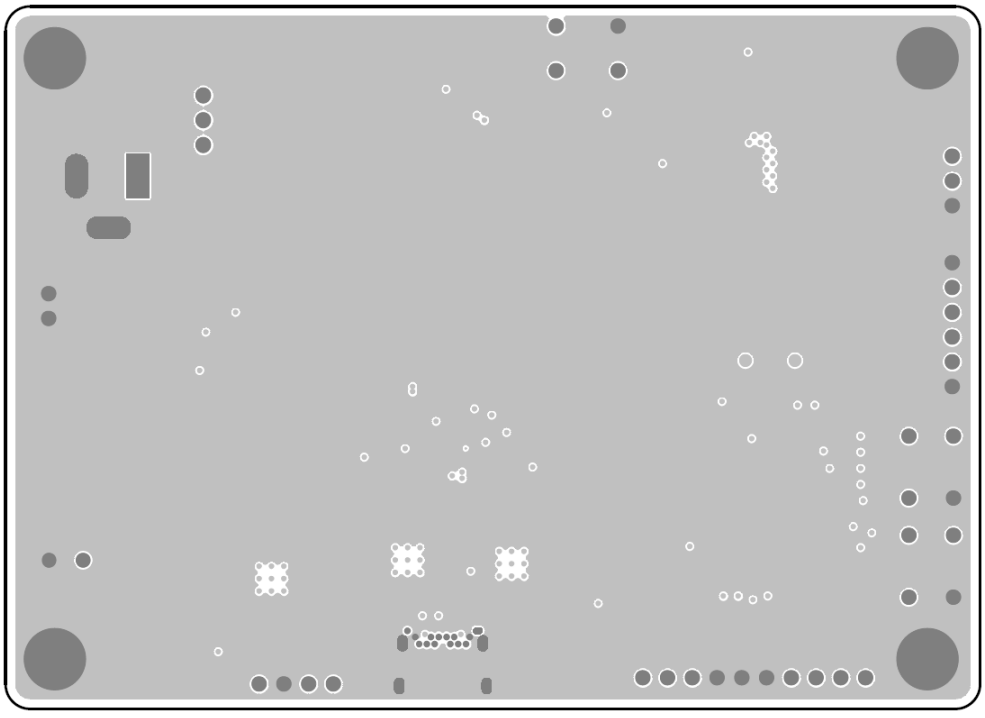


Figure 2. PCB Layout—Inner Side (2nd Layer)

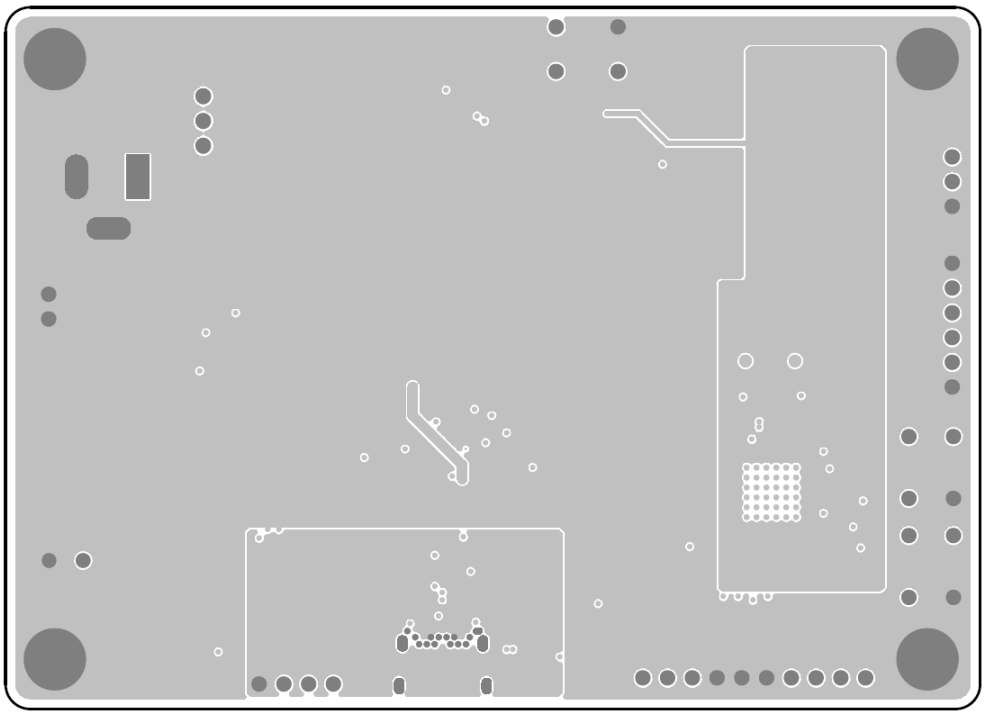


Figure 3. PCB Layout—Inner Side (3rd Layer)

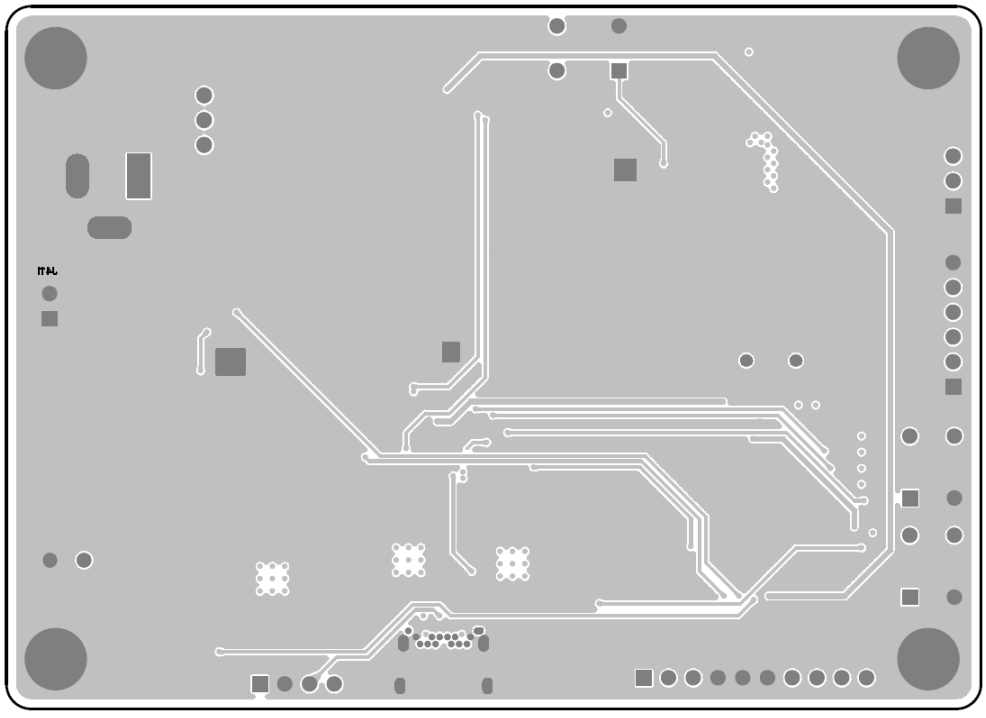


Figure 4. Bottom View (4th Layer)

More Information

For more information, please find the related datasheet or application notes from Richtek website http://www.richtek.com.

Important Notice for Richtek Evaluation Board