RT1715 Type-C Port Controller Evaluation Board

Purpose

The RT1715 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 RT1715 evaluation board (EVB), and provides information to enable operation, modification of the evaluation board and circuit to suit individual requirements.

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Introduction

General Product Information

The RT1715 is a USB Type-C controller that complies with the latest USB Type-C and PD standards. The RT1715 integrates a complete Type-C Transceiver including the Rp and Rd resistors. It does the USB Type-C detection including attach and orientation. The RT1715 integrates the physical layer of the USB BMC power delivery protocol to allow up to 100W of power and role swap. The BMC PD block enables full support for alternative interfaces of the Type-C specification.

Product Feature

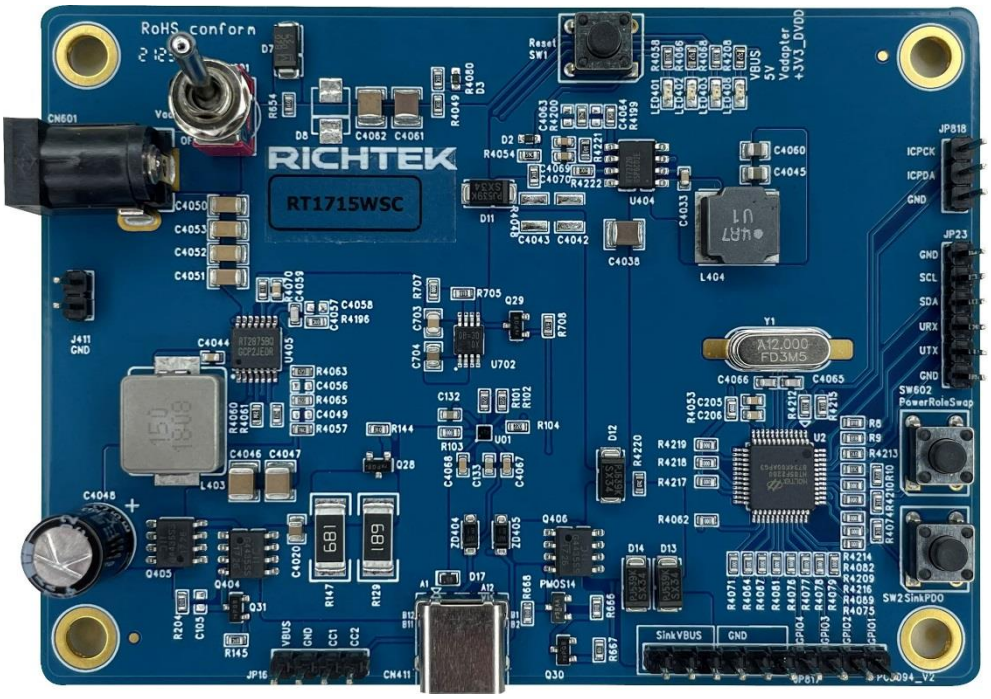
- **Dual-Role PD Compatible**
- **Attach/Detach Detection as Host, Device or DRP**
- **Current Capability Definition and Detection**
- **Cable Recognition**
- **Alternate Mode Support**
- **Supporting VCONN with Programmable OCP**
- **Dead Battery Support**
- **Ultra-Low Power Mode for Attach Detection**
- **Simple I^2C Interface with AP or EC**
- **BIST Mode Supported**
- **Supported PD 3.0 except Fast Role Swap Function**
- **e-fuse IP**
- **9-Ball WL-CSP Package**

Key Performance Summary Table

Key Features	Evaluation Board Number : PCB094_V2
Default Input Voltage	12V
VBUS Output Current	3A
VBUS Voltage	5V as RT1715 is source. 5V to 20V as RT1715 is sink.
Default Marking & Package Type	RT1715WSC, WL-CSP-9B 1.38x1.34 (BSC)
Operation Mode	DRP, Dead battery

Bench Test Setup Conditions

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	Signal	Comment (expected waveforms or voltage levels on test points)
VBUS	Voltage	5V as RT1715 is souorce. 5V to 20V as the RT1715 is sink.
CC1	Configuration channel 1	CC1 is used to establish and manage the Source-to-Sink connection.
CC2	Configuration channel 2	CC2 is used to establish and manage the Source-to-Sink connection.
GND	Ground	Ground.
SinkVBUS	Sink voltage	As the RT1715 is sink, sink path will turn on. The RT1715 will get power from port partner for system applications.
GPIO1 to GPIO 4	General purpose I/O 1 to 4	These four pins are used to control other functions in system for user.
UTX, URX	Signal for log	These two pins are used to trace log of Micron.
SDA, SCL	I^2C signal	These two pins are I^2C communication between the RT1715 and Micron.
ICPDA, ICPCK	Signal for programming	These two pins are used to program Micron.

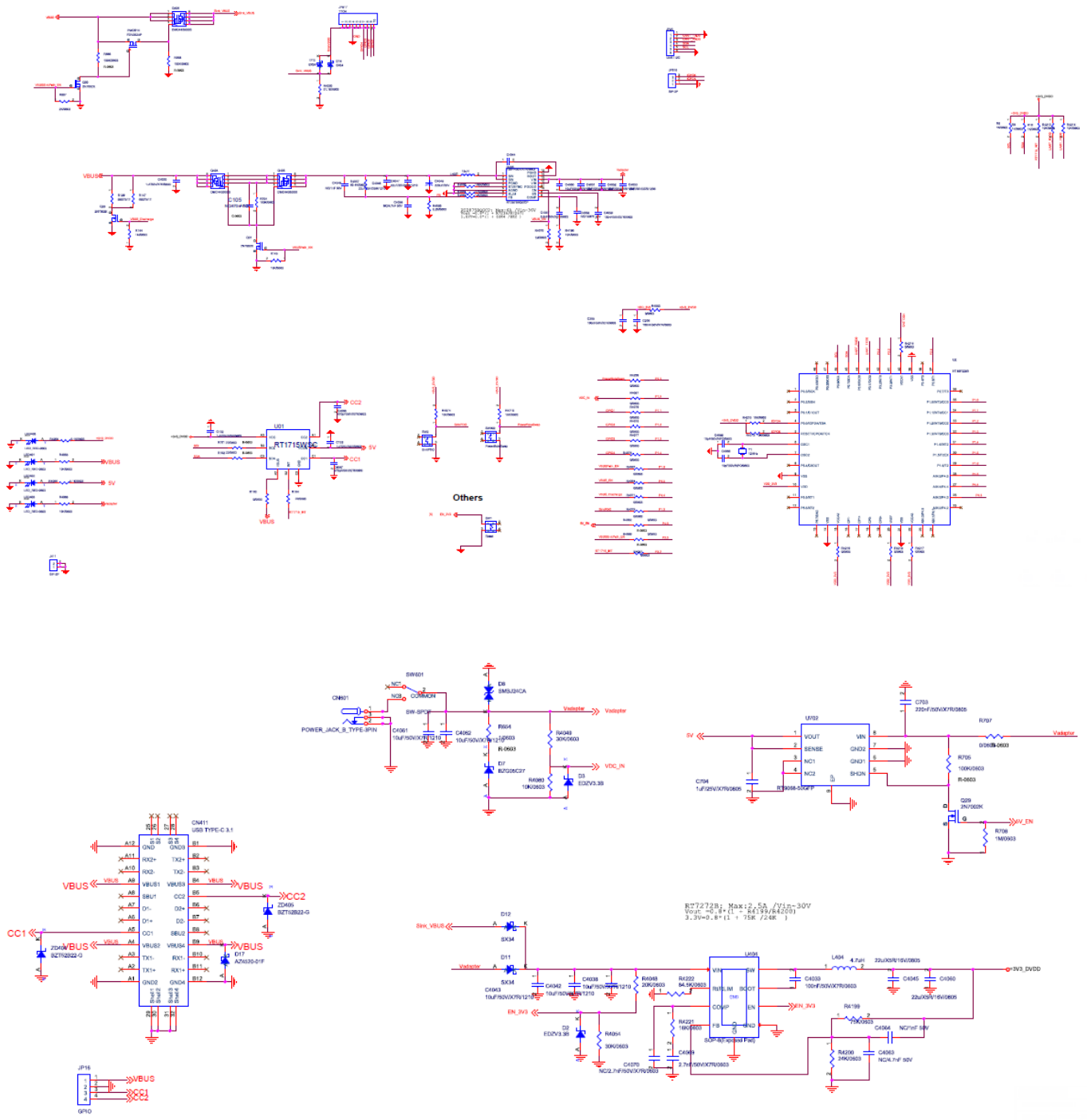
Operations

The RT1715 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, Vadapter, and +3V3_DVDD LEDs wll light up. CC1 and CC2 will start DRP toggling.
2. If the RT1715 is attached as source, ie CC is presented as 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 RT1715 will swap to sink, sink path will be on, and there will be 5V at SinkVBUS.
   After the RT1715 swaps to sink, pressing “SinkPDO” button will ask next PDO (PD_Object) from port partner.
3. If the RT1715 is attached as sink, ie CC is presented as 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 RT1715 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.
5. Pressing “Reset” button will reset +3V3_DVDD. Micron and the RT1715 will be reseted.

Schematic, Bill of Materials & Board Layout

EVB Schematic Diagram

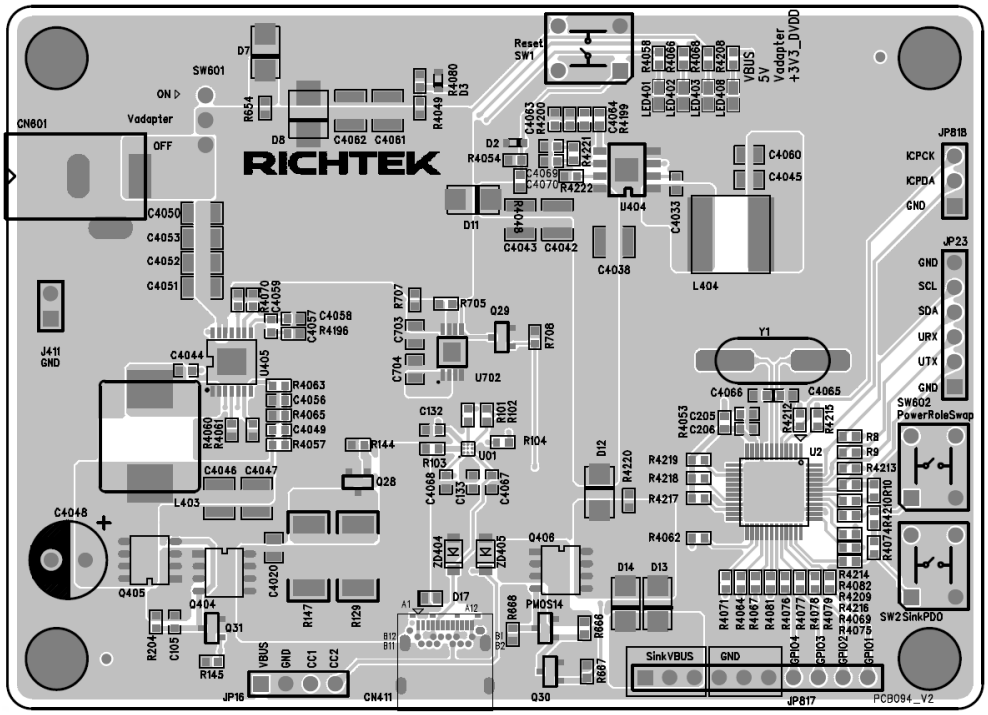


Bill of Materials

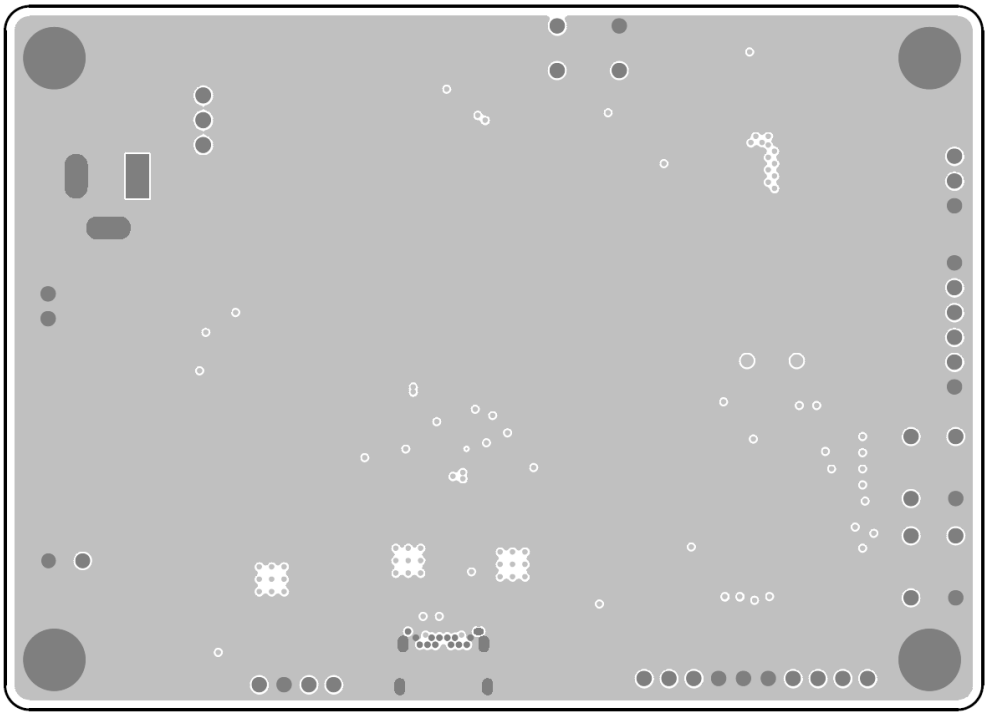
Reference	Qty	Part Number	Description	Package	Manufacturer
C105	1		NC/470nF/50V		
C132, C133	2	TMK107BJ105KA-T	1μF/25V/X5R	0603	TAIYO YUDEN
C205, C206, C4033, C4044, C4059	5	GRM188R71H104KA93D	100nF/50V/X7R	0603	muRata
C703	1	C2012X7R1H224K125AA	220nF/50V/X7R	0805	TDK
C704	1	UMK212B7105KG-T	1μF/25V/X7R	0805	TAIYO YUDEN
C4020	1	UMK212B7105KG-T	1μF/50V/X7R	0805	TAIYO YUDEN
C4038, C4061, C4062	3		10μF/50V/X7R	1210	muRata
C4042, C4043	2		NC/10μF/50V/X7R	1210	muRata
C4045, C4060	2	C2012X5R1C226KT0001	22μ/X5R/16V	0805	TDK
C4046, C4047	2	GRM32E61E226KE15L	22μF/25V/X5R	1210	muRata
C4048	1	35YXG220MEFC8X16	220μF/35V	徑向	Rubycon
C4049	1		NC/1nF/50V	0603	
C4050, C4051, C4052, C4053	4	C3216X5R1H106K160AB	10μF/50V/X5R	1206	TDK
C4056	1		NC/4.7nF/50V	0603	
C4057	1	0603B682K500CT	6.8nF/50V/X7R	0603	WALSIN
C4058	1		NC/180pF/50V	0603	
C4063	1		NC/4.7nF/50V	0603	
C4064	1		NC/1nF/50V	0603	
C4065, C4066	2	0603N100J500CT	10pF/50V/NPO	0603	WALSIN
C4067, C4068	2	0603B471K500CT	470pF/50V/X7R	0603	WALSIN
C4069, C4070	2	0603B272K500CT	2.7nF/50V/X7R	0603	WALSIN
CN411	1	121U-3CST-09CR	USB Type-C 3.1	9.87x9.75mm	JEM (建舜電子)
CN601	1		POWER_JACK_B_TYPE-3PIN	PWR_JACK_B_360B	
D2, D3	2	MM5Z2V7	MM5Z2V7	SOD-523	SECOS
D7	1	BZG05C27	BZG05C27	SMA/DO-214AC	Vishay
D8	1		NC		
D11, D12, D13, D14	4	SX34	SX34	SMA/DO-214AC	PANJIT
D17	1	AZ4520-01F	AZ4520-01F	1.6x1.0mm	Amazing
L403	1	M10A1509MT-C	15μH	L-M104L	Nichtek
L404	1	NR8040T4R7N	4.7μH	L-8x8	TAIYO YUDEN
LED401, LED402, LED403, LED408	4	LNL-191SUR	LED_RED-0603	LED-0603	LighTop
PMOS14	1	FDN352AP	FDN352AP	SOT-23-3/TO-236	FAIRCHILD
Q28, Q29, Q30, Q31	4	2N7002K	2N7002K	SOT-23	PANJIT
Q404, Q405, Q406	3	DMG4435SSS	DMG4435SSS	SOIC-8	DIODES
R8, R9, R10	3	RTT031001FTP	1k	0603	RALEC

Reference	Qty	Part Number	Description	Package	Manufacturer
R101, R102, R104	3	WR06X22R0FTL	22	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	0603	WALSIN
R129, R147	2	3520680RJT	680	2512	TE Connectivity
R144, R708, R4070	3	WR06X1004FTL	1M	0603	WALSIN
R145, R4048, R4058, R4068, R4074, R4080, R4196, R4210, R4212, R4213, R4214, R4215	12	WR06X1002FTL	10k	0603	WALSIN
R204, R666, R668, R705	4	WR06X1003FTL	100k	0603	WALSIN
R654	1	WR06W1R00FTL	1	0603	WALSIN
R667	1	WR06X2001FTL	2k	0603	WALSIN
R4049	1	WR06X3002FTL	30k	0603	WALSIN
R4054	1	WR06X4022FTL	40.2k	0603	WALSIN
R4057	1	WR06X6204FTL	60.4k	0603	WALSIN
R4060	1	RTT031693FTP	169k	0603	RALEC
R4061	1	WR06X4702FTL	47k	0603	WALSIN
R4063	1	WR06X1202FTL	12k	0603	WALSIN
R4065	1	WR06X8201FTL	8.2k	0603	WALSIN
R4066, R4208	2	WR06X5101FTL	5.1k	0603	WALSIN
R4199	1	WR06X7502FTL	75k	0603	WALSIN
R4200	1	WR06X2402FTL	24k	0603	WALSIN
R4220	1	RTT035112FTP	51.1k	0603	RALEC
R4221	1	WR06X1602FTL	16k	0603	WALSIN
R4222	1	WR06X8452FTL	84.5k	0603	WALSIN
SW1, SW2, SW602	3	HTS6601H	Reset	TACT-BTN	High-Tronics
SW601	1	DS-41T1B1A1QN	SW-SPDT	27.69x8.13x5.08x 2.54mm	YUAN CHIN
U01	1	RT1715WSC	USB Type-C PD Controller	WL-CSP-9L 1.38x1.34 (BSC)	Richtek
U2	1	HT85F2280	HT85F2280	LQFP7_48L	HOLTEK
U404	1	RT7272BGSP	DC-DC Converter	PSOP-8	Richtek
U405	1	RT2875BQGCP	Step-Down Converter	TSSOP-14	Richtek
U702	1	RT9068-50GFP	Linear Regulator	MSOP-8	Richtek
Y1	1	HC-49S	12MHz	HC-49S	AKER
ZD404, ZD405	2	BZT52B22	BZT52B22	SOD-123	VISHAY

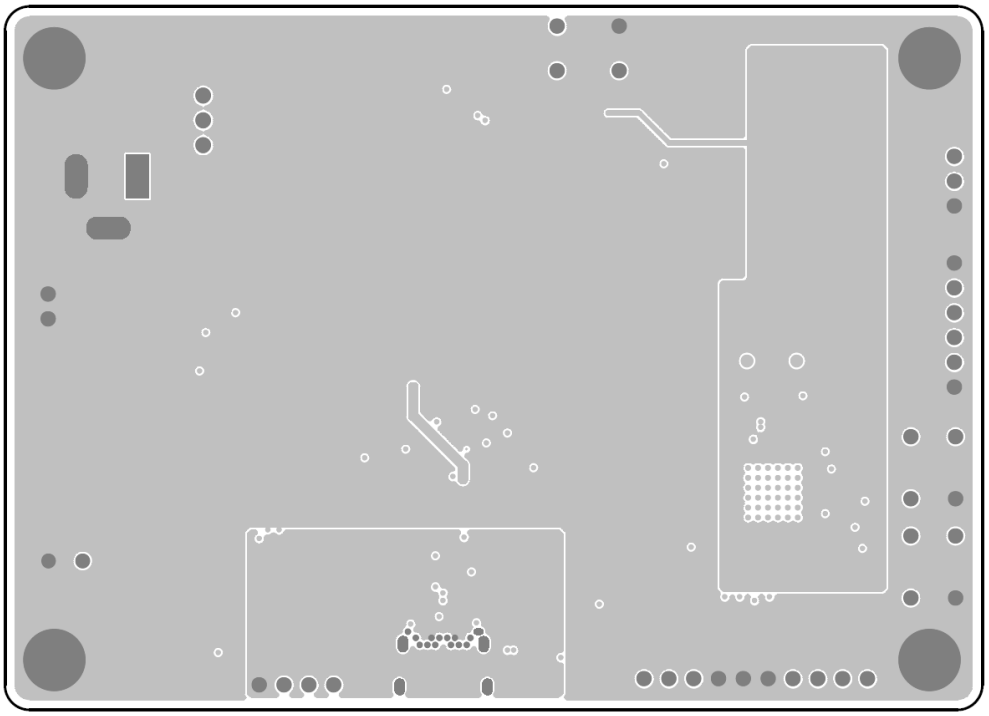
PCB Layout



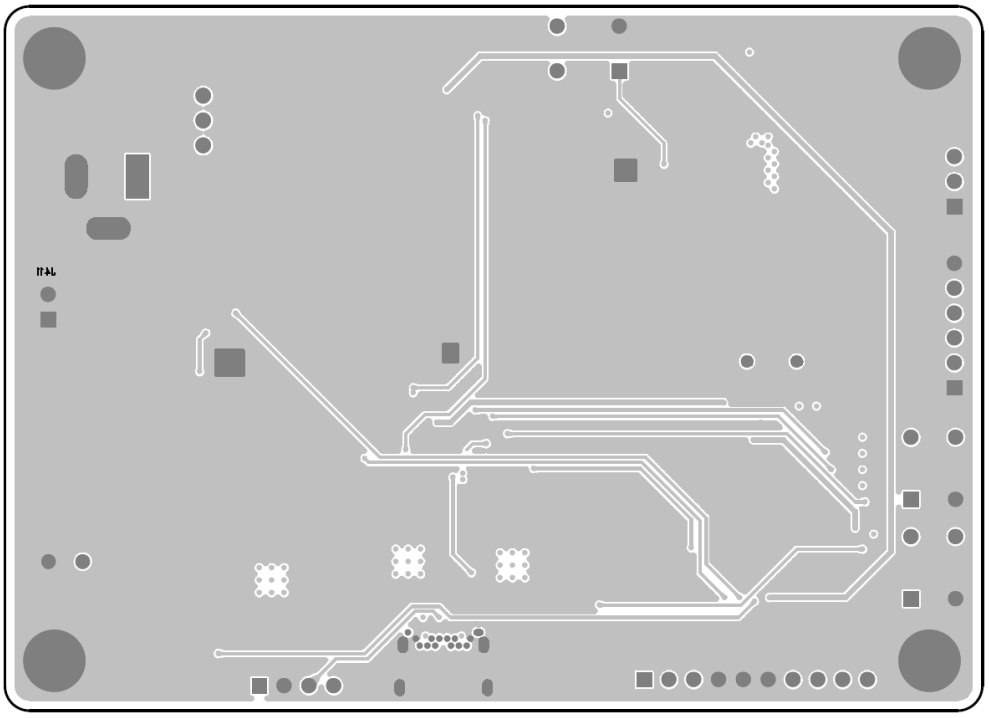
Top View (1st layer)



PCB Layout—Inner Side (2nd Layer)



PCB Layout—Inner Side (3rd Layer)



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