

## Type-C Port Controller Evaluation Board

### **General Description**

The RT1719GQW is a Sink-Only USB Type-C controller that complies with the latest USB Type-C and PD standards. This document explains the function and use of the RT1719GQW 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 RT1719GQW Evaluation Board performance specification is provided in Table 1. The ambient temperature is 25°C.

Table 1. RT1719GQW Evaluation Board Performance Specification Summary

Specification	Test Conditions	Min	Typ	Max	Unit
<b>VBUS Voltage Range</b>		5	--	20	V
<b>Power Consumption</b>	LED indication	--	--	35	mA

## Power-up Procedure

RT1719GQW is a sink only Type-C port controller. The main function is to request Vbus (Fixed Power) for the system. RT1719GQW requests the matched and maximum power Source PDO according to the settings at Table\_SEL, PSEL2, and PSEL1. Table\_SEL, PSEL2, and PSEL1 can be configured by adjusting JP964, JP955, and JP961 respectively. The following two tables show the Sink PDO for 128 configurations.

Table 2. Table\_Sel Setting = 1

Table_Sel setting	PSEL2 setting	PSEL1 setting	Min. V	Max. V	PDO1		PDO2		PDO3		PDO4		PDO5	
					V (V)	I (mA)	V (V)	I (mA)	V (V)	I (mA)	V (V)	I (mA)	V (V)	I (mA)
1	111	111	5	9	5	500	9	500	NA	NA	--	--	--	--
1	111	110	5	9	5	1000	9	1000	NA	NA	--	--	--	--
1	111	101	5	9	5	1500	9	1500	NA	NA	--	--	--	--
1	111	100	5	9	5	2000	9	2000	NA	NA	--	--	--	--
1	111	011	5	9	5	2500	9	2500	NA	NA	--	--	--	--
1	111	010	5	9	5	3000	9	3000	NA	NA	--	--	--	--
1	111	001	5	9	5	3500	9	3500	NA	NA	--	--	--	--
1	111	000	5	9	5	4000	9	4000	NA	NA	--	--	--	--
1	110	111	5	9	5	4500	9	4500	NA	NA	--	-	--	--
1	110	110	5	9	5	5000	9	5000	NA	NA	--	---	--	--
1	110	101	5	12	5	500	9	500	12	500	NA	NA	--	--
1	110	100	5	12	5	1000	9	1000	12	1000	NA	NA	--	--
1	110	011	5	12	5	1500	9	1500	12	1500	NA	NA	--	--
1	110	010	5	12	5	2000	9	2000	12	2000	NA	NA	--	--
1	110	001	5	12	5	2500	9	2500	12	2500	NA	NA	--	--
1	110	000	5	12	5	3000	9	3000	12	3000	NA	NA	--	--
1	101	111	5	12	5	3500	9	3500	12	3500	NA	NA	--	--
1	101	110	5	12	5	4000	9	4000	12	4000	NA	NA	--	--
1	101	101	5	12	5	4500	9	4500	12	4500	NA	NA	--	--
1	101	100	5	12	5	5000	9	5000	12	5000	NA	NA	--	--

Table_Sel setting	PSEL2 setting	PSEL1 setting	Min. V	Max. V	PDO1		PDO2		PDO3		PDO4		PDO5	
					V (V)	I (mA)	V (V)	I (mA)	V (V)	I (mA)	V (V)	I (mA)	V (V)	I (mA)
1	101	011	12	12	5	1000	12	1000	NA	NA	--	--	--	--
1	101	010	12	12	5	1500	12	1500	NA	NA	--	--	--	--
1	101	001	12	12	5	2000	12	2000	NA	NA	--	--	--	--
1	101	000	12	12	5	2500	12	2500	NA	NA	--	--	--	--
1	100	111	12	12	5	3000	12	3000	NA	NA	--	--	--	--
1	100	110	12	12	5	3500	12	3500	NA	NA	--	--	--	--
1	100	101	12	12	5	4000	12	4000	NA	NA	--	--	--	--
1	100	100	12	12	5	4500	12	4500	NA	NA	--	--	--	--
1	100	011	12	12	5	5000	12	5000	NA	NA	--	--	--	--
1	100	010	5	15	5	500	9	500	12	500	15	500	NA	NA
1	100	001	5	15	5	1000	9	1000	12	1000	15	1000	NA	NA
1	100	000	5	15	5	1500	9	1500	12	1500	15	1500	NA	NA
1	011	111	5	15	5	2000	9	2000	12	2000	15	2000	NA	NA
1	011	110	5	15	5	2500	9	2500	12	2500	15	2500	NA	NA
1	011	101	5	15	5	3000	9	3000	12	3000	15	3000	NA	NA
1	011	100	5	15	5	3500	9	3500	12	3500	15	3500	NA	NA
1	011	011	5	15	5	4000	9	4000	12	4000	15	4000	NA	NA
1	011	010	5	15	5	4500	9	4500	12	4500	15	4500	NA	NA
1	011	001	5	15	5	5000	9	5000	12	5000	15	5000	NA	NA
1	011	000	15	15	5	1000	15	1000	NA	NA	--	--	--	--
1	010	111	15	15	5	1500	15	1500	NA	NA	--	--	--	--
1	010	110	15	15	5	2000	15	2000	NA	NA	--	--	--	--
1	010	101	15	15	5	2500	15	2500	NA	NA	--	--	--	--
1	010	100	15	15	5	3000	15	3000	NA	NA	--	--	--	--
1	010	011	15	15	5	3500	15	3500	NA	NA	--	--	--	--
1	010	010	15	15	5	4000	15	4000	NA	NA	--	--	--	--
1	010	001	15	15	5	4500	15	4500	NA	NA	--	--	--	--
1	010	000	15	15	5	5000	15	5000	NA	NA	--	--	--	--
1	001	111	5	20	5	1000	9	1000	12	1000	15	1000	20	1000
1	001	110	5	20	5	2000	9	2000	12	2000	15	2000	20	2000
1	001	101	5	20	5	2500	9	2500	12	2500	15	2500	20	2500
1	001	100	5	20	5	3000	9	3000	12	3000	15	3000	20	3000
1	001	011	5	20	5	3500	9	3500	12	3500	15	3500	20	3500
1	001	010	5	20	5	4000	9	4000	12	4000	15	4000	20	4000
1	001	001	5	20	5	4500	9	4500	12	4500	15	4500	20	4500
1	001	000	5	20	5	5000	9	5000	12	5000	15	5000	20	5000
1	000	111	20	20	5	1000	20	1000	NA	NA	--	--	--	--
1	000	110	20	20	5	2000	20	2000	NA	NA	--	--	--	--

Table_Sel setting	PSEL2 setting	PSEL1 setting	Min. V	Max. V	PDO1		PDO2		PDO3		PDO4		PDO5	
					V (V)	I (mA)	V (V)	I (mA)	V (V)	I (mA)	V (V)	I (mA)	V (V)	I (mA)
1	000	101	20	20	5	2500	20	2500	NA	NA	--	--	--	--
1	000	100	20	20	5	3000	20	3000	NA	NA	--	--	--	--
1	000	011	20	20	5	3500	20	3500	NA	NA	--	--	--	--
1	000	010	20	20	5	4000	20	4000	NA	NA	--	--	--	--
1	000	001	20	20	5	4500	20	4500	NA	NA	--	--	--	--
1	000	000	20	20	5	5000	20	5000	NA	NA	--	--	--	--

Table 3. Table\_Sel Setting = 0

Table_Sel setting	PSEL2 setting	PSEL1 setting	Min. V	Max. V	PDO1		PDO2		PDO3		PDO4		PDO5	
					V (V)	I (mA)	V (V)	I (mA)	V (V)	I (mA)	V (V)	I (mA)	V (V)	I (mA)
0	111	111	5	5	5	500	NA	NA	--	--	--	--	--	--
0	111	110	5	5	5	1500	NA	NA	--	--	--	--	--	--
0	111	101	5	5	5	2000	NA	NA	--	--	--	--	--	--
0	111	100	5	5	5	3000	NA	NA	--	--	--	--	--	--
0	111	011	5	9	5	1500	9	830	NA	NA	--	--	--	--
0	111	010	5	9	5	2000	9	1110	NA	NA	--	--	--	--
0	111	001	5	9	5	3000	9	1660	NA	NA	--	--	--	--
0	111	000	5	9	5	4000	9	2220	NA	NA	--	--	--	--
0	110	111	5	9	5	5000	9	2770	NA	NA	--	--	--	--
0	110	110	5	12	5	1500	9	830	12	620	NA	NA	--	--
0	110	101	5	12	5	2000	9	1110	12	830	NA	NA	--	--
0	110	100	5	12	5	3000	9	1660	12	1250	NA	NA	--	--
0	110	011	5	12	5	4000	9	2220	12	1660	NA	NA	--	--
0	110	010	5	12	5	5000	9	2770	12	2080	NA	NA	--	--
0	110	001	5	15	5	1500	9	830	12	620	15	500	NA	NA
0	110	000	5	15	5	2000	9	1110	12	830	15	660	NA	NA
0	101	111	5	15	5	3000	9	1660	12	1250	15	1000	NA	NA
0	101	110	5	15	5	4000	9	2220	12	1660	15	1330	NA	NA
0	101	101	5	15	5	5000	9	2770	12	2080	15	1660	NA	NA
0	101	100	5	20	5	1500	9	830	12	620	15	500	20	370
0	101	011	5	20	5	2000	9	1110	12	830	15	660	20	500
0	101	010	5	20	5	3000	9	1660	12	1250	15	1000	20	750
0	101	001	5	20	5	4000	9	2220	12	1660	15	1330	20	1000
0	101	000	5	20	5	5000	9	2770	12	2080	15	1660	20	1250
0	100	111	9	12	5	1800	9	1000	12	750	NA	NA	--	--
0	100	110	9	12	5	2400	9	1330	12	1000	NA	NA	--	--
0	100	101	9	12	5	3600	9	2000	12	1500	NA	NA	--	--

Table_Sel setting	PSEL2 setting	PSEL1 setting	Min. V	Max. V	PDO1		PDO2		PDO3		PDO4		PDO5	
					V (V)	I (mA)	V (V)	I (mA)	V (V)	I (mA)	V (V)	I (mA)	V (V)	I (mA)
0	100	100	9	12	5	4800	9	2660	12	2000	NA	NA	--	--
0	100	011	9	12	5	5000	9	3000	12	2250	NA	NA	--	--
0	100	010	9	12	5	5000	9	4000	12	3000	NA	NA	--	--
0	100	001	9	12	5	5000	9	5000	12	3750	NA	NA	--	--
0	100	000	9	15	5	1800	9	1000	12	750	15	600	NA	NA
0	011	111	9	15	5	3000	9	1660	12	1250	15	1000	NA	NA
0	011	110	9	15	5	4000	9	2220	12	1660	15	1330	NA	NA
0	011	101	9	15	5	5000	9	3000	12	2250	15	1800	NA	NA
0	011	100	9	15	5	5000	9	4000	12	3000	15	2400	NA	NA
0	011	011	9	15	5	5000	9	5000	12	3750	15	3000	NA	NA
0	011	010	9	20	5	1800	9	1000	12	750	15	600	20	450
0	011	001	9	20	5	3000	9	1660	12	1250	15	1000	20	750
0	011	000	9	20	5	4000	9	2220	12	1660	15	1330	20	1000
0	010	111	9	20	5	5000	9	3000	12	2250	15	1800	20	1350
0	010	110	9	20	5	5000	9	4000	12	3000	15	2400	20	1800
0	010	101	9	20	5	5000	9	5000	12	3750	15	3000	20	2250
0	010	100	12	15	5	2000	12	830	15	660	NA	NA	--	--
0	010	011	12	15	5	3000	12	1250	15	1000	NA	NA	--	--
0	010	010	12	15	5	4800	12	2000	15	1600	NA	NA	--	--
0	010	001	12	15	5	5000	12	2500	15	2000	NA	NA	--	--
0	010	000	12	15	5	5000	12	3000	15	2400	NA	NA	--	--
0	001	111	12	15	5	5000	12	3750	15	3000	NA	NA	--	--
0	001	110	12	15	5	5000	12	5000	15	4000	NA	NA	--	--
0	001	101	12	20	5	2000	12	830	15	660	20	500	NA	NA
0	001	100	12	20	5	3000	12	1250	15	1000	20	750	NA	NA
0	001	011	12	20	5	4800	12	2000	15	1600	20	1200	NA	NA
0	001	010	12	20	5	5000	12	3000	15	2400	20	1800	NA	NA
0	001	001	12	20	5	5000	12	3750	15	3000	20	2250	NA	NA
0	001	000	12	20	5	5000	12	5000	15	4000	20	3000	NA	NA
0	000	111	15	20	5	2000	15	660	20	500	NA	NA	--	--
0	000	110	15	20	5	3000	15	1000	20	750	NA	NA	--	--
0	000	101	15	20	5	4000	15	1330	20	1000	NA	NA	--	--
0	000	100	15	20	5	5000	15	1660	20	1250	NA	NA	--	--
0	000	011	15	20	5	5000	15	2000	20	1500	NA	NA	--	--
0	000	010	15	20	5	5000	15	3000	20	2250	NA	NA	--	--
0	000	001	15	20	5	5000	15	4000	20	3000	NA	NA	--	--
0	000	000	15	20	5	5000	15	5000	20	3750	NA	NA	--	--

RT1719GQW supports DR\_Swap but does not support Alternate Mode. The following table shows how RT1719GQW responds the DR\_Swap and expresses the USB ability in Sink Capability. It is configured at JP969.

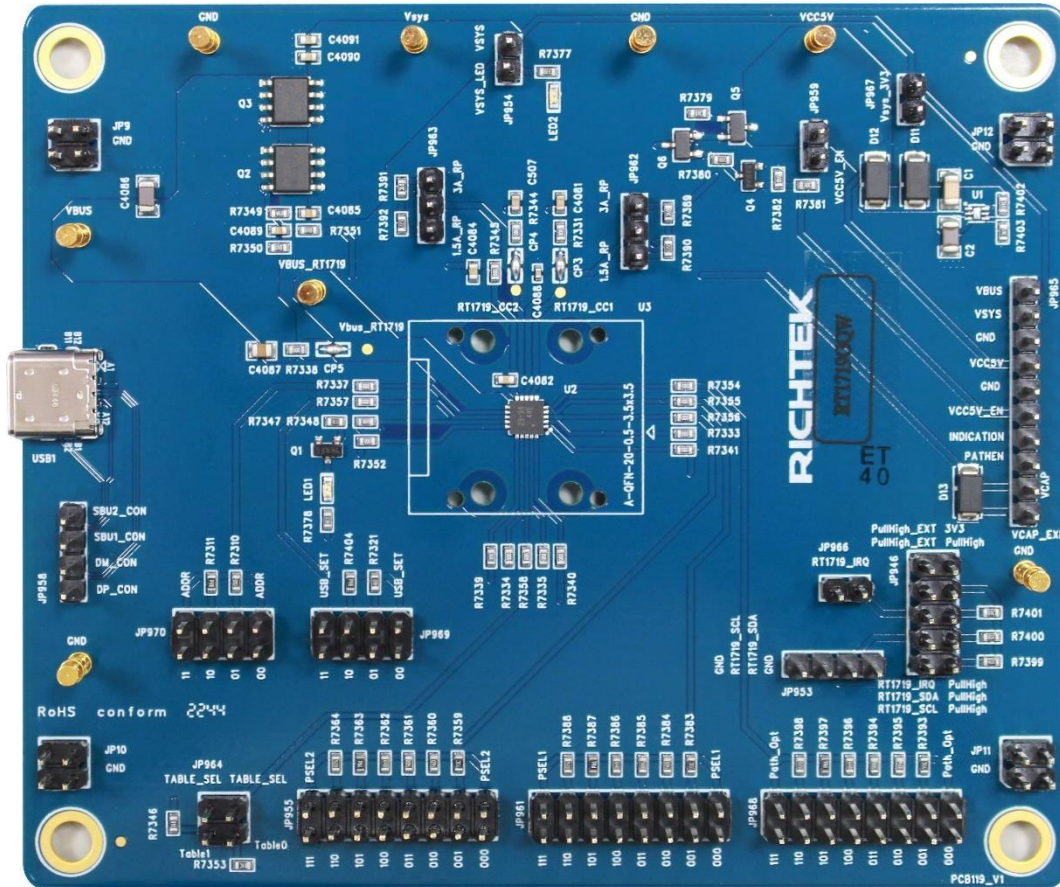
USB Setting	Resistance between USB_SET and GND (unit: kΩ)	0x3E[1:0]	Behavior
USB ability, Data role swap	Open	11b	<ol style="list-style-type: none"> <li>Response "Accept" to "DR_Swap," and 0x35[7] will be 1b if "DR_Swap" is received.</li> <li>USB Communications Capable in "Sink_Capabilities" is 1b.</li> <li>MCU can send "DR_Swap" by 0x03[7] = 1b.</li> </ol>
USB ability, No Data role swap (UFP only)	309	01b	<ol style="list-style-type: none"> <li>Response "Reject" to "DR_Swap," and 0x35[6] will be 1b if "DR_Swap" is received.</li> <li>USB Communications Capable in "Sink_Capabilities" is 1b.</li> </ol>
No USB ability	0	00b	<ol style="list-style-type: none"> <li>Response "Reject" to "DR_Swap," and 0x35[6] will be 1b if "DR_Swap" is received.</li> <li>USB Communications Capable in "Sink_Capabilities" is 0b.</li> </ol>

The sink path control can be also configured for applications. The following table shows the Path\_EN behavior and the HV/LV Bound of VBUS. It is configured at JP970.

Path Option Setting	Resistance between Path_Opt and GND (unit: kΩ)	0x3F[2:0]	Behavior	HV Bound	LV Bound
Option 7	Open	111b	The same with Path option = 000	The same with Path option 0	The same with Path option 0
Option 6	887	110b	PATHEN is low no matter if Sink PDO is matched with Source DPO.	20V	5V
Option 5	649	101b	PATHEN is low no matter if Sink PDO is matched with Source DPO.	15V	5V
Option 4	453	100b	PATHEN is low no matter if Sink PDO is matched with Source DPO.	12V	5V
Option 3	324	011b	PATHEN is low no matter if Sink PDO is matched with Source DPO.	9V	5V
Option 2	143	010b	PATHEN is low no matter if Sink PDO is matched with Source DPO.	5V	5V
Option 1	56.2	001b	PATHEN is low no matter if Sink PDO is matched with Source DPO.	Depending on Max. V of the Sink capability	<ol style="list-style-type: none"> <li>Match: Depending on the requested PDO.</li> <li>Mismatch: 5V</li> </ol>
Option 0	0	000b	Match: PATHEN is low. Mismatch: PATHEN is high.	Depending on Max. V of the Sink capability	<ol style="list-style-type: none"> <li>Match: Depending on the requested PDO.</li> <li>Mismatch: 5V</li> </ol>

## 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](mailto: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
<b>VBUS</b>	5V to 20V.
<b>CC1</b>	CC1 is used to establish and manage the Source-to-Sink connection.
<b>CC2</b>	CC2 is used to establish and manage the Source-to-Sink connection.
<b>GND</b>	Ground.
<b>Vsys</b>	After sink path on, the system can get power from this net.



Test Point/ Pin Name	Function
<b>INDICATION</b>	This pin will be high if there is a mismatch for Sink PDO and Source PDO.
<b>PATHEN</b>	This pin will be low to turn on the external PMOS.
<b>SDA/SCL</b>	These two pins are I <sup>2</sup> C communication between RT1719GQW and MCU.
<b>IRQB</b>	This pin will be low to inform I <sup>2</sup> C master.
<b>Table_SEL</b>	Connect this pin to VCAP or GND through a 10kΩ resistor.
<b>PSEL2</b>	Connect this pin to with the dedicate resistors.
<b>PSEL1</b>	Connect this pin to with the dedicate resistors.
<b>ADDR</b>	Connect this pin to with the dedicate resistors.
<b>USB_SET</b>	Connect this pin to with the dedicate resistors.



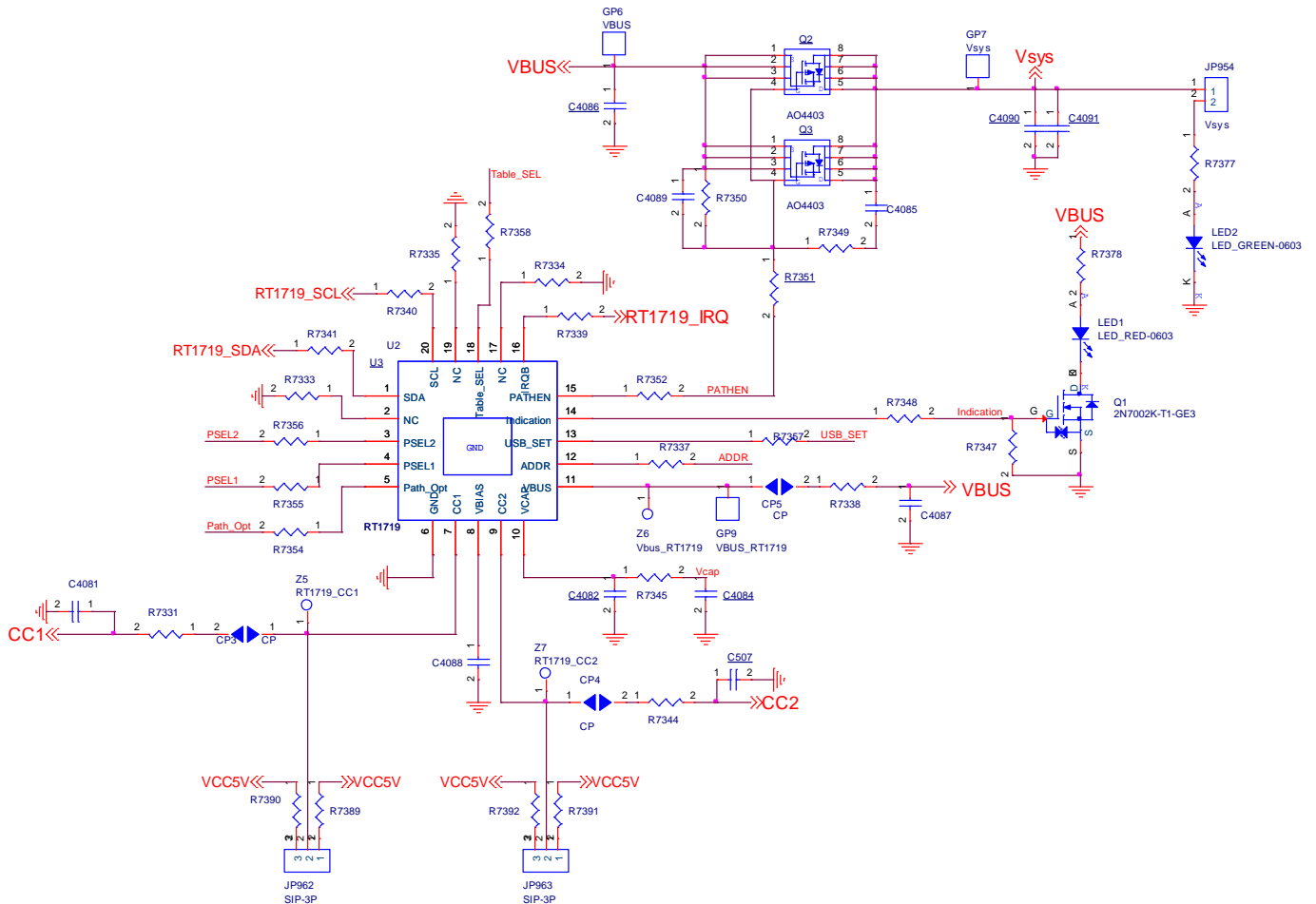
**Bill of Materials**

Reference	Count	Part Number	Value	Description	Package	Manufacturer
C1	1	1206B105K5	1 $\mu$ F	50V/X7R	1206	WALSIN
C2	1	1206B225K500CT	2.2 $\mu$ F	50V/X7R	1206	WALSIN
C507, C4081	2	0603B471K500CT	470pF	50V/X7R	0603	WALSIN
C4082, C4084, C4090, C4091	4	0603X105K250CT	1 $\mu$ F	25V/X5R	0603	WALSIN
C4085, C4089	2	C1608X7R1H104KT000N	0.1 $\mu$ F	50V/X7R	0603	TDK
C4086	1	UMK316AB7475KL-T	4.7 $\mu$ F	50V/X7R	1206	TAIYO YUDEN
C4087	1	GRM21BR71H105KA12L	1 $\mu$ F	50V/X7R	0805	MURATA
C4088	1	0402B104K500CT	0.1 $\mu$ F	50V/X7R	0402	WALSIN
D11, D12, D13	3	SX34	SX34	SX34	SMA/DO-214AC	PANJIT
LED1	1	LNL-191SUR	RED	LED_RED-0603	0603	LighTop
LED2	1	LNL-190SUG	GREEN	LED_GREEN-0603	0603	LighTop
Q1, Q4	2	2N7002K-T1-GE3	2N7002K-T1-GE3	2N7002K-T1-GE3	SOT-23	VISHAY
Q2, Q3	2	AO4403	AO4403	AO4403	SOIC-8	Alpha & Omega
Q5, Q6	2	AO3403	AO3403	AO3403	SOT-23-3L	Alpha & Omega
R7310, R7321	2	WR06X3093FTL	309k	Resistor, Chip, 1/10W, 1%	0603	WALSIN
R7311, R7404	2	RTT036653FTP	665k	Resistor, Chip, 1/10W, 1%	0603	RALEC
R7331, R7333, R7334, R7335, R7337, R7338, R7339, R7340, R7341, R7344, R7345, R7348, R7352, R7354, R7355, R7356, R7357, R7358	18	WR06X000 PTL	0	Resistor, Chip, 1/10W, 1%	0603	WALSIN

Reference	Count	Part Number	Value	Description	Package	Manufacturer
R7346, R7353, R7379, R7389, R7391, R7401, R7402	7	WR06X1002FTL	10k	Resistor, Chip, 1/10W, 1%	0603	WALSIN
R7347	1	WR06X1004FTL	1M	Resistor, Chip, 1/10W, 1%	0603	WALSIN
R7349	1	WR06X1000FTL	100	Resistor, Chip, 1/10W, 1%	0603	WALSIN
R7350, R7351, R7382	3	WR06X1003FTL	100k	Resistor, Chip, 1/10W, 1%	0603	WALSIN
R7359, R7383, R7393	3	RTT035622FTP	56.2k	Resistor, Chip, 1/10W, 1%	0603	RALEC
R7360, R7384, R7395	3	WR06X1433FTL	143k	Resistor, Chip, 1/10W, 1%	0603	WALSIN
R7361, R7385, R7394	3	WR06X3243FTL	324k	Resistor, Chip, 1/10W, 1%	0603	WALSIN
R7362, R7386, R7396	3	WR06X4533FTL	453k	Resistor, Chip, 1/10W, 1%	0603	WALSIN
R7363, R7387, R7397	3	RTT036493FTP	649k	Resistor, Chip, 1/10W, 1%	0603	RALEC
R7364, R7388, R7398	3	RTT038873FTP	887k	Resistor, Chip, 1/10W, 1%	0603	RALEC
R7377, R7378	2	WR06X2151FTL	2.15k	Resistor, Chip, 1/10W, 1%	0603	WALSIN
R7380, R7399, R7400	3	WR06X2001FTL	2k	Resistor, Chip, 1/10W, 1%	0603	WALSIN
R7381	1	WR06X2002FTL	20k	Resistor, Chip, 1/10W, 1%	0603	WALSIN
R7390, R7392	2	WR06X2202FTL	22k	Resistor, Chip, 1/10W, 1%	0603	WALSIN
R7403	1	WR06X4022FTL	40.2k	Resistor, Chip, 1/10W, 1%	0603	WALSIN
U2	1	RT1719GQW	RT1719GQW	Sink Only Type-C Port Controller	WQFN-20L 3.5x3.5	RICHTEK
USB1	1	C-NBR2L-AK5320	USB TYPE-C	USB TYPE-C	9.24x9.1mm	ADVANCED- CONNECTEK

**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 to Figure 4 are RT1719GQW Evaluation Board layout. This board size is 70mm x 50mm and is constructed on four-layer PCB, outer layers with 2 oz. Cu and inner layers with 1 oz. Cu.

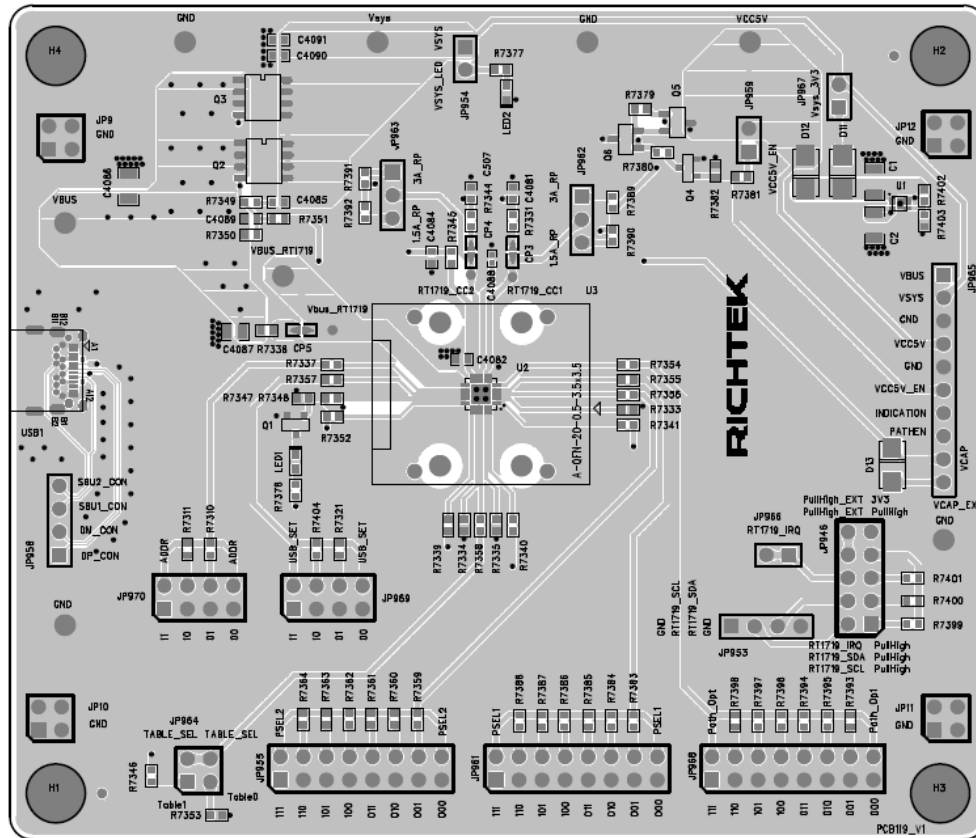


Figure 1. Top View (1<sup>st</sup> layer)

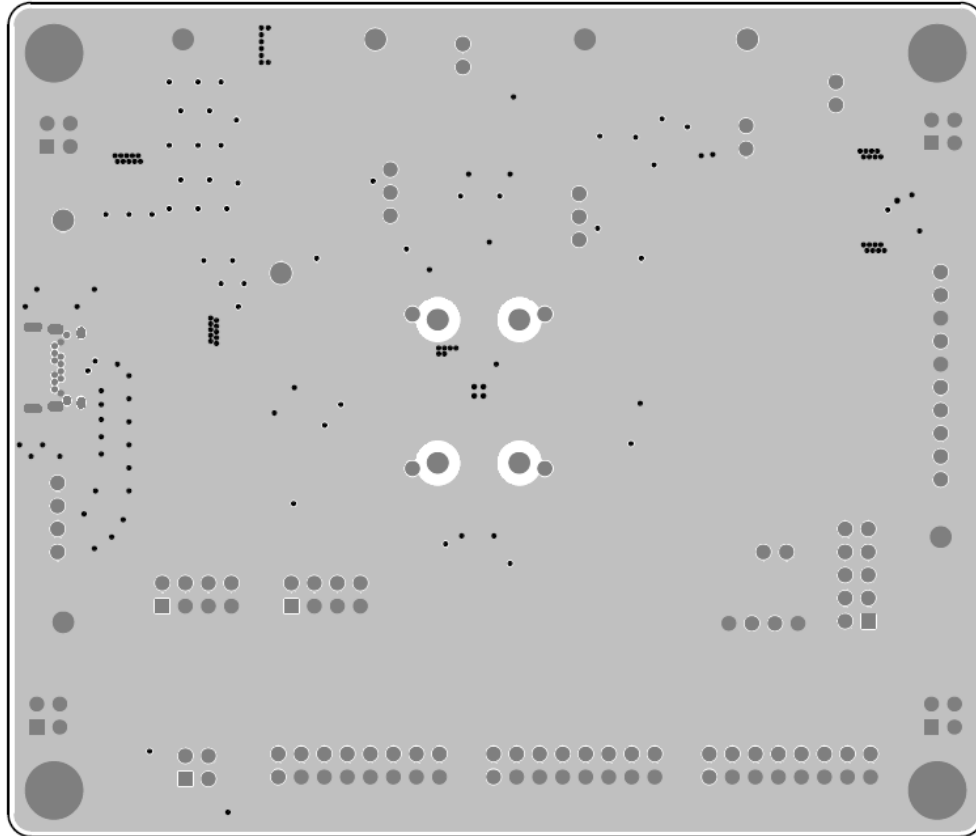


Figure 2. PCB Layout—Inner Side (2<sup>nd</sup> Layer)

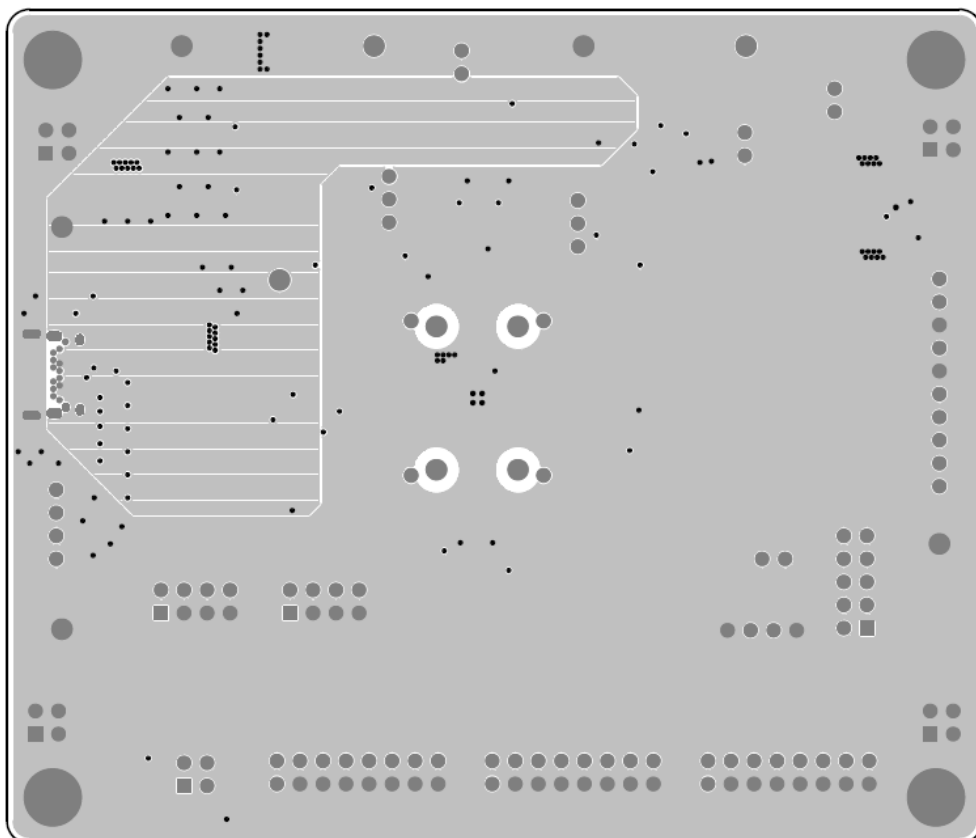


Figure 3. PCB Layout—Inner Side (3<sup>rd</sup> Layer)

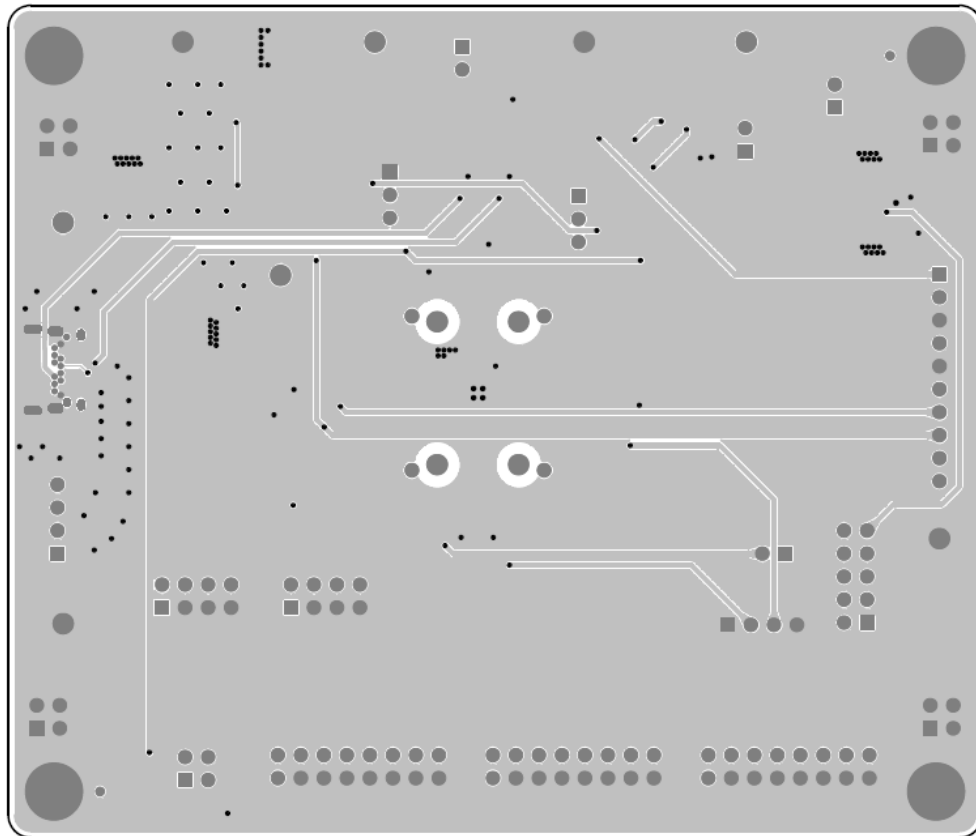


Figure 4. Bottom View (4<sup>th</sup> Layer)

### ***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***

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