RTQ6360GQW, 60V_{IN}, 0.5A, Asynchronous Step-Down Converter Evaluation Board

General Description

The Evaluation Board demonstrates the RTQ6360GQW to be designed for a 5V/0.5A output from a 8V to 60V input at 500kHz switching frequency. The wide input range makes it suitable for communications and industrial 12V, 24V and 48V power systems. The RTQ6360GQW provides complete protection functions such as input under-voltage lockout, output under-voltage protection, over-current protection and thermal shut down. Cycle-by-cycle current limit provides protection against shorted outputs and soft-start eliminates input current surge during start-up.

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Performance Sepcification Summary

Summary of the RTQ6360GQW Evaluation Board performance specificiaiton is provided in Table 1. The ambient temperature is 25°C.

Table 1. RTQ6360GQW Evaluation Board Performance Specification Summary

Specification	Test Conditions	Min	Typ	Max	Unit
Input Voltage Range		8	--	60	V
Output Current		0	--	0.5	A
Default Output Voltage		--	5	--	V
Operation Frequency		--	500	--	kHz
Output Ripple Voltage	I_{OUT} = 0.5A	--	10	--	mVp-p
Line Regulation	I_{OUT} = 0.5A, V_{IN} = 8V to 60V	--	±1	--	%
Load Regulation	V_{IN} = 12V, I_{OUT} = 0.001A to 0.5A	--	±1	--	%
Load Transient Response	I_{OUT} = 0.25A to 0.5A	--	±5	--	%
Maximum Efficiency	V_{IN} = 12V, V_{OUT} = 5V, I_{OUT} = 0.5A	--	90.9	--	%

Power-up Procedure

Suggestion Required Equipments

- RTQ6360GQW Evaluation Board
- DC power supply capable of at least 60V and 1A
- Electronic load capable of 6A
- Function Generator
- Oscilloscope

Quick Start Procedures

The Evaluation Board is fully assembled and tested. Follow the steps below to verify board operation. Do not turn on supplies until all connections are made. When measuring the output voltage ripple, care must be taken to avoid a long ground lead on the oscilloscope probe. Measure the output voltage ripple by touching the probe tip and ground ring directly across the last output capacitor.

Proper measurement equipment setup and follow the procedure below.

1) With power off, connect the input power supply to VIN and GND pins.

2) With power off, connect the electronic load between the VOUT and nearest GND pins.

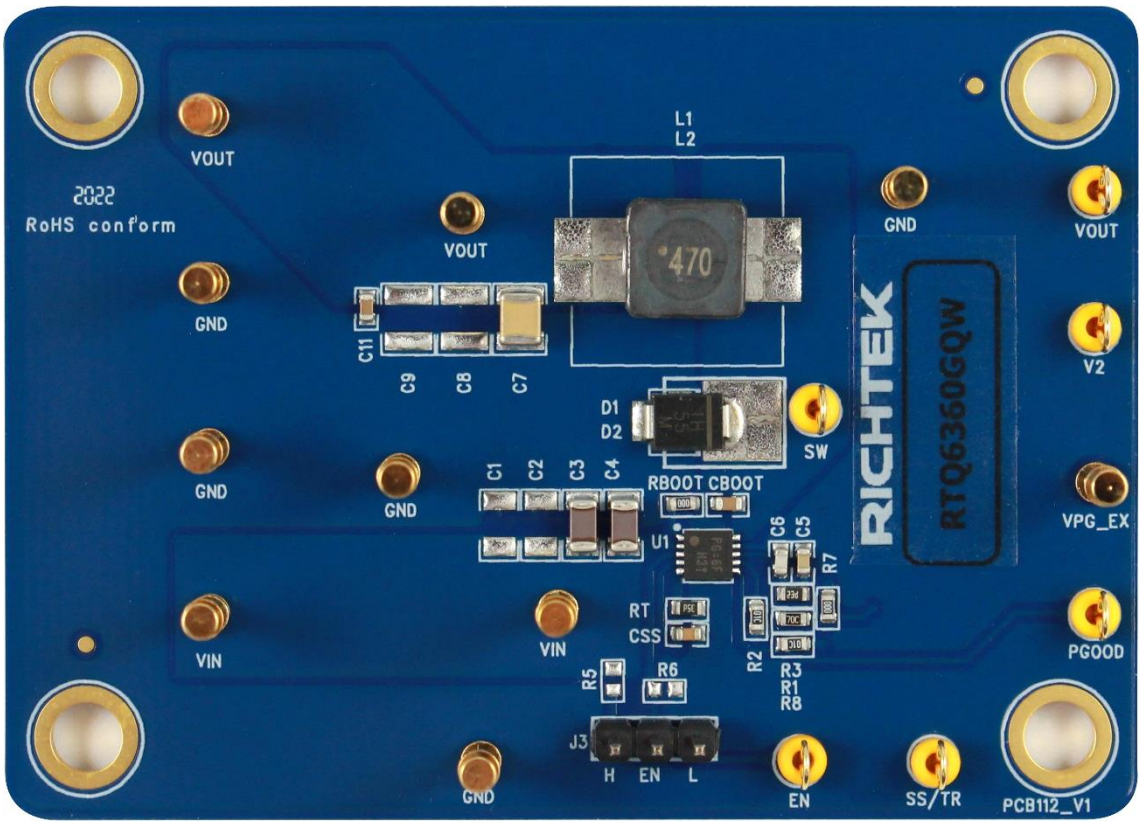
4) Turn on the power supply at the input. Make sure that the input voltage does not exceeds 60V on the Evaluation Board.

5) Check for the proper output voltage using a voltmeter.

6) Once the proper output voltage is established, adjust the load within the operating ranges and observe the output voltage regulation, ripple voltage, efficiency and other performance.

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.

Enable

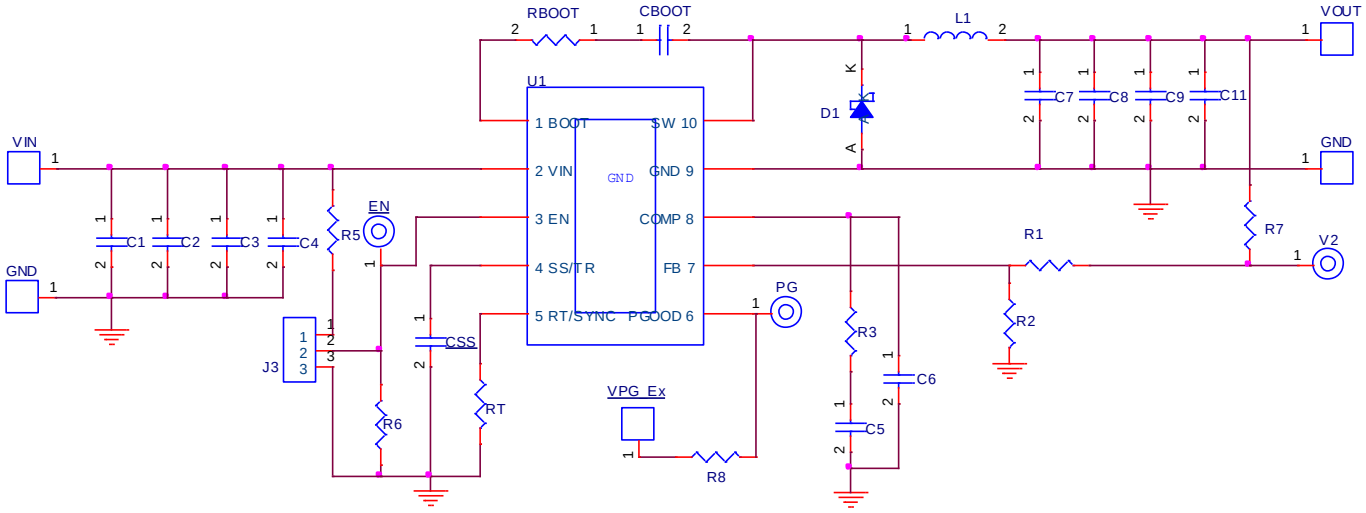
For automatic start-up, the EN pin has an internal pull-up current source that enables operation of the RTQ6360 when the EN pin floats. Shut down the converter by short EN pin to GND through the J3.

Bill of Materials

V_{IN} = 12V, V_{OUT} = 5.0V, I_{OUT} = 0.5A, f_{SW} = 500kHz						
Reference	Count	Part Number	Value	Description	Package	Manufacturer
U1	1	RTQ6360GQW	RTQ6360GQW	Step-Down Converter	WDFN-10SL 3x3	RICHTEK
C3, C4	2	HMK316AC7225KLHTE	2.2µF	Capacitor, Ceramic, 100V, X7R	1206	Taiyo Yuden
C5	1	0603B182K500CT	1.8nF	Capacitor, Ceramic, 50V, X7R	0603	WALSIN
C7	1	GRM32ER61C476KE15L	47µF	Capacitor, Ceramic, 16V, X5R	1210	MURATA
C11	1	C1608X7R1H104KT	0.1µF	Capacitor, Ceramic, 50V, X7R	0603	TDK
CBOOT	1	C1608X7R1H104KT	0.1µF	Capacitor, Ceramic, 50V, X7R	0603	TDK
CSS	1	C1608X7R1H103KT000N	10nF	Capacitor, Ceramic, 50V, X7R	0603	TDK
D1	1	VS-10BQ060-M3	Schottky Diode, 60V/1A	Schottky Diode, 60V/1A	SMB	VISHAY
L1	1	744777147	47µH	Inductor, Isat = 1.1A, 170mΩ		WURTH ELEKTRONIK
R1	1	WR06X5232FTL	52.3k	Resistor, Chip, 1/10W, 1%	0603	WALSIN
R2, R8	2	WR06X1002FTL	10k	Resistor, Chip, 1/10W, 1%	0603	WALSIN
R3	1	RTT031693FTP	169k	Resistor, Chip, 1/10W, 1%	0603	RALEC
R7, RBOOT	2	WR06X000 PTL	0	Resistor, Chip, 1/10W, 1%	0603	WALSIN
RT	1	RTT032323FTP	232k	Resistor, Chip, 1/10W, 1%	0603	RALEC

Typical Applications

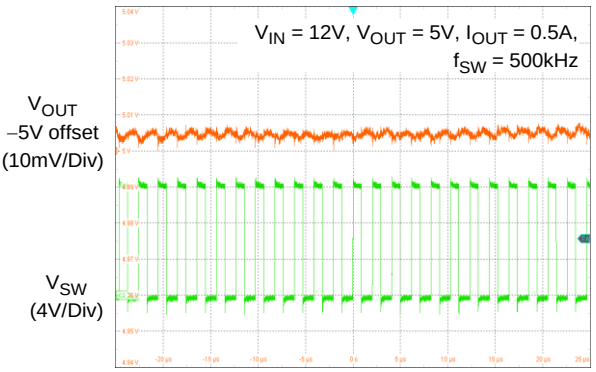
EVB Schematic Diagram



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.

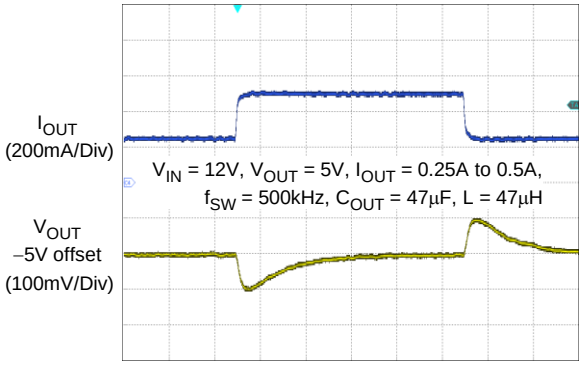
Measure Result

Output Ripple Measurement



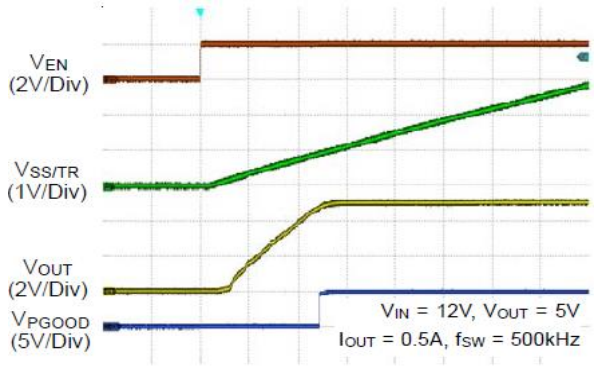
Time (5μs/Div)

Load Transient Response



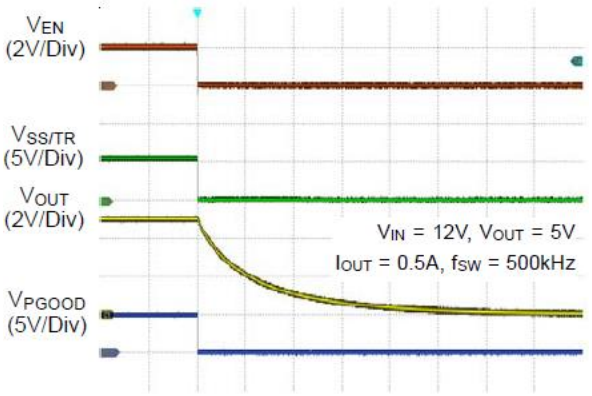
Time (100μs/Div)

Power On from EN



Time (2ms/Div)

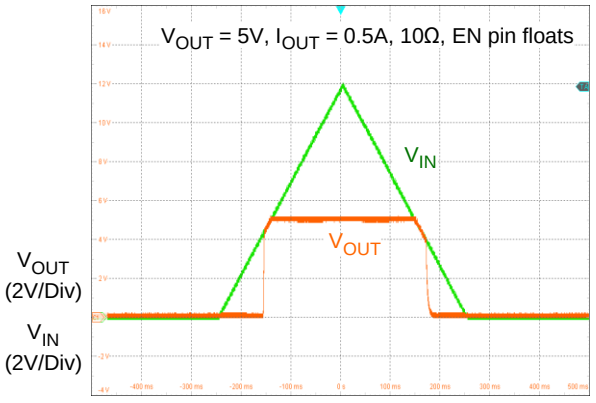
Power Off from EN



Time (400μs/Div)

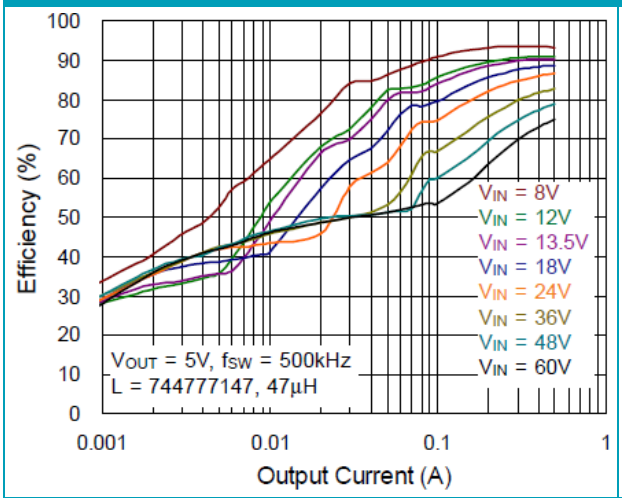
Short Circuit Response – Short and Recovery

Start-Up Dropout Performance

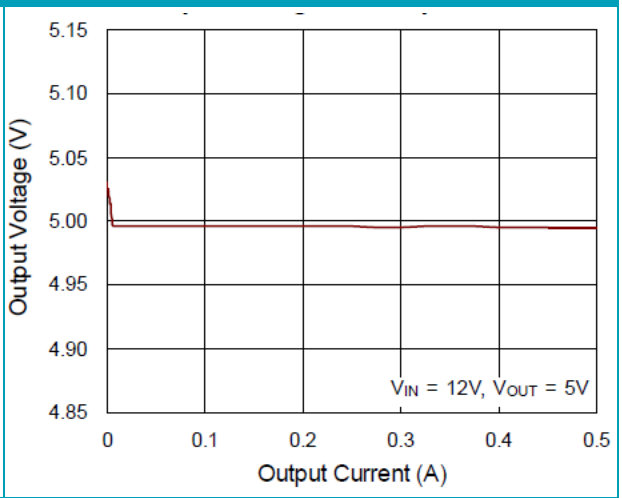


Time (100ms/Div)

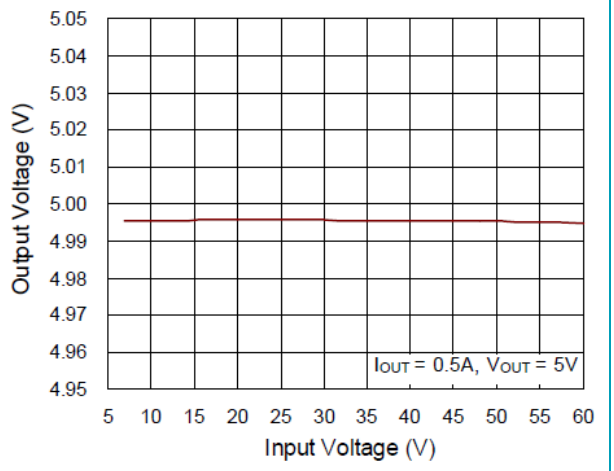
Efficiency vs. Output Current



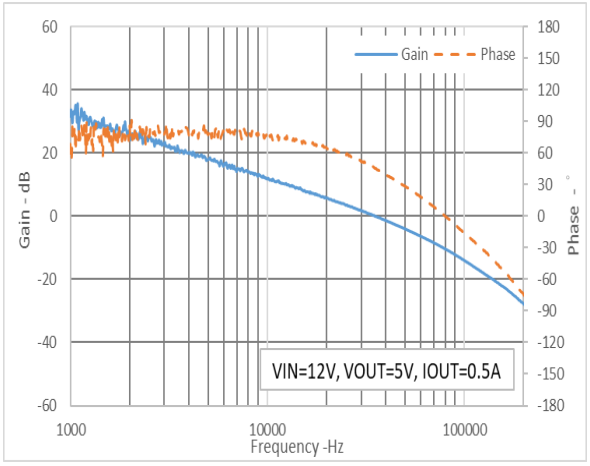
Output Voltage vs. Output Current



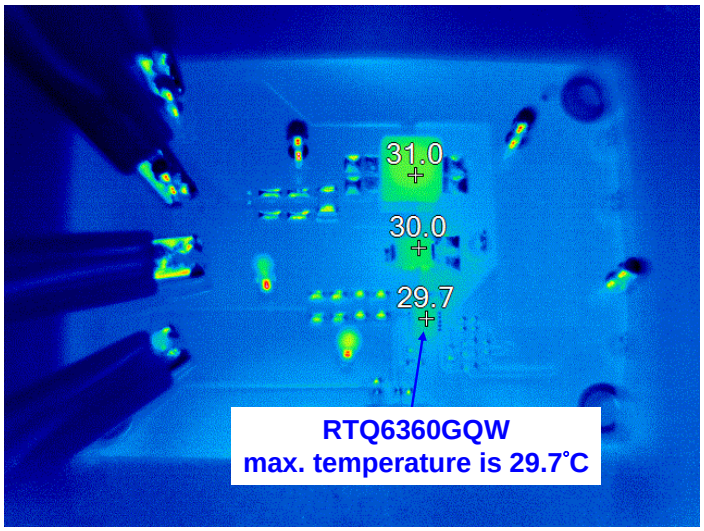
Output Voltage vs. Input Voltage



Loop Response



Thermal Image at V_{IN} = 12V, V_{OUT} = 5V, I_{OUT} = 0.5A



Note : When measuring the input or output voltage ripple, care must be taken to avoid a long ground lead on the oscilloscope probe. Measure the output voltage ripple by touching the probe tip directly across the output capacitor.

Evaluation Board Layout

Figure 1 to Figure 4 are RTQ6360GQW 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.

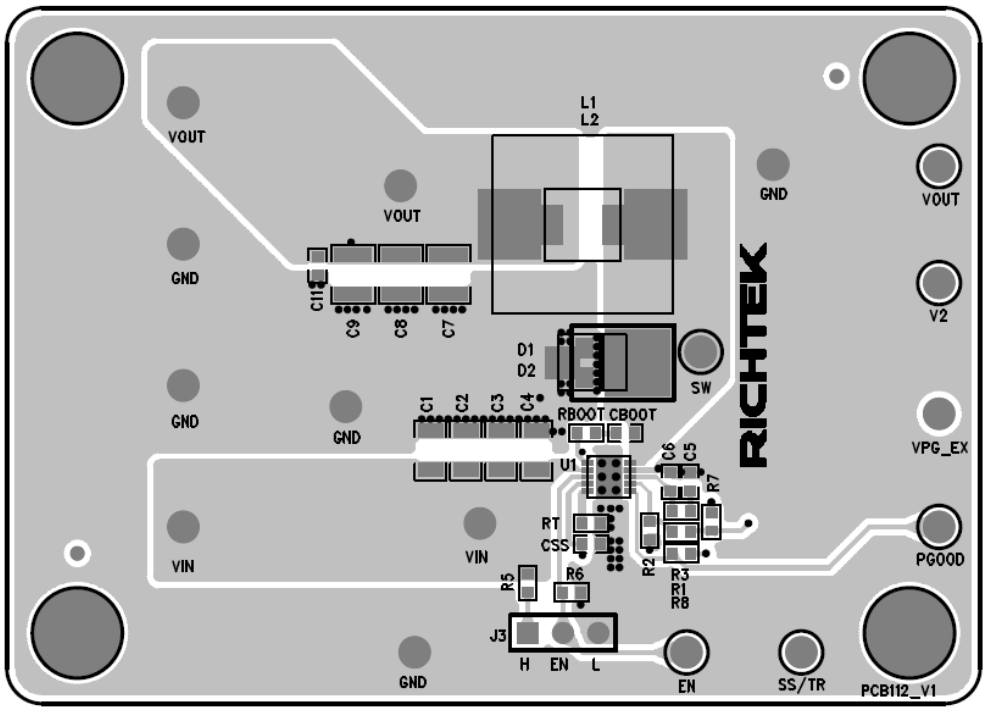


Figure 1. Top View (1st layer)

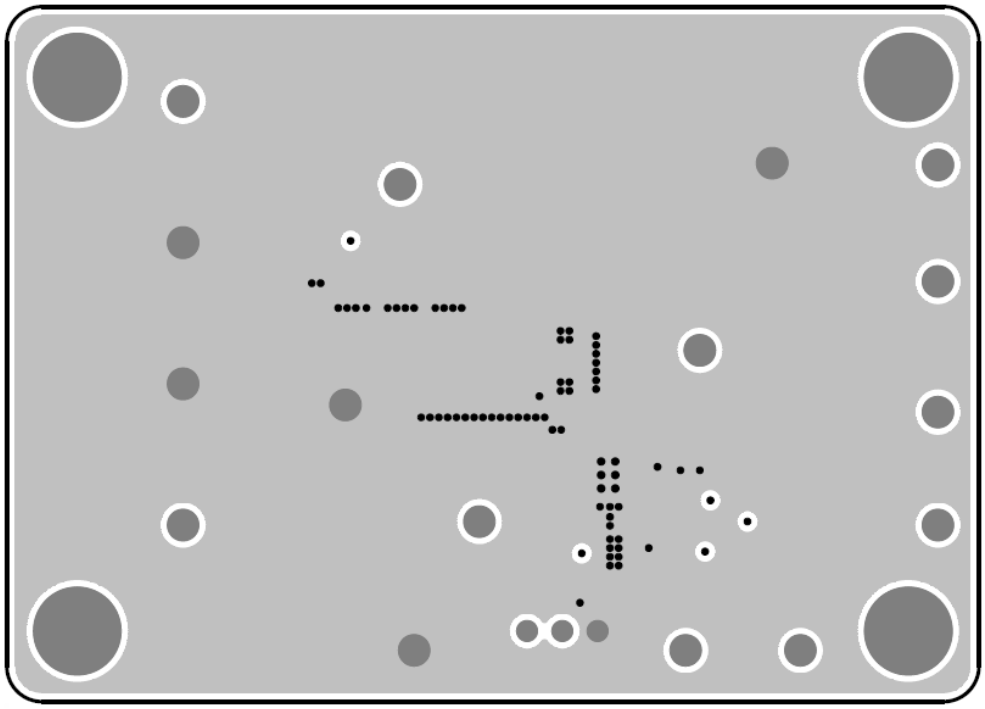


Figure 2. PCB Layout—Inner Side (2nd Layer)

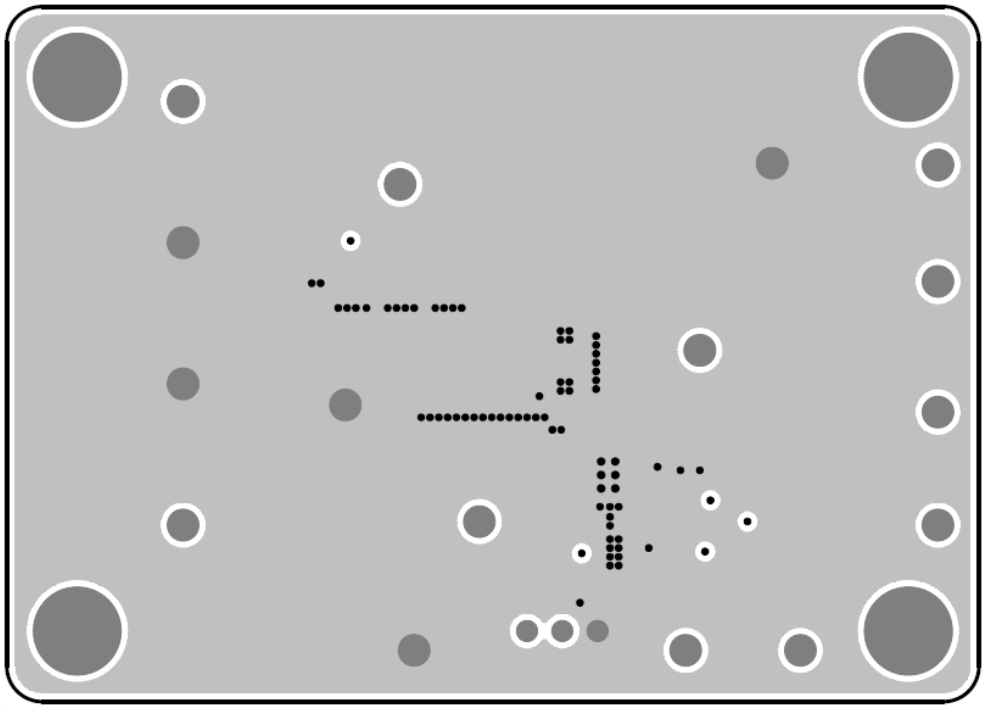


Figure 3. PCB Layout—Inner Side (3rd Layer)

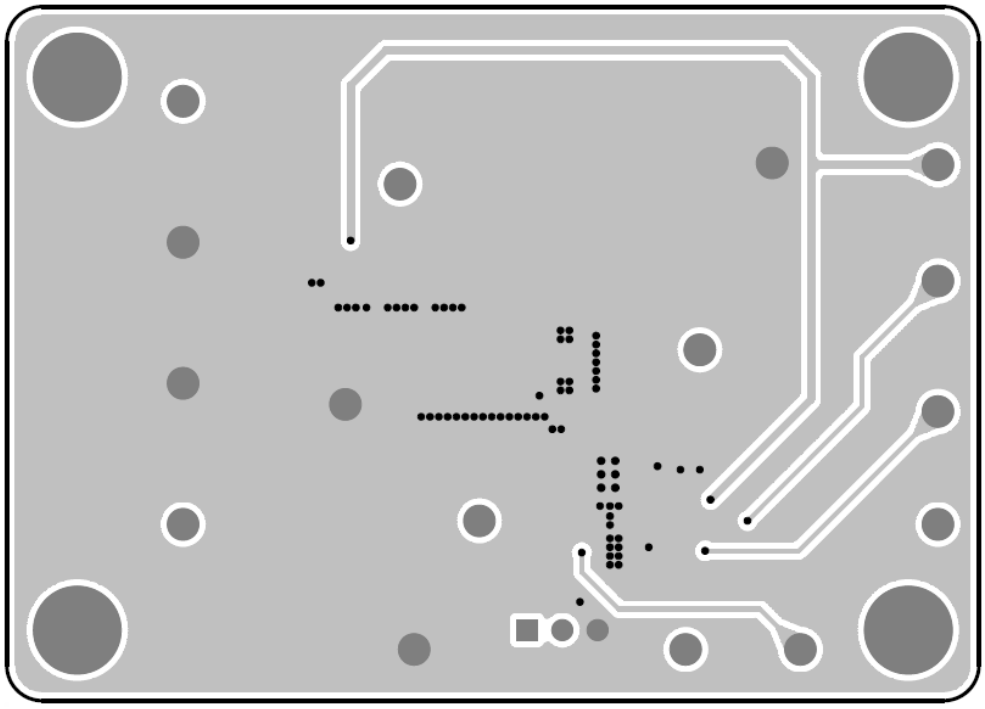


Figure 4. Bottom View (4th Layer)

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