User Guide for RTQ2533W Low Dropout Linear Regulator Evaluation Board

General Description

The Evaluation Board user guide describes the operational use of the RTQ2533W evaluation board as a reference design for demonstration and evaluation of the RTQ2533W, a high-current, ultra-low noise, ultra low-dropout (LDO) linear regulator.

Included in this user guide are setup and operating instructions, thermal and layout guidelines, a printed circuit board (PCB) layout, a schematic diagram, and a bill of materials (BOM). For more detail information, please refer to the RTQ2533W datasheet.

Table of Contents

Performance Specification Summary

Summary of the RTQ2533W Evaluation Board performance specificiaiton is provided in Table 1. The ambient temperature is 25°C.

Table 1. RTQ2533W Evaluation Board Performance Specification Summary

Specification	Test Conditions	Min	Typ	Max	Unit
Input Voltage Range		1.1	1.1	6.5	V
Output Current		0	--	3	A
Output Voltage Range	Using ecternal resistors	0.8	0.8	5.5	V
Line Regulation	I_{OUT} = 1mA, 1.1V ≤ V_{IN} ≤ 6.5V	--	0.05	--	%/V
Load Regulation	1mA ≤ I_{OUT} ≤ 3A	--	0.08	--	%/A
Dropout Voltage	V_{IN} = 1.1V to 6.5V, I_{OUT} = 3A, VFB = 0.8V - 3%	--	110	180	mV

Power-up Procedure

Suggestion Required Equipments

- RTQ2533W Evaluation Board
- DC power supply capable of at least 6.5V and 3A
- Electronic load capable of 3A
- Function generator
- Oscilloscope

Quick Start Procedures

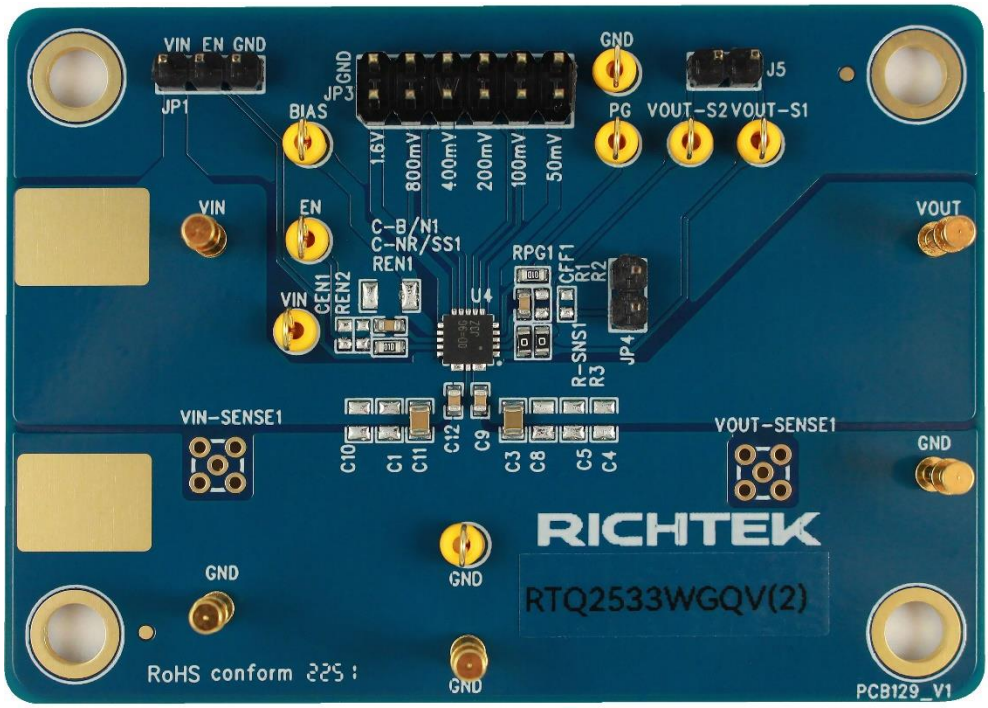
The Evaluation Board is fully assembled and tested. Follow the steps below to verify board operation. Do not turn on supplies until all connections are made. When measuring the output voltage ripple, care must be taken to avoid a long ground lead on the oscilloscope probe. Measure the output voltage ripple by touching the probe tip and groundring 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.
3) Turn on the power supply at the input. Make sure that the input voltage does not exceeds 6V on the Evaluation Board.
4) Check for the proper output voltage using a voltmeter.
5) Once the proper output voltage is established, adjust the load within the operating ranges and observe the output voltage regulation, quiescent current, dropout voltage, PSRR, noise 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.

Test Points

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

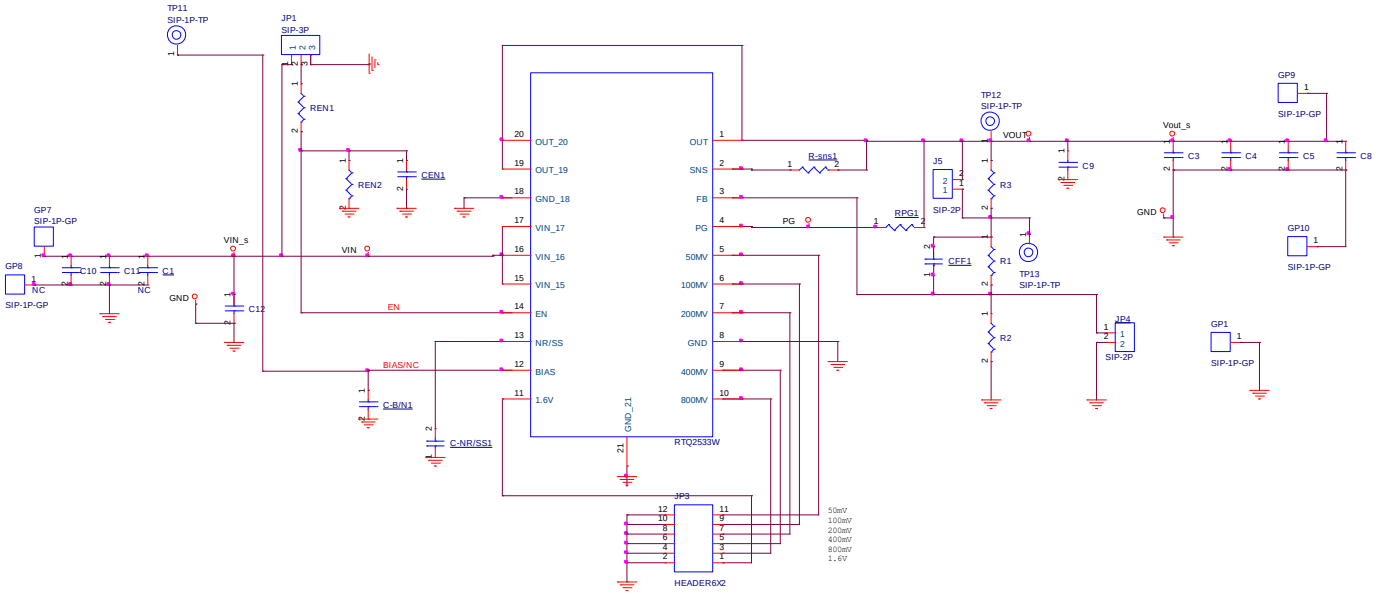
Test Point/ Pin Name	Function
VOUT	Output of the regulator.
VIN	Supply input pin.
BIAS	Bias input pin.
PG	Power good sense pin.
GND	System ground pin.
EN	Enable sense pin.
VOUT-S1/VOUT-S2	Waveform sense pin for resistor R3.
JP1	User can decide EN pin connected to high or low.
JP3	Output voltage setting pin.
JP4	Feedback voltage sense pin.
J5	Short to by-pass resistor R3.

Bill of Materials

V_{IN} = 1.1V to 6.5V, V_{OUT} = 0.8V to 5.5V, I_{OUT} = 2A						
Reference	Count	Part Number	Value	Description	Package	Manufacturer
U1	1	RTQ2533WGQW(2)	RTQ2533WGQW(2)	LDO	VQFN-20L 3.5x3.5	RICHTEK
C-NR/SS, CFF1	2	GRM033R71E103KE14	10nF	Capacitor, ceramic, 50V, X7R	0603	MURATA
C3, C11	2	GRM21BR61A476ME15	47µF	Capacitor, ceramic, 10V, X5R	0805	MURATA
C9, C12	2	0603B104K500CT	0.1µF	Capacitor, ceramic, 50V, X7R	0603	WALSIN
R-SNS, R3	2	WR06X000 PTL	0	Resistor, Chip	0603	WALSIN
REN1, RPG1	2	WR06X1003FTL	100k	Resistor, Chip	0603	WALSIN

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.
3. VOUT select pin settings of JP3 please refer to Table 2.

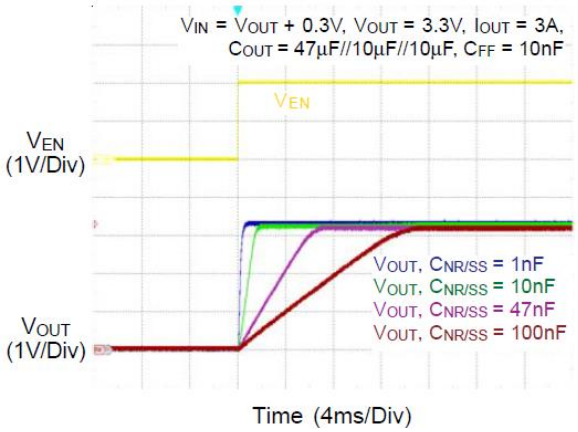
Table 2. V_{OUT} Select Pin Settings for Different Targets

V_{OUT} (V)	50mV	100mV	200mV	400mV	800mV	1.6V
0.8	Open	Open	Open	Open	Open	Open
0.85	GND	Open	Open	Open	Open	Open
0.9	Open	GND	Open	Open	Open	Open
0.95	GND	GND	Open	Open	Open	Open
1	Open	Open	GND	Open	Open	Open
1.05	GND	Open	GND	Open	Open	Open
1.1	Open	GND	GND	Open	Open	Open
1.15	GND	GND	GND	Open	Open	Open
1.2	Open	Open	Open	GND	Open	Open
1.25	GND	Open	Open	GND	Open	Open
1.3	Open	GND	Open	GND	Open	Open
1.35	GND	GND	Open	GND	Open	Open
1.4	Open	Open	GND	GND	Open	Open
1.45	GND	Open	GND	GND	Open	Open
1.5	Open	GND	GND	GND	Open	Open
1.55	GND	GND	GND	GND	Open	Open
1.6	Open	Open	Open	Open	GND	Open
1.65	GND	Open	Open	Open	GND	Open
1.7	Open	GND	Open	Open	GND	Open
1.75	GND	GND	Open	Open	GND	Open
1.8	Open	Open	GND	Open	GND	Open
1.85	GND	Open	GND	Open	GND	Open
1.9	Open	GND	GND	Open	GND	Open
1.95	GND	GND	GND	Open	GND	Open
2	Open	Open	Open	GND	GND	Open
2.05	GND	Open	Open	GND	GND	Open
2.1	Open	GND	Open	GND	GND	Open
2.15	GND	GND	Open	GND	GND	Open
2.2	Open	Open	GND	GND	GND	Open
2.25	GND	Open	GND	GND	GND	Open
2.3	Open	GND	GND	GND	GND	Open
2.35	GND	GND	GND	GND	GND	Open

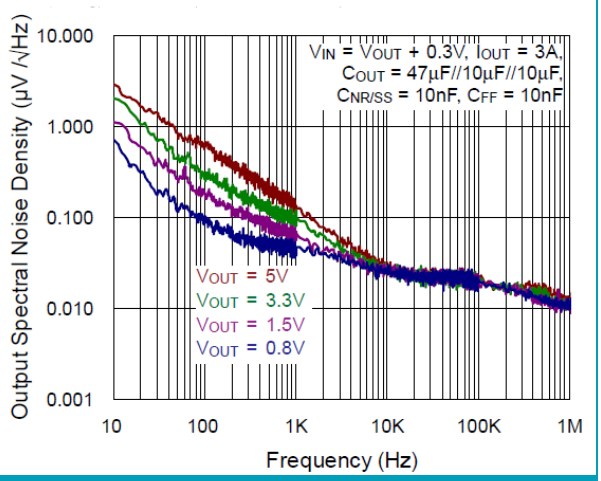
V_{OUT} (V)	50mV	100mV	200mV	400mV	800mV	1.6V
2.4	Open	Open	Open	Open	Open	GND
2.45	GND	Open	Open	Open	Open	GND
2.5	Open	GND	Open	Open	Open	GND
2.55	GND	GND	Open	Open	Open	GND
2.6	Open	Open	GND	Open	Open	GND
2.65	GND	Open	GND	Open	Open	GND
2.7	Open	GND	GND	Open	Open	GND
2.75	GND	GND	GND	Open	Open	GND
2.8	Open	Open	Open	GND	Open	GND
2.85	GND	Open	Open	GND	Open	GND
2.9	Open	GND	Open	GND	Open	GND
2.95	GND	GND	Open	GND	Open	GND
3	Open	Open	GND	GND	Open	GND
3.05	GND	Open	GND	GND	Open	GND
3.1	Open	GND	GND	GND	Open	GND
3.15	GND	GND	GND	GND	Open	GND
3.2	Open	Open	Open	Open	GND	GND
3.25	GND	Open	Open	Open	GND	GND
3.3	Open	GND	Open	Open	GND	GND
3.35	GND	GND	Open	Open	GND	GND
3.4	Open	Open	GND	Open	GND	GND
3.45	GND	Open	GND	Open	GND	GND
3.5	Open	GND	GND	Open	GND	GND
3.55	GND	GND	GND	Open	GND	GND
3.6	Open	Open	Open	GND	GND	GND
3.65	GND	Open	Open	GND	GND	GND
3.7	Open	GND	Open	GND	GND	GND
3.75	GND	GND	Open	GND	GND	GND
3.8	Open	Open	GND	GND	GND	GND
3.85	GND	Open	GND	GND	GND	GND
3.9	Open	GND	GND	GND	GND	GND
3.95	GND	GND	GND	GND	GND	GND

Measure Result

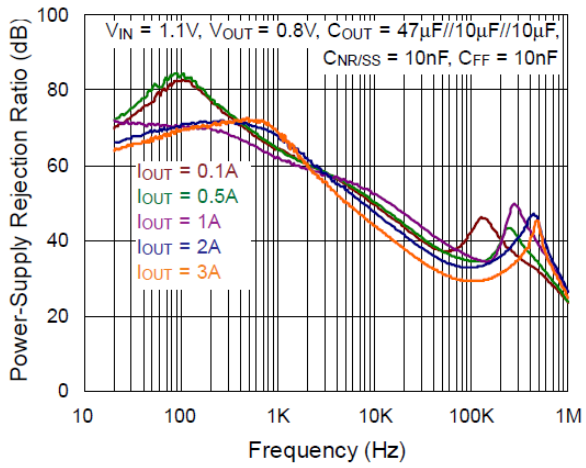
Power Up Response



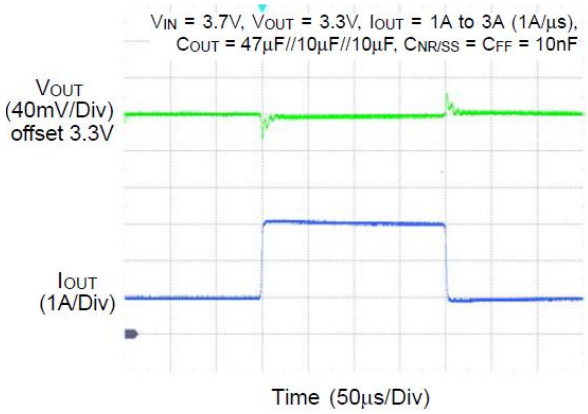
Output Noise vs. Frequency and Output Voltage



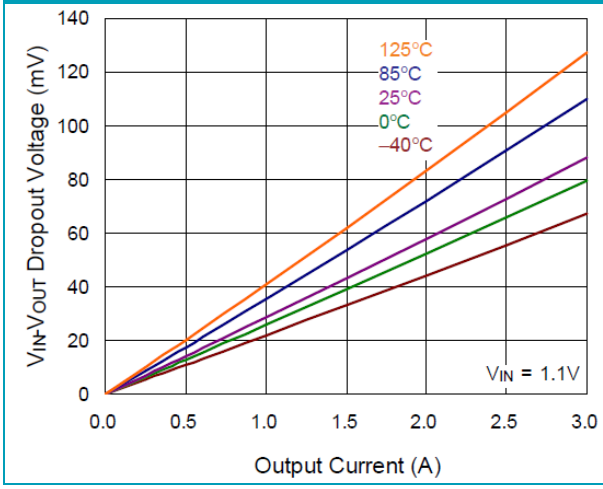
PSRR vs. Frequency and Iout



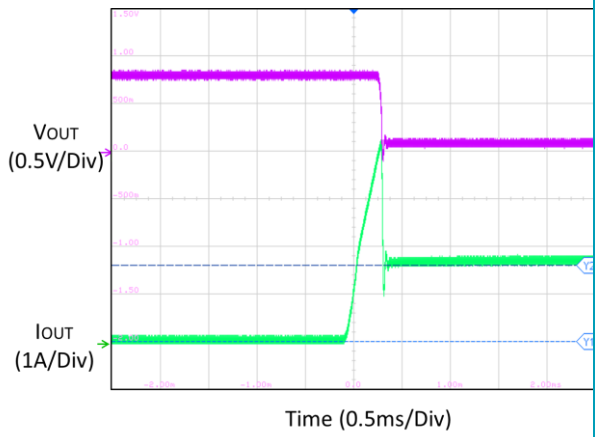
Load Transient Response



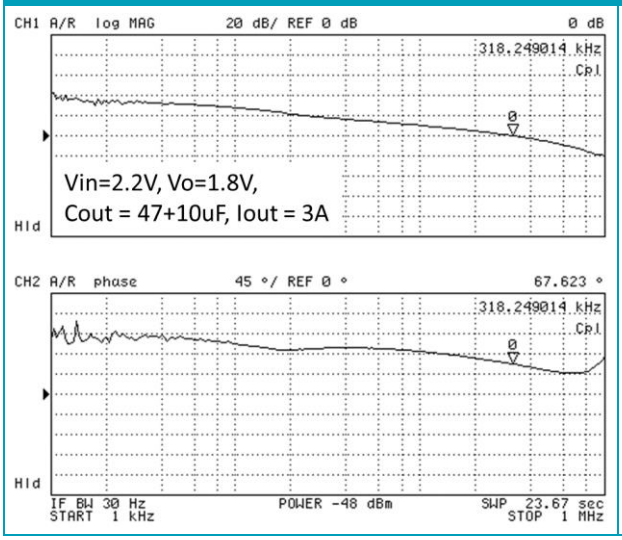
Dropout Voltage vs. Output Current



OCP



Bode plot



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 RTQ2533W Evaluation Board layout. This board is constructed on four-layer PCB, outer layers with 1 oz. Cu and inner layers with 1 oz. Cu.

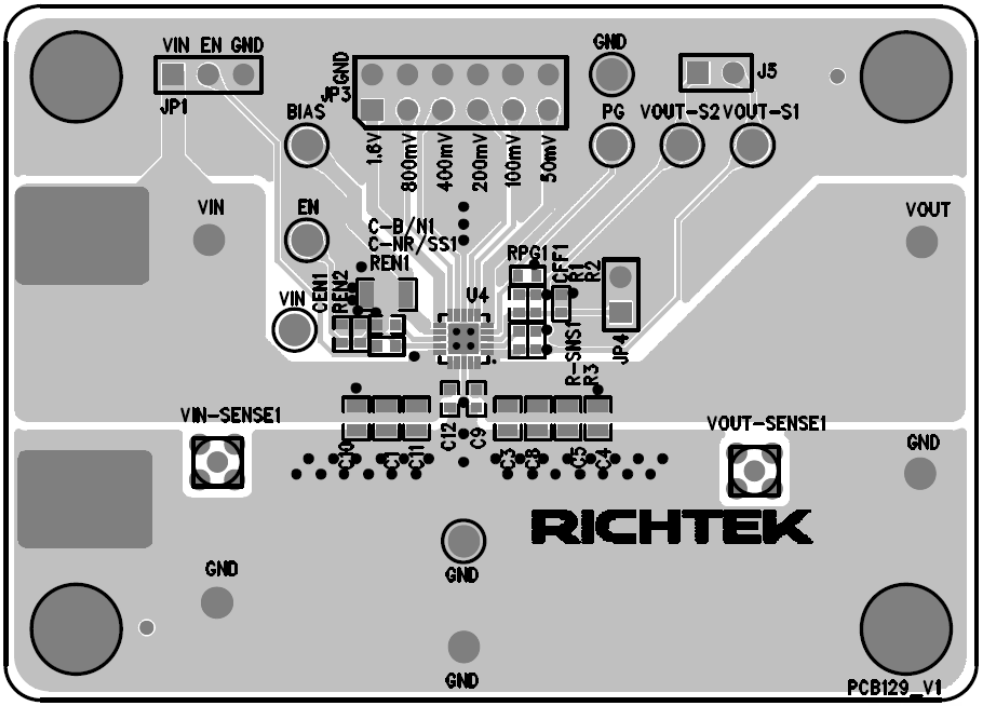


Figure 1. Top View (1st layer)

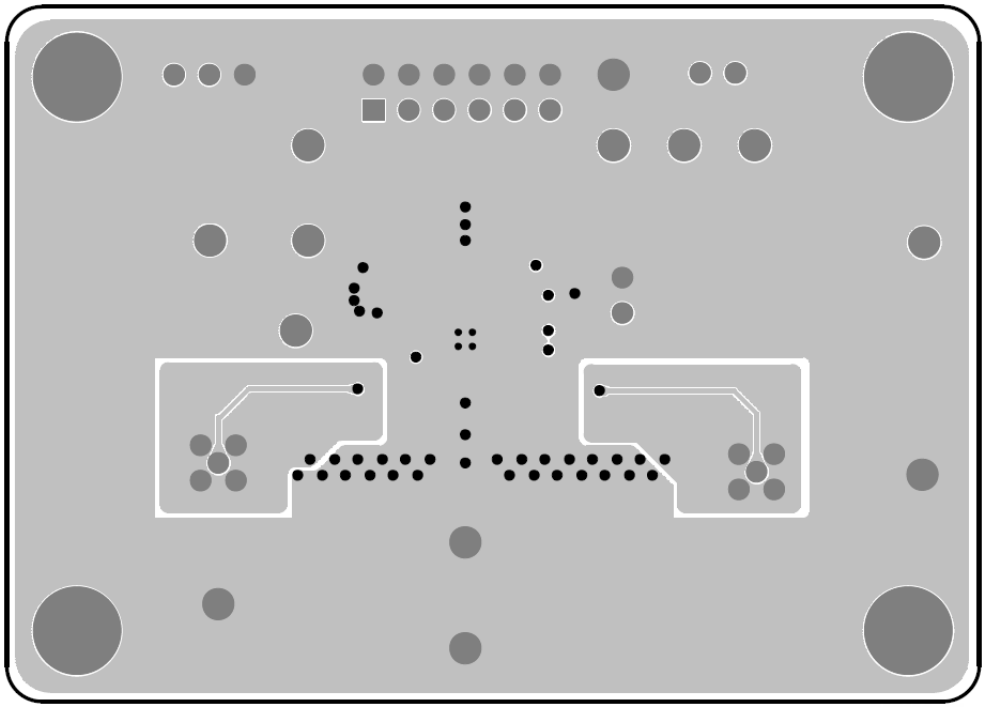


Figure 2. PCB Layout—Inner Side (2nd Layer)

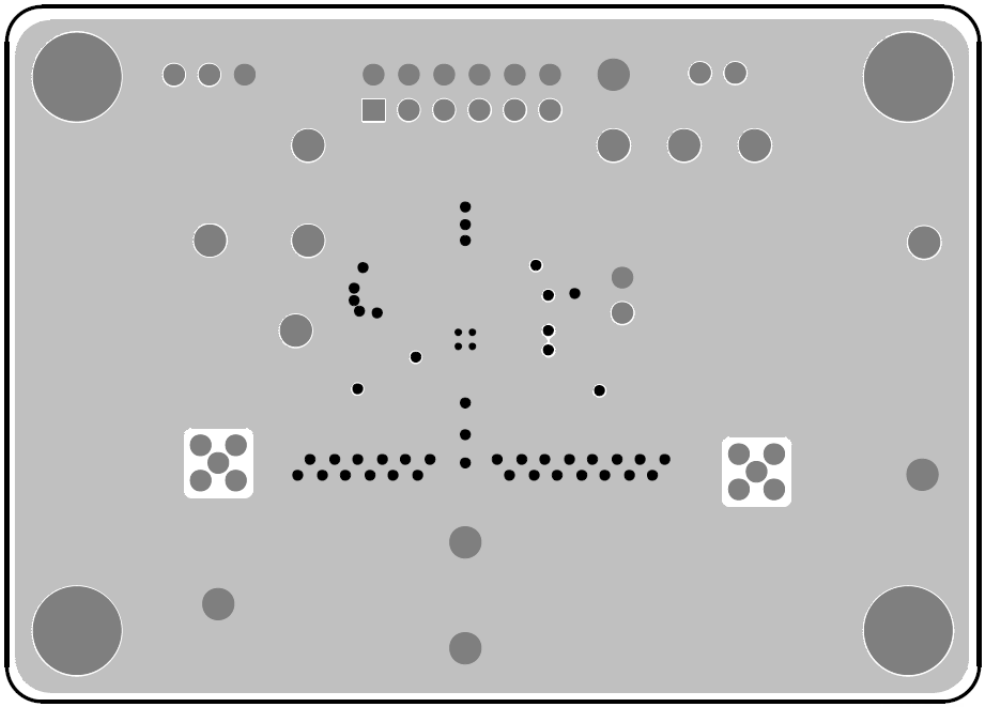


Figure 3. PCB Layout—Inner Side (3rd Layer)

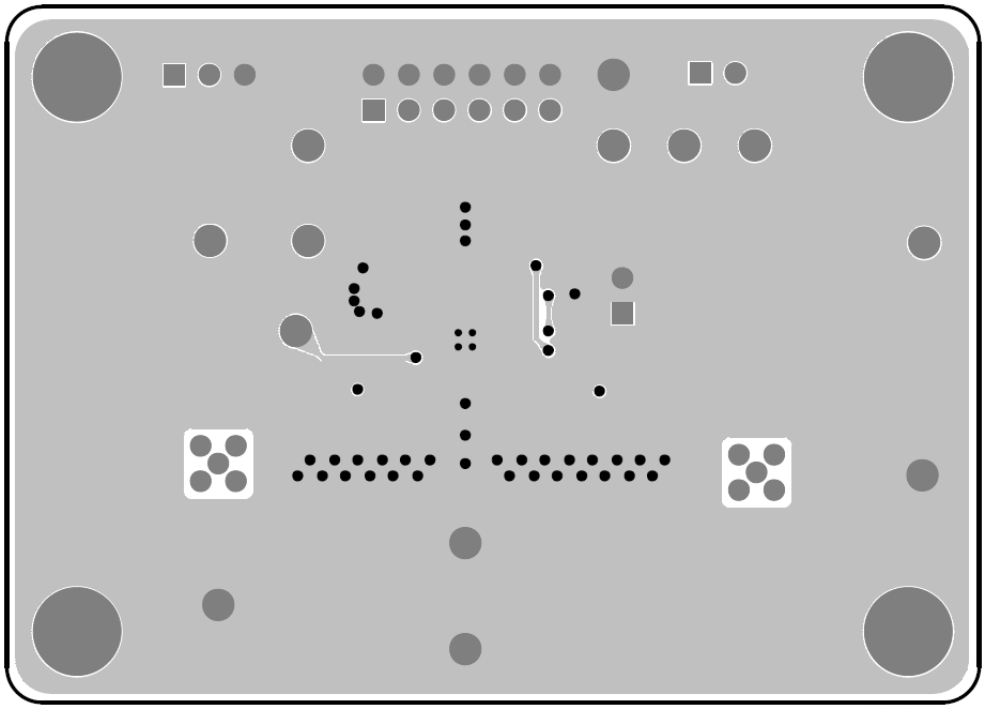


Figure 4. Bottom View (4th Layer)

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