RT6158H High Efficiency, Low Quiescent, 3A Buck-Boost Converter Evaluation Board

General Description

The RT6158H is a synchronous current mode constant on/off time (CMCOT) switching Buck-Boost converter designed to an adjustable output voltage with an input supply that can be above, equal, or under the output voltage.The RT6158H converter is a high efficiency single inductor converter which can operate with wide input voltage 2.5V to 5.5V such as battery which is higher or lower than the output voltage and it can supply the load current up to 3A. This document explains the function and use of the RT6158H evaluation board (EVB), and provides information to related setting of the evaluation board.

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Performance Specification Summary

Summary of the RT6158H Evaluation Board performance specificiaiton is provided in Table 1. The ambient temperature is 25°C.

Table 1. RT6158H Evaluation Board Performance Specification Summary

Specification	Test Conditions	Min	Typ	Max	Unit
Input Voltage Range		2.5	--	5.5	V
Output Current		0	--	3	A
Output Voltage Range		2.1	--	5.2	V
Operation Frequency		--	2	--	MHz
IQVIN	Non-switching. V_{IN} = 4.2V, V_{OUT} = 3.5V, EN = VIN, Mode = VIN	2	5	8	uA
ISHDN	VIN = 3.5V, EN = L	--	--	1	uA

Power-up Procedure

Suggestion Required Equipments

- RT6158H Evaluation Board
- DC power supply capable of at least 5.5V and 7A
- Electronic load capable of 6A
- Function Generator
- Oscilloscope

Quick Start Procedures

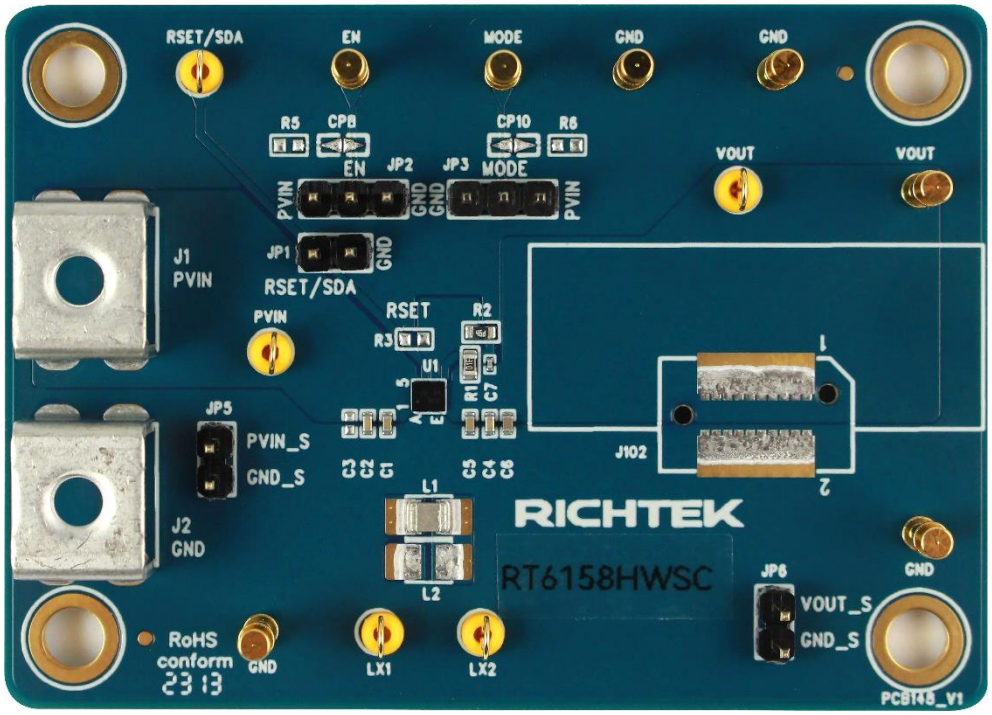
The Evaluation Board is fully assembled and tested. Follow the steps below to verify board operation. Do not turn on supplies until all connections are made. When measuring the output voltage ripple, care must be taken to avoid a long ground lead on the oscilloscope probe. Measure the output voltage 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) Output voltage setting. The output voltage of the RT6158H is adjustable from 2.1V to 5.2V, and can be set by the external divided resistor R1 and R2 on FB pin.
2) Mode selection for PFM or FPWM
3) With power off, connect the input power supply to VIN and GND pins.
4) With power off, connect the electronic load between the VOUT and nearest GND pins.
5) Turn on the power supply at the input. Make sure that the input voltage does not exceeds 5.5V on the EVB.
6) Pull the En pin to high to enable device, When the EN pin is higher than the threshold of logic high, the device starts operation with soft-start.
7) Check for the proper output voltage using a voltmeter.
8) 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.

Test Points

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

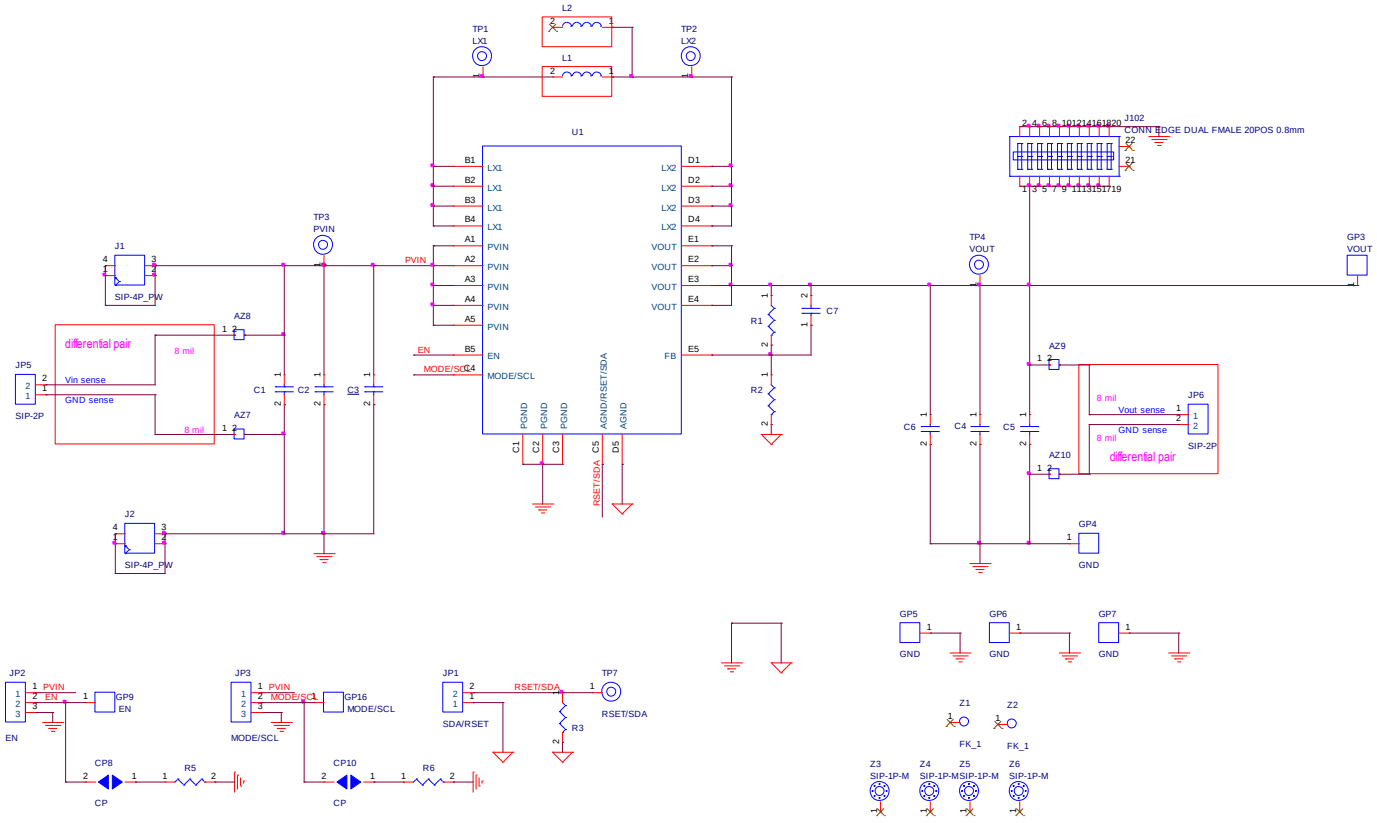
Test Point/ Pin Name	Function
VIN	Input voltage.
VOUT	Output voltage.
GND	Ground.
EN	Enable test point.
MODE	High for PFM mode, low for FCCM mode. This pin also can be used to synchronize switching frequency with 2.2MHz to 2.6MHz.

Bill of Materials

Reference	Count	Part Number	Value	Description	Package	Manufacturer
U1	1	RT6158HWSC	RT6158HWSC	Buck-Boost Converter	WL-CSP-25B 2.07x2.33	RICHTEK
C1, C2, C4, C5	4	GRM155R60J106ME05	10µF	10µF/6.3V/X5R	0402	Murata
C6	1	GRM158R61A226ME15D	22µF	22µF/10V/X5R	0402	Murata
C7	1	GRM0335C1H560JA01D	56pF	56pF/50V/C0G	0201	Murata
R1	1	WR06X1004FTL	1M	1M, 1%	0603	WALSIN
R2	1	CR0603F294KP05Z	294k	294k, 1%	0603	EVER OHMS
L1	1	DFE252010F-1R0M = P02	1µH	1µH, ±20%	2520	Murata

Typical Applications

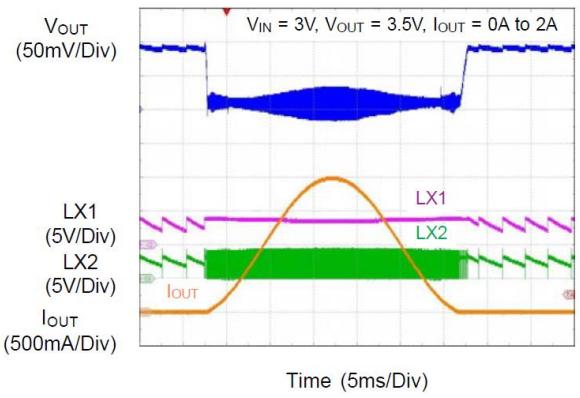
EVB Schematic Diagram



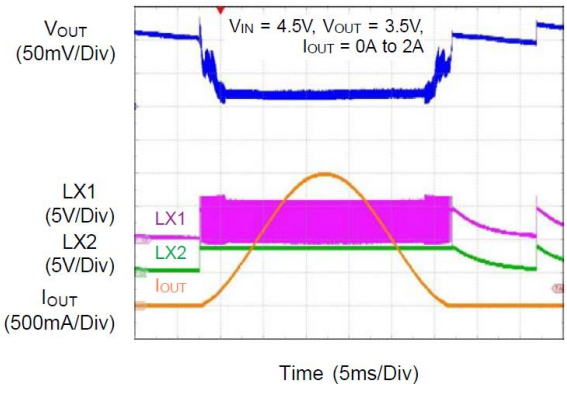
1. The capacitance values of the input and output capacitors will influence the input and output voltage ripple.
2. MLCC capacitors have degrading capacitance at DC bias voltage, and especially smaller size MLCC capacitors will have much lower capacitance.

Measure Result

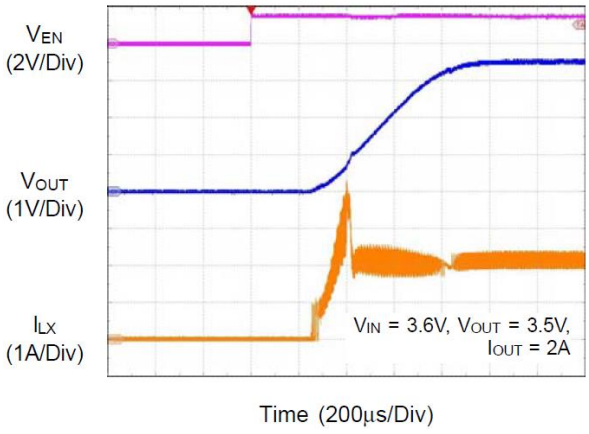
VOUT Ripple Voltage



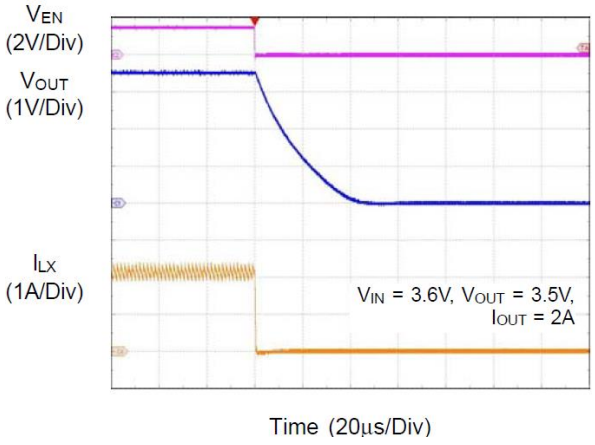
VOUT Ripple Voltage



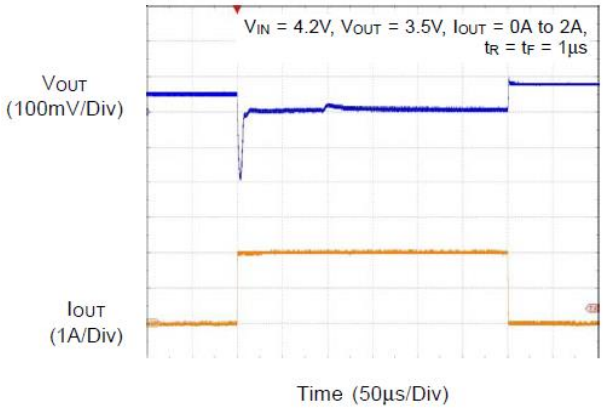
Power On from EN



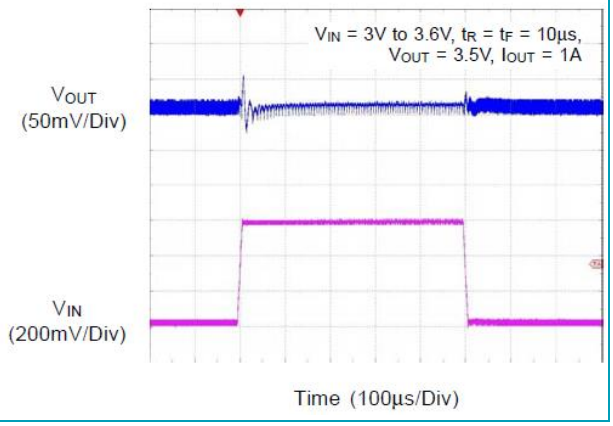
Power Off from EN



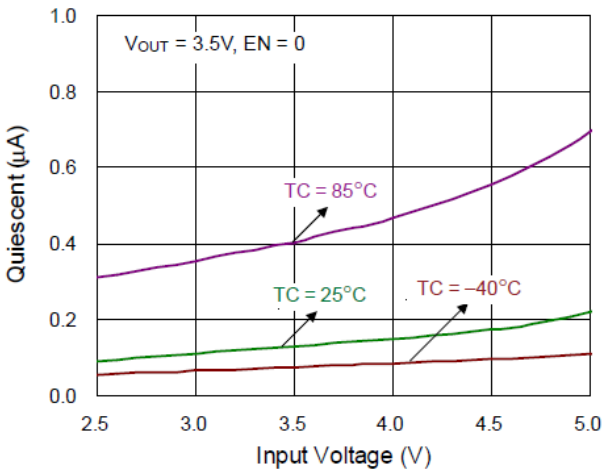
Load Transient



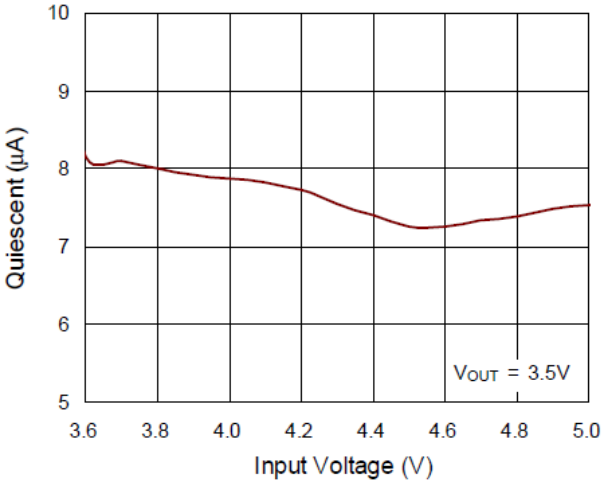
Start-Up Dropout Performance



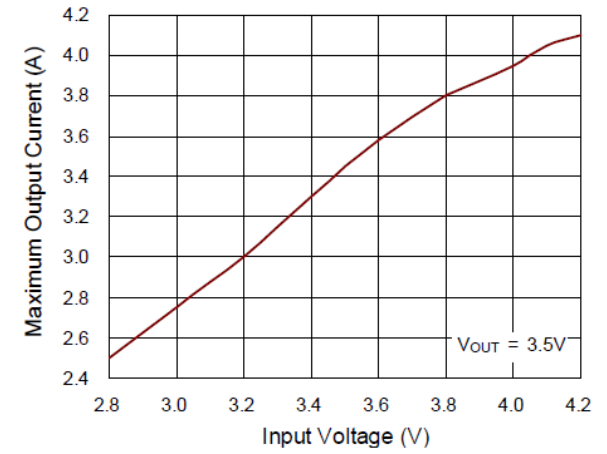
Shutdown Current



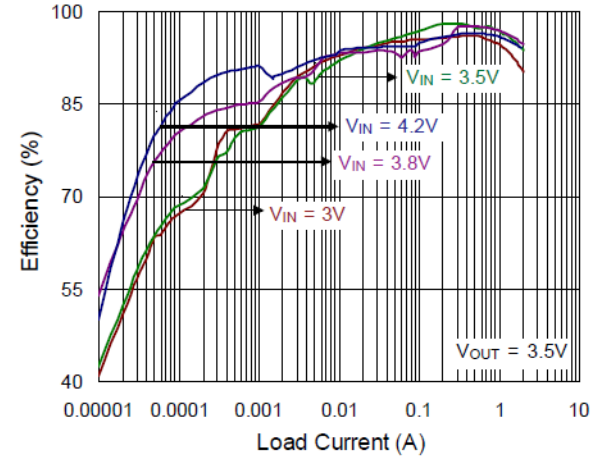
Switching Quiescent Current



Maximum Output Current vs. Input Voltage



Efficiency



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 RT6158H Evaluation Board layout. This board size is 70mm x 50mm and is constructed on four-layer PCB.

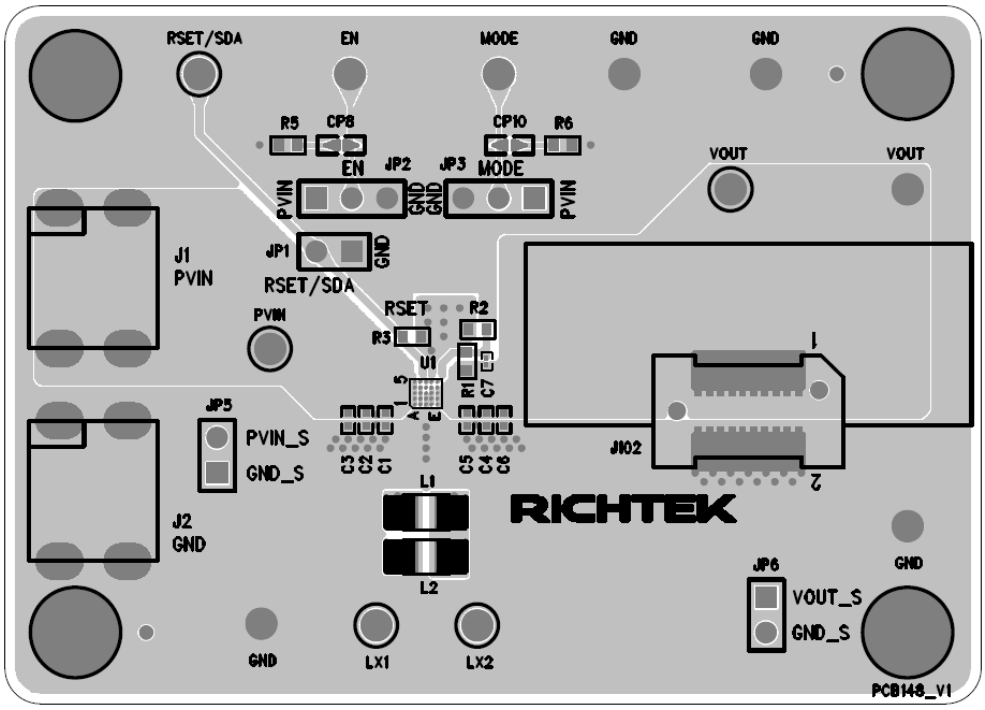


Figure 1. Top View (1st layer)

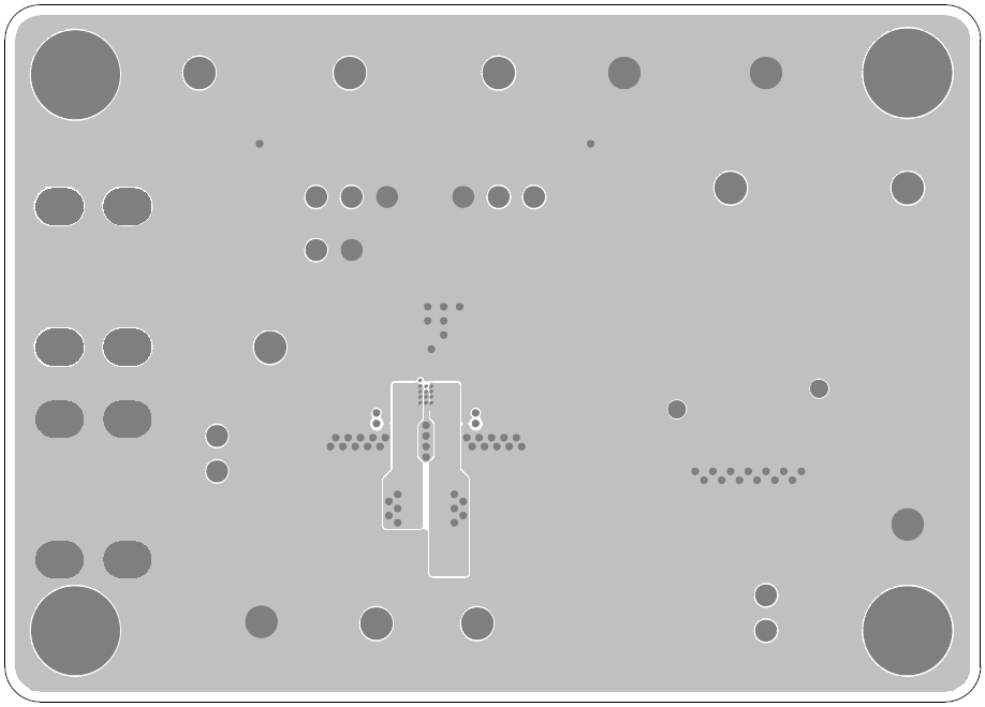


Figure 2. PCB Layout—Inner Side (2nd Layer)

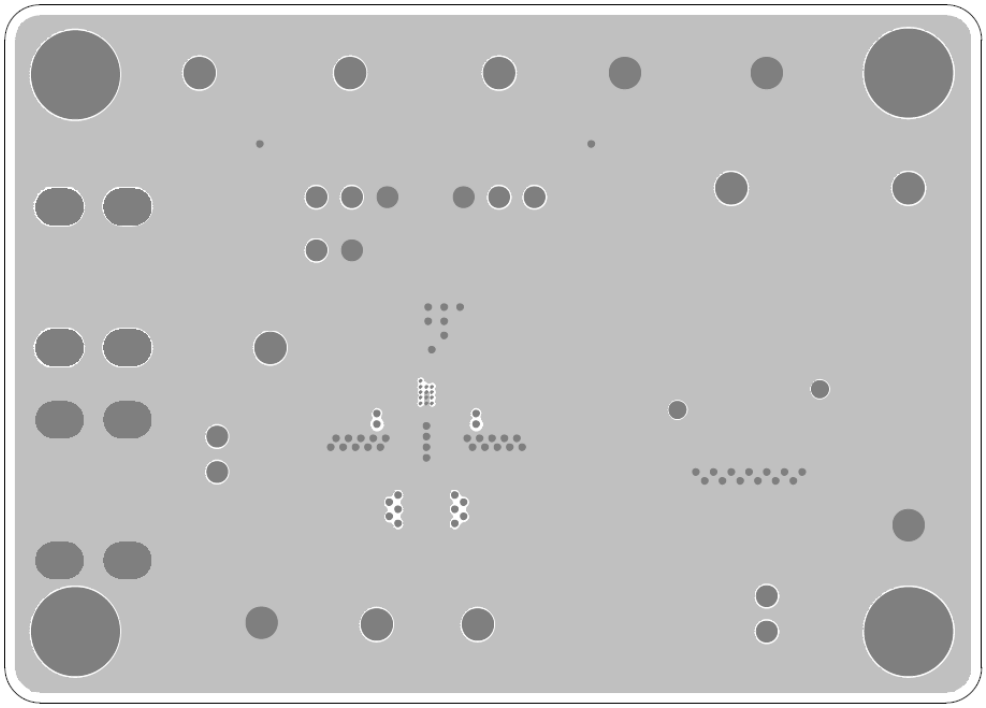


Figure 3. PCB Layout—Inner Side (3rd Layer)

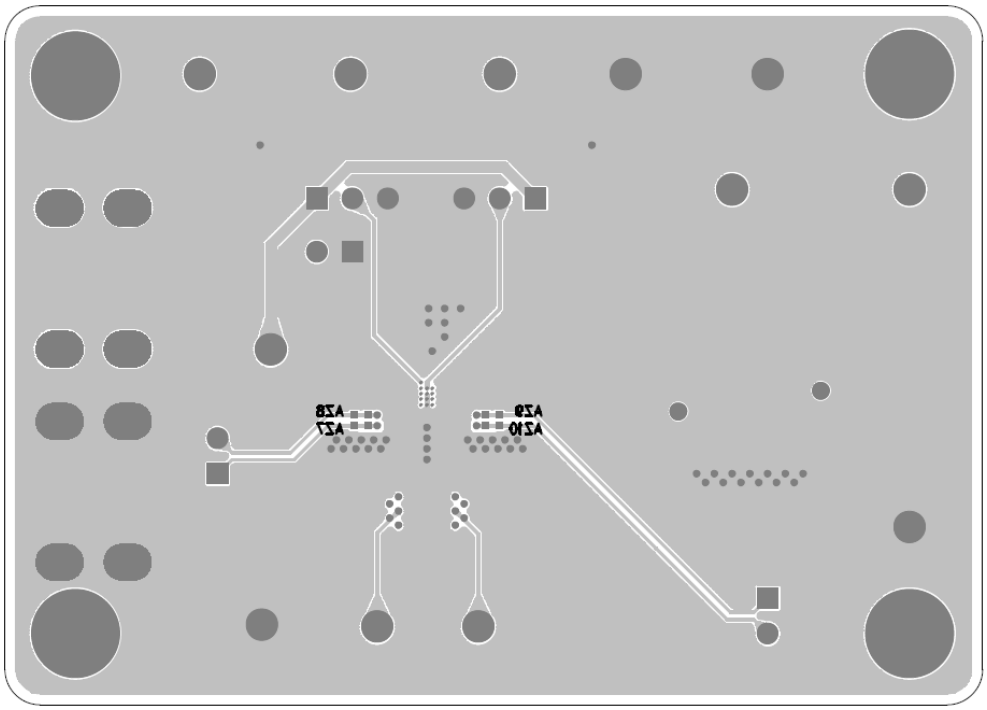


Figure 4. Bottom View (4th Layer)

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