

Automotive CIS/CCM PMIC for Ultra Compact Camera and High Image Quality System

General Description

The Evaluation Board demonstrates the RTQ2072BAGQVT-QT-11 to be designed with three step down converters and one high PSRR low-dropout (LDO) regulator for automotive camera applications. The high-voltage step down converter is operated with input voltage range up to 18.5V for Power Over Coax (POC) connection. Two low-voltage step down converters provide constant output voltage. All step down converters operate in a forced fixed-frequency PWM mode. The LDO output voltage is easily set via an external resistor. The RTQ2072B provides 10 power sequences by a resistor on SEQ pin for flexibility.

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Performance Specification Summary

Summary of the RTQ2072B Evaluation Board performance specification is provided in Table 1. The ambient temperature is 25°C.

Table 1. RTQ2072B Evaluation Board Performance Specification Summary

Specification	Test Conditions	Min	Typ	Max	Unit
Input Voltage Range		4	--	18.5	V
Buck1 Output Current		2	--	--	A
Buck2 Output Current		1.5	--	--	A
Buck3 Output Current		0.75	--	--	A
LDO Output Current		300	--	--	mA
Buck1 Default Output Voltage		--	3.6	--	V
Buck2 Default Output Voltage		--	1.1	--	V
Buck3 Default Output Voltage		--	1.8	--	V
LDO Default Output Voltage		--	3.3	--	V
Buck Operation Frequency		--	2.1	--	MHz
Buck1 Ripple Voltage	$V_{IN} = 6V$, $V_{OUT} = 3.6V$, one switching cycle	--	20	--	mVpp
Buck2 Ripple Voltage	$V_{IN} = 3.6V$, $V_{OUT} = 1.1V$, one switching cycle	--	10	--	mVpp
Buck3 Ripple Voltage	$V_{IN} = 3.6V$, $V_{OUT} = 1.8V$, one switching cycle	--	10	--	mVpp
Buck1 Load Transient Response	$V_{IN} = 6V$, $V_{OUT} = 3.6V$, $I_{OUT} = 10mA$ to $500mA$, $1\mu s$	--	± 150	--	mV
Buck2 Load Transient Response	$V_{IN} = 3.6V$, $V_{OUT} = 1.1V$, $I_{OUT} = 10mA$ to $500mA$, $1\mu s$	--	± 50	--	mV
Buck3 Load Transient Response	$V_{IN} = 3.6V$, $V_{OUT} = 1.8V$, $I_{OUT} = 10mA$ to $300mA$, $1\mu s$	--	± 50	--	mV
LDO Load Transient Response	$V_{IN} = 3.6V$, $V_{OUT} = 3.3V$, $I_{OUT} = 10mA$ to $200mA$, $1\mu s$	--	± 25	--	mV

Power-up Procedure

Suggestion Required Equipments

- RTQ2072B Evaluation Board
- DC power supply capable of at least 20V and 2A (depends on application)
- Electronic load capable of 2A (depends on application)
- Function Generator
- Oscilloscope

Quick Start Procedures

The Evaluation Board is fully assembled and tested. Follow below steps 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

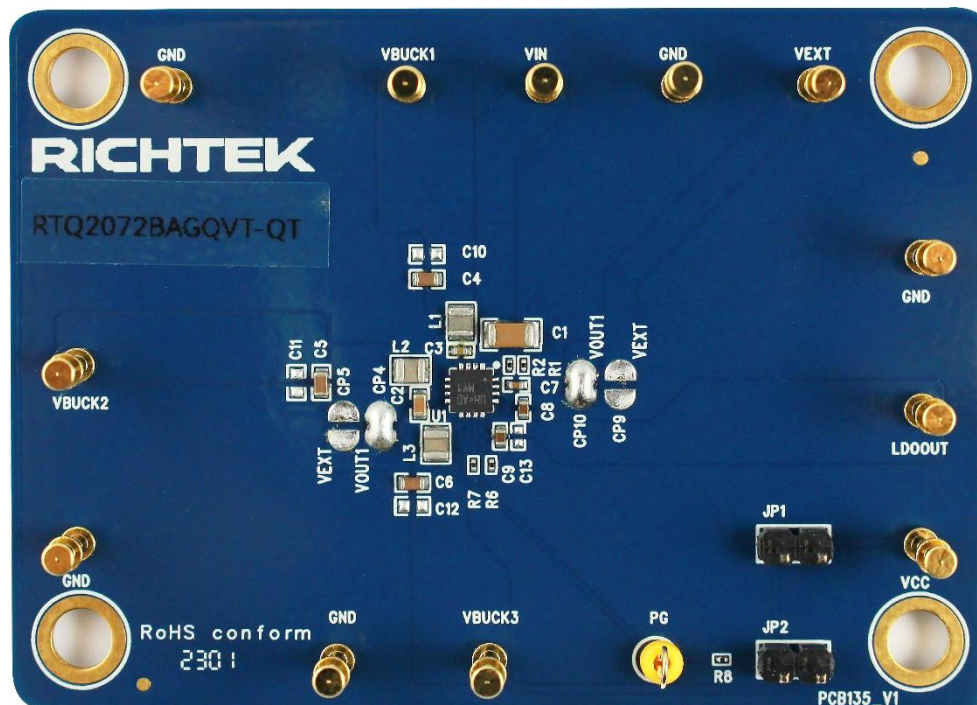
long ground lead on the oscilloscope probe. Measure the output voltage ripple by touching the probe tip and ground ring directly across the last output capacitor.

Follow below procedure for proper setup of measurement and EVB operation.

- 1) With power off state, connect the input power supply to VIN and GND pins.
- 2) With power off state, 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 $24V_{AMR}$ 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, 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 below table.

Test Point/ Pin Name	Function
VIN	Input voltage.
VBUCK1	BUCK1 output voltage.
VBUCK2	BUCK2 output voltage.
VBUCK3	BUCK3 output voltage.
LDOOUT	LDO output voltage.
VEXT	Additional BUCK2, BUCK3 and LDO input voltage.
VCC	Additional pull high voltage for PG indication.
JP1	PG pull high voltage supplied by VCC if short connection. Deafult is non-connected.
JP2	PG pull high voltage supplied by BUCK3 if short connection. Deafult is connected.
CP4	BUCK2/BUCK3 input voltage supplied by BUCK1 if short connection. Deafult is connected.
CP5	BUCK2/BUCK3 input voltage supplied by VEXT if short connection. Deafult is non-connected.

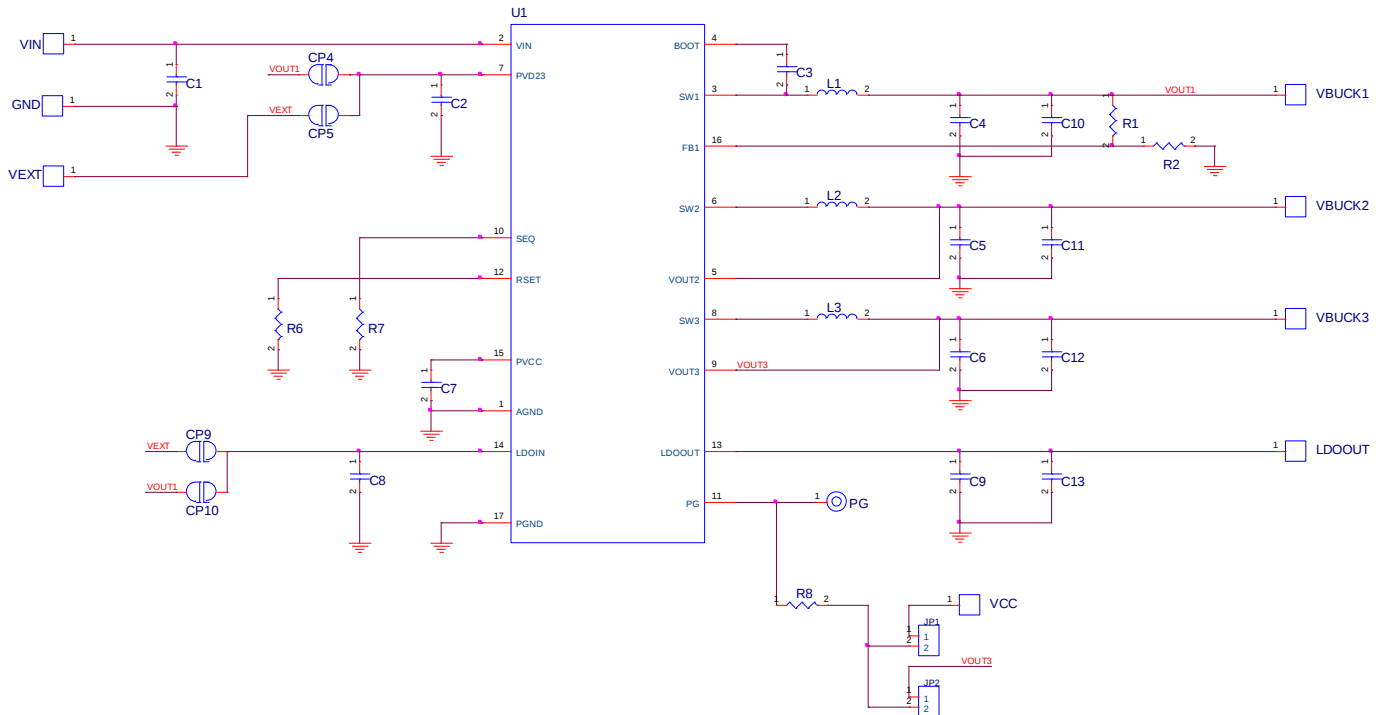
Test Point/ Pin Name	Function
CP9	LDO input voltage supplied by VEXT if short connection. Deafult is non-connected.
CP10	LDO input voltage supplied by BUCK1 if short connection. Deafult is connected.
GND	Ground.
PG	Power-good indication test point.

Bill of Materials

Reference	Count	Part Number	Description	Package	Manufacturer
U1	1	RTQ2072BAGQVT-QT-11	PMIC	WETD-VQFN-16L 3x3	RICHTEK
C1	1	GCJ31CR71E475KA12	4.7μF/25V/X7R	1206	MURATA
C2	1	GRT188C81C475KE13	4.7μF/16V/X6S	0603	MURATA
C3	1	GRT155R71C104KE01	0.1μF/16V/X7R	0402	MURATA
C4, C5, C6	3	GRT188C81A106ME13	10μF/10V/X6S	0603	MURATA
C7	1	GRT155C81A105KE01	1μF/10V/X6S	0402	MURATA
C8, C9	2	GRT155C81A225KE13	2.2μF/10V/X6S	0402	MURATA
L1	1	TFM201610ALMA1R5MTAA	1.5μH	0806	TDK
L2, L3	2	TFM201610ALMA1R0MTAA	1μH	0806	TDK
R1	1	MR02X1372FAL	13.7k	0201	WALSIN
R2	1	MR02X3921FAL	3.92k	0201	WALSIN
R6, R7	2	MR02X000 PAL	0	0201	WALSIN
R8	1	MR02X1002FAL	10k	0201	WALSIN

Typical Applications

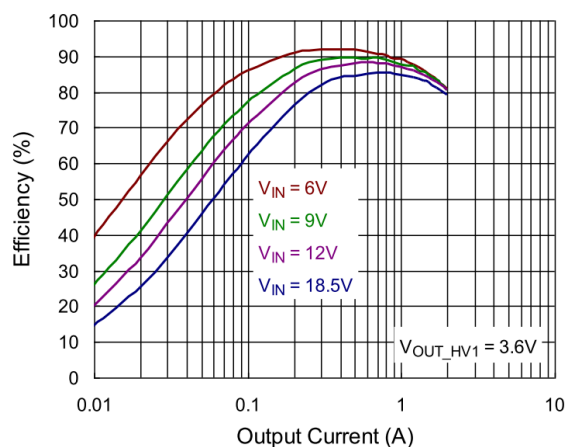
EVB Schematic Diagram



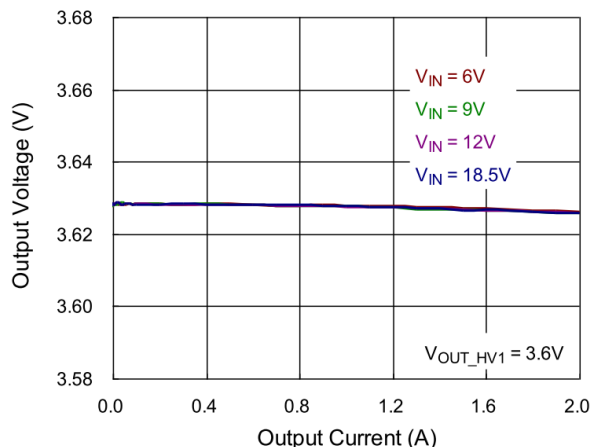
1. The capacitance of the input and output capacitors will influence the input and output voltage ripple.
2. MLCC capacitors have degrading capacitance at DC bias voltage and temperature. Especially, smaller size MLCC capacitors will have much lower capacitance.

Measure Result

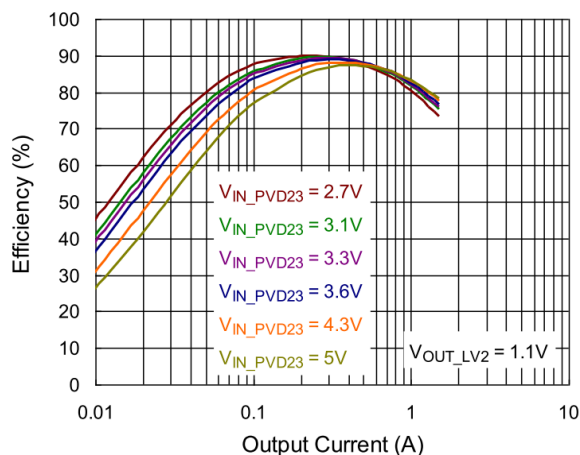
BUCK1 Efficiency



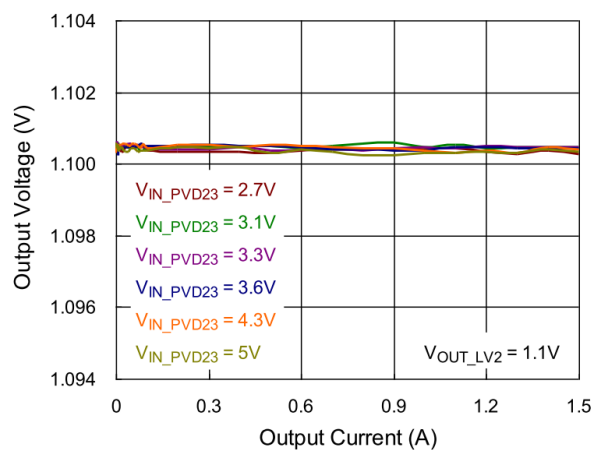
BUCK1 Load Regulation



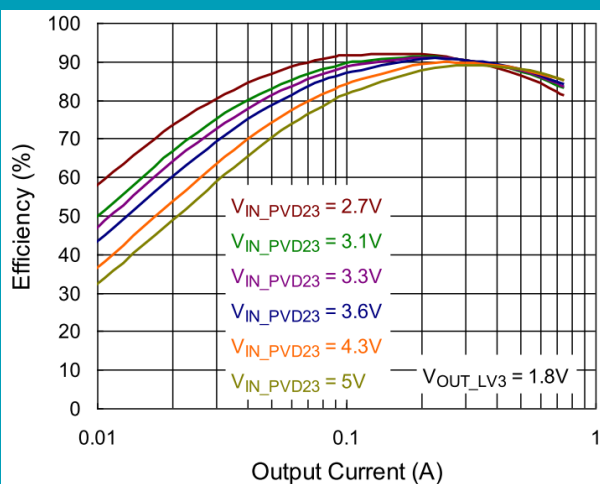
BUCK2 Efficiency



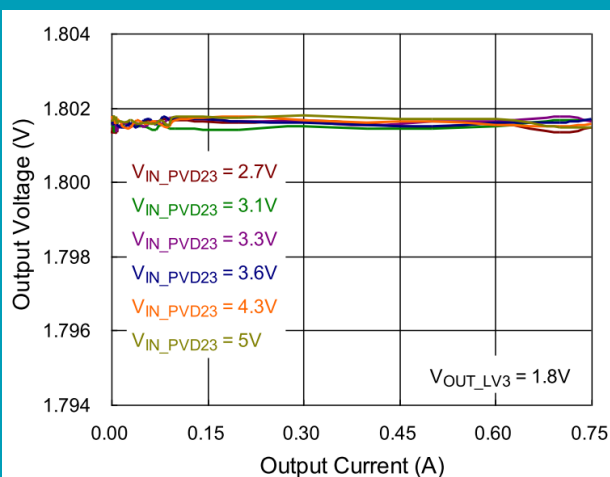
BUCK2 Load Regulation

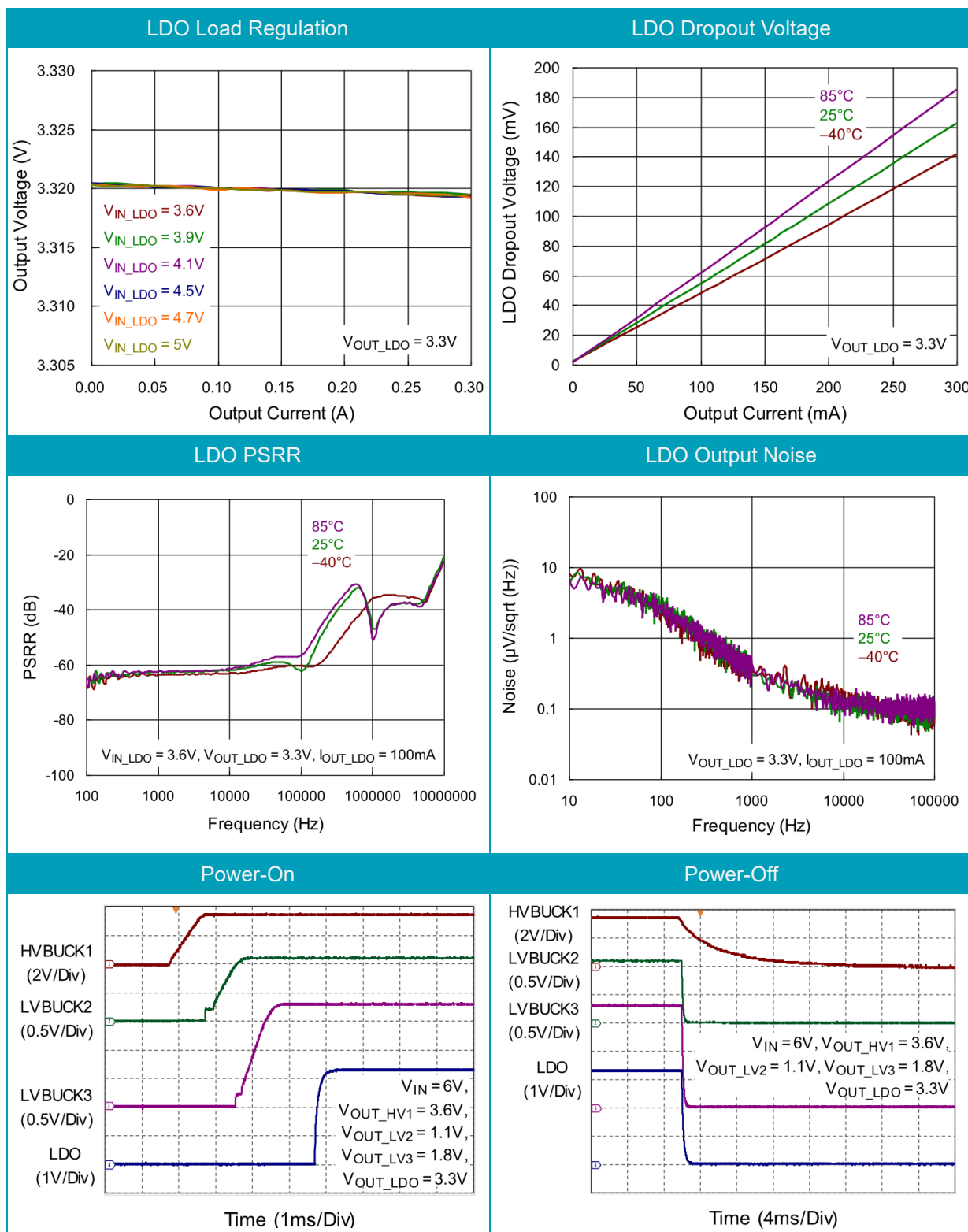


BUCK3 Efficiency



BUCK3 Load Regulation





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 RTQ2072BAGQVT-QT Evaluation Board layout. This board size is 70mm x 50mm and is constructed on four-layer PCB with 2 oz. Cu.

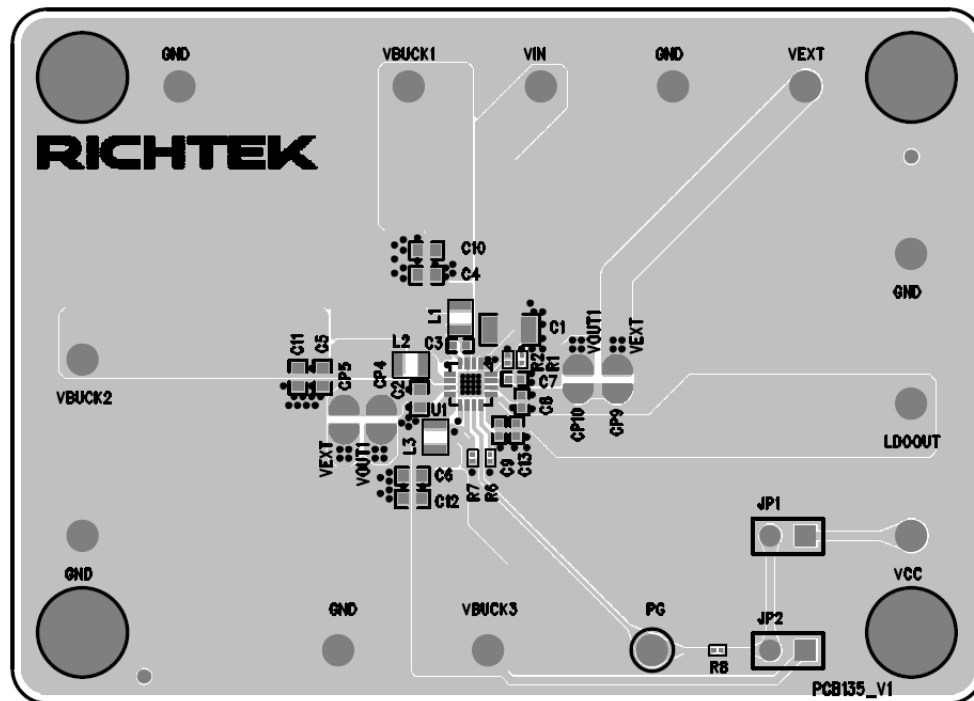


Figure 1. Top View (1st layer)

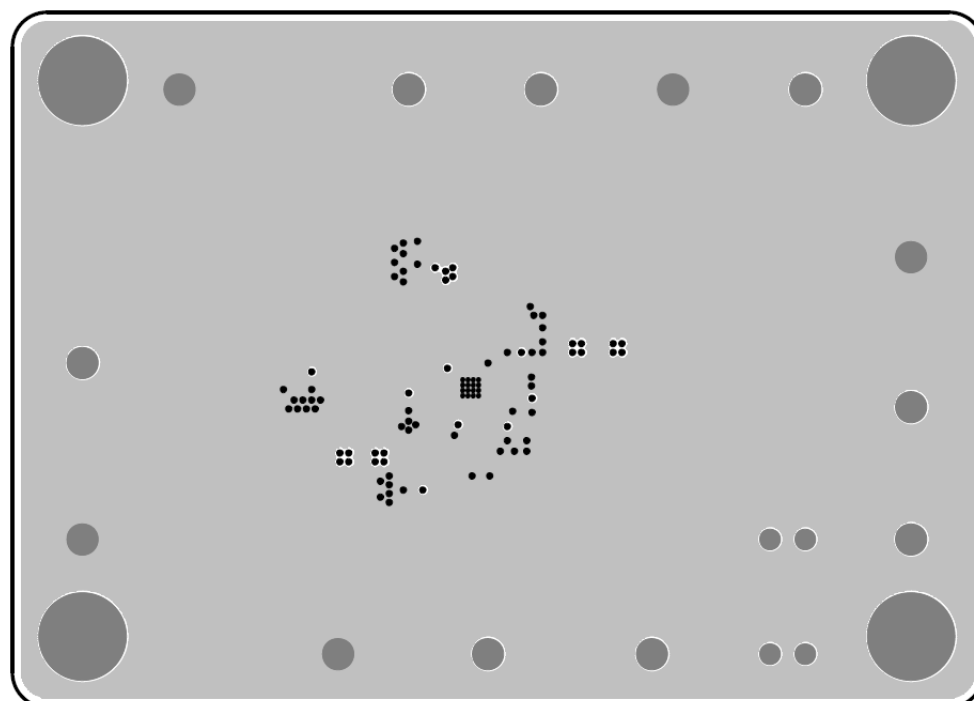


Figure 2. PCB Layout—Inner Side (2nd Layer)

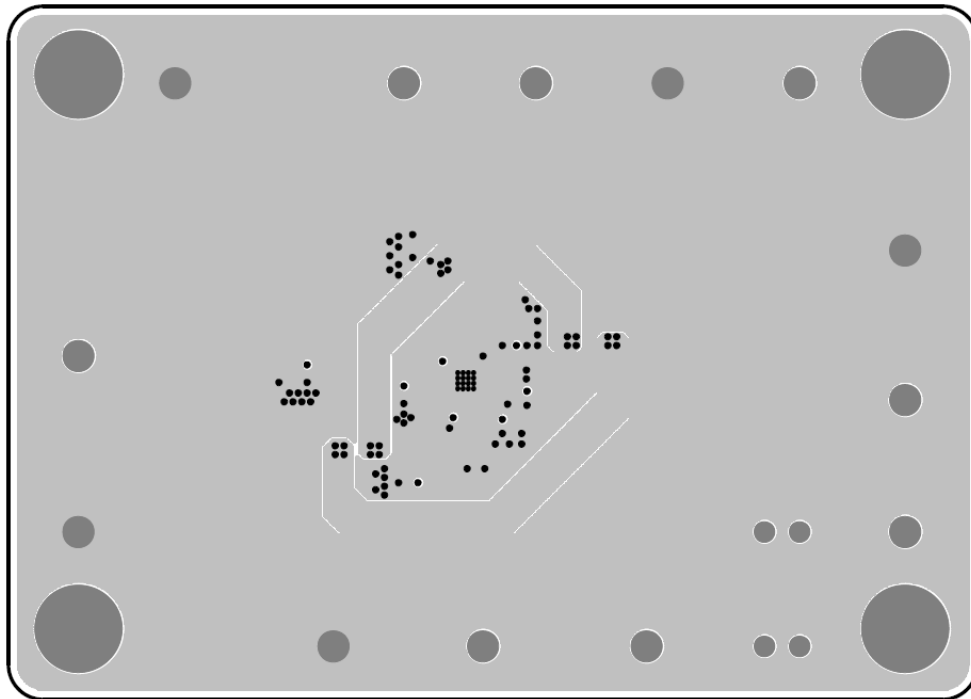


Figure 3. PCB Layout—Inner Side (3rd Layer)

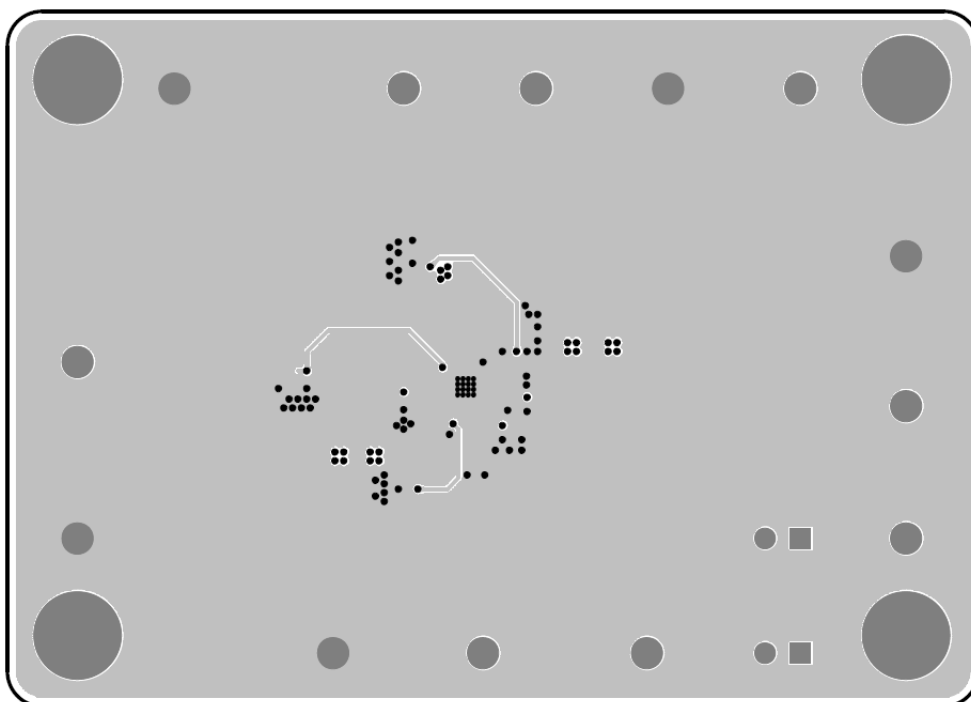


Figure 4. Bottom View (4th Layer)

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

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