

# 36V High Efficiency Converter with I<sup>2</sup>C Controlled 6-CH LED Driver Evaluation Board

## **General Description**

The Evaluation Board demonstrates the RT4527A to be designed for high efficiency driver for white LEDs. It is suitable for single/two cell battery input to drive LED light bars which contains six strings in parallel and up to 10 WLEDs per string.

The RT4527A contains I<sup>2</sup>C interface for controlling the dimming mode, operating frequency and the LED current. The internal 250mΩ, 36V power switch with current-mode control provides overcurrent protection. The switching frequency of the RT4527A is also adjustable from 100kHz to 1.6MHz, which allows flexibility between efficiency and component size.

The RT4527A is available in the WQFN-20L 3.5x3.5 package.

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## Performance Specification Summary

Summary of the RT4527AGQW Evaluation Board performance specification is provided in Table 1. The ambient temperature is 25°C.

Table 1. RT4527A Evaluation Board Performance Specification Summary

Specification	Test Conditions	Min	Typ	Max	Unit
<b>Input Voltage Range</b>		2.7	--	24	V
<b>Minimum CHx Regulation Voltage</b>		0.4	--	0.56	V
<b>LED Channel Current</b>		6	--	25	mA
<b>Output Voltage Limit</b>	Register address = '02h', 5 bits step = 1V, default = 36V, C <sub>OUT</sub> = 4.7μF	--	36	--	V
<b>Boost Operates at PWM Mode</b>		0.1	--	1.6	MHz
<b>LED Current Accuracy</b>	PWM duty = 100%, I <sub>CHx</sub> = 20mA, PWM Freq = 1kHz	-3	--	3	%
<b>LED Current Matching</b>	PWM duty = 100%, I <sub>CHx</sub> = 20mA, PWM Freq = 1kHz	-2	--	2	%
<b>DC Dimming Resolution</b>	PWM Freq < 2kHz	--	4096	--	Steps
	PWM Freq = 2 to 4kHz	--	2048	--	
	PWM Freq = 4 to 8kHz	--	1024	--	
	PWM Freq = 8 to 25kHz	--	512	--	

## Power-up Procedure

### Suggestion Required Equipments

- RT4527A Evaluation Board
- DC power supply capable of at least 30V and 5A
- LED Load Board
- 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.

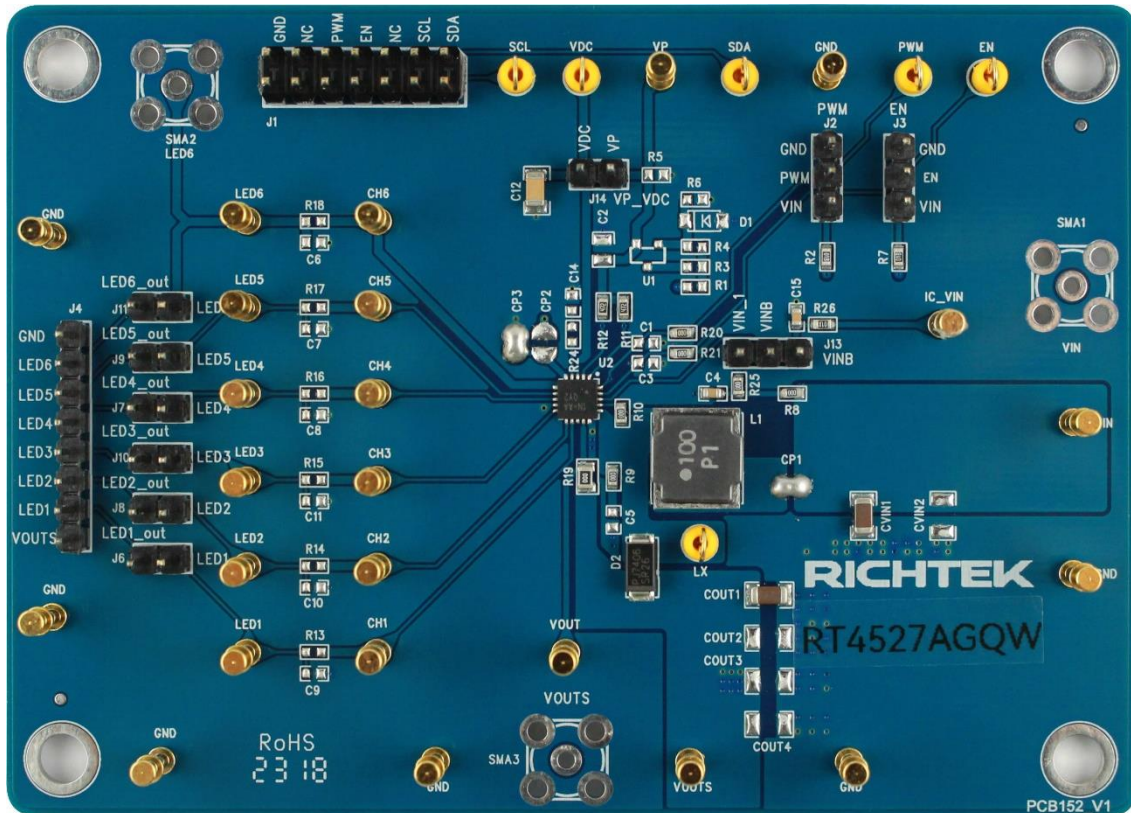
### Proper measurement equipment setup and follow the procedure below.

- 1) With power off, connect the power supply for VIN and GND pins.
- 2) With power off, use jumper to pull high for EN pin.
- 3) With power off, connect the Function Generator to PWM pin.

- 4) With power off, connect the LED Load Board to VOUT and LEDx pins.
- 5) Turn on the power supply at the input. Make sure that the input voltage does not exceeds 24V on the Evaluation Board.
- 6) Turn on the Function Generator at the PWM pin.
- 7) Check LED Load Board brightness.
- 8) Once the proper output voltage is established, adjust the PWM duty within the operating ranges and observe the output LED brightness, I<sub>CHx</sub>, 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](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>SDA</b>	Data signal pin of I <sup>2</sup> C interface.
<b>SCL</b>	Clock signal pin of I <sup>2</sup> C interface.
<b>VDC</b>	Output of internal regulator.
<b>COMP</b>	Boost external compensator pin.
<b>A0</b>	Device address select (7bits), A0 = 0 (Low) → (0x6Ch), A0 = 1 (High) → (0x6Eh).
<b>CH6</b>	Current sink for LED6.
<b>CH5</b>	Current sink for LED5.

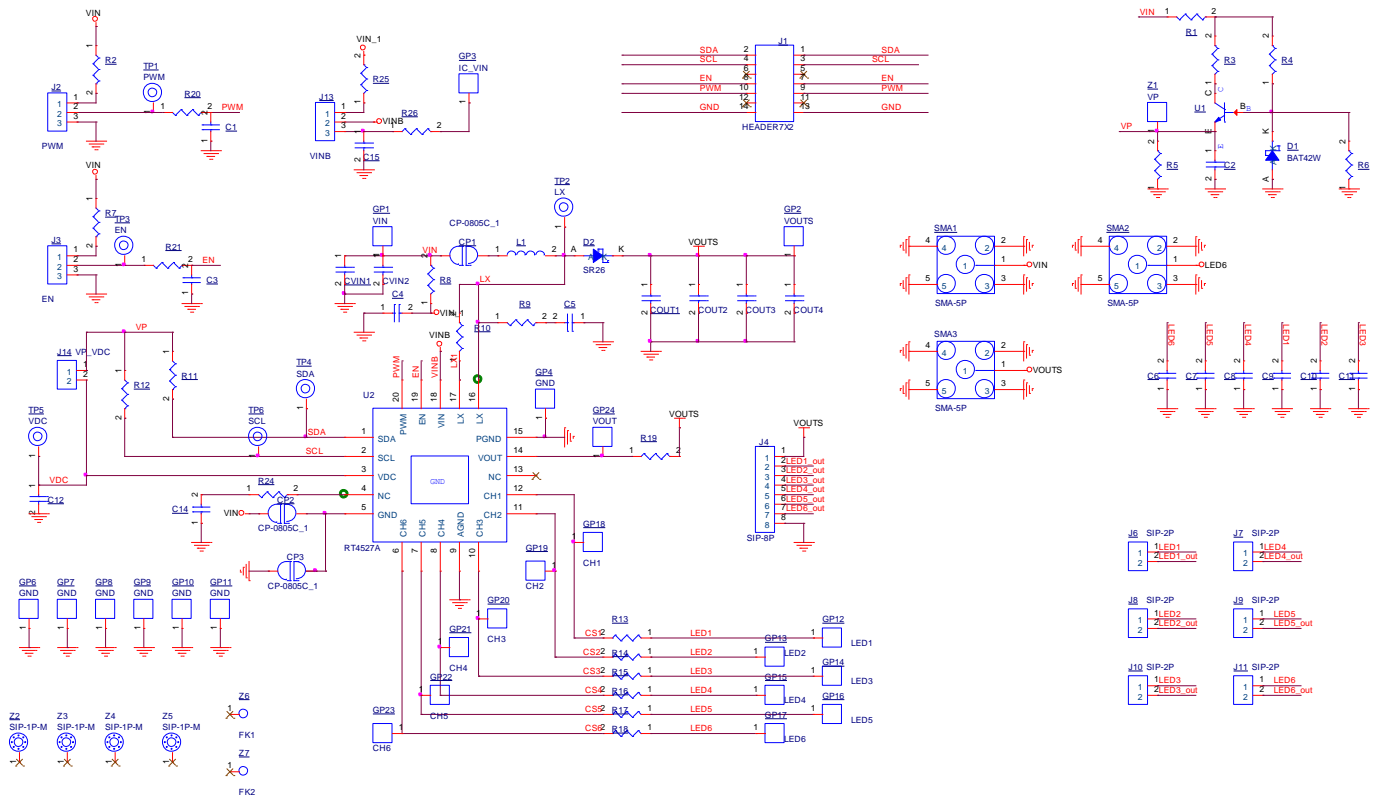
Test Point/ Pin Name	Function
<b>CH4</b>	Current sink for LED4.
<b>CH3</b>	Current sink for LED3.
<b>CH2</b>	Current sink for LED2.
<b>CH1</b>	Current sink for LED1.
<b>VOUT</b>	Output of boost converter.
<b>PGND</b>	Power ground.
<b>LX</b>	Switch node of boost converter.
<b>VIN</b>	Power supply input.
<b>EN</b>	Enable control input (active high).
<b>PWM</b>	PWM dimming control input.
<b>AGND</b>	Analog ground. The exposed pad must be soldered to a large PCB and connect to AGND for maximum power dissipation.

**Bill of Materials**

VIN = 12V, VOUT = LED Load Board , IOUT = 20mA						
Reference	Count	Part Number	Value	Description	Package	Manufacturer
U2	1	RT4527AGQW	RT4527A	LED Driver	WQFN-20L 3.5x3.5	RICHTEK
C4	1	0603B104K500CT	100nF	Capacitor, Ceramic 50V/X7R	0603	WALSIN
C12	1	1206B105K500CT	1μF	Capacitor, Ceramic 50V/X7R	1206	WALSIN
C15	1	0603B102K500CT	1nF	Capacitor, Ceramic 50V/X7R	0603	WALSIN
COUT1, CVIN1	2	UMK316AB7475KL-T	4.7μF	Capacitor, Ceramic 50V/X7R	1206	TAIYO YUDEN
D2	1	SR26	60V/2A	D-SMA_DO-214AC	SMA/DO-214AC	PAN JIT
L1	1	LSXNH8080YKL100MJG	10μH	L-8x8		TAIYO YUDEN
R2, R7	2	WR06X1001FTL	1k	Resistor, Chip 0603	0603	WALSIN
R8, R9, R10, R20, R21, R25	6	WR06X000 PTL	0	Resistor, Chip 0603	0603	WALSIN
R11, R12	2	WR06X4701FTL	4.7k	Resistor, Chip 0603	0603	WALSIN
R19	1	RTT05000JTP	0	Resistor, Chip 0805	0805	RALEC
R26	1	WR06X10R0FTL	10	Resistor, Chip 0603	0603	WALSIN

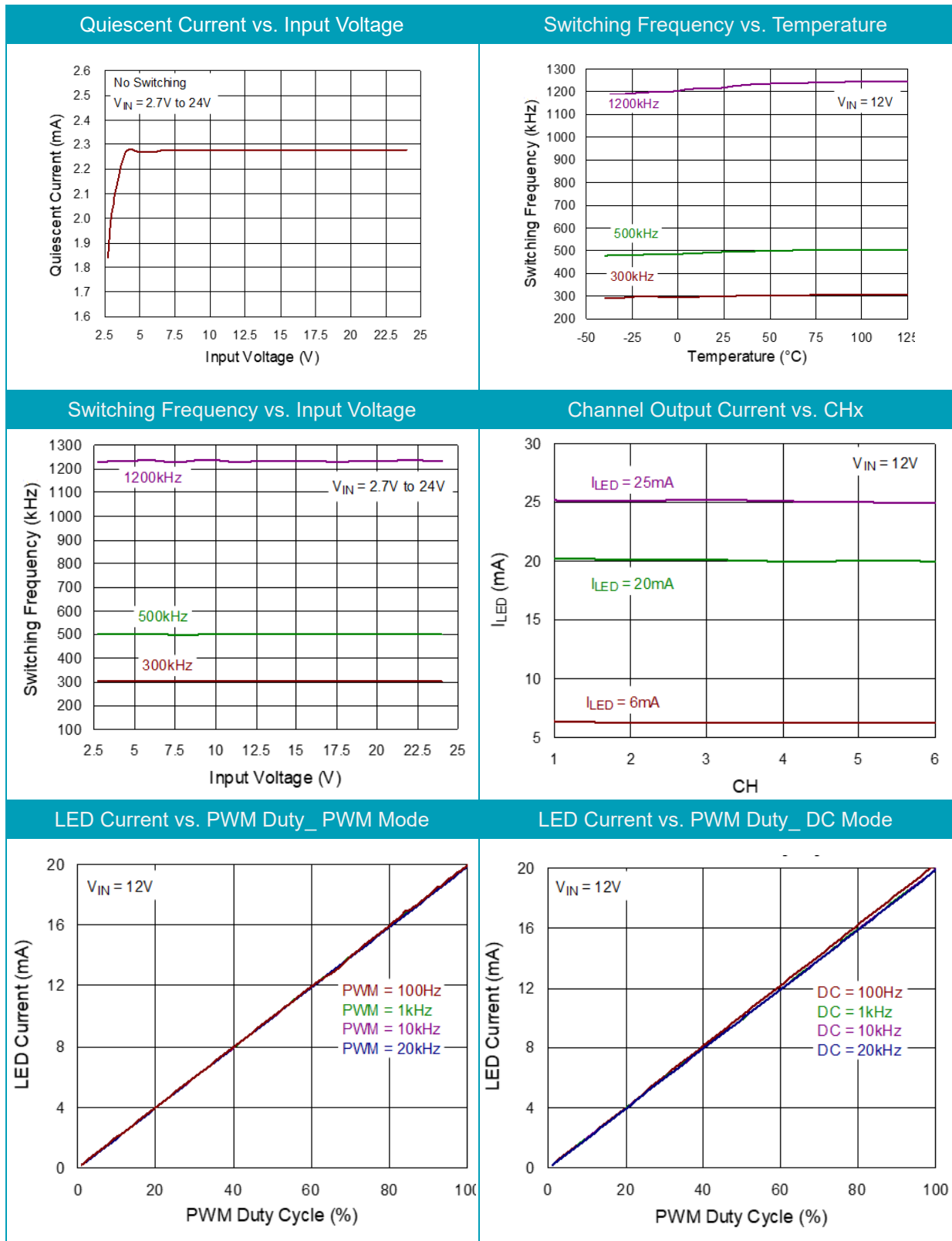
**Typical Applications**

**EVB Schematic Diagram**

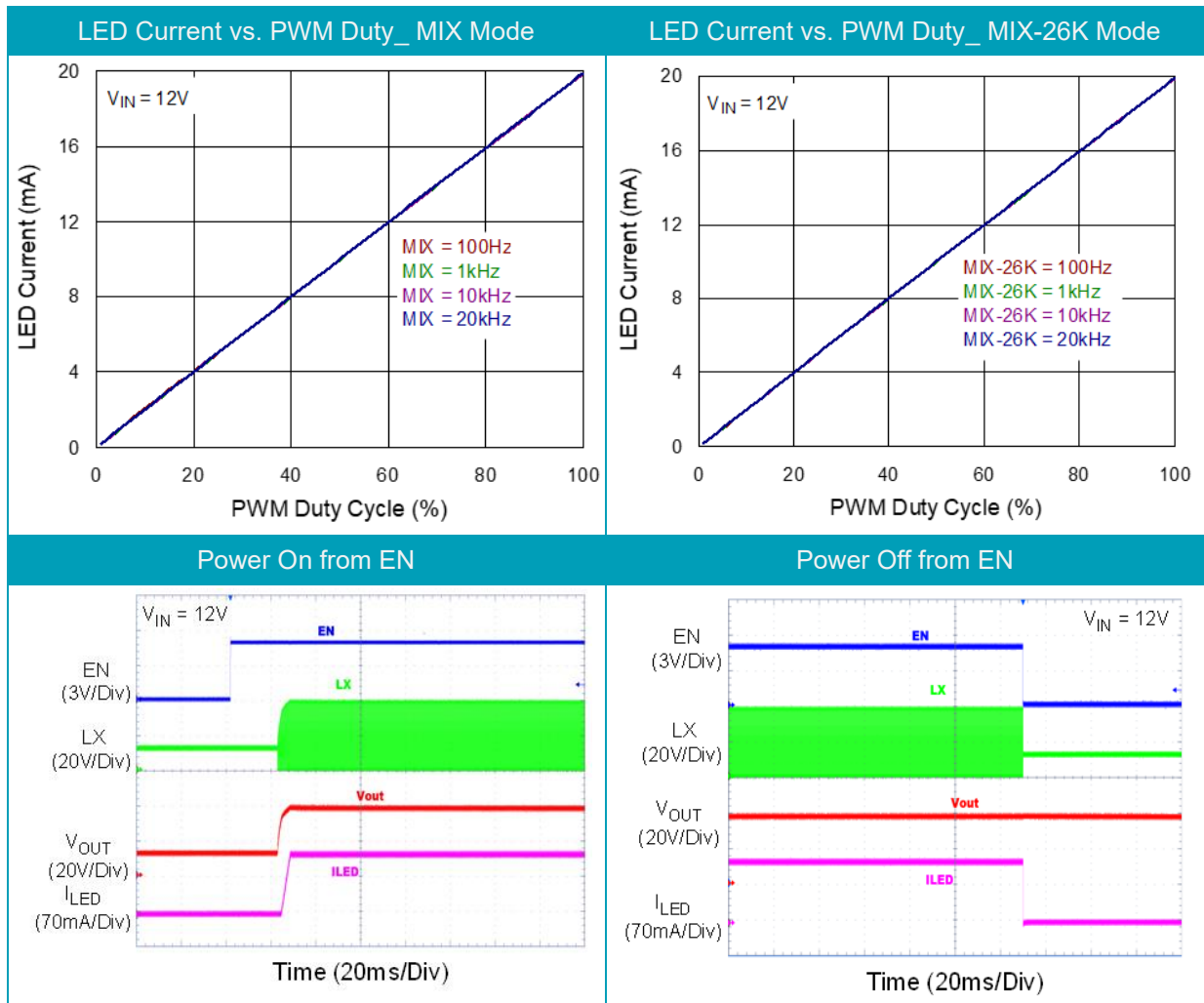


1. The capacitance values of the input and output capacitors will influence the input and output voltage ripple.
2. MLCC capacitors have degrading capacitance at DC bias voltage, and especially smaller size MLCC capacitors will have much lower capacitance.

Measure Result







**Evaluation Board Layout**

Figure 1 to Figure 4 are RT4527A Evaluation Board layout. This board size is 70mmx50mm and is constructed on four-layer PCB, outer layers with 2 oz. Cu and inner layers with 1 oz. Cu.

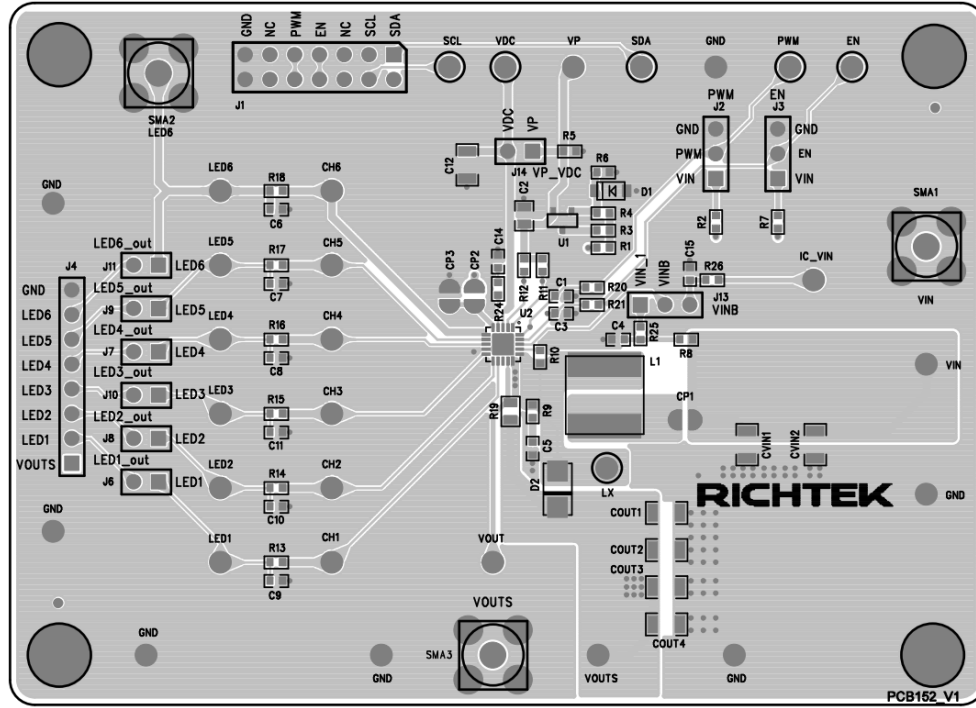


Figure 1. Top View (1<sup>st</sup> layer)

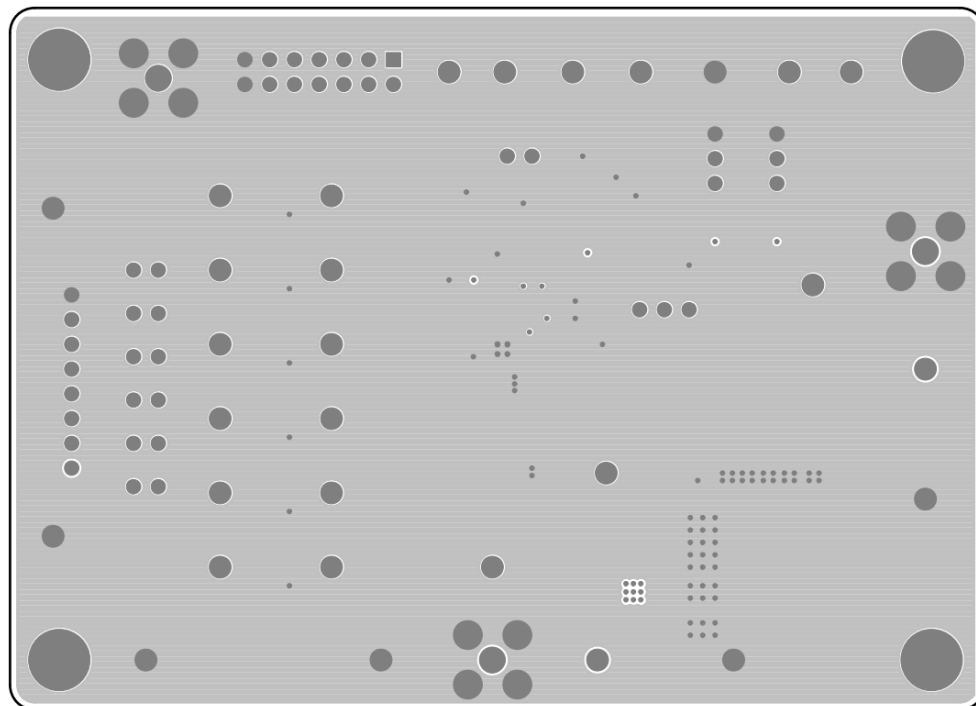


Figure 2. PCB Layout—Inner Side (2<sup>nd</sup> Layer)

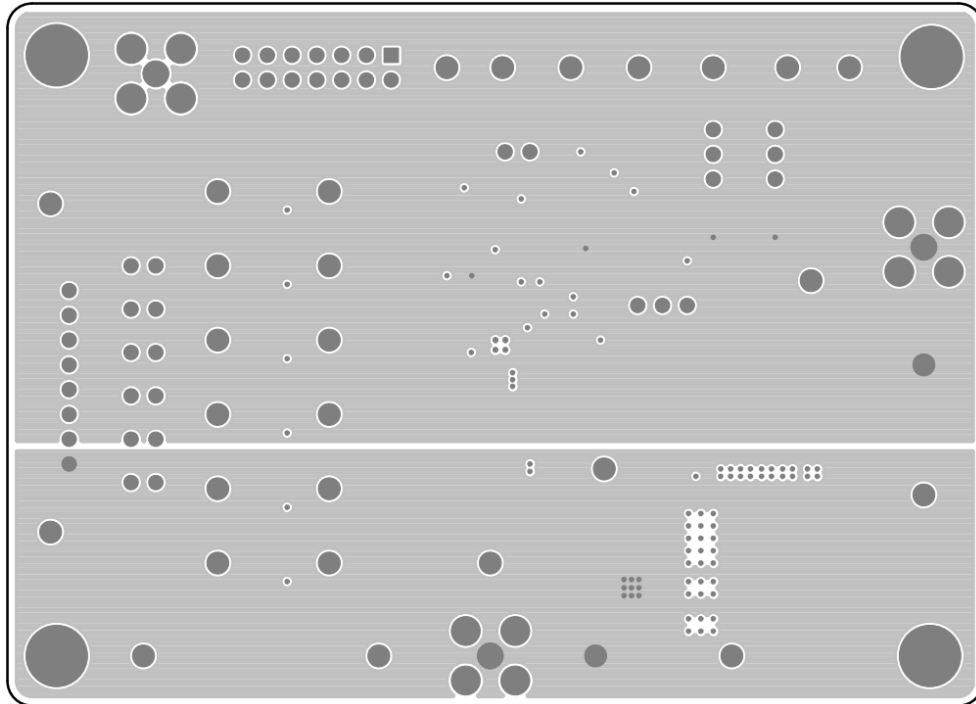


Figure 3. PCB Layout—Inner Side (3<sup>rd</sup> Layer)

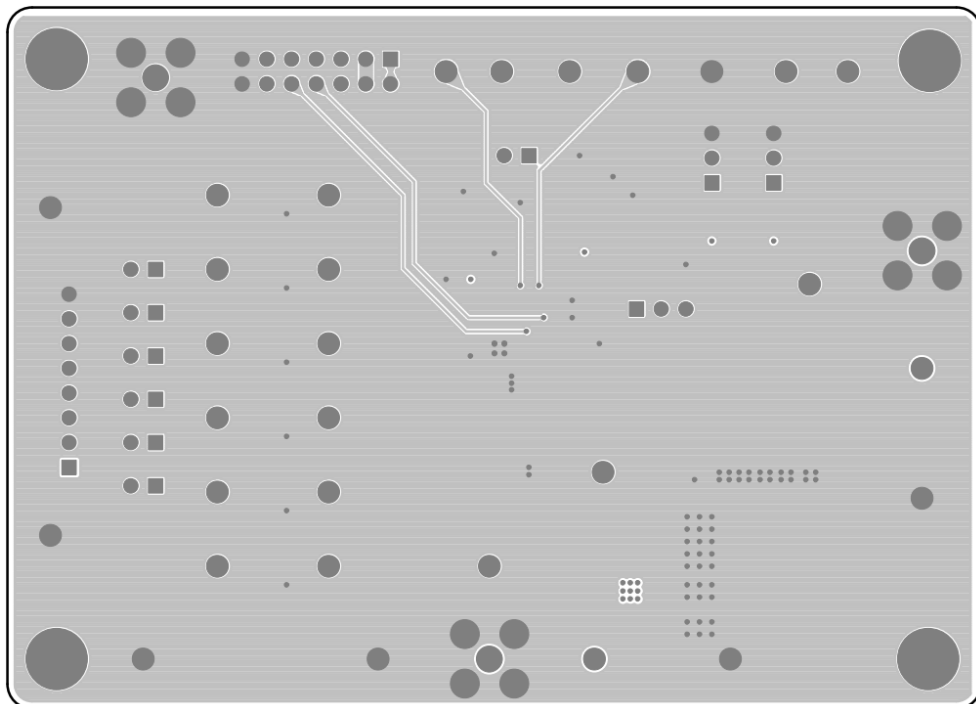


Figure 4. Bottom View (4<sup>th</sup> Layer)

### ***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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