

## **8A, 18V, 500kHz, ACOT™ Synchronous Step-Down Converter**

### ***Purpose***

The RT6238A is an ACOT control architecture step-down converter, which the input voltage range is from 4.5V to 18V and the output is adjustable from 0.7V to 8V. This document explains the function and use of the RT6238A evaluation board (EVB), and provides information to enable operation, modification of the evaluation board and circuit to suit individual requirements.

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## Introduction

### General Product Information

The RT6238A is a high-performance 500kHz, 8A step-down regulator with internal power switches and synchronous rectifiers. It features quick transient response using its Advanced Constant On-Time (ACOT™) control architecture that provides stable operation with small ceramic output capacitors and without complicated external compensation, among other benefits. With internal 35mΩ switches and 14mΩ synchronous rectifiers, the RT6238A displays excellent efficiency and good behavior across a range of applications, especially for low output voltages and low duty cycles. Cycle-by-cycle current limit provides protection against shorted outputs, input under-voltage lockout, externally-adjustable soft-start, output under- and over-voltage protection, and thermal shutdown provide safe and smooth operation in all operating conditions. The RT6238A is available in the UQFN-14L 2x3 (FC) package, with exposed thermal pad.

### Product Features

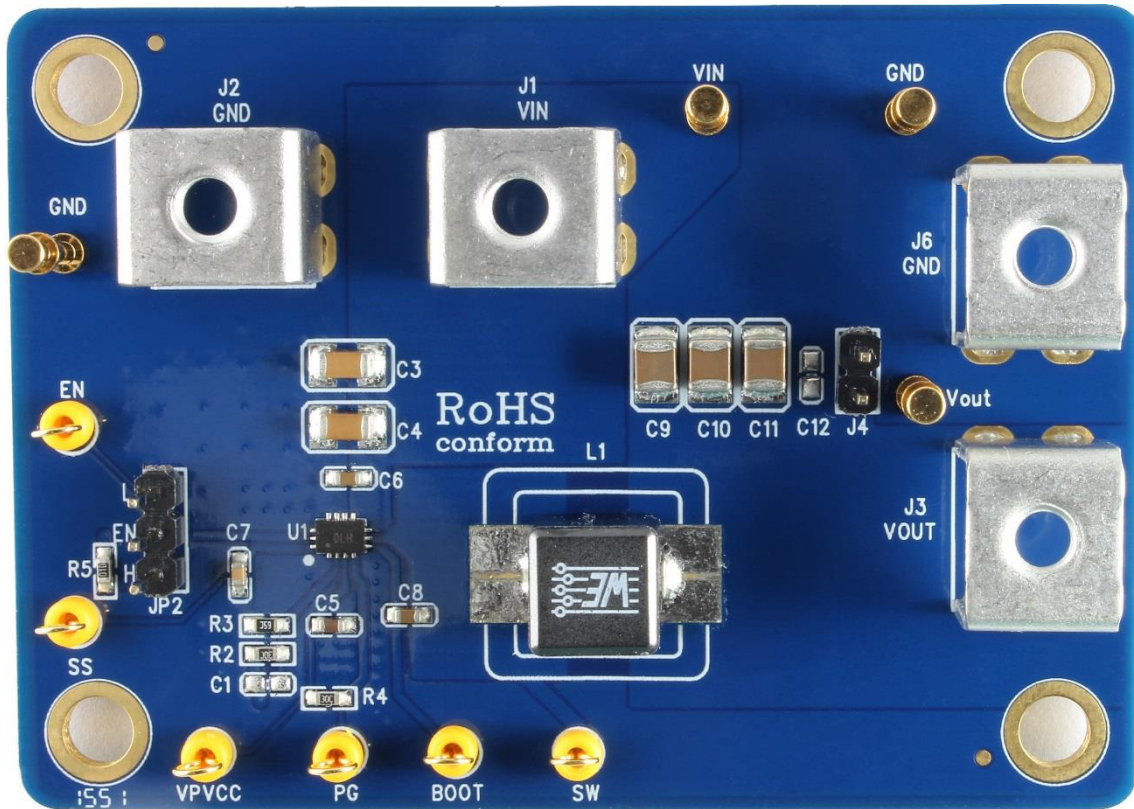
- Fast Transient Response
- Advanced Constant On-Time (ACOT™) Control
- 4.5V to 18V Input Voltage Range
- Adjustable Output Voltage from 0.7V to 8V
- 8A Output Current
- 35mΩ Internal High-Side N-MOSFET and 14mΩ Internal Low-Side N-MOSFET
- Steady 500kHz Switching Frequency
- Up to 95% Efficiency
- Optimized for All Ceramic Capacitors
- Externally-Adjustable, Pre-Biased Compatible Soft-Start
- Cycle-by-Cycle Current Limit
- Input Under-Voltage Lockout
- Output Over- and Under-Voltage Protection
- Power Good Output
- Thermal Shutdown

### Key Performance Summary Table

Key Features	Evaluation Board Number : PCB063_V1
Input Voltage Range	12V
Max Output Current	8A
Default Output Voltage	1.0V
Default Marking & Package Type	RT6238AHGQUF, UQFN-14L 2x3 (FC)
Operation Frequency	Steady 500kHz at all loads

**Bench Test Setup Conditions**

**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	Signal Name	Description
<b>VIN</b>	Input Voltage	Power input. The input voltage range is from 4.5V to 18V. Must bypass with a suitably large ( $\geq 10\mu\text{F} \times 2$ ) ceramic capacitor.
<b>EN</b>	Enable	Enable control input. A logic-high enables the converter; a logic-low forces the IC into shutdown mode reducing the supply current to less than 10 $\mu\text{A}$ . Attach this pin to PVCC with a 100k $\Omega$ pull-up resistor for automatic start-up.
<b>GND</b>	Ground	Ground.
<b>VPVCC</b>	Internal Regulator Output	Internal regulator output. Connect a 1 $\mu\text{F}$ capacitor to GND to stabilize output voltage.
<b>PG</b>	Power Good Output	Power good indicator open-drain output.
<b>BOOT</b>	Bootstrap Supply	Connect a capacitor between the SW and BOOT pins to form a floating supply across the power switch driver. A 0.1 $\mu\text{F}$ capacitor is recommended for use.
<b>SW</b>	Switch Node	Connect this pin to an external L-C filter.
<b>SS</b>	Soft-Start Control	An external capacitor should be connected between this pin and GND.

### Power-Up & Measurement Procedure

1. Apply a 12V nominal input power supply ( $4.5\text{V} < V_{\text{IN}} < 18\text{V}$ ) to the VIN and GND terminals.
2. Set the jumper at JP1 to connect terminals 2 and 3, connecting EN to VIN through resistor R5, to enable operation.
3. Verify the output voltage (approximately 1V) between VOUT and GND.
4. Connect an external load up to 8A to the VOUT and GND terminals and verify the output voltage and current.

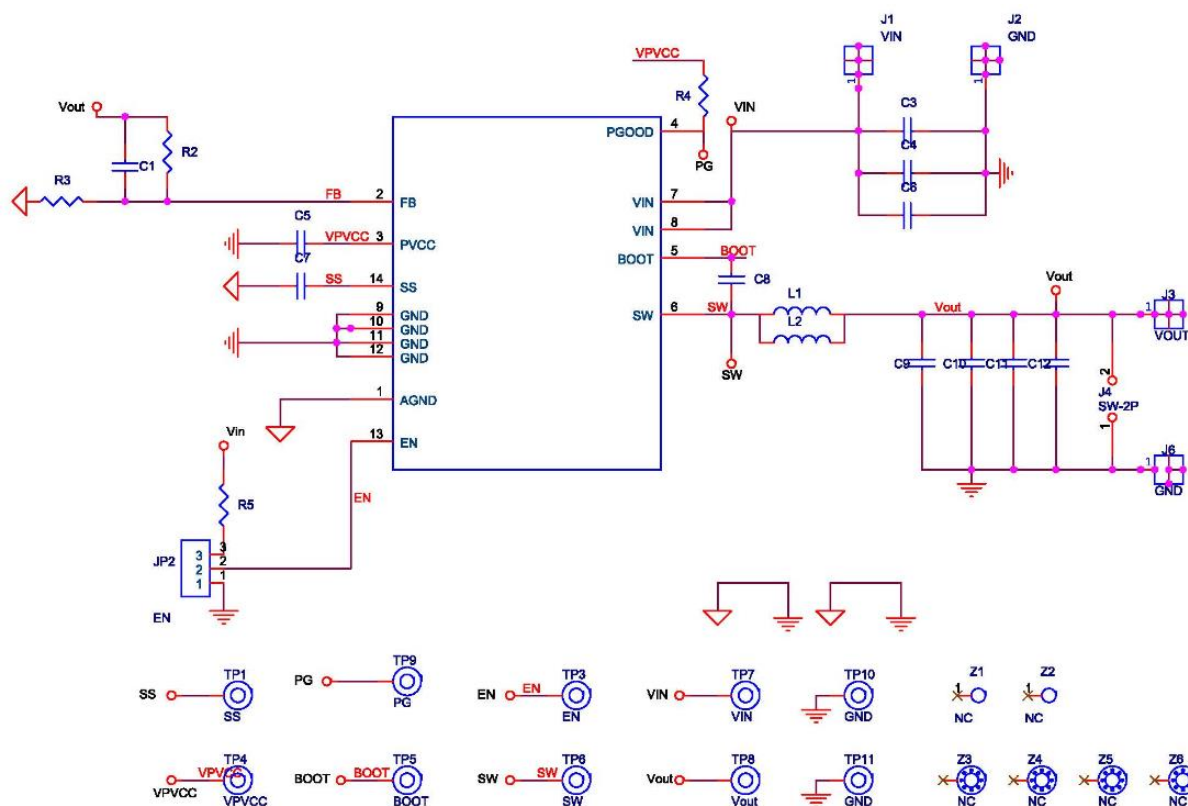
### Output Voltage Setting

Set the output voltage with the resistive divider (R2, R3) between VOUT and GND with the midpoint connected to FB. The output is set by the following formula :

$$V_{\text{OUT}} = 0.7 \times \left( 1 + \frac{R2}{R3} \right)$$

**Schematic, Bill of Materials & Board Layout**

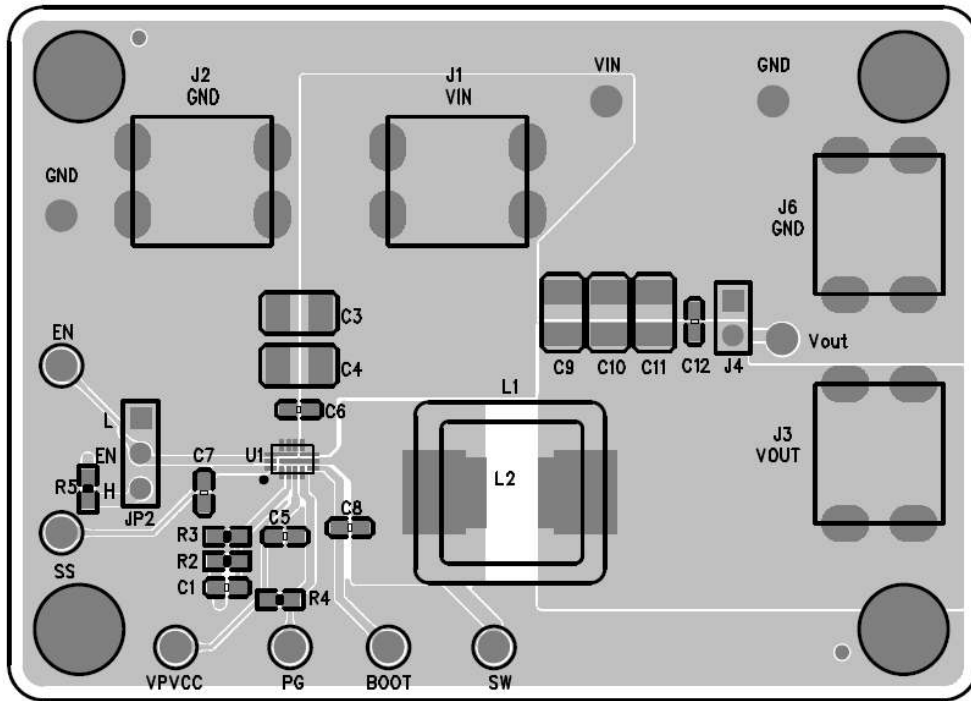
**EVB Schematic Diagram**



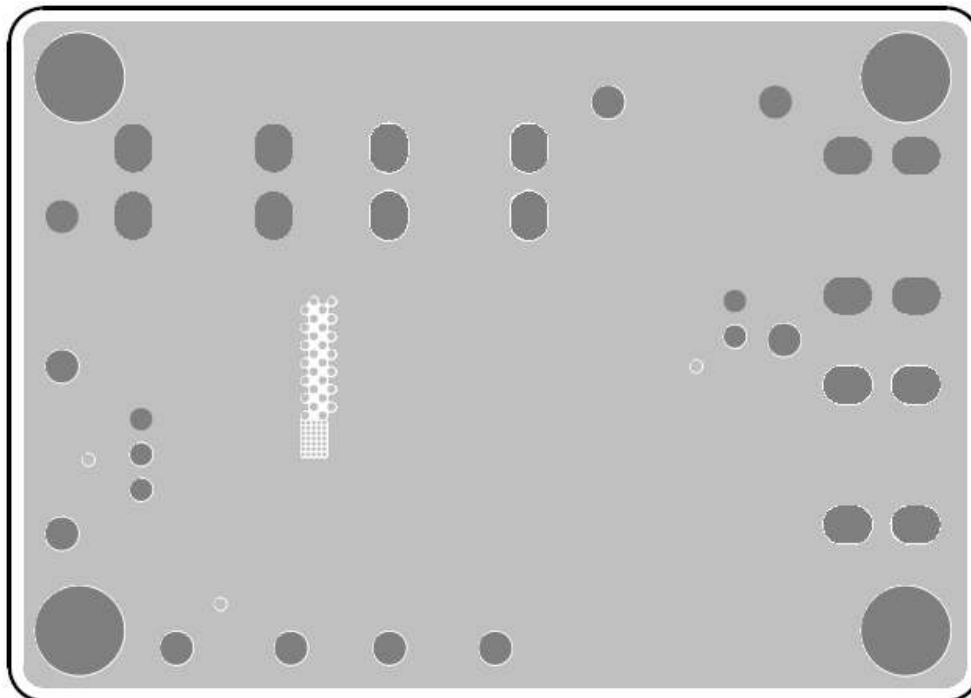
**Bill of Materials**

Reference	Qty	Part Number	Description	Package	Manufacturer
U1	1	RT6238AHGQUF	DC-DC Converter	UQFN-14L 2x3 (FC)	RICHTEK
C1, C12	2		NC		
C3, C4	2	C3216X5R1E106KT000E	10μF/25V/X5R	C-1210	TDK
C5	1	C1608X5R1E105KT000E	1μF/25V/X5R	C-0603	TDK
C6, C8	2	C1608X7R1H104KT000N	0.1μF/50V/X7R	C-0603	TDK
C7	1	0603B103K500	10nF/50V/X7R	C-0603	WALSIN
C9, C10, C11	3	C3225X5R1E226MT000E	22μF/16V/X5R	C-1210	TDK
R2, R4	2	0603T-1-20K	20k	R-0603	旺詮
R3	1	0603T-1-46K4	46.4k	R-0603	旺詮
R5	1	0603 100K 1%	100k	R-0603	WALSIN
L1	1		NC		
L2	1	7443340100	1μH	L-744325120	Würth Elektronik

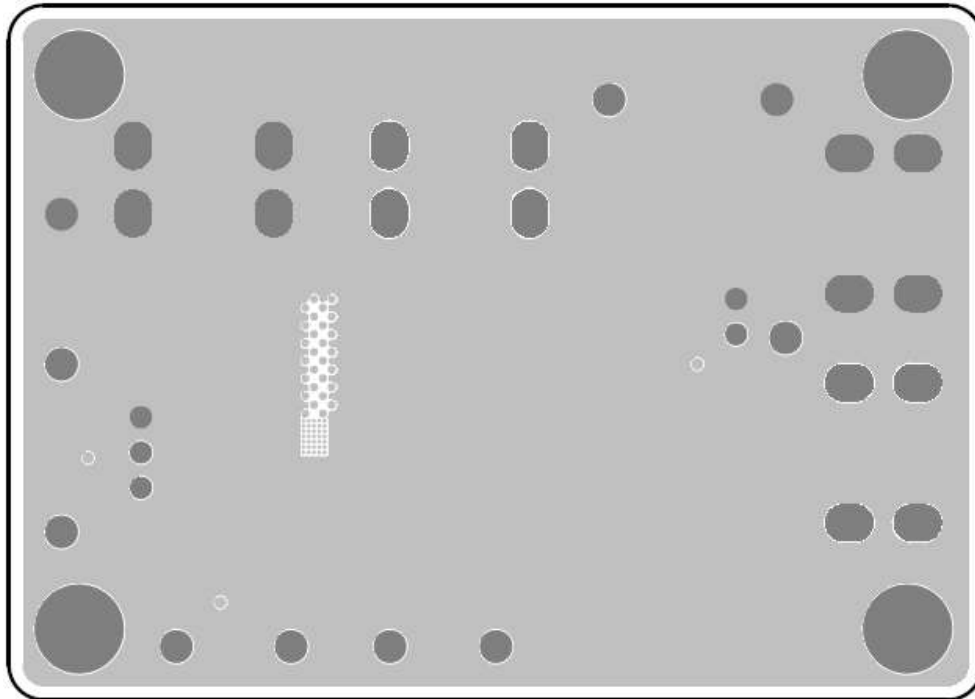
**PCB Layout**



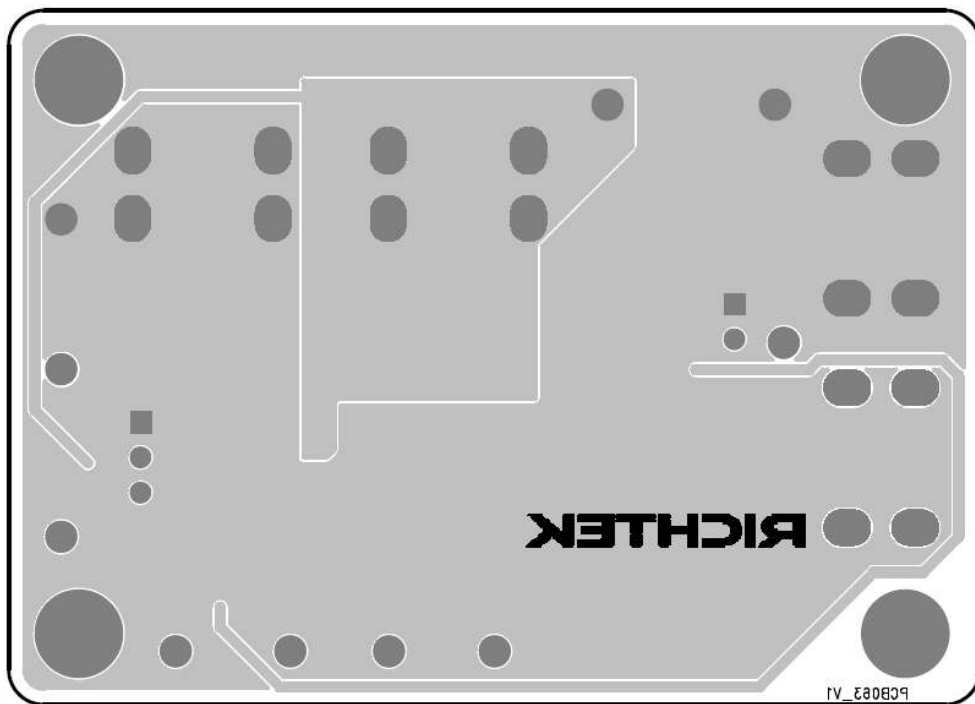
Top View (1<sup>st</sup> layer)



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



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



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

### ***More Information***

For more information, please refer to the related datasheets or application notes from Richtek website <http://www.richtek.com>.

### ***Important Notice for Richtek Evaluation Board***

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