

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

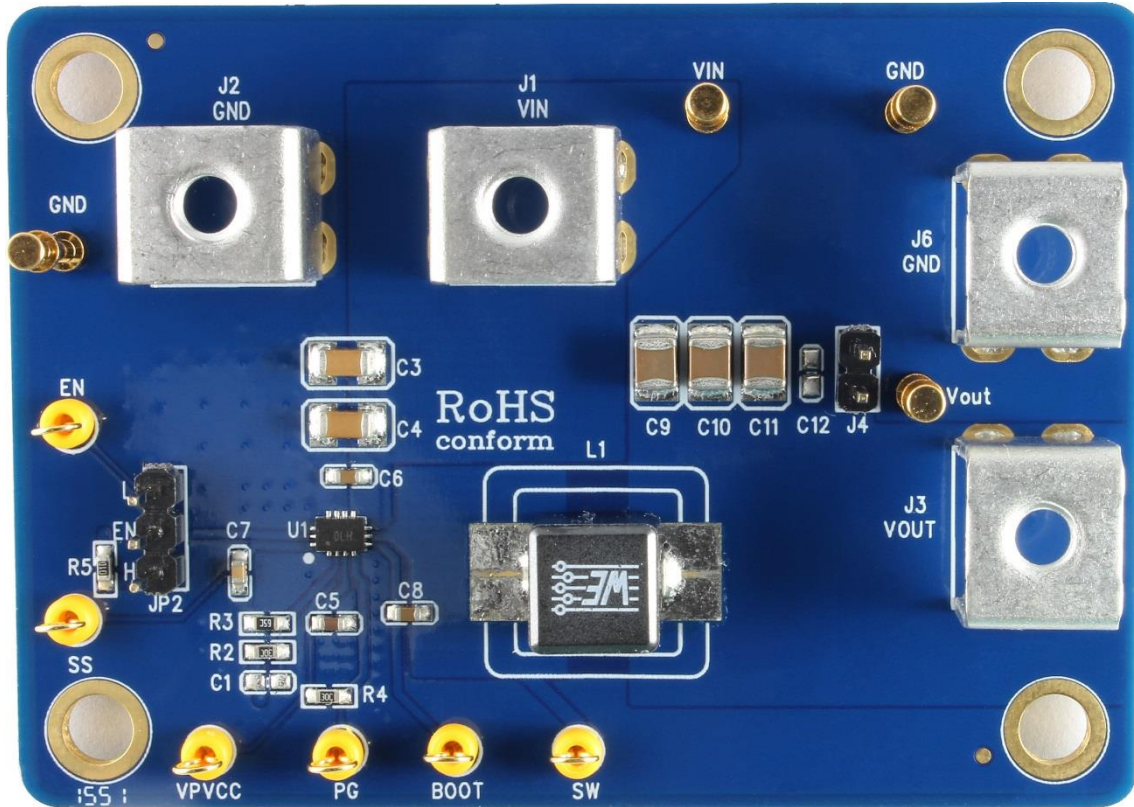
- Fast Transient Response
- Advanced Constant On-Time (ACOT™) Control
- 4.5V to 18V Input Voltage Range
- Adjustable Output Voltage from 0.7V to 8V
- 8A Output Current
- 35mΩ Internal High-Side N-MOSFET and 14mΩ Internal Low-Side N-MOSFET
- Steady 500kHz Switching Frequency
- Up to 95% Efficiency
- Optimized 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.

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 |
|-------------------------|---------------------------|--|
| VIN | 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. |
| EN | 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 μA . Attach this pin to PVCC with a 100k Ω pull-up resistor for automatic start-up. |
| GND | Ground | Ground. |
| VPVCC | Internal Regulator Output | Internal regulator output. Connect a 1 μF capacitor to GND to stabilize output voltage. |
| PG | Power Good Output | Power good indicator open-drain output. |
| BOOT | Bootstrap Supply | Connect a capacitor between the SW and BOOT pins to form a floating supply across the power switch driver. A 0.1 μF capacitor is recommended for use. |
| SW | Switch Node | Connect this pin to an external L-C filter. |
| SS | 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.

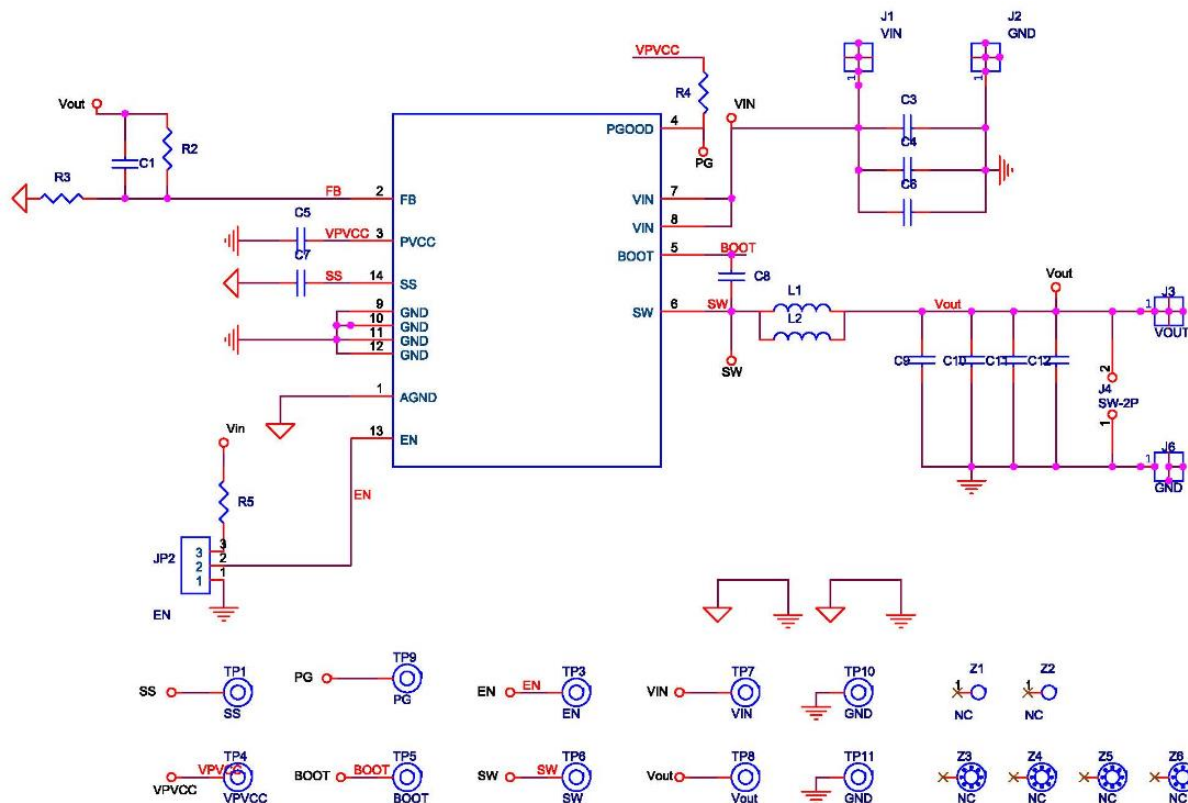
Output Voltage Setting

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

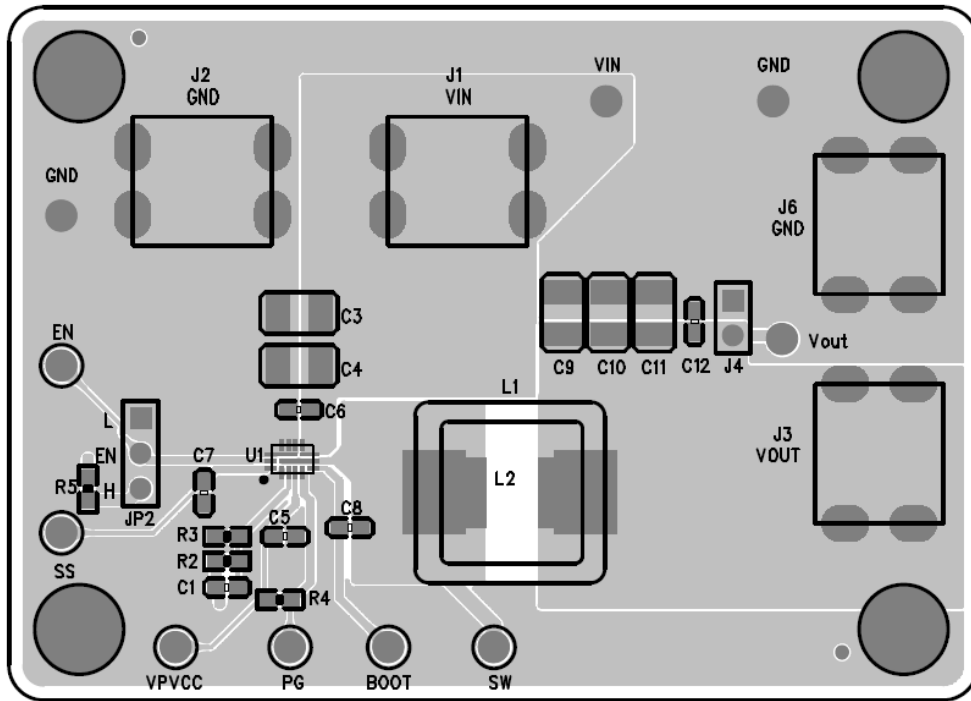
EVB Schematic Diagram



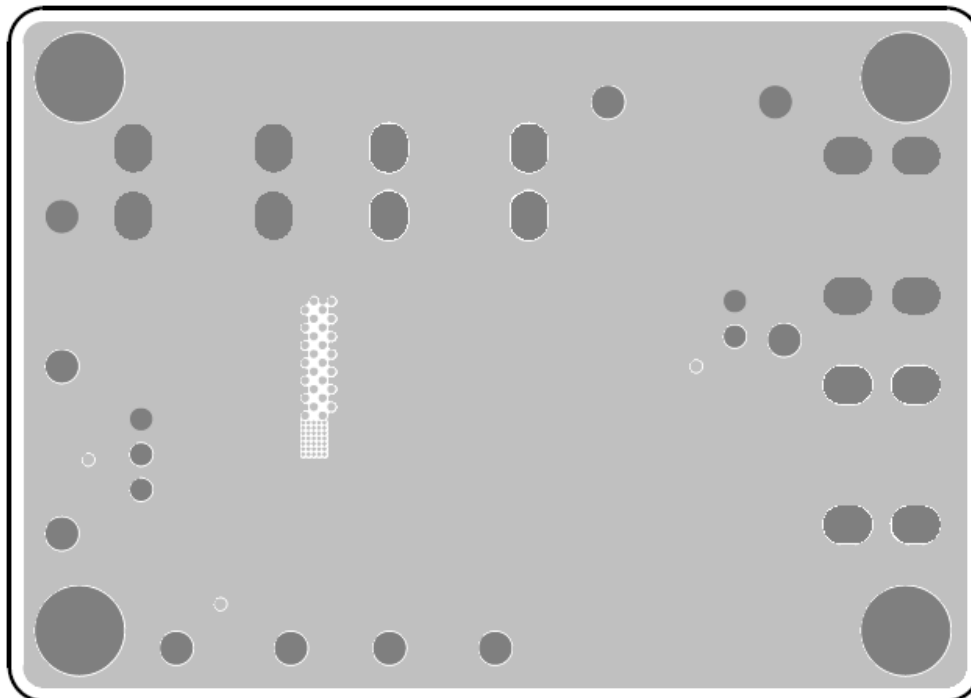
Bill of Materials

| 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 | 10 μ F/25V/X5R | C-1210 | TDK |
| C5 | 1 | C1608X5R1E105KT000E | 1 μ F/25V/X5R | C-0603 | TDK |
| C6, C8 | 2 | C1608X7R1H104KT000N | 0.1 μ F/50V/X7R | C-0603 | TDK |
| C7 | 1 | 0603B103K500 | 10nF/50V/X7R | C-0603 | WALSIN |
| C9, C10, C11 | 3 | C3225X5R1E226MT000E | 22 μ F/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 | 1 μ H | L-744325120 | Würth Elektronik |

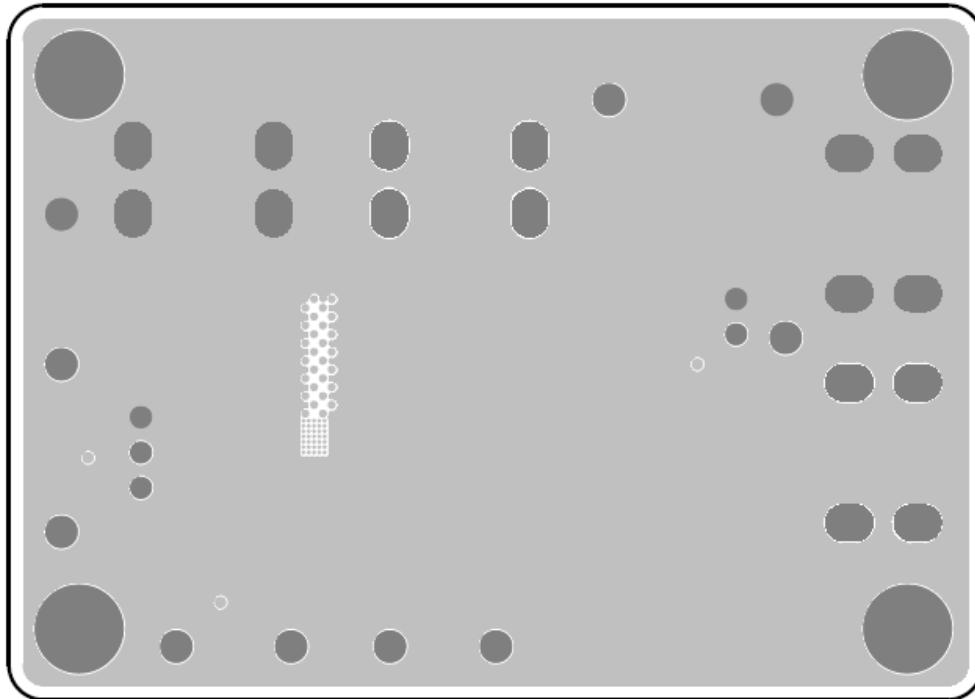
PCB Layout



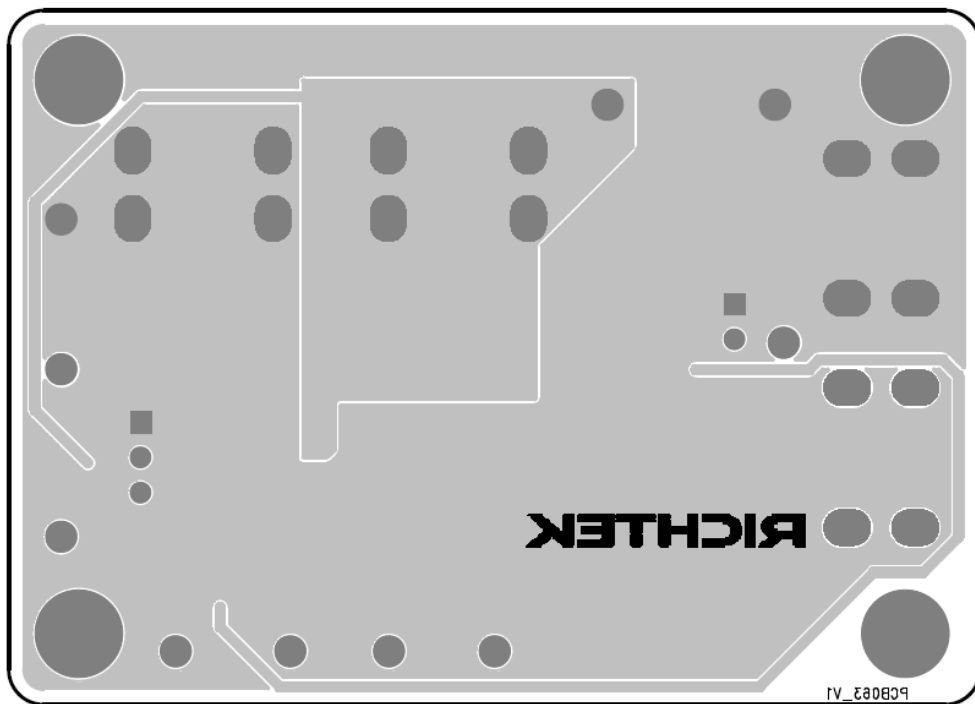
Top View (1st layer)



PCB Layout—Inner Side (2nd Layer)



PCB Layout—Inner Side (3rd Layer)



Bottom View (4th 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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