12A, 18V, 500kHz, ACOT™ Synchronous Step-Down Converter

Purpose

The RT6242A is an Advanced Constant On-Time (ACOT™) mode step-down converter with the input voltage range from 4.5V to 18V and provides 12A output current. This document explains the function and use of the RT6242A evaluation board (EVB), and provides information to enable operation, modification of the evaluation board and circuit to suit individual requirements.

Table of Contents

Introduction

General Product Information

The RT6242A is a synchronous step-down converter with Advanced Constant On-Time (ACOT™) mode control. The ACOT™ provides a very fast transient response with few external components. The low impedance internal MOSFET supports high efficiency operation with wide input voltage range from 4.5V to 18V. The proprietary circuit of the RT6242A enables to support all ceramic capacitors. The output voltage can be adjustable between 0.7V and 8V. The soft-start time is adjustable by an external capacitor.

Product Feature

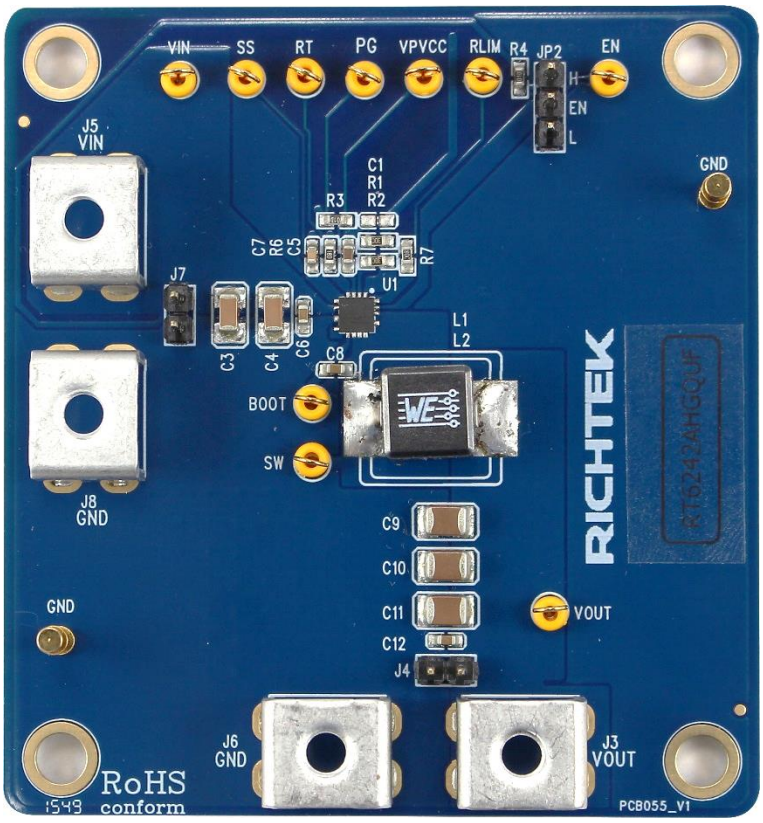
- **4.5V to 18V Input Voltage Range**
- **12A Output Current**
- **12mΩ Internal High-Side N-MOSFET and 5.4mΩ Internal Low-Side N-MOSFET**
- **Advanced Constant On-Time Control**
- **Fast Transient Response**
- **Support All Ceramic Capacitors**
- **Up to 95% Efficiency**
- **Adjustable Switching Frequency from 300kHz to 700kHz**
- **Adjustable Output Voltage from 0.7V to 8V**
- **Adjustable Soft-Start**
- **Pre-bias Start-Up**
- **Adjustable Current Limit from 6A to 16A**
- **Cycle-by-Cycle Over Current Protection**
- **Power Good Output**
- **Input Under-Voltage Lockout**
- **Hiccup Mode Under-Voltage Protection**
- **Thermal Shutdown Protection**

Key Performance Summary Table

Key Features	Evaluation Board Number : PCB055_V1
Default Input Voltage	12V
Max Output Current	12A
Default Output Voltage	1.4V
Default Marking & Package Type	RT6242AHGQUF, UQFN-16JL 3x3 (FC)
Operation Frequency	Steady 500kHz at PWM

Bench Test Setup Conditions

Headers Description and Placement



Please carefully inspect the EVB IC and external components, comparing them to the following Bill of Materials, to ensure that all components are installed and undamaged. If any components are missing or damaged during transportation, please contact the distributor or send e-mail to 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	Comment (expected waveforms or voltage levels on test points)
PVCC	Internal Regulator Output	5V bias supply output. Connect a 1µF capacitor to ground.
SS	Soft-Start Time Setting	Soft-Start Time Setting. An external capacitor should be connected between this pin and GND.
VIN	Input voltage	Power Input. The input voltage range is from 4.5V to 18V. Must bypass with a suitably large ceramic capacitor.
GND	Ground	Ground.
PG	Power Good Indicator	Power Good Indicator Open-Drain Output.
BOOT	Bootstrap supply test point	Bootstrap. This capacitor is needed to drive the power switch's gate above the supply voltage. It is connected between SW and BOOT pins to form a floating supply across the power switch driver. A 0.1µF capacitor is recommended for use.
SW	Switch node test point	Connect this pin to an external L-C filter.
EN	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 10µA.

Power-up & Measurement Procedure

1. Apply a 12V nominal input power supply (4.5V < V_{IN} < 18V) to the VIN and GND terminals.
2. Set the jumper at JP2 to connect terminals 2 and 3, connecting EN to VIN through resistor R4, to enable operation.
3. Verify the output voltage (approximately 1.4V) between VOUT and GND.
4. Connect an external load up to 12A to the VOUT and GND terminals and verify the output voltage and current.

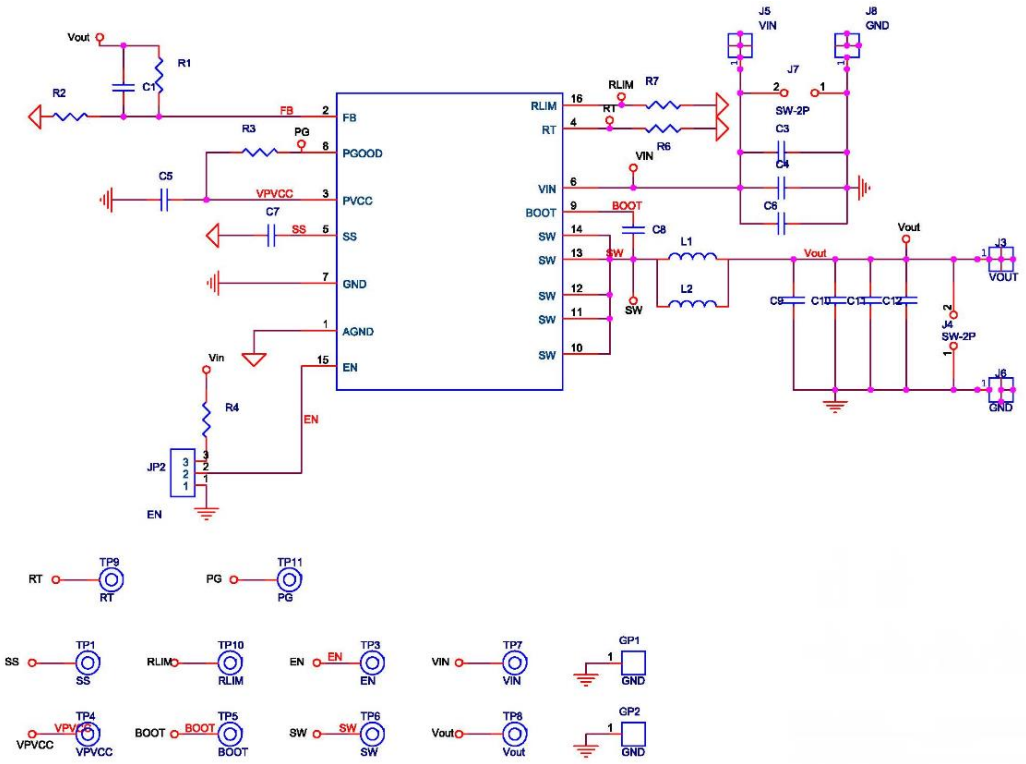
Output Voltage Setting

Set the output voltage with the resistive divider (R1, R2) between VOUT and GND with the midpoint connected to FB. The output is set by the following formula :

$$V_{OUT} = V_{FB} \times \left(1 + \frac{R1}{R2}\right)$$

Schematic, Bill of Materials & Board Layout

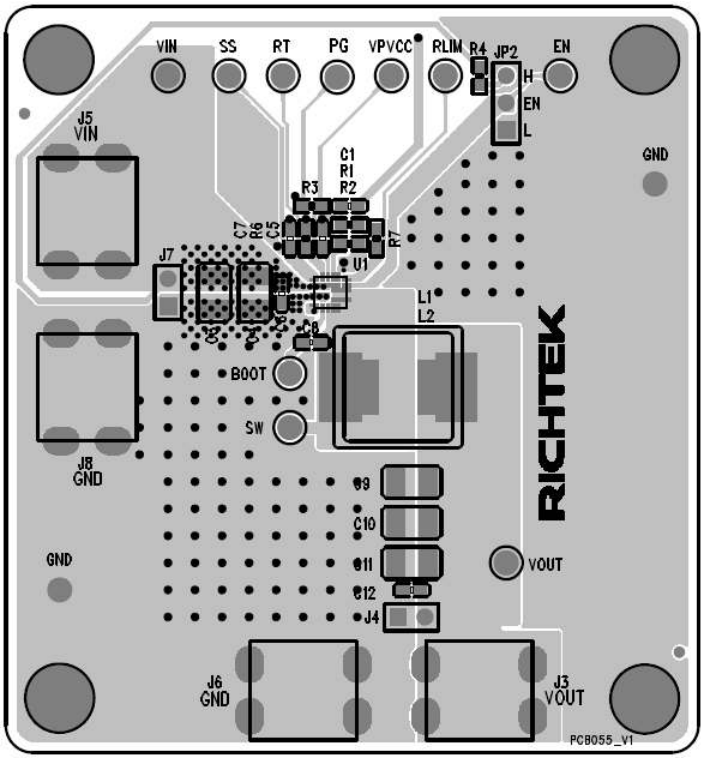
EVB Schematic Diagram



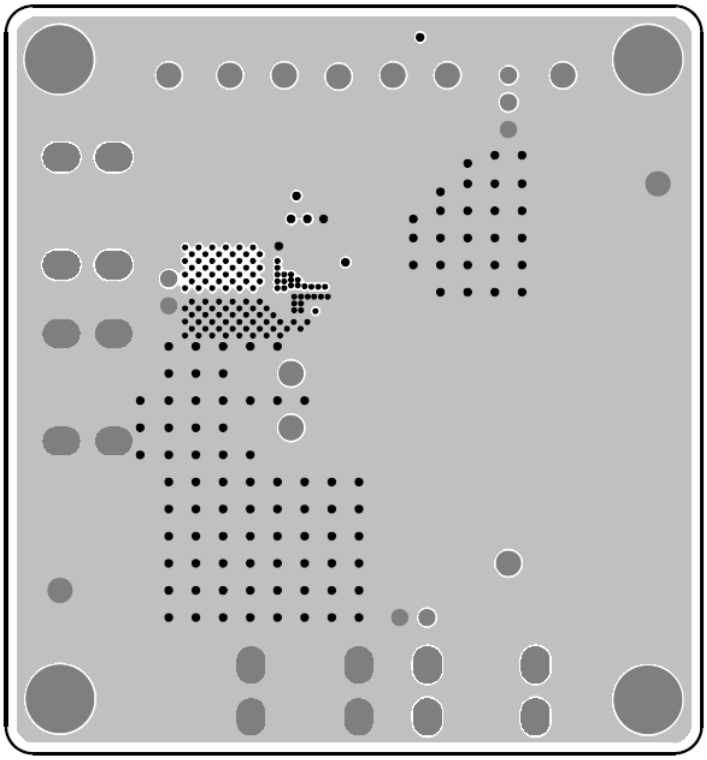
Bill of Materials

Reference	Qty	Part Number	Description	Package	Manufacture
U1	1	RT6242AHGQUF	DC/DC Converter	UQFN-16JL 3x3 (FC)	RICHTEK
C1	1		NA	C-0603	
C3, C4	2	UMK325BJ106MM	10µF/50V/X5R/1210	C-1210	TAIYO YUDEN
C5	1	C1608X5R1E105KT000E	1µF/25V/X5R/0603	C-0603	TDK
C6, C8, C12	3	C1608X7R1H104KT000N	0.1µF/50V/X7R/0603	C-0603	TDK
C7	1	0603B103K500	10nF/50V/X7R/0603	C-0603	WALSIN
C9	1	C3225X5R1E226MT	22µF/25V/X5R/1210	C-1210	TDK
C10, C11	2	C3225X5R1E226MT	22µF/25V/X5R/1210	C-1210	TDK
L1	1	7443340100	1.0µH/17A	8.4 x 7.9 x 7.2mm	Wurth Elektronik
L2	1		NA		
R1, R2	2		20k	R-0603	
R6	1		150k	R-0603	
R7	1		66k	R-0603	
R3, R4	2		100k	R-0603	

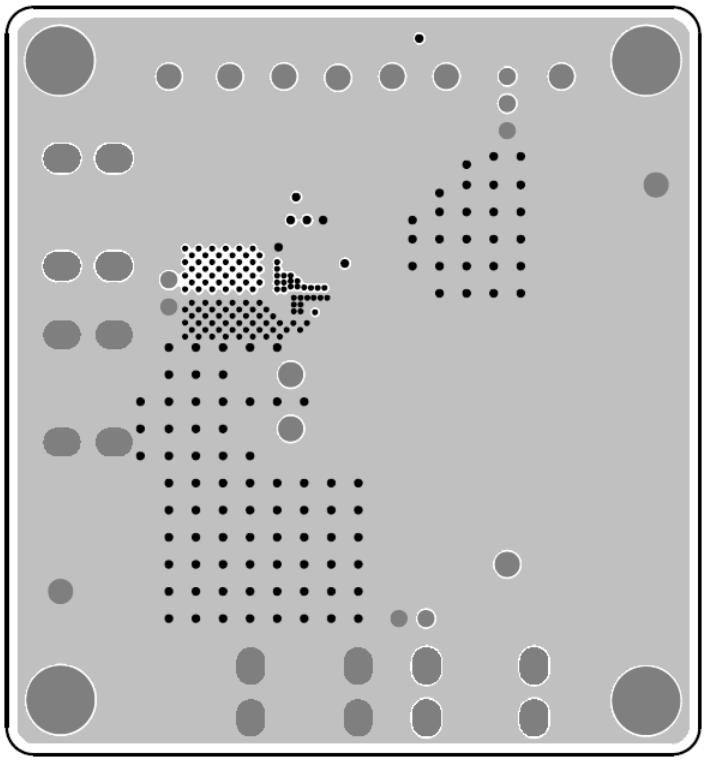
PCB Layout



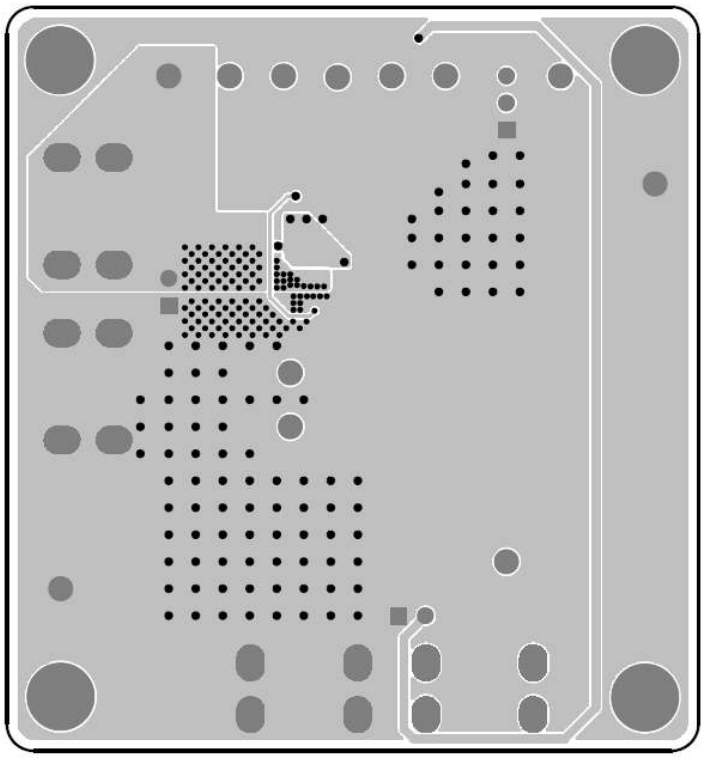
Top View (1st layer)



PCB Layout—Inner Side (2nd Layer)



PCB Layout—Inner Side (3rd Layer)



Bottom View (4th Layer)

More Information

For more information, please find the related datasheet or application notes from Richtek website http://www.richtek.com.

Important Notice for Richtek Evaluation Board