

## **3A, 18V, 650kHz, ACOT™ Synchronous Step-Down Converter**

### ***Purpose***

The RT2859BH are high-performance 650kHz 3A step-down regulators with internal power switches and synchronous rectifiers. This document explains the function and use of the RT2859BH 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 RT2859BH are high-performance 650kHz 3A step-down regulators with internal power switches and synchronous rectifiers. The feature quick transient response using Advanced Constant On-Time (ACOT™) control architecture that provides stable operation with small ceramic output capacitors and without complicated external compensation, among other benefits. The input voltage range is from 4.5V to 18V and the output is adjustable from 0.765V to 7V. The proprietary ACOT™ control improves upon other fast response constant on-time architectures, achieving nearly constant switching frequency over line, load, and output voltage ranges. Since there is no internal clock, response to transients is nearly instantaneous and inductor current can ramp quickly to maintain output regulation without large bulk output capacitance. The RT2859BH are stable with and optimized for ceramic output capacitors. With internal 70mΩ switches and 70mΩ synchronous rectifiers, the RT2859BH display excellent efficiency and good behavior across a range of applications, especially for low output voltages and low duty cycles. Cycle-by-cycle current limit, input under-voltage lock-out, externally adjustable soft-start, output under- and over-voltage protection, and thermal shutdown provide safe and smooth operation in all operating conditions. The RT2859BH is available in WQFN-16L 3x3 package, with exposed thermal pads.

### Product Feature

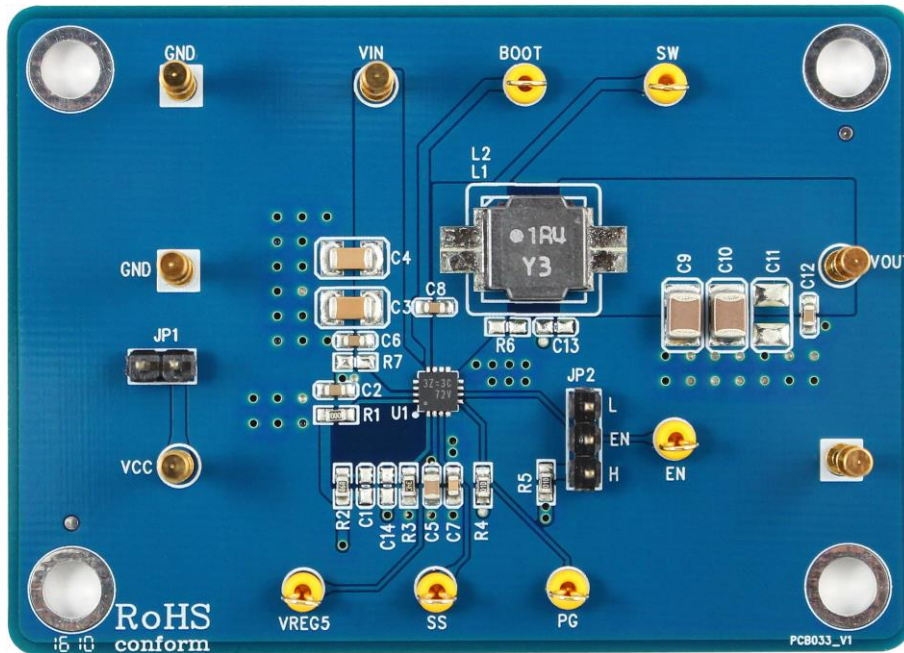
- Fast Transient Response
- Steady 650kHz Switching Frequency at all Load Current
- 3A Output Current
- Advanced Constant On-Time (ACOT™) Control
- Optimized for Ceramic Output Capacitors
- 4.5V to 18V Input Voltage Range
- Internal 70mΩ Switch and 70mΩ Synchronous Rectifier
- 0.765V to 7V Adjustable Output Voltage
- Externally-adjustable, Pre-biased Compatible Soft-Start
- Cycle-by-Cycle Current Limit
- Optional Output Discharge Function
- With Hiccup Mode Output Over- and Under-voltage Shut-down protection
- Input Under-Voltage Lockout
- Thermal Shutdown

### Key Performance Summary Table

Key Features	Evaluation Board Number : PCB033_V1
Input Voltage Range	4.5V to 18V
Max Output Current	3A
Default Output Voltage	1.05V
Default Marking & Package Type	RT2859BHGQW, WQFN-16L 3x3
Operation Frequency	Fixed 650kHz

**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](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	Comment (expected waveforms or voltage levels on test points)
<b>VIN</b>	Input voltage	Power input.
<b>EN</b>	Enable test point	Externally pulled high to enable and pulled low to disable this chip. It is internally pulled up to high when the pin is floating.
<b>GND</b>	Ground	The exposed pad must be soldered to a large PCB and connected to GND for maximum power dissipation.
<b>VREG5</b>	Internal Regulator Output	Internal Regulator Output. Connect a 1 $\mu$ F capacitor to GND to stabilize output voltage.
<b>SS</b>	Soft-Start Control	Connect an external capacitor between this pin and GND to set the soft-start time.
<b>PG</b>	Power good test point	Output of power good indicator.
<b>BOOT</b>	Bootstrap supply test point	Bootstrap supply for High-Side gate driver. Connect a capacitor between the BOOT and SW pins.
<b>SW</b>	Switch node test point	Connect this pin to an external L-C filter.

### ***Power-up & Measurement Procedure***

1. Apply a 12V nominal input power supply ( $4.5 < V_{IN} < 18V$ ) to the VIN and GND terminals.
2. Set the jumper at JP2 to connect terminals 2 and 3, connecting EN to enable operation.
3. Set the jumper at JP1 to connect terminals 1 and 2, power VCC pin by VIN voltage source.
4. Verify the output voltage (approximately 1.05V) between VOUT and GND.
5. Connect an external load up to 3A to the VOUT and GND terminals and verify the output voltage and current.

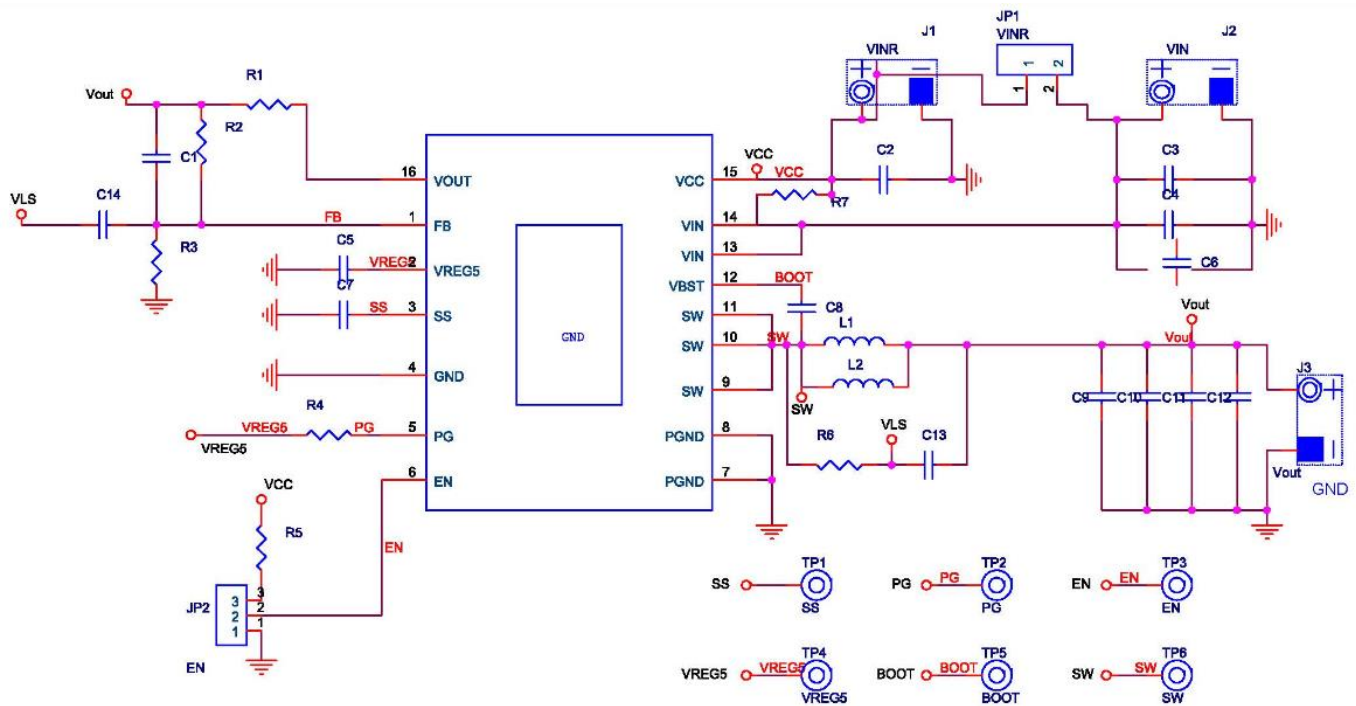
### ***Output Voltage Setting***

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 :

$$V_{OUT} = 0.765 \times \left( 1 + \frac{R_2}{R_3} \right)$$

### Schematic, Bill of Materials & Board Layout

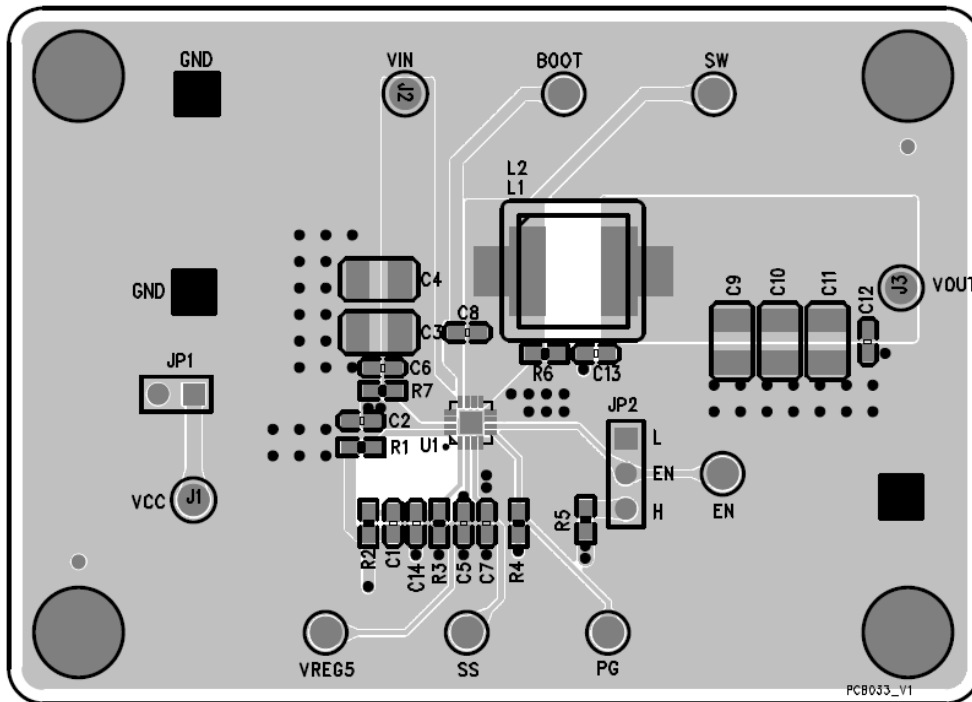
#### EVB Schematic Diagram



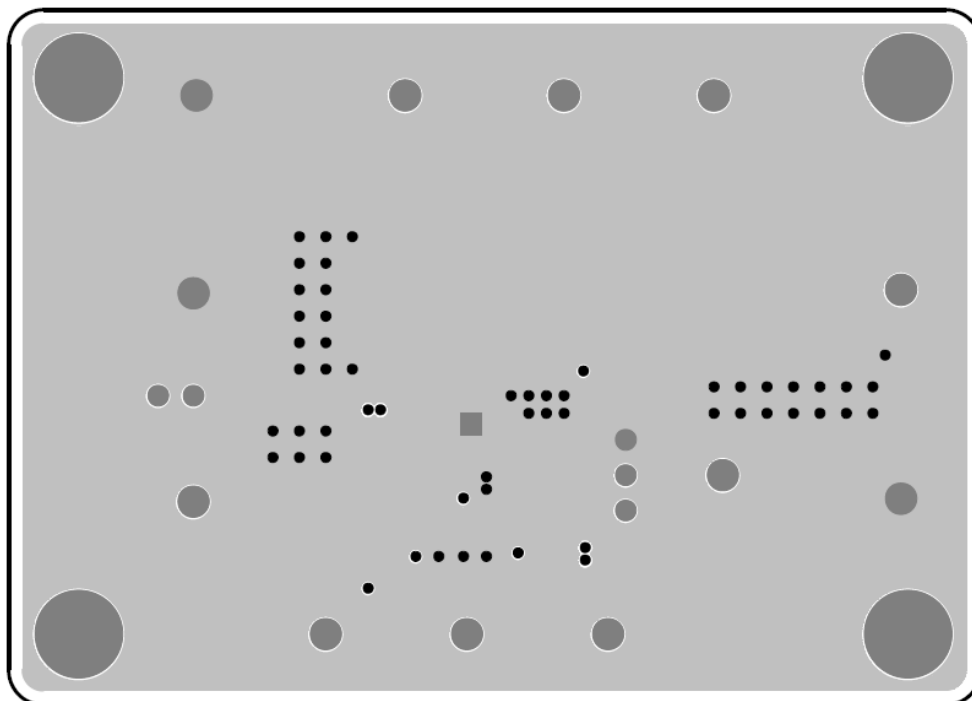
#### Bill of Materials

Reference	Qty	Part Number	Description	Package	Manufacture
U1	1	RT2859BHGQW	DC/DC Converter	WQFN-16L 3x3	RICHTEK
C2, C6, C8, C12	4	C1608X7R1H104KT000N	0.1 $\mu$ F/50V/X7R	C-0603	TDK
C3, C4	2	GRM31CR71E106KA12L	10 $\mu$ F/25V/X7R	C-1206	MURATA
C5	1	C2012X7R1H105KT	1 $\mu$ F/50V/X7R	C-0805	TDK
C7	1	0603B332K500	3.3nF/50V/X7R	C-0603	WALSIN
C9,C10	2	C3225X5R1E226MT	22 $\mu$ F/25V/X7R	C-1210	TDK
C1, C11, C13, C14, R6, R7	6		NA		
L1	1	NR8040T1R4N	1.4 $\mu$ H/7A	8 x 8 x 4 mm	TAIYO YUDEN
R1	1	0603 JUMP	0 $\Omega$	R-0603	WALSIN
R2	1	0603 8K25 1%	8.25k	R-0603	WALSIN
R3	1	0603 22K1 1%	22.1k	R-0603	WALSIN
R4, R5	2	0603 100K 1%	100k	R-0603	WALSIN

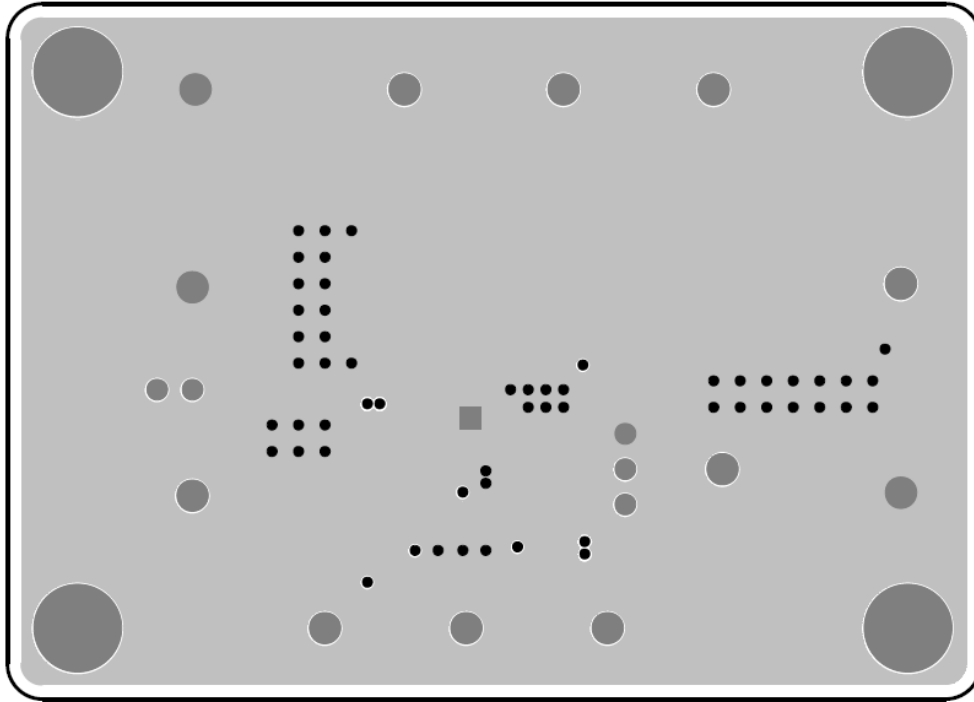
**PCB Layout**



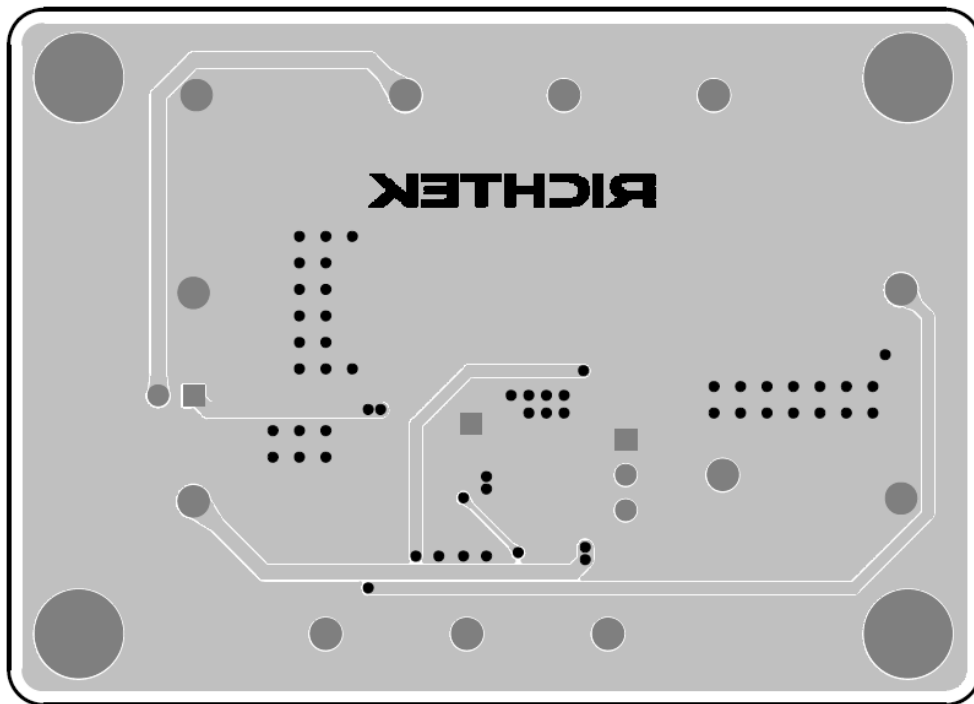
Top View (1<sup>st</sup> layer)



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 find the related datasheet or application notes from Richtek website <http://www.richtek.com>.

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

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