

## **RT6278BHGQUF Step-Down Converter Evaluation Board**

### ***Purpose***

The RT6278B is an advanced constant on-time (ACOT<sup>®</sup>) mode synchronous buck converter with the input voltage range from 4.5V to 23V and provides 8A output current. This document explains the function and use of the RT6278B 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 RT6278B is an advanced constant on-time (ACOT<sup>®</sup>) mode synchronous buck converter. The main control loop of the RT6278B using an advanced constant on-time (ACOT<sup>®</sup>) mode control which provides a very fast transient response. The RT6278B operates from 4.5V to 23V input voltage, the output voltage can be programmed between 0.6V to 5.1V.

### Product Feature

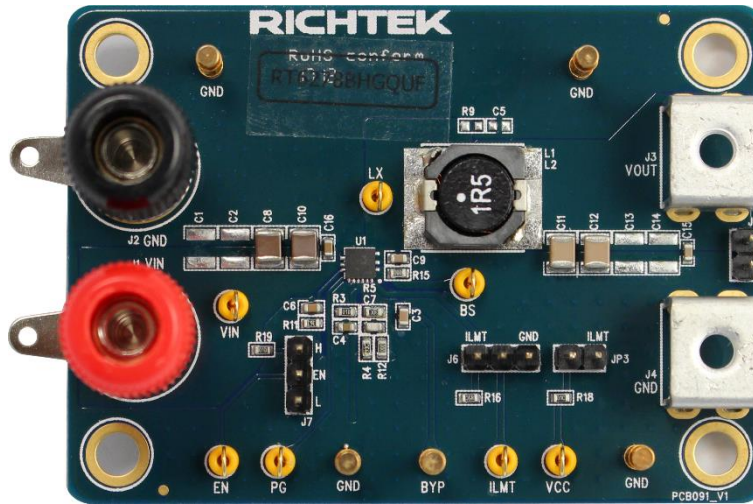
- Input Voltage Range : 4.5V to 23V
- 8A Output Current
- ACOT<sup>®</sup> Mode Performs Fast Transient Response
- ACOT<sup>®</sup> Architecture to Enable All MLCC Output Capacitor Usage
- Fixed 500kHz Switching Frequency
- High Efficient Internal Power MOSFET Switch 24m $\Omega$  (High-Side) and 12m $\Omega$  (Low-Side)
- Adjustable Output Voltage from 0.6V to 5.1V
- Pre-biased Soft-Start
- Cycle-by-Cycle Over-Current Protection
- Input Under-Voltage Lockout
- Thermal Shutdown Protection
- Output Over/Under-Voltage Protection

### Key Performance Summary Table

Key Features	Evaluation Board Number: PCB091_V1
Default Input Voltage	12V
Max Output Current	8A
Default Output Voltage	3.3V
Default Marking & Package Type	RT6278BHGQUF, UQFN-12HL 3x3 (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	Comment (expected waveforms or voltage levels on test points)
VIN	Input voltage	Power input. Support 4.5V to 23V Input Voltage. Must bypass with a suitable large ceramic capacitor at this pin.
EN	Enable test point	Enable control. Pull this pin high to turn on the Buck. Do not leave this pin floating.
GND	Ground	Ground.
PGOOD	Power good test point	Power good Indicator. Open drain output when the output voltage is within 90% to 120% of regulation point.
FB	Feedback voltage input	The pin is used to set the output voltage of the converter to regulate to the desired voltage via a resistive divider. Feedback reference = 0.6V.
VCC	Internal regulator output	5V linear regulator Output for Internal Control Circuit. A capacitor (typical 1 $\mu$ F) should be connected to AGND. Don't connect to external Load.
BOOT	Bootstrap supply test point	Bootstrap supply for high-side gate driver. Connect a 0.1 $\mu$ F ceramic capacitor between the BOOT and SW pins.
LX	Switch node test point	Connect this pin to an external L-C filter.
BYP	Bypass test point	Bypass input for the internal LDO. BYP is externally connected to the output of switching regulator. When the BYP voltage rises above the bypass switch turn-on threshold, the LDO regulator shuts down and the VCC pin is connected to the BYP pin through an internal switch.
ILIMIT	Current limit setting	Current limit setting pin. The current limit is set to 8A, 10A or 12A when this pin is pull low, floating or pull high respectively.

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

1. Connect input power ( $4.5V < V_{IN} < 23V$ ) and input ground to VIN and GND test pins respectively.
2. Connect positive end and negative terminals of load to VOUT and GND test pins respectively.
3. Set the jumper at J7 to connect terminals 2 and 3, connecting EN to VIN through resistor REN, to enable operation.
4. Verify the output voltage (approximately 3.3V) between VOUT and GND.
5. Connect an external load up to 8A to the VOUT and GND terminals and verify the output voltage and current.

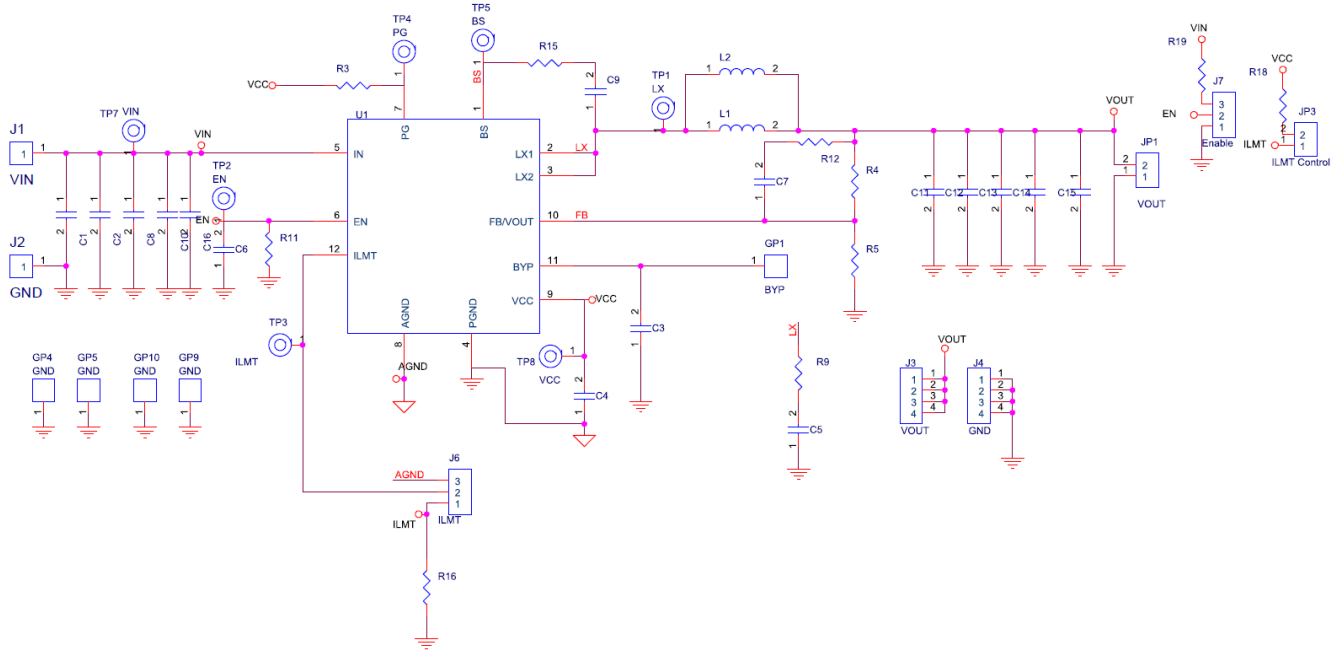
### ***Output Voltage Setting***

Set the output voltage with the resistive divider (R4, R5) between VOUT and GND with the midpoint connected to FB. The output is set by the following formula:

$$V_{OUT} = V_{FB} \times \left(1 + \frac{R4}{R5}\right)$$

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

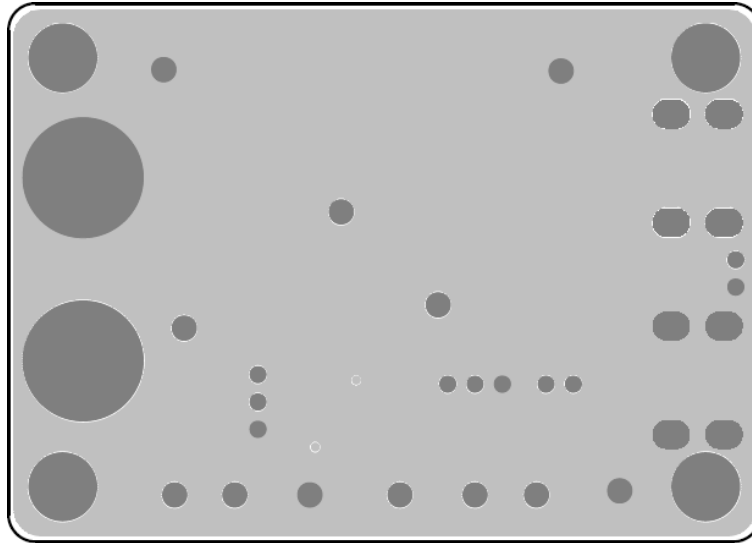
**EVB Schematic Diagram**



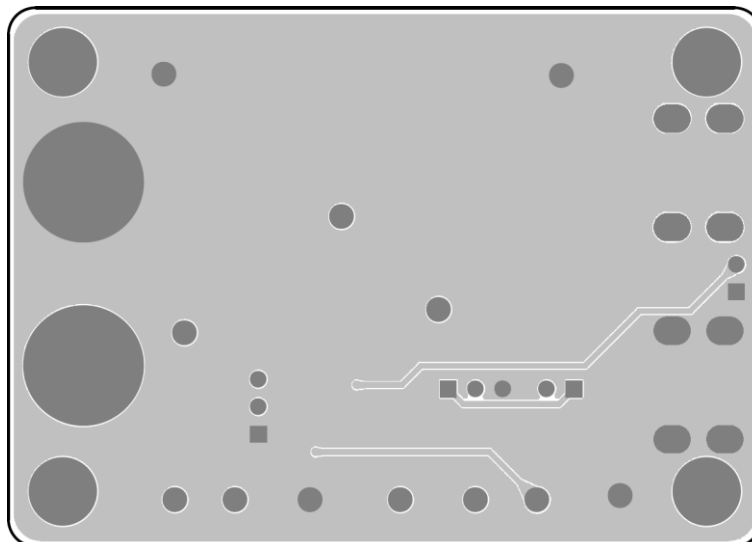
**Bill of Materials**

Reference	Qty	Part Number	Description	Package	Manufacturer
U1	1	RT6278BHGQUF	DC-DC Converter	UQFN-12HL 3x3	RICHTEK
C3	1	C1608X5R0J475KT	4.7μF/6.3V/0603	C-0603	TDK
C4	1	C1608X5R1E105KT000E	1μF/25V/X5R/0603	C-0603	TDK
C6, C9, C15, C16	4	C1608X7R1H104KT000N	0.1μF/50V/X7R/0603	C-0603	TDK
C7	1	0603N680J500	68pF/50V/NPO/0603	C-0603	WALSIN
C8, C10	2	UMK325BJ106MM	10μF/50V/X5R/1210	C-1210	TAIYO YUDEN
C11, C12	2	C3225X5R1E226MT	22μF/25V/X5R/1210	C-1210	TDK
L1	1	7447714015	1.5μH	L-NR8040_2	WE
R3, R19	2	WR06X1003FTL	100k/0603	R-0603	WALSIN
R4	1	RTT039092FTP	90.9k/0603	R-0603	WALSIN
R5	1	WR06X2002FTL	20k/0603	R-0603	WALSIN
R11	1	WR06X3602FTL	36k/0603	R-0603	WALSIN
R12, R15	2	WR06X000PTL	0R/0603	R-0603	WALSIN
R16	1	WR06X7502FTL	75k/0603	R-0603	WALSIN
R18	1	WR06X1002FTL	10k/0603	R-0603	WALSIN





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



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