

## RT4813 High Efficiency Boost Converter

### *Purpose*

The RT4813 is a Boost converter with the input voltage range from 1.8V to 5.5V and provide an average output current limit range from 0.55A to 3.1A. This document explains the function and use of the RT4813 evaluation board (EVB), and provides information to enable operation, output voltage setting of the evaluation board.

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## Introduction

### General Product Information

The RT4813 allows systems to take advantage of new battery chemistries that can supply significant energy when the battery voltage is lower than the required voltage for system power ICs. By combining built-in power transistors, synchronous rectification, and low supply current; this IC provides a compact solution for systems using advanced Li-Ion battery chemistries.

The RT4813 is a boost regulator designed to provide a minimum output voltage from a single-cell Li-Ion battery, even when the battery voltage is below system minimum. In boost mode, output voltage regulation is guaranteed to a maximum load current of 3.1A. Quiescent current in Shutdown Mode is less than 1 $\mu$ A, which maximizes battery life.

### Product Feature

- CMCOT Topology and Small Output Ripple when VIN Close VOUT Voltage
- Operates from a Single Li-ion Cell : 1.8V to 5.5V
- Adjustable Output Voltage : 1.8V to 5.5V
- PSM Operation
- Up to 96% Efficiency
- Input Over Current Limit
- Input/Output Over Voltage Protection
- Programmable Average Output Current Limit Range : 3100mA to 550mA
- Internal Compensation
- Output Discharge
- Output Short Protection
- True Load Disconnect

### Key Performance Summary Table

Key Features	Evaluation Board Number: PCB090_V1
Default Input Voltage	3.6V
Max Output Current	3.1A
Default Output Voltage	V <sub>OUT</sub> = 5V
Default Marking & Package Type	RT4813GQUF, UQFN-9L 2x2 (FC)

## 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)
<b>VIN</b>	Input voltage	Input voltage with range 1.8V to 5.5V.
<b>EN</b>	VOUT Enable	Enable control pin for VOUT.
<b>SW</b>	Switching Node	Switching Node.
<b>PGND/GND</b>	Ground	Ground.
<b>SDA/SCL</b>	I2C Control	Pins to set functions such as ILIM_OFF / IPCHG.
<b>VOUT</b>	Output Voltage	Default voltage : 5V $\pm$ 1%.
<b>FB</b>	Feedback Voltage	Default voltage : 0.5V $\pm$ 1%.

**Power-up & Measurement Procedure**

1. Connect input voltage ( $1.8V < V_{IN} < 5.5V$ ).
2. To use a jumper at “H” option to tie EN pin to input voltage  $V_{IN}$  via JP1 or external voltage for enabling the device. Inversely, to use a jumper at “L” option to tie EN pin to ground GND for disabling the device.
3. To verify the output voltage  $V_{OUT}$  via the dividing resistors.
4. To connect an external load up to 1A and verify the output voltage and current.

**I2C Register Setting**

The register as the table shown can be programmed by a MCU through the dedicated I2C interface. The device slave address is 0x39.

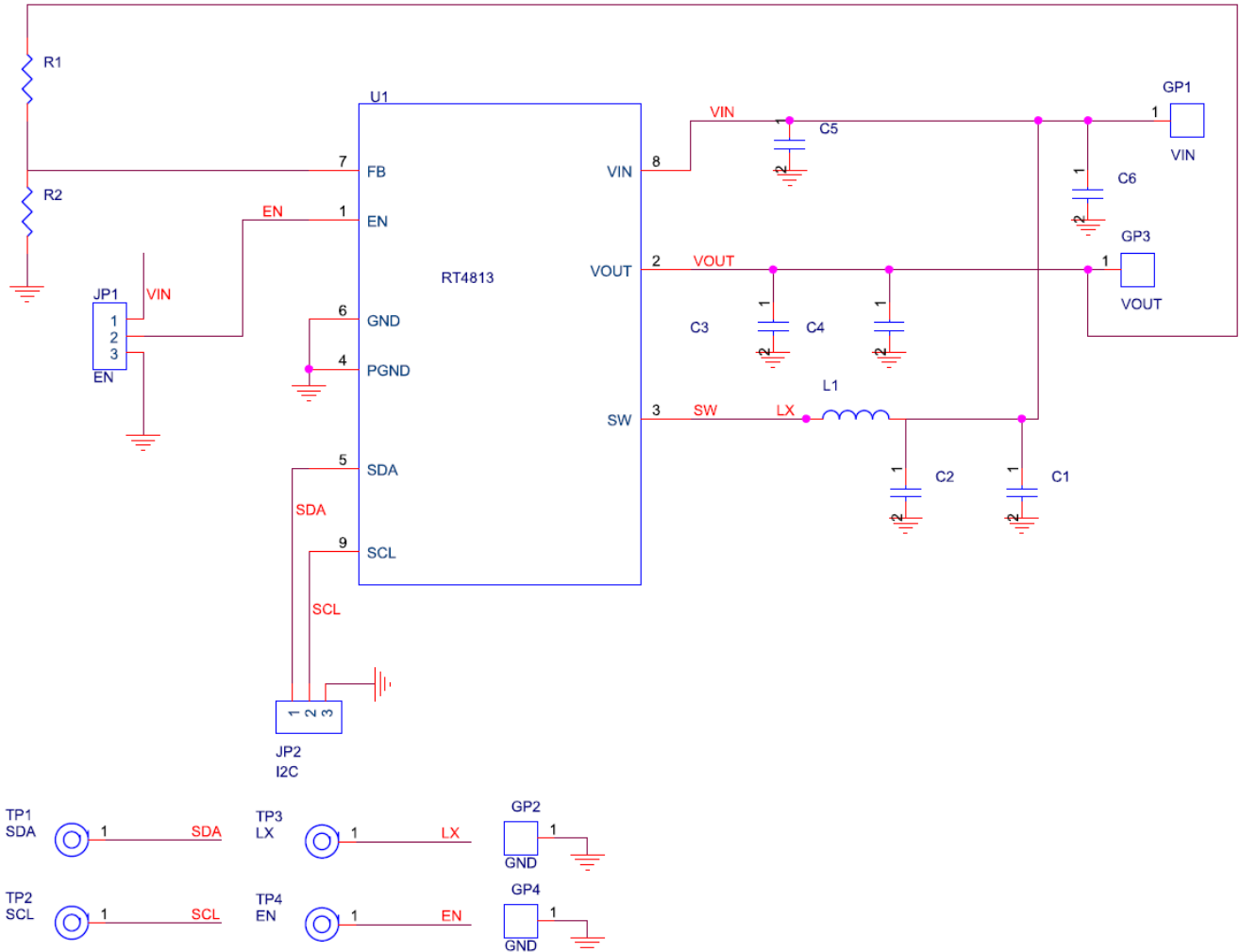
Function	Register Address		b[7] (MSB)	b[6]	b[5]	b[4]	b[3]	b[2]	b[1]	b[0] (LSB)
Config	0X01	Meaning	Reversed	ILIM_OFF	IPCHG		DRV_SEL<2:0>			SSFM
		Default	0	0	0	1	1	1	1	0
		Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W
ILIM_OFF		Boost valley current limit setting 0 : Boost current limit enable (default) 1 : Boost current limit disable								
IPCHG		Pre-charge current setting. 00 : 0.5A 01 : 1A (default) 10 : 1.5A 11 : 2A								
DRV_SEL<2:0>		LG driver driving capability 000 : Slowest : : : 111 : Fastest (default)								
SSFM		Spread spectrum setting. 0 : Spread spectrum disable (default) 1 : Spread spectrum enable								

Function	Register Address	b[7] (MSB)	b[6]	b[5]	b[4]	b[3]	b[2]	b[1]	b[0] (LSB)	
Charger Control 3	0X03	Meaning	ILIM_SS<7:4>				ILIM_AVG<3:0>			
		Default	0	0	0	0	0	0	0	0
		Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W
ILIM_SS<7:4>	Soft-start period boost current limit setting. The default current is 1500mA.									
	Code	Current	Code	Current	Code	Current	Code	Current	Code	
	0000	1500mA (default)	0100	1500mA	1000	2500mA	1100	4500mA		
	0001	1500mA	0101	1500mA	1001	3000mA	1101	5000mA		
	0010	1500mA	0110	1500mA	1010	3500mA	1110	5500mA		
	0011	1500mA	0111	2000mA	1011	4000mA	1111	6000mA		
ILIM_AVG<3:0>	Average Output Current limit setting. The default current is 3000mA.									
	Code	Current	Code	Current	Code	Current	Code	Current	Code	
	0000	3100mA (Default)	0100	2420mA	1000	1740mA	1100	1060mA		
	0001	2930mA	0101	2250mA	1001	1570mA	1101	890mA		
	0010	2760mA	0110	2080mA	1010	1400mA	1110	720mA		
	0011	2590mA	0111	1910mA	1011	1230mA	1111	550mA		

Function	Register Address	b[7] (MSB)	b[6]	b[5]	b[4]	b[3]	b[2]	b[1]	b[0] (LSB)	
OPTION	0X04	Meaning	Reversed	Reversed	Reversed	Reversed	FSW		EN_IavgCL	EN_Discharge
		Default	0	0	0	0	1	1	1	1
		Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W
FSW	Boost frequency setting. 00 : 2MHz 01 : Do not allowed 10 : 1MHz 11 : 500kHz (default)									
EN_IavgCL	Enable average output current limit 0 : Disable 1 : Enable (default)									
EN_Discharge	Enable discharge 0 : Disable 1 : Enable (default)									

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

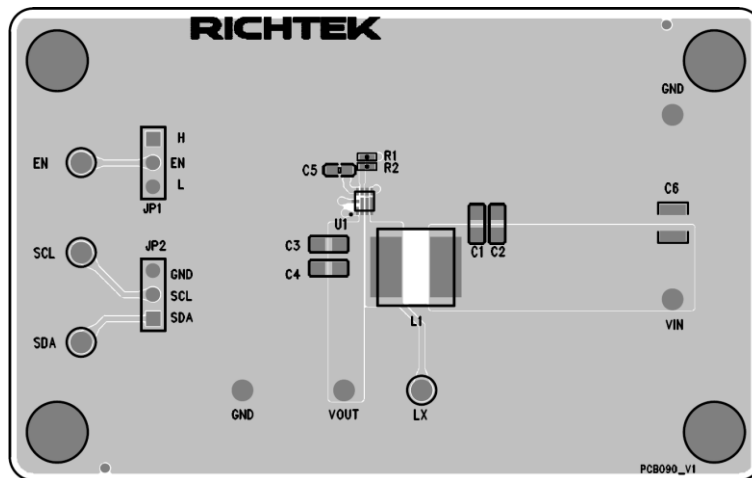
**EVB Schematic Diagram**



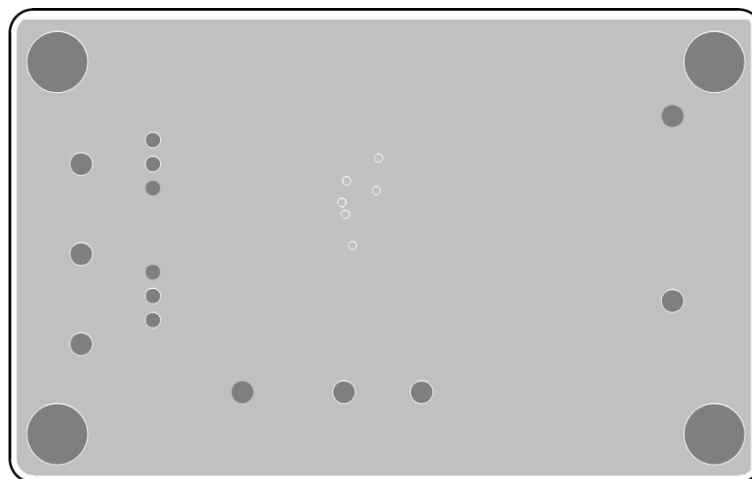
**Bill of Materials**

Reference	Qty	Part number	Description	Package	Manufacture
U1	1	RT4813GQUF	Boost Converter	UQFN-9L 2x2 (FC)	Richtek
C1, C2, C3, C4	4	GRM21BR61A226ME51	22 $\mu$ F/10V/X7R/0805	C-0805	Murata
C5	1	GRM185R61C105KE44D	1 $\mu$ F/16V/X5R/0603	C-0603	Murata
C6	1	GRM32ER61A107ME20L	100 $\mu$ F/10V/X5R/1210	C-1210	Murata
L1	1	SPM6530T-1R5M100	1.5 $\mu$ H	L-SH8018	TDK
R1	1	PFR059093FNH	909K/0402/1%	R-0402	乾坤
R2	1	PFR05104FNH	100K/0402/1%	R-0402	乾坤

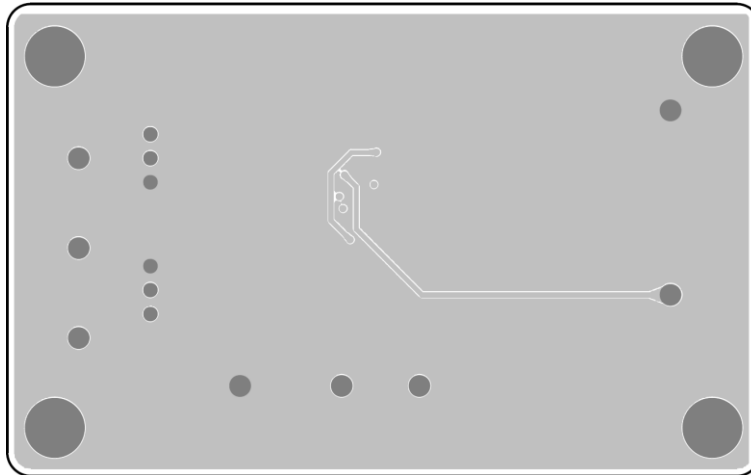
**PCB Layout**



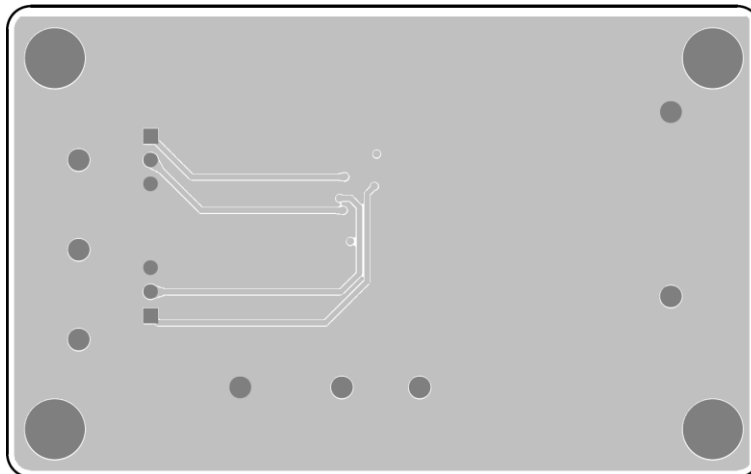
Top View (1<sup>st</sup> layer)



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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