

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 μ 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 _{OUT} = 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.

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 | Input voltage with range 1.8V to 5.5V. |
| EN | VOUT Enable | Enable control pin for VOUT. |
| SW | Switching Node | Switching Node. |
| PGND/GND | Ground | Ground. |
| SDA/SCL | I2C Control | Pins to set functions such as ILIM_OFF / IPCHG. |
| VOUT | Output Voltage | Default voltage : 5V ± 1%. |
| FB | Feedback Voltage | Default voltage : 0.5V ± 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.

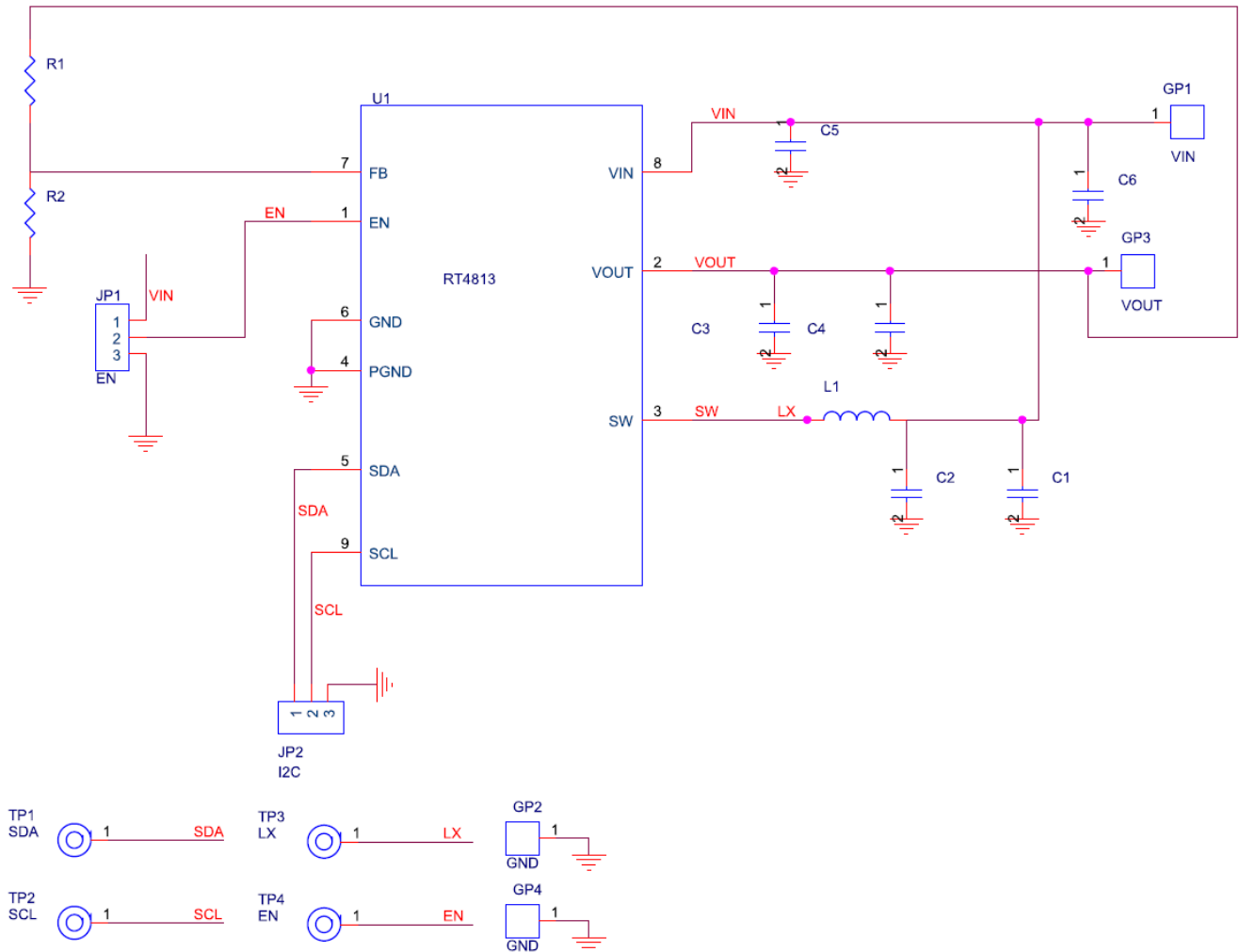
| Function | Register Address | | b[7] (MSB) | b[6] | b[5] | b[4] | b[3] | b[2] | b[1] | b[0] (LSB) |
|--------------|------------------|---|---------------|----------|-------|------|--------------|------|------|---------------|
| Config | 0X01 | Meaning | Reversed | ILIM_OFF | IPCHG | | DRV_SEL<2:0> | | | 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 | Current |
| | 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 | | |
| ILIM_AVG<3:0> | Average Output Current limit setting. The default current is 3000mA. | | | | | | | | | |
| | Code | Current | Code | Current | Code | Current | Code | Current | Code | Current |
| | 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

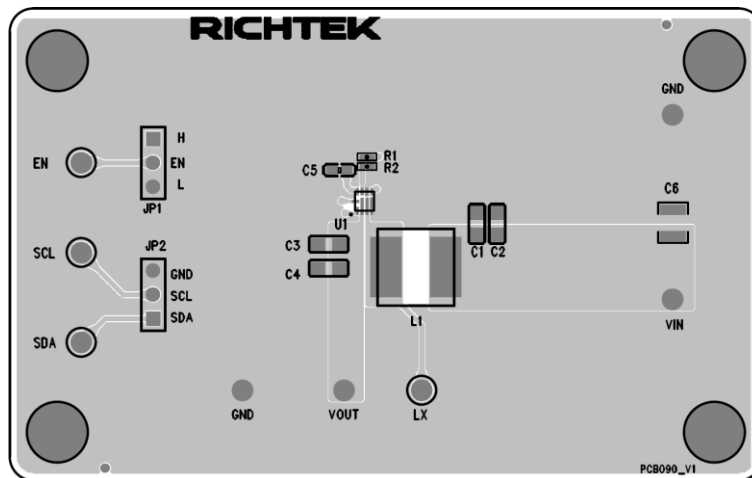
EVB Schematic Diagram



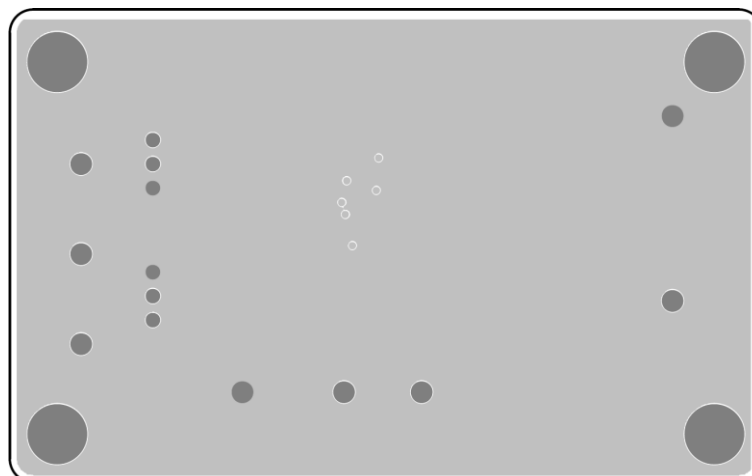
Bill of Materials

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

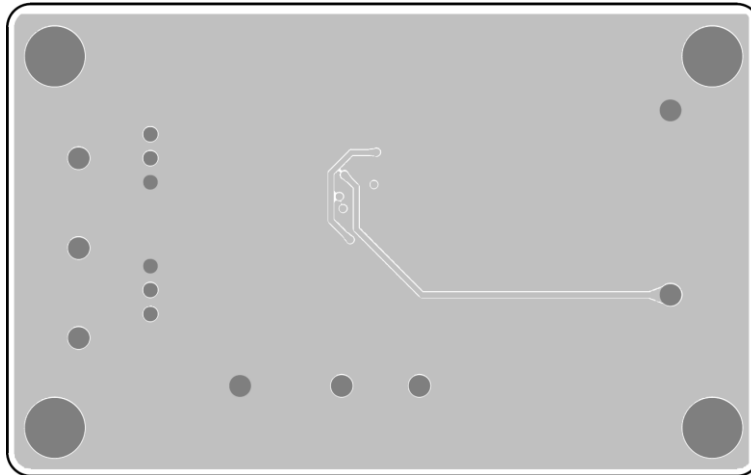
PCB Layout



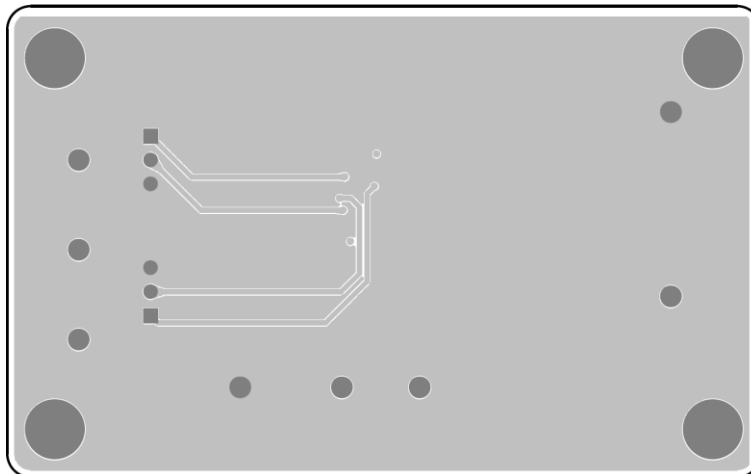
Top View (1st layer)



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

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