Single Cell Li-Ion Battery Charger Evaluation Board

General Description

The evaluation board demonstrates the RT9527GQW to be designed for a fully integrated low cost single-cell Li-ion battery charger ideal for portable applications. The RT9527GQW optimizes the charging task by using a control algorithm, which includes pre-charge mode, fast-charge mode and constant voltage mode. The charging current is adjustable via an external resistor. It provides a wide fast-charge current setting from 10mA up to 600mA. The RT9527GQW features 28V maximum rating voltage for VIN and provides protection functions including undervoltage protection and overvoltage protection for the AC adapter supply. Besides, the internal thermal feedback circuitry regulates the die temperature to optimize the charge rate for all ambient temperatures.

Table of Contents

Performance Specifications

The performance specificiaitons of RT9527GQW evaluation board are listed in Table 1. The test conditions are V_{IN} = 5V, V_{BAT} = 4V and T_A = 25°C, unless otherwise specified.

Table 1. Performance Specifications of RT9527GQW Evaluation Board

Specification	Test Conditions	Min	Typ	Max	Unit
VIN Operating Range		4.4	--	6	V
VIN Undervoltage Lockout Threshold	V_{IN} = 0V to 5V	3.1	3.3	3.5	V
VIN Undervoltage Lockout Hysteresis	V_{IN} = 5V to 0V	--	240	--	mV
Battery Voltage Regulation	0°C to 85°C	4.158	4.2	4.242	V
Re-Charge Threshold	Battery Regulation – Recharge Level	60	100	140	mV
VIN Charging Setting Range		10	--	600	mA
Fast-Charge Current Factor	$I_{CHG\_F1} = K_{CHG\_F1} / R_{ISET}$, I_{CHG_F1} = 10mA to 50mA	510	600	690	AΩ
	$I_{CHG\_F2} = K_{CHG\_F2} / R_{ISET}$, I_{CHG_F2} = 50mA to 600mA	570	600	630	AΩ
Pre-Charge Current Factor	$I_{CHG\_P} = K_{CHG\_P} / R_{ISET}$	30	60	90	AΩ
BAT Pre-Charge Threshold	V_{BAT} falling	2.7	2.8	2.9	V
BAT Pre-Charge Threshold Hysteresis		--	200	--	mV
Termination Current Ratio	$V_{BAT} > V_{PREC}$, $I_{CHG} < I_{TERMI}$, $\overline{CHG}$ = L to H	5	10	15	%
Overvoltage Protection		6.2	6.5	6.8	V
Overvoltage Protect Hysteresis		--	0.2	--	V
ISET Pin Short Protection		375	500	625	Ω
Thermal Regulation		--	125	--	°C
Pre-Charge Fault Time	C_{TIMER} = 1μF	1440	1800	2160	s
Fast-Charge Fault Time	C_{TIMER} = 1μF	11520	14400	17280	s

Power-up Procedure

Required Equipment

- RT9527GQW evaluation board
- DC power supply
- Electronic load
- Multimeter
- Oscilloscope

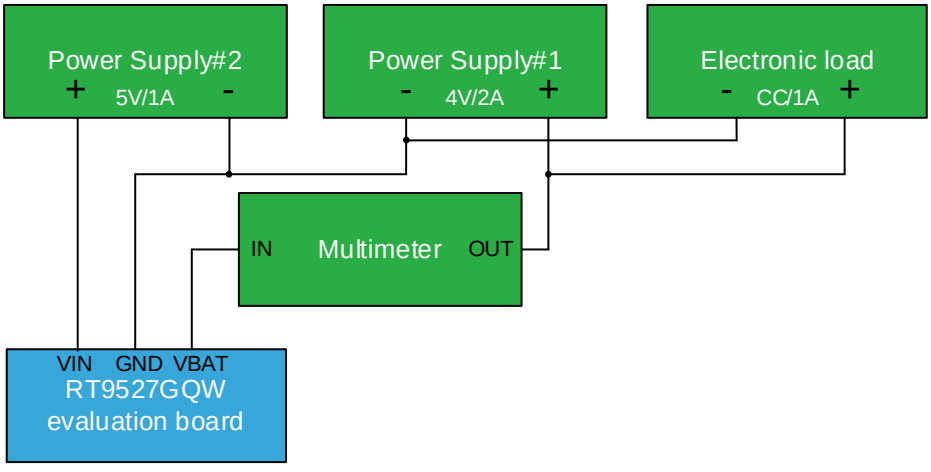
Quick Test Procedures

Inspect all the components on the EVB and make sure they are undamaged. Do not turn on power supplies until they are connetced well on the EVB.

Equipment setup and the test procedures are stated below:

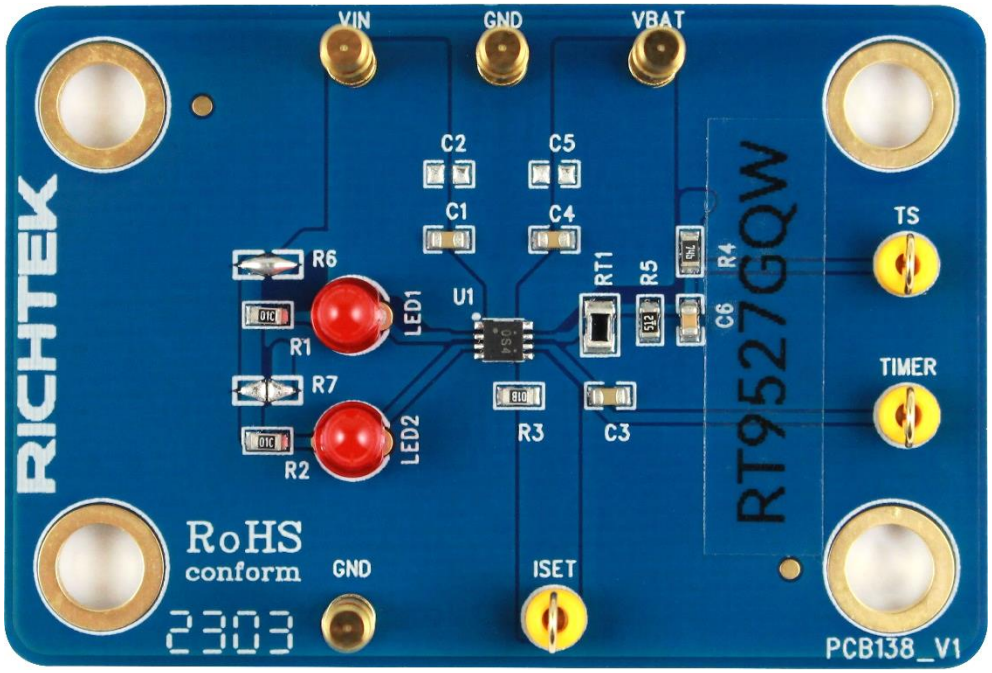
1) Set power supply#1 voltage = 4V and current = 2A and connect it to VBAT pin through meter and GND pin on the EVB.
2) Connect an e-load with power supply#1 in parallel and sink 1A in CC mode.
3) Set power supply#2 voltage = 5V and current = 1A and connect it to VIN and GND pins on the EVB.
4) Turn on power supply#1 and the electronic load.
5) Turn on power supply#2.
6) Check whether LED1 and LED2 light or not.
7) Use a multimeter to check whether IBAT equals to KCHG_Fx / RISET or not.

Test Environment Diagram



Detailed Description of Hardware

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

Test points are provided on the EVB and their pin names are listed in the table as shown below.

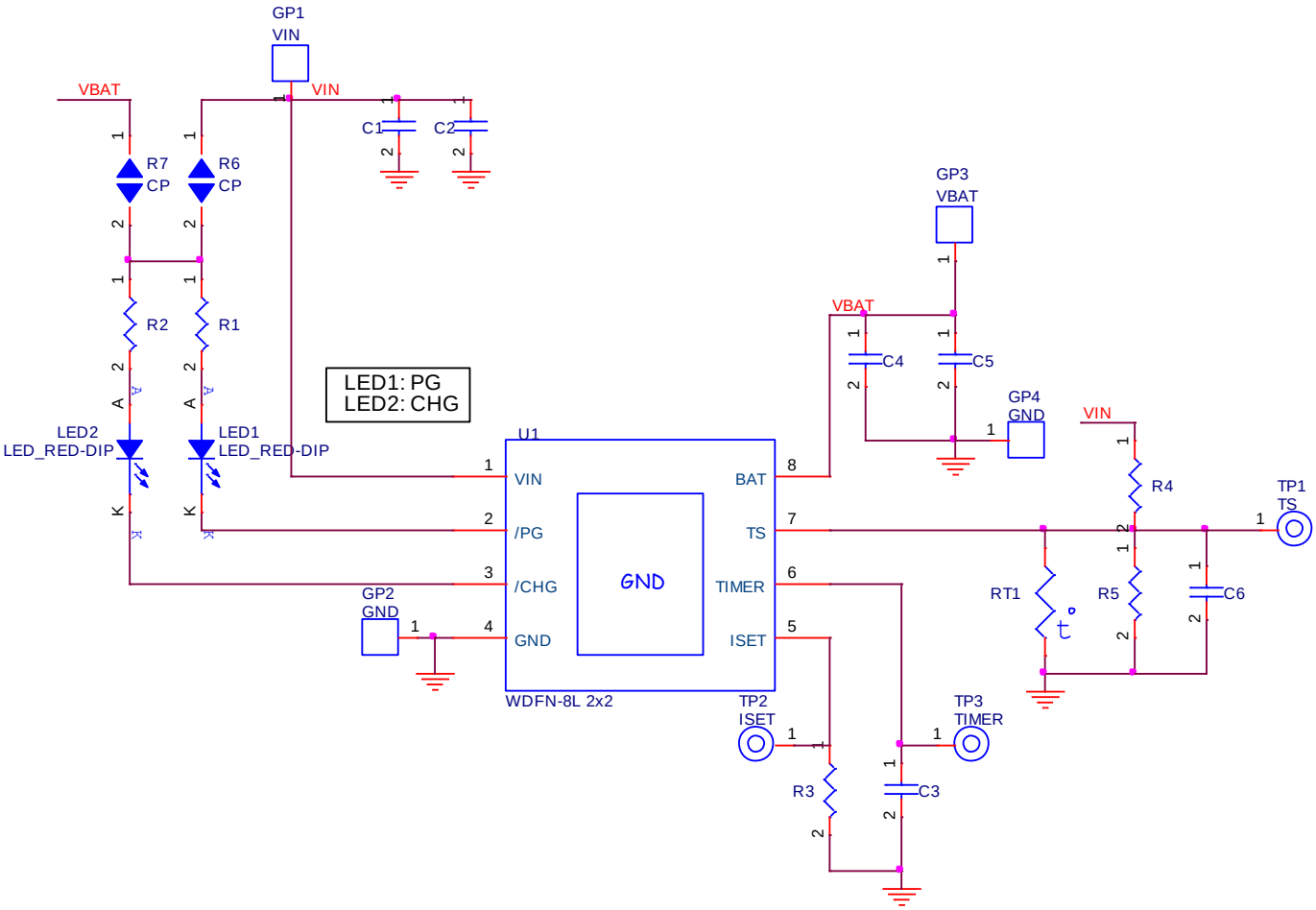
Test Point/ Pin Name	Pin Function
VIN	Supply voltage input.
VBAT	Charge current output for battery.
GND	Ground.
TS	Battery temperature sense input.
TIMER	Safe-charge timer setting.
ISET	Charge current setting.

Bill of Material

Reference	Count	Part Number	Value	Description	Package	Manufacturer
U1	1	RT9527GQW	RT9527GQW	Single Cell Li-Ion Battery Charger	WDFN-8L 2x2	RICHTEK
C1, C3, C4	3	0603X105K250CT	1µF	Ceramic Capacitor, 25V/X5R	0603	WALSIN
C2, C5	2	--	NC	--	--	--
C6	1	0603B102K500CT	1nF	Ceramic Capacitor, 50V/X7R	0603	WALSIN
R1, R2	2	WR06X1002FTL	10k	Chip Resistor, 1/10W, 1%	0603	WALSIN
R3	1	WR06X1001FTL	1k	Chip Resistor, 1/10W, 1%	0603	WALSIN
R4	1	RTT035761FTP	5.76k	Chip Resistor, 1/10W, 1%	0603	RALEC
R5	1	RC0603FR-075K1L	5.1k	Chip Resistor, 1/10W, 1%	0603	YAGEO
LED1, LED2	2	LNL-302RD000A1	RED	LED	DIP	LighTop
RT1	1	NCP21XH103F03RC	10k	Chip Resistor, NTC	0805	MURATA

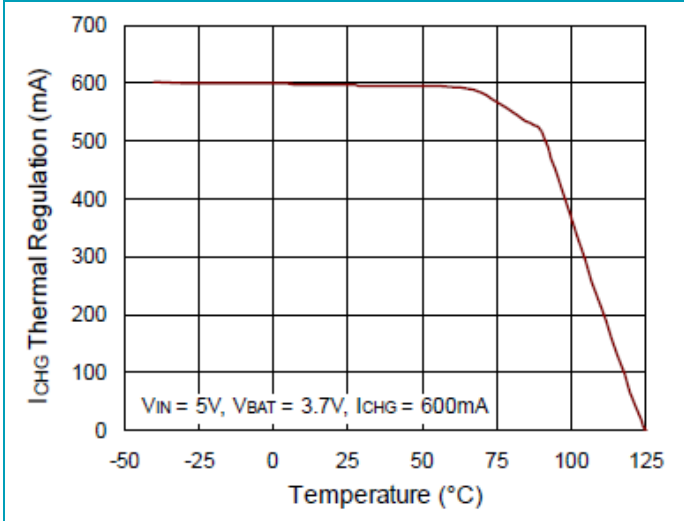
Typical Applications

EVB Schematic Diagram

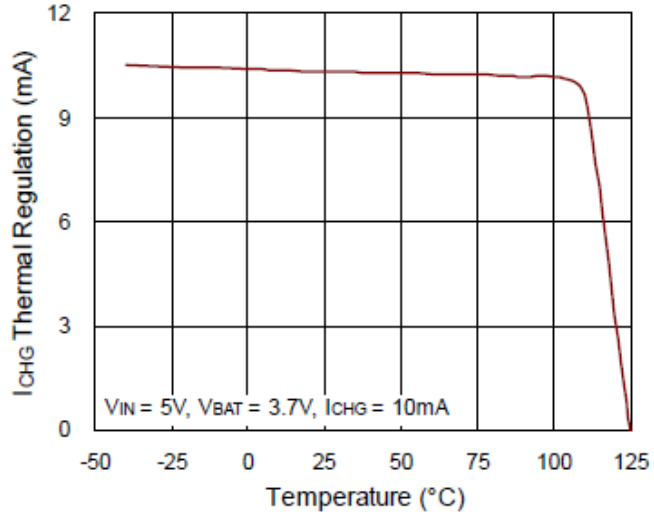


Measurement Result

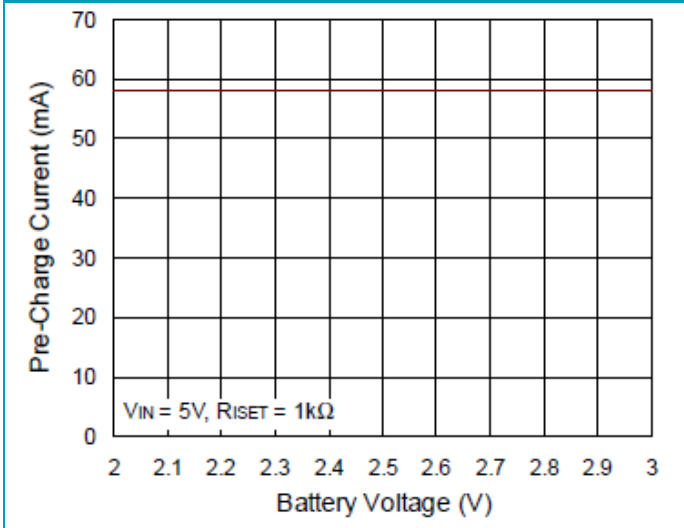
Charge Current (I_{CHG} = 600mA) vs. Temperature



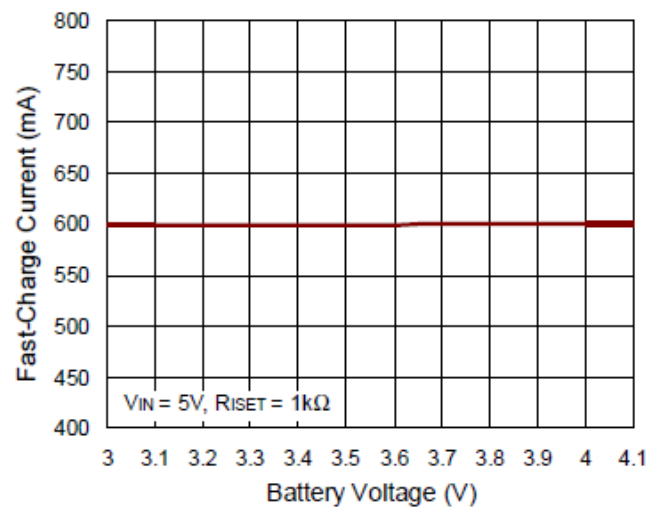
Charge Current (I_{CHG} = 10mA) vs. Temperature



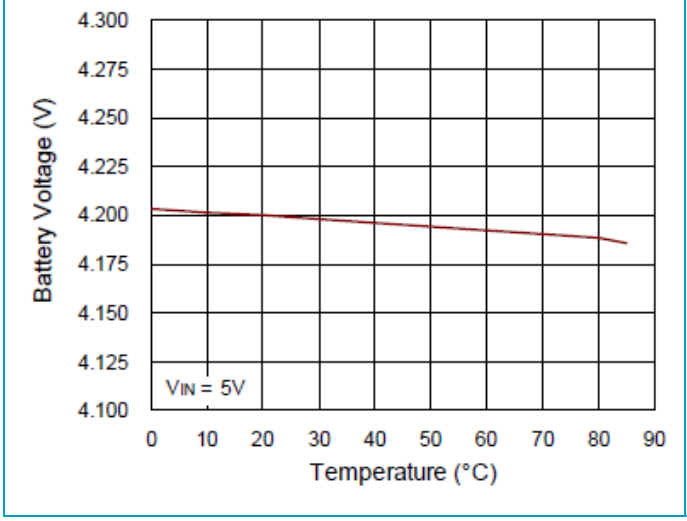
Pre-charge Current vs. Battery Voltage



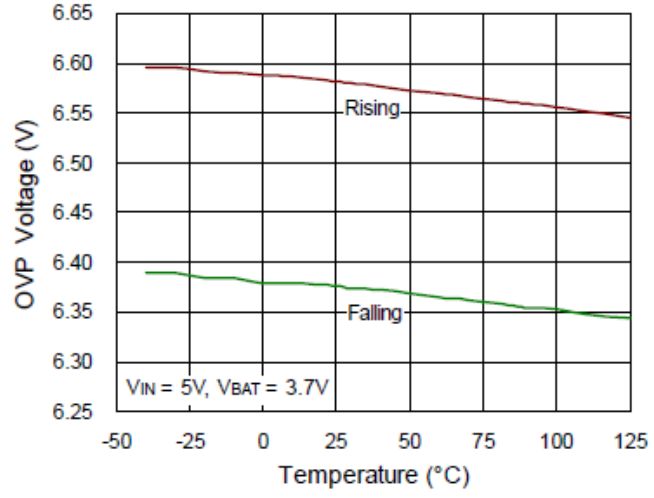
Fast-charge Current vs. Battery Voltage



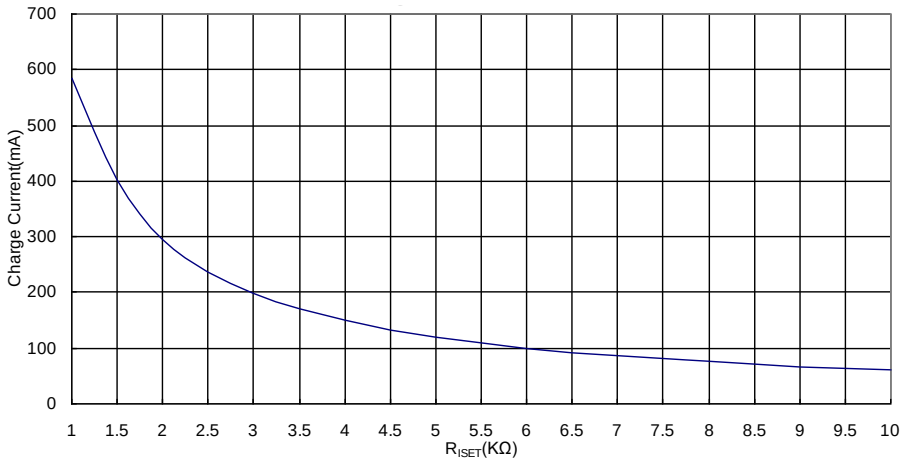
Battery Regulation Voltage v.s. Temperature



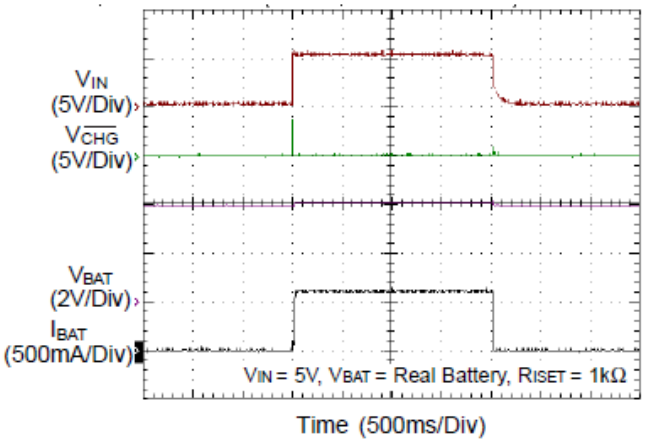
OVP Threshold Voltage vs. Temperature



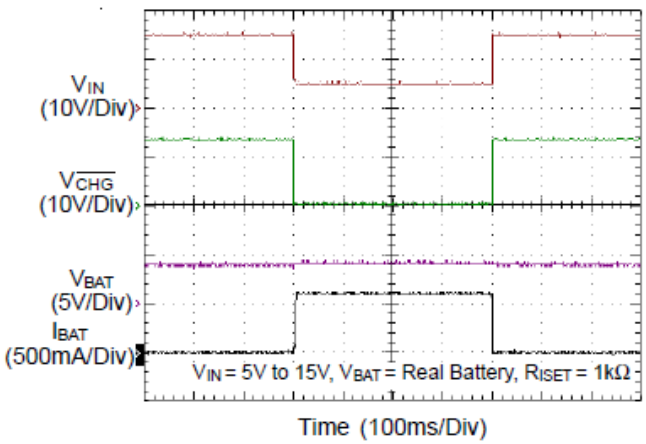
Charge Current vs. RISET



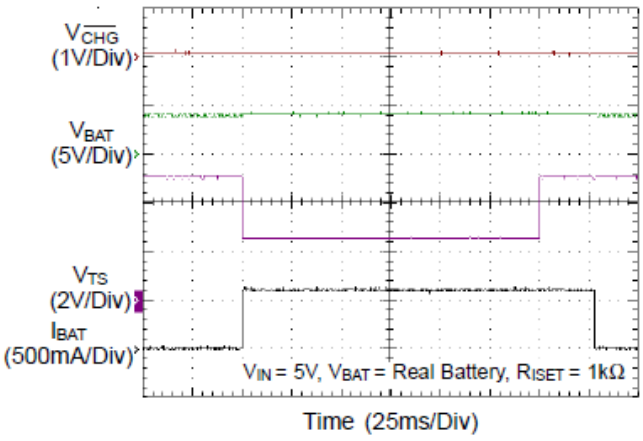
Charge On/Off Control from VIN



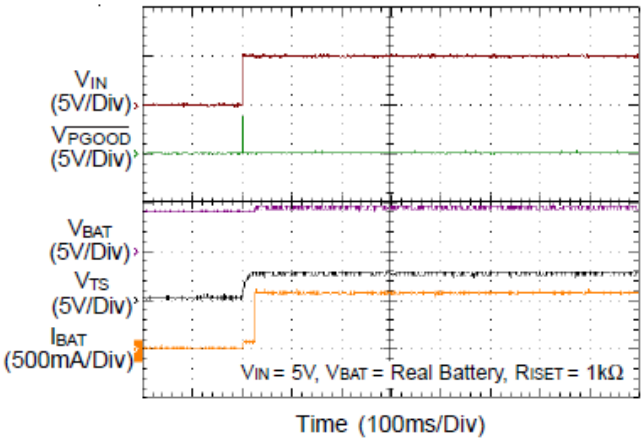
VIN Overvoltage Protection



TS Inserted/Removed



VIN Hot-Plug with Battery and NTC



Evaluation Board Layout

The layout of RT9527GQW evaluation board is shown in Figure 1 and Figure 2. It is a two-layer PCB with 1 oz. Cu coated on both top and bottom sides and the PCB size is 70mm x 50mm.

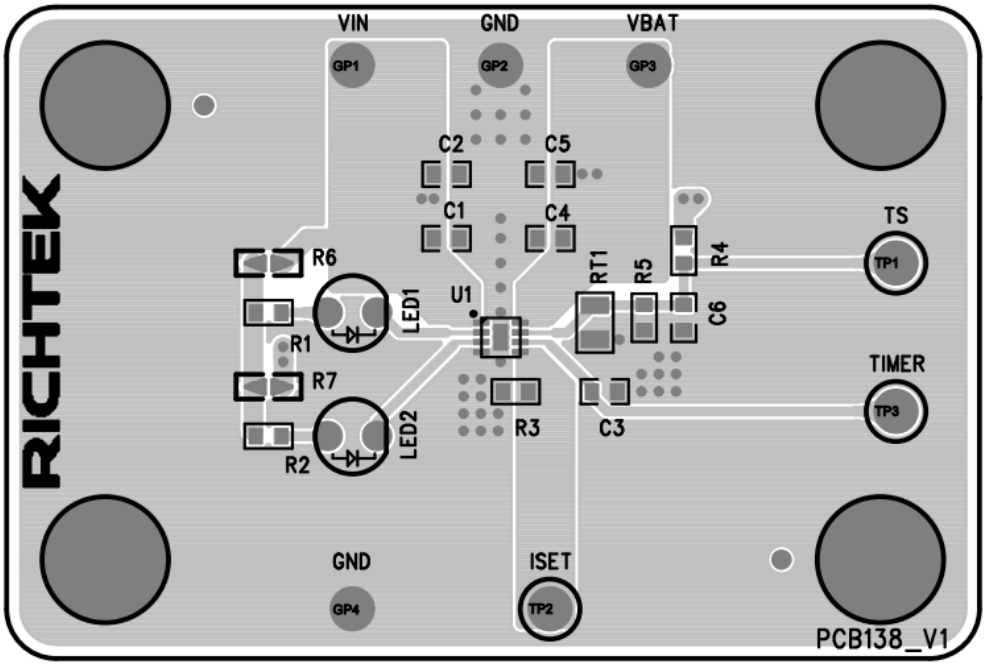


Figure 1. Top View (1st layer)

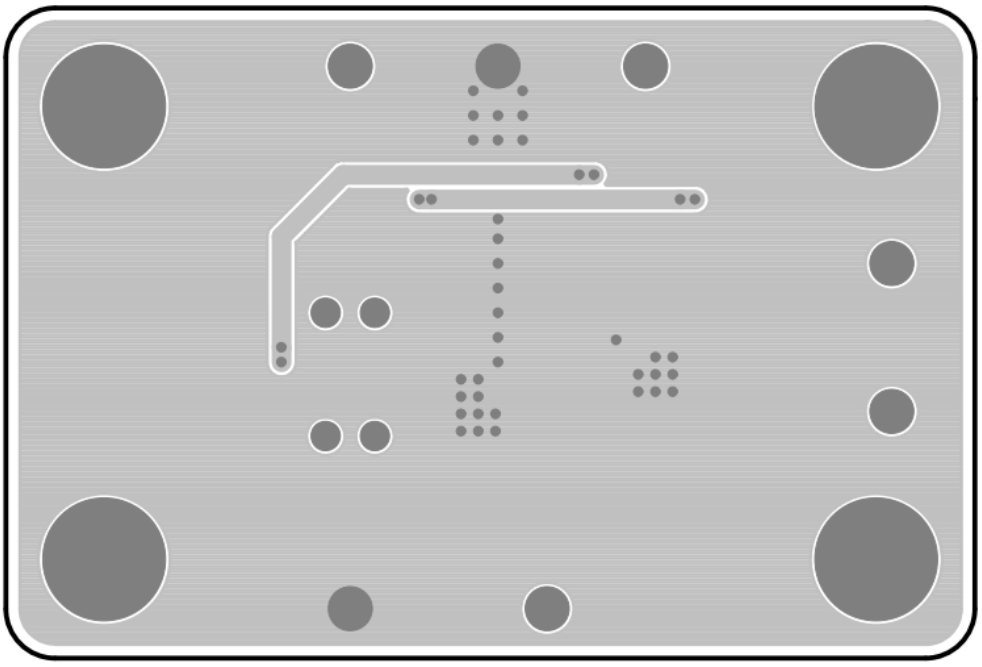


Figure 2. Bottom View (2nd layer)

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