

GLF73912/ GLF73915 Ultra-Efficient I_QSmart™ Battery Protection IC

DESCRIPTION

The EV011-GLF73912/ GLF73915 evaluation board features the GLF73912/ GLF73915 that is an I_QSmart™ ultra-efficient, full battery protection IC with an accurate over charge voltage, over discharge voltage, shipping mode, over charge current, and short circuit protection for lithium-ion/Polymer battery safety.

The over charge and discharge voltage protections keep a rechargeable battery working within the desired safe operating condition. When the battery is charged past the over voltage detection level, the GLF73912/ GLF73915 charging switch opens in a preset delay time. As the battery voltage decreases below the over discharge detection voltage level, the GLF73915 discharging switch is turned off immediately to cut off the battery power rail, consuming an ultra-low leakage current (I_{SD}) to save the battery. In addition, when the load current reaches the I_{SC} short circuit protection level, the GLF73912/ GLF73915 is turned off and will maintain the off state to avoid any serious damage to system. The short circuit delay time avoids any false trigger which might open the switch.

The GLF73915 provides a shipping mode pin to prevent smart devices with a non-removable battery from discharging during the shipping period. When a charged battery cell is connected the GLF73912/ GLF73915 remains in the off state and consumes an ultra-low leakage current (I_{SD}) until the V_{ON} voltage is applied to VOUT pin. Note that the GLF73912/ GLF73915 is activated only by a V_{ON} voltage from a charger output.

FEATURES

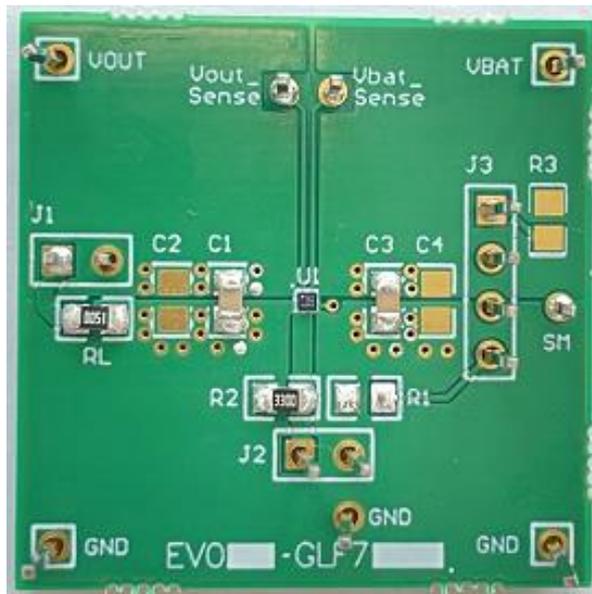
- Over Charge Detection, V_{OC} : $4.35 V_{BAT}$
- Over Discharge Detection, V_{OD} : $2.80 V_{BAT}$
- I_{OC} , Over Charge Current Detection
- Load Short Circuit Protection with Delay Time to avoid a false trigger
- Activated by Applying V_{ON} to the VOUT Pin from Charger
- 1.5 A Continuous Charging Current Capability from VOUT to VBAT Pin
- Low R_{ON} : $57 m\Omega$ Typ. @ $3.6 V_{BAT}$
- Quiescent Current:
 $I_Q = 940 nA$ Typ. @ $3.6 V_{BAT}$
- Shutdown Current
 - $I_{SD} = 7 nA$ Typ. @ $V_{BAT} < V_{OD}$
 - $I_{SD} = 8 nA$ Typ. @ $V_{BAT} = 3.6 V$, Shipping Mode
 - $I_{SD} = 9 nA$ Typ. @ $V_{BAT} = 4.2 V$, Shipping Mode
- Latch-off at Over Discharge Detection and Short Circuit Protection. Apply V_{ON} to VOUT pin to turn on
- Shipping Mode Implementation: GLF73915
- 0 V Battery Minimum Voltage for Charging
- Reverse Polarity Connection Protection
- Patent Pending Circuit Architecture
- HBM: 8 kV, CDM: 2 kV
- 0.97 mm x 0.97 mm x 0.55 mm Chip Scale Package 4 Bumps, 0.5 mm Pitch

PRODUCT TABLE

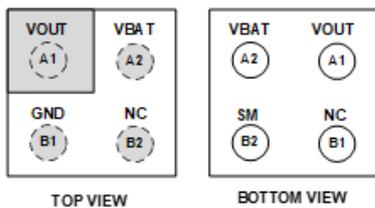
Eval Board Ordering Info: EV011-GLF73912/ GLF73915

Part Number	Top Mark	RON (Typ) $V_{BAT}=3.6\text{ V}$	Over Charge Detection, VOC	Over Discharge Detection, VOD	Over Charge Current, IOC	Short Circuit Current, ISC	$V_{BAT}=0\text{ V}$ Charging	Shipping Mode
GLF73915	CN	57 mΩ	4.35 V	2.80 V	350 mA	0.5 A	Available	Available
GLF73912	NC	57 mΩ	4.35 V	2.80 V	350 mA	0.5 A	Available	N/A

EVALUATION BOARD, DEVICE PACKAGE, AND PINOUT



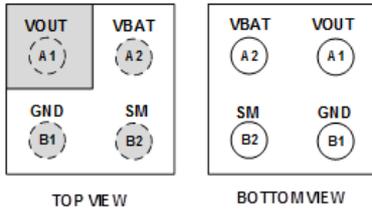
GLF73912 Pin Definition



0.97 mm x 0.97 mm x 0.55 mm WLCSP

Pin #	Name	Description
A1	VOUT	VOUT pin is connected to the charger output and system load. If the switch is in the off state, applying the appropriate voltage (V_{ON}) to V_{OUT} turns the switch back on.
A2	VBAT	VBAT pin is connected to the positive terminal of a battery pack to monitor the battery voltage. When the V_{BAT} voltage reaches the V_{OD} , the main switch is turned off and maintains the off state to save the battery from discharging.
B1	GND	Ground
B2	NC	No Connection. Tie this pin to GND directly.

GLF73915 Pin Definition



0.97 mm x 0.97 mm x 0.55 mm WLCSP

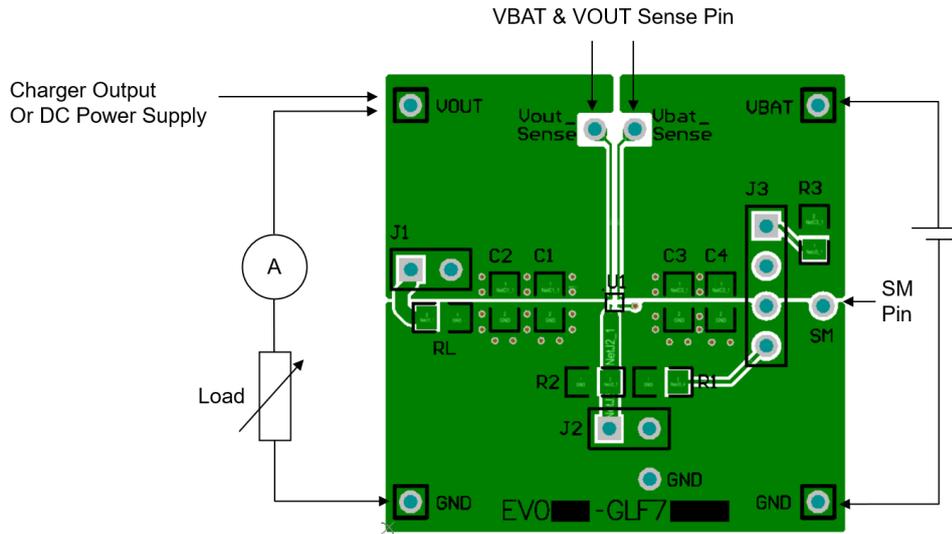
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B1	GND	Ground
B2	SM	Shipping Mode Control. Active high.

QUICK START GUIDE

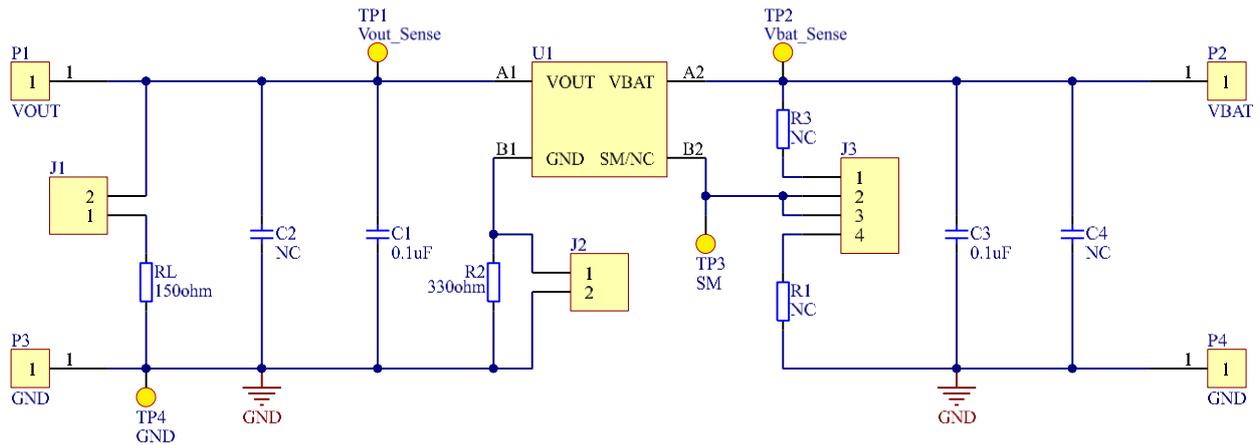
The evaluation board EV011-GLF73912/ GLF73915 is easy to set up to evaluate the performance of GLF73912/ GLF73915.

1. Connect the positive and negative terminals of the input power supply or a Li-battery pack higher than 3 V to VBAT pin and GND respectively. The V_{bat_Sense} and V_{out_Sense} can be used for measurement points. Make sure there is no high peak voltage generated when a VBAT input source is hot-plugged in.
2. Applying V_{ON} to the VOUT pin is necessary to turn on the GLF73912/ GLF73915 switch. With a charger IC connected with the VOUT on the board, enabling the charger IC can start charging.
3. The load resistor, $R_L=150 \Omega$, has been populated on the PCB board. Short the J1 to use the R_L . To increase the output current, connect an electronic load to VOUT pin and GND.
4. When the VBAT voltage decreases to the V_{OD} , the GLF73912/ GLF73915 is latched-off. In order to wake up the latched-off GLF73912/ GLF73915, the on voltage, V_{ON} needs to be applied to VOUT connector from a charger IC or a DC power supplier.
5. When the VBAT voltage reaches the V_{OC} , the GLF73912/ GLF73915 switch is turned off to stop charging and gets back to the on state as the VBAT voltage decreases by V_{OC_HYS} , 80 mV below V_{OC} .
6. When the I_{OUT} current exceeds the I_{SC} , the GLF73912/ GLF73915 is latched off immediately. In order to restart, set GLF73915 within the range of operating voltage and current, the V_{ON} needs to be applied to VOUT pin.
7. When the GLF73915 switch is turn on, applying a voltage higher than 1.2 V to SM pin at least $t_{SM} = 20$ ms, the GLF73915 will turn off after $t_{dSM} = 500$ ms delay. It could save battery energy during transportation and storage.
8. The $R_2 = 330 \Omega$ between the GND pin and the ground plane on the board prevents the GLF73912/ GLF73915 from being damaged by a reverse polarity connection of a battery.

TEST SETUP



SCHEMATIC



BILL OF MATERIALS

Qty	Reference	Value	Part Description	Note
1	U1	GLF73912/ GLF73915	GLF73912/ GLF73915	GLF Integrated Power
1	C1	0.1 μ F	Cap., X7R, 50 V, 10 % 0805	YAGEO CC0805KKX7R9BB104
1	C3	0.1 μ F	Cap., X7R, 50 V, 10 % 0805	YAGEO CC0805KKX7R9BB104
1	R2	330 Ω	Resistor, 5 % 0805	YAGEO RC0805FR-07330RL
1	RL	150 Ω	Resistor, 5 % 0805	YAGEO RC0805FR-07150RL
1	J1	Jumper	Jumper	
2	J2, J3	Jumper	Jumper	DNP (Do Not Place)
4	R1, R3, C2, C4	-	-	DNP (Do Not Place)

PRINTED CIRCUIT BOARD LAYOUT

Fig 1. Top Layer

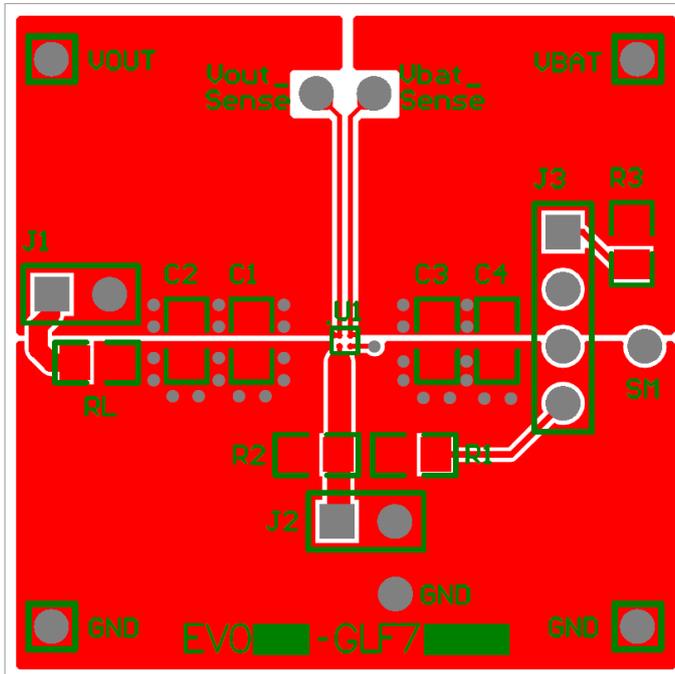
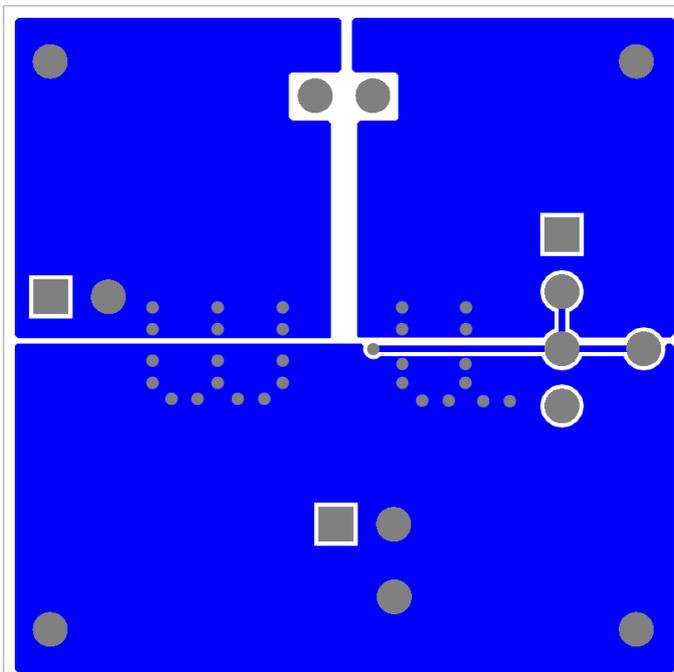


Fig 2. Bottom Layer



NOTICE: The evaluation board provided by GLF Integrated Power is intended for use for ENGINEERING DEVELOPMENT, OR EVALUATION PURPOSES ONLY and is not for any commercial use. The user assumes all responsibility and liability for proper and safe handling of the goods.