

LS0502SCD33S Evaluation Board

Quick Reference Guide

About this document

This Evaluation Board (EVB) quick reference guide describes an advanced linear charger to single-cell super capacitor storage load. It contains the EVB specification, PCB layout, schematic, bill of materials (BOM), and LEDs indication function.

Table of Contents

Topic	Page
1. Introduction	1
2. LS0502SCD33S Evaluation Board (EVB)	2
2.1 PCB Layout	2
2.2 Schematic	3
2.3 BOM	3
3. Function Setting	4
4. Connectors, Jumper Setting , EVB LED and Mode Summary	5-6
5. Reference List	6

1. Introduction

The LS0502SCD33S protection IC provides a complete solution designed for systems with backup storage capacitors or the capacitor bank. This integrated system implements essential features such as input overvoltage and overcurrent protection circuits, a reverse blocking switch, and a super capacitor charging control circuit. With these capabilities, the LS0502SCD33S offers a reliable and efficient solution for managing energy storage and safeguarding the system components

The LS0502SCD33S is an advanced linear charger. It provides a constant current to charge the super capacitors. It also offers the following functions, programmable super capacitor charging current, programmable input current, programmable input overcurrent, protection automatic cell balancing and automatic main/backup switchover.

The LED indicators will display the current operating state of the IC.

To increase discharging output current capability, there is a load switch IC LQ05041RCS6 and to bypass the internal MOSFET M3. It will be enabled by JP3 when discharging output current is required more than 2.7A.

2. LS0502SCD33S Evaluation Board (EVB)

This section covers LS0502SCD33S load switch evaluation board, PCB layout, schematic and BOM.

Figure 1. LS0502SCD33 evaluation board



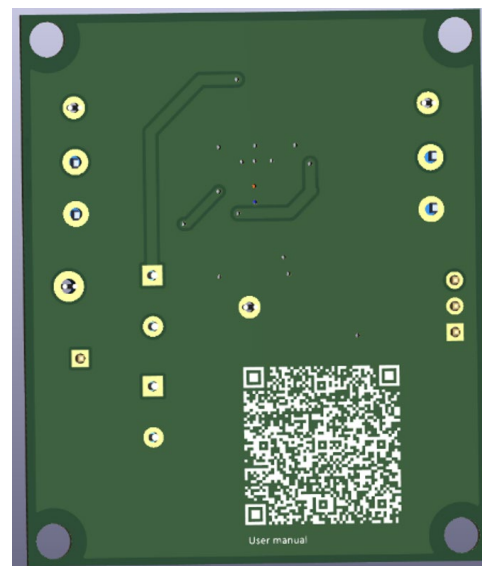
2.1 PCB layout

The top-side of the board is shown in Figure 2, and the bottom side in Figure 3. This section covers LS0502SCD33S evaluation board PCB layout, schematic and BOM. In the bottom side, there is a QR code link for this user manual PDF.

Figure 2. Top-side copper and component



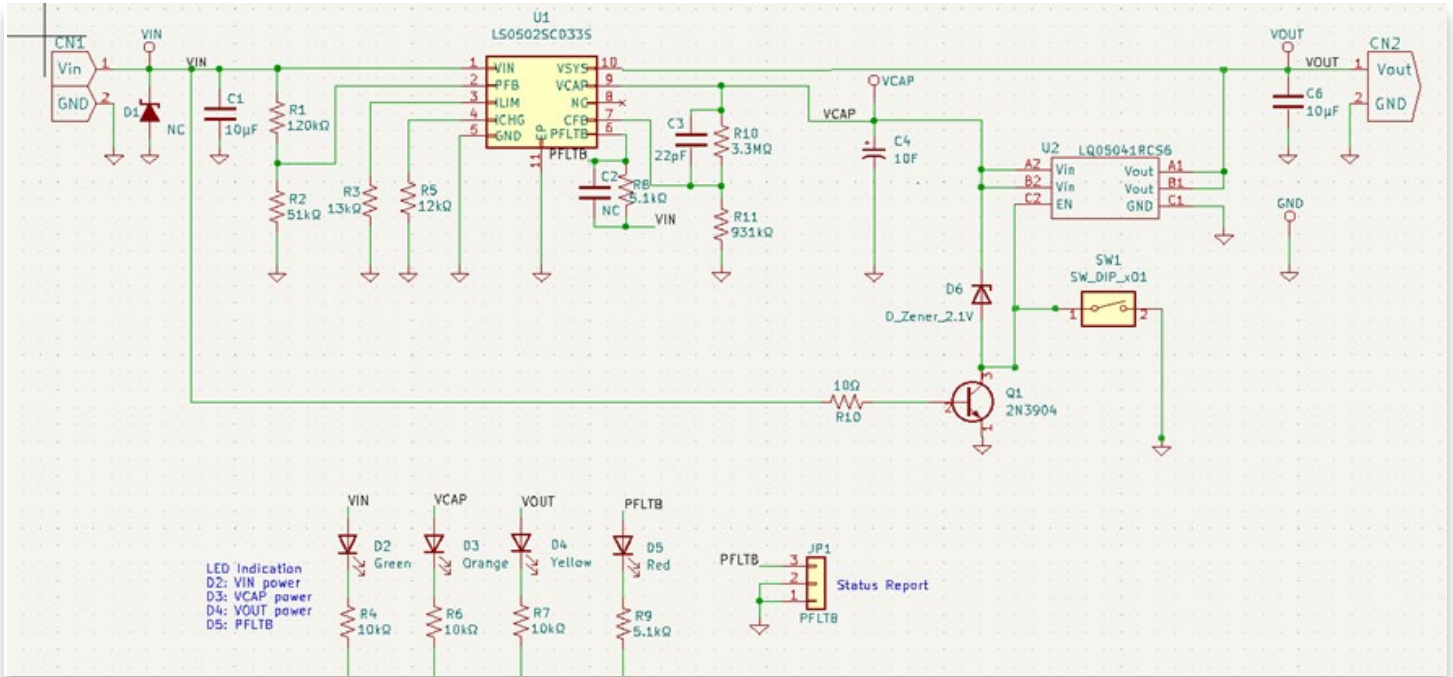
Figure 3. Bottom-side copper



2.2 Schematic

Figure 4 provides the EVB schematic. The jumpers are highlighted. See Figure 5 for the jumper locations on the board.

Figure 4. Schematic



2.3 BOM

Table 1 provides the EVB bill of materials (BOM).

Table 1. BOM

Item	Qty	Reference Designator	Description	Part number	Manufacturer	Package Size
1	1	R1	RES 34K OHM 1% 1/10W 0603	RC0603FR-0734KL	YAGEO	0603
2	1	R2	RES 51K OHM 1% 1/10W 0603	RC0603FR-0751KL	YAGEO	0603
3	1	R3	RES 13K OHM 1% 1/10W 0603	RC0603FR-0713KL	YAGEO	0603
4	4	R4, R4,R7, R13	RES SMD 10K OHM 1% 1/10W 0603	AT0603FRE0710KL	YAGEO	0603
5	1	R5	RES 12K OHM 1% 1/10W 0603	RC0603FR-105K1L	YAGEO	0603
6	2	R8, R9	RES 5.1K OHM 1% 1/10W 0603	AT0603FRE0710KL	YAGEO	0603
7	1	R10	RES 430K OHM 1% 1/10W 0603	RC0603FR-07430KL	YAGEO	0603
8	1	R11	RES 330K OHM 5% 1/10W 0603	RC0603JR-07330KL	YAGEO	0603
9	1	R12	RES 0 OHM JUMPER 1/10W 0603	RC0603FR-070RL	YAGEO	0603
10	2	C1, C6	CAP CER 10µF 10V X5R 0603	CC0603MRX5R6BB106	YAGEO	0603
11	1	C3	CAP CER 22PF 50V COG/NPO 0603	CC0603JPNPO9BN220	YAGEO	0603
12	2	C4	Super CAP 3V 10F	WEC3R0106QA	PAC ELECTRONICS	P 10X25
13	1	D2	LED GREEN CLEAR SMD	LTST-C191KGKT	LITEON	0603
14	1	D3	LED ORANGE CLEAR SMD	LTST-C191KFKT	LITEON	0603
15	1	D4	LED YELLOW CLEAR SMD	LTST-C191KSKT	LITEON	0603
16	1	D5	LED RED CLEAR SMD	LTST-C191KRKT	LITEON	0603
17	1	U1	Super Capacitor Protection IC	LS0502SCD33	Littelfuse	DFN3x3_10
18	4	Vin, Vout, Vcap, GND	PC TEST POINT MINIATURE	5000	Keystone	Hole Ø0.8~Ø1.0
19	2	CN1, CN2	TERMINAL BLOCK, PLUGGABLE, 2P 5.08	282836-2	TE	2Px5.08
20	2	C7, C8	CAP CER 1µF 10V X5R 0603	CC0603MRX5R6BB106	YAGEO	0603
21	1	U2	Load switch IC	LQ05041RCS6	Littelfuse	WLCSP
22	1	R14	RES 3.3K OHM 1% 1/10W 0603	RC0603FR-334K1L	YAGEO	0603
23	1	Q1	TRANS NPN 40V 0.2A SOT23-3	MMBT3904-7-F	Diodes	SOT23-3
24	2	JP2, JP3	TERMINAL pins	3 pins		P2.54x3
25	1	D1	NC			

3. Function Setting

The current limit, charging current setting, input voltage sensing and stop charging voltage, as defined in Table 2.

Table 2. EVB function list

Functions	Value
Input Current Limit (A)	2.3
Charging Current (A)	0.275
Input Low Voltage Sensing (V)	4.02
Stop Charging Voltage (V)	5.03

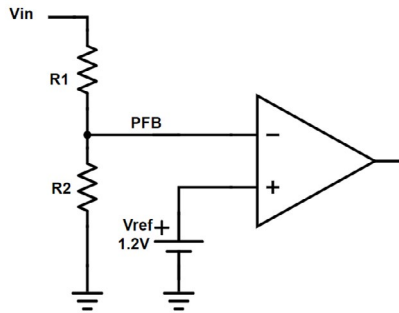
- Use the following equation to calculate the current limit value

$$I_{LIM} = 30A * k\Omega / R_{LIMT}$$

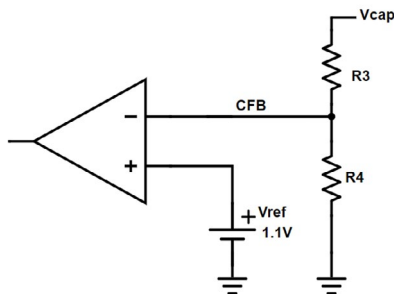
- At standby mode, $I_{LIM} = I_{out}$.
- At charge mode, $I_{LIM} = I_{out} + I_{CHG}$
- Use the following equation to calculate the charging current value

$$I_{CHG} = 3.3A * k\Omega / R_{CHG}$$

- Use the resistors and the voltage divider to set input low voltage value and the reference voltage is 1.2 V.



- Vin power good setting voltage value is $V_{in_PG} = 1.2V * (R1+R2) / (R1)$
- Use the resistors and the voltage divider to set stop charging voltage value and the reference voltage is 1.1 V.



- Stopping charge Vcap voltage setting value is $V_{cap_SC} = 1.1V * (R3+R4) / (R4)$

4. Connectors, Jumpers and LEDs Indication

To configure the EVB for operation, reference Table 3 below. This table lists a summary of the EVB's connectors, jumpers and LEDs. The location of the connectors and jumpers are shown in Figure 5. EVB LED indication and mode summaryb are as shown in Table 4 and table 5 below.

Figure 5. EVB connector and jumpers

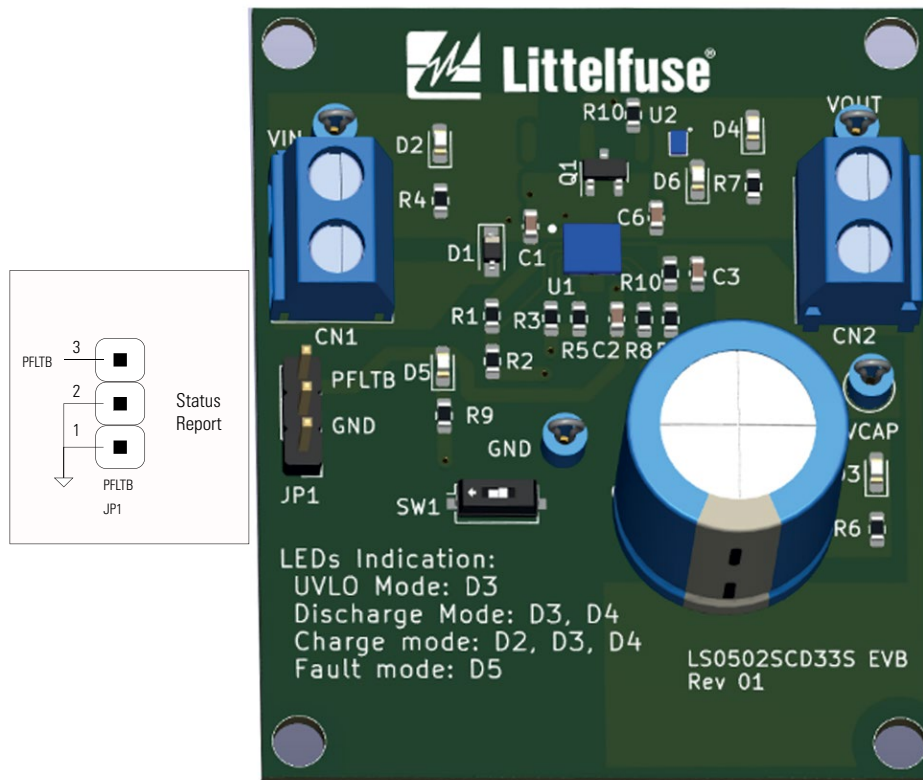


Table 3. EVB connectors and jumpers

Connector	Description
CN1 for Vin	DC positive pin (Vin+) and Ground (GND) pin
CN2 for Vout	DC positive pin (Vout+) and Ground (GND) pin
Jumper Options	Description
JP1	Input power failure indicator
JP2	Two capacitors middle point voltage
JP3	Load switch IC enable / diable

Table 4. EVB LED summary list

LED	Description
D2	Vin power
D3	Vcap power
D4	Vout power
D5	off when the PFB drop below 1.2 V or (Vin-Vout) exceed 360 mV

Table 5. EVB Mode summary table

Mode	Description
Standby	D2:ON, D3:ON, D4:ON, D5:ON
Charge	D2:ON, D3:ON, D4:ON, D5:ON
Discharge	D2:Off, D3:ON, D4:ON, D5:Off

5. References List

Power management IC LS0502SCD33S: www.littelfuse.com/products/protection-ic/efuse/l0502scd33S.aspx

Load switch IC LQ05041RCS6: www.littelfuse.com/products/protection-ic/load-switch/lq05041rcs6.aspx

application notes: [Comprehensive Power Backup Solution for Utilizations of Supercapacitors](#)