Deep Discharge Protector for 3.6V Li-Ion Battery

A rechargeable battery's load should be disconnected at the point of complete discharge, to avoid a further (deep) discharge that can shorten its life or destroy it. Because a battery's terminal voltage recovers when you disconnect the load, you can't simply disconnect the load when the terminal voltage dips below the established threshold and then re-connect it when the voltage returns above that threshold. Such action may produce chatter in the disconnect switch. The project shown here is a complete solution to this problem.

The circuit disconnects the load when the battery level goes below a set point. The project is built using the MAX882 chip, which has a low-battery comparator and error amplifier that share the internal reference and the external resistor divider. With the resistor values shown, the low-battery output (LBO) goes low and disconnects both the battery and load when the output falls eighty percent below its nominal value. The battery and load then remain disconnected until RESET is clicked by SW1. Two factors enable the latching action in this circuit: the low-battery comparator remains active during shutdown (most regulators deactivate this comparator during shutdown), and the circuit monitors the regulated output voltage instead of the battery voltage (regulator voltage can't recover until the regulator is turned back on). The circuit also provides an active-low POWER FAIL signal (LBO, pin 1) that goes low 50ms before the output is turned off. When LBO goes low, C1 discharges through R1 until the active low STBY input reaches its threshold (1.15V). The IC then enters its standby mode and disconnects the battery. IC1 is a linear regulator capable of sourcing 150mA with a 350mV dropout voltage. It has a 10µA standby current.The disconnect voltage level is set to 3.08V.

When the battery voltage drops to 3.08V, it disconnects the load, to reverse the condition, recharge the battery or replace and press the Sw1.

Note: It is advisable to use low tolerance 0.1% resistors (R4, R5, R6, R7), for high accuracy,
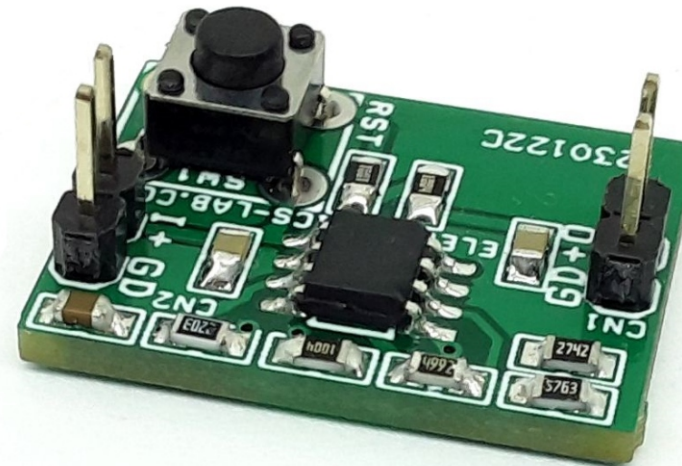
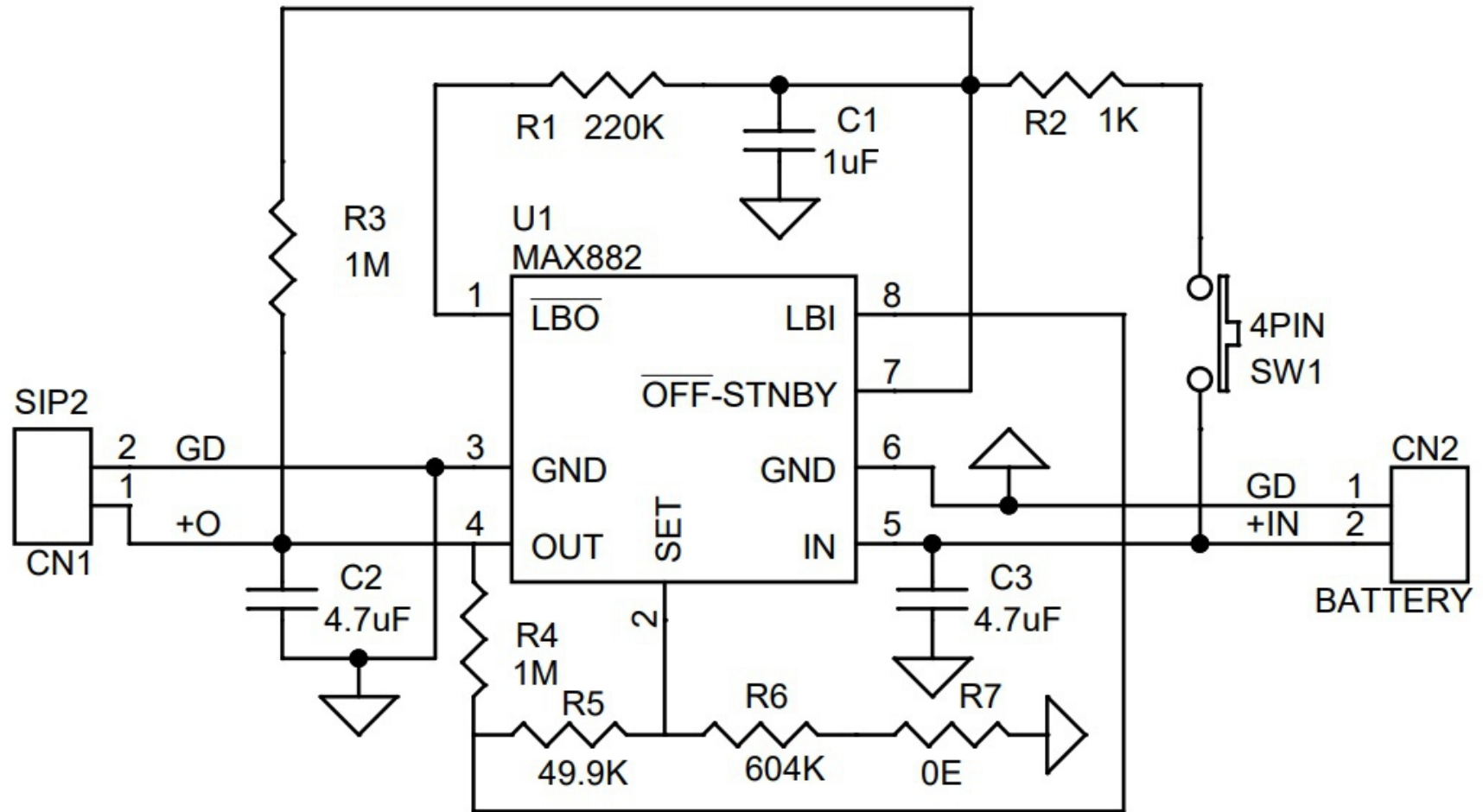**Circuit Credits:** Maxim Semiconductor

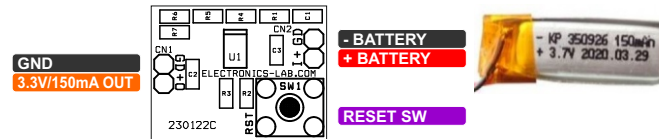**Connections and Other Details**
- CN1: Pin 1 +V 3.3V Output, Pin 2 GND
- CN2: Pin 1 -Battery (GND), Pin 2 + Battery
- SW1: Reset Switch

**Features**
- Good for 3.6V Li-Ion Battery
- Output 3.3V @ 150mA
- Cut-off Voltage 3.08V
- Load Up to 150mA
- On Board Reset Switch
- PCB Dimensions 23.18 x 17.46mm

07005

R1 220K

C1 1uF

R2 1K

R3 1M

U1 MAX882

1 LBO

LBI 8

OFF-STNBY

7

SIP2

2 GD

3 GND

GND 6

4PIN SW1

CN2

GD 1

1 +O

4 OUT

SET

IN 5

+IN 2

CN1

C2 4.7uF

BATTERY

R4 1M

2

C3 4.7uF

R5 49.9K

R6 604K

R7 0E

07005

BOM						
NO	QNTY.	REF.	DESC	MANUFACTURER	SUPPLIER	SUPPLIER PART NO
1	1	CN1	2 PIN MALE HEADER PITCH 2.54MM	WURTH	DIGIKEY	732-5315-ND
2	1	CN2	2 PIN MALE HEADER PITCH 2.54MM	WURTH	DIGIKEY	732-5315-ND
3	1	C1	1uF/10V SMD SIZE 0805	YAGEO/MURATA	DIGIKEY	
4	2	C2,C3	4.7uF/10V SMD SIZE 0805	YAGEO/MURATA	DIGIKEY	
5	1	R1	220K 5% SMD SIZE 0805	YAGEO/MURATA	DIGIKEY	
6	1	R2	1K 1% SMD SIZE 0805	YAGEO/MURATA	DIGIKEY	
7	2	R3,R4	1M 0.1% SMD SIZE 0805	YAGEO/MURATA	DIGIKEY	
8	1	R5	49.9K 0.1% SMD SIZE 0805	YAGEO/MURATA	DIGIKEY	
9	1	R6	604K 0.1%	YAGEO/MURATA	DIGIKEY	
10	1	R7	0E SMD SIZE 0805	YAGEO/MURATA	DIGIKEY	
11	1	SW1	TACTILE SWITCH	NKK SWITCH	DIGIKEY	HP0215AFKP2-ND
12	1	U1	MAX882 SOIC8	ANALOG DEVICE	DIGIKEY	MAX882CSA+-ND

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SILK SCREEN TOP   BOTTOM LAYER   TOP LAYER
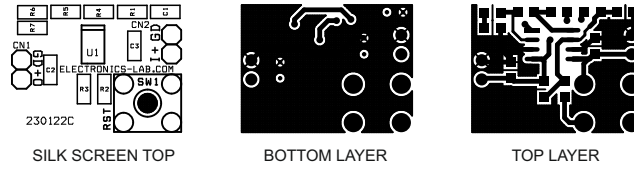
PCB DIMENSIONS 23.18MM X 17.46MM

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