Linear Charge Management Controllers

Description

The SC62A10 is a highly advanced complete constant-current/ constant voltage linear charger for cell lithium-ion batteries. Its package and low external component count make the SC62A10 ideally suited for portable applications. The charge current can be programmed externally with a single resistor, which may be programmed up to 1A.

SC62A10 determines the charge mode by detecting the battery voltage: Pre-charge, constant current charging, constant voltage charging. The charge current of 0pre-charging and constant–current charging is adjustable.

The SC62A10 is monitored by temperature monitor during the constant-current and constant-voltage charging. There are two LEDs indicate the charge mode.

The SC62A10 is available in the SOP-8PP package.

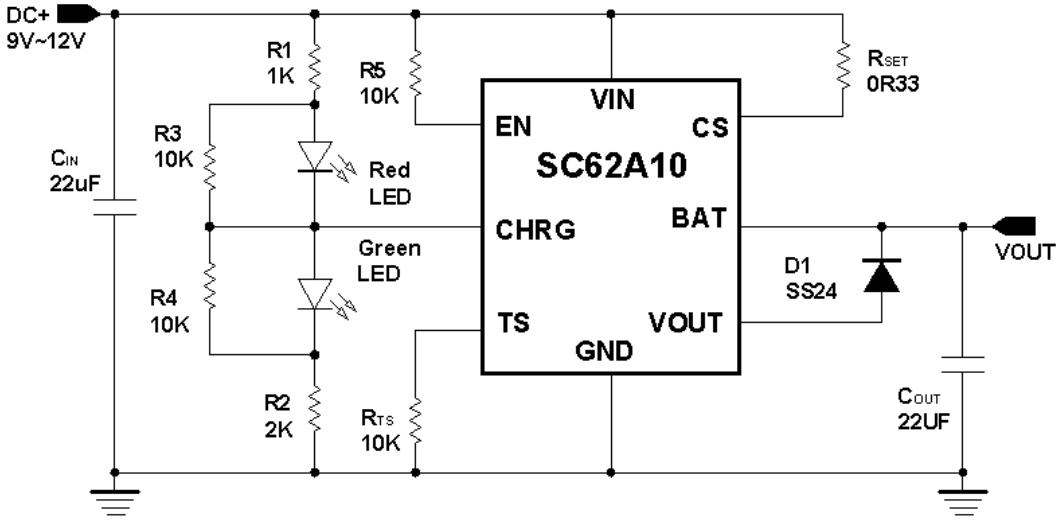
Features

- **Input Voltage Range: 9V-16V**
- **Preset Charge Voltage with ±1% Accuracy**
- **Programmable Charge Current Up to 1A**
- **Pre-Charging, the Charge Current is adjustable**
- **Ideal for Dual-Cell（8.4V）Li-Ion Batteries**
- **No MOSFET**
- **Constant-Voltage Charging**
- **Constant-Current/Constant-Voltage Charge with Temperature Monitoring**
- **Automatic Recharge**
- **Double LEDs Charge Status Indication**
- **Available in SOP-8PP Package**

Applications

- **Charges For Li-Ion Coin Cell Batteries**
- **Portable MP3 Players**
- **Bluetooth Applications**
- **MID**
- **Wireless Headsets**

Typical Application Circuit

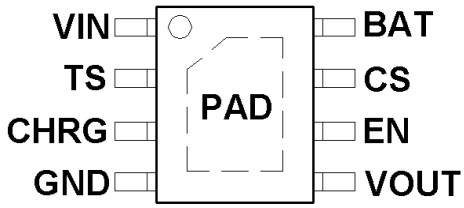


- ✶ **The charge current can be set by :I_{OUT} =Vcs/R_{SET} (Vcs is usually 200mV)**
- ✶ **The reverse-blocking protection diode is optional. In addition, the reverse-leakage current of the diode should be kept as small as possible.**

Condition	LED1	LED2
Battery charging	ON	OFF
Charge complete(done)	OFF	ON

Figure 1: Typical Application Circuit with tow LEDs

Pin Configurations

Package Type	Pin Configurations
SC62A10 SOP-8PP	

Pin Description

PIN SOP-8PP	NAME	DESCRIPTION
1.	VIN	Positive Input Supply Voltage. It Provides power to the charger VIN and should be bypassed with a 10μF capacitor.
2.	TS	Temperature Sense.
3.	CHRG	Charge Status Indication. When the battery is charging, the CHRG pin is pulled low.When the charge cycle is completed, the CHRG pin is pulled high. When no AC is detected, CHRG is forced high impedance.
4.	GND	Ground.
5.	VOUT	Charge Current Output. It should be bypassed with at least a 10μF capacitor. It provides charge current to the battery and regulates the final float voltage to 8.4V.
6.	EN	En Control Input. Forcing this pin above 1V enables the part. Forcing this pin below 0.8V shuts down the device. In shutdown, all functions are disabled drawing <1μA supply current. Do not leave EN floating.
7.	CS	Charge Current Program, Charge Current Monitor and Shutdown Pin. The charge current is programmed by connecting a resistor, R_{SET}.
8.	BAT	Battery Connection.
9.	PAD	Output.The PAD must be connected to the VOUT pin.

Absolute Maximum Ratings

- Input Supply Voltage (V_{IN}) ---------- –0.3V to 18V
- CHRG1、TS、CS---------- – 0.3V to V_{IN} + 0.3V
- V_{OUT} Pin Current ---------- 1000mA
- Maximum Junction Temperature ---------- 125℃
- Operating Ambient Temperature Range ---------- –40℃ to 85℃
- Storage Temperature Range ---------- –65℃ to 125℃
- Lead Temperature (Soldering, 10 sec) ---------- 300℃

Electrical Characteristics

Operating Conditions: T_A=25 ℃

SYMBOL	PARAMETER	CONDITIONS	SC62A10			UNTIS
			MIN	TYP	MAX	
V_{IN}	Input Supply Voltage		9		16	V
I_{IN}	Input Supply Current	Standby Mode(Charge Terminated)		0.25		mA
I_{SLEEP}	Sleep Current	Sum of currents into OUT pin, V_{IN}=0		25		μA
Battery Voltage Regulation Constant-current Charge						
$V_{O(REG)}$	Output voltage		8.317	8.4	8.484	V
$V_{(CS)}$	Current regulation threshold	Voltage at pin CS , relative to V_{IN}	180	200	220	mV
Precharge Current Regulation						
$I_{(PRECHG)}$	Precharge current regulation	Voltage at pin CS, relative to V_{IN}, R_{SET} =1Ω		18		mA
		Voltage at pin CS, relative to V_{IN}, R_{SET} =1Ω，V_{IN}=9V	10		35	
Trickle Charge						
V_{TRIKL}	Trickle Charge Threshold Voltage	V_{BAT} < V_{TRIKL}, R_{SET} =0.33Ω	5.6	6	6.2	V
I_{TRIKL}	Trickle Charge Current	V_{BAT} Rising, R_{SET} =0.33Ω		60		mA
VRCH comparator（Battery Recharge Threshold）						
V（RCH）	Recharge Battery Threshold Voltage	V_{FLOAT} - V_{RECHRG}		$V_{O(REG)}$ -400mV		V
CHRG Pin						
$V_{OL(CHRG)}$	Output（low）voltage	I_{OL} =10mA		1.5		V
$V_{OH(CHRG)}$	Output（high）voltage	I_{OH} =5mA	V_{IN} -2			
Temperature Sense Comparator						
V_{TS}	TS Pin Threshold Voltage（cold）	V_{TS} from Low to High		2.486		V
	TS Pin Threshold Voltage（hot）	V_{TS} from High to Low		0.49		
I_{TS}	Current source			84		μA

Application Information

Functional Description

The SC62A10 is an advanced 1A linear charge controller for two-cell Li-Ion of Li-Pol applications. Refer to Blocking Diagram (Figure 2) and Operation Flow Chart (Figure 3) in this section.

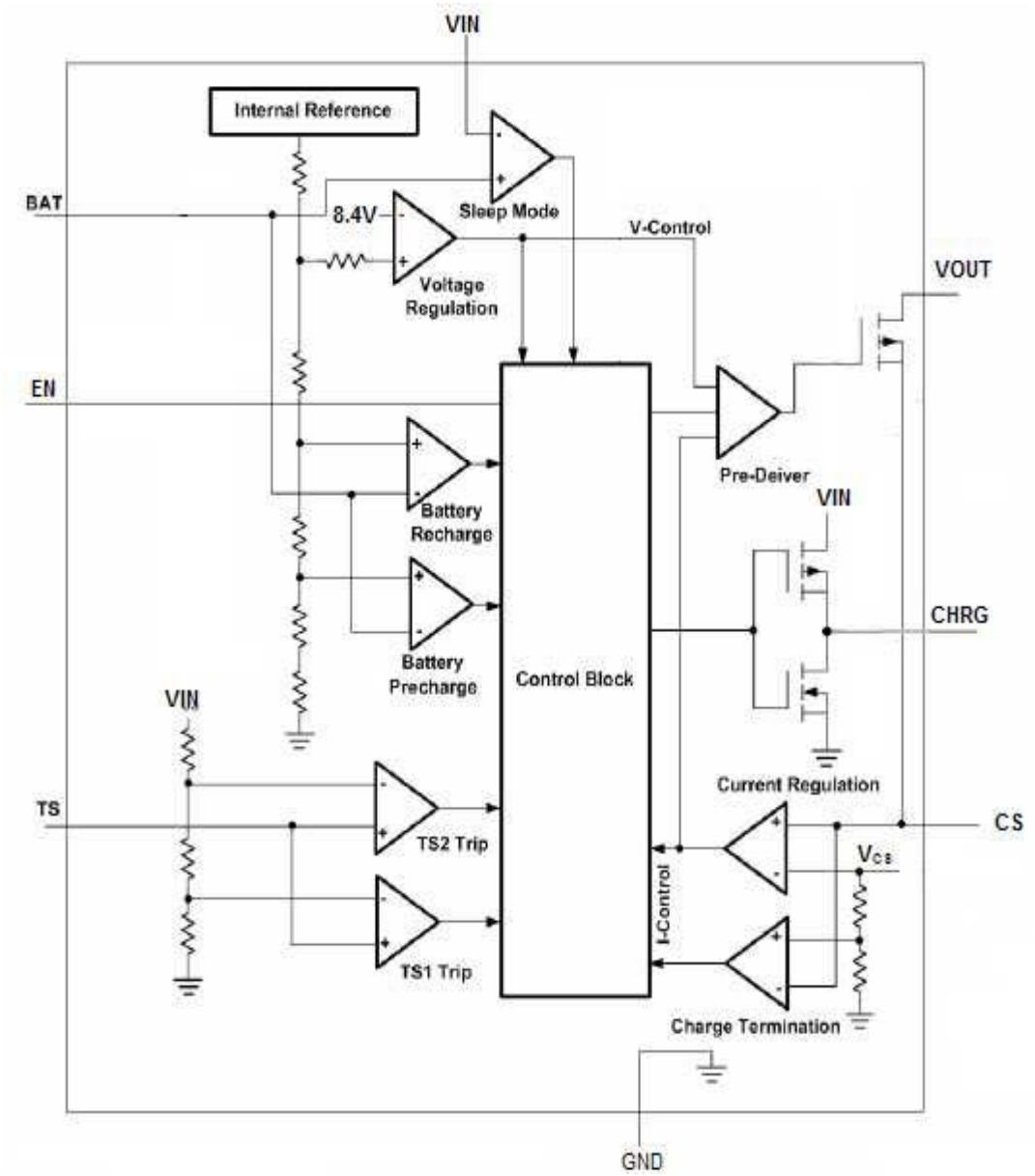


Figure 2: Blocking Diagram

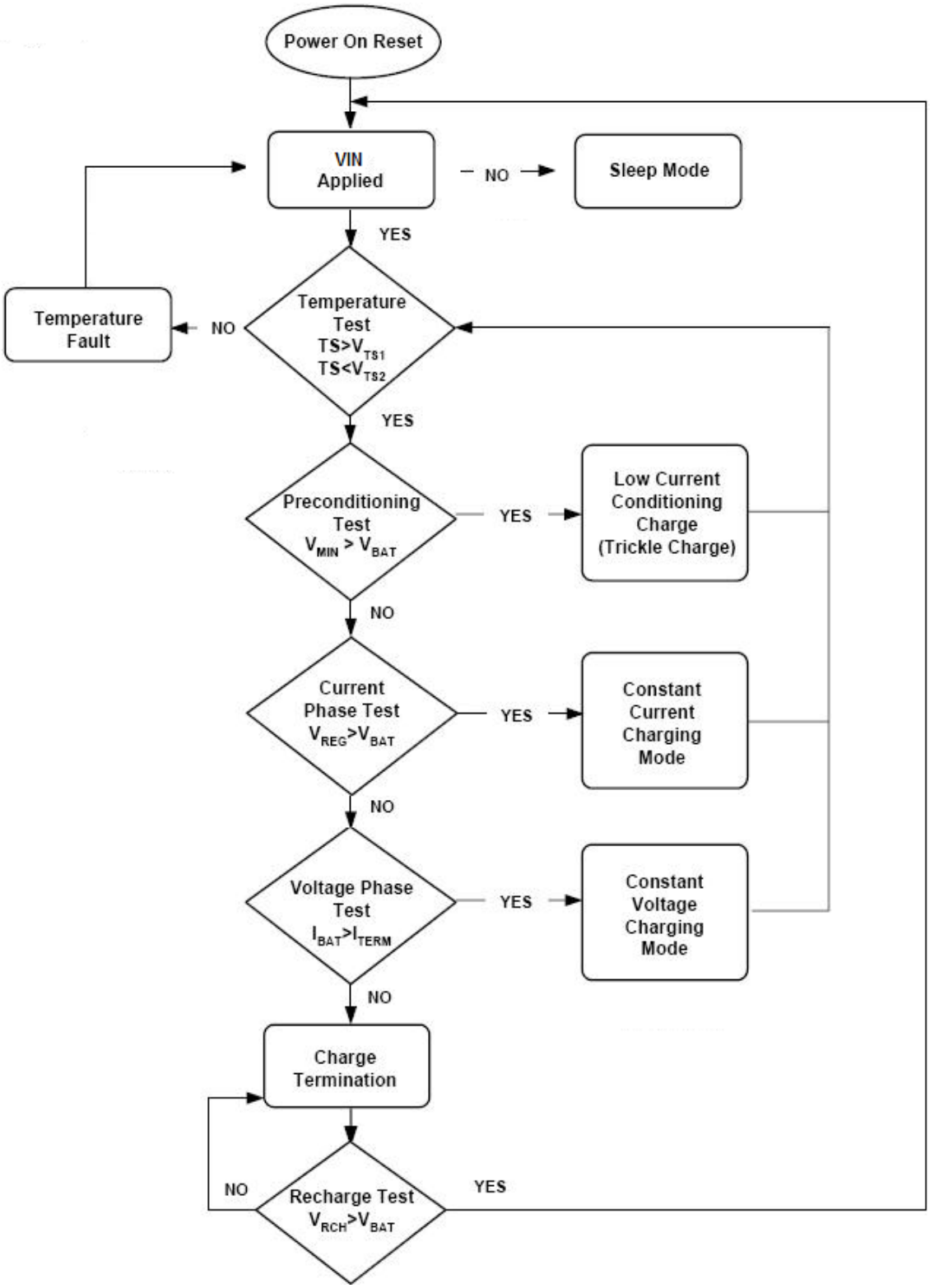


Figure 3: Operation Flow Chart

Qualification and Precharge

When power is applied, the SC62A10 starts a charge-cycle i f a battery is already present or when a battery is inserted. Charge qualification is based on battery temperature and voltage.

The SC62A10 suspends charge if the battery temperature is outside the V_{TS1} to V_{TS2} range and suspends charge until the battery temperature is within the allowed range. The SC62A10 also checks the battery voltage. If the battery voltage is below the precharge threshold $V_{(min)}$, the SC62A10 uses precharge to condition the battery. The conditioning charge rate $I_{(PRECHG)}$ is set at approximately 10% of the regulation current. The conditioning current also minimizes heat dissipation in the external pass-element during the initial stage of charge. See Figure 4 for a typical charge-profile.

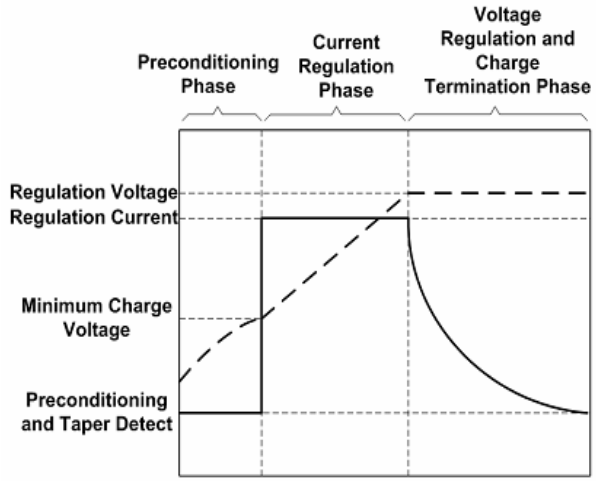


Figure 4: Typical Charge Profile

Current Regulation Phase

The SC62A10 regulates current while the battery-pack voltage is less than the regulation voltage, $V_{O(REG)}$.The SC62A10 monitors charge current at the CS input by the voltage drop across a sense-resistor, R_{SET},in series with the battery pack. In current sensing configuration, RSET is between the VIN and CS pins,charge-current feedback, applied through pin CS, maintains a voltage of VCS across the current sense resistor. The following formula calculates the value of the Sense resistor:

$$R_{SET} = \frac{V_{CS}}{I_{REG}}$$

Where $I_{O(REG)}$ is the desired charging current.

Voltage Phase

The voltage regulation feedback is through the BAT pin. This input is tied directly to the positive side of the battery pack. The SC62A10 monitors the battery-pack voltage between the BAT and GND pins. The SC62A10 is offered 8.4V output voltage.

Charge Termination Recharge

The SC62A10 monitors the charging current during the voltage-regulation phase. The SC62A10 declares a done condition and terminates charge when the current drops to the charge termination threshold, ITERM.A new charge cycle begins when the battery voltage falls below the VRCH threshold.

Battery Temperature Monitoring

The SC62A10 continuously monitors temperature by measuring the voltage between the TS and GND pin.An internal current source provides the bias for most common 10kΩ negative-temperature coefficient thermistors. The SC62A10 compares this voltage against its internal V_{TS1} and V_{TS2} thresholds to determine if charging is allowed (See Figure 5). The temperature sensing circuit is immune to any fluctuation in V_{IN}, since both

the external voltage divider and the internal thresholds V_{TS1} and V_{TS2} are referenced to V_{IN}.

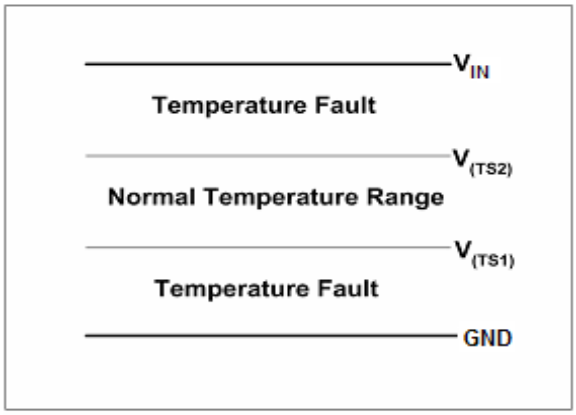


Figure 5: TS Input Thresholds

Charge Status Indication

The SC62A10 reports the status of the charge on the 3-state CHRG pin. The following table summarized the operation of the CHRG pin. The STAT pin can be used to drive a dual- chip LEDs.

Condition	CHRG pin
Battery conditioning and charging	Low
Charge complete(done)	High
Temperature fault or sleep mode	Hi-Z

Low-Power Sleep Mode

When the input supply is disconnected, the charger automatically enters power-saving sleep mode. This feature prevents draining the battery pack during the absence of V_{IN}.

Selecting Input Capacitor

In most applications, all that is high-frequency decoupling capacitor. The SC62A10 works with both regulated an unregulated external dc supplies. If a non-regulated supply is chosen, the supply voltage to the minimum required input voltage at maximum load. If not, more capacitance must be added to the input of the charger

Selecting Output Capacitor

The SC62A10 does not require any output capacitor for loop stability. In order to maintain good AC stability in constant Voltage mode, a minimum capacitance of 10uF is recommenced to bypass the BAT pin to GND. This capacitance provides compensation when there is no battery load. In addition, the battery and interconnections appear inductive at high frequencies. These elements are in the control feedback loop during Constant Voltage mode. Therefore, the bypass capacitance may be necessary to compensate for the inductive nature of the battery pack. Virtually any good quality output filter capacitor can be used, independent of the capacitor's minimum ESR (Effective Series Resistance) value. The actual value of the capacitor and its associated ESR depends on the forward transconductance (gm) and capacitance of the external pass transistor. A 10uF tantalum or aluminum electrolytic capacitor at the output is usually sufficient to ensure stability for up to a 1A output current.

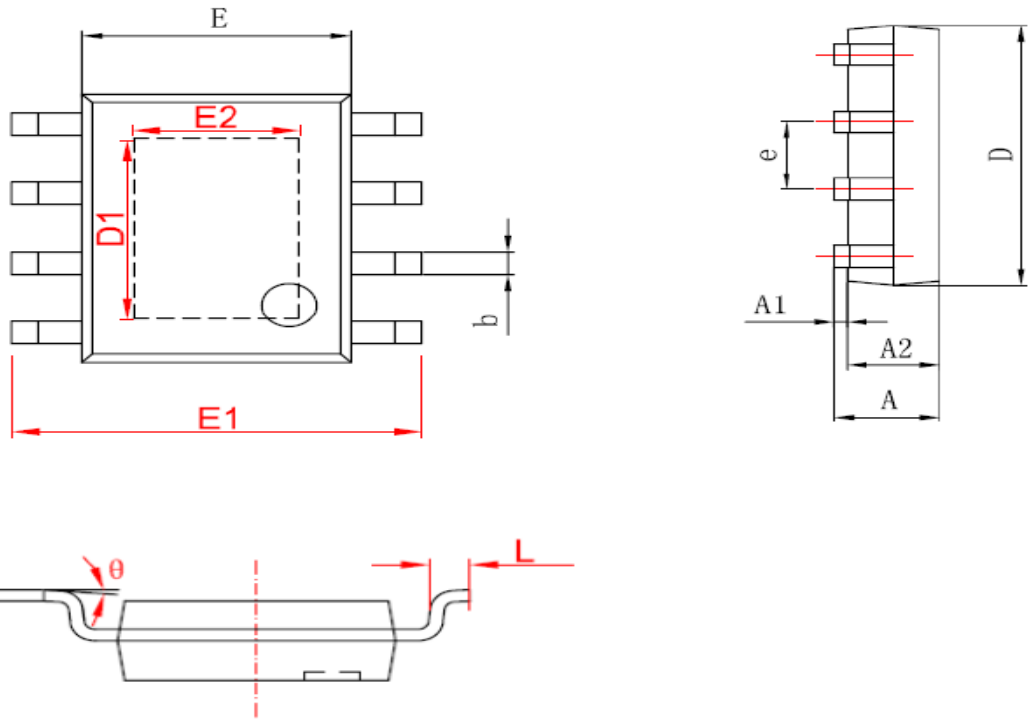
Reverse Blocking Protection

The reverse-blocking protection diode, depicted in Figure1 provides protection from a faulted or shorted input, or from a reversed-polarity input source. Without the protection diode, a faulted of shorted input would discharge the battery pack through the body diode of the external pass transistor. If a reverse-protection diode is incorporated in the design, it should be chosen to handle the fast charge current continuously at the maximum ambient temperature. In addition, the reverse-leakage

current of the diode should be kept as small as possible.

Packaging Information

SOP-8L Package Outline Dimension



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.050	0.150	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.006	0.010
D	4.700	5.100	0.185	0.200
D1	3.202	3.402	0.126	0.134
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
E2	2.313	2.513	0.091	0.099
e	1.270(BSC)		0.050(BSC)	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°