

Green, RoHS Compliant, and Pb-Free Product

Package Style: SOT-23-6L

Description

The SLM4900 is a complete constant-current constant-voltage linear charger for single cell lithium-ion batteries. Its SOT-23-6L package and low external component count make the SLM4900 ideally suited for portable applications. Furthermore, the SLM4900 is specifically designed to work within USB power specifications.

Application

- Cellular Telephones/ PDAs/ MP3 Players
- Charging Docks and Cradles
- Bluetooth Applications

Typical Application

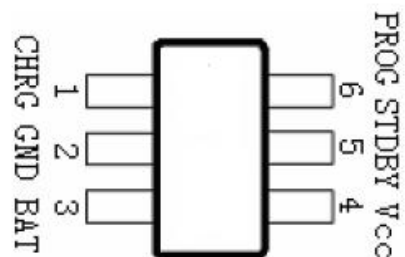
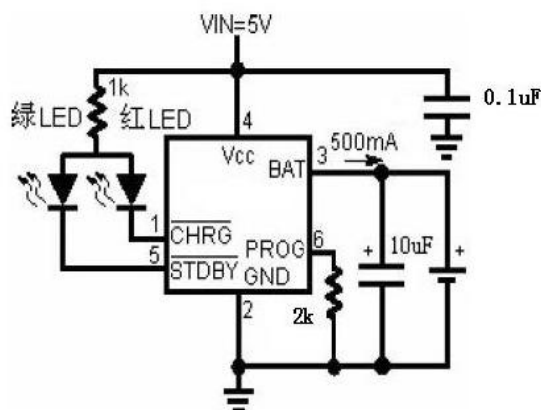


Figure 1.SOT-23-6L Package

RoHS

Features

- Programmable Charge Current Up to 800mA
- No MOSFET, Sense Resistor or Blocking Diode Required
- Constant-Current/Constant-Voltage Operation with Thermal Regulation
- Charges Single Cell Li-Ion Battery Directly from USB Port
- Battery Reversal Protection
- Preset 4.2V Charge Voltage with $\pm 1\%$ Accuracy
- 2.9V Trickle Charge Threshold
- Available Without Trickle Charge
- Soft-Start Limits Inrush Current
- RoHS Compliant and 100% Lead (Pb)-Free



SLM4900-4.2

Standalone Linear Li-Ion Battery Charger

Pin Configurations

No.	PIN	DESCRIPTION
1s	CHRG	Open-Drain Status Output
2	GND	Ground
3	BAT	Charge Current Output
4	VCC	Positive Input Supply Voltage
5	STDBY	Open-Drain Status Output
6	PROG	Charge Current Program, Monitor and Shutdown Pin

CHRG(PIN 1): Open-Drain Charge Status Output. When the battery is charging, the CHRG pin is pulled low by an internal N-channel MOSFET. When the charge cycle is completed, or the SLM4900 detects an under-voltage lockout condition, CHRG is forced high impedance.

GND (PIN 2): Ground.

BAT (PIN 3): Charge Current Output. Provides charge current to the battery and regulates the final float voltage to 4.2V. An internal precision resistor divider from this pin sets the float voltage which is disconnected in shutdown mode.

VCC (PIN 4): Positive Input Supply Voltage. Provides power to the charger. VCC can range from 4.5V to 6.5V and should be bypassed with at least a 1μF capacitor.

CHRG(PIN 5): Open-Drain Charge Status Output. When the battery is full, the STDBY pin is pulled low by an internal N-channel MOSFET. Otherwise, STDBY is forced high impedance.

PROG (PIN 6): Charge Current Program, Charge Current Monitor and Shutdown Pin. The charge current is programmed by connecting a 1% resistor, RPROG, to ground. When charging in constant-current mode, this pin serves to 1V. In all modes, the voltage on this pin can be used to measure the charge current using the following formula:

$$I_{BAT} = 900V_{PROG}/R_{PROG}$$

The PROG pin can also be used to shutdown the charger. Disconnecting the program resistor from ground allows a 3μA current to pull the PROG pin high. When it reaches the 1.94V shutdown threshold voltage, the charger enters shutdown mode, charging stops and the input supply current drops to 25μA.



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Absolute Maximum Ratings (1)

Parameter	Rating
Input Supply Voltage (VCC)	-0.3V to +8V
PROG (VPROG)	VCC +0.3V
BAT (VBAT)	+8V
CHRG(VCHRG)	+8V
CHRG(VCHRG)	+8V
BAT Short-Circuit Duration (IBAT)	850mA
Maximum Junction Temperature	+125°C
Operating Ambient Temperature Range	-65°C to +125°C
Storage Temperature Range	-40°C to +85°C
Lead Temperature (Soldering, 10s)	+300°C

Operating Ambient Range (2)

Parameter	Sysmbol	Range	Unit
Input Supply Voltage	Vcc	-0.3~+8	V
Junction Temperature	Tj	-40~+80	°C

Electrical Characteristics

(VCC = 5V, TJ= 25 °C, unless otherwise noted)

Parameter	Sysmbol	CONDITIONS	MIN	TYP	MA X	UNIT S
Input Supply Voltage	VCC		4.25		6.5	V
Input Supply Current	ICC	Charge Mode , RPROG = 10k		190		μA
		Standby Mode		85		
		Shutdown Mode (RPROG Not Connected,VCC < VBAT, or VCC < VUV)		45		



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Regulated Output (Float) Voltage	VFLOAT	0°C≤T _J ≤85°C, IBAT=40mA	4.158	4.2	4.24	V
BAT Pin Current	IBAT	RPROG = 10k, Current Mode		90		mA
		RPROG = 2k, Current Mode		450		mA
		Standby Mode, VBAT = 4.2V		2.5		μA
		Shutdown Mode (RPROG Not Connected)		±0.1		μA
		Sleep Mode, VCC = 0V		±0.1		μA
Trickle Charge Current	ITRIKL	VBAT<VTRIKL, RPROG= 10K		8		mA
Trickle Charge Threshold Voltage	VTRIKL	RPROG = 10k, VBAT Rising		2.9		V
Manual Shutdown Threshold Voltage	VMSD	PROG Pin Rising			1.25	V
		PROG Pin Falling			1.2	
VCC – VBAT Lockout Threshold Voltage	VASD	VCC from Low to High		100		mV
		PROG Pin Falling		30		
C/10 Termination Current Threshold	ITERM	RPROG= 10K(4)		10		mA
		R PROG= 2K		45		
PROG Pin Voltage	VPROG	RPROG=10K, 充电		1		V
CHRG Pin Weak Pull-Down Current	ICHRG	VCHRG=5V		0		uA
CHRG Pin Output Low Voltage	VCHRG	ICHRG=5mA		0.35		V
STDBY Pin Weak Pull-Down Current	ISTDBY	VSTDBY=5V		0		uA
STDBY Pin Output Low Voltage	VSTDBY	ISTDBY=5mA		0.35		V
Recharge Battery Threshold Voltage	ΔVRHRG	VFLOAT – VRECHRG		150		mV
Junction Temperatur	TLIM			120		°C
Soft-Start Time	tss	IBAT=0至1000V/RPROG		100		uS
Recharge Comparator Filter Time	tRECHRG	VBAT Low to High		2		mS



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Termination Comparator Filter Time		IBAT to ICHRG /10		1000		uS
PROG Pin Pull-Up Current	I _{PROG}			1		uA

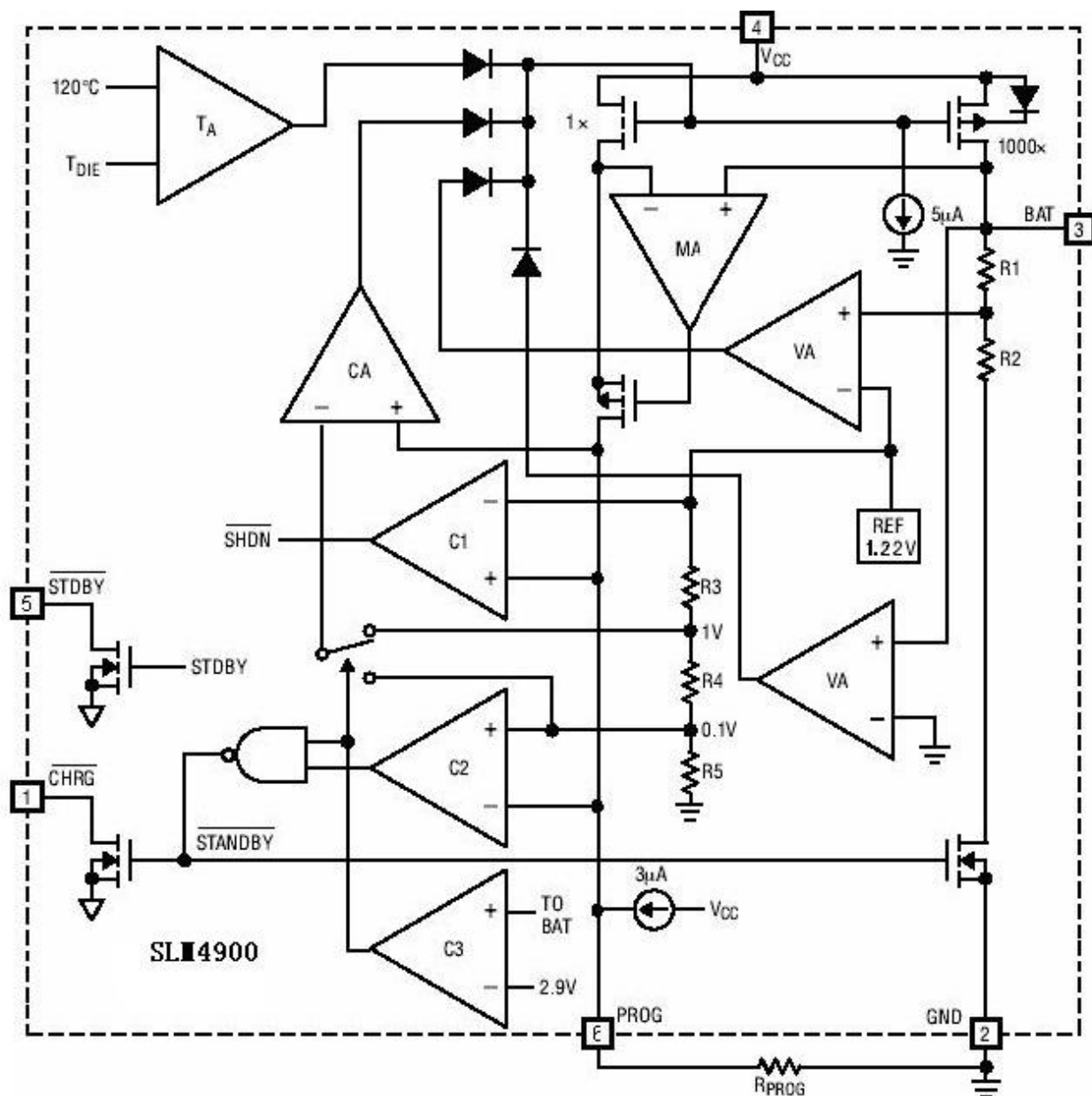
Note1: Absolute Maximum Ratings are those values beyond which the life of the device may be impaired.

Note2: The SLM4900 are NOT guaranteed to meet performance specifications OUT of this Range.

Note3: Supply current includes PROG pin current (approximately 100uA) but does not include any current delivered to the battery through the BAT pin (approximately 100mA).

Note4: I_{TERM} is expressed as a fraction of measured full charge current with indicated PROG resistor.

Block





Application Information

Status Indications

Battery connected		
Status	Red LED (Charge)	Green LED (STDBY)
Charge	Light	Dark
Full	Dark	Light
Vcc under-voltage, or battery reversal	Dark	Dark
Battery not connected		
Status	Red LED (Charge)	Green LED (STDBY)
A 10uF capacitor is connected between BAT pin and GND pin	Flicker	Light
A 100k resistor is connected between VCC pin and BAT pin	Dark	Light
A 5k resistor is connected between VCC pin and BAT pin	Dark	Dark

Stability Considerations

The constant-voltage mode feedback loop is stable without an output capacitor provided a battery is connected to the charger output. With no battery present, an output capacitor is recommended to reduce ripple voltage.

In constant-current mode, the PROG pin is in the feedback loop, not the battery. The constant-current mode stability is affected by the impedance at the PROG pin. With no additional capacitance on the PROG pin, the charger is stable with program resistor values as high as 20k. However, additional capacitance on this node reduces the maximum allowed program resistor.



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VCC Bypass Capacitor

Many types of capacitors can be used for input bypassing, however, caution must be exercised when using multilayer ceramic capacitors. Because of the self-resonant and high Q characteristics of some types of ceramic capacitors, high voltage transients can be generated under some start-up conditions, such as connecting the charger input to a live power source. 0.1uF or 1uF capacitor is recommended for VCC bypass capacitor

Power Dissipation

The conditions that cause the SLM4900 to reduce charge current through thermal feedback can be approximated by considering the power dissipated in the IC. Nearly all of this power dissipation is generated by the internal MOSFET is calculated to be approximately:

$$PD = (VCC - VBAT) I_{BAT}$$

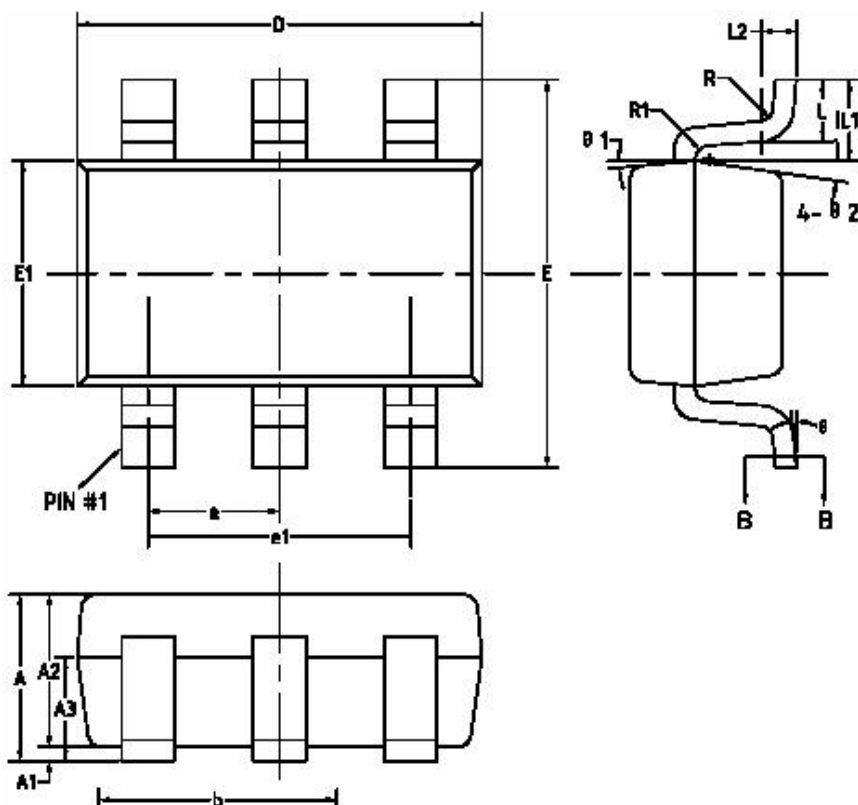
The approximate ambient temperature at which the thermal feedback begins to protect the IC is:

$$T_A = 120^{\circ}\text{C} - PD \theta_{JA} = 120^{\circ}\text{C} - (VCC - VBAT) I_{BAT} \theta_{JA}$$

Thermal Considerations

Because of the small size of the SOT-23-6L package, it is very important to use an excellent thermal PCB board layout to maximize the available charge current. The thermal path for the heat generated by the IC is from the die to the copper lead frame, through the package leads, (especially the ground lead) to the PCB board copper. The PCB board copper is the heat sink. The footprint copper pads should be as wide as possible and expand out to larger copper areas to spread and dissipate the heat to the surrounding ambient. Other heat sources on the board, not related to the charger, must also be considered when designing a PCB board layout because they will affect overall temperature rise and the maximum charge current.

Package Information



COMMON DIMENSIONS
(UNITS OF MEASURE=MILLIMETER)

SYMBOL	MIN	NOM	MAX
A	—	—	1.25
A1	0	—	0.15
A2	1.00	1.10	1.20
A3	0.60	0.65	0.70
b	0.38	—	0.50
b1	0.38	0.38	0.45
c	0.14	—	0.20
c1	0.14	0.15	0.16
D	2.828	2.928	3.028
E	2.80	2.80	3.00
E1	1.528	1.628	1.728
e	0.95BSC		
e1	1.90BSC		
L	0.35	0.45	0.80
L1	0.59REF		
L2	0.25BSC		
R	0.10	—	—
R1	0.10	—	0.20
θ	0°	—	8°
θ 1	3°	5°	7°
θ 2	6°	8°	10°