Product Overview

HX6610SA complete single-cell lithium-ion battery charger with reverse polarity protection and constant current/constant voltage linear control

The low number of external components makesHX6610SIdeal for portable applications.HX6610SCan be suitable forUSBPower supply and adapter

The adapter power supply is working.

Due to the internalPMOSFETThe architecture, coupled with the anti-reverse charging circuit, does not require an external detection resistor and isolation diode.

The charge current can be automatically adjusted to limit the chip temperature under high power operation or high ambient temperature conditions.

When the battery reachesVfloat(Typical4.22V) after which the charging current drops to the set value1/10,HX6610S

Charging will terminate automatically.

When the input voltage (AC adapter orUSBWhen the power supply is removed,HX6610SAutomatically enters a low current state, battery drain current

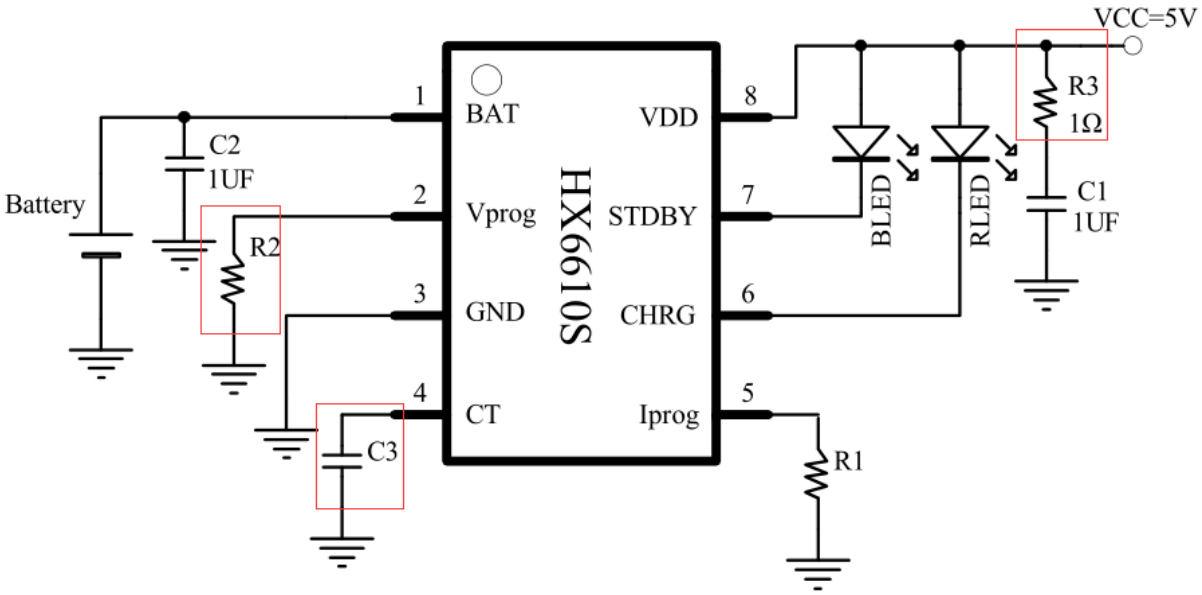
3uAthe following.HX6610SOther features include charge current monitor, undervoltage lockout, automatic recharge and two end-of-charge and output

The status pin to which the input voltage is connected.

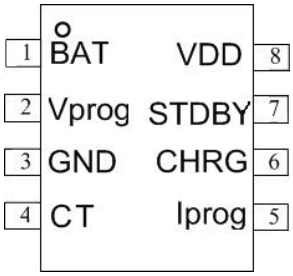
Main Features

- Presets4.22V±1%Charging voltage;
- The charging voltage is externally adjustable and can be as high as the input voltage;
- Trickle/constant current/constant voltage three-stage charging, charging current externally adjustable, maximum charging current can reach1A;
- Maximum input voltage:7V;
- Support0VBattery charging;
- Standby current is less than1uA;
- Short circuit protection function;
- OVPProtection function, input higher than6.2V, stop charging
- BAT-VDDVoltage backflow prevention function;
- Battery reverse polarity protection to prevent the chip from being burned due to reverse polarity of the battery;
- Intelligent temperature control technology, the charging current will decrease as the temperature rises, and the maximum charging current will be output without overheating protection;
- Soft start limits inrush current;
- Directly fromUSBThe port charges a single-cell lithium-ion battery;
- Automatic recharging;
- support1light mode and two-light mode;
- Highly integrated, with very few peripheral components;
- ESOP-8 (HX6610S) and DIP-8 (HX6610D) packages

Schematic

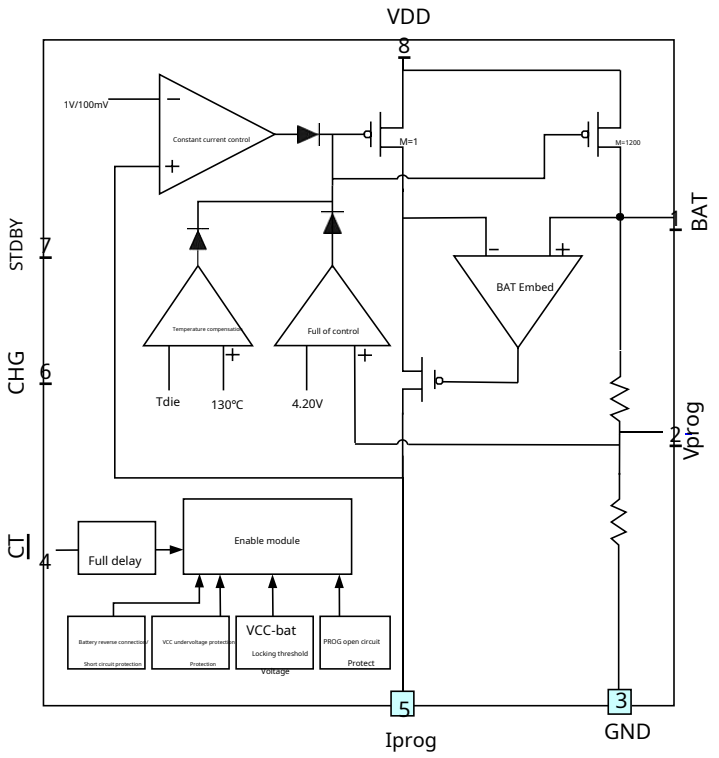


Pin Definition



Pin Name	Pinout	Functional Description
BAT	1	Battery positive terminal
Vprog	2	No-load voltage adjustment pin:1,R2When not answering,Vfloat =4.22V 2, by settingR2Resistance value, set the floating charge threshold voltage according to usage requirements
GND	3	Negative pole of power supply (ground)
CT	4	Full time delay setting (not required if delay is not needed)
Iprog	5	Charge current adjustment pin
CHG	6	Charging indicator pin
STDBY	7	Saturation indicator pin
VDD	8	Positive power supply

Circuit internal structure diagram



Electrical characteristics parameters

(Unless otherwise specified, all parameters are measured at room temperature and areGNDThe terminal potential is0Potential

symbol	characteristic	Test conditions	unit	Min	Type	Max
VIN	Input voltage range		V	4.5		6
VINPower failure monitoring Test	VINLow to High	Vin>BAT	mV	-	100	-
	VINHigh to Low	Vin>BAT	mV	-	30	-
Vfloat	Float charge threshold voltage	VDD=5V,R2No	V	4.18	4.22	4.26
VOVP	Input overvoltage protection		V		6.2	
Ibat	BATBackflow current	Vcc=3.5V,Vbat=4.2V Vcc=0V,R2No	uA	- —	±0.5 —	±5 1
VTRKL	Trickle flow to constant flow	VBATLow to High	V	-	2.8	-
VTRHYS	Trickle charge hysteresis voltage		mV	-	100	-
VUV	VccUndervoltage lockout threshold	VccLow to High	V	-	3.7	-
VUVHYS	VccUndervoltage Lockout Hysteresis		mV	-	200	-
Vmsd	Manual shutdown threshold voltage		V	-	1.2	-
VxDV	Manual shutdown hysteresis voltage		mV	-	50	-
Vprog1	TricklePROGVoltage		V	-	0.1	-
Vprog2	At high currentPROGVoltage		V	-	1	-
OTR	Over temperature recovery (constant temperature mode)	VDD=5V	℃	-	130	-

Application Information

Normal charging cycle

whenVccThe pin voltage rises toUVLOAbove the threshold level andPROGA precision1%Setting of electric

A charging cycle begins when a resistor is connected or when a battery is connected to the charger output.BATThe pin level is lower than2.8V, the charger enters

In this mode,HX6610SProvide about1/10Set the charging current to increase the current voltage to a safe level.

level, thus achieving full current charging.BATThe pin voltage rises to2.8VWhen the current is above 200V, the charger enters the constant current mode, supplying

Provides a constant charging current.BATpin voltage reaches the final float voltage (typical4.22V)hour,HX6610SEntering constant voltage mode,

And the charging current starts to decrease. When the charging current drops to the set value1/10, the charging cycle ends.

Charging current setting

The charging current is connected toPROGThe resistor between the pin and ground is used to set the charging current.

Calculate by formula: Determine the resistor value according to the required charging current, formula 1:$R = \frac{1200}{Ibat}$Example 1: When the charging current needs to be set toIBAT

=0.2AWhen , use formula 1 to calculate:$R = \frac{1200}{0.2}$ =6000 ΩRight nowRPROG=6kΩThe maximum charging current can be set to1A, but in greater than

0.5AIn the application, the chip heat is relatively large, the temperature protection will reduce the charging current, and the test current in different environments will also be different from the theoretical value calculated by the formula.

Completely consistent. In customer applications, you can select the appropriate size according to your needs.RPROG.

Full voltage setting

HX6610SThe floating charge threshold voltage is adjusted byVprogThe resistor and the full voltage are set using the following formulas:

Formula: Determine the resistor value according to the required full charge. When the full charge voltage is set higher than4.22V(Typical value) ,VprogConnect an electric

ResistanceR, using formula 1:$R = \frac{2.20 * 265000}{Vprog - 4.20}$ Example 1: When the full voltage needs to be setVprog=4.5VWhen using formula 1

have to:$R = \frac{2.20 * 265000}{4.5 - 4.20}$ =1.940MΩWhen the full voltage is set below4.2V,VprogarriveBATConnect a resistorR, using formula 2:

$R//265000 = \frac{(Vprog - 2.2) * 291500}{2.2}$, Example 2, when the full voltage needs to be set toVprog=3.6VWhen , use formula 2 to calculate:

R = 618KΩ.

Shutdown delay setting

HX6610SThe full turn-off delay is adjusted byCTThe capacitor and the turn-off delay are set using the following formula:

To calculate: Determine the capacitance value according to the required shutdown delay,

$C=\frac{1.5*10^{-6}}{2.2}*T$ Example 1: When you need to set the shutdown delay to30msWhen , the formula is used to calculate:$C=\frac{1.5*10^{-6}}{2.2}*30*10^{-3}$

=20.50nF

Battery reverse polarity protection function

With lithium battery reverse connection protection function, when the positive and negative poles of the lithium battery are reversely connected toHX6610SVbatOutput pins,HX6610SWill stop display Fault condition, twoledAll lights are off. At this time, the leakage current of the reverse-connected lithium battery is less than0.5mA. Connect the reversed battery correctly.HX6610S Restore normal charging state. In case of reverse connection of battery, the power supply voltage plus the battery voltage cannot exceed8V.

Charging status indicator (CHRG STDBY)

HX6610SThere are two open-drain status indication outputs.CHGandSTDBYWhen the charger is in charging state,CHGquilt Pull to low level,STDBYIn high impedance state. When the battery is reversed or short-circuited,CHGandSTDBYBoth are in high impedance state and both lights are off.

When the status indication function is not used, connect the unused status indication output terminal toGND.

VIN	**BAT**	CHG	STDBY
disconnect	Access	Destroy	Destroy
Access	disconnect	Destroy	Bright
Access	Charging	Bright	Destroy
Access	full	Destroy	Bright
Access	Short circuit/reverse connection	Destroy	Destroy

Thermal Limitation

If the chip temperature attempts to rise to approximately130If the temperature rises above a preset value, an internal thermal feedback loop will reduce the set charge current. PreventsHX6610Soverheating and allows the user to push the upper limit of a given board’s power handling capabilities without damageHX6610Srisk. The charger can be set based on typical (rather than worst-case) ambient temperature, with the assurance that the charger will automatically reduce current under worst-case conditions. Electric current.

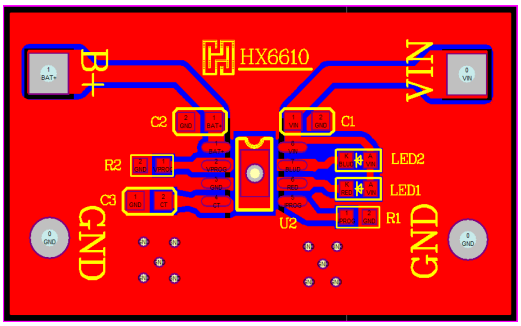
Increased thermal regulation

reduceICofV_{CC}andBATThe pressure drop across the two ends can be significantly reducedICThis has the effect of increasing the charging current during thermal regulation. The input power supply can beV_{CC}Connect one in series0.25 ΩThe power resistance or forward voltage drop is less than0.5VThe diode transfers part of the power Consume.

Undervoltage Lockout

An internal undervoltage lockout circuit monitors the input voltage andVDDKeeps the charger in shutdown mode until it exceeds the undervoltage lockout threshold model.UVLOThe circuit will keep the charger in shutdown mode.UVLOIf the comparator jumps,VDDRising to a voltage higher than the battery voltage 50mVThe charger will not exit shutdown mode before then.

PCBDesign Guidelines



In designHX6610SPCBThe following guidelines apply:

VDDThe bypass capacitor needs to be close to the chipVDDandGNDPin.

VbatThe bypass capacitor needs to be close to the chipVbatandGNDPin.

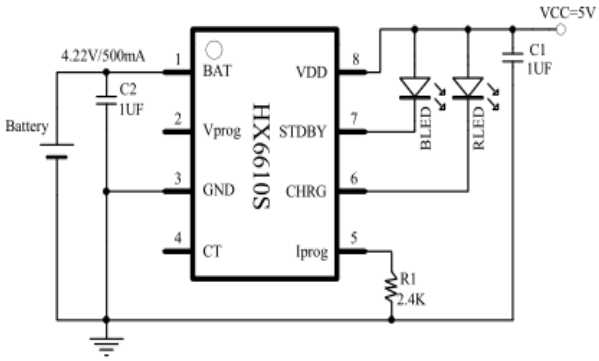
R2Need to be close to the chipVprog, in order to reduceVfloatinterference.

Static Electricity Protection Measures

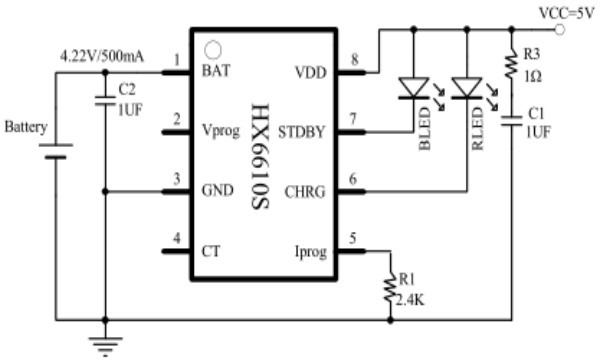
MOSThe circuit is an electrostatically sensitive device. The following precautions should be taken during production and transportation to effectively preventMOSThe circuit is Damage caused by electrostatic discharge:

- Operators must be grounded using an anti-static wrist strap;
- The casing of production equipment must be grounded;
- Tools used during assembly must be grounded;
- Conductive packaging or antistatic materials must be used for packaging or transportation.

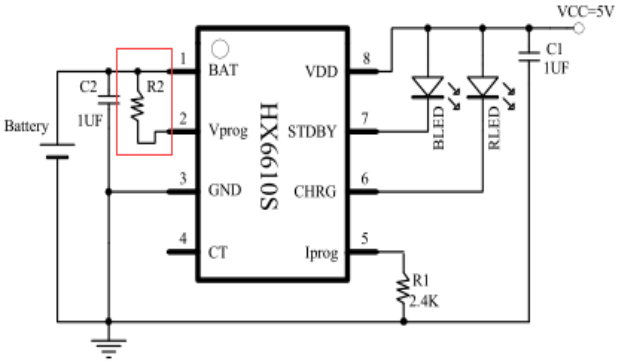
Typical application reference circuit



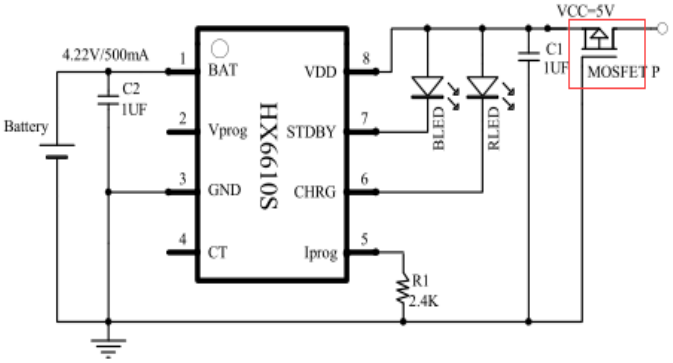
General use



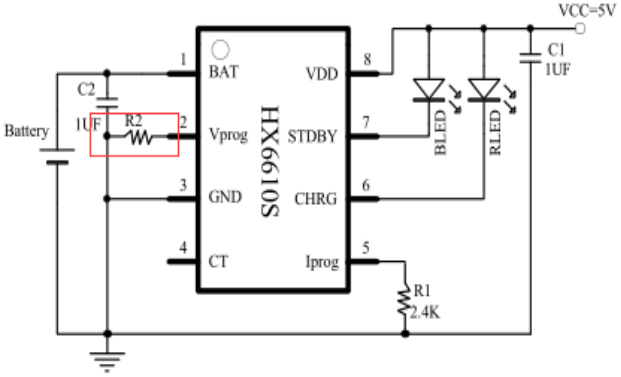
Reduce the instantaneous high voltage of the charger



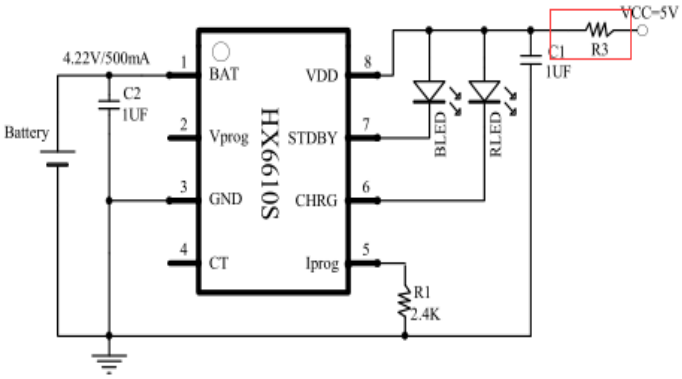
Full voltage is lower than 4.2V



With input reverse polarity protection



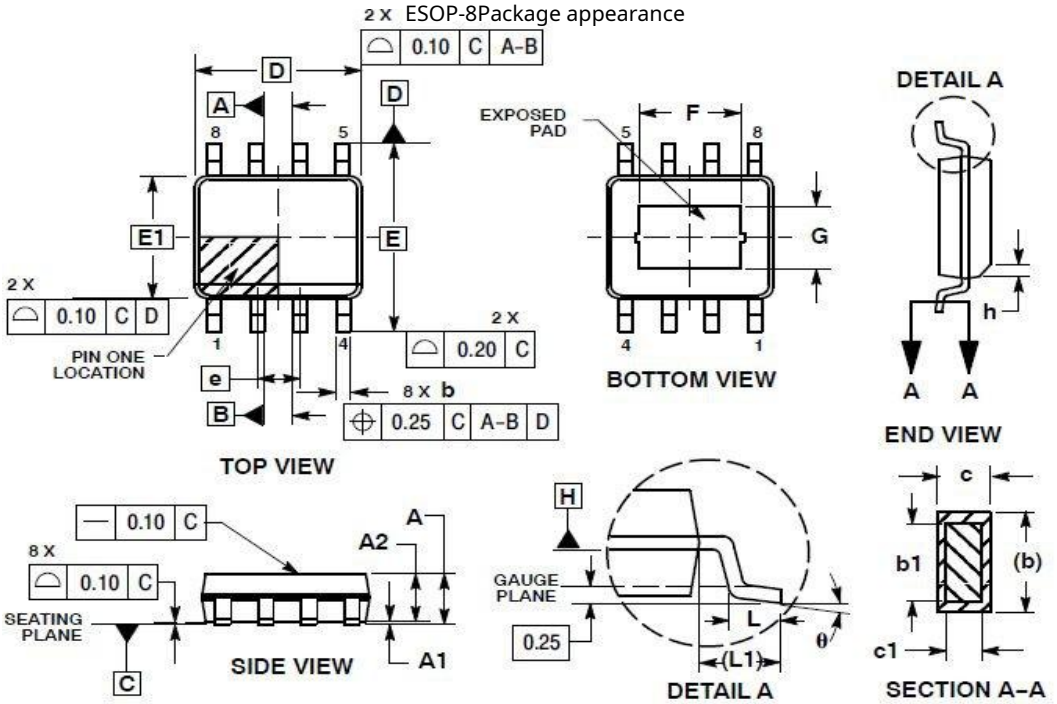
Full charge voltage is higher than 4.22V



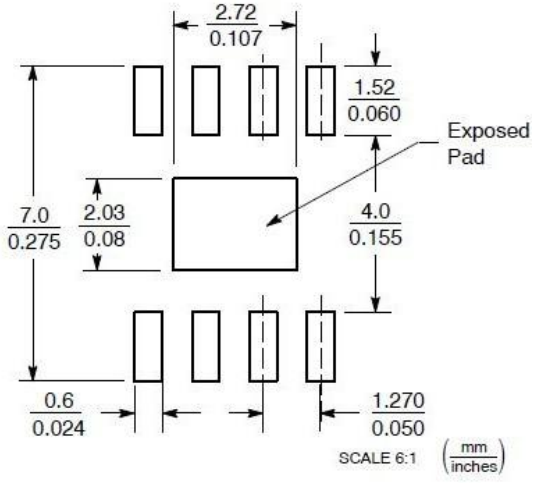
Full function connection dissipation resistor

Packaging information

2 X ESOP-8Package appearance

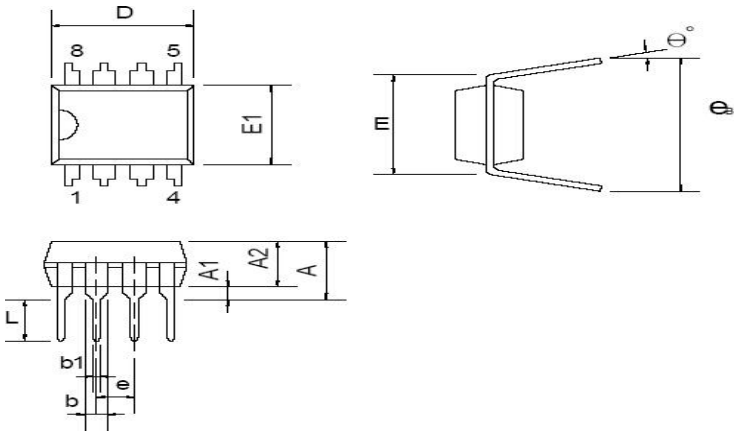


SOLDERING FOOTPRINT



DIM	MILLIMETERS MIN	MAX
A	1.35	1.75
A1	0.00	0.10
A2	1.35	1.65
b	0.31	0.51
b1	0.28	0.48
c	0.17	0.25
c1	0.17	0.23
D	4.90 BSC	
E	6.00 BSC	
E1	3.90 BSC	
e	1.27 BSC	
L	0.40	1.27
L1	1.04 REF	
F	2.24	3.20
G	1.55	2.51
h	0.25	0.50
θ	0 °	8 °

DIP-8Package appearance



symbol	Millimeters			inch		
	Minimum	typical	maximum	Minimum	typical	maximum
A			5.334			0.210
A1	0.381			0.015		
A2	3.175	3.302	3.429	0.125	0.130	0.135
b		1.524			0.060	
b1		0.457			0.018	
D	9.017	9.271	10.160	0.355	0.365	0.400
E		7.620			0.300	
E1	6.223	6.350	6.477	0.245	0.250	0.255
e		2.540			0.100	
L	2.921	3.302	3.810	0.115	0.130	0.150
eB	8.509	9.017	9.525	0.335	0.355	0.375
θ	0	7°	15°	0°	7°	15°