

Linear Charge Management Controllers

Description

The SC64A08 is a single-cell lithium-ion battery charger using a constant-current/constant-voltage algorithm. It can deliver up to 800mA of charge current (using a good thermal PC board layout) with a final float voltage accuracy of $\pm 1\%$. The SC64A08 includes an internal P-channel power MOSFET and thermal regulation circuitry. No blocking diode or external current sense resistor is required and the SC64A08 is capable of operating from a USB power source.

The charge voltage is fixed at 4.2V, and the charge current can be programmed externally with a single resistor. The SC64A08 automatically terminates the charge cycle when the charge current drops to $1/10^{\text{th}}$ the programmed value after the final float voltage is reached.

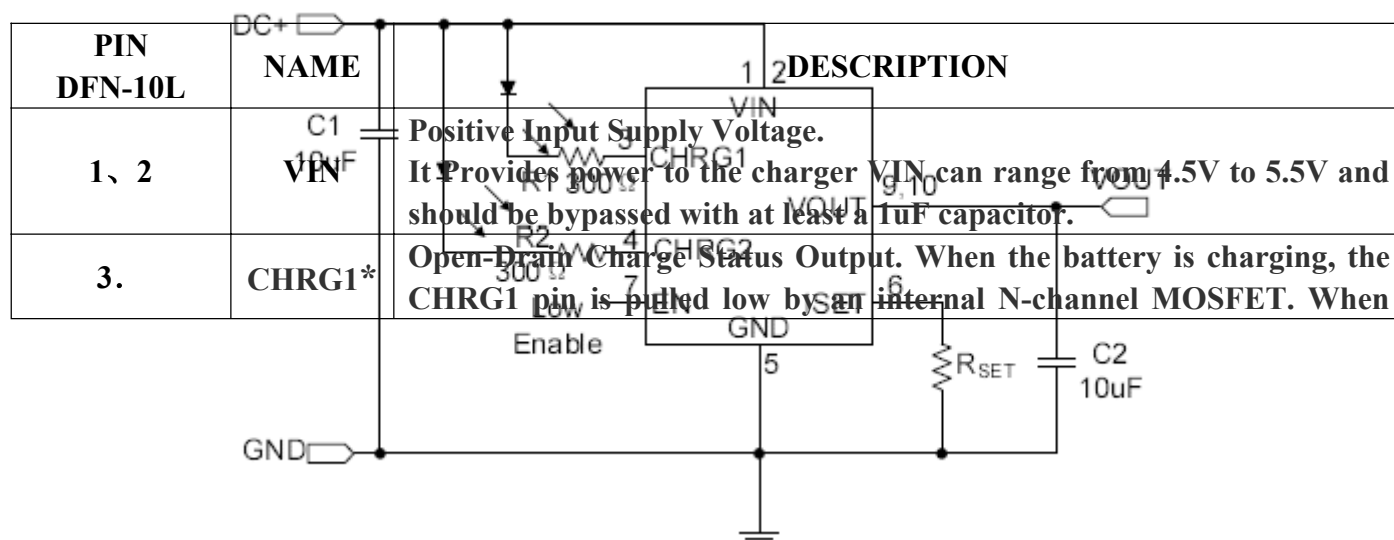
The SC64A08 converters are available in the industry standard DFN3 \varnothing 3-10L power packages (or upon request).

Features

- Input Voltage Range: 4.5V-5.5V
- No MOSFET, Sense Resistor
- Complete Switching Charger for Single Cell Lithium-Ion Battery
- Constant-Current/Constant-Voltage Charge
- Charges Single Cell Li-Ion Batteries
- Directly from USB Port
- Automatic Recharge
- 10-Lead DFN Package

Applications

- Charges Single Cell Li-Ion Batteries
- Portable MP3 Players, Wireless Headsets
- Bluetooth Applications
- MID
- Mobile power



Package Type	Pin Configurations
SC64A08 DFN3-10L	<p>VIN 1 10 VOUT</p> <p>VIN 2 9 VOUT</p> <p>CHRG1 3 8 N/C</p> <p>CHRG2 4 7 EN</p> <p>GND 5 6 ISET</p> <p>11 GND</p>

Pin Description

		the charge cycle is completed or reverse battery lockout / No AC is detected, CHRG1 is forced high impedance.
4.	CHRG2*	Open-Drain Charge Status Output. When the battery is charging, the CHRG2 pin is pulled low by an internal N-channel MOSFET. When the charge cycle is completed or reverse battery lockout / No AC is detected, CHRG2 is forced high impedance
5.	GND	Ground.
6.	ISET	Charge Current Set Pin. The charge current is programmed by connecting a 1% resistor, R _{ISET} , 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: $I_{OUT} = (V_{ISET}/R_{ISET}) \times 900$. The ISET pin can also be used to shut down the charger. Disconnecting the program resistor from ground allows a weak current to pull the ISET pin high.
7.	EN	ON/OFF Control (Low Enable). The EN digital input is used to disable or enable the charge process. A low-level signal on this pin enables the charge and a high-level signal disables the charge and places the device in a low-power mode.
8.	N/C	No Connect.
9、10	VOUT	Charge Current Output. It should be bypassed with at least a 1μF capacitor. It 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.
11.	GND	Ground.

* The open-drain CHRG1 and CHRG2 outputs indicate various charger operations as shown in the following table. These status pins can be used to drive LEDs or communicate to the host processor. Note that OFF indicates the open-drain transistor is turned off.

CHARGE STATE	CHRG1	CHRG2
Precharge in progress	ON	OFF
Fast charge in progress	ON	OFF
Charge done	OFF	ON
Sleep mode	OFF	OFF

Figure 1. Status Pins Summary

Absolute Maximum Ratings

- Input Supply Voltage (V_{IN}) ----- $-0.3V$ to $7V$
- CHRG1、CHRG2 ----- $-0.3V$ to $V_{IN} + 0.3V$
- ISET ----- $-0.3V$ to $7V$
- VOUT ----- $-0.3V$ to $7V$
- VOUT Pin Current ----- $800mA$
- Maximum Junction Temperature ----- $125^{\circ}C$
- Operating Ambient Temperature Range ----- $-40^{\circ}C$ to $85^{\circ}C$
- Storage Temperature Range ----- $-65^{\circ}C$ to $125^{\circ}C$
- Lead Temperature (Soldering, 10 sec) ----- $300^{\circ}C$

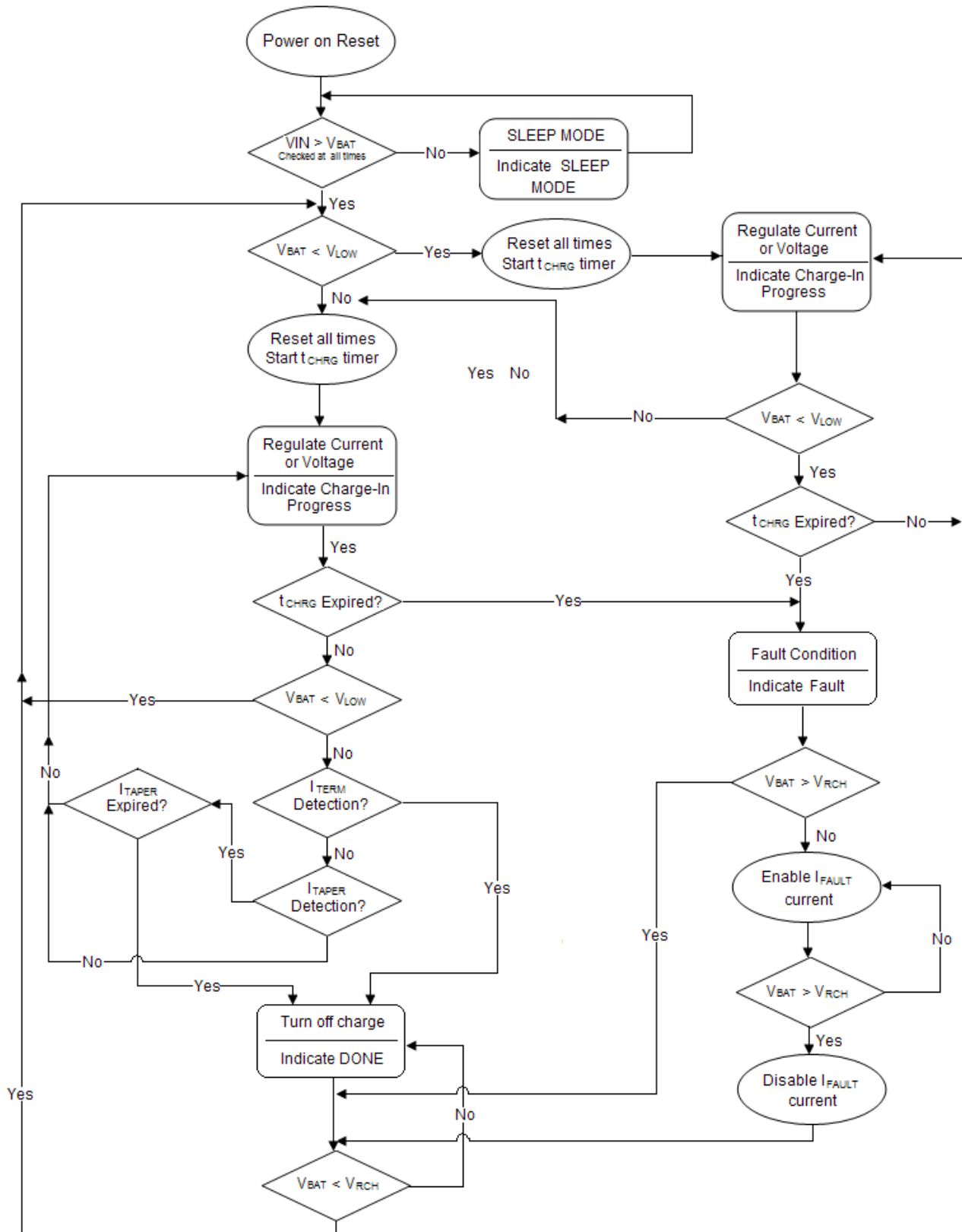
Electrical Characteristics

(Operating Conditions: $T_A=25^{\circ}C$, $V_{IN}=5V$ unless otherwise specified.)

SYMBOL	PARAMETER	CONDITIONS	SC64A08			UNITS
			MIN	TYP	MAX	

V_{IN}	Input Supply Voltage		4.5	5.0	5.5	V
I_{IN}	Input Supply Current	Standby Mode (Charge Terminated)		48		μA
		Shutdown Mode (R_{ISET} Not Connected, V_{IN} < V_{OUT})		80		μA
V_{FLOAT}	Regulated Output (Float) Voltage	0°C ≤ T_A ≤ 85°C	4.15	4.2	4.24	V
I_{OUT}	V_{OUT} Pin Current	R_{ISET} = 10k, Current Mode		90		mA
		R_{ISET} = 2k, Current Mode		450		mA
		Standby Mode, V_{OUT} = 4.2V		7		μA
		Shutdown Mode (R_{ISET} Not Connected)		13		μA
		Sleep Mode, V_{IN} = 0V		0.1	1	μA
I_{TRIKL}	Trickle Charge Current	V_{OUT} < V_{TRIKL}, R_{ISET} = 2k		45		mA
V_{TRIKL}	Trickle Charge Threshold Voltage	R_{ISET} = 10k, V_{OUT} Rising		2.9		V
ΔV_{RECHRG}	Recharge Battery Threshold Voltage	V_{FLOAT} - V_{RECHRG}		250		mV
V_{PROG}	PROG Pin Voltage	R_{ISET} = 2k, Current Mode		1		V
I_{TERM}	C/10 Termination Current Threshold	R_{ISET} = 2k		45		mA
R_{ON}		Power FET “ON” Resistance (Between V_{IN} and V_{OUT})		660		mΩ
V_{TS-COLD}	TS Pin Threshold Voltage (cold)	V_{TS} from Low to High		2.35		V
V_{TS- HOT}	TS Pin Threshold Voltage (hot)	V_{TS} from High to Low		0.49		V
I_{TS}	Current source			88.5		μA

Operational Flow Chart



Normal Charge

Charging begins when the voltage at the V_{IN} pin rises above 4.5V and a program resistor is

connected from the ISET pin to ground. If the VOUT pin voltage is below 2.9V, the charger enters trickle charge mode. In this mode, the SC64A08 supplies approximately 1/10 the programmed charge current to bring the battery voltage up to a safe level for full current charging.

When the VOUT pin voltage rises above 2.9V, the charger enters constant-current mode, where the programmed charge current is supplied to the battery. When the VOUT pin approaches the final float voltage (4.2V), the SC64A08 enters constant-voltage mode, and the charge current begins to decrease.

Battery Temperature Monitoring

A negative temperature coefficient (NTC) thermistor located close to the battery pack can be used to monitor battery temperature and will not allow charging unless the battery temperature is within an acceptable range. Connect a 10k Ω thermistor from the TS pin to ground. With the 88.5 μ A pull-up current source, the hot temperature voltage threshold is 490mV. For Cold temperature, the voltage threshold is set at 2.35V with 88.5 μ A of pull-up current. The charge cycle begins or resumes once the temperature is within the acceptable range.

VIN 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. Adding a 1.5W resistor in series with an X5R ceramic capacitor will minimize start-up voltage transients.

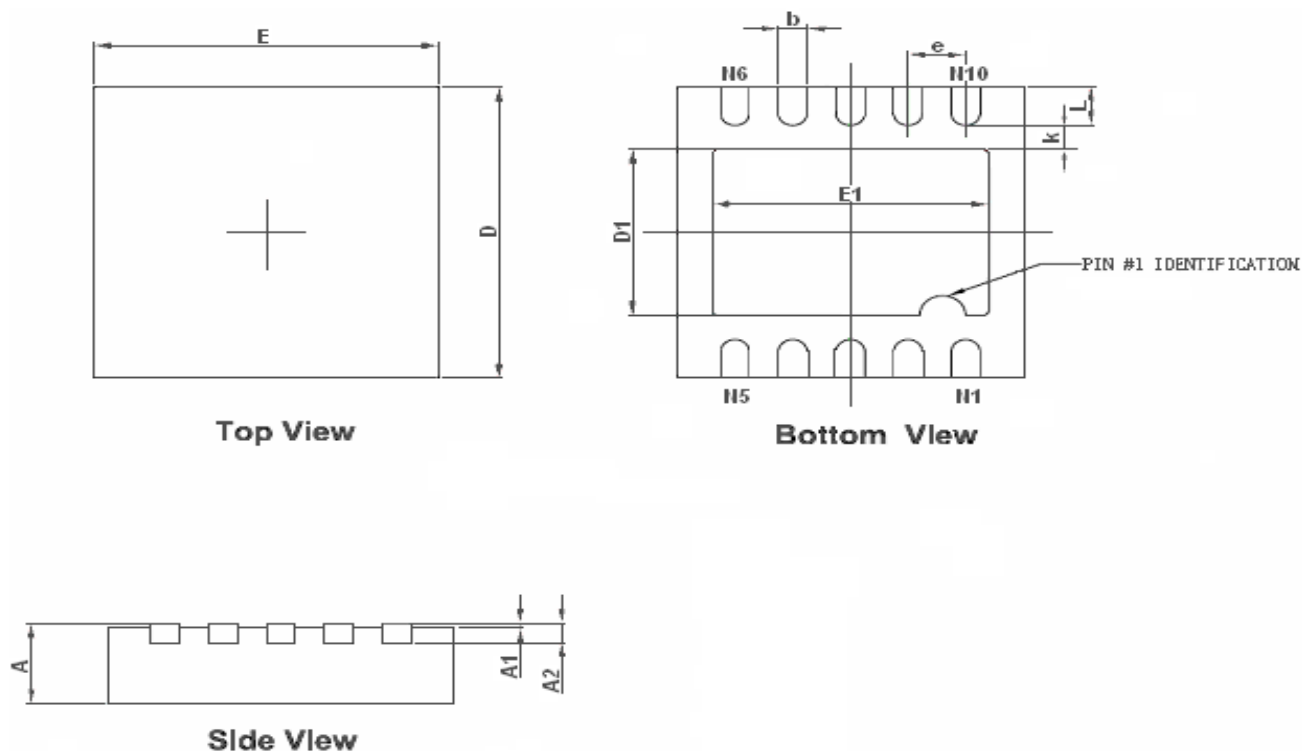
Charge Current Soft-Start

The SC64A08 includes a soft-start circuit to minimize the inrush current at the start of a charge cycle. When charging begins, the charge current ramps from zero to the fullscale current over a period of approximately 100ms. This has the effect of minimizing the transient current load on the power supply during startup.

Thermal Limiting

An internal thermal feedback loop reduces the programmed charge current if the die temperature attempts to rise above a preset value of approximately 120°C. This feature protects the SC64A08 from excessive temperature and allows the user to push the limits of the power handling capability of a given circuit board without risk of damaging the SC64A08. The charge current can be set according to typical (not worst-case) ambient temperature with the assurance that the charger will automatically reduce the current in worst-case conditions.

Packaging Information

DFN3Ø3-10L Package Outline Dimension


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.700/0.800	0.800/0.900	0.028/0.031	0.031/0.035
A1	0.000	0.050	0.000	0.002
A2	0.153	0.253	0.006	0.010
D	2.900	3.100	0.114	0.122
E	2.900	3.100	0.114	0.122
D1	1.600	1.800	0.063	0.071
E1	2.300	2.500	0.091	0.098
k	0.200MIN		0.008MIN	
b	0.200	0.300	0.008	0.012
e	0.500TYP		0.020TYP	
L	0.300	0.500	0.012	0.020