1A Standalone Linear Li-Ion Battery Charger with Thermal Regulation TD9056A/B

General Description

The TD9056 is a complete constant-current/constant-voltage linear charger for single cell lithium-ion batteries. Its SOP package and low external component count make the TD9056 ideally suited for portable applications. Furthermore, the TD9056 can work within USB and wall adapter.
No blocking diode is required due to the internal PMOSFET architecture and have prevent to negative Charge Current Circuit. Thermal feedback regulates the charge current to limit the die temperature during high power operation or high ambient temperature. The charge voltage is fixed at 4.2V, and the charge current can be programmed externally with a single resistor. The TD9056 automatically terminates the charge cycle when the charge current drops to 1/10th the programmed value after the final float voltage is reached.
TD9056 Other features include current monitor, under voltage lockout, automatic recharge and two status pin to indicate charge termination and the presence of an input voltage.

Features

- Programmable Charge Current Up to 1000mA
- No MOSFET, Sense Resistor or Blocking Diode Rquired
- Complete Linear Charger in SOP-8 Package for Single Cell Lithium-Ion Batteries
- Constant-Current/Constant-Voltage
- Charges Single Cell Li-Ion Batteries Directly from USB Port
- Preset 4.2V Charge Voltage with 1.5% Accuracy
- Automatic Recharge
- Charge Status Output Pins
- C/10 Charge Termination
- 2.9V Trickle Charge Threshold (TD9056)
- Soft-Start Limits Inrush Current
- Available Radiator in SOP8/SOT23-5 Package,the Radiator need connect GND or impending

Applications

- Cellular Telephones, PDAs, GPS
- Charging Docks and Cradles
- Digital Still Cameras, Portable Devices
- USB Bus-Powered Chargers,Chargers

Package Types

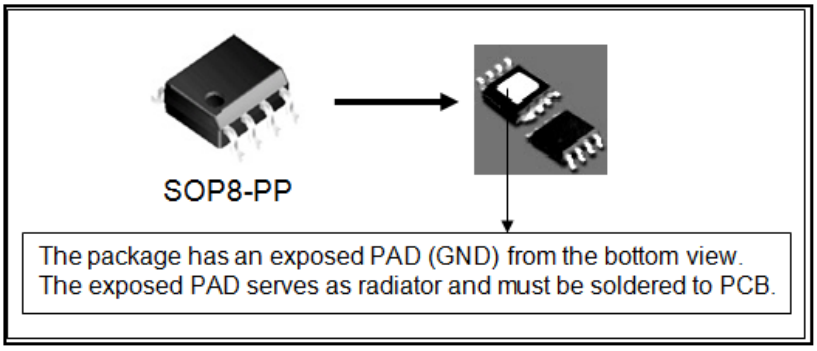


Figure 1. Package Types of TD9056

Pin Configurations

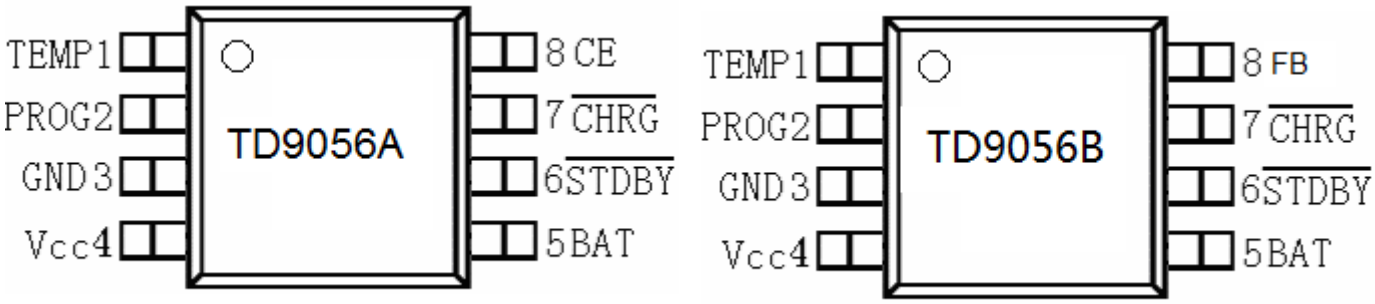
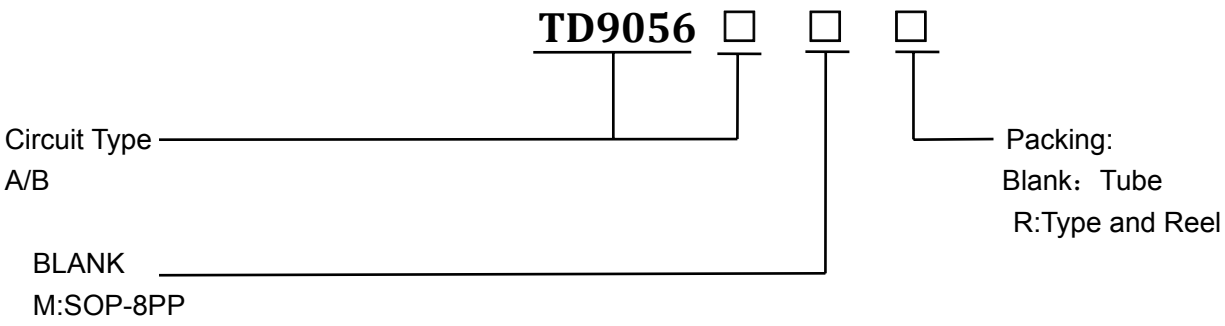


Figure 2 Pin Configuration of TD9056(Top View)

Pin Description

Pin Name		Pin Number	Description
TD9056A	TD9056B		
TEMP		1	Connecting TEMP pin to NTC thermistor's output in Lithium ion battery pack. If TEMP pin's voltage is below 45% or above 80% of supply voltage V_{IN} for more than 0.15S, this means that battery's temperature is too high or too low, charging is suspended. The temperature sense function can be disabled by grounding the TEMP pin.
PROG		2	charge current is set by connecting a resistor R_{ISET} from this pin to GND. When in precharge mode, the ISET pin's voltage is regulated to 0.2V. When in constant charge current mode, the ISET pin's voltage is regulated to 2V.In all modes during charging, the voltage on ISET pin can be used to measure the charge current as follows: $I_{BAT}=(V_{ISET}/R_{ISET})*1200$----(TD9056A) $I_{BAT}=(V_{ISET}/R_{ISET})*1250$----(TD9056B)
GND		3	GND
Vcc		4	V_{IN} is the power supply to the internal circuit. When V_{IN} drops to within 30mv of the BAT pin voltage, TD9056 enters low power sleep mode, dropping BAT pin's current to less than 2uA.
BAT		5	Connect the positive terminal of the battery to BAT pin. BAT pin draws less than 2uA current in chip disable mode or in sleep mode. BAT pin provides charge current to the battery and provides regulation voltage of 4.2V.
STBY		6	When the battery Charge Termination, the $\overline{STDBY}$ pin is pulled low by an internal switch, otherwise $\overline{STDBY}$ pin is in high impedance state.
CHRG		7	When the battery is being charged, the $\overline{CHRG}$ pin is pulled low by an internal switch, otherwise $\overline{CHRG}$ pin is in high impedance state.
CE	FB	8	A high input will put the device in the normal operating mode.Pulling the CE pin to low level will put the YP4056 into disable mode. The CE pin can be driven by TTL or CMOS logic level.(TD9056A) This pin can test Kelvin battery voltage, and thus precisely modulated constant voltage battery charging voltage, avoiding the positive from the battery to the BAT pin LN2051 or contact resistance between the resistance wire and other parasitic resistance of the charge. If the FB pin and the BAT pin is an indirect one resistor, users can adjust the constant charging voltage(TD9056B)

Ordering Information



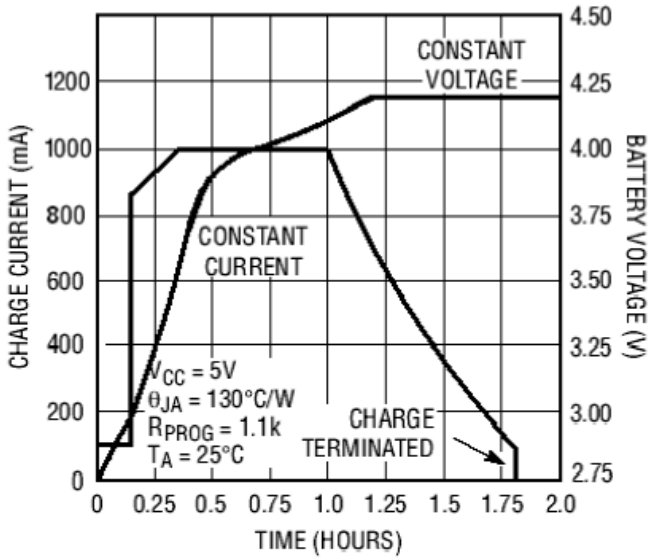
Electrical Characteristics

(V_{IN} = 5V, V_{OUT}=12V, I_{OUT}=100mA, T_A = 25°C unless otherwise specified)

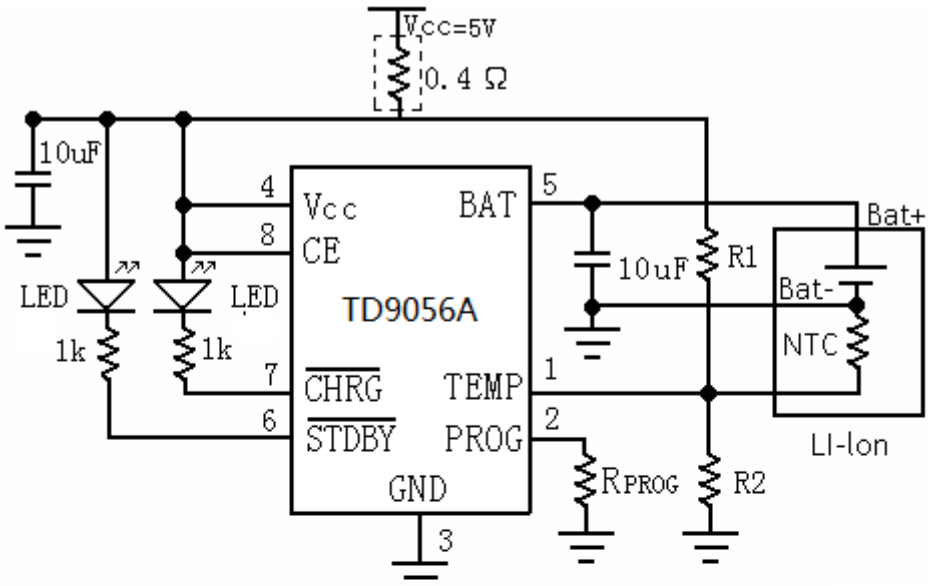
Parameters	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Input Supply Voltage	V_{CC}		4.0	5	8.0	V
Input Supply Current	I_{CC}	Charge Mode, R_{PROG} = 1.2kStandbyMode(Charge Terminated)Shutdown Mode (R_{PROG} Not Connected,V_{CC} < V_{BAT}, or V_{CC}< V_{UV})		150 55 55	500 100 100	μA
Regulated Output (Float) Voltage	V_{FLOAL}	0℃≤TA≤85℃，IBAT=40mA	4.137	4.2	4.263	V
BAT Pin Current Test	I_{BAT}	RPROG = 2.4k, Current Mode RPROG = 1.2k, Current Mode Standby Mode, V_{BAT} = 4.2V	450 950 0	500 1000 -2.5	550 1050 -2.6	mA mA uA
Trickle Charge Current	I_{TRIKL}	V_{BAT}<V_{TRIKL}, R_{PROG}=1.2K	120	130	140	mA
Trickle Charge Threshold Voltage	V_{TRIKL}	R_{PROG}=1.2K, V_{BAT} Rising	2.8	2.9	3.0	V
Trickle Charge Hysteresis Voltage	V_{TRHYS}	R_{PROG}=1.2K	60	80	100	mV
Junction Temperature in Constant Temperature Mode	T_{LIM}			145		℃

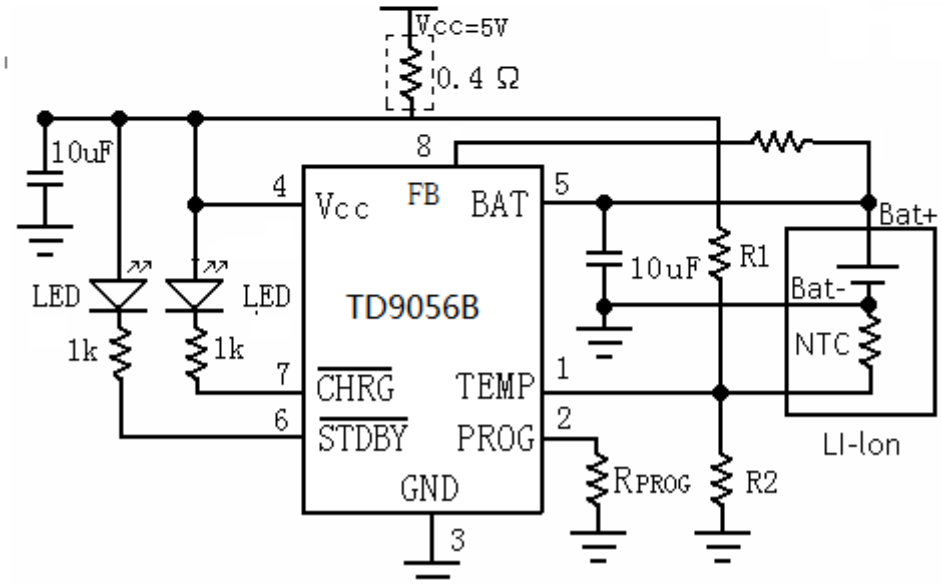
Typical Performance Characteristics

Complete Charge Cycle (1000mAh Battery)



Typical Application Circuit





indicator light state

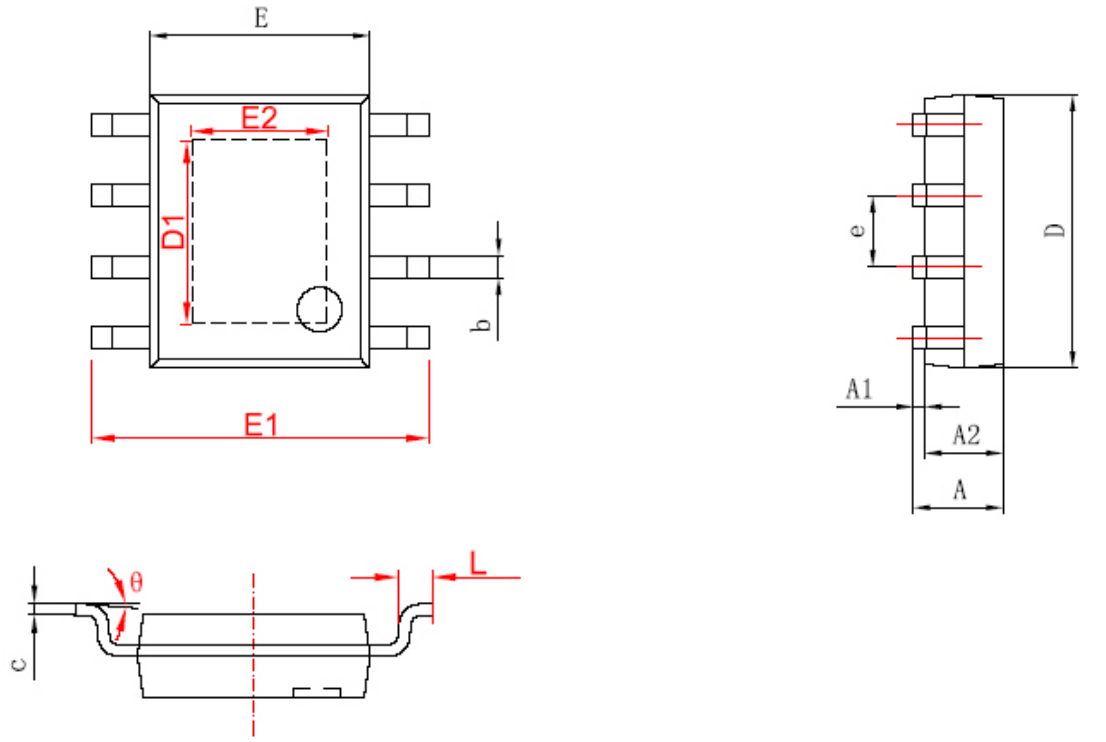
Charge state	Red LED（CHRG）	Greed LED(STDBY)
charging	bright	extinguish
Charge Termination	extinguish	bright
Vin too low;Temperature of battery too low or too high; no battery	extinguish	extinguish
BAT PIN Connect 10u Capacitance; No battery	Greed LED bright，Red LED Coruscate T=1-4 S	

Rprog Current Setting

RPROG(K)	10	5	4	3	2	1.66	1.5	1.33	1.2
IBAT(mA)	130	250	300	400	580	690	780	900	1000

Package Information

SOP8-PP Package Outline Dimensions



	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°

Design Notes