4056 High Voltage Ver.

Using SOP8/MSOP8 package
1A Linear Li-Ion Battery Charger

General Description

The 4056 is a complete constant current & constant voltage linear charger for single cell lithium-ion batteries. Its SOP/MSOP package and low external component count make the 4056 ideally suited for portable applications. Furthermore, the 4056 is specifically designed to work within USB power specifications.
No external sense resistor is needed, and no blocking diode is required due to the internal MOSFET architecture. 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 4056 automatically terminates the charge cycle when the charge current drops to 1/10th the programmed value after the final float voltage is reached.
When the input supply (wall adapter or USB supply) is removed, the 4056 automatically enters a low current state, dropping the battery drain current to less than 2uA. The 4056 can be put into shutdown mode, reducing the supply current to 50uA.
Other features include Battery temperature monitor, under-voltage lockout, automatic recharge and two status pins to indicate charge and charge termination.

Applications

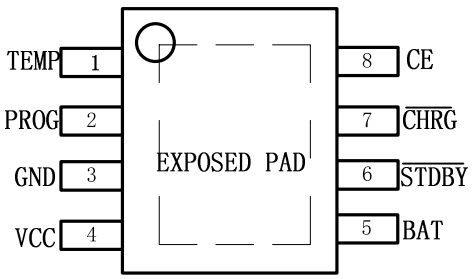
- Cellular Telephones, PDAs, MP3 /MP4 Players
- Charging Docks and Cradles
- Bluetooth 、GPS Applications

Features

- Programmable Charge Current Up to 1200mA
- Wide input voltage：4.25V to 10V
- No MOSFET, Sense Resistor or Blocking Diode Required
- Complete Linear Charger in SOP/MSOP Package for single Cell Lithium-Ion Batteries
- Constant-Current/Constant-Voltage Operation with Thermal Regulation to Maximize Charge Rate Without Risk of Overheating
- Charges Single Cell Li-Ion Batteries Directly from USB Port
- Preset 4.2V Charge Voltage with ±1% Accuracy
- Charge Current Monitor Output for Gas Gauging
- Automatic Recharge
- Charge state pairs of output, no battery and fault status display
- C/10 Charge Termination
- 50uA Supply Current in Shutdown
- 2.9V Trickle Charge Threshold
- Soft-Start Limits Inrush Current
- Battery temperature monitoring function
- Available in SOP8-PP/ MSOP8-PP Package

Package

SOP8-PP/MSOP8-PP



Typical Application Circuit

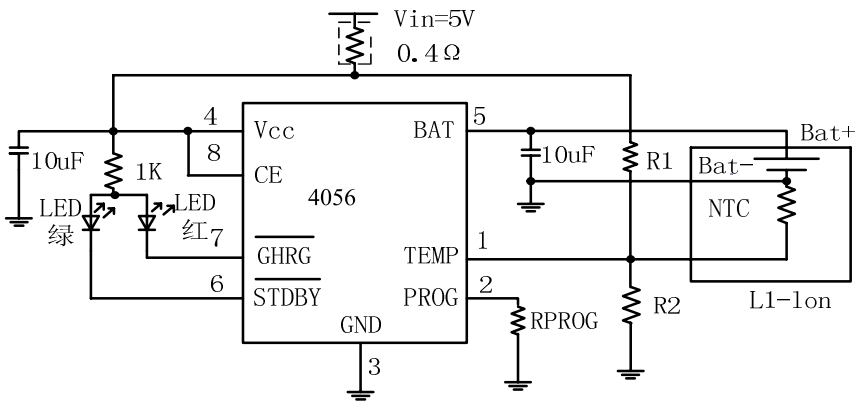


Figure 1. Basic Application Circuit with 4056

Pin Description

Pin No.	Pin Name	Pin Function
1	TEMP	Battery temperature detection input.
2	PROG	Charge Current Program, Charge Current Monitor and Shutdown Pin.
3	GND	Ground.
4	VCC	Positive Input Supply Voltage.
5	BAT	Charge Current Output.
6	STDBY	The completion of battery charging instructions side.
7	CHRG	Open-Drain Charge Status Output.
8	CE	Chip enable input.

Functional Block Diagram

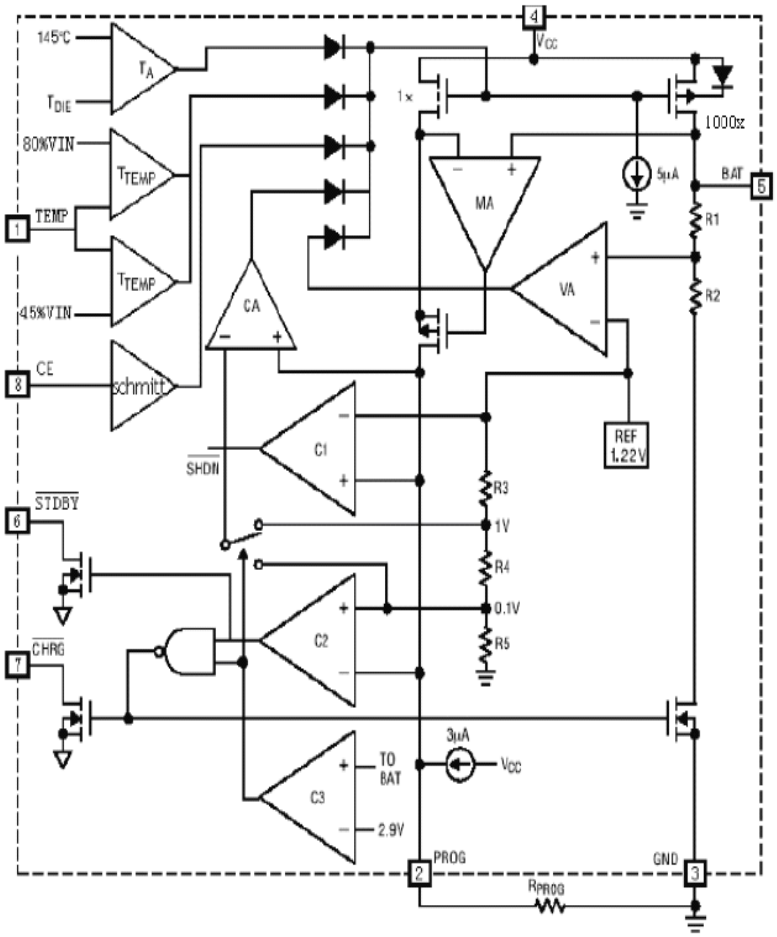


Figure 2. Block Diagram

Absolute Maximum Ratings

PARAMETER	SYMBOL	MAXIMUM RATING	UNIT
Input Supply Voltage	V_{cc}	V_{SS}-0.3～V_{SS}+10	V
PROG pin Voltage	Vprog	V_{SS}-0.3～V_{cc}+0.3	
BAT pin Voltage	Vbat	Vss-0.3～10	
CHAG pin Voltage	Vchrg	V_{SS}-0.3～V_{SS}+10	
BAT pin Current	Ibat	1500	mA
PROG pin Current	Iprog	1500	uA
Operating Ambient Temperature	Topa	-40～+85	°C
Storage Temperature	Tstr	-65～+125	
Lead Temperature (Soldering, 10s)		260	

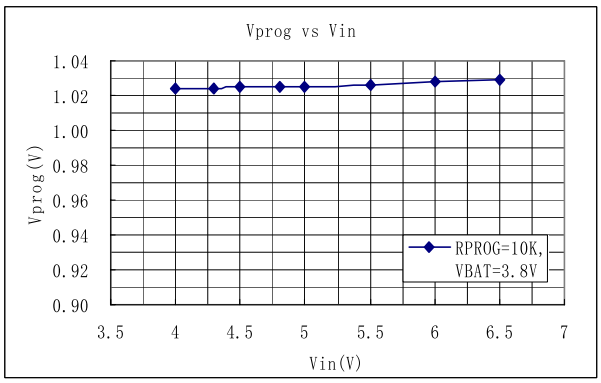
Caution: The absolute maximum ratings are rated values exceeding which the product could suffer physical damage. These values must therefore not be exceeded under any conditions.

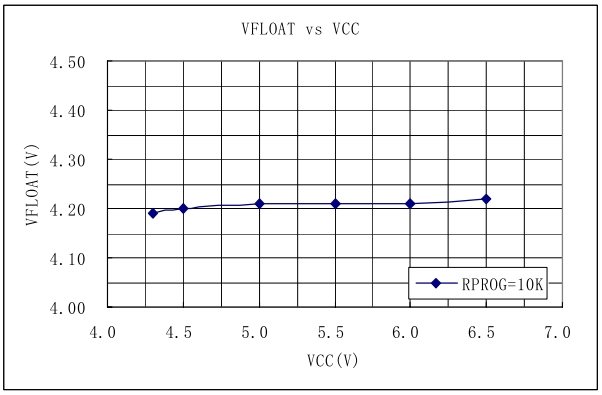
Electrical Characteristics

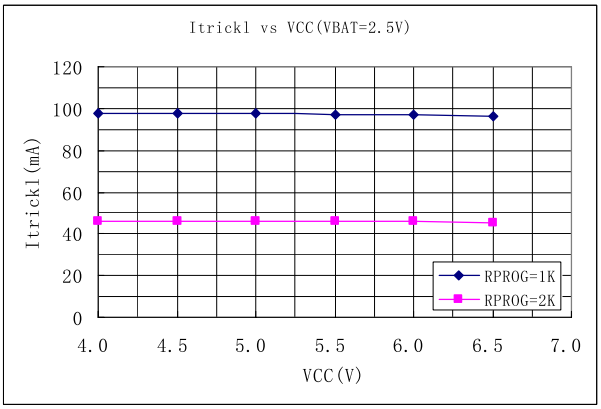
Parameter	Symbol	CONDITION	MIN	TYP	MAX	UNIT
Input supply voltage	Vcc		4.25	5.0	10	V
Input supply current	Icc	Charge mode, R_{PROG} =10K		350	2000	uA
		Standby mode		150	500	uA
		Shutdown mode(R_{PROG} not connected,Vcc<Vbat or Vcc<Vuv)		50	100	uA
Regulated Output Voltage	Vfloat	0°C≤T $_A$≤85°C, I_{BAT} =	4.158	4.2	4.242	V
BAT pin Current I_{BAT} =1200/R_{PROG}	Ibat	R_{PROG} =2.4k,Current mode	450	500	550	mA
		R_{PROG} =1.2k,Current mode	900	1000	1100	mA
		Standby mode,Vbat=4.2V	0	-2.5	-6	uA
		Shutdown mode		± 1	± 2.5	uA
		Sleep mode,Vcc=0V		0.3	± 2.5	uA
Trickle charge current	Itrikl	Vbat<Vtrikl,Rprog=1k	90	100	110	mA
Trickle charge Threshold Voltage	Vtrikl	R_{PROG} =10K，Vbat Rising	2.8	2.9	3.0	V
Trickle voltage hysteresis voltage	Vtrhys	R_{PROG} =1k	60	80	110	mV
Vcc Undervoltage lockout Threshold	Vuv	From Vcc low to high	3.7	3.8	3.93	V
Vcc undervoltage lockout hysteresis	Vuvhys		150	200	300	mV
Vcc-Vbat Lockout Threshold voltage	Vasd	Vcc from low to high	50	100	140	mV
		Vcc from high to low	5	40	50	mV
C/10 Termination Current Threshold	Iterm	R_{PROG}=1.2k	0.085	0.1	0.115	mA/mA
		R_{PROG}=2.4k	0.085	0.1	0.115	mA/mA
PROG pin Voltage	Vprog	R_{PROG} =1.2k, Current mode	1.03	1.2	1.27	V

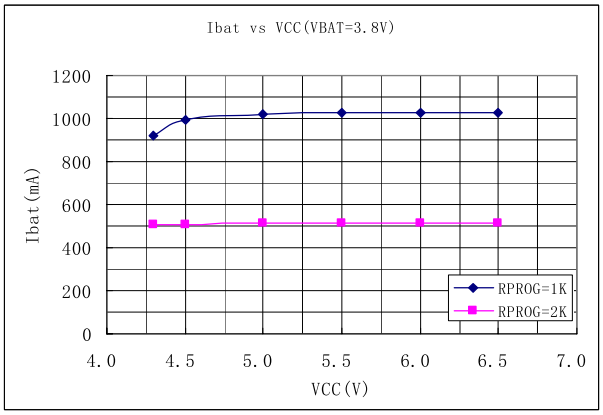
CHRG pin Output low voltage	Vchrg	Ichrg=5mA		0.35	0.6	V
STDBY pin Output low voltage	Vstdby	Istdby=5mA		0.35	0.6	V
Recharge Battery threshold Voltage	ΔVrecg	V_{FLOAT} - V_{RECHRG}		100	200	mV
CE high voltage	Vce-h		1.2			V
CE low voltage	Vce-l		.		0.6	V
TEMP pin voltage of the high-end flip	Vtemp-h			80	82	%Vcc
TEMP pin voltage of the low-end flip	Vtemp-l		43	45		%Vcc
Limited temperature patterns in the junction temperature	Tlim			145		℃

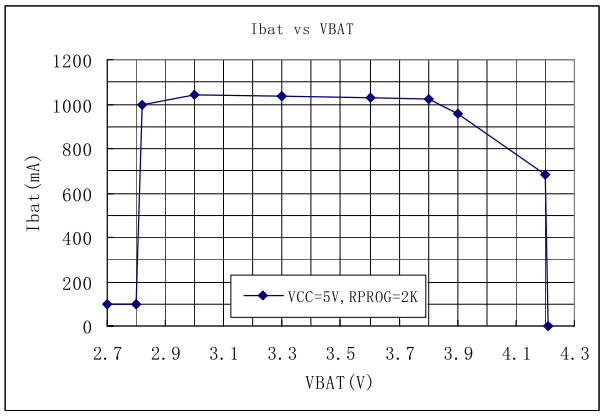
Typical Performance Characteristics

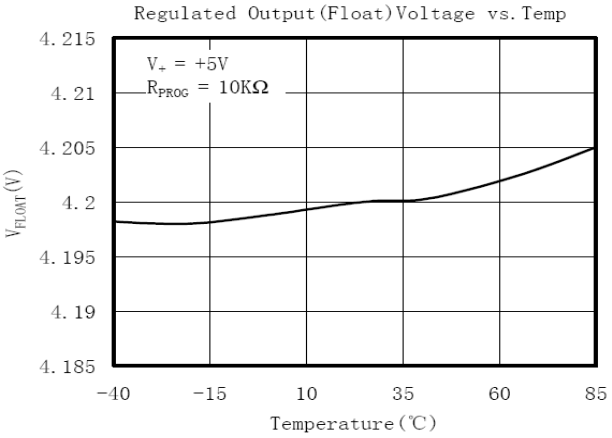


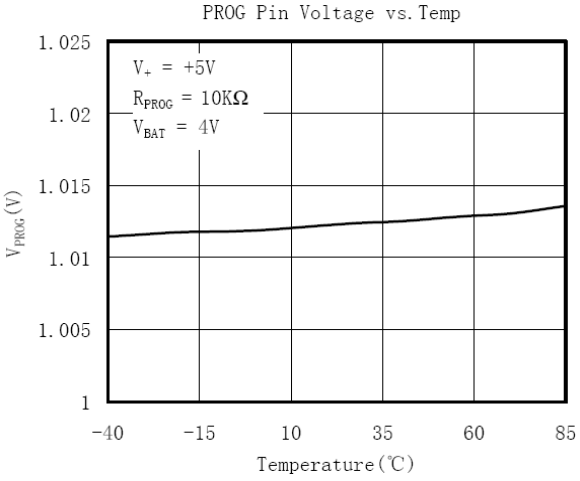


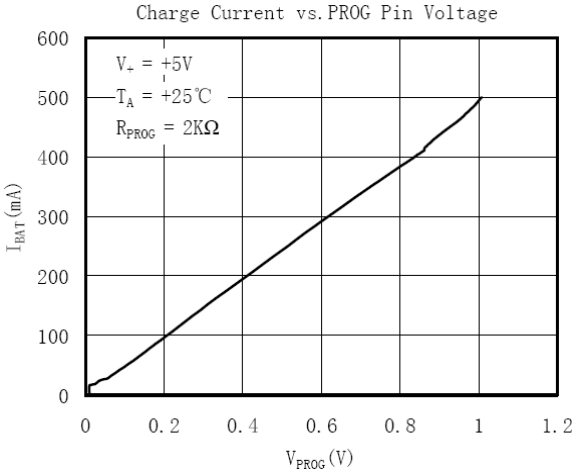


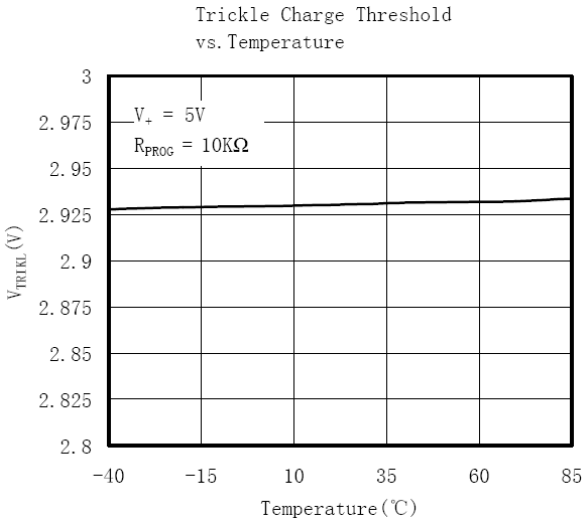


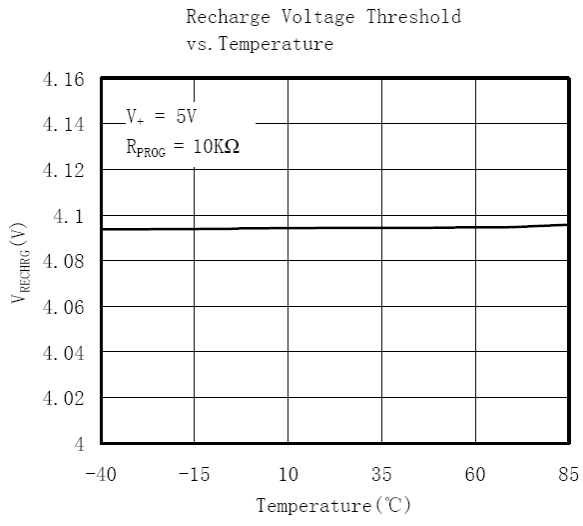

Ibat vs VBAT
Ibat(mA)
1200
1000
800
600
400
200
0
2.7
2.9
3.1
3.3
3.5
3.7
3.9
4.1
4.3
VBAT(V)
VCC=5V, RPROG=2K

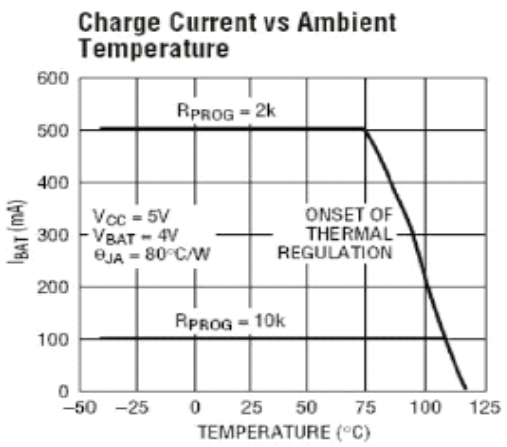

Regulated Output(Float)Voltage vs. Temp
V+ = +5V
RPROG = 10KΩ
VFLOAT(V)
4.215
4.21
4.205
4.2
4.195
4.19
4.185
-40
-15
10
35
60
85
Temperature(℃)

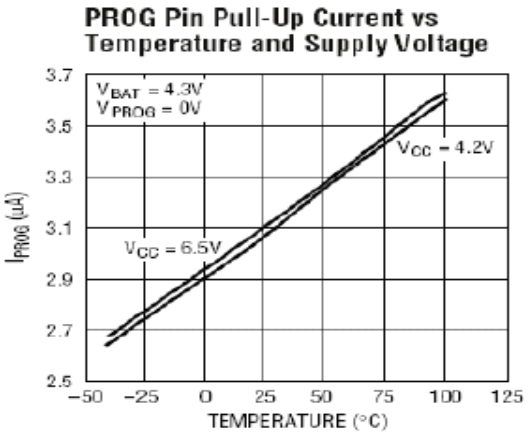

PROG Pin Voltage vs. Temp
V+ = +5V
RPROG = 10KΩ
VBAT = 4V
VPROG(V)
1.025
1.02
1.015
1.01
1.005
1
-40
-15
10
35
60
85
Temperature(℃)

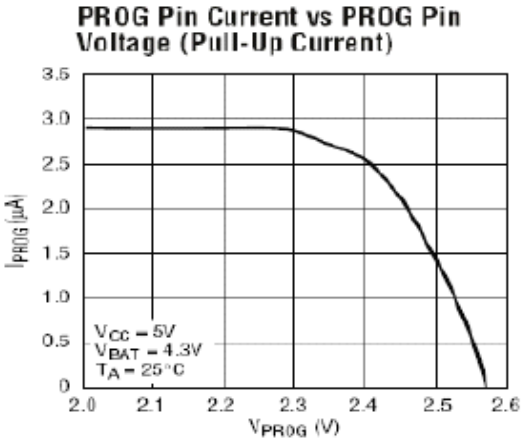

Charge Current vs. PROG Pin Voltage
V+ = +5V
TA = +25℃
RPROG = 2KΩ
IBAT(mA)
600
500
400
300
200
100
0
0
0.2
0.4
0.6
0.8
1
1.2
VPROG(V)

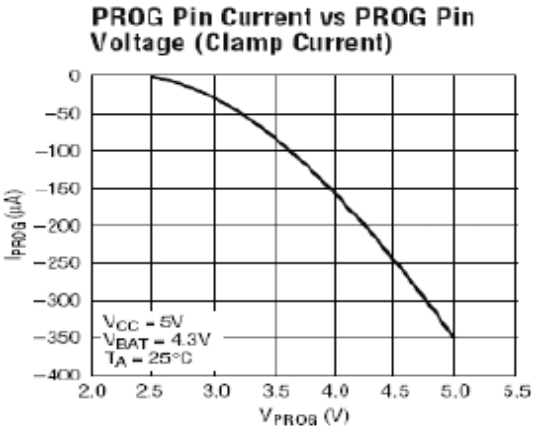

Trickle Charge Threshold
vs. Temperature
V+ = 5V
RPROG = 10KΩ
VTRIKL(V)
3
2.975
2.95
2.925
2.9
2.875
2.85
2.825
2.8
-40
-15
10
35
60
85
Temperature(℃)


Recharge Voltage Threshold
vs. Temperature
V+ = 5V
RPROG = 10KΩ
VRECHRG(V)
4.16
4.14
4.12
4.1
4.08
4.06
4.04
4.02
4
-40
-15
10
35
60
85
Temperature(℃)









Ordering Information

Part Number	Top Mark	Package
4056	4056 XXXX [1]	SOP8-PP

1. XXXX= date code

Pin Function

TEMP (Pin 1): Battery temperature detection input. TEMP pin to receive the battery NTC sensor output. If the TEMP pin voltage is less than the input voltage is greater than 45% or 80% of the input voltage means the battery temperature is too low or too high, then the charge has been suspended.
If the TEMP direct access GND, battery temperature detection canceled, the other charged and functioning properly.

PROG (Pin 2): 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 servos to 1V. In all modes, the voltage on this pin can be used to measure the charge current using the following formula:
IBAT = (VPROG/RPROG) ·1200. mA
The PROG pin can also be used to shut down the charger. Disconnecting the program resistor from ground allows a 3uA current to pull the PROG pin high. When it reaches the 1.21V shutdown threshold voltage, the charger enters shutdown mode, charging stops and the input supply current drops to 50uA. This pin is also clamped to approximately 2.4V. Driving this pin to voltages beyond the clamp voltage will draw currents as high as 1.5mA. Reconnecting RPROG to ground will return the charger to normal operation.

GND (Pin 3): Ground.

VCC (Pin 4): Positive Input Supply Voltage. Provides power to the charger, VCC can range from 4.25V to 10V and should be bypassed with at least a 10uF capacitor. When VCC drops to within 30mV of the BAT pin voltage, the ZCC4056 enters shutdown mode, dropping IBAT to less than 2uA.

BAT (Pin 5): 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.

STDBY (Pin 6): The completion of battery charging instructions side. When the battery charge is complete, STDBY pulled low by internal switches, indicating the completion of charging. In addition, STDBY pin will be in a high-impedance state.

CHRG (Pin 7): 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, CHRG pin will be in a high-impedance state.

CE (Pin 8): Chip enable input. High input level woul 4 0 5 6 is in normal working condition; low input level so that ZCC4056 is prohibited charging status. CE pin can be TTL or CMOS level-level driver.

TEMP(PIN 1) 配置参考：

不使用电池温度检测时,将NTC直接接地。

带有电池温度检测10K NTC的应用，可以配置如下：

R1=6.2K R2=100K

00 摄氏度时R2 的有效值为 24.3K TEMP=79.6% 接近低温关闭

25 摄氏度时R2 的有效值为 9.09K TEMP=59%

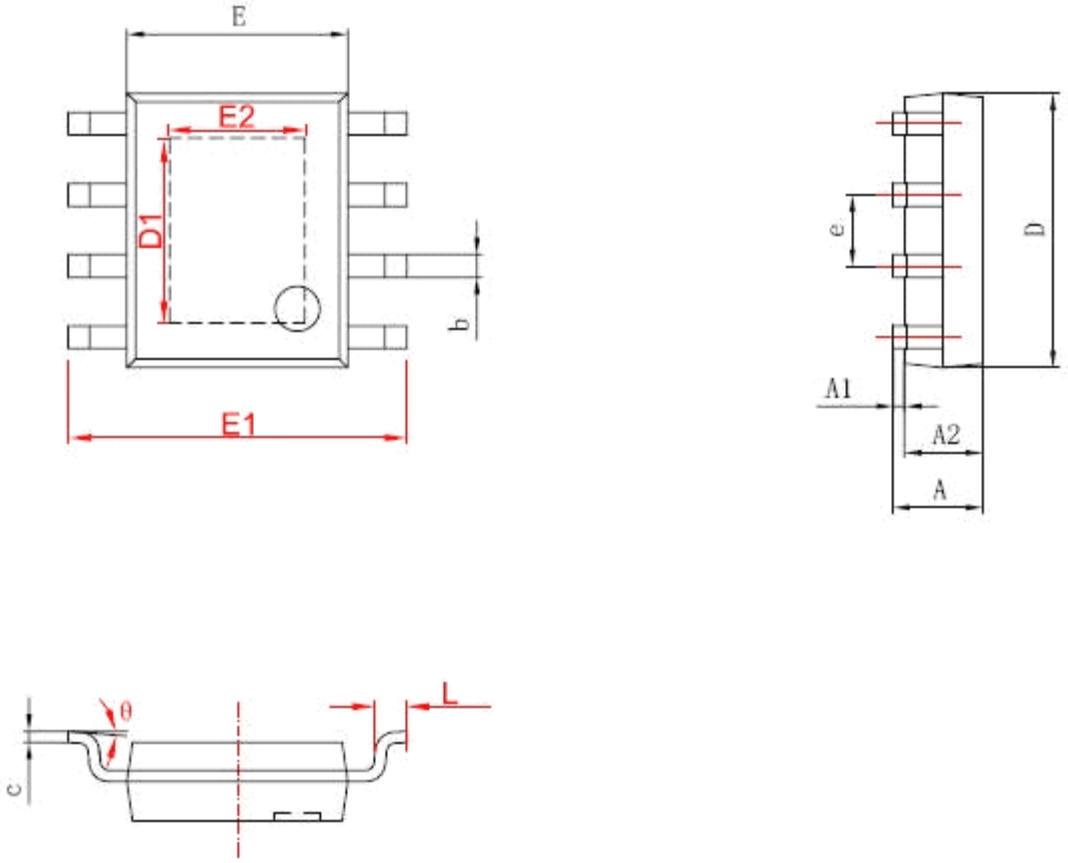
40 摄氏度时R2 的有效值为 5.03K TEMP=46.1% 接近关闭温度

42 摄氏度时R2 的有效值为 4.67K TEMP=42.96 % 关闭输出

此NTC保证为25摄氏度时10K阻值。 R2有效值：R2与NTC并联的有效阻值,R1和R2为精密电阻

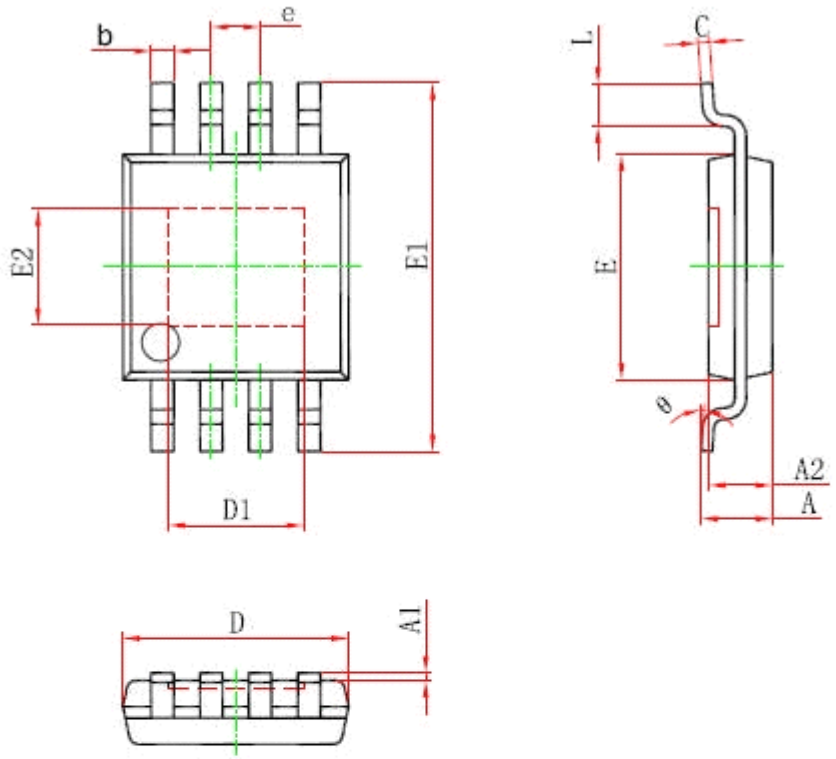
Package Information

SOP8-PP(EXP PAD) PACKAGE OUTLINE DIMENSIONS



字符	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°

MSOP8/PP PACKAGE OUTLINE DIMENSIONS



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.820	1.100	0.032	0.043
A1	0.020	0.150	0.001	0.006
A2	0.750	0.950	0.030	0.037
b	0.250	0.380	0.010	0.015
c	0.090	0.230	0.004	0.009
D	2.900	3.100	0.114	0.122
D1	1.700	1.900	0.067	0.075
e	0.65 (BSC)		0.026(BSC)	
E	2.900	3.100	0.114	0.122
E1	4.750	5.050	0.187	0.199
E2	1.450	1.650	0.057	0.065
L	0.400	0.800	0.016	0.031
θ	0°	6°	0°	6°