Nanjing Tuowei Integrated Circuit Co., Ltd.

NanJing Top Power ASIC Corp.

Data sheet

DATASHEET

TP4057

(500mA Linear Li-Ion Battery Charger)

F Tuowei integration

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TP4057

SOT23 package 500mA anti-lithium battery reverse polarity charger

describe

TP4057 is a complete single-cell Li-ion battery charger with battery positive and negative reverse polarity protection, and adopts constant current/constant voltage linear control. Its SOT package and low external component count make the TP4057 ideal for portable applications. TP4057 can work with USB power supply and adapter power supply.

No external sense resistors and blocking diodes are required due to the internal PMOSFET architecture and anti-reverse charging circuitry. Thermal feedback automatically adjusts charge current for high power operation or high ambient temperature conditions limit the chip temperature. The full charge voltage is fixed at 4.2V, while the charge current can be set externally with a single resistor. When the battery reaches 4.2V, the charging current drops to 1/10 of the set value, and TP4057 will automatically terminate

charging. When the input voltage (AC adapter or USB power supply) is removed, TP4057 automatically enters a low current state, and the battery leakage current is below 2uA. Other features of the TP4057 include a charge current monitor, undervoltage lockout, automatic recharge, and two status pins to indicate end-of-charge and input voltage access.

features

- Lithium battery positive and negative polarity reverse connection protection;
- Programmable charge current up to 500A;
- No MOSFET, sense resistor or blocking diode required; ·
- For single-cell Li-ion batteries
- ·Constant current/constant voltage operation, and can be operated without overheating 危

Thermal regulation to maximize charge rate in dangerous situations;

Charge single-cell Li-ion batteries directly from the USB port;

- Accuracy reaches ±14.2V preset charging voltage;
- , the highest input can reach 9V;
- automatic recharging;
- 2 charge status open-drain output pins;
- C10 charge termination;
- The supply current in standby mode is 40uA;
- 2.9V trickle charge device version;
- Soft-start limits inrush current;
- Packaged in a 6-pin SOT-23.

Absolute Maximum Ratings

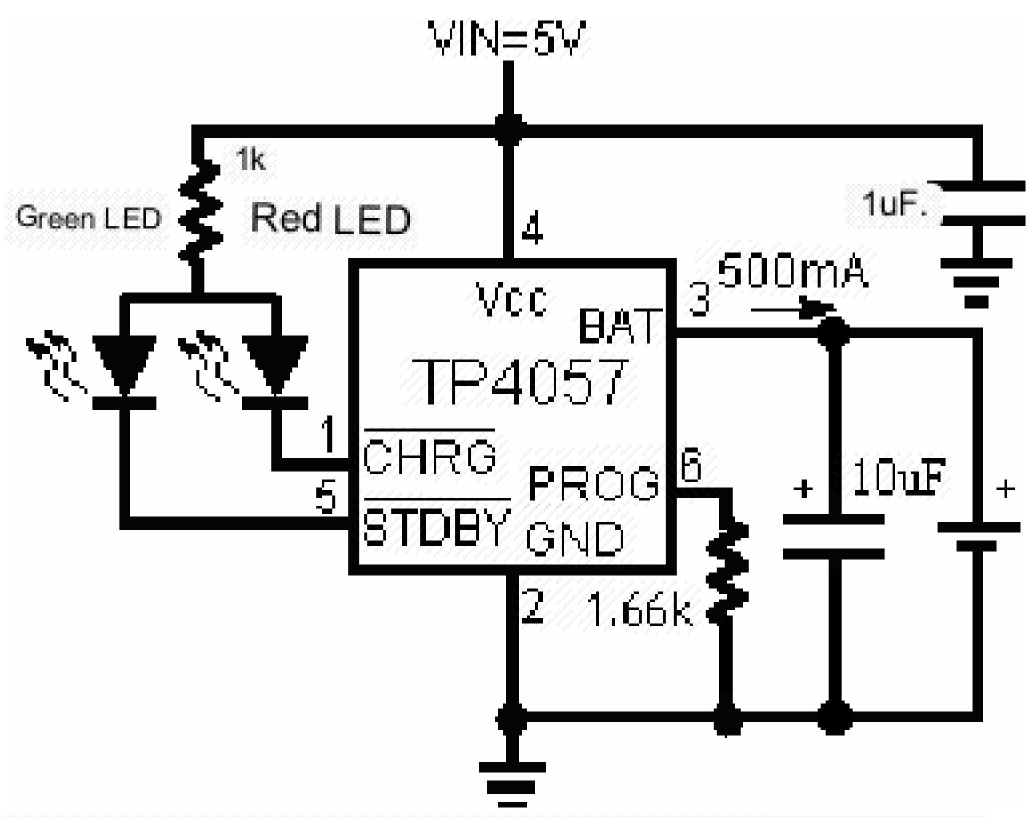
- ·Input power supply voltage (V): -0.3V~9V
- PROG:-0.3V~Vo+0.3V
- BAT:-4.2V~7V
- CHRG:- 0.3V~10V
- BAT short circuit duration: continuous
- BAT pin current: 500mA
- PROG pin current: 800uA
- Maximum junction temperature: 145°C
- Working environment temperature range: -40°C~85°C
- Storage temperature range: -65°C~125°C
- Lead temperature (soldering time 10 seconds): 260°C

application

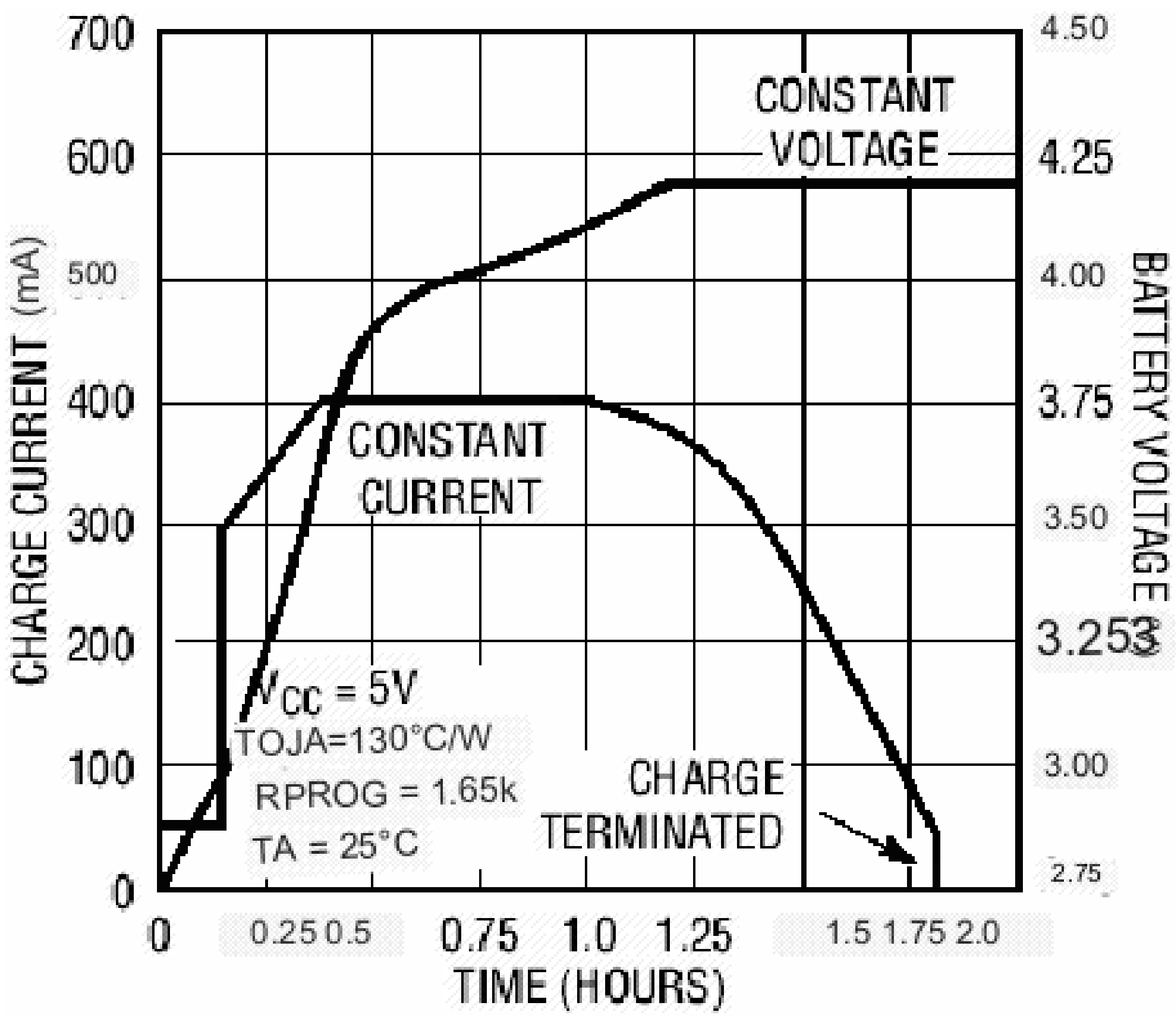
- charging stand
- · Cell phone, PDA, MP3 player
- Bluetooth application

Typical application

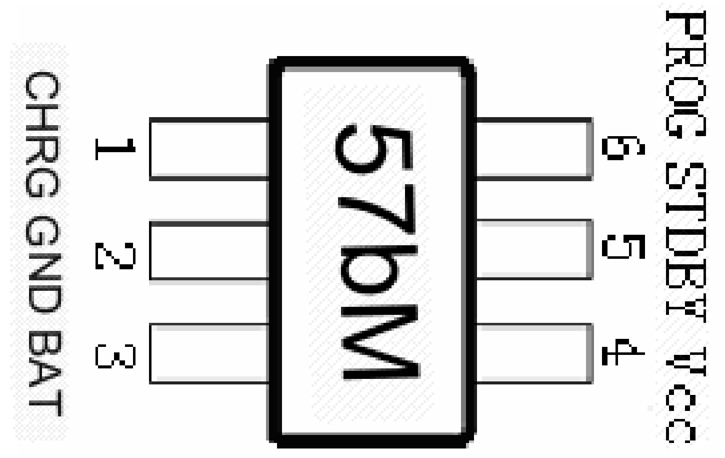
500mA Single-Cell Li-Ion Battery Charger



400mA full charge cycle (600mAh)



Packaging/Ordering Information



6-Pin Plastic SOT-23-6 Package

Order model
TP4057-42-SOT26-R
Device marking
57bm (m is the production batch number, variable)

electrical characteristics

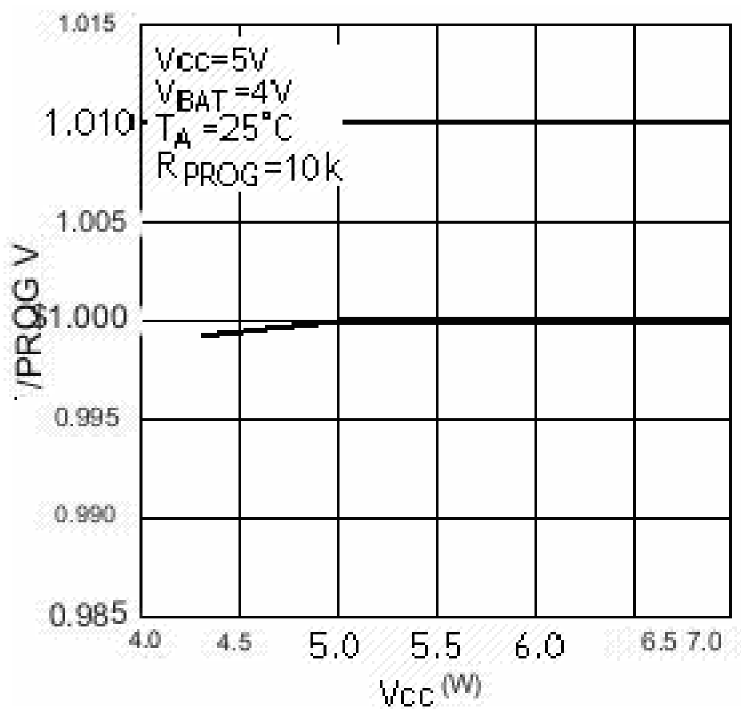
Where Table Note ● indicates that the indicator is suitable for the entire working temperature range, otherwise it only refers to T=25℃, Voe=5V, unless Special note.

symbol	parameter	condition		Minimum	Typical	Maximum	unit
V_{CC}	Input supply voltage		●	4.0	5	9.0	V
I_{CC}	Input power current	Charging mode, RPROG=10K	●		150	500	μ A
		Standby Mode (Charge Termination)	●		40	100	MA
		Shutdown mode (RPrOG not connected,	●		40	100	μ A
		Vec<VBar, or Vcc<Vuv)			40	100	
VFLOAL	Stable output (float voltage	0℃≤TA≤85℃, IBAT-40mA		4. 158	4.2	4. 242	V
IBAT	BAT pin current (Vbat=4.0v unless stated)	RPROG=10K, current mode	●	90	100	110	MA
		RPROG=2K, current mode	●	380	400	420	mA
		RPROG=1.6K, current mode	●	480	500	520	mA
		Standby mode, VBAT=4.2V			-2.5	-6	μ A
		Shutdown mode (RPROG not connected)			±1	±2	MA
		Sleep mode, Vcc=0V			-1	-2	μ A
ITRIKL	Trickle charge current	VBAT V TRIKL, RPROG=10K	●	10	15	20	mA
VTRIKL	Trickle charge threshold voltage	RPROG=10K, VBAT rises		2.8	2.9	3.0	V
VTRHYS	Trickle Charge Hysteresis Voltage	R_{PROG}=10K		60	80	100	mV
Vuv	Vec undervoltage lockout threshold	From Vec low to high	●	3.4	3.6	3.8	V
V_{UVHYS}	Vec undervoltage lockout hysteresis		●	150	200	300	mV
V MSD	Manual shutdown threshold voltage	PROG pin level rises	●	3.40	3.50	3.60	V
		PROG pin level falls	●	1.90	2.00	2.10	V
VASD	Vee-VBar lockout threshold voltage	Vec low to high		60	100	140	mV
		Vec from high to low		5	30	50	mV
I_{TERM}	C/10 termination current threshold	R_{PROG}=10K	●	8	10	12	mA
		R_{PROG}=1.66K	●	30	40	50	mA
V_{PROG}	PROG pin voltage	RPROG=10K, current mode	●	0.9	1.0	1.1	V
$I_{\overline{CHRG}}$	$\overline{\text{CHRG}}$ Pin Leakage Current	$V_{\overline{CHRG}}$ =5V (standby mode)			0	1	MA
$V_{\overline{CHRG}}$	$\overline{\text{CHRG}}$ pin output low voltage	$I_{\overline{CHRG}}$ =5mA			0.3	0.6	v

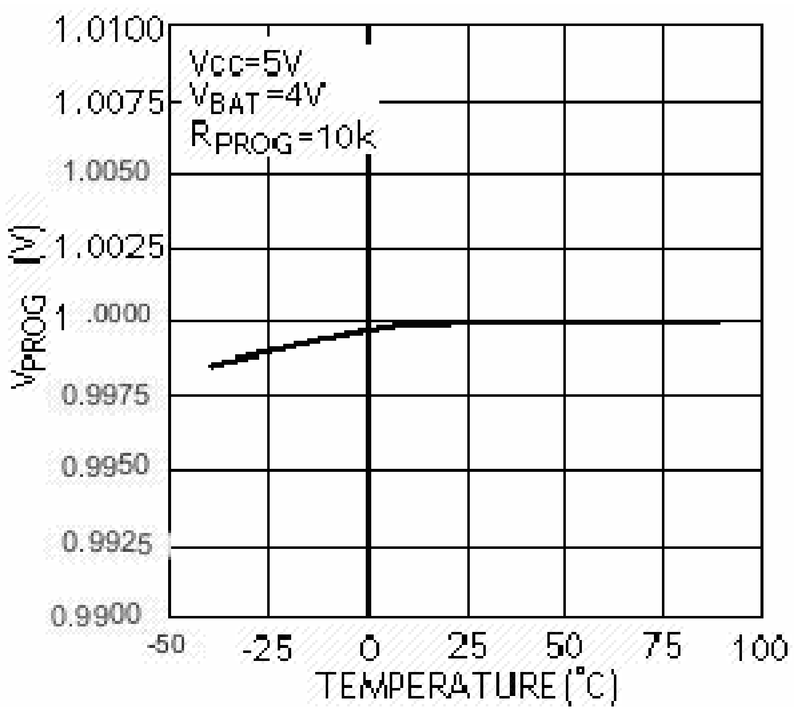
I_{STDET}	STDBY pin leakage current	· STDBY mode)			0	1	μ A
V_{STDBY}	STDBY pin outputs low level	I_{STDBY} =5mA			0.3	0.6	v
ΔV_{RECHRG}	Recharging Battery Threshold Voltage	$V_{FLOAT}-V_{RECHRG}$		100	150	200	mV
TLIM	Junction temperature in limited				120		℃
R_{ON}	temperature mode Power FET "on" resistance (between Vec and BAT)				650		MΩ
tes	soft start time	IBAT=0 IBAT=1000V/RPROG			20		ms
tRECHARGE	Recharge Comparator Filter Time	VBAT high to low		0.8	1.8	4	ms
t_{TERM}	Termination of comparator filter	IBAT falls below Icn/10		0.8	1.8	4	ns
IPROG	time PROG pin pull-up current				2.0		μ A

Typical Performance Characteristics

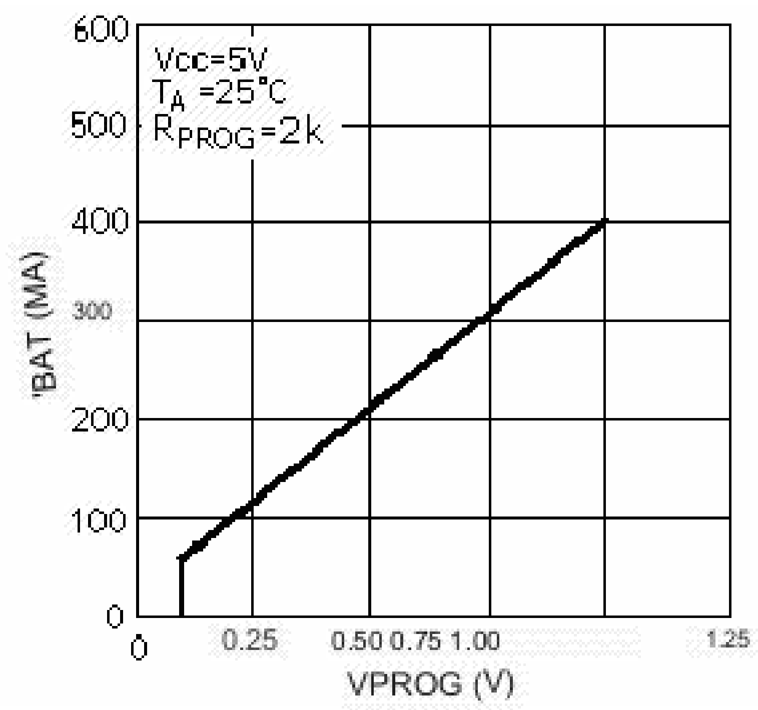
PROG pin voltage versus supply voltage in constant current mode



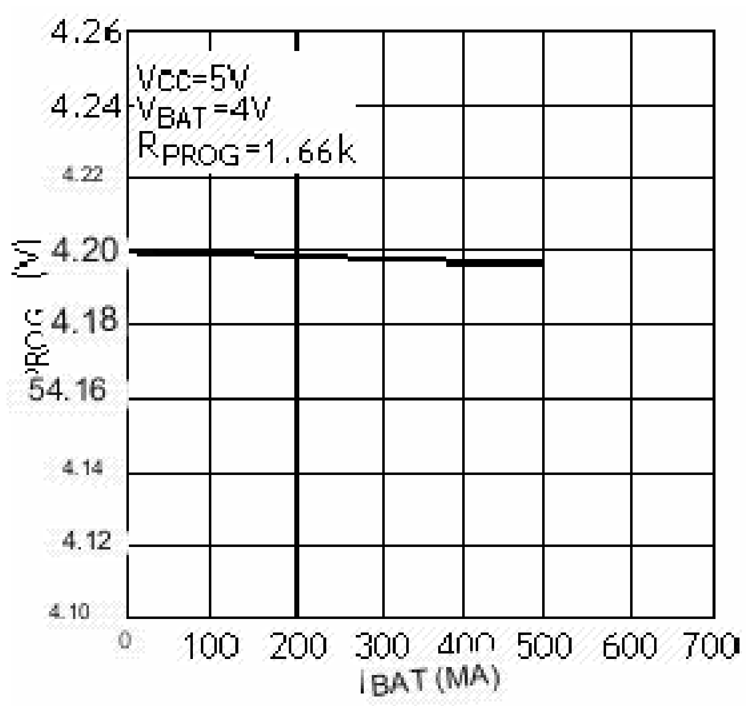
PROG pin voltage versus temperature curve



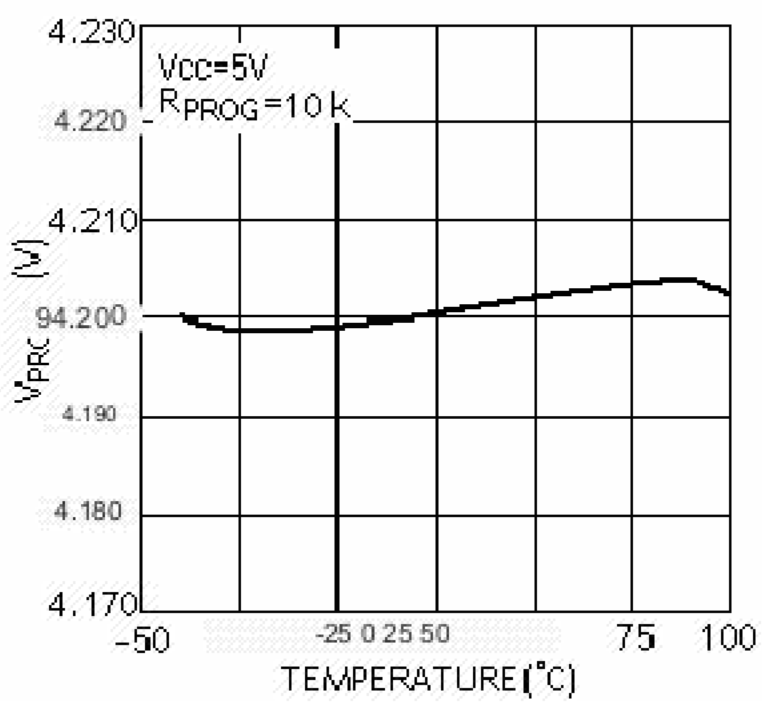
Relationship Curve of Charge Current vs. PROG Pin Voltage



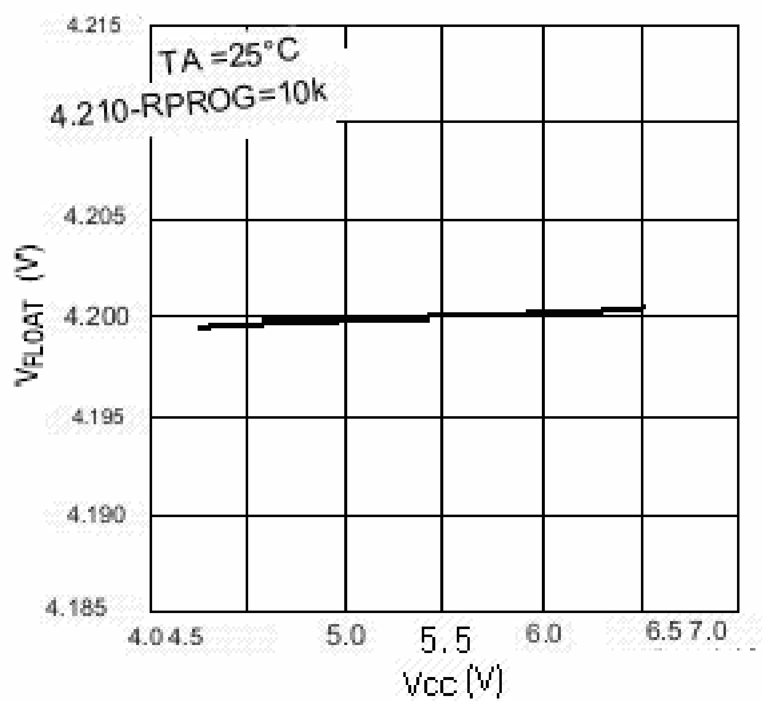
Stable output (relationship curve between floating voltage and charging current



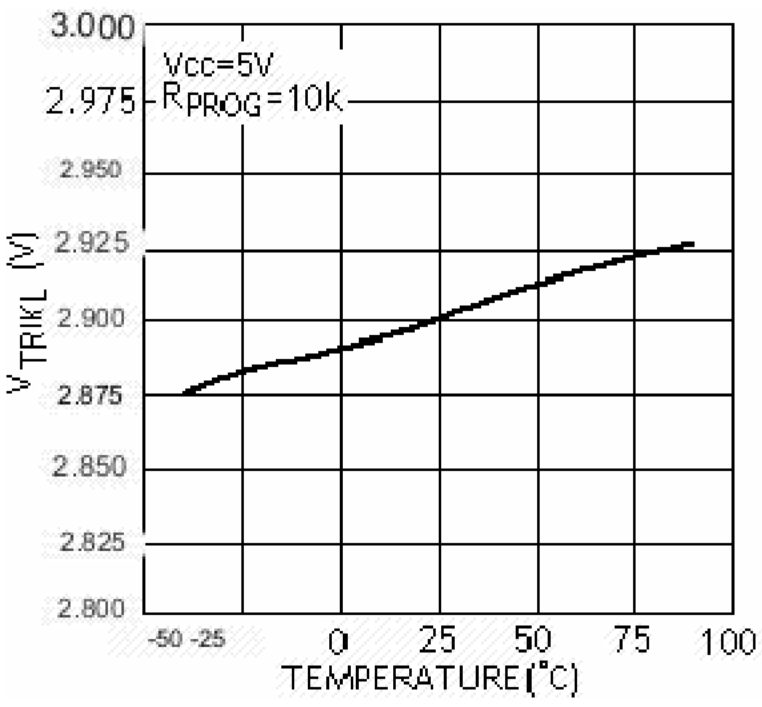
Stable output (float charge) voltage versus temperature curve



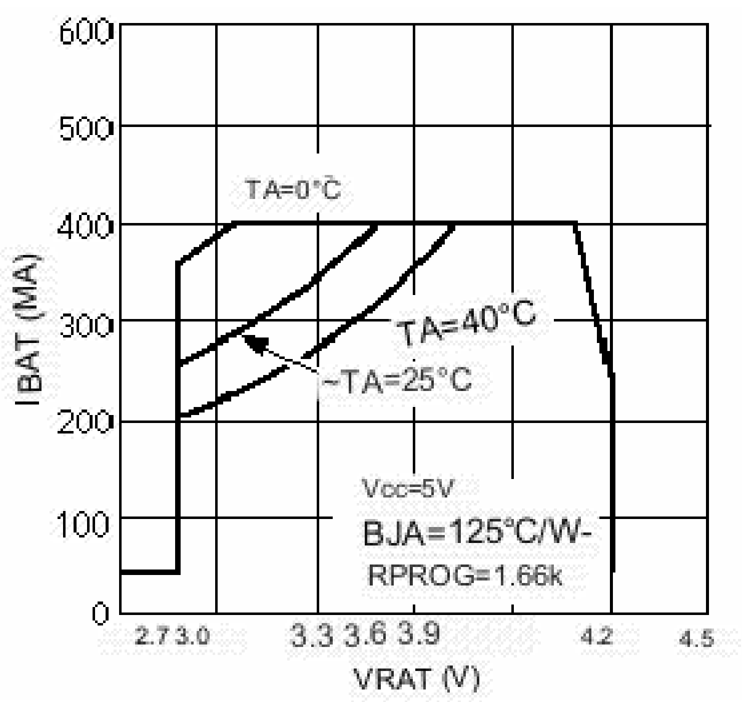
Stable output (relationship curve between float voltage and voltage



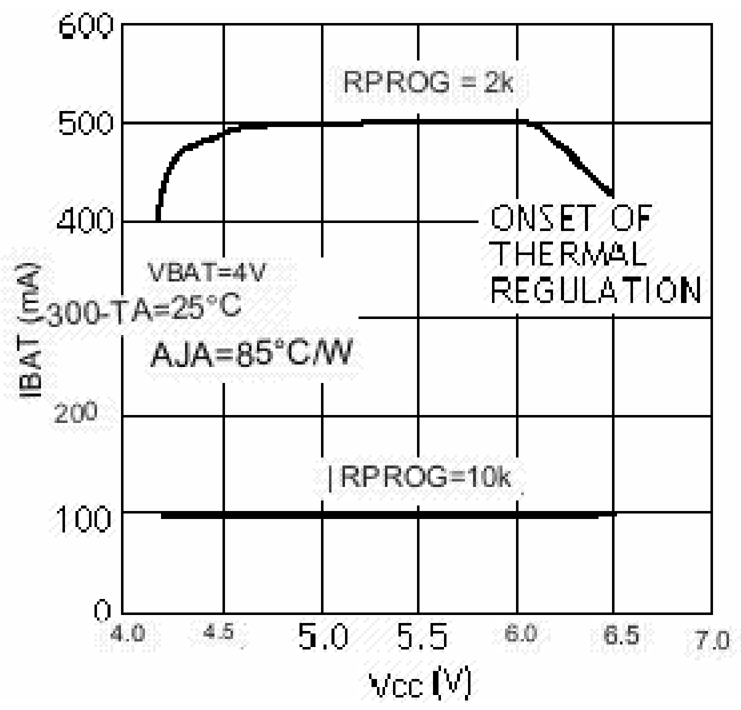
Trickle Charge Threshold vs. Temperature Curve



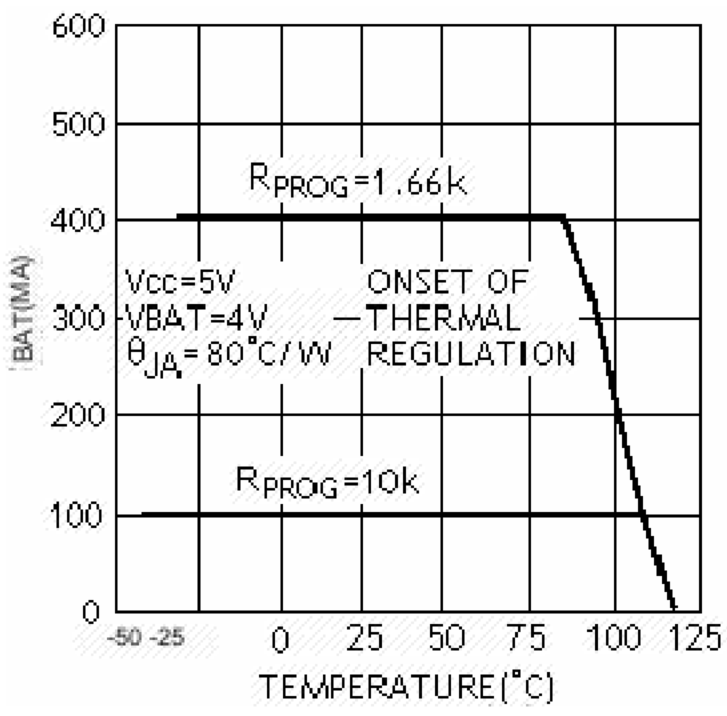
The relationship curve between charging current and battery voltage



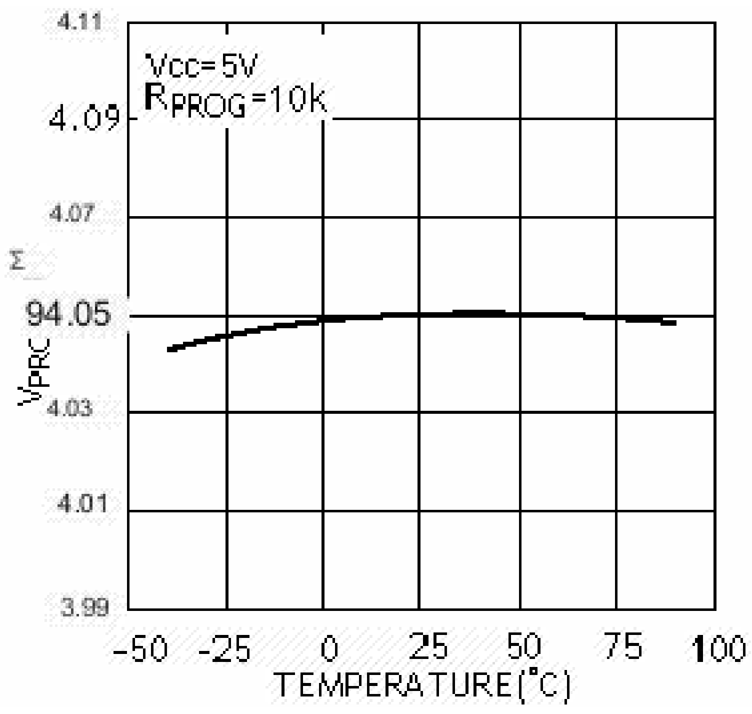
The relationship curve between charging current and supply voltage



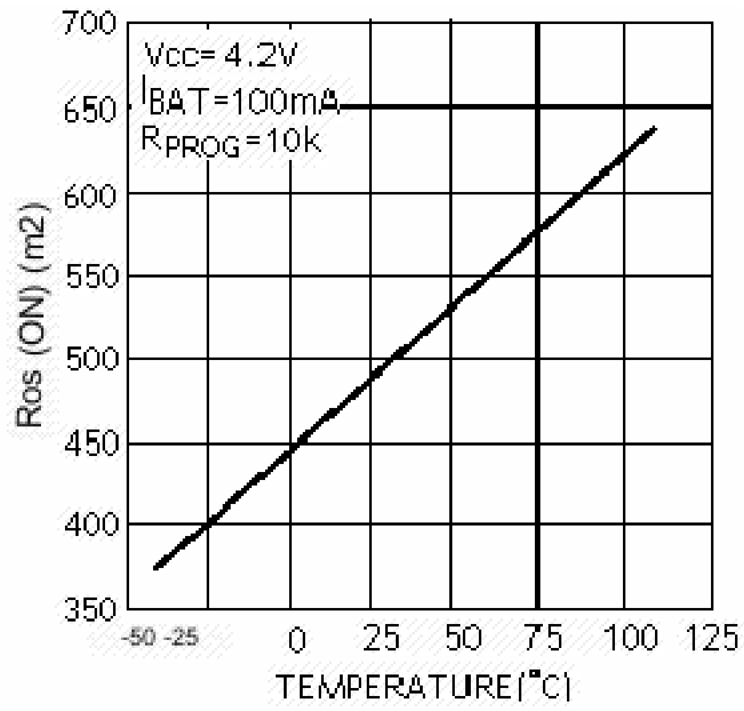
The relationship between charging current and ambient temperature tie curve



Recharge Voltage Threshold vs Temperature



Power FET "On-Resistance vs. Temperature



pin function

CHRG (Pin 1): Charge status indicator terminal for open-drain output. When the charger battery is charging, the CHRG pin is pulled low by the internal switch, indicating that charging is in progress; otherwise, the CHRG pin is in a high-impedance state.

GND (Pin 2): Ground

BAT (Pin 3): Charge current output. This pin goes to The battery supplies the charge current and regulates the final float voltage to 4.2V. A precision internal resistor-divider on this pin sets the float voltage. In shutdown mode, this internal resistor-divider is disconnected.

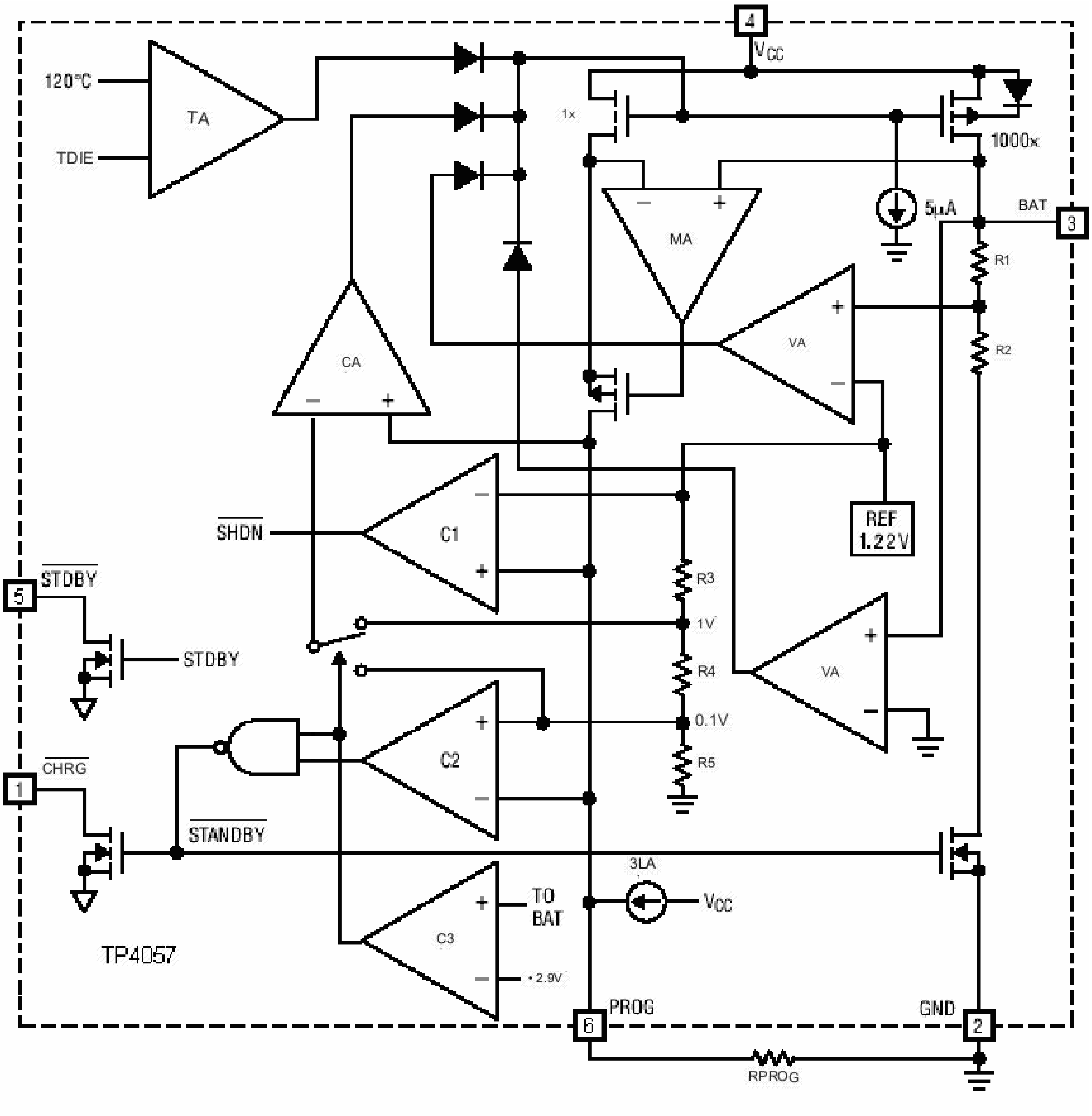
Vec (Pin 4): Positive Input Supply Voltage. This pin supplies power to the charger. Vec can vary from 4V to 9V and should be connected through at least one 1uF 旁 capacitor. When Vec falls within 30mV of the BAT pin voltage, the TP4057 enters shutdown mode, thereby reducing IgAT To below 2# A.

STDBY (pin 5): battery charge completion indication terminal. When the battery charging is completed, STDBY is pulled low by the internal switch, indicating that the charging is complete. Otherwise, the STDBY pin will be in a high-impedance state.

PROG (pin 6): charging current setting, charging current Monitor and shutdown pins. Connect a 1% resistor RProG from this pin to ground to set the charge current. When charging in constant current mode, the voltage at the pin is maintained at 1V.

The PROG pin can also be used to shut down the charger. With the setting resistor disconnected from ground, an internal 将 2.5 uA current pulls the PROG pin high. When the voltage on this pin reaches the shutdown threshold voltage of 2.7V, the charger enters shutdown mode, charging stops and the input supply current drops to 40uA. Reconnecting RProc to ground will return the charger to normal operation.

block diagram



working principle

TP4057 is a single-cell Li-ion battery charger with constant current/constant voltage algorithm. It is capable of delivering 500mA of charge current (with a thermally well-designed PCB layout) and an internal P-channel power MOSFET and thermal regulation circuitry. No blocking diodes or external current sense resistors are required; therefore, only two external components are required for the basic charger circuit. Not only that, TP4057 can also get working power from a USB power supply.

normal charge cycle

A charge cycle begins when the Vec pin voltage rises above the UVLO threshold level and a 1% programmed resistor is connected from the PROG pin to ground or when a battery is connected to the charger output. . If the BAT pin level is lower than 2.9V, the charger enters trickle charge mode. In this mode, TP4057 provides about 1/10 of the set charging current to boost the current voltage to a safe level for full current charging.

When the BAT pin voltage rises above 2.9V, the charger enters constant current mode, which provides a constant charging current to the battery. When the BAT pin voltage reaches the final float voltage (4.2V), TP4057 enters constant voltage mode, and the charging current starts to decrease. When the charging current drops to 1/10 of the set value, the charging cycle ends.

Setting of charging current

Charge current is programmed with a resistor connected from the PROG pin to ground. The setting resistor and charging current are calculated using the following formula:

Determine the resistor value according to the required charging current,

Formula 1: $R_{PROG} = \frac{1000}{I_{BAT}}$ (IBAT≤ 0.3A)

Example 1: When the charging current needs to be set to Igar=0.2A,

Calculated using formula 1:

$$R_{PROG} = \frac{1000}{0.2} = 5000 \ (\Omega)$$

That is RproG=5k2

Formula 2:

$$R_{PROG} = \frac{1000}{I_{BAT}} \times (1.3 - I_{BAT}) \ (I_{BAT} > 0.3A)$$

In the application of more than 0.3A, the heat of the chip is relatively large, and the temperature High degree of protection will reduce the charging current, and the test current in different environments is not completely consistent with the theoretical value calculated by the formula. In customer application, RPROG of appropriate size can be selected according to the requirement. The relationship between RPROG and charging current can be determined by referring to the following table:

RPROG (k)	IBAT (mA)
20k	50
10k	100
5k	200
4k	250
3k	300
2k	400
1.6k	500

charge termination

The charge cycle is terminated when the charge current drops to 1/10 of the set value after reaching the final float voltage.

This condition is detected by monitoring the PROG pin with an internal filtered comparator. Charging is terminated when the PROG pin voltage falls below 100mV for longer than tTERM (typically 1.8s). The charging current is blocked, and the TP4057 enters standby mode, at which point the input power current drops to 40A. (Note: 10 terminations are disabled in trickle charge and thermal limit modes).

While charging, transient loads on the BAT pin will briefly drop the PROG pin voltage below 100mV between DC charge current drops to 1/10 of the programmed value. A 1.8ns filter time (TERM) on the termination comparator ensures that transient loads of this nature do not cause premature termination of the charge cycle. Once the average charge current drops below 1/10 of the set value, the TP4057 terminates the charge cycle and stops supplying any current through the BAT pin. In this state, all loads on the BAT pin must be powered by the battery.

In standby mode, TP4057 continuously monitors the BAT pin voltage. If the voltage on this pin drops below the recharge voltage threshold (VRECHRG) of 4.1V, another charge cycle begins and current is supplied to the battery again. When manually restarting a charge cycle in standby mode, the input voltage must be removed and reapplied, or the charger must be shut down and restarted using the PROG pin. Figure 2 shows a State diagram of a typical charging cycle.

Battery reverse polarity protection

TP4057 has a lithium battery reverse polarity protection function. If the positive and negative poles of the high-grade lithium battery are reversely connected to the current output pin of TP4057, TP4057 will stop and display a fault state without charging current.

The two charging indicator pins are in high impedance state, and the two LED lights are all off. At this time, the leakage current of the reversed lithium battery is less than 0.8mA. Connect the reversed battery correctly, and the TP4057 will automatically start the charging cycle.

TP4057 after reverse connection When the battery is removed, because the BAT pin capacitance potential of the TP4057 output terminal is still negative, the TP4057 indicator light will not light up normally immediately, and only when the battery is connected correctly can the charging be activated automatically. Or wait for a long time for the negative potential of the BAT terminal capacitor to emit light, and the BAT terminal potential is greater than zero volts, and the TP4057 will display a normal no-battery indicator light state.

In the case of reverse connection, the power supply voltage should be around 5V standard voltage and should not exceed 8V. If the power supply voltage is too high, the chip voltage difference will exceed 10V when the battery voltage is reversed, so the power supply voltage should not be too high in the case of reverse connection.

Charge Status Indicator (CHRG STDBY)

TP4057 has two open-drain status indication outputs, CHRG and STDBY. When the charger is in the charging state, CHRG is pulled to a low level, and in other states, CHRG is in a high-impedance state. When the battery is not connected to the charger, CHRG outputs a pulse signal to indicate that the battery is not installed. When the external capacitance of the BAT pin of the battery connection terminal is 10uF, the CHRG flashing period is about 0.5-2 seconds.

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

charging	red light CHRG	Green light STDBY
Charging	Bright	off
The battery is fully charged, the battery	off on	
is reversed, and the power supply is undervoltage	off	off

There are three options for the status of the indicator light without battery connection:

Standby without battery	red light	green light
Application 1: BAT to one 10U electrolytic capacitor	flashing	Bright
Application 2: Connect BAT with 100k resistor to the power supply (see P12 for the	off	Bright
picture) Application 3: Add 5k resistor for BAT terminal to the power supply (that is, replace the above 100k with a 5k resistor. See P12 for the picture)	both lights off	

Note: When the BAT terminal connects a 5k resistor to the power supply, the power supply will charge to the battery through the resistor, and the magnitude is about 0.2mA. Such a small electricity

Even if the battery is not removed in time after the battery is fully charged, it will not cause harm such as overcharging to the battery.

heat limit

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 prevents the TP4057 from overheating and allows the user to increase the upper limit of a given board's power handling capability without risk of damaging the TP4057. Under the premise of ensuring that the charger will automatically reduce the current under worst-case conditions, the charging current can be set according to the typical (not worst-case) ambient temperature. SOT power considerations are discussed further in the Thermal Considerations section.

undervoltage lockout

An internal undervoltage lockout circuit monitors the input voltage and keeps the charger in shutdown until Vec rises above the undervoltage lockout threshold. The UVLO circuit will keep the charger in shutdown mode. If the UVLO comparator trips, the charger will not exit shutdown until Vec rises 50mV above the battery voltage.

manual shutdown

The TP4057 can be placed in shutdown mode at any time during the charge cycle by removing RPROG (thus floating the PROG pin). This reduces battery drain current to less than 2uA and supply current to less than 50A. Reconnecting the set resistor starts a new charge cycle. Figure 1 uses the NMOS tube to turn off the PROG pin to float.

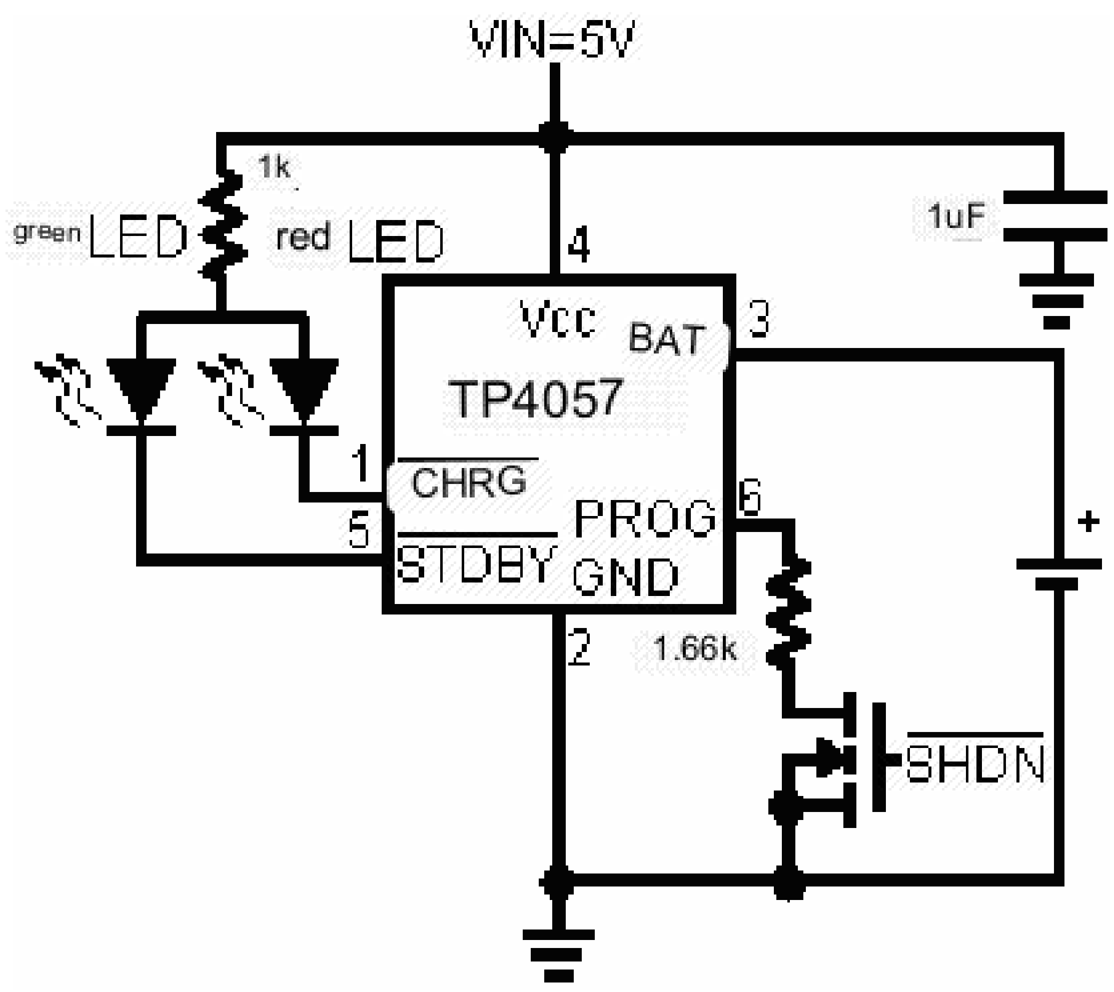


Figure 1: Signal-controlled charging circuit

auto restart

Once the charge cycle is terminated, the TP4057 immediately adopts

—A comparator with 1.8ms filter time (RECHARGE) continuously monitors the voltage on the BAT pin. When the battery voltage drops below 4.1V (roughly corresponding to 80% to 90% of the battery capacity), the charge cycle restarts. This ensures that the battery is maintained at (or close to) a fully charged state and eliminates the need for periodic charge cycle initiation. During the recharge cycle, the CHRG pin output re-enters a strong pull-down state and the STDBY pin output re-enters a high-impedance state.

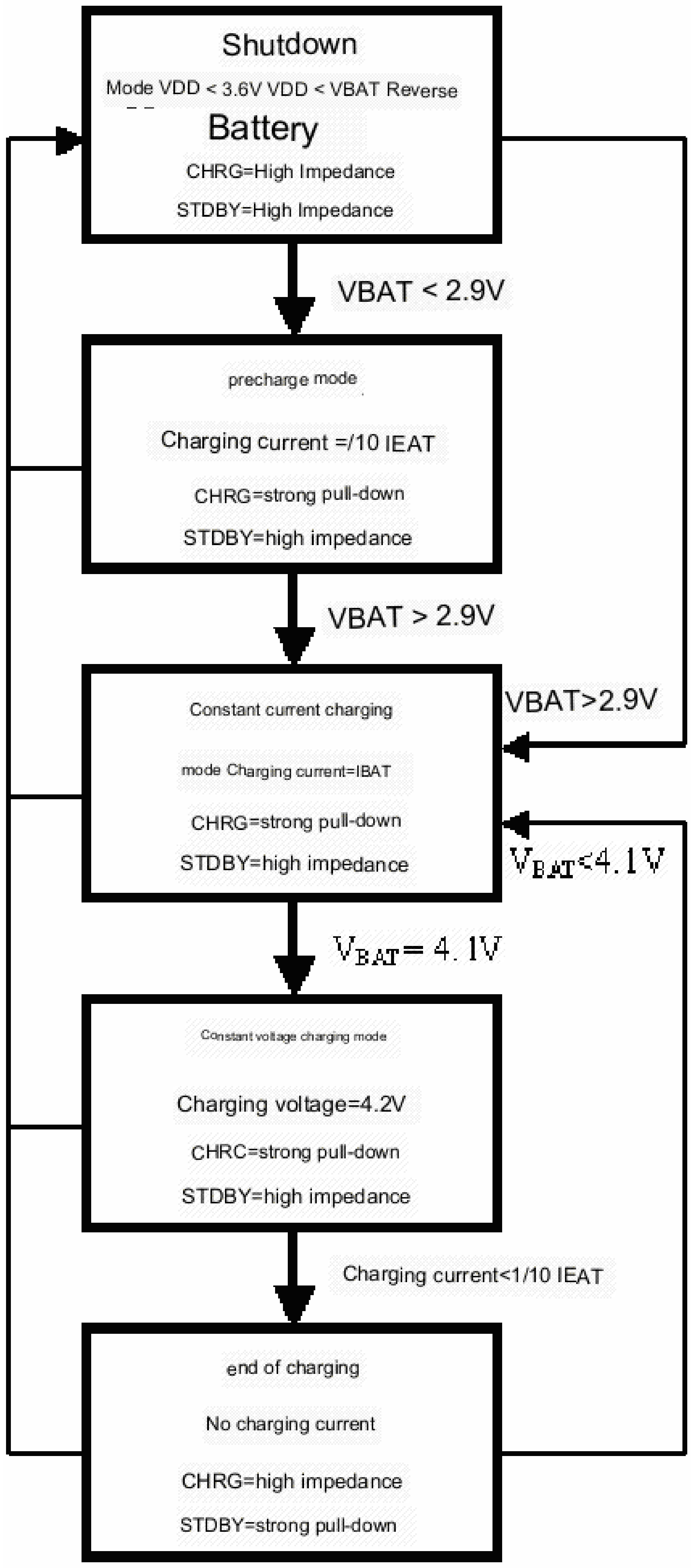


Figure 2: State Diagram of a Typical Charge Cycle

stability considerations

As long as the battery is connected to the output of the charger, the constant voltage mode feedback loop can be used without an external voltage. Keep stable in container. In order to reduce the ripple voltage when no battery is connected, it is recommended to use an output capacitor. When using large value low ESR ceramic capacitors, it is recommended to add a Ω resistor in series with the capacitor. If tantalum capacitors are used, no series resistor is required.

In constant current mode, it is the PROG pin, not the battery, that is in the feedback loop. Constant current mode stability is affected by the PROG pin impedance. When there is no additional capacitance on the PROG pin it will reduce the maximum allowable resistance of the programming resistor. If the pole frequency on the PROG pin should be kept at CPROG, the following formula can be used to calculate the maximum resistor value of RPROG:

$$R_{PROG} \leq \frac{1}{2 \text{ yuan} \cdot 10^{\circ} \cdot C_{PROG}}$$

For the user, they may be more interested in the charging current rather than the transient current. For example, if a switching power supply running in low current mode is connected in parallel with a battery, the average current drawn from the BAT pin is usually more important than the transient current pulses. In this case, a simple RC filter can be used on the PROG pin to measure the average battery current (as shown in Figure 3). A 10k resistor is added between the PROG pin and the filter capacitor for stability.

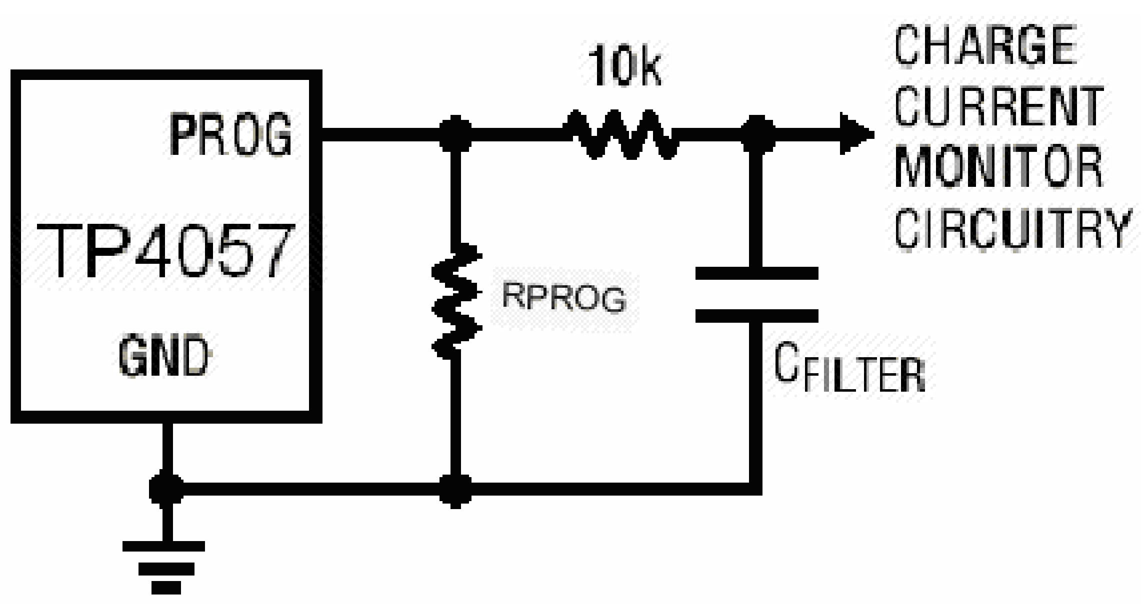


Figure 3: Isolating Capacitive Loads and Filtering Circuits on PROG Pins

Power loss

The conditions under which the TP4057 reduces the charging current due to thermal feedback can be estimated from the power loss in the IC. Almost all of this power loss is generated by the internal MOSFETs—this can be approximated by:

= (Vcc-VBar) • IBAT where PD

is the dissipated power, Vec is the input supply voltage, VBAT is the battery voltage, and Igar is the charging current. When thermal feedback starts to protect the IC, the ambient temperature is approximately: TA=120°C

- PDO JA T=120°C-(Vcc-VBAT)•I $_{BAT}$ · θ_{JA}

Example: Programming a 5V USB Power Supply to Work

The TP4057 used as the power supply provides 400mA full-scale current to a discharged Li-ion battery with a voltage of 3.75V. Assuming •150°C/W (see board layout considerations), when TP4057 starts to reduce the charging current, the ambient temperature is approximately:

$$T_A = 120°C - (5V - 3.75V) \bullet (400mA) \bullet 150°C/W$$
$$T_A = 120°C - 0.5W \bullet 150°C/W = 120°C - 75°C$$
$$T_A = 45°C$$

TP4057 can be used at ambient temperature above 45°C, but the charging current will be reduced below 400mA. For a given ambient temperature, the charging current can be approximated by the following formula:

$$I_{BAT} = \frac{120°C - T_A}{\text{(VCC-VBAT) JA}}$$

Consider the previous example again with an ambient temperature of 60°C. The charging current will be reduced to approximately:

$$I_{BAT} = \frac{120°C - 60°C}{(5V - 3.75V) \bullet 150°C/W} = \frac{60°C}{187.5°C/A}$$
$$I_{BAT} = 320mA$$

Not only that, but as discussed in the Theory of Operation section, when thermal feedback reduces the charge current, the voltage on the PROG pin will decrease proportionally.

It is important to remember that it is not necessary to consider the worst thermal conditions in the TP4057 application design because the IC will automatically reduce the power dissipation when the junction temperature reaches around 120°C.

hot consideration

Due to the small size of the SOT23-6 package, poor heat dissipation in high current applications (above 400mA) may cause the charging current to be reduced due to temperature protection. Please design the heat dissipation resistor according to the actual power supply voltage. The best input voltage at the Vec terminal of the chip is 4.6V, which can get a larger charging current. The general heat dissipation resistance is 0.5 to 1 ohm. It is also important to have a thermally well-designed PC board layout to maximize the available charge current. The thermal path used to dissipate the heat generated by the IC runs from the chip to the lead frame and through the peak back leads (especially the ground lead) to the PC board copper plane. The copper surface of the PC board is a heat sink. The copper area where the pins are connected should be as wide as possible and extend out to a larger copper area to spread the heat into the surrounding environment. Vias to internal or backside copper circuit layers are important in improving charger Overall thermal performance is also useful. When designing the PC board layout, other heat sources on the board that are not related to the charger must also be considered because they will have an impact on the overall temperature rise and the maximum charge current.

The following table lists the thermal resistance for several different board sizes and copper areas. All measurements were made in still air on a 3/32" FR-4 board (the top) obtained.

Table 1: Measured thermal resistance (two-layer circuit board*)

copper area		PCB Area	Junction to Ambient Thermal Resistance
Top	Bottom		
surface 2500mm²	2500mm²	2500mm²	125°C/W
1000mm²	2500mm²	2500mm²	125°C/W
225mm²	2500mm²	2500mm²	130°C/W
100mm²	2500mm²	2500mm²	135°C/W
50mm²	2500mm²	2500mm²	150°C/W

*Each layer uses 1 oz copper foil

Table 2; Measured thermal resistance (four-layer circuit board**)]

Copper area (per side)	Board Area	Junction to Ambient Thermal Resistance
2500mm² **2	2500mm²	80°C/W

2 oz copper foil on late and bottom layers. 1 oz copper foil for the inner layer.

**Total copper area is 10,000mm²

Vec bypass capacitor

Various types of capacitors can be used for input bypassing. However, care must be taken when using multilayer ceramic capacitors. Since some types of ceramic capacitors have the characteristics of self-resonance and high Q value, it is recommended to use electrolytic or tantalum capacitors.

Charging Current Soft Start

The TP4057 includes a soft-start circuit to minimize inrush current at the beginning of a charge cycle. When a charge cycle is initiated, the charge current will ramp from 0 to full-scale full-scale value in about 20s. This serves to minimize transient current loads on the power supply during start-up.

CHRG status output pin

When a discharged battery is connected to the charger, the constant current portion of the charge cycle begins and the CHRG pin is pulled to ground. The CHRG pin is capable of sinking up to 10A to drive a among the LEDs.

When the battery is nearly full, the charger enters the constant voltage portion of the charge cycle and the charge current begins to drop. When the charging current drops to less than 1/10 of the set current, the charging cycle ends and the strong pull-down high-impedance state is replaced, indicating that the charging cycle has ended. If the input voltage is removed or drops below the undervoltage lockout threshold, the CHRG pin will also become high impedance. A microprocessor can detect both states from this pin using a pull-up resistor, as shown in Figure

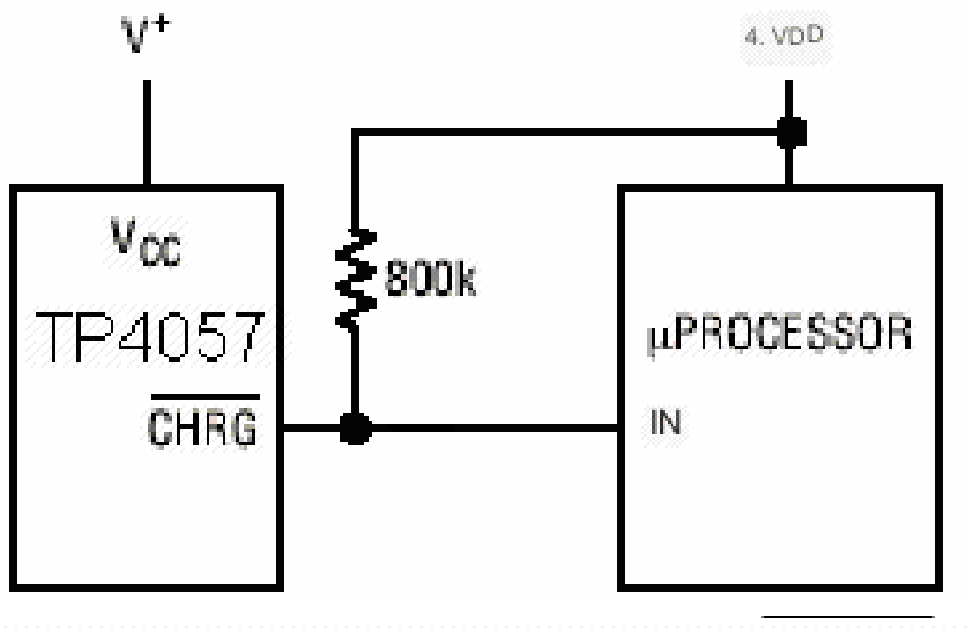


Figure 4: Using a microprocessor to determine the CHRG pin state

To detect when the TP4057 is in charge mode, an N-channel MOSFET pulls this pin low with a 100k pull-up resistor. once charged The cycle terminates, the N-channel MOSFET is turned off, the CHRG pin is high impedance and the IN pin is then pulled high by the 100k pull-up resistor. Of course, in the case of undervoltage lockout and insufficient input voltage, the IN pin will also be pulled to high level, indicating that the device is in a UVLO state.

Input voltage reverse polarity protection

In some applications, reverse polarity voltage protection on Vec is required. If the supply voltage is high enough, a series blocking diode can be used. In other cases where low dropout must be maintained, a P-channel MOSFET can be used (as shown in Figure 5).

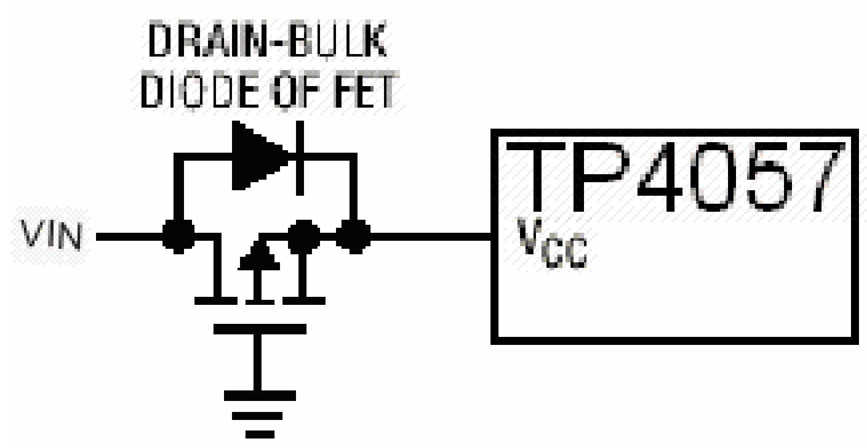
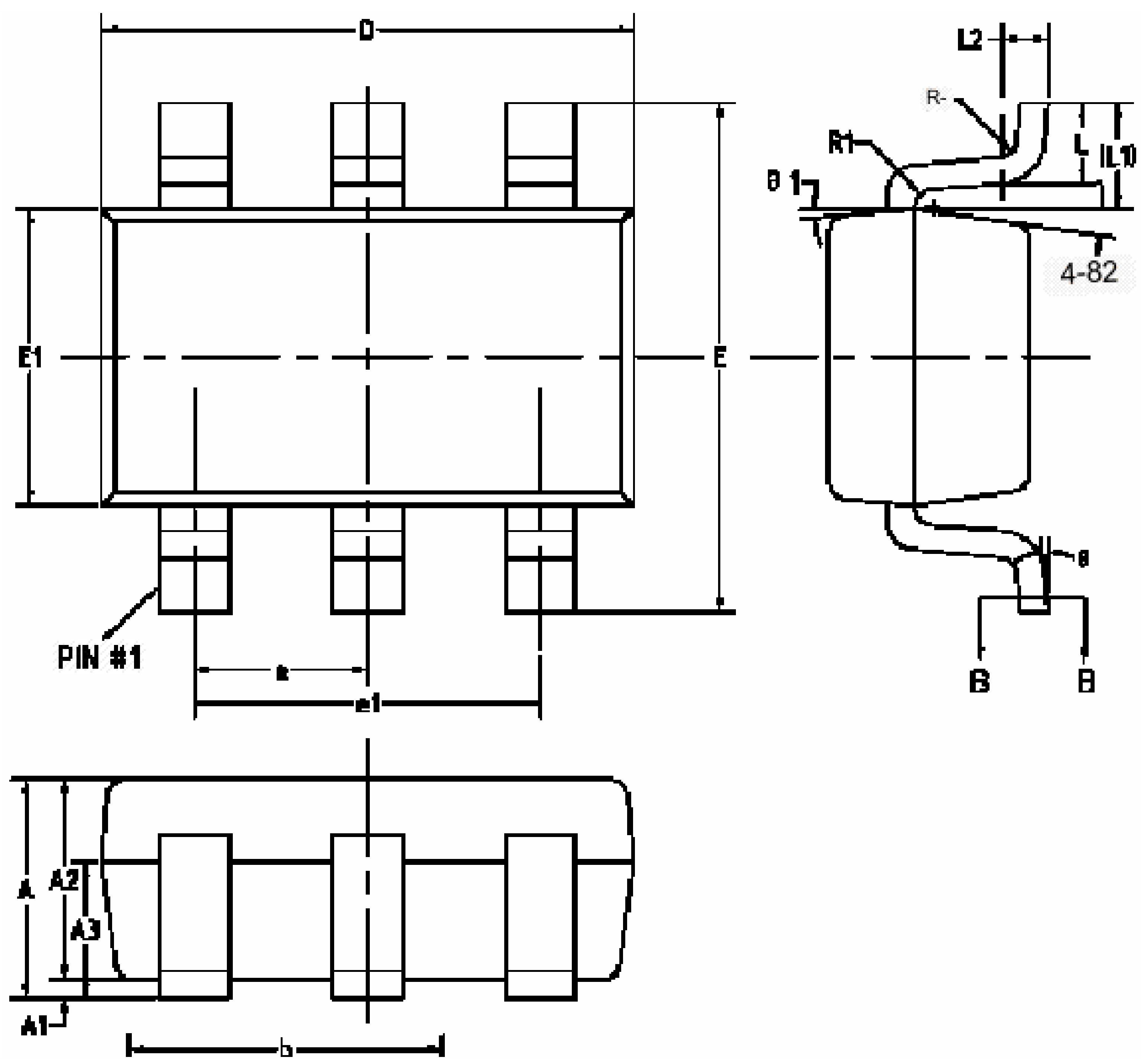


Figure 5: Low-loss input reverse polarity protection

Package Description

S5 package

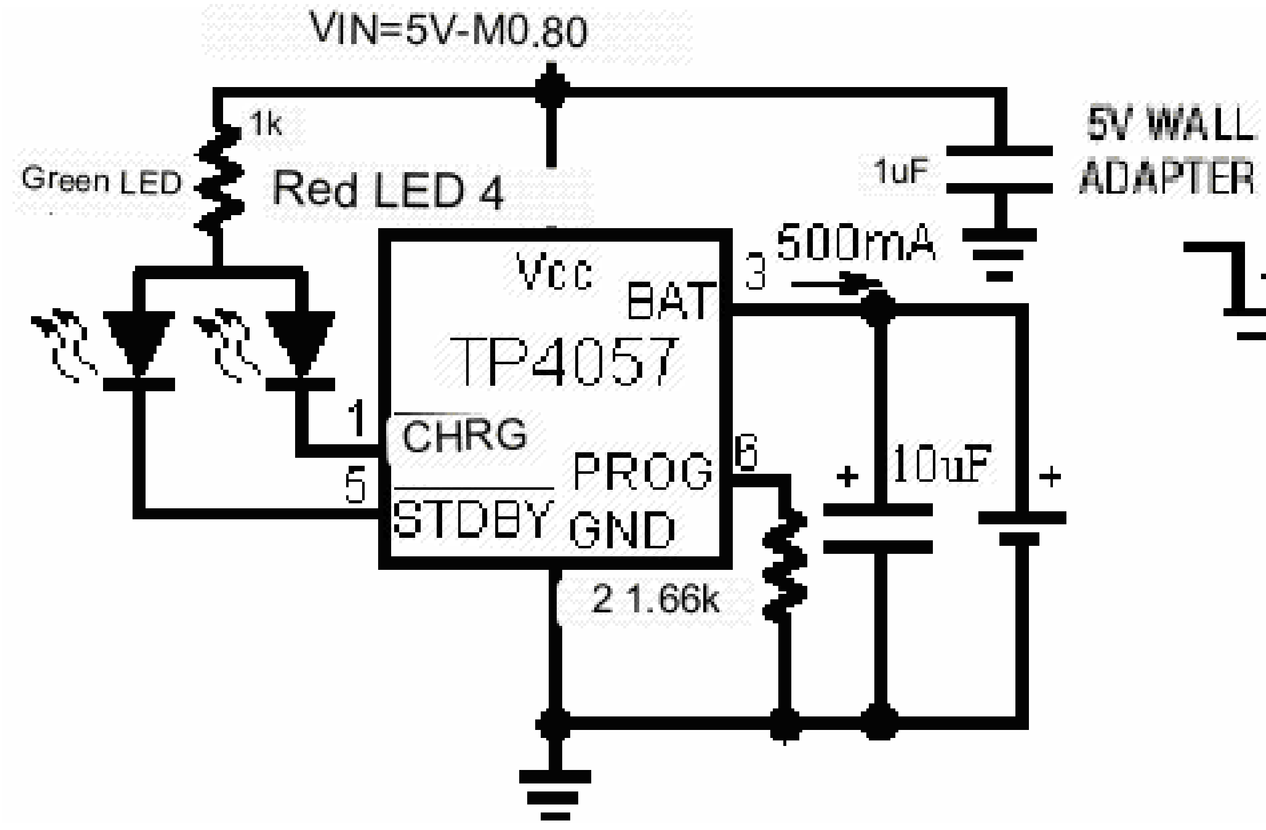
5-Pin Plastic SOT-23-5 Package

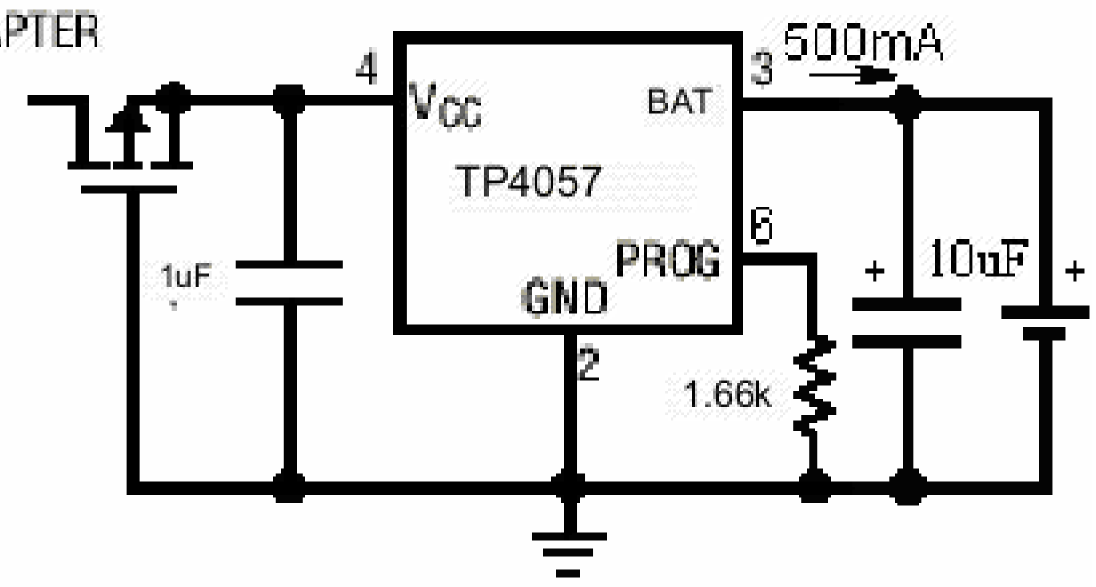


COMMON DIMENSIONS
(UNITS OF MEASURE=MILLIMETER)

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	0.36		0.50
b1	0.36	0.38 0.45	
c	0.14	—	0.20
c1	0.14	0.15	0.16
D.	2.826 2.928 3.026		
E.	2.B0 2.80 3.00		
E1	1.526	1.628	1.726
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°

typical application

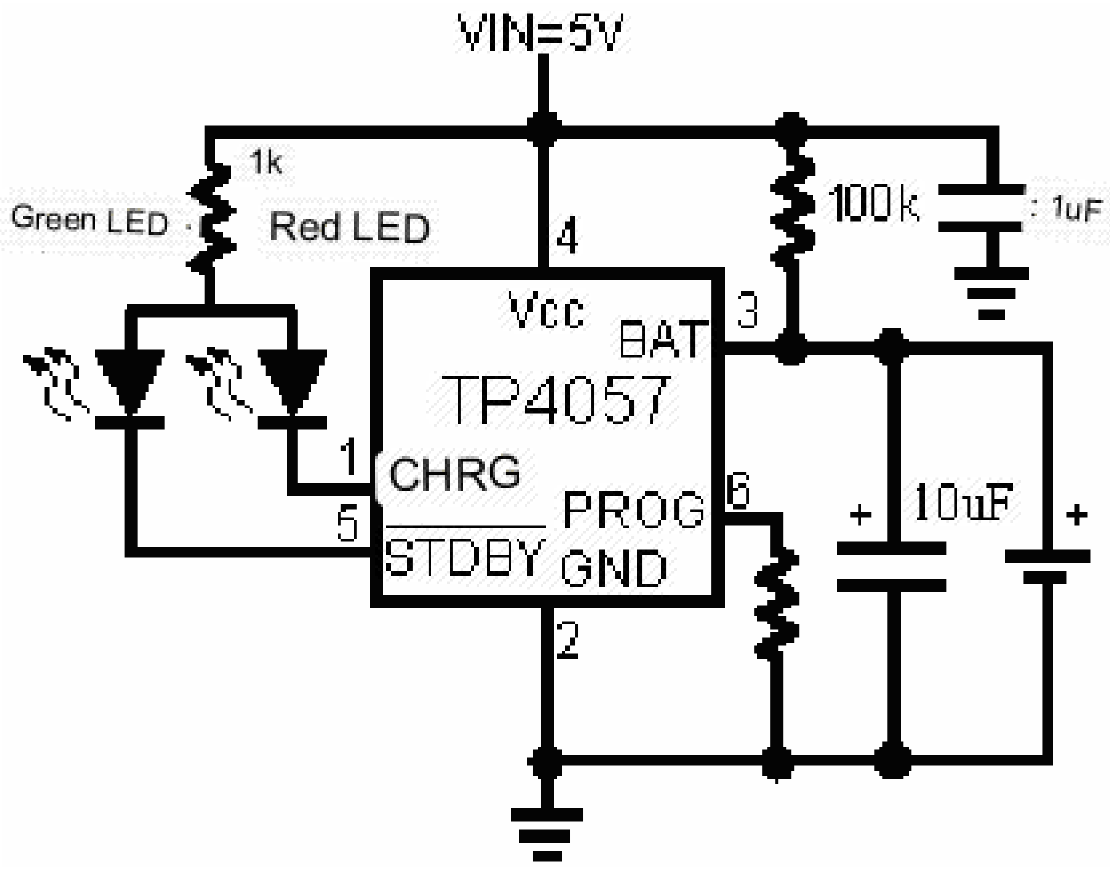


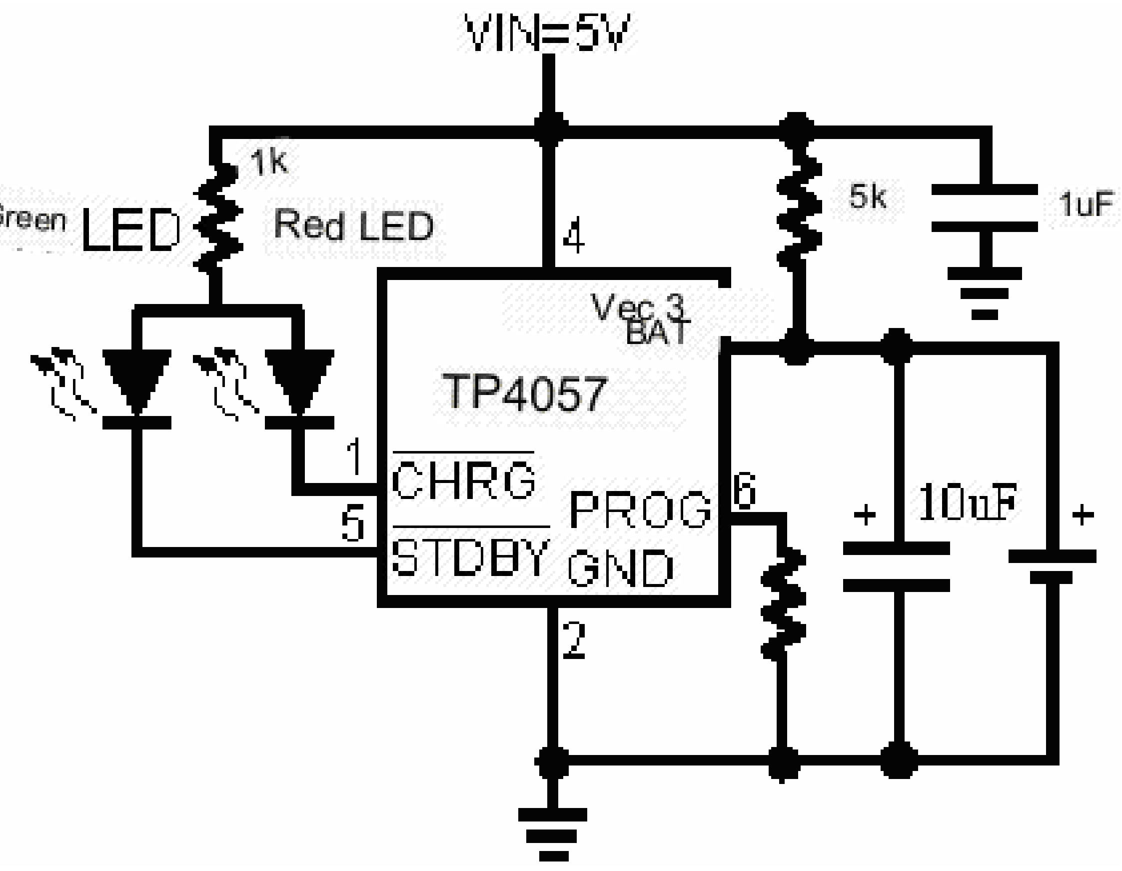


Full-featured single-cell lithium battery charger (connected to dissipating resistor)

Charger with Input Reverse Polarity Protection

(Green light is on and red light is flashing when there is no battery)





No battery, no flashing lights, single-cell lithium battery charger, no battery, double lights, all off, single-cell lithium battery charger

(The green light is on and the red light is off without battery, which does not affect other status indications)

TP4057 Test Use Precautions

1. During the TP4057 test, the BAT terminal (pin 3) of the chip should be directly connected to the positive pole of the battery, and the ammeter cannot be connected in series. The ammeter can be connected to the Vcc terminal of the chip.

2. In order to ensure reliable use in various situations and prevent chip damage caused by peak and glitch voltages, it is recommended that the VIN terminal and BAT terminal of TP4057 be connected to 1uF and 10uF electrolytic capacitors respectively, and a 0.1u capacitor can be connected to each if possible. Ceramic capacitors. The location of all capacitors is preferably close to the chip pins, It should not be too

far. 3. Adopt SOT23 package, poor heat dissipation effect in high current application (above 400mA) may cause the charging current to be reduced due to temperature protection. The customer can not connect the dissipating resistor. If the current cannot meet the requirements, please design the thermal dissipating resistor according to the actual power supply voltage. The input voltage of the Vcc terminal of the chip is 4.6V is the best, and a larger charging current can be obtained. Generally, the thermal dissipating resistor is 0.5 to 1 ohm. Also good PCB board layout can effectively reduce the impact of temperature on current in high current charging applications.