500mA linear anti reverse connection lithium battery charger

■ DESCRIPTION

HM4057G is a complete single lithium-ion battery charging management chip with constant current/ constant voltage. Its small SOT package and small number of external components make it an ideal device for portable applications. HM4057G can be suitable for USB power supply and adapter power supply. Due to the internal PMOSFET architecture and anti reverse charging circuit, no external detection resistor and isolation diode are required. The thermal feedback can adjust the charging current to limit the chip temperature under high-power operation or high ambient temperature conditions. The charging voltage is fixed at 4.2V, and the charging current can be set externally through a resistor. When the charging current drops to 1/10 of the set value after reaching the final floating charge voltage, HM4057G will automatically terminate the charging cycle. When the input voltage (AC adapter or USB power supply) is removed, HM4057G automatically enters a low current state, reducing the battery leakage current to less than 2uA. The HM4057G can also be placed in the shutdown mode to reduce the supply current to 25uA. Other features of the HM4057G include a charging current monitor, undervoltage lockout, automatic recharging, and a status pin for indicating the end of charging and input voltage on. The chip is integrated with a dual indicator for charging status, which can be configured to turn on the red light when charging, and turn on the green light when fully charged.

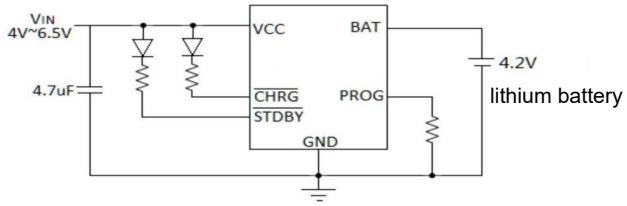
■ FEATURES

- Programmable charging current 500mA
- No external MOSFET is required to detect resistance and isolation diode
- Constant current/constant voltage operation, with thermal regulation function to maximize the charging rate without overheating risk
- 4.2V precharge voltage with an accuracy of ±1%
- Charging current monitor output for battery power detection
- Automatic recharging
- Charge state dual output, no battery and fault state display
- C/10 charging termination
- Supply current in shutdown mode is 25uA
- 2.9V trickle charging, with battery anti reverse connection function
- Soft start limit surge current
- Temperature range from - 40 ℃ to+85 ℃

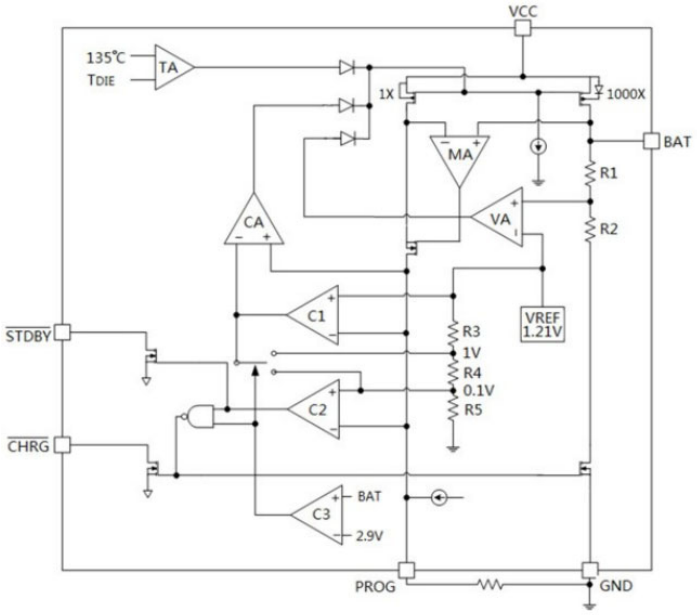
■ APPLICATIONS

- MP3 and MP4 players
- Bluetooth, GPS navigator
- Portable device charger
- Mobile phone, PDA, power bank

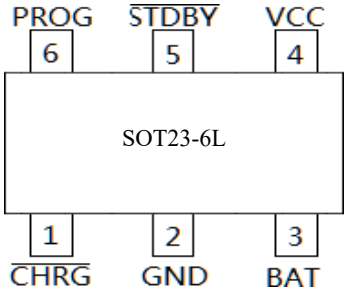
■ Typical application circuit



■ BLOCK DIAGRAM



■ RECOMMEND PACKAGE TYPE



Pin	Name	Function
1	CHRG	Charging state indication
2	GND	Ground terminal
3	BAT	Connected to battery
4	VCC	Power input
5	STDBY	Charging state indication
6	PROG	Charging current programming pin

■ ABSOLUTE MAXIMUM RATINGS

T_a=25℃,Note

VCC input voltage……..……..……..……..0.3V to 6.5V
Operating temperature range……..……..……..-40°C to +85°C
Lead temperature (brazing, 10s)……..……..……..……+300°C
θ_{JA}……..……..……..……250°C/W
θ_{JC} ……..……..……..……130°C/W
Maximum power consumption……..……..……..……400mW
BAT terminal current……..……..……..……..500mA
Storage temperature range……..……..……..…… -65°C to 125°C
Junction temperature……..……..……..……..……+125°C
ESD (Human Body Made) HMB……..……..……..……4KV
ESD (Machine Made) MM……..……..……..…….... 400V

Note 1: Exceeding these ratings may damage the device.

Note2: The equipment cannot be guaranteed to operate outside its working conditions.

■ ELECTRICAL CHARACTERISTICS

T_A=25℃ ， unless otherwise noted

Symbol	Parameter	Condition	Min	Typ	Max	Unit
VCC	Input power supply voltage		4.25	5	6.5	V
ICC	Chip current consumption	Charging mode R_{PROG}=10k		240	500	uA
		Low power consumption mode (charging completed)		45		uA
		Shutdown mode (R_{PROG} is not connected to VCC<V_{BAT}, or VCC<V_{UV})		25	50	uA
V_{FLOAT}	Stable floating charge voltage	V_{BAT}<V_{TRIKL},R_{PROG}=10k	4.158	4.2	4.242	V
I_{BAT}	BAT current charging current	Current mode，R_{PROG}=10k	90	100	130	mA
		Current mode，R_{PROG}=2k		500		mA
		Low power consumption mode,V_{BAT}=4.2V		1	2	uA
		Off mode (PROG not connected)		0.5	1	uA
		Sleep mode,VCC=0V		0	1	uA
I_{TRIKL}	trickle charge current	V_{BAT}<V_{TRIKL},R_{PROG}=10k		10		mA
V_{TRIKL}	Trickle charge threshold voltage	R_{PROG}=10k,V_{BAT} rise	2.8	2.9	3	V
V_{UV}	VCC undervoltage lockout threshold	From VCC Low to High		3.7		V
V_{UVHYS}	VCC undervoltage lockout hysteresis			130		mV
V_{ASD}	VCC charging threshold voltage	VCC from low to high		100		mV
		VCC from high to low		30		mV
V_{CHRG}	CHRG pin output voltage	I_{CHRG}=5mA		20	50	mV
V_{PROG}	Charging reference voltage	Current mode，R_{PROG}=10k	0.9	1	1.1	V
△V_{RECHRG}	Automatic recharge hysteresis voltage	V_{FLOAT} - V_{RECHRG}		150		mV
T_{LIM}	Overtemperature shutdown point			150		℃
I_{PROG}	PROG pull-up current			1.5		uA

Note 3: * Parameters are guaranteed by the design.

► Exceeding the maximum operating range may damage the chip

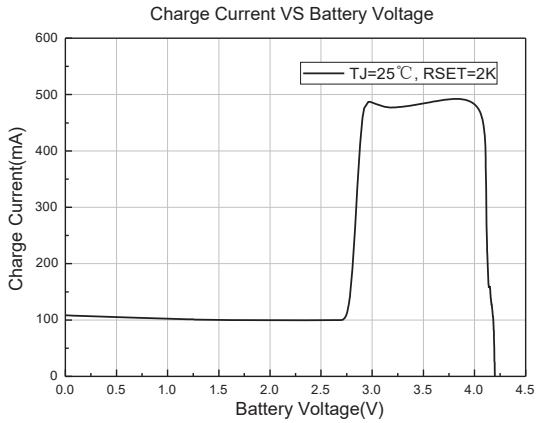
► The chip is not recommended to work in the limit parameter state

► The working current of the chip includes the current consumed by the external resistor of PROG Pin (about 100uA), but does not include the current charged by the chip through BAT Pin (about 100mA)

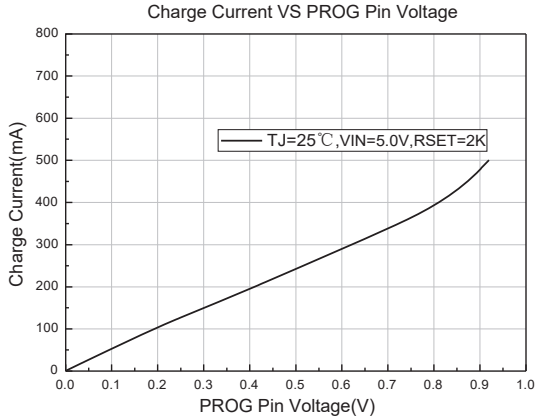
► The charging termination current is generally 0.1 times of the set charging current

■ TYPICAL CHARACTERISTICS

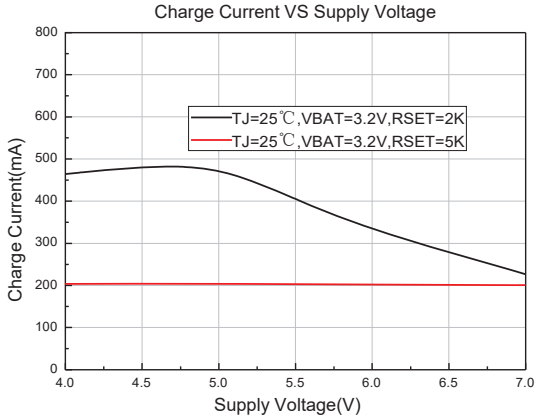
1. Charging current VS BAT terminal voltage



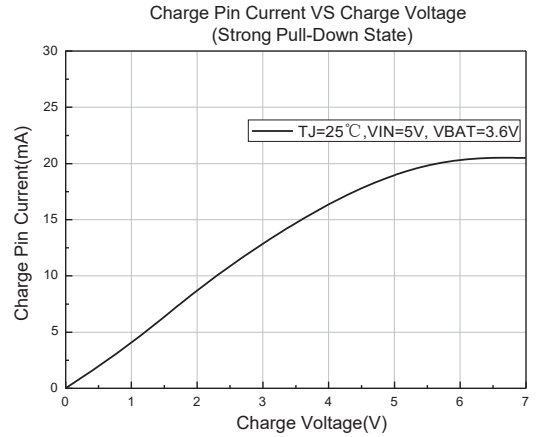
2. Charging current VS PROG terminal voltage



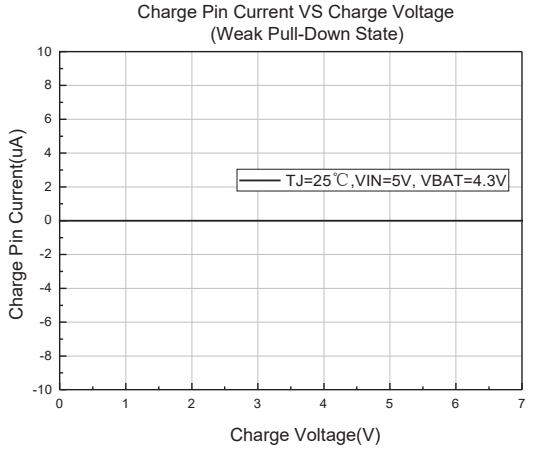
3. Charging current VS input voltage



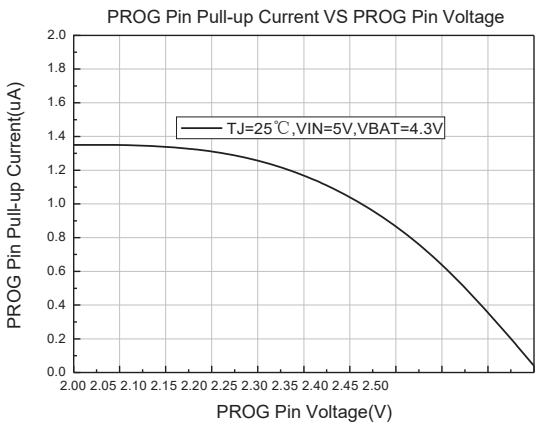
4. CHARGE terminal current VS CHARGE terminal voltage (during charging)



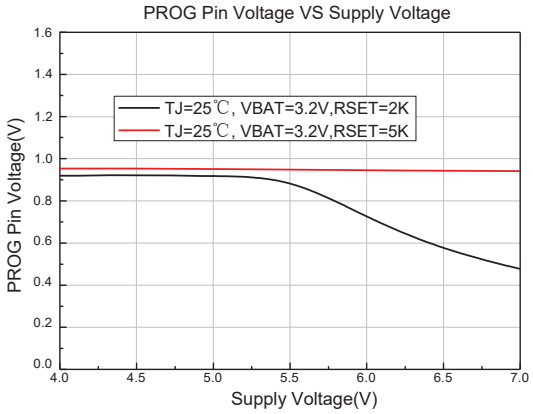
5. CHARGE terminal current VS CHARGE terminal voltage (fully charged)



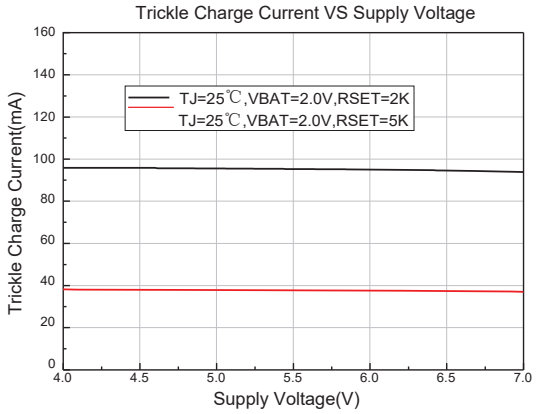
6. PROG terminal current VS PROG terminal pull-up voltage



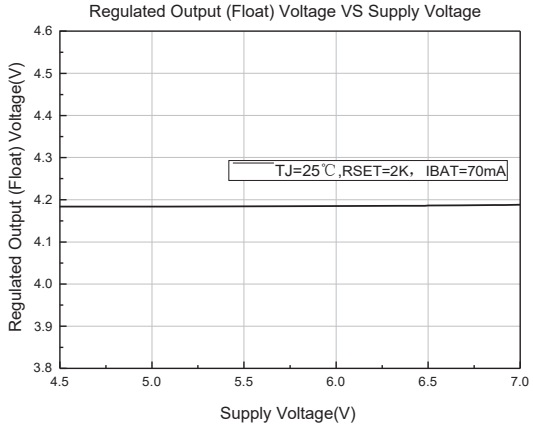
7. PROG terminal voltage VS input voltage



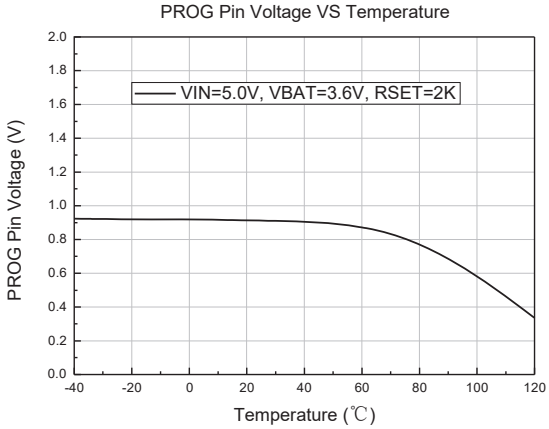
8. Trickle charging current VS input voltage



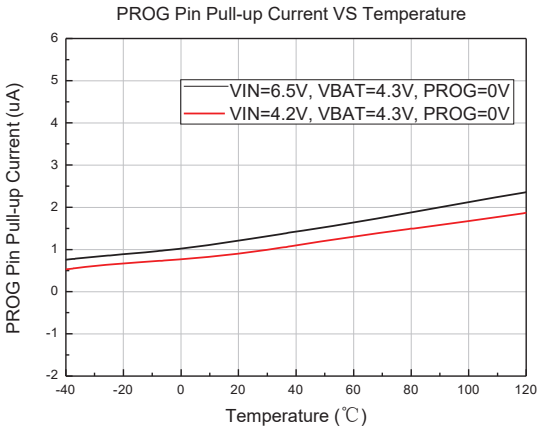
9. VBAT VS input voltage



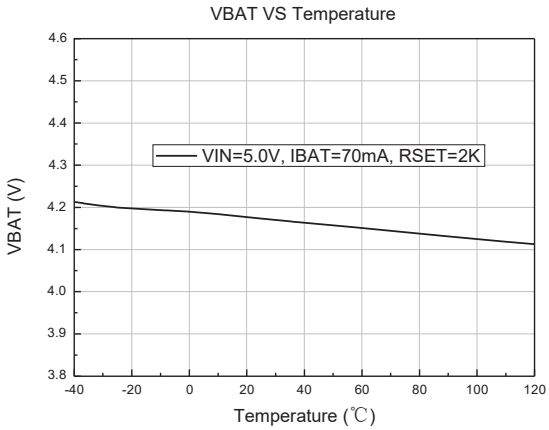
10. PROG terminal voltage VS temperature



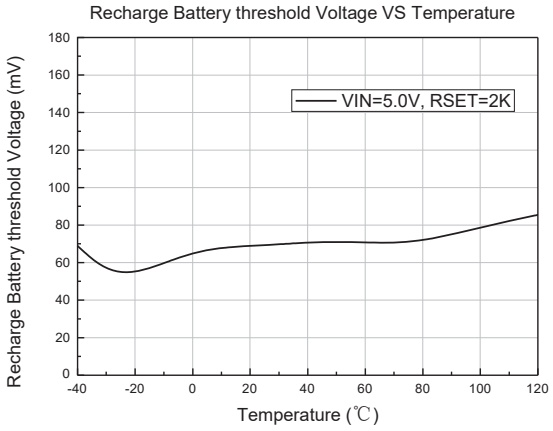
11. PROG terminal pull-up current VS temperature



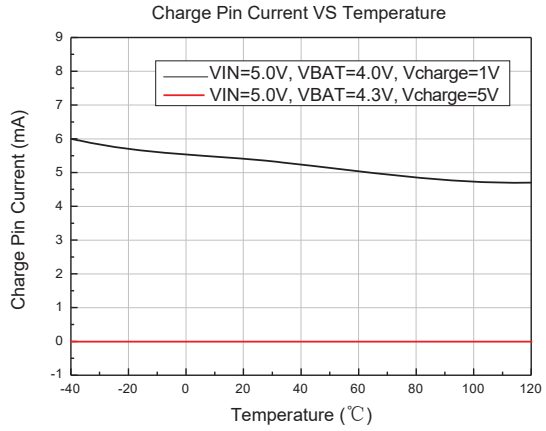
12. BAT terminal temperature curve



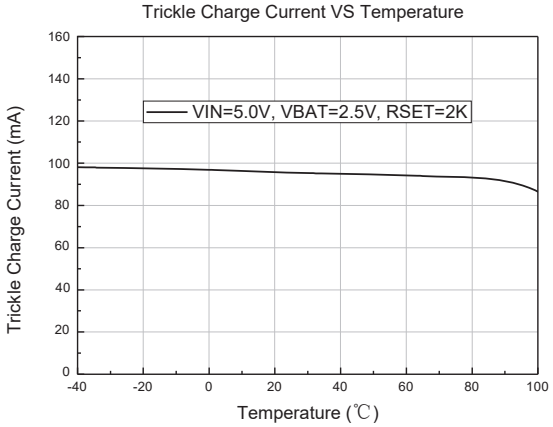
13. Recharging hysteresis voltage VS temperature



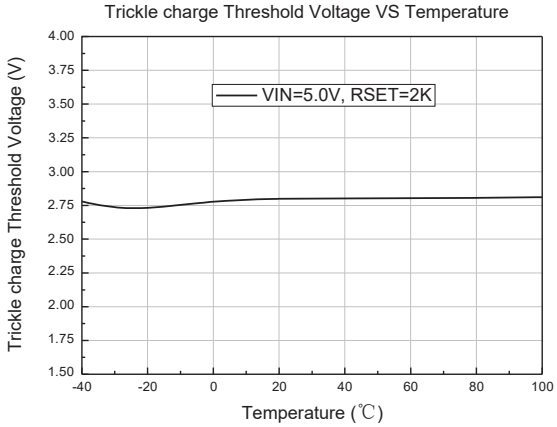
14. CHRG terminal current VS temperature



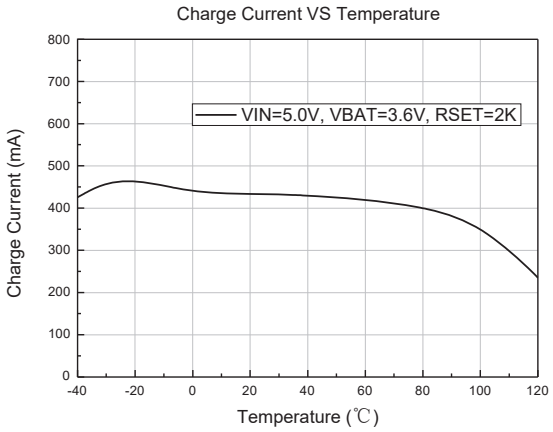
15. Trickle charging current VS temperature



16. Trickle charging limit voltage VS temperature



17. Charging current temperature curve



18. Power tube internal resistance VS temperature