Standalone Linear Li-Ion Battery Charger With Thermal Regulation In SOT

● DESCRIPTION

The VIC6105 is a complete constant current & constant voltage linear charger for single celllithium-ion batteries.Its SOT package and low external component count make the ideally suited for portable applications.Furthermore, the is specifically designed to work within USB powerspecifications.

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 duringhigh power operation or high ambient temperature. The charge voltage is fixed at 4.2V, and the charge current can beprogrammed externally with a single resistor. The VIC6105 automatically terminates thecharge cycle when the charge current drops to $1/10^{th}$ the programmed value after the final float voltage is reached.

When the input supply (wall adapter or USB supply) is removed, the VIC6105 automatically enters a low current state, dropping the battery drain current to less than 2uA.The VIC6105 can be put into shutdown mode, reducing the supply current to 25uA.

When battery reversed,the internal protected the BAT pin throughout about 0.7mA current from GND. Also,The BAT pin has a 7KV ESD(HBM) capability.

Other features include charge current monitor,under-voltage lockout, automatic recharge and a status pin to indicate charge termination and the presence of an input voltage.

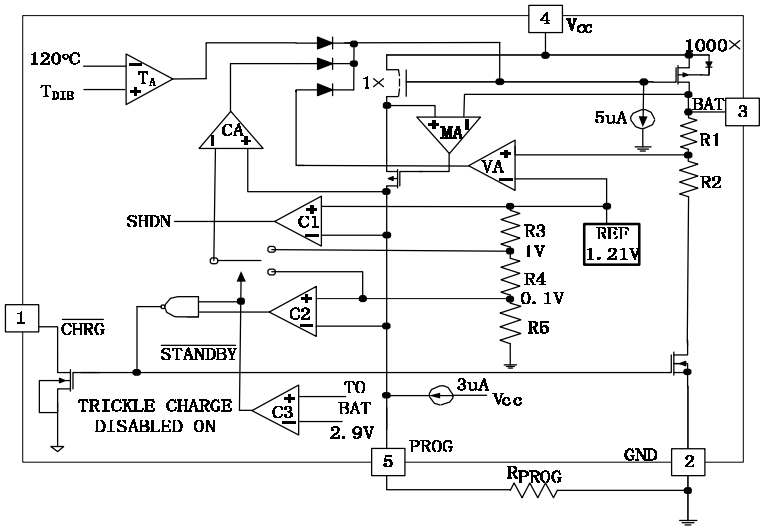
● FEATURE

- ◆ Preset 4.2V Charge Voltage with ±1% Accuracy
- ◆ Programmable Charge Current Up to 500mA
- ◆ No MOSFET, Sense Resistor or Blocking Diode Required
- ◆ Complete Linear Charger in SOT 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
- ◆ Charge Current Monitor Output for Gas Gauging
- ◆ Automatic Recharge
- ◆ 7KV ESD(HBM) capability
- ◆ Charge Status Output Pin
- ◆ C/10 Charge Termination
- ◆ Battery reversed protection
- ◆ 25uA Supply Current in Shutdown
- ◆ 2.9V Trickle Charge Threshold
- ◆ Soft-Start Limits Inrush Current
- ◆ Available in 5-Lead SOT-23 Package

● APPLICATIONS

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

● PIN CONFIGURATION



● ABSOLUTE MAXIMUM RATINGS(TA=25℃ Unless otherwise noted)

Parameter	Symbol	Maximum Rating	Unit
Input Supply Voltage	Vcc	Vss-0.3～Vss+7	V
PROG pin Voltage	Vprog	Vss-0.3～Vcc+0.3	
BAT pin Voltage	Vbat	Vss-0.3～7	
CHAG pin Voltage	Vchrg	Vss-0.3～Vss+7	
BAT pin Current	Ibat	500	mA
PROG pin Current	Iprog	800	uA
Operating Ambient Temperature	Topa	-40～+85	°C
Storage Temperature	Tstr	-65～+125	

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.

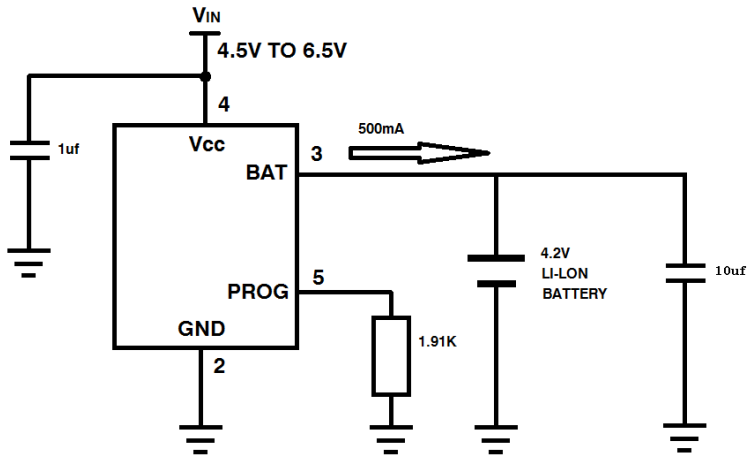
● ELECTRICAL CHARACTERISTICS(TA=25℃ Unless otherwise noted)

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Input supply voltage	Vcc		4.25		6.5	V
Input supply current	Icc	Charge mode, R_{PROG} =10K		300	2000	uA
		Standby mode		200	500	uA
		Shutdown mode(R_{PROG} not connected,Vcc<Vbat or Vcc<Vuv)		25	50	uA
Regulated Output Voltage	Vfloat	0℃≤ T_A≤ 85°C, I_{BAT} = 40mA	4.158	4.2	4.342	V
BAT pin Current	Ibat	R_{PROG} =10k,Current mode	93	100	107	mA
		R_{PROG} =2k,Current mode	465	500	535	mA
		Standby mode,Vbat=4.2V	0	-2.5	-6	uA
		Shutdown mode		1	2	uA
		Sleep mode,Vcc=0V		0.3	2	uA
Trickle charge current	Itrikl	Vbat<Vtrikl,Rprog=2k	20	45	70	mA
		Vbat<Vtrikl,Rprog=51k	5	--	--	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} =10k	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
Manual shutdown threshold	Vmsd	P_{ROG} pin rising	1.15	1.25	1.30	V
		P_{ROG} pin falling	0.9	1.0	1.1	V
Vcc-Vbat Lockout Threshold	Vasd	Vcc from low to high	70	100	140	mV
		Vcc from high to low	5	40	50	mV
C/10 Termination Current	Iterm	R_{PROG}=10k	0.085	0.10	0.115	mA/mA
		R_{PROG}=2k	0.085	0.10	0.115	mA/mA
PROG pin Voltage	Vprog	R_{PROG} =10k, Current mode	0.93	1.0	1.07	V

CHRG pin weak pull-down Current	Ichrg	Vchrg=5V	8	15	35	uA
CHRG pin Output low voltage	Vchrg	Ichrg=5mA		0.35	0.6	V
Recharge Battery threshold Voltage	ΔVrecg	V_{FLOAT} - V_{RECHRG}		100	200	mV

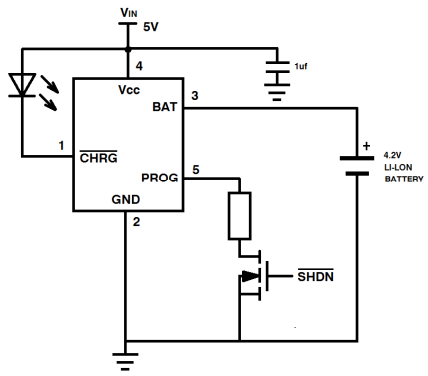
● TYPICAL Application Circuit

1. Basic circuit

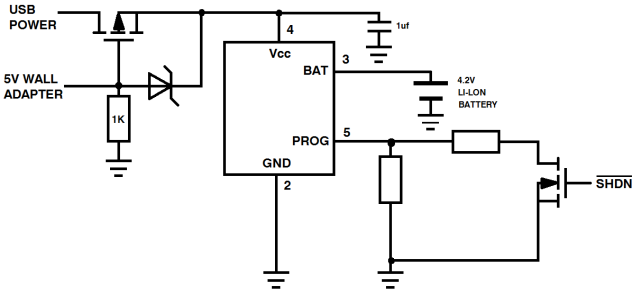


2. Typical circuit

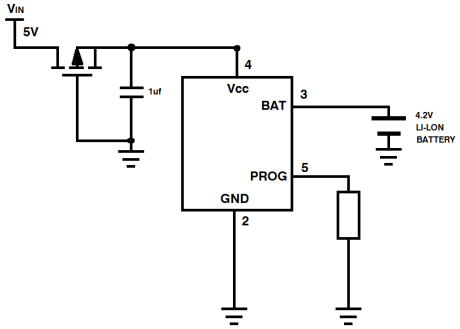
Full Featured Single Cell Li-Ion Charger



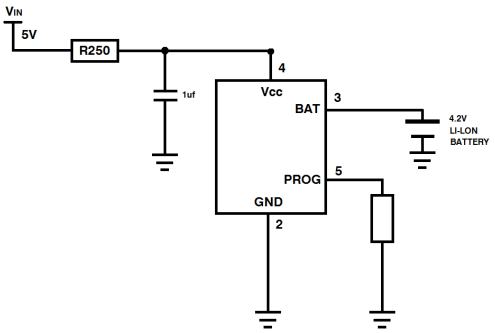
USB/WALL Adapter Power Li-Ion Charger



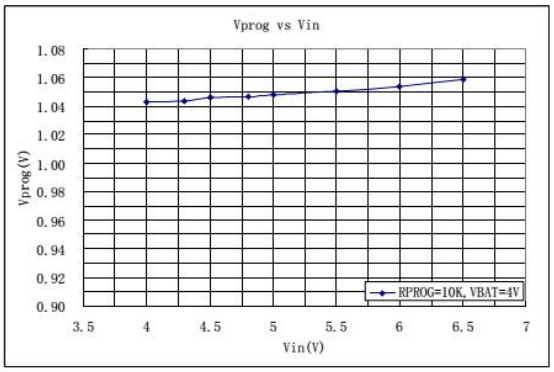
Baisc Li-Ion Charger With Reverse Polarity Input Protection

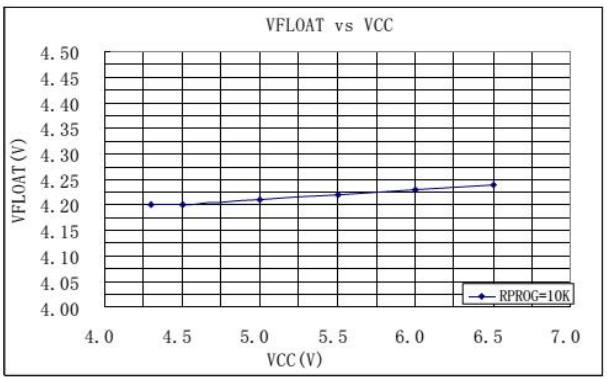


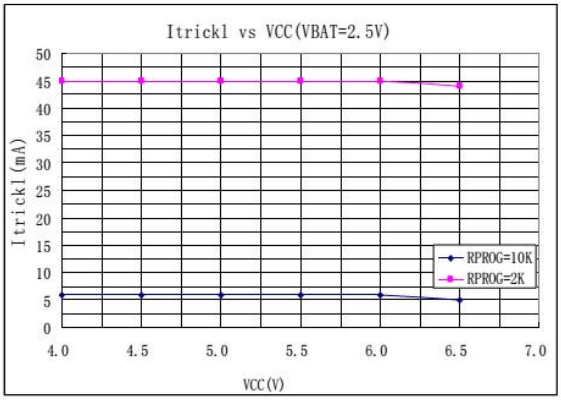
Li-Ion Charger with External Power Dissipation

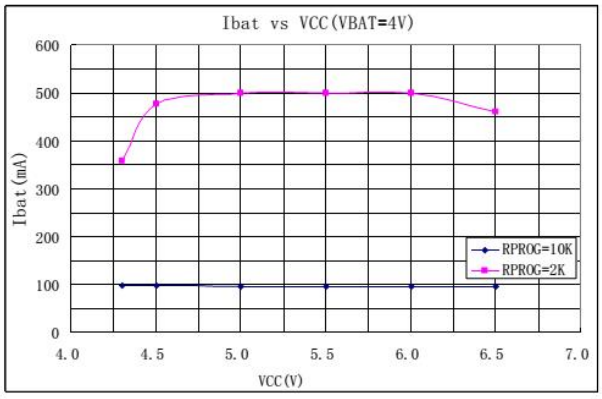


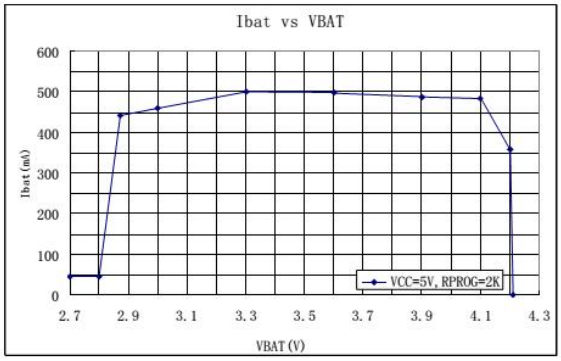
● TYPICAL CHARACTERISTICS (TA=25℃ Unless otherwise noted)

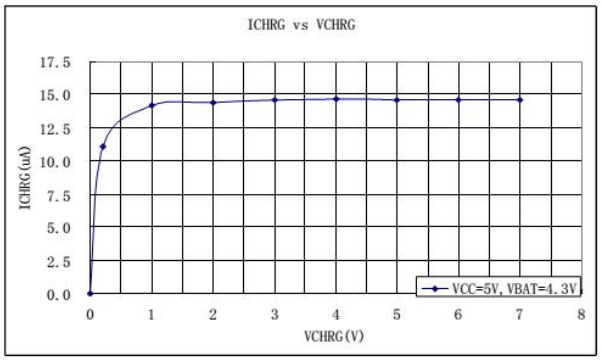


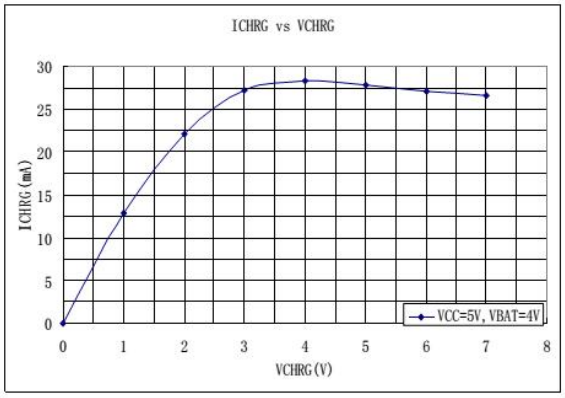


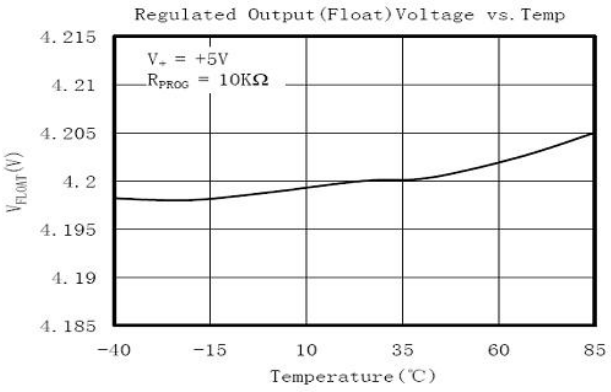






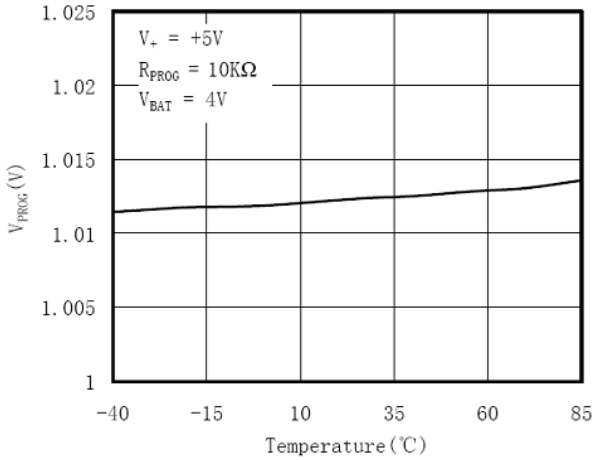




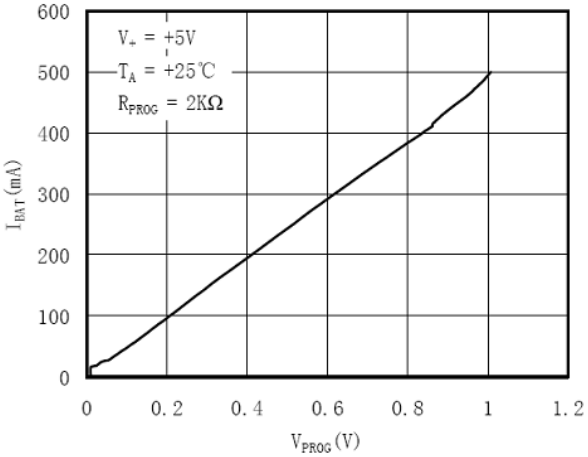


● TYPICAL CHARACTERISTICS (TA=25℃ Unless otherwise noted)

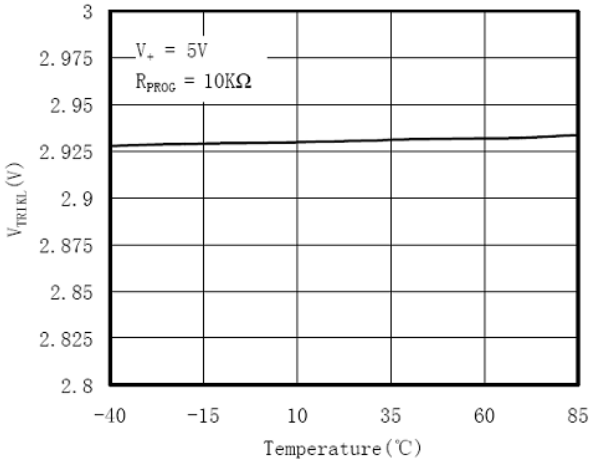
PROG Pin Voltage vs. Temp



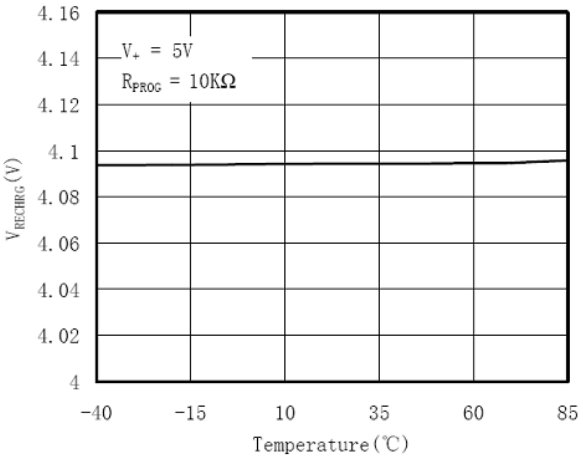
Charge Current vs. PROG Pin Voltage



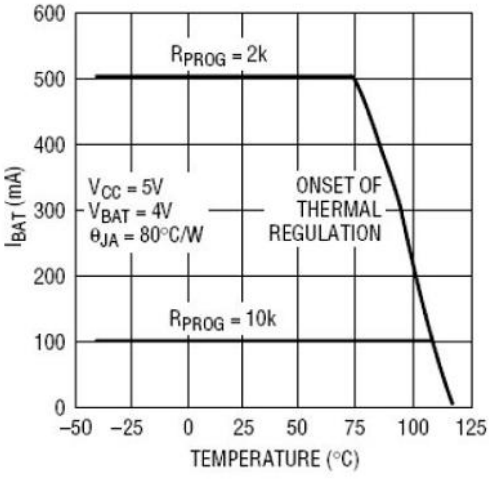
Trickle Charge Threshold vs. Temperature



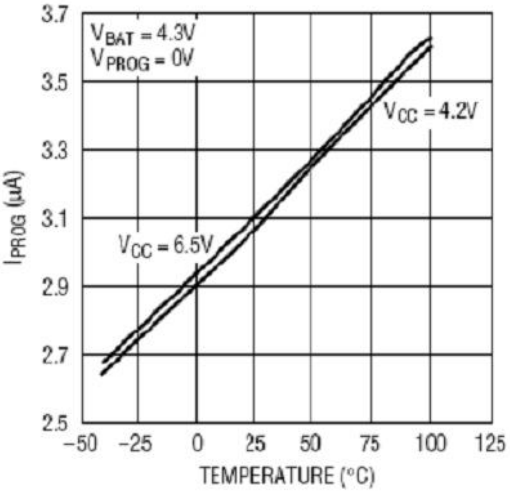
Recharge Voltage Threshold vs. Temperature

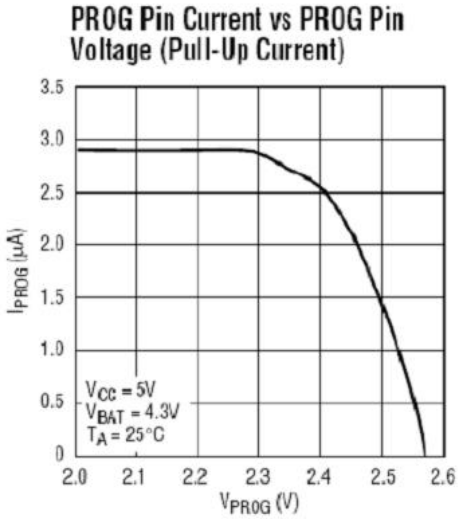


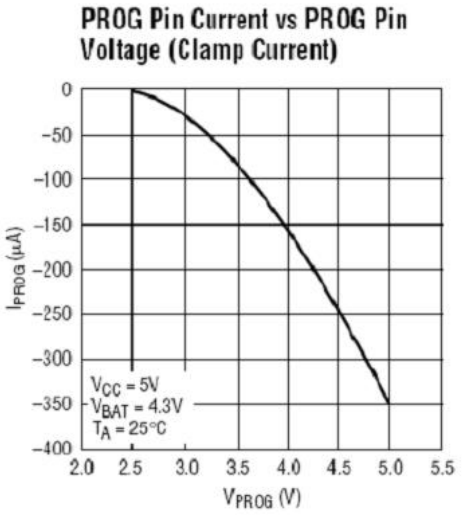
Charge Current vs Ambient Temperature



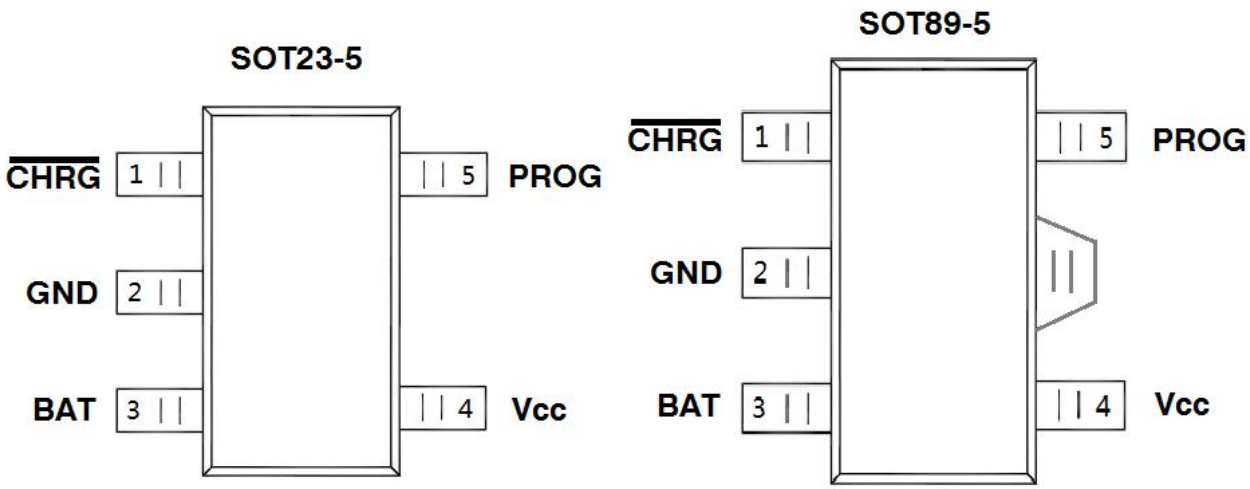
PROG Pin Pull-Up Current vs Temperature and Supply Voltage







● Pin Configuration



● Pin Assignment

Pin Number		Pin Name
SOT23-5	SOT89-5	
1	1	CHRG
2	2	GND
3	3	BAT
4	4	VCC
5	5	PROG

● Pin Function

CHRG (Pin 1): 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, a weak pull-down of approximately 20uA is connected to the CHRG pin, indicating an "AC present" condition. When the VIC6105 detects an under voltage lockout condition, CHRG is forced high impedance.

GND (Pin 2):
Ground.

BAT (Pin 3): 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

.

VCC (Pin 4): Positive Input Supply Voltage. Provides power to the charger, VCC can range from 4.25V to 6.5V and should be bypassed with at least a 1uF capacitor. When VCC drops to within 30mV of the BAT pin voltage, the VIC6015 enters shutdown mode, dropping IBAT to less than 2uA.

PROG (Pin 5): 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:

$$I_{BAT} = (V_{PROG}/R_{PROG}) * 1000$$

The PROG pin can also be used to shut down the charger. Disconnecting the program resistor from ground allows a 3 uA 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 25uA. 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.

● Output Current Accuracy (TA=25℃ V_{BAT}=3.6V)

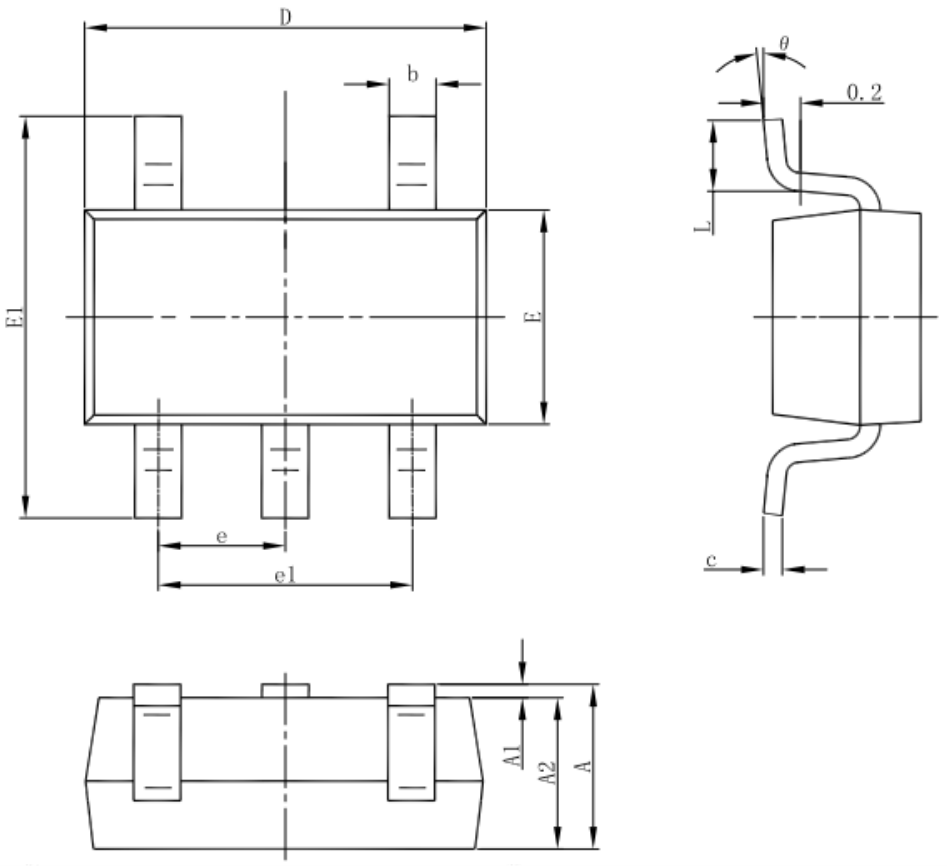
RPROG	IBAT(test)	IBAT(calculation)	Deviation
20K	50mA	50mA	0%
10K	101mA	100mA	1%
5K	151mA	150mA	0.67%
2K	478mA	500mA	4.4%
1.91K	495mA	524mA	5.5%

Caution: Charge Current with ±7% Accuracy.

● ORDERING INFORMATION

Part Number	Package code	Shipping
VIC6105DK	DK: SOT23-5	3000/Tape & Reel

● PACKAGE DIMENSIONS

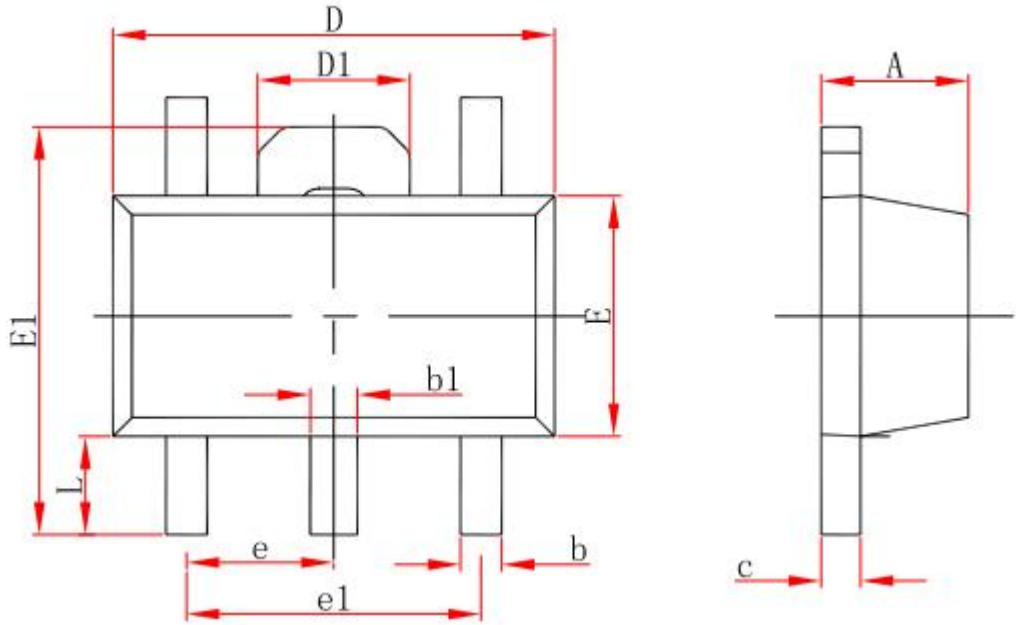


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950(BSC)		0.037(BSC)	
e1	1.800	2.000	0.071	0.079
L	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°

● ORDERING INFORMATION

Part Number	Package code	Shipping
VIC6105DM	DM: SOT89-5	3000/Tape & Reel

● PACKAGE DIMENSIONS



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	1.400	1.600	0.055	0.063
b	0.320	0.520	0.013	0.020
b1	0.380	0.580	0.015	0.023
c	0.350	0.440	0.014	0.017
D	4.400	4.600	0.173	0.181
D1	1.550 REF.		0.061 REF.	
E	2.300	2.600	0.091	0.102
E1	3.940	4.250	0.155	0.167
e	1.500 TYP.		0.060TYP.	
e1	3.000 TYP.		0.118 TYP.	
L	0.900	1.200	0.035	0.047