

800mA Standalone Linear Li-Ion Battery Charger with Thermal Regulation in SOT23-5/TSOT23-5

FEATURES

- Programmable Charge Current Up to 800mA
- No MOSFET, Sense Resistor or Blocking Diode Required
- Preset 4.2V Charge Voltage with $\pm 1\%$ Accuracy
- Charge Current Monitor Output for Gas Gauging
- Thermal Regulation Maximizes Charge Rate Without Risk of Overheating
- Charges Single Cell Li-Ion Batteries Directly from USB Port
- Over-Voltage Protect
- Automatic Recharge
- Charge Status Output Pin
- C/10 Charge Termination
- 25 μ A Supply Current in Shutdown
- 2.9V Trickle Charge Threshold
- Soft-Start Limits Inrush Current
- Available in 5-Lead SOT-23 Package

APPLICATIONS

- Cellular and Smart Phones
- Charging Docks and Cradles
- BlueTooth Applications
- PDAs
- MP3/MP4/MP5 Players

DESCRIPTION

The BL4054/BL4054B is a complete constant current / constant voltage linear charger for single cell Lithium-Ion batteries. No external sense

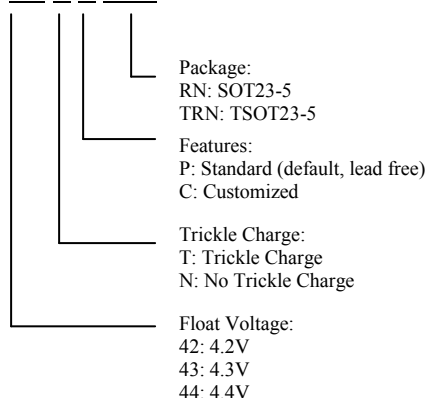
resistor is needed, and no blocking diode is required due to the internal MOSFET architecture. Thermal feedback regulates the charge current to limit the die temperature during high power operation or high ambient temperature. The charge voltage is fixed at 4.2V, and the charge current can be programmed externally with a single resistor. The BL4054/BL4054B automatically terminates the charge cycle when the charge current drops to 1/10 the programmed value after the final float voltage is reached.

When the input supply (wall adapter or USB supply) is removed, the BL4054/BL4054B automatically enters a low current state, dropping the battery drain current to less than 2 μ A. The BL4054/BL4054B can be put into shutdown mode, reducing the supply current to 25 μ A. 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.

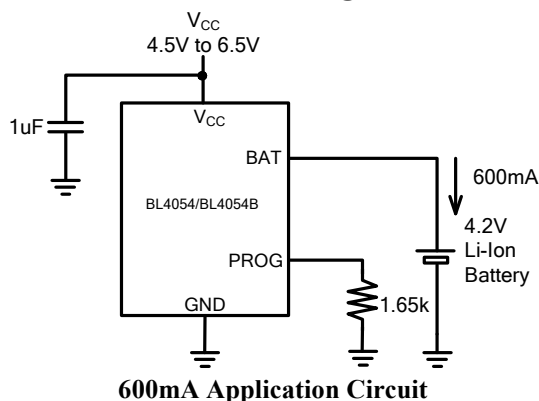
The only difference between BL4054 and BL4054B is that at power on, BL4054 will check the battery voltage first, it will not start charging unless the battery voltage is below the auto-recharge threshold. BL4054B does not perform this check. So BL4054B can guarantee the high battery capacity at all time, while BL4054 can prevent the battery from being repeatedly charged in some specific applications.

ORDERING INFORMATION

BL4054/BL4054B – XX X X XXX



TYPICAL APPLICATION



Absolute Maximum Rating (Note 1)

Input Supply Voltage (V_{CC})	-0.3V to +10V	PROG Pin Current	800 μ A
PROG Voltage	-0.3V to + V_{CC}	Maximum Junction Temperature	125°C
BAT Voltage	-0.3V to 7V	Operating Temperature Range ^(Note2)	-40°C to 85°C
CHRGb	-0.3V to 10V	Storage Temperature Range	-65°C to 125°C
BAT Short-Circuit Duration	Continuous	Lead Temperature (Soldering, 10s)	300°C
BAT Pin Current	800mA		

Package Information

TSOT23-5/SOT23-5 TOP VIEW CHRGb1 GND2 BAT3 MARKING 5PROG 4V_{CC}		
Part Number	Top Mark	Temp Range
BL4054-4.2	B A Y W ^(Note3)	-40°C to +85°C
BL4054-4.3	B B Y W	
BL4054-4.4	B C Y W	
BL4054B-4.2	<u>B</u> A Y W	
BL4054B-4.3	<u>B</u> B Y W	
BL4054B-4.4	<u>B</u> C Y W	

Thermal Resistance (Note 4)

Package	Θ_{JA}	Θ_{JC}
TSOT23-5	220°C/W	110°C/W
SOT23-5	250°C/W	130°C/W

Note 1: Absolute Maximum Ratings are those values beyond which the life of a device may be impaired.

Note 2: The BL4054/BL4054B is guaranteed to meet performance specifications from 0°C to 70°C. Specifications over the -40°C to 85°C operating temperature range are assured by design, characterization and correlation with statistical process controls.

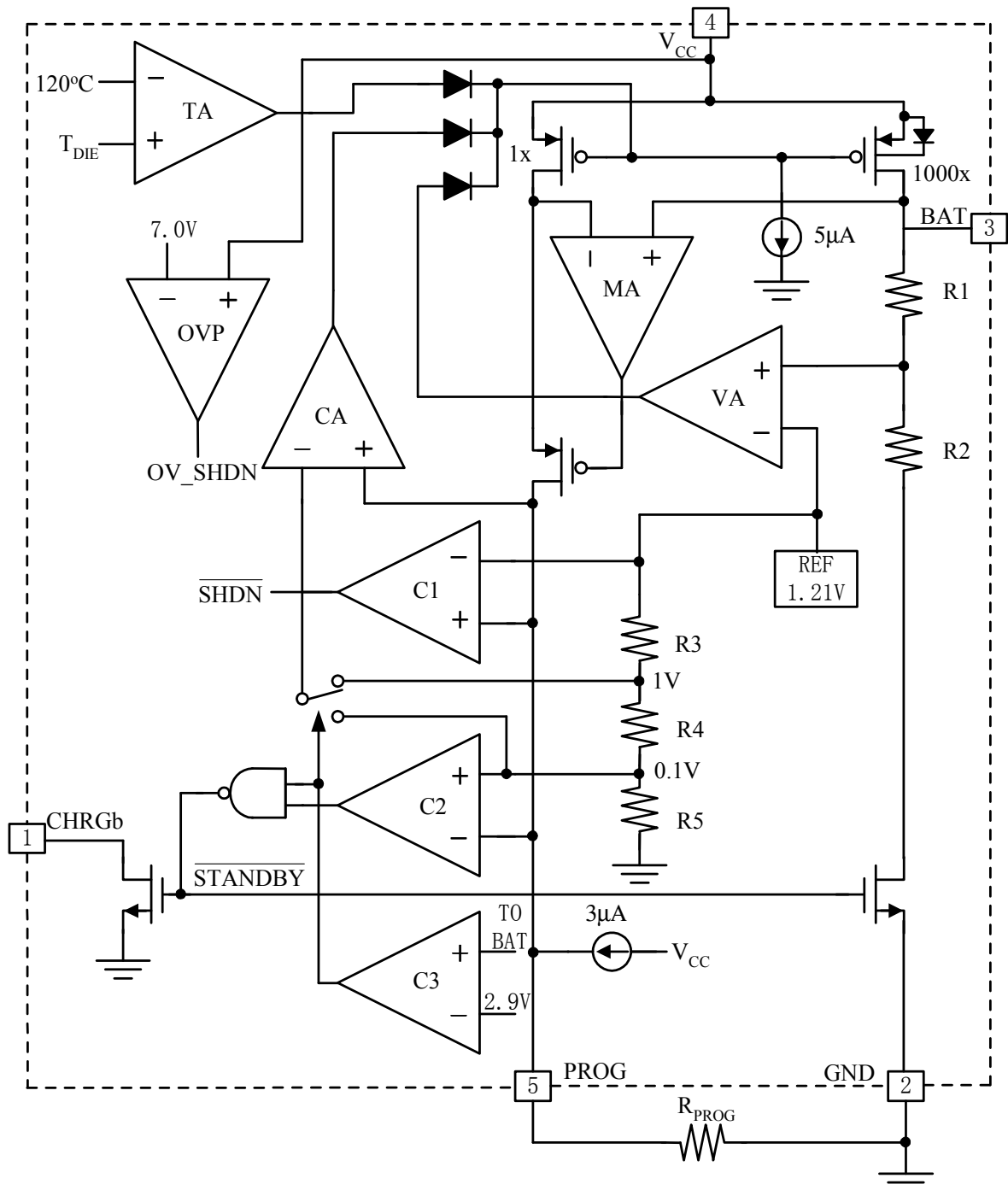
Note 3: X: Product Code(BL4054:B,BL4054B:B) V: Voltage Code(4.2V:A,4.3V:B,4.4V:C) Y: Year of Manufacturing(9:2009) W: Week of Manufacturing(W:A-Z, a-z).

Note 4: Thermal Resistance is specified with approximately 1 square of 1 oz copper

Pin Description

PIN	NAME	FUNCTION
1	CHRGb	Open-Drain Charge Status Output. When the battery is charging, the CHRGb pin is pulled low by an internal N-channel MOSFET. When the charge cycle is completed, a weak pull-down of approximately 12μA is connected to the CHRGb pin, indicating an “AC present” condition. When the BL4054/BL4054B detects an under-voltage lockout condition, CHRGb is forced high impedance.
2	GND	Ground
3	BAT	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.
4	V _{CC}	Positive Input Supply Voltage. Provides power to the charger. V _{CC} can range from 4.25V to 6.5V and should be bypassed with at least a 1μF capacitor. When V _{CC} drops to within 30mV of the BAT pin voltage, the BL4054/BL4054B enters shutdown mode, dropping I _{BAT} to less than 2μA.
5	PROG	Charge Current Program, Charge Current Monitor and Shutdown Pin. The charge current is Programmed by connecting a 1% resistor, R _{PROG} , from this pin to ground. When charging in constant-current mode, this pin serves to 1V. In all modes, the voltage on this pin can be used to measure the charge current using the following formula: $I_{BAT} = (V_{PROG} / R_{PROG}) \cdot 1000$ The PROG pin can also be used to shut down the charger. Disconnecting the Program resistor from ground allows a 3μA 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 25μA. 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 R _{PROG} to ground will return the charger to normal operation.

Block Diagram



Electrical Characteristics ^(Note 5) ($V_{CC} = 5V$, $T_A = 25^\circ C$, unless otherwise noted.)

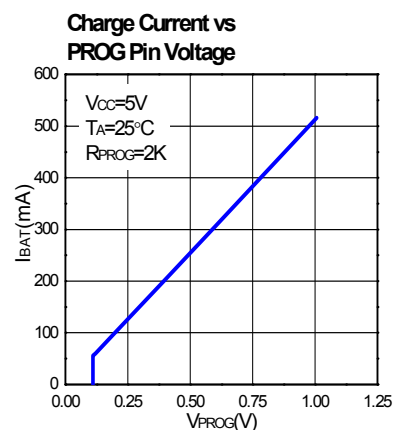
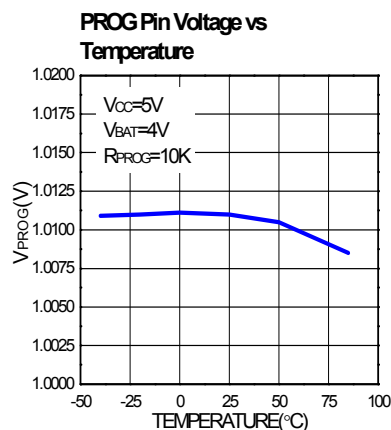
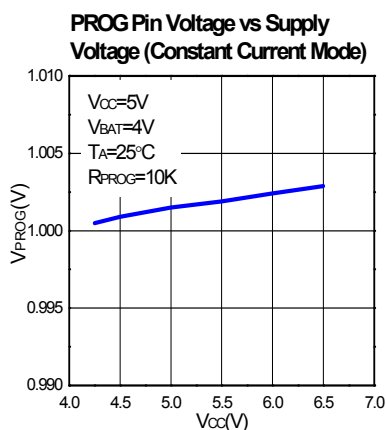
Symbol	Parameter	Conditions	Min	Typ	Max
$I_{SPLYCHRG}$	Charge Mode Supply Current ^(Note6)	$R_{PROG}=2k\Omega$ $R_{PROG}=10k\Omega$		300 μA	2000 μA 2000 μA
$I_{BATCHRG}$	Charge Mode Battery Current	$R_{PROG}=2k\Omega$ $R_{PROG}=10k\Omega$	465mA 93mA	500mA 100mA	535mA 107mA
$V_{PROGCHRG}$	PROG Pin Voltage	$R_{PROG}=2k\Omega$ $R_{PROG}=10k\Omega$	0.93V 0.93V	1V 1V	1.07V 1.07V
$I_{SPLYSTBY}$	Standby Mode Supply Current			100 μA	500 μA
$I_{BATSTBY}$	Standby Mode Battery Current		0	-2.5 μA	-6 μA
$I_{SPLYMSD}$	Manual Shutdown Mode Supply Current				90 μA
I_{BATMSD}	Manual Shutdown Mode Battery Current		-2 μA	0	2 μA
$V_{PROGCLMP}$	PROG Pin Clamp Voltage		2V		3V
$I_{SPLYASD}$	Automatic Shutdown Mode Supply Current			25 μA	50 μA
I_{BATASD}	Automatic Shutdown Mode Battery Current		-2 μA	0	2 μA
$I_{SPLYUVLO}$	UVLO Mode Supply Current			25 μA	50 μA
$I_{BATUVLO}$	UVLO Mode Battery Current		-2 μA		2 μA
$I_{BATSLEEP}$	Sleep Mode Battery Current		-1 μA		1 μA
V_{FLOAT}	Float Voltage		4.158V	4.2V	4.242V
I_{TRIKL}	Trickle Charge Current	$R_{PROG}=2k\Omega$ $R_{PROG}=10k\Omega$	20mA 5mA	50mA 10mA	70mA 15mA
V_{TRIKL}	Trickle Charge Threshold		2.8V	2.9V	3V
$V_{TRIKL, HYS}$	Trickle Charge Hysteresis		60mV	100mV	150mV
V_{UVLO}	UVLO Threshold		3.7V	3.9V	4.1V
$V_{UVLO, HYS}$	UVLO Hysteresis		150mV	200mV	300mV
V_{OVP}	Input Over-Voltage Protect Threshold		6.8V	7V	7.2V
$V_{OVP, HYS}$	Input Over-Voltage Protect Hysteresis			200mV	

$V_{MSD, RISE}$	Manual Shutdown Threshold, PROG rising		1.15V	1.21V	1.3V
$V_{MSD, FALL}$	Manual Shutdown Threshold, PROG falling		0.95V	1.0V	1.05V
$V_{ASD, RISE}$	Automatic Shutdown Threshold, BAT rising		5mV	30mV	50mV
$V_{ASD, FALL}$	Automatic Shutdown Threshold, BAT falling		70mV	100mV	140mV
I_{TERM}	C/10 Termination Current Threshold		85mV	100mV	115mV
V_{RECHRG}	Auto Recharge Battery Voltage		4V	4.05V	4.1V
I_{CHRGb}	CHRGb Pin Weak Pull-down Current		8 μ A	12 μ A	35 μ A
V_{CHRGb}	CHRGb Pin Output Low Voltage			0.35V	0.6V
T_{LIM}	Junction Temperature In Constant Temperature Mode			120°C	
R_{ON}	Power FET ON Resistance			600m Ω	
T_{SS}	Soft-Start Time	$R_{PROG} = 2k\Omega$		50 μ s	
T_{RECHRG}	Recharge Comparator Filter Time		0.75ms	2ms	4.5ms
T_{TERM}	Termination Comparator Filter Time		0.4ms	1ms	2.5ms
I_{PROG}	PROG Pin Pull-up Current			3 μ A	

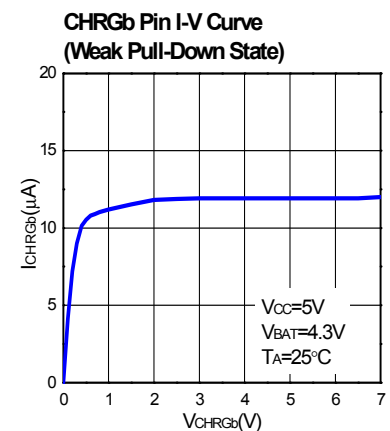
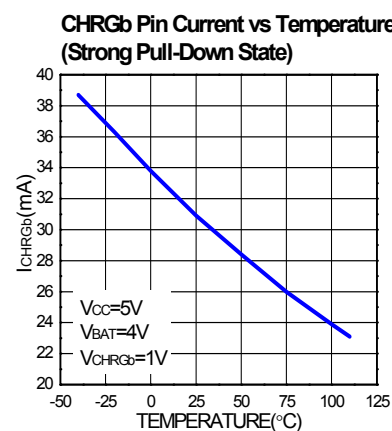
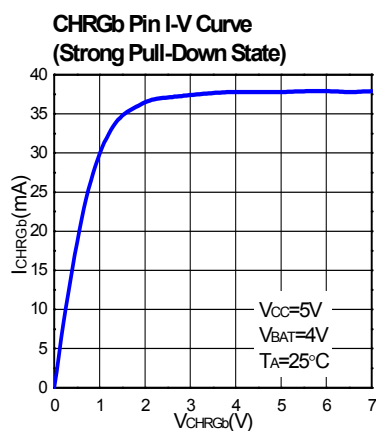
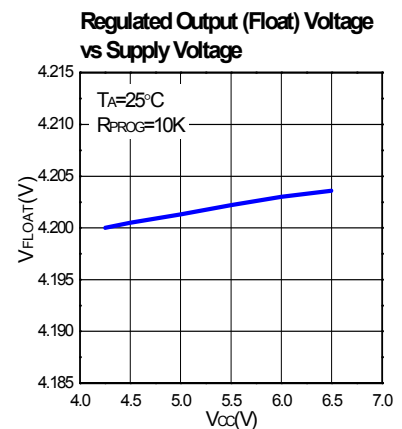
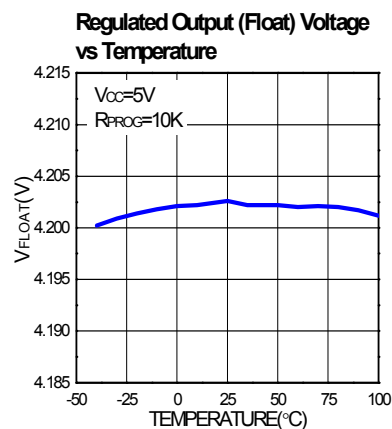
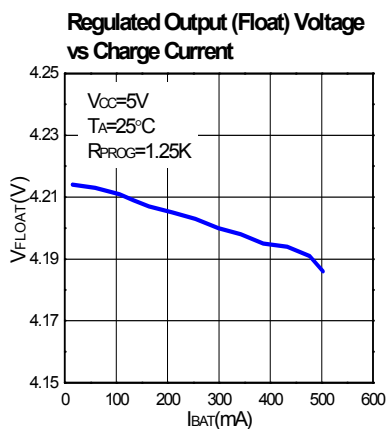
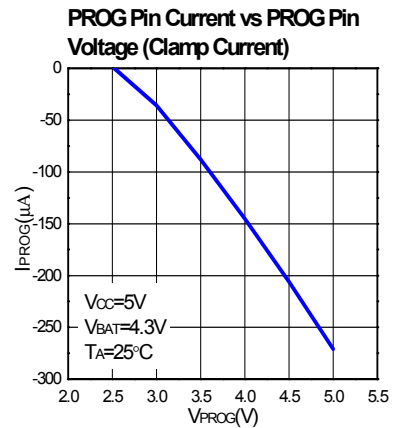
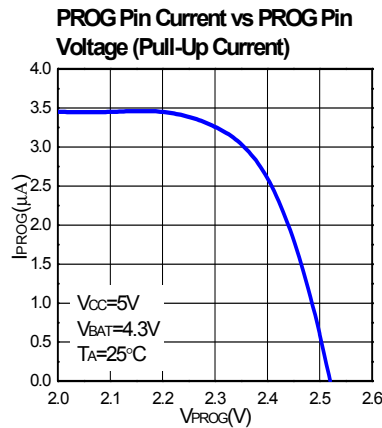
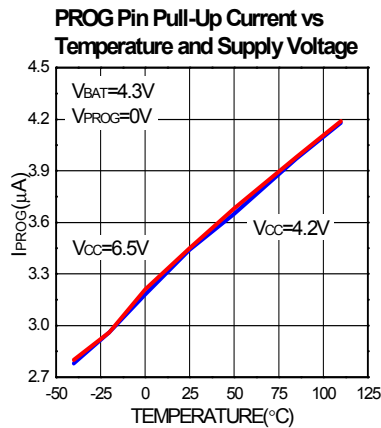
Note 5: 100% production test at +25°C. Specifications over the temperature range are guaranteed by design and characterization.

Note 6: Supply current includes PROG pin current (approximately 100 μ A) but does not include any current delivered to the battery through the BAT pin (approximately 100mA).

Typical Performance Characteristics



Typical Performance Characteristics



Typical Performance Characteristics

