DESCRIPTION

The A4054A is a complete constant-current / constant-voltage linear charger for single cell lithium-Ion batteries. Low external components make the A4054A ideally suited for portable applications. Furthermore, the A4054A 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 A4054A 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 A4054A automatically enters a low current state, dropping the battery drain current to less than 2μA. The A4054A can be put into shutdown mode, reducing the supply current to 25μA.

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 A4054A is available in SOT-25 Package

ORDERING INFORMATION

Package Type	Part Number	
SOT-25	E5	A4054AE5R
		A4054AE5VR
Note	R: Tape & Reel V: Green package	
AiT provides all Pb free products Suffix " V " means Green Package		

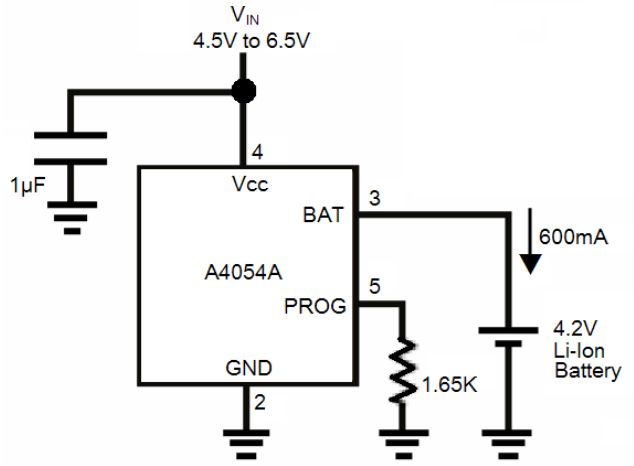
FEATURES

- Programmable Charge Current Up to 800mA
- No MOSFET, Sense Resistor or Blocking Diode Required
- Complete Linear Charger in 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 Status Output Pin
- C/10 Charge Termination
- 25μA Supply Current in Shutdown
- 2.9V Trickle Charge Threshold
- Soft-Start Limits Inrush Current
- Available in SOT-25 Package▾

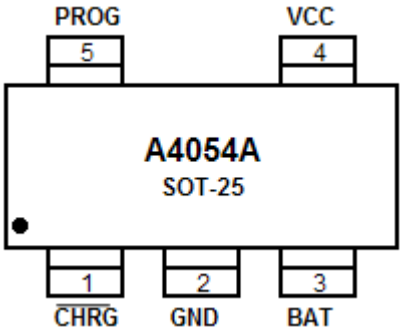
APPLICATION

- Cellular Telephones, PDAs, MP3 Players
- Charging Docks and Cradles
- Bluetooth Applications

Typical Application



PIN DESCRIPTION



Top View

Pin #	Symbol	Function
1	$\overline{CHRG}$	Open-Drain Charge Status Output. When the battery is charging, the $\overline{CHRG}$ pin is pulled low by an internal N-channel MOSFET. When the charge cycle is completed, a weak pull-down of approximately 20μA is connected to the $\overline{CHRG}$ pin, indicating an “AC present” condition. When the A4054A detects an undervoltage lockout condition, $\overline{CHRG}$ 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. VCC can range from 4.25V to 6.5V and should be bypassed with at least a 1μF capacitor. When VCC drops to within 30mV of the BAT pin voltage, the A4054A enters shutdown mode, dropping IBAT 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, 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) •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 RPROG to ground will return the charger to normal operation.

ABSOLUTE MAXIMUM RATINGS

Input Supply Voltage, V_{CC}	V_{SS}-0.3 ~ V_{SS}+10V
PROG pin Voltage, V_{PROG}	V_{SS}-0.3 ~ V_{CC}+0.3V
BAT pin Voltage, V_{BAT}	V_{SS}-0.3 ~ 7V
CHAG pin Voltage, V_{CHRG}	V_{SS}-0.3 ~ V_{SS}+10V
BAT pin Current, I_{BAT}	800mA
PROG pin Current, I_{PROG}	800uA
Operating Ambient Temperature, T_{OPA}	-40 ~ +85℃
Storage Temperature, T_{STR}	-65 ~ +125℃

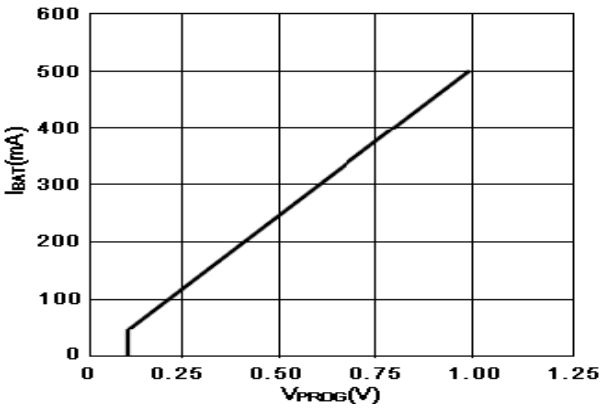
Note: The absolute maximum ratings are rated values exceeding which the product could suffer physical damage. These values must therefore not be exceeded under any conditions.

ELECTRICAL CHARACTERISTICS

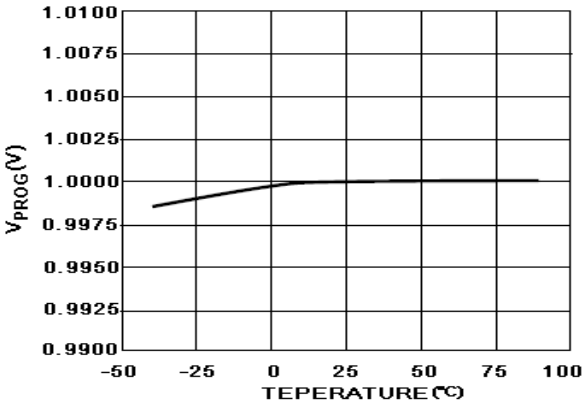
Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Input supply voltage	V_{CC}		4.25		6.5	V
Input supply current	I_{CC}	Charge mode,R_{PROG}=10K		300	2000	μA
		Standby mode		200	500	μA
		Shutdown mode(R_{PROG} not connected,Vcc<V_{BAT} or Vcc<V_{UV})		25	50	μA
Regulated Output Voltage	V_{FLOAT}	0°C≦T_A≦°C, I_{BAT} = 40mA	4.158	4.2	4.342	V
BAT pin Current	I_{BAT}	R_{PROG}=10k,Current mode	93	100	107	mA
		R_{PROG}=2k,Current mode	465	500	535	mA
		Standby mode,V_{BAT}=4.2V	0	-2.5	-6	μA
		Shutdown mode		□±1	±2	μA
		Sleep mode,Vcc=0V		±1	±2	μA
Trickle charge current	I_{TRIKL}	V_{BAT}<V_{TRIKL},Rp_{ROG}=2k	20	45	70	mA
Trickle charge Threshold Voltage	V_{TRIKL}	R_{PROG}=10K , V_{BAT} Rising	2.8	2.9	3.0	V
Trickle voltage hysteresis voltage	V_{TRHYS}	R_{PORG}=10k	60	80	110	mV
Vcc Undervoltage lockout Threshold	V_{UV}	From V_{CC} low to high	3.7	3.8	3.93	V
Vcc undervoltage lockout hysteresis	V_{UVHYS}		150	200	300	mV
Manual shutdown threshold voltage	V_{MSD}	PROG pin rising	1.15	1.21	1.30	V
		PROG pin falling	0.9	1.0	1.1	V
Vcc-Vbat Lockout Threshold voltage	V_{ASD}	Vcc from low to high	70	100	140	mV
		Vcc from high to low	5	30	50	mV
C/10 Termination Current Threshold	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	V_{PROG}	R_{PROG}=10k, Current mode	0.93	1.0	1.07	V
CHRG pin weak pull-down Current	I_{CHRG}	V_{CHRG}=5V	8	20	35	μA
CHRG pin Output low voltage	V_{CHRG}	I_{CHRG}=5mA		0.35	0.6	V
Recharge Battery threshold Voltage	ΔV_{RECG}	V_{FLOAT} - V_{RECHRG}		100	200	mV

TYPICAL PERFORMANCE CHARACTERISTICS

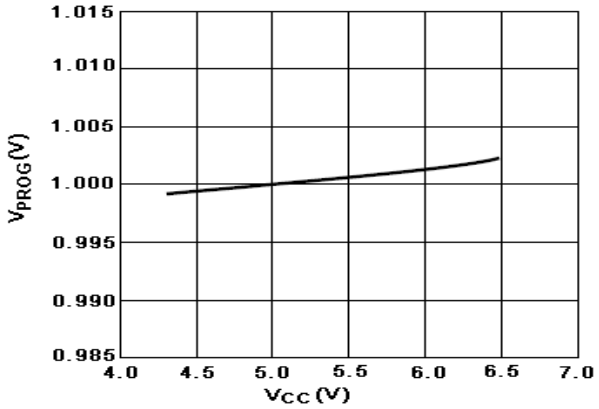
1. Charge Current vs. PROG Pin Voltage
V_{CC}=5V T_A=25℃ R_{PROG}=2k



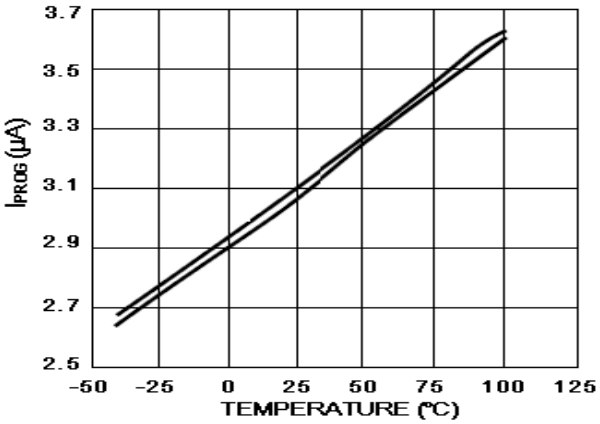
2. PROG Pin Voltage vs. Temperature
V_{CC}=5V V_{BAT}=4V R_{PROG}=10k



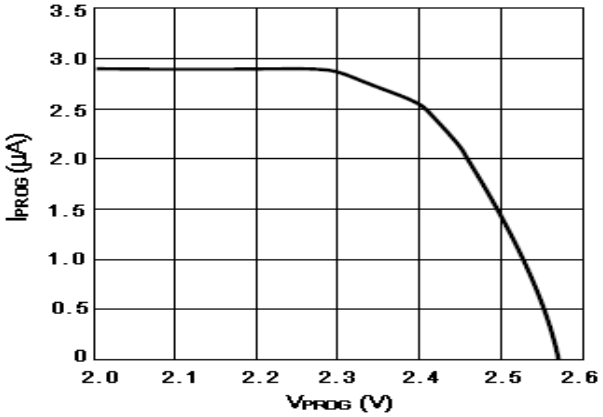
3. PROG Pin Voltage vs. Supply Voltage (Constant Current Mode)
V_{CC}=5V V_{BAT}=4V T_A=25℃ R_{PROG}=10k



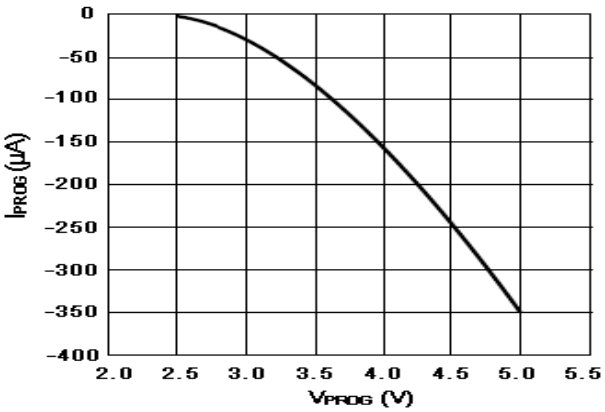
4. PROG Pin Pull-Up Current vs. Temperature and Supply Voltage
V_{CC}=4.2V V_{BAT}=4.3V V_{PROG}=0V V_{CC}=6.5V



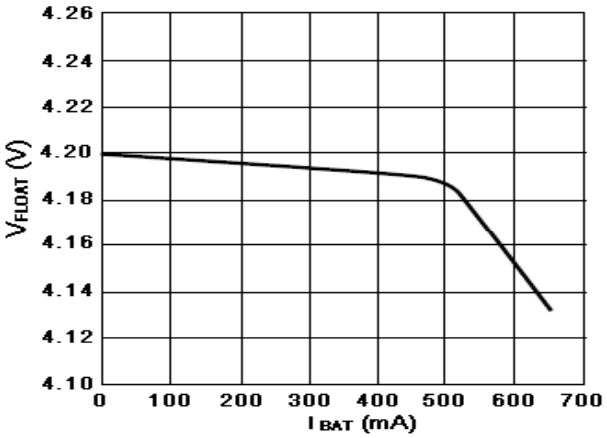
5. PROG Pin Current vs. PROG Pin Voltage (Pull-up Current)
V_{CC}=5V V_{BAT}=4.3V T_A=25℃



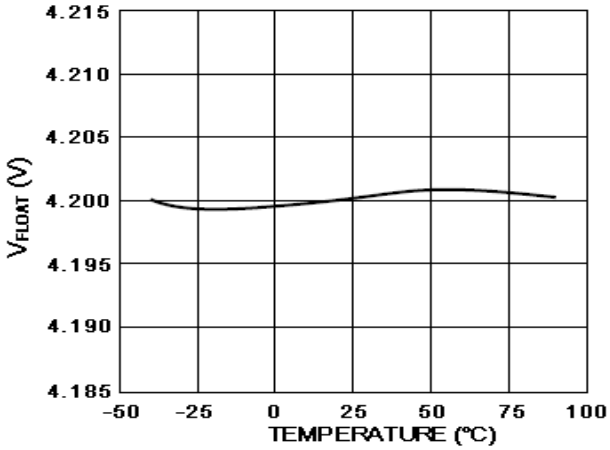
6. PROG Pin Current vs. PROG Pin Voltage (Clamp Current)
V_{CC}=5V V_{BAT}=4.3V T_A=25℃



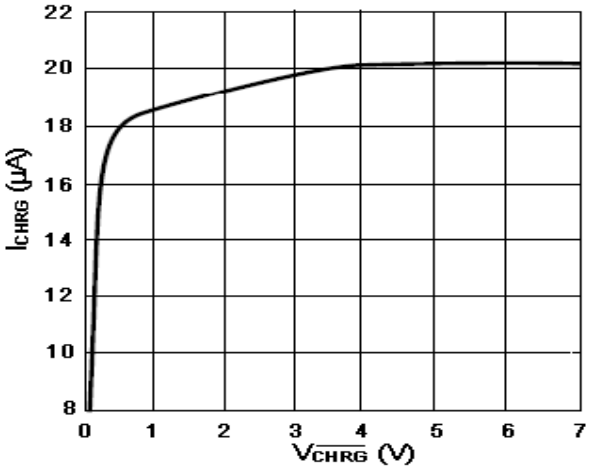
7. Regulated Output (Float) Voltage vs. Charge Current
V_{CC}=5V T_A=25℃ R_{PROG}=1.25V



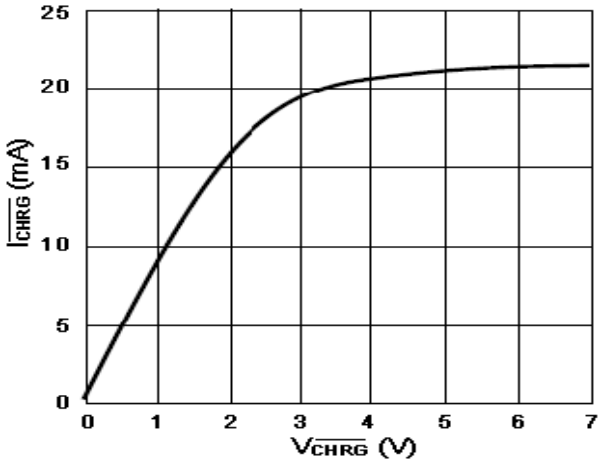
8. Regulated Output(Float) Voltage vs. Temperature
V_{CC}=5V R_{PROG}=10k



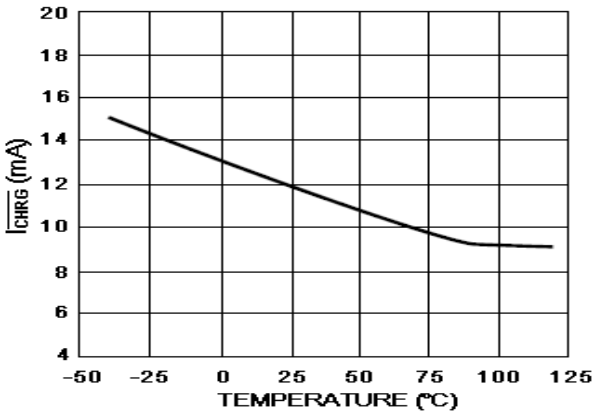
9. $\overline{CHRG}$ Pin I-V Curve (Weak Pull-Down State)
V_{CC}=5V V_{BAT}=4.3V T_A=25℃



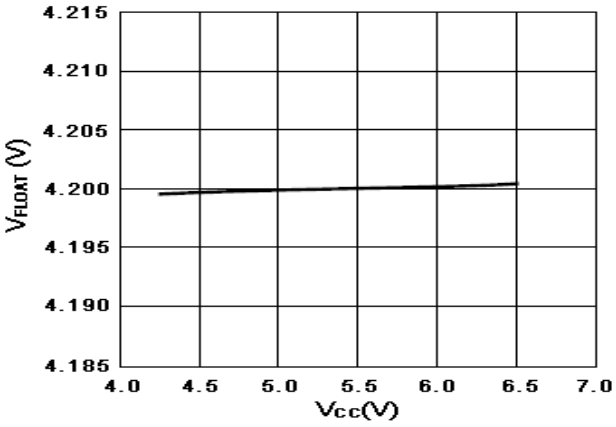
10. $\overline{CHRG}$ Pin I-V Curve (Strong Pull-Down State)
V_{CC}=5V V_{BAT}=4V T_A=25℃



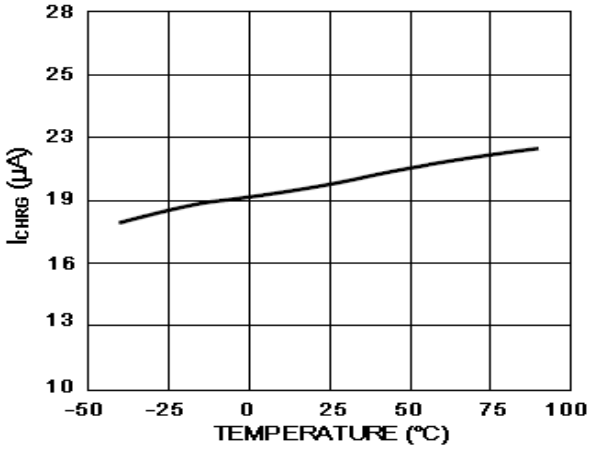
11. $\overline{CHRG}$ Pin Current vs. Temperature (Strong Pull-Down State)
V_{CC}=5V V_{BAT}=4V V_{CHRG}=1V



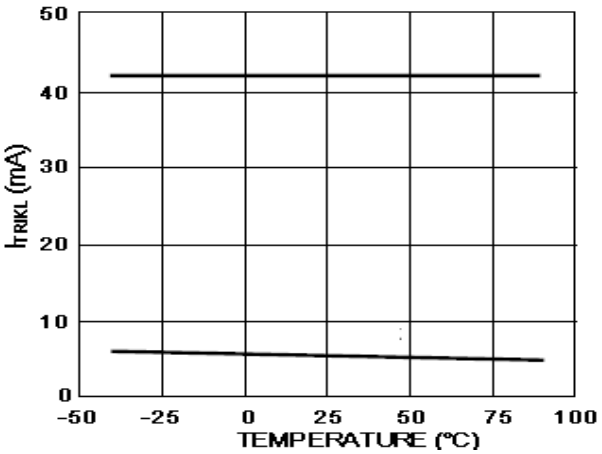
12. Regulated Output(Float) Voltage vs. Supply Voltage
T_A=25℃ R_{PROG}=10V



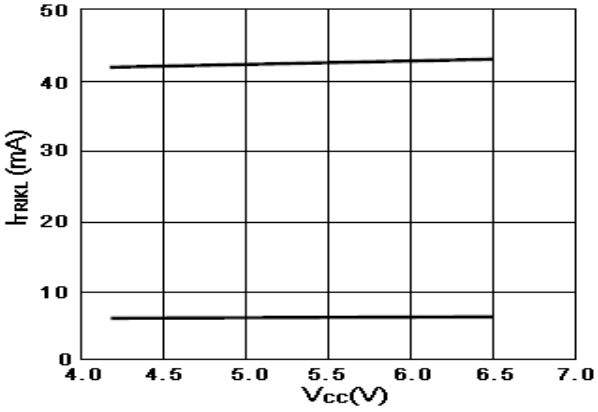
13. $\overline{CHRG}$ Pin Current vs. Temperature
(Weak Pull-Down State)
V_{CC}=5V V_{BAT}=4.3V V_{CHRG}=5V



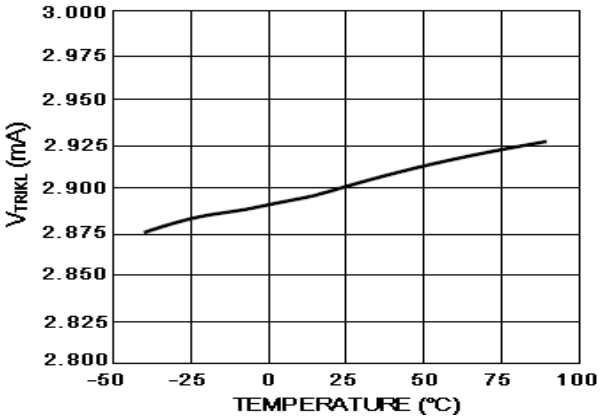
14. Trickle Charge Current vs. Temperature
V_{CC}=5V V_{BAT}=2.5V R_{PROG}=2k R_{PROG}=10k



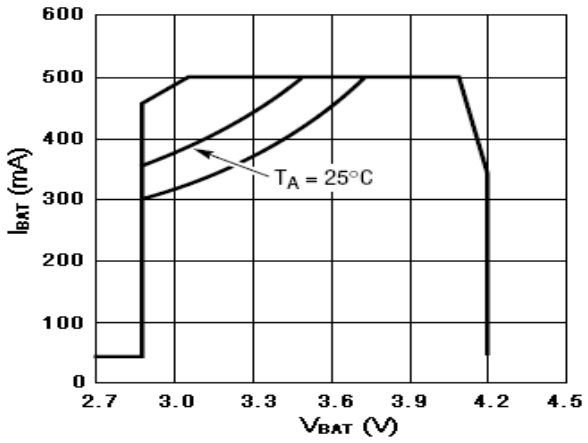
15. Trickle Charge Current vs. Supply Voltage
V_{BAT}=2.5V T_A=25°C R_{PROG}=10k R_{PROG}=2k



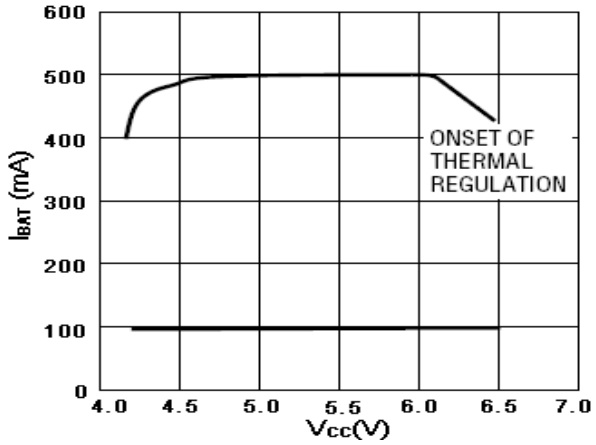
16. Trickle Charge Threshold vs. Temperature
V_{CC}=5V R_{PROG}=10k



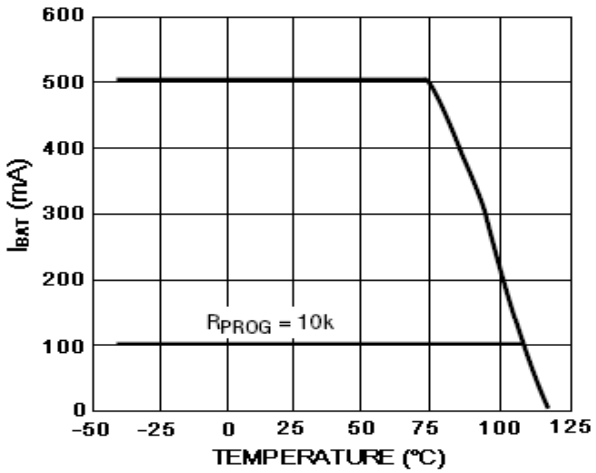
17. Charge Current vs. Battery Voltage
V_{CC}=5V θ_{JA}=125°C/W R_{PROG}=2k T_A=0°C
T_A=40°C T_A=25°C



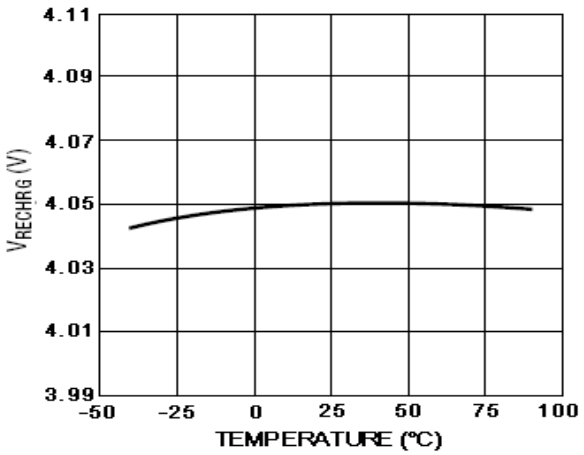
18. Charge Current vs. Supply Voltage
V_{BAT}=5V θ_{JA}=80°C/W T_A=25°C R_{PROG}=2k
R_{PROG}=10k



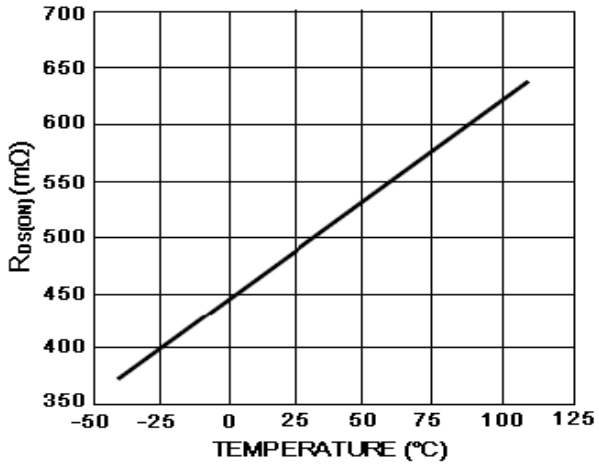
19. Charge Current vs. Ambient Temperature
V_{CC}=5V V_{BAT}=4V θ_{JA}=80℃/W R_{PROG}=2k
R_{PROG}=10k



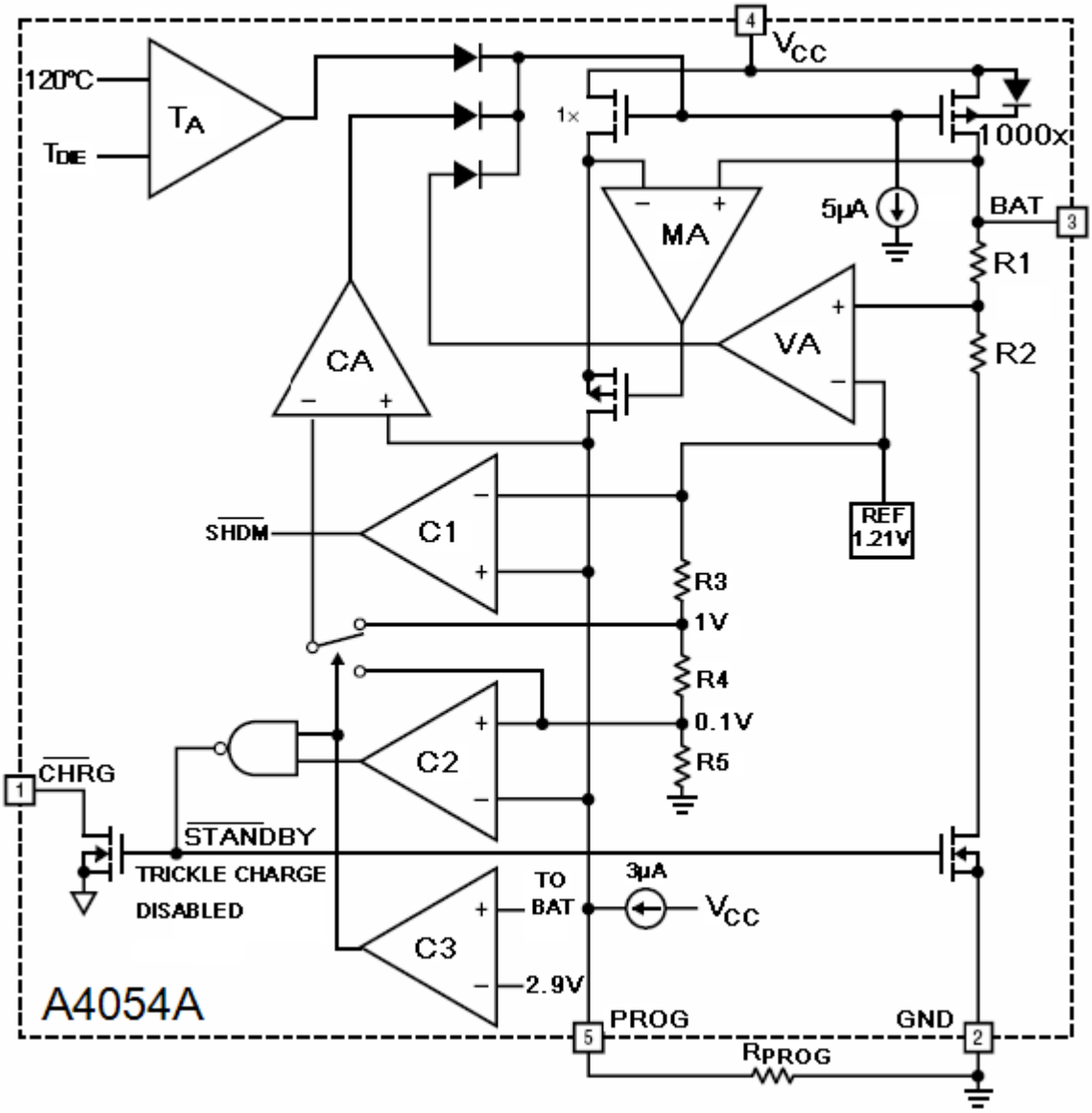
20. Recharge Voltage Threshold vs. Temperature
V_{CC}=5V R_{PORG}=10k



21. Power FET "NO" Resistance vs. Temperature
V_{CC}=4.2V I_{BAT}=100mA R_{PROG}=2k

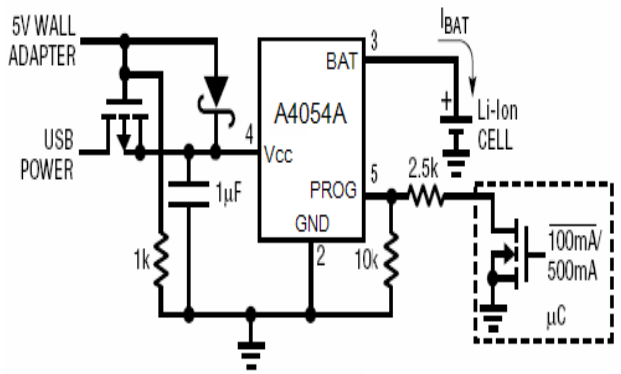


BLOCK DIAGRAM

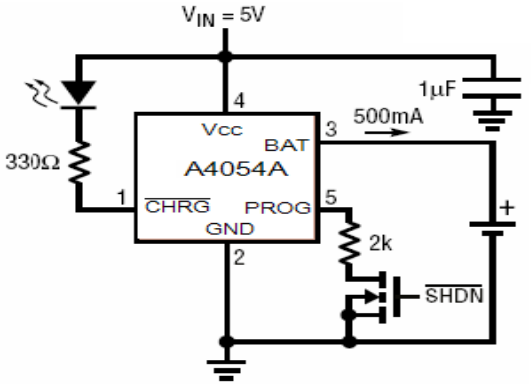


Typical Circuit

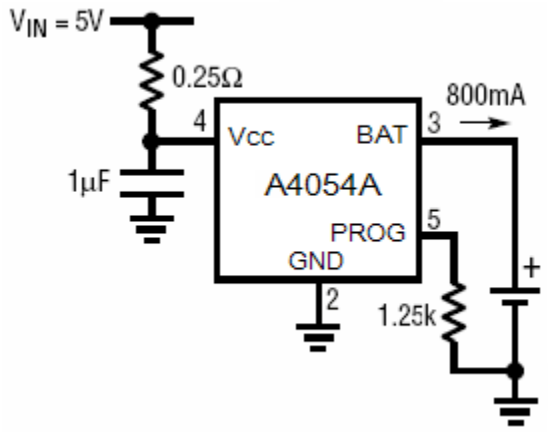
1. USB/Wall Adapter Power Li-Ion Charger



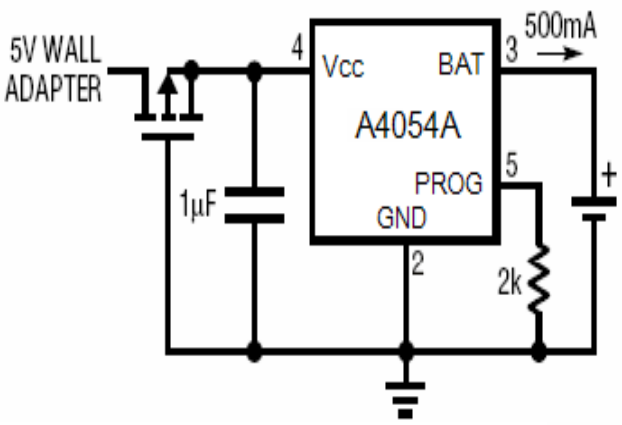
2. Full Featured Single Cell Li-Ion Charger



3. 800mA Li-Ion Charger with External Power Dissipation

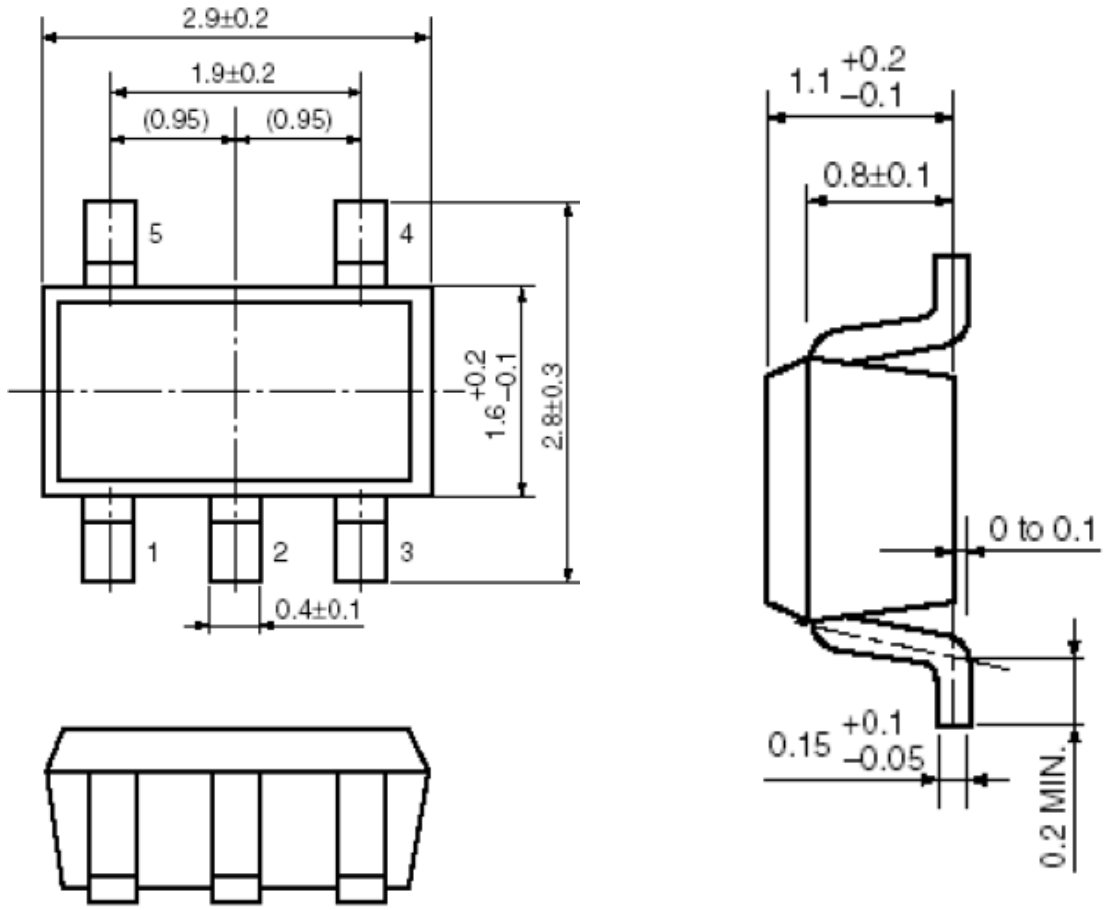


4. Basic Li-Ion Charger with Reverse Polarity Input Protection

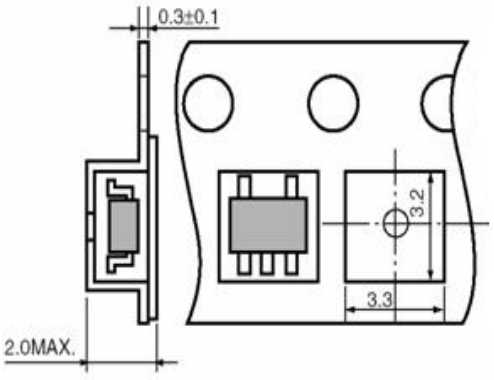


PACKAGE INFORMATION

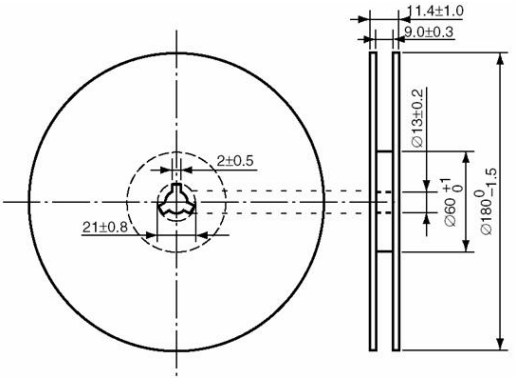
Dimension in SOT-25 Package (Unit: mm)



Tape Dimension



Reel Dimension



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