Descriptions

The CTCL4054CME is a complete constant-current/constant voltage linear charger for single cell lithium-ion batteries. Its Thin SOT package and low external component count make the CTCL4054CME ideally suited for portable applications. Furthermore, the CTCL4054CME 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 CTCL4054CME automatically terminates the charge cycle when the charge current drops to 1/10th the programmed value after the final float voltage is reached.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.

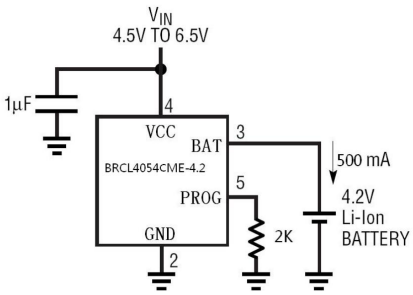
Features

- Programmable charge current up to 500mA
- No MOSFET, sense resistor or blocking diode required
- Complete linear charger in 5-Lead SOT-23 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 portCharger detection function;
- 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
- 2.9V trickle charging
- Soft-start limits Inrush current
- When using a single lamp, the light is completely extinguished after fully charging
- Halogen-free product

Applications

- Cellular telephones, PDAs, MP3 players
- Charging docks and cradles
- Bluetooth applications.

Pinning And Application Circuit



Pin Number	Pin Name	Pin Description
1	CHRG	Open drain charge state output. When charging, the CHRG port is placed at low potential by a built-in N-channel MOSFET. When charging is completed, CHRG presents a high resistance state. When a low voltage locking condition is detected, the CHRG presents a high resistance state. When a 1µF is connected between bat pin and ground , you can complete the indication of whether the battery is connected. When there is no battery, the LED light will flash quickly.
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 shut down mode.
4	VCC	Positive Input Supply Voltage. 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, Enter shutdown mode, dropping IBAT to less than 2µA.
5	PROG	Charge Current Program 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.

Marking

See Marking Instructions

Absolute Maximum Ratings(Ta=25℃)

Parameter	Rating	Unit
Input Supply Voltage (V_{CC})	-0.3 to 10	V
PROG	-0.3 to V_{CC} + 0.3	V
BAT	-0.3 to 7	V
$\overline{CHRG}$	-0.3 to 10	V
BAT Pin Current	500	mA
Operating Ambient Temperature Range	-40~85	℃
Storage Temperature Range	-65~150	℃
Lead Temperature (Soldering,10sec)	300	℃

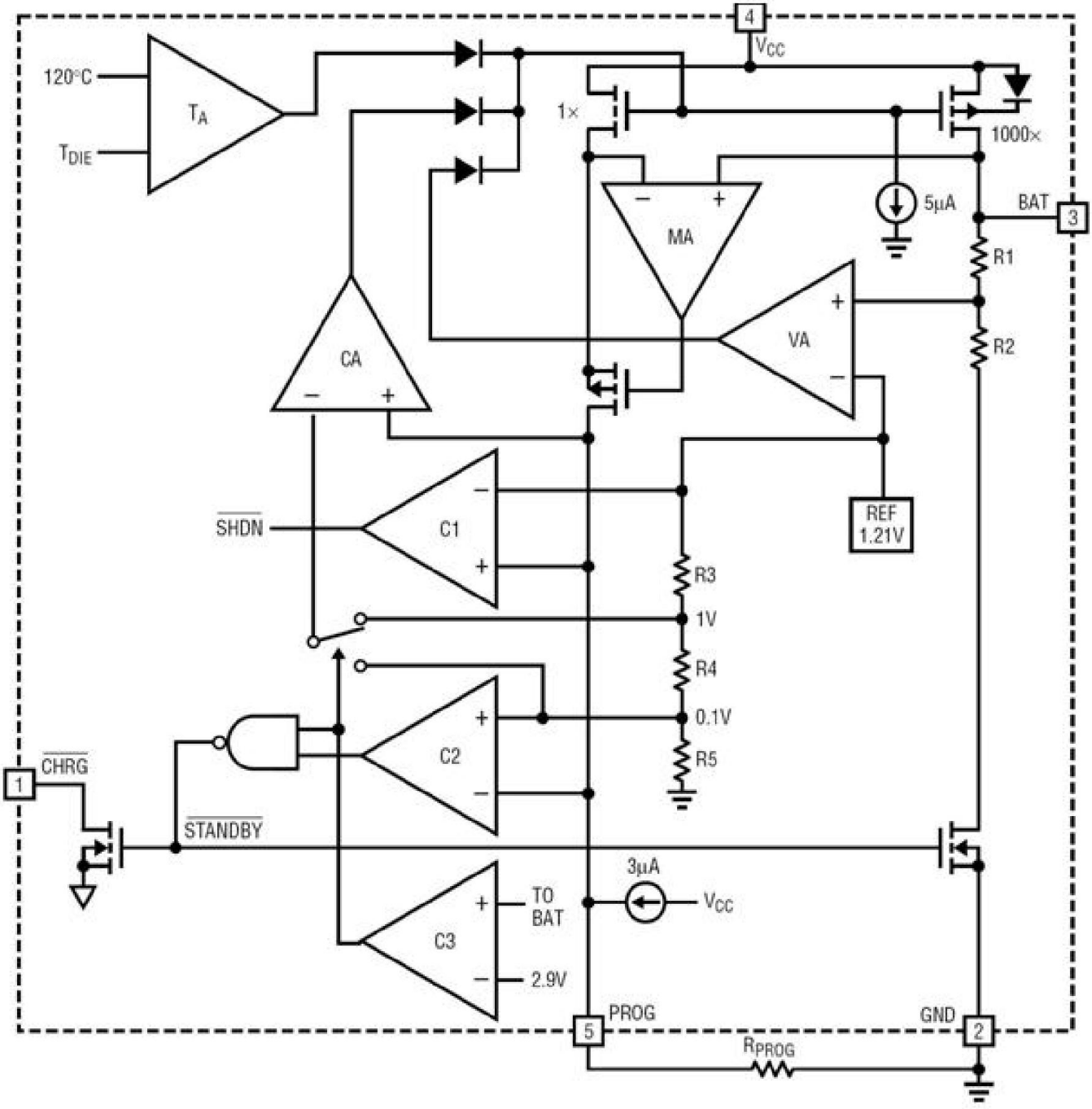
Electrical Characteristics(Ta=25℃)

Parameter	Symbol	Test 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 (Charge Terminated)		200	500	μA
		Shutdown Mode (R_{PROG} Not Connected V_{CC}<V_{BAT}, or V_{CC}<V_{UV})		25	50	μA
Regulated Output (Float) Voltage	V_{FLOAT}	0℃≤T_A≤85℃ I_{BAT} =40mA	4.158	4.20	4.242	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	-6.0	μA
		Shutdown Mode (R_{PROG} Not Connected)		±1.0	±2.0	μA
		Sleep Mode V_{CC} = 0V		±1.0	±2.0	μA
Trickle Charge Current	I_{TRIKL}	V_{BAT} <V_{TRIKL} R_{PROG}=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 Charge Hysteresis Voltage	V_{TRHYS}	R_{PROG} = 10k	60	80	110	mV

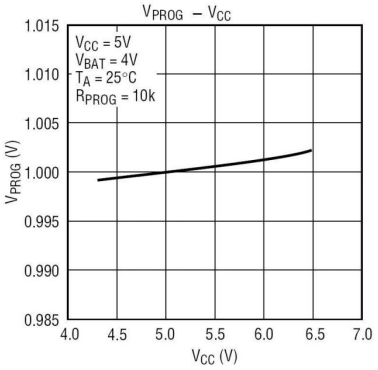
Electrical Characteristic Curve

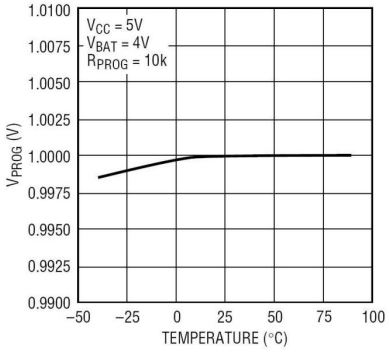
Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
V_{CC} Undervoltage Lockout Threshold	V_{UV}	From V_{CC} Low to High	3.7	3.8	3.92	V
V_{CC} Undervoltage Lockout Hysteresis	V_{UVHYS}		150	200	300	mV
Manual Shutdown Threshold Voltage	V_{MSD}	PROG Pin Rising	1.15	1.21	1.30	V
		PROG Pin Falling	0.9	1.0	1.1	V
V_{CC} – V_{BAT} Lockout Threshold Voltage	V_{ASD}	V_{CC} from Low to High	70	100	140	mV
		V_{CC} from High to Low	5.0	30	50	mV
C/10 Termination Current Threshold	I_{TERM}	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
$\overline{CHRG}$ Pin Weak Pull-Down Current	I_{CHRG}	V_{CHRG}=5V	8.0	20	35	μA
$\overline{CHRG}$ Pin Output Low Voltage	V_{CHRG}	I_{CHRG}= 5mA		0.35	0.60	V
Recharge Battery Threshold Voltage	V_{RECHRG}	V_{FLOAT}-V_{RECHRG}	100	150	200	mV
Junction Temperature in Constant Temperature Mode	T_{LIM}			120		℃
Soft-Start Time	t_{SS}	I_{BAT}=0 to I_{BAT}=1000V/R_{PROG}		100		μs
Recharge Comparator Filter Time	$t_{RECHARGE}$	V_{BAT} High to Low	0.75	2.0	4.5	ms
Termination Comparator Filter Time	t_{TERM}	I_{BAT} Falling Below I_{CHG}/10	400	1000	2500	μs
PROG Pin Pull-Up Current	I_{PROG}			3.0		μA

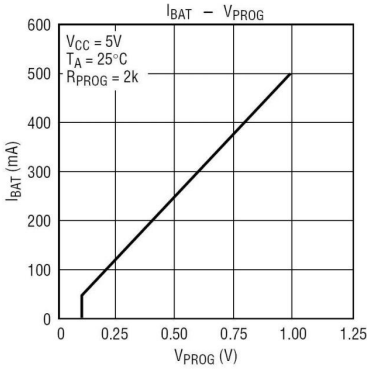
Functionl Block Diagram

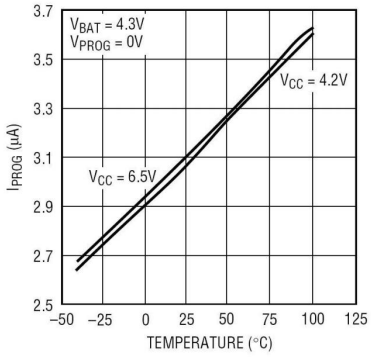


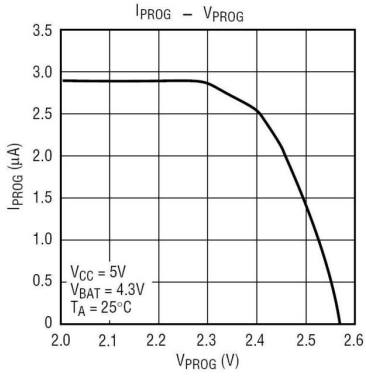
Electrical Characteristic Curve

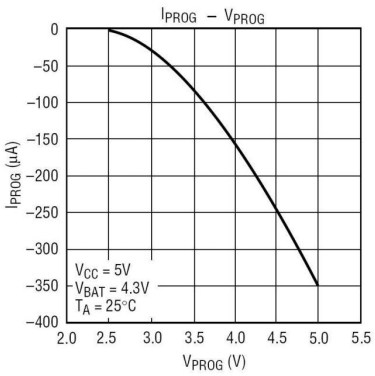


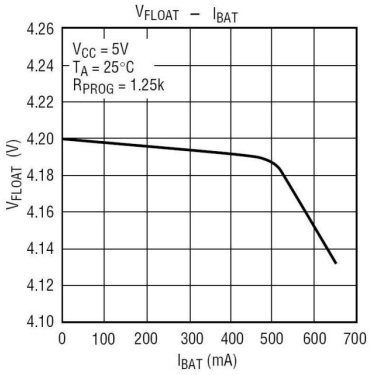


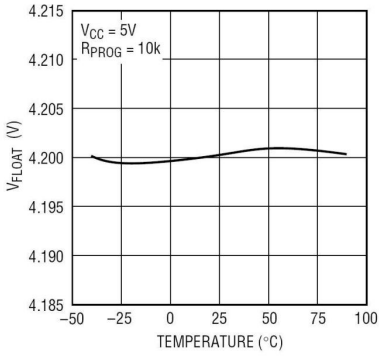


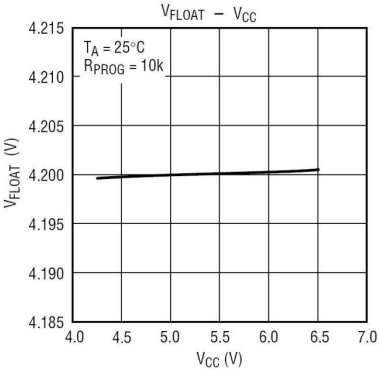


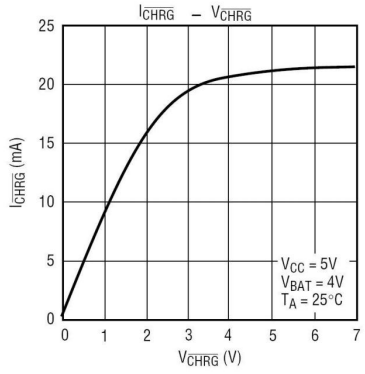


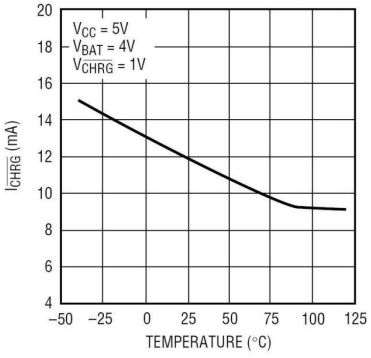


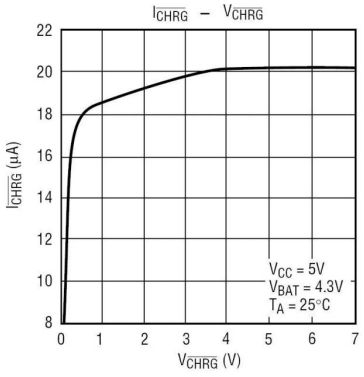




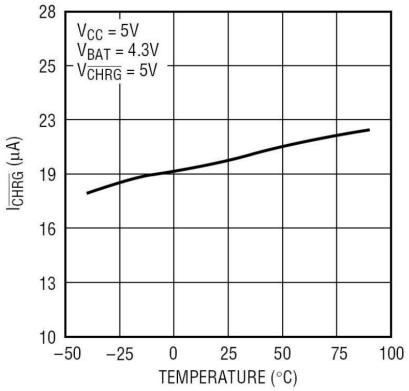


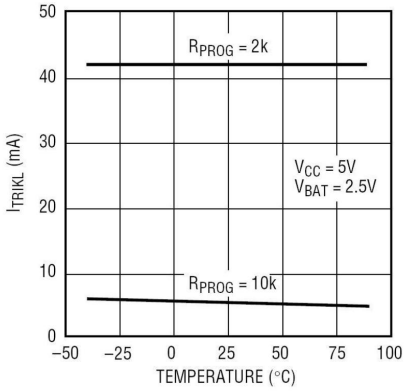


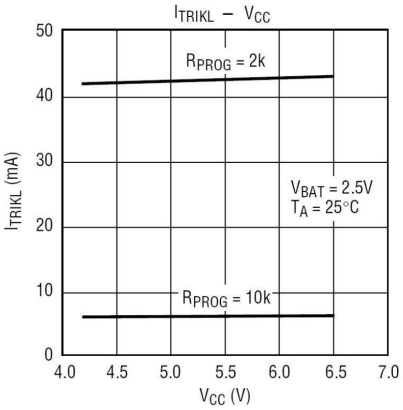


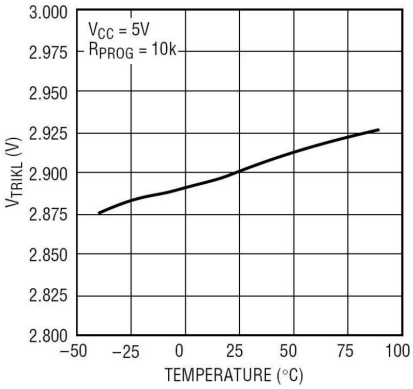


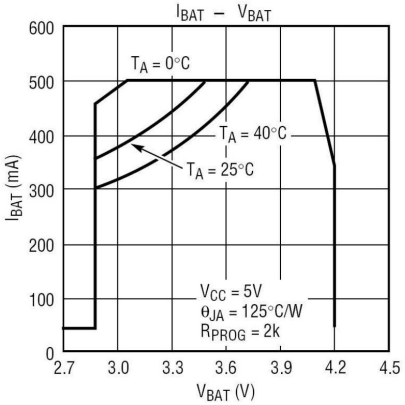
Electrical Characteristic Curve

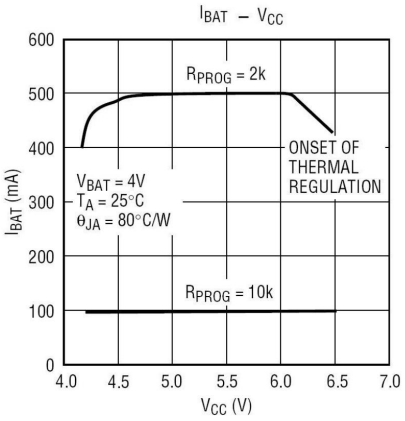


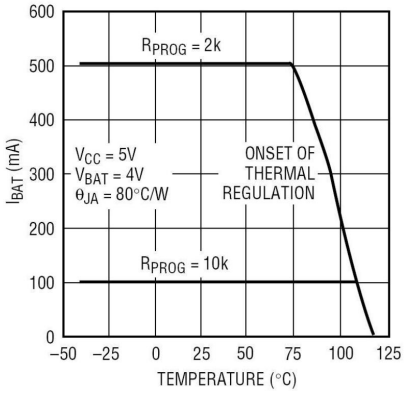


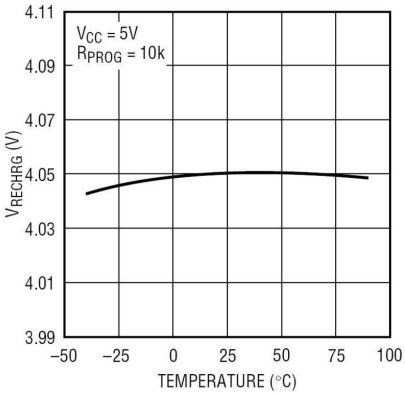


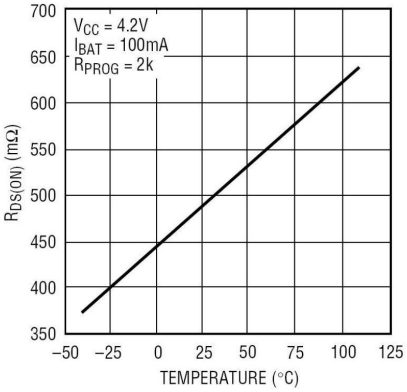












Function description

A charge cycle begins when the voltage at the VCC pin rises above the UVLO threshold level and a 1% program resistor is connected from the PROG pin to ground or when a battery is connected to the charger output. If the BAT pin is less than 2.9V, the charger enters trickle charge mode. In this mode, the CTCL4054CME supplies approximately 1/10 the programmed charge current to bring the battery voltage up to a safe level for full current charging.

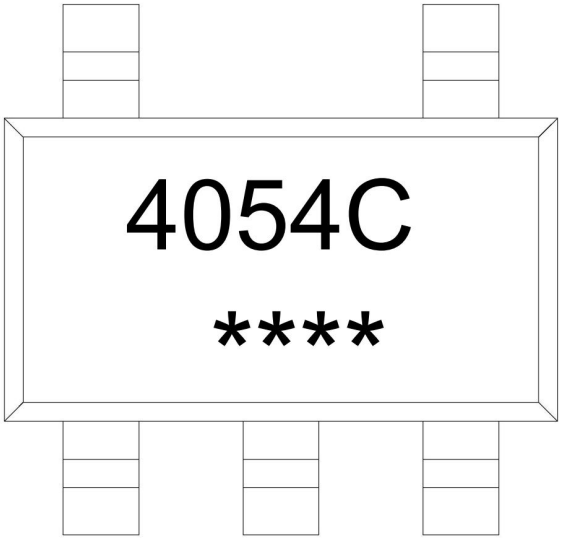
When the BAT pin voltage rises above 2.9V, the charger enters constant-current mode, where the programmed charge current is supplied to the battery. When the BAT pin approaches the final float voltage (4.2V), the CTCL4054CME enters constant-voltage mode and the charge current begins to decrease. When the charge current drops to 1/10 of the programmed value, the charge cycle ends.

The CTCL4054CME constantly monitors the BAT pin voltage in standby mode. If this voltage drops below the 4.05V recharge threshold (VRECHRG), another charge cycle begins and current is once again supplied to the battery. To manually restart a charge cycle when in standby mode, the input voltage must be removed and reapplied, or the charger must be shut down and restarted using the PROG pin.

The charging current is set by a resistor connected between prog pin and ground. The charging current is 1000 times the output current of prog pin. The setting resistor and charging current are calculated using the following formula：

$$I_{BAT} = \frac{V_{PROG}}{R_{PROG}} \bullet 1000$$

Marking Instructions



Note:

4054C: Product Type

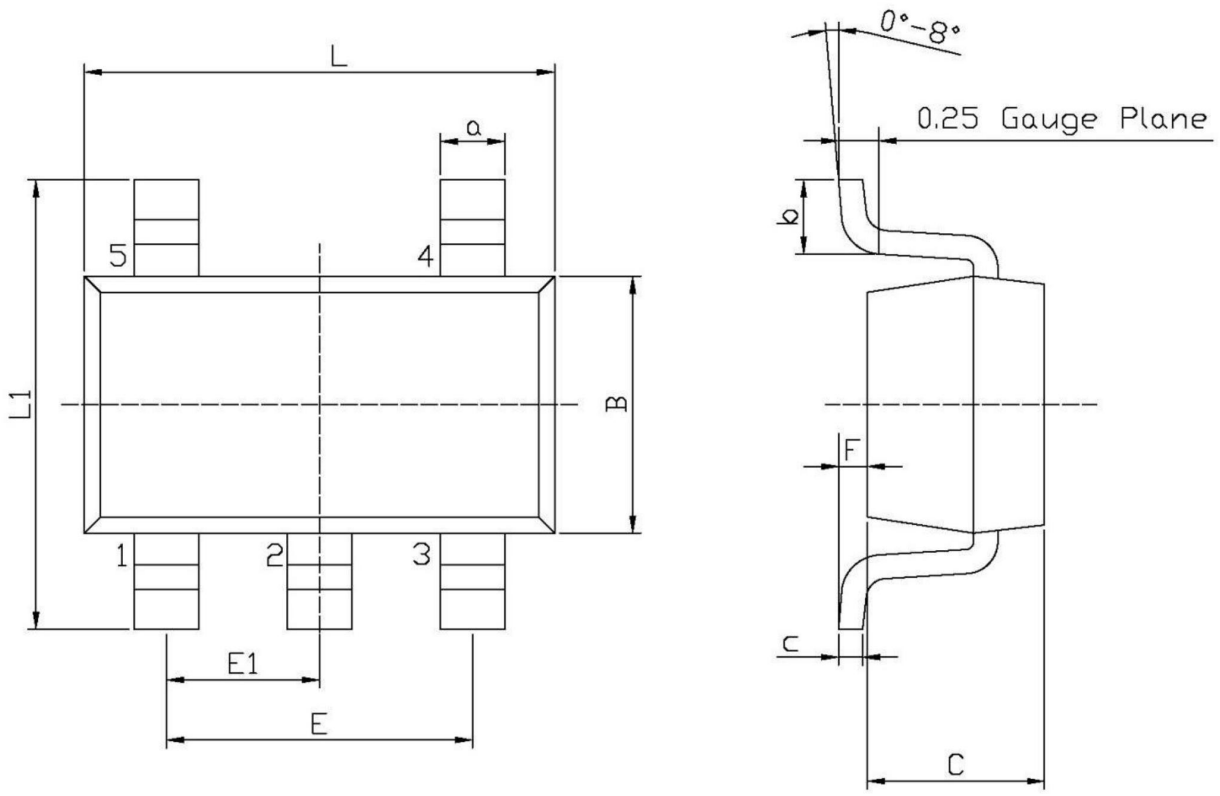
****: Lot No. Code, code change with Lot N

Packaging SPEC.

REEL

Package Type	Units					Dimension (unit：mm³)		
	Units/Reel	Reels/Inner Box	Units/Inner Box	Inner Boxes/Outer Box	Units/Outer Box	Reel	Inner Box	Outer Box
SOT23-5/6	3,000	10	30,000	4	120,000	7″ ×8	210×205×205	445×230×435

Package Dimensions



Unit: mm

Symbol	Dimensions In Millimeters		Symbol	Dimensions In Millimeters	
	Min	Max		Min	Max
L	2.82	3.02	E1	0.85	1.05
B	1.50	1.70	a	0.35	0.50
C	0.90	1.30	c	0.10	0.20
L1	2.60	3.00	b	0.35	0.55
E	1.80	2.00	F	0	0.15

SOT23-5