

/ Descriptions

BRCL3230EME	/	BRCL3230EME
	MOSFET	
BRCL3230EME	SOT23-5	
	BRCL3230EME	

The BRCL3230EME series product is a high integration solution for lithium-ion/polymer battery protection. BRCL3230EME contains advanced power MOSFET, high-accuracy voltage detection circuits and delay circuits.

BRCL3230EME is put into an ultra-small SOT23-5 package makes it an ideal solution in limited space of battery pack. BRCL3230EME has all the protection functions required in the battery application including overcharging, overdischarging, overcurrent and load short circuiting protection etc. The low standby current drains little current from the cell while in storage. The device is not only targeted for digital cellular phones, but also for any other Li-Ion and Li-Poly battery-powered information appliances requiring long-term battery life.

/ Features

	25mΩ	MOSFET
	SOT23-5	
	RC	
2	1	2
0V	3.0uA,	1.7uA;

Integrate advanced power MOSFET with Equivalent of 25mΩ $R_{DS(ON)}$;

Ultra-small SOT23-5 package;

Internal integration RC without any peripheral devices;

Over-temperature Protection;

Overcharge Current Protection;

Three-step Overcurrent Detection: Overdischarge Current1, Overdischarge Current2, Load Short Circuiting

Charger detection function;

0V battery charging function, delay times are generated inside, High-accuracy voltage detection.

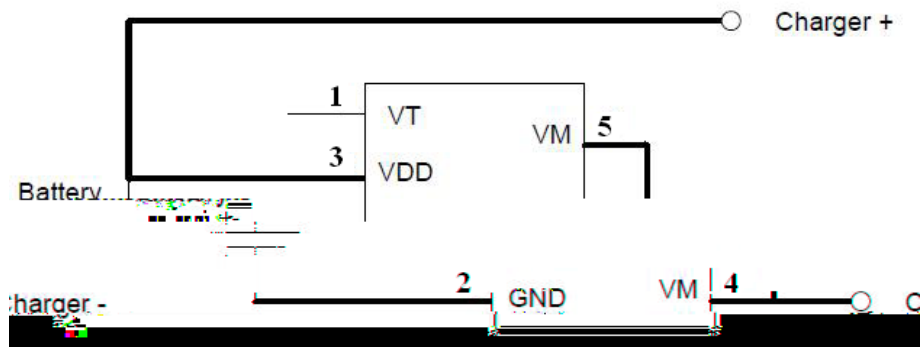
Low Current Consumption, Operation Mode: 3.0μA typ, Power-down Mode: 1.7μA typ ;

HF Product;

/ Applications

One-Cell lithium-ion battery pack; Lithium-Polymer battery pack.

/ Typical Application



(1)

(2)

Notes

- (1) The chip power consumption shall not exceed the maximum power consumed by the package.
- (2) This product has anti-static protection function, but do not exceed the maximum capacity of the product to withstand static electricity.

/ Pinning



Pin Number	Pin Name	Pin Description
1	VT	Test pin
2	GND	Ground, connect the negative terminal of the battery to this pin.
3	VDD	Power Supply
4 5	VM	The negative terminal of the charger. The internal FET switch connects this terminal to GND.

/ Marking

See Marking Instructions.

/ Absolute Maximum Ratings(Ta=25)

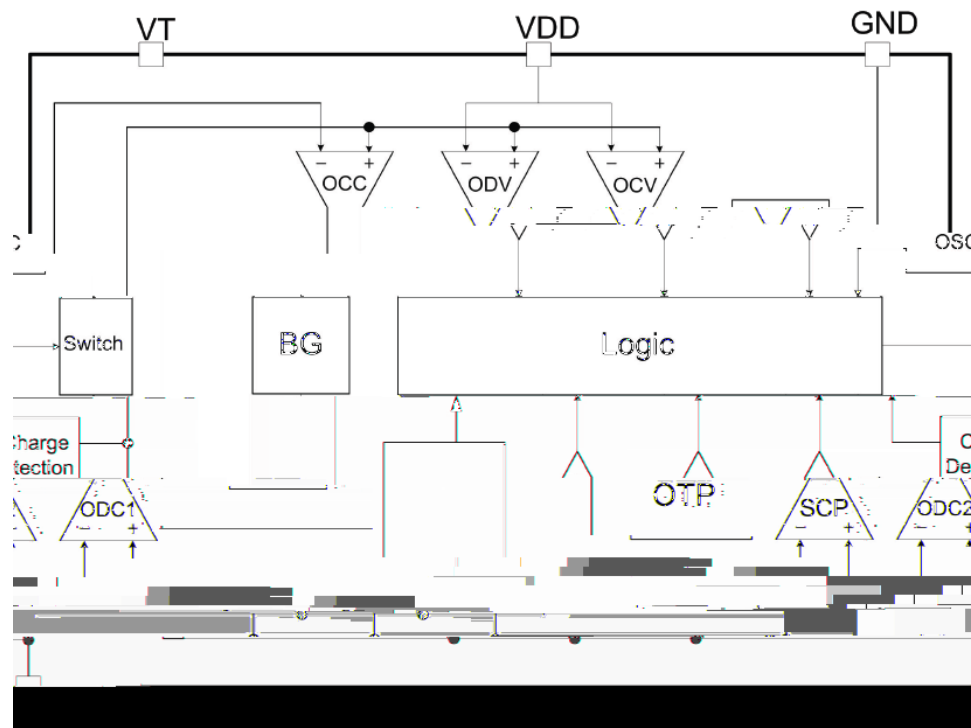
/Parameter	/Symbol	/Value	/Unit
V _{DD} input pin voltage	V _{IN}	-0.3 to +6	V
V _M input pin voltage	V _{VM}	-6 to +10	V
Power Dissipation	P _D	400	mW
Maximum Junction Temperature	T _J	125	°C
Lead Temperature	T _L	300	
Operating Junction Temperature	T _{opr}	-40 to +85	
Storage Temperature	T _{stg}	-55 to +150	
Package Thermal Resistance	R _{θJA}	250	/W
	R _{θJC}	130	/W
ESD	ESD	2000	V

/ Electrical Characteristics(Ta=25)

/Parameter	/Symbol	/Test Condition	/Min	/Typ	/Max	/Unit
Detection voltage						
Overcharge Detection Voltage	V _{CU}		4.25	4.30	4.35	V
Overcharge Release Voltage	V _{CL}		4.05	4.10	4.15	V
Overdischarge Detection Voltage	V _{DL}		2.30	2.40	2.50	V
Overdischarge Release Voltage	V _{DR}		2.90	3.00	3.10	V
Charger Detection Voltage	V _{CHA}		-0.3	-0.4	-0.5	V
Detection current						
Overcharge Current Detection	I _{IOCC}	V _{dd} =3.6V	4.5	6.5	8.5	A
Overdischarge Current1 Detection	I _{IOV1}	V _{dd} =3.6V	4.5	6.5	8.5	A
Overdischarge Current2 Detection	I _{IOV2}	V _{dd} =3.6V		9		A
Load Short-Circuiting Detection	I _{SHORT}	V _{dd} =3.6V		18		A
Static current						
Current Consumption in Normal Operation	I _{OPE}	V _{dd} =3.6V V _M =0V	1.5	3.0	6.0	μA
Current Consumption in power Down	I _{PDN}	V _{dd} =2V, V _M floating	1	1.7	2.5	μA

/ Electrical Characteristics(Ta=25)

Equivalent FET on Resistance						
Equivalent FET on Resistance	R_{DS}	$V_{dd}=3.6V$ $I_{VM}=1A$	15	25	40	mΩ
Over temperature protection						
Over Temperature Protection	OTP			140		
Over Temperature Recovery Degree	OTPR			115		
Delay time						
Overcharge Current Detection Delay Time	T_{OCC}	$V_{dd}=3.6V$	3.5	5	6.5	ms
Overcharge Voltage Detection Delay Time	T_{CU}	$V_{DD}=3.6V\sim 4.4V$	55	85	115	ms
Overdischarge Voltage Detection Delay Time	T_{DL}	$V_{DD}=3.6V\sim 2.0V$	25	40	55	ms
Overdischarge Current1 Detection Delay Time	T_{IOV1}	$V_{DD}=3.6V$	3.5	5	6.5	ms
Overdischarge Current2 Detection Delay Time	T_{IOV2}	$V_{DD}=3.6V$	0.4	0.6	0.8	ms
Load Short-Circuiting Detection Delay Time	T_{SHORT}	$V_{DD}=3.6V$		100	300	us

FunctionI Block Diagram


Functional Description

BRCL3230EME

MOSFET

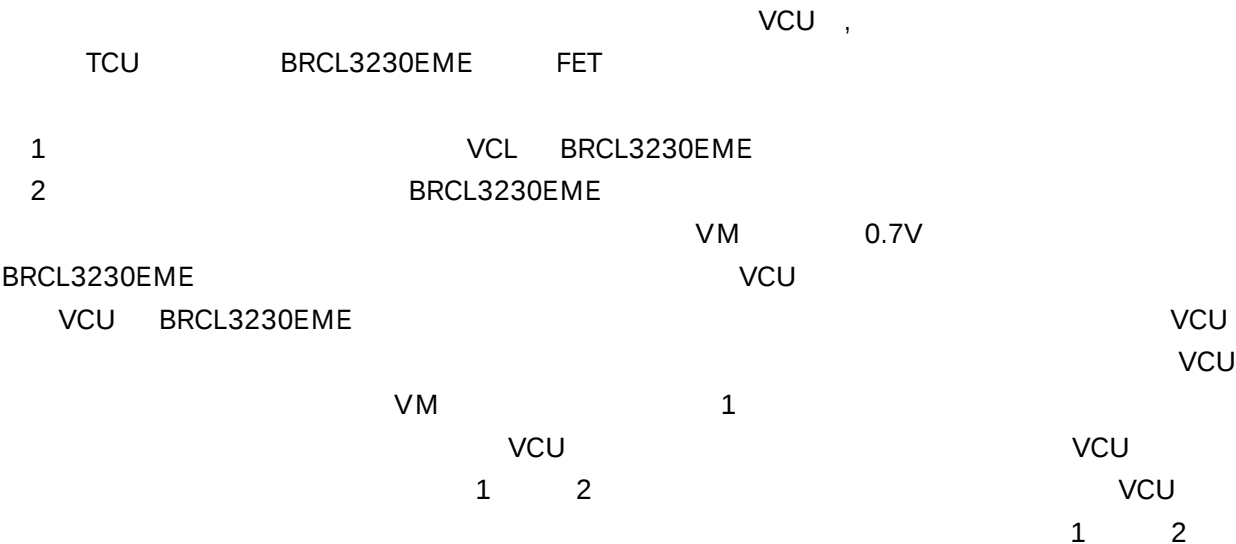
25mΩ

The BRCL3230EME monitors the voltage and current of a battery and protects it from being damaged due to overcharge voltage, overdischarge voltage, overdischarge current, and short circuit conditions by disconnecting the battery from the load or charger. The peripheral circuit is very simple. The MOSFET is integrated and its $R_{DS(ON)}$ is as low as 25mΩ typical.

Normal Operating mode

If no exception condition is detected, charging and discharging can be carried out freely. This condition is called the normal operating mode.

Overcharge Condition



When the battery voltage becomes higher than the overcharge detection voltage (VCU) during charging under normal condition and the state continues for the overcharge detection delay time (TCU) or longer, the BRCL3230EME turns the charging control FET off to stop charging. This condition is called the overcharge condition.

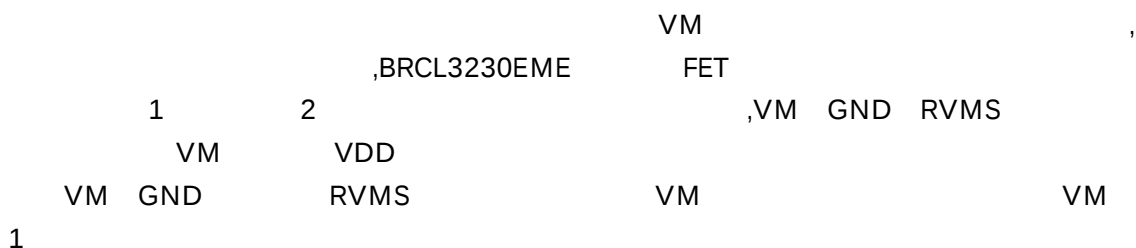
The overcharge condition is released in the following two cases:

- 1 When the battery voltage drops below the overcharge release voltage (VCL), the BRCL3230EME
- g1

Overcharge Condition

The BRCL3230EME detects this voltage and releases the overcharge condition. Consequently, in the case that the battery voltage is equal to or lo

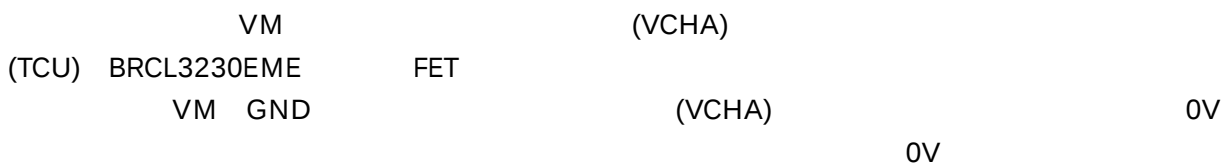
Overcurrent Condition



When the discharging current becomes equal to or higher than a specified value (the VM pin voltage is equal to or higher than the overcurrent detection voltage) during discharging under normal condition and the state continues for the overcurrent detection delay time or longer, the BRCL3230EME turns off the discharging control FET to stop discharging. This condition is called overcurrent condition. (The overcurrent includes overcurrent, or load shortcircuiting.) The VM and GND pins are shorted internally by the RVMS resistor under the overcurrent condition. When a load is connected, the VM pin voltage equals the VDD voltage due to the load.

Because of the connection between the VM and the GND by the RVMS resistor when the load is removed, the VM pin goes back to the GND potential since the VM pin is shorted the GND pin with the RVMS resistor. Detecting that the VM pin potential is lower than the overcurrent detection voltage (VIOV1), the IC returns to the normal condition.

Abnormal Charge Current Detection



If the VM pin voltage drops below the charger detection voltage (VCHA) during charging under the normal condition and it continues for the overcharge detection delay time (TCU) or longer, the BRCL3230EME turns the charging control FET off and stops charging. This action is called abnormal charge current detection.

Abnormal charge current detection is released when the voltage difference between VM pin and GND pin becomes higher than the charger detection voltage (VCHA) by separating the charger. Since the 0 V battery charging function has higher priority than the abnormal charge current detection function, abnormal charge current may not be detected by the product with the 0 V battery charging function while the battery voltage is low.

Load Short-circuiting Condition



If voltage of VM pin is higher short circuiting protection voltage (VSHORT) and it continues for the tSHORT or longer, the BRCL3230EME will stop discharging and battery is disconnected from load. This status is released when voltage of VM pin is higher than short protection voltage (VSHORT), such as when disconnecting the load.

0V Battery Charging Function



This function enables the charging of a connected battery whose voltage is 0V by self-discharge. When connects to a charger , the discharging control FET is off and the charging current flows through the internal parasitic diode in the discharging control FET. If the battery voltage becomes equal to or higher than the overdischarge release voltage (VDL), the normal condition returns.

Notes

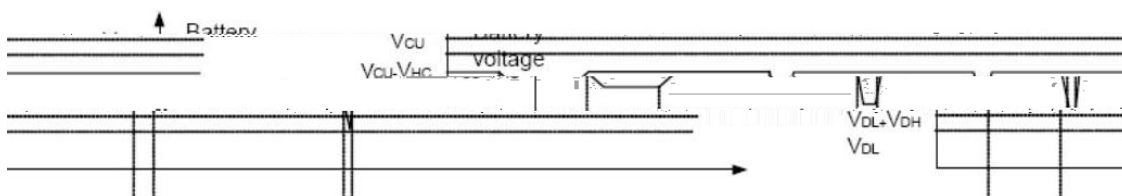
- (1) Some battery providers do not recommend charging of completely discharged batteries. Please refer to battery providers before the selection of 0 V battery charging function.
- (2) The 0V battery charging function has higher priority than the abnormal charge current detection function. Consequently, a product with the 0 V battery charging function charges a battery and abnormal charge current cannot be detected during the battery voltage is low.
- (3) When a battery is connected to the IC for the first time, the IC may not enter the normal condition in which discharging is possible. In this case, set the VM pin voltage equal to the GND voltage (short the VM and GND pins or connect a charger) to enter the normal condition.

Timing Chart

Overcharge And Overdischarge Detection

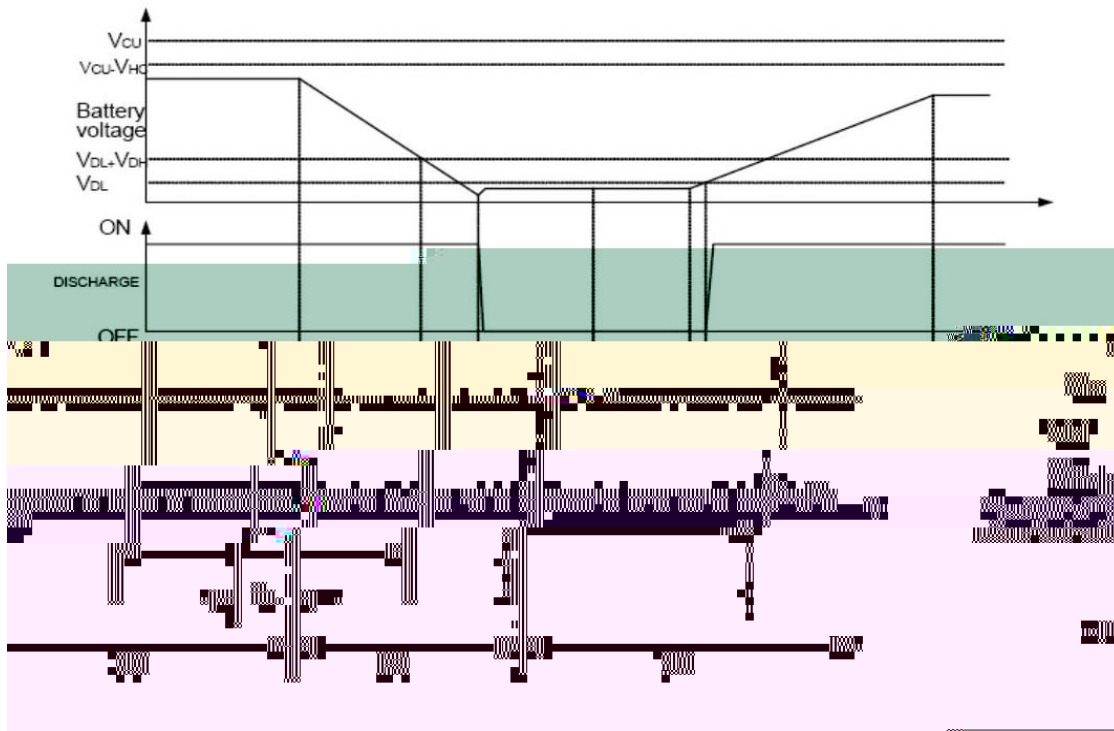


Overdischarge Current Detection

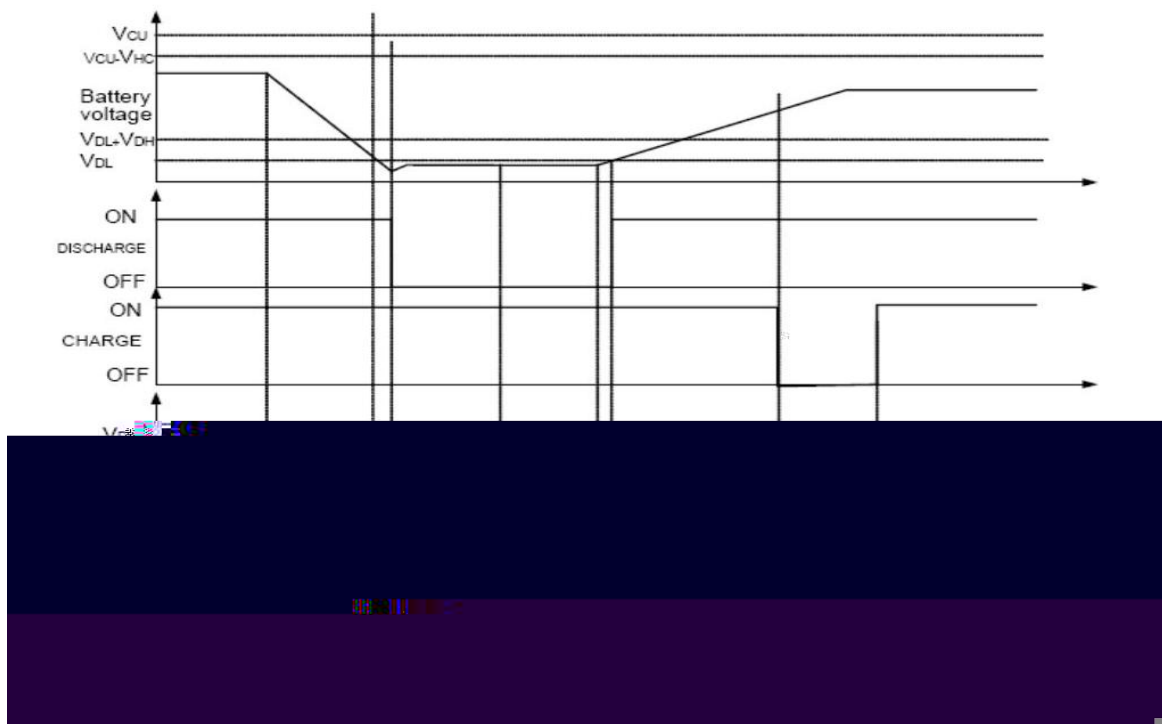


Timing Chart

Charger Detection



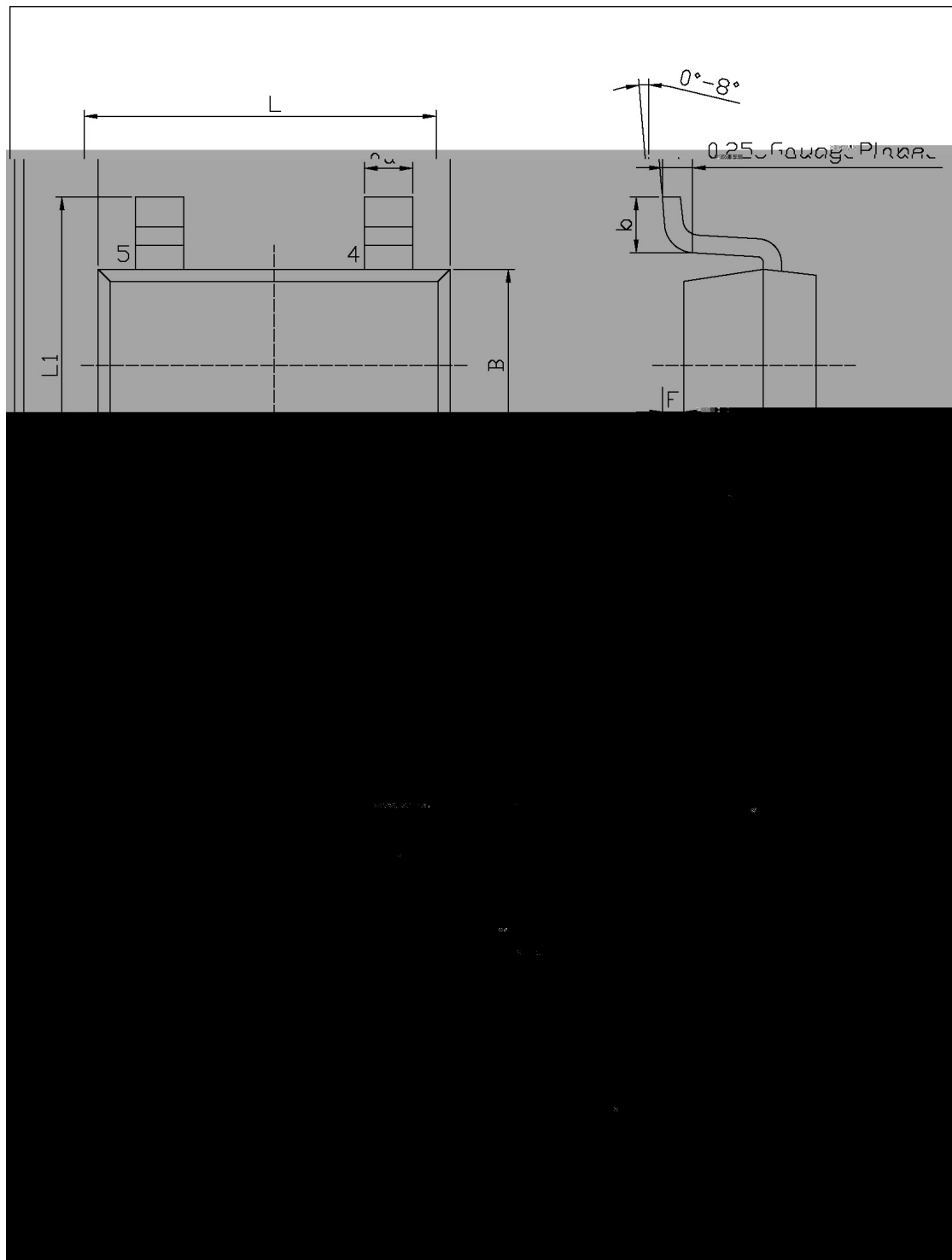
Abnormal Charge Detection



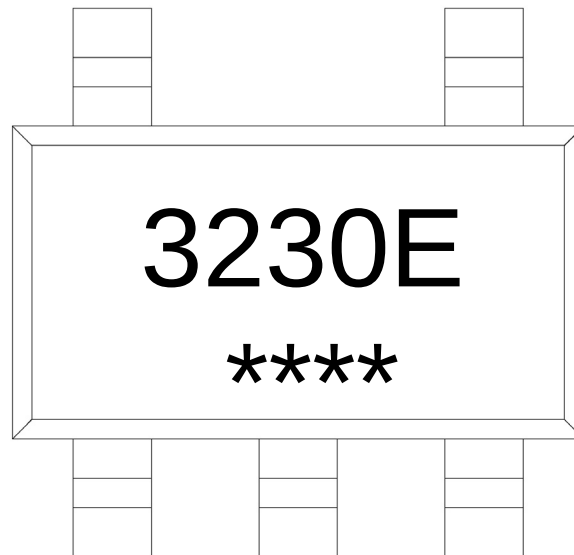
Notes: (1) Normal condition (2) Overcharge voltage condition (3) Overdischarge voltage condition (4) Overcurrent condition



/ Package Dimensions



/ Marking Instructions



3230E

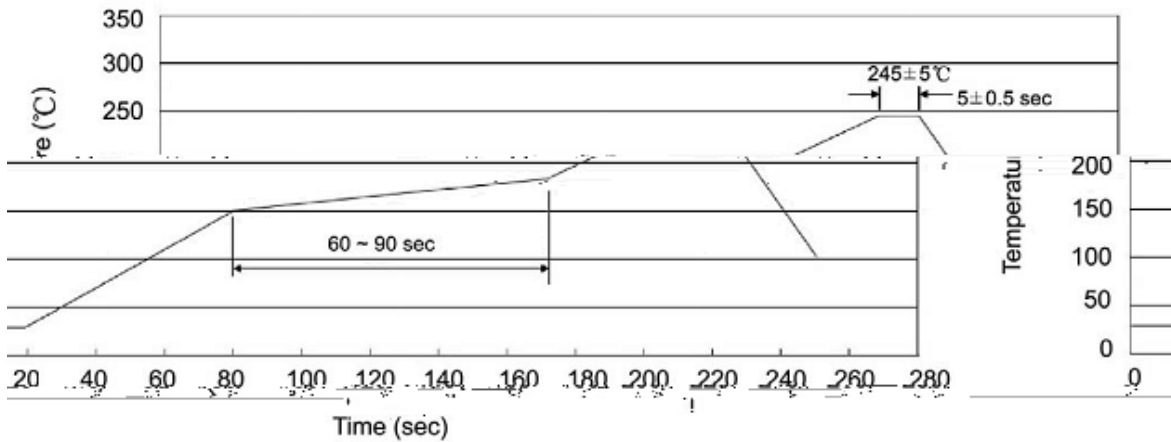
Note:

3230E: Product Type.

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



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Note:

- | | | | | | |
|---|-------|-----|-----------|--------|---|
| 1 | 150 | 180 | 60 | 90sec; | 1.Preheating:150~180 , Time:60~90sec. |
| 2 | 245±5 | | 5±0.5sec; | | 2.Peak Temp.:245±5 , Duration:5±0.5sec. |
| 3 | | 2 | 10 | /sec. | 3. Cooling Speed: 2~10 /sec. |

/ Resistance to Soldering Heat Test Conditions

260±5 10±1 sec. Temp.:260±5 Time:10±1 sec

/ Packaging SPEC.

/ REEL

Package Type	Units					Dimension (unit mm ³)		
	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	435×225×420

/ Notices