/ Revised record

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A	2019-7-10				
B	2021-11-26				

/ Descriptions

BRCL3230BSE / BRCL3230BSE
MOSFET
BRCL3230BSE ESOP-8
BRCL3230BSE

The BRCL3230BSE series product is a high integration solution for lithium-lion/polymer battery protection.BRCL3230BSE contains advanced power MOSFET, high-accuracy voltage detection circuits and delay circuits.
BRCL3230BSE is put into an ultra-small ESOP-8 package makes it an ideal solution in limited space of battery pack. BRCL3230BSE 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.

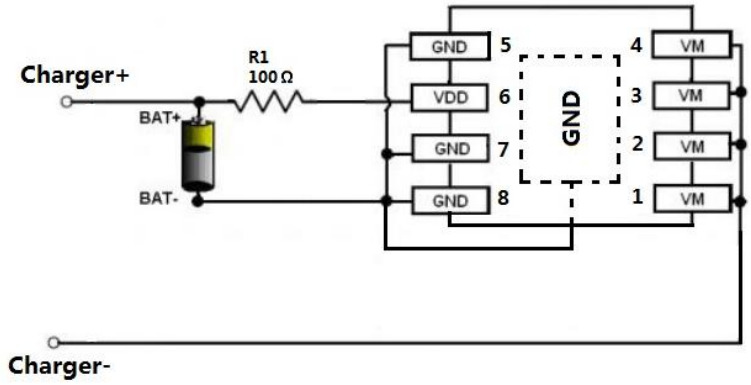
/ Features

- 15mΩ MOSFET
- ESOP-8
-
-
-
- 2 1 2
-
- 0V
- 7.0uA , 4.0uA ;
-
- Integrate advanced power MOSFET with Equivalent of 15mΩ $R_{DS(ON);}$
- Ultra-small ESOP-8 package;
- No capacitance is required for peripheral circuits;
- 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: 7.0μA typ,Power-down Mode: 4.0μA typ ;
- HF Product.

/ Applications

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

/ Typical Application



(1)

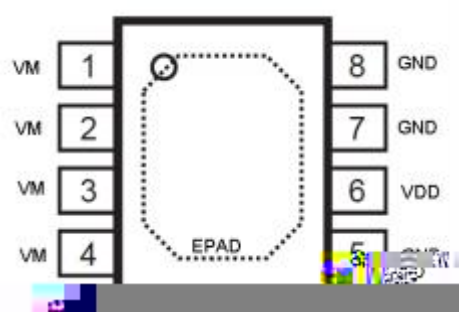
(2)

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



1 2 3 4	VM	GND
5 7 8	GND	
6	VDD	
9	EPAD	EPAD 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	℃
Lead Temperature	T_L	300	
Operating Junction Temperature	T_{opr}	-40 to +85	
Storage Temperature	T_{stg}	-55 to +150	
Package Thermal Resistance	$R_{\theta JA}$	250	/W
	$R_{\theta Jc}$	130	/W
ESD	ESD	2000	V

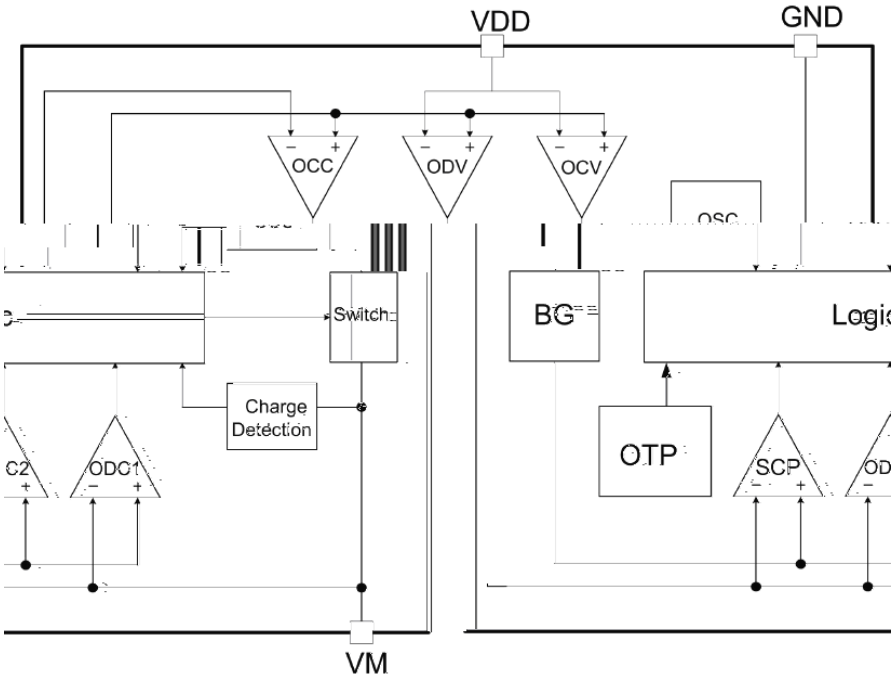
/ Electrical Characteristics(Ta=25)

/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	9	11	13	A
Overdischarge Current1 Detection	I_{IOV1}	V_{dd}=3.6V	8	10	12	A
Overdischarge Current2 Detection	I_{IOV2}	V_{dd}=3.6V	14	19	22	A
Load Short-Circuiting Detection	I_{SHORT}	V_{dd}=3.6V	24	36	50	A
Static current						
Current Consumption in Normal Operation	I_{OPE}	V_{dd}=3.6V V_M=0V	3	7	10	μA
Current Consumption in power Down	I_{PDN}	V_{dd}=2V,V_M floating	1	4	6	μA

/ Electrical Characteristics(Ta=25)

Equivalent FET on Resistance						
Equivalent FET on Resistance	R_{DS}	V_{dd}=3.6V I_{VM}=1A		15	20	mΩ
Over temperature protection						
Over Temperature Protection	OTP		125	140	155	
Over Temperature Recovery Degree	OTPR		100	115	130	
Delay time						
Overcharge Current Detection Delay Time	T_{OCC}	V_{dd}=3.6V	5.6	8	10.4	ms
Overcharge Voltage Detection Delay Time	T_{CU}	V_{DD}=3.6V~4.4V	95	135	175	ms
Overdischarge Voltage Detection Delay Time	T_{DL}	V_{DD}=3.6V~2.0V	25	35	45	ms
Overdischarge Current1 Detection Delay Time	T_{IOV1}	V_{DD}=3.6V	5.6	8	10.4	ms
Overdischarge Current2 Detection Delay Time	T_{IOV2}	V_{DD}=3.6V	0.7	1	1.3	ms
Load Short-Circuiting Detection Delay Time	T_{SHORT}	V_{DD}=3.6V		100	300	us

/ Functionl Block Diagram



/ Functional Description

BRCL3230BSE

MOSFET

15mΩ

The BRCL3230BSE 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 15mΩ 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

VCU ,

TCU BRCL3230BSE FET

1 VCL BRCL3230BSE

2 BRCL3230BSE

VM 0.7V

BRCL3230BSE VCU

VCU BRCL3230BSE VCU

VCU

VM 1

VCU VCU

1 2 VCU

1 2

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 BRCL3230BSE 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 BRCL3230BSE turns the charging control FET on and returns to the normal condition.

2 When a load is connected and discharging starts, the BRCL3230BSE turns the charging control FET on and returns to the normal condition. The release mechanism is as follows: the discharging current flows through an internal parasitic diode of the charging FET immediately after a load is connected and discharging starts, and the VM pin voltage increases about 0.7 V (forward voltage of the diode) from the GND pin voltage momentarily.

/ Overcharge Condition

The BRCL3230BSE detects this voltage and releases the overcharge condition. Consequently, in the case that the battery voltage is equal to or lower than the overcharge detection voltage (VCU), the BRCL3230BSE returns to the normal condition immediately, but in the case the battery voltage is higher than the overcharge detection voltage (VCU),the chip does not return to the normal condition until the battery voltage drops below the overcharge detection voltage (VCU) even if the load is connected. In addition, if the VM pin voltage is equal to or lower than the overcurrent 1 detection voltage when a load is connected and discharging starts, the chip does not return to the normal condition.

Note: If the battery is charged to a voltage higher than the overcharge detection voltage (VCU) and the battery voltage does not drops below the overcharge detection voltage (VCU) even when a heavy load, which causes an overcurrent, is connected, the overcurrent 1 and overcurrent 2 do not work until the battery voltage drops below the overcharge detection voltage (VCU). Since an actual battery has, however, an internal impedance of several dozens of mΩ, and the battery voltage drops immediately after a heavy load which causes an overcurrent is connected, the overcurrent 1 and overcurrent 2 work. Detection of load shortcircuiting works regardless of the battery voltage.

/ Overdischarge Condition

VDL ,
TDL BRCL3230BSE
FET VM VM VDD RVMD
IPDN VM VDD
RVMD VM VCHA ,
FET (VDL) BRCL3230BSE
FET
VM VCHA ,
VDR

When the battery voltage drops below the overdischarge detection voltage (VDL) during discharging under normal condition and it continues for the overdischarge detection delay time (tDL) or longer, the BRCL3230BSE turns the discharging control FET off and stops discharging. This condition is called overdischarge condition. After the discharging control FET is turned off, the VM pin is pulled μ d

/ Overcurrent Condition

VM ,
,BRCL3230BSE FET
1 2 ,VM GND RVMS
VM VDD
VM GND RVMS VM VM
1

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 BRCL3230BSE 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

VM (VCHA)
(TCU) BRCL3230BSE FET
VM GND (VCHA) 0V
0V

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 BRCL3230BSE 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.

0V / 0V Battery Charging Function

0V

VDL IC

(1)

“ 0V ” “ 0V ”

(2) “ 0V ” “ ” , “ 0V ”

IC VDL

(3)

VM GND VM GND

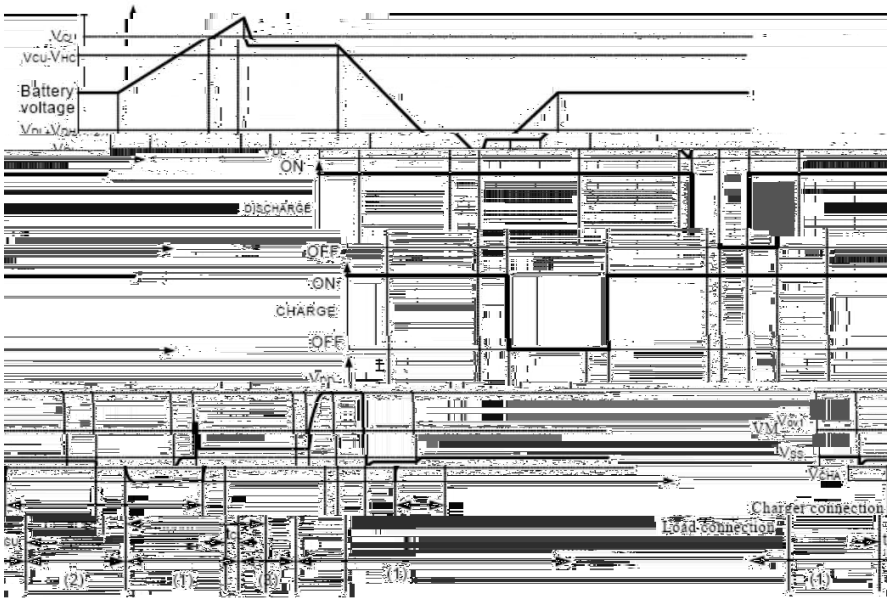
This function enables the charging of a connected battery whose voltage is 0V by self-discharge. When connectes to a charger , the discharging control FET is off and the charging current flows through the internal parasitic diode in the discharging control FET. If the battery voltage becomes equal to 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)ao ¸

/ Timing Chart

/Overcharge And Overdischarge Detection

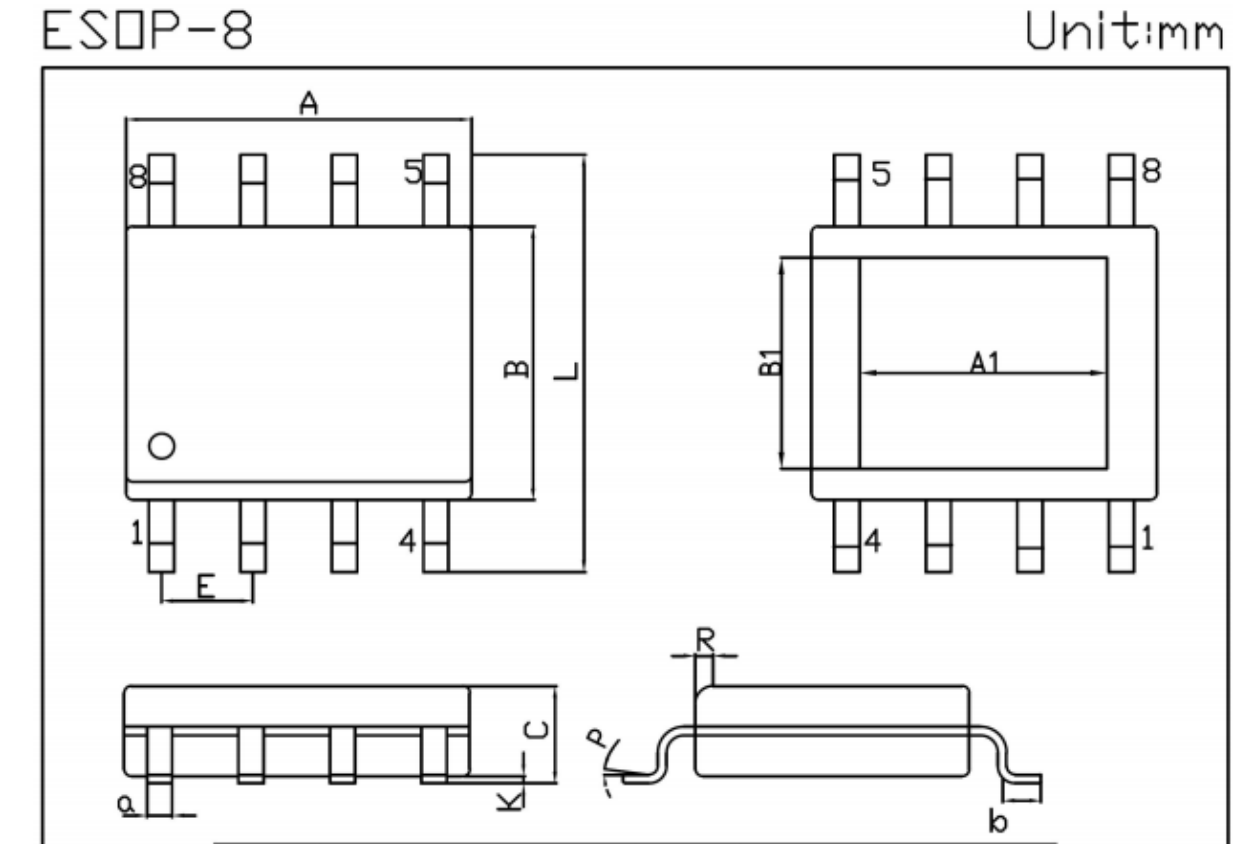


1 2 3

/Overcharge Overdischarge Current Detection

1 2 3

/ Package Dimensions



Symbol	Min	Max
C	1.35	1.75
a	0.35	0.49
R	0.30	0.60
P	0°	7°
b	0.40	1.25
B1	2.2	2.6

Symbol	Min	Max
A	4.70	5.10
B	3.70	4.10
L	6.00	6.40
E	1.27BSC	
K	0.02	0.10
A1	3.1	3.5

/ Marking Instructions

说明：

BR: 为公司代码

3230B： 为产品型号

****： 为生产批号代码，随生产批号变化。

Note:

BR: Company Code

3230B: Product Type.

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

( ) / Temperature Profile for IR Reflow Soldering(Pb-Free)

Note:

1 150 180 60 90sec; 1.Preheating:150~180℃, T