## 5 é / Descriptions

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(8)2 (3) ,4¯ ä 359,+:k ä ¤ † 9 y è y • ž èož
(8)2 (3) À Ä ³ o 4 95: /x k ...±¥˜^³o `• 9q•'ò±³o4 U
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The BRCL3230BMC series product is a high integration solution for lithium-lion/polymer battery protection.BRCL3230BMC contains advanced power MOSFET, high-accuracy voltage detection circuits and delay circuits.
BRCL3230BMC is put into an ultra-small SOT23-3 package makes it an ideal solution in limited space of battery pack. BRCL3230BMC 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.

## ¤ª / Features

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‹ —)í D }
‹ Integrate advanced power MOSFET with Equivalent of 25m $R_{DS(ON);}$
‹ Ultra-small SOT23-3 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: 3.0 A typ,Power-down Mode: 1.7 A typ ;
‹ HF Product;

## Đ ÷ / Applications

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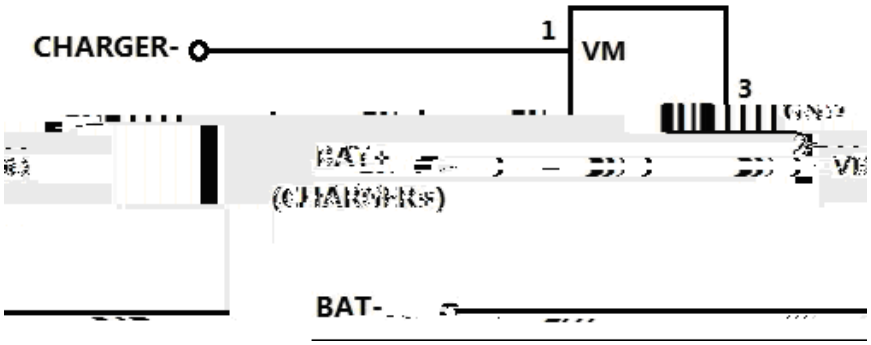
One-Cell lithium-ion battery pack; Lithium-Polymer battery pack.

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Notes Ö

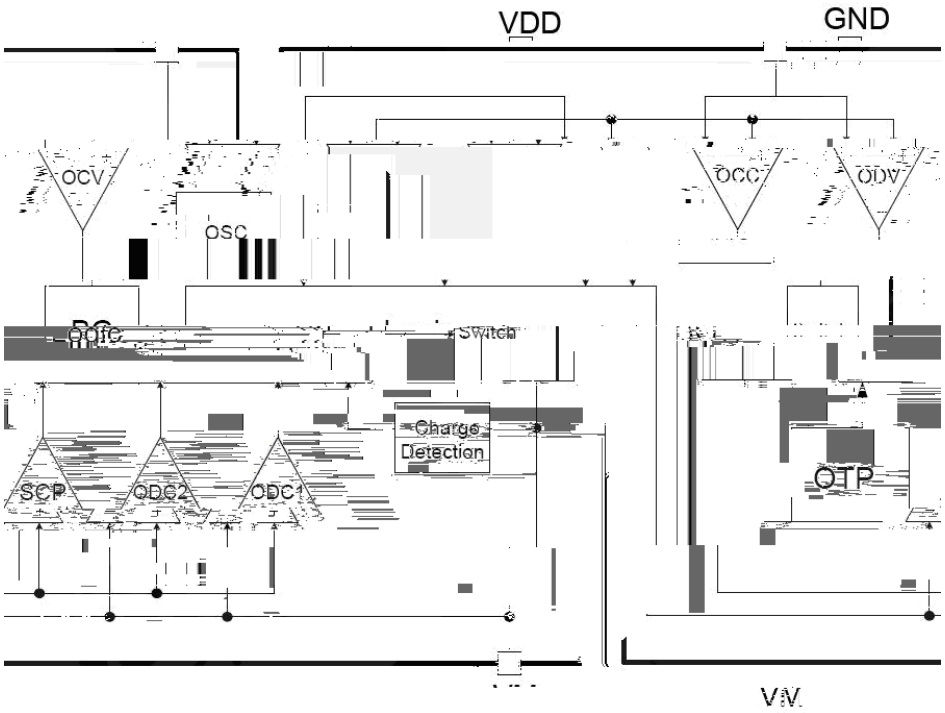
(1) The chip power consumption shall not exceed the maximum power cons

| @ ƒ/Parameter | … Z/Symbol | ƒ › /Value | % y/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 | $R_{JA}$ | 250 | /W |

## Ô4ì × ? d / Electrical Characteristics( c , ¤ ï g Ta=25 ; )

| | | | | | | |
|---|---|---|---|---|---|---|
| **Equivalent FET on Resistance** | | | | | | |
| Equivalent FET on Resistance | $R_{DS}$ | $V_{dd}$=3.6V È$I_{VM}$=1A | 15 | 25 | 40 | m |
| **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 | $T_{CU}$ | $V_{DD}$=3.6V4.4V | 95 | 135 | 175 | ms |
| Overdischarge Voltage Detection Delay Time | $T_{DL}$ | $V_{DD}$=3.6V2.0V | 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 |

## × ä ¢ Functionl Block Diagram



## × 5 é Functional Description

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Ú ¬ Ô 85Š Đ

## Ú Z Ô W5Š Đ **Overcurrent Condition**

3 o W • % ” k ¢ y v ^ 9 ê ä 9 — › g < 3 9 ^ 9 ê ä 9 v y 9 h w 4 Ò ž
• ñ y v y • ž • ( 8 ) 2 ( 3 ) ¼ • y , + : k 2 y ož _ Õ Ñ f y v Õ Ñ g
, y v k y v y ¿ ú ? è v h ož y v Õ Ñ < 3 y - 4 * t 8 < 3 9 Š Ë ? N 4ož ¢ %²
¿ ú N k < 3 9 ^ 9 < * * × > ¿ ú Š 9ož
9 < 3 y - 4 * $ • N 8 < 3 9 Š k ¢ ¿ ú • • k < 3 9 t ñ ª yož ¢ y ñ < 3 y z 9 v
y 9 k / Ì › ñ 3 o Ù Áož

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 BRCL3230BMC 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 k 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.

## • n ¬ Ô Ô W ó Z **Abnormal Charge Current Detection**

3 o - ž k ò ç < 3 9 ‘ ñ - y 9 Y < ) . ' k w 4 Ò ž • Ý - v y • ž ž •
: ) ; k ( 8 ) 2 ( 3 ) ¼ • - , + : 2 - ož _ Õ Ñ f ‘ o - v yož
• • - ˜ k < 3 y - 4 * $ • 9 ä 9 - ˜ y 9 < ) . ' ž k ‘ o - v % ” † ”ož 9 < P
- i ¯ ´ ä 9 3 o v - y k P 9 ® z P 3 ¨ g < - ž k ‘ o - v y
1 W •ož

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 BRCL3230BMC 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.

## Ž É ·5Š Đ **Load Short-circuiting Condition**

ò ç < 3 9 ä 9 ? è ‘ 9 g < 9 . 5 8 : h k w 4 Ò ž • Ý ? è y • ž • g Z 9 . 5 8 : h k
( 8 ) 2 ( 3 ) 1 ¿ ú • • 2 y ož ¢ < 3 9 z 9 ? è ‘ 9 g < 9 . 5 8 : h ž k † ò ¿ ú t g
” k ¿ ú ? è Õ Ñ 1 † ”ož

If voltage of VM pin is higher short circuiting protection voltage (VSHORT) and it continues for the tSHORT or longer, the BRCL3230BMC 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.

## < Ô 1 ¬ Ô × 0V Battery Charging Function

4 9 + ] Æ y ñ < P g Ç - ož¢ - ˜V ž kk * Ä B 8 â ' Û Ë P g - k ¢ P 9 ä 9 y y 9 g < * 2 h ž k ' / ) µ 3 o W • Ù Áož h y î ? ¶ y e P k ª • t Ç ) - k © eO P Ô Å Ð ož ¬ ¤ | P ˆ • Œ k G • ñ Æ 1 P © k À Õ ª • g < P - k © W 2 g < P - ož ª • g < P - A - v y i ¯ ´ ¾ äož œ 4 … ª • g < P - / ) k ¨ P 9 û z ž ˜ k ò - ož P 9 z 9 y y 9 g < * 2 h Y ž k g - v Ù Á yož ¢ P †%² ) N ' è ž k è U k µ 3 o % " k 4 ž — c y ožò ç D ÿ _ ë » k … < 3 ' 9 ˆ 9 - 4 * 9 g 1 < 3 - 4 * ? è ê N - ˜ h k < U Y µ 3 o % "ož

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 y

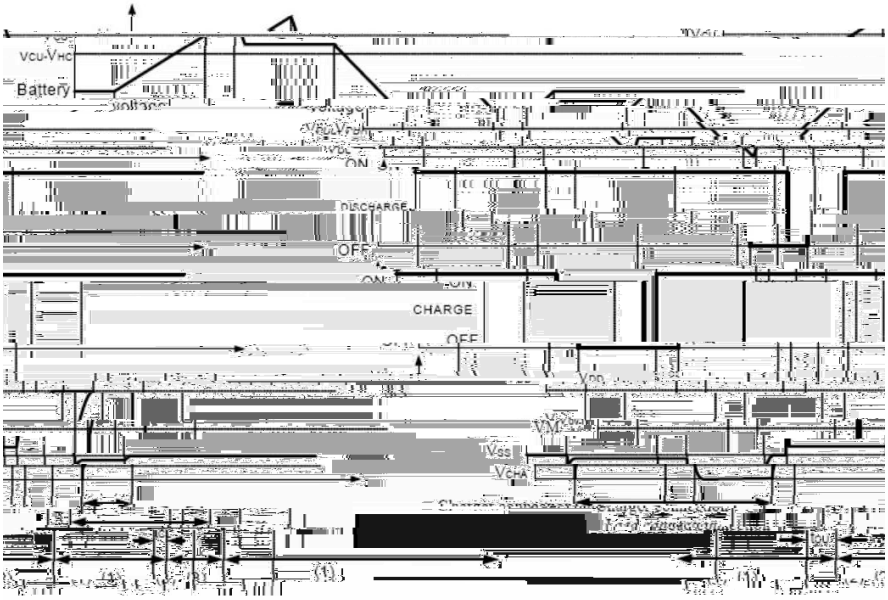
(1) Some battery providers do not recommend charging of completely discharged batteries. Please refer to battery providers before the selection of 0 V battery charging function.

(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.

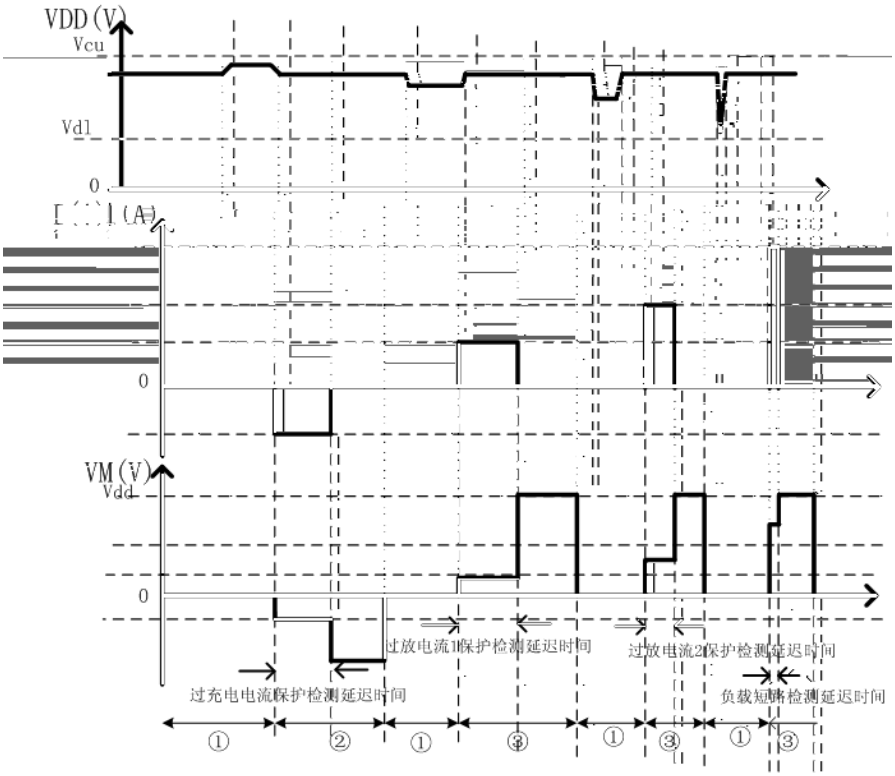
## • } ¢ Timing Chart

### Ú ¬ x Ú Z Ô 8 ó Z **Overcharge And Overdischarge Detection**




"¼ Ø Ä 1 Å ! 7 ™ ‰ Ä 2 ÅE› + _ ™ ‰ Ä 3 ÅE› + _ ™ ‰

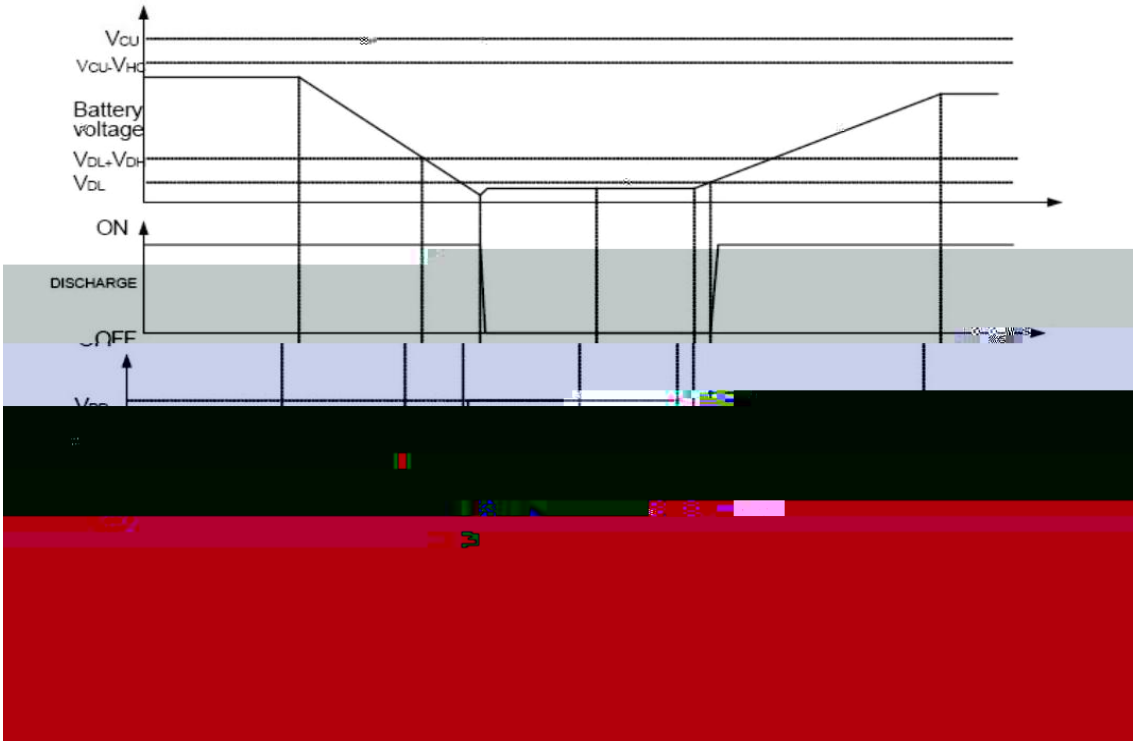
### Ú ¬ Z Ô W ó Z 5 \ K X I N G Ø Overdischarge Current Detection



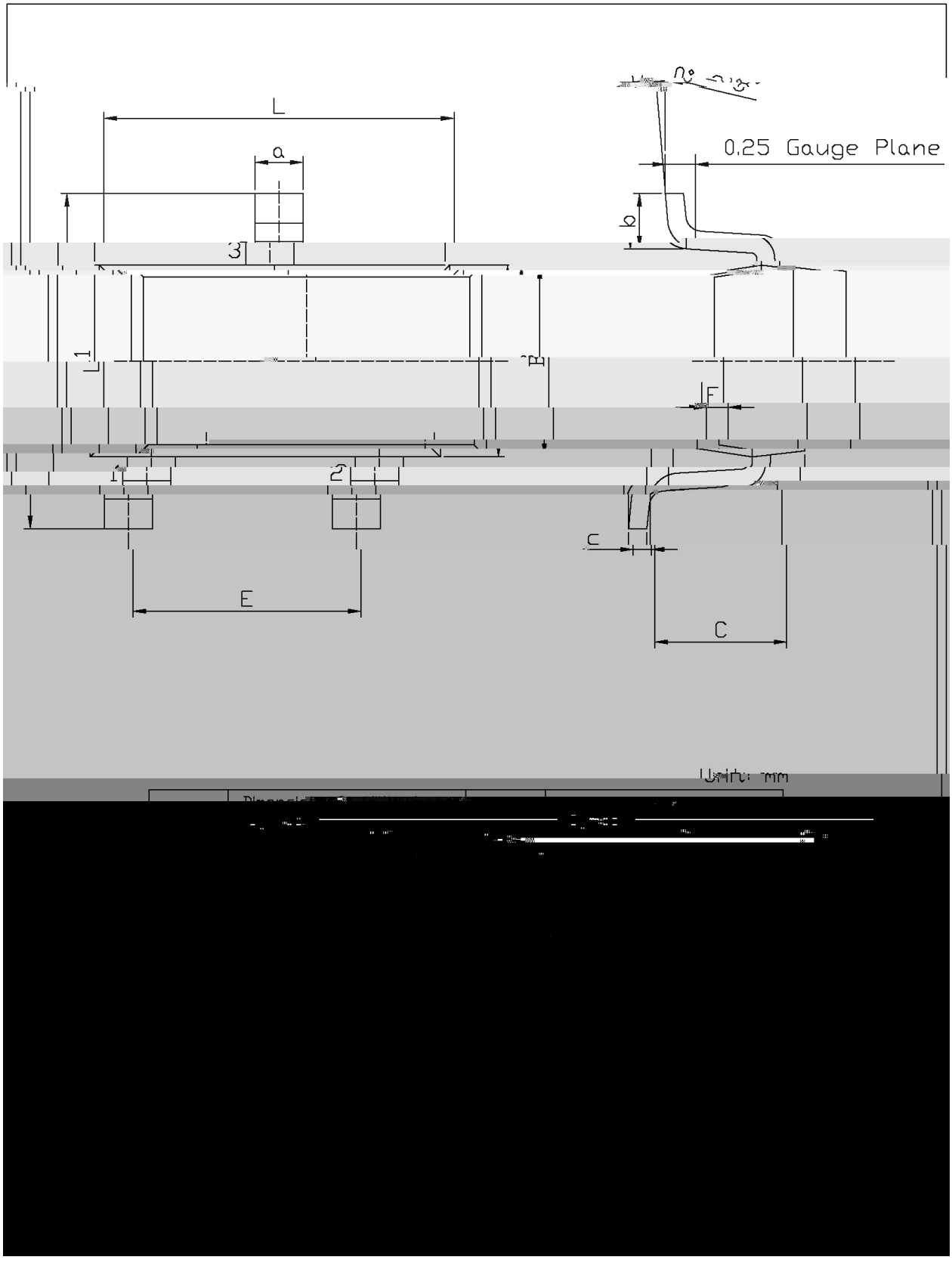

"¼ Ø Ä 1 Å ! 7 ™ ‰ Ä 2 ÅE› + # (Š Õ Ä 3 ÅE› + # (Š Õ

## • } ¢ Timing Chart

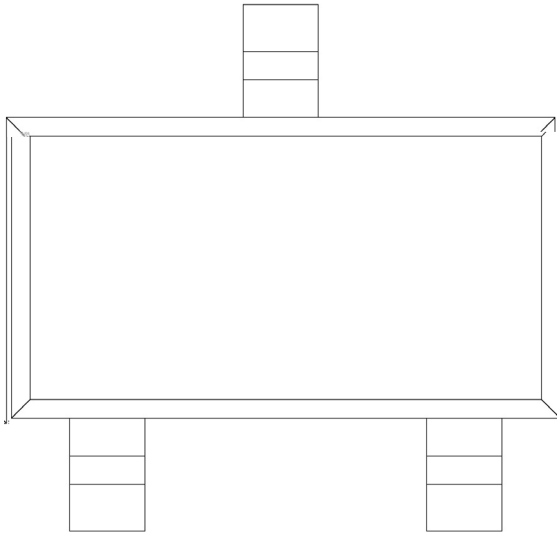
### ¬ Ô — ó Z Charger Detection



## Ø ¤ = ) ¢ / Package Dimensions



## , M y ƒ / Marking Instructions



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Note:

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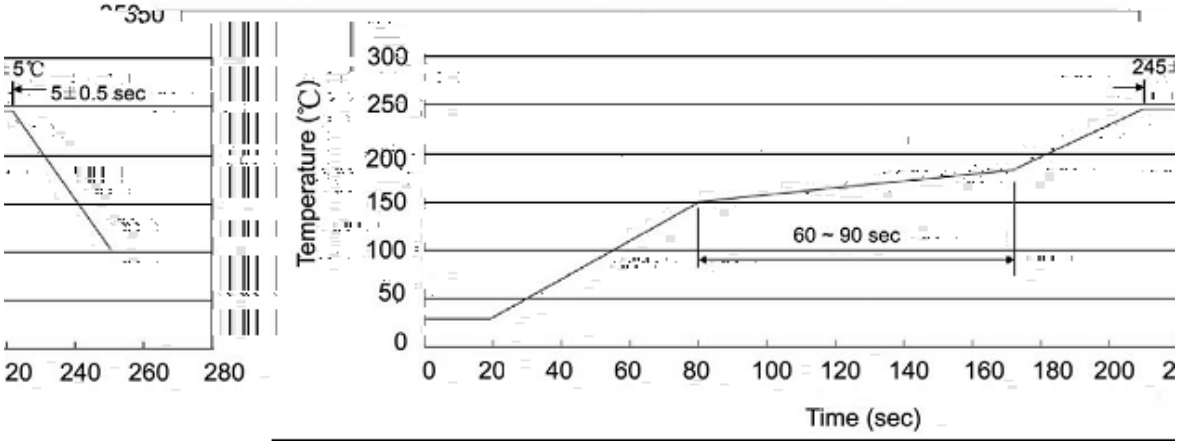


ª ¢ y

1o• Ä ½ “ † 150 ½180 - k ž • 60 ½90sec;

2o• Q › “ † 245 r5 - k ž • 4 Ò 5 r0.5sec;

3o•D N ò i Ò 0 , † 2 ½10 - /sec.

Note:

1.Preheating:150±180 - , Time:60±90sec.

2.Peak Temp.:245 r5 - , Duration:5 r0.5sec.

3. Cooling Speed: 2±0 - /sec.

## ÂD /Cã p ¯ » ] / Resistance to Soldering Heat Test Conditions

“ † y 260 r5 - ž • y 10 r1 sec.

Temp.:260 r5 - Time:10 r1 sec

## G P á / Packaging SPEC.

2 & x / REEL

| 6 G I Q G M K : _ V K / x ¥ ” | ; T O Z Y x ƒ O | | | | | * O S K T Y O U T x > * [ T O Z y S S | | |
|---|---|---|---|---|---|---|---|---|
| | ; T O Z Y Q 2 & | 8 K K R Y / T T K X ( U ^ Y 5 [ Z K X ( U ^ " 2 & " | K T K O Z U ^ / T T K X ( U ^ Y 5 [ Z K X ( U ^ " Q " | K T K X ( U ^ Y 5 [ Z K X ( U ^ " " " | Z T K O Z Y ( U 5 [ Z K X ( U ^ " Q " | 8 K K R | / T T K X ( U ^ " | 5 [ Z K X ( U ^ " |
| SOT-23-3 | 3,000 | 10 | 30,000 | 4 | 120,000 | 7 s ×8 | 210×205×205 | 445×230×435 |

## „ Ð y ƒ / Notices