# BSS84

## P-Channel Enhancement Mode Trench Power MOSFET

| Voltage: | -50 | Volts | Current: | -0.13 | Amperes | Package: | SOT-23 |
|---|---|---|---|---|---|---|---|

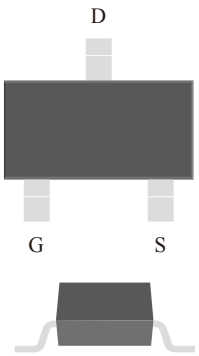
### Features

- NH'S Advanced Trench Technology
- Low Rds(on) For Low On-State Loss
- High EAS For High Reliability
- Excellent Qg*Rds(on) Product(FOM）

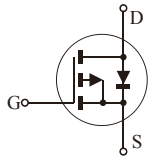
### Typical Applications

- DC-DC Converter
- Battery Management System(BMS)
- Printed Circuit Board For Control Circuit
- Uninterrupible Power Supplies(UPS)

**Diagram:**




**Polarity:**




***100% UIS TESTED**

***100% ΔVDS TESTED**

### Product Summary

| | | |
|---|---|---|
| VDS Min.@$T_j$ | -50 | **V** |
| $I_D$ Min.@Ta | -0.13 | **A** |
| RDS(ON)(TYP)@-10V | 3600 | **mΩ** |

### Absolute Maximum Ratings (Ta=25℃ Unless Otherwise Specified )

| Parameter | Test Conditions | Symbol | Ratings | Unit |
|---|---|---|---|---|
| Drain-Source Voltage | | $V_{DS}$ | -50 | V |
| Gate-Source Voltage | | $V_{GS}$ | ±20 | V |
| Continuous Drain Current (Note 1) | Ta= 25 ℃<br>Ta= 100 ℃ | $I_D$ | -0.13<br>-0.08 | A |
| Drain Current-Pulse (Note 1) | $T_J$< 150 ℃ | $I_{DM}$ | -0.52 | A |
| Maximum Power Dissipation Power<br>Dissipation Derating Factor Above 25℃ | Ta= 25 ℃<br>Ta= 100 ℃ | $P_D$ | 224<br>90 | mW |
| Derating Factor | | $D_F$ | 1.79 | mW/℃ |

### Thermal Characteristcs (Ta=25℃ Unless Otherwise Specified)

| Parameter | Test Conditions | Symbol | Typ. | Unit |
|---|---|---|---|---|
| Junction Temperature | | $T_J$ | -55 to 150 | ℃ |
| Storage Temperature Range | | $T_{STD}$ | -55 to 150 | ℃ |
| Thermal Resistance Junction To Ambient<br>With Steady-State | Still Air Environment<br>With Ta=25℃ | $R_{\theta JA}$ | 556 | ℃/W |

Notes: 1.Pulse Width Limited By Max. Junction Temperature. (See Fig.14)

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## P-Channel Enhancement Mode Trench Power MOSFET

Pb Pb-Free RoHS COMPLIANT

### Electrical Characteristcs (Ta=25℃ Unless Otherwise Specified )

| Parameter | Test Conditions | Symbol | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| **Static Off Characteristics** | | | | | | |
| Drain-Source Breakdown Voltage | VGS=0V,ID=250uA | $BV_{DSS}$ | -50 | -- | -- | V |
| Bvdss Temperature Coefficient | ID=250uA,Reference25℃ | $\Delta BV_{DSS}/\Delta T_J$ | -- | 0.06 | -- | V/℃ |
| Drain-Source Leakage Current | VDS= -50 V,VGS=0V | $I_{DSS}$ | -- | -- | -1 | uA |
| Gate-Body Leakage Current | VGS= ±20 V,VDS=0V | $I_{GSS}$ | -- | -- | ±100 | nA |
| **Static On Characteristics** | | | | | | |
| Gate Threshold Voltage | VGS= VDS ID=-250uA | $V_{GS(TH)}$ | -1 | -1.4 | -2 | V |
| Drain-Source On Resistance | ID= -0.1 A,VGS= -10.0 V<br>ID= -0.1 A,VGS= -5.0 V | $R_{DS(ON)}$ | --<br>-- | 3600<br>5220 | 5000<br>7500 | mΩ |
| **Dynamic Characteristics** | | | | | | |
| Input Capacitance | VDS= -25 V<br>VGS= 0 V<br>F= 1 MHZ | $C_{iss}$ | -- | 44 | -- | pF |
| Output Capacitance | | $C_{oss}$ | -- | 3.2 | -- | pF |
| Reverse Transfer Capacitance | | $C_{rss}$ | -- | 2.1 | -- | pF |
| **Switching Paramters With Inductive Load(Test Circuit & Waveform See Fig.15)** | | | | | | |
| Turn-On Delay Time | VDS= -25 V<br>VGS= -10.0 V<br>RG= 10.0 Ω | $t_{d(on)}$ | -- | 8.8 | -- | ns |
| Turn-On Rise Time | | $t_r$ | -- | 21 | -- | ns |
| Turn-Off Delay Time | | $t_{d(off)}$ | -- | 17 | -- | ns |
| Turn-Off Rise Time | | $t_f$ | -- | 79 | -- | ns |
| **Gate Charge Paramters (Test Circuit & Waveform See Fig.16)** | | | | | | |
| Total Gate Charge | VDS= -25 V<br>VGS= -10.0 V<br>ID= -0.1 A | $Q_g$ | -- | 1.8 | -- | nC |
| Gate-Source Charge | | $Q_{gs}$ | -- | 0.6 | -- | nC |
| Gate-Drain Charge | | $Q_{gd}$ | -- | 0.2 | -- | nC |
| **Drain-Source Diode Characteristics And Maximum Ratings (Test Circuit & Waveform See Fig.18)** | | | | | | |
| Max. Diode Forward Current | | $I_S$ | -- | -- | -0.1 | A |
| Max. Pulsed Forward Current | | $I_{SM}$ | -- | -- | -1 | A |
| Diode Forward Voltage | ID= -0.1 A,VGS=0V | $V_{SD}$ | -- | -0.7 | -1.2 | V |

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## Typical Characteristics Curves

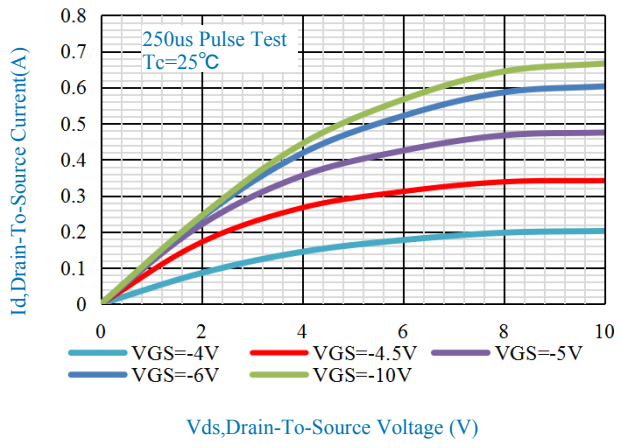



Fig.1-Output Characteristic

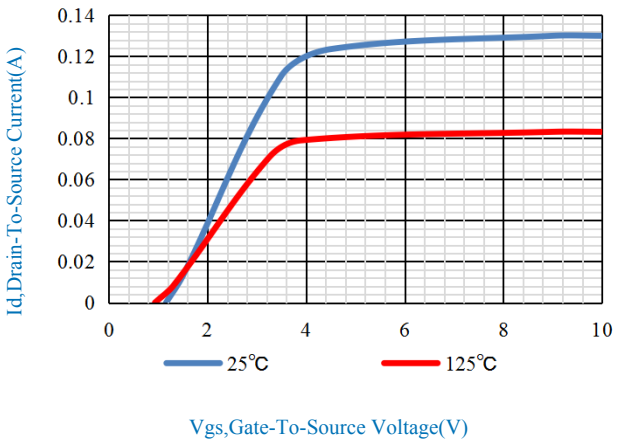



Fig.2-Transfer Characteristic

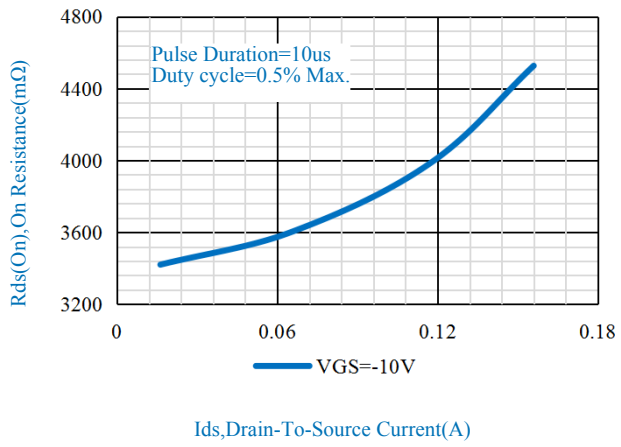



Fig.3-On Resistance Vs. Drain Current

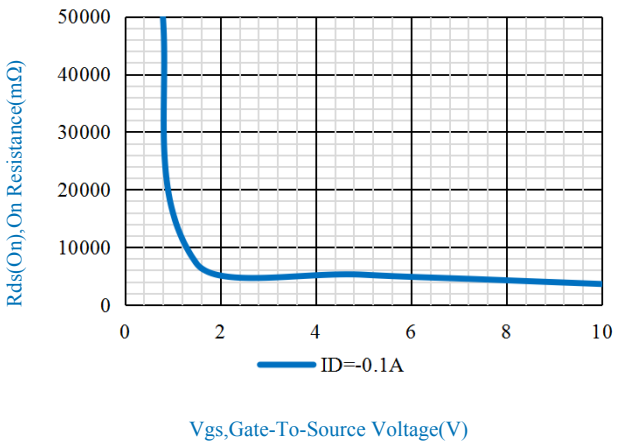



Fig.4-On Resistance Vs. Gate Source Voltage

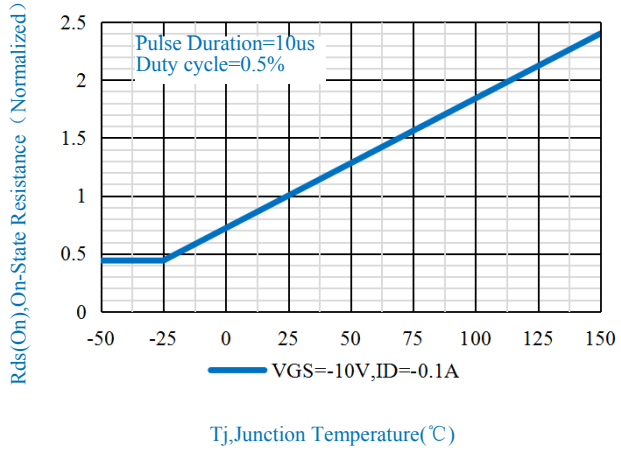



Fig.5-On Resistance Vs. Junction Temperature

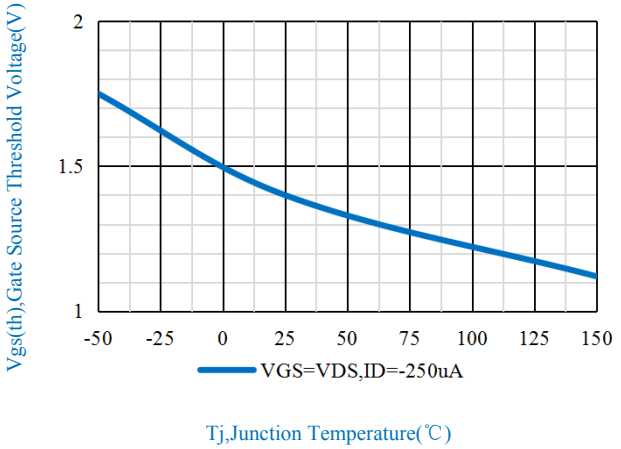



Fig.6-Gate Source Threshold Voltage Vs. Junction Temperature

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## Typical Characteristics Curves

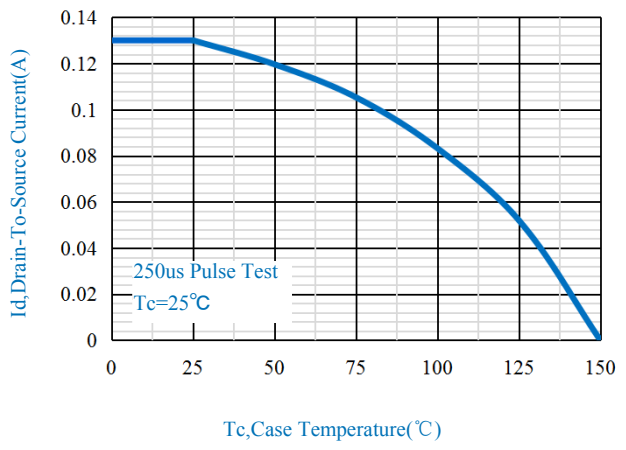



Fig.7-Maximum Continuous Drain Current Vs. Case Temperature

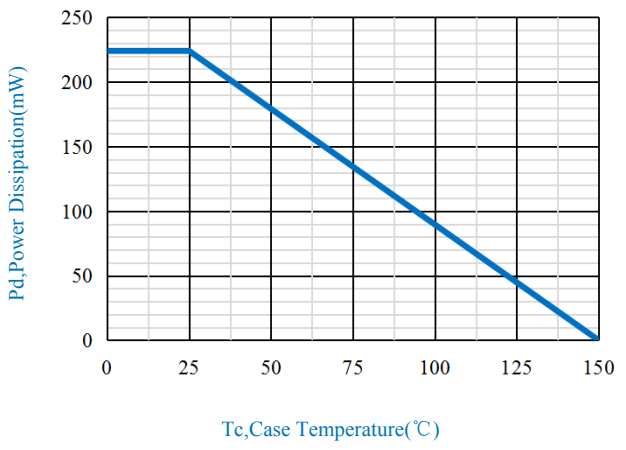



Fig.8-Maximum Power Dissipation Vs. Case Temperature

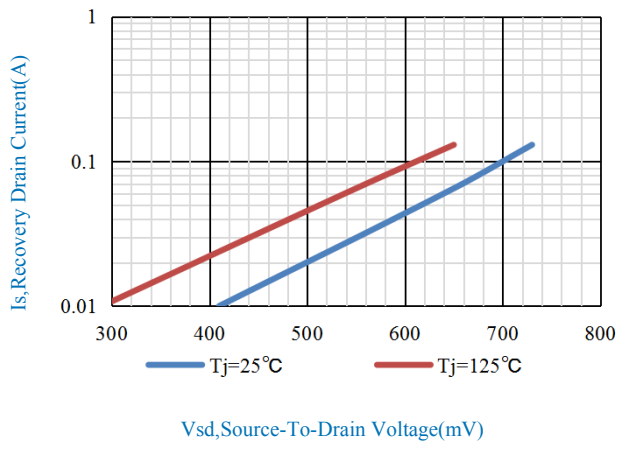



Fig.9-Source-To-Drain Diode Forward Voltage

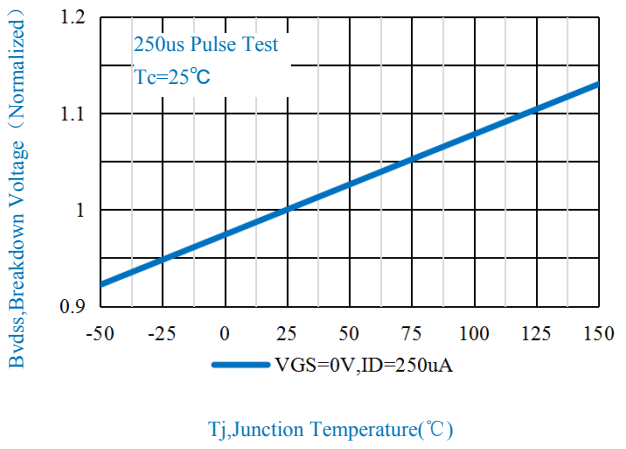



Fig.10-Breakdown Voltage Vs. Junction Temperature

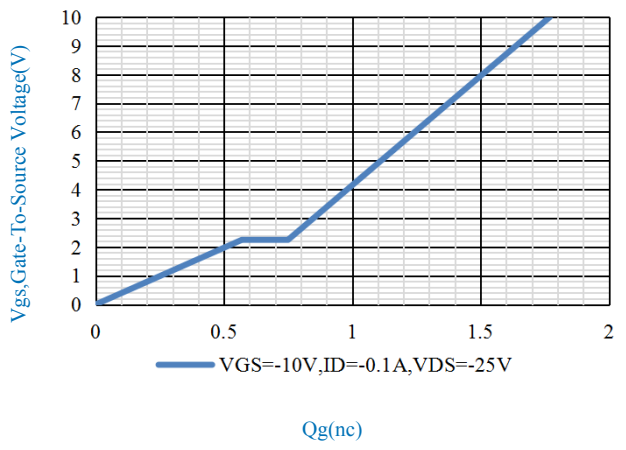



Fig.11-Gate Charge Waveform

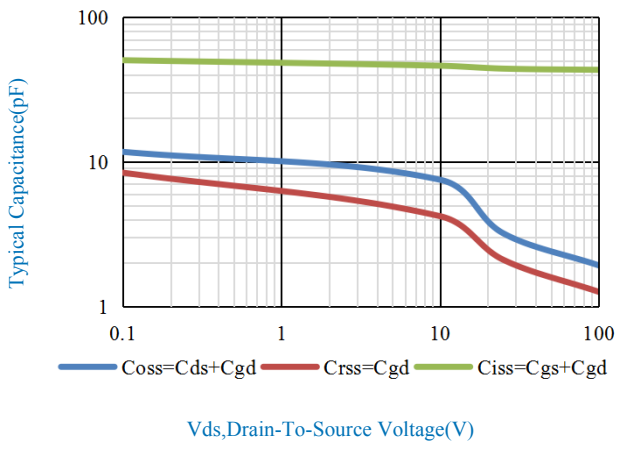



Fig.12-Typical Capacitance Vs. Drain-To-Source Voltage

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## Typical Characteristics Curves

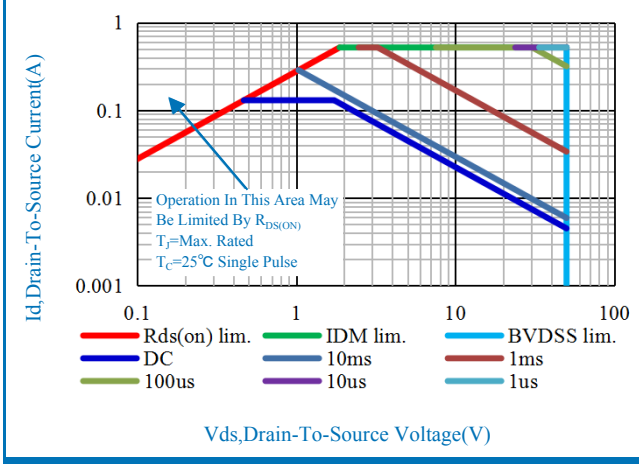



Fig.13-Maximum Safe Operating Area(SOA)

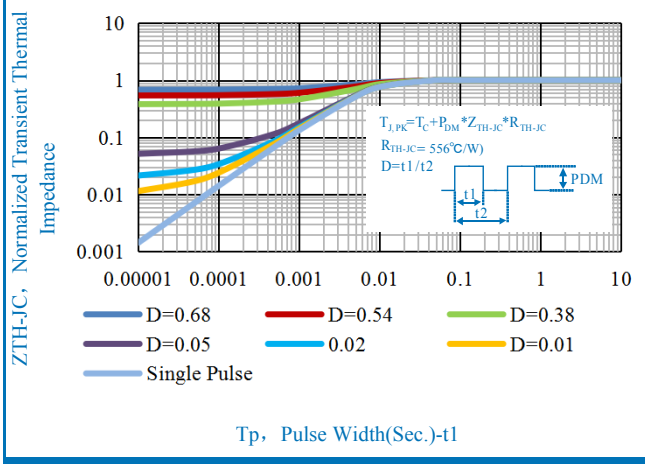
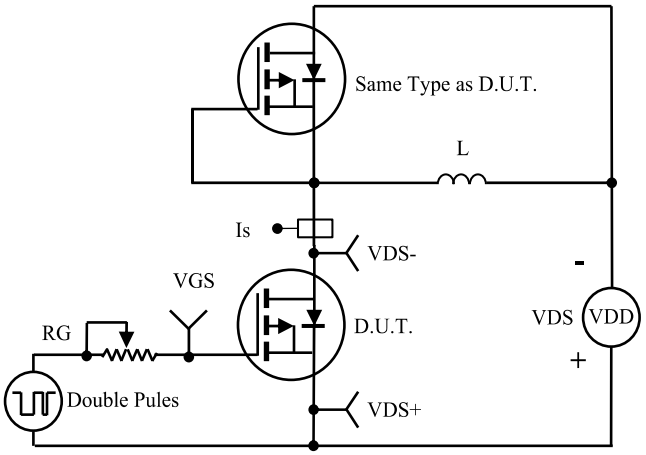



Fig.14- Normalized Maximum Transient Thermal Impedance Vs.Pulse Width

## Inductive Load Test Circuit & Waveform



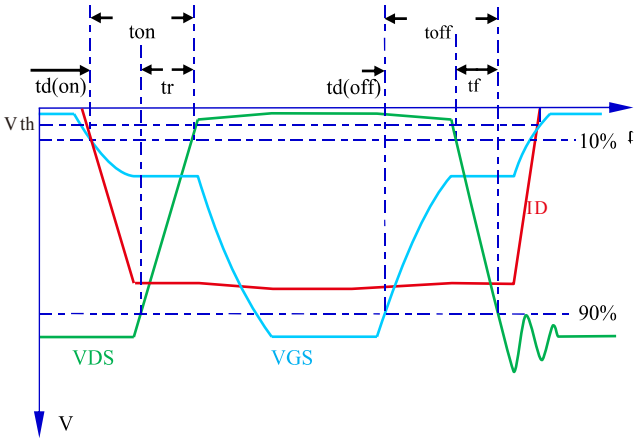



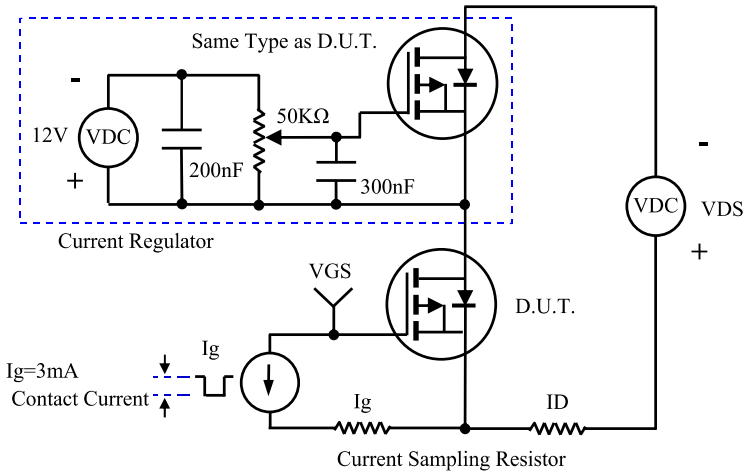

Fig.15- Inductive Switching Test Circuit & Waveform

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## Test Circuit & Waveform



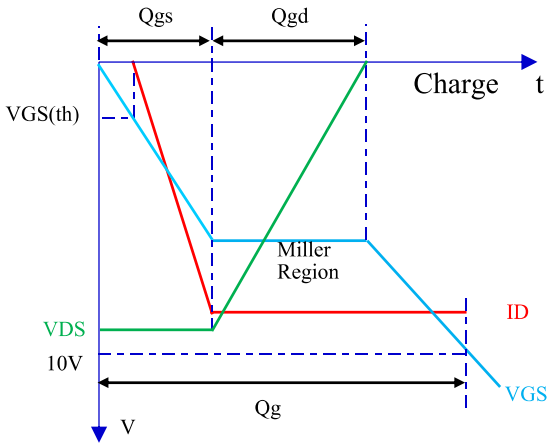
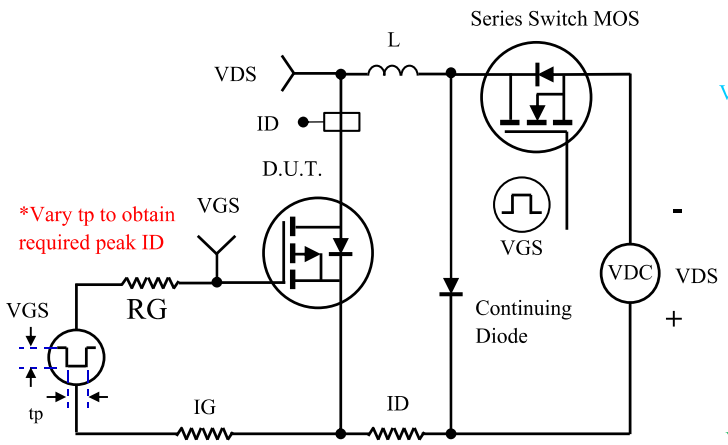




Fig.16-Gate Charge Test Circuit & Waveform



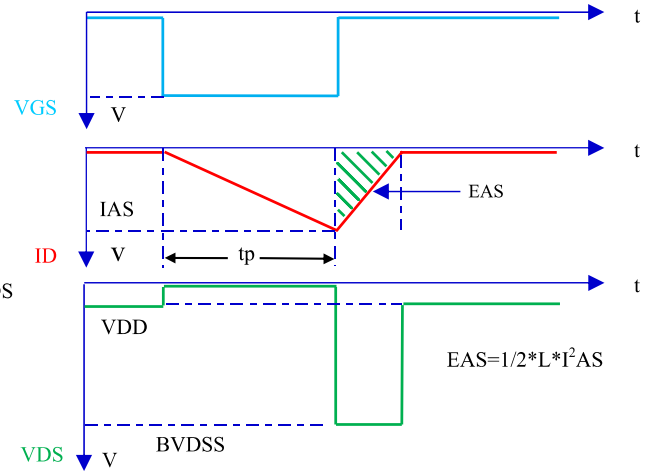
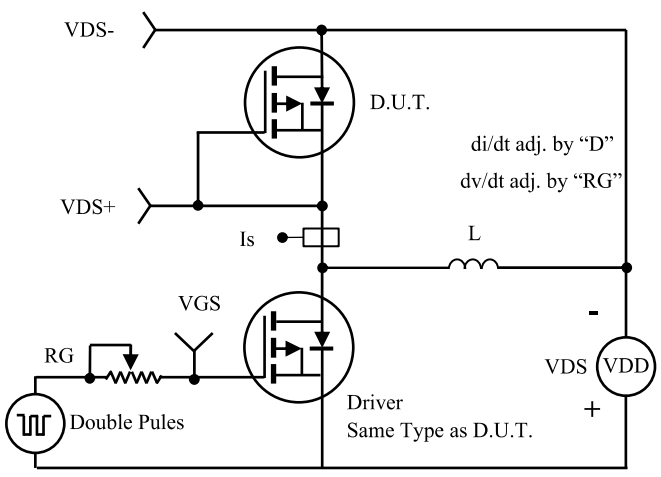




Fig.17- Unclamped Inductive Switching (UIS) Test Circuit & Waveform



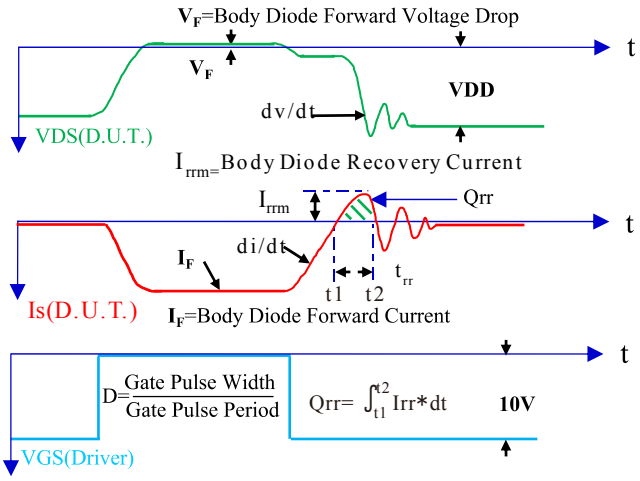



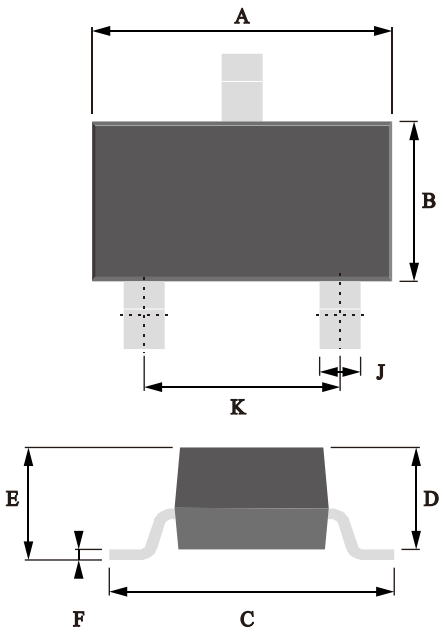

Fig.18- Diode Recovery Test Circuit & Waveform

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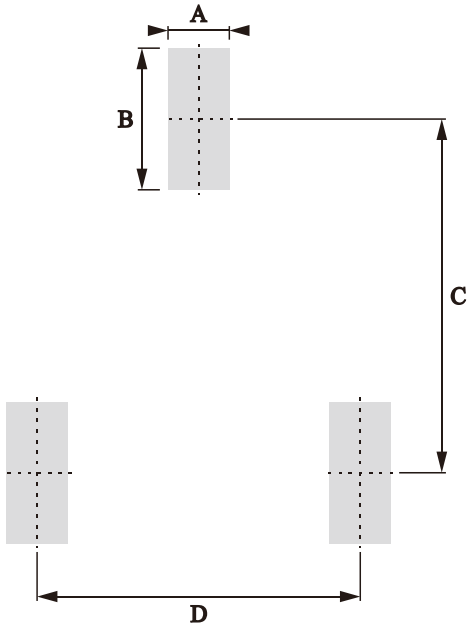
## OUTLINE DRAWINGS




## BSS84

| OUTLINE DIMENSIONS | | | | | | |
|---|---|---|---|---|---|---|
| Dim. | Milimeters | | | Inches | | |
| | Min. | Typ. | Max. | Min. | Typ. | Max. |
| A | 2.80 | - | 3.20 | 0.1102 | - | 0.1260 |
| B | 1.15 | - | 1.45 | 0.0453 | - | 0.0571 |
| C | 2.25 | - | 2.65 | 0.0886 | - | 0.1043 |
| D | 0.85 | - | 1.15 | 0.0335 | - | 0.0453 |
| E | 0.90 | - | 1.20 | 0.0354 | - | 0.0472 |
| F | 0.08 | - | 0.18 | 0.0031 | - | 0.0071 |
| J | 0.30 | - | 0.50 | 0.0118 | - | 0.0197 |
| K | 1.70 | - | 2.10 | 0.0669 | - | 0.0827 |

## RECOMMEDNED LAYOUT DRAWINGS




## BSS84

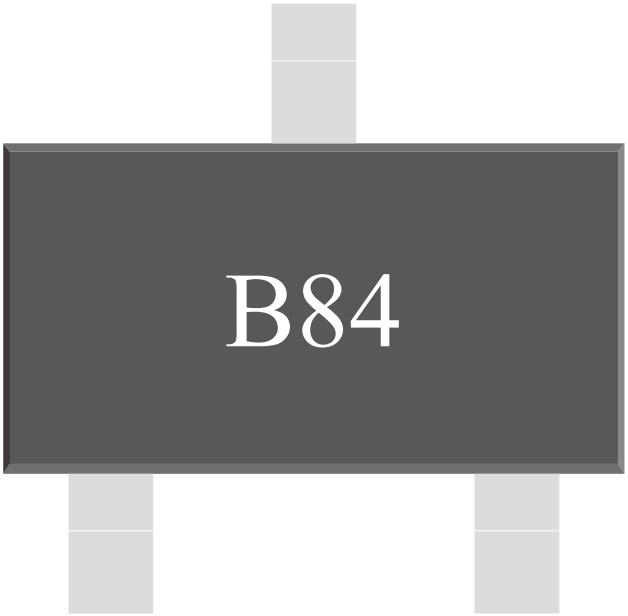
| OUTLINE DIMENSIONS | | | | | | |
|---|---|---|---|---|---|---|
| Dim. | Milimeters | | | Inches | | |
| | Min. | Typ. | Max. | Min. | Typ. | Max. |
| A | - | 0.60 | - | - | 0.0000 | - |
| B | - | 0.80 | - | - | 0.0315 | - |
| C | - | 2.00 | - | - | 0.0787 | - |
| D | - | 1.90 | - | - | 0.0748 | - |

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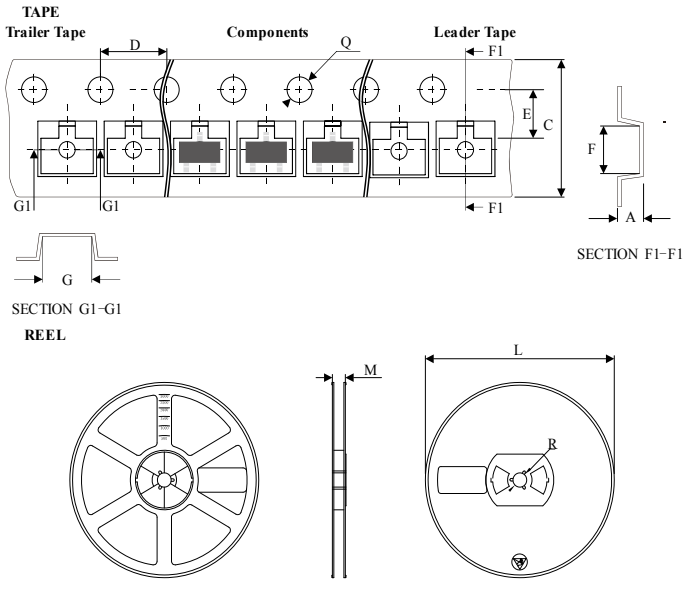
## MARKING




## MARKING INSTRUCTION

**B84=MarK**

## PACKAGING




## SOT-23

| OUTLINE DIMENSIONS | | | | | | |
|---|---|---|---|---|---|---|
| Dim. | Milimeters | | | Inches | | |
| | Min. | Typ. | Max. | Min. | Typ. | Max. |
| **TAPE** | | | | | | |
| A | 1.12 | - | 1.32 | 0.0441 | - | 0.0520 |
| C | 7.90 | - | 8.10 | 0.3110 | - | 0.3189 |
| D | 3.70 | - | 4.30 | 0.1457 | - | 0.1693 |
| E | 3.40 | - | 3.60 | 0.1339 | - | 0.1417 |
| F | 2.67 | - | 2.87 | 0.1051 | - | 0.1130 |
| G | 3.05 | - | 3.25 | 0.1201 | - | 0.1280 |
| Q Φ | 1.40 | - | 1.60 | 0.0551 | - | 0.0630 |
| **REEL** | | | | | | |
| L Φ | 176.00 | - | 180.00 | 6.929 | - | 7.087 |
| R | 12.00 | - | 14.00 | 0.4724 | - | 0.5512 |
| M | 11.00 | - | 13.00 | 0.4331 | - | 0.5118 |

## PACKING INFORMATION

| Package Type | Package Code | Productor Weight Approx(g/Pcs) | Package Method | Quantity (Pcs/Min. Pack.) | Quantity (Pcs/Inner Box) | Quantity (Pcs/Carton) |
|---|---|---|---|---|---|---|
| SOT-23 | P1 | 0.008 | 7" Reel | 3000 | 45000 | 180000 |

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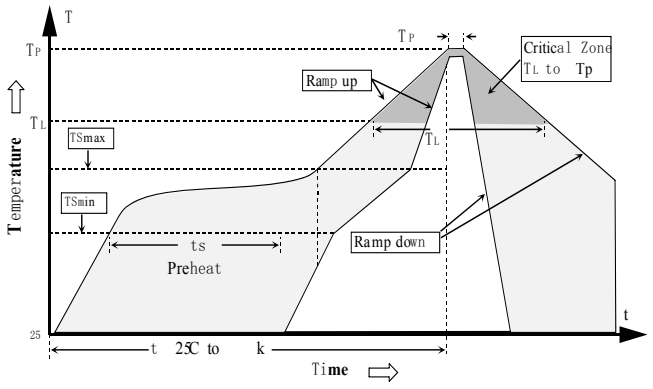
P-Channel Enhancement Mode Trench Power MOSFET

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## Recommended wave soldering condition

| Product | Peak Temperature | Soldering Time |
|---|---|---|
| Pb-free devices | 260 +0/-5 °C | 5 +1/-1 seconds |

## Recommended temperature profile for IR reflow




| Profile feature | Sn-Pb eutectic Assembly | Pb-free Assembly |
|---|---|---|
| Average ramp-up rate (Tsmax to Tp) | 3°C/second max. | 3°C/second max. |
| Preheat−Temperature Min (TS min)<br>−Temperature Max (TS max)<br>−Time(ts min to ts max) | 100°C<br>150°C<br>60-120 seconds | 150°C<br>200°C<br>60-180 seconds |
| Time maintained above:<br>−Temperature (TL)<br>− Time (tL) | 183°C<br>60-150 seconds | 217°C<br>60-150 seconds |
| Peak Temperature(TP) | 240 +0/-5 °C | 260 +0/-5 °C |
| Time within 5°C of actual peak temperature (tp) | 10-30 seconds | 20-40 seconds |
| Ramp down rate | 6°C/second max. | 6°C/second max. |
| Time 25 °C to peak temperature | 6 minutes max. | 8 minutes max. |

Note : All temperatures refer to topside of the package, measured on the package body surface.

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Pb Pb-Free RoHS COMPLIANT

## Specification Revision History

| Rev. | Date | Changed Items | Pre-Changed Content | Changed Content |
|---|---|---|---|---|
| A/1 | 2014-10-20 | First Issue | | |

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