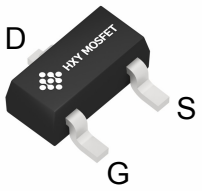
# SI2399DS-T1-BE3

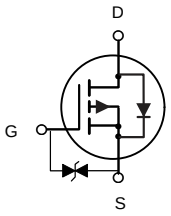
P-Channel Enhancement Mode MOSFET

## Description

The SI2399DS-T1-BE3 uses advanced trench technology to provide excellent $R_{DS(ON)}$, low gate charge and operation with gate voltages as low as1.8V. This device is suitable for use as a load switch or in PWM applications .It is ESD protested.




**SOT-23**




P-Channel MOSFET

## General Features

$V_{DS}$ = -20V,$I_D$ =-5A

$R_{DS(ON)}$ < 40mΩ @ $V_{GS}$=-4.5V

$R_{DS(ON)}$ < 60mΩ @ $V_{GS}$=-2.5V

ESD Rating: 1500V HBM

## Application

PWM application

Load switch

## Package Marking and Ordering Information

| Product ID | Pack | Marking | Qty(PCS) |
|---|---|---|---|
| SI2399DS-T1-BE3 | SOT-23 | 3415/AF4E | 3000 |

## Absolute Maximum Ratings ($T_A$=25°C unless otherwise noted)

| Symbol | Parameter | Limit | Unit |
|---|---|---|---|
| $V_{DS}$ | Drain-Source Voltage | -20 | V |
| $V_{GS}$ | Gate-Source Voltage | ±10 | V |
| $I_D$ | Drain Current-Continuous | -5 | A |
| $I_{DM}$ | Drain Current-Pulsed (Note 1) | -30 | A |
| $P_D$ | Maximum Power Dissipation | 1.4 | W |
| $T_J$,$T_{STG}$ | Operating Junction and Storage Temperature Range | -55 To 150 | ℃ |
| $R_{\theta JA}$ | Thermal Resistance,Junction-to-Ambient (Note 2) | 89.3 | ℃/W |

## Electrical Characteristics (TA=25°C unless otherwise noted)

| Parameter | Symbol | Condition | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **Off Characteristics** | | | | | | |
| Drain-Source Breakdown Voltage | $BV_{DSS}$ | $V_{GS}$=0V $I_D$=-250μA | -20 | | - | V |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | $V_{DS}$=-20V,$V_{GS}$=0V | - | - | 1 | μA |
| Gate-Body Leakage Current | $I_{GSS}$ | $V_{GS}$=±10V,$V_{DS}$=0V | - | - | ±10 | μA |
| **On Characteristics (Note 3)** | | | | | | |
| Gate Threshold Voltage | $V_{GS(th)}$ | $V_{DS}$=$V_{GS}$,$I_D$=-250μA | -0.35 | -0.55 | -0.9 | V |
| Drain-Source On-State Resistance | $R_{DS(ON)}$ | $V_{GS}$=-4.5V, $I_D$=-4A | - | 30 | 40 | mΩ |
| | | $V_{GS}$=-2.5V, $I_D$=-4A | - | 44 | 60 | mΩ |
| Forward Transconductance | $g_{FS}$ | $V_{DS}$=-5V,$I_D$=-4A | 8 | - | - | S |
| **Dynamic Characteristics (Note4)** | | | | | | |
| Input Capacitance | $C_{lss}$ | $V_{DS}$=-10V,$V_{GS}$=0V, F=1.0MHz | - | 950 | - | PF |
| Output Capacitance | $C_{oss}$ | | - | 165 | - | PF |
| Reverse Transfer Capacitance | $C_{rss}$ | | - | 120 | - | PF |
| **Switching Characteristics (Note 4)** | | | | | | |
| Turn-on Delay Time | $t_{d(on)}$ | $V_{DD}$=-10V,$R_L$=2. 5Ω $V_{GS}$=-4.5V,$R_{GEN}$=3Ω | - | 12 | | nS |
| Turn-on Rise Time | $t_r$ | | - | 10 | | nS |
| Turn-Off Delay Time | $t_{d(off)}$ | | - | 19 | | nS |
| Turn-Off Fall Time | $t_f$ | | - | 25 | | nS |
| Total Gate Charge | $Q_g$ | $V_{DS}$=-10V,$I_D$=-4A, $V_{GS}$=-4.5V | - | 12 | | nC |
| Gate-Source Charge | $Q_{gs}$ | | - | 1.4 | - | nC |
| Gate-Drain Charge | $Q_{gd}$ | | - | 3.6 | - | nC |
| **Drain-Source Diode Characteristics** | | | | | | |
| Diode Forward Voltage (Note 3) | $V_{SD}$ | $V_{GS}$=0V,$I_S$=-4A | - | - | -1.2 | V |
| Diode Forward Current (Note 2) | $I_S$ | | - | - | -4 | A |

## Notes:

**1.** Repetitive Rating: Pulse width limited by maximum junction temperature.
**2.** Surface Mounted on FR4 Board, t ≤ 10 sec.
**3.** Pulse Test: Pulse Width ≤ 300μs, Duty Cycle ≤ 2%.
**4.** Guaranteed by design, not subject to production

## Typical Electrical And Thermal Characteristics

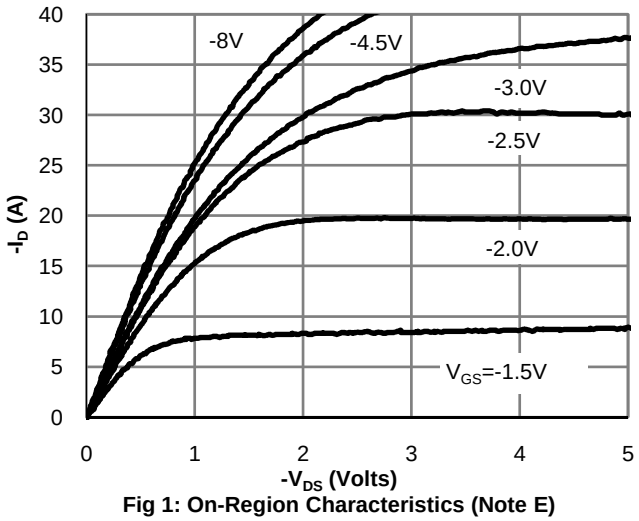



Fig 1: On-Region Characteristics (Note E)

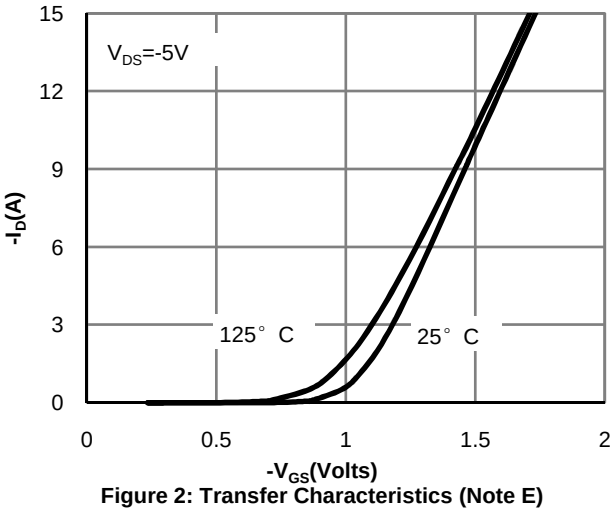



Figure 2: Transfer Characteristics (Note E)

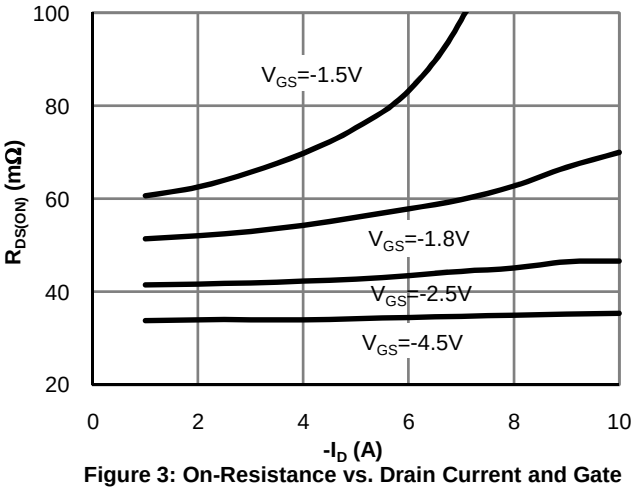



Figure 3: On-Resistance vs. Drain Current and Gate Voltage (Note E)

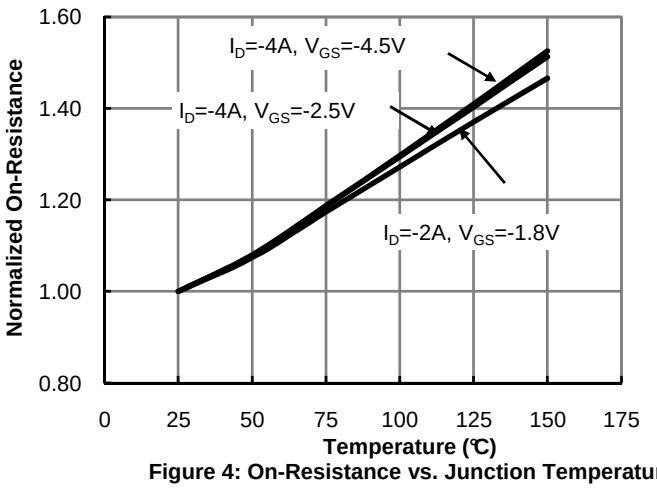



Figure 4: On-Resistance vs. Junction Temperature (Note E)

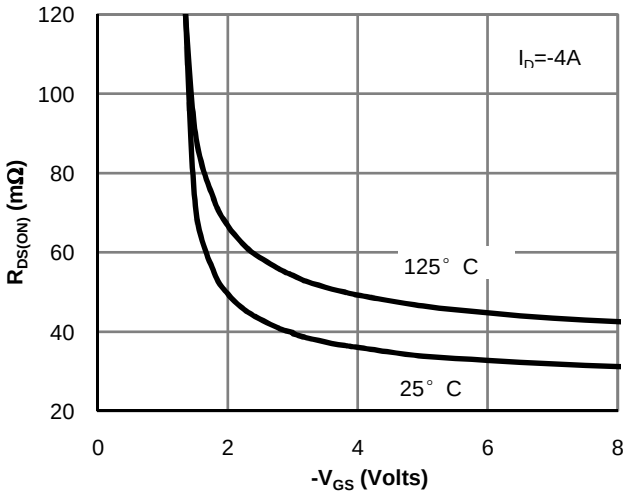



Figure 5: On-Resistance vs. Gate-Source Voltage (Note E)

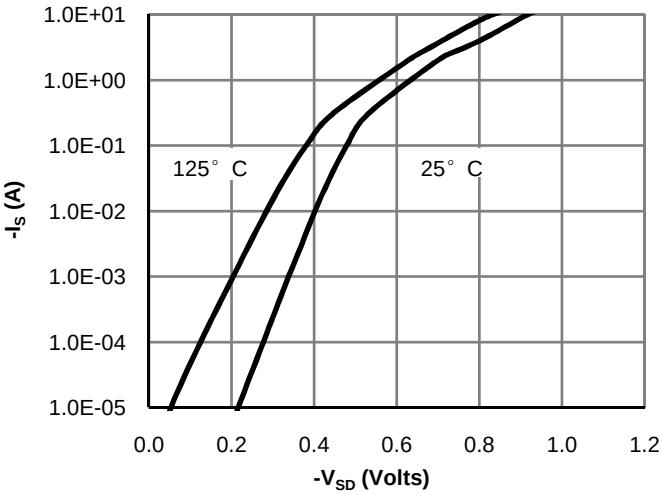



Figure 6: Body-Diode Characteristics (Note E)

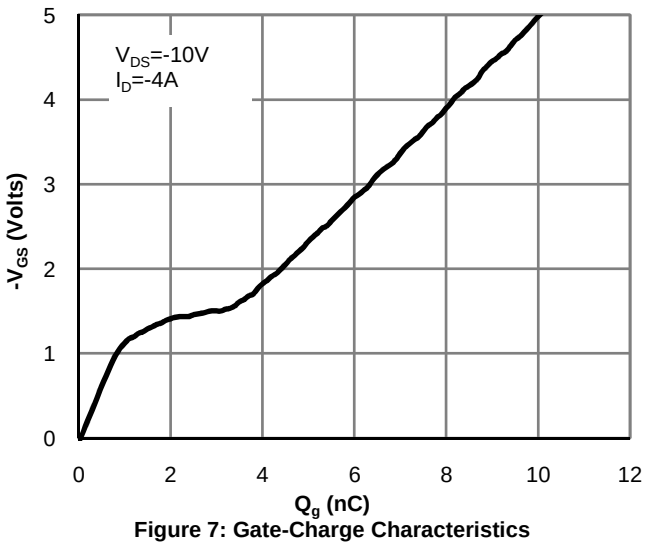



**Figure 7: Gate-Charge Characteristics**

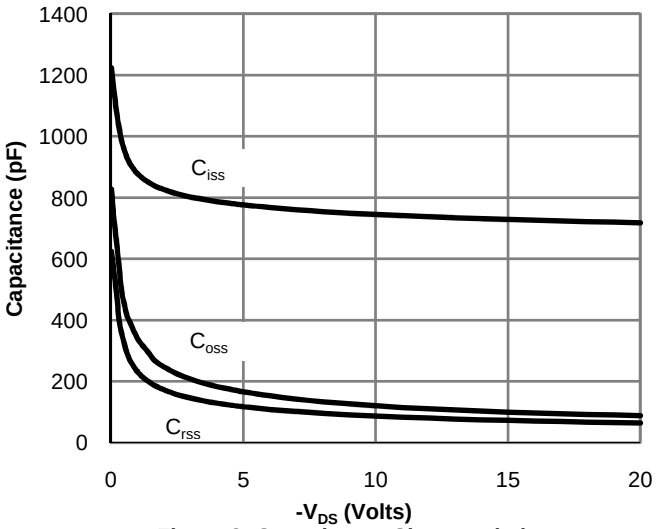



**Figure 8: Capacitance Characteristics**

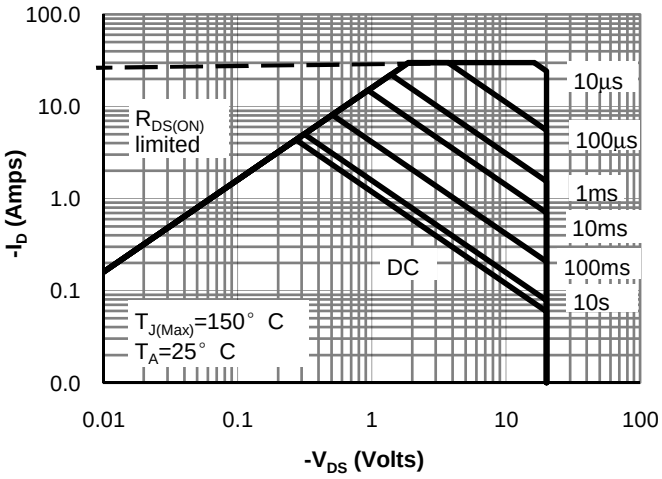



**Figure 9: Maximum Forward Biased Safe Operating Area (Note F)**

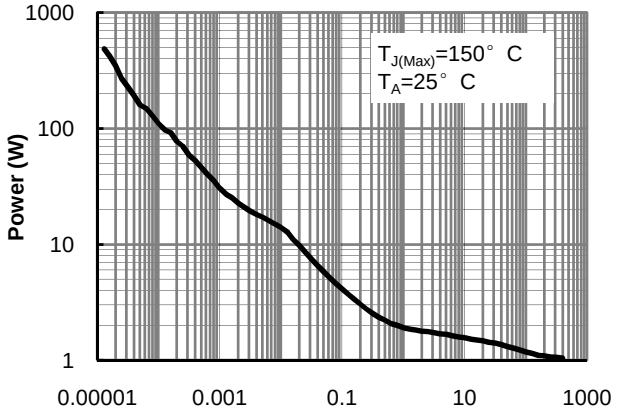



**Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note F)**

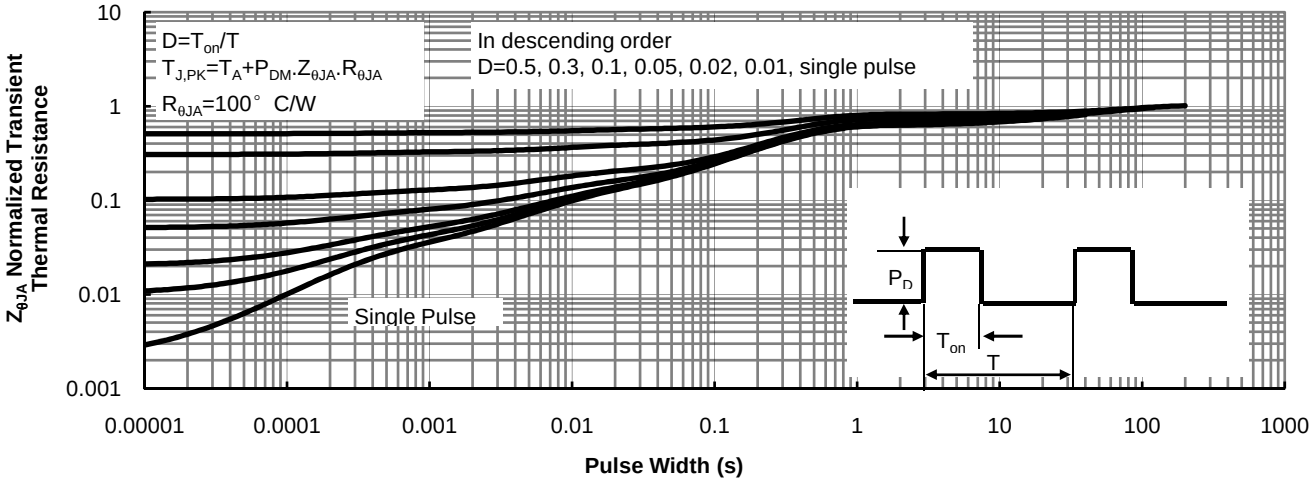
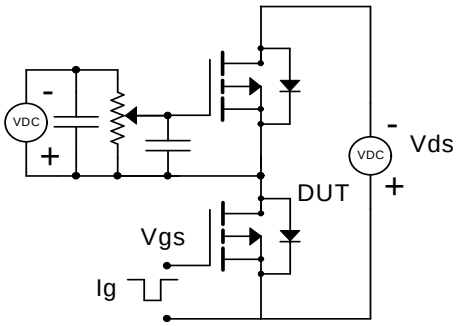
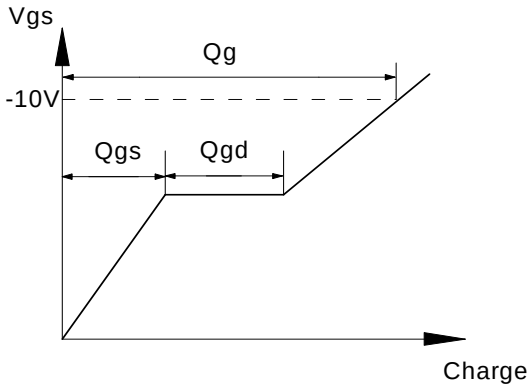


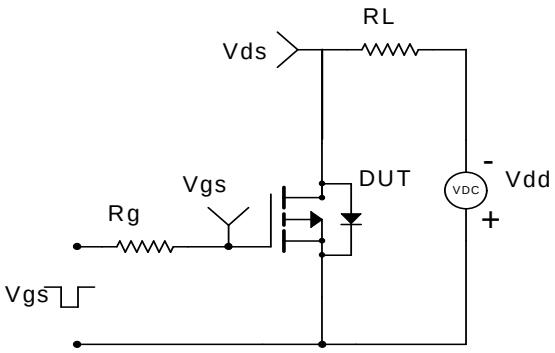

**Figure 11: Normalized Maximum Transient Thermal Impedance (Note F)**

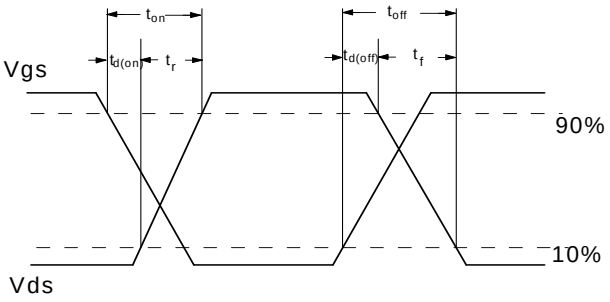
## Gate Charge Test Circuit & Waveform



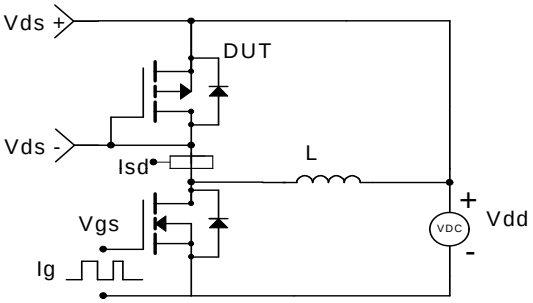



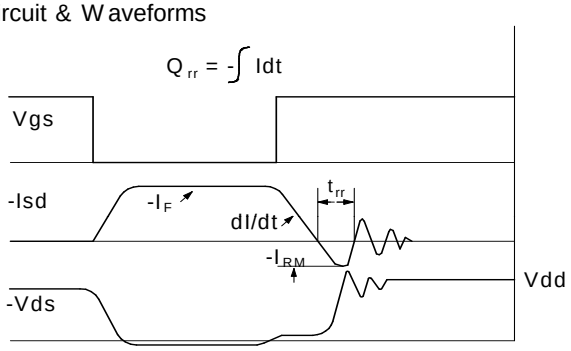

## Resistive Switching Test Circuit & Waveforms



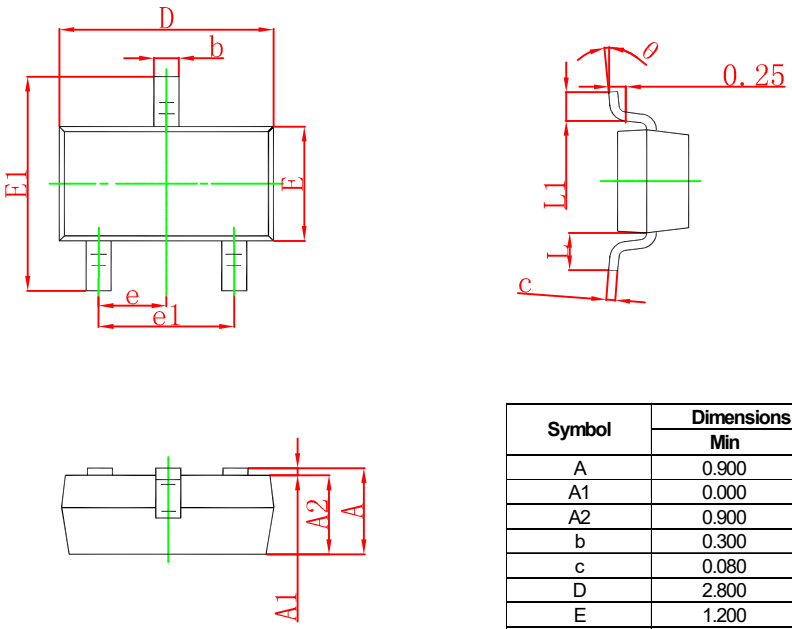




## Diode Recovery Test Circuit & Waveforms



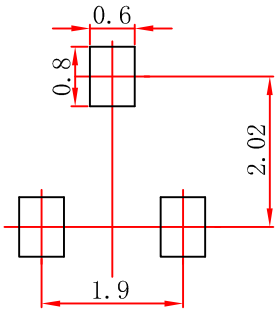



## SOT-23 Package Outline Dimensions




| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|---|---|---|---|---|
| | Min | Max | Min | Max |
| A | 0.900 | 1.150 | 0.035 | 0.045 |
| A1 | 0.000 | 0.100 | 0.000 | 0.004 |
| A2 | 0.900 | 1.050 | 0.035 | 0.041 |
| b | 0.300 | 0.500 | 0.012 | 0.020 |
| c | 0.080 | 0.150 | 0.003 | 0.006 |
| D | 2.800 | 3.000 | 0.110 | 0.118 |
| E | 1.200 | 1.400 | 0.047 | 0.055 |
| E1 | 2.250 | 2.550 | 0.089 | 0.100 |
| e | 0.950 TYP | | 0.037 TYP | |
| e1 | 1.800 | 2.000 | 0.071 | 0.079 |
| L | 0.550 REF | | 0.022 REF | |
| L1 | 0.300 | 0.500 | 0.012 | 0.020 |
| θ | 0° | 8° | 0° | 8° |

## SOT-23 Suggested Pad Layout




Note:
1.Controlling dimension:in millimeters.
2.General tolerance:± 0.05mm.
3.The pad layout is for reference purposes only.

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