

**-4.5A, -20V P-Channel Power MOSFET**

**GENERAL DESCRIPTION**

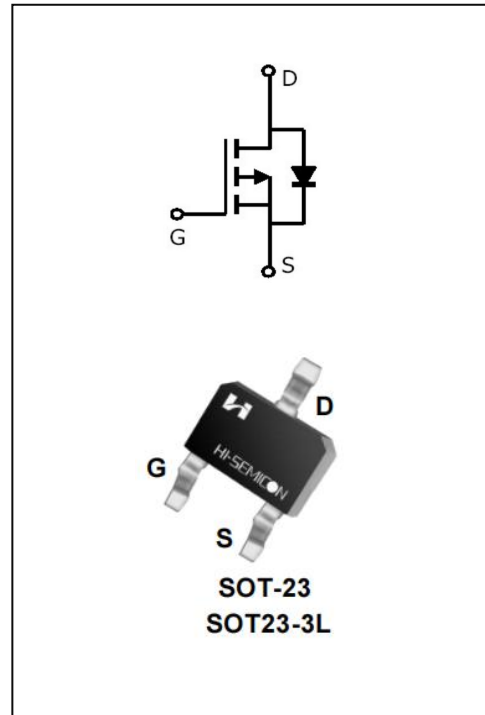
The Power MOSFET has extremely low on resistance, making it especially suitable for applications which require superior power density and outstanding efficiency.

**Features**

- ◆  $V_{DS}=-20V, I_D=-4.5A$
- ◆  $R_{DS(ON)}$   
 TYP:31mΩ@ $V_{GS}= -4.5V$   
 TYP:43mΩ@ $V_{GS}= -2.5V$

**Applications**

- ◆ Power faction correction (PFC)
- ◆ Switched mode power supplies (SMPS)
- ◆ Uninterruptible power supply (UPS)
- ◆ LED lighting power



**ORDERING INFORMATION**

| Part No. | Package             | Marking | Material | Packing |
|----------|---------------------|---------|----------|---------|
| SFS2305  | SOT-23<br>SOT-23-3L | 2305    | Pb Free  | Reel    |

## ABSOLUTE MAXIMUM RATINGS (T<sub>J</sub>=25°C unless otherwise noted)

| Characteristics   |                       | Symbol           | Ratings  | Unit |
|---|-----------------------|------------------|----------|------|
| Drain-Source Voltage  |                       | V <sub>DS</sub>  | -20      | V    |
| Gate-Source Voltage   |                       | V <sub>GS</sub>  | ±12      | V    |
| Drain Current   | T <sub>C</sub> = 25°C | I <sub>D</sub>   | -4.5     | A    |
|   | T <sub>C</sub> = 75°C |                  | -3.6     |      |
| Drain Current Pulsed(Note 1)  |                       | I <sub>DM</sub>  | -18      | A    |
| Power Dissipation(T <sub>C</sub> =25°C)<br>-Derate above 25°C                 |                       | P <sub>D</sub>   | 1.7      | W    |
| Single Pulsed Avalanche Energy (Note 2)                                       |                       | E <sub>AS</sub>  | 40.5     | mJ   |
| Operation Junction Temperature Range  |                       | T <sub>J</sub>   | -55~+150 | °C   |
| Storage Temperature Range   |                       | T <sub>stg</sub> | -55~+150 | °C   |
| Maximum lead temperature for soldering purposes, 1/8" from case for 5 seconds |                       | TL               | 300      | °C   |

## ELECTRICAL CHARACTERISTICS

| Characteristics                          | Symbol              | Test conditions  | Min.  | Typ.  | Max.  | Unit |
|--|---------------------|--|-------|-------|-------|------|
| <b>Off Characteristics</b>               |                     |  |       |       |       |      |
| Drain -Source Breakdown Voltage          | B <sub>VDS</sub>    | V <sub>GS</sub> = 0V, I <sub>D</sub> = -250μA  | -20   | --    | --    | V    |
| Drain-Source Leakage Current             | I <sub>DSS</sub>    | V <sub>DS</sub> = -20V, V <sub>GS</sub> = 0V   | --    | --    | 1     | uA   |
| Gate-Source Leakage Current              | I <sub>GSS</sub>    | V <sub>GS</sub> = 12V, V <sub>DS</sub> = 0V  | --    | --    | 100   | nA   |
| Gate-Source Leakage Current              | I <sub>GSS</sub>    | V <sub>GS</sub> = -12V, V <sub>DS</sub> = 0V   | --    | --    | -100  |      |
| <b>On Characteristics</b>                |                     |  |       |       |       |      |
| Gate Threshold Voltage                   | V <sub>GS(th)</sub> | V <sub>GS</sub> = V <sub>DS</sub> , I <sub>D</sub> = -250μA  | -0.45 | -0.72 | -0.85 | V    |
| Static Drain- Source On State Resistance | R <sub>DSON</sub>   | V <sub>GS</sub> = -4.5V, I <sub>D</sub> = -3.0A  | --    | 31    | 42    | mΩ   |
|  |                     | V <sub>GS</sub> = -2.5V, I <sub>D</sub> = -3.0A  | --    | 43    | 52    |      |
|  |                     | V <sub>GS</sub> = -1.8V, I <sub>D</sub> = -2.0A  | --    | 70    | 90    |      |
| <b>Dynamic Characteristics</b>           |                     |  |       |       |       |      |
| Input Capacitance                        | C <sub>iss</sub>    | V <sub>DS</sub> = -10V   | --    | 715   | --    | pF   |
| Output Capacitance                       | C <sub>oss</sub>    | V <sub>GS</sub> = 0V   | --    | 160   | --    |      |
| Reverse Transfer Capacitance             | C <sub>rss</sub>    | f=1.0MHZ   | --    | 110   | --    |      |
| <b>Switching Characteristics</b>         |                     |  |       |       |       |      |
| Turn-on Delay Time                       | t <sub>d(on)</sub>  | V <sub>DD</sub> = -4.5V, V <sub>GS</sub> = -4.5V<br>R <sub>G</sub> = 6Ω , I <sub>D</sub> = -3.0A<br>(Note 3.4) | --    | 14.3  | --    | nS   |
| Turn-on Rise Time                        | t <sub>r</sub>      |  | --    | 31.2  | --    |      |
| Turn-off Delay Time                      | t <sub>d(off)</sub> |  | --    | 28.6  | --    |      |
| Turn-off Fall Time                       | t <sub>f</sub>      |  | --    | 11.5  | --    |      |
| Total Gate Charge                        | Q <sub>g</sub>      | V <sub>DS</sub> =-4.5V, I <sub>D</sub> =-3A<br>V <sub>GS</sub> =-4.5V<br>(Note 3.4)                            | --    | 9.2   | --    | nC   |
| Gate-Source Charge                       | Q <sub>gs</sub>     |  | --    | 3.5   | --    |      |
| Gate-Drain Charge                        | Q <sub>gd</sub>     |  | --    | 2.1   | --    |      |

**SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS**

| Characteristics           | Symbol   | Test conditions   | Min. | Typ. | Max. | Unit |
|---------------------------|----------|---|------|------|------|------|
| Continuous Source Current | $I_S$    | Integral Reverse P-N<br>Junction Diode in the<br>MOSFET | --   | --   | -4.5 | A    |
| Pulsed Source Current     | $I_{SM}$ |   | --   | --   | -18  |      |
| Diode Forward Voltage     | $V_{SD}$ | $I_S = -3A, V_{GS} = 0V$                                | --   | -0.8 | -1.2 | V    |

NOTE:

1. Pulse width limited by maximum junction temperature
2.  $L=1mH, V_{DD}=-10V, V_G=-4.5V, R_G=25\Omega$ , starting  $T_J=25^\circ C$
3. Pulse Test: Pulse width  $\leq 300\mu s$ , Duty cycle  $\leq 2\%$
4. Essentially independent of operating temperature

Typical Performance Characteristics

Figure 1. Output Characteristics

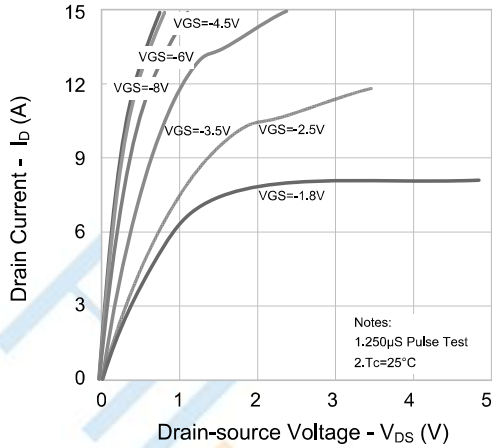


Figure 2. Transfer Characteristics

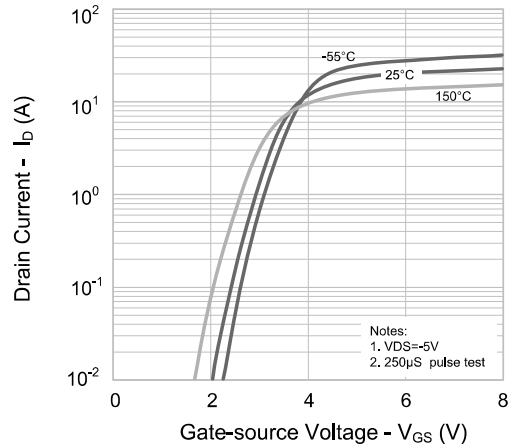


Figure 3. On-resistance vs. Drain Current

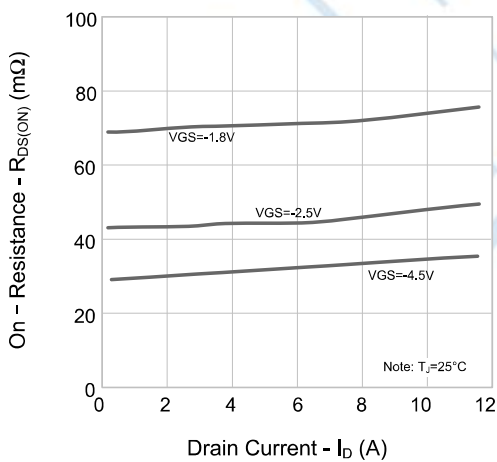


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

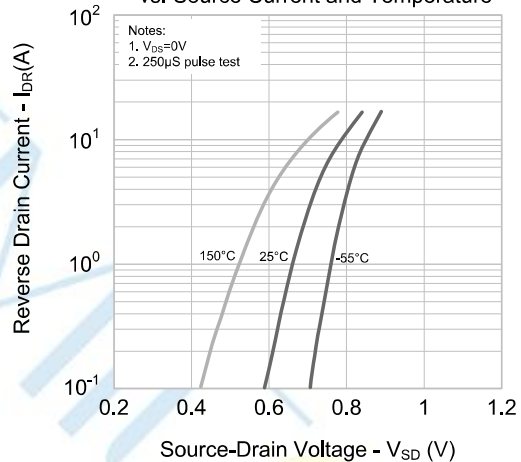


Figure 5. Capacitance Characteristics

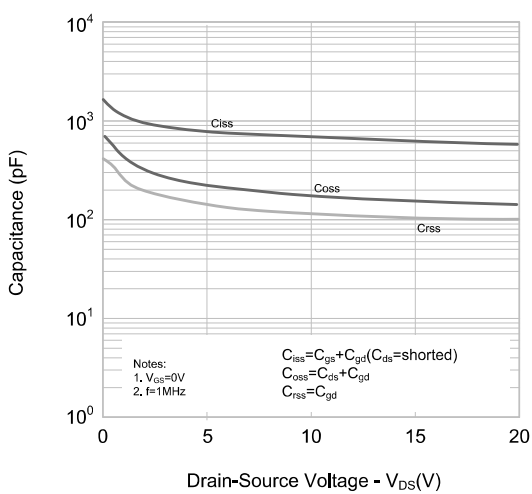
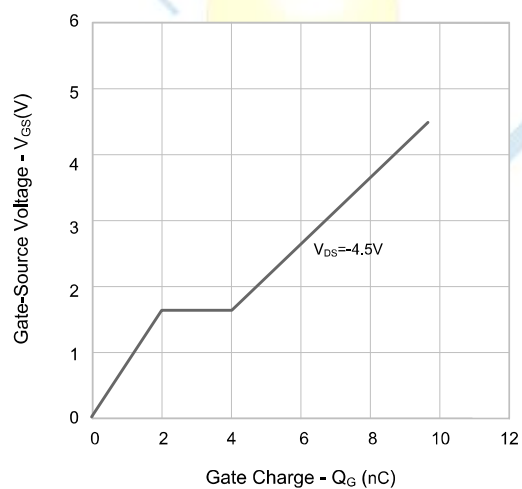
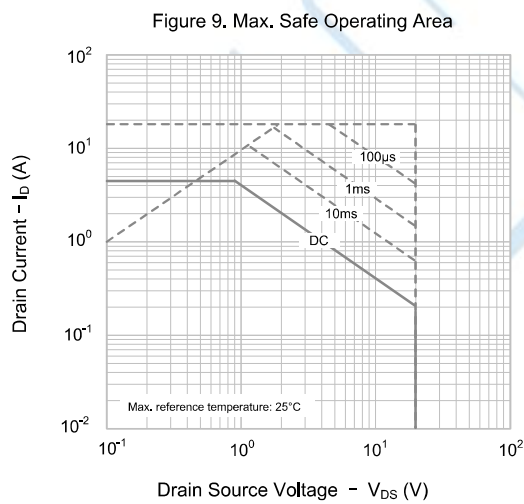
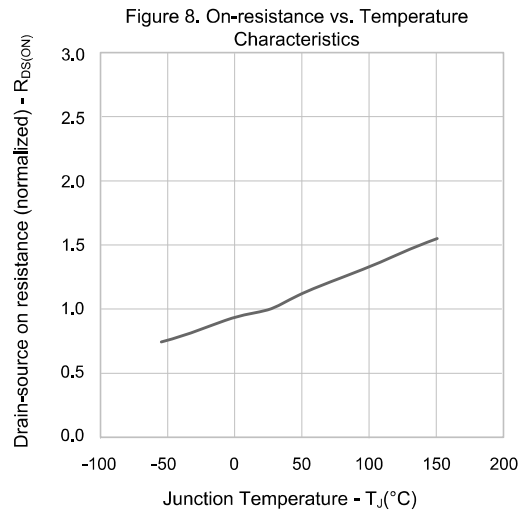
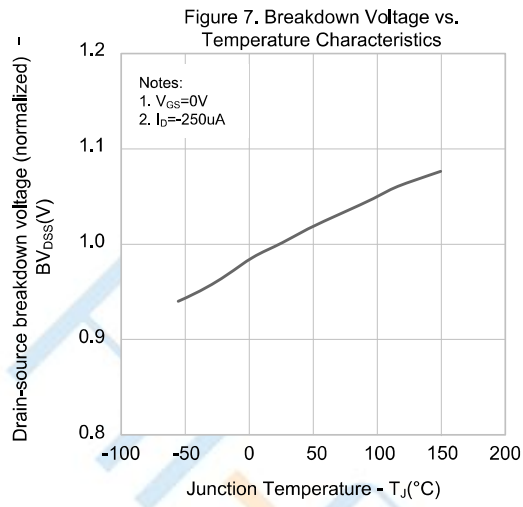


Figure 6. Gate Charge

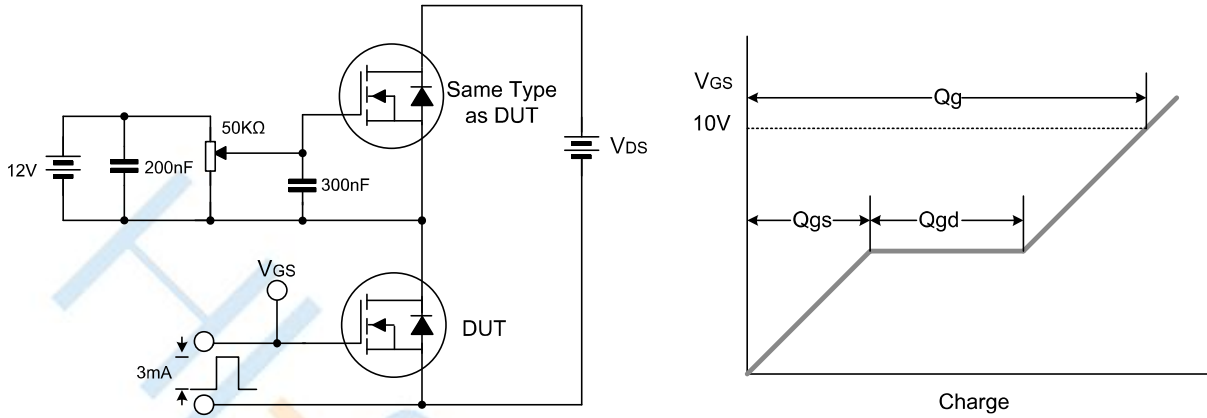


Typical Performance Characteristics

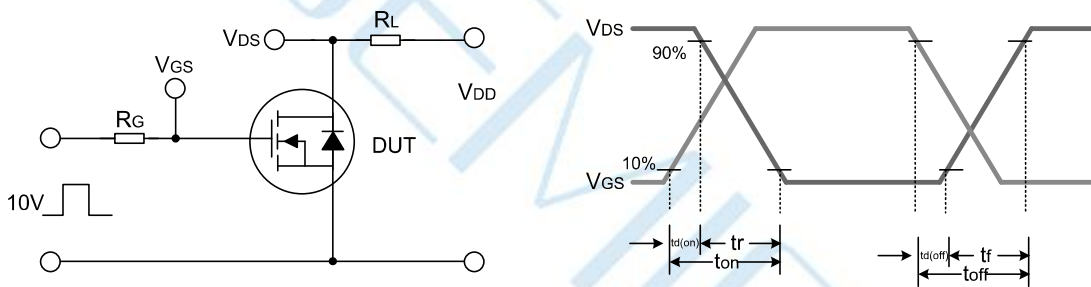


Test Circuit

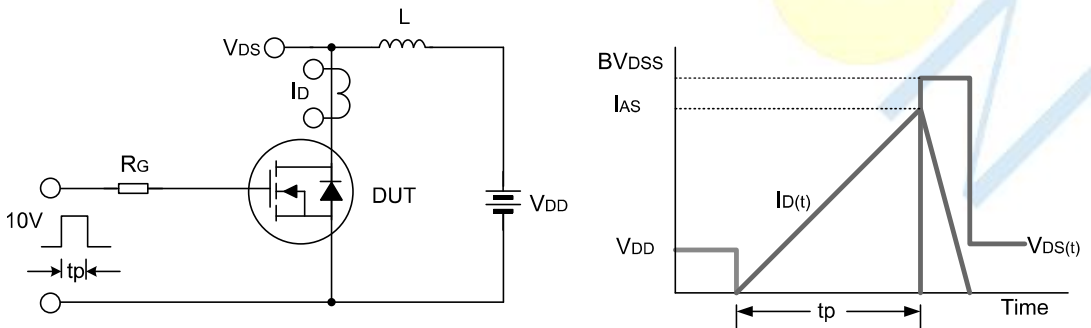
Gate Charge Test Circuit & Waveform



Resistive Switching Test Circuit & Waveform

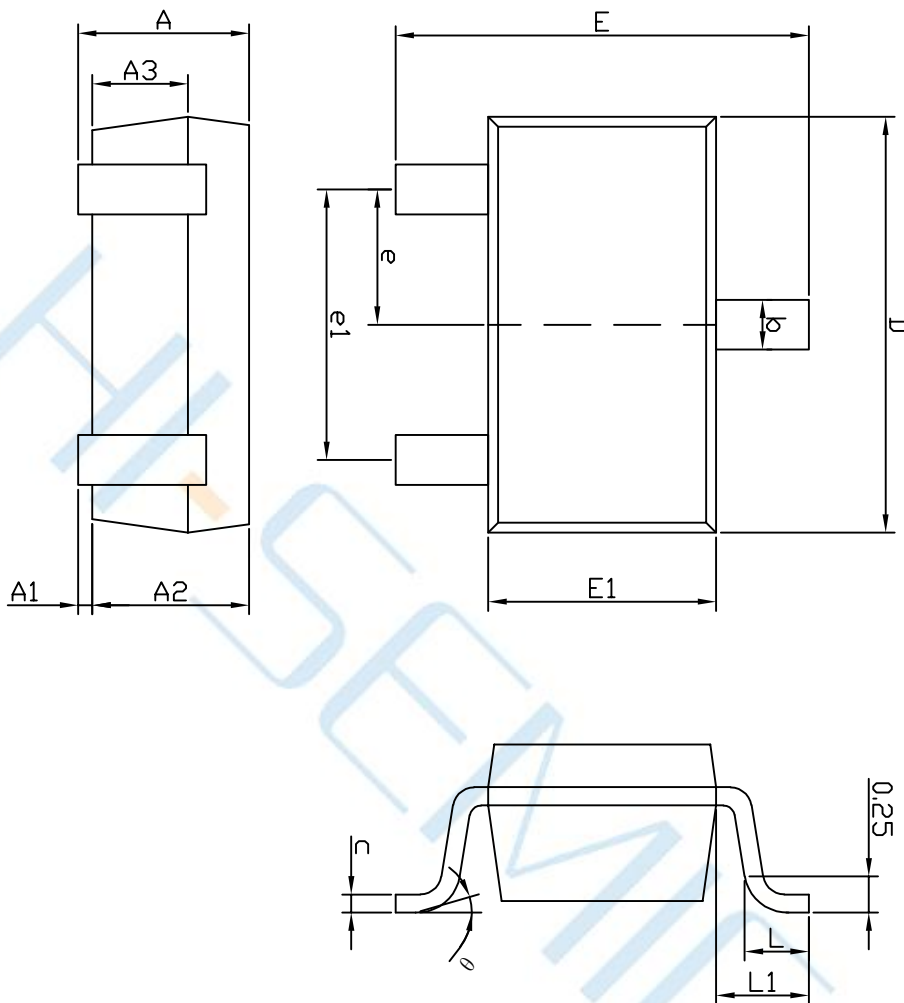


Unclamped Inductive Switching Test Circuit & Waveform



Package Dimensions of SOT23-3L

Unit:mm

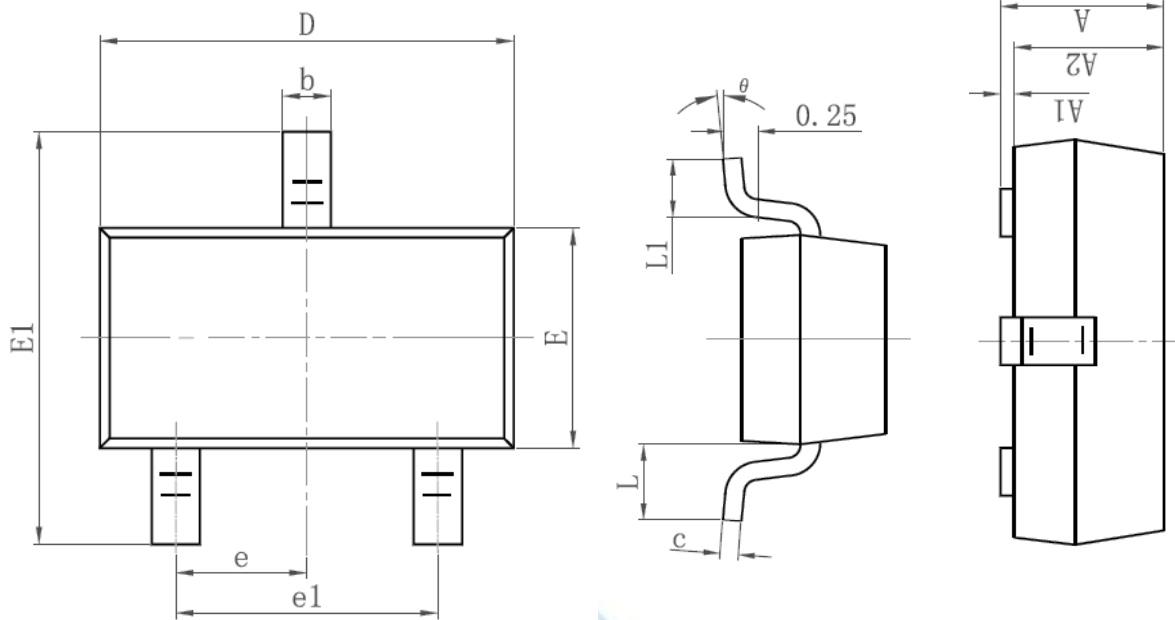


COMMON DIMENSIONS  
(UNITS OF MEASURE=MILLIMETER)

| SYMBOL | MIN     | NOM  | MAX  |
|--------|---------|------|------|
| A      | -       | -    | 1.25 |
| A1     | 0.04    | -    | 0.10 |
| A2     | 1.00    | 1.10 | 1.20 |
| A3     | 0.60    | 0.65 | 0.70 |
| b      | 0.33    | -    | 0.41 |
| c      | 0.11    | -    | 0.20 |
| D      | 2.82    | 2.92 | 3.02 |
| E      | 2.60    | 2.80 | 3.00 |
| E1     | 1.50    | 1.60 | 1.70 |
| e      | 0.95BSC |      |      |
| e1     | 1.90BSC |      |      |
| L      | 0.30    | -    | 0.60 |
| L1     | 0.60REF |      |      |
| θ      | 0°      | -    | 8°   |

Package Dimensions of SOT-23

Unit:mm



| Symbol   | Dimensions in Millimeters |       |
|----------|---------------------------|-------|
|          | MIN.                      | MAX.  |
| A        | 0.900                     | 1.150 |
| A1       | 0.000                     | 0.100 |
| A2       | 0.900                     | 1.050 |
| b        | 0.300                     | 0.500 |
| c        | 0.080                     | 0.150 |
| D        | 2.800                     | 3.000 |
| E        | 1.200                     | 1.400 |
| E1       | 2.250                     | 2.550 |
| e        | 0.950TYP                  |       |
| e1       | 1.800                     | 2.000 |
| L        | 0.550REF                  |       |
| L1       | 0.300                     | 0.500 |
| $\theta$ | 0°                        | 8°    |



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