

## P-Channel Enhancement Mode MOSFET

### 1. Product Information

#### Features

- Surface mount package
- High power and current handling capability
- Lead free product is acquired

#### Pin Description

| Pin | Description |
|-----|-------------|
| 1   | Gate(G)     |
| 2   | Source(S)   |
| 3   | Drain(D)    |

#### Applications

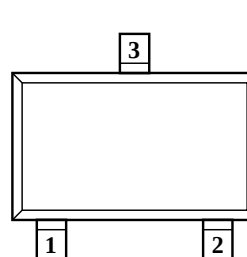
- PWM applications
- Load switch
- Power management
- Halogen-free

#### Quick reference

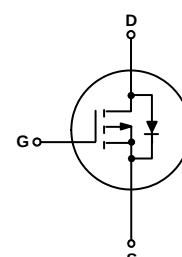
- $V_{DS} \geq -20V$
- $I_D \leq -6.0A$
- $R_{DS(ON)} \leq 30m\Omega$  @  $V_{GS} = -4.5V$  (Type: 25m $\Omega$ )
- $R_{DS(ON)} \leq 45m\Omega$  @  $V_{GS} = -2.5V$  (Type: 35m $\Omega$ )

#### Simplified Outline

#### Symbol



SOT-23



#### Package Marking and Ordering Information

| Product Name | Package | Marking | Reel Size | Tape width | Quantity |
|--------------|---------|---------|-----------|------------|----------|
| KJ2333S      | SOT-23  | 2333    | -         | -          | 3000     |

### 2. Absolute Maximum Ratings (TC=25°C unless otherwise noted)

| Parameter                                        | Symbol         | Limit      | Unit |
|--------------------------------------------------|----------------|------------|------|
| Drain-Source Voltage                             | $V_{DS}$       | -20        | V    |
| Gate-Source Voltage                              | $V_{GS}$       | $\pm 12$   | V    |
| Drain Current -Continuous                        | $I_D$          | -6         | A    |
| Drain Current -Pulsed <sup>(Note 1)</sup>        | $I_{DM}$       | -20        | A    |
| Maximum Power Dissipation                        | $P_D$          | 1.8        | W    |
| Operating Junction and Storage Temperature Range | $T_J, T_{STG}$ | -55 To 150 | °C   |

#### Thermal Characteristic

|                                                             |                 |    |      |
|-------------------------------------------------------------|-----------------|----|------|
| Thermal Resistance, Junction-to-Ambient <sup>(Note 2)</sup> | $R_{\theta JA}$ | 69 | °C/W |
|-------------------------------------------------------------|-----------------|----|------|

### 3. Electrical Characteristics (T<sub>J</sub>=25°C, unless otherwise noted)

| Parameter                                     | Symbol              | Condition                                                                                                   | Min  | Typ   | Max  | Unit |
|-----------------------------------------------|---------------------|-------------------------------------------------------------------------------------------------------------|------|-------|------|------|
| Off Characteristics                           |                     |                                                                                                             |      |       |      |      |
| Drain-Source Breakdown Voltage                | BV <sub>DSS</sub>   | V <sub>GS</sub> =0V I <sub>D</sub> =-250μA                                                                  | -20  | -     | -    | V    |
| Zero Gate Voltage Drain Current               | I <sub>DSS</sub>    | V <sub>DS</sub> =-12V,V <sub>GS</sub> =0V                                                                   | -    | -     | -1   | μA   |
| Gate-Body Leakage Current                     | I <sub>GSS</sub>    | V <sub>GS</sub> =±12V,V <sub>DS</sub> =0V                                                                   | -    | -     | ±100 | nA   |
| On Characteristics <sup>(Note 3)</sup>        |                     |                                                                                                             |      |       |      |      |
| Gate Threshold Voltage                        | V <sub>GS(th)</sub> | V <sub>DS</sub> =V <sub>GS</sub> ,I <sub>D</sub> =-250μA                                                    | -0.4 | -0.65 | -1.0 | V    |
| Drain-Source On-State Resistance              | R <sub>DS(ON)</sub> | V <sub>GS</sub> =-4.5V, I <sub>D</sub> =-6A                                                                 | -    | 25    | 30   | mΩ   |
|                                               |                     | V <sub>GS</sub> =-2.5V, I <sub>D</sub> =-5A                                                                 | -    | 35    | 45   |      |
| Forward Transconductance                      | g <sub>FS</sub>     | V <sub>DS</sub> =-5V,I <sub>D</sub> =-6A                                                                    |      | 17    | -    | S    |
| Dynamic Characteristics <sup>(Note4)</sup>    |                     |                                                                                                             |      |       |      |      |
| Input Capacitance                             | C <sub>iss</sub>    | V <sub>DS</sub> =-6V,V <sub>GS</sub> =0V,<br>F=1.0MHz                                                       | -    | 1100  | -    | PF   |
| Output Capacitance                            | C <sub>oss</sub>    |                                                                                                             | -    | 390   | -    | PF   |
| Reverse Transfer Capacitance                  | C <sub>rss</sub>    |                                                                                                             | -    | 300   | -    | PF   |
| Switching Characteristics <sup>(Note 4)</sup> |                     |                                                                                                             |      |       |      |      |
| Turn-on Delay Time                            | t <sub>d(on)</sub>  | V <sub>DD</sub> =-6V,I <sub>D</sub> =-1A ,<br>R <sub>L</sub> =6Ω,V <sub>GEN</sub> =-4.5V,R <sub>g</sub> =6Ω | -    | 25    | -    | nS   |
| Turn-on Rise Time                             | t <sub>r</sub>      |                                                                                                             | -    | 45    | -    | nS   |
| Turn-Off Delay Time                           | t <sub>d(off)</sub> |                                                                                                             | -    | 72    | -    | nS   |
| Turn-Off Fall Time                            | t <sub>f</sub>      |                                                                                                             | -    | 60    | -    | nS   |
| Total Gate Charge                             | Q <sub>g</sub>      | V <sub>DS</sub> =-6V,I <sub>D</sub> =-6A,V <sub>GS</sub> =-4.5V                                             | -    | 11.5  | -    | nC   |
| Gate-Source Charge                            | Q <sub>gs</sub>     |                                                                                                             | -    | 1.5   | -    | nC   |
| Gate-Drain Charge                             | Q <sub>gd</sub>     |                                                                                                             | -    | 3.2   | -    | nC   |
| Drain-Source Diode Characteristics            |                     |                                                                                                             |      |       |      |      |
| Diode Forward Voltage <sup>(Note 3)</sup>     | V <sub>SD</sub>     | V <sub>GS</sub> =0V,I <sub>S</sub> =-1.0A                                                                   | -    | -     | -1.2 | V    |
| Diode Forward Current <sup>(Note 2)</sup>     | I <sub>S</sub>      |                                                                                                             | -    | -     | -6   | 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

## 4. Typical Characteristics

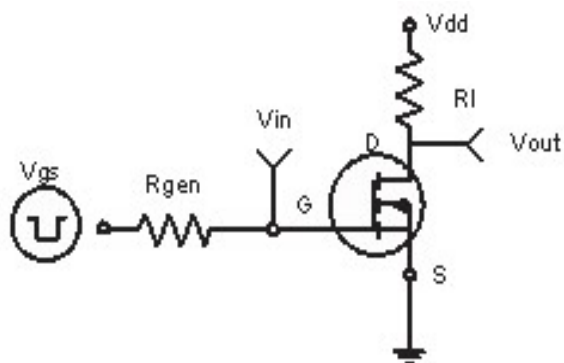


Figure 1: Switching Test Circuit

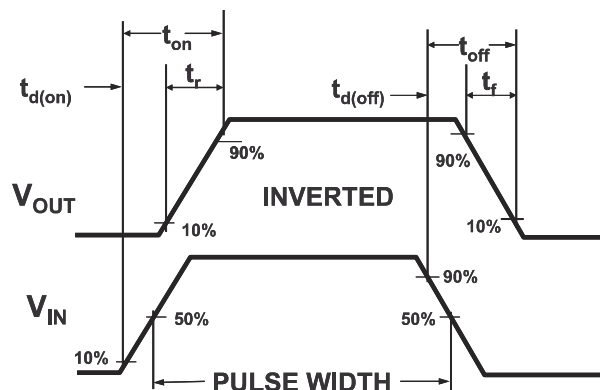


Figure 2: Switching Waveforms

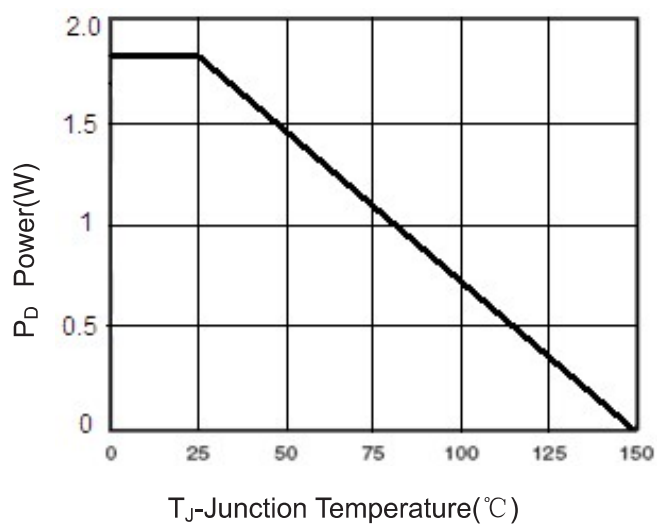


Figure 3 Power Dissipation

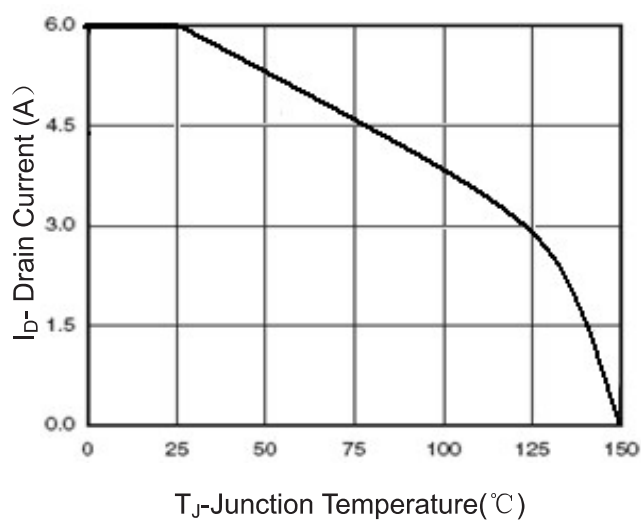


Figure 4 Drain Current

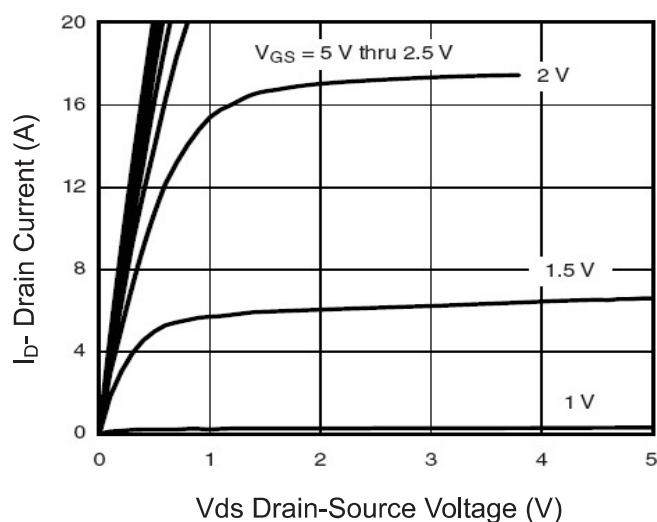


Figure 5 Output Characteristics

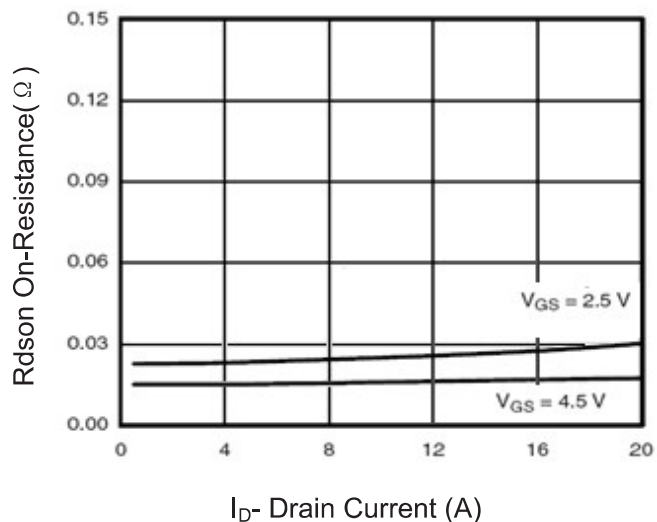
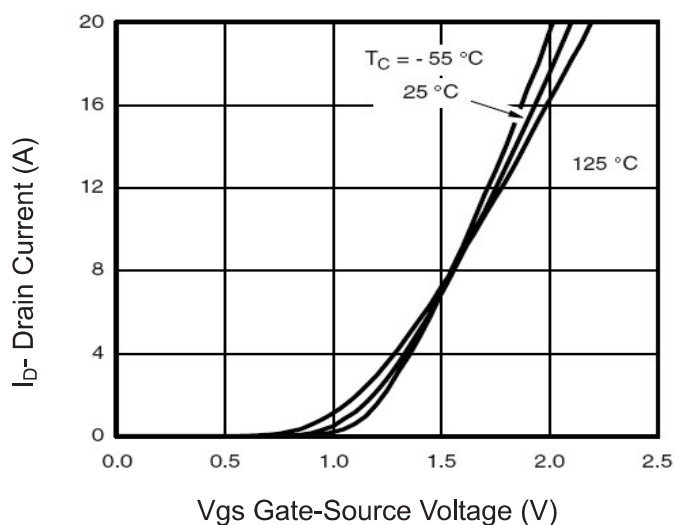
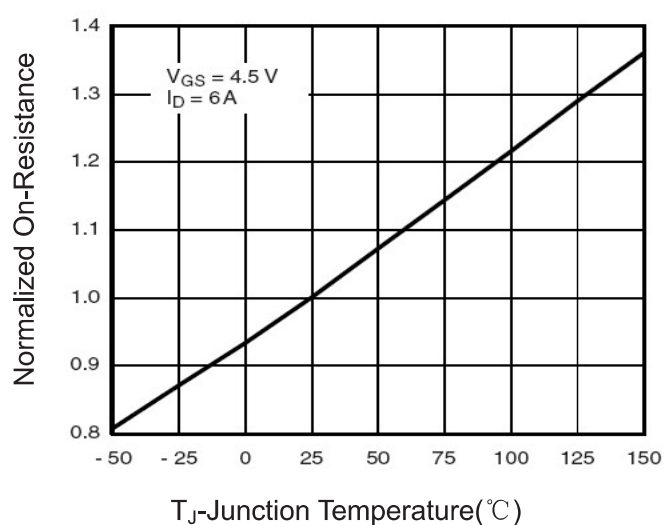


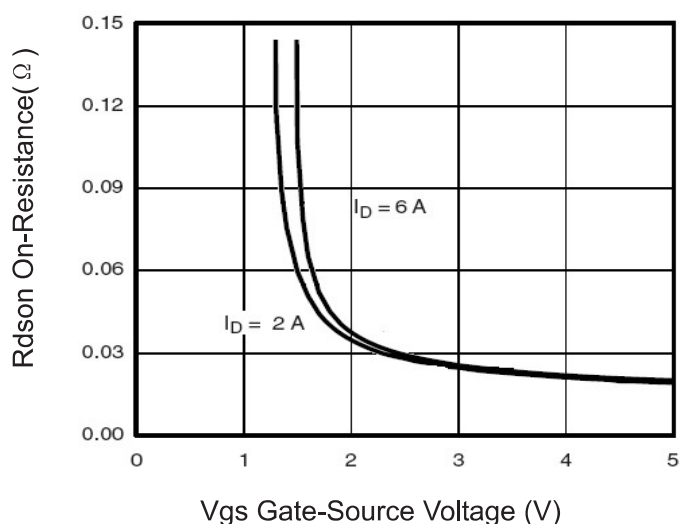
Figure 6 Drain-Source On-Resistance



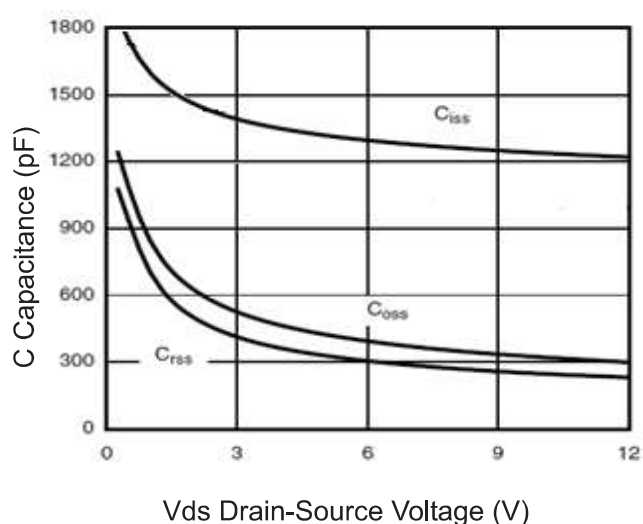
**Figure 7 Transfer Characteristics**



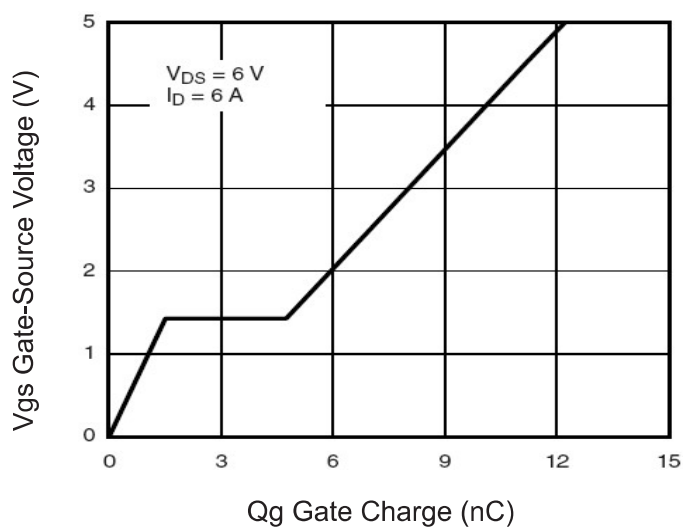
**Figure 8 Drain-Source On-Resistance**



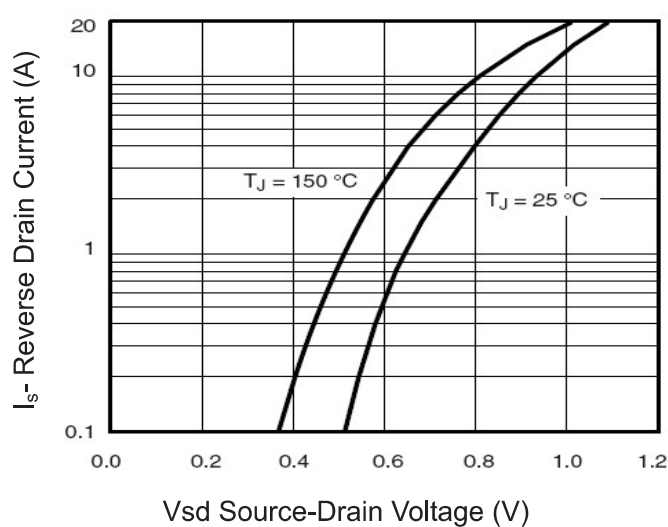
**Figure 9 Rdson vs VGS**



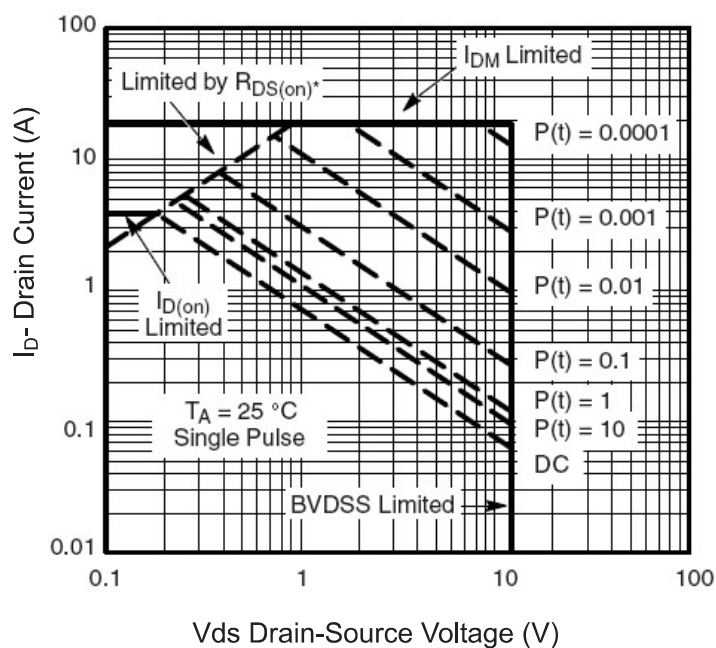
**Figure 10 Capacitance vs Vds**



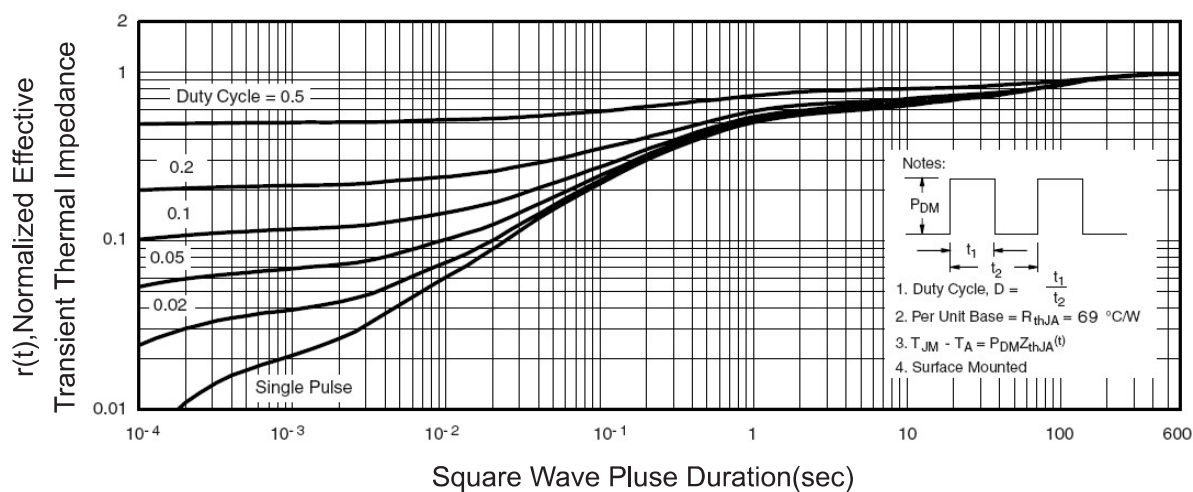
**Figure 11 Gate Charge**



**Figure 12 Source- Drain Diode Forward**



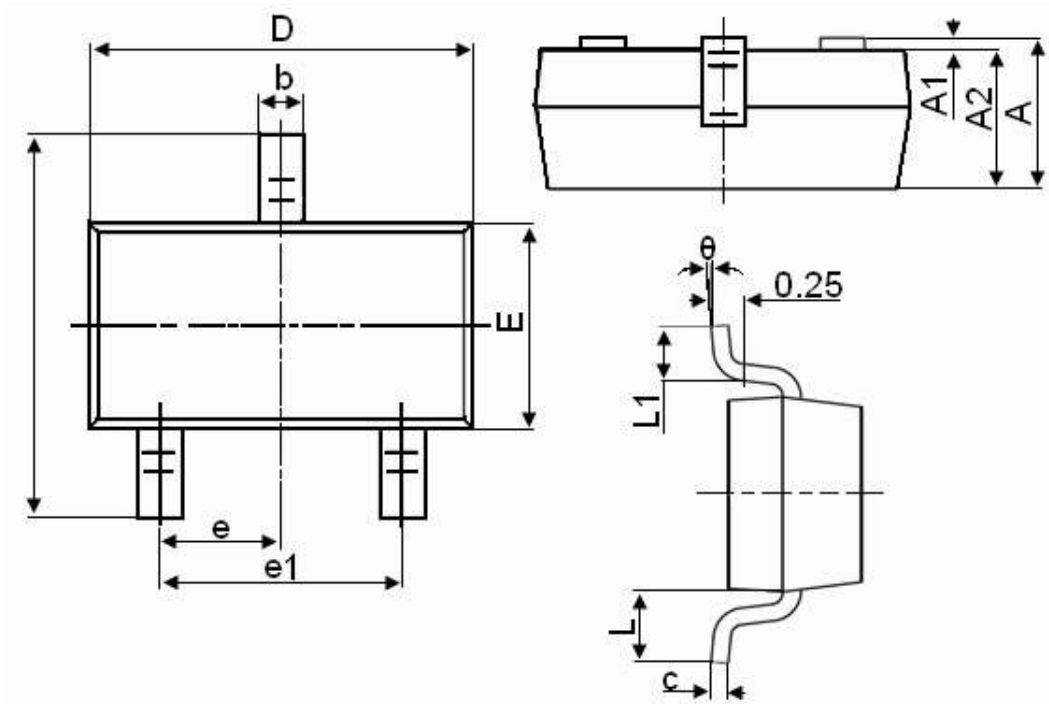
**Figure 13 Safe Operation Area**



**Figure 14 Normalized Maximum Transient Thermal Impedance**

## 5.Package Mechanical Data

SOT-23



| 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 |
| θ      | 0°                        | 8°    |

### Notes

1. All dimensions are in millimeters.
2. Tolerance  $\pm 0.10\text{mm}$  (4 mil) unless otherwise specified
3. Package body sizes exclude mold flash and gate burrs. Mold flash at the non-lead sides should be less than 5 mils.
4. Dimension L is measured in gauge plane.
5. Controlling dimension is millimeter, converted inch dimensions are not necessarily exact.