

## N-Channel Enhancement Mode Power MOSFET

### Description

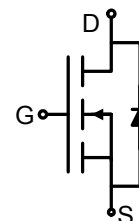
The BLM2312 uses advanced trench technology to provide excellent  $R_{DS(ON)}$ , low gate charge and operation with gate voltages as low as 2.5V. This device is suitable for use as a battery protection or in other switching application.

### General Features

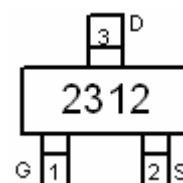
- $V_{DS} = 20V, I_D = 4.5A$   
 $R_{DS(ON)} < 40m\Omega @ V_{GS}=2.5V$   
 $R_{DS(ON)} < 33m\Omega @ V_{GS}=4.5V$
- High power and current handling capability
- Lead free product is acquired
- Surface mount package

### Application

- Battery protection
- Load switch
- Power management



Schematic diagram



Marking and pin assignment



SOT-23 top view

### Package Marking and Ordering Information

| Device Marking | Device  | Device Package | Reel Size | Tape width | Quantity   |
|----------------|---------|----------------|-----------|------------|------------|
| 2312           | BLM2312 | SOT-23         | Ø180mm    | 8 mm       | 3000 units |

### Absolute Maximum Ratings ( $T_A=25^\circ\text{C}$ unless otherwise noted)

| Parameter                                        |                          | Symbol         | Limit      | Unit             |
|--------------------------------------------------|--------------------------|----------------|------------|------------------|
| Drain-Source Voltage                             |                          | $V_{DS}$       | 20         | V                |
| Gate-Source Voltage                              |                          | $V_{GS}$       | $\pm 12$   | V                |
| Continuous Drain Current                         | $T_A = 25^\circ\text{C}$ | $I_D$          | 4.5        | A                |
|                                                  | $T_A = 70^\circ\text{C}$ |                | 3.6        |                  |
| Drain Current-Pulsed (Note 1)                    |                          | $I_{DM}$       | 13.5       | A                |
| Maximum Power Dissipation                        |                          | $P_D$          | 1.25       | W                |
| Operating Junction and Storage Temperature Range |                          | $T_J, T_{STG}$ | -55 To 150 | $^\circ\text{C}$ |

### Thermal Characteristic

|                                                  |                 |     |                    |
|--------------------------------------------------|-----------------|-----|--------------------|
| Thermal Resistance, Junction-to-Ambient (Note 2) | $R_{\theta JA}$ | 100 | $^\circ\text{C/W}$ |
|--------------------------------------------------|-----------------|-----|--------------------|

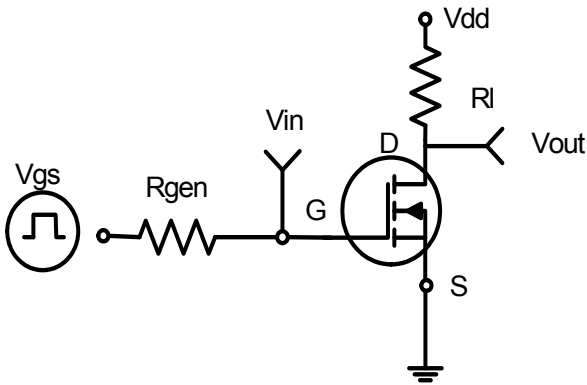
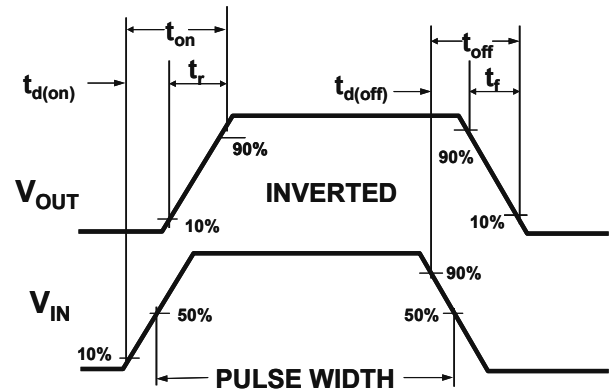
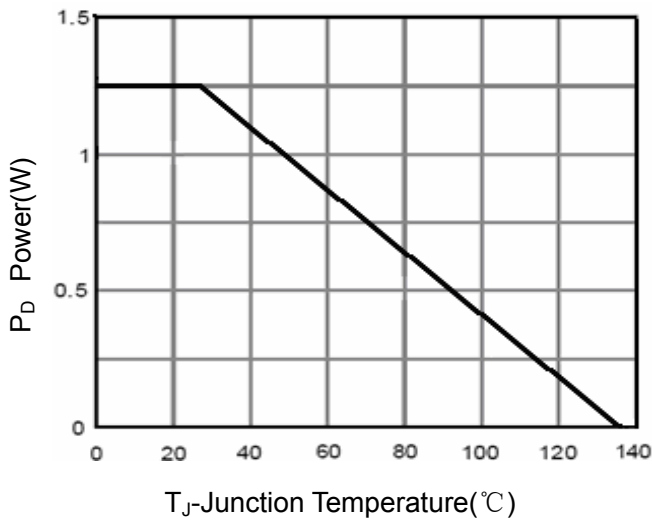
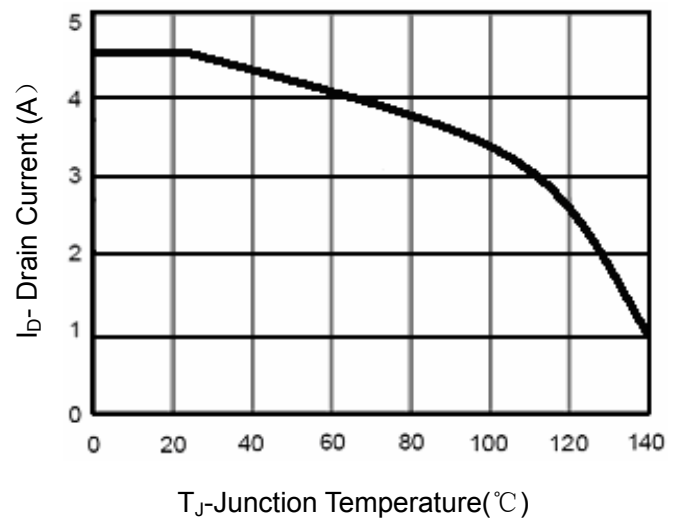
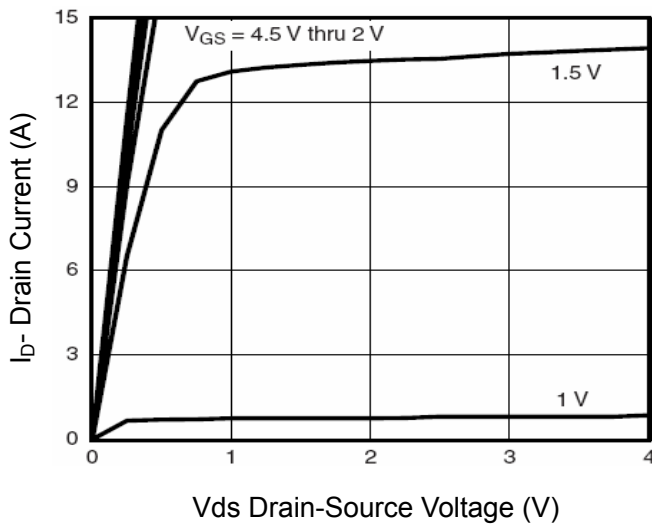
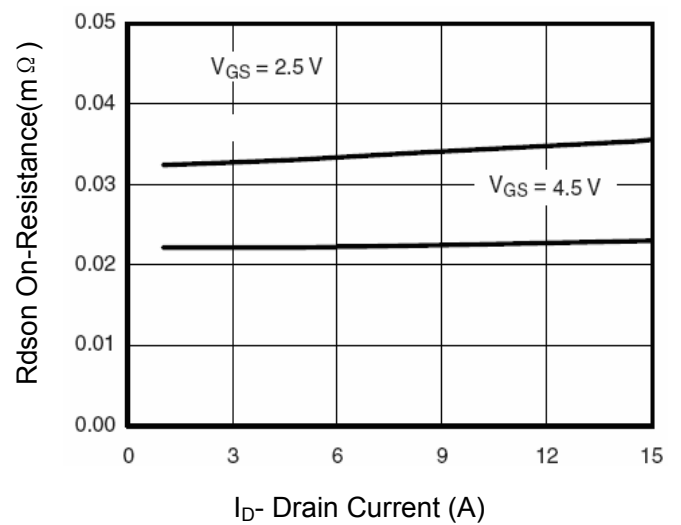
### Electrical Characteristics ( $T_A=25^\circ\text{C}$ unless otherwise noted)

| Parameter                      | Symbol     | Condition                 | Min | Typ | Max | Unit |
|--------------------------------|------------|---------------------------|-----|-----|-----|------|
| <b>Off Characteristics</b>     |            |                           |     |     |     |      |
| Drain-Source Breakdown Voltage | $BV_{DSS}$ | $V_{GS}=0V, I_D=250\mu A$ | 20  | 22  | -   | V    |

|                                    |                     |                                                                                         |     |      |      |    |
|------------------------------------|---------------------|-----------------------------------------------------------------------------------------|-----|------|------|----|
| Zero Gate Voltage Drain Current    | I <sub>DSS</sub>    | V <sub>DS</sub> =20V, 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 (Note 3)        |                     |                                                                                         |     |      |      |    |
| Gate Threshold Voltage             | V <sub>GS(th)</sub> | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA                                | 0.5 | 0.65 | 1.2  | V  |
| Drain-Source On-State Resistance   | R <sub>DS(ON)</sub> | V <sub>GS</sub> =2.5V, I <sub>D</sub> =4.0 A                                            | -   | 33   | 40   | mΩ |
|                                    |                     | V <sub>GS</sub> =4.5V, I <sub>D</sub> =4.5A                                             | -   | 22   | 33   | mΩ |
| Forward Transconductance           | g <sub>FS</sub>     | V <sub>DS</sub> =10V, I <sub>D</sub> =4A                                                | -   | 10   | -    | S  |
| Dynamic Characteristics (Note4)    |                     |                                                                                         |     |      |      |    |
| Input Capacitance                  | C <sub>iss</sub>    | V <sub>DS</sub> =8V, V <sub>GS</sub> =0V,<br>F=1.0MHz                                   | -   | 500  | -    | PF |
| Output Capacitance                 | C <sub>Oss</sub>    |                                                                                         | -   | 300  | -    | PF |
| Reverse Transfer Capacitance       | C <sub>rss</sub>    |                                                                                         | -   | 140  | -    | PF |
| Switching Characteristics (Note 4) |                     |                                                                                         |     |      |      |    |
| Turn-on Delay Time                 | t <sub>d(on)</sub>  | V <sub>DD</sub> =10V, I <sub>D</sub> =1A<br>V <sub>GS</sub> =4.5V, R <sub>GEN</sub> =6Ω | -   | 20   | 40   | nS |
| Turn-on Rise Time                  | t <sub>r</sub>      |                                                                                         | -   | 18   | 40   | nS |
| Turn-Off Delay Time                | t <sub>d(off)</sub> |                                                                                         | -   | 60   | 108  | nS |
| Turn-Off Fall Time                 | t <sub>f</sub>      |                                                                                         | -   | 28   | 56   | nS |
| Total Gate Charge                  | Q <sub>g</sub>      | V <sub>DS</sub> =10V, I <sub>D</sub> =3A, V <sub>GS</sub> =4.5V                         | -   | 10   | 15   | nC |
| Gate-Source Charge                 | Q <sub>gs</sub>     |                                                                                         | -   | 2.3  | -    | nC |
| Gate-Drain Charge                  | Q <sub>gd</sub>     |                                                                                         | -   | 2.9  | -    | nC |
| Drain-Source Diode Characteristics |                     |                                                                                         |     |      |      |    |
| Diode Forward Voltage (Note 3)     | V <sub>SD</sub>     | V <sub>GS</sub> =0V, I <sub>S</sub> =1A                                                 | -   | -    | 1.2  | V  |
| Diode Forward Current (Note 2)     | I <sub>S</sub>      |                                                                                         | -   | -    | 1    | A  |

## Notes:

1. Repetitive rating: pulse width limited by maximum junction temperature.
2. Surface mounted on FR4 Board,  $t \leq 10$  sec.
3. Pulse test: pulse width  $\leq 300\mu s$ , duty cycle  $\leq 2\%$ .
4. Guaranteed by design, not subject to production

**Typical Electrical and Thermal 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**

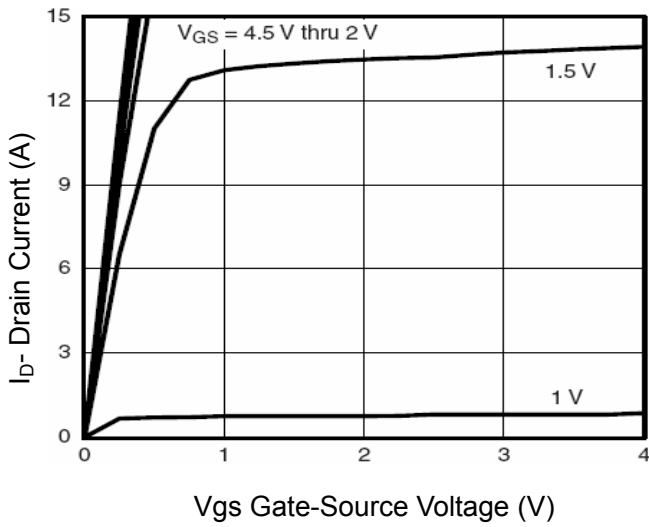


Figure 7 Transfer Characteristics

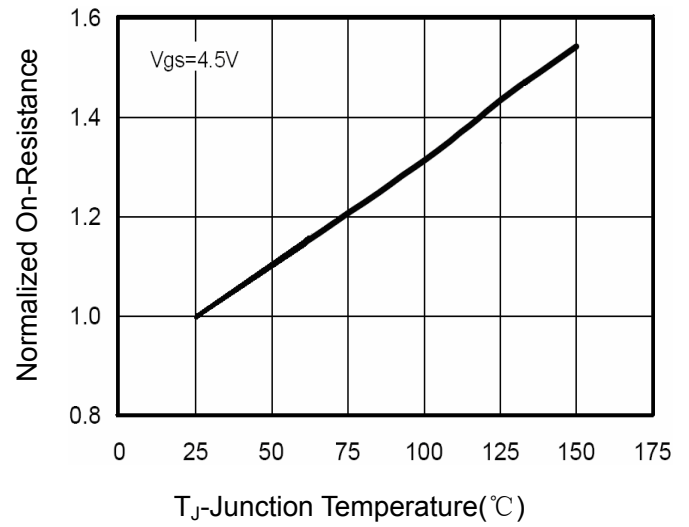


Figure 8 Drain-Source On-Resistance

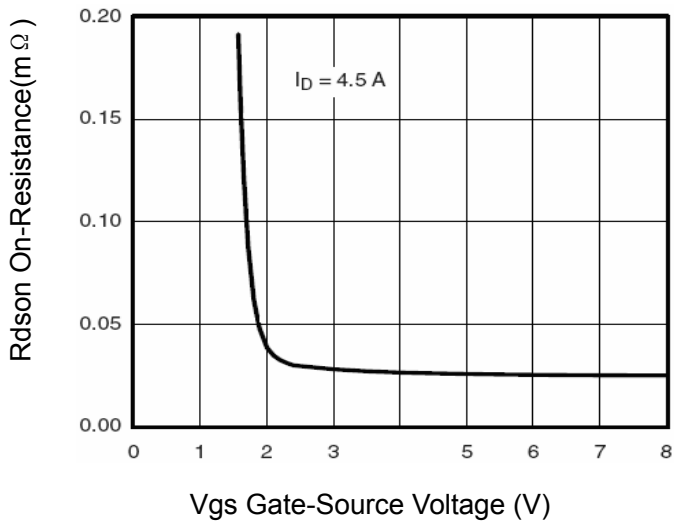


Figure 9 Rdson vs Vgs

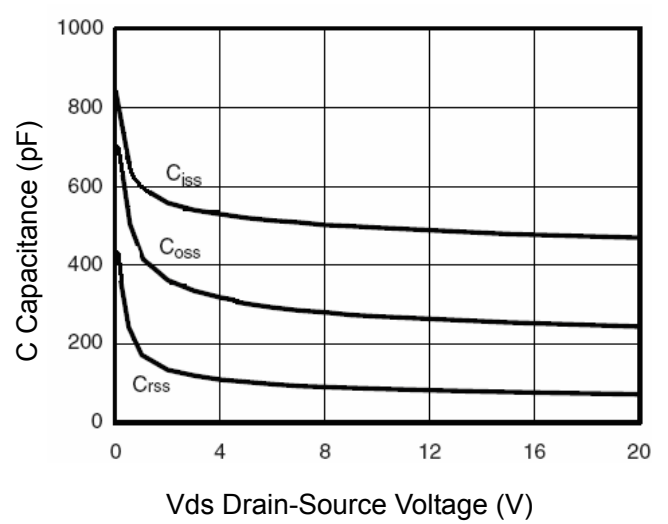


Figure 10 Capacitance vs Vds

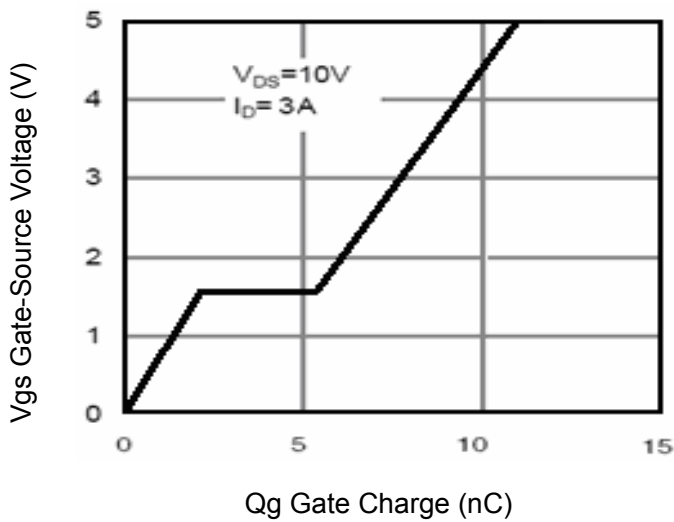


Figure 11 Gate Charge

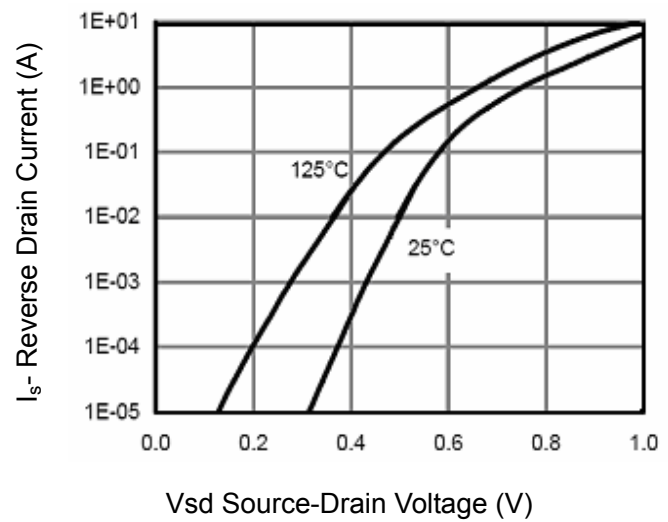
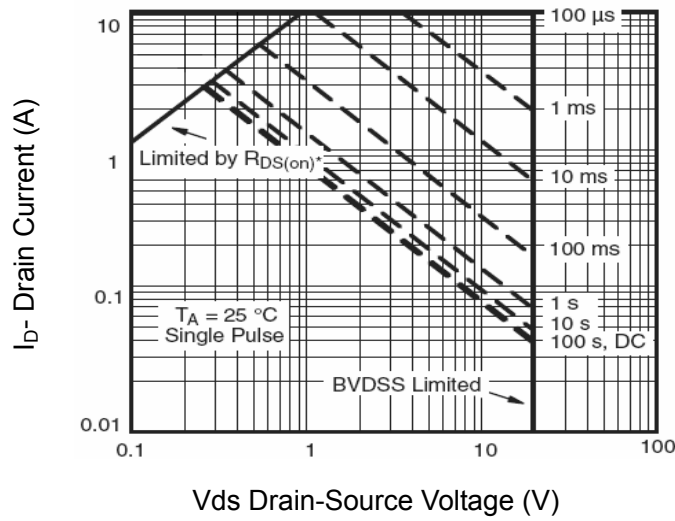
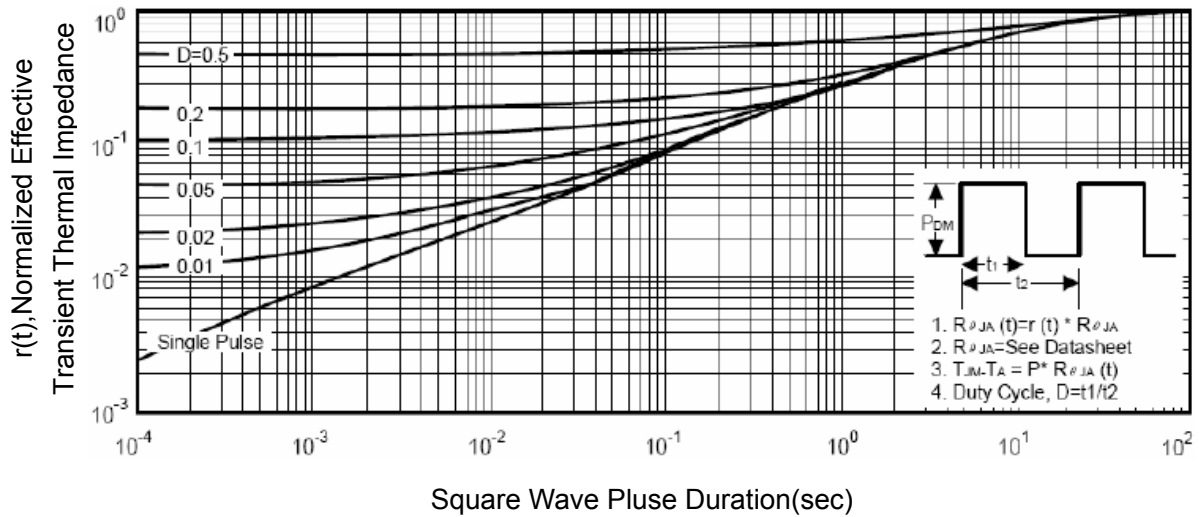


Figure 12 Source- Drain Diode Forward

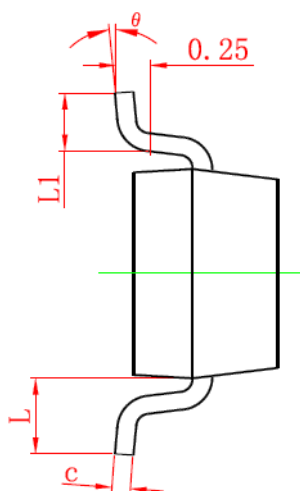
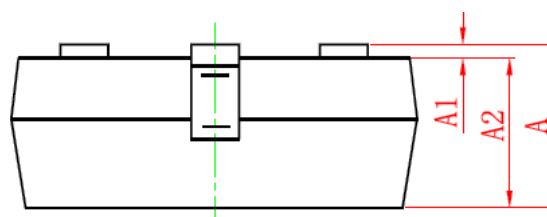
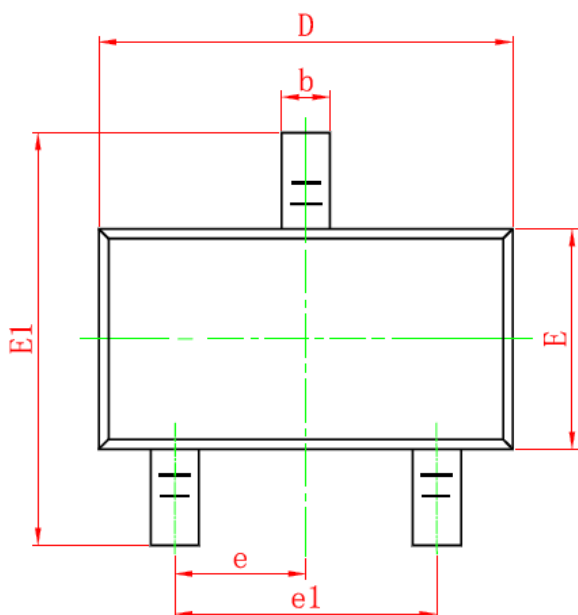


**Figure 13 Safe Operation Area**



**Figure 14 Normalized Maximum Transient Thermal Impedance**

## SOT-23 Package Information



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

### 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.