

## P-Channel Enhancement Mode Power MOSFET

### Description

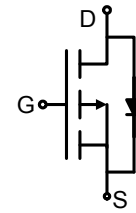
The HM2301B uses advanced trench technology to provide excellent  $R_{DS(ON)}$ , low gate charge and operation with gate voltages as low as 1.8V. This device is suitable for use as a load switch or in PWM applications.

### General Features

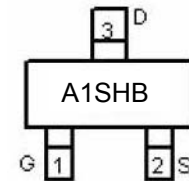
- $V_{DS} = -20V, I_D = -2.5A$   
 $R_{DS(ON)} < 160m\Omega @ V_{GS} = -2.5V$   
 $R_{DS(ON)} < 120m\Omega @ V_{GS} = -4.5V$
- High power and current handling capability
- Lead free product is acquired
- Surface mount package

### Application

- PWM applications
- Load switch



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   |
|----------------|---------|----------------|-----------|------------|------------|
| A12SHB         | HM2301B | 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                |
| Drain Current-Continuous                         | $I_D$          | -2.5       | A                |
| Drain Current -Pulsed (Note 1)                   | $I_{DM}$       | -10        | A                |
| Maximum Power Dissipation                        | $P_D$          | 0.9        | 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) | $R_{\theta JA}$ | 138 | $^\circ\text{C/W}$ |
|--------------------------------------------------|-----------------|-----|--------------------|

### 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 |     | -   | V       |
| Zero Gate Voltage Drain Current | $I_{DSS}$  | $V_{DS} = -20V, V_{GS} = 0V$   | -   | -   | -1  | $\mu A$ |

| Parameter                          | Symbol              | Condition                                                                                 | Min  | Typ  | Max  | Unit |
|------------------------------------|---------------------|-------------------------------------------------------------------------------------------|------|------|------|------|
| 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                                 | -0.4 | -0.7 | -1   | V    |
| Drain-Source On-State Resistance   | R <sub>DS(ON)</sub> | V <sub>GS</sub> =-4.5V, I <sub>D</sub> =-2 A                                              | -    | 78   | 120  | mΩ   |
|                                    |                     | V <sub>GS</sub> =-2.5V, I <sub>D</sub> =-1.8A                                             | -    | 102  | 160  | mΩ   |
| Forward Transconductance           | g <sub>FS</sub>     | V <sub>DS</sub> =-5V, I <sub>D</sub> =-1A                                                 | 6    | -    | -    | S    |
| Dynamic Characteristics (Note4)    |                     |                                                                                           |      |      |      |      |
| Input Capacitance                  | C <sub>ISS</sub>    | V <sub>DS</sub> =-10V, V <sub>GS</sub> =0V,<br>F=1.0MHz                                   | -    | 325  | -    | PF   |
| Output Capacitance                 | C <sub>OSS</sub>    |                                                                                           | -    | 63   | -    | PF   |
| Reverse Transfer Capacitance       | C <sub>RSS</sub>    |                                                                                           | -    | 37   | -    | PF   |
| Switching Characteristics (Note 4) |                     |                                                                                           |      |      |      |      |
| Turn-on Delay Time                 | t <sub>d(on)</sub>  | V <sub>DD</sub> =-10V, R <sub>L</sub> =5Ω<br>V <sub>GS</sub> =-4.5V, R <sub>GEN</sub> =3Ω | -    | 11   | -    | nS   |
| Turn-on Rise Time                  | t <sub>r</sub>      |                                                                                           | -    | 5.5  | -    | nS   |
| Turn-Off Delay Time                | t <sub>d(off)</sub> |                                                                                           | -    | 22   | -    | nS   |
| Turn-Off Fall Time                 | t <sub>f</sub>      |                                                                                           | -    | 8    | -    | nS   |
| Total Gate Charge                  | Q <sub>g</sub>      | V <sub>DS</sub> =-10V, I <sub>D</sub> =-2A,<br>V <sub>GS</sub> =-4.5V                     | -    | 3.2  | -    | nC   |
| Gate-Source Charge                 | Q <sub>gs</sub>     |                                                                                           | -    | 0.6  | -    | nC   |
| Gate-Drain Charge                  | Q <sub>gd</sub>     |                                                                                           | -    | 0.9  | -    | nC   |
| Drain-Source Diode Characteristics |                     |                                                                                           |      |      |      |      |
| Diode Forward Voltage (Note 3)     | V <sub>SD</sub>     | V <sub>GS</sub> =0V, I <sub>S</sub> =2A                                                   | -    | -    | -1.2 | V    |
| Diode Forward Current (Note 2)     | I <sub>S</sub>      |                                                                                           | -    | -    | -2.5 | 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

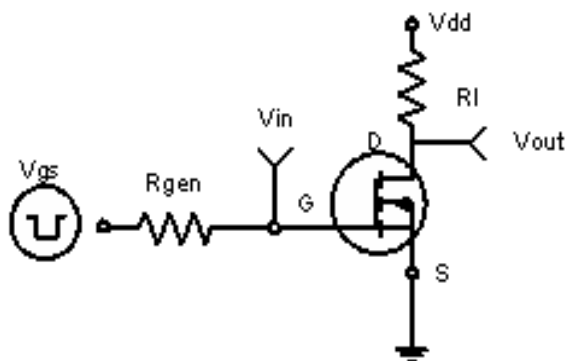


Figure 1: Switching Test Circuit

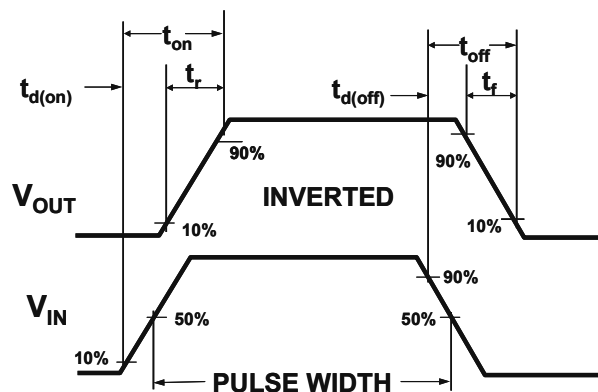


Figure 2: Switching Waveforms

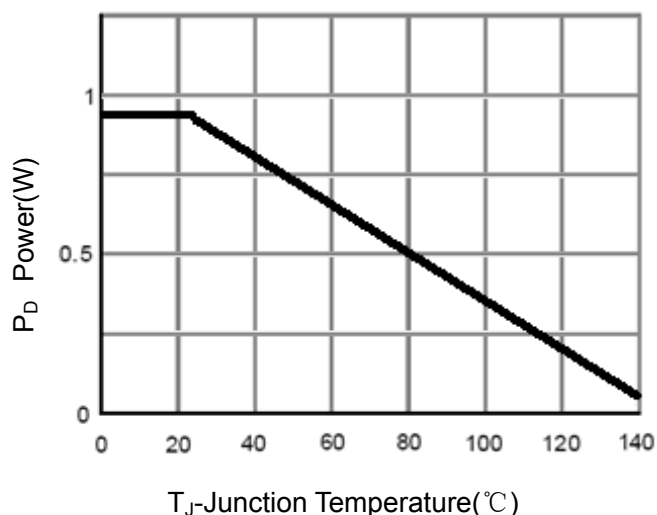


Figure 3 Power Dissipation

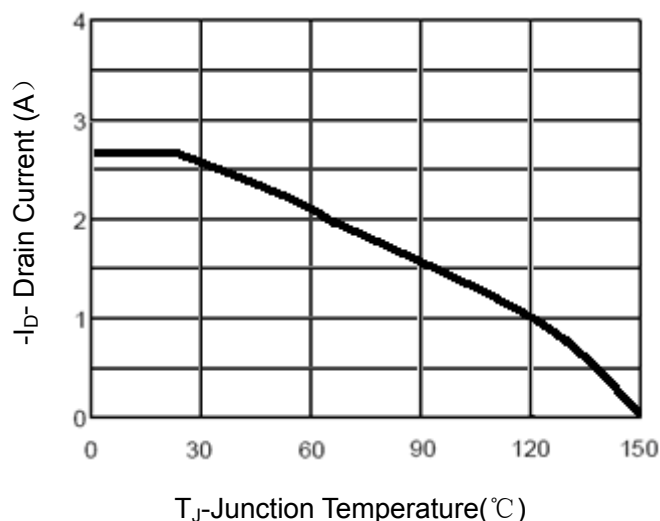


Figure 4 Drain Current

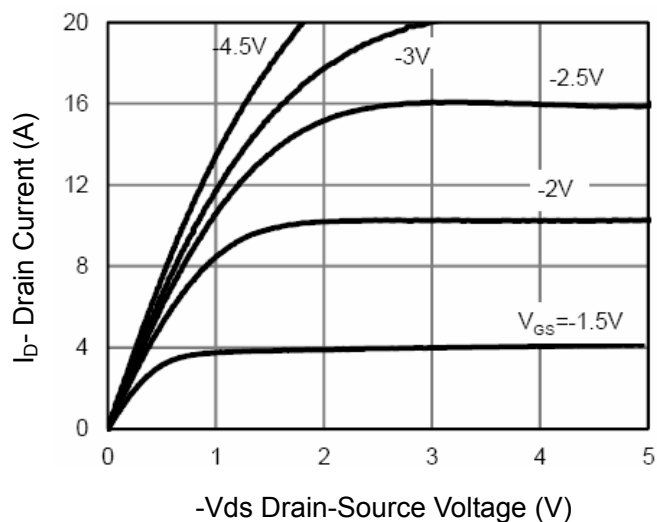


Figure 5 Output Characteristics

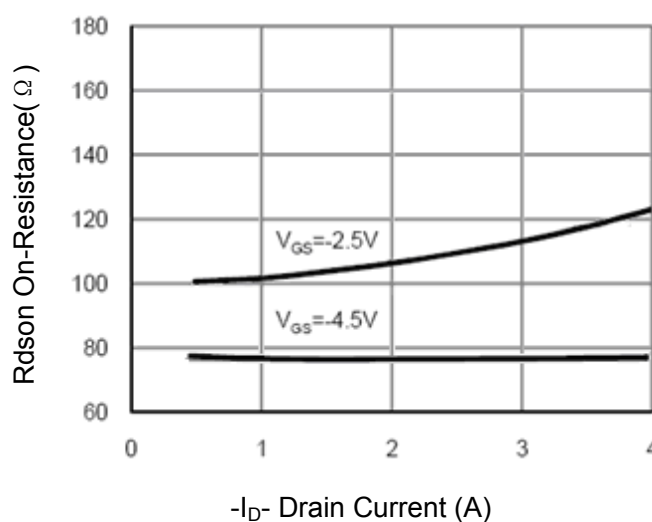


Figure 6 Drain-Source On-Resistance

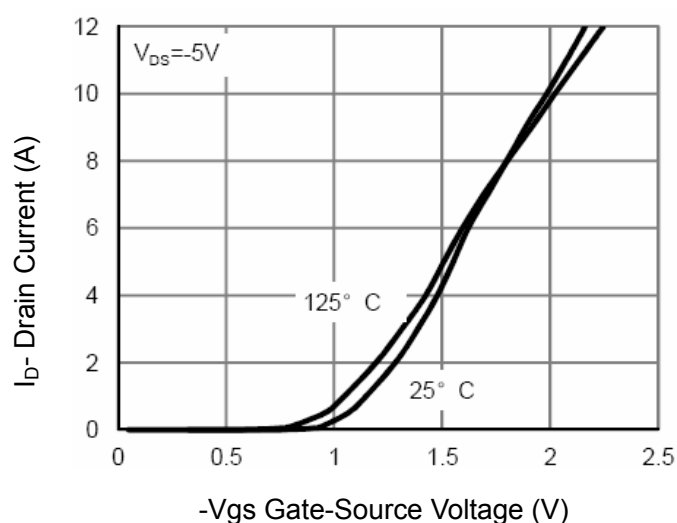


Figure 7 Transfer Characteristics

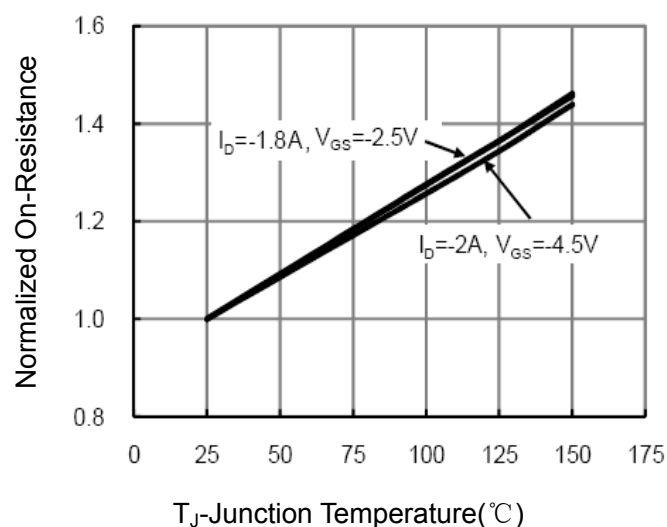


Figure 8 Drain-Source On-Resistance

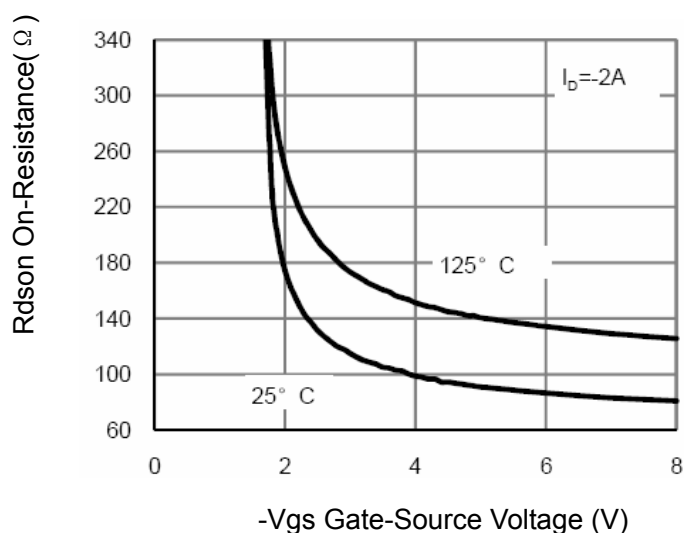


Figure 9 Rdson vs Vgs

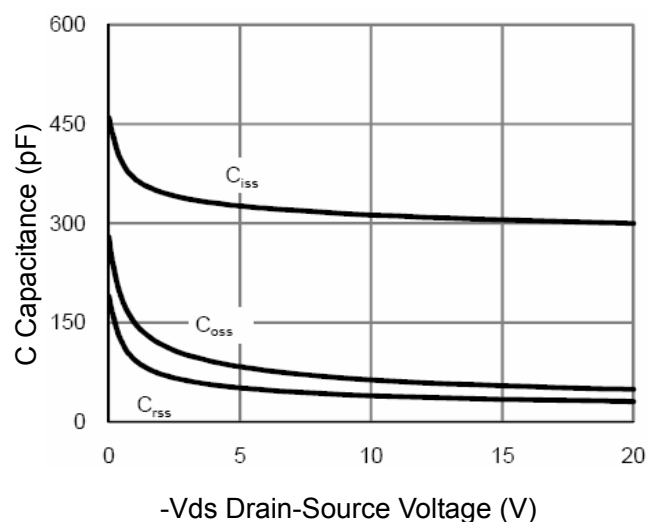


Figure 10 Capacitance vs Vds

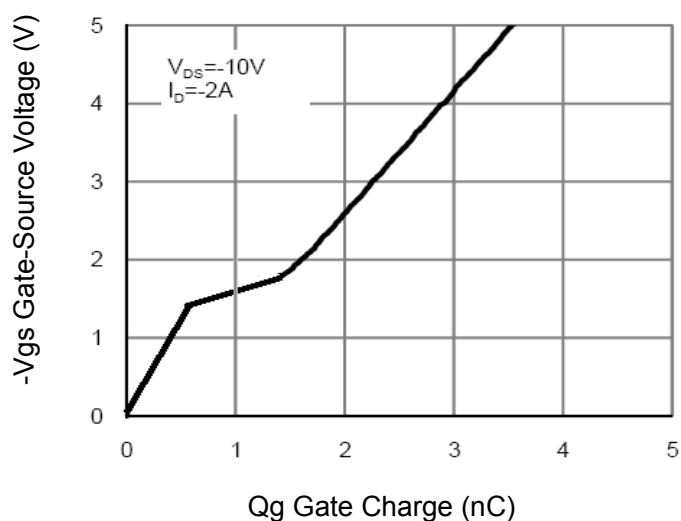


Figure 11 Gate Charge

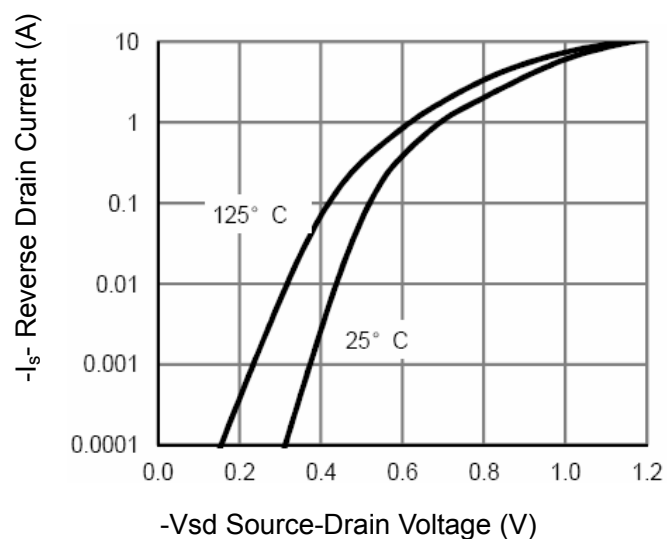


Figure 12 Source- Drain Diode Forward

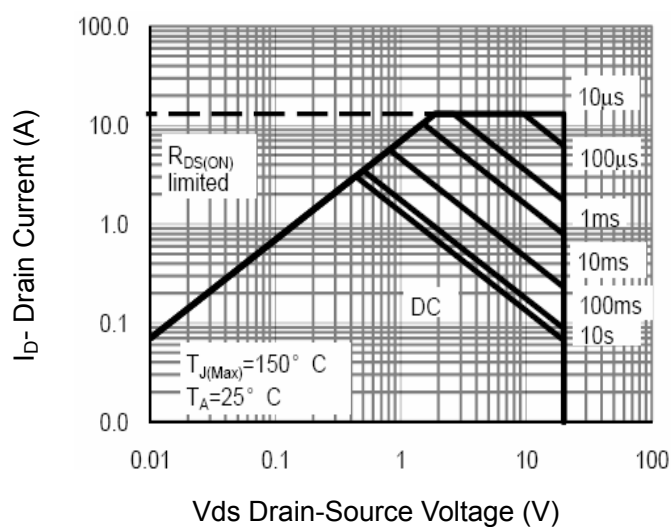


Figure 13 Safe Operation Area

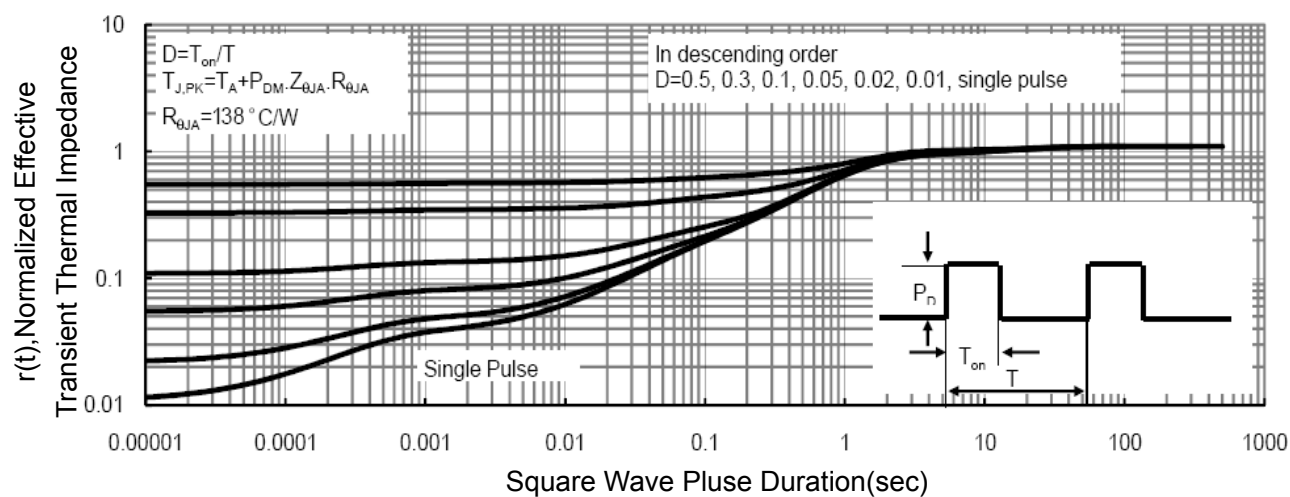
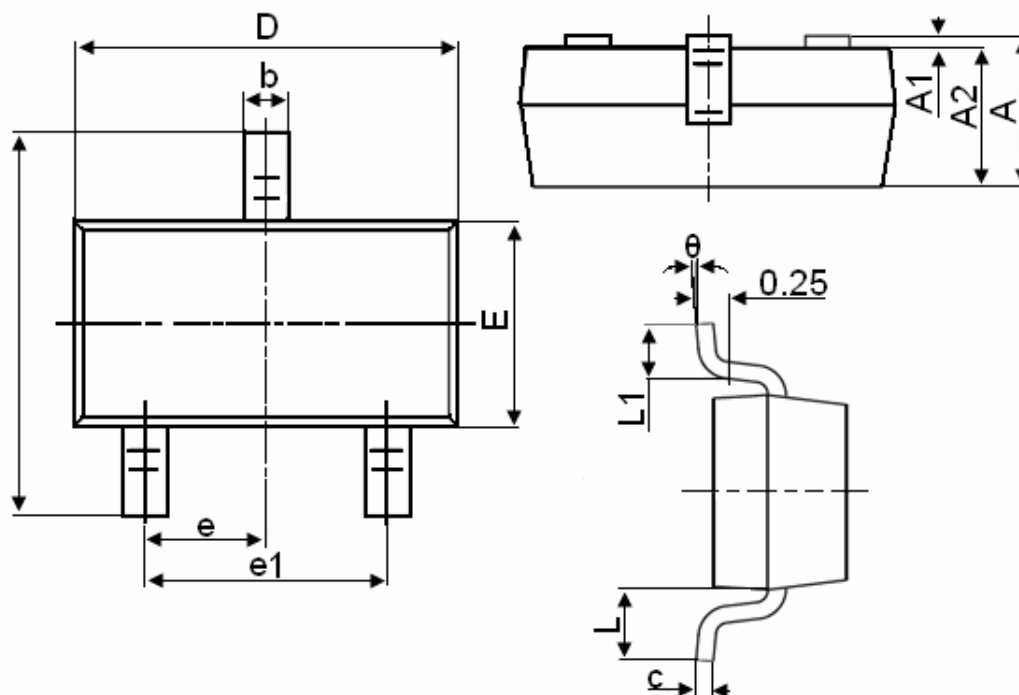


Figure 14 Normalized Maximum Transient Thermal Impedance

## SOT-23 Package Information



| Symbol | Dimensions in Millimeters |       |
|--------|---------------------------|-------|
|        | MIN.                      | MAX.  |
| 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.