

## N-Channel Enhancement Mode Power MOSFET

### Description

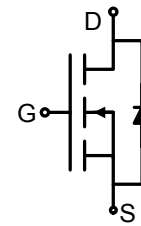
The HM3N10 uses advanced trench technology and design to provide excellent  $R_{DS(ON)}$  with low gate charge. It can be used in a wide variety of applications.

### General Features

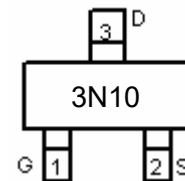
- $V_{DS} = 100V, I_D = 2.6A$   
 $R_{DS(ON)} = 115m\Omega$  (Typ) @  $V_{GS} = 10V$   
 $R_{DS(ON)} = 126m\Omega$  (Typ) @  $V_{GS} = 4.5V$
- High density cell design for ultra low  $R_{DS(ON)}$
- Fully characterized avalanche voltage and current
- Excellent package for good heat dissipation

### Application

- Power switching application
- Hard switched and high frequency circuits
- Uninterruptible power supply



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   |
|----------------|--------|----------------|-----------|------------|------------|
| 3N10           | HM3N10 | SOT-23         | Ø330mm    | 12mm       | 2500 units |

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

| Parameter                                        | Symbol         | Limit      | Unit             |
|--------------------------------------------------|----------------|------------|------------------|
| Drain-Source Voltage                             | $V_{DS}$       | 100        | V                |
| Gate-Source Voltage                              | $V_{GS}$       | $\pm 20$   | V                |
| Drain Current-Continuous                         | $I_D$          | 2.6        | A                |
| Drain Current-Pulsed (Note 1)                    | $I_{DM}$       | 7.8        | 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  | $BV_{DSS}$ | $V_{GS} = 0V, I_D = 250\mu A$ | 100 | 110 | -   | V       |
| Zero Gate Voltage Drain Current | $I_{DSS}$  | $V_{DS} = 100V, V_{GS} = 0V$  | -   | -   | 1   | $\mu A$ |

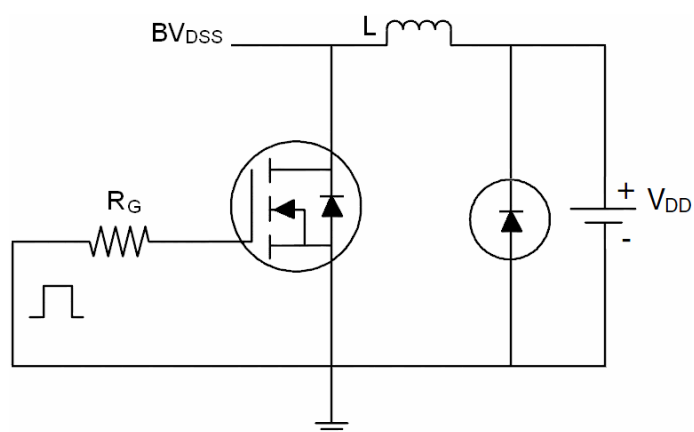
|                                    |                     |                                                                                                             |     |      |      |    |
|------------------------------------|---------------------|-------------------------------------------------------------------------------------------------------------|-----|------|------|----|
| Gate-Body Leakage Current          | I <sub>GSS</sub>    | V <sub>GS</sub> =±20V, 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                                                    | 1.2 | 1.7  | 2.2  | V  |
| Drain-Source On-State Resistance   | R <sub>DS(on)</sub> | V <sub>GS</sub> =10V, I <sub>D</sub> =1A                                                                    | -   | 115  | 144  | mΩ |
|                                    |                     | V <sub>GS</sub> =4.5V, I <sub>D</sub> =1A                                                                   | -   | 126  | 164  | mΩ |
| Forward Transconductance           | g <sub>FS</sub>     | V <sub>DS</sub> =5V, I <sub>D</sub> =1A                                                                     | 1   | -    | -    | S  |
| Dynamic Characteristics (Note4)    |                     |                                                                                                             |     |      |      |    |
| Input Capacitance                  | C <sub>iss</sub>    | V <sub>DS</sub> =50V, V <sub>GS</sub> =0V,<br>F=1.0MHz                                                      | -   | 190  | -    | PF |
| Output Capacitance                 | C <sub>oss</sub>    |                                                                                                             | -   | 22   | -    | PF |
| Reverse Transfer Capacitance       | C <sub>rss</sub>    |                                                                                                             | -   | 13   | -    | PF |
| Switching Characteristics (Note 4) |                     |                                                                                                             |     |      |      |    |
| Turn-on Delay Time                 | t <sub>d(on)</sub>  | V <sub>DD</sub> =50V, I <sub>D</sub> =1.3A, R <sub>L</sub> =39Ω<br>V <sub>GS</sub> =10V, R <sub>G</sub> =1Ω | -   | 6    | -    | nS |
| Turn-on Rise Time                  | t <sub>r</sub>      |                                                                                                             | -   | 10   | -    | nS |
| Turn-Off Delay Time                | t <sub>d(off)</sub> |                                                                                                             | -   | 10   | -    | nS |
| Turn-Off Fall Time                 | t <sub>f</sub>      |                                                                                                             | -   | 6    | -    | nS |
| Total Gate Charge                  | Q <sub>g</sub>      | V <sub>DS</sub> =50V, I <sub>D</sub> =1.3A,<br>V <sub>GS</sub> =10V                                         | -   | 5.2  |      | nC |
| Gate-Source Charge                 | Q <sub>gs</sub>     |                                                                                                             | -   | 0.75 | -    | nC |
| Gate-Drain Charge                  | Q <sub>gd</sub>     |                                                                                                             | -   | 1.4  | -    | nC |
| Drain-Source Diode Characteristics |                     |                                                                                                             |     |      |      |    |
| Diode Forward Voltage (Note 3)     | V <sub>SD</sub>     | V <sub>GS</sub> =0V, I <sub>S</sub> =1.3A                                                                   | -   | -    | 1.2  | V  |
| Diode Forward Current (Note 2)     | I <sub>S</sub>      |                                                                                                             | -   | -    | 2.6  | A  |

## Notes:

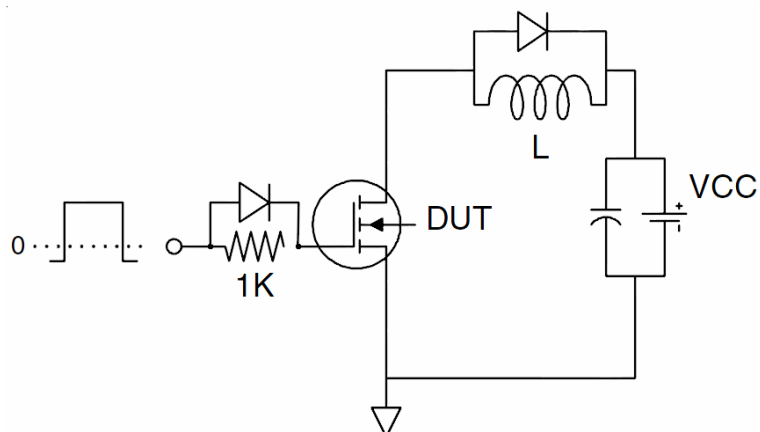
1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board,  $t \leq 10$  sec.
3. Pulse Test: Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 2\%$ .
4. Guaranteed by design, not subject to production

## Test Circuit

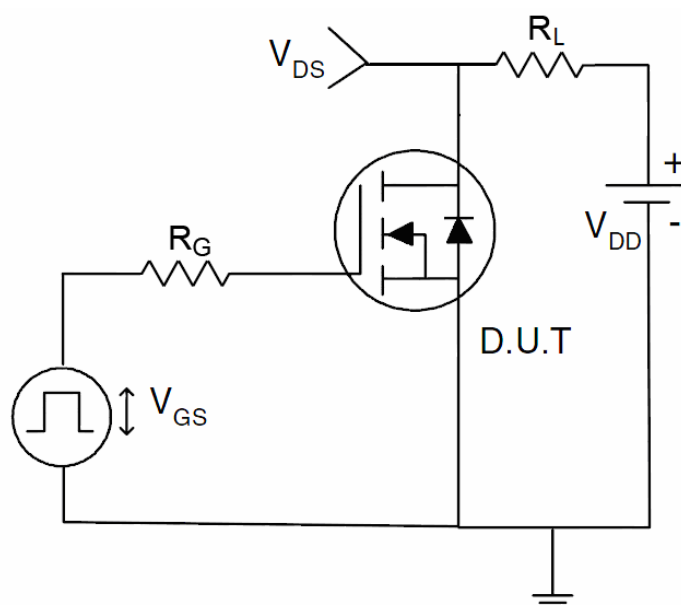
### 1) $E_{AS}$ test circuit



### 2) Gate charge test circuit



### 3) Switch Time Test Circuit



## Typical Electrical and Thermal Characteristics (Curves)

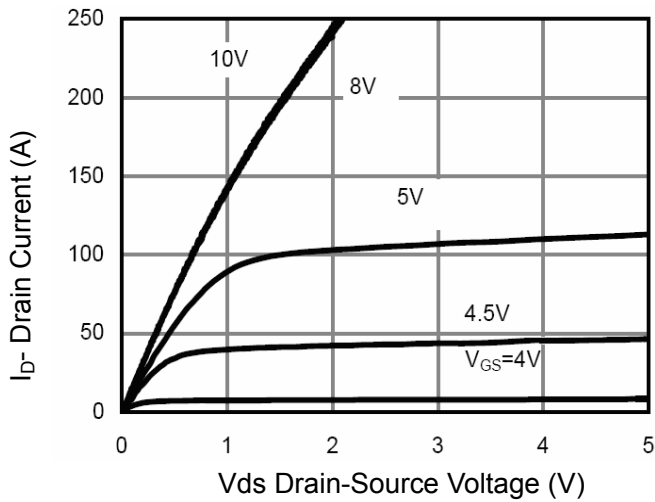


Figure 1 Output Characteristics

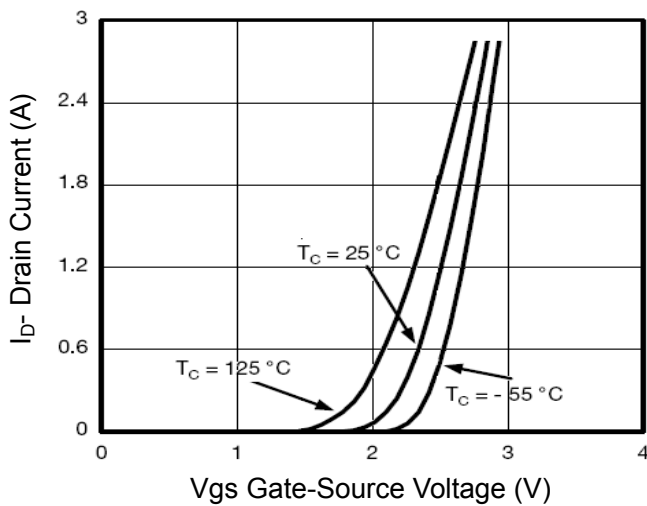


Figure 2 Transfer Characteristics

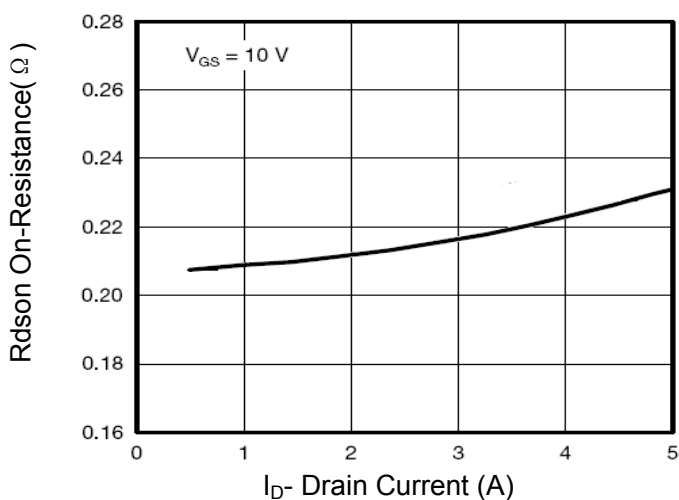


Figure 3  $R_{DS(on)}$ - Drain Current

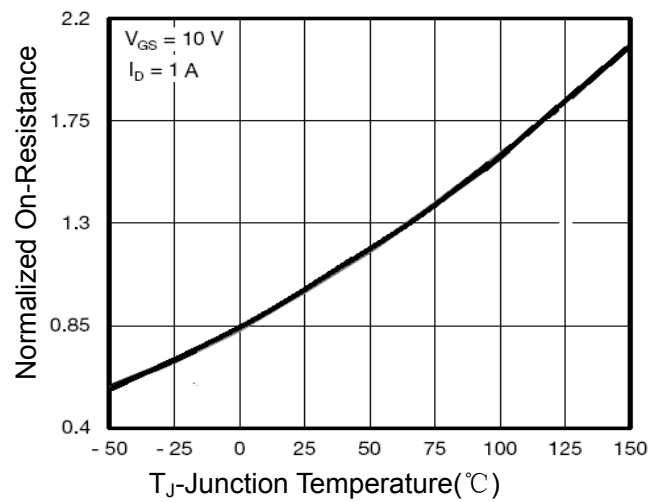


Figure 4  $R_{DS(on)}$ -Junction Temperature

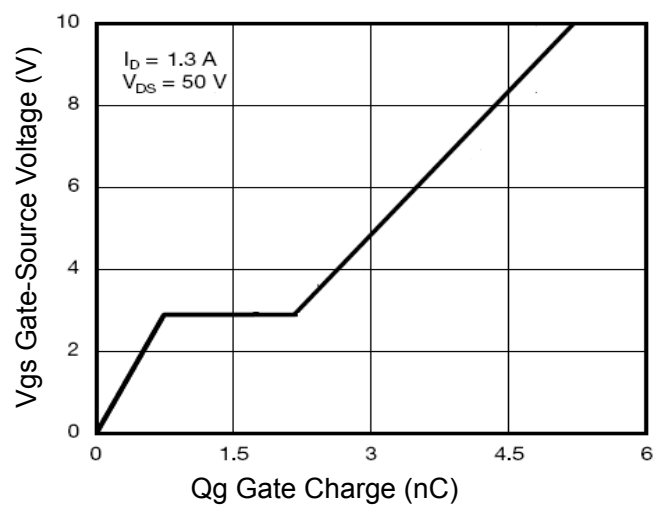


Figure 5 Gate Charge

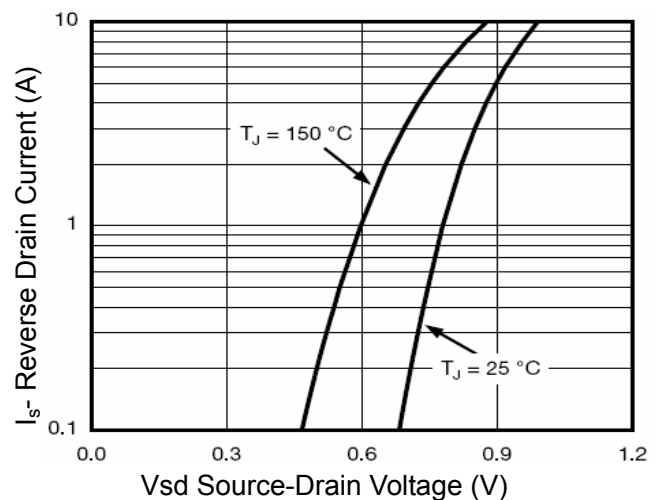


Figure 6 Source- Drain Diode Forward

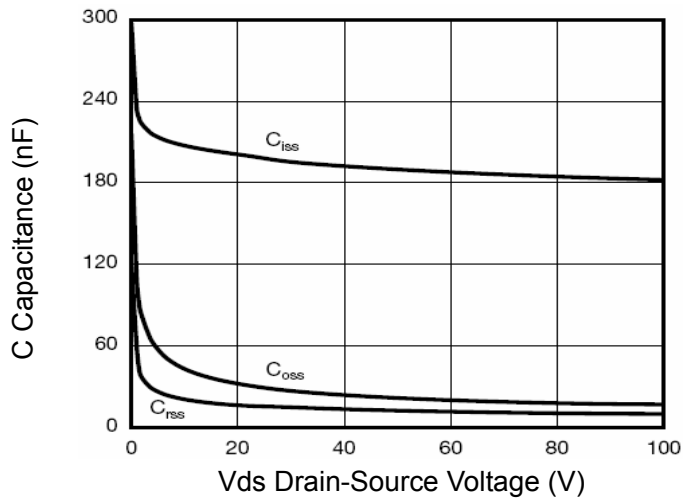


Figure 7 Capacitance vs Vds

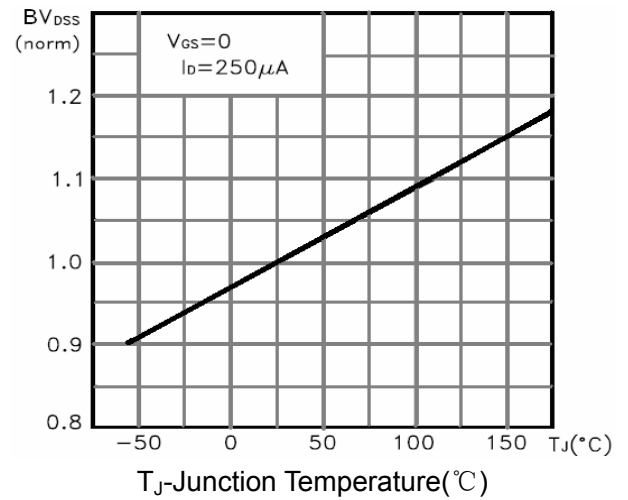


Figure 9  $BV_{DSS}$  vs Junction Temperature

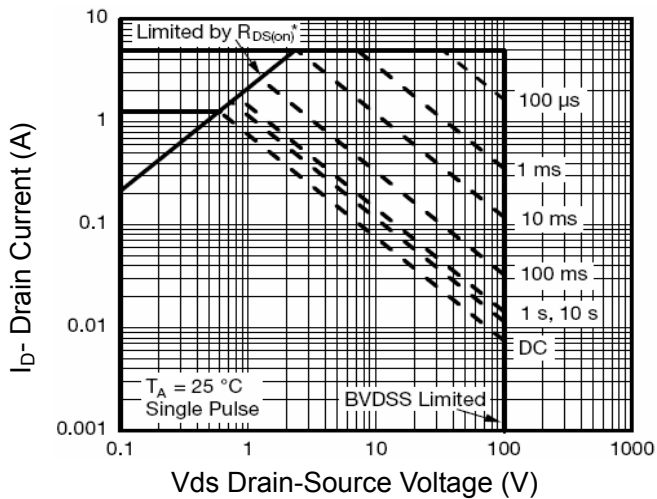


Figure 8 Safe Operation Area

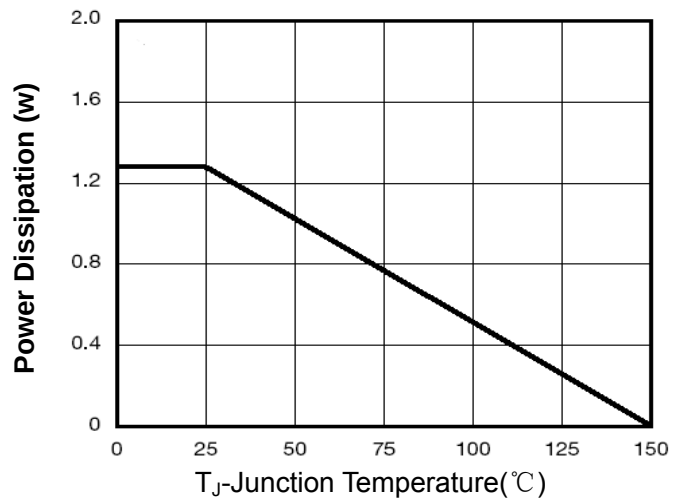


Figure 10 Power De-ratin

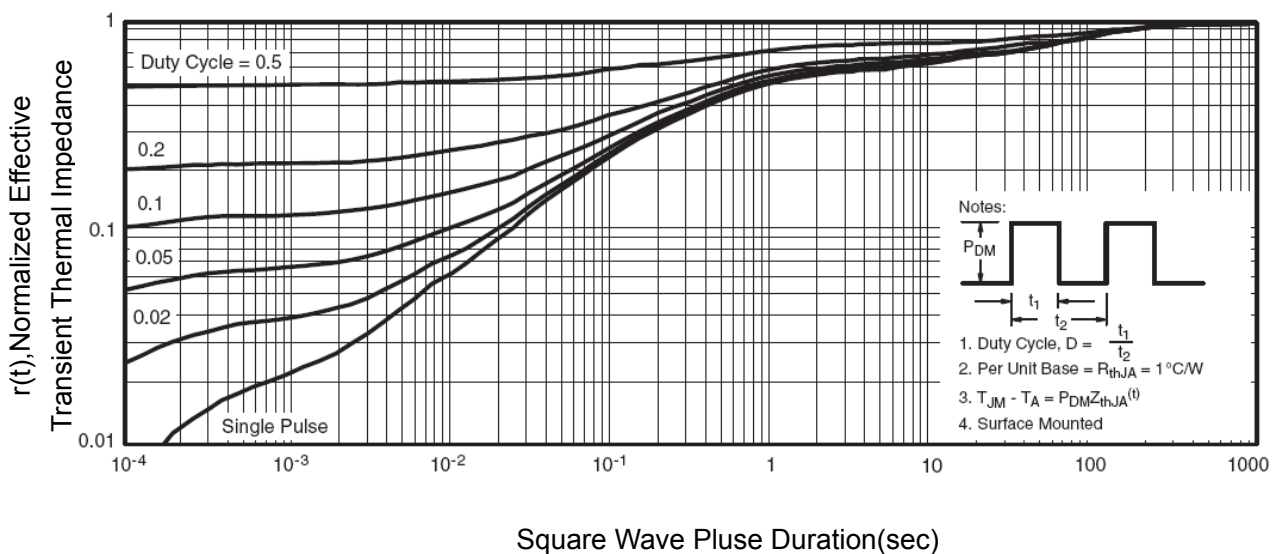
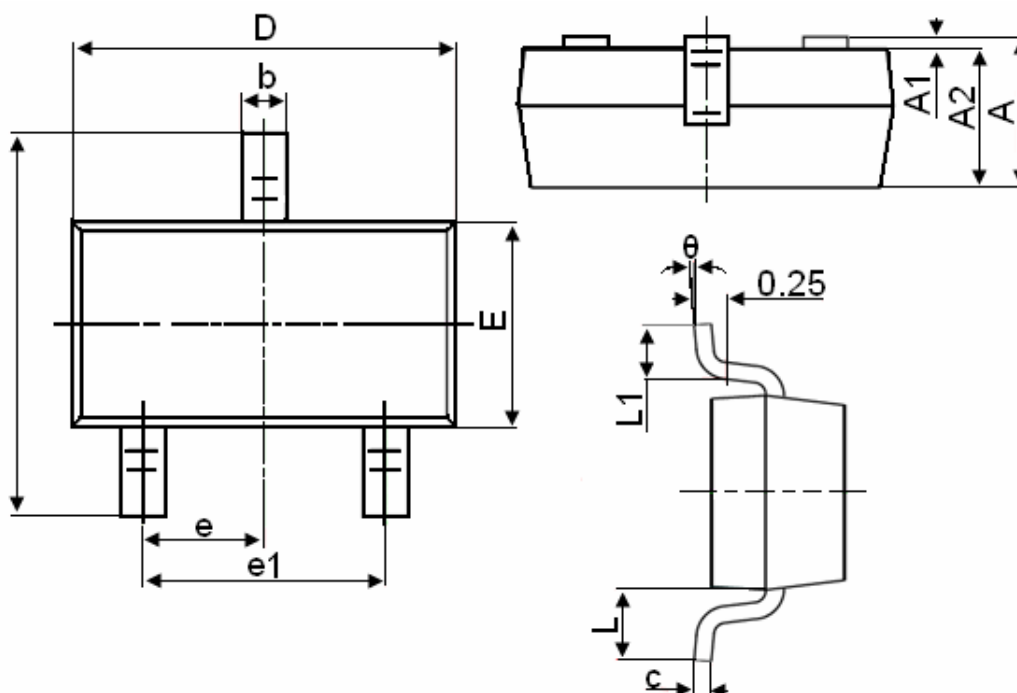


Figure 11 Normalized Maximum Transient Thermal Impedance

## 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.