

## Description

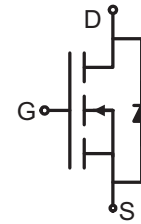
The RM04N30S2 uses advanced trench technology to provide excellent  $R_{DS(ON)}$  and low gate charge. This device is suitable for use as a load switch or in PWM applications.

## General Features

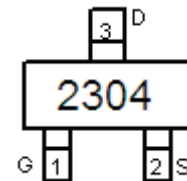
- $V_{DS} = 30V, I_D = 3.6A$   
 $R_{DS(ON)} < 73m\Omega @ V_{GS}=4.5V$   
 $R_{DS(ON)} < 58m\Omega @ V_{GS}=10V$
- High power and current handling capability
- Lead free product is acquired
- Surface mount package

## 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   |
|----------------|-----------|----------------|-----------|------------|------------|
| 2304           | RM04N30S2 | 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                             | $V_{DS}$       | 30         | V                |
| Gate-Source Voltage                              | $V_{GS}$       | $\pm 20$   | V                |
| Drain Current-Continuous                         | $I_D$          | 3.6        | A                |
| Drain Current-Pulsed (Note 1)                    | $I_{DM}$       | 15         | A                |
| Maximum Power Dissipation                        | $P_D$          | 1.7        | 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) | $R_{\theta JA}$ | 73.5 | $^\circ\text{C/W}$ |
|--------------------------------------------------|-----------------|------|--------------------|

## 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  | $BV_{DSS}$ | $V_{GS}=0V, I_D=250\mu A$ | 30  | 33  | -   | V       |
| Zero Gate Voltage Drain Current | $I_{DSS}$  | $V_{DS}=30V, V_{GS}=0V$   | -   | -   | 1   | $\mu A$ |

|                           |           |                             |   |   |           |    |
|---------------------------|-----------|-----------------------------|---|---|-----------|----|
| Gate-Body Leakage Current | $I_{GSS}$ | $V_{GS}=\pm 20V, V_{DS}=0V$ | - | - | $\pm 100$ | nA |
|---------------------------|-----------|-----------------------------|---|---|-----------|----|

#### On Characteristics (Note 3)

|                                  |              |                               |     |     |     |            |
|----------------------------------|--------------|-------------------------------|-----|-----|-----|------------|
| Gate Threshold Voltage           | $V_{GS(th)}$ | $V_{DS}=V_{GS}, I_D=250\mu A$ | 1.2 | 1.5 | 2.2 | V          |
| Drain-Source On-State Resistance | $R_{DS(ON)}$ | $V_{GS}=4.5V, I_D=3.1A$       | -   | 58  | 73  | m $\Omega$ |
|                                  |              | $V_{GS}=10V, I_D=3.6A$        | -   | 40  | 58  | m $\Omega$ |
| Forward Transconductance         | $g_{FS}$     | $V_{DS}=5V, I_D=3.6A$         | -   | 11  | -   | S          |

#### Dynamic Characteristics (Note4)

|                              |           |                                        |   |     |   |    |
|------------------------------|-----------|----------------------------------------|---|-----|---|----|
| Input Capacitance            | $C_{iss}$ | $V_{DS}=15V, V_{GS}=0V,$<br>$F=1.0MHz$ | - | 230 | - | PF |
| Output Capacitance           | $C_{oss}$ |                                        | - | 40  | - | PF |
| Reverse Transfer Capacitance | $C_{rss}$ |                                        | - | 17  | - | PF |

#### Switching Characteristics (Note 4)

|                     |              |                                                          |   |      |   |    |
|---------------------|--------------|----------------------------------------------------------|---|------|---|----|
| Turn-on Delay Time  | $t_{d(on)}$  | $V_{DD}=10V, I_D=3.6A$<br>$V_{GS}=4.5V, R_{GEN}=6\Omega$ | - | 10   | - | nS |
| Turn-on Rise Time   | $t_r$        |                                                          | - | 50   | - | nS |
| Turn-Off Delay Time | $t_{d(off)}$ |                                                          | - | 10   | - | nS |
| Turn-Off Fall Time  | $t_f$        |                                                          | - | 20   | - | nS |
| Total Gate Charge   | $Q_g$        | $V_{DS}=15V, I_D=3.6A,$<br>$V_{GS}=10V$                  | - | 4.0  | - | nC |
| Gate-Source Charge  | $Q_{gs}$     |                                                          | - | 0.75 | - | nC |
| Gate-Drain Charge   | $Q_{gd}$     |                                                          | - | 0.65 | - | nC |

#### Drain-Source Diode Characteristics

|                                |          |                       |   |     |     |   |
|--------------------------------|----------|-----------------------|---|-----|-----|---|
| Diode Forward Voltage (Note 3) | $V_{SD}$ | $V_{GS}=0V, I_S=2.7A$ | - | 0.8 | 1.2 | V |
| Diode Forward Current (Note 2) | $I_S$    |                       | - | -   | 1.6 | 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

## RATING AND CHARACTERISTICS CURVES ( RM04N30S2)

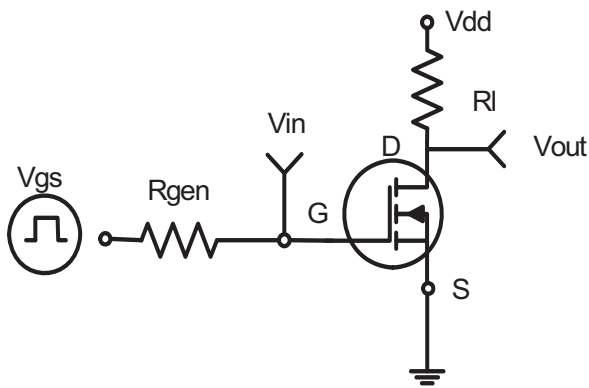


Figure 1: Switching Test Circuit

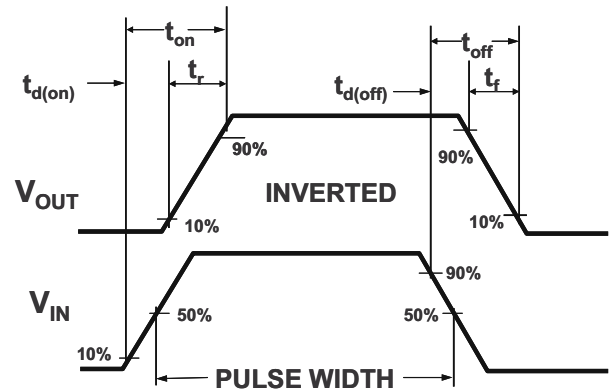


Figure 2: Switching Waveforms

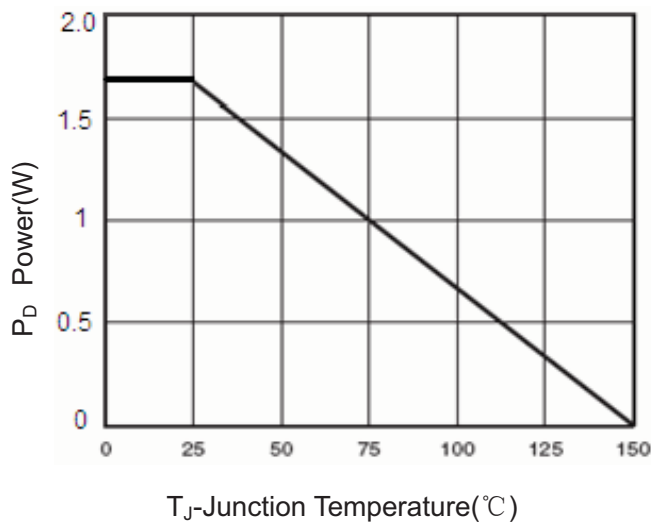


Figure 3 Power Dissipation

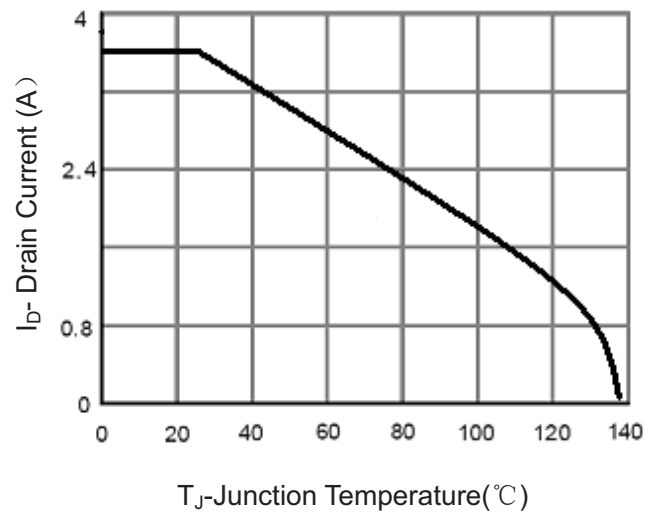


Figure 4 Drain Current

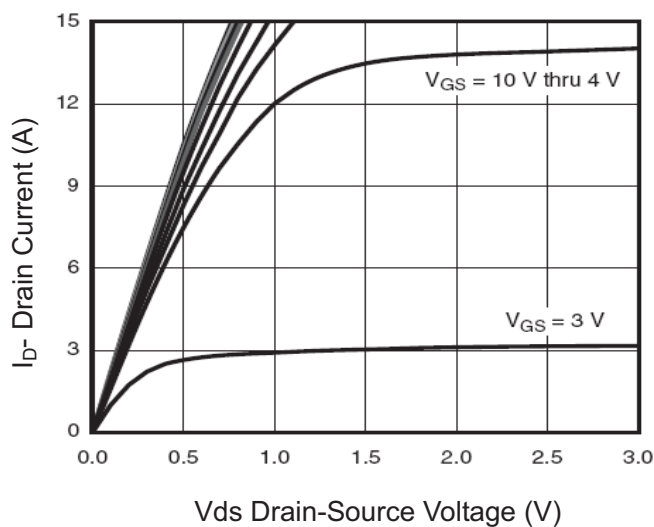


Figure 5 Output Characteristics

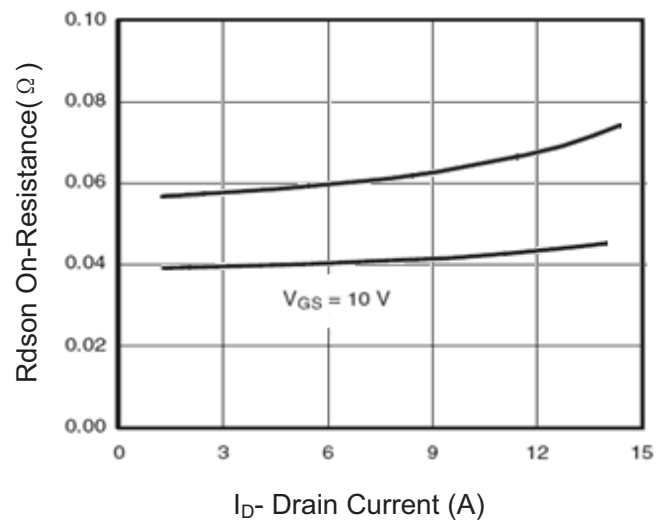
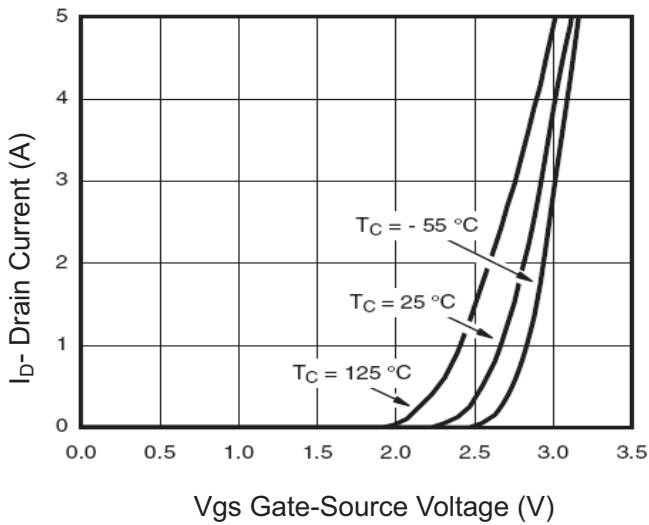
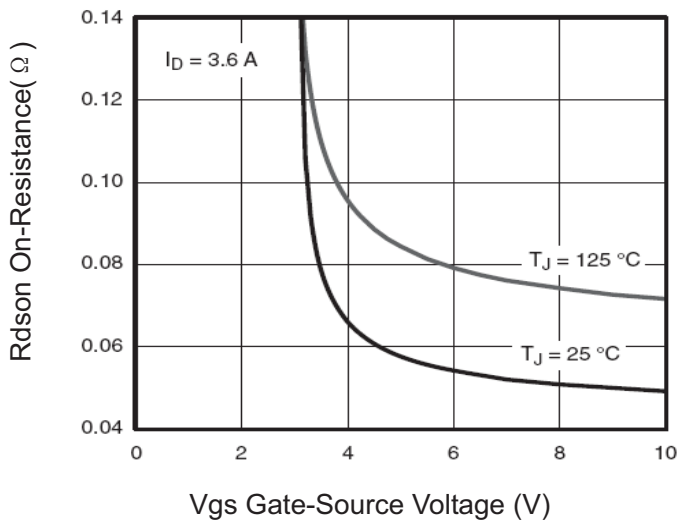


Figure 6 Drain-Source On-Resistance

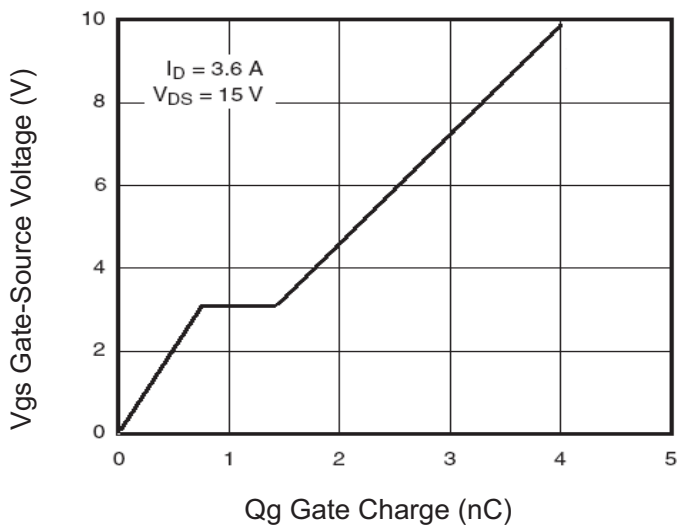
## RATING AND CHARACTERISTICS CURVES ( RM04N30S2 )



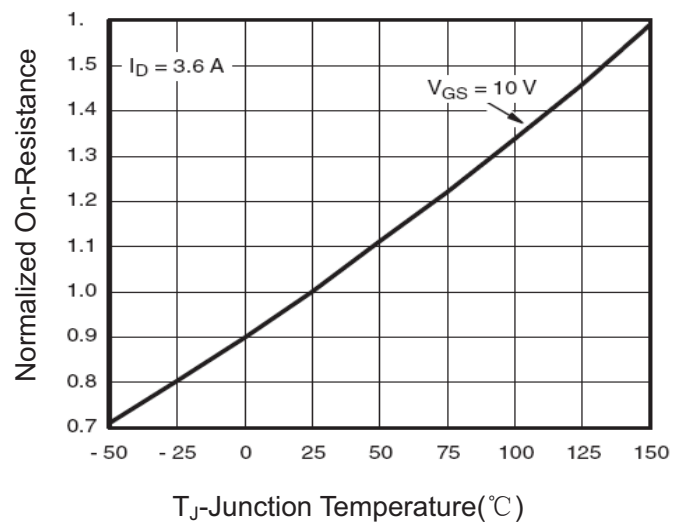
**Figure 7 Transfer Characteristics**



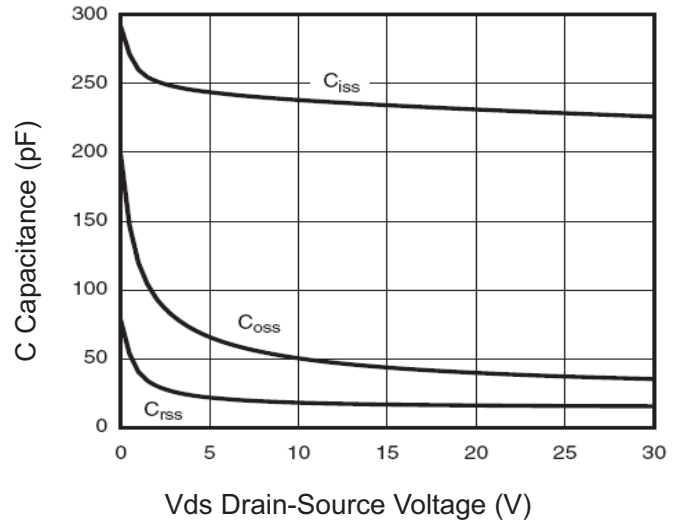
**Figure 9  $R_{DS(on)}$  vs  $V_{GS}$**



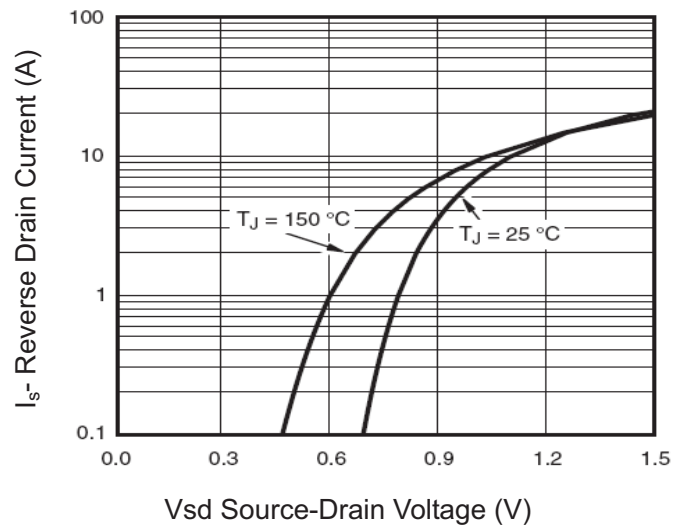
**Figure 11 Gate Charge**



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



**Figure 10 Capacitance vs  $V_{DS}$**



**Figure 12 Source- Drain Diode Forward**

## RATING AND CHARACTERISTICS CURVES ( RM04N30S2 )

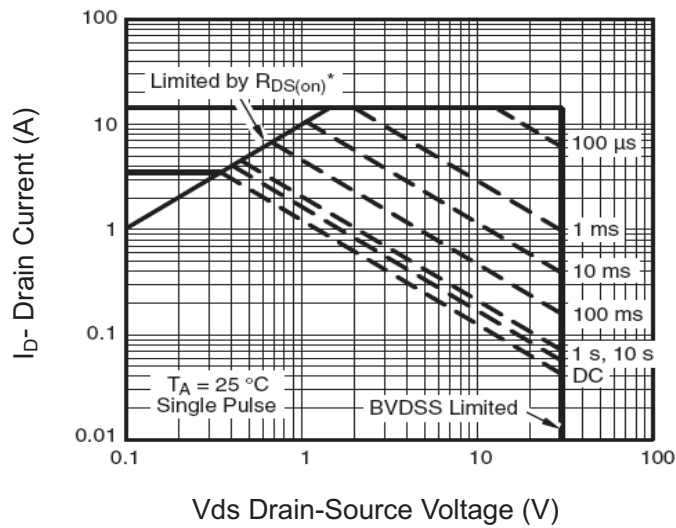


Figure 13 Safe Operation Area

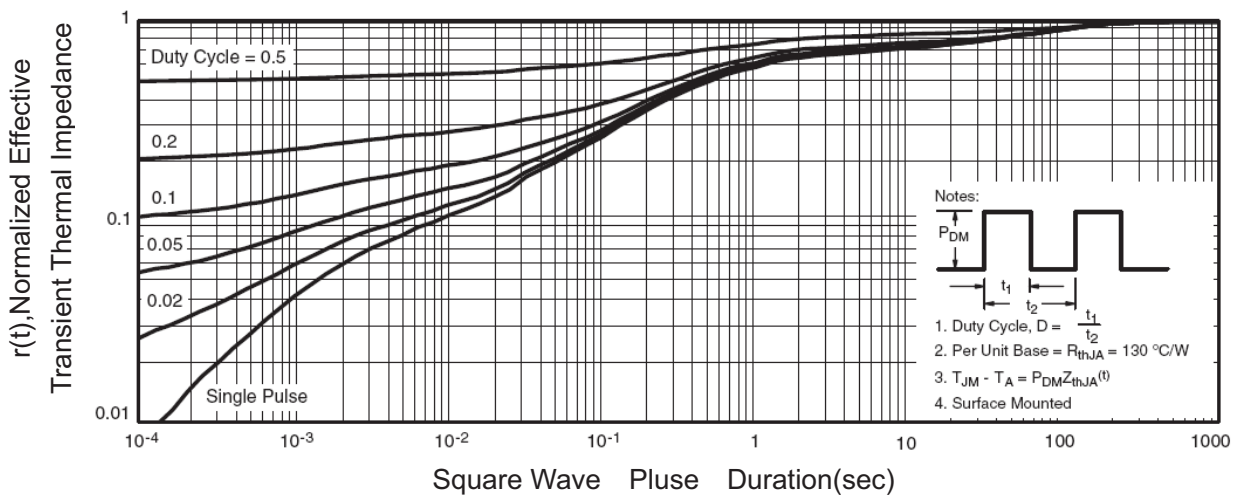
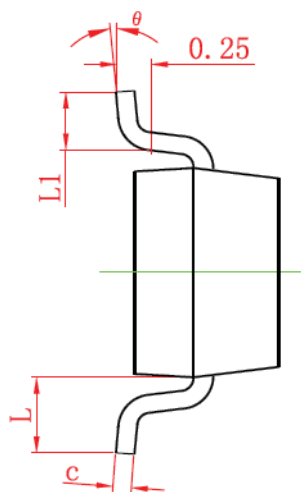
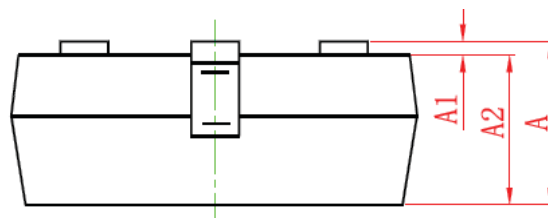
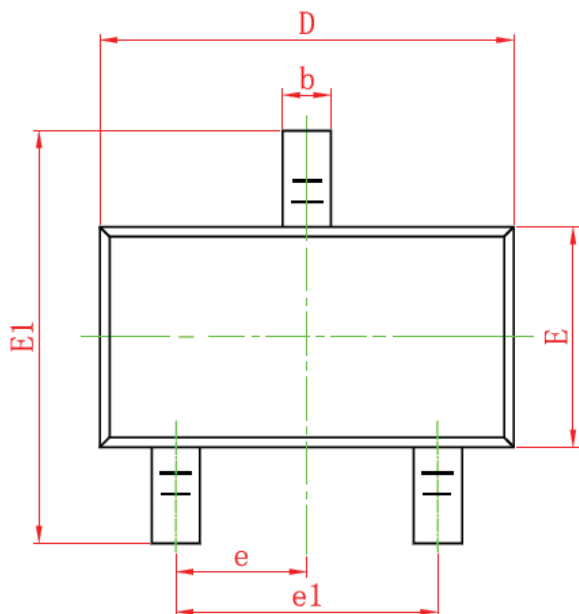


Figure 14 Normalized Maximum Transient Thermal Impedance

## 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 |
| $\theta$ | 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.

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