

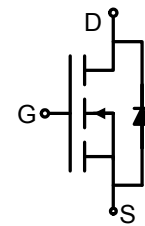
## NCE N-Channel Enhancement Mode Power MOSFET

### Description

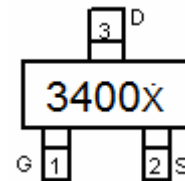
The NCE3400 uses advanced trench technology to provide excellent  $R_{DS(ON)}$ , low gate charge and operation with gate voltages as low as 2.5V. This device is suitable for use as a Battery protection or in other Switching application.

### General Features

- $V_{DS} = 30V, I_D = 5.8A$ 
  - $R_{DS(ON)} < 57m\Omega @ V_{GS}=2.5V$
  - $R_{DS(ON)} < 41m\Omega @ V_{GS}=4.5V$
  - $R_{DS(ON)} < 35m\Omega @ V_{GS}=10V$
- High power and current handing capability
- Lead free product is acquired
- Surface mount package
- PWM applications
- 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   |
|----------------|---------|----------------|-----------|------------|------------|
| 3400 X         | NCE3400 | SOT-23         | Ø180mm    | 8 mm       | 3000 units |

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

| Parameter  | Symbol         | Limit      | Unit       |
|--|----------------|------------|------------|
| Drain-Source Voltage                             | $V_{DS}$       | 30         | V          |
| Gate-Source Voltage                              | $V_{GS}$       | $\pm 12$   | V          |
| Drain Current-Continuous                         | $I_D$          | 5.8        | A          |
| Drain Current-Pulsed <sup>(Note 1)</sup>         | $I_{DM}$       | 30         | A          |
| Maximum Power Dissipation                        | $P_D$          | 1.4        | W          |
| Operating Junction and Storage Temperature Range | $T_J, T_{STG}$ | -55 To 150 | $^\circ C$ |

### Thermal Characteristic

|   |                 |    |              |
|---|-----------------|----|--------------|
| Thermal Resistance, Junction-to-Ambient <sup>(Note 2)</sup> | $R_{\theta JA}$ | 89 | $^\circ C/W$ |
|---|-----------------|----|--------------|

### Electrical Characteristics ( $T_A=25^\circ C$ 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                                | $I_{GSS}$    | $V_{GS}=\pm 12V, V_{DS}=0V$                                  | -   | -   | $\pm 100$ | nA         |
| <b>On Characteristics</b> <small>(Note 3)</small>        |              |  |     |     |           |            |
| Gate Threshold Voltage                                   | $V_{GS(th)}$ | $V_{DS}=V_{GS}, I_D=250\mu A$                                | 0.7 | 0.9 | 1.2       | V          |
| Drain-Source On-State Resistance                         | $R_{DS(ON)}$ | $V_{GS}=2.5V, I_D=4A$  | -   | 28  | 57        | m $\Omega$ |
|  |              | $V_{GS}=4.5V, I_D=5A$  | -   | 24  | 41        | m $\Omega$ |
|  |              | $V_{GS}=10V, I_D=5A$   | -   | 22  | 35        | m $\Omega$ |
| Forward Transconductance                                 | $g_{FS}$     | $V_{DS}=5V, I_D=5A$  | 10  | -   | -         | S          |
| <b>Dynamic Characteristics</b> <small>(Note4)</small>    |              |  |     |     |           |            |
| Input Capacitance  | $C_{iss}$    | $V_{DS}=15V, V_{GS}=0V,$<br>$F=1.0MHz$                       | -   | 820 | -         | PF         |
| Output Capacitance                                       | $C_{oss}$    |  | -   | 99  | -         | PF         |
| Reverse Transfer Capacitance                             | $C_{rss}$    |  | -   | 77  | -         | PF         |
| <b>Switching Characteristics</b> <small>(Note 4)</small> |              |  |     |     |           |            |
| Turn-on Delay Time                                       | $t_{d(on)}$  | $V_{DD}=15V, R_L=2.7\Omega$<br>$V_{GS}=10V, R_{GEN}=3\Omega$ | -   | 3.3 | -         | nS         |
| Turn-on Rise Time  | $t_r$        |  | -   | 4.8 | -         | nS         |
| Turn-Off Delay Time                                      | $t_{d(off)}$ |  | -   | 26  | -         | nS         |
| Turn-Off Fall Time                                       | $t_f$        |  | -   | 4   | -         | nS         |
| Total Gate Charge  | $Q_g$        | $V_{DS}=15V, I_D=5A,$<br>$V_{GS}=4.5V$                       | -   | 9.5 | -         | nC         |
| Gate-Source Charge                                       | $Q_{gs}$     |  | -   | 1.5 | -         | nC         |
| Gate-Drain Charge  | $Q_{gd}$     |  | -   | 3   | -         | nC         |
| <b>Drain-Source Diode Characteristics</b>                |              |  |     |     |           |            |
| Diode Forward Voltage <small>(Note 3)</small>            | $V_{SD}$     | $V_{GS}=0V, I_S=5A$  | -   | -   | 1.2       | V          |
| Diode Forward Current <small>(Note 2)</small>            | $I_S$        |  | -   | -   | 5.8       | 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

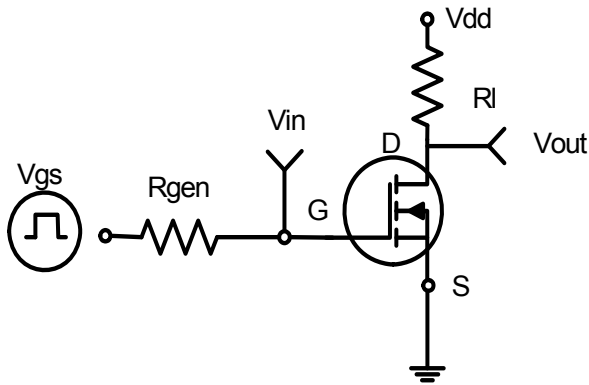


Figure 1: Switching Test Circuit

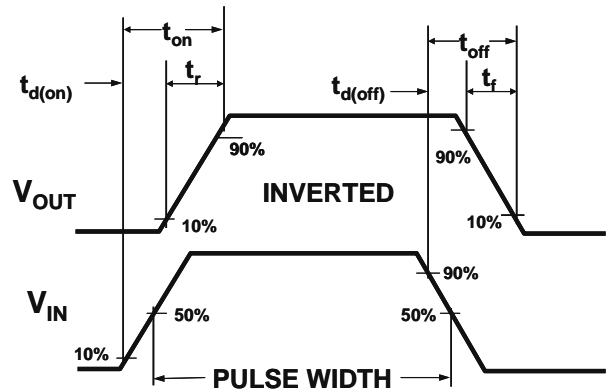


Figure 2: Switching Waveforms

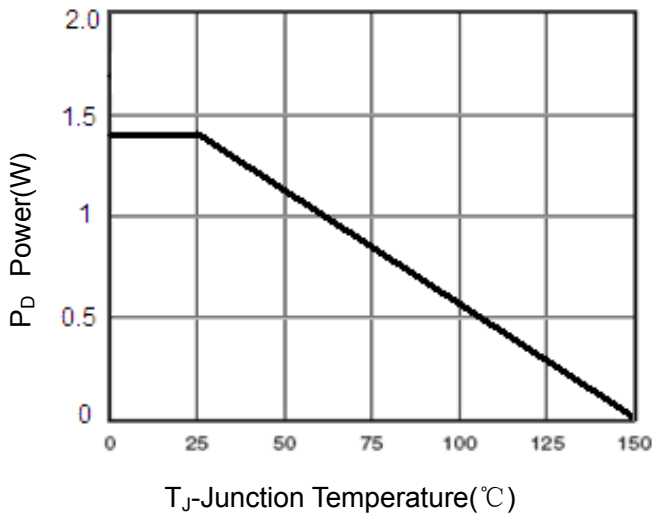


Figure 3 Power Dissipation

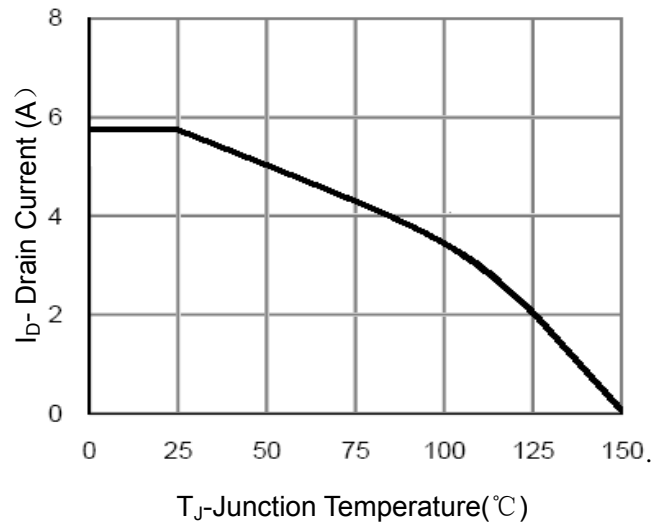


Figure 4 Drain Current

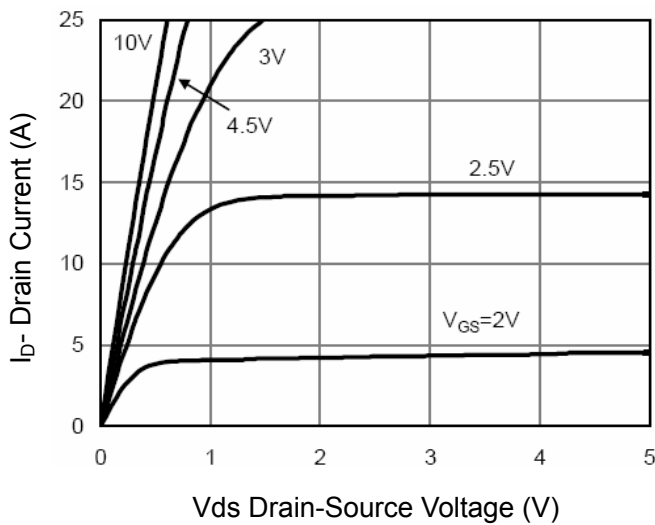


Figure 5 Output Characteristics

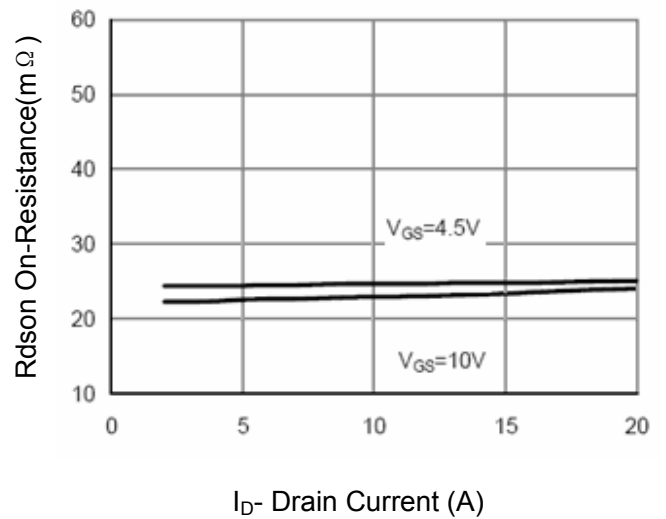


Figure 6 Drain-Source On-Resistance

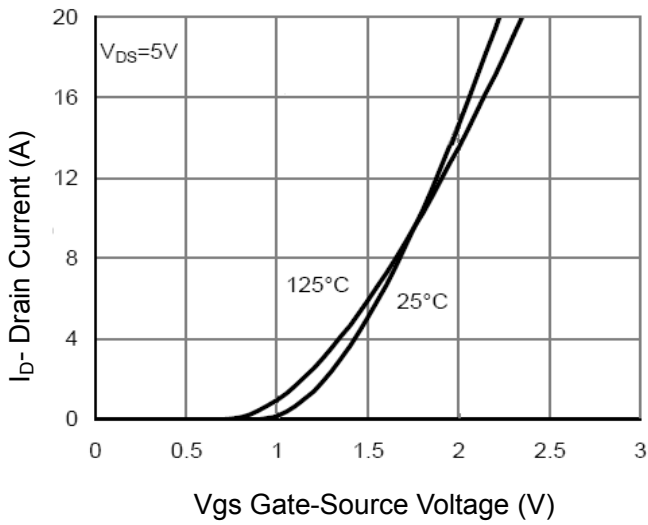


Figure 7 Transfer Characteristics

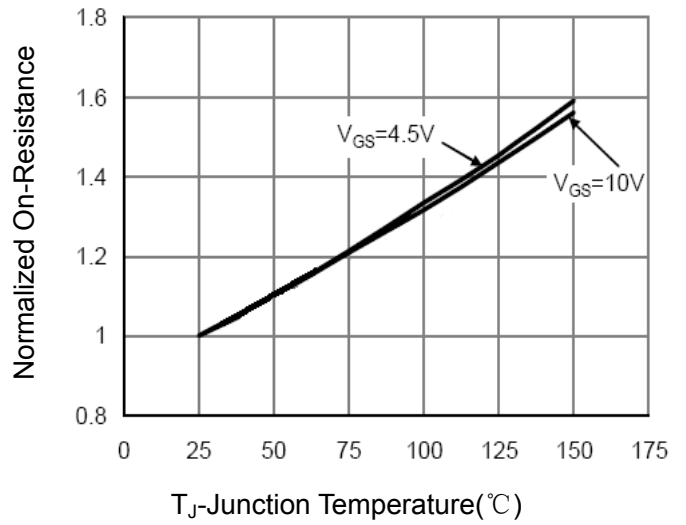


Figure 8 Drain-Source On-Resistance

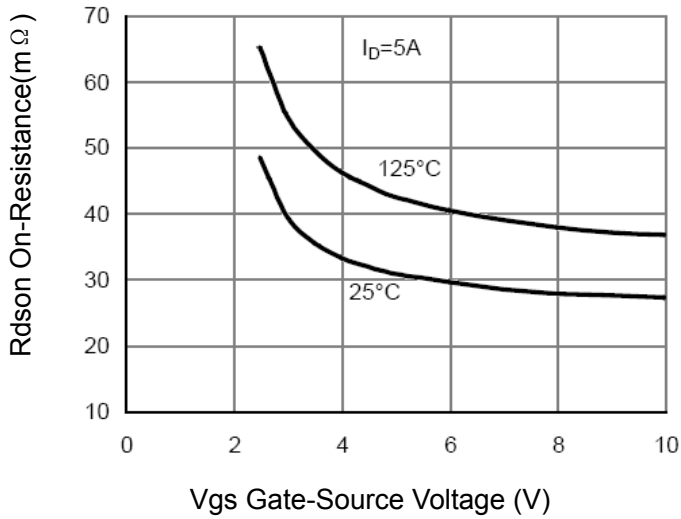


Figure 9 Rdson vs Vgs

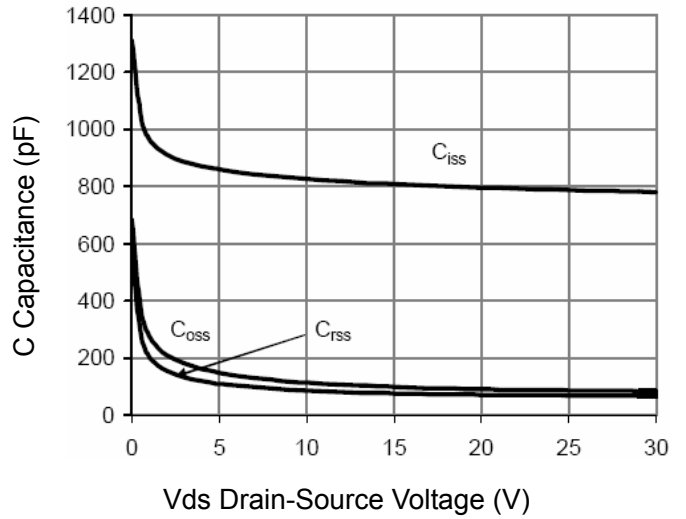


Figure 10 Capacitance vs Vds

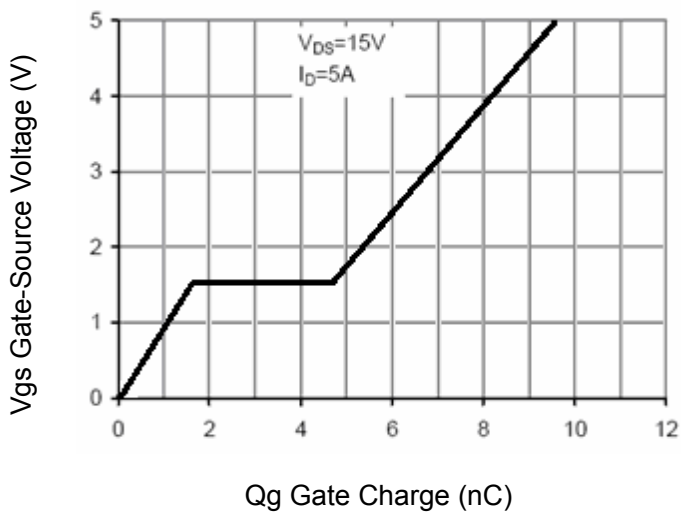


Figure 11 Gate Charge

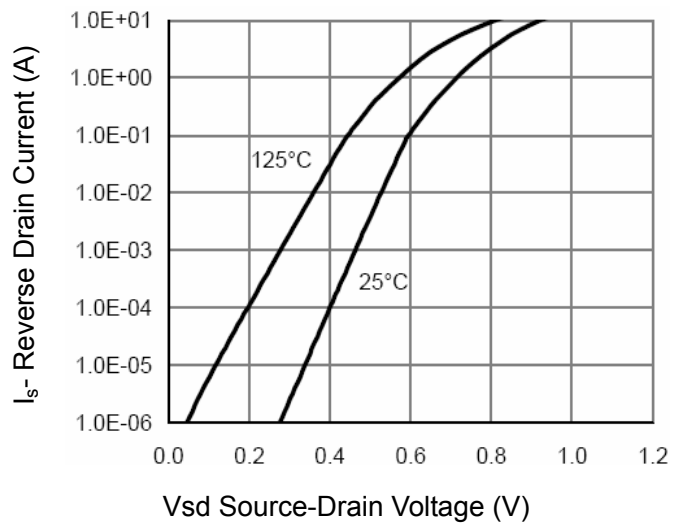


Figure 12 Source- Drain Diode Forward

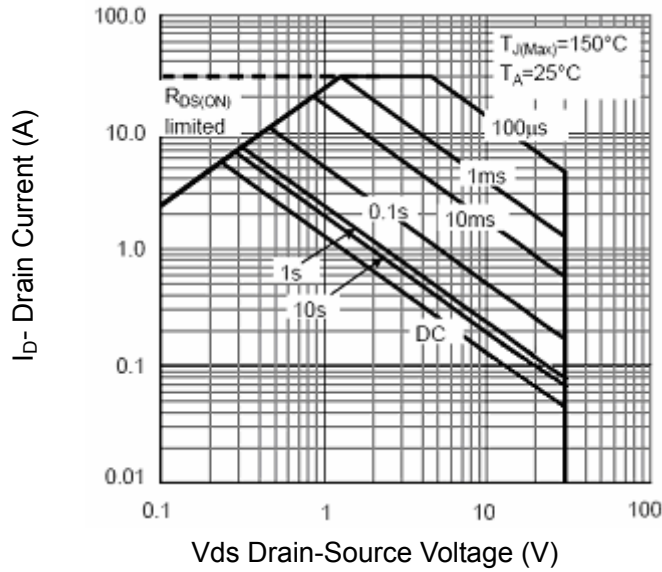


Figure 13 Safe Operation Area

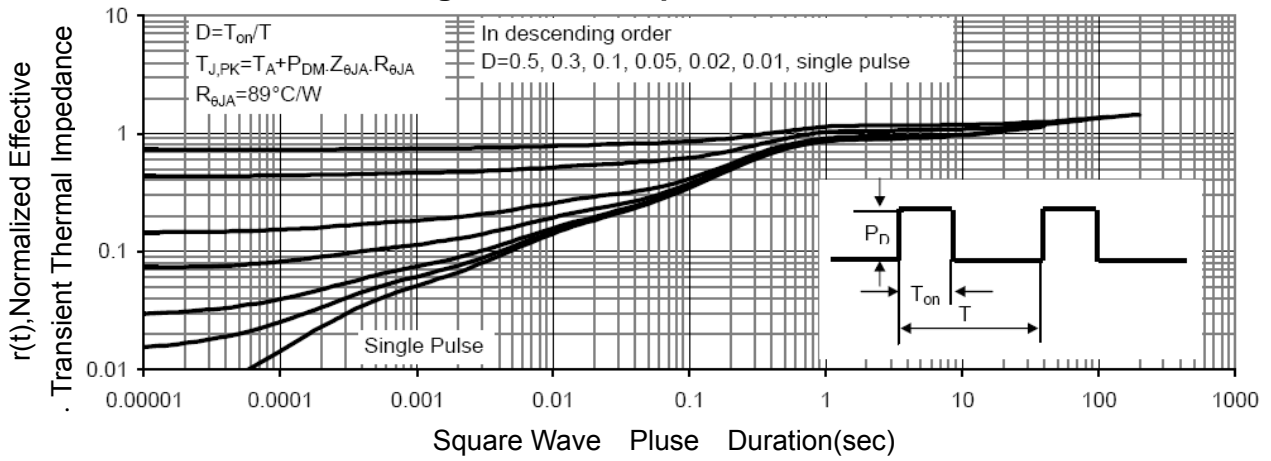
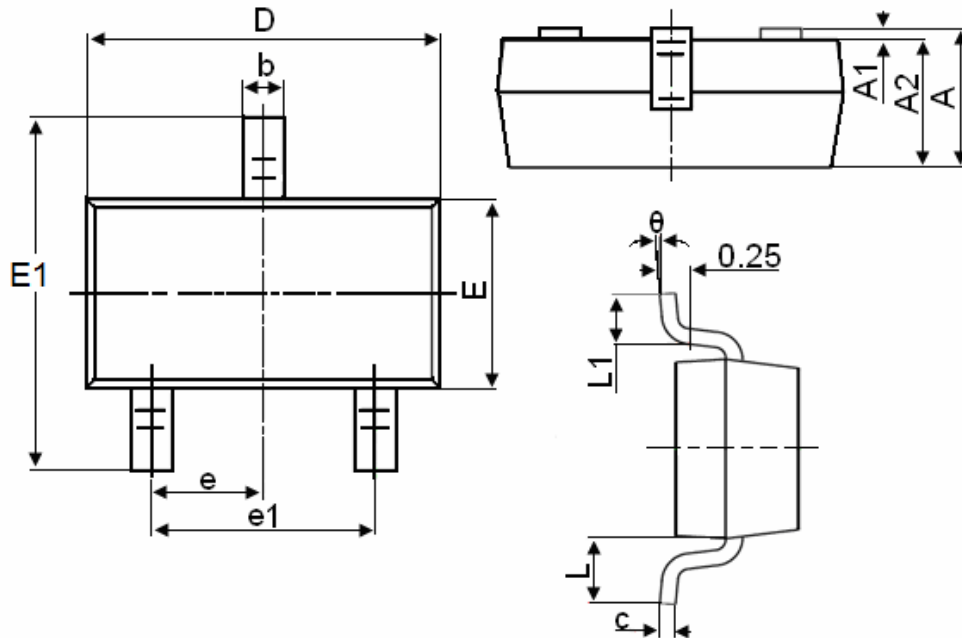


Figure 14 Normalized Maximum Transient Thermal Impedance

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 |
| $\theta$ | 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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