



YOUSHANG SEMICONDUCTOR

**设计研发新型功率器件**

**各类小信号开关**

**中低压及高压大电流等场效应管**

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企业微信二维码



企业QQ二维码

## Product Summary

| BV <sub>DSS</sub> | R <sub>DS(ON)</sub> Max         | I <sub>D</sub><br>T <sub>C</sub> = +25°C |
|-------------------|---------------------------------|--|
| -60V              | 250mΩ @ V <sub>GS</sub> = -10V  | -6.1A                                    |
|                   | 300mΩ @ V <sub>GS</sub> = -4.5V | -5.6A                                    |

## Features and Benefits

- 100% Unclamped Inductive Switch (UIS) Test in Production
- Low Gate Drive
- Low Input Capacitance
- Fast Switching Speed

## Description and Applications

This MOSFET is designed to meet the stringent requirements of Automotive applications. It is qualified to AEC-Q101, supported by a PPAP and is ideal for use in:

- Motor Control
- DC-DC Converters
- Power Management Functions
- Uninterrupted Power Supply

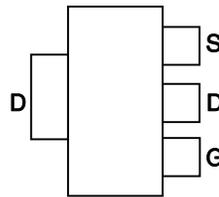
## Mechanical Data

- Case: SOT223
- Case Material: Molded Plastic, "Green" Molding Compound. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals Connections: See Diagram Below
- Terminals: Finish - Matte Tin Annealed over Copper Lead Frame. Solderable per MIL-STD-202, Method 208 
- Weight: 0.112 grams (Approximate)

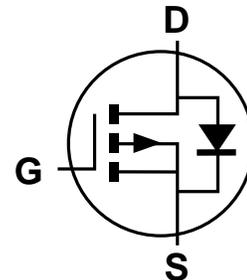
SOT223



Top View



Pin Out - Top View



Equivalent Circuit

**Maximum Ratings** (@T<sub>A</sub> = +25°C, unless otherwise specified.)

| Characteristic   | Symbol           | Value                          | Unit |
|--|------------------|--------------------------------|------|
| Drain-Source Voltage                                     | V <sub>DSS</sub> | -60                            | V    |
| Gate-Source Voltage                                      | V <sub>GS</sub>  | ±20                            | V    |
| Continuous Drain Current (Note 5) V <sub>GS</sub> = -10V | I <sub>D</sub>   | T <sub>C</sub> = +25°C<br>-6.1 | A    |
|  |                  | T <sub>C</sub> = +70°C<br>-4.9 |      |
| Maximum Body Diode Continuous Current                    | I <sub>S</sub>   | -6.1                           | A    |
| Pulsed Drain Current (10μs Pulse, Duty Cycle = 1%)       | I <sub>DM</sub>  | -14                            | A    |
| Single Pulsed Avalanche Current (Note 6) L = 0.1mH       | I <sub>AS</sub>  | -12                            | A    |
| Single Pulsed Avalanche Energy (Note 6) L = 0.1mH        | E <sub>AS</sub>  | 8                              | mJ   |

**Thermal Characteristics** (@T<sub>A</sub> = +25°C, unless otherwise specified.)

| Characteristic                                   | Symbol                            | Value                         | Unit |
|--|-----------------------------------|-------------------------------|------|
| Total Power Dissipation (Note 5)                 | P <sub>D</sub>                    | T <sub>A</sub> = +25°C<br>1.8 | W    |
| Thermal Resistance, Junction to Ambient (Note 5) |                                   | R <sub>θJA</sub><br>69        |      |
| Total Power Dissipation (Note 5)                 | P <sub>D</sub>                    | T <sub>C</sub> = +25°C<br>14  | W    |
| Thermal Resistance, Junction to Case (Note 5)    |                                   | R <sub>θJC</sub><br>8.7       |      |
| Operating and Storage Temperature Range          | T <sub>J</sub> , T <sub>STG</sub> | -55 to +150                   | °C   |

**Electrical Characteristics** (@T<sub>A</sub> = +25°C, unless otherwise specified.)

| Characteristic                              | Symbol              | Min | Typ  | Max  | Unit | Test Condition  |
|---|---------------------|-----|------|------|------|---|
| <b>OFF CHARACTERISTICS</b> (Note 7)         |                     |     |      |      |      |   |
| Drain-Source Breakdown Voltage              | BV <sub>DSS</sub>   | -60 | —    | —    | V    | I <sub>D</sub> = -250μA, V <sub>GS</sub> = 0V   |
| Zero Gate Voltage Drain Current             | I <sub>DSS</sub>    | —   | —    | -1   | μA   | V <sub>DS</sub> = -60V, V <sub>GS</sub> = 0V  |
| Gate-Source Leakage                         | I <sub>GSS</sub>    | —   | —    | ±100 | nA   | V <sub>GS</sub> = ±20V, V <sub>DS</sub> = 0V  |
| <b>ON CHARACTERISTICS</b> (Note 7)          |                     |     |      |      |      |   |
| Gate Threshold Voltage                      | V <sub>GS(TH)</sub> | -1  | —    | -3   | V    | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = -250μA                                   |
| Static Drain-Source On-Resistance           | R <sub>DS(ON)</sub> | —   | 128  | 250  | mΩ   | V <sub>GS</sub> = -10V, I <sub>D</sub> = -1.0A  |
|   |                     |     | 156  | 300  |      | V <sub>GS</sub> = -4.5V, I <sub>D</sub> = -0.5A   |
| Diode Forward Voltage                       | V <sub>SD</sub>     | —   | -0.8 | -1.2 | V    | V <sub>GS</sub> = 0V, I <sub>S</sub> = -2.0A  |
| <b>DYNAMIC CHARACTERISTICS</b> (Note 8)     |                     |     |      |      |      |   |
| Input Capacitance                           | C <sub>iss</sub>    | —   | 551  | —    | pF   | V <sub>DS</sub> = -30V, V <sub>GS</sub> = 0V<br>f = 1MHz                                      |
| Output Capacitance                          | C <sub>oss</sub>    | —   | 25.7 | —    | pF   |   |
| Reverse Transfer Capacitance                | C <sub>rss</sub>    | —   | 19.1 | —    | pF   |   |
| Gate Resistance                             | R <sub>g</sub>      | —   | 12.1 | —    | Ω    | V <sub>DS</sub> = 0V, V <sub>GS</sub> = 0V, f = 1MHz  |
| Total Gate Charge (V <sub>GS</sub> = -4.5V) | Q <sub>g</sub>      | —   | 4.8  | —    | nC   | V <sub>DS</sub> = -30V, I <sub>D</sub> = -2A  |
| Total Gate Charge (V <sub>GS</sub> = -10V)  | Q <sub>g</sub>      | —   | 9.7  | —    | nC   |   |
| Gate-Source Charge                          | Q <sub>gs</sub>     | —   | 1.5  | —    | nC   |   |
| Gate-Drain Charge                           | Q <sub>gd</sub>     | —   | 1.6  | —    | nC   |   |
| Turn-On Delay Time                          | t <sub>D(ON)</sub>  | —   | 6.3  | —    | ns   | V <sub>DS</sub> = -30V, V <sub>GS</sub> = -10V,<br>R <sub>G</sub> = 50Ω, I <sub>D</sub> = -1A |
| Turn-On Rise Time                           | t <sub>R</sub>      | —   | 10.3 | —    | ns   |   |
| Turn-Off Delay Time                         | t <sub>D(OFF)</sub> | —   | 91.4 | —    | ns   |   |
| Turn-Off Fall Time                          | t <sub>F</sub>      | —   | 39.8 | —    | ns   |   |
| Reverse Recovery Time                       | t <sub>RR</sub>     | —   | 9.2  | —    | ns   | I <sub>S</sub> = -1A, di/dt = 100A/μs   |
| Reverse Recovery Charge                     | Q <sub>RR</sub>     | —   | 3.9  | —    | nC   |   |

- Notes:
- Device mounted on FR-4 substrate PC board, 2oz copper, with 1inch square copper plate.
  - I<sub>AS</sub> and E<sub>AS</sub> ratings are based on low frequency and duty cycles to keep T<sub>J</sub> = +25°C.
  - Short duration pulse test used to minimize self-heating effect.
  - For design aid only, not subject to production testing.

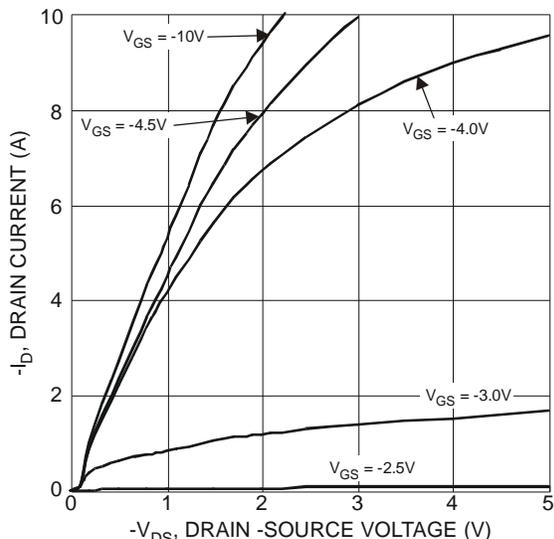


Figure 1 Typical Output Characteristics

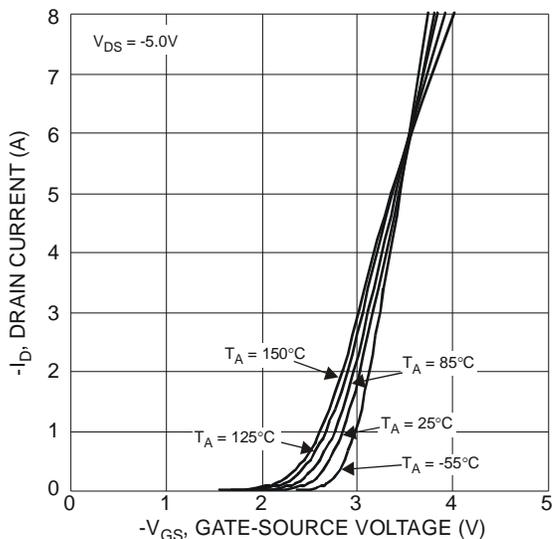


Figure 2 Typical Transfer Characteristics

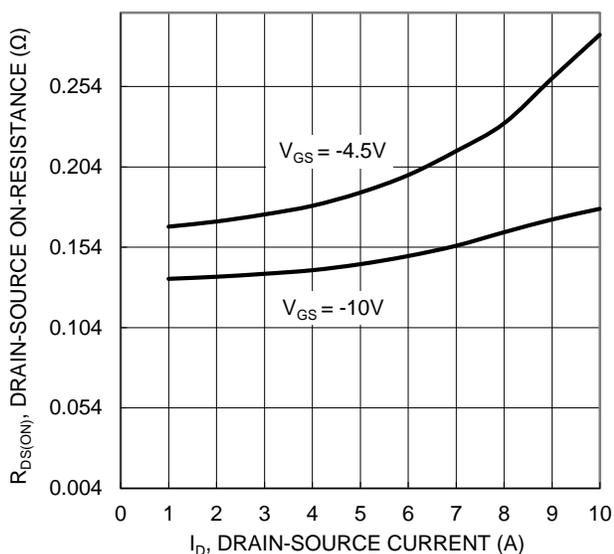


Figure 3. Typical On-Resistance vs. Drain Current and Gate Voltage

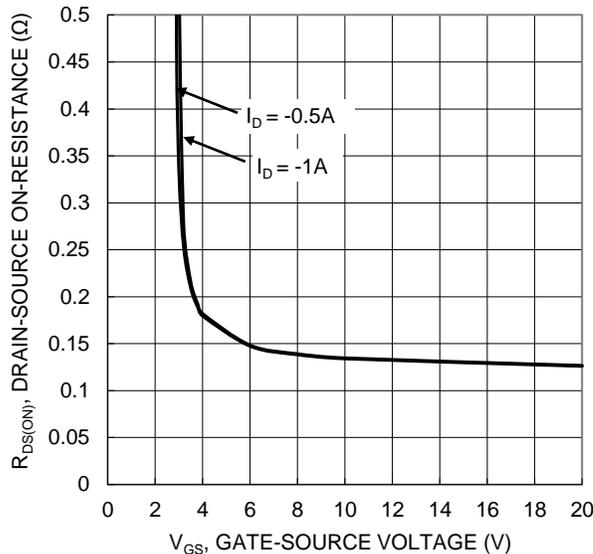


Figure 4. Typical Transfer Characteristic

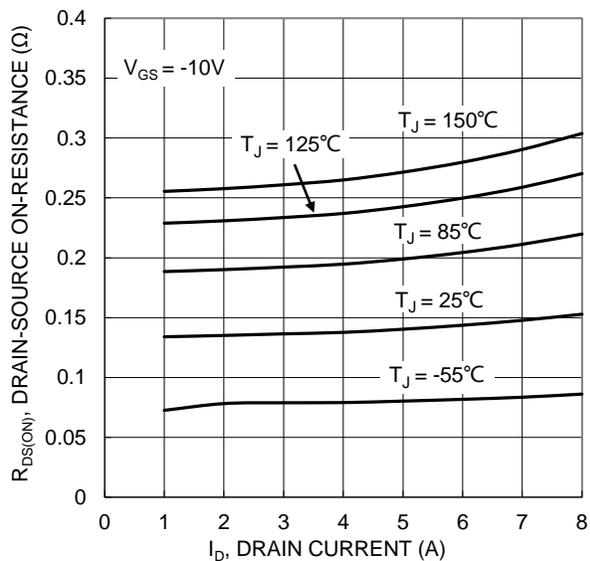


Figure 5. Typical On-Resistance vs. Drain Current and Temperature

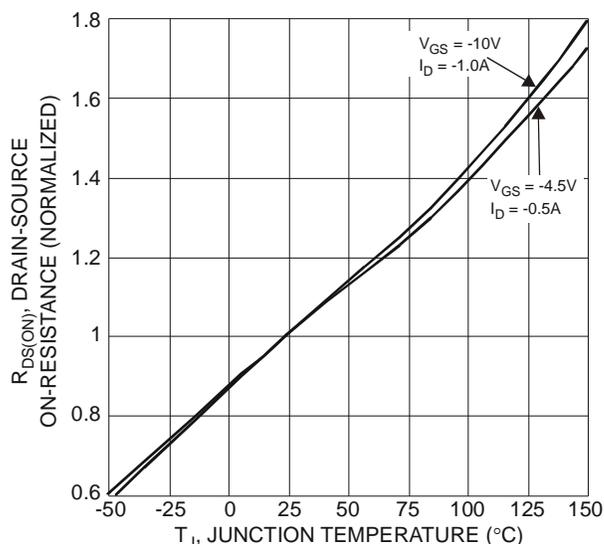


Figure 6 On-Resistance Variation with Temperature

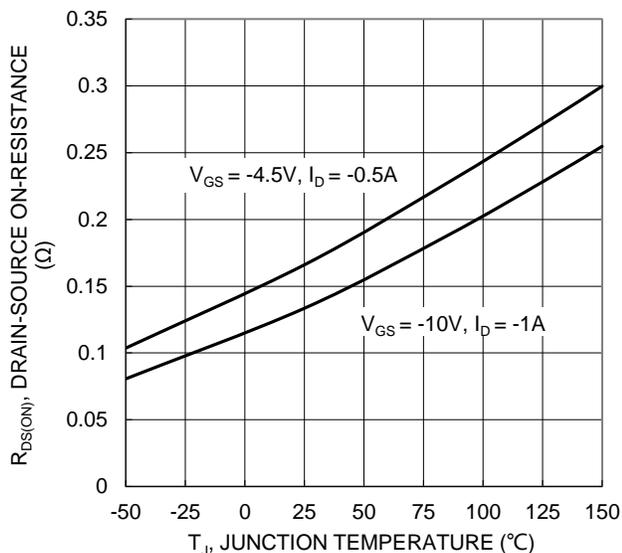


Figure 7. On-Resistance Variation with Temperature

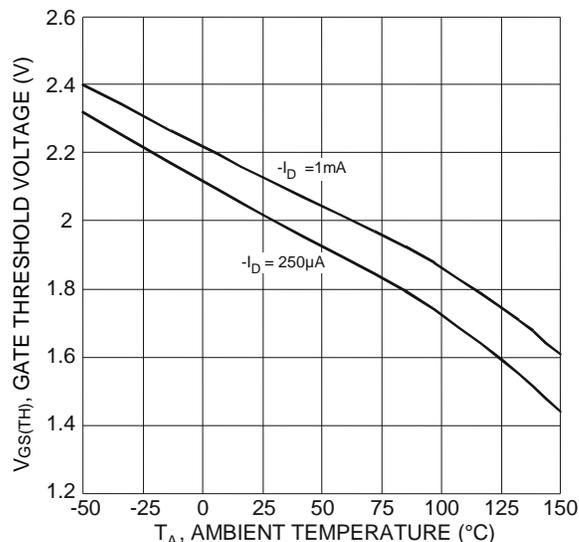


Figure 8 Gate Threshold Variation vs. Ambient Temperature

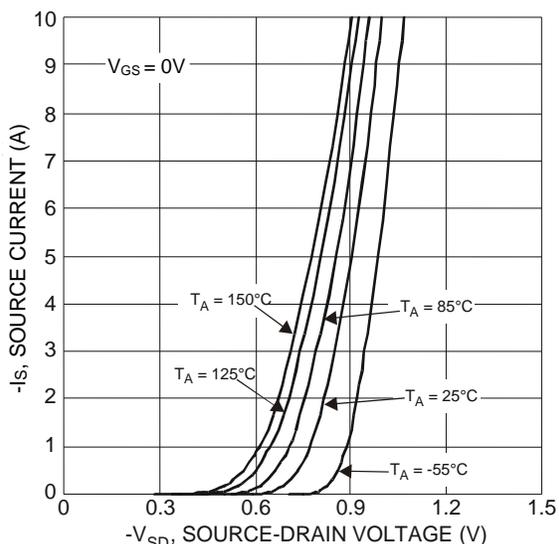


Figure 9 Diode Forward Voltage vs. Current

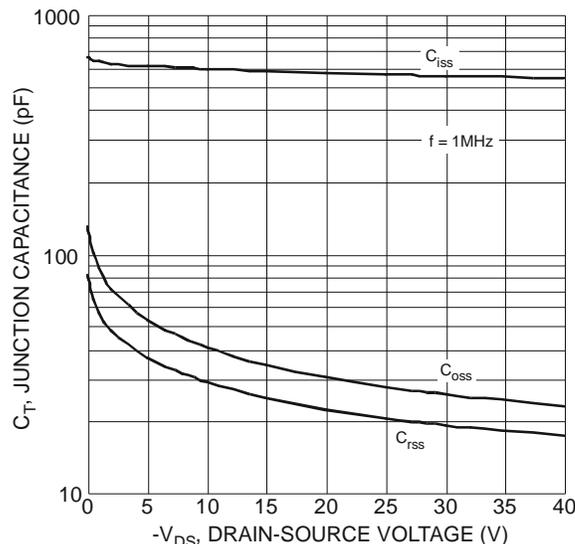


Figure 10 Typical Junction Capacitance

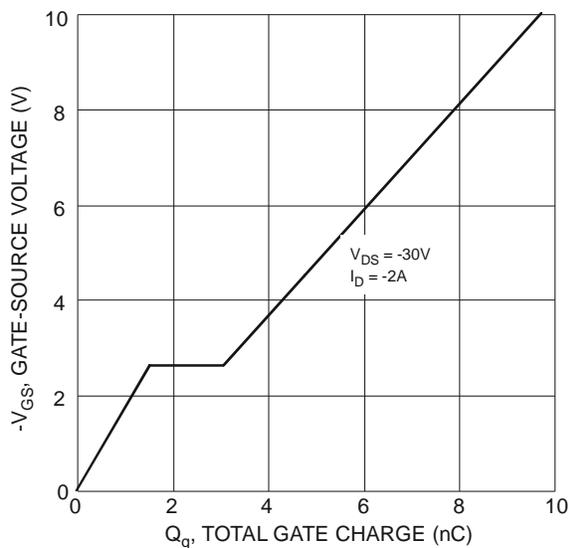


Figure 11 Gate-Charge Characteristics

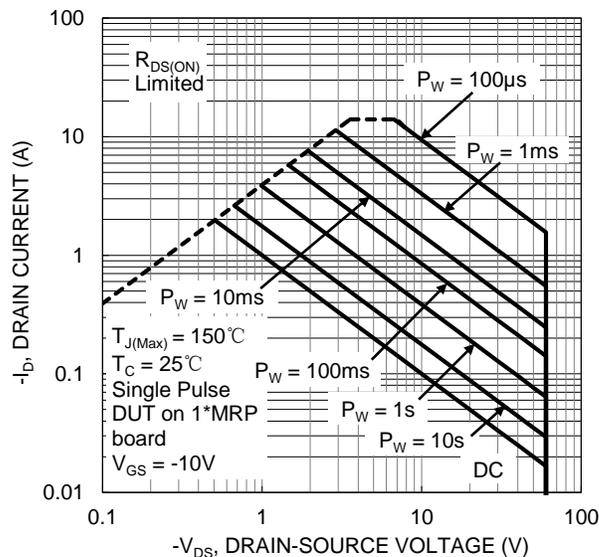


Figure 12. SOA, Safe Operation Area

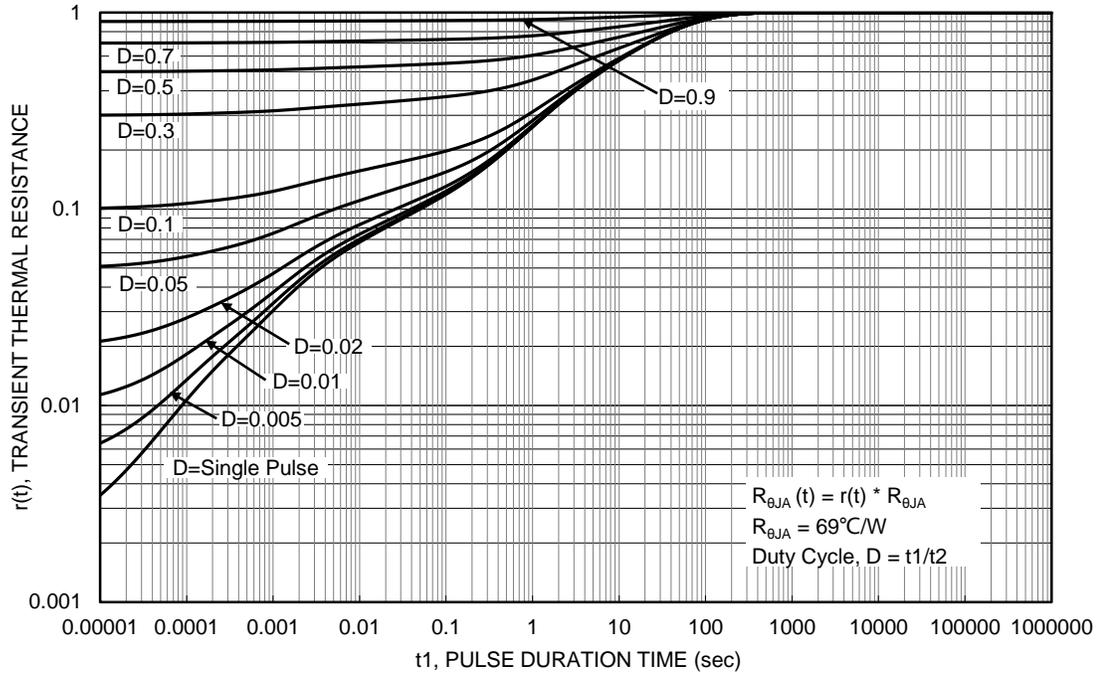
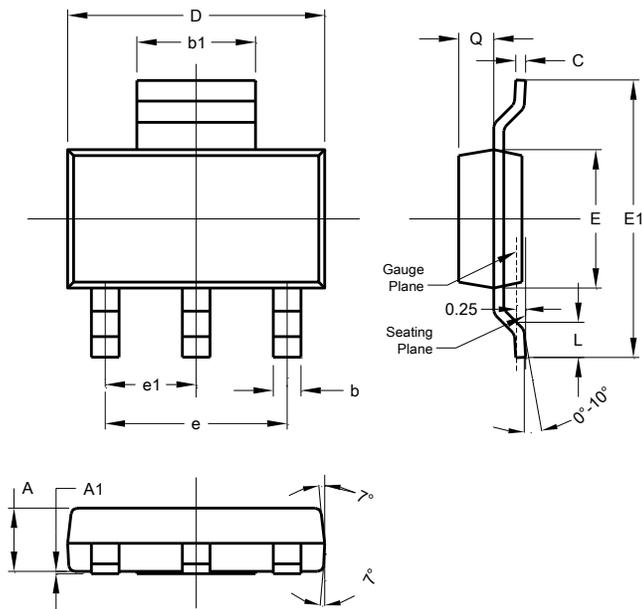


Figure 13. Transient Thermal Resistance

**Package Outline Dimensions**

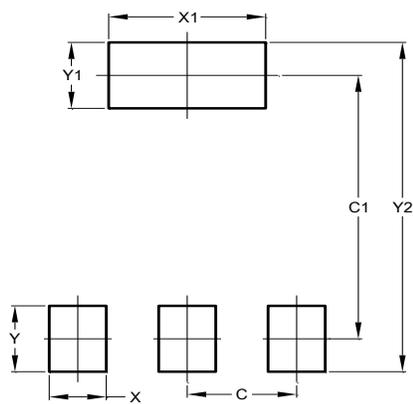
**SOT223**



| SOT223               |       |      |      |
|----------------------|-------|------|------|
| Dim                  | Min   | Max  | Typ  |
| A                    | 1.55  | 1.65 | 1.60 |
| A1                   | 0.010 | 0.15 | 0.05 |
| b                    | 0.60  | 0.80 | 0.70 |
| b1                   | 2.90  | 3.10 | 3.00 |
| C                    | 0.20  | 0.30 | 0.25 |
| D                    | 6.45  | 6.55 | 6.50 |
| E                    | 3.45  | 3.55 | 3.50 |
| E1                   | 6.90  | 7.10 | 7.00 |
| e                    | -     | -    | 4.60 |
| e1                   | -     | -    | 2.30 |
| L                    | 0.85  | 1.05 | 0.95 |
| Q                    | 0.84  | 0.94 | 0.89 |
| All Dimensions in mm |       |      |      |

**Suggested Pad Layout**

**SOT223**



| Dimensions | Value (in mm) |
|------------|---------------|
| C          | 2.30          |
| C1         | 6.40          |
| X          | 1.20          |
| X1         | 3.30          |
| Y          | 1.60          |
| Y1         | 1.60          |
| Y2         | 8.00          |