

## N-Channel 200-V (D-S) MOSFET

### PRODUCT SUMMARY

| $V_{(BR)DSS}$ (V) | $R_{DS(on)}$ ( $\Omega$ ) | $I_D$ (A) | $Q_g$ (Typ.) |
|-------------------|---------------------------|-----------|--------------|
| 200               | 0.038 at $V_{GS} = 15$ V  | 40        | 57           |
|                   | 0.043 at $V_{GS} = 10$ V  | 35        |              |

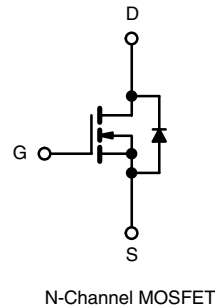
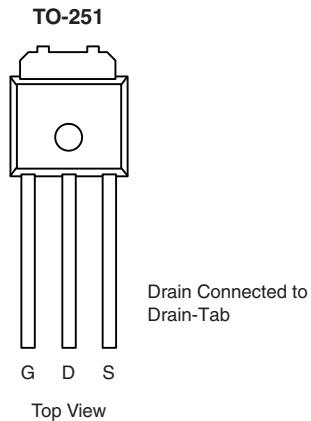
### FEATURES

- Trench Power MOSFETS
- 175 °C Junction Temperature
- 100 %  $R_g$  and UIS Tested


**RoHS**  
 COMPLIANT

### APPLICATIONS

- Power Supply
- Lighting Systems



### ABSOLUTE MAXIMUM RATINGS $T_A = 25$ °C, unless otherwise noted

| Parameter                                        | Symbol         | Limit            | Unit |
|--------------------------------------------------|----------------|------------------|------|
| Drain-Source Voltage                             | $V_{DS}$       | 200              | V    |
| Gate-Source Voltage                              | $V_{GS}$       | $\pm 25$         |      |
| Continuous Drain Current ( $T_J = 175$ °C)       | $I_D$          | 40               | A    |
|                                                  |                | 26               |      |
| Pulsed Drain Current                             | $I_{DM}$       | 150              |      |
| Single Pulse Avalanche Current                   | $I_{AS}$       | 20               |      |
| Single Pulse Avalanche Energy <sup>a</sup>       | $E_{AS}$       | 20               | mJ   |
| Maximum Power Dissipation <sup>a</sup>           | $P_D$          | 146 <sup>b</sup> | W    |
|                                                  |                | 3.12             |      |
| Operating Junction and Storage Temperature Range | $T_J, T_{stg}$ | - 55 to 175      | °C   |

### THERMAL RESISTANCE RATINGS

| Parameter                                    | Symbol     | Limit | Unit |
|----------------------------------------------|------------|-------|------|
| Junction-to-Ambient (PCB Mount) <sup>c</sup> | $R_{thJA}$ | 40    | °C/W |
| Junction-to-Case (Drain)                     | $R_{thJC}$ | 0.75  |      |

Notes:

a. Duty cycle  $\leq 1$  %.

b. See SOA curve for voltage derating.

c. When Mounted on 1" square PCB (FR-4 material).

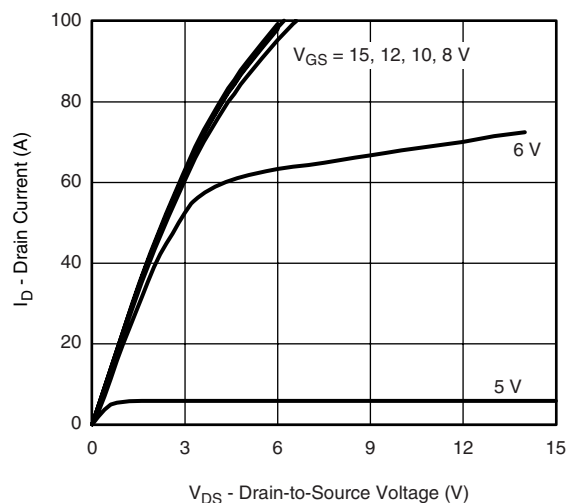
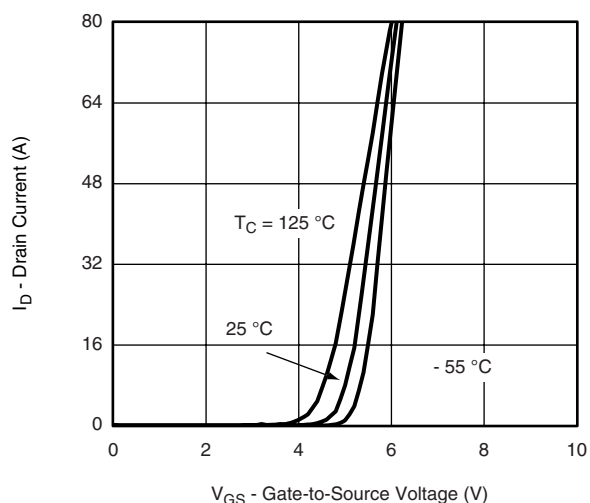
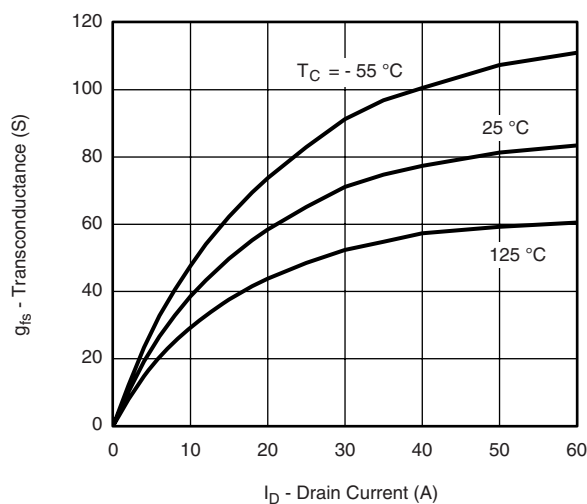
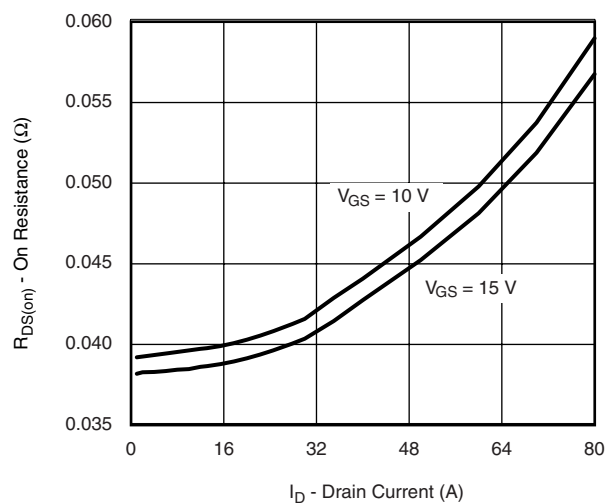
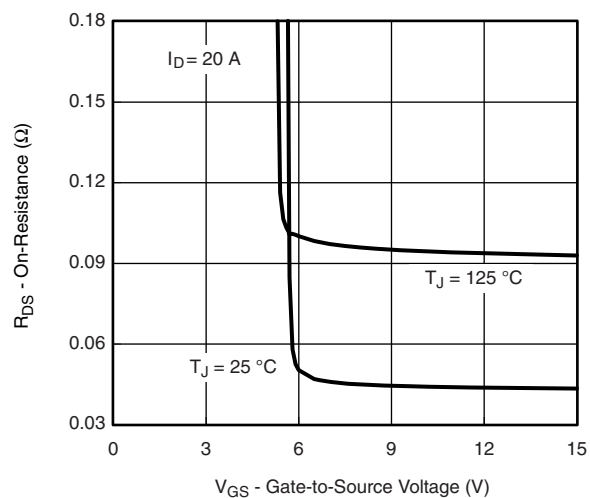
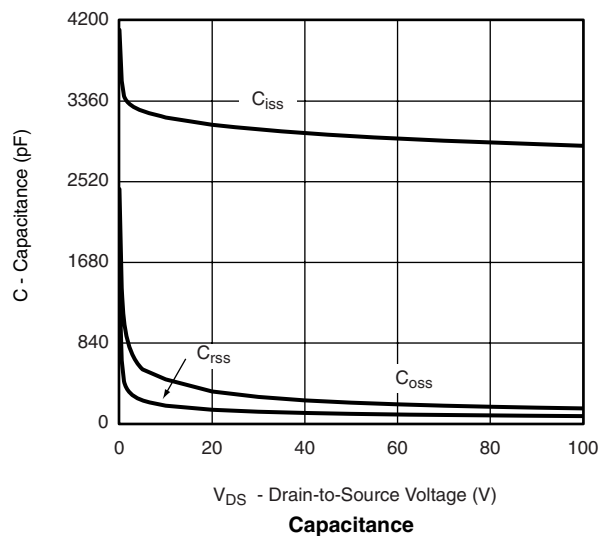
**SPECIFICATIONS**  $T_J = 25\text{ }^{\circ}\text{C}$ , unless otherwise noted

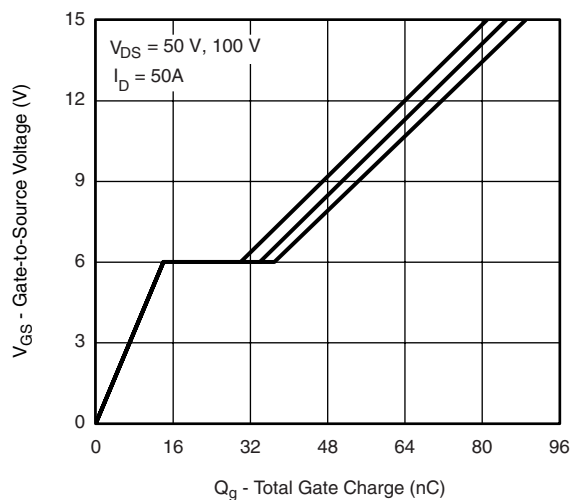
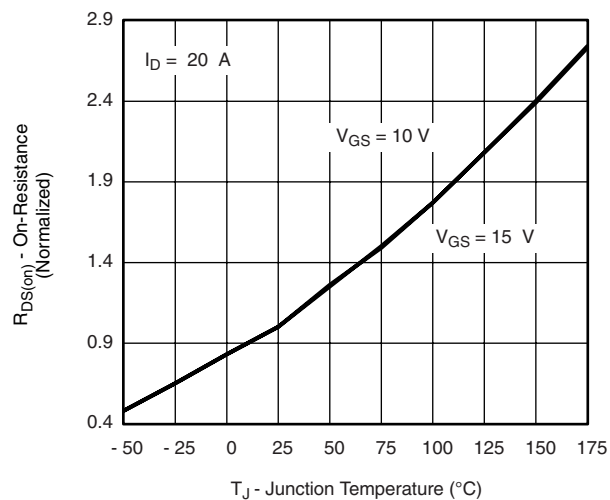
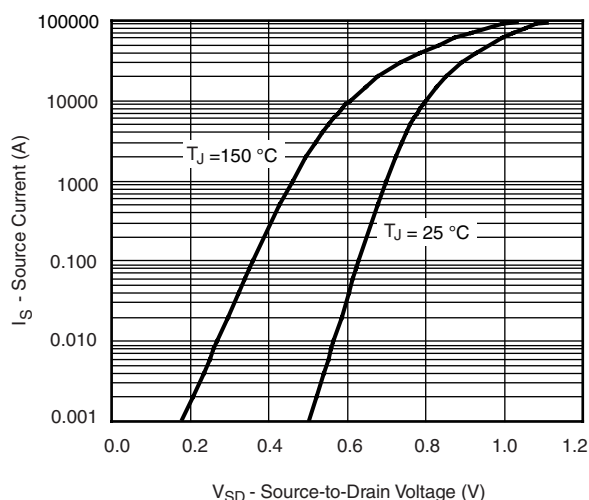
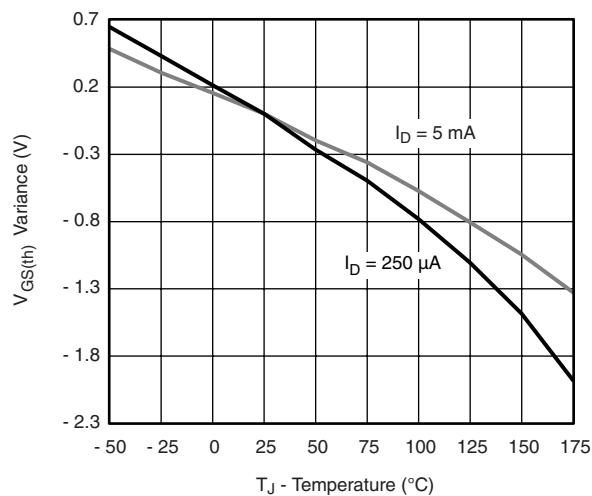
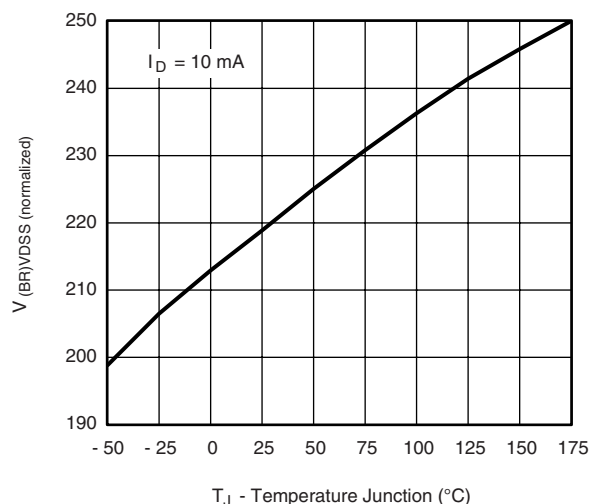
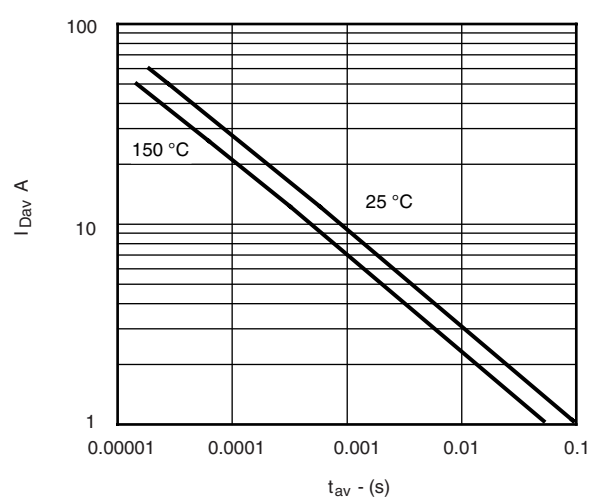
| Parameter                                                                         | Symbol        | Test Conditions                                                                                                         | Min. | Typ.  | Max.      | Unit          |
|-----------------------------------------------------------------------------------|---------------|-------------------------------------------------------------------------------------------------------------------------|------|-------|-----------|---------------|
| Static                                                                            |               |                                                                                                                         |      |       |           |               |
| Drain-Source Breakdown Voltage                                                    | $V_{(BR)DSS}$ | $V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$                                                                     | 200  |       |           | V             |
| Gate Threshold Voltage                                                            | $V_{GS(th)}$  | $V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$                                                                         | 2.5  |       | 4.5       |               |
| Gate-Body Leakage                                                                 | $I_{GSS}$     | $V_{DS} = 0\text{ V}, V_{GS} = \pm 20\text{ V}$                                                                         |      |       | $\pm 100$ | nA            |
|                                                                                   |               | $V_{DS} = 0\text{ V}, V_{GS} = \pm 25\text{ V}$                                                                         |      |       | $\pm 300$ |               |
| Zero Gate Voltage Drain Current                                                   | $I_{DSS}$     | $V_{DS} = 200\text{ V}, V_{GS} = 0\text{ V}$                                                                            |      |       | 1         | $\mu\text{A}$ |
|                                                                                   |               | $V_{DS} = 200\text{ V}, V_{GS} = 0\text{ V}, T_J = 100\text{ }^{\circ}\text{C}$                                         |      |       | 25        |               |
|                                                                                   |               | $V_{DS} = 200\text{ V}, V_{GS} = 0\text{ V}, T_J = 150\text{ }^{\circ}\text{C}$                                         |      |       | 250       |               |
| On-State Drain Current <sup>a</sup>                                               | $I_{D(on)}$   | $V_{DS} \geq 10\text{ V}, V_{GS} = 10\text{ V}$                                                                         | 40   |       |           | A             |
| Drain-Source On-State Resistance <sup>a</sup>                                     | $R_{DS(on)}$  | $V_{GS} = 10\text{ V}, I_D = 20\text{ A}$                                                                               |      | 0.038 |           | $\Omega$      |
|                                                                                   |               | $V_{GS} = 15\text{ V}, I_D = 20\text{ A}$                                                                               |      | 0.043 |           |               |
|                                                                                   |               | $V_{GS} = 10\text{ V}, I_D = 20\text{ A}, T_J = 100\text{ }^{\circ}\text{C}$                                            |      | 0.088 |           |               |
|                                                                                   |               | $V_{GS} = 10\text{ V}, I_D = 20\text{ A}, T_J = 150\text{ }^{\circ}\text{C}$                                            |      | 0.120 |           |               |
| Forward Transconductance <sup>a</sup>                                             | $g_{fs}$      | $V_{DS} = 15\text{ V}, I_D = 20\text{ A}$                                                                               | 25   |       |           | S             |
| Dynamic <sup>b</sup>                                                              |               |                                                                                                                         |      |       |           |               |
| Input Capacitance                                                                 | $C_{iss}$     | $V_{GS} = 0\text{ V}, V_{DS} = 25\text{ V}, f = 1\text{ MHz}$                                                           |      | 3100  |           | pF            |
| Output Capacitance                                                                | $C_{oss}$     |                                                                                                                         |      | 300   |           |               |
| Reverse Transfer Capacitance                                                      | $C_{rss}$     |                                                                                                                         |      | 135   |           |               |
| Total Gate Charge <sup>c</sup>                                                    | $Q_g$         | $V_{DS} = 100\text{ V}, V_{GS} = 15\text{ V}, I_D = 50\text{ A}$                                                        |      | 85    | 127       | nC            |
|                                                                                   |               | $V_{DS} = 100\text{ V}, V_{GS} = 10\text{ V}, I_D = 50\text{ A}$                                                        |      | 57    | 85        |               |
| Gate-Source Charge <sup>c</sup>                                                   | $Q_{gs}$      |                                                                                                                         |      | 14    |           |               |
| Gate-Drain Charge <sup>c</sup>                                                    | $Q_{gd}$      |                                                                                                                         |      | 20    |           |               |
| Gate Resistance                                                                   | $R_g$         | $f = 1\text{ MHz}$                                                                                                      |      | 1.2   | 1.8       | $\Omega$      |
| Turn-On Delay Time <sup>c</sup>                                                   | $t_{d(on)}$   | $V_{DD} = 100\text{ V}, R_L = 2\text{ }\Omega$<br>$I_D \cong 50\text{ A}, V_{GEN} = 10\text{ V}, R_g = 1\text{ }\Omega$ |      | 16    | 25        | ns            |
| Rise Time <sup>c</sup>                                                            | $t_r$         |                                                                                                                         |      | 170   | 260       |               |
| Turn-Off Delay Time <sup>c</sup>                                                  | $t_{d(off)}$  |                                                                                                                         |      | 27    | 42        |               |
| Fall Time <sup>c</sup>                                                            | $t_f$         |                                                                                                                         |      | 9     | 18        |               |
| Source-Drain Diode Ratings and Characteristics $T_C = 25\text{ }^{\circ}\text{C}$ |               |                                                                                                                         |      |       |           |               |
| Continuous Current                                                                | $I_S$         |                                                                                                                         |      |       | 36        | A             |
| Pulsed Current                                                                    | $I_{SM}$      |                                                                                                                         |      |       | 80        |               |
| Forward Voltage <sup>a</sup>                                                      | $V_{SD}$      | $I_F = 20\text{ A}, V_{GS} = 0\text{ V}$                                                                                |      | 0.86  | 1.5       | V             |
| Reverse Recovery Time                                                             | $t_{rr}$      | $I_F = 40\text{ A}, di/dt = 100\text{ A}/\mu\text{s}$                                                                   |      | 116   | 175       | ns            |
| Peak Reverse Recovery Current                                                     | $I_{RM(REC)}$ |                                                                                                                         |      | 9     | 14        | A             |
| Reverse Recovery Charge                                                           | $Q_{rr}$      |                                                                                                                         |      | 0.53  | 0.8       | $\mu\text{C}$ |
| Reverse Recovery Fall Time                                                        | $t_a$         |                                                                                                                         |      | 84    |           | nS            |
| Reverse Recovery Rise Time                                                        | $t_b$         |                                                                                                                         |      | 32    |           |               |

Notes:

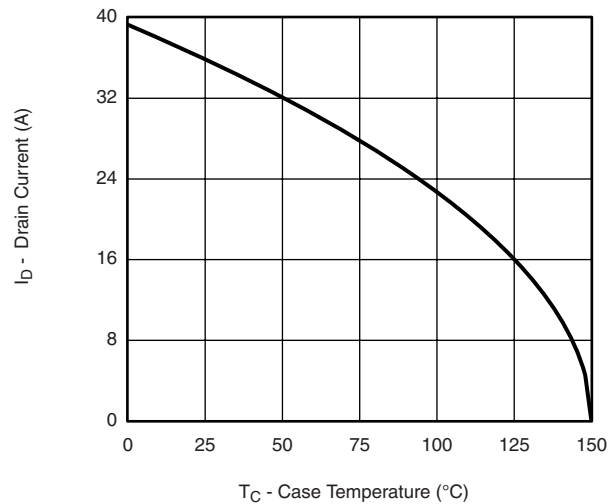
- a. Pulse test; pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$ .  
 b. Guaranteed by design, not subject to production testing.  
 c. Independent of operating temperature.

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

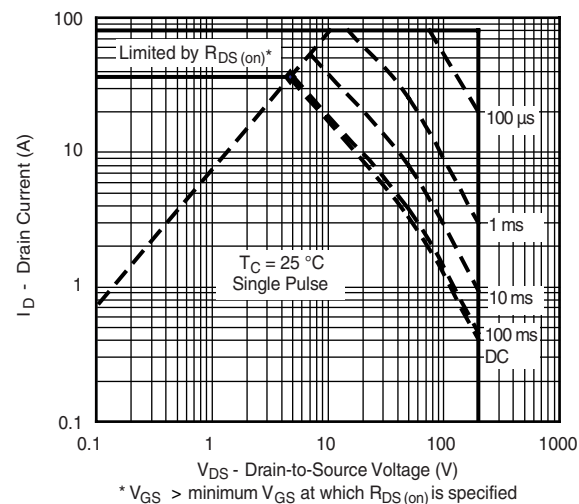
**TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted

**Output Characteristics**

**Transfer Characteristics**

**Transconductance**

**On-Resistance vs. Drain Current**

**On-Resistance vs. Gate-to-Source Voltage**

**Capacitance**

**TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted

**Gate Charge**

**On-Resistance vs. Junction Temperature**

**Source-Drain Diode Forward Voltage**

**Threshold Voltage**

**Drain Source Breakdown vs. Junction Temperature**

**Single Pulse Avalanche Current Capability vs. Time**

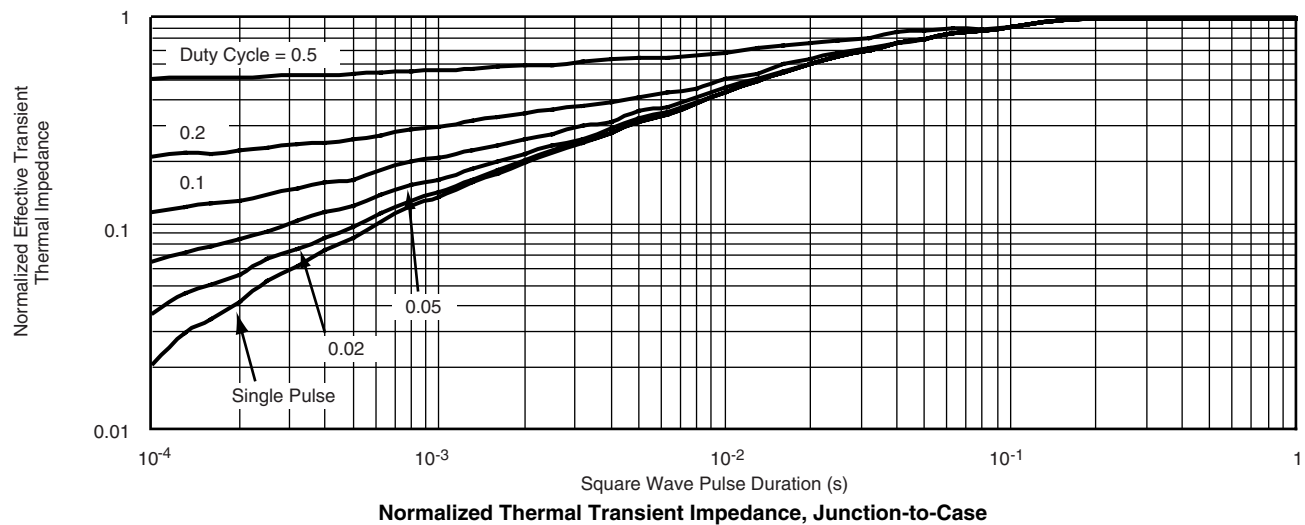
**THERMAL RATINGS**



**Maximum Drain Current vs. Case Temperature**

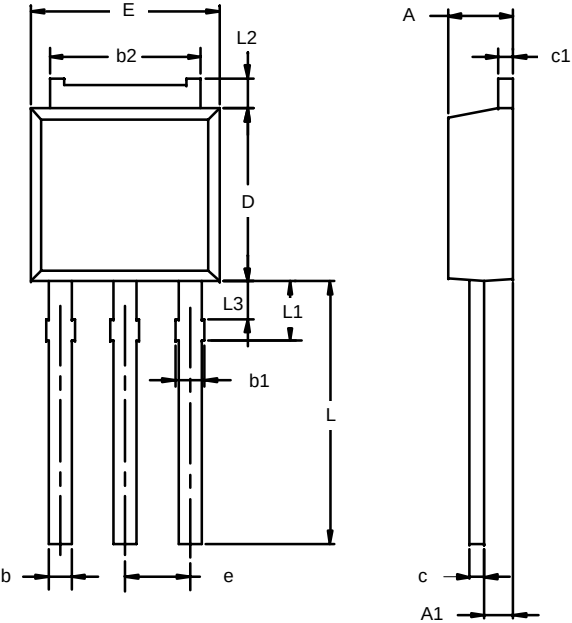


**Safe Operating Area**



**Normalized Thermal Transient Impedance, Junction-to-Case**

TO-251AA



Note: Dimension L3 is for reference only.

| Dim                                         | MILLIMETERS |      | INCHES    |       |
|---------------------------------------------|-------------|------|-----------|-------|
|                                             | Min         | Max  | Min       | Max   |
| A                                           | 2.21        | 2.38 | 0.087     | 0.094 |
| A1                                          | 0.89        | 1.14 | 0.035     | 0.045 |
| b                                           | 0.71        | 0.89 | 0.028     | 0.035 |
| b1                                          | 0.76        | 1.14 | 0.030     | 0.045 |
| b2                                          | 5.23        | 5.43 | 0.206     | 0.214 |
| c                                           | 0.46        | 0.58 | 0.018     | 0.023 |
| c1                                          | 0.46        | 0.58 | 0.018     | 0.023 |
| D                                           | 5.97        | 6.22 | 0.235     | 0.245 |
| E                                           | 6.48        | 6.73 | 0.255     | 0.265 |
| e                                           | 2.28 BSC    |      | 0.090 BSC |       |
| L                                           | 3.89        | 9.53 | 0.153     | 0.375 |
| L1                                          | 1.91        | 2.28 | 0.075     | 0.090 |
| L2                                          | 0.89        | 1.27 | 0.035     | 0.050 |
| L3                                          | 1.15        | 1.52 | 0.045     | 0.060 |
| ECN: S-03946—Rev. E, 09-Jul-01<br>DWG: 5346 |             |      |           |       |

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