

## 2SJ387STL-E-VB Datasheet

### P-Channel 20-V (D-S) MOSFET

#### PRODUCT SUMMARY

| $V_{DS}$ (V) | $R_{DS(on)}$ ( $\Omega$ )   | $I_D$ (A) <sup>d</sup> | $Q_g$ (Typ.) |
|--------------|-----------------------------|------------------------|--------------|
| - 20         | 0.016 at $V_{GS} = - 4.5$ V | - 40                   | 13 nC        |
|              | 0.025 at $V_{GS} = - 2.5$ V | - 35                   |              |

#### FEATURES

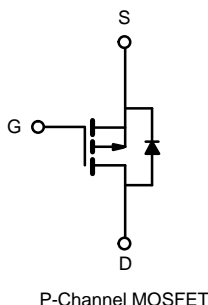
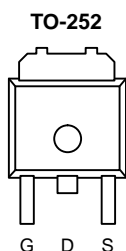
- Halogen-free According to IEC 61249-2-21 Definition
- Trench Power MOSFET
- 100 %  $R_g$  Tested



**RoHS**  
COMPLIANT  
HALOGEN  
**FREE**  
Available

#### APPLICATIONS

- Load Switch
- Battery Switch



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

| Parameter  | Symbol         | Limit                  | Unit |
|--|----------------|------------------------|------|
| Drain-Source Voltage                             | $V_{DS}$       | - 20                   | V    |
| Gate-Source Voltage                              | $V_{GS}$       | $\pm 12$               |      |
| Continuous Drain Current ( $T_J = 150$ °C)       | $T_C = 25$ °C  | - 40                   | A    |
|  | $T_C = 70$ °C  | - 35                   |      |
|  | $T_A = 25$ °C  | - 30.0 <sup>a, b</sup> |      |
|  | $T_A = 70$ °C  | - 28 <sup>a, b</sup>   |      |
| Pulsed Drain Current                             | $I_{DM}$       | - 150                  |      |
| Continuous Source-Drain Diode Current            | $T_C = 25$ °C  | - 3.5                  |      |
|  | $T_A = 25$ °C  | - 2.1 <sup>a, b</sup>  |      |
| Maximum Power Dissipation                        | $T_C = 25$ °C  | 40                     | W    |
|  | $T_C = 70$ °C  | 27                     |      |
|  | $T_A = 25$ °C  | 2.5 <sup>a, b</sup>    |      |
|  | $T_A = 70$ °C  | 1.6 <sup>a, b</sup>    |      |
| Operating Junction and Storage Temperature Range | $T_J, T_{stg}$ | - 55 to 150            | °C   |

#### THERMAL RESISTANCE RATINGS

| Parameter                                   | Symbol     | Typical | Maximum | Unit |
|---|------------|---------|---------|------|
| Maximum Junction-to-Ambient <sup>a, c</sup> | $R_{thJA}$ | 40      | 50      | °C/W |
| Maximum Junction-to-Foot                    | $R_{thJF}$ | 24      | 30      |      |

Notes:

- Surface mounted on 1" x 1" FR4 board.
- $t = 10$  s.
- Maximum under Steady State conditions is 95 °C/W.
- Based on  $T_C = 25$  °C.

| SPECIFICATIONS T <sub>J</sub> = 25 °C, unless otherwise noted |                                      |  |      |        |       |       |
|---|--------------------------------------|--|------|--------|-------|-------|
| Parameter   | Symbol                               | Test Conditions  | Min. | Typ.   | Max.  | Unit  |
| Static  |                                      |  |      |        |       |       |
| Drain-Source Breakdown Voltage                                | V <sub>DS</sub>                      | V <sub>GS</sub> = 0 V, I <sub>D</sub> = - 250 μA   | - 20 |        |       | V     |
| V <sub>DS</sub> Temperature Coefficient                       | ΔV <sub>DS</sub> /T <sub>J</sub>     | I <sub>D</sub> = - 250 μA  |      | - 31   |       | mV/°C |
| V <sub>GS(th)</sub> Temperature Coefficient                   | ΔV <sub>GS(th)</sub> /T <sub>J</sub> |  |      | 4.5    |       |       |
| Gate-Source Threshold Voltage                                 | V <sub>GS(th)</sub>                  | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = - 250 μA  | -0.5 |        | - 2.0 | V     |
| Gate-Source Leakage   | I <sub>GSS</sub>                     | V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ± 12 V  |      |        | ± 100 | nA    |
| Zero Gate Voltage Drain Current                               | I <sub>DSS</sub>                     | V <sub>DS</sub> = - 20 V, V <sub>GS</sub> = 0 V  |      |        | - 1   | μA    |
|   |                                      | V <sub>DS</sub> = -20 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 55 °C   |      |        | - 5   |       |
| On-State Drain Current <sup>a</sup>                           | I <sub>D(on)</sub>                   | V <sub>DS</sub> ≤ - 5 V, V <sub>GS</sub> = - 10 V  | - 40 |        |       | A     |
| Drain-Source On-State Resistance <sup>a</sup>                 | R <sub>DS(on)</sub>                  | V <sub>GS</sub> = - 4.5 V I <sub>D</sub> = - 7.0 A   |      | 0.016  |       | Ω     |
|   |                                      | V <sub>GS</sub> = - 2.5 V, I <sub>D</sub> = - 5.6 A  |      | 0.025  |       |       |
| Forward Transconductance <sup>a</sup>                         | g <sub>fs</sub>                      | V <sub>DS</sub> = - 15 V, I <sub>D</sub> = - 7.0 A   |      | 18     |       | S     |
| Dynamic <sup>b</sup>  |                                      |  |      |        |       |       |
| Input Capacitance   | C <sub>iss</sub>                     | V <sub>DS</sub> = - 10 V, V <sub>GS</sub> = 0 V, f = 1 MHz   |      | 1455   |       | pF    |
| Output Capacitance  | C <sub>oss</sub>                     |  |      | 180    |       |       |
| Reverse Transfer Capacitance                                  | C <sub>rss</sub>                     |  |      | 145    |       |       |
| Total Gate Charge   | Q <sub>g</sub>                       | V <sub>DS</sub> = - 10 V, V <sub>GS</sub> = - 10 V, I <sub>D</sub> = - 7.0 A   |      | 25     | 38    | nC    |
|   |                                      | V <sub>DS</sub> = - 10 V, V <sub>GS</sub> = - 4.5 V, I <sub>D</sub> = - 7.0 A  |      | 13     | 20    |       |
| Q <sub>gs</sub>   |                                      |  | 3.5  |        |       |       |
| Q <sub>gd</sub>   |                                      |  | 5.5  |        |       |       |
| Gate Resistance   | R <sub>g</sub>                       | f = 1 MHz  | 0.4  | 2.0    | 4.0   | Ω     |
| Turn-On Delay Time  | t <sub>d(on)</sub>                   | V <sub>DD</sub> = - 10 V, R <sub>L</sub> = 2.7 Ω<br>I <sub>D</sub> ≡ - 5.6 A, V <sub>GEN</sub> = - 10 V, R <sub>g</sub> = 1 Ω  |      | 10     | 20    | ns    |
| Rise Time   | t <sub>r</sub>                       |  |      | 13     | 20    |       |
| Turn-Off DelayTime  | t <sub>d(off)</sub>                  |  |      | 23     | 35    |       |
| Fall Time   | t <sub>f</sub>                       |  |      | 9      | 18    |       |
| Turn-On Delay Time  | t <sub>d(on)</sub>                   | V <sub>DD</sub> = - 10 V, R <sub>L</sub> = 2.7 Ω<br>I <sub>D</sub> ≡ - 5.6 A, V <sub>GEN</sub> = - 4.5 V, R <sub>g</sub> = 1 Ω |      | 38     | 57    |       |
| Rise Time   | t <sub>r</sub>                       |  |      | 89     | 134   |       |
| Turn-Off DelayTime  | t <sub>d(off)</sub>                  |  |      | 22     | 33    |       |
| Fall Time   | t <sub>f</sub>                       |  |      | 11     | 17    |       |
| Drain-Source Body Diode Characteristics                       |                                      |  |      |        |       |       |
| Continous Source-Drain Diode Current                          | I <sub>S</sub>                       | T <sub>C</sub> = 25 °C   |      |        | - 6.5 | A     |
| Pulse Diode Forward Current                                   | I <sub>SM</sub>                      |  |      |        | - 30  |       |
| Body Diode Voltage  | V <sub>SD</sub>                      | I <sub>S</sub> = - 5.6 A, V <sub>GS</sub> = 0 V  |      | - 0.71 | - 1.2 | V     |
| Body Diode Reverse Recovery Time                              | t <sub>rr</sub>                      | I <sub>F</sub> = - 5.6 A, dI/dt = 100 A/μs, T <sub>J</sub> = 25 °C   |      | 22     | 33    | ns    |
| Body Diode Reverse Recovery Charge                            | Q <sub>rr</sub>                      |  |      | 17     | 26    | nC    |
| Reverse Recovery Fall Time                                    | t <sub>a</sub>                       |  |      | 13     |       | ns    |
| Reverse Recovery Rise Time                                    | t <sub>b</sub>                       |  |      | 9      |       |       |

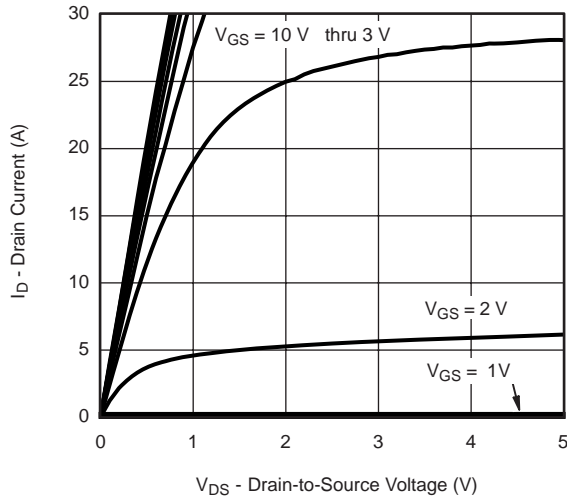
Notes:

a. Pulse test; pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$ .

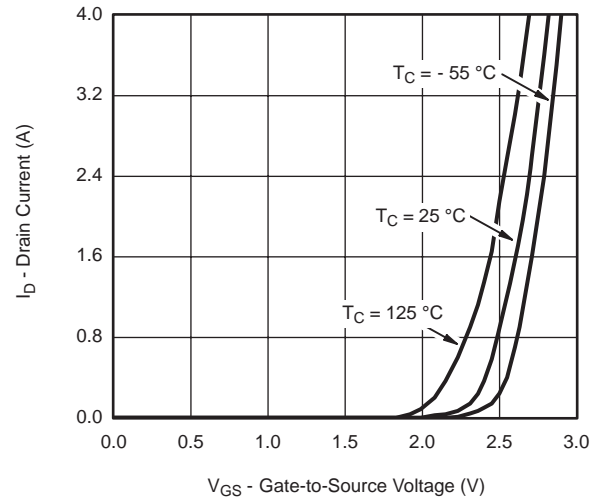
b. Guaranteed by design, not subject to production testing.

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.

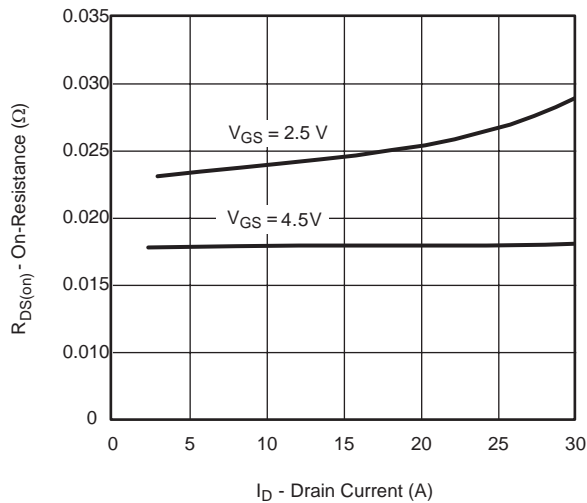
## TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



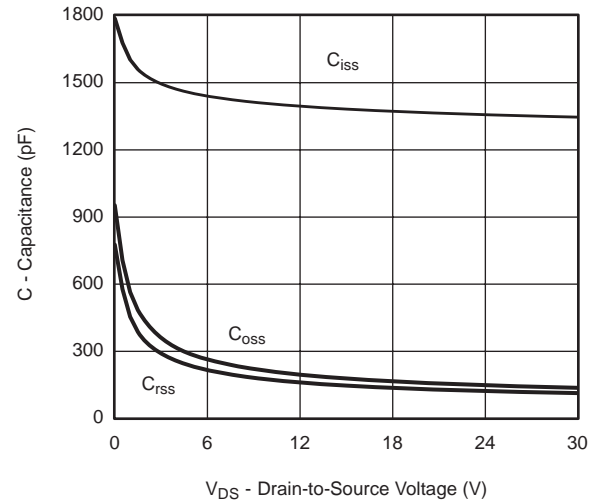
Output Characteristics



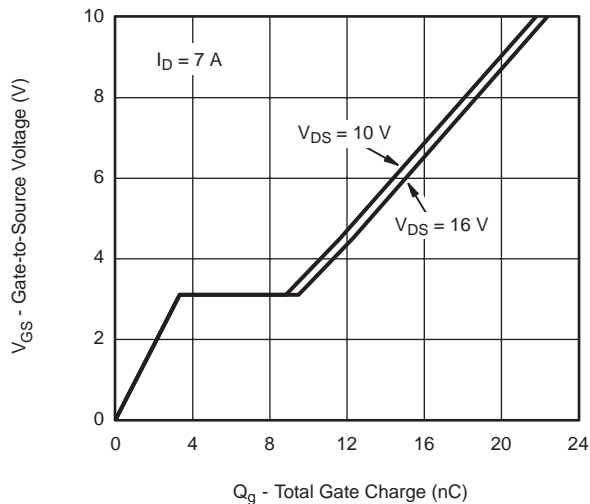
Transfer Characteristics



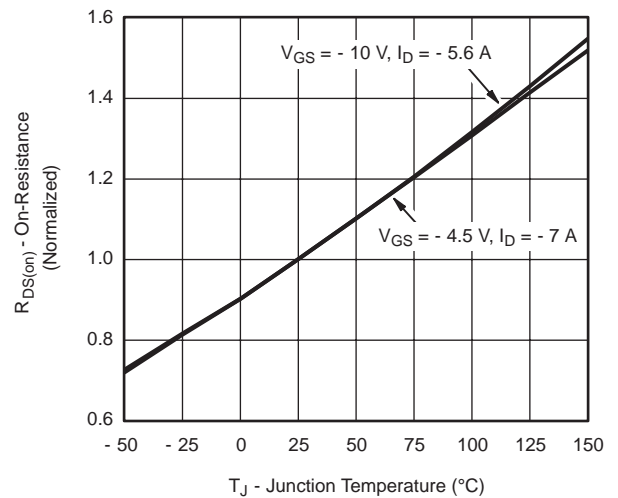
On-Resistance vs. Drain Current



Capacitance

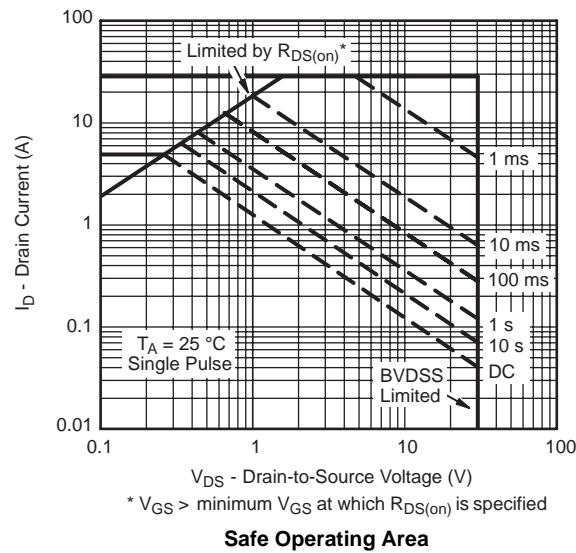
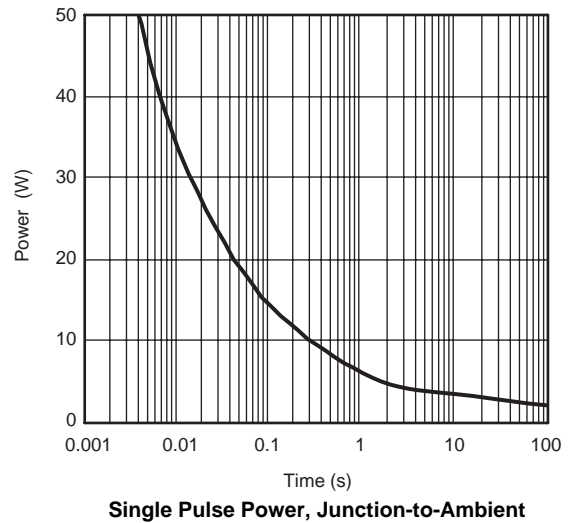
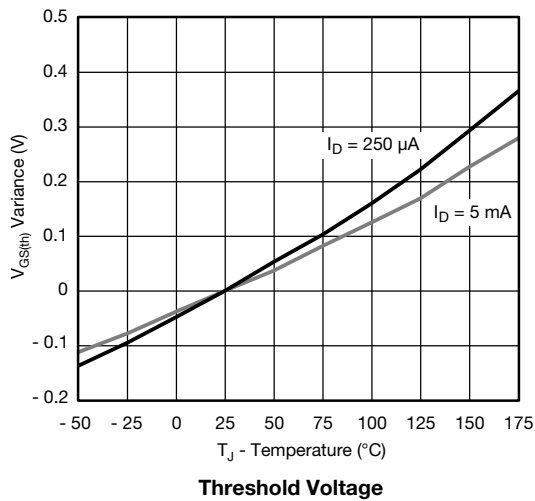
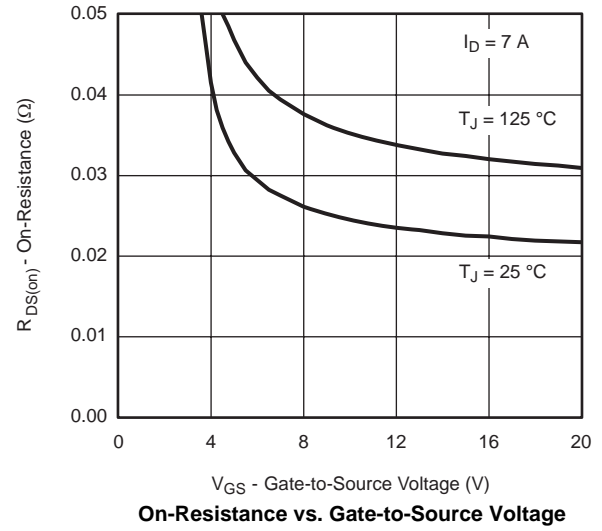
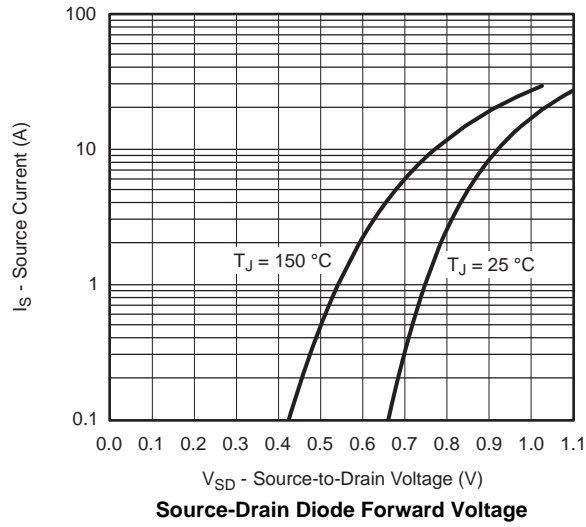


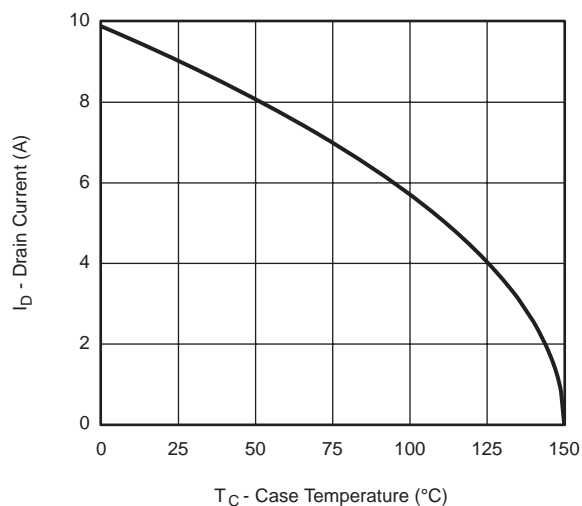
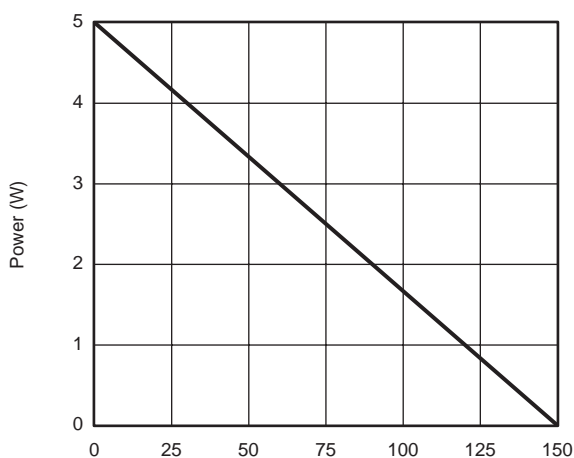
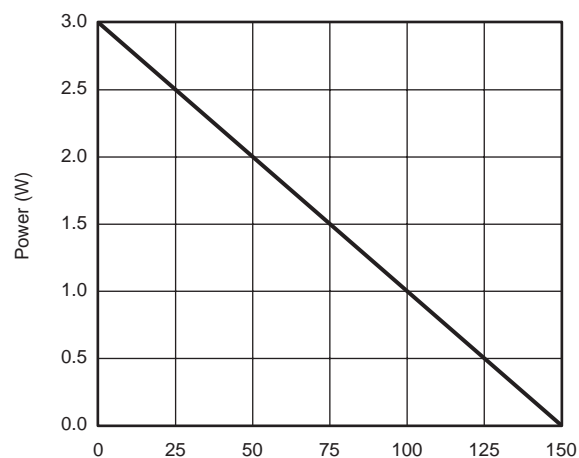
Gate Charge



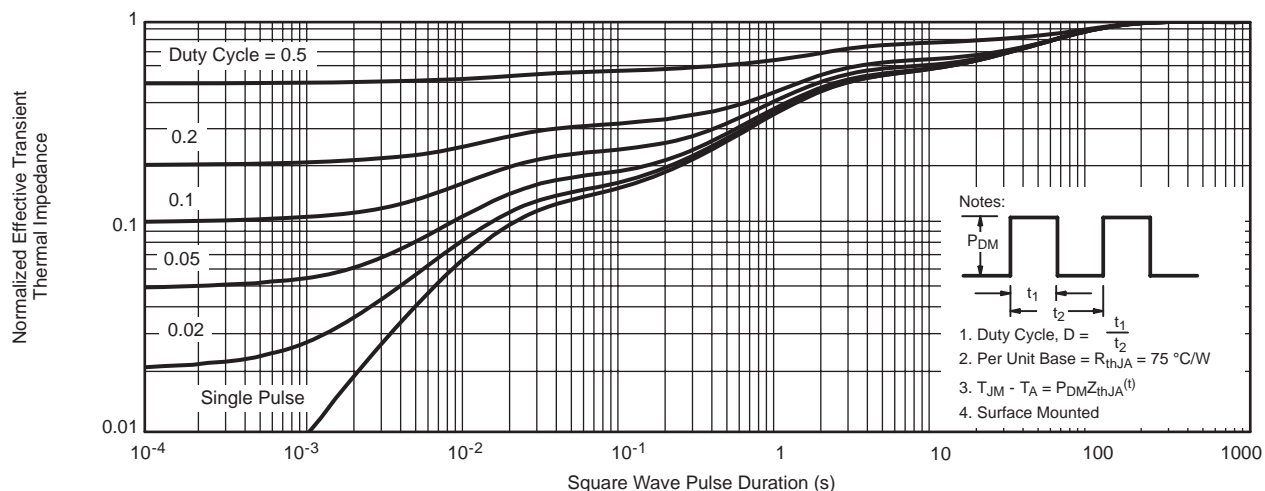
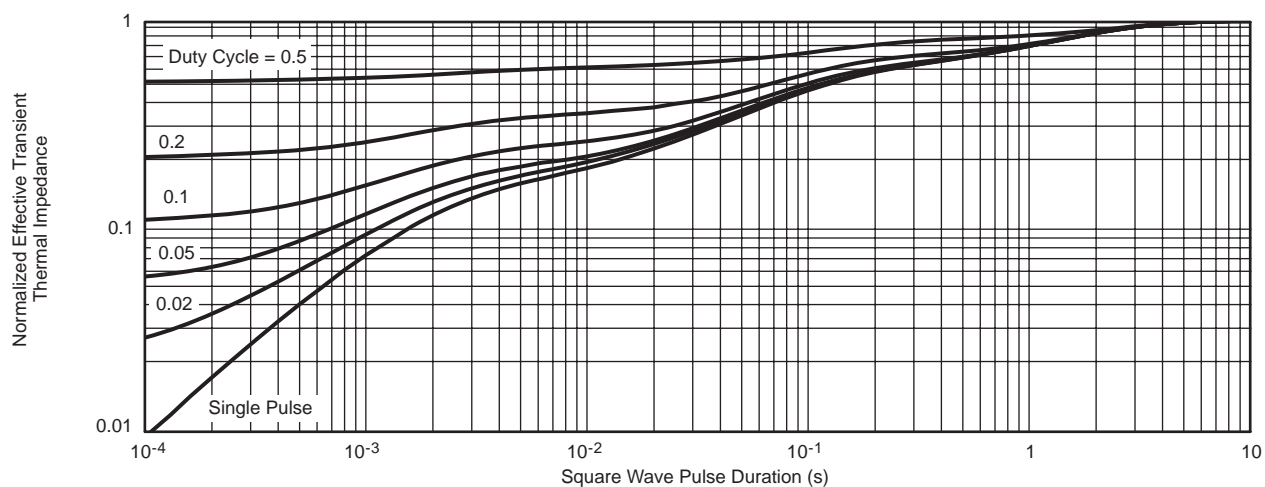
On-Resistance vs. Junction Temperature

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

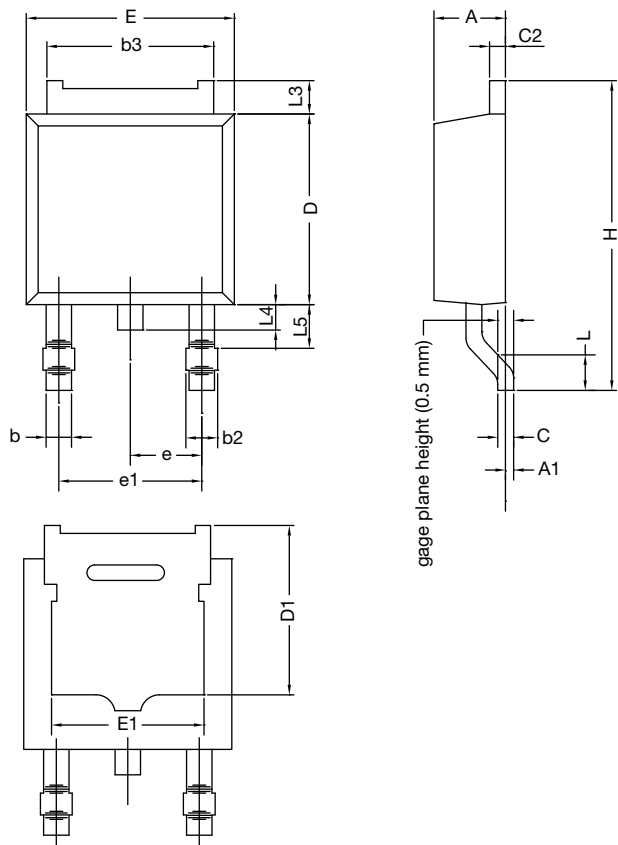


**TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted

**Current Derating\***

**Power, Junction-to-Foot**

**Power Derating, Junction-to-Ambient**

\* The power dissipation  $P_D$  is based on  $T_{J(max)} = 150$  °C, using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below the package limit.

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

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

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

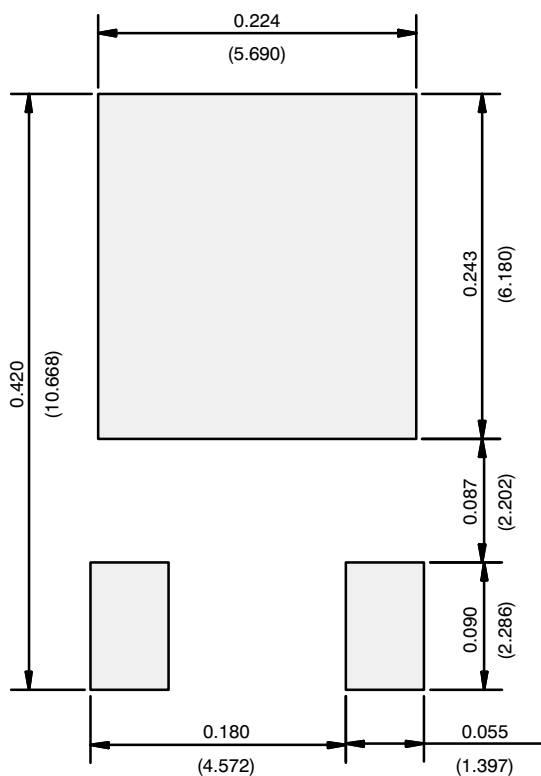
TO-252AA CASE OUTLINE



| DIM.                            | MILLIMETERS |       | INCHES    |       |
|---------------------------------|-------------|-------|-----------|-------|
|                                 | MIN.        | MAX.  | MIN.      | MAX.  |
| A                               | 2.18        | 2.38  | 0.086     | 0.094 |
| A1                              | -           | 0.127 | -         | 0.005 |
| b                               | 0.64        | 0.88  | 0.025     | 0.035 |
| b2                              | 0.76        | 1.14  | 0.030     | 0.045 |
| b3                              | 4.95        | 5.46  | 0.195     | 0.215 |
| C                               | 0.46        | 0.61  | 0.018     | 0.024 |
| C2                              | 0.46        | 0.89  | 0.018     | 0.035 |
| D                               | 5.97        | 6.22  | 0.235     | 0.245 |
| D1                              | 5.21        | -     | 0.205     | -     |
| E                               | 6.35        | 6.73  | 0.250     | 0.265 |
| E1                              | 4.32        | -     | 0.170     | -     |
| H                               | 9.40        | 10.41 | 0.370     | 0.410 |
| e                               | 2.28 BSC    |       | 0.090 BSC |       |
| e1                              | 4.56 BSC    |       | 0.180 BSC |       |
| L                               | 1.40        | 1.78  | 0.055     | 0.070 |
| L3                              | 0.89        | 1.27  | 0.035     | 0.050 |
| L4                              | -           | 1.02  | -         | 0.040 |
| L5                              | 1.14        | 1.52  | 0.045     | 0.060 |
| ECN: X12-0247-Rev. M, 24-Dec-12 |             |       |           |       |
| DWG: 5347                       |             |       |           |       |

- Note**
- Dimension L3 is for reference only.

RECOMMENDED MINIMUM PADS FOR DPAK (TO-252)



Recommended Minimum Pads  
Dimensions in Inches/(mm)



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