# NTF2955, NVF2955

# Power MOSFET
## −60 V, −2.6 A, Single P−Channel SOT−223

### Features
- Design for low $R_{DS(on)}$
- Withstands High Energy in Avalanche and Commutation Modes
- AEC−Q101 Qualified − NVF2955
- These Devices are Pb−Free and are RoHS Compliant

### Applications
- Power Supplies
- PWM Motor Control
- Converters
- Power Management

**MAXIMUM RATINGS** ($T_J$ = 25°C unless otherwise noted)

| Parameter | | | Symbol | Value | Unit |
|---|---|---|---|---|---|
| Drain−to−Source Voltage | | | $V_{DSS}$ | −60 | V |
| Gate−to−Source Voltage | | | $V_{GS}$ | ±20 | V |
| Continuous Drain Current (Note 1) | Steady State | $T_A$ = 25°C | $I_D$ | −2.6 | A |
| | | $T_A$ = 85°C | | −2.0 | |
| Power Dissipation (Note 1) | Steady State | $T_A$ = 25°C | $P_D$ | 2.3 | W |
| Continuous Drain Current (Note 2) | Steady State | $T_A$ = 25°C | $I_D$ | −1.7 | A |
| | | $T_A$ = 85°C | | −1.3 | |
| Power Dissipation (Note 2) | | $T_A$ = 25°C | $P_D$ | 1.0 | W |
| Pulsed Drain Current | tp = 10 μs | | $I_{DM}$ | −17 | A |
| Operating Junction and Storage Temperature | | | $T_J$, $T_{STG}$ | −55 to 175 | °C |
| Single Pulse Drain−to−Source Avalanche Energy ($V_{DD}$ = 25 V, $V_G$ = 10 V, $I_{PK}$ = 6.7 A, L = 10 mH, $R_G$ = 25 Ω) | | | EAS | 225 | mJ |
| Lead Temperature for Soldering Purposes (1/8" from case for 10 seconds) | | | $T_L$ | 260 | °C |

**THERMAL RESISTANCE RATINGS**

| Parameter | Symbol | Max | Unit |
|---|---|---|---|
| Junction−to−Tab (Drain) − Steady State (Note 2) | $R_{\theta JC}$ | 14 | °C/W |
| Junction−to−Ambient − Steady State (Note 1) | $R_{\theta JA}$ | 65 | |
| Junction−to−Ambient − Steady State (Note 2) | $R_{\theta JA}$ | 150 | |

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. When surface mounted to an FR4 board using 1 in. pad size (Cu. area = 1.127 $in^2$ [1 oz] including traces)
2. When surface mounted to an FR4 board using the minimum recommended pad size (Cu. area = 0.341 $in^2$)

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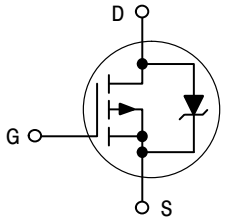
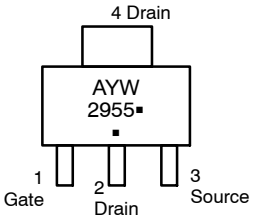
| $V_{(BR)DSS}$ | $R_{DS(on)}$ TYP | $I_D$ MAX |
|---|---|---|
| −60 V | 145 mΩ @ −10 V | −2.6 A |

**P−Channel**




**MARKING DIAGRAM AND PIN ASSIGNMENT**


**SOT−223**
**CASE 318E**
**STYLE 3**




A = Assembly Location
Y = Year
W = Work Week
▪ = Pb−Free Package
(Note: Microdot may be in either location)

**ORDERING INFORMATION**

| Device | Package | Shipping† |
|---|---|---|
| NTF2955T1G | SOT−223 (Pb−Free) | 1000 /Tape & Reel |
| NVF2955T1G | SOT−223 (Pb−Free) | 1000/ Tape & Reel |

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specification Brochure, BRD8011/D.

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**ELECTRICAL CHARACTERISTICS** ($T_J$=25°C unless otherwise stated)

| Parameter | Symbol | Test Condition | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | | | | |
| Drain−to−Source Breakdown Voltage | $V_{(BR)DSS}$ | $V_{GS}$ = 0 V, $I_D$ = −250 μA | | −60 | | | V |
| Drain−to−Source Breakdown Voltage Temperature Coefficient | $V_{(BR)DSS}/T_J$ | | | | 66.4 | | mV/°C |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | $V_{GS}$ = 0 V, $V_{DS}$ = −60 V | $T_J$ = 25°C | | | −1.0 | μA |
| | | | $T_J$ = 125°C | | | −50 | |
| Gate−to−Source Leakage Current | $I_{GSS}$ | $V_{DS}$ = 0 V, $V_{GS}$ = ±20 V | | | | ±100 | nA |
| **ON CHARACTERISTICS** (Note 3) | | | | | | | |
| Gate Threshold Voltage | $V_{GS(TH)}$ | $V_{GS}$ = $V_{DS}$, $I_D$ = −1.0 mA | | −2.0 | | −4.0 | V |
| Drain−to−Source On Resistance | $R_{DS(on)}$ | $V_{GS}$ = −10 V, $I_D$ = −0.75 A | | | 145 | 170 | mΩ |
| | | $V_{GS}$ = −10 V, $I_D$ = −1.5 A | | | 150 | 180 | |
| | | $V_{GS}$ = −10 V, $I_D$ = −2.4 A | | | 154 | 185 | |
| Forward Transconductance | $g_{FS}$ | $V_{GS}$ = −15 V, $I_D$ = −0.75 A | | | 1.77 | | S |
| **CHARGES AND CAPACITANCES** | | | | | | | |
| Input Capacitance | $C_{ISS}$ | $V_{GS}$ = 0 V, f = 1.0 MHz, $V_{DS}$ = 25 V | | | 492 | | pF |
| Output Capacitance | $C_{OSS}$ | | | | 165 | | |
| Reverse Transfer Capacitance | $C_{RSS}$ | | | | 50 | | |
| Total Gate Charge | $Q_{G(TOT)}$ | $V_{GS}$ = 10 V, $V_{DS}$ = 30 V, $I_D$ = 1.5 A | | | 14.3 | | nC |
| Threshold Gate Charge | $Q_{G(TH)}$ | | | | 1.2 | | |
| Gate−to−Source Charge | $Q_{GS}$ | | | | 2.3 | | |
| Gate−to−Drain Charge | $Q_{GD}$ | | | | 5.2 | | |
| **SWITCHING CHARACTERISTICS** (Note 4) | | | | | | | |
| Turn−On Delay Time | $t_{d(ON)}$ | $V_{GS}$ = 10 V, $V_{DD}$ = 25 V, $I_D$ = 1.5 A, $R_G$ = 9.1 Ω $R_L$ = 25 Ω | | | 11 | | ns |
| Rise Time | $t_r$ | | | | 7.6 | | |
| Turn−Off Delay Time | $t_{d(OFF)}$ | | | | 65 | | |
| Fall Time | $t_f$ | | | | 38 | | |
| **DRAIN−SOURCE DIODE CHARACTERISTICS** | | | | | | | |
| Forward Diode Voltage | $V_{SD}$ | $V_{GS}$ = 0 V, $I_S$ = 1.5 A | $T_J$ = 25°C | | −1.10 | −1.30 | V |
| | | | $T_J$ = 125°C | | −0.9 | | |
| Reverse Recovery Time | $t_{RR}$ | $V_{GS}$ = 0 V, $dI_S/dt$ = 100 A/μs, $I_S$ = 1.5 A | | | 36 | | ns |
| Charge Time | $t_a$ | | | | 20 | | |
| Discharge Time | $t_b$ | | | | 16 | | |
| Reverse Recovery Charge | $Q_{RR}$ | | | | 0.139 | | nC |

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

3. Pulse Test: pulse width ≤ 300μs, duty cycle ≤ 2%.
4. Switching characteristics are independent of operating junction temperatures.

**TYPICAL PERFORMANCE CURVES** ($T_J$ = 25°C unless otherwise noted)

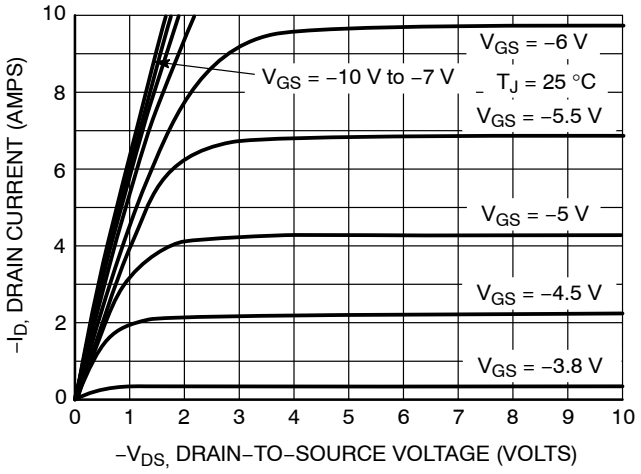



**Figure 1. On−Region Characteristics**

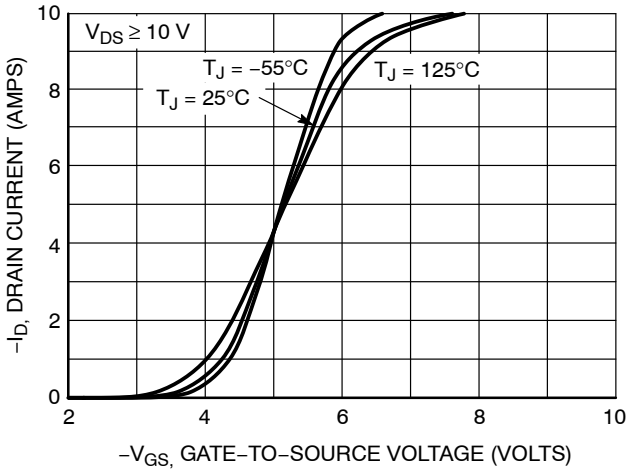



**Figure 2. Transfer Characteristics**

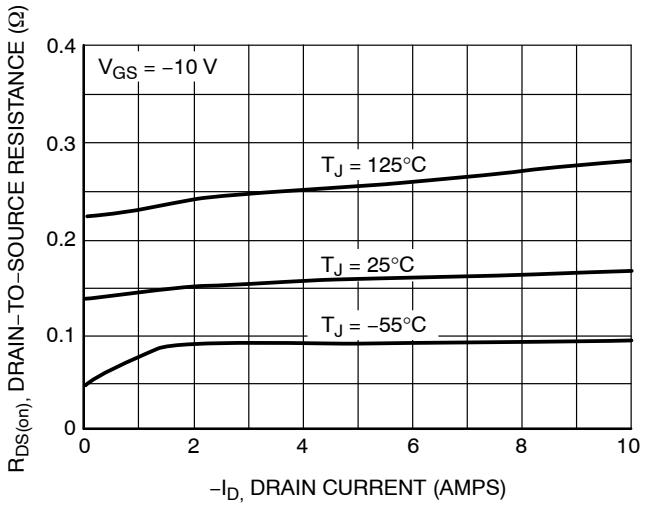



**Figure 3. On−Resistance versus Drain Current and Temperature**

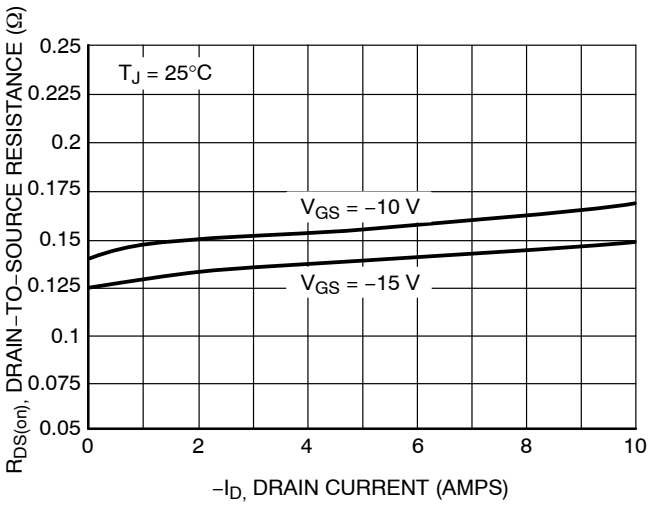



**Figure 4. On−Resistance versus Drain Current and Gate Voltage**

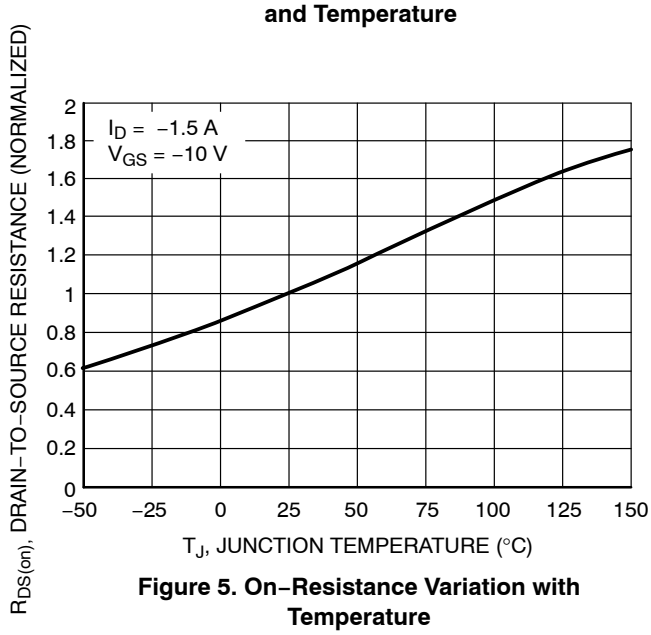



**Figure 5. On−Resistance Variation with Temperature**

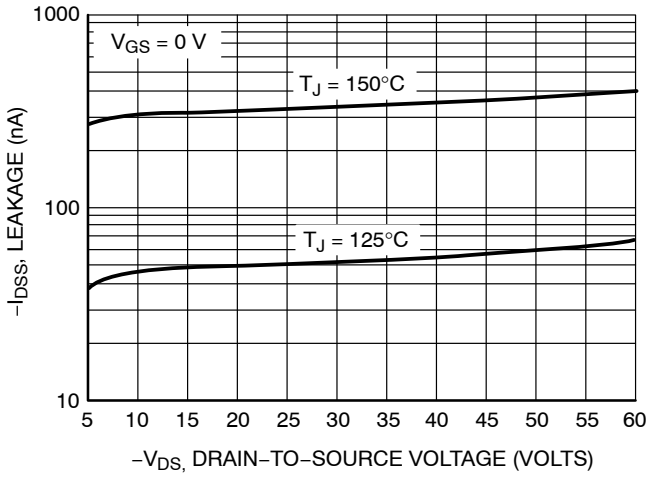



**Figure 6. Drain−to−Source Leakage Current versus Voltage**

## TYPICAL PERFORMANCE CURVES ($T_J$ = 25°C unless otherwise noted)

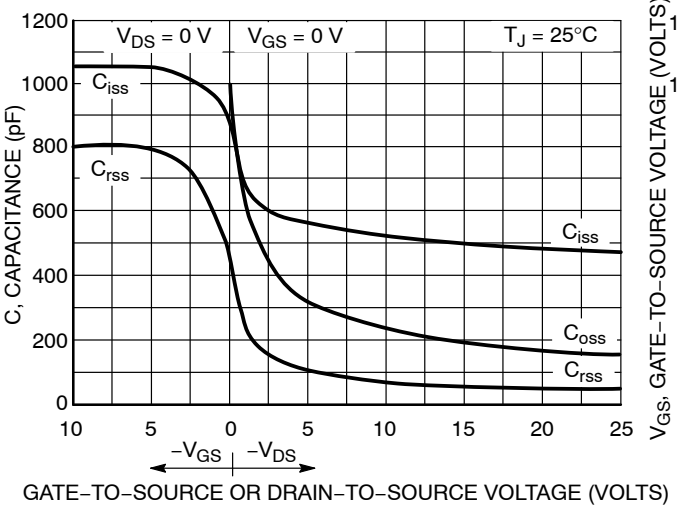



**Figure 7. Capacitance Variation**

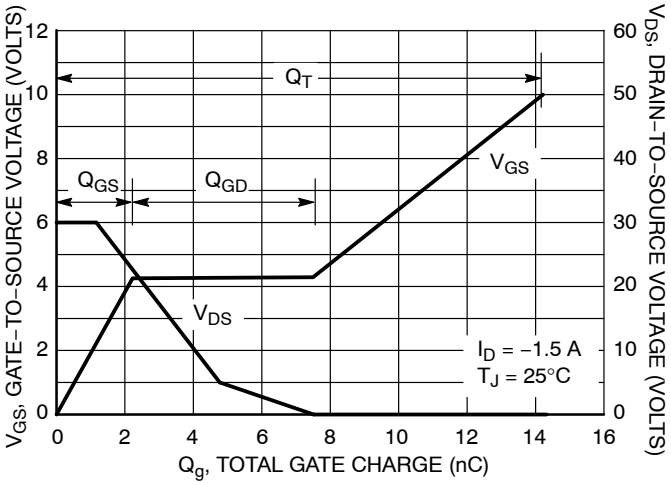



**Figure 8. Gate−to−Source and Drain−to−Source Voltage versus Total Charge**

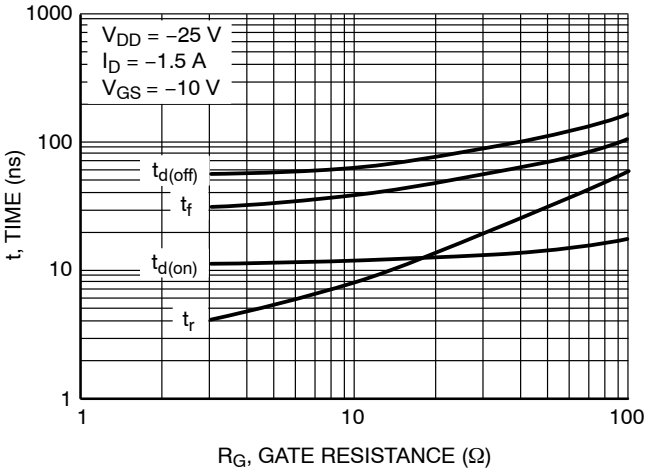



**Figure 9. Resistive Switching Time Variation versus Gate Resistance**

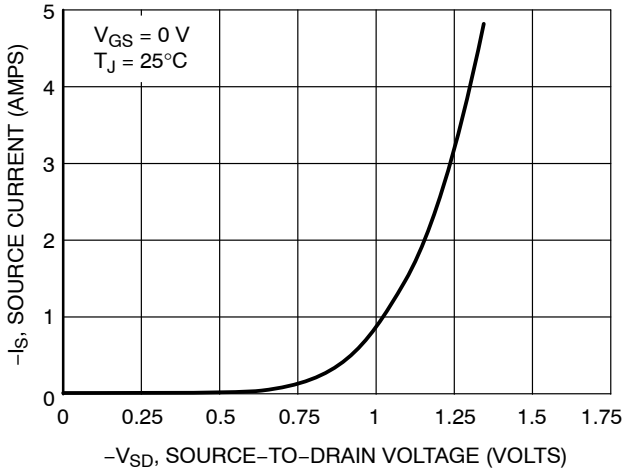



**Figure 10. Diode Forward Voltage versus Current**

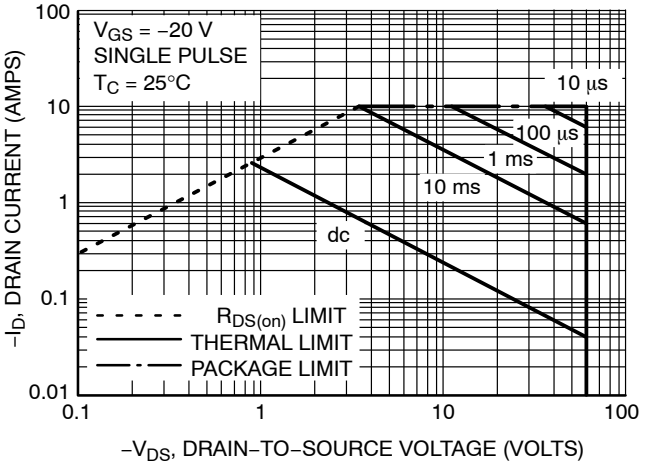



**Figure 11. Maximum Rated Forward Biased Safe Operating Area**

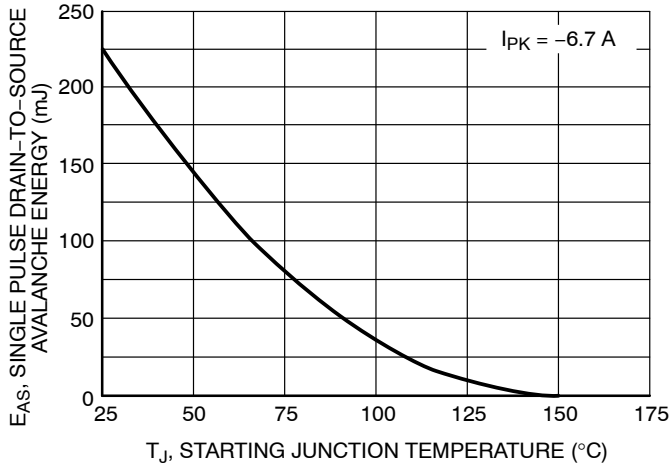



**Figure 12. Maximum Avalanche Energy versus Starting Junction Temperature**

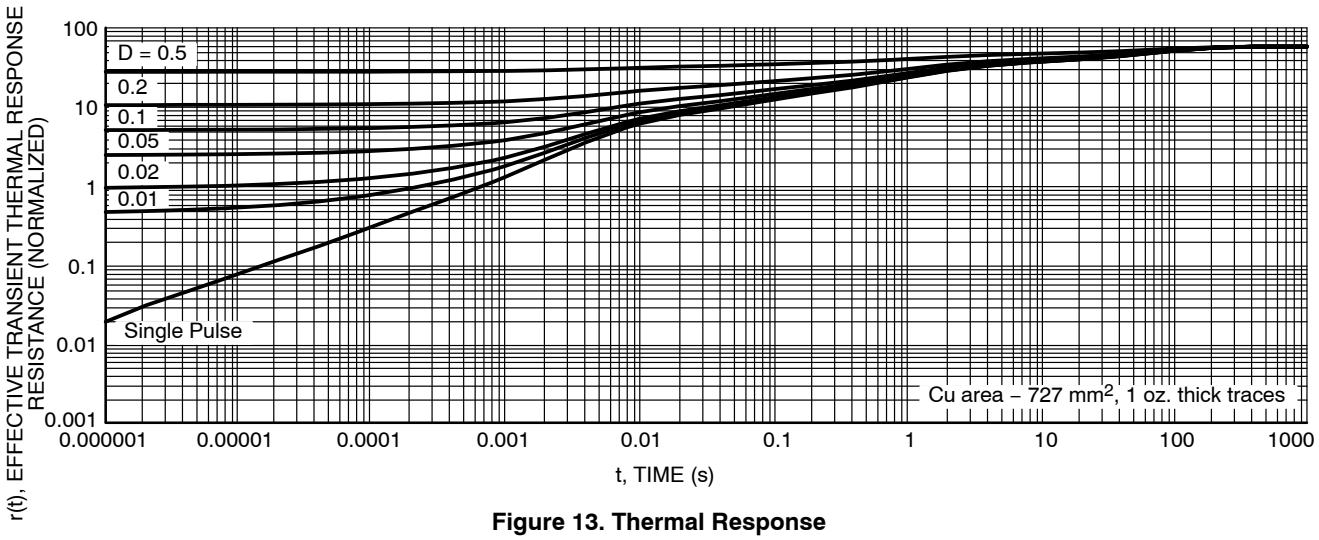
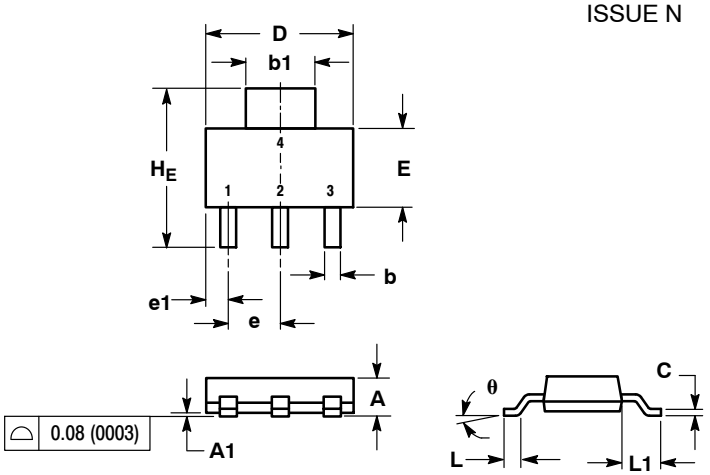



**Figure 13. Thermal Response**

## PACKAGE DIMENSIONS

**SOT−223 (TO−261)**
CASE 318E−04
ISSUE N

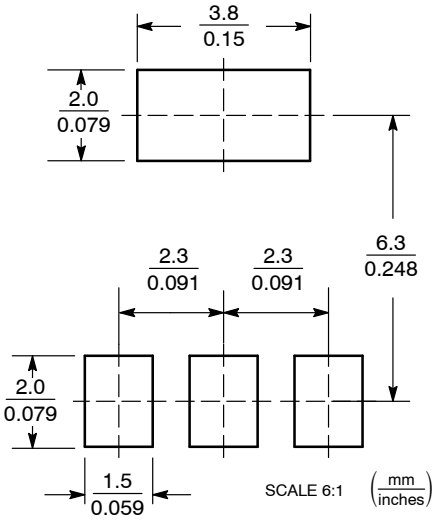



NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: INCH.

| | MILLIMETERS | | | INCHES | | |
|---|---|---|---|---|---|---|
| DIM | MIN | NOM | MAX | MIN | NOM | MAX |
| A | 1.50 | 1.63 | 1.75 | 0.060 | 0.064 | 0.068 |
| A1 | 0.02 | 0.06 | 0.10 | 0.001 | 0.002 | 0.004 |
| b | 0.60 | 0.75 | 0.89 | 0.024 | 0.030 | 0.035 |
| b1 | 2.90 | 3.06 | 3.20 | 0.115 | 0.121 | 0.126 |
| c | 0.24 | 0.29 | 0.35 | 0.009 | 0.012 | 0.014 |
| D | 6.30 | 6.50 | 6.70 | 0.249 | 0.256 | 0.263 |
| E | 3.30 | 3.50 | 3.70 | 0.130 | 0.138 | 0.145 |
| e | 2.20 | 2.30 | 2.40 | 0.087 | 0.091 | 0.094 |
| e1 | 0.85 | 0.94 | 1.05 | 0.033 | 0.037 | 0.041 |
| L | 0.20 | −−− | −−− | 0.008 | −−− | −−− |
| L1 | 1.50 | 1.75 | 2.00 | 0.060 | 0.069 | 0.078 |
| $H_E$ | 6.70 | 7.00 | 7.30 | 0.264 | 0.276 | 0.287 |
| θ | 0° | – | 10° | 0° | – | 10° |

STYLE 3:
PIN 1. GATE
2. DRAIN
3. SOURCE
4. DRAIN

### SOLDERING FOOTPRINT*




*For additional information on our Pb−Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

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