

# NTF2955, NVF2955, NVF2955P

## 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, NVF2955P
- These Devices are Pb-Free and are RoHS Compliant

### Applications

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

### MAXIMUM RATINGS ( $T_J = 25^\circ\text{C}$ unless otherwise noted)

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

### THERMAL RESISTANCE RATINGS

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

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

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

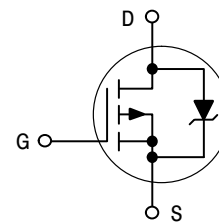


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| $V_{(BR)DSS}$ | $R_{DS(on)}$ TYP       | $I_D$ MAX |
|---------------|------------------------|-----------|
| -60 V         | 145 m $\Omega$ @ -10 V | -2.6 A    |

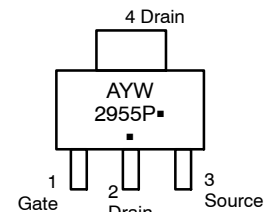
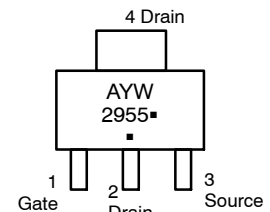
### P-Channel



### MARKING DIAGRAMS 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 <sup>†</sup> |
|-------------|-------------------|-----------------------|
| NTF2955T1G  | SOT-223 (Pb-Free) | 1000 /Tape & Reel     |
| NVF2955T1G  | SOT-223 (Pb-Free) | 1000/ Tape & Reel     |
| NVF2955PT1G | SOT-223 (Pb-Free) | 1000/ Tape & Reel     |

<sup>†</sup>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.

# NTF2955, NVF2955, NVF2955P

## ELECTRICAL CHARACTERISTICS ( $T_J=25^\circ\text{C}$ unless otherwise stated)

| Parameter | Symbol | Test Condition | Min | Typ | Max | Unit |
|-----------|--------|----------------|-----|-----|-----|------|
|-----------|--------|----------------|-----|-----|-----|------|

### OFF CHARACTERISTICS

|   |                   |   |                           |      |           |                      |
|---|-------------------|---|---------------------------|------|-----------|----------------------|
| Drain-to-Source Breakdown Voltage                         | $V_{(BR)DSS}$     | $V_{GS} = 0\text{ V}, I_D = -250\ \mu\text{A}$  | -60                       |      |           | V                    |
| Drain-to-Source Breakdown Voltage Temperature Coefficient | $V_{(BR)DSS}/T_J$ |   |                           | 66.4 |           | mV/ $^\circ\text{C}$ |
| Zero Gate Voltage Drain Current                           | $I_{DSS}$         | $V_{GS} = 0\text{ V}, V_{DS} = -60\text{ V}$    | $T_J = 25^\circ\text{C}$  |      | -1.0      | $\mu\text{A}$        |
|   |                   |   | $T_J = 125^\circ\text{C}$ |      | -50       |                      |
| Gate-to-Source Leakage Current                            | $I_{GSS}$         | $V_{DS} = 0\text{ V}, V_{GS} = \pm 20\text{ V}$ |                           |      | $\pm 100$ | nA                   |

### ON CHARACTERISTICS (Note 3)

|                               |              |   |      |      |      |            |
|-------------------------------|--------------|---|------|------|------|------------|
| Gate Threshold Voltage        | $V_{GS(TH)}$ | $V_{GS} = V_{DS}, I_D = -1.0\text{ mA}$       | -2.0 |      | -4.0 | V          |
| Drain-to-Source On Resistance | $R_{DS(on)}$ | $V_{GS} = -10\text{ V}, I_D = -0.75\text{ A}$ |      | 145  | 170  | m $\Omega$ |
|                               |              | $V_{GS} = -10\text{ V}, I_D = -1.5\text{ A}$  |      | 150  | 180  |            |
|                               |              | $V_{GS} = -10\text{ V}, I_D = -2.4\text{ A}$  |      | 154  | 185  |            |
| Forward Transconductance      | $g_{FS}$     | $V_{GS} = -15\text{ V}, I_D = -0.75\text{ A}$ |      | 1.77 |      | S          |

### CHARGES AND CAPACITANCES

|                              |              |  |  |      |  |    |
|------------------------------|--------------|--|--|------|--|----|
| Input Capacitance            | $C_{ISS}$    | $V_{GS} = 0\text{ V}, f = 1.0\text{ MHz}, V_{DS} = 25\text{ V}$  |  | 492  |  | pF |
| Output Capacitance           | $C_{OSS}$    |  |  | 165  |  |    |
| Reverse Transfer Capacitance | $C_{RSS}$    |  |  | 50   |  |    |
| Total Gate Charge            | $Q_{G(TOT)}$ | $V_{GS} = 10\text{ V}, V_{DS} = 30\text{ V}, I_D = 1.5\text{ A}$ |  | 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  | $t_{d(ON)}$  | $V_{GS} = 10\text{ V}, V_{DD} = 25\text{ V}, I_D = 1.5\text{ A}, R_G = 9.1\ \Omega, R_L = 25\ \Omega$ |  | 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   | $V_{SD}$ | $V_{GS} = 0\text{ V}, I_S = 1.5\text{ A}$                                     | $T_J = 25^\circ\text{C}$  |       | -1.10 | -1.30 | V  |
|                         |          |   | $T_J = 125^\circ\text{C}$ |       | -0.9  |       |    |
| Reverse Recovery Time   | $t_{RR}$ | $V_{GS} = 0\text{ V}, di_S/dt = 100\text{ A}/\mu\text{s}, I_S = 1.5\text{ A}$ |                           | 36    |       | ns    |    |
| Charge Time             | $t_a$    |   |                           | 20    |       |       |    |
| Discharge Time          | $t_b$    |   |                           | 16    |       |       |    |
| Reverse Recovery Charge | $Q_{RR}$ |   |                           | 0.139 |       |       | nC |

3. Pulse Test: pulse width  $\leq 300\ \mu\text{s}$ , duty cycle  $\leq 2\%$ .

4. Switching characteristics are independent of operating junction temperatures.

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## TYPICAL PERFORMANCE CURVES ( $T_J = 25^\circ\text{C}$ unless otherwise noted)

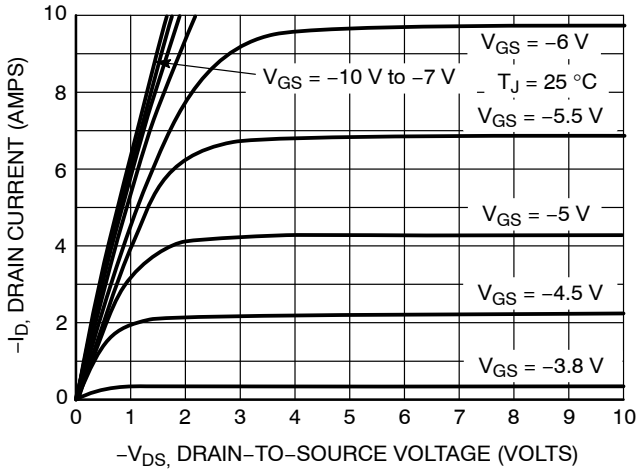


Figure 1. On-Region Characteristics

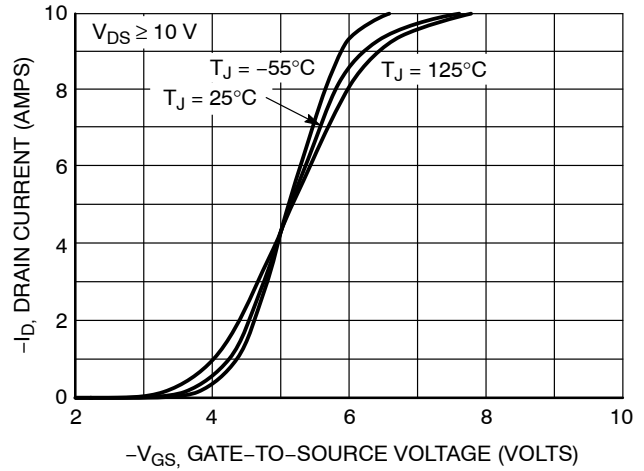


Figure 2. Transfer Characteristics

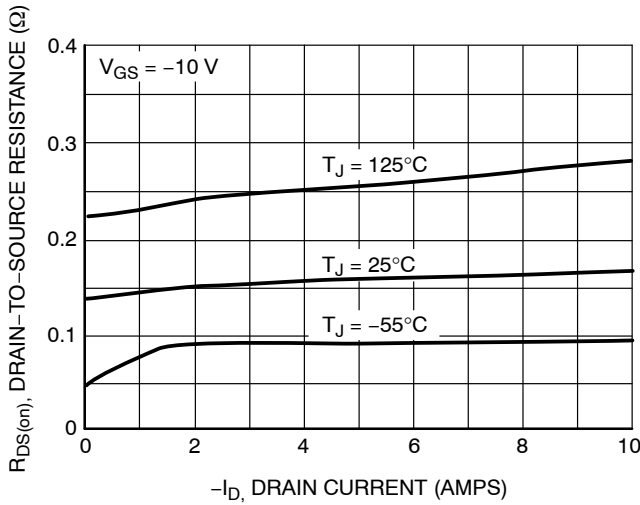


Figure 3. On-Resistance versus Drain Current and Temperature

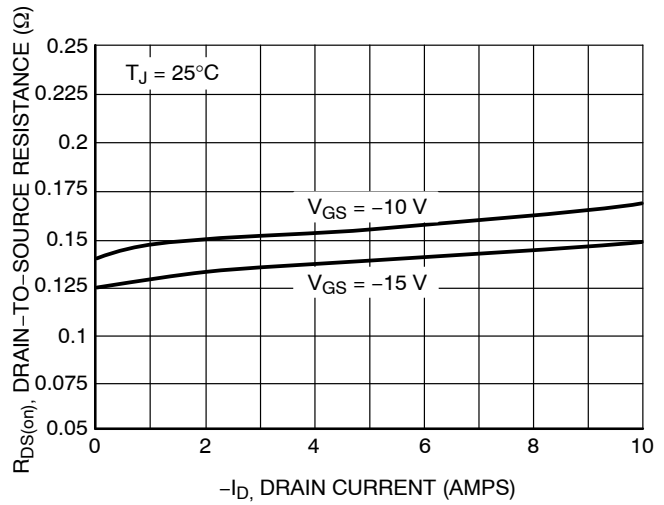


Figure 4. On-Resistance versus Drain Current and Gate Voltage

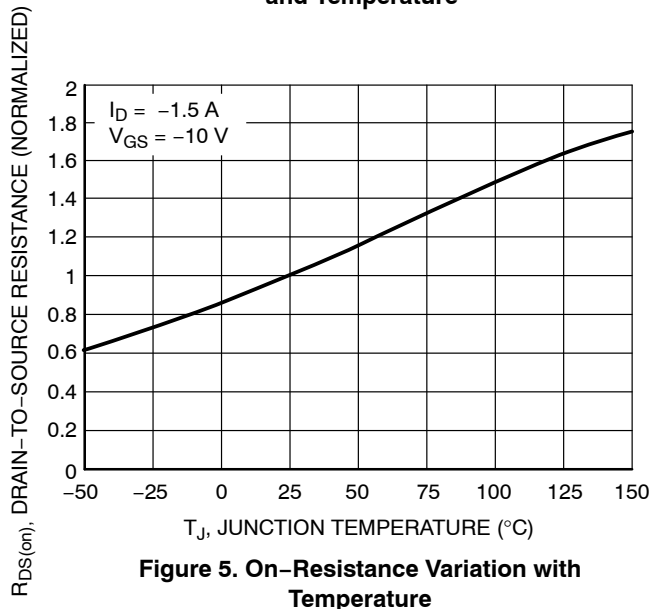


Figure 5. On-Resistance Variation with Temperature

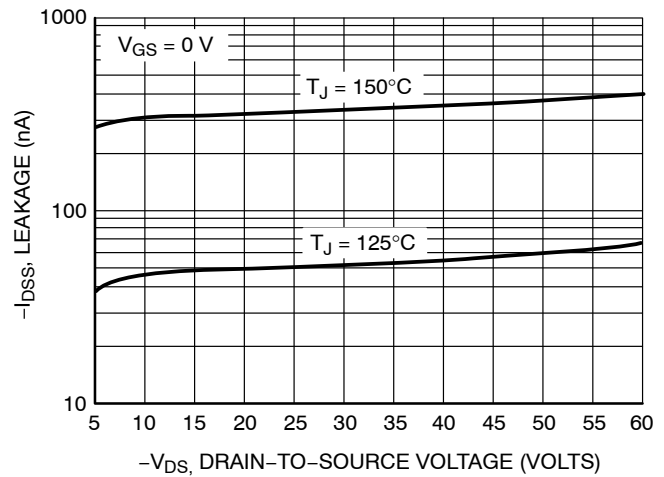


Figure 6. Drain-to-Source Leakage Current versus Voltage

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## TYPICAL PERFORMANCE CURVES ( $T_J = 25^\circ\text{C}$ unless otherwise noted)

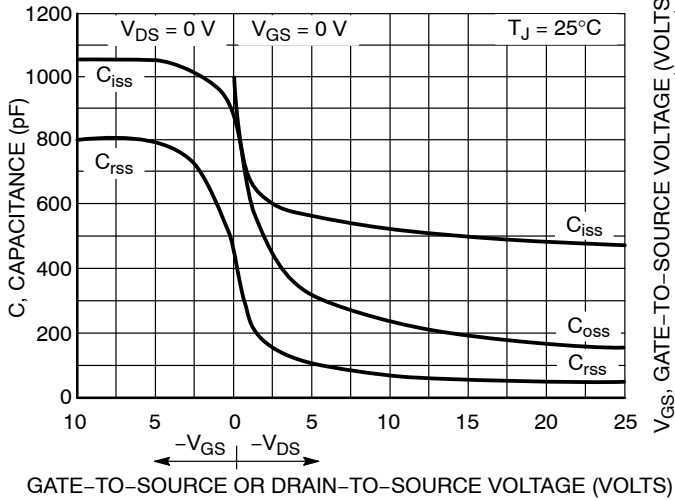


Figure 7. Capacitance Variation

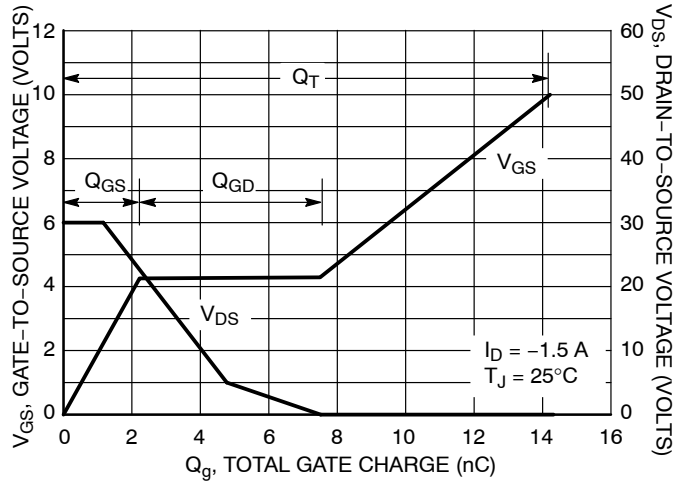


Figure 8. Gate-to-Source and Drain-to-Source Voltage versus Total Charge

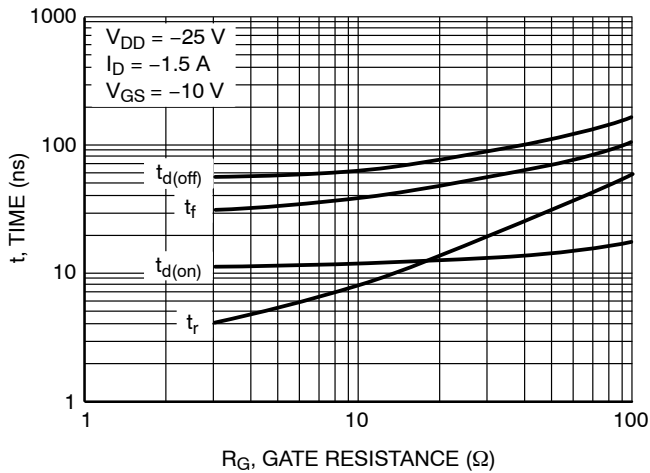


Figure 9. Resistive Switching Time Variation versus Gate Resistance

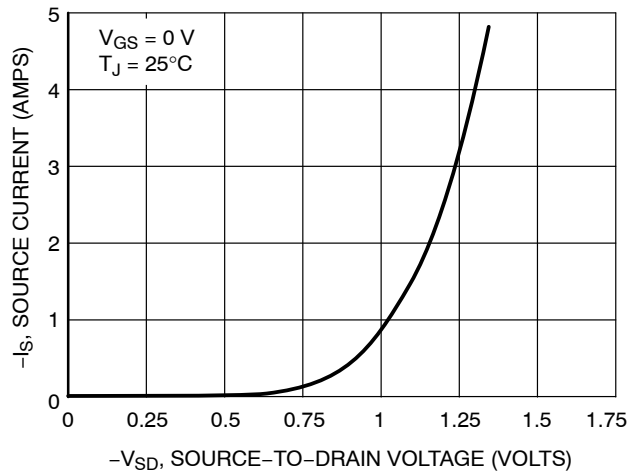


Figure 10. Diode Forward Voltage versus Current

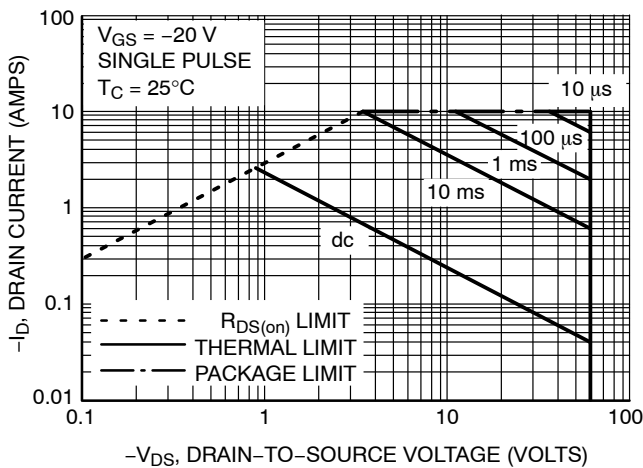


Figure 11. Maximum Rated Forward Biased Safe Operating Area

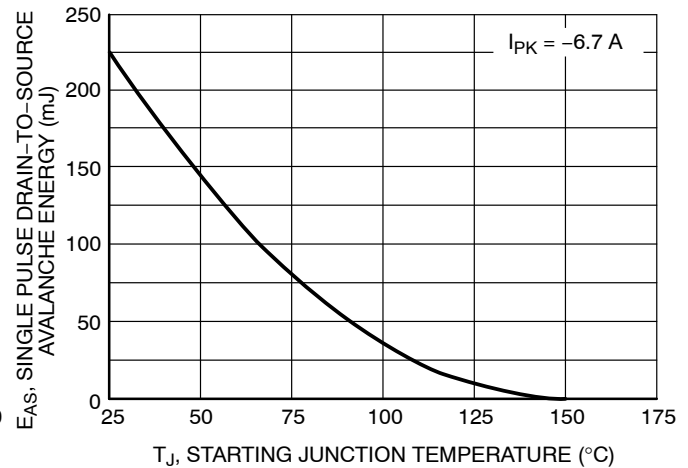
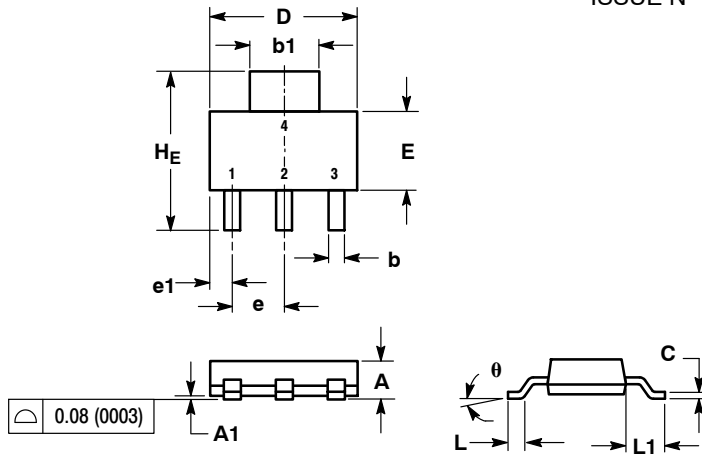


Figure 12. Maximum Avalanche Energy versus Starting Junction Temperature

# NTF2955, NVF2955, NVF2955P

## PACKAGE DIMENSIONS

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

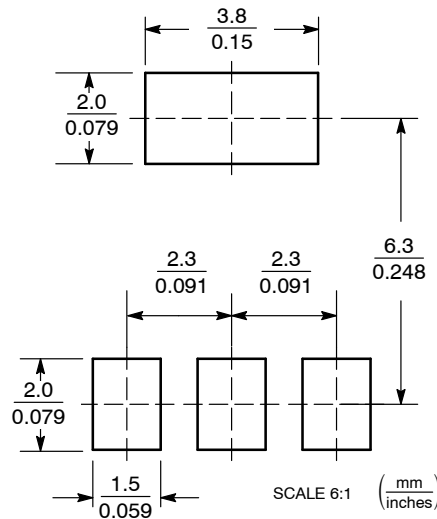


NOTES:  
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.  
2. CONTROLLING DIMENSION: INCH.

| DIM | MILLIMETERS |      |      | INCHES |       |       |
|-----|-------------|------|------|--------|-------|-------|
|     | 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 |
| HE  | 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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