

# NTP2955

## Power MOSFET

–60 V, –12 A, Single P–Channel, TO–220

### Features

- Low  $R_{DS(on)}$
- Rugged Performance
- Fast Switching
- These are Pb–Free Devices\*

### Applications

- Industrial
- Automotive
- Power Supplies

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

| Parameter  |  |                                     | Symbol                         | Value      | Unit               |
|--|--|-------------------------------------|--------------------------------|------------|--------------------|
| Drain-to-Source Voltage  |  |                                     | $V_{\text{DSS}}$               | −60        | V                  |
| Gate-to-Source Voltage   |  |                                     | $V_{\text{GS}}$                | ±20        | V                  |
| Continuous Drain Current (Note 1)  | Steady State                           | $T_{\text{C}} = 25^{\circ}\text{C}$ | $I_{\text{D}}$                 | −12        | A                  |
|  |  | $T_{\text{C}} = 85^{\circ}\text{C}$ |                                | −9.0       |                    |
| Power Dissipation (Note 1)   |  | $T_{\text{C}} = 25^{\circ}\text{C}$ | $P_{\text{D}}$                 | 62.5       | W                  |
| Continuous Drain Current (Note 1)  | Steady State                           | $T_{\text{A}} = 25^{\circ}\text{C}$ | $I_{\text{D}}$                 | −2.4       | A                  |
|  |  | $T_{\text{A}} = 85^{\circ}\text{C}$ |                                | −1.8       |                    |
| Power Dissipation (Note 1)   |  | $T_{\text{A}} = 25^{\circ}\text{C}$ | $P_{\text{D}}$                 | 2.4        | W                  |
| Pulsed Drain Current   | $t_{\text{p}} = 10\text{ }\mu\text{s}$ |                                     | $I_{\text{DM}}$                | −42        | A                  |
| Operating Junction and Storage Temperature   |  |                                     | $T_{\text{J}}, T_{\text{STG}}$ | −55 to 175 | $^{\circ}\text{C}$ |
| Source Current (Body Diode)  |  |                                     | $I_{\text{S}}$                 | −12        | A                  |
| Single Pulse Drain-to-Source Avalanche Energy ( $V_{\text{DD}} = -30\text{ V}$ , $V_{\text{G}} = -10\text{ V}$ , $I_{\text{PK}} = -12\text{ A}$ , $L = 3.0\text{ mH}$ , $R_{\text{G}} = 3.0\text{ }\Omega$ ) |  |                                     | EAS                            | 216        | mJ                 |
| Lead Temperature for Soldering Purposes (1/8" from case for 10 s)  |  |                                     | $T_{\text{L}}$                 | 260        | $^{\circ}\text{C}$ |

### THERMAL RESISTANCE RATINGS

| Parameter                                   | Symbol          | Max  | Unit               |
|---|-----------------|------|--------------------|
| Junction–to–Case                            | $R_{\theta JC}$ | 2.4  | $^\circ\text{C/W}$ |
| Junction–to–Ambient – Steady State (Note 1) | $R_{\theta JA}$ | 62.5 |                    |

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 sq [1 oz] including traces).

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

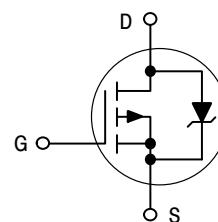


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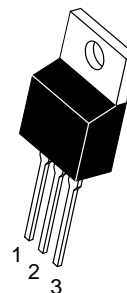
[www.onsemi.com](http://www.onsemi.com)

| $V_{(BR)DSS}$ | $R_{DS(on)}$ Typ       | $I_D$ MAX |
|---------------|------------------------|-----------|
| –60 V         | 156 m $\Omega$ @ –10 V | –12 A     |

### P–Channel



### MARKING DIAGRAM & PIN ASSIGNMENT



TO–220  
CASE 221A  
STYLE 5



A = Assembly Location  
Y = Year  
WW = Work Week  
G = Pb–Free Package

### ORDERING INFORMATION

| Device   | Package          | Shipping        |
|----------|------------------|-----------------|
| NTP2955G | TO–220 (Pb–Free) | 50 Units / Rail |

# NTP2955

## ELECTRICAL CHARACTERISTICS (T<sub>J</sub>=25°C unless otherwise stated)

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

### OFF CHARACTERISTICS

|   |                                      |   |                        |    |      |       |
|---|--------------------------------------|---|------------------------|----|------|-------|
| Drain-to-Source Breakdown Voltage                         | V <sub>(BR)DSS</sub>                 | V <sub>GS</sub> = 0 V, I <sub>D</sub> = -250 μA   | -60                    |    |      | V     |
| Drain-to-Source Breakdown Voltage Temperature Coefficient | V <sub>(BR)DSS</sub> /T <sub>J</sub> |   |                        | 67 |      | mV/°C |
| Zero Gate Voltage Drain Current                           | I <sub>DSS</sub>                     | V <sub>GS</sub> = 0 V,<br>V <sub>DS</sub> = -48 V | T <sub>J</sub> = 25°C  |    | -1.0 | μA    |
|   |                                      |   | T <sub>J</sub> = 125°C |    | -10  |       |
| Gate-to-Source Leakage Current                            | I <sub>GSS</sub>                     | V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ±20 V    |                        |    | ±100 | nA    |

### ON CHARACTERISTICS (Note 2)

|  |                                     |  |      |     |      |       |
|--|-------------------------------------|--|------|-----|------|-------|
| Gate Threshold Voltage                     | V <sub>GS(TH)</sub>                 | V <sub>GS</sub> = V <sub>DS</sub> , I <sub>D</sub> = -250 μA | -2.0 |     | -4.0 | V     |
| Negative Threshold Temperature Coefficient | V <sub>GS(TH)</sub> /T <sub>J</sub> |  |      | 56  |      | mV/°C |
| Drain-to-Source On Resistance              | R <sub>DS(on)</sub>                 | V <sub>GS</sub> = -10 V, I <sub>D</sub> = -12 A              |      | 156 | 196  | mΩ    |
| Forward Transconductance                   | g <sub>FS</sub>                     | V <sub>DS</sub> = -60 V, I <sub>D</sub> = -12 A              |      | 6.0 |      | S     |

### CHARGES AND CAPACITANCES

|                              |                     |   |  |     |     |    |
|------------------------------|---------------------|---|--|-----|-----|----|
| Input Capacitance            | C <sub>ISS</sub>    | V <sub>GS</sub> = 0 V, f = 1.0 MHz,<br>V <sub>DS</sub> = -25 V              |  | 507 | 700 | pF |
| Output Capacitance           | C <sub>OSS</sub>    |   |  | 150 | 250 |    |
| Reverse Transfer Capacitance | C <sub>RSS</sub>    |   |  | 48  | 98  |    |
| Total Gate Charge            | Q <sub>G(TOT)</sub> | V <sub>GS</sub> = -10 V, V <sub>DS</sub> = -48 V,<br>I <sub>D</sub> = -12 A |  | 14  |     | nC |
| Threshold Gate Charge        | Q <sub>G(TH)</sub>  |   |  | 1.6 | 2.5 |    |
| Gate-to-Source Charge        | Q <sub>GS</sub>     |   |  | 3.4 |     |    |
| Gate-to-Drain Charge         | Q <sub>GD</sub>     |   |  | 6.2 |     |    |

### SWITCHING CHARACTERISTICS (Note 3)

|                     |                     |   |  |    |    |    |
|---------------------|---------------------|---|--|----|----|----|
| Turn-On Delay Time  | t <sub>d(on)</sub>  | V <sub>GS</sub> = -10 V, V <sub>DD</sub> = -30 V,<br>I <sub>D</sub> = -12 A, R <sub>G</sub> = 9.1 Ω |  | 10 | 20 | ns |
| Rise Time           | t <sub>r</sub>      |   |  | 41 | 80 |    |
| Turn-Off Delay Time | t <sub>d(off)</sub> |   |  | 27 | 47 |    |
| Fall Time           | t <sub>f</sub>      |   |  | 45 | 85 |    |

### DRAIN-SOURCE DIODE CHARACTERISTICS

|                         |                 |  |                        |    |       |      |    |
|-------------------------|-----------------|--|------------------------|----|-------|------|----|
| Forward Diode Voltage   | V <sub>SD</sub> | V <sub>GS</sub> = 0 V,<br>I <sub>S</sub> = -12 A                                 | T <sub>J</sub> = 25°C  |    | -1.6  | -2.0 | V  |
|                         |                 |  | T <sub>J</sub> = 125°C |    | -1.36 |      |    |
| Reverse Recovery Time   | t <sub>RR</sub> | V <sub>GS</sub> = 0 V, dI <sub>S</sub> /dt = 100 A/μs,<br>I <sub>S</sub> = -12 A |                        | 53 |       | ns   |    |
| Charge Time             | t <sub>a</sub>  |  |                        | 42 |       |      |    |
| Discharge Time          | t <sub>b</sub>  |  |                        | 12 |       |      |    |
| Reverse Recovery Charge | Q <sub>RR</sub> |  |                        |    | 126   |      | nC |

2. Pulse Test: pulse width ≤ 300 μs, duty cycle ≤ 2%.

3. Switching characteristics are independent of operating junction temperatures.

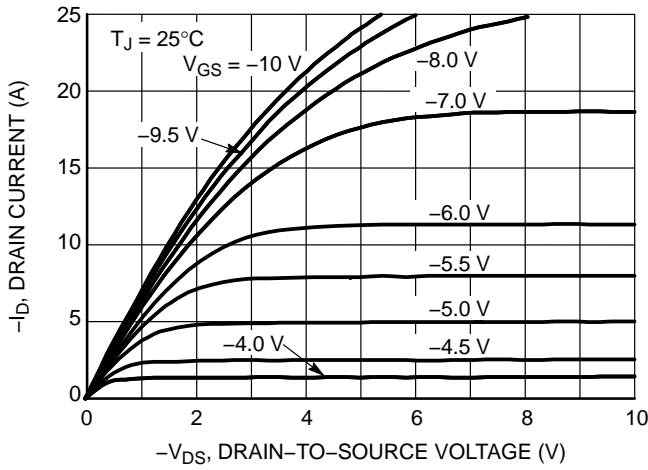


Figure 1. On-Region Characteristics

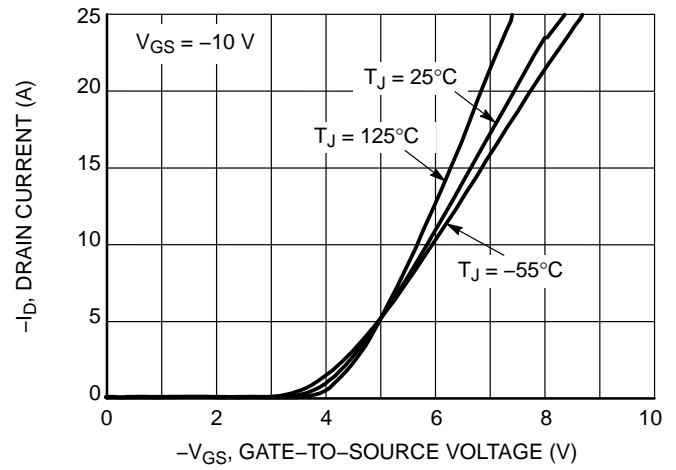


Figure 2. Transfer Characteristics

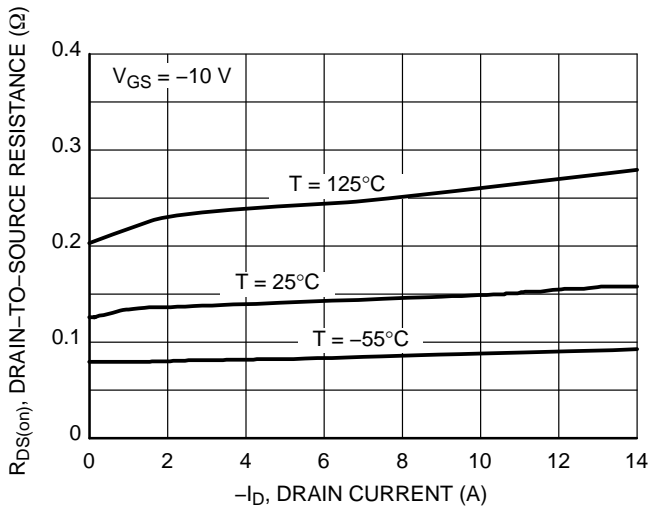


Figure 3. On-Resistance versus Drain Current and Temperature

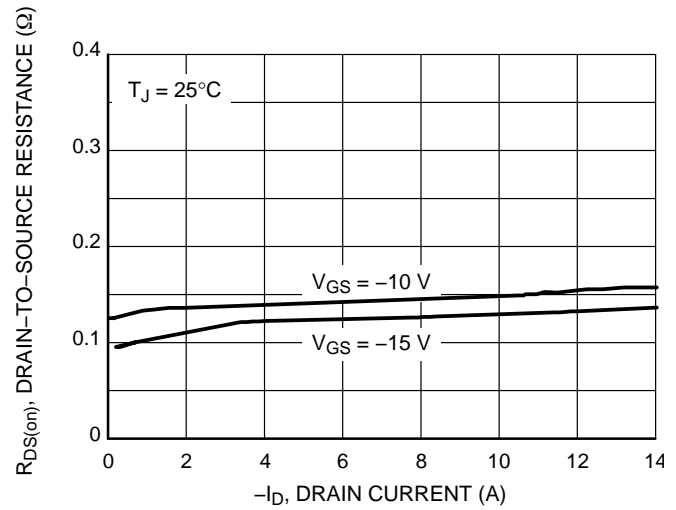


Figure 4. On-Resistance versus Drain Current and Gate Voltage

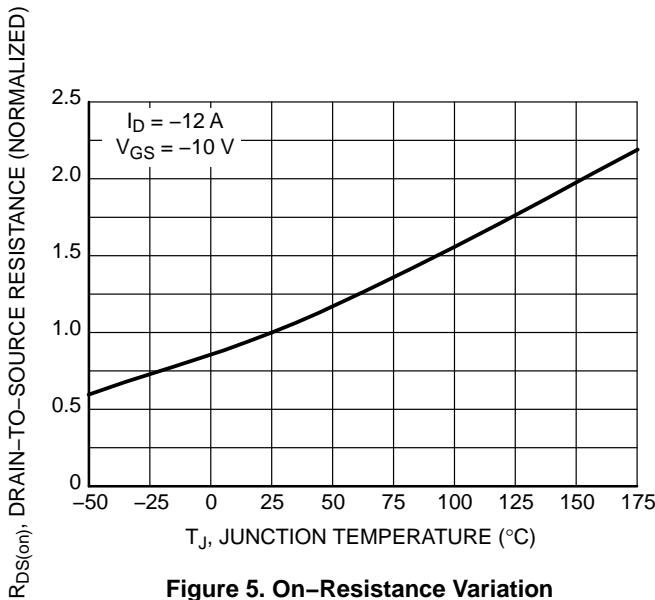


Figure 5. On-Resistance Variation with Temperature

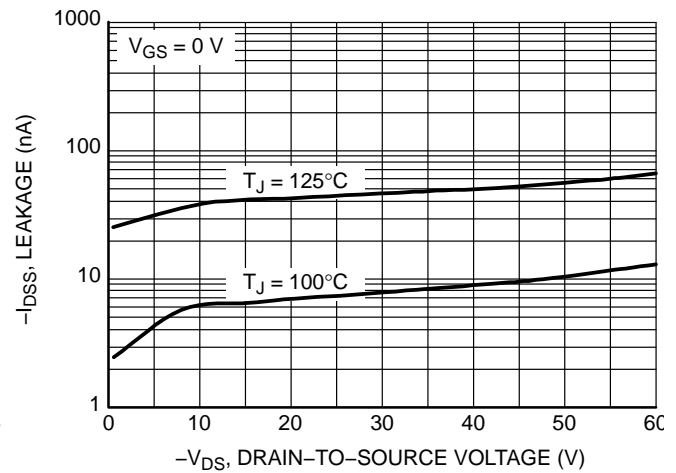


Figure 6. Drain-to-Source Leakage versus Voltage

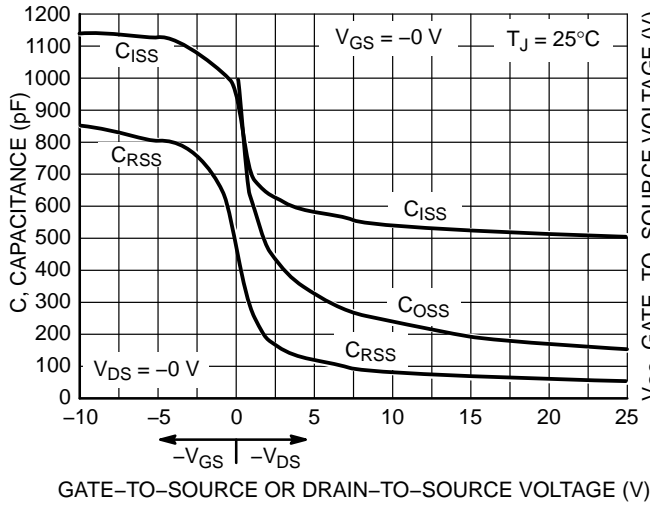


Figure 7. Capacitance Variation

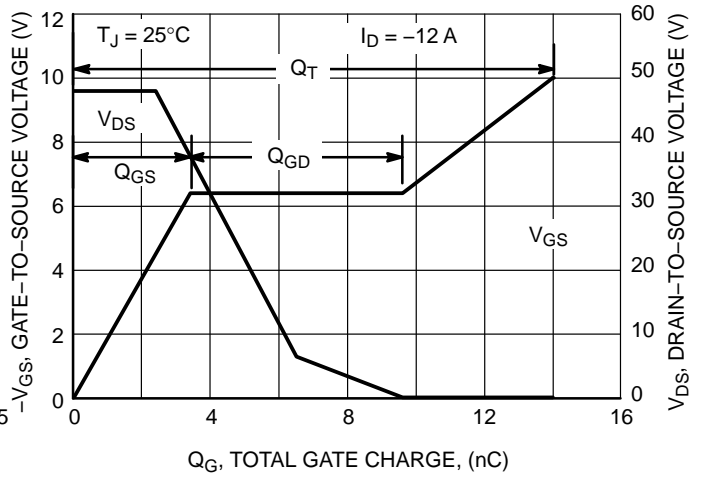


Figure 8. Gate-to-Source and Drain-to-Source Voltage versus Total Charge

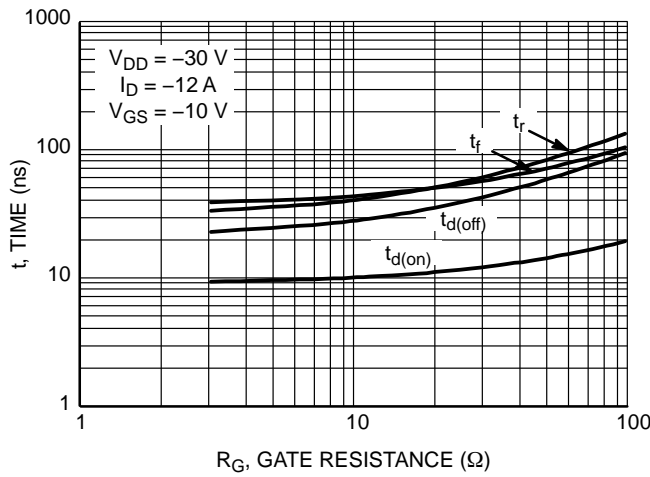


Figure 9. Resistive Switching Time Variation versus Gate Resistance

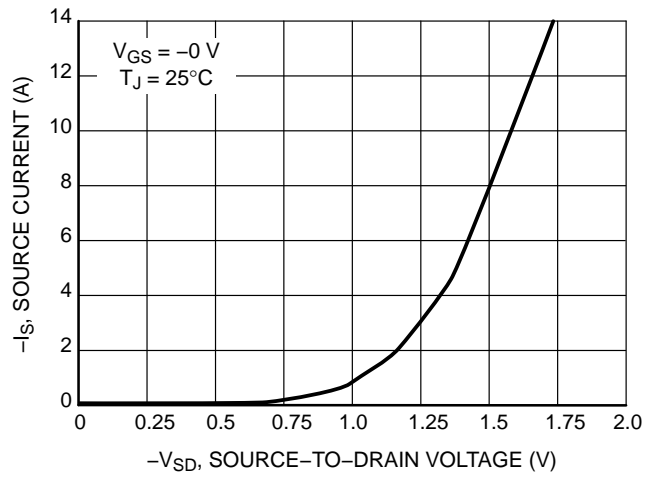


Figure 10. Diode Forward Voltage versus Current

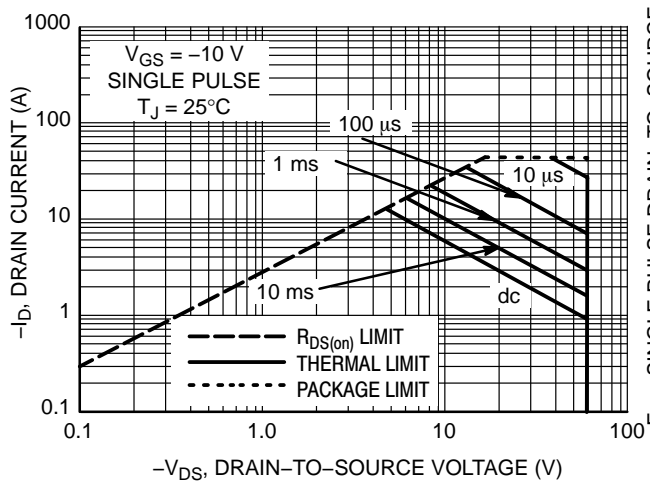


Figure 11. Maximum Rated Forward Biased Safe Operating Area

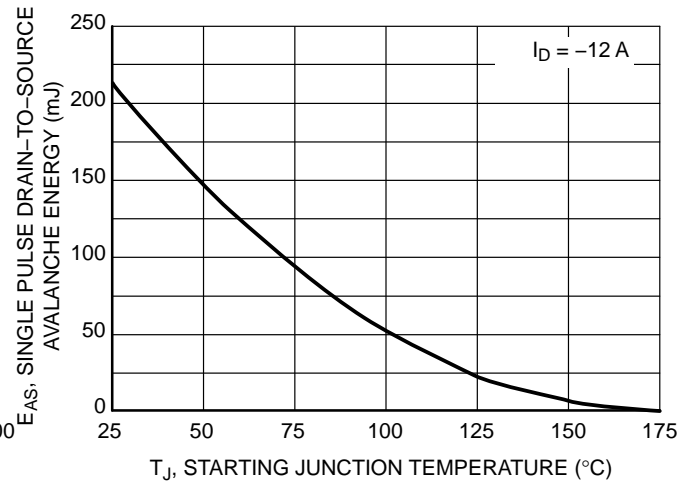
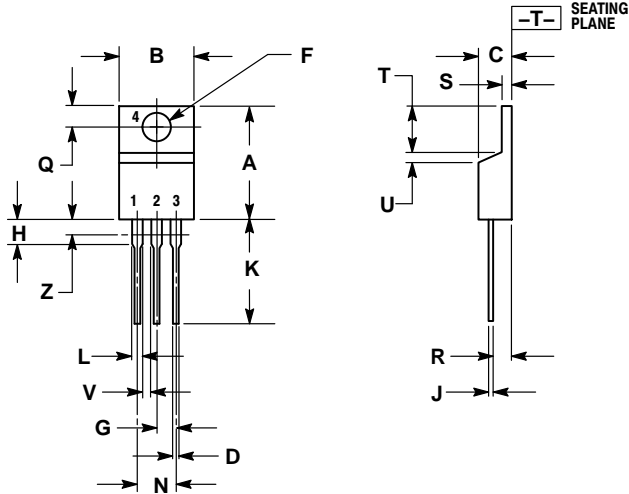


Figure 12. Maximum Avalanche Energy versus Starting Junction Temperature

# NTP2955

## PACKAGE DIMENSIONS

TO-220  
CASE 221A-09  
ISSUE AH




### NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION Z DEFINES A ZONE WHERE ALL BODY AND LEAD IRREGULARITIES ARE ALLOWED.

| DIM | INCHES |       | MILLIMETERS |       |
|-----|--------|-------|-------------|-------|
|     | MIN    | MAX   | MIN         | MAX   |
| A   | 0.570  | 0.620 | 14.48       | 15.75 |
| B   | 0.380  | 0.415 | 9.66        | 10.53 |
| C   | 0.160  | 0.190 | 4.07        | 4.83  |
| D   | 0.025  | 0.038 | 0.64        | 0.96  |
| F   | 0.142  | 0.161 | 3.61        | 4.09  |
| G   | 0.095  | 0.105 | 2.42        | 2.66  |
| H   | 0.110  | 0.161 | 2.80        | 4.10  |
| J   | 0.014  | 0.024 | 0.36        | 0.61  |
| K   | 0.500  | 0.562 | 12.70       | 14.27 |
| L   | 0.045  | 0.060 | 1.15        | 1.52  |
| N   | 0.190  | 0.210 | 4.83        | 5.33  |
| Q   | 0.100  | 0.120 | 2.54        | 3.04  |
| R   | 0.080  | 0.110 | 2.04        | 2.79  |
| S   | 0.045  | 0.055 | 1.15        | 1.39  |
| T   | 0.235  | 0.255 | 5.97        | 6.47  |
| U   | 0.000  | 0.050 | 0.00        | 1.27  |
| V   | 0.045  | ---   | 1.15        | ---   |
| Z   | ---    | 0.080 | ---         | 2.04  |

### STYLE 5:

- PIN 1. GATE  
2. DRAIN  
3. SOURCE  
4. DRAIN

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