# NTD5407N, STD5407N

# Power MOSFET
## 40 V, 38 A, Single N−Channel, DPAK

### Features
- Low $R_{DS(on)}$
- High Current Capability
- Low Gate Charge
- AEC Q101 Qualified − STB5407N
- These Devices are Pb−Free and are RoHS Compliant

### Applications
- Electronic Brake Systems
- Electronic Power Steering
- Bridge Circuits

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

| Parameter | | | Symbol | Value | Unit |
|---|---|---|---|---|---|
| Drain−to−Source Voltage | | | $V_{DSS}$ | 40 | V |
| Gate−to−Source Voltage | | | $V_{GS}$ | ±20 | V |
| Continuous Drain Current − $R_{\theta JC}$ | Steady State | $T_C$ = 25°C | $I_D$ | 38 | A |
| | | $T_C$ = 100°C | | 27 | |
| Power Dissipation − $R_{\theta JC}$ | Steady State | $T_C$ = 25°C | $P_D$ | 75 | W |
| Continuous Drain Current $R_{\theta JA}$ (Note 1) | Steady State | $T_A$ = 25°C | $I_D$ | 7.6 | A |
| | | $T_A$ = 100°C | | 5.3 | |
| Power Dissipation − $R_{\theta JA}$ (Note 1) | Steady State | $T_A$ = 25°C | $P_D$ | 2.9 | W |
| Pulsed Drain Current | $t_p$ = 10 μs | | $I_{DM}$ | 75 | A |
| Operating Junction and Storage Temperature | | | $T_J$, $T_{STG}$ | −55 to 175 | °C |
| Source Current (Body Diode) | | | $I_S$ | 36 | A |
| Single Pulse Drain−to Source Avalanche Energy − ($V_{DD}$ = 50 V, $V_{GS}$ = 10 V, $I_{PK}$ = 17 A, L = 1 mH, $R_G$ = 25 Ω) | | | EAS | 150 | mJ |
| Lead Temperature for Soldering Purposes (1/8" from case for 10 s) | | | $T_L$ | 260 | °C |

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.

**THERMAL RESISTANCE RATINGS** (Note 1)

| Parameter | Symbol | Max | Unit |
|---|---|---|---|
| Junction−to−Case (Drain) | $R_{\theta JC}$ | 2.0 | °C/W |
| Junction−to−Case (Note 1) | $R_{\theta JA}$ | 52 | °C/W |

1. Surface mounted on FR4 board using 1 sq in pad size, (Cu Area 1.127 sq in [2 oz] including traces).

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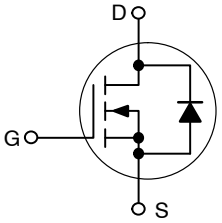
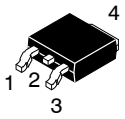
| $V_{(BR)DSS}$ | $R_{DS(ON)}$ TYP | $I_D$ MAX (Note 1) |
|---|---|---|
| 40 V | 21 mΩ @ 10 V | 38 A |

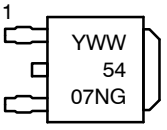
**N−Channel**




**DPAK**
**CASE 369C**
**STYLE 2**

**MARKING DIAGRAM**




Y = Year
WW = Work Week
5407N = Specific Device Code
G = Pb−Free Device

**ORDERING INFORMATION**

| Device | Package | Shipping† |
|---|---|---|
| NTD5407NT4G | DPAK (Pb−Free) | 2500 / Tape & Reel |
| STD5407NT4G | DPAK (Pb−Free) | 2500 / Tape & Reel |

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

**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 | | 40 | | | V |
| Drain−to−Source Breakdown Voltage Temperature Coefficient | $V_{(BR)DSS}/T_J$ | | | | 39 | | mV/°C |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | $V_{GS}$ = 0 V, $V_{DS}$ = 40 V | $T_J$ = 25°C | | | 1.0 | μA |
| | | | $T_J$ = 100°C | | | 10 | |
| Gate−to−Source Leakage Current | $I_{GSS}$ | $V_{DS}$ = 0 V, $V_{GS}$ = ±30 V | | | | ±100 | nA |
| **ON CHARACTERISTICS** (Note 2) | | | | | | | |
| Gate Threshold Voltage | $V_{GS(TH)}$ | $V_{GS}$ = $V_{DS}$, $I_D$ = 250 μA | | 1.5 | | 3.5 | V |
| Gate Threshold Temperature Coefficient | $V_{GS(TH)}/T_J$ | | | | −6.0 | | mV/°C |
| Drain−to−Source On Resistance | $R_{DS(on)}$ | $V_{GS}$ = 10 V, $I_D$ = 20 A | | | 21 | 26 | mΩ |
| | | $V_{GS}$ = 5.0 V, $I_D$ = 10 A | | | 32 | 40 | |
| Forward Transconductance | $g_{FS}$ | $V_{GS}$ = 10 V, $I_D$ = 18 A | | | 15 | | S |
| **CHARGES AND CAPACITANCES** | | | | | | | |
| Input Capacitance | $C_{ISS}$ | $V_{GS}$ = 0 V, f = 1.0 MHz, $V_{DS}$ = 32 V | | | 615 | 1000 | pF |
| Output Capacitance | $C_{OSS}$ | | | | 173 | | |
| Reverse Transfer Capacitance | $C_{RSS}$ | | | | 80 | | |
| Total Gate Charge | $Q_{G(TOT)}$ | $V_{GS}$ = 10 V, $V_{DS}$ = 32 V, $I_D$ = 38 A | | | 20 | | nC |
| Gate−to−Source Charge | $Q_{GS}$ | | | | 2.25 | | |
| Gate−to−Drain Charge | $Q_{GD}$ | | | | 10.5 | | |
| **SWITCHING CHARACTERISTICS, $V_{GS}$ = 10 V** (Note 3) | | | | | | | |
| Turn−On Delay Time | $t_{d(ON)}$ | $V_{GS}$ = 10 V, $V_{DD}$ = 32 V, $I_D$ = 38 A, $R_G$ = 2.5 Ω | | | 6.8 | | ns |
| Rise Time | $t_r$ | | | | 17 | | |
| Turn−Off Delay Time | $t_{d(OFF)}$ | | | | 66 | | |
| Fall Time | $t_f$ | | | | 51 | | |
| **SWITCHING CHARACTERISTICS, $V_{GS}$ = 5 V** (Note 3) | | | | | | | |
| Turn−On Delay Time | $t_{d(ON)}$ | $V_{GS}$ = 5 V, $V_{DD}$ = 20 V, $I_D$ = 20 A, $R_G$ = 2.5 Ω | | | 10 | | ns |
| Rise Time | $t_r$ | | | | 175 | | |
| Turn−Off Delay Time | $t_{d(OFF)}$ | | | | 13 | | |
| Fall Time | $t_f$ | | | | 23 | | |
| **DRAIN−SOURCE DIODE CHARACTERISTICS** (Note 2) | | | | | | | |
| Forward Diode Voltage | $V_{SD}$ | $V_{GS}$ = 0 V, $I_S$ = 5.0 A | $T_J$ = 25°C | | 0.9 | 1.1 | V |
| | | | $T_J$ = 125°C | | 0.75 | | |
| Reverse Recovery Time | $t_{RR}$ | $V_{GS}$ = 0 V, $dI_S/dt$ = 100 A/μs, $I_S$ = 15 A | | | 38 | | ns |
| Charge Time | $t_a$ | | | | 20.5 | | |
| Discharge Time | $t_b$ | | | | 17 | | |
| Reverse Recovery Charge | $Q_{RR}$ | | | | 40 | | nC |

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

## TYPICAL PERFORMANCE CURVES

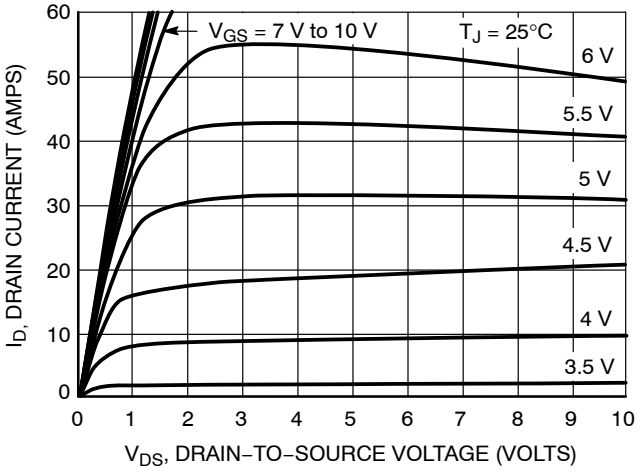



**Figure 1. On−Region Characteristics**

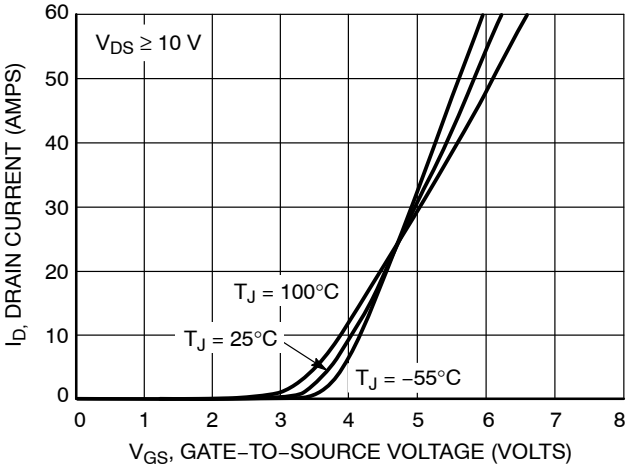



**Figure 2. Transfer Characteristics**

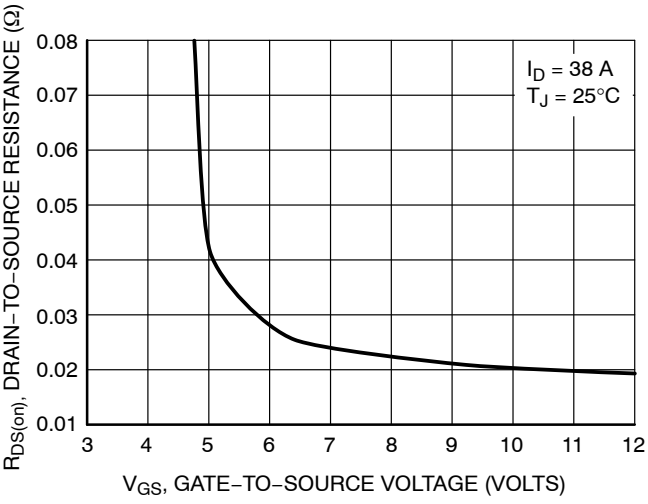



**Figure 3. On−Resistance vs. Gate−to−Source Voltage**

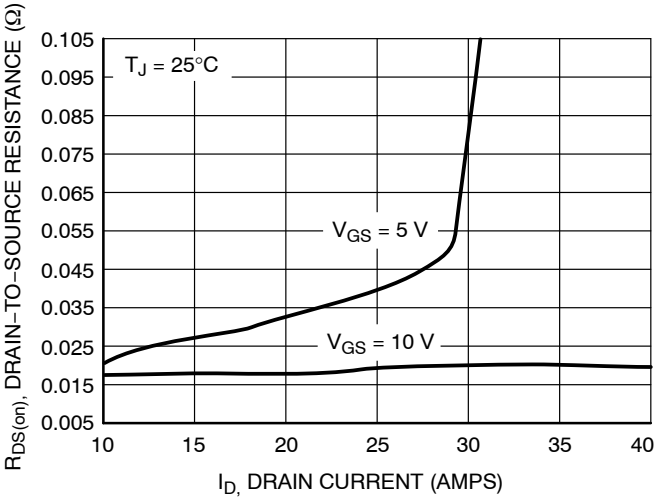



**Figure 4. On−Resistance vs. Drain Current and Gate Voltage**

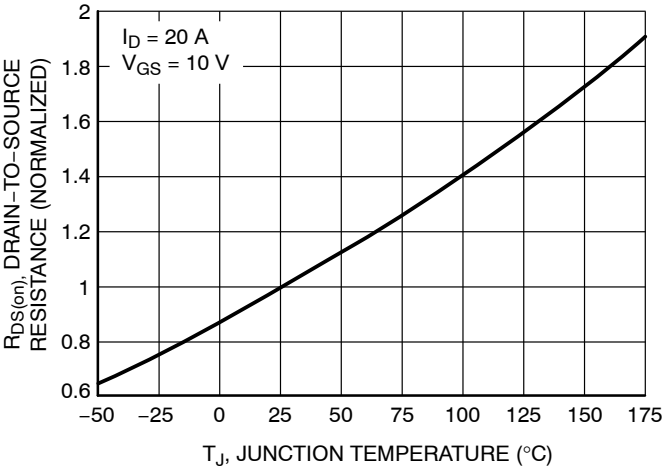



**Figure 5. On−Resistance Variation with Temperature**

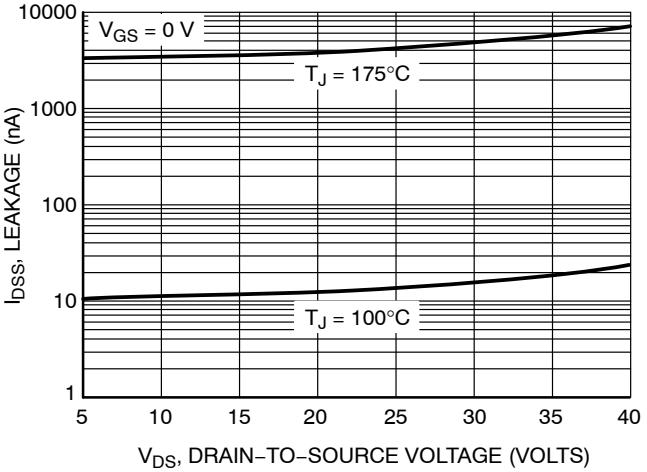



**Figure 6. Drain−to−Source Leakage Current vs. Voltage**

## TYPICAL PERFORMANCE CURVES

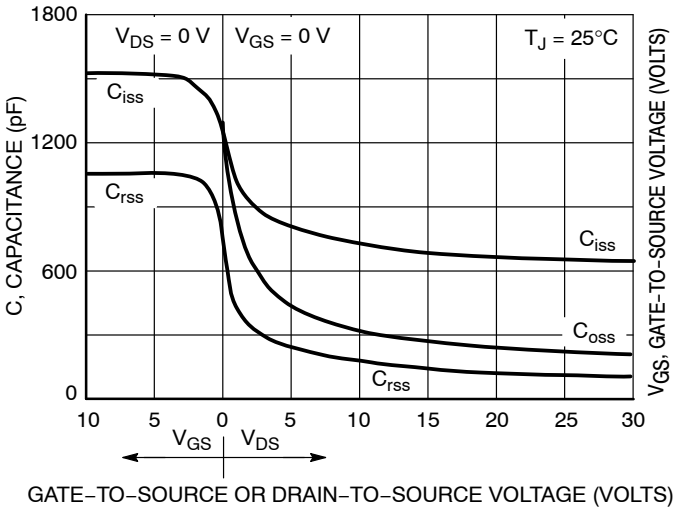



**Figure 7. Capacitance Variation**

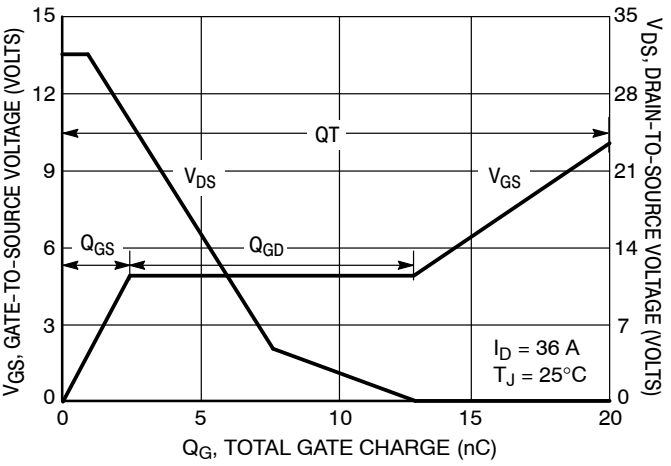



**Figure 8. Gate−To−Source and Drain−To−Source Voltage vs. Total Charge**

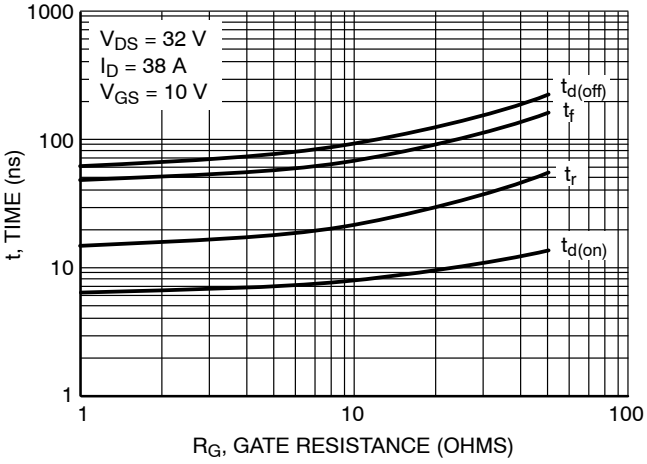



**Figure 9. Resistive Switching Time Variation vs. Gate Resistance**

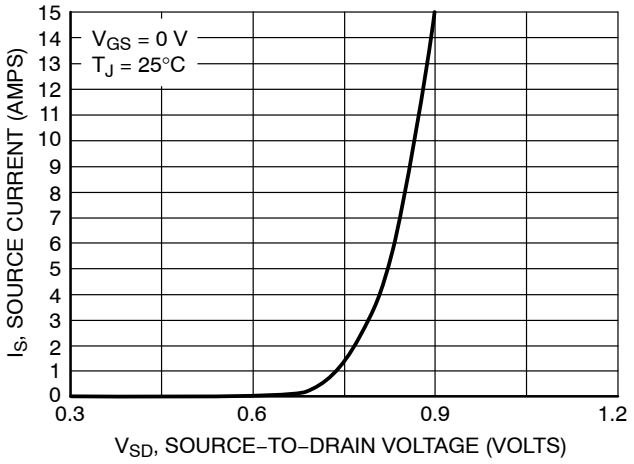



**Figure 10. Diode Forward Voltage vs. Current**

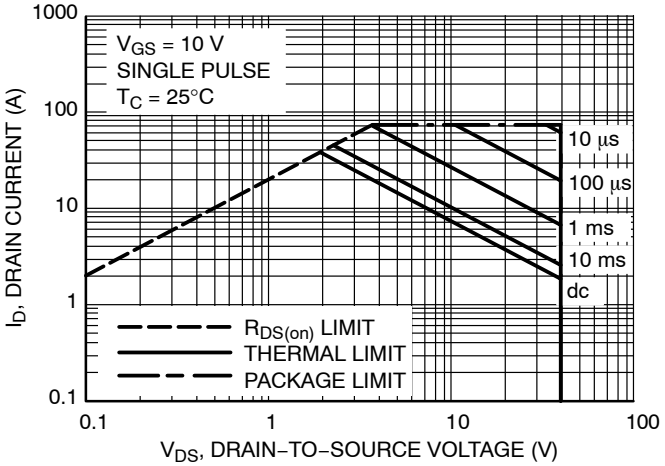



**Figure 11. Maximum Rated Forward Biased Safe Operating Area**

## TYPICAL PERFORMANCE CURVES

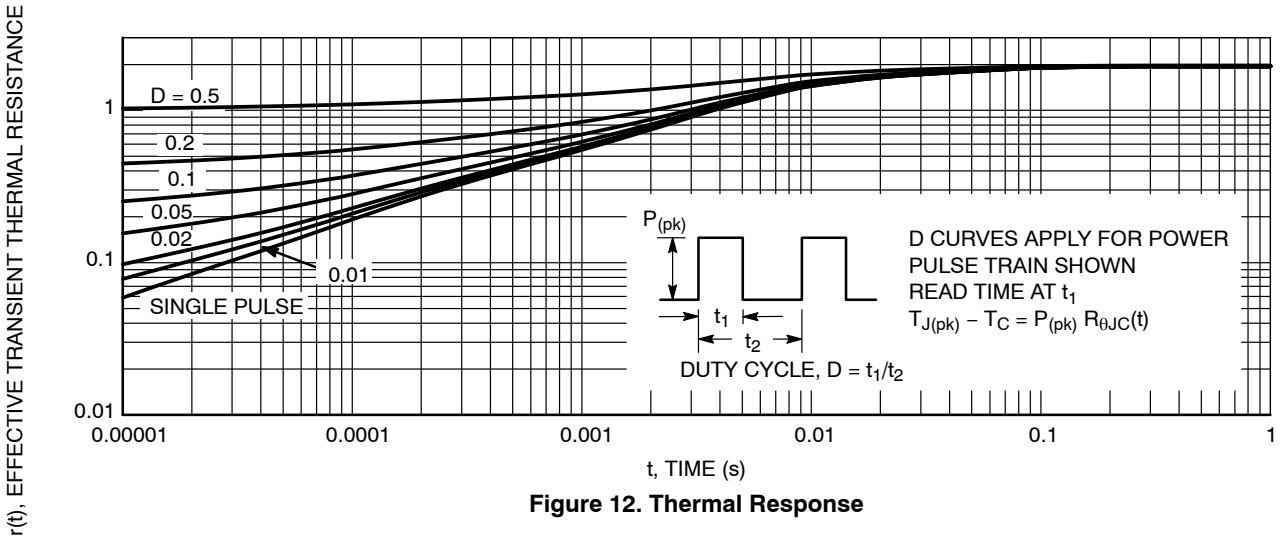
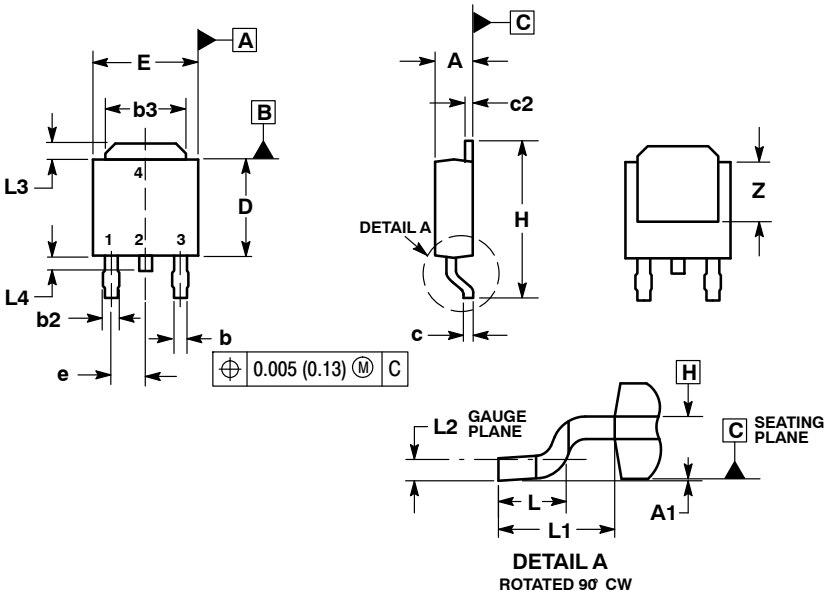



**Figure 12. Thermal Response**

## PACKAGE DIMENSIONS

### DPAK (SINGLE GAUGE)
CASE 369C−01
ISSUE D

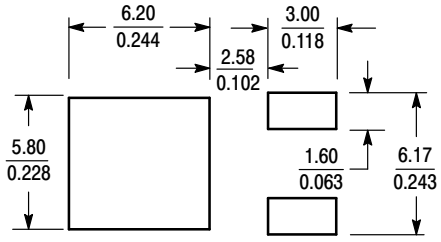



NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: INCHES.
3. THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSIONS b3, L3 and Z.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.006 INCHES PER SIDE.
5. DIMENSIONS D AND E ARE DETERMINED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY.
6. DATUMS A AND B ARE DETERMINED AT DATUM PLANE H.

| | INCHES | | MILLIMETERS | |
|---|---|---|---|---|
| DIM | MIN | MAX | MIN | MAX |
| A | 0.086 | 0.094 | 2.18 | 2.38 |
| A1 | 0.000 | 0.005 | 0.00 | 0.13 |
| b | 0.025 | 0.035 | 0.63 | 0.89 |
| b2 | 0.030 | 0.045 | 0.76 | 1.14 |
| b3 | 0.180 | 0.215 | 4.57 | 5.46 |
| c | 0.018 | 0.024 | 0.46 | 0.61 |
| c2 | 0.018 | 0.024 | 0.46 | 0.61 |
| D | 0.235 | 0.245 | 5.97 | 6.22 |
| E | 0.250 | 0.265 | 6.35 | 6.73 |
| e | 0.090 BSC | | 2.29 BSC | |
| H | 0.370 | 0.410 | 9.40 | 10.41 |
| L | 0.055 | 0.070 | 1.40 | 1.78 |
| L1 | 0.108 REF | | 2.74 REF | |
| L2 | 0.020 BSC | | 0.51 BSC | |
| L3 | 0.035 | 0.050 | 0.89 | 1.27 |
| L4 | −−− | 0.040 | −−− | 1.01 |
| Z | 0.155 | −−− | 3.93 | −−− |

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

### SOLDERING FOOTPRINT*




SCALE 3:1 (mm / inches)

*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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