# NTD20N03L27, NVD20N03L27

# Power MOSFET

## 20 A, 30 V, N−Channel DPAK

This logic level vertical power MOSFET is a general purpose part that provides the “best of design” available today in a low cost power package. Avalanche energy issues make this part an ideal design in. The drain−to−source diode has a ideal fast but soft recovery.

### Features

- Ultra−Low $R_{DS(on)}$, Single Base, Advanced Technology
- SPICE Parameters Available
- Diode is Characterized for use in Bridge Circuits
- $I_{DSS}$ and $V_{DS(on)}$ Specified at Elevated Temperatures
- High Avalanche Energy Specified
- ESD JEDAC rated HBM Class 1, MM Class A, CDM Class 0
- NVD Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC−Q101 Qualified and PPAP Capable
- These Devices are Pb−Free and are RoHS Compliant

### Typical Applications

- Power Supplies
- Inductive Loads
- PWM Motor Controls
- Replaces MTD20N03L in many Applications

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

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Drain−to−Source Voltage | $V_{DSS}$ | 30 | Vdc |
| Drain−to−Gate Voltage ($R_{GS}$ = 1.0 MΩ) | $V_{DGR}$ | 30 | Vdc |
| Gate−to−Source Voltage<br>− Continuous<br>− Non−Repetitive ($t_p \le 10$ ms) | <br>$V_{GS}$<br>$V_{GS}$ | <br>±20<br>±24 | Vdc |
| Drain Current<br>− Continuous @ $T_A$ = 25°C<br>− Continuous @ $T_A$ = 100°C<br>− Single Pulse ($t_p \le 10$ μs) | <br>$I_D$<br>$I_D$<br>$I_{DM}$ | <br>20<br>16<br>60 | <br>Adc<br><br>Apk |
| Total Power Dissipation @ $T_A$ = 25°C<br>Derate above 25°C<br>Total Power Dissipation @ $T_C$ = 25°C (Note 1) | $P_D$ | 74<br>0.6<br>1.75 | W<br>W/°CW |
| Operating and Storage Temperature Range | $T_J$, $T_{stg}$ | −55 to 150 | °C |
| Single Pulse Drain−to−Source Avalanche Energy − Starting $T_J$ = 25°C ($V_{DD}$ = 30 Vdc, $V_{GS}$ = 5 Vdc, L = 1.0 mH, $I_{L(pk)}$ = 24 A, $V_{DS}$ = 34 Vdc) | $E_{AS}$ | 288 | mJ |
| Thermal Resistance<br>− Junction−to−Case<br>− Junction−to−Ambient<br>− Junction−to−Ambient (Note 1) | <br>$R_{\theta JC}$<br>$R_{\theta JA}$<br>$R_{\theta JA}$ | <br>1.67<br>100<br>71.4 | °C/W |
| Maximum Lead Temperature for Soldering Purposes, 1/8″ from case for 10 seconds | $T_L$ | 260 | °C |

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 the minimum recommended pad size and repetitive rating; pulse width limited by maximum junction temperature.

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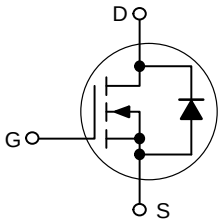
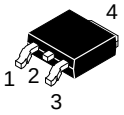
**20 A, 30 V, $R_{DS(on)}$ = 27 mΩ**

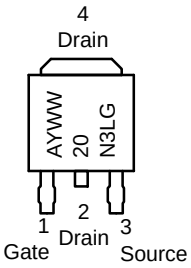
**N−Channel**




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

**MARKING DIAGRAM & PIN ASSIGNMENTS**




A = Assembly Location*
20N3L = Device Code
Y = Year
WW = Work Week
G = Pb−Free Package

* The Assembly Location code (A) is front side optional. In cases where the Assembly Location is stamped in the package, the front side assembly code may be blank.

**ORDERING INFORMATION**

See detailed ordering and shipping information in the package dimensions section on page 2 of this data sheet.

**ELECTRICAL CHARACTERISTICS** ($T_C$ = 25°C unless otherwise noted)

| Characteristic | | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | | | |
| Drain−to−Source Breakdown Voltage (Note 2)<br>($V_{GS}$ = 0 Vdc, $I_D$ = 250 μAdc)<br>Temperature Coefficient (Positive) | | $V_{(BR)DSS}$ | <br>30<br>− | <br>−<br>43 | <br>−<br>− | Vdc<br><br>mV/°C |
| Zero Gate Voltage Drain Current<br>($V_{DS}$ = 30 Vdc, $V_{GS}$ = 0 Vdc)<br>($V_{DS}$ = 30 Vdc, $V_{GS}$ = 0 Vdc, $T_J$ =150°C) | | $I_{DSS}$ | <br>−<br>− | <br>−<br>− | <br>10<br>100 | μAdc |
| Gate−Body Leakage Current ($V_{GS}$ = ±20 Vdc, $V_{DS}$ = 0 Vdc) | | $I_{GSS}$ | − | − | ±100 | nAdc |
| **ON CHARACTERISTICS** (Note 2) | | | | | | |
| Gate Threshold Voltage (Note 2)<br>($V_{DS}$ = $V_{GS}$, $I_D$ = 250 μAdc)<br>Threshold Temperature Coefficient (Negative) | | $V_{GS(th)}$ | <br>1.0<br>− | <br>1.6<br>5.0 | <br>2.0<br>− | Vdc<br><br>mV/°C |
| Static Drain−to−Source On−Resistance (Note 2)<br>($V_{GS}$ = 4.0 Vdc, $I_D$ = 10 Adc)<br>($V_{GS}$ = 5.0 Vdc, $I_D$ = 10 Adc) | | $R_{DS(on)}$ | <br>−<br>− | <br>28<br>23 | <br>31<br>27 | mΩ |
| Static Drain−to−Source On−Voltage (Note 2)<br>($V_{GS}$ = 5.0 Vdc, $I_D$ = 20 Adc)<br>($V_{GS}$ = 5.0 Vdc, $I_D$ = 10 Adc, $T_J$ = 150°C) | | $V_{DS(on)}$ | <br>−<br>− | <br>0.48<br>0.40 | <br>0.54<br>− | Vdc |
| Forward Transconductance (Note 2) ($V_{DS}$ = 5.0 Vdc, $I_D$ = 10 Adc) | | $g_{FS}$ | − | 21 | − | mhos |
| **DYNAMIC CHARACTERISTICS** | | | | | | |
| Input Capacitance | ($V_{DS}$ = 25 Vdc, $V_{GS}$ = 0 Vdc, f = 1.0 MHz) | $C_{iss}$ | − | 1005 | 1260 | pF |
| Output Capacitance | | $C_{oss}$ | − | 271 | 420 | |
| Transfer Capacitance | | $C_{rss}$ | − | 87 | 112 | |
| **SWITCHING CHARACTERISTICS** (Note 3) | | | | | | |
| Turn−On Delay Time | ($V_{DD}$ = 20 Vdc, $I_D$ = 20 Adc, $V_{GS}$ = 5.0 Vdc, $R_G$ = 9.1 Ω) (Note 2) | $t_{d(on)}$ | − | 17 | 25 | ns |
| Rise Time | | $t_r$ | − | 137 | 160 | |
| Turn−Off Delay Time | | $t_{d(off)}$ | − | 38 | 45 | |
| Fall Time | | $t_f$ | − | 31 | 40 | |
| Gate Charge | ($V_{DS}$ = 48 Vdc, $I_D$ = 15 Adc, $V_{GS}$ = 10 Vdc) (Note 2) | $Q_T$ | − | 13.8 | 18.9 | nC |
| | | $Q_1$ | − | 2.8 | − | |
| | | $Q_2$ | − | 6.6 | − | |
| **SOURCE−DRAIN DIODE CHARACTERISTICS** | | | | | | |
| Forward On−Voltage | ($I_S$ = 20 Adc, $V_{GS}$ = 0 Vdc) (Note 2)<br>($I_S$ = 20 Adc, $V_{GS}$ = 0 Vdc, $T_J$ = 125°C) | $V_{SD}$ | <br>−<br>− | <br>1.0<br>0.9 | <br>1.15<br>− | Vdc |
| Reverse Recovery Time | ($I_S$ =15 Adc, $V_{GS}$ = 0 Vdc, $dI_S/dt$ = 100 A/μs) (Note 2) | $t_{rr}$ | − | 23 | − | ns |
| | | $t_a$ | − | 13 | − | |
| | | $t_b$ | − | 10 | − | |
| Reverse Recovery Stored Charge | | $Q_{RR}$ | − | 0.017 | − | μC |

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.

2. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2%.
3. Switching characteristics are independent of operating junction temperature.

## ORDERING INFORMATION

| Device | Package | Shipping† |
|---|---|---|
| NTD20N03L27T4G | DPAK<br>(Pb−Free) | 2500 / Tape & Reel |
| NVD20N03L27T4G* | DPAK<br>(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.

*NVD Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC−Q101 Qualified and PPAP Capable.

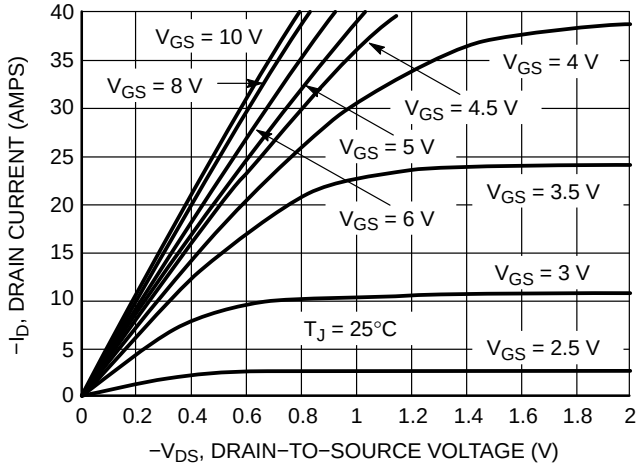



**Figure 1. On−Region Characteristics**

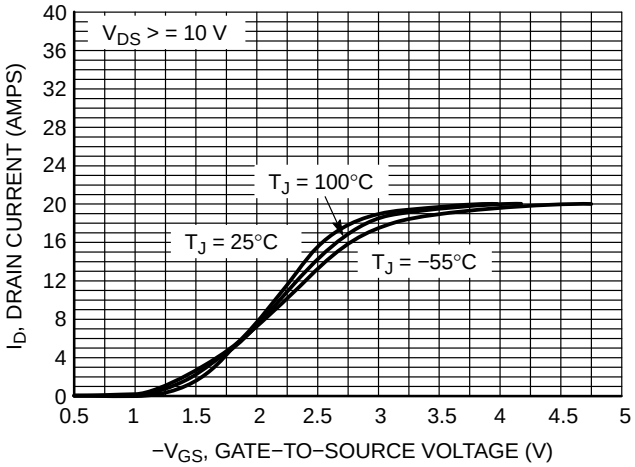



**Figure 2. Transfer Characteristics**

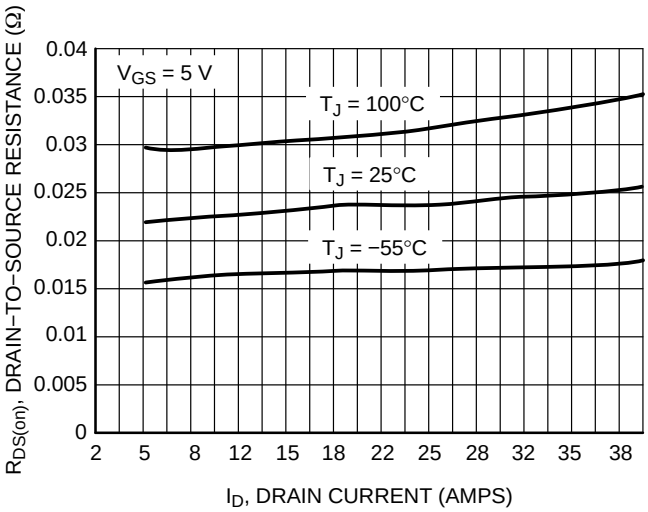



**Figure 3. On−Resistance vs. Drain Current and Temperature**

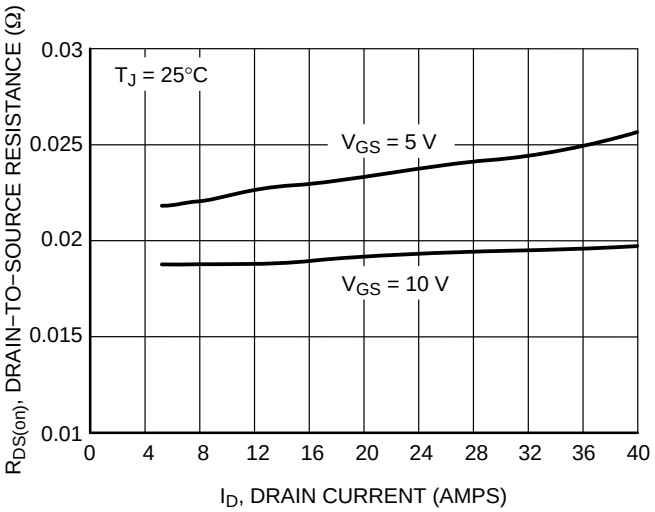



**Figure 4. On−Resistance vs. Drain Current and Gate Voltage**

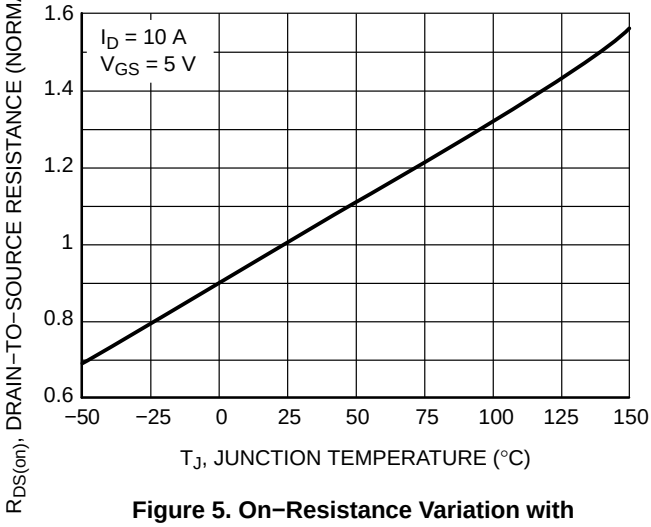



**Figure 5. On−Resistance Variation with Temperature**

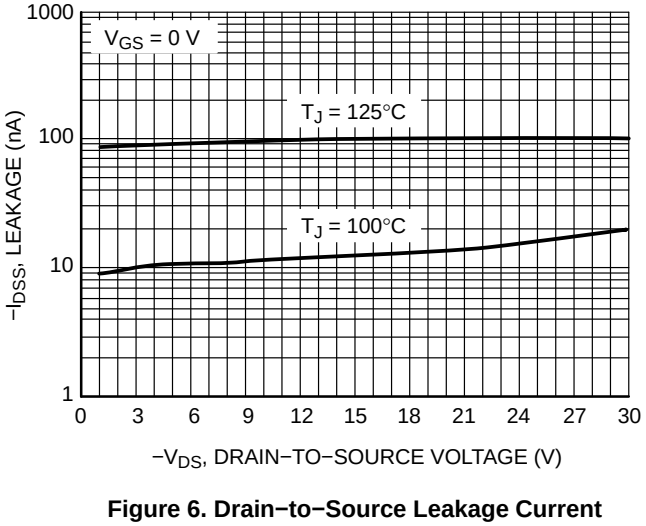



**Figure 6. Drain−to−Source Leakage Current vs. Voltage**

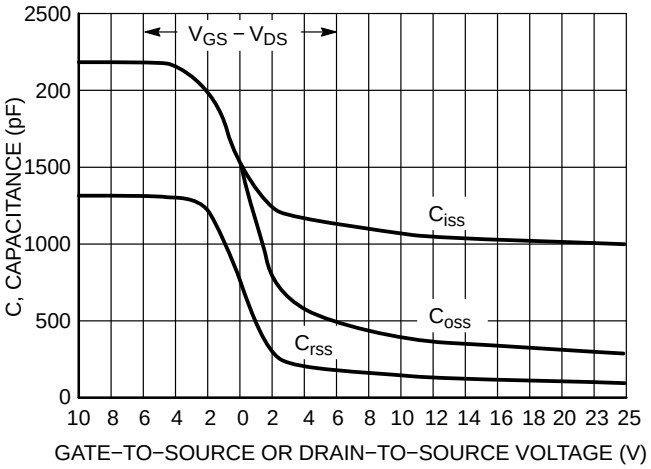



**Figure 7. Capacitance Variation**

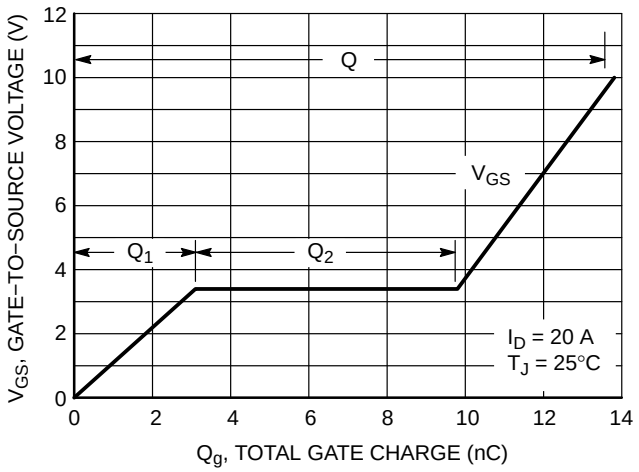



**Figure 8. Gate−to−Source and Drain−to−Source Voltage vs. Total Charge**

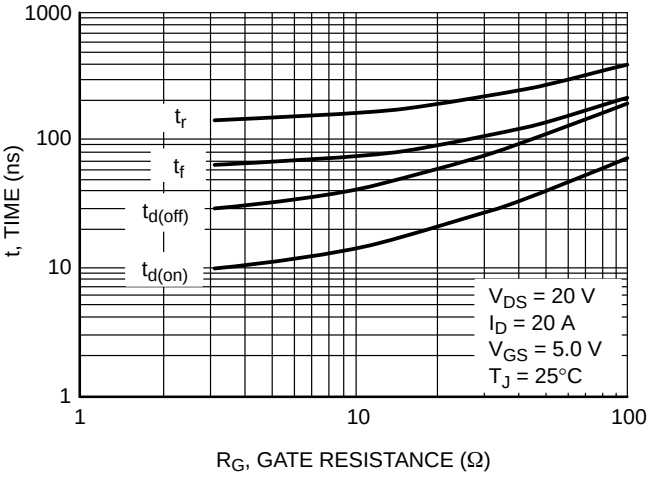



**Figure 9. Resistive Switching Time Variation vs. Gate Resistance**

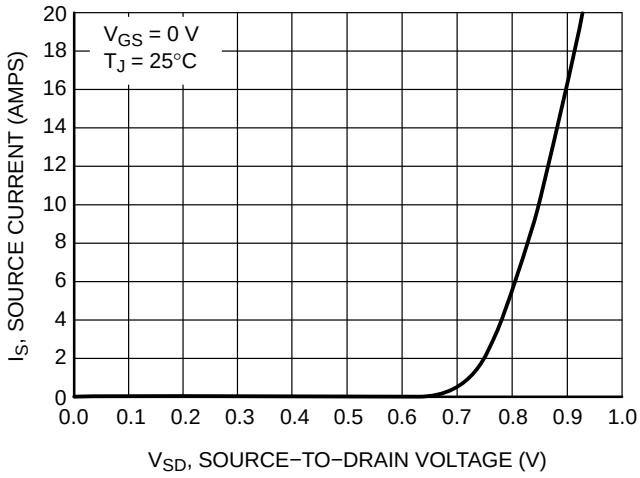



**Figure 10. Diode Forward Voltage vs. Current**

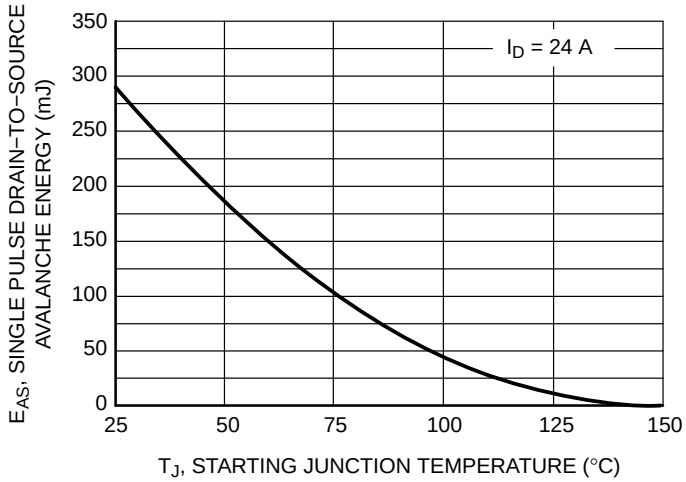
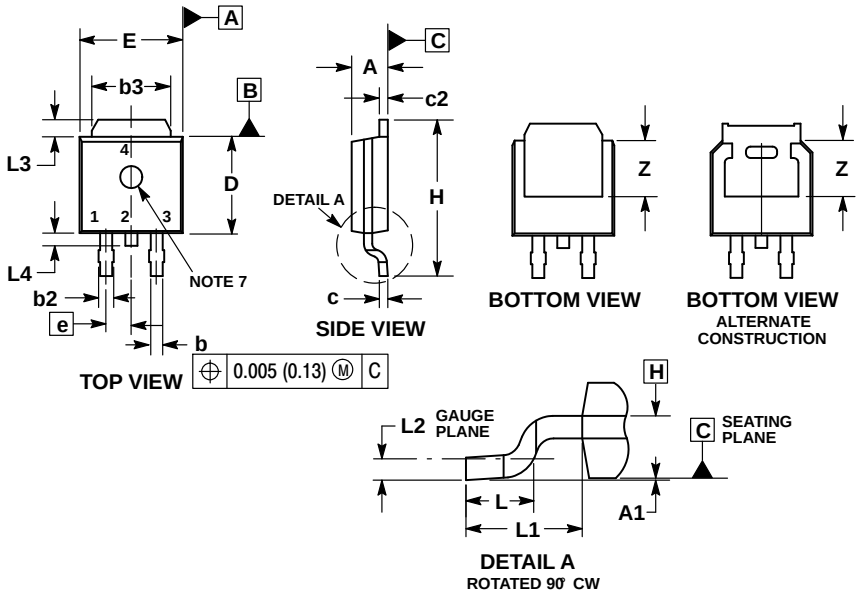



**Figure 11. Maximum Avalanche Energy vs. Starting Junction Temperature**

## PACKAGE DIMENSIONS

**DPAK (SINGLE GAUGE)**
CASE 369C
ISSUE E

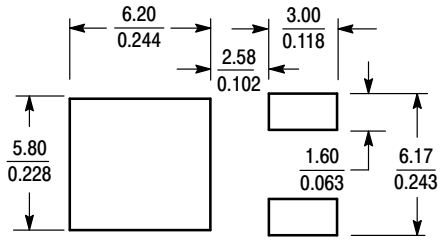



NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: INCHES.
3. THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSIONS b3, L3 and Z.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.006 INCHES 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.
7. OPTIONAL MOLD FEATURE.

| | 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 | 0.028 | 0.045 | 0.72 | 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 | 0.114 REF | | 2.90 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.



### PUBLICATION ORDERING INFORMATION

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**NTD20N03L27/D**

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