

# NTD80N02

## Power MOSFET

### 24 V, 80 A, N-Channel DPAK

Designed for low voltage, high speed switching applications in power supplies, converters and power motor controls and bridge circuits.

#### Features

- These Devices are Pb-Free and are RoHS Compliant

#### Typical Applications

- Power Supplies
- Converters
- Power Motor Controls
- Bridge Circuits

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

| Rating                                                                                                                                                                                                                | Symbol                                                | Value             | Unit               |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------|-------------------|--------------------|
| Drain-to-Source Voltage                                                                                                                                                                                               | $V_{DS}$                                              | 24                | Vdc                |
| Gate-to-Source Voltage – Continuous                                                                                                                                                                                   | $V_{GS}$                                              | $\pm 20$          | Vdc                |
| Drain Current – Continuous @ $T_C = 25^\circ\text{C}$<br>– Single Pulse ( $t_p = 10 \mu\text{s}$ )                                                                                                                    | $I_D$<br>$I_{DM}$                                     | 80*<br>200        | Adc                |
| Total Power Dissipation @ $T_C = 25^\circ\text{C}$                                                                                                                                                                    | $P_D$                                                 | 75                | Watts              |
| Operating and Storage Temperature Range                                                                                                                                                                               | $T_J, T_{stg}$                                        | -55 to 150        | $^\circ\text{C}$   |
| Single Pulse Drain-to-Source Avalanche Energy – Starting $T_J = 25^\circ\text{C}$<br>( $V_{DD} = 24 \text{ Vdc}$ , $V_{GS} = 10 \text{ Vdc}$ ,<br>$I_L = 17 \text{ Apk}$ , $L = 5.0 \text{ mH}$ , $R_G = 25 \Omega$ ) | $E_{AS}$                                              | 733               | mJ                 |
| Thermal Resistance<br>– Junction-to-Case<br>– Junction-to-Ambient (Note 1)<br>– Junction-to-Ambient (Note 2)                                                                                                          | $R_{\theta JC}$<br>$R_{\theta JA}$<br>$R_{\theta JA}$ | 1.65<br>67<br>120 | $^\circ\text{C/W}$ |
| Maximum Lead Temperature for Soldering Purposes, 1/8" from case for 10 seconds                                                                                                                                        | $T_L$                                                 | 260               | $^\circ\text{C}$   |

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.

1. When surface mounted to an FR4 board using 1" pad size, (Cu Area 1.127 in<sup>2</sup>).
2. When surface mounted to an FR4 board using the minimum recommended pad size, (Cu Area 0.412 in<sup>2</sup>).

\*Chip current capability limited by package.

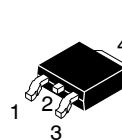
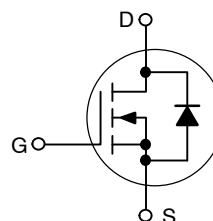


ON Semiconductor®

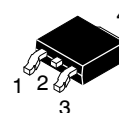
<http://onsemi.com>

| $V_{(BR)DSS}$ | $R_{DS(on)}$ TYP | $I_D$ MAX |
|---------------|------------------|-----------|
| 24 V          | 5.0 m $\Omega$   | 80 A      |

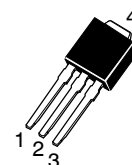
#### N-Channel



CASE 369AA  
DPAK  
(Surface Mount)  
STYLE 2

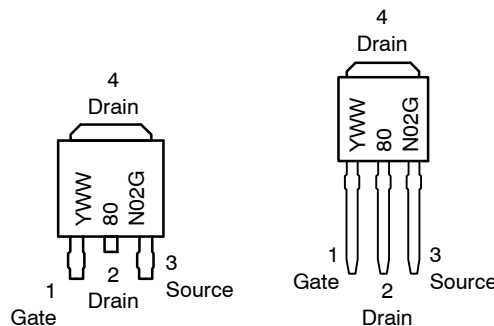


CASE 369C  
DPAK  
(Surface Mount)  
STYLE 2



CASE 369D  
DPAK  
(Straight Lead)  
STYLE 2

#### MARKING DIAGRAMS & PIN ASSIGNMENTS



80N02 = Device Code  
Y = Year  
WW = Work Week  
G = Pb-Free Package

#### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 5 of this data sheet.

# NTD80N02

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

| Characteristic | Symbol | Min | Typ | Max | Unit |
|----------------|--------|-----|-----|-----|------|
|----------------|--------|-----|-----|-----|------|

### OFF CHARACTERISTICS

|                                                                                                                                                                       |                      |         |          |           |              |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|---------|----------|-----------|--------------|
| Drain-to-Source Breakdown Voltage (Note 3)<br>(V <sub>GS</sub> = 0 Vdc, I <sub>D</sub> = 250 μAdc)<br>Positive Temperature Coefficient                                | V <sub>(BR)DSS</sub> | 24<br>– | 27<br>25 | –<br>–    | Vdc<br>mV/°C |
| Zero Gate Voltage Drain Current<br>(V <sub>GS</sub> = 0 Vdc, V <sub>DS</sub> = 24 Vdc)<br>(V <sub>GS</sub> = 0 Vdc, V <sub>DS</sub> = 24 Vdc, T <sub>J</sub> = 125°C) | I <sub>DSS</sub>     | –<br>–  | –<br>–   | 1.0<br>10 | μAdc         |
| Gate-Body Leakage Current (V <sub>GS</sub> = ±20 Vdc, V <sub>DS</sub> = 0 Vdc)                                                                                        | I <sub>GSS</sub>     | –       | –        | ±100      | nAdc         |

### ON CHARACTERISTICS (Note 3)

|                                                                                                                                                                                                                                                                             |                     |             |                          |                          |              |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|-------------|--------------------------|--------------------------|--------------|
| Gate Threshold Voltage (Note 3)<br>(V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μAdc)<br>Negative Threshold Temperature Coefficient                                                                                                                            | V <sub>GS(th)</sub> | 1.0<br>–    | 1.9<br>–3.8              | 3.0<br>–                 | Vdc<br>mV/°C |
| Static Drain-to-Source On-Resistance (Note 3)<br>(V <sub>GS</sub> = 10 Vdc, I <sub>D</sub> = 80 Adc)<br>(V <sub>GS</sub> = 4.5 Vdc, I <sub>D</sub> = 40 Adc)<br>(V <sub>GS</sub> = 10 Vdc, I <sub>D</sub> = 20 Adc)<br>(V <sub>GS</sub> = 4.5 Vdc, I <sub>D</sub> = 20 Adc) | R <sub>DS(on)</sub> | –<br>–<br>– | 5.0<br>7.5<br>5.0<br>7.5 | 5.8<br>9.0<br>5.8<br>9.0 | mΩ           |
| Forward Transconductance (V <sub>DS</sub> = 15 Vdc, I <sub>D</sub> = 10 Adc) (Note 3)                                                                                                                                                                                       | g <sub>FS</sub>     | –           | 20                       | –                        | Mhos         |

### DYNAMIC CHARACTERISTICS

|                      |                                                                      |                  |   |      |      |    |
|----------------------|----------------------------------------------------------------------|------------------|---|------|------|----|
| Input Capacitance    | (V <sub>DS</sub> = 20 Vdc,<br>V <sub>GS</sub> = 0 V,<br>f = 1.0 MHz) | C <sub>iss</sub> | – | 2250 | 2600 | pF |
| Output Capacitance   |                                                                      | C <sub>oss</sub> | – | 900  | 1100 |    |
| Transfer Capacitance |                                                                      | C <sub>rss</sub> | – | 400  | 525  |    |

### SWITCHING CHARACTERISTICS (Note 4)

|                     |                                                                                                                 |                     |   |     |     |    |
|---------------------|-----------------------------------------------------------------------------------------------------------------|---------------------|---|-----|-----|----|
| Turn-On Delay Time  | (V <sub>GS</sub> = 4.5 Vdc,<br>V <sub>DD</sub> = 20 Vdc,<br>I <sub>D</sub> = 20 Adc,<br>R <sub>G</sub> = 2.5 Ω) | t <sub>d(on)</sub>  | – | 17  | 30  | ns |
| Rise Time           |                                                                                                                 | t <sub>r</sub>      | – | 67  | 125 |    |
| Turn-Off Delay Time |                                                                                                                 | t <sub>d(off)</sub> | – | 28  | 45  |    |
| Fall Time           |                                                                                                                 | t <sub>f</sub>      | – | 40  | 75  |    |
| Gate Charge         | (V <sub>GS</sub> = 4.5 Vdc,<br>I <sub>D</sub> = 20 Adc,<br>V <sub>DS</sub> = 20 Vdc) (Note 3)                   | Q <sub>T</sub>      | – | 30  | 42  | nC |
|                     |                                                                                                                 | Q <sub>1</sub>      | – | 7.0 | 12  |    |
|                     |                                                                                                                 | Q <sub>2</sub>      | – | 18  | 28  |    |

### SOURCE-DRAIN DIODE CHARACTERISTICS

|                                                                                                                                                                                                                       |                                                                                                |                 |   |       |     |     |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|-----------------|---|-------|-----|-----|
| Forward On-Voltage<br>(I <sub>S</sub> = 20 Adc, V <sub>GS</sub> = 0 Vdc) (Note 3)<br>(I <sub>S</sub> = 40 Adc, V <sub>GS</sub> = 0 Vdc)<br>(I <sub>S</sub> = 20 Adc, V <sub>GS</sub> = 0 Vdc, T <sub>J</sub> = 150°C) |                                                                                                | V <sub>SD</sub> | – | 0.92  | 1.2 | Vdc |
|                                                                                                                                                                                                                       |                                                                                                |                 | – | 1.05  | –   |     |
|                                                                                                                                                                                                                       |                                                                                                |                 | – | 0.70  | –   |     |
| Reverse Recovery Time                                                                                                                                                                                                 | (I <sub>S</sub> = 20 Adc, V <sub>GS</sub> = 0 Vdc,<br>dI <sub>S</sub> /dt = 100 A/μs) (Note 3) | t <sub>rr</sub> | – | 38    | 52  | ns  |
|                                                                                                                                                                                                                       |                                                                                                | t <sub>a</sub>  | – | 20    | –   |     |
|                                                                                                                                                                                                                       |                                                                                                | t <sub>b</sub>  | – | 18    | –   |     |
| Reverse Recovery Stored Charge                                                                                                                                                                                        |                                                                                                | Q <sub>rr</sub> | – | 0.038 | –   | μC  |

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

TYPICAL CHARACTERISTICS

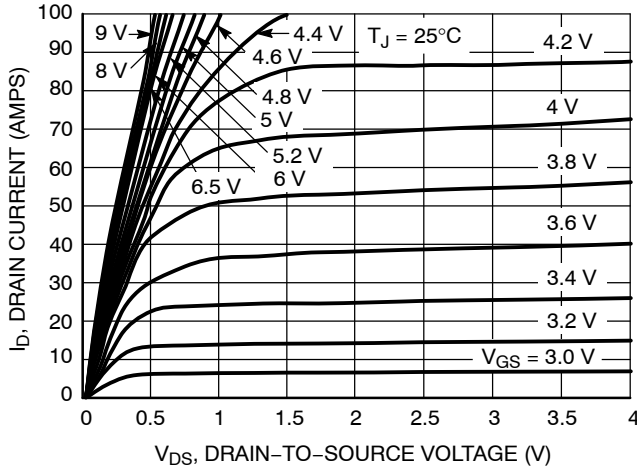


Figure 1. On-Region Characteristics

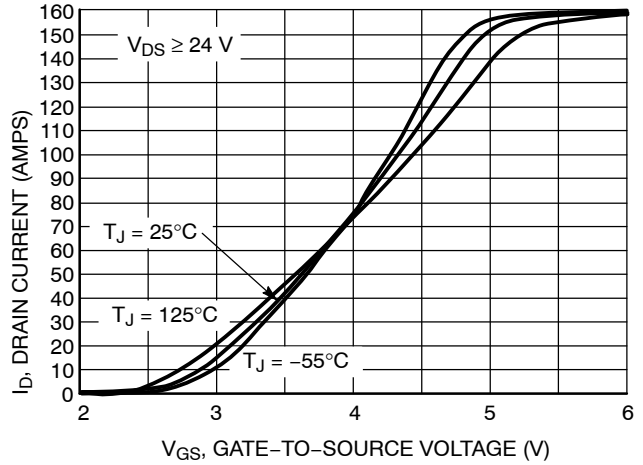


Figure 2. Transfer Characteristics

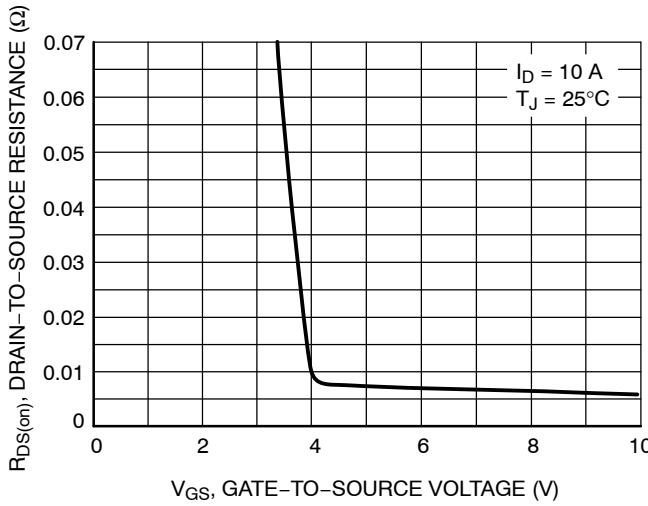


Figure 3. On-Resistance versus Gate-to-Source Voltage

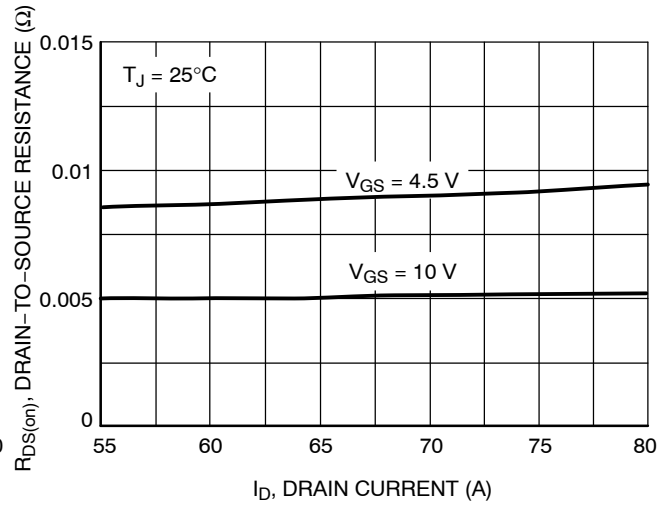


Figure 4. On-Resistance versus Drain Current and Gate Voltage

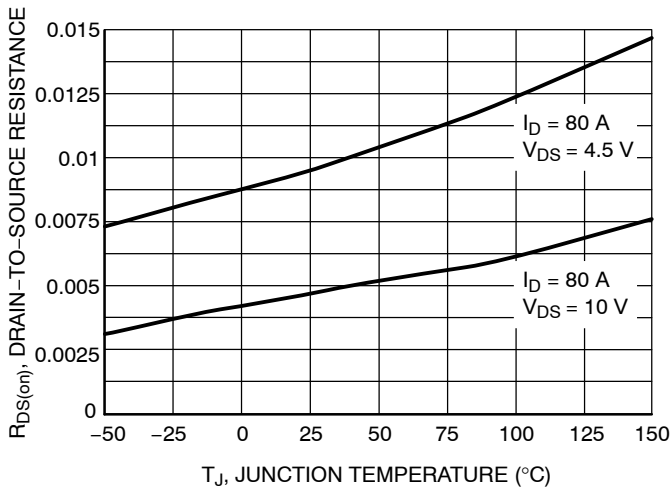


Figure 5. On-Resistance Variation with Temperature

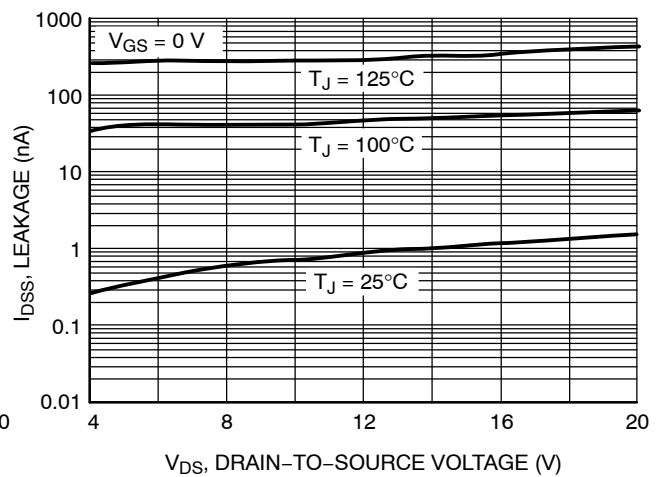


Figure 6. Drain-to-Source Leakage Current versus Voltage

TYPICAL CHARACTERISTICS

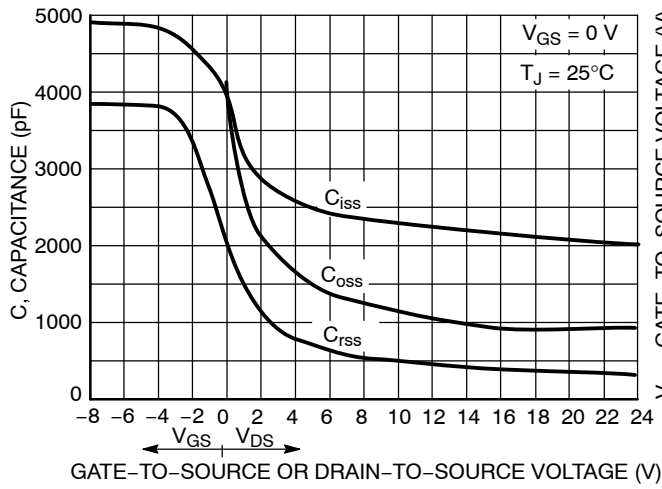


Figure 7. Capacitance Variation

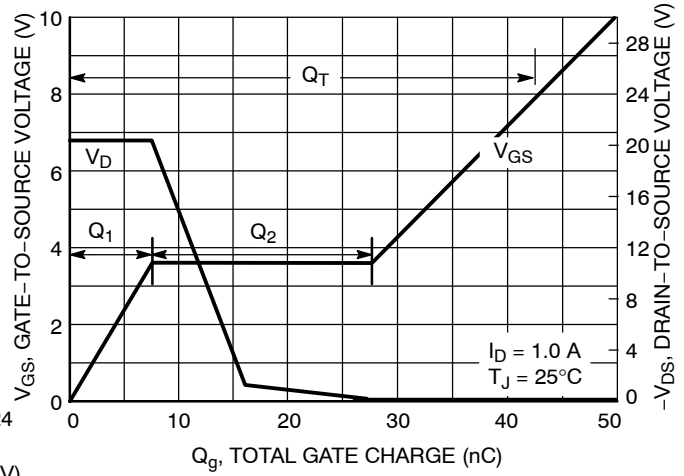


Figure 8. Gate-to-Source and Drain-to-Source Voltage versus Total Charge

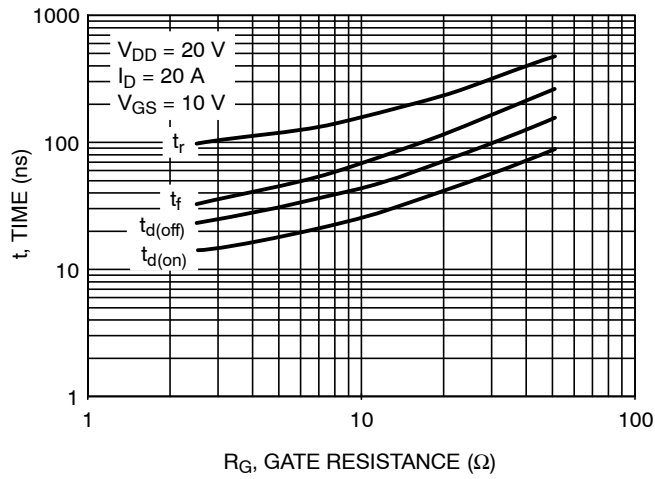


Figure 9. Resistive Switching Time Variation versus Gate Resistance

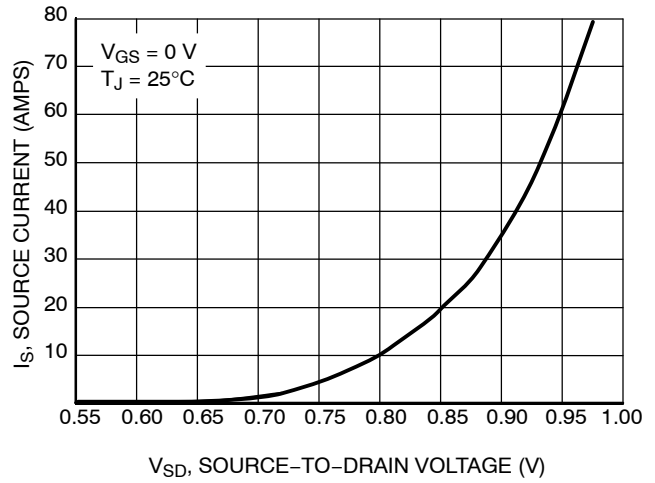
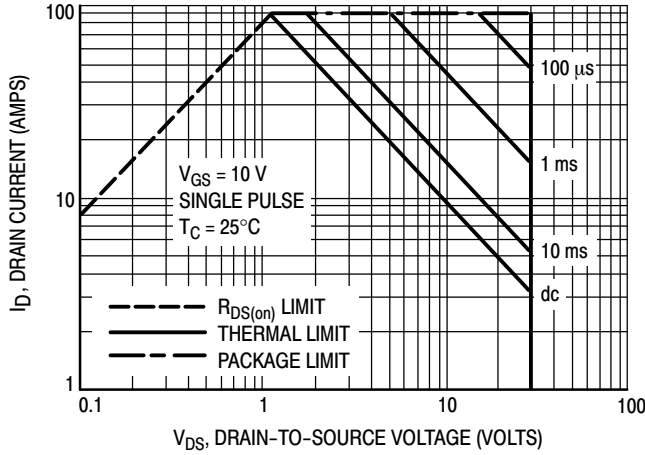


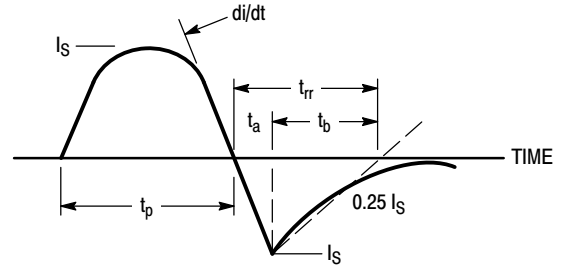
Figure 10. Diode Forward Voltage versus Current

# NTD80N02

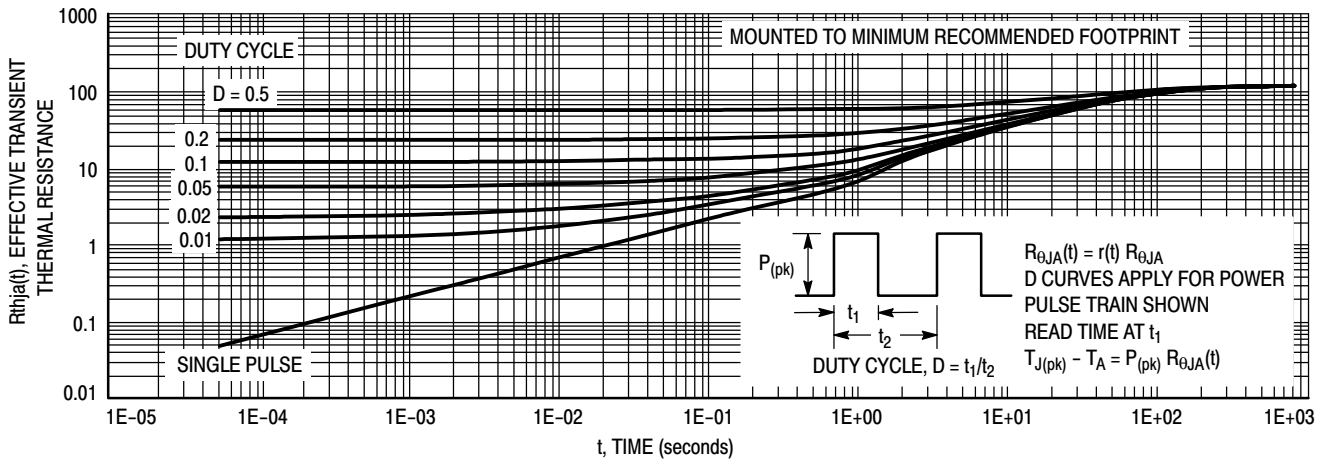
## TYPICAL CHARACTERISTICS



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



**Figure 12. Diode Reverse Recovery Waveform**



**Figure 13. Thermal Response – Various Duty Cycles**

## ORDERING INFORMATION

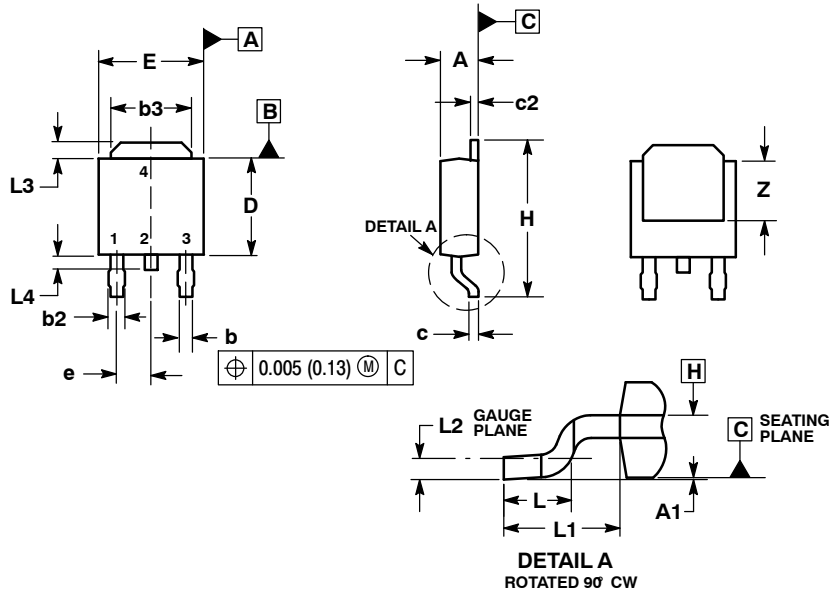
| Order Number | Package                           | Shipping†          |
|--------------|-----------------------------------|--------------------|
| NTD80N02T4G  | DPAK-3<br>(Pb-Free)               | 2500 / Tape & Reel |
| NTD80N02-1G  | DPAK-3 Straight Lead<br>(Pb-Free) | 75 Units / Rail    |

†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.

# NTD80N02

## PACKAGE DIMENSIONS

### DPAK (SINGLE GAUGE) CASE 369AA-01 ISSUE B

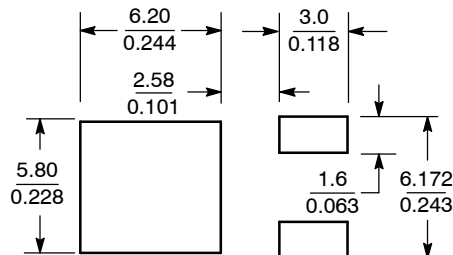


#### NOTES:

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.

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

#### SOLDERING FOOTPRINT\*



SCALE 3:1 (mm/inches)

#### STYLE 2:

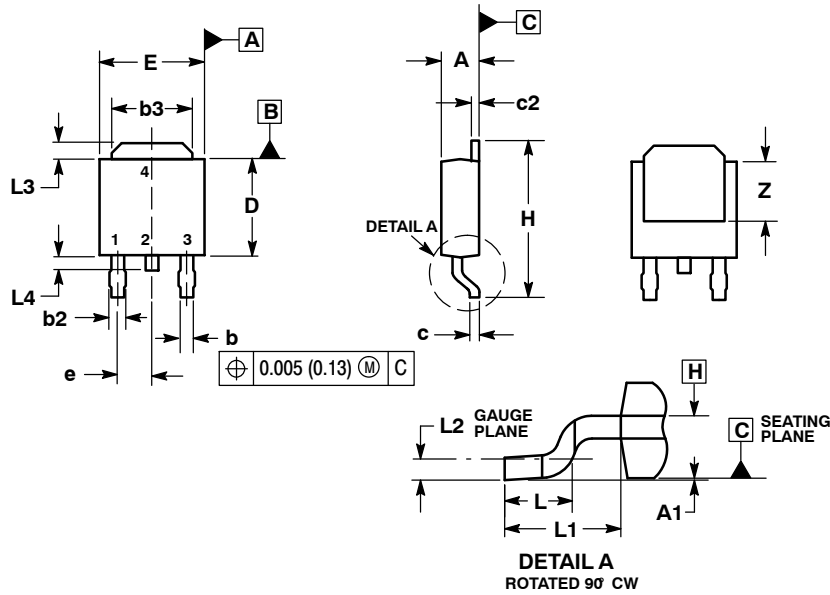
- PIN 1. GATE
- DRAIN
- SOURCE
- DRAIN

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

# NTD80N02

## 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.

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

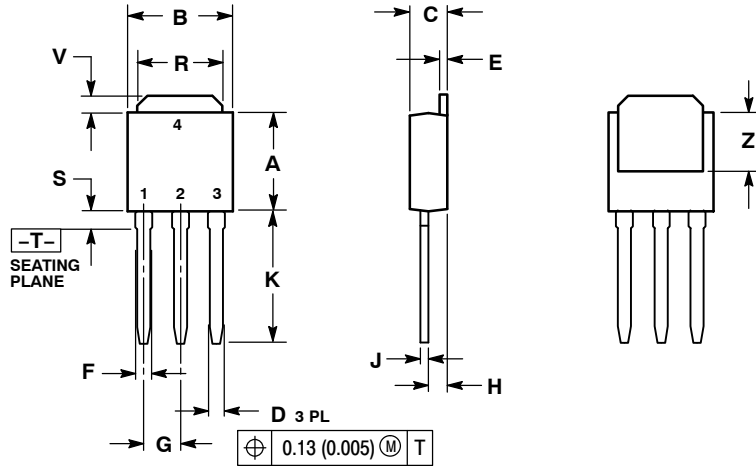
#### STYLE 2:

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

# NTD80N02

## PACKAGE DIMENSIONS

### DPAK CASE 369D-01 ISSUE B



#### NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.

| DIM | INCHES    |       | MILLIMETERS |      |
|-----|-----------|-------|-------------|------|
|     | MIN       | MAX   | MIN         | MAX  |
| A   | 0.235     | 0.245 | 5.97        | 6.35 |
| B   | 0.250     | 0.265 | 6.35        | 6.73 |
| C   | 0.086     | 0.094 | 2.19        | 2.38 |
| D   | 0.027     | 0.035 | 0.69        | 0.88 |
| E   | 0.018     | 0.023 | 0.46        | 0.58 |
| F   | 0.037     | 0.045 | 0.94        | 1.14 |
| G   | 0.090 BSC |       | 2.29 BSC    |      |
| H   | 0.034     | 0.040 | 0.87        | 1.01 |
| J   | 0.018     | 0.023 | 0.46        | 0.58 |
| K   | 0.350     | 0.380 | 8.89        | 9.65 |
| R   | 0.180     | 0.215 | 4.45        | 5.45 |
| S   | 0.025     | 0.040 | 0.63        | 1.01 |
| V   | 0.035     | 0.050 | 0.89        | 1.27 |
| Z   | 0.155     | ---   | 3.93        | ---  |

#### STYLE 2:

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

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