

# NTD5806N

## Power MOSFET

40 V, 33 A, Single N-Channel, DPAK/IPAK

### Features

- Low  $R_{DS(on)}$
- High Current Capability
- Avalanche Energy Specified
- These are Pb-Free Devices

### Applications

- CCFL Backlight
- DC Motor Control
- Power Supply Secondary Side Synchronous Rectification

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

| Parameter  | Symbol                 | Value                     | Unit             |   |
|--|------------------------|---------------------------|------------------|---|
| Drain-to-Source Voltage  | $V_{DS}$               | 40                        | V                |   |
| Gate-to-Source Voltage – Continuous  | $V_{GS}$               | $\pm 20$                  | V                |   |
| Gate-to-Source Voltage – Non-Repetitive ( $t_p < 10 \mu\text{s}$ )   | $V_{GS}$               | $\pm 30$                  | V                |   |
| Continuous Drain Current ( $R_{\theta JC}$ ) (Note 1)  | Steady State           | $T_C = 25^\circ\text{C}$  | $I_D$ 33         | A |
|  |                        | $T_C = 100^\circ\text{C}$ | 23               |   |
| Power Dissipation ( $R_{\theta JC}$ ) (Note 1)   |                        | $T_C = 25^\circ\text{C}$  | $P_D$ 40         | W |
| Pulsed Drain Current   | $t_p = 10 \mu\text{s}$ | $I_{DM}$                  | 67               | A |
| Operating Junction and Storage Temperature   | $T_J, T_{stg}$         | -55 to 175                | $^\circ\text{C}$ |   |
| Source Current (Body Diode)  | $I_S$                  | 33                        | A                |   |
| Single Pulse Drain-to-Source Avalanche Energy ( $V_{DD} = 50 \text{ V}, V_{GS} = 10 \text{ V}, R_G = 25 \Omega, I_{L(pk)} = 28 \text{ A}, L = 0.1 \text{ mH}, V_{DS} = 40 \text{ V}$ ) | $E_{AS}$               | 39                        | mJ               |   |
| Lead Temperature for Soldering Purposes (1/8" from case for 10 s)  | $T_L$                  | 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.

### THERMAL RESISTANCE MAXIMUM RATINGS

| Parameter                                   | Symbol          | Value | Unit               |
|---|-----------------|-------|--------------------|
| Junction-to-Case (Drain)                    | $R_{\theta JC}$ | 3.7   | $^\circ\text{C/W}$ |
| Junction-to-Ambient – Steady State (Note 1) | $R_{\theta JA}$ | 57.5  |                    |

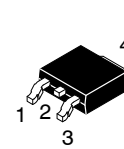
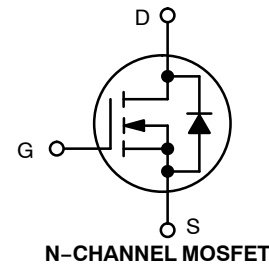
1. Surface-mounted on FR4 board using 1 in sq pad size (Cu area = 1.127 in sq [1 oz] including traces).



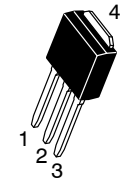
ON Semiconductor®

<http://onsemi.com>

| $V_{(BR)DSS}$ | $R_{DS(on)}$ MAX      | $I_D$ MAX |
|---------------|-----------------------|-----------|
| 40 V          | 26 m $\Omega$ @ 4.5 V | 33 A      |
|               | 19 m $\Omega$ @ 10 V  |           |

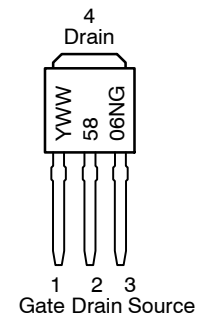
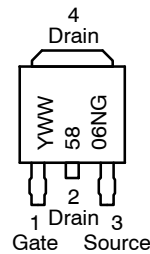


DPAK  
CASE 369C  
(Surface Mount)  
STYLE 2



IPAK  
CASE 369D  
(Straight Lead  
DPAK)

### MARKING DIAGRAMS & PIN ASSIGNMENT



- Y = Year
- WW = Work Week
- 5806N = Device Code
- G = Pb-Free Package

### ORDERING INFORMATION

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

# NTD5806N

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

| Parameter   | Symbol                               | Test Condition                                   | Min                    | Typ  | Max  | Unit  |
|---|--------------------------------------|--|------------------------|------|------|-------|
| <b>OFF CHARACTERISTICS</b>                                |                                      |  |                        |      |      |       |
| Drain-to-Source Breakdown Voltage                         | V <sub>(BR)DSS</sub>                 | V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA   | 40                     | 45.5 |      | V     |
| Drain-to-Source Breakdown Voltage Temperature Coefficient | V <sub>(BR)DSS</sub> /T <sub>J</sub> |  |                        | 29.5 |      | mV/°C |
| Zero Gate Voltage Drain Current                           | I <sub>DSS</sub>                     | V <sub>GS</sub> = 0 V,<br>V <sub>DS</sub> = 40 V | T <sub>J</sub> = 25°C  |      | 1.0  | μA    |
|   |                                      |  | T <sub>J</sub> = 150°C |      | 100  |       |
| 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 | 1.4 |      | 2.5 | V     |
| Negative Threshold Temperature Coefficient | V <sub>GS(TH)</sub> /T <sub>J</sub> |   |     | 5.8  |     | mV/°C |
| Drain-to-Source On Resistance              | R <sub>DS(on)</sub>                 | V <sub>GS</sub> = 10 V, I <sub>D</sub> = 15 A               |     | 12.7 | 19  | mΩ    |
|  |                                     | V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 10 A              |     | 17.8 | 26  |       |

## CHARGES, CAPACITANCES AND GATE RESISTANCES

|                              |                     |  |  |      |    |    |
|------------------------------|---------------------|--|--|------|----|----|
| Input Capacitance            | C <sub>iss</sub>    | V <sub>GS</sub> = 0 V, f = 1.0 MHz,<br>V <sub>DS</sub> = 25 V            |  | 860  |    | pF |
| Output Capacitance           | C <sub>oss</sub>    |  |  | 130  |    |    |
| Reverse Transfer Capacitance | C <sub>rss</sub>    |  |  | 100  |    |    |
| Total Gate Charge            | Q <sub>G(TOT)</sub> | V <sub>GS</sub> = 10 V, V <sub>DS</sub> = 20 V,<br>I <sub>D</sub> = 30 A |  | 17   | 38 | nC |
| Threshold Gate Charge        | Q <sub>G(TH)</sub>  |  |  | 0.95 |    |    |
| Gate-to-Source Charge        | Q <sub>GS</sub>     |  |  | 3.4  |    |    |
| Gate-to-Drain Charge         | Q <sub>GD</sub>     |  |  | 4.5  |    |    |

## SWITCHING CHARACTERISTICS (Note 3)

|                     |                     |   |  |      |  |    |
|---------------------|---------------------|---|--|------|--|----|
| Turn-On Delay Time  | t <sub>d(on)</sub>  | V <sub>GS</sub> = 4.5 V, V <sub>DD</sub> = 20 V,<br>I <sub>D</sub> = 30 A, R <sub>G</sub> = 2.5 Ω |  | 10.6 |  | ns |
| Rise Time           | t <sub>r</sub>      |   |  | 93.7 |  |    |
| Turn-Off Delay Time | t <sub>d(off)</sub> |   |  | 14.2 |  |    |
| Fall Time           | t <sub>f</sub>      |   |  | 4.3  |  |    |
| Turn-On Delay Time  | t <sub>d(on)</sub>  | V <sub>GS</sub> = 10 V, V <sub>DD</sub> = 20 V,<br>I <sub>D</sub> = 30 A, R <sub>G</sub> = 2.5 Ω  |  | 8.0  |  | ns |
| Rise Time           | t <sub>r</sub>      |   |  | 49   |  |    |
| Turn-Off Delay Time | t <sub>d(off)</sub> |   |  | 19.8 |  |    |
| Fall Time           | t <sub>f</sub>      |   |  | 2.6  |  |    |

## DRAIN-SOURCE DIODE CHARACTERISTICS

|                         |                 |   |                        |      |      |     |    |
|-------------------------|-----------------|---|------------------------|------|------|-----|----|
| Forward Diode Voltage   | V <sub>SD</sub> | V <sub>GS</sub> = 0 V,<br>I <sub>S</sub> = 10 A                                 | T <sub>J</sub> = 25°C  |      | 0.86 | 1.2 | V  |
|                         |                 |   | T <sub>J</sub> = 150°C |      | 0.69 |     |    |
| 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> = 30 A |                        | 18.8 |      | ns  |    |
| Charge Time             | t <sub>a</sub>  |   |                        | 11.8 |      |     |    |
| Discharge Time          | t <sub>b</sub>  |   |                        | 7.0  |      |     |    |
| Reverse Recovery Charge | Q <sub>RR</sub> |   |                        | 10.9 |      |     | nC |

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

TYPICAL CHARACTERISTICS

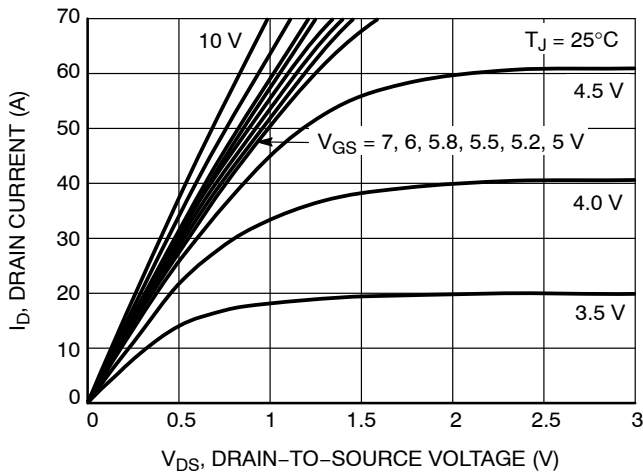


Figure 1. On-Region Characteristics

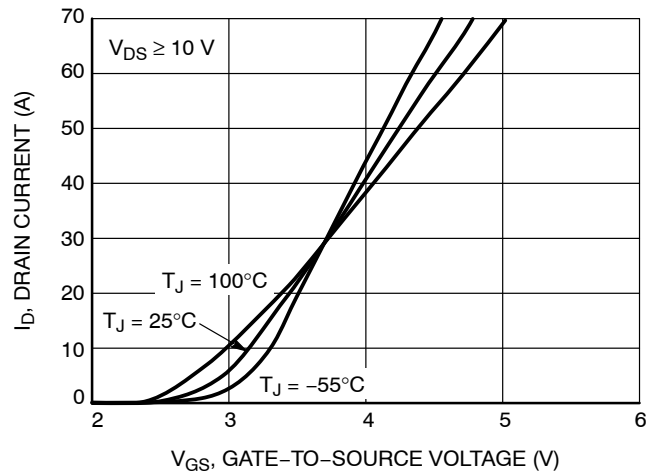


Figure 2. Transfer Characteristics

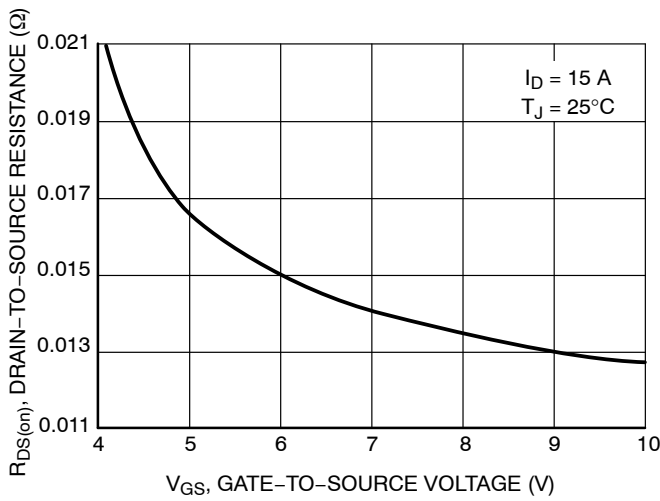


Figure 3. On-Resistance vs. Drain Current

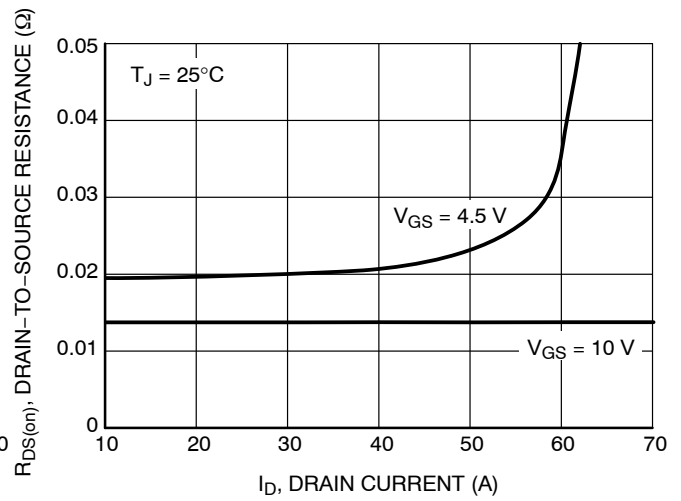


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

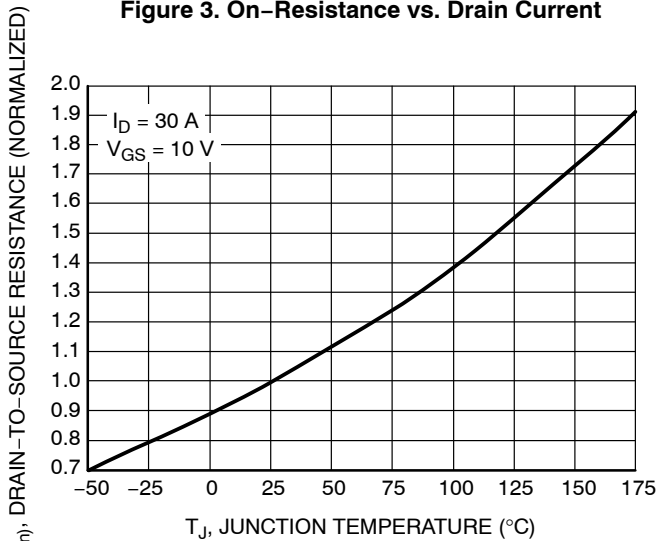


Figure 5. On-Resistance Variation with Temperature

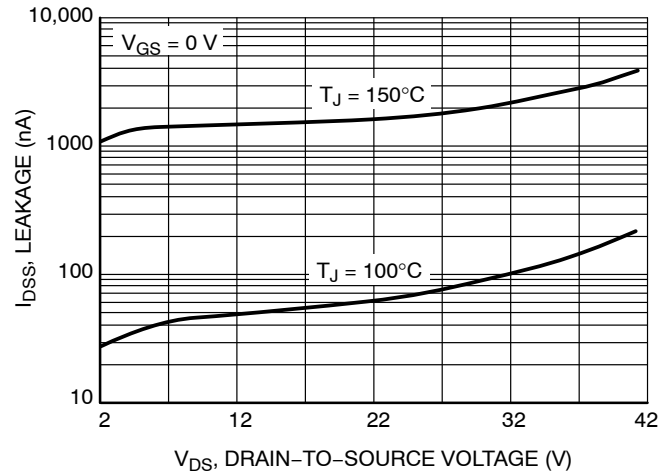


Figure 6. Drain-to-Source Leakage Current vs. Voltage

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## TYPICAL CHARACTERISTICS

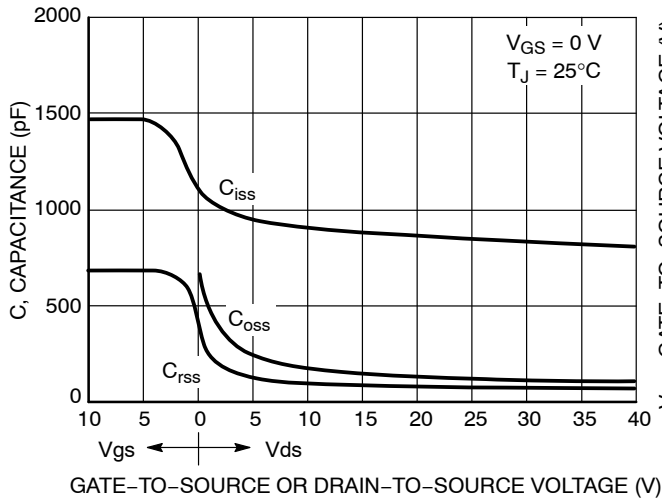


Figure 7. Capacitance Variation

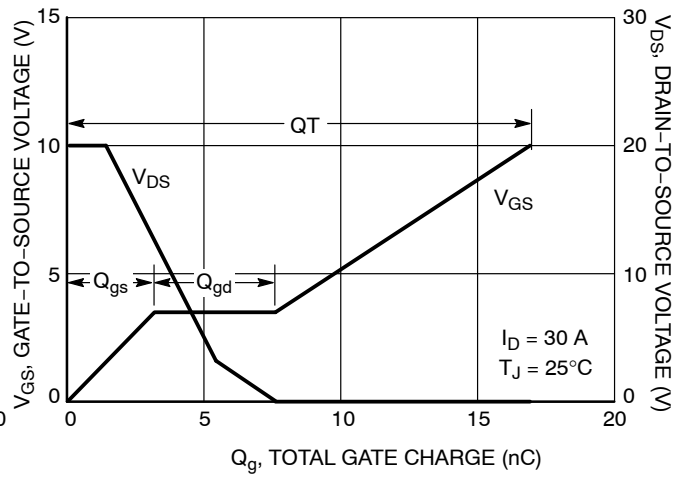


Figure 8. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge

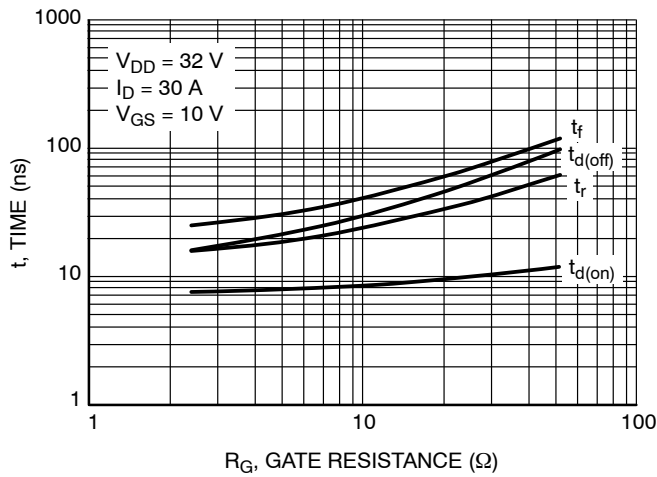


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

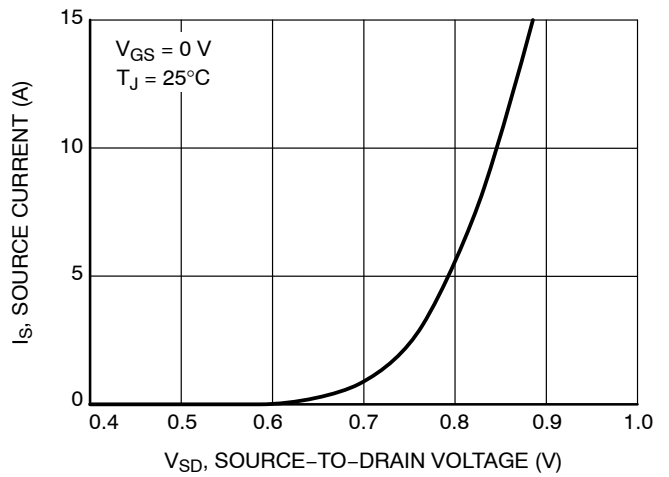


Figure 10. Diode Forward Voltage vs. Current

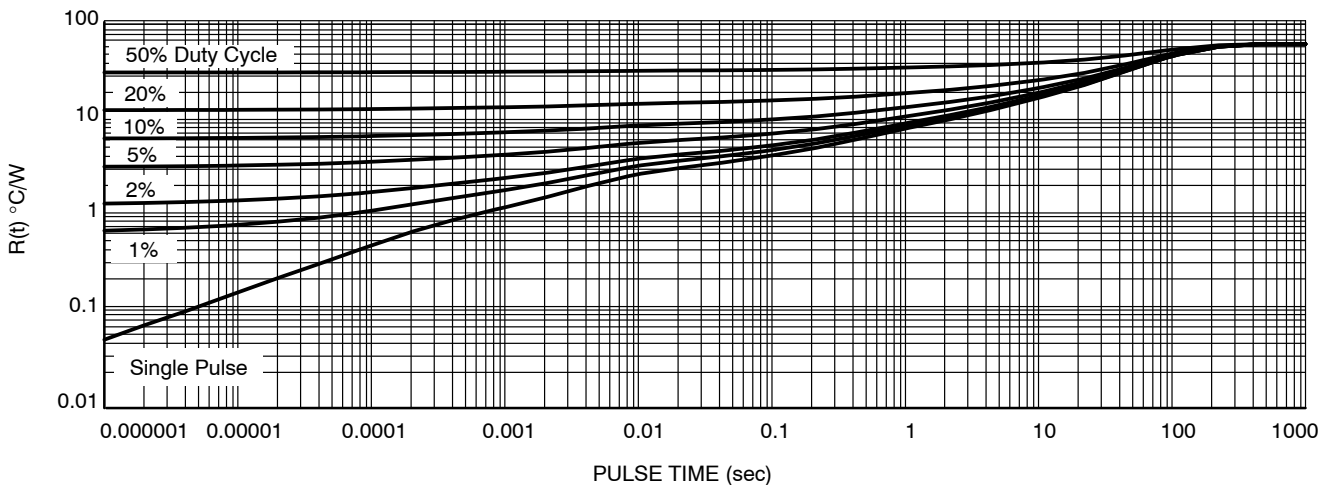


Figure 11. Transient Thermal Resistance - DPAK Version

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## ORDERING INFORMATION

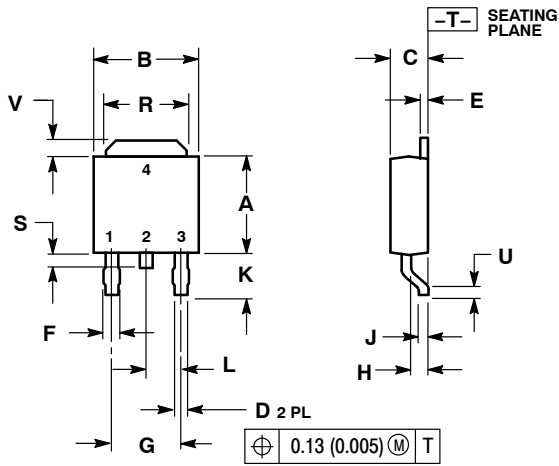
| Order Number | Package                                | Shipping†          |
|--------------|--|--------------------|
| NTD5806NG    | IPAK (Straight Lead DPAK)<br>(Pb-Free) | 75 Units / Rail    |
| NTD5806NT4G  | DPAK<br>(Pb-Free)                      | 2500 / Tape & Reel |

†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.

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## PACKAGE DIMENSIONS

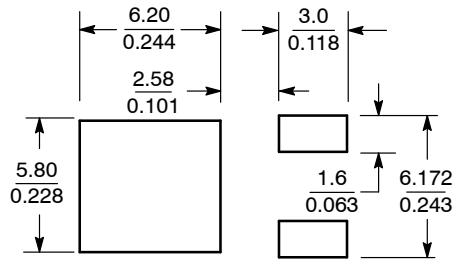
DPAK  
CASE 369C-01  
ISSUE O



- 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        | 6.22 |
| 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   | 0.180 BSC |       | 4.58 BSC    |      |
| H   | 0.034     | 0.040 | 0.87        | 1.01 |
| J   | 0.018     | 0.023 | 0.46        | 0.58 |
| K   | 0.102     | 0.114 | 2.60        | 2.89 |
| L   | 0.090 BSC |       | 2.29 BSC    |      |
| R   | 0.180     | 0.215 | 4.57        | 5.45 |
| S   | 0.025     | 0.040 | 0.63        | 1.01 |
| U   | 0.020     | ---   | 0.51        | ---  |
| V   | 0.035     | 0.050 | 0.89        | 1.27 |
| Z   | 0.155     | ---   | 3.93        | ---  |

### SOLDERING FOOTPRINT\*



SCALE 3:1  $\left(\frac{\text{mm}}{\text{inches}}\right)$

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

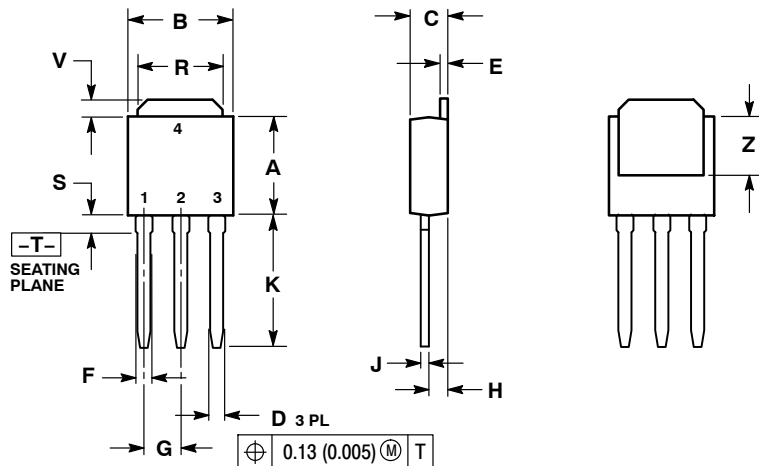
# NTD5806N

## PACKAGE DIMENSIONS

### IPAK (STRAIGHT LEAD 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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