

# NTP30N06, NTB30N06

## Power MOSFET 30 Amps, 60 Volts

### N-Channel TO-220 and D<sup>2</sup>PAK

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

#### Features

- Pb-Free Packages are Available

#### 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                                                                                                                                                                                                                           | $V_{DS}$                   | 60                   | Vdc                      |
| Drain-to-Gate Voltage ( $R_{GS} = 10\text{ M}\Omega$ )                                                                                                                                                                                            | $V_{DGR}$                  | 60                   | Vdc                      |
| Gate-to-Source Voltage <ul style="list-style-type: none"><li>– Continuous</li><li>– Non-Repetitive (<math>t_p \leq 10\text{ ms}</math>)</li></ul>                                                                                                 | $V_{GS}$<br>$V_{GS}$       | $\pm 20$<br>$\pm 30$ | Vdc                      |
| Drain Current <ul style="list-style-type: none"><li>– Continuous @ <math>T_A = 25^\circ\text{C}</math></li><li>– Continuous @ <math>T_A = 100^\circ\text{C}</math></li><li>– Single Pulse (<math>t_p \leq 10\text{ }\mu\text{s}</math>)</li></ul> | $I_D$<br>$I_D$<br>$I_{DM}$ | 27<br>15<br>80       | Adc<br>Adc<br>Apk        |
| Total Power Dissipation @ $T_A = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$                                                                                                                                                             | $P_D$                      | 88.2<br>0.59         | W<br>W/ $^\circ\text{C}$ |
| Operating and Storage Temperature Range                                                                                                                                                                                                           | $T_J, T_{stg}$             | $-55$ to $+175$      | $^\circ\text{C}$         |
| Single Pulse Drain-to-Source Avalanche Energy – Starting $T_J = 25^\circ\text{C}$<br>( $V_{DD} = 50\text{ Vdc}$ , $V_{GS} = 10\text{ Vdc}$ , $L = 0.3\text{ mH}$<br>$I_{L(pk)} = 26\text{ A}$ , $V_{DS} = 60\text{ Vdc}$ )                        | $E_{AS}$                   | 101                  | mJ                       |
| Thermal Resistance, Junction-to-Case                                                                                                                                                                                                              | $R_{\theta JC}$            | 1.7                  | $^\circ\text{C/W}$       |
| Maximum Lead Temperature for Soldering<br>Purposes, 1/8 in from case for 10 seconds                                                                                                                                                               | $T_L$                      | 260                  | $^\circ\text{C}$         |

Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur and reliability may be affected.

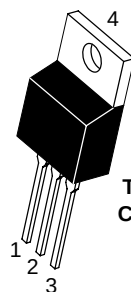
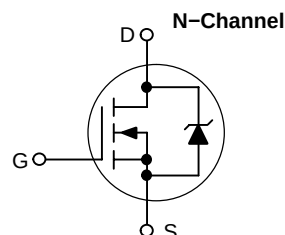


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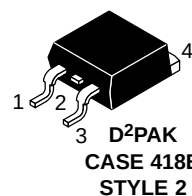
<http://onsemi.com>

30 AMPERES, 60 VOLTS

$R_{DS(on)} = 42\text{ m}\Omega$

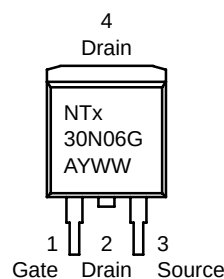
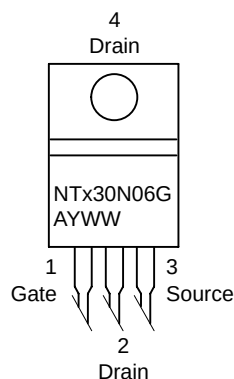


TO-220AB  
CASE 221A  
STYLE 5



D<sup>2</sup>PAK  
CASE 418B  
STYLE 2

#### MARKING DIAGRAMS & PIN ASSIGNMENTS



NTx30N06 = Device Code  
x = B or P  
A = Assembly Location  
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.

# NTP30N06, NTB30N06

## 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 1)<br>(V <sub>GS</sub> = 0 Vdc, I <sub>D</sub> = 250 μAdc)<br>Temperature Coefficient (Positive)                              | V <sub>(BR)DSS</sub> | 60<br>– | 71.1<br>70 | –<br>–    | Vdc<br>mV/°C |
| Zero Gate Voltage Drain Current<br>(V <sub>DS</sub> = 60 Vdc, V <sub>GS</sub> = 0 Vdc)<br>(V <sub>DS</sub> = 60 Vdc, V <sub>GS</sub> = 0 Vdc, T <sub>J</sub> = 150°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 1)

|                                                                                                                                                                                  |                     |          |             |          |              |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|----------|-------------|----------|--------------|
| Gate Threshold Voltage (Note 1)<br>(V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μAdc)<br>Threshold Temperature Coefficient (Negative)                               | V <sub>GS(th)</sub> | 2.0<br>– | 3.05<br>7.3 | 4.0<br>– | Vdc<br>mV/°C |
| Static Drain-to-Source On-Resistance (Note 1)<br>(V <sub>GS</sub> = 10 Vdc, I <sub>D</sub> = 15 Adc)                                                                             | R <sub>DS(on)</sub> | –        | 35          | 42       | mΩ           |
| Static Drain-to-Source On-Voltage (Note 1)<br>(V <sub>GS</sub> = 10 Vdc, I <sub>D</sub> = 30 Adc)<br>(V <sub>GS</sub> = 10 Vdc, I <sub>D</sub> = 15 Adc, T <sub>J</sub> = 150°C) | V <sub>DS(on)</sub> | –<br>–   | 1.1<br>0.98 | 1.5<br>– | Vdc          |
| Forward Transconductance (Note 1) (V <sub>DS</sub> = 7.0 Vdc, I <sub>D</sub> = 15 Adc)                                                                                           | g <sub>FS</sub>     | –        | 16          | –        | mhos         |

### DYNAMIC CHARACTERISTICS

|                      |                                                                     |                  |   |     |      |    |
|----------------------|---------------------------------------------------------------------|------------------|---|-----|------|----|
| Input Capacitance    | (V <sub>DS</sub> = 25 Vdc, V <sub>GS</sub> = 0 Vdc,<br>f = 1.0 MHz) | C <sub>iss</sub> | – | 850 | 1200 | pF |
| Output Capacitance   |                                                                     | C <sub>oss</sub> | – | 250 | 350  |    |
| Transfer Capacitance |                                                                     | C <sub>rss</sub> | – | 68  | 100  |    |

### SWITCHING CHARACTERISTICS (Note 2)

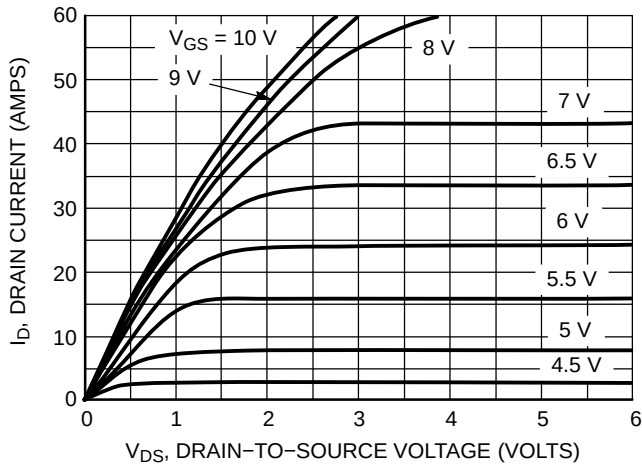
|                     |                                                                                                                   |                     |   |      |    |    |
|---------------------|-------------------------------------------------------------------------------------------------------------------|---------------------|---|------|----|----|
| Turn-On Delay Time  | (V <sub>DD</sub> = 30 Vdc, I <sub>D</sub> = 30 Adc,<br>V <sub>GS</sub> = 10 Vdc, R <sub>G</sub> = 9.1 Ω) (Note 1) | t <sub>d(on)</sub>  | – | 11   | 25 | ns |
| Rise Time           |                                                                                                                   | t <sub>r</sub>      | – | 36   | 80 |    |
| Turn-Off Delay Time |                                                                                                                   | t <sub>d(off)</sub> | – | 24   | 50 |    |
| Fall Time           |                                                                                                                   | t <sub>f</sub>      | – | 31   | 60 |    |
| Gate Charge         | (V <sub>DS</sub> = 48 Vdc, I <sub>D</sub> = 30 Adc,<br>V <sub>GS</sub> = 10 Vdc) (Note 1)                         | Q <sub>T</sub>      | – | 23.4 | 46 | nC |
|                     |                                                                                                                   | Q <sub>1</sub>      | – | 5.1  | –  |    |
|                     |                                                                                                                   | Q <sub>2</sub>      | – | 11   | –  |    |

### SOURCE-DRAIN DIODE CHARACTERISTICS

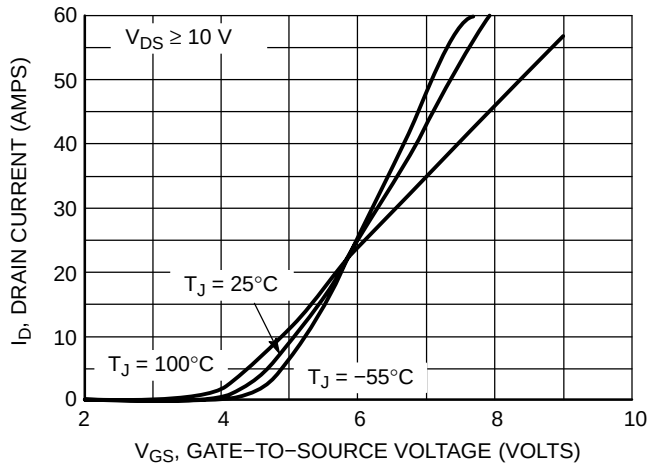
|                                |                                                                                                                                           |                 |        |              |           |     |
|--------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|-----------------|--------|--------------|-----------|-----|
| Forward On-Voltage             | (I <sub>S</sub> = 30 Adc, V <sub>GS</sub> = 0 Vdc) (Note 1)<br>(I <sub>S</sub> = 30 Adc, V <sub>GS</sub> = 0 Vdc, T <sub>J</sub> = 150°C) | V <sub>SD</sub> | –<br>– | 1.03<br>1.05 | 1.15<br>– | Vdc |
| Reverse Recovery Time          | (I <sub>S</sub> = 30 Adc, V <sub>GS</sub> = 0 Vdc,<br>di <sub>S</sub> /dt = 100 A/μs) (Note 1)                                            | t <sub>rr</sub> | –      | 52           | –         | ns  |
|                                |                                                                                                                                           | t <sub>a</sub>  | –      | 38           | –         |     |
|                                |                                                                                                                                           | t <sub>b</sub>  | –      | 15           | –         |     |
| Reverse Recovery Stored Charge |                                                                                                                                           | Q <sub>RR</sub> | –      | 0.094        | –         | μC  |

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

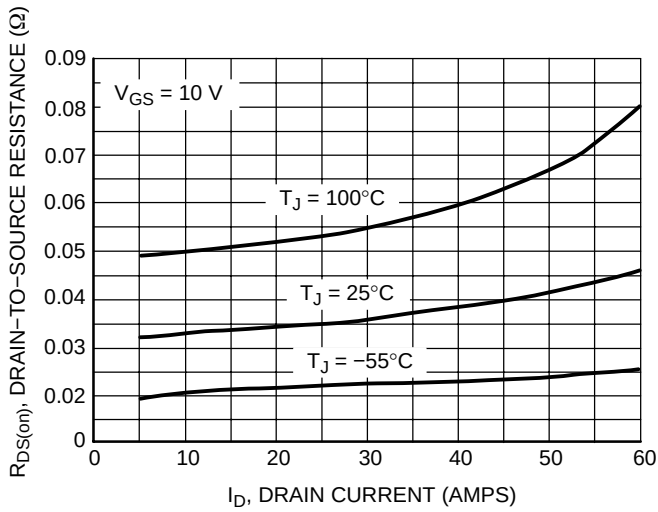
# NTP30N06, NTB30N06



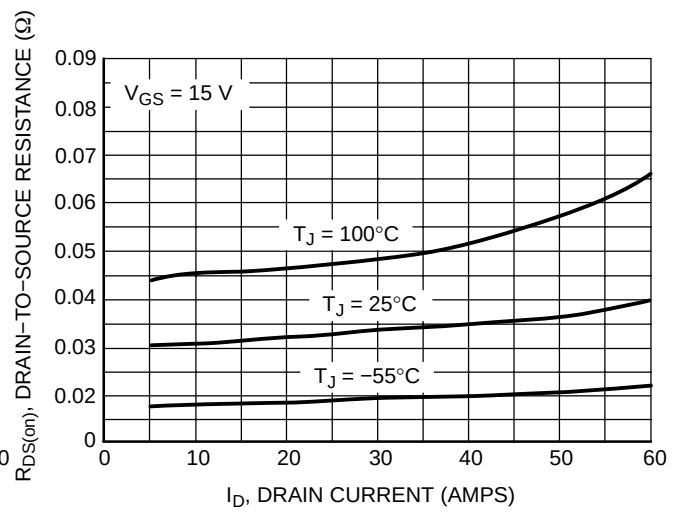
**Figure 1. On-Region Characteristics**



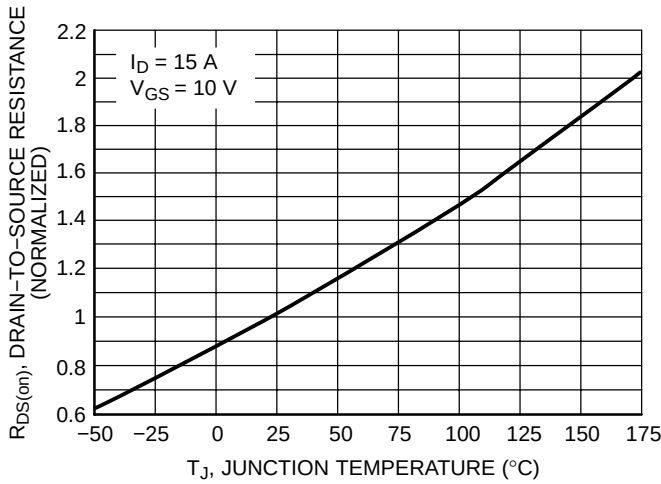
**Figure 2. Transfer Characteristics**



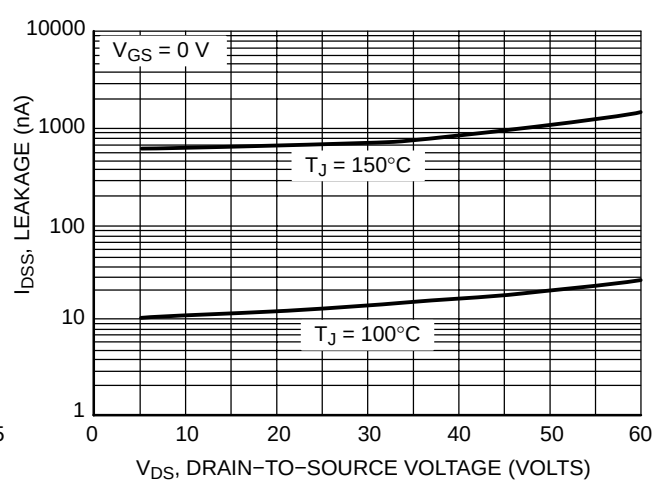
**Figure 3. On-Resistance versus Gate-to-Source Voltage**



**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**

# NTP30N06, NTB30N06

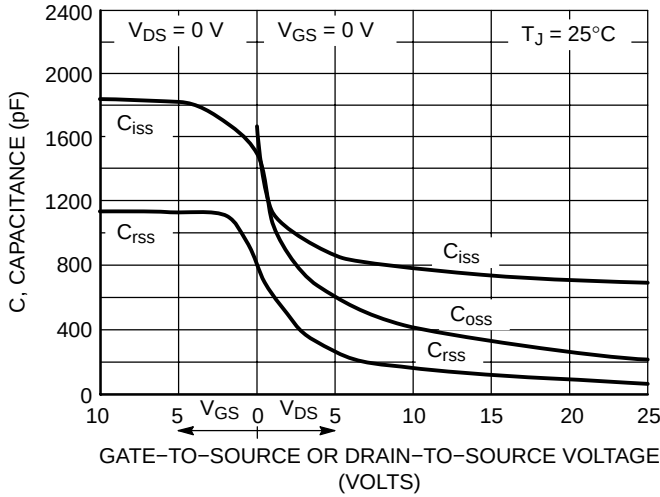


Figure 7. Capacitance Variation

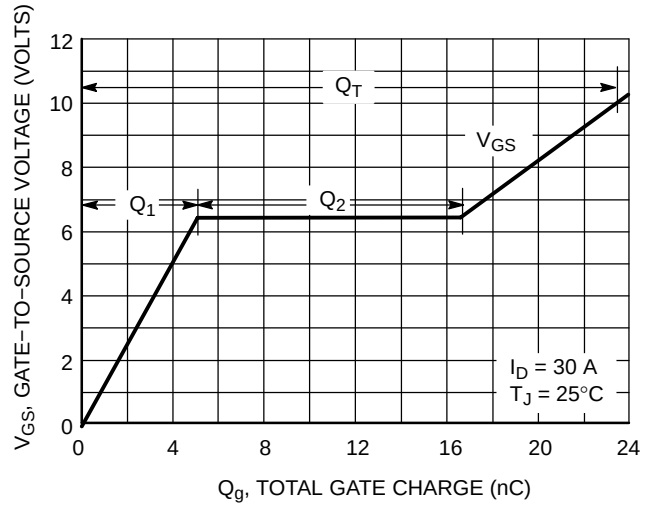


Figure 8. Gate-to-Source and Drain-to-Source Voltage versus Total Charge

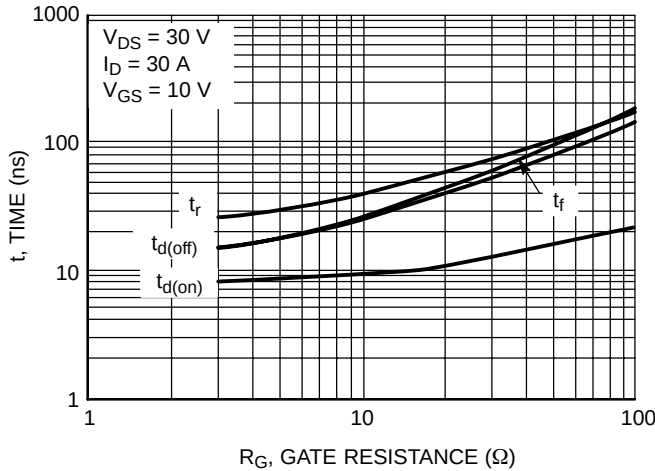


Figure 9. Resistive Switching Time Variation versus Gate Resistance

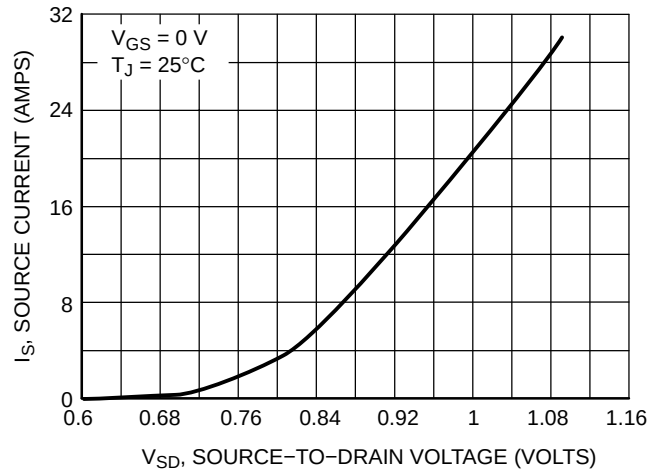


Figure 10. Diode Forward Voltage versus Current

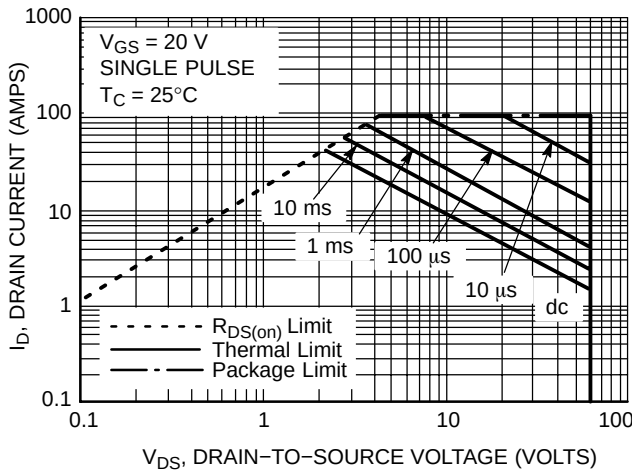


Figure 11. Maximum Rated Forward Biased Safe Operating Area

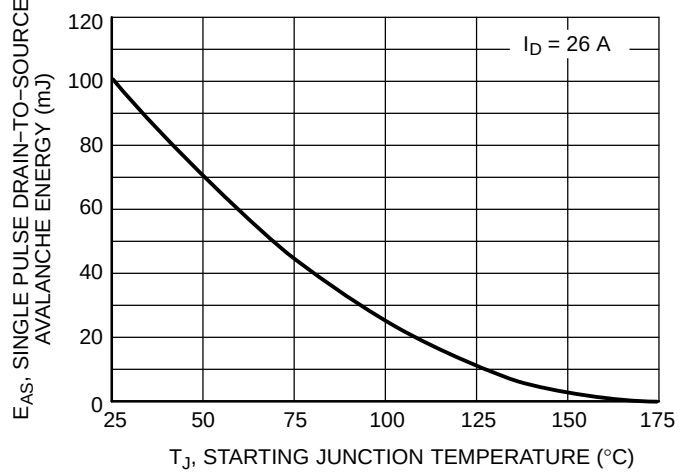
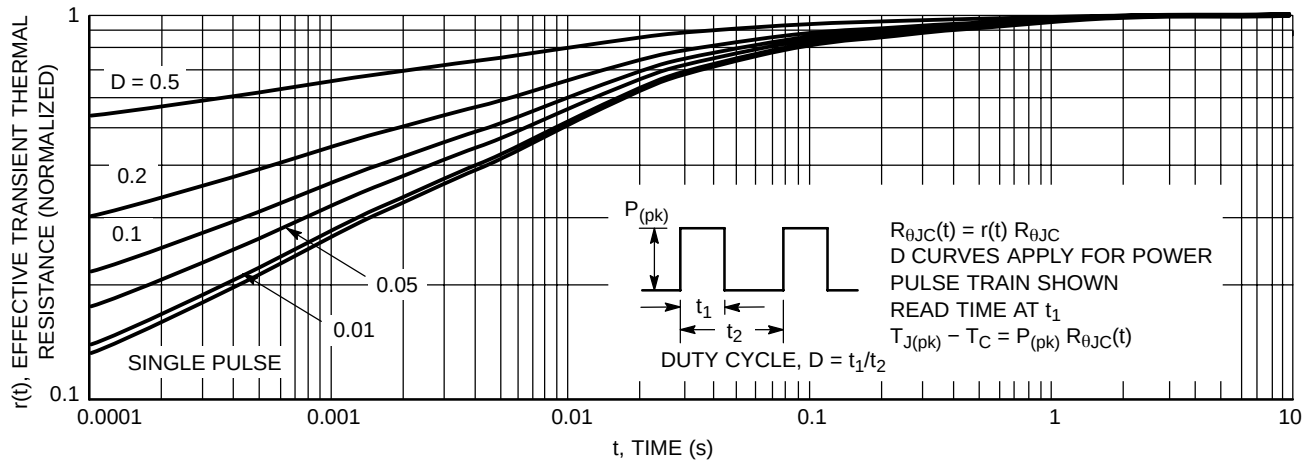
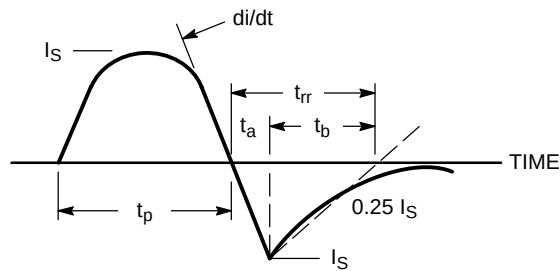


Figure 12. Maximum Avalanche Energy versus Starting Junction Temperature

## NTP30N06, NTB30N06



**Figure 13. Thermal Response**



**Figure 14. Diode Reverse Recovery Waveform**

### ORDERING INFORMATION

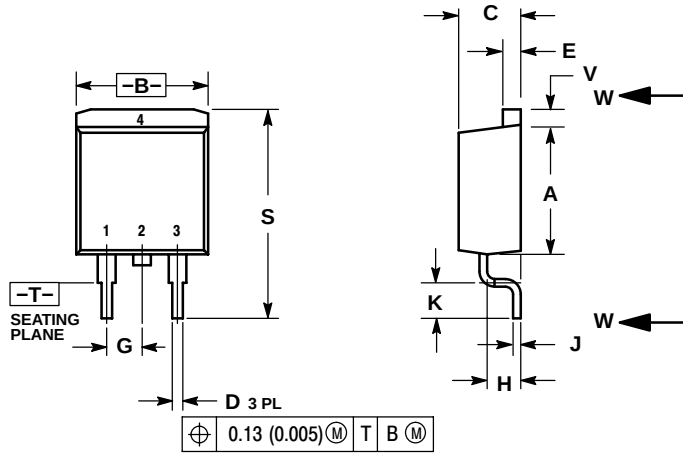
| Device      | Package                         | Shipping <sup>†</sup>   |
|-------------|---------------------------------|-------------------------|
| NTP30N06    | TO-220AB                        | 50 Units / Rail         |
| NTB30N06    | D <sup>2</sup> PAK              | 50 Units / Rail         |
| NTB30N06G   | D <sup>2</sup> PAK<br>(Pb-Free) | 50 Units / Rail         |
| NTB30N06T4  | D <sup>2</sup> PAK              | 800 Units / Tape & Reel |
| NTB30N06T4G | D <sup>2</sup> PAK<br>(Pb-Free) | 800 Units / Tape & Reel |

<sup>†</sup>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.

# NTP30N06, NTB30N06

## PACKAGE DIMENSIONS

**D<sup>2</sup>PAK**  
CASE 418B-04  
ISSUE J



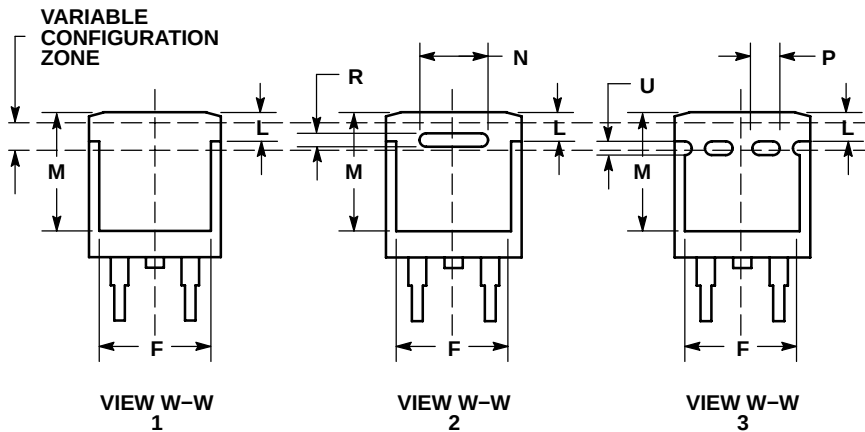
### NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. 418B-01 THRU 418B-03 OBSOLETE, NEW STANDARD 418B-04.

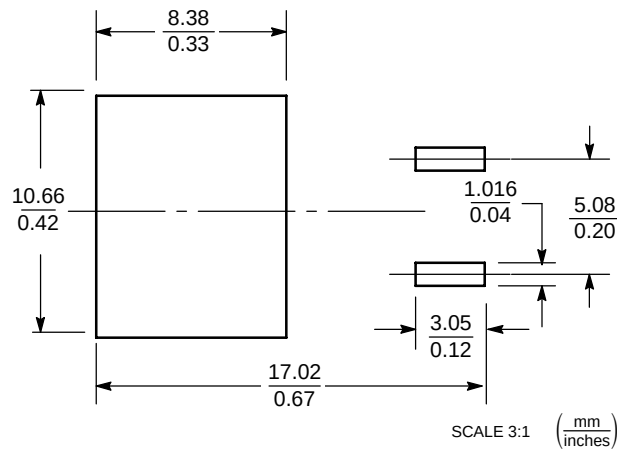
| DIM | INCHES    |       | MILLIMETERS |       |
|-----|-----------|-------|-------------|-------|
|     | MIN       | MAX   | MIN         | MAX   |
| A   | 0.340     | 0.380 | 8.64        | 9.65  |
| B   | 0.380     | 0.405 | 9.65        | 10.29 |
| C   | 0.160     | 0.190 | 4.06        | 4.83  |
| D   | 0.020     | 0.035 | 0.51        | 0.89  |
| E   | 0.045     | 0.055 | 1.14        | 1.40  |
| F   | 0.310     | 0.350 | 7.87        | 8.89  |
| G   | 0.100 BSC |       | 2.54 BSC    |       |
| H   | 0.080     | 0.110 | 2.03        | 2.79  |
| J   | 0.018     | 0.025 | 0.46        | 0.64  |
| K   | 0.090     | 0.110 | 2.29        | 2.79  |
| L   | 0.052     | 0.072 | 1.32        | 1.83  |
| M   | 0.280     | 0.320 | 7.11        | 8.13  |
| N   | 0.197 REF |       | 5.00 REF    |       |
| P   | 0.079 REF |       | 2.00 REF    |       |
| R   | 0.039 REF |       | 0.99 REF    |       |
| S   | 0.575     | 0.625 | 14.60       | 15.88 |
| V   | 0.045     | 0.055 | 1.14        | 1.40  |

### STYLE 2:

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



### SOLDERING FOOTPRINT\*

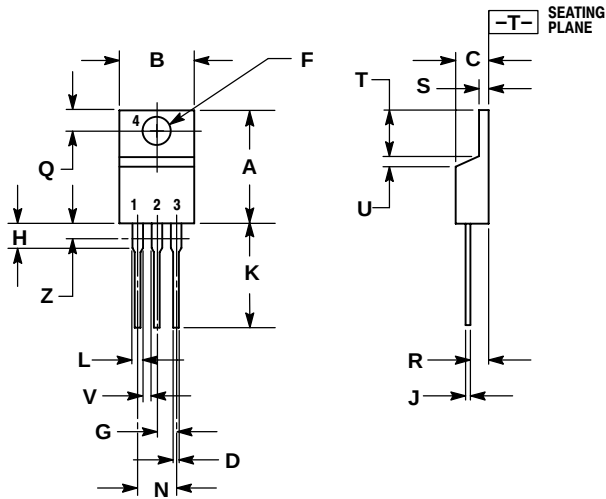


\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

# NTP30N06, NTB30N06

## PACKAGE DIMENSIONS

TO-220  
CASE 221A-09  
ISSUE AA



### 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  | 0.405 | 9.66        | 10.28 |
| C   | 0.160  | 0.190 | 4.07        | 4.82  |
| D   | 0.025  | 0.035 | 0.64        | 0.88  |
| F   | 0.142  | 0.147 | 3.61        | 3.73  |
| G   | 0.095  | 0.105 | 2.42        | 2.66  |
| H   | 0.110  | 0.155 | 2.80        | 3.93  |
| J   | 0.018  | 0.025 | 0.46        | 0.64  |
| 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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