

# NTP75N03-06, NTB75N03-06

## Power MOSFET 75 Amps, 30 Volts N-Channel TO-220 and D<sup>2</sup>PAK

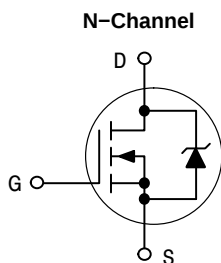
This 20 V<sub>GS</sub> gate drive vertical Power MOSFET is a general purpose part that provides the “best of design” available today in a low cost power package. This power MOSFET is designed to withstand high energy in the avalanche and commutation modes. The Drain-to-Source Diode has a fast response with soft recovery.

### Features

- Ultra-Low R<sub>DS(on)</sub>, Single Base, Advanced Technology
- SPICE Parameters Available
- Diode is Characterized for Use in Bridge Circuits
- I<sub>DSS</sub> and V<sub>DS(on)</sub> Specified at Elevated Temperatures
- High Avalanche Energy Capability
- ESD JEDAC Rated HBM Class 1, MM Class B, CDM Class 0

### Typical Applications

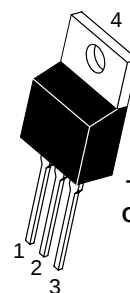
- Power Supplies
- Inductive Loads
- PWM Motor Controls
- Replaces MTP1306 and MTB1306



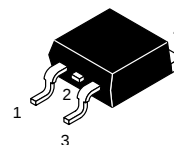
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| V <sub>(BR)DSS</sub> | R <sub>DS(on)</sub> TYP | I <sub>D</sub> MAX |
|----------------------|-------------------------|--------------------|
| 30 A                 | 5.3 mΩ @ 10 V           | 75 A               |

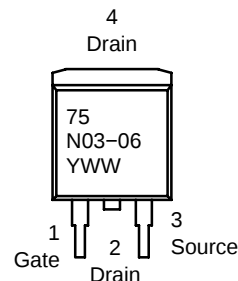
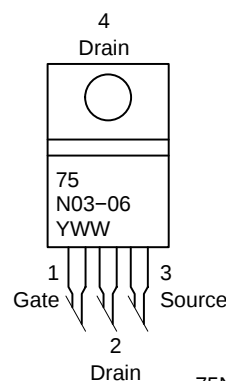


**TO-220AB  
CASE 221A  
Style 5**



**D<sup>2</sup>PAK  
CASE 418AA  
Style 2**

### MARKING DIAGRAMS & PIN ASSIGNMENTS



75N03-06 = Device Code  
Y = Year  
WW = Work Week

### ORDERING INFORMATION

| Device        | Package            | Shipping <sup>†</sup> |
|---------------|--------------------|-----------------------|
| NTP75N03-06   | TO-220             | 50 Units/Rail         |
| NTB75N03-06   | D <sup>2</sup> PAK | 50 Units/Rail         |
| NTB75N03-06T4 | D <sup>2</sup> PAK | 800/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.

# NTP75N03-06, NTB75N03-06

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

| Rating                                                                                                                                                                                                                       | Symbol                                                | Value             | Unit                          |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------|-------------------|-------------------------------|
| Drain-to-Source Voltage                                                                                                                                                                                                      | $V_{DSS}$                                             | 30                | Vdc                           |
| Drain-to-Gate Voltage<br>( $R_{GS} = 10\text{ M}\Omega$ )                                                                                                                                                                    | $V_{DGB}$                                             | 30                | Vdc                           |
| Gate-to-Source Voltage – Continuous                                                                                                                                                                                          | $V_{GS}$                                              | $\pm 20$          | Vdc                           |
| Non-repetitive ( $t_p \leq 10\text{ ms}$ )                                                                                                                                                                                   | $V_{GS}$                                              | $\pm 24$          | Vdc                           |
| Drain Current<br>– Continuous @ $T_C = 25^\circ\text{C}$<br>– Continuous @ $T_C = 100^\circ\text{C}$<br>– Single Pulse ( $t_p \leq 10\text{ }\mu\text{s}$ )                                                                  | $I_D$<br>$I_D$<br>$I_{DM}$                            | 75<br>59<br>225   | Adc<br>Adc<br>Apk             |
| Total Power Dissipation @ $T_C = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$<br>Total Power Dissipation @ $T_A = 25^\circ\text{C}$ (Note 1)                                                                         | $P_D$                                                 | 125<br>1.0<br>2.5 | W<br>W/ $^\circ\text{C}$<br>W |
| Operating and Storage Temperature Range                                                                                                                                                                                      | $T_J$ and $T_{stg}$                                   | $-55$ to $150$    | $^\circ\text{C}$              |
| Single Pulse Drain-to-Source Avalanche Energy – Starting $T_J = 25^\circ\text{C}$<br>( $V_{DD} = 38\text{ Vdc}$ , $V_{GS} = 10\text{ Vdc}$ , $L = 1\text{ mH}$ , $I_L(\text{pk}) = 55\text{ A}$ , $V_{DS} = 40\text{ Vdc}$ ) | $E_{AS}$                                              | 1500              | mJ                            |
| Thermal Resistance<br>– Junction-to-Case<br>– Junction-to-Ambient<br>– Junction-to-Ambient (Note 1)                                                                                                                          | $R_{\theta JC}$<br>$R_{\theta JA}$<br>$R_{\theta JA}$ | 1.0<br>62.5<br>50 | $^\circ\text{C/W}$            |
| Maximum Lead Temperature for Soldering Purposes, 1/8" from case for 10 seconds                                                                                                                                               | $T_L$                                                 | 260               | $^\circ\text{C}$              |

1. When surface mounted to an FR4 board using the minimum recommended pad size.

# NTP75N03-06, NTB75N03-06

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

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

### OFF CHARACTERISTICS

|                                                                                                                                                                       |                      |        |          |           |             |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|--------|----------|-----------|-------------|
| Drain-Source Breakdown Voltage (Note 2)<br>(V <sub>GS</sub> = 0 Vdc, I <sub>D</sub> = 250 μAdc)<br>Temperature Coefficient (Negative)                                 | V <sub>(BR)DSS</sub> | 30     | –<br>–57 | –<br>–    | Vdc<br>mV°C |
| Zero Gate Voltage Drain Current<br>(V <sub>DS</sub> = 30 Vdc, V <sub>GS</sub> = 0 Vdc)<br>(V <sub>DS</sub> = 30 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 2)

|                                                                                                                                                                                       |                     |          |              |              |             |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|----------|--------------|--------------|-------------|
| Gate Threshold Voltage (Note 2)<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> | 1.0<br>– | 1.6<br>–6    | 2.0<br>–     | Vdc<br>mV°C |
| Static Drain-to-Source On-Resistance (Note 2)<br>(V <sub>GS</sub> = 10 Vdc, I <sub>D</sub> = 37.5 Adc)                                                                                | R <sub>DS(on)</sub> | –        | 5.3          | 6.5          | mΩ          |
| Static Drain-to-Source On Resistance (Note 2)<br>(V <sub>GS</sub> = 10 Vdc, I <sub>D</sub> = 75 Adc)<br>(V <sub>GS</sub> = 10 Vdc, I <sub>D</sub> = 37.5 Adc, T <sub>J</sub> = 125°C) | V <sub>DS(on)</sub> | –<br>–   | 0.53<br>0.35 | 0.68<br>0.50 | Vdc         |
| Forward Transconductance (Notes 2 & 4) (V <sub>DS</sub> = 3 Vdc, I <sub>D</sub> = 20 Adc)                                                                                             | g <sub>FS</sub>     | –        | 58           | –            | Mhos        |

### DYNAMIC CHARACTERISTICS (Note 4)

|                      |                                                                 |                  |   |      |      |    |
|----------------------|-----------------------------------------------------------------|------------------|---|------|------|----|
| Input Capacitance    | (V <sub>DS</sub> = 25 Vdc, V <sub>GS</sub> = 0,<br>f = 1.0 MHz) | C <sub>iss</sub> | – | 4398 | 5635 | pF |
| Output Capacitance   |                                                                 | C <sub>oss</sub> | – | 1160 | 1894 |    |
| Transfer Capacitance |                                                                 | C <sub>rss</sub> | – | 317  | 430  |    |

### SWITCHING CHARACTERISTICS (Notes 3 and 4)

|                     |                                                                                                                       |                     |   |     |     |    |
|---------------------|-----------------------------------------------------------------------------------------------------------------------|---------------------|---|-----|-----|----|
| Turn-On Delay Time  | (V <sub>GS</sub> = 5.0 Vdc,<br>V <sub>DD</sub> = 20 Vdc, I <sub>D</sub> = 75 Adc,<br>R <sub>G</sub> = 4.7 Ω) (Note 2) | t <sub>d(on)</sub>  | – | 16  | 30  | ns |
| Rise Time           |                                                                                                                       | t <sub>r</sub>      | – | 130 | 200 |    |
| Turn-Off Delay Time |                                                                                                                       | t <sub>d(off)</sub> | – | 65  | 110 |    |
| Fall Time           |                                                                                                                       | t <sub>f</sub>      | – | 105 | 175 |    |
| Gate Charge         | (V <sub>GS</sub> = 5.0 Vdc,<br>I <sub>D</sub> = 75 Adc,<br>V <sub>DS</sub> = 24 Vdc) (Note 2)                         | Q <sub>T</sub>      | – | 57  | 75  | nC |
|                     |                                                                                                                       | Q <sub>1</sub>      | – | 11  | 15  |    |
|                     |                                                                                                                       | Q <sub>2</sub>      | – | 34  | 50  |    |

### SOURCE-DRAIN DIODE CHARACTERISTICS

|                                            |                                                                                                                                              |                 |        |              |           |     |
|--------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|-----------------|--------|--------------|-----------|-----|
| Forward On-Voltage                         | (I <sub>S</sub> = 75 Adc, V <sub>GS</sub> = 0 Vdc)<br>(I <sub>S</sub> = 75 Adc, V <sub>GS</sub> = 0 Vdc, T <sub>J</sub> = 125°C)<br>(Note 2) | V <sub>SD</sub> | –<br>– | 1.19<br>1.09 | 1.25<br>– | Vdc |
| Reverse Recovery Time<br>(Note 4)          | (I <sub>S</sub> = 75 Adc, V <sub>GS</sub> = 0 Vdc<br>di <sub>S</sub> /dt = 100 A/μs) (Note 2)                                                | t <sub>rr</sub> | –      | 37           | –         | ns  |
|                                            |                                                                                                                                              | t <sub>a</sub>  | –      | 20           | –         |     |
| Reverse Recovery Stored<br>Charge (Note 4) |                                                                                                                                              | t <sub>b</sub>  | –      | 17           | –         | μC  |
|                                            |                                                                                                                                              | Q <sub>RR</sub> | –      | 0.023        | –         |     |

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

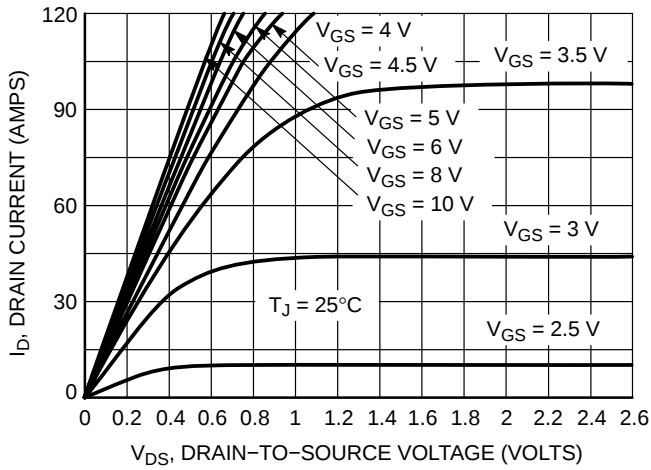


Figure 1. On-Region Characteristics

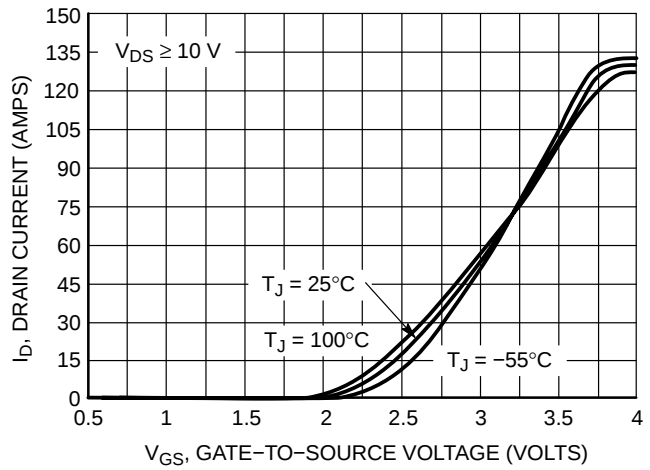


Figure 2. Transfer Characteristics

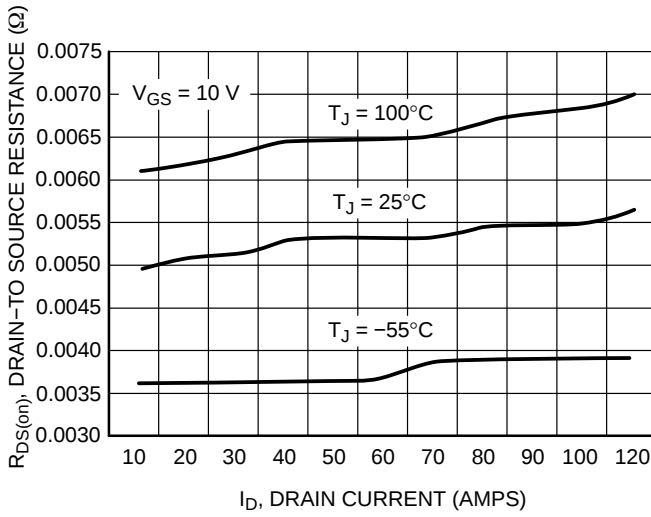


Figure 3. On-Resistance vs. Drain Current and Temperature

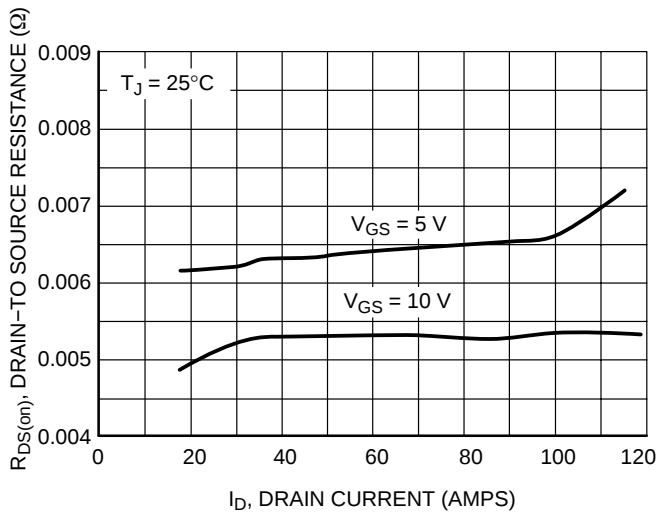


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

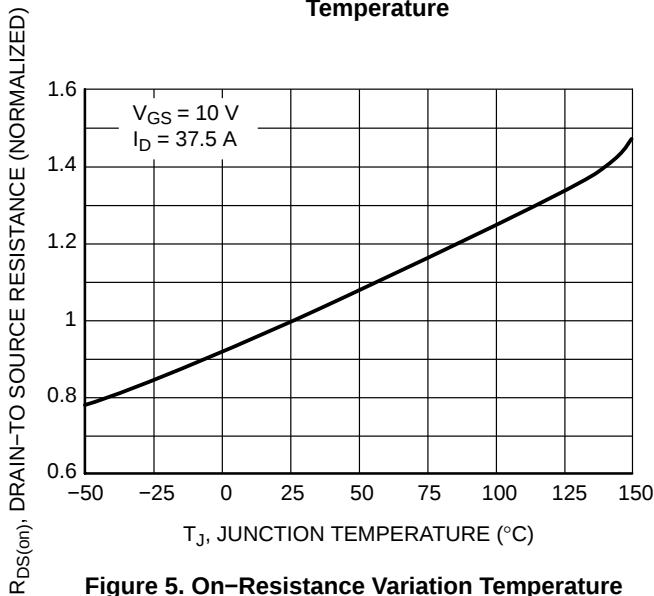


Figure 5. On-Resistance Variation Temperature

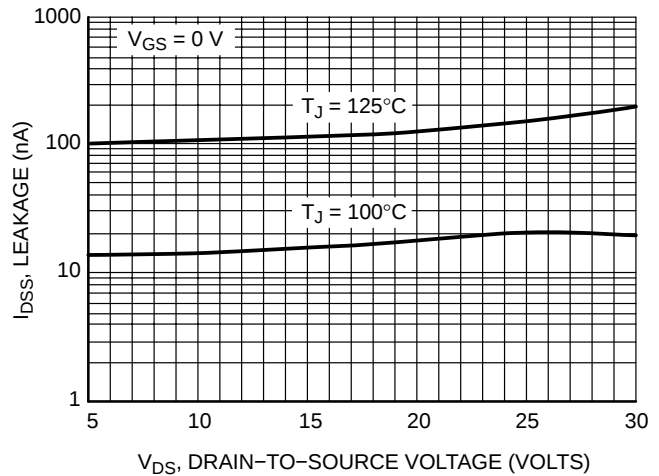


Figure 6. Drain-to-Source Leakage Current vs. Voltage

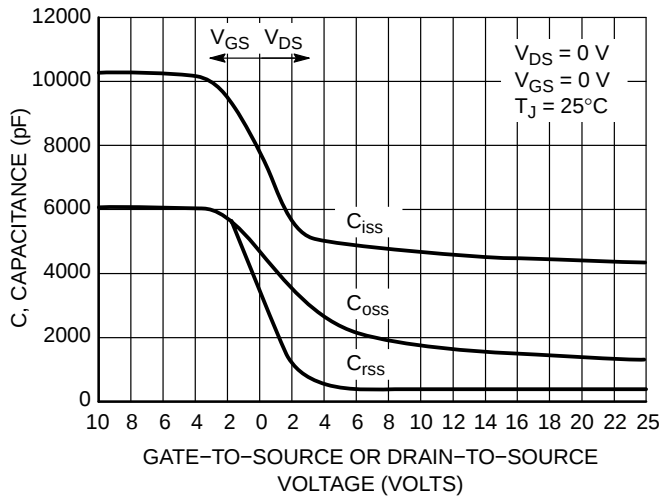


Figure 7. Capacitance Variation

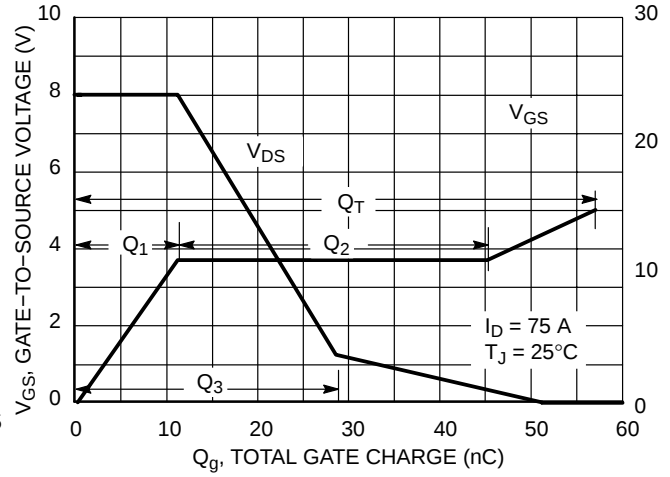


Figure 8. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge

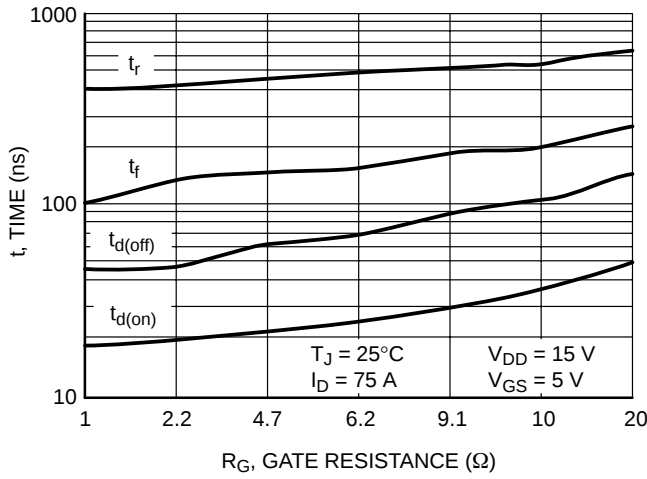


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

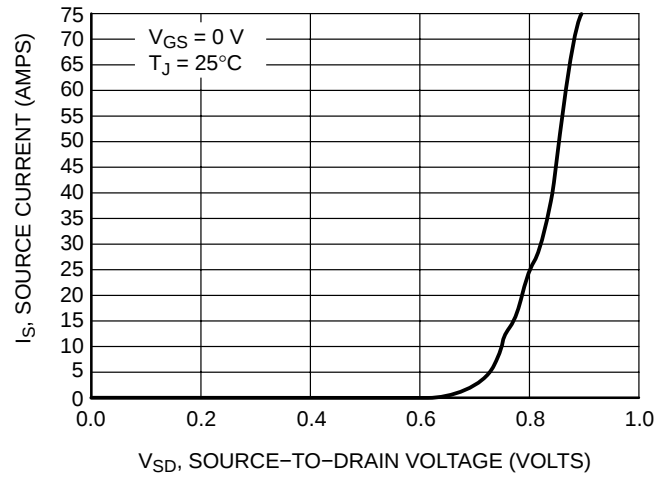


Figure 10. Diode Forward Voltage vs. Current

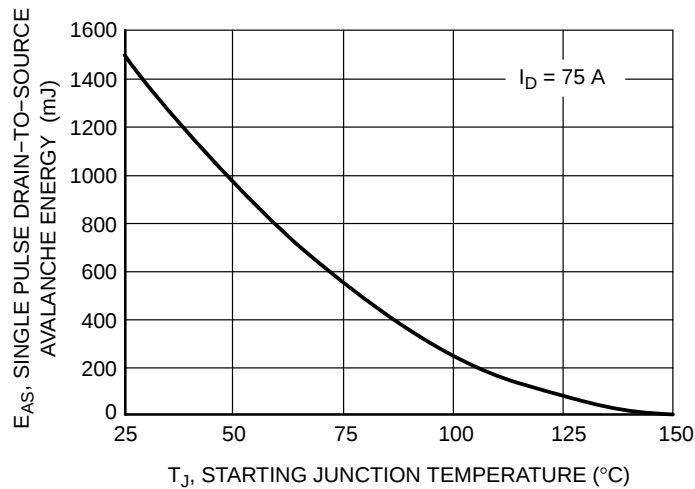
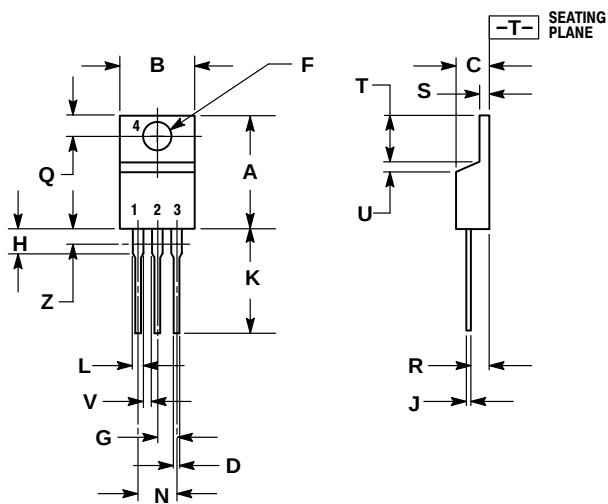


Figure 11. Maximum Avalanche Energy vs. Starting Junction Temperature

PACKAGE DIMENSIONS

TO-220 THREE-LEAD  
TO-220AB  
CASE 221A-09  
ISSUE AA

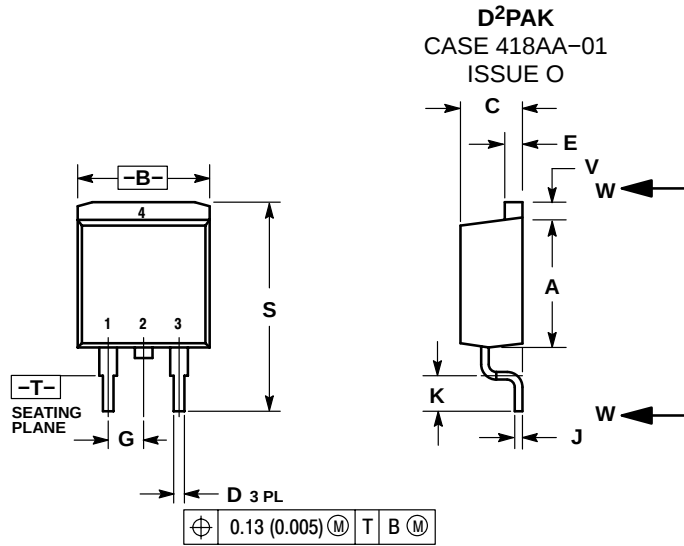


- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: INCH.
  3. DIMENSION Z DEFINES A ZONE WHERE ALL BODY AND LEAD IRREGULARITIES ARE ALLOWED.

| 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

PACKAGE DIMENSIONS



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

| 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     | 0.036 | 0.51        | 0.92  |
| E   | 0.045     | 0.055 | 1.14        | 1.40  |
| F   | 0.310     | ---   | 7.87        | ---   |
| G   | 0.100 BSC | ---   | 2.54 BSC    | ---   |
| J   | 0.018     | 0.025 | 0.46        | 0.64  |
| K   | 0.090     | 0.110 | 2.29        | 2.79  |
| M   | 0.280     | ---   | 7.11        | ---   |
| S   | 0.575     | 0.625 | 14.60       | 15.88 |
| V   | 0.045     | 0.055 | 1.14        | 1.40  |

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

SOLDERING FOOTPRINT\*

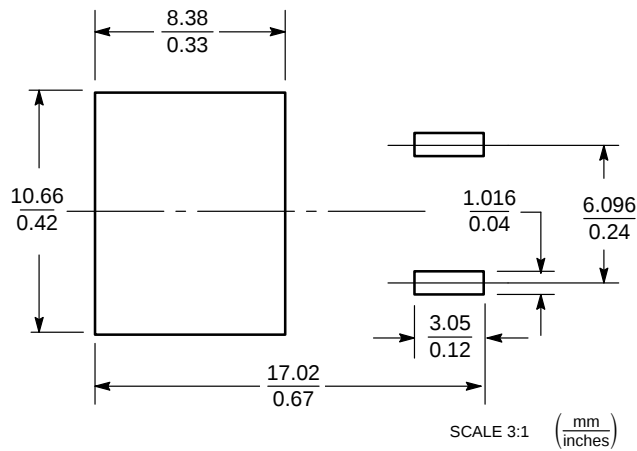


Figure 12. D<sup>2</sup>PAK

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