

NTP22N06, NTB22N06



Power MOSFET 22 Amps, 60 Volts N-Channel TO-220 and D²PAK

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

Typical Applications

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

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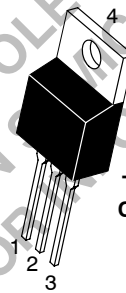
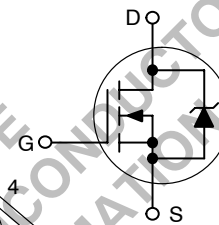
**22 AMPERES
60 VOLTS**

$R_{DS(on)} = 60 \text{ m}\Omega$

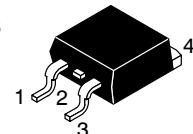
MAXIMUM RATINGS ($T_J = 25^\circ\text{C}$ unless otherwise noted)

| Rating | Symbol | Value | Unit |
|--|------------------------------------|-------------------|---------------------------|
| Drain-to-Source Voltage | V_{DSS} | 60 | Vdc |
| Drain-to-Gate Voltage ($R_{GS} = 10 \text{ M}\Omega$) | V_{DGR} | 60 | Vdc |
| Gate-to-Source Voltage | V_{GS} | ± 20 | Vdc |
| - Continuous | V_{GS} | ± 30 | |
| - Non-Repetitive ($t_p \leq 10 \text{ ms}$) | | | |
| Drain Current | I_D | 22 | Adc |
| - Continuous @ $T_A = 25^\circ\text{C}$ | I_D | 10 | |
| - Continuous @ $T_A = 100^\circ\text{C}$ | I_{DM} | 66 | Apk |
| - Single Pulse ($t_p \leq 10 \mu\text{s}$) | | | |
| Total Power Dissipation @ $T_A = 25^\circ\text{C}$ Derate above 25°C | P_D | 60 0.4 | W 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 $T_J = 25^\circ\text{C}$ ($V_{DD} = 50 \text{ Vdc}$, $V_{GS} = 10 \text{ Vdc}$, $L = 1.0 \text{ mH}$, $V_{DS} = 60 \text{ Vdc}$, $I_{L(pk)} = 12 \text{ A}$, $R_G = 25 \Omega$) | E_{AS} | 72 | mJ |
| Thermal Resistance | $R_{\theta JC}$ $R_{\theta JA}$ | 2.5 62.5 | $^\circ\text{C}/\text{W}$ |
| - Junction-to-Case | | | |
| - Junction-to-Ambient | | | |
| Maximum Lead Temperature for Soldering Purposes, 1/8" from case for 10 seconds | T_L | 260 | $^\circ\text{C}$ |

N-Channel

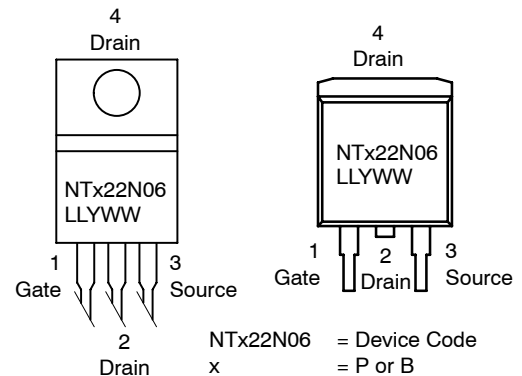


**TO-220AB
CASE 221A
STYLE 5**



**D²PAK
CASE 418B
STYLE 2**

MARKING DIAGRAMS & PIN ASSIGNMENTS



NTx22N06 = Device Code
x = P or B
LL = Location Code
Y = Year
WW = Work Week

ORDERING INFORMATION

| Device | Package | Shipping |
|------------|--------------------|-----------------|
| NTP22N06 | TO-220AB | 50 Units/Rail |
| NTB22N06 | D ² PAK | 50 Units/Rail |
| NTB22N06T4 | D ² PAK | 800/Tape & Reel |

NTP22N06, NTB22N06

ELECTRICAL CHARACTERISTICS (T_J = 25°C unless otherwise noted)

| Characteristic | Symbol | Min | Typ | Max | Unit |
|---|----------------------|---------|----------|-----------|--------------|
| OFF CHARACTERISTICS | | | | | |
| Drain-to-Source Breakdown Voltage (Note 1) (V _{GS} = 0 Vdc, I _D = 250 μAdc) Temperature Coefficient (Positive) | V _{(BR)DSS} | 60 - | 71 71 | - - | Vdc mV/°C |
| Zero Gate Voltage Drain Current (V _{DS} = 60 Vdc, V _{GS} = 0 Vdc) (V _{DS} = 60 Vdc, V _{GS} = 0 Vdc, T _J = 150°C) | I _{DSS} | - - | - - | 1.0 10 | μAdc |
| Gate-Body Leakage Current (V _{GS} = ±20 Vdc, V _{DS} = 0 Vdc) | I _{GSS} | - | - | ±100 | nAdc |

ON CHARACTERISTICS (Note 1)

| | | | | | |
|--|---------------------|----------|-------------|----------|--------------|
| Gate Threshold Voltage (Note 1) (V _{DS} = V _{GS} , I _D = 250 μAdc) Threshold Temperature Coefficient (Negative) | V _{GS(th)} | 2.0 - | 3.09 7.0 | 4.0 - | Vdc mV/°C |
| Static Drain-to-Source On-Resistance (Note 1) (V _{GS} = 10 Vdc, I _D = 11 Adc) | R _{DS(on)} | - | 52 | 60 | mΩ |
| Static Drain-to-Source On-Voltage (Note 1) (V _{GS} = 10 Vdc, I _D = 22 Adc) (V _{GS} = 10 Vdc, I _D = 11 Adc, T _J = 150°C) | V _{DS(on)} | - - | 1.2 1.11 | 1.6 - | Vdc |
| Forward Transconductance (Note 1) (V _{DS} = 7.0 Vdc, I _D = 11 Adc) | g _{FS} | - | 12 | - | mhos |

DYNAMIC CHARACTERISTICS

| | | | | | | |
|----------------------|---|------------------|---|-----|-----|----|
| Input Capacitance | (V _{DS} = 25 Vdc, V _{GS} = 0 Vdc, f = 1.0 MHz) | C _{iss} | - | 502 | 700 | pF |
| Output Capacitance | | C _{oss} | - | 160 | 225 | |
| Transfer Capacitance | | C _{rss} | - | 46 | 65 | |

SWITCHING CHARACTERISTICS (Note 2)

| | | | | | | |
|---------------------|---|---------------------|---|------|----|----|
| Turn-On Delay Time | (V _{DD} = 30 Vdc, I _D = 22 Adc, V _{GS} = 10 Vdc, R _G = 9.1 Ω) (Note 1) | t _{d(on)} | - | 12 | 25 | ns |
| Rise Time | | t _r | - | 39 | 80 | |
| Turn-Off Delay Time | | t _{d(off)} | - | 18 | 40 | |
| Fall Time | | t _f | - | 34 | 70 | |
| Gate Charge | (V _{DS} = 48 Vdc, I _D = 22 Adc, V _{GS} = 10 Vdc) (Note 1) | Q _T | - | 15.5 | 32 | nC |
| | | Q ₁ | - | 3.4 | - | |
| | | Q ₂ | - | 7.7 | - | |

SOURCE-DRAIN DIODE CHARACTERISTICS

| | | | | | | |
|--------------------------------|---|-----------------|--------|-------------|-----------|-----|
| Forward On-Voltage | (I _S = 22 Adc, V _{GS} = 0 Vdc) (Note 1) (I _S = 22 Adc, V _{GS} = 0 Vdc, T _J = 150°C) | V _{SD} | - - | 1.07 1.0 | 1.15 - | Vdc |
| Reverse Recovery Time | (I _S = 22 Adc, V _{GS} = 0 Vdc, di _S /dt = 100 A/μs) (Note 1) | t _{rr} | - | 43 | - | ns |
| | | t _a | - | 32 | - | |
| | | t _b | - | 11 | - | |
| Reverse Recovery Stored Charge | | Q _{RR} | - | 0.071 | - | μC |

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

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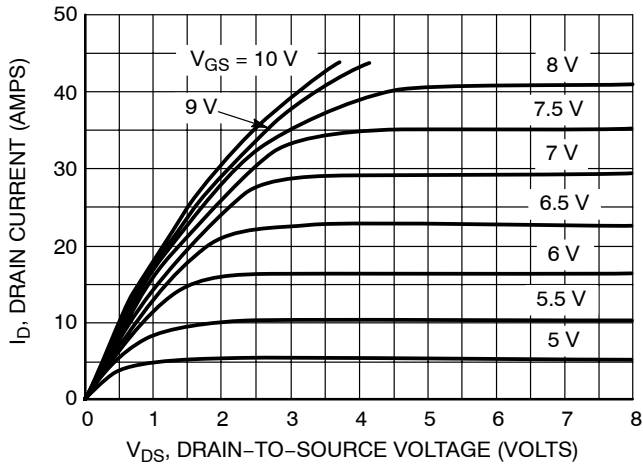


Figure 1. On-Region Characteristics

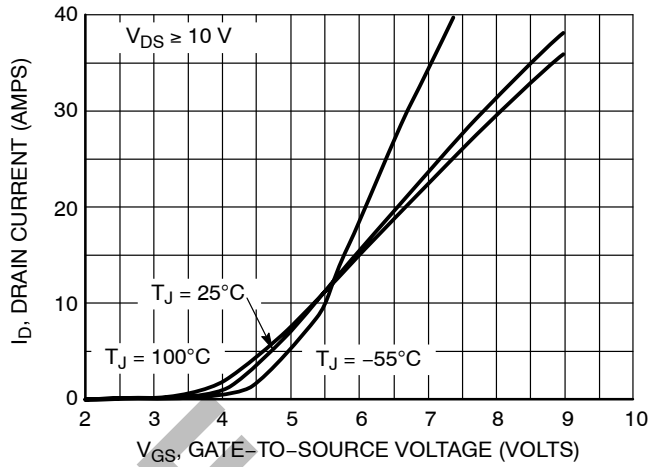


Figure 2. Transfer Characteristics

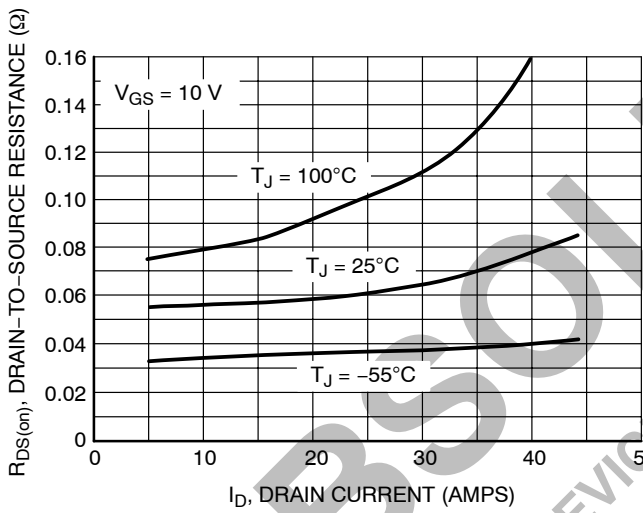


Figure 3. On-Resistance versus Gate-to-Source Voltage

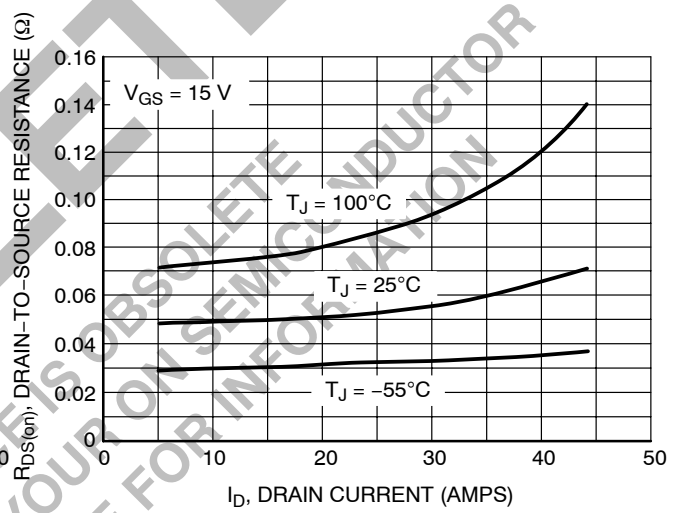


Figure 4. On-Resistance versus Drain Current and Gate Voltage

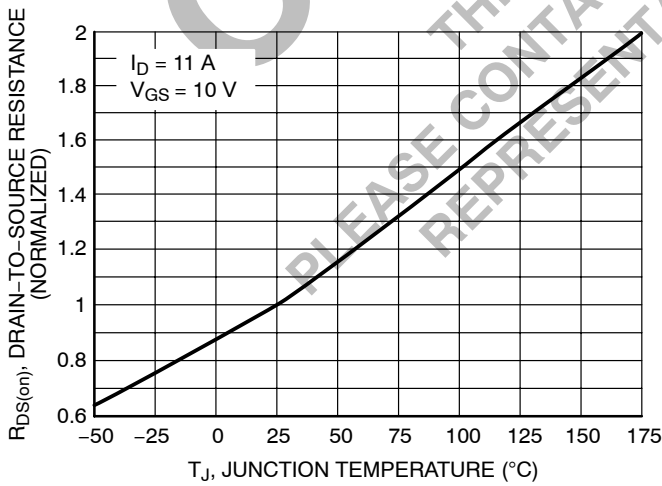


Figure 5. On-Resistance Variation with Temperature

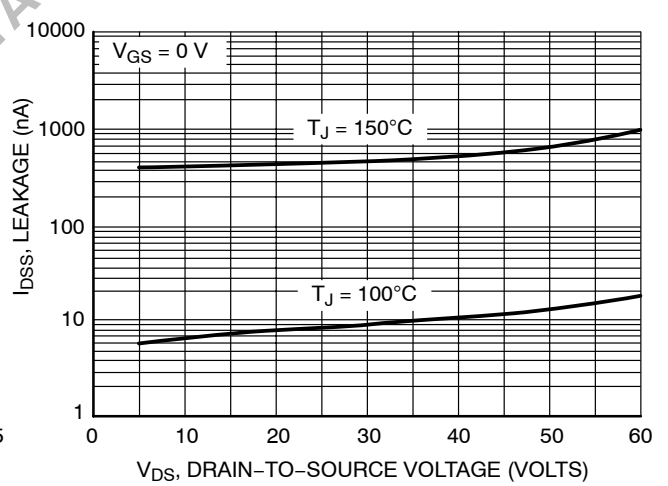


Figure 6. Drain-to-Source Leakage Current versus Voltage

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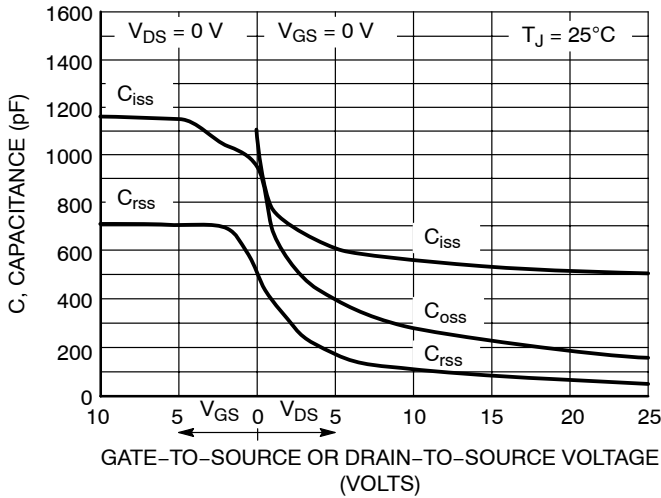


Figure 7. Capacitance Variation

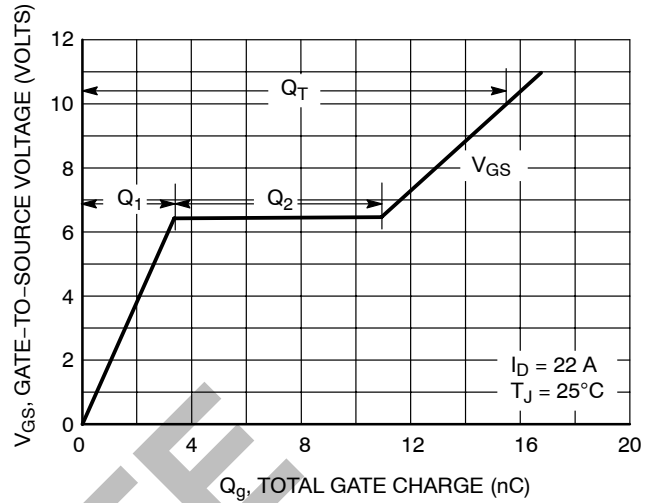


Figure 8. Gate-to-Source and Drain-to-Source Voltage versus Total Charge

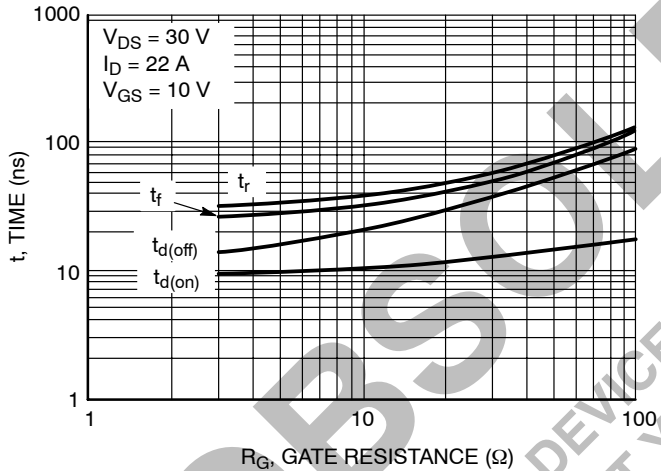


Figure 9. Resistive Switching Time Variation versus Gate Resistance

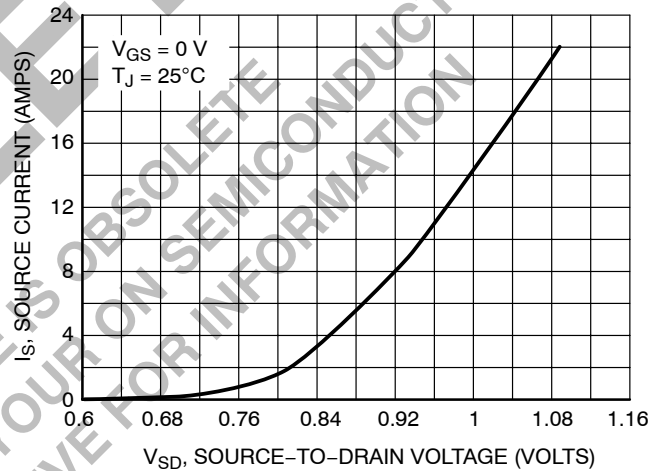


Figure 10. Diode Forward Voltage versus Current

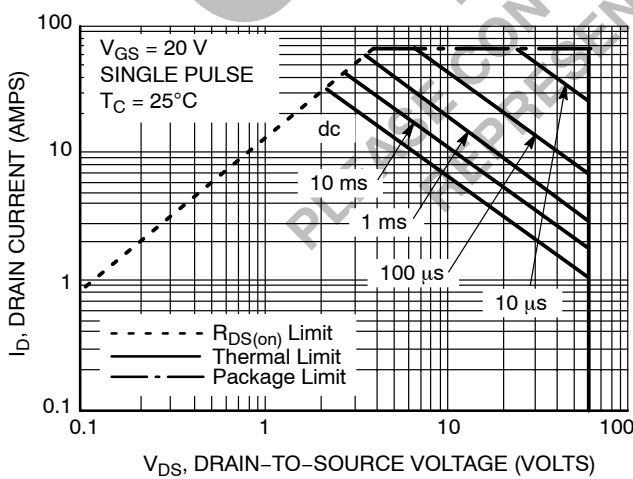


Figure 11. Maximum Rated Forward Biased Safe Operating Area

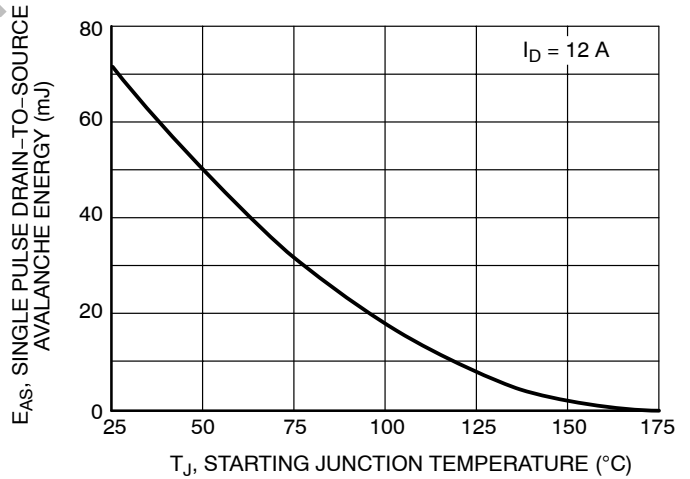


Figure 12. Maximum Avalanche Energy versus Starting Junction Temperature

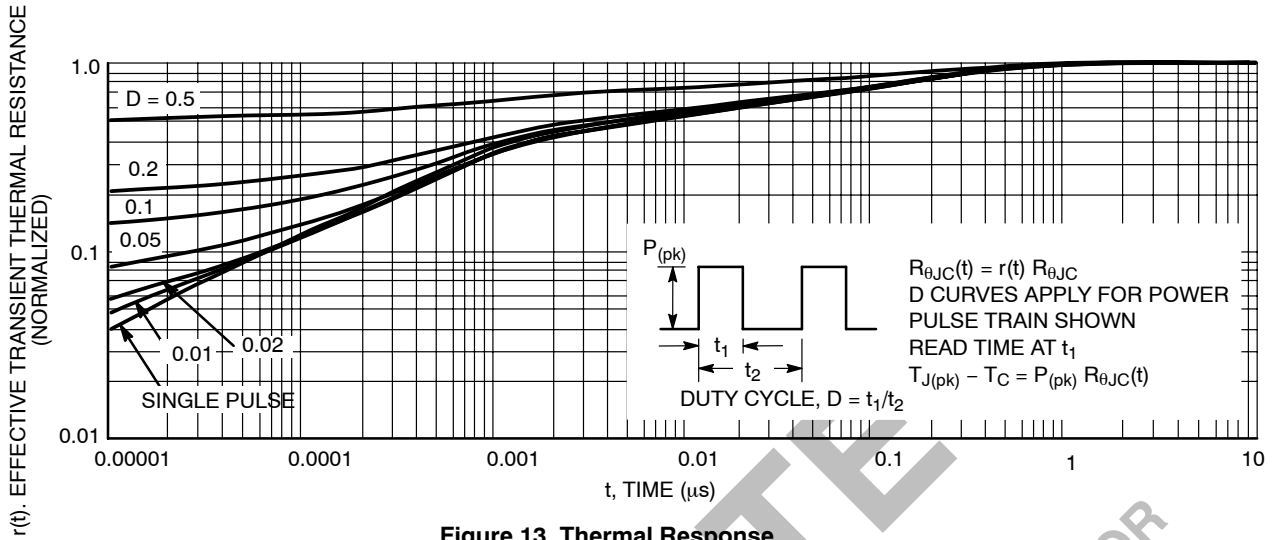


Figure 13. Thermal Response

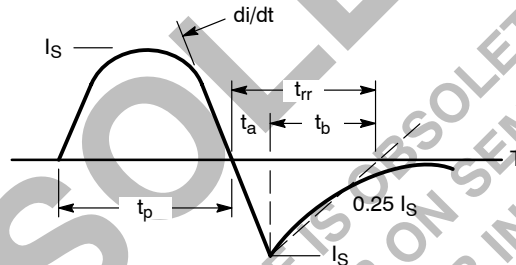
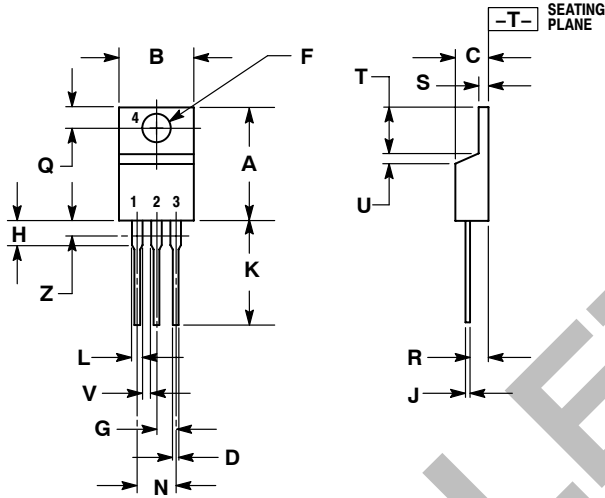


Figure 14. Diode Reverse Recovery Waveform

NTP22N06, NTB22N06

PACKAGE DIMENSIONS

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



NOTES:

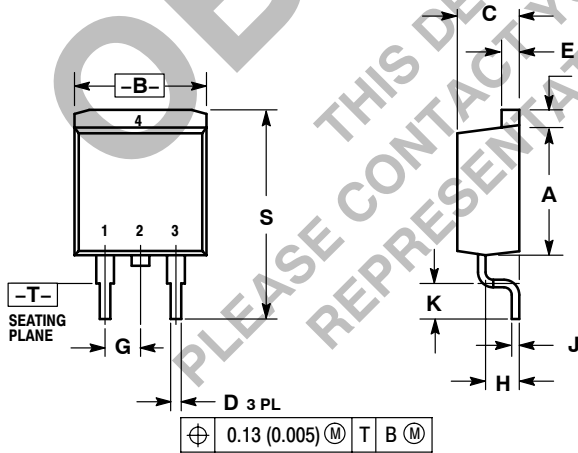
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION Z DEFINES A ZONE WHERE ALL BODY AND LEAD IRREGULARITIES ARE ALLOWED.

| 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 | 4.89 | 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

D²PAK
CASE 418B-03
ISSUE D



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 | 0.035 | 0.51 | 0.89 |
| E | 0.045 | 0.055 | 1.14 | 1.40 |
| 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 |
| 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

OBSOLETE
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