

NTP22N06L, NTB22N06L

Power MOSFET 22 Amps, 60 Volts, Logic Level 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

MAXIMUM RATINGS (T_J = 25°C unless otherwise noted)

| Rating | Symbol | Value | Unit |
|--|--------------------------------------|----------------|-----------|
| Drain-to-Source Voltage | V _{DS} | 60 | Vdc |
| Drain-to-Gate Voltage (R _{GS} = 10 MΩ) | V _{DGR} | 60 | Vdc |
| Gate-to-Source Voltage | V _{GS} | ±10 | Vdc |
| – Continuous | V _{GS} | ±20 | |
| – Non-Repetitive (t _p ≤ 10 ms) | | | |
| Drain Current | I _D | 22 | Adc |
| – Continuous @ T _A = 25°C | I _D | 10 | |
| – Continuous @ T _A = 100°C | I _{DM} | 66 | Apk |
| – Single Pulse (t _p ≤ 10 μs) | | | |
| Total Power Dissipation @ T _A = 25°C Derate above 25°C | P _D | 60 0.4 | W W/°C |
| Operating and Storage Temperature Range | T _J , T _{stg} | –55 to +175 | °C |
| Single Pulse Drain-to-Source Avalanche Energy – Starting T _J = 25°C (V _{DD} = 50 Vdc, V _{GS} = 5.0 Vdc, L = 1.0 mH I _{L(pk)} = 12 A, V _{DS} = 60 Vdc, R _G = 25 Ω) | E _{AS} | 72 | mJ |
| Thermal Resistance | R _{θJC} R _{θJA} | 2.5 62.5 | °C/W |
| – Junction-to-Case | | | |
| – Junction-to-Ambient | | | |
| Maximum Lead Temperature for Soldering Purposes, 1/8" from case for 10 seconds | T _L | 260 | °C |

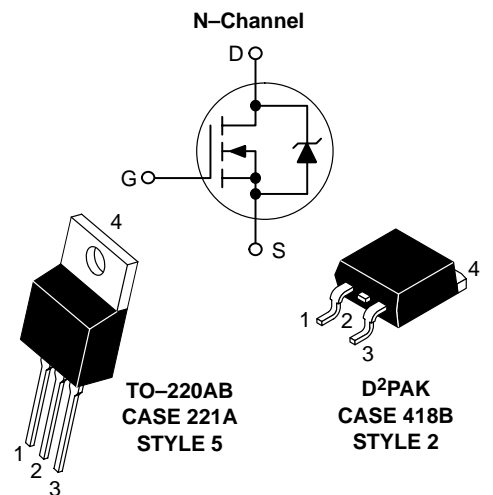


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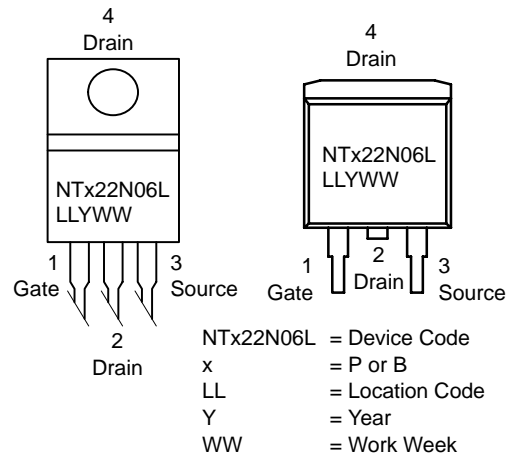
<http://onsemi.com>

**22 AMPERES
60 VOLTS**

R_{DS(on)} = 65 mΩ



MARKING DIAGRAMS & PIN ASSIGNMENTS



ORDERING INFORMATION

| Device | Package | Shipping |
|-------------|--------------------|-----------------|
| NTP22N06L | TO-220AB | 50 Units/Rail |
| NTB22N06L | D ² PAK | 50 Units/Rail |
| NTB22N06LT4 | D ² PAK | 800/Tape & Reel |

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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 – | 68.2 81 | – – | 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} = ±15 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)} | 1.0 – | 1.79 5.0 | 2.0 – | Vdc mV/°C |
| Static Drain-to-Source On-Resistance (Note 1.) (V _{GS} = 5.0 Vdc, I _D = 11 Adc) | R _{DS(on)} | – | 57 | 65 | mΩ |
| Static Drain-to-Source On-Voltage (Note 1.) (V _{GS} = 5.0 Vdc, I _D = 22 Adc) (V _{GS} = 5.0 Vdc, I _D = 11 Adc, T _J = 150°C) | V _{DS(on)} | – – | 1.4 1.17 | 1.7 – | Vdc |
| Forward Transconductance (Note 1.) (V _{DS} = 7.0 Vdc, I _D = 11 Adc) | g _{FS} | – | 14.6 | – | mhos |

DYNAMIC CHARACTERISTICS

| | | | | | | |
|----------------------|---|------------------|---|-----|-----|----|
| Input Capacitance | (V _{DS} = 25 Vdc, V _{GS} = 0 Vdc, f = 1.0 MHz) | C _{iSS} | – | 490 | 690 | pF |
| Output Capacitance | | C _{oSS} | – | 167 | 230 | |
| Transfer Capacitance | | C _{rSS} | – | 56 | 80 | |

SWITCHING CHARACTERISTICS (Note 2.)

| | | | | | | |
|---------------------|---|---------------------|---|------|-----|----|
| Turn-On Delay Time | (V _{DD} = 30 Vdc, I _D = 22 Adc, V _{GS} = 5.0 Vdc, R _G = 9.1 Ω) (Note 1.) | t _{d(on)} | – | 10 | 20 | ns |
| Rise Time | | t _r | – | 115 | 230 | |
| Turn-Off Delay Time | | t _{d(off)} | – | 21 | 40 | |
| Fall Time | | t _f | – | 56 | 120 | |
| Gate Charge | (V _{DS} = 48 Vdc, I _D = 22 Adc, V _{GS} = 5.0 Vdc) (Note 1.) | Q _T | – | 10.4 | 20 | nC |
| | | Q ₁ | – | 2.5 | – | |
| | | Q ₂ | – | 7.0 | – | |

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} | – – | 1.03 0.98 | 1.2 – | Vdc |
| Reverse Recovery Time | (I _S = 22 Adc, V _{GS} = 0 Vdc, di _S /dt = 100 A/μs) (Note 1.) | t _{rr} | – | 42 | – | ns |
| | | t _a | – | 26 | – | |
| | | t _b | – | 16 | – | |
| Reverse Recovery Stored Charge | | Q _{RR} | – | 0.060 | – | μC |

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

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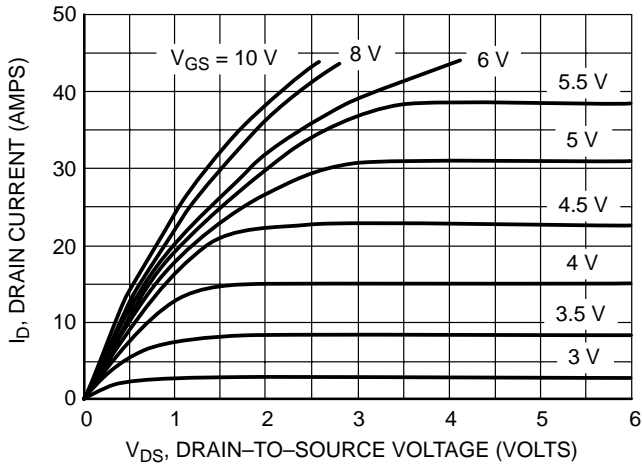


Figure 1. On-Region Characteristics

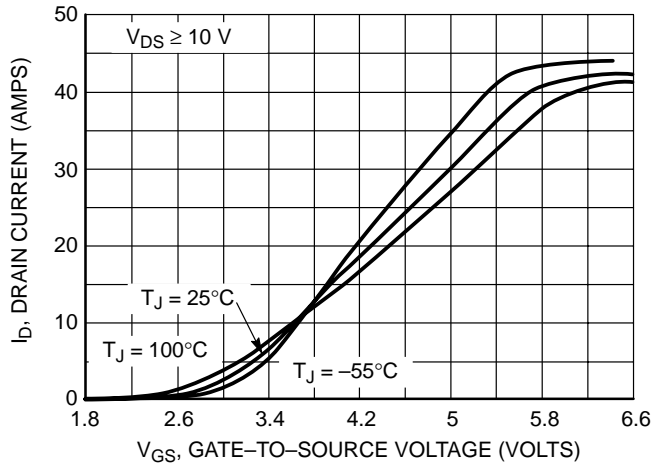


Figure 2. Transfer Characteristics

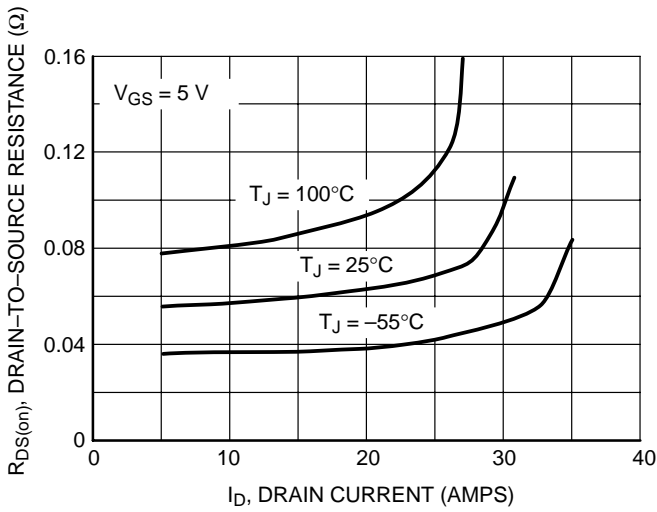


Figure 3. On-Resistance versus Gate-to-Source Voltage

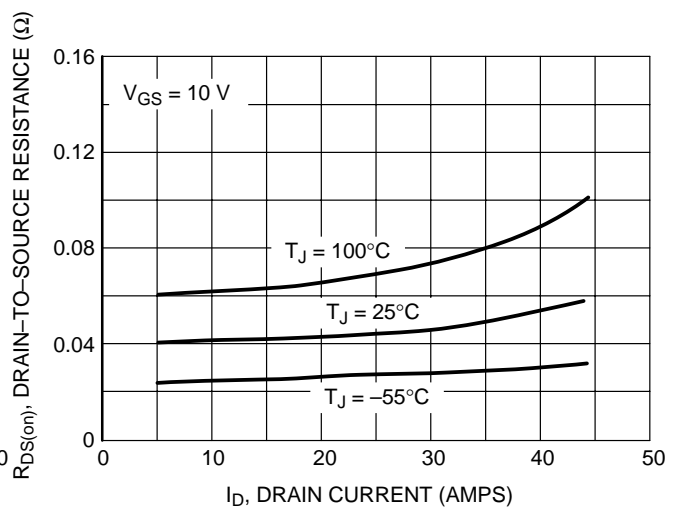


Figure 4. On-Resistance versus Drain Current and Gate Voltage

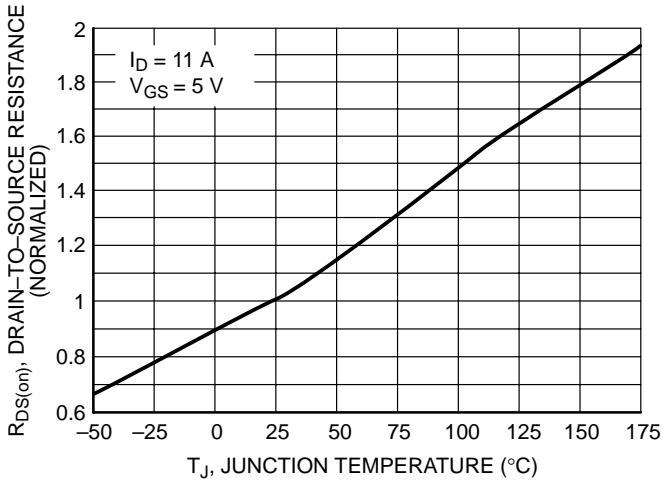


Figure 5. On-Resistance Variation with Temperature

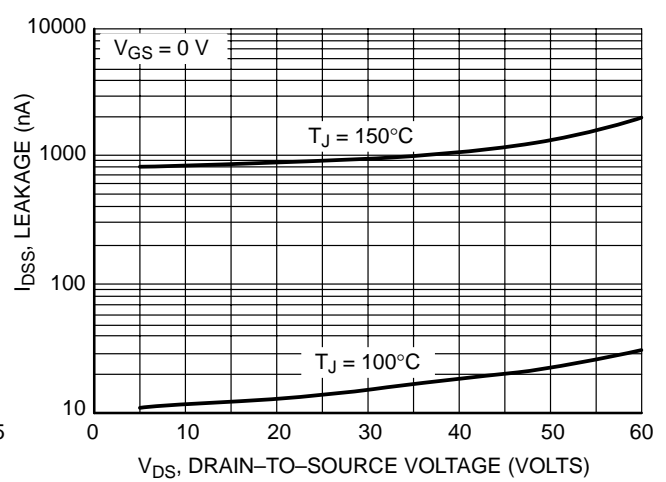


Figure 6. Drain-to-Source Leakage Current versus Voltage

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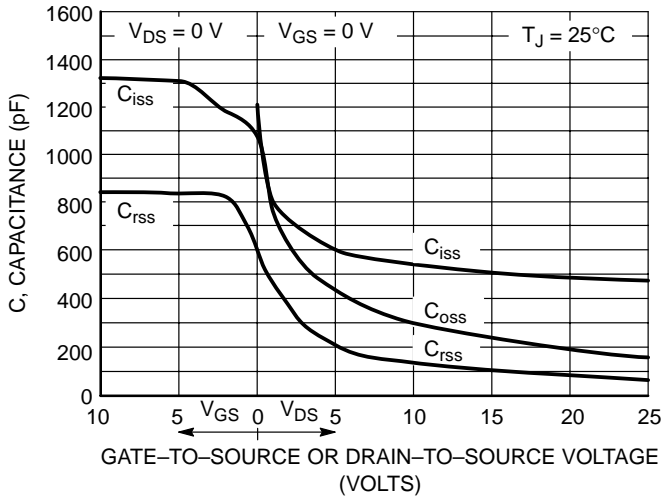


Figure 7. Capacitance Variation

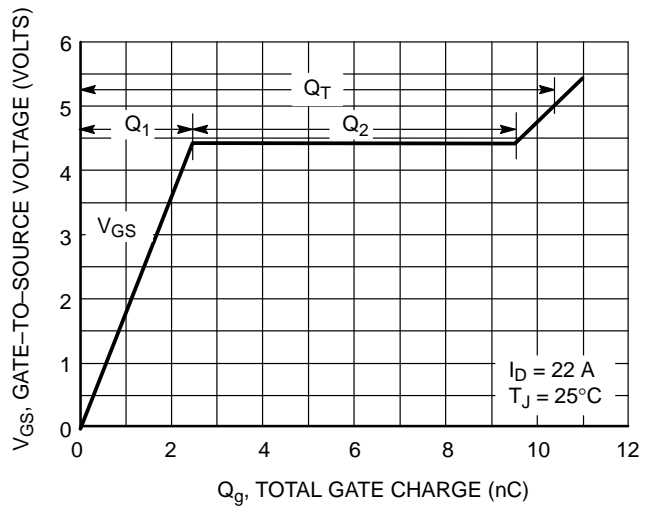


Figure 8. Gate-to-Source and Drain-to-Source Voltage versus Total Charge

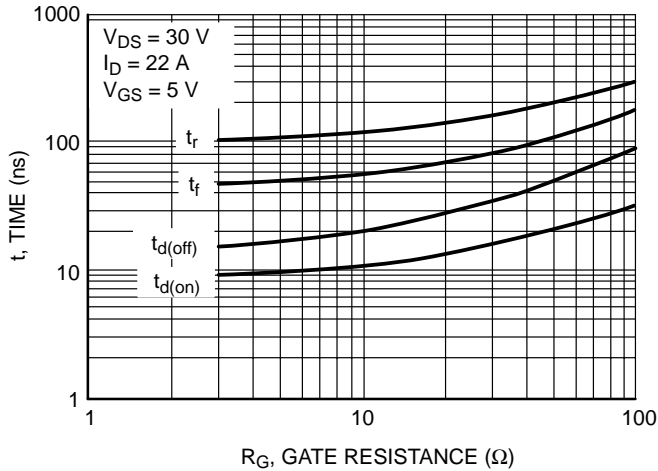


Figure 9. Resistive Switching Time Variation versus Gate Resistance

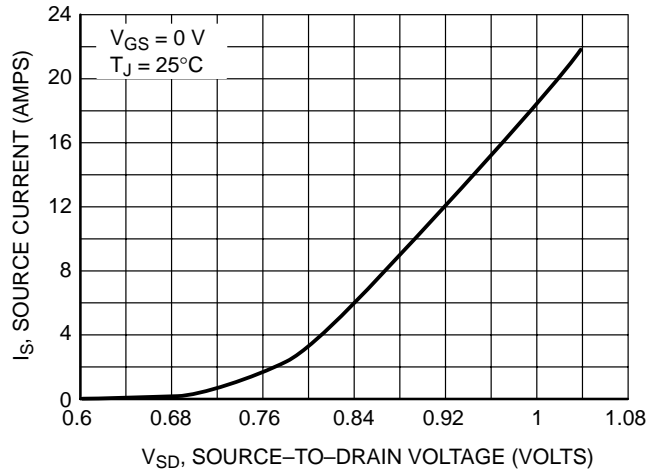


Figure 10. Diode Forward Voltage versus Current

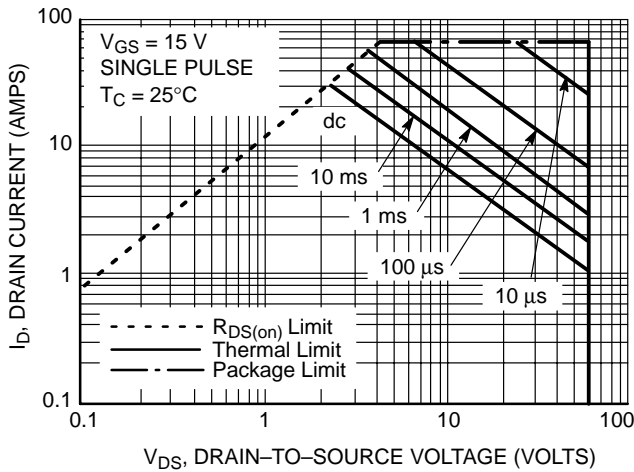


Figure 11. Maximum Rated Forward Biased Safe Operating Area

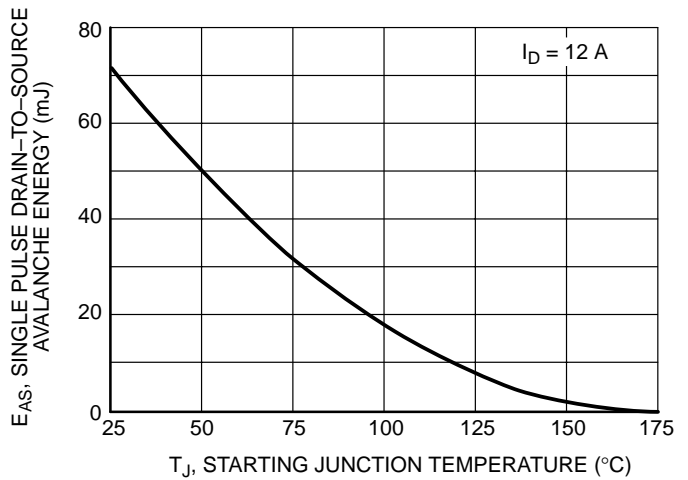


Figure 12. Maximum Avalanche Energy versus Starting Junction Temperature

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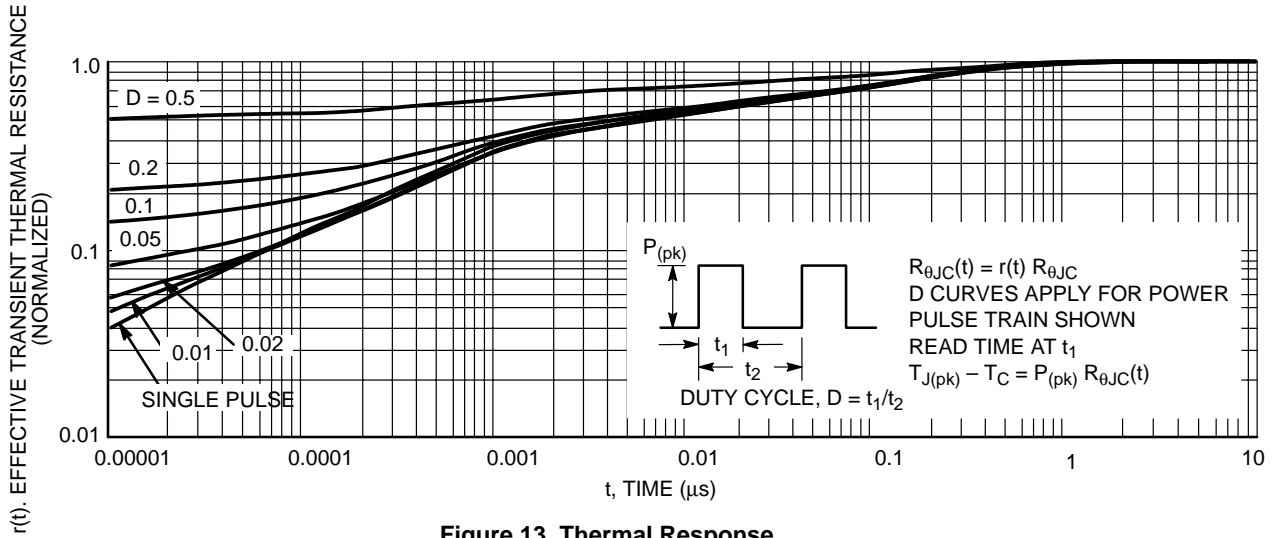


Figure 13. Thermal Response

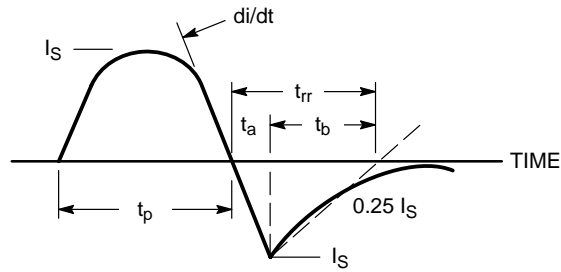


Figure 14. Diode Reverse Recovery Waveform

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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 |

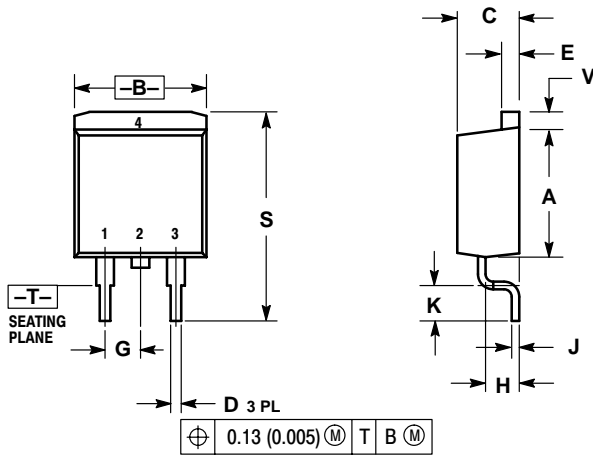
STYLE 5:

- PIN 1. GATE
- DRAIN

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PACKAGE DIMENSIONS

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

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