

MOSFET - Power, N-Channel

100 V, 76 A, 13 mΩ

NTB6410AN, NTP6410AN, NVB6410AN

Features

- Low $R_{DS(on)}$
- High Current Capability
- 100% Avalanche Tested
- NVB Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q101 Qualified and PPAP Capable
- These Devices are Pb-Free and are RoHS Compliant

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

| Parameter | Symbol | Value | Unit |
|---|----------------|---------------------------|------------------|
| Drain-to-Source Voltage | V_{DS} | 100 | V |
| Gate-to-Source Voltage – Continuous | V_{GS} | ± 20 | V |
| Continuous Drain Current $R_{\theta JC}$ | I_D | $T_C = 25^\circ\text{C}$ | A |
| | | $T_C = 100^\circ\text{C}$ | |
| Power Dissipation $R_{\theta JC}$ | P_D | 188 | W |
| Pulsed Drain Current | I_{DM} | 305 | A |
| Operating Junction and Storage Temperature Range | T_J, T_{stg} | -55 to $+175$ | $^\circ\text{C}$ |
| Source Current (Body Diode) | I_S | 76 | A |
| Single Pulse Drain-to-Source Avalanche Energy ($V_{DD} = 50$ Vdc, $V_{GS} = 10$ Vdc, $I_{L(pk)} = 57.7$ A, $L = 0.3$ mH, $R_G = 25$ Ω) | E_{AS} | 500 | mJ |
| Lead Temperature for Soldering Purposes, 1/8" from Case for 10 Seconds | T_L | 260 | $^\circ\text{C}$ |

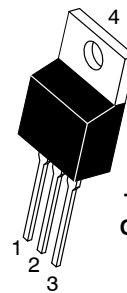
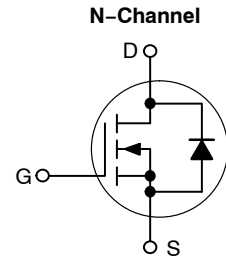
THERMAL RESISTANCE RATINGS

| Parameter | Symbol | Max | Unit |
|---------------------------------------|-----------------|-----|--------------------|
| Junction-to-Case (Drain) Steady State | $R_{\theta JC}$ | 0.8 | $^\circ\text{C/W}$ |
| Junction-to-Ambient (Note 1) | $R_{\theta JA}$ | 32 | |

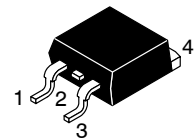
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. Surface mounted on FR4 board using 1 sq in pad size, (Cu Area 1.127 sq in [2 oz] including traces).

| $V_{(BR)DSS}$ | $R_{DS(ON)} \text{ MAX}$ | $I_D \text{ MAX}$ (Note 1) |
|---------------|--------------------------|-------------------------------|
| 100 V | 13 mΩ @ 10 V | 76 A |

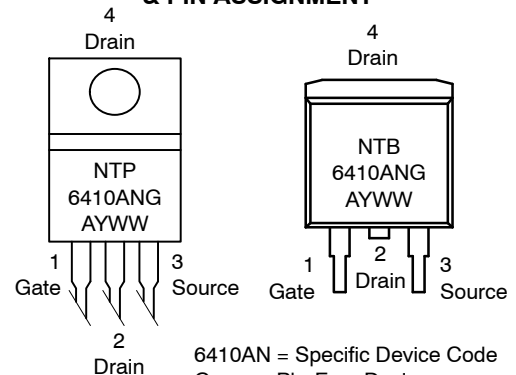


TO-220AB
CASE 221A
STYLE 5



D²PAK
CASE 418B
STYLE 2

MARKING DIAGRAM & PIN ASSIGNMENT



6410AN = Specific Device Code
 G = Pb-Free Device
 A = Assembly Location
 Y = Year
 WW = Work Week

ORDERING INFORMATION

See detailed ordering and shipping information on page 5 of this data sheet.

NTB6410AN, NTP6410AN, NVB6410AN

ELECTRICAL CHARACTERISTICS (T_J = 25°C Unless otherwise specified)

| Characteristics | Symbol | Test Condition | Min | Typ | Max | Unit |
|-----------------|--------|----------------|-----|-----|-----|------|
|-----------------|--------|----------------|-----|-----|-----|------|

OFF CHARACTERISTICS

| | | | | | | |
|---|--------------------------------------|---|------------------------|----|------|-------|
| Drain-to-Source Breakdown Voltage | V _{(BR)DSS} | V _{GS} = 0 V, I _D = 250 μA | 100 | | | V |
| Drain-to-Source Breakdown Voltage Temperature Coefficient | V _{(BR)DSS} /T _J | | | 94 | | mV/°C |
| Zero Gate Voltage Drain Current | I _{DSS} | V _{GS} = 0 V, V _{DS} = 100 V | T _J = 25°C | | 1.0 | μA |
| | | | T _J = 150°C | | 100 | |
| Gate-to-Source Leakage Current | I _{GSS} | V _{DS} = 0 V, V _{GS} = ±20 V | | | ±100 | nA |

ON CHARACTERISTICS (Note 2)

| | | | | | | |
|--|-------------------------------------|---|-----|-----|-----|-------|
| Gate Threshold Voltage | V _{GS(th)} | V _{GS} = V _{DS} , I _D = 250 μA | 2.0 | | 4.0 | V |
| Negative Threshold Temperature Coefficient | V _{GS(th)} /T _J | | | 9.0 | | mV/°C |
| Drain-to-Source On-Resistance | R _{DS(on)} | V _{GS} = 10 V, I _D = 76 A | | 11 | 13 | mΩ |
| | | V _{GS} = 10 V, I _D = 20 A | | 10 | 12 | |
| Forward Transconductance | g _{FS} | V _{DS} = 5 V, I _D = 20 A | | 40 | | S |

CHARGES, CAPACITANCES & GATE RESISTANCE

| | | | | | | |
|------------------------------|---------------------|--|--|------|--|----|
| Input Capacitance | C _{iss} | V _{DS} = 25 V, V _{GS} = 0 V, f = 1 MHz | | 4500 | | pF |
| Output Capacitance | C _{oss} | | | 650 | | |
| Reverse Transfer Capacitance | C _{rss} | | | 250 | | |
| Total Gate Charge | Q _{G(TOT)} | V _{GS} = 10 V, V _{DS} = 80 V, I _D = 76 A | | 120 | | nC |
| Threshold Gate Charge | Q _{G(TH)} | | | 5.2 | | |
| Gate-to-Source Charge | Q _{GS} | | | 20 | | |
| Gate-to-Drain Charge | Q _{GD} | | | 57 | | |
| Plateau Voltage | V _{GP} | | | 5.1 | | V |
| Gate Resistance | R _G | | | 2.4 | | Ω |

SWITCHING CHARACTERISTICS, V_{GS} = 10 V (Note 3)

| | | | | | | |
|---------------------|---------------------|--|--|-----|--|----|
| Turn-On Delay Time | t _{d(on)} | V _{GS} = 10 V, V _{DD} = 80 V, I _D = 76 A, R _G = 6.2 Ω | | 17 | | ns |
| Rise Time | t _r | | | 170 | | |
| Turn-Off Delay Time | t _{d(off)} | | | 120 | | |
| Fall Time | t _f | | | 190 | | |

DRAIN-SOURCE DIODE CHARACTERISTICS

| | | | | | | | |
|-------------------------|-----------------|--|------------------------|-----|-----|-----|----|
| Forward Diode Voltage | V _{SD} | I _S = 76 A | T _J = 25°C | | 1.0 | 1.3 | V |
| | | | T _J = 125°C | | 0.9 | | |
| Reverse Recovery Time | t _{rr} | V _{GS} = 0 V, I _S = 76 A, di _{SD} /dt = 100 A/μs | | 93 | | | ns |
| Charge Time | t _a | | | 69 | | | |
| Discharge Time | t _b | | | 24 | | | |
| Reverse Recovery Charge | Q _{RR} | | | 300 | | | nC |

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

2. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2%.

3. Switching characteristics are independent of operating junction temperatures.

NTB6410AN, NTP6410AN, NVB6410AN

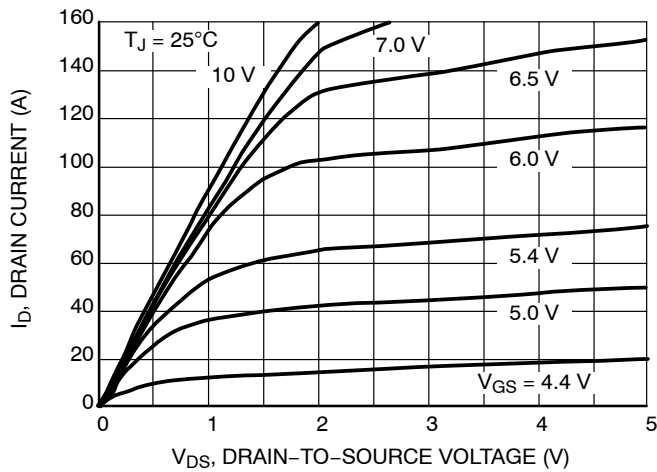


Figure 1. On-Region Characteristics

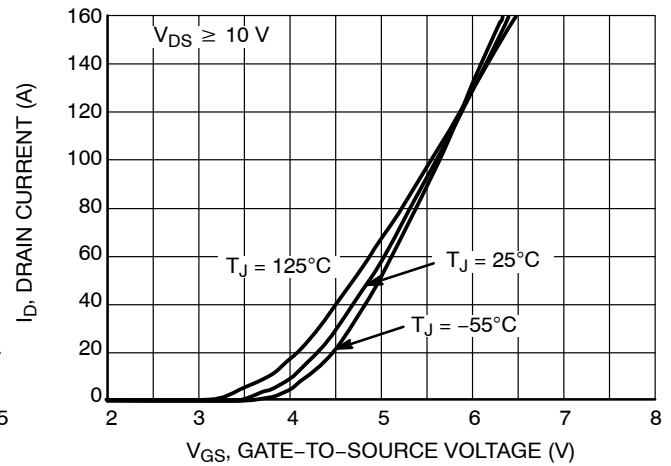


Figure 2. Transfer Characteristics

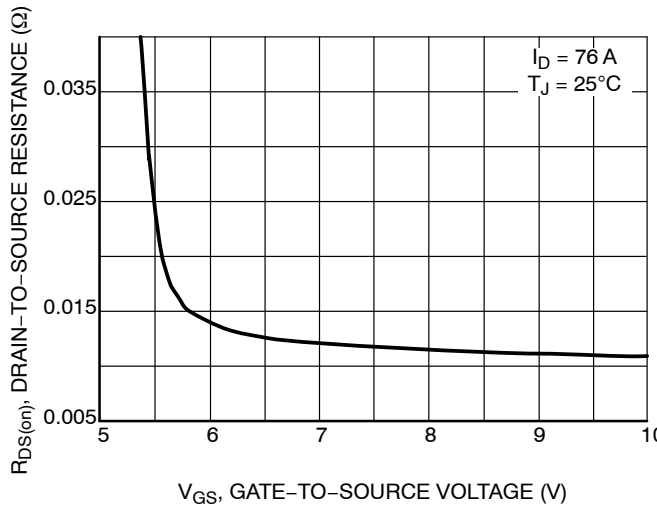


Figure 3. On-Region versus Gate Voltage

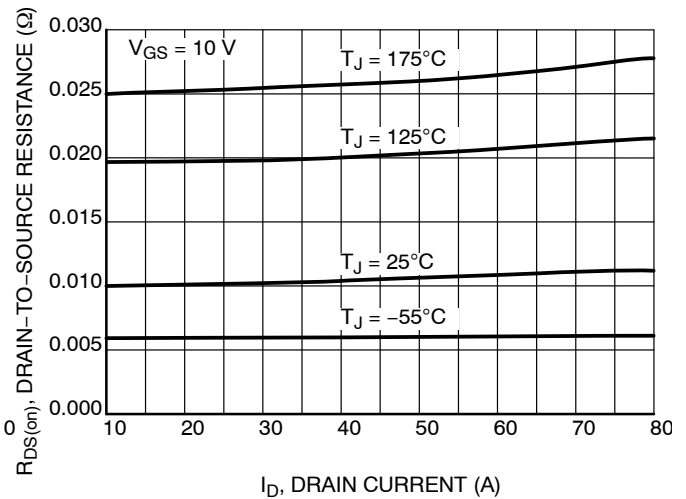


Figure 4. On-Region versus Drain Current and Gate Voltage

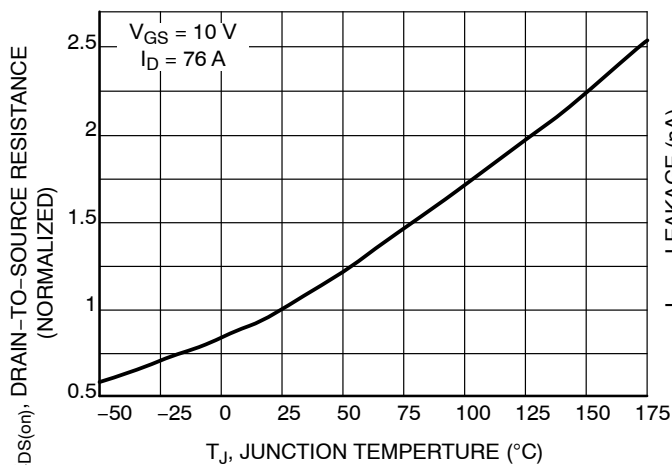


Figure 5. On-Resistance Variation with Temperature

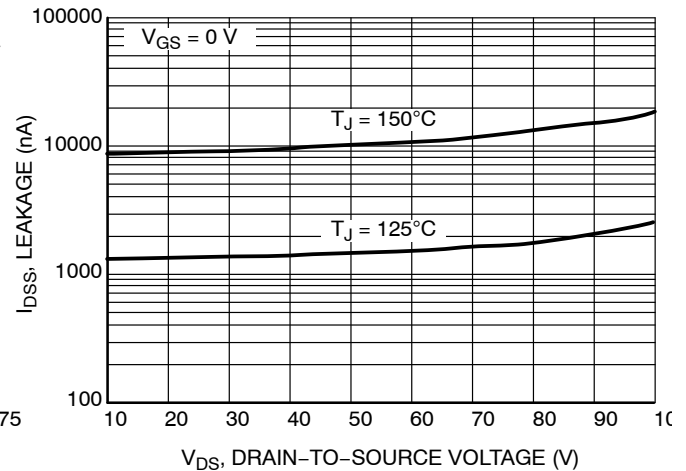


Figure 6. Drain-to-Source Leakage Current versus Voltage

NTB6410AN, NTP6410AN, NVB6410AN

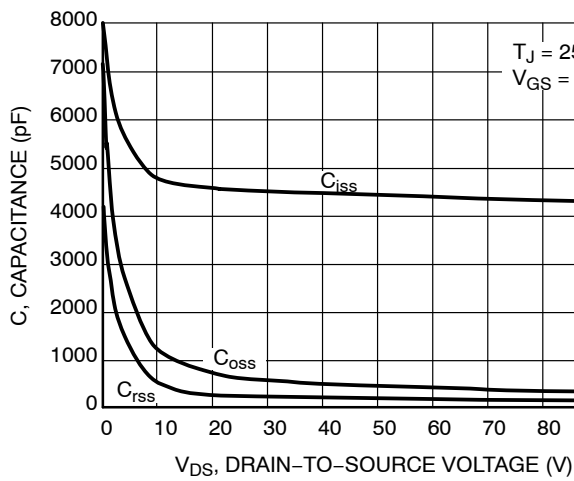


Figure 7. Capacitance Variation

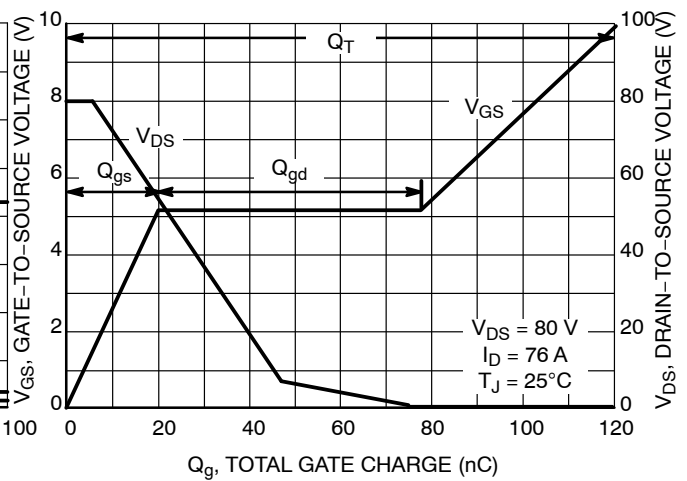


Figure 8. Gate-to-Source and Drain-to-Source Voltage versus Total Charge

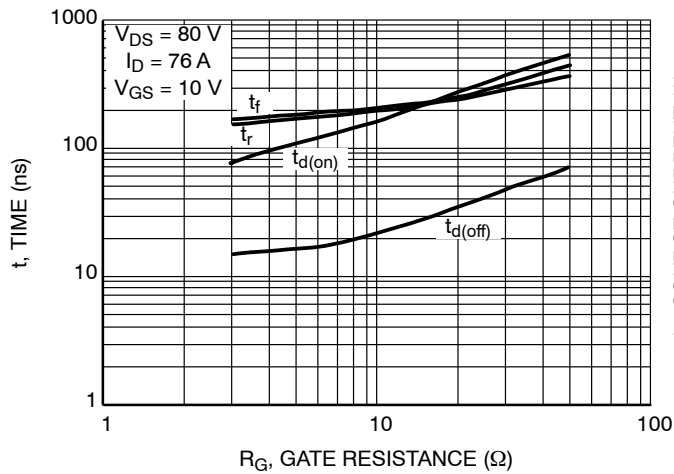


Figure 9. Resistive Switching Time Variation versus Gate Resistance

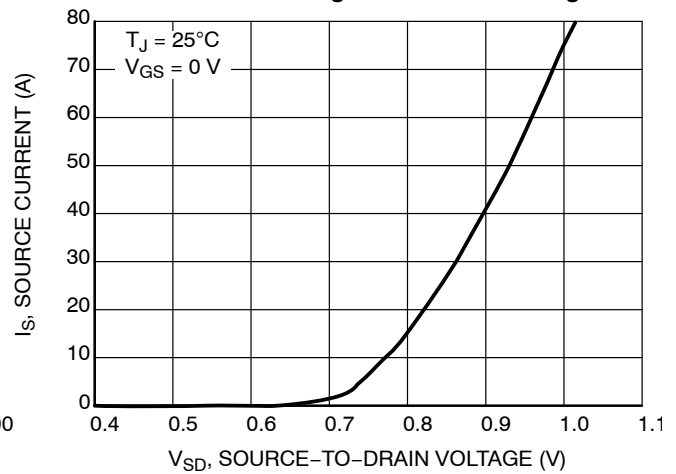


Figure 10. Diode Forward Voltage versus Current

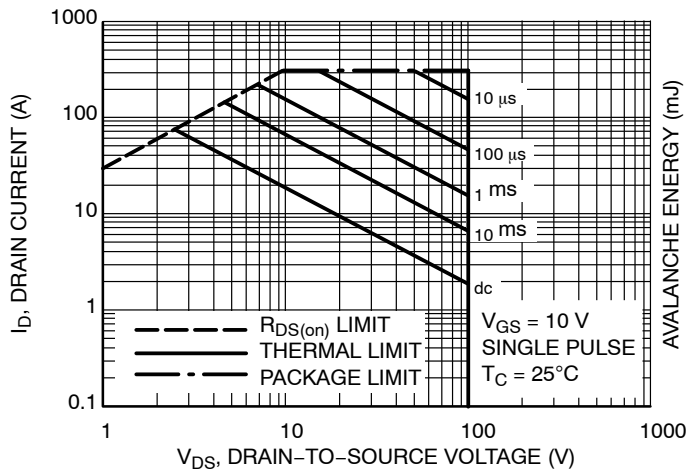


Figure 11. Maximum Rated Forward Biased Safe Operating Area

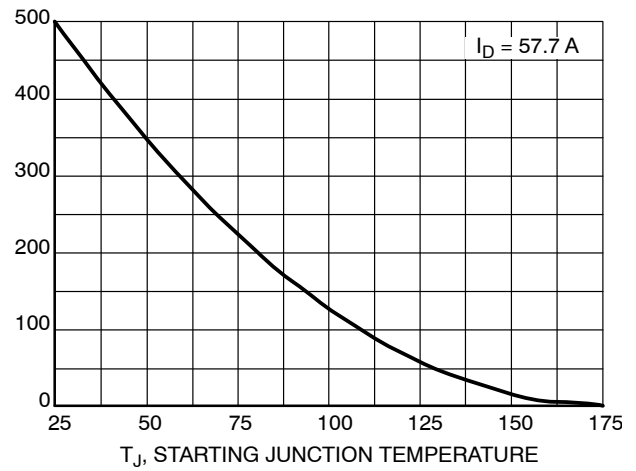


Figure 12. Maximum Avalanche Energy versus Starting Junction Temperature

NTB6410AN, NTP6410AN, NVB6410AN

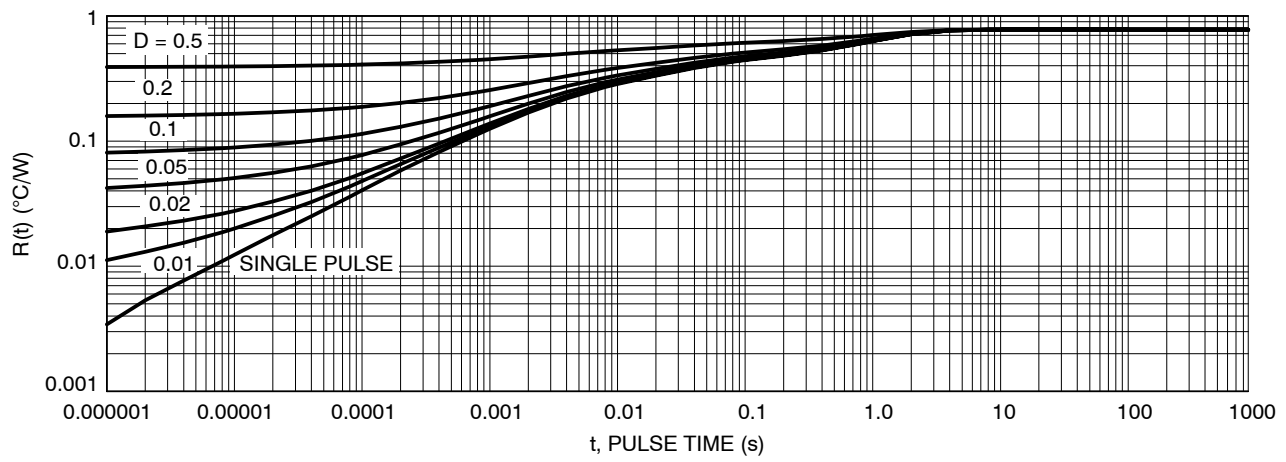


Figure 13. Thermal Response

ORDERING INFORMATION

| Device | Package | Shipping [†] |
|--------------|---------------------------------|-----------------------|
| NTB6410ANG | D ² PAK (Pb-Free) | 50 Units / Rail |
| NTB6410ANT4G | D ² PAK (Pb-Free) | 800 / Tape & Reel |
| NTP6410ANG | TO-220 (Pb-Free) | 50 Units / Rail |
| NVB6410ANT4G | D ² PAK (Pb-Free) | 800 / 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.

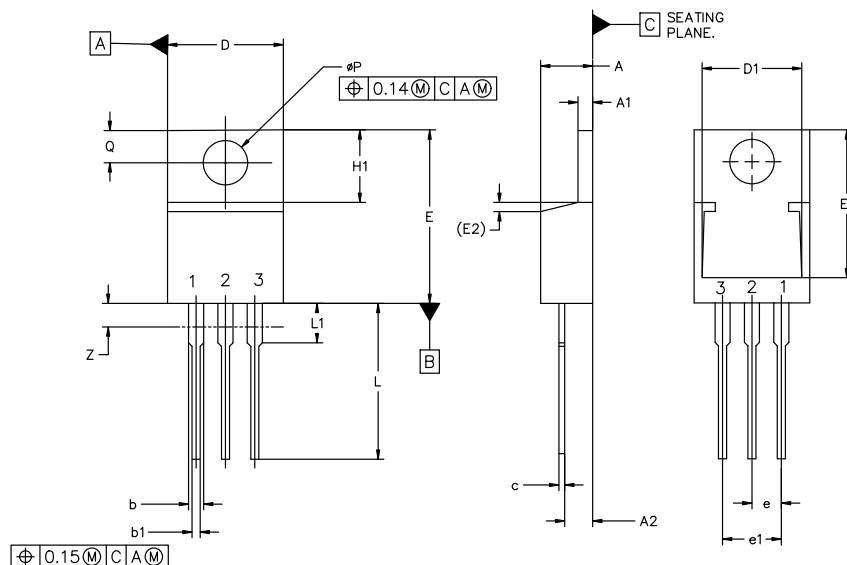


TO-220-3 10.10x15.12x4.45, 2.54P

CASE 221A

ISSUE AL

DATE 05 FEB 2025



| MILLIMETERS | | | |
|-------------|----------|-------|-------|
| DIM | MIN | NOM | MAX |
| A | 4.07 | 4.45 | 4.83 |
| A1 | 1.15 | 1.28 | 1.41 |
| A2 | 2.04 | 2.42 | 2.79 |
| b | 1.15 | 1.34 | 1.52 |
| b1 | 0.64 | 0.80 | 0.96 |
| c | 0.36 | 0.49 | 0.61 |
| D | 9.66 | 10.10 | 10.53 |
| D1 | 8.43 | 8.63 | 8.83 |
| E | 14.48 | 15.12 | 15.75 |
| E1 | 12.58 | 12.78 | 12.98 |
| E2 | 1.27 REF | | |

| MILLIMETERS | | | |
|-------------|-------|-------|-------|
| DIM | MIN | NOM | MAX |
| e | 2.42 | 2.54 | 2.66 |
| e1 | 4.83 | 5.08 | 5.33 |
| H1 | 5.97 | 6.22 | 6.47 |
| L | 12.70 | 13.49 | 14.27 |
| L1 | 2.80 | 3.45 | 4.10 |
| Q | 2.54 | 2.79 | 3.04 |
| øP | 3.60 | 3.85 | 4.09 |
| Z | --- | --- | 3.48 |

NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2018.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSION Z DEFINES A ZONE WHERE ALL BODY AND LEAD IRREGULARITIES ARE ALLOWED.

STYLE 1:
PIN 1. BASE
2. COLLECTOR
3. EMITTER
4. COLLECTOR

STYLE 2:
PIN 1. BASE
2. EMITTER
3. COLLECTOR
4. EMITTER

STYLE 3:
PIN 1. CATHODE
2. ANODE
3. GATE
4. ANODE

STYLE 4:
PIN 1. MAIN TERMINAL 1
2. MAIN TERMINAL 2
3. GATE
4. MAIN TERMINAL 2

STYLE 5:
PIN 1. GATE
2. DRAIN
3. SOURCE
4. DRAIN

STYLE 6:
PIN 1. ANODE
2. CATHODE
3. ANODE
4. CATHODE

STYLE 7:
PIN 1. CATHODE
2. ANODE
3. CATHODE
4. ANODE

STYLE 8:
PIN 1. CATHODE
2. ANODE
3. EXTERNAL TRIP/DELAY
4. ANODE

STYLE 9:
PIN 1. GATE
2. COLLECTOR
3. EMITTER
4. COLLECTOR

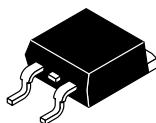
STYLE 10:
PIN 1. GATE
2. SOURCE
3. DRAIN
4. SOURCE

STYLE 11:
PIN 1. DRAIN
2. SOURCE
3. GATE
4. SOURCE

STYLE 12:
PIN 1. MAIN TERMINAL 1
2. MAIN TERMINAL 2
3. GATE
4. NOT CONNECTED

| | | |
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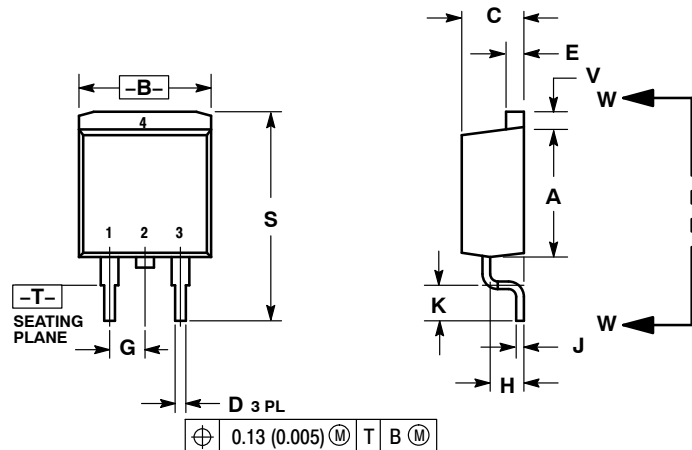
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D²PAK 3
CASE 418B-04
ISSUE L

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SCALE 1:1

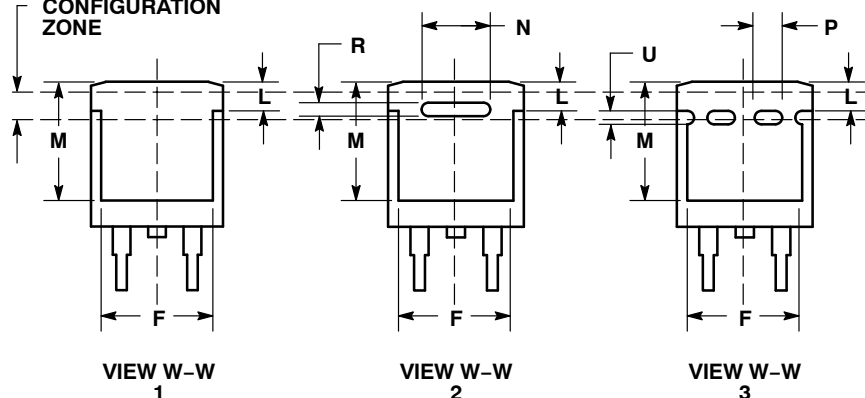


NOTES:

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 |

VARIABLE
CONFIGURATION
ZONE



STYLE 1:

- PIN 1. BASE
2. COLLECTOR
3. EMITTER
4. COLLECTOR

STYLE 2:

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

STYLE 3:

- PIN 1. ANODE
2. CATHODE
3. ANODE
4. CATHODE

STYLE 4:

- PIN 1. GATE
2. COLLECTOR
3. EMITTER
4. COLLECTOR

STYLE 5:

- PIN 1. CATHODE
2. ANODE
3. CATHODE
4. ANODE

STYLE 6:

- PIN 1. NO CONNECT
2. CATHODE
3. ANODE
4. CATHODE

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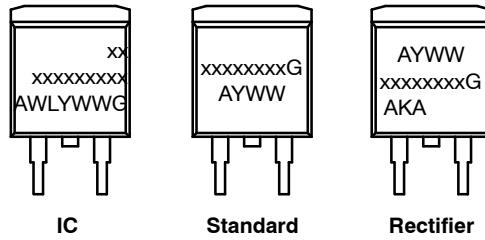
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CASE 418B-04
ISSUE L

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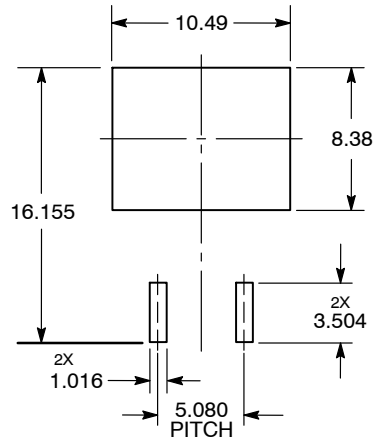
**GENERIC
MARKING DIAGRAM***



xx = Specific Device Code
A = Assembly Location
WL = Wafer Lot
Y = Year
WW = Work Week
G = Pb-Free Package
AKA = Polarity Indicator

*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "▪", may or may not be present. Some products may not follow the Generic Marking.

SOLDERING FOOTPRINT*



DIMENSIONS: MILLIMETERS

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

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