

NDF04N62Z, NDP04N62Z, NDD04N62Z

N-Channel Power MOSFET 620 V, 1.8 Ω

Features

- Low ON Resistance
- Low Gate Charge
- 100% Avalanche Tested
- These Devices are Pb-Free and RoHS Compliant

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

| Parameter | Symbol | NDF | NDP | NDD | Unit |
|---|--------------------|-----------------|-----|-----|------------------|
| Drain-to-Source Voltage | V_{DSS} | 620 | | | V |
| Continuous Drain Current $R_{\theta JC}$ | I_D | 4.4 (Note 2) | 4.4 | 4.1 | A |
| Continuous Drain Current $R_{\theta JC}, T_A = 100^\circ\text{C}$ | I_D | 2.8 (Note 2) | 2.8 | 2.6 | A |
| Pulsed Drain Current, $V_{GS} @ 10\text{V}$ | I_{DM} | 18 (Note 2) | 18 | 16 | A |
| Power Dissipation $R_{\theta JC}$ (Note 1) | P_D | 28 | 96 | 83 | W |
| Gate-to-Source Voltage | V_{GS} | ± 30 | | | V |
| Single Pulse Avalanche Energy, $I_D = 4.0\text{ A}$ | E_{AS} | 120 | | | mJ |
| ESD (HBM) (JESD22-A114) | V_{esd} | 3000 | | | V |
| RMS Isolation Voltage ($t = 0.3\text{ sec.}, R.H. \leq 30\%,$ $T_A = 25^\circ\text{C}$) (Figure 14) | V_{ISO} | 4500 | - | - | V |
| Peak Diode Recovery | dv/dt | 4.5 (Note 3) | | | V/ns |
| Continuous Source Current (Body Diode) | I_S | 4.0 | | | A |
| Maximum Temperature for Soldering Leads, 0.063" (1.6 mm) from Case for 10 s Package Body for 10 s | T_L T_{PKG} | 300 260 | | | $^\circ\text{C}$ |
| Operating Junction and Storage Temperature Range | T_J, T_{stg} | -55 to 150 | | | $^\circ\text{C}$ |

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

1. Surface mounted on FR4 board using 1" sq. pad size (Cu area = 1.127 in sq [2 oz] including traces).
2. Limited by maximum junction temperature
3. $I_{SD} = 4.0\text{ A}$, $di/dt \leq 100\text{ A}/\mu\text{s}$, $V_{DD} \leq BV_{DSS}$, $T_J = +150^\circ\text{C}$

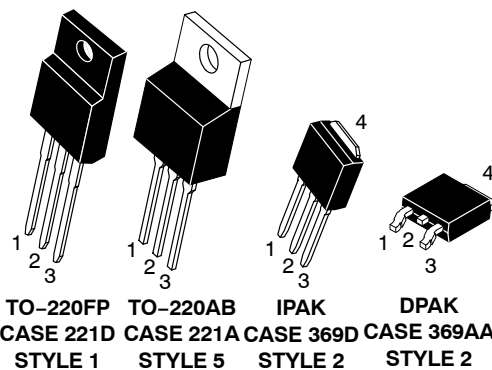
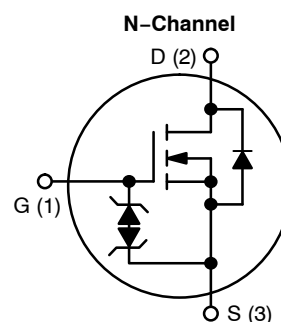
This document contains information on some products that are still under development. ON Semiconductor reserves the right to change or discontinue these products without notice.



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| V_{DSS} | $R_{DS(ON)}$ (TYP) @ 2 A |
|-----------|--------------------------|
| 620 V | 1.8 Ω |



ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 6 of this data sheet.

NDF04N62Z, NDP04N62Z, NDD04N62Z

THERMAL RESISTANCE

| Parameter | Symbol | Value | Unit |
|----------------------------------|----------------------|-------|------|
| Junction-to-Case (Drain) | NDP04N62Z | 1.3 | °C/W |
| | NDF04N62Z | 4.4 | |
| | NDD04N62Z | 1.5 | |
| Junction-to-Ambient Steady State | (Note 4) NDP04N62Z | 50 | |
| | (Note 4) NDF04N62Z | 50 | |
| | (Note 1) NDD04N62Z | 38 | |
| | (Note 4) NDD04N62Z-1 | 80 | |

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

| Characteristic | Test Conditions | Symbol | Min | Typ | Max | Unit |
|----------------|-----------------|--------|-----|-----|-----|------|
|----------------|-----------------|--------|-----|-----|-----|------|

OFF CHARACTERISTICS

| | | | | | | |
|---|--|---|-------|-----|-----|------|
| Drain-to-Source Breakdown Voltage | V _{GS} = 0 V, I _D = 1 mA | BV _{DSS} | 620 | | | V |
| Breakdown Voltage Temperature Coefficient | Reference to 25°C, I _D = 1 mA | ΔBV _{DSS} / ΔT _J | | 0.6 | | V/°C |
| Drain-to-Source Leakage Current | V _{DS} = 620 V, V _{GS} = 0 V | I _{DSS} | 25°C | | 1 | μA |
| | | | 125°C | | 50 | |
| Gate-to-Source Forward Leakage | V _{GS} = ±20 V | I _{GSS} | | | ±10 | μA |

ON CHARACTERISTICS (Note 5)

| | | | | | | |
|--------------------------------------|--|---------------------|-----|-----|-----|---|
| Static Drain-to-Source On-Resistance | V _{GS} = 10 V, I _D = 2.0 A | R _{DS(on)} | | 1.8 | 2.0 | Ω |
| Gate Threshold Voltage | V _{DS} = V _{GS} , I _D = 50 μA | V _{GS(th)} | 3.0 | | 4.5 | V |
| Forward Transconductance | V _{DS} = 15 V, I _D = 2.0 A | g _{FS} | | 3.3 | | S |

DYNAMIC CHARACTERISTICS

| | | | | | | |
|---------------------------------|--|------------------|--|-----|--|----|
| Input Capacitance | V _{DS} = 25 V, V _{GS} = 0 V, f = 1.0 MHz | C _{iss} | | 535 | | pF |
| Output Capacitance | | C _{oss} | | 62 | | |
| Reverse Transfer Capacitance | | C _{rss} | | 14 | | |
| Total Gate Charge | V _{DD} = 310 V, I _D = 4.0 A, V _{GS} = 10 V | Q _g | | 19 | | nC |
| Gate-to-Source Charge | | Q _{gs} | | 3.9 | | |
| Gate-to-Drain ("Miller") Charge | | Q _{gd} | | 10 | | |
| Plateau Voltage | | V _{GP} | | 6.4 | | V |
| Gate Resistance | | R _g | | 4.7 | | Ω |

RESISTIVE SWITCHING CHARACTERISTICS

| | | | | | | |
|---------------------|--|---------------------|--|----|--|----|
| Turn-On Delay Time | V _{DD} = 310 V, I _D = 4.0 A, V _{GS} = 10 V, R _G = 5 Ω | t _{d(on)} | | 12 | | ns |
| Rise Time | | t _r | | 13 | | |
| Turn-Off Delay Time | | t _{d(off)} | | 25 | | |
| Fall Time | | t _f | | 14 | | |

SOURCE-DRAIN DIODE CHARACTERISTICS (T_C = 25°C unless otherwise noted)

| | | | | | | |
|-------------------------|---|-----------------|--|-----|-----|----|
| Diode Forward Voltage | I _S = 4.0 A, V _{GS} = 0 V | V _{SD} | | | 1.6 | V |
| Reverse Recovery Time | V _{GS} = 0 V, V _{DD} = 30 V I _S = 4.0 A, di/dt = 100 A/μs | t _{rr} | | 285 | | ns |
| Reverse Recovery Charge | | Q _{rr} | | 1.3 | | μC |

4. Insertion mounted

5. Pulse Width ≤ 380 μs, Duty Cycle ≤ 2%.

TYPICAL CHARACTERISTICS

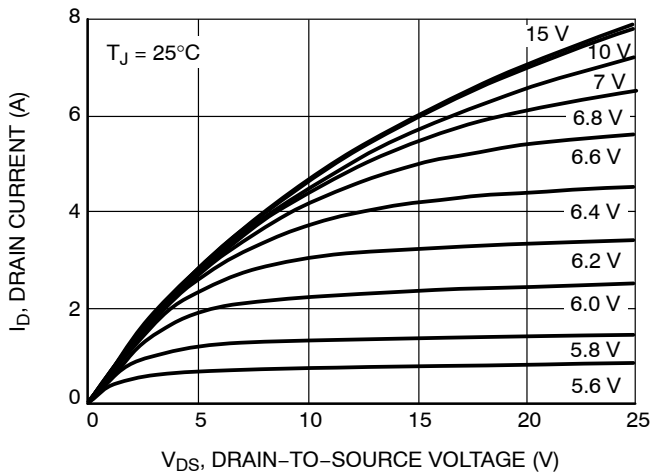


Figure 1. On-Region Characteristics

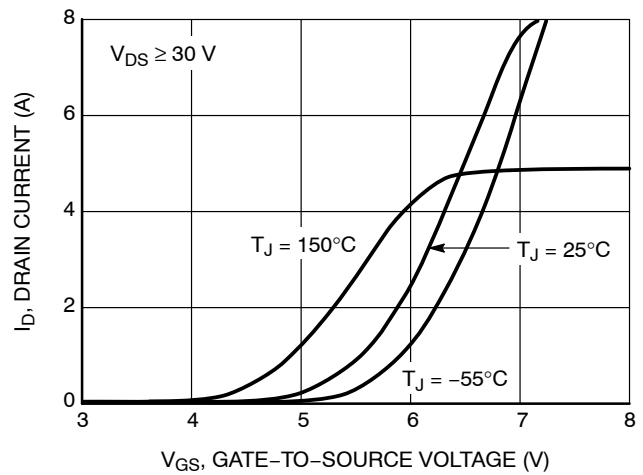


Figure 2. Transfer Characteristics

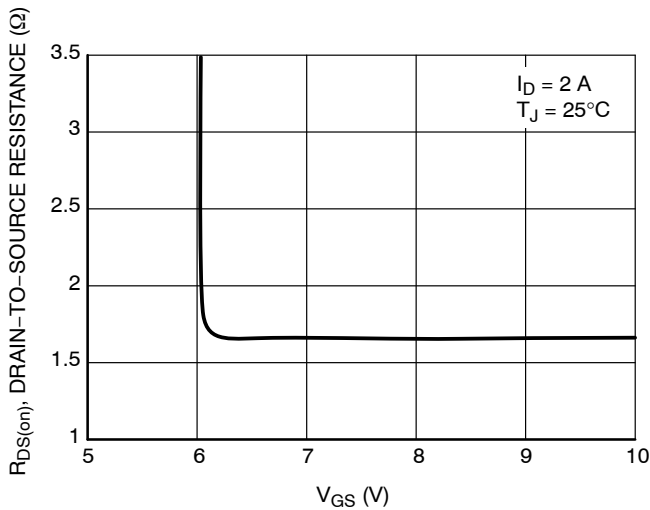


Figure 3. On-Resistance vs. Gate Voltage

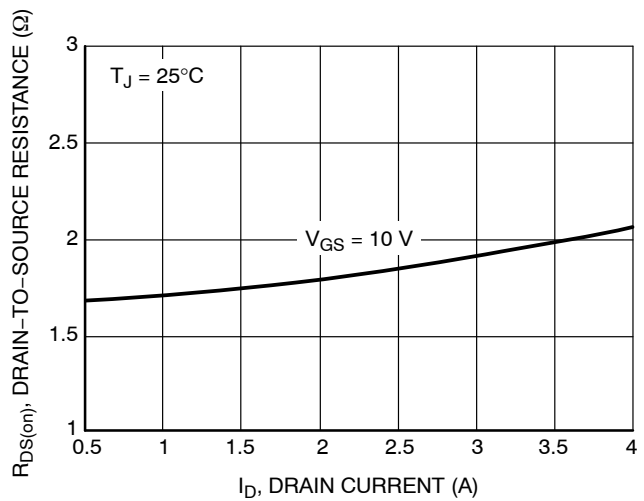


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

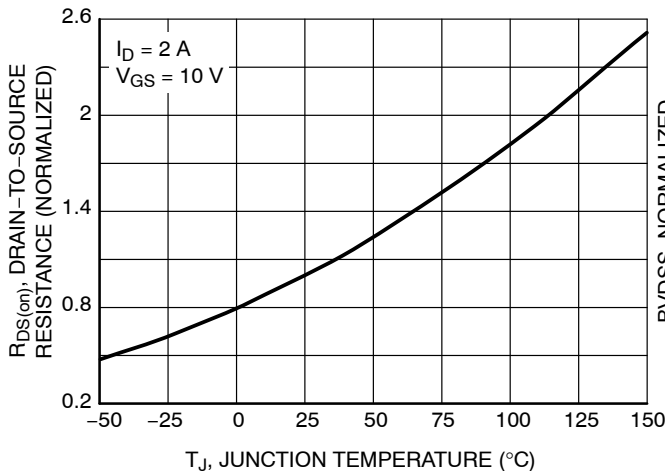


Figure 5. On-Resistance Variation with Temperature

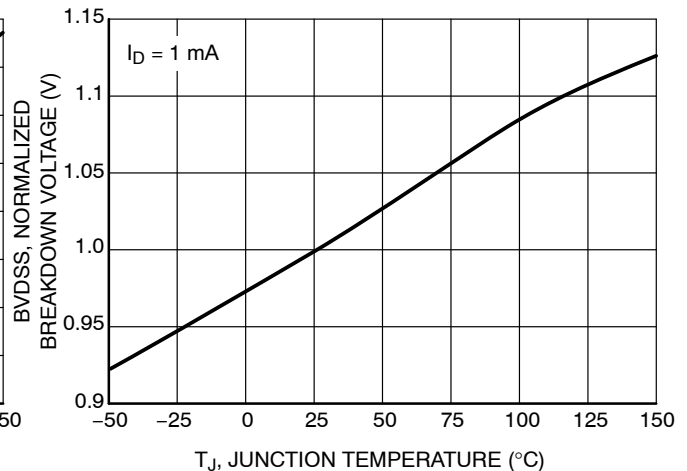


Figure 6. BVDSS Variation with Temperature

TYPICAL CHARACTERISTICS

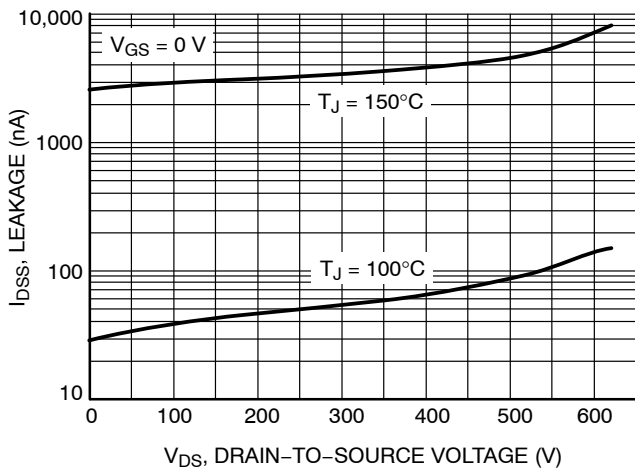


Figure 7. Drain-to-Source Leakage Current vs. Voltage

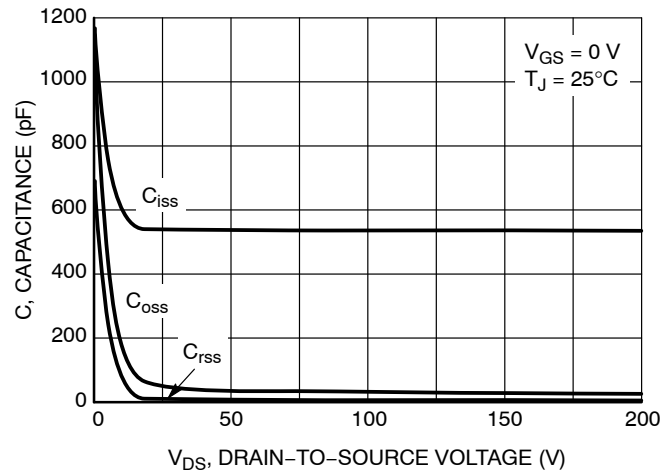


Figure 8. Capacitance Variation

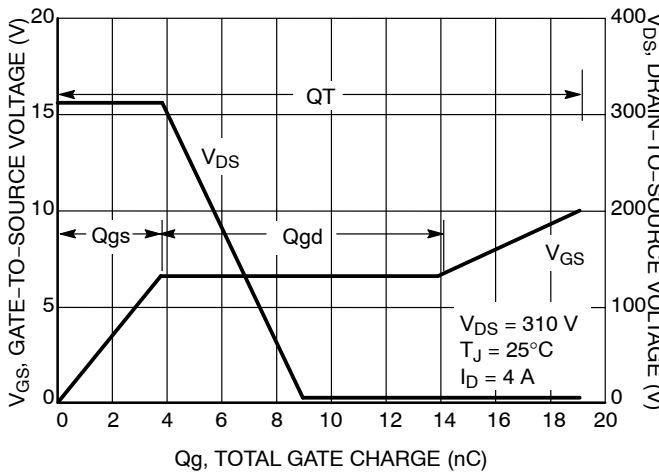


Figure 9. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge

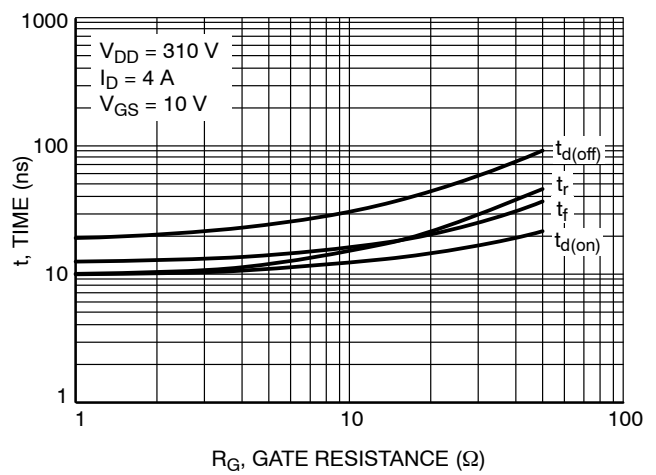


Figure 10. Resistive Switching Time Variation vs. Gate Resistance

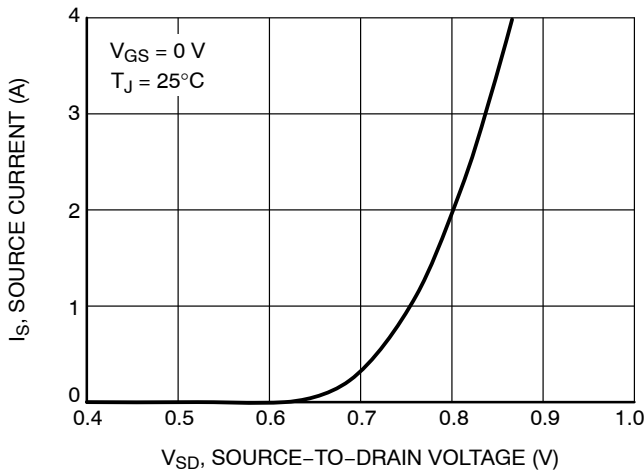


Figure 11. Diode Forward Voltage vs. Current

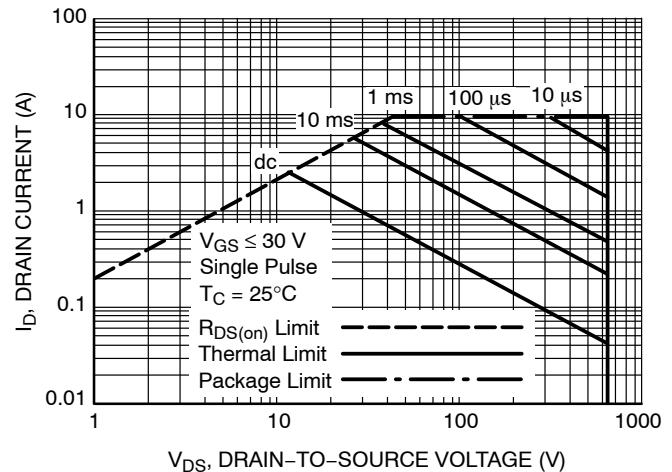


Figure 12. Maximum Rated Forward Biased Safe Operating Area for NDF04N62Z

TYPICAL CHARACTERISTICS

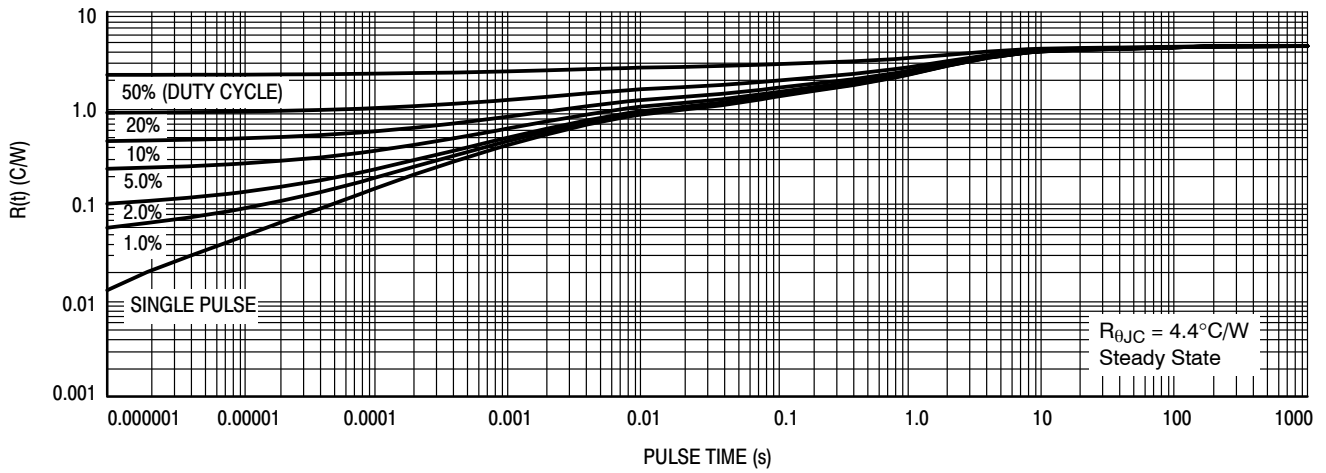


Figure 13. Thermal Impedance for NDF04N62Z

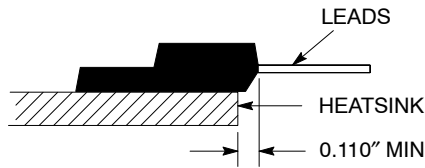


Figure 14. Isolation Test Diagram

Measurement made between leads and heatsink with all leads shorted together.

*For additional mounting information, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

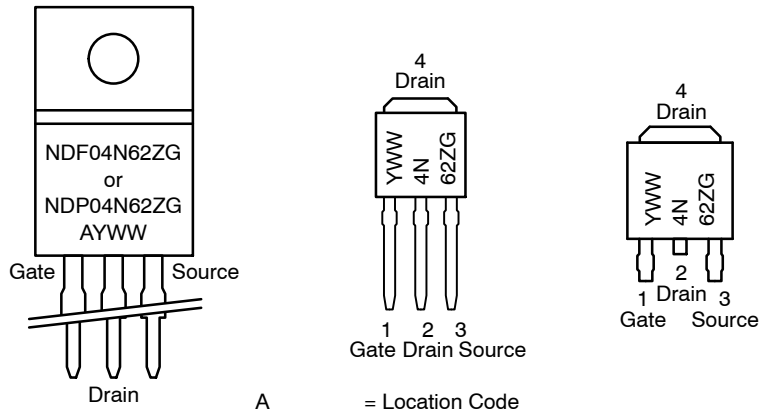
NDF04N62Z, NDP04N62Z, NDD04N62Z

ORDERING INFORMATION

| Order Number | Package | Shipping† |
|--------------|-----------------------|--|
| NDF04N62ZG | TO-220FP (Pb-Free) | 50 Units / Rail |
| NDP04N62ZG | TO-220AB (Pb-Free) | 50 Units / Rail (In Development) |
| NDD04N62Z-1G | IPAK (Pb-Free) | 75 Units / Rail (In Development) |
| NDD04N62ZT4G | DPAK (Pb-Free) | 2500 / Tape & Reel (In Development) |

†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.

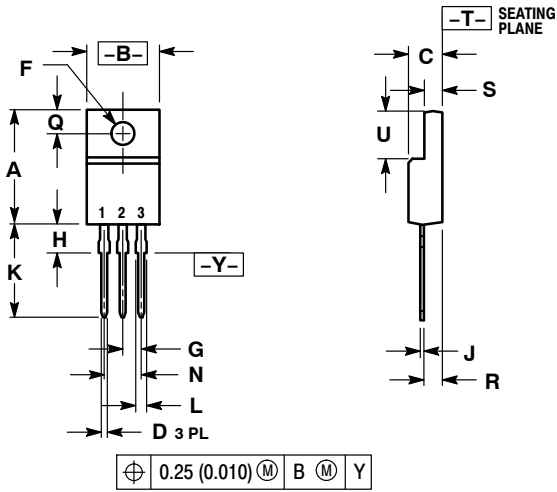
MARKING DIAGRAMS



A = Location Code
 Y = Year
 WW = Work Week
 G = Pb-Free Package

PACKAGE DIMENSIONS

TO-220 FULLPAK
CASE 221D-03
ISSUE J

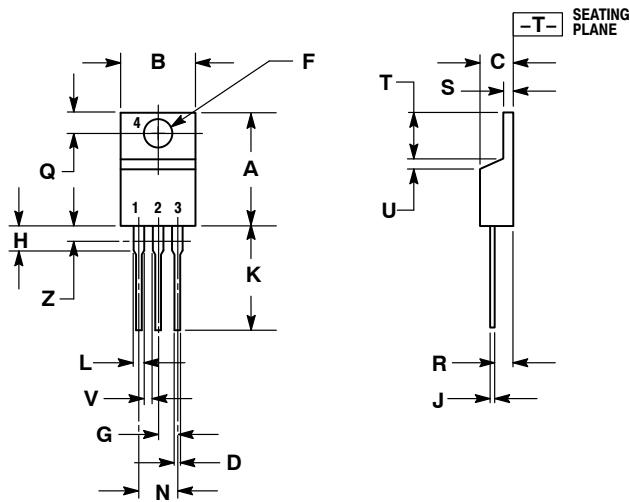


- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
 2. CONTROLLING DIMENSION: INCH
 3. 221D-01 THRU 221D-02 OBSOLETE, NEW STANDARD 221D-03.

| DIM | INCHES | | MILLIMETERS | |
|-----|-----------|-------|-------------|-------|
| | MIN | MAX | MIN | MAX |
| A | 0.617 | 0.635 | 15.67 | 16.12 |
| B | 0.392 | 0.419 | 9.96 | 10.63 |
| C | 0.177 | 0.193 | 4.50 | 4.90 |
| D | 0.024 | 0.039 | 0.60 | 1.00 |
| F | 0.116 | 0.129 | 2.95 | 3.28 |
| G | 0.100 BSC | | 2.54 BSC | |
| H | 0.118 | 0.135 | 3.00 | 3.43 |
| J | 0.018 | 0.025 | 0.45 | 0.63 |
| K | 0.503 | 0.541 | 12.78 | 13.73 |
| L | 0.048 | 0.058 | 1.23 | 1.47 |
| N | 0.200 BSC | | 5.08 BSC | |
| Q | 0.122 | 0.138 | 3.10 | 3.50 |
| R | 0.099 | 0.117 | 2.51 | 2.96 |
| S | 0.092 | 0.113 | 2.34 | 2.87 |
| U | 0.239 | 0.271 | 6.06 | 6.88 |

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

TO-220AB
CASE 221A-09
ISSUE AE



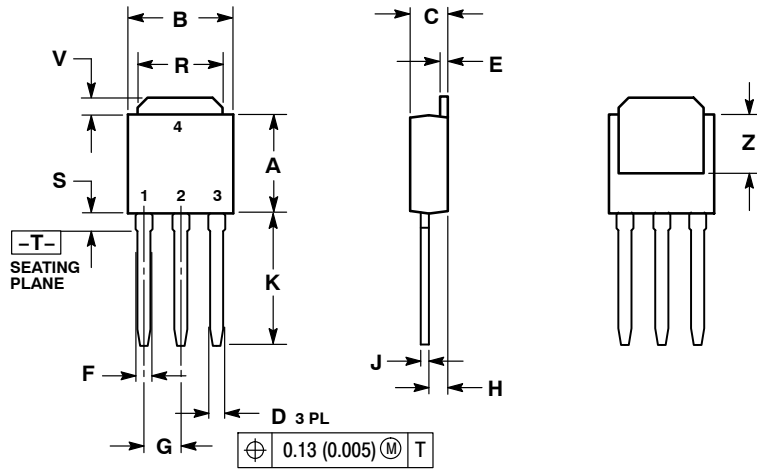
- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
 2. CONTROLLING DIMENSION: INCH.
 3. DIMENSION Z DEFINES A ZONE WHERE ALL BODY AND LEAD IRREGULARITIES ARE ALLOWED.

| 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 | 0.161 | 3.61 | 4.09 |
| G | 0.095 | 0.105 | 2.42 | 2.66 |
| H | 0.110 | 0.155 | 2.80 | 3.93 |
| J | 0.014 | 0.025 | 0.36 | 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

IPAK
CASE 369D-01
ISSUE B



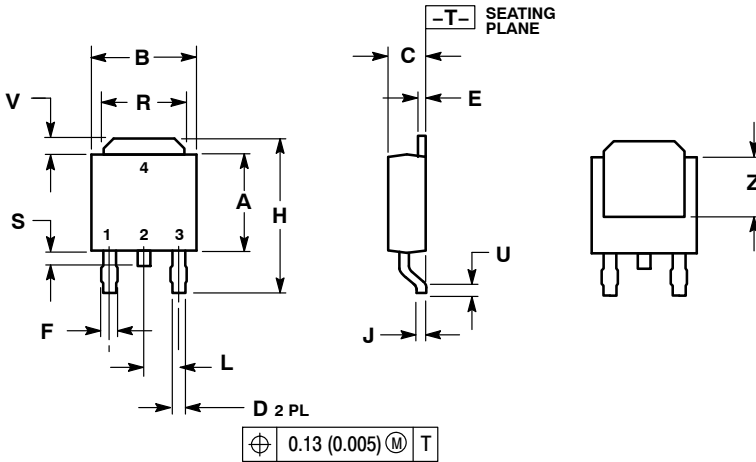
- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.

| DIM | INCHES | | MILLIMETERS | |
|-----|-----------|-------|-------------|------|
| | MIN | MAX | MIN | MAX |
| A | 0.235 | 0.245 | 5.97 | 6.35 |
| B | 0.250 | 0.265 | 6.35 | 6.73 |
| C | 0.086 | 0.094 | 2.19 | 2.38 |
| D | 0.027 | 0.035 | 0.69 | 0.88 |
| E | 0.018 | 0.023 | 0.46 | 0.58 |
| F | 0.037 | 0.045 | 0.94 | 1.14 |
| G | 0.090 BSC | | 2.29 BSC | |
| H | 0.034 | 0.040 | 0.87 | 1.01 |
| J | 0.018 | 0.023 | 0.46 | 0.58 |
| K | 0.350 | 0.380 | 8.89 | 9.65 |
| R | 0.180 | 0.215 | 4.45 | 5.45 |
| S | 0.025 | 0.040 | 0.63 | 1.01 |
| V | 0.035 | 0.050 | 0.89 | 1.27 |
| Z | 0.155 | --- | 3.93 | --- |

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

PACKAGE DIMENSIONS

DPAK
CASE 369AA-01
ISSUE A

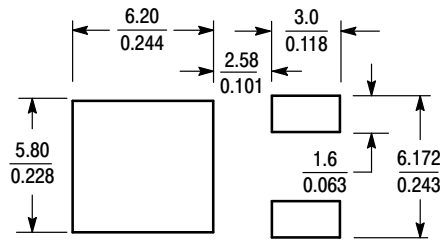


- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.

| DIM | INCHES | | MILLIMETERS | |
|-----|-----------|-------|-------------|-------|
| | MIN | MAX | MIN | MAX |
| A | 0.235 | 0.245 | 5.97 | 6.22 |
| B | 0.250 | 0.265 | 6.35 | 6.73 |
| C | 0.086 | 0.094 | 2.19 | 2.38 |
| D | 0.025 | 0.035 | 0.63 | 0.89 |
| E | 0.018 | 0.024 | 0.46 | 0.61 |
| F | 0.030 | 0.045 | 0.77 | 1.14 |
| H | 0.386 | 0.410 | 9.80 | 10.40 |
| J | 0.018 | 0.023 | 0.46 | 0.58 |
| L | 0.090 BSC | | 2.29 BSC | |
| R | 0.180 | 0.215 | 4.57 | 5.45 |
| S | 0.024 | 0.040 | 0.60 | 1.01 |
| U | 0.020 | --- | 0.51 | --- |
| V | 0.035 | 0.050 | 0.89 | 1.27 |
| Z | 0.155 | --- | 3.93 | --- |

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

SOLDERING FOOTPRINT*



SCALE 3:1 (mm/inches)

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

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