

NDF08N60Z

N-Channel Power MOSFET 600 V, 0.95 Ω

Features

- Low ON Resistance
- Low Gate Charge
- ESD Diode-Protected Gate
- 100% Avalanche Tested
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

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

| Rating | Symbol | NDF08N60Z | Unit |
|---|----------------|------------|------------------|
| Drain-to-Source Voltage | V_{DSS} | 600 | V |
| Continuous Drain Current $R_{\theta JC}$ (Note 1) | I_D | 8.4 | A |
| Continuous Drain Current $R_{\theta JC}$ $T_A = 100^\circ\text{C}$ (Note 1) | I_D | 5.3 | A |
| Pulsed Drain Current, $V_{GS} @ 10\text{ V}$ | I_{DM} | 30 | A |
| Power Dissipation | P_D | 36 | W |
| Gate-to-Source Voltage | V_{GS} | ± 30 | V |
| Single Pulse Avalanche Energy, $I_D = 7.5\text{ A}$ | E_{AS} | 235 | mJ |
| ESD (HBM) (JESD 22-A114) | V_{esd} | 4000 | 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 (Note 2) | dv/dt | 4.5 | V/ns |
| Continuous Source Current (Body Diode) | I_S | 7.5 | A |
| Maximum Temperature for Soldering Leads | T_L | 260 | $^\circ\text{C}$ |
| Operating Junction and Storage Temperature Range | T_J, T_{stg} | -55 to 150 | $^\circ\text{C}$ |

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.

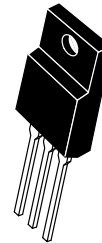
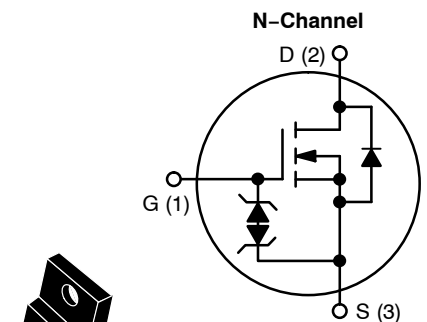
1. Limited by maximum junction temperature
2. $I_D \leq 7.5\text{ A}$, $di/dt \leq 200\text{ A}/\mu\text{s}$, $V_{DD} \leq BV_{DSS}$, $T_J \leq 150^\circ\text{C}$.



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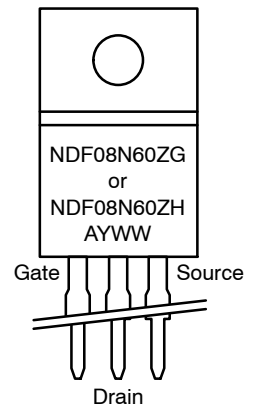
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| V_{DSS} | $R_{DS(ON)} (MAX) @ 3.5\text{ A}$ |
|-----------|-----------------------------------|
| 600 V | 0.95 Ω |



NDF08N60ZG,
NDF08N60ZH
TO-220FP
CASE 221AH

MARKING DIAGRAM



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

ORDERING INFORMATION

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

NDF08N60Z

THERMAL RESISTANCE

| Parameter | Symbol | NDF08N60Z | Unit |
|---|-----------------|-----------|------|
| Junction-to-Case (Drain) | $R_{\theta JC}$ | 3.5 | °C/W |
| Junction-to-Ambient Steady State (Note 3) | $R_{\theta JA}$ | 50 | |

3. Insertion mounted

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

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

OFF CHARACTERISTICS

| | | | | | | |
|---|--|------------------------------|-------|-----|-----|------|
| Drain-to-Source Breakdown Voltage | $V_{GS} = 0\text{ V}, I_D = 1\text{ mA}$ | BV_{DSS} | 600 | | | V |
| Breakdown Voltage Temperature Coefficient | Reference to 25°C , $I_D = 1\text{ mA}$ | $\Delta BV_{DSS}/\Delta T_J$ | | 0.6 | | V/°C |
| Drain-to-Source Leakage Current | $V_{DS} = 600\text{ V}, V_{GS} = 0\text{ V}$ | I_{DSS} | 25°C | | 1 | μA |
| | | | 125°C | | 50 | |
| Gate-to-Source Forward Leakage | $V_{GS} = \pm 20\text{ V}$ | I_{GSS} | | | ±10 | μA |

ON CHARACTERISTICS (Note 4)

| | | | | | | |
|--------------------------------------|---|--------------|-----|------|------|---|
| Static Drain-to-Source On-Resistance | $V_{GS} = 10\text{ V}, I_D = 3.5\text{ A}$ | $R_{DS(on)}$ | | 0.82 | 0.95 | Ω |
| Gate Threshold Voltage | $V_{DS} = V_{GS}, I_D = 100\text{ }\mu\text{A}$ | $V_{GS(th)}$ | 3.0 | 3.9 | 4.5 | V |
| Forward Transconductance | $V_{DS} = 15\text{ V}, I_D = 3.5\text{ A}$ | g_{FS} | | 6.3 | | S |

DYNAMIC CHARACTERISTICS

| | | | | | | |
|--|--|-----------|-----|------|------|----|
| Input Capacitance (Note 5) | $V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V},$ $f = 1.0\text{ MHz}$ | C_{iss} | 913 | 1140 | 1370 | pF |
| Output Capacitance (Note 5) | | C_{oss} | 105 | 129 | 160 | |
| Reverse Transfer Capacitance (Note 5) | | C_{rss} | 20 | 30 | 40 | |
| Total Gate Charge (Note 5) | $V_{DD} = 300\text{ V}, I_D = 7.5\text{ A},$ $V_{GS} = 10\text{ V}$ | Q_g | 20 | 39 | 58 | nC |
| Gate-to-Source Charge (Note 5) | | Q_{gs} | 4 | 7.5 | 11.5 | |
| Gate-to-Drain ("Miller") Charge (Note 5) | | Q_{gd} | 10 | 21 | 31 | |
| Plateau Voltage | | V_{GP} | | 6.2 | | V |
| Gate Resistance | | R_g | | 1.6 | | Ω |

RESISTIVE SWITCHING CHARACTERISTICS

| | | | | | | |
|---------------------|---|--------------|--|----|--|----|
| Turn-On Delay Time | $V_{DD} = 300\text{ V}, I_D = 7.5\text{ A},$ $V_{GS} = 10\text{ V}, R_G = 5\text{ }\Omega$ | $t_{d(on)}$ | | 14 | | ns |
| Rise Time | | t_r | | 22 | | |
| Turn-Off Delay Time | | $t_{d(off)}$ | | 36 | | |
| Fall Time | | t_f | | 15 | | |

SOURCE-DRAIN DIODE CHARACTERISTICS ($T_C = 25^\circ\text{C}$ unless otherwise noted)

| | | | | | | |
|-------------------------|---|----------|--|-----|-----|----|
| Diode Forward Voltage | $I_S = 7.5\text{ A}, V_{GS} = 0\text{ V}$ | V_{SD} | | | 1.6 | V |
| Reverse Recovery Time | $V_{GS} = 0\text{ V}, V_{DD} = 30\text{ V}$ $I_S = 7.5\text{ A}, di/dt = 100\text{ A}/\mu\text{s}$ | t_{rr} | | 320 | | ns |
| Reverse Recovery Charge | | Q_{rr} | | 2.2 | | μC |

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.

4. Pulse Width $\leq 380\text{ }\mu\text{s}$, Duty Cycle $\leq 2\%$.

5. Guaranteed by design.

TYPICAL CHARACTERISTICS

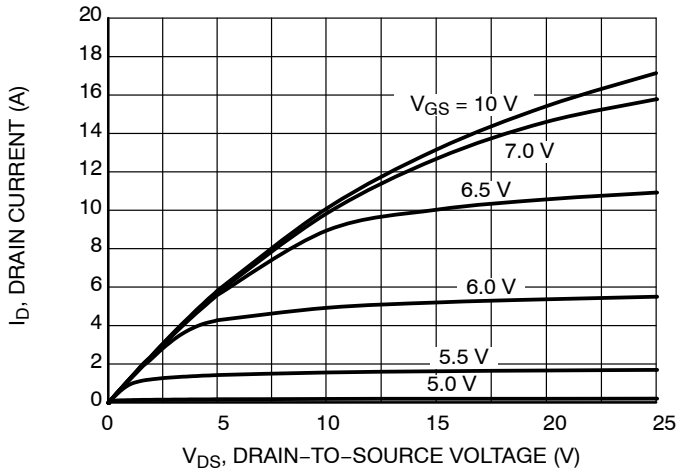


Figure 1. On-Region Characteristics

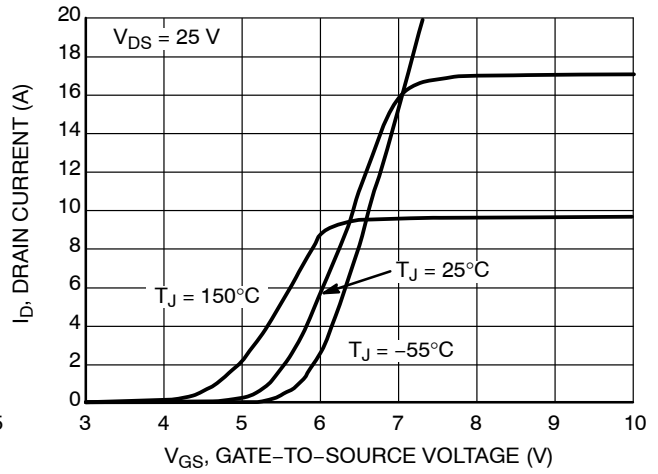


Figure 2. Transfer Characteristics

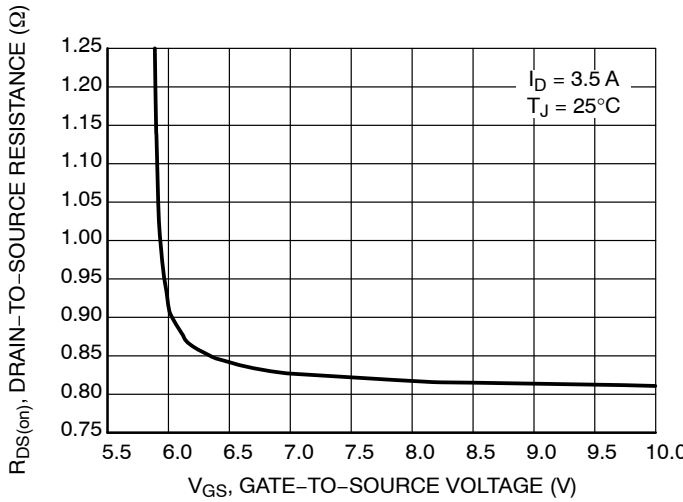


Figure 3. On-Region versus Gate-to-Source Voltage

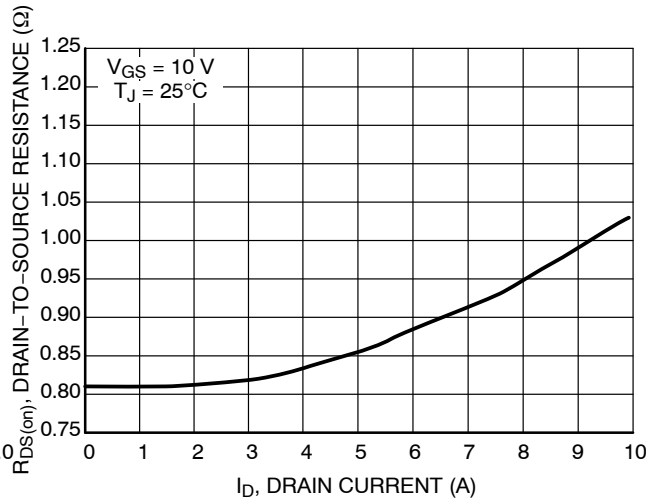


Figure 4. On-Resistance versus Drain Current and Gate Voltage

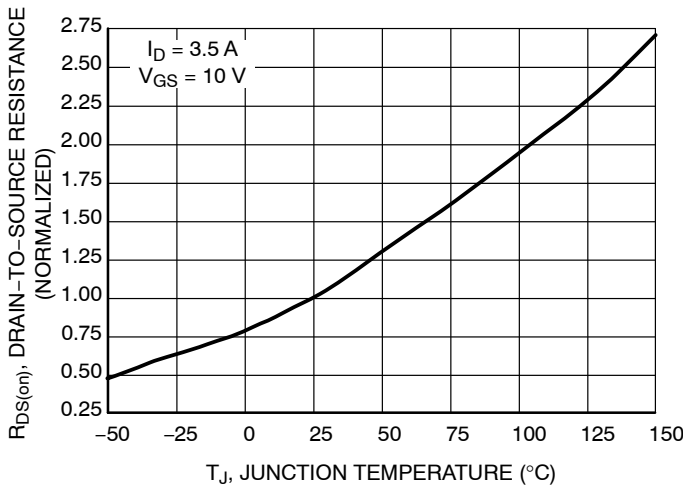


Figure 5. On-Resistance Variation with Temperature

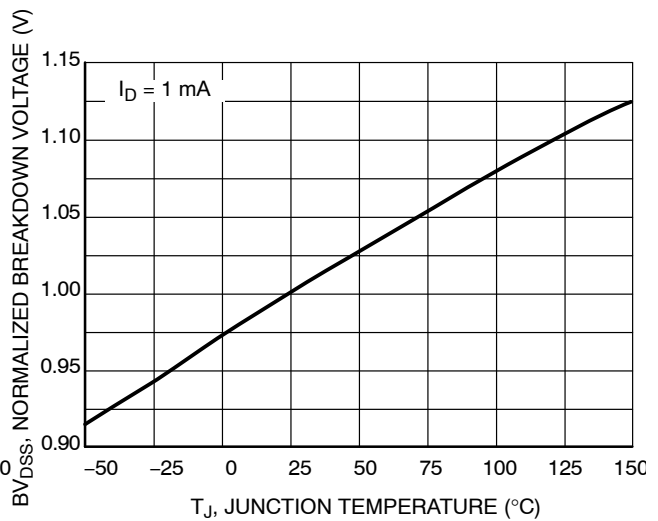


Figure 6. BV_{DSS} Variation with Temperature

NDF08N60Z

TYPICAL CHARACTERISTICS

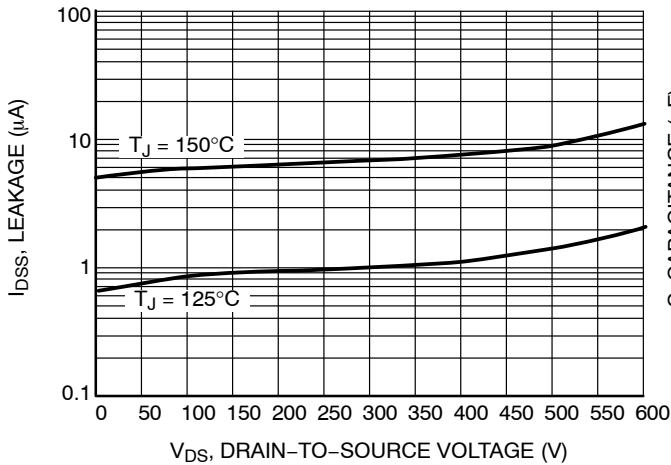


Figure 7. Drain-to-Source Leakage Current versus Voltage

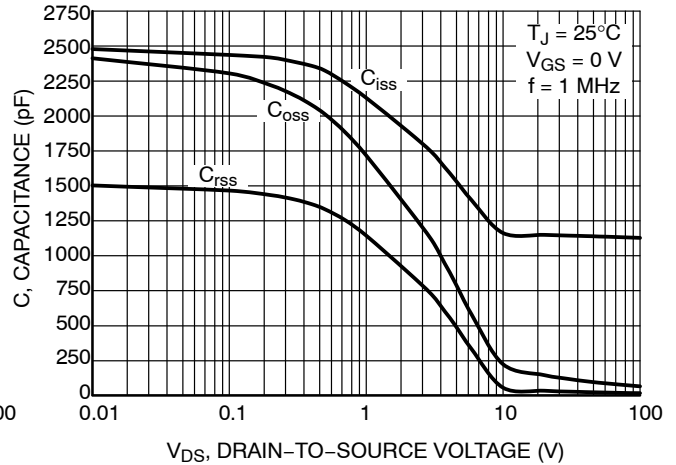


Figure 8. Capacitance Variation

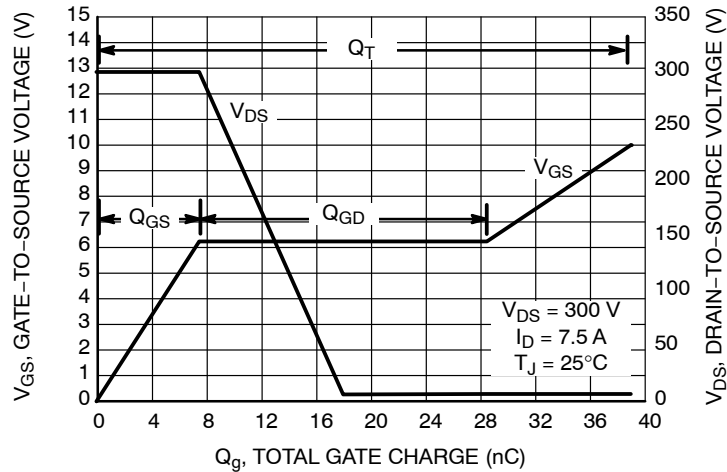


Figure 9. Gate-to-Source Voltage and Drain-to-Source Voltage versus Total Charge

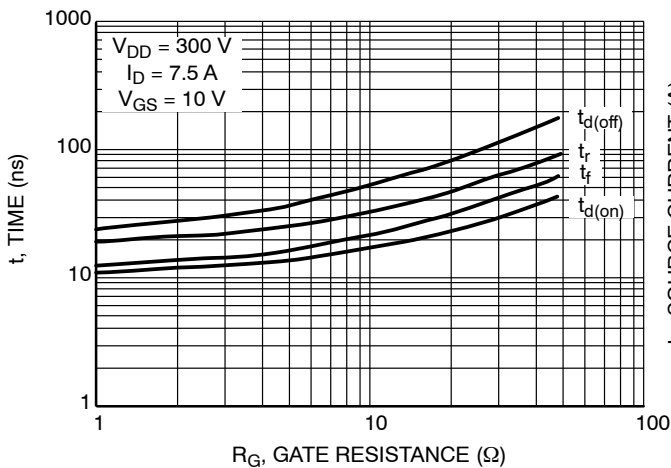


Figure 10. Resistive Switching Time Variation versus Gate Resistance

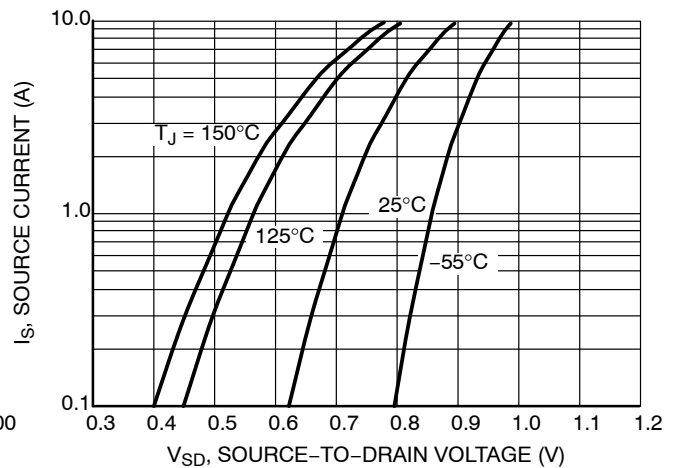


Figure 11. Diode Forward Voltage versus Current

NDF08N60Z

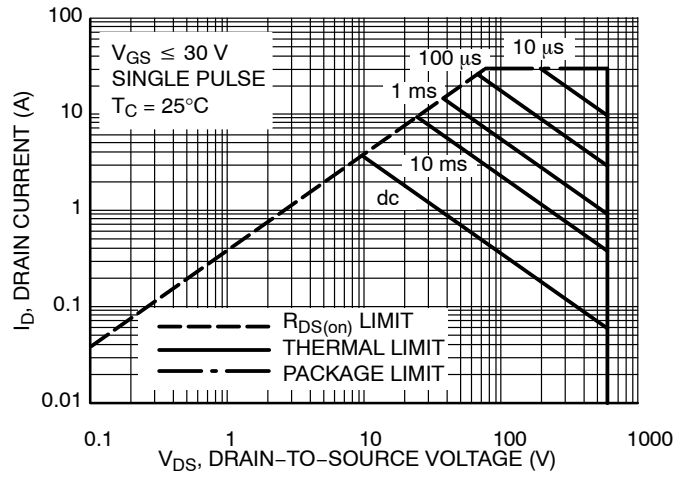


Figure 12. Maximum Rated Forward Biased Safe Operating Area NDF08N60Z

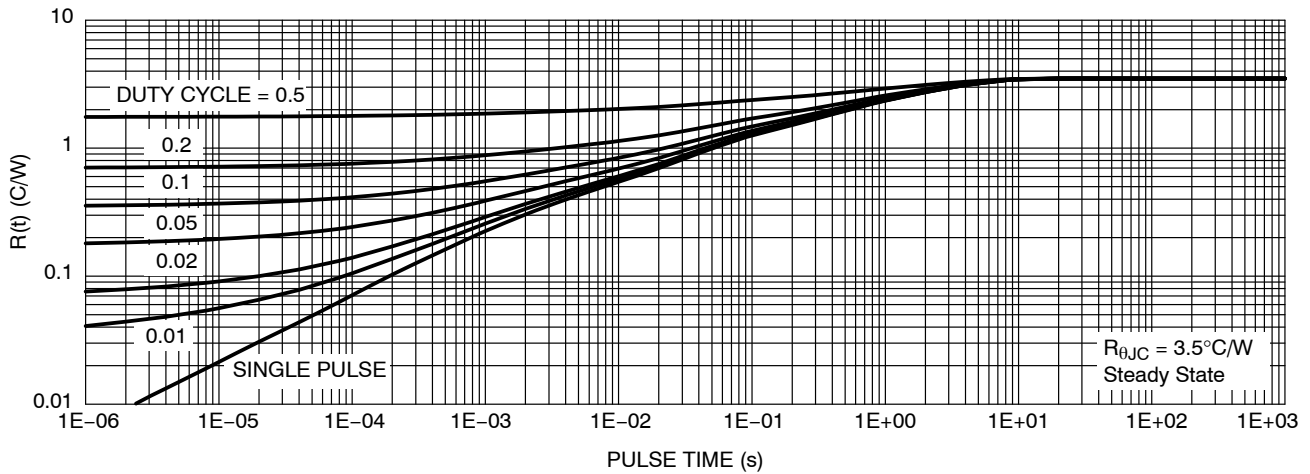


Figure 13. Thermal Impedance (Junction-to-Case) for NDF08N60Z

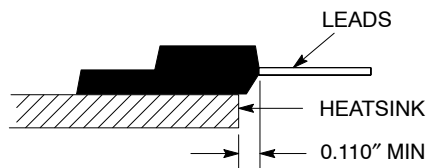


Figure 14. Isolation Test Diagram

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.

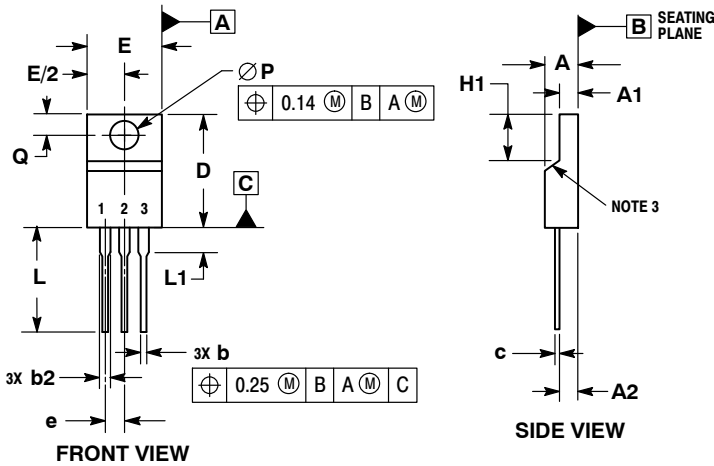
ORDERING INFORMATION

| Order Number | Package | Shipping |
|--------------|-------------------------------------|-----------------|
| NDF08N60ZG | TO-220FP (Pb-Free, Halogen-Free) | 50 Units / Rail |
| NDF08N60ZH | TO-220FP (Pb-Free, Halogen-Free) | 50 Units / Rail |

NDF08N60Z

PACKAGE DIMENSIONS

TO-220 FULLPACK, 3-LEAD CASE 221AH ISSUE F

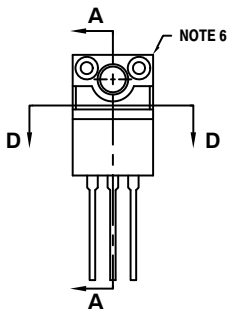


FRONT VIEW

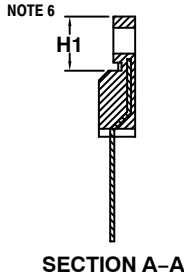
SIDE VIEW



SECTION D-D



ALTERNATE CONSTRUCTION



SECTION A-A

NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. CONTOUR UNCONTROLLED IN THIS AREA.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH AND GATE PROTRUSIONS. MOLD FLASH AND GATE PROTRUSIONS NOT TO EXCEED 0.13 PER SIDE. THESE DIMENSIONS ARE TO BE MEASURED AT OUTERMOST EXTREME OF THE PLASTIC BODY.
5. DIMENSION b2 DOES NOT INCLUDE DAMBAR PROTRUSION. LEAD WIDTH INCLUDING PROTRUSION SHALL NOT EXCEED 2.00.
6. CONTOURS AND FEATURES OF THE MOLDED PACKAGE BODY MAY VARY WITHIN THE ENVELOPE DEFINED BY DIMENSIONS A1 AND H1 FOR MANUFACTURING PURPOSES.

| MILLIMETERS | | |
|-------------|----------|-------|
| DIM | MIN | MAX |
| A | 4.30 | 4.70 |
| A1 | 2.50 | 2.90 |
| A2 | 2.50 | 2.90 |
| b | 0.54 | 0.84 |
| b2 | 1.10 | 1.40 |
| c | 0.49 | 0.79 |
| D | 14.70 | 15.30 |
| E | 9.70 | 10.30 |
| e | 2.54 BSC | |
| H1 | 6.60 | 7.10 |
| L | 12.50 | 14.73 |
| L1 | --- | 2.80 |
| P | 3.00 | 3.40 |
| Q | 2.80 | 3.20 |

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