

# NDF08N60Z

## N-Channel Power MOSFET 600 V, 0.95 $\Omega$

### 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	$V_{DS}$	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	$V_{GS}$	$\pm 30$	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 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.

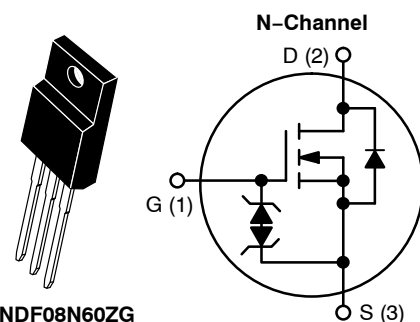
1. Limited by maximum junction temperature
2.  $I_D \leq 7.5\text{ A}$ ,  $dv/dt \leq 200\text{ A}/\mu\text{s}$ ,  $V_{DD} \leq BV_{DS}$ ,  $T_J \leq 150^\circ\text{C}$ .



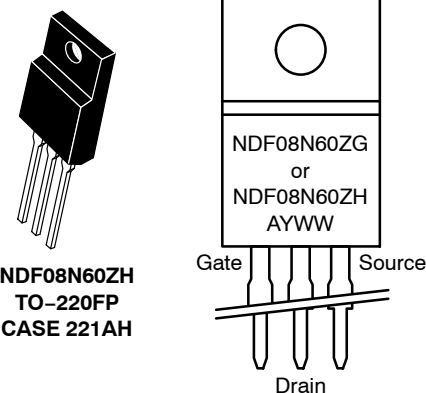
**ON Semiconductor®**

<http://onsemi.com>

$V_{DS}$	$R_{DS(ON)} (MAX) @ 3.5\text{ A}$
600 V	0.95 $\Omega$



**NDF08N60ZG  
TO-220FP  
CASE 221D**



**NDF08N60ZH  
TO-220FP  
CASE 221AH**

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

### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section 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
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### 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 $25^\circ\text{C}$ , $I_D = 1\text{ mA}$	$\Delta BV_{DSS}/\Delta T_J$		0.6		V/°C
Drain-to-Source Leakage Current	$V_{DS} = 600\text{ V}, V_{GS} = 0\text{ V}$	$I_{DSS}$			1	$\mu\text{A}$
					50	
Gate-to-Source Forward Leakage	$V_{GS} = \pm 20\text{ V}$	$I_{GSS}$			$\pm 10$	$\mu\text{A}$

### 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	$\Omega$
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		$\Omega$

### 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		$\mu\text{C}$

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

5. Guaranteed by design.

TYPICAL CHARACTERISTICS

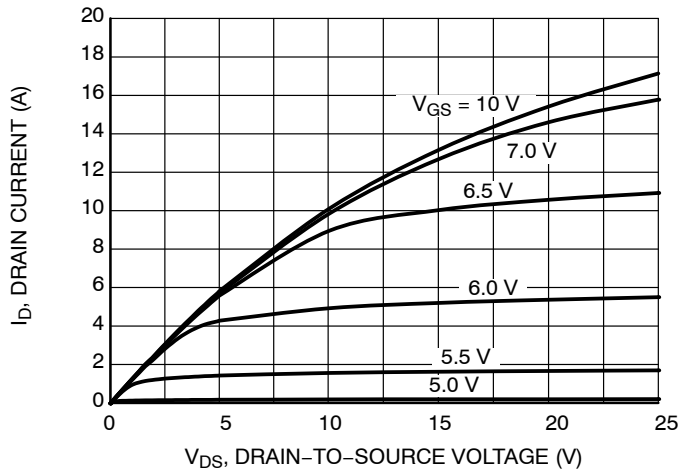


Figure 1. On-Region Characteristics

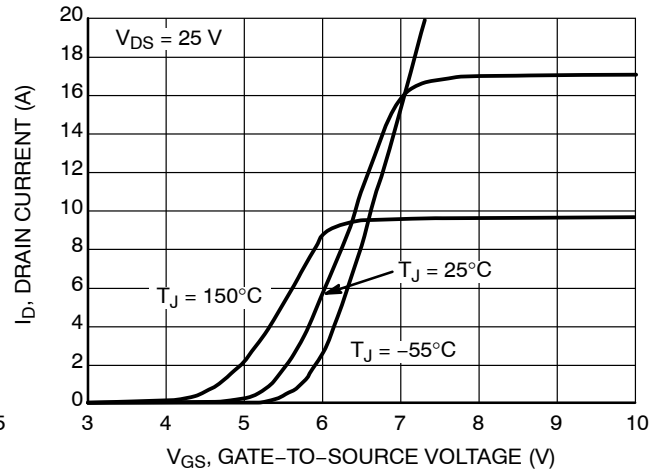


Figure 2. Transfer Characteristics

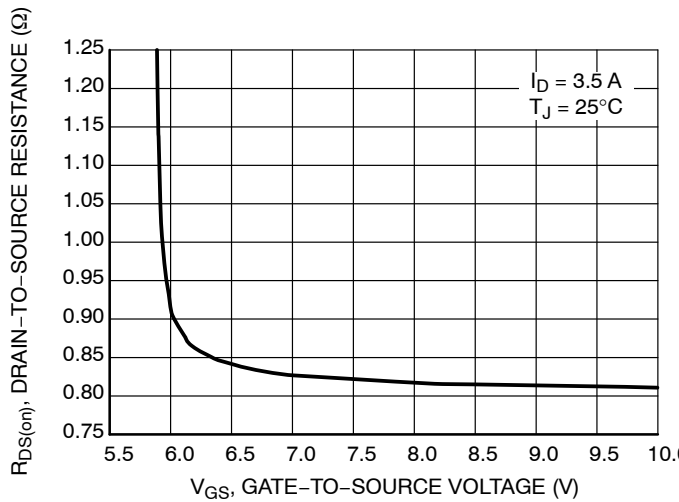


Figure 3. On-Region versus Gate-to-Source Voltage

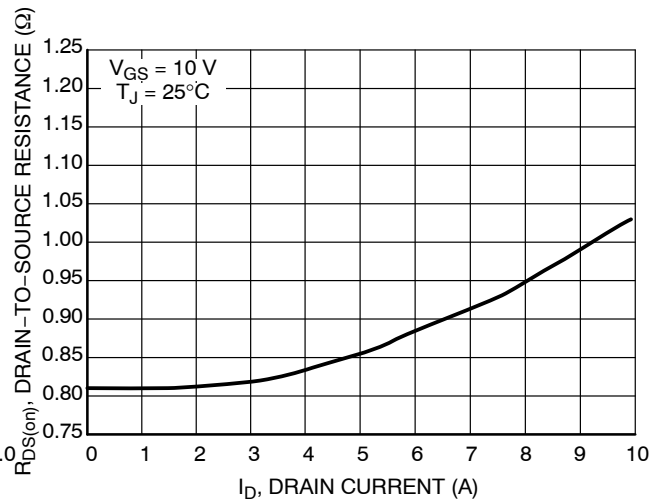


Figure 4. On-Resistance versus Drain Current and Gate Voltage

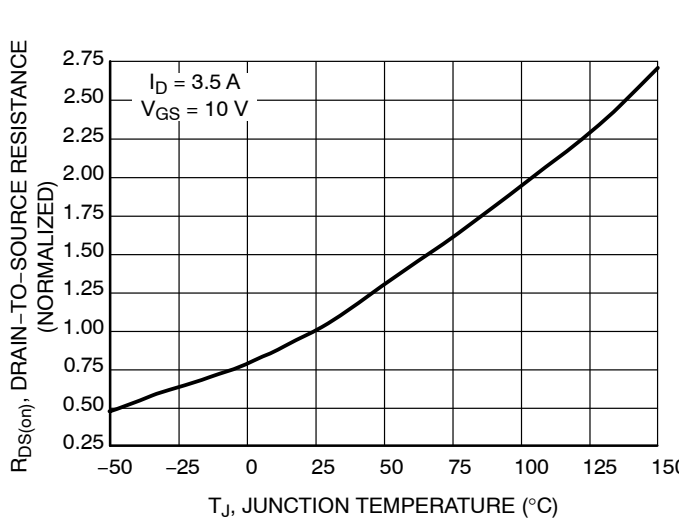


Figure 5. On-Resistance Variation with Temperature

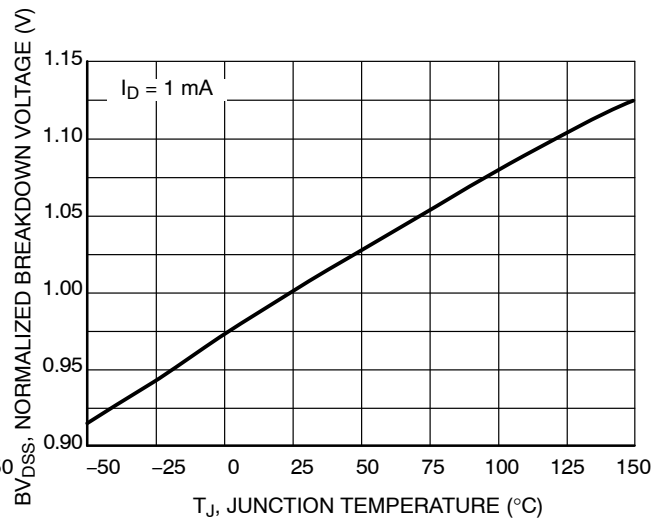


Figure 6.  $BV_{DSS}$  Variation with Temperature

TYPICAL CHARACTERISTICS

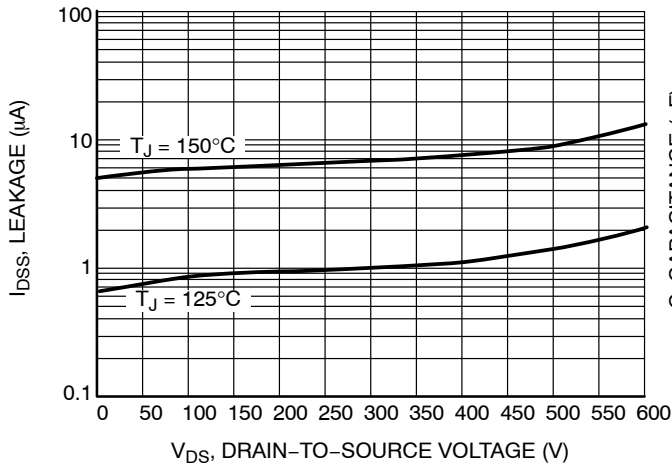


Figure 7. Drain-to-Source Leakage Current versus Voltage

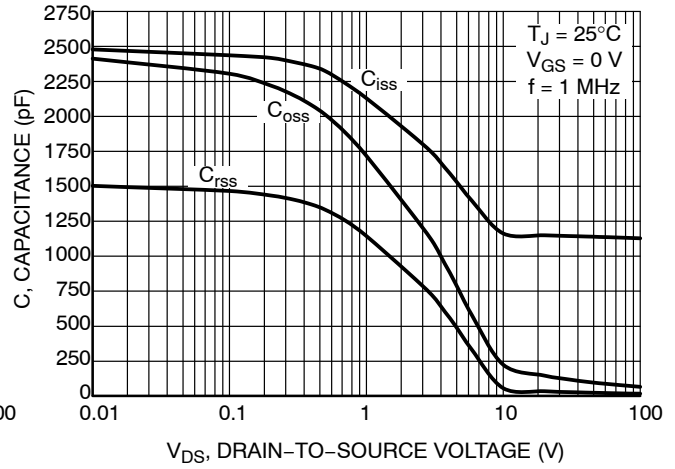


Figure 8. Capacitance Variation

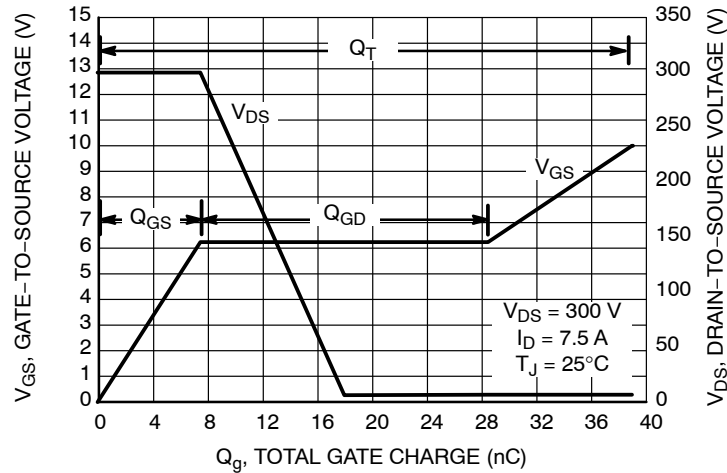


Figure 9. Gate-to-Source Voltage and Drain-to-Source Voltage versus Total Charge

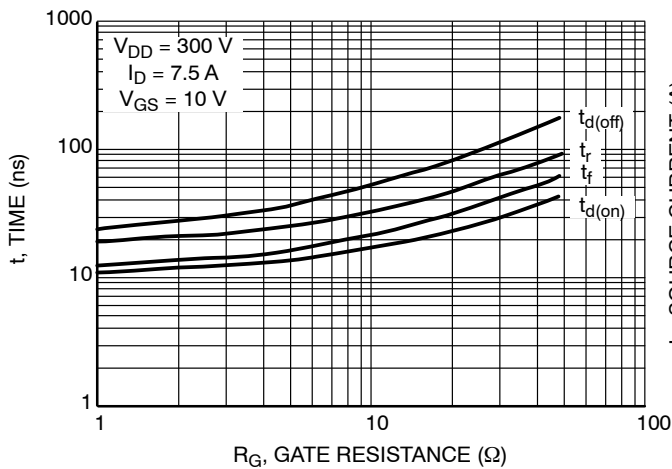


Figure 10. Resistive Switching Time Variation versus Gate Resistance

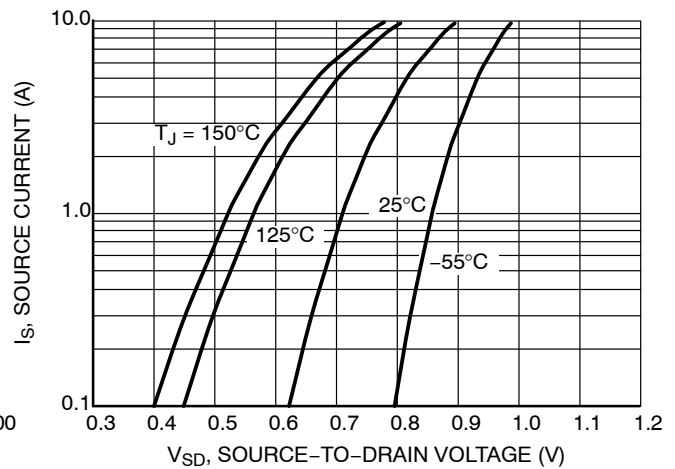
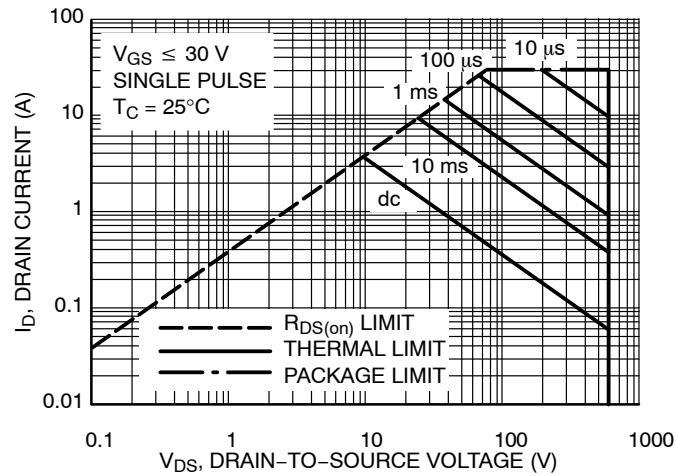
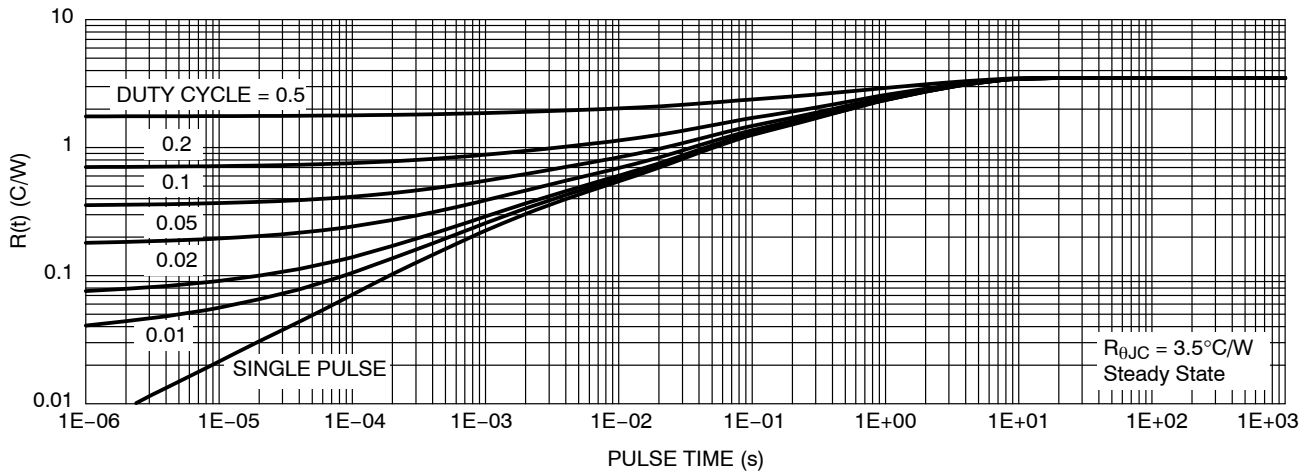


Figure 11. Diode Forward Voltage versus Current

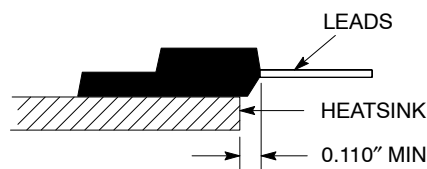
## NDF08N60Z



**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.

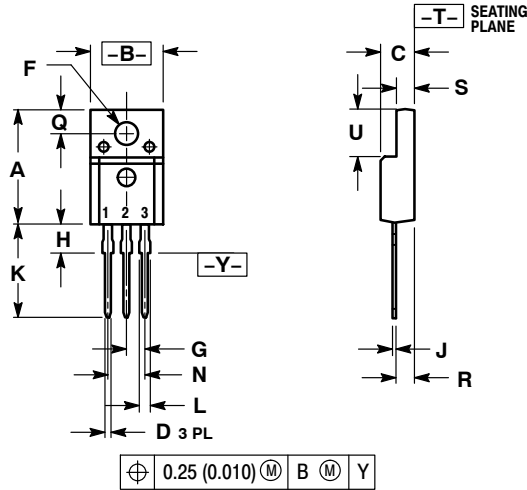
\*For additional mounting information, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

### 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

PACKAGE DIMENSIONS

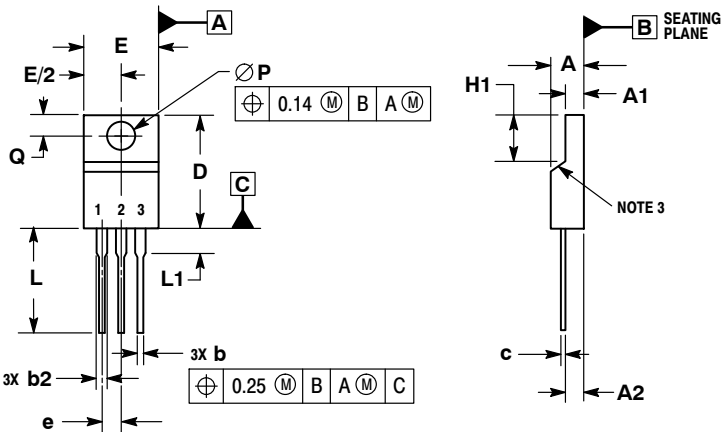
TO-220 FULLPAK  
CASE 221D-03  
ISSUE K



- 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

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



- 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.

DIM	MILLIMETERS	
	MIN	MAX
A	4.30	4.70
A1	2.50	2.90
A2	2.50	2.70
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	6.70	7.10
L	12.70	14.73
L1	---	2.10
P	3.00	3.40
Q	2.80	3.20

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