

NDF11N50Z

N-Channel Power MOSFET 500 V, 0.52 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°C unless otherwise noted)

Rating	Symbol	NDF	Unit
Drain-to-Source Voltage	V _{DSS}	500	V
Continuous Drain Current, R _{θJC} (Note 1)	I _D	12	A
Continuous Drain Current T _A = 100°C, R _{θJC} (Note 1)	I _D	7.4	A
Pulsed Drain Current, t _p = 10 μs	I _{DM}	44	A
Power Dissipation, R _{θJC}	P _D	39	W
Gate-to-Source Voltage	V _{GS}	±30	V
Single Pulse Avalanche Energy, I _D = 10 A	E _{AS}	420	mJ
ESD (HBM) (JESD22-A114)	V _{esd}	4000	V
RMS Isolation Voltage (t = 0.3 sec., R.H. ≤ 30%, T _A = 25°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	12	A
Maximum Temperature for Soldering Leads	T _L	260	°C
Operating Junction and Storage Temperature Range	T _J , T _{stg}	-55 to 150	°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.

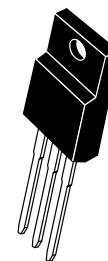
1. Limited by maximum junction temperature
2. I_d ≤ 10.5 A, di/dt ≤ 200 A/μs, V_{DD} ≤ BV_{DSS}, T_J ≤ 150°C.



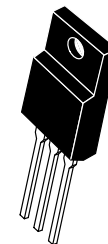
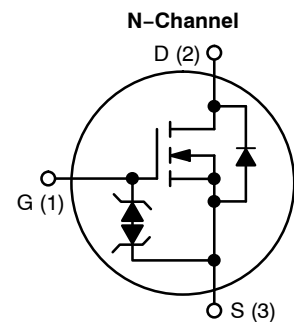
ON Semiconductor®

<http://onsemi.com>

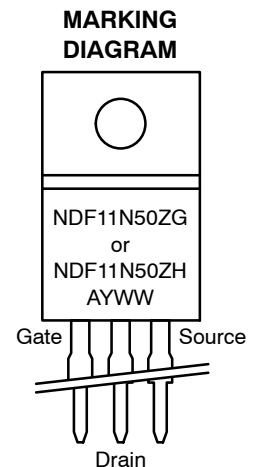
V _{DSS}	R _{DS(ON)} (MAX) @ 4.5 A
500 V	0.52 Ω



**NDF11N50ZG
TO-220FP
CASE 221D**



**NDF11N50ZH
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 6 of this data sheet.

NDF11N50Z

THERMAL RESISTANCE

Parameter	Symbol	NDF11N50Z	Unit
Junction-to-Case (Drain)	$R_{\theta JC}$	3.2	°C/W
Junction-to-Ambient Steady State (Note 3)	$R_{\theta JA}$	50	

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}	500			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	$V_{DS} = 500\text{ V}, V_{GS} = 0\text{ V}$	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	$V_{GS} = 10\text{ V}, I_D = 4.5\text{ A}$	$R_{DS(on)}$		0.48	0.52	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	$V_{DS} = 15\text{ V}, I_D = 4.5\text{ A}$	g_{FS}		7.7		S

DYNAMIC CHARACTERISTICS

Input Capacitance (Note 5)	$V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V},$ $f = 1.0\text{ MHz}$	C_{iss}	1097	1375	1645	pF
Output Capacitance (Note 5)		C_{oss}	132	166	199	
Reverse Transfer Capacitance (Note 5)		C_{rss}	30	40	50	
Total Gate Charge (Note 5)	$V_{DD} = 250\text{ V}, I_D = 10.5\text{ A},$ $V_{GS} = 10\text{ V}$	Q_g	23	46	69	nC
Gate-to-Source Charge (Note 5)		Q_{gs}	4.5	8.7	13	
Gate-to-Drain ("Miller") Charge (Note 5)		Q_{gd}	12.5	25	37.5	
Plateau Voltage		V_{GP}		6.2		V
Gate Resistance		R_g		1.4		Ω

RESISTIVE SWITCHING CHARACTERISTICS

Turn-On Delay Time	$V_{DD} = 250\text{ V}, I_D = 10.5\text{ A},$ $V_{GS} = 10\text{ V}, R_G = 5\text{ }\Omega$	$t_{d(on)}$		15		ns
Rise Time		t_r		32		
Turn-Off Delay Time		$t_{d(off)}$		40		
Fall Time		t_f		23		

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

Diode Forward Voltage	$I_S = 10.5\text{ A}, V_{GS} = 0\text{ V}$	V_{SD}			1.6	V
Reverse Recovery Time	$V_{GS} = 0\text{ V}, V_{DD} = 30\text{ V}$ $I_S = 10.5\text{ A}, di/dt = 100\text{ A}/\mu\text{s}$	t_{rr}		310		ns
Reverse Recovery Charge		Q_{rr}		2.5		μC

3. Insertion mounted

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

5. Guaranteed by design.

NDF11N50Z

TYPICAL CHARACTERISTICS

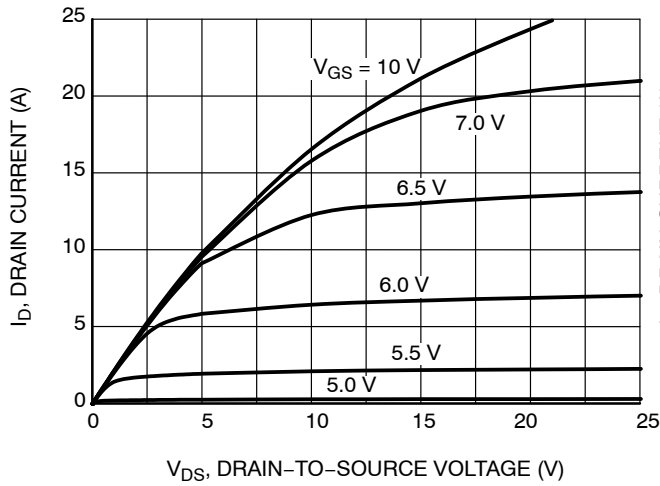


Figure 1. On-Region Characteristics

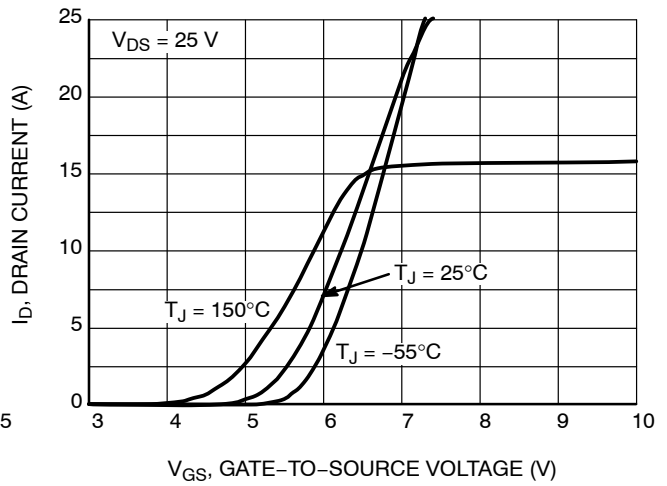


Figure 2. Transfer Characteristics

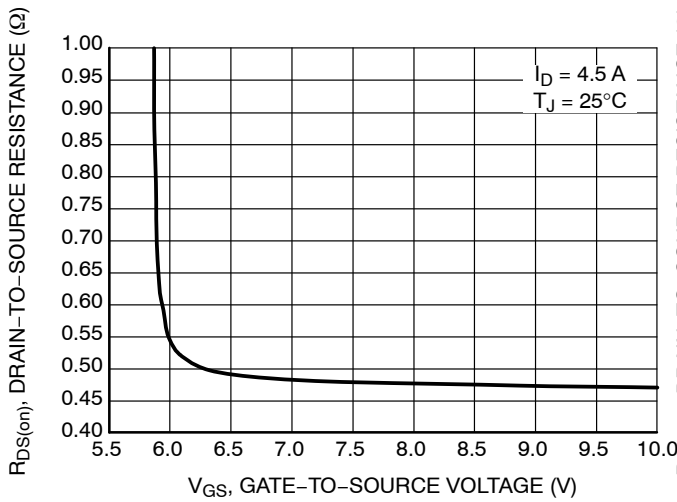


Figure 3. On-Region versus Gate-to-Source Voltage

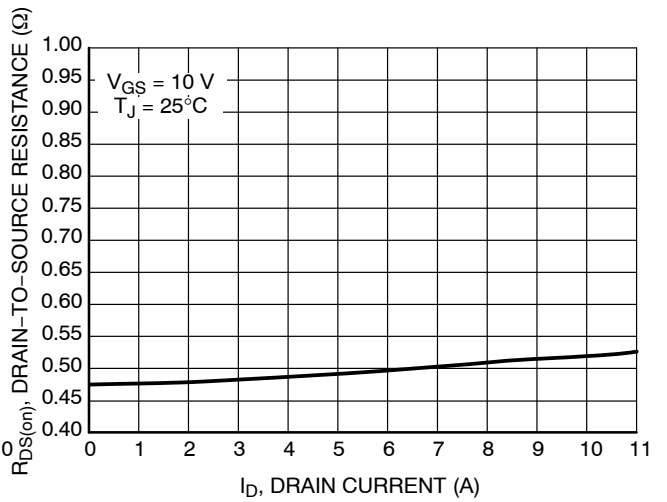


Figure 4. On-Resistance versus Drain Current and Gate Voltage

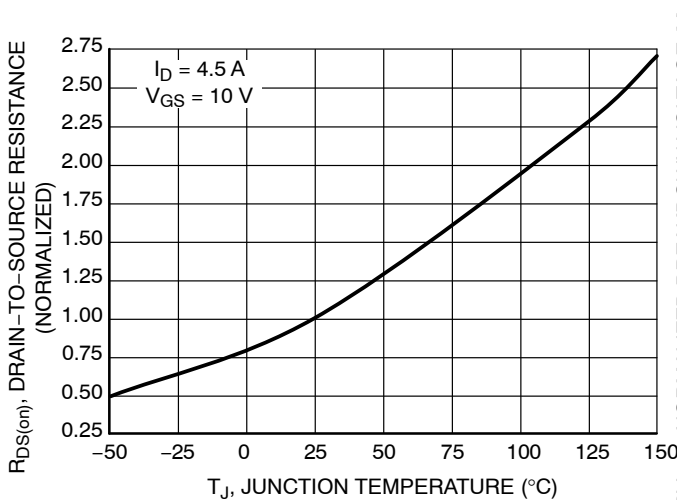


Figure 5. On-Resistance Variation with Temperature

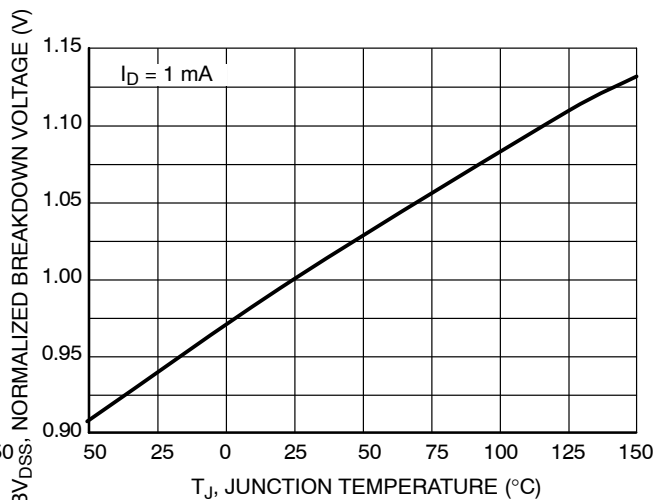


Figure 6. BV_{DSS} Variation with Temperature

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TYPICAL CHARACTERISTICS

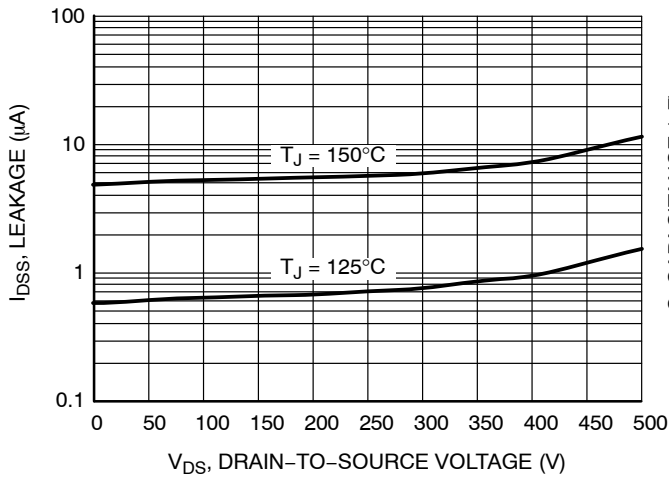


Figure 7. Drain-to-Source Leakage Current versus Voltage

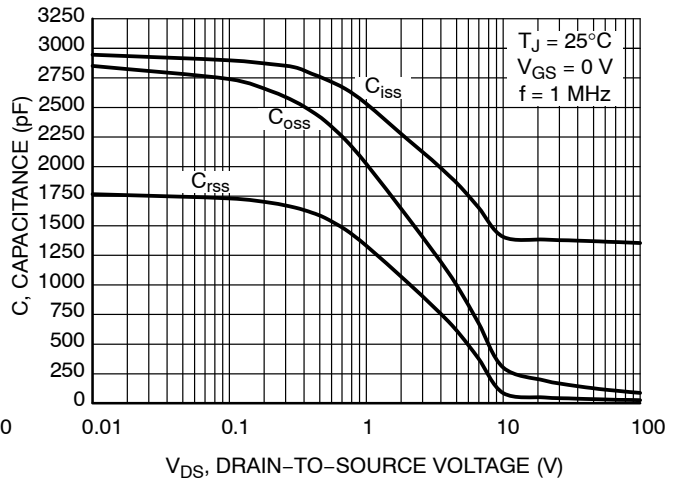


Figure 8. Capacitance Variation

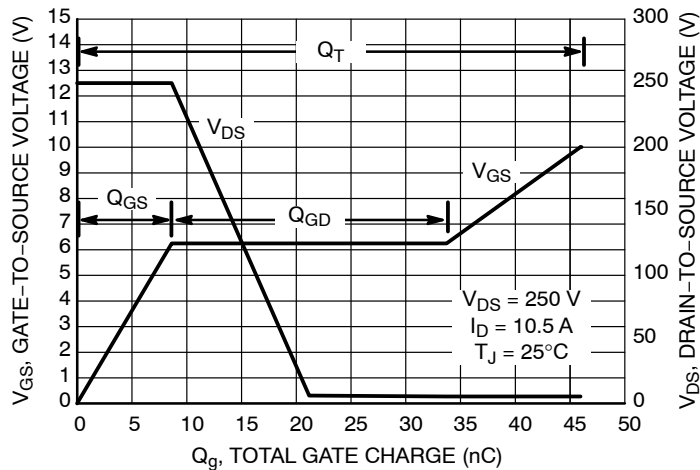


Figure 9. Gate-to-Source Voltage and Drain-to-Source Voltage versus Total Charge

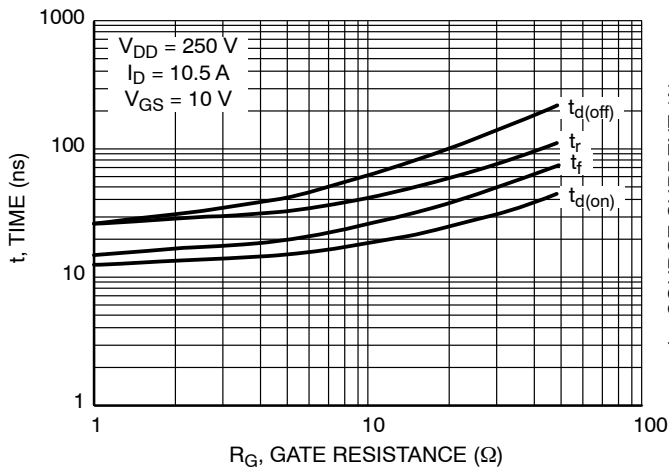


Figure 10. Resistive Switching Time Variation versus Gate Resistance

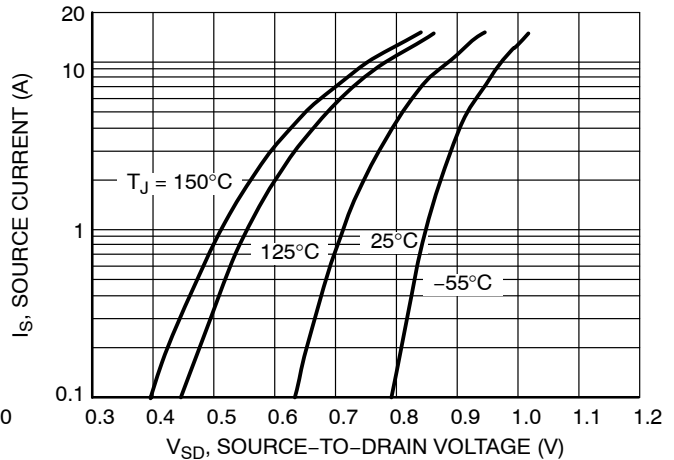


Figure 11. Diode Forward Voltage versus Current

NDF11N50Z

TYPICAL CHARACTERISTICS

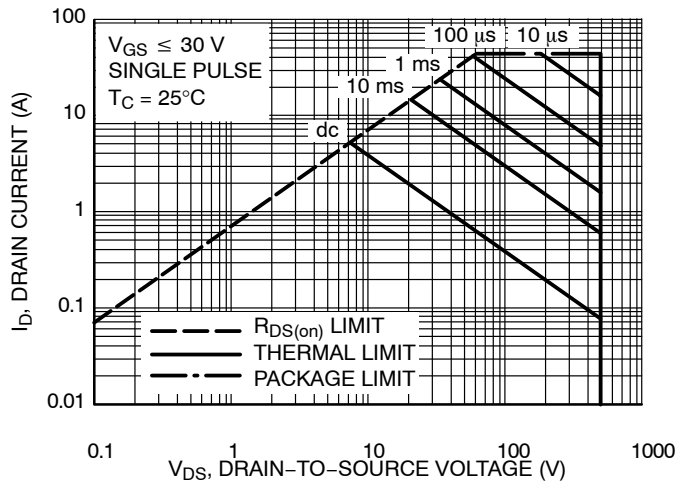


Figure 12. Maximum Rated Forward Biased Safe Operating Area NDF11N50Z

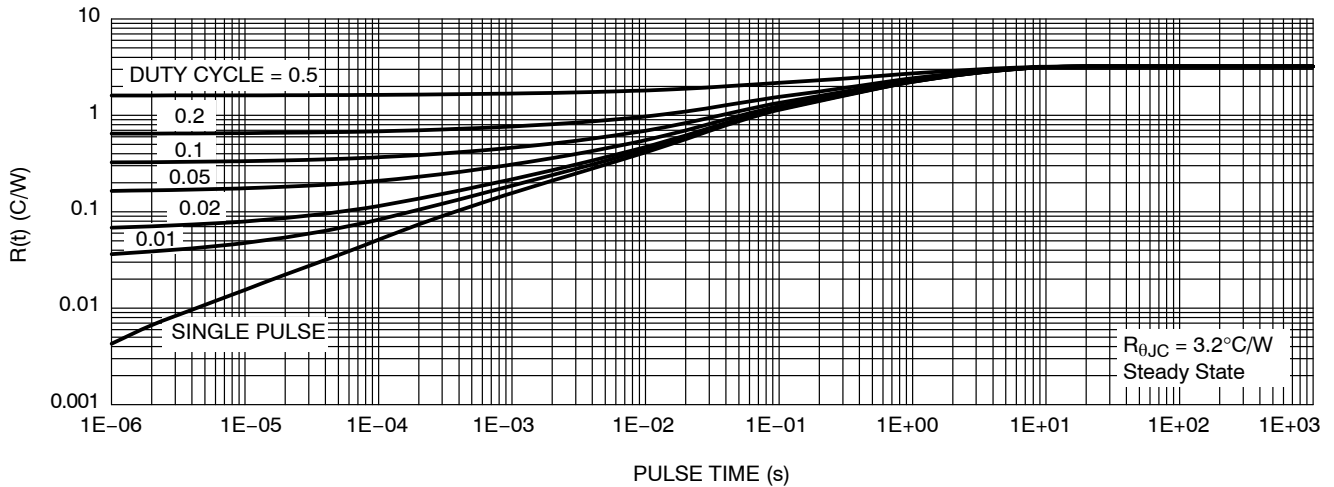


Figure 13. Thermal Impedance (Junction-to-Case) for NDF11N50Z

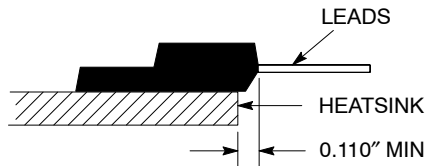


Figure 14. Isolation Test Diagram

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.

NDF11N50Z

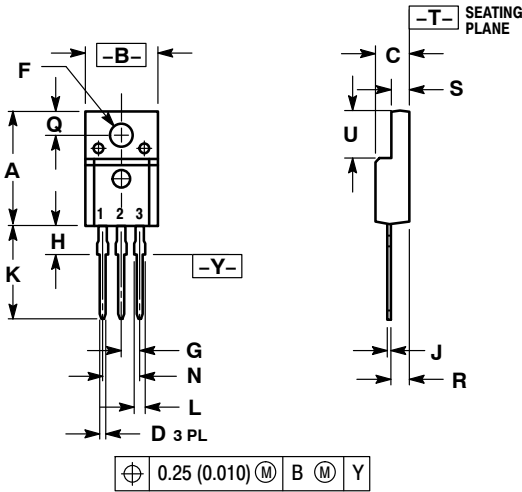
ORDERING INFORMATION

Order Number	Package	Shipping
NDF11N50ZG	TO-220FP (Pb-Free, Halogen-Free)	50 Units / Rail
NDF11N50ZH	TO-220FP (Pb-Free, Halogen-Free)	50 Units / Rail

NDF11N50Z

PACKAGE DIMENSIONS

TO-220FP CASE 221D-03 ISSUE K

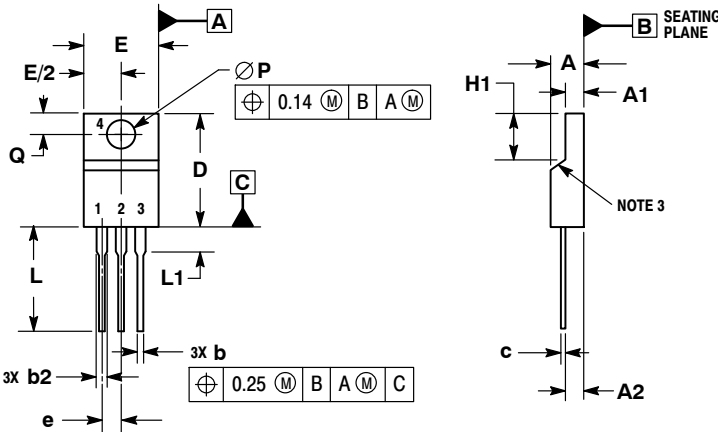


NOTES:

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 B



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	---	2.80
P	3.00	3.40
Q	2.80	3.20

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