

NDF11N50Z, NDP11N50Z

N-Channel Power MOSFET 500 V, 0.52 Ω

Features

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

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

Rating	Symbol	NDF11N50Z	NDP11N50Z	Unit
Drain-to-Source Voltage	V_{DS}	500		V
Continuous Drain Current, $R_{\theta JC}$	I_D	10.5 (Note 2)	10.5	A
Continuous Drain Current $T_A = 100^\circ\text{C}$, $R_{\theta JC}$	I_D	6.7 (Note 2)	6.7	A
Pulsed Drain Current, $V_{GS} @ 10\text{ V}$	I_{DM}	42 (Note 2)	42	A
Power Dissipation, $R_{\theta JC}$ (Note 1)	P_D	36	145	W
Gate-to-Source Voltage	V_{GS}	± 30		V
Single Pulse Avalanche Energy, $I_D = 10.5\text{ A}$	E_{AS}	190		mJ
ESD (HBM) (JESD22-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	dv/dt	4.5 (Note 3)		V/ns
Continuous Source Current (Body Diode)	I_S	10.5		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.

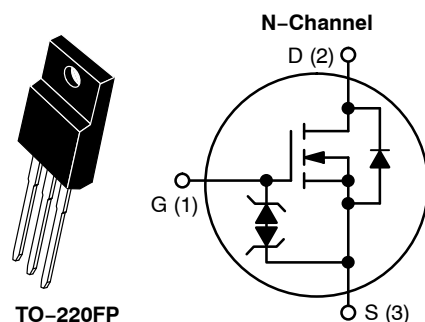
1. Surface mounted on FR4 board using 1" sq. pad size, (Cu area = 1.127 in sq [2 oz] including traces).
2. Limited by maximum junction temperature
3. $I_d \leq 10.5\text{ A}$, $di/dt \leq 200\text{ A}/\mu\text{s}$, $V_{DD} \leq BV_{DS}$, $T_J \leq 150^\circ\text{C}$.



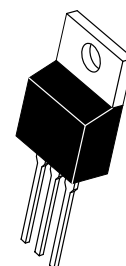
ON Semiconductor®

<http://onsemi.com>

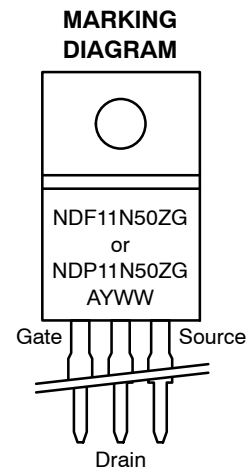
V_{DS}	$R_{DS(ON)} (MAX) @ 4.5\text{ A}$
500 V	0.52 Ω



TO-220FP
CASE 221D
STYLE 1



TO-220
CASE 221A
STYLE 5



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

ORDERING INFORMATION

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

NDF11N50Z, NDP11N50Z

THERMAL RESISTANCE

Parameter	Symbol	NDF11N50Z	NDP11N50Z	Unit
Junction-to-Case (Drain)	$R_{\theta JC}$	3.4	0.9	°C/W
Junction-to-Ambient Steady State (Note 4)	$R_{\theta JA}$	50	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}			1	μA
					50	
Gate-to-Source Forward Leakage	$V_{GS} = \pm 20\text{ V}$	I_{GSS}			± 10	μA

ON CHARACTERISTICS (Note 5)

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		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	$V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V},$ $f = 1.0\text{ MHz}$	C_{iss}		1375		pF
Output Capacitance		C_{oss}		166		
Reverse Transfer Capacitance		C_{rss}		40		
Total Gate Charge	$V_{DD} = 250\text{ V}, I_D = 10.5\text{ A},$ $V_{GS} = 10\text{ V}$	Q_g		46		nC
Gate-to-Source Charge		Q_{gs}		8.7		
Gate-to-Drain ("Miller") Charge		Q_{gd}		25		
Plateau Voltage		V_{GP}		6.2		
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

4. Insertion mounted

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

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TYPICAL CHARACTERISTICS

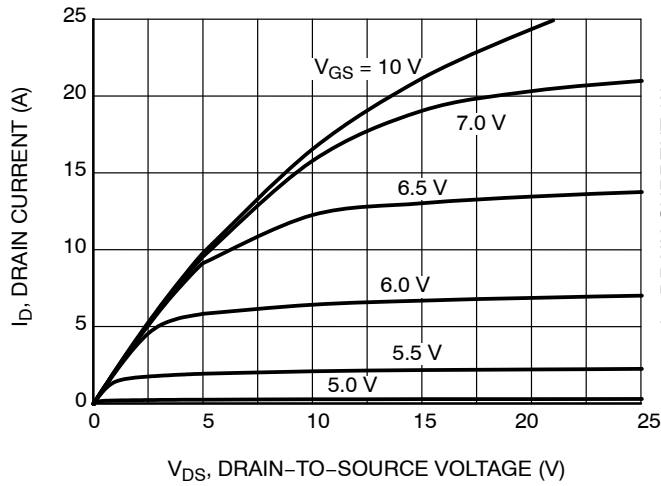


Figure 1. On-Region Characteristics

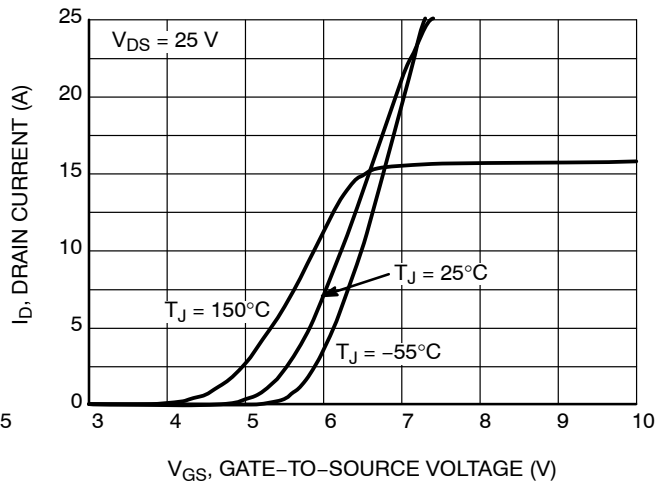


Figure 2. Transfer Characteristics

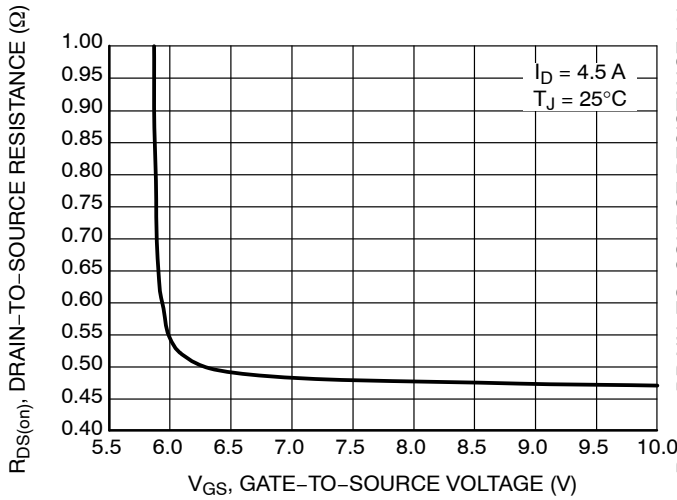


Figure 3. On-Region versus Gate-to-Source Voltage

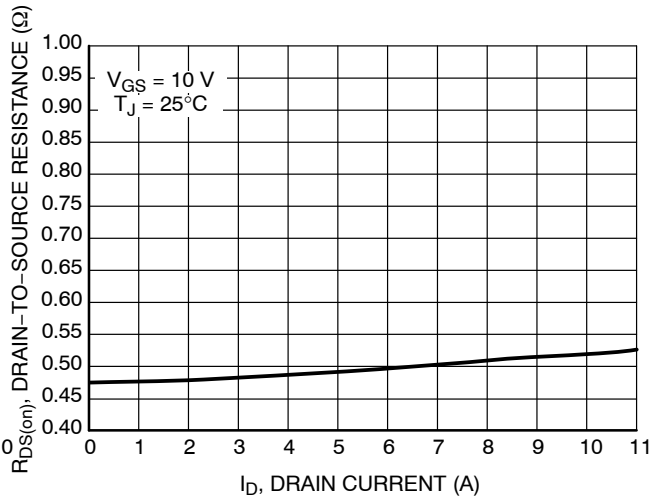


Figure 4. On-Resistance versus Drain Current and Gate Voltage

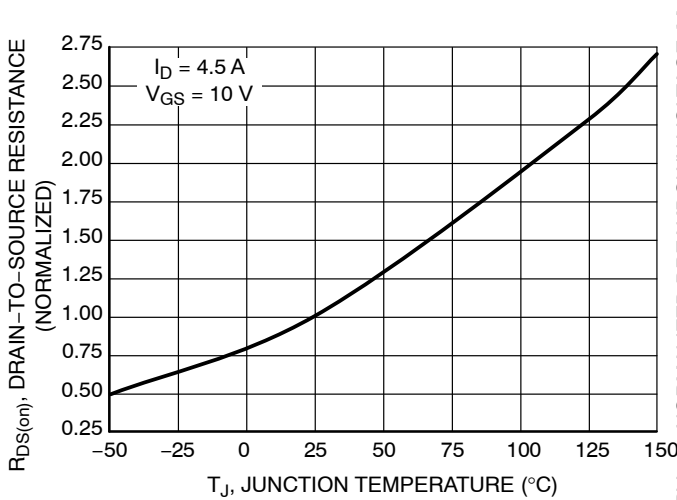


Figure 5. On-Resistance Variation with Temperature

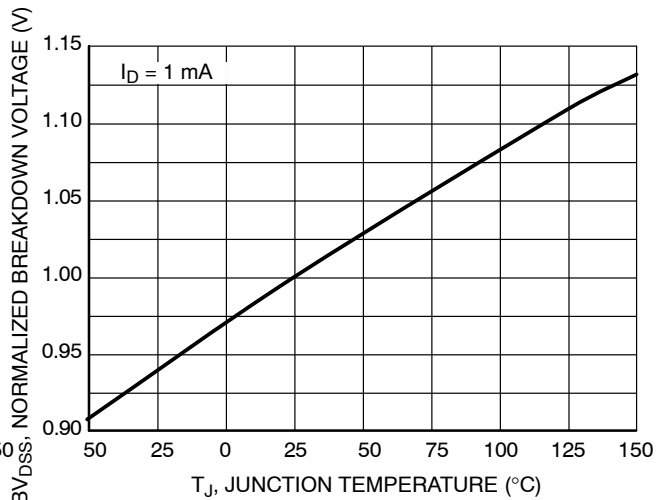


Figure 6. BV_{DSS} Variation with Temperature

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TYPICAL CHARACTERISTICS

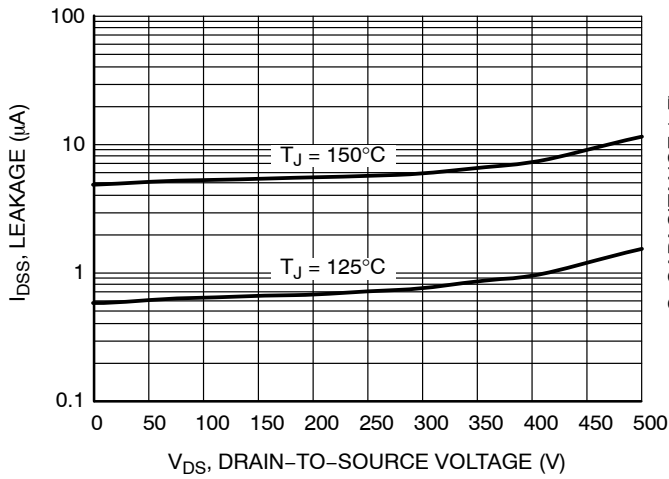


Figure 7. Drain-to-Source Leakage Current versus Voltage

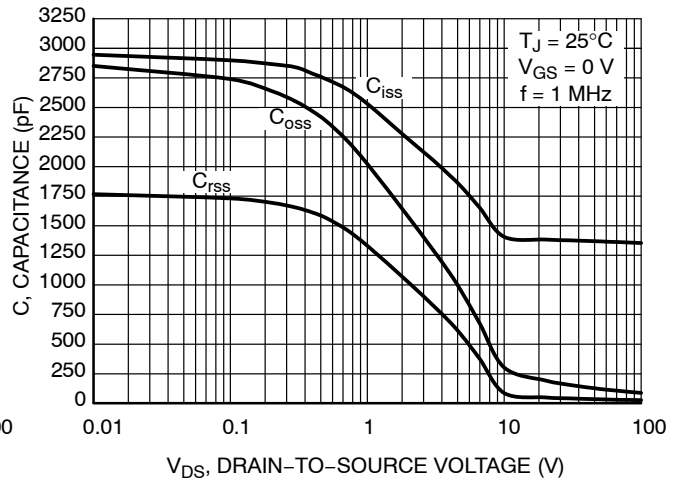


Figure 8. Capacitance Variation

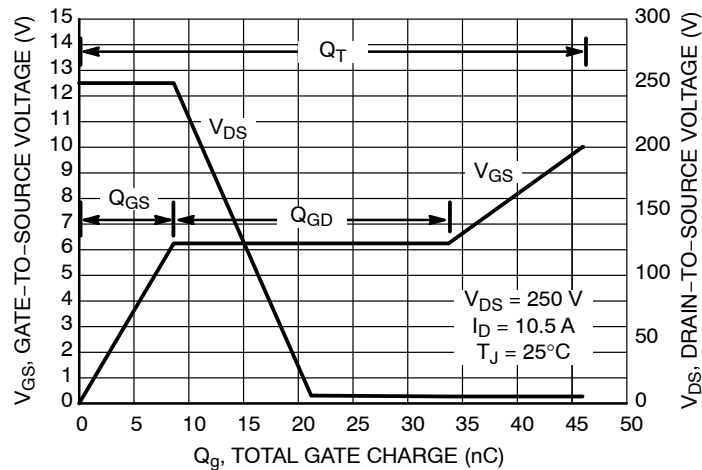


Figure 9. Gate-to-Source Voltage and Drain-to-Source Voltage versus Total Charge

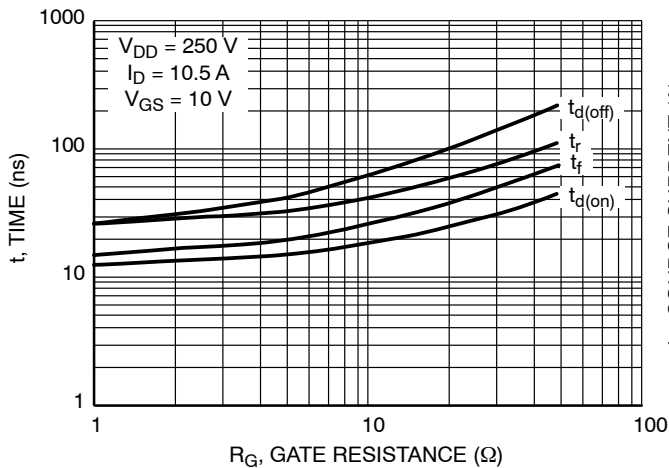


Figure 10. Resistive Switching Time Variation versus Gate Resistance

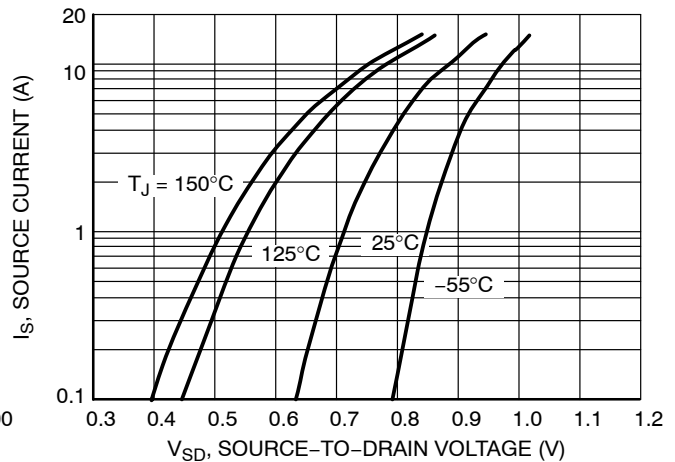


Figure 11. Diode Forward Voltage versus Current

NDF11N50Z, NDP11N50Z

TYPICAL CHARACTERISTICS

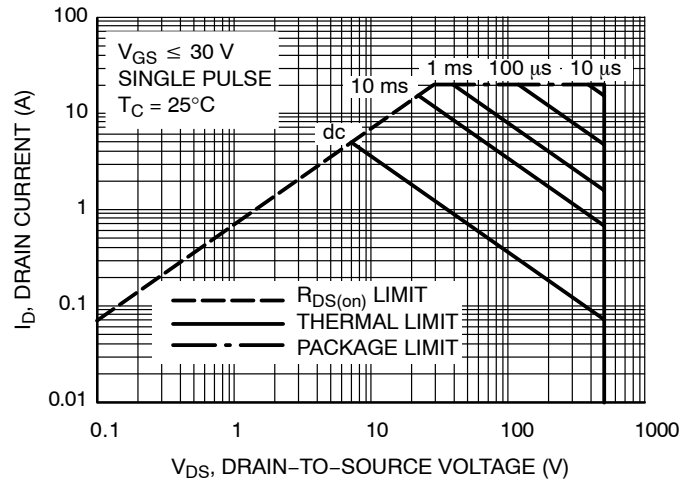


Figure 12. Maximum Rated Forward Biased Safe Operating Area NDF11N50Z

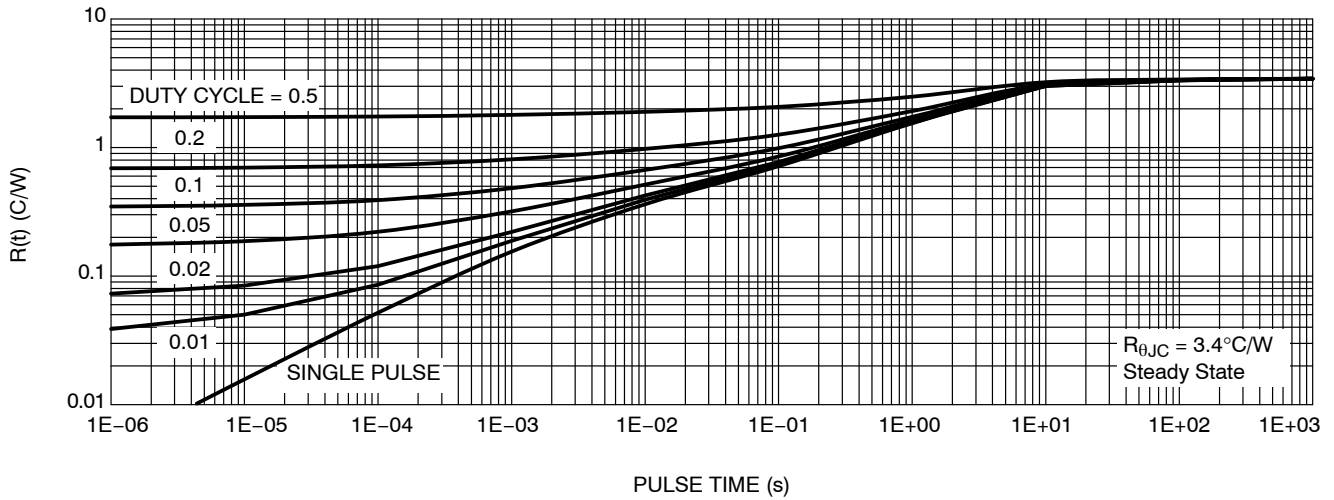


Figure 13. Thermal Impedance (Junction-to-Case) for NDF11N50Z

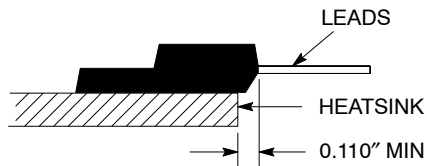


Figure 14. Isolation Test Diagram

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.

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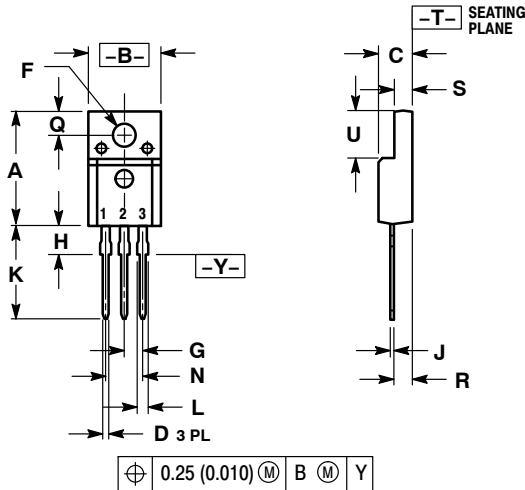
ORDERING INFORMATION

Order Number	Package	Shipping
NDF11N50ZG	TO-220FP (Pb-Free)	50 Units / Rail
NDP11N50ZG	TO-220AB (Pb-Free)	50 Units / Rail (In Development)

NDF11N50Z, NDP11N50Z

PACKAGE DIMENSIONS

TO-220FP CASE 221D-03 ISSUE K

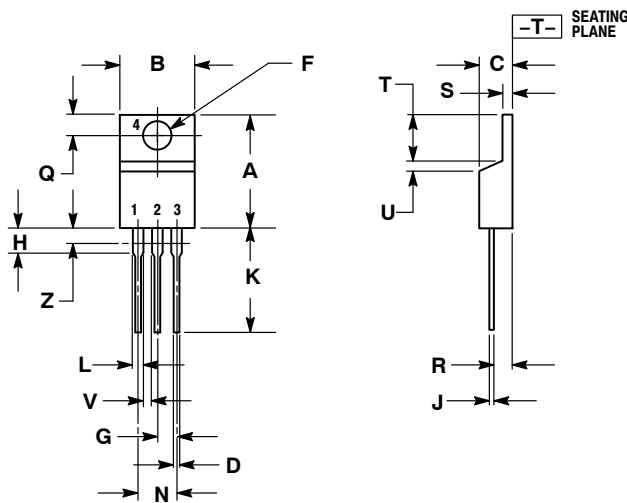


- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
 2. CONTROLLING DIMENSION: INCH
 3. 221D-01 THRU 221D-02 OBSOLETE, NEW STANDARD 221D-03.

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

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

TO-220 CASE 221A-09 ISSUE AF



- 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
 - DRAIN
 - SOURCE
 - DRAIN

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