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°C unless otherwise noted)

Rating	Symbol	NDF	NDP	Unit
Drain−to−Source Voltage	V_{DSS}	500		V
Continuous Drain Current, $R_{\theta JC}$ (Note 1)	I_D	12		A
Continuous Drain Current T_A = 100°C, $R_{\theta JC}$ (Note 1)	I_D	7.4		A
Pulsed Drain Current, t_P = 10 μs	I_{DM}	44		A
Power Dissipation, $R_{\theta JC}$	P_D	39	178	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	dv/dt	4.5 (Note 2)		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

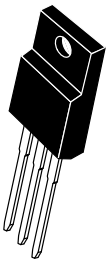
Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

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

ON Semiconductor®

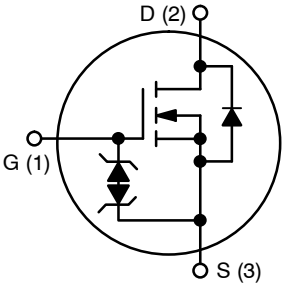
http://onsemi.com

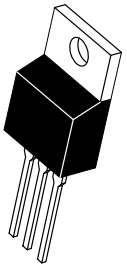
V_{DSS}	$R_{DS(ON)}$ (MAX) @ 4.5 A
500 V	0.52 Ω



TO−220FP
CASE 221D
STYLE 1

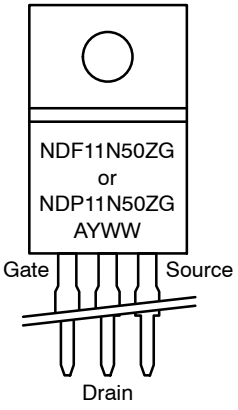
N−Channel





TO−220
CASE 221A
STYLE 5

MARKING DIAGRAM



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.

THERMAL RESISTANCE

Parameter	Symbol	NDF11N50Z	NDP11N50Z	Unit
Junction−to−Case (Drain)	$R_{\theta JC}$	3.2	0.7	°C/W
Junction−to−Ambient Steady State (Note 3)	$R_{\theta JA}$	50	50	

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}	500			V
Breakdown Voltage Temperature Coefficient	Reference to 25°C, I_D = 1 mA		$\Delta BV_{DSS}/\Delta T_J$		0.6		V/°C
Drain−to−Source Leakage Current	V_{DS} = 500 V, V_{GS} = 0 V	25°C	I_{DSS}			1	μA
		125°C				50	
Gate−to−Source Forward Leakage	V_{GS} = ±20 V		I_{GSS}			±10	μA
ON CHARACTERISTICS (Note 4)							
Static Drain−to−Source On−Resistance	V_{GS} = 10 V, I_D = 4.5 A		$R_{DS(on)}$		0.48	0.52	Ω
Gate Threshold Voltage	V_{DS} = V_{GS}, I_D = 100 μA		$V_{GS(th)}$	3.0		4.5	V
Forward Transconductance	V_{DS} = 15 V, I_D = 4.5 A		g_{FS}		7.7		S
DYNAMIC CHARACTERISTICS							
Input Capacitance	V_{DS} = 25 V, V_{GS} = 0 V, f = 1.0 MHz		C_{iss}		1375		pF
Output Capacitance			C_{oss}		166		
Reverse Transfer Capacitance			C_{rss}		40		
Total Gate Charge	V_{DD} = 250 V, I_D = 10.5 A, V_{GS} = 10 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		V
Gate Resistance			R_g		1.4		Ω
RESISTIVE SWITCHING CHARACTERISTICS							
Turn−On Delay Time	V_{DD} = 250 V, I_D = 10.5 A, V_{GS} = 10 V, R_G = 5 Ω		$t_{d(on)}$		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°C unless otherwise noted)

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

3. Insertion mounted
4. Pulse Width ≤ 380 μs, Duty Cycle ≤ 2%.

TYPICAL CHARACTERISTICS

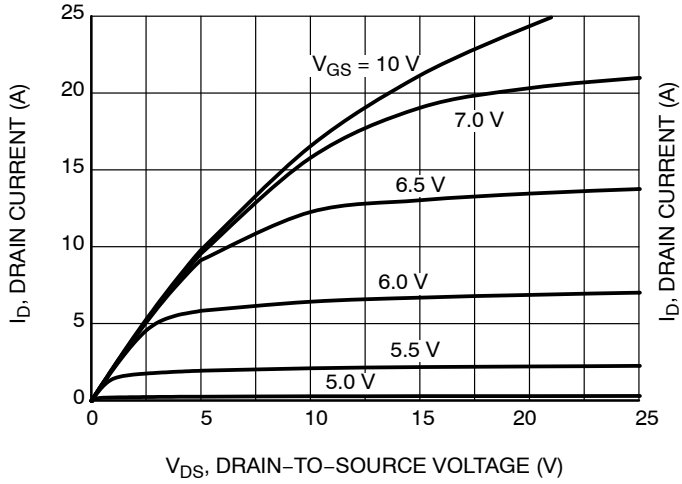


Figure 1. On−Region Characteristics

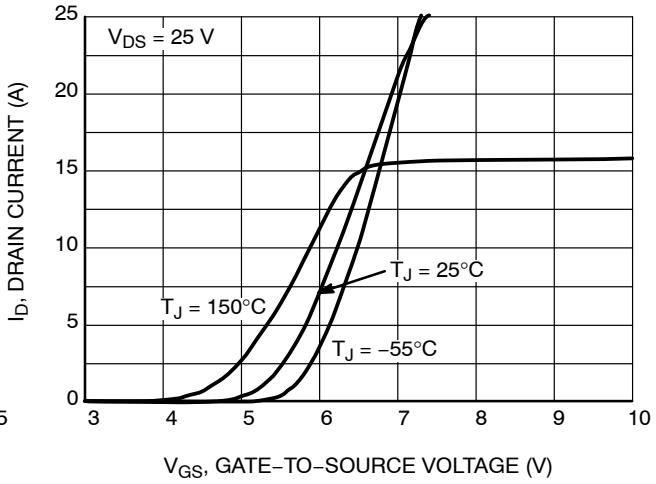


Figure 2. Transfer Characteristics

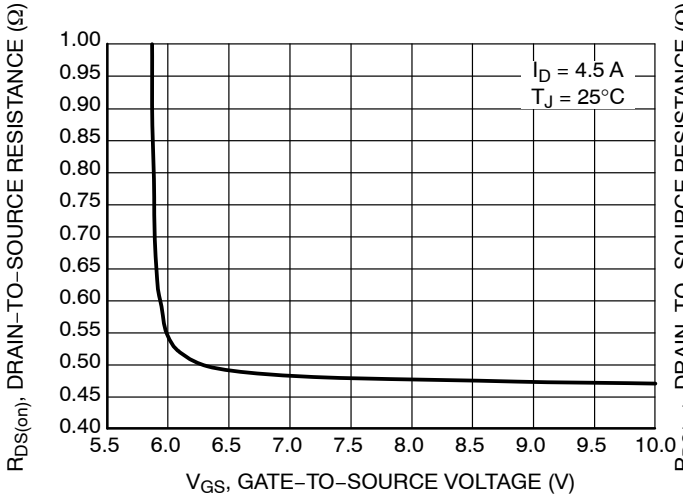


Figure 3. On−Region versus Gate−to−Source Voltage

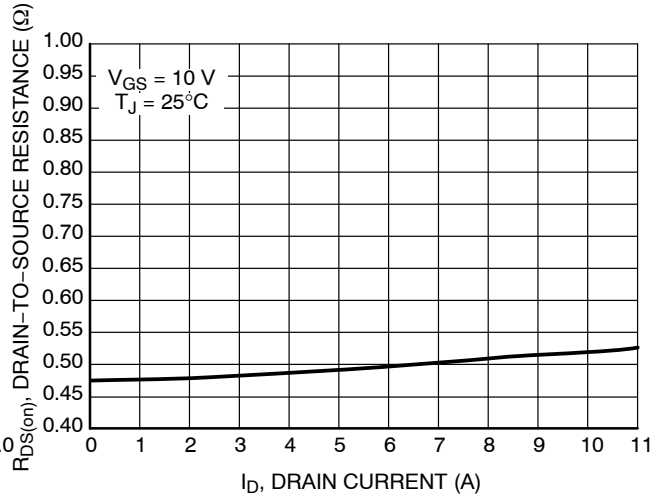


Figure 4. On−Resistance versus Drain Current and Gate Voltage

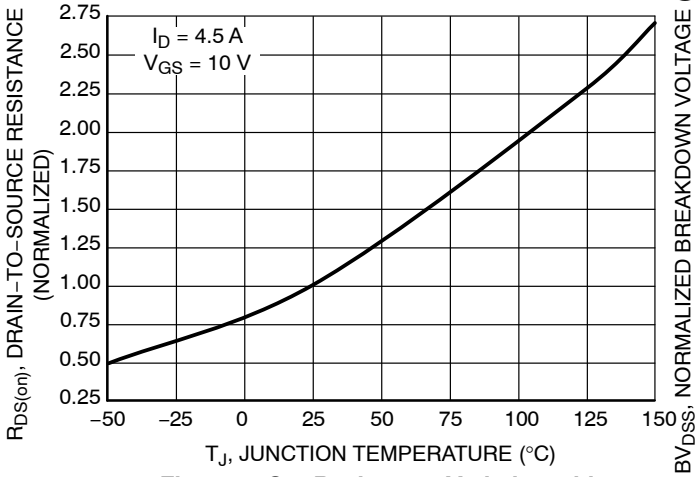


Figure 5. On−Resistance Variation with Temperature

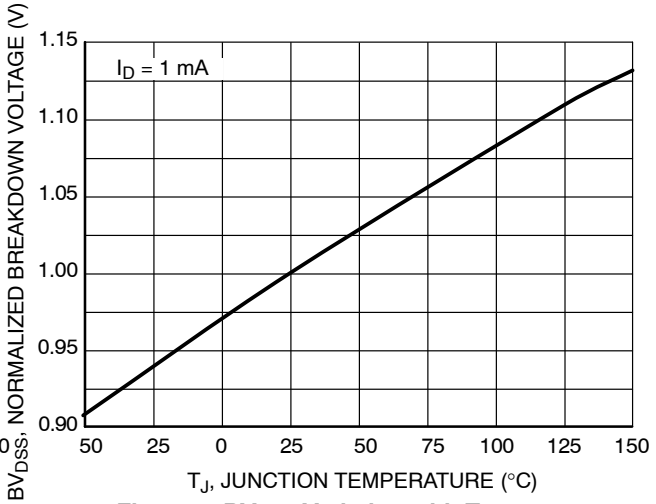


Figure 6. BV_{DSS} Variation with Temperature

TYPICAL CHARACTERISTICS

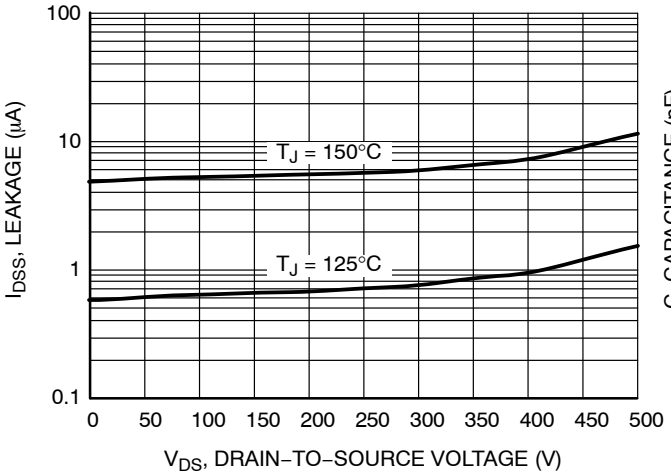


Figure 7. Drain−to−Source Leakage Current versus Voltage

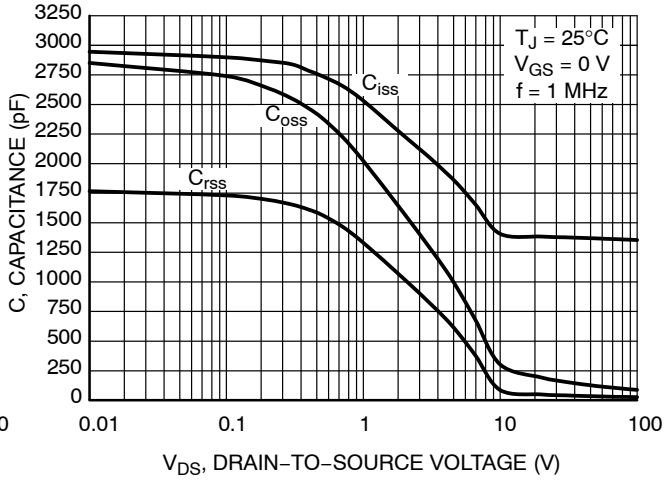


Figure 8. Capacitance Variation

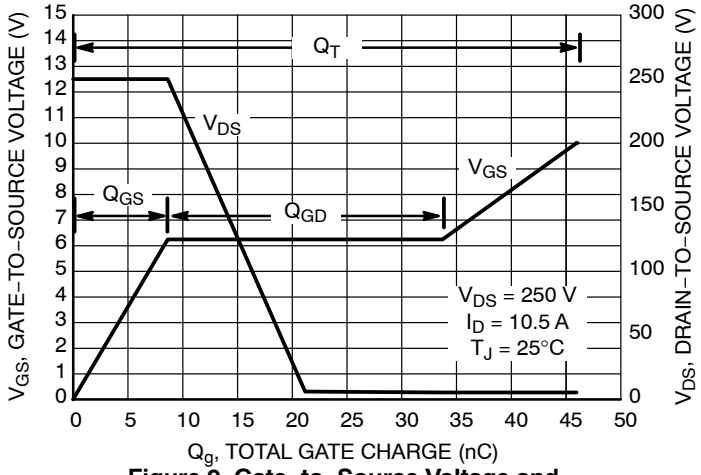


Figure 9. Gate−to−Source Voltage and Drain−to−Source Voltage versus Total Charge

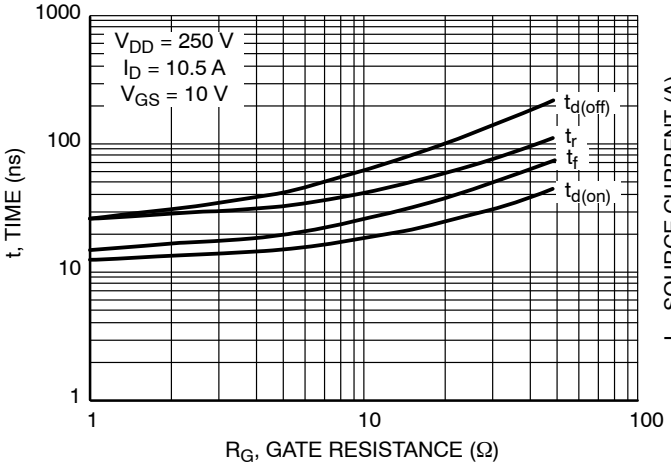


Figure 10. Resistive Switching Time Variation versus Gate Resistance

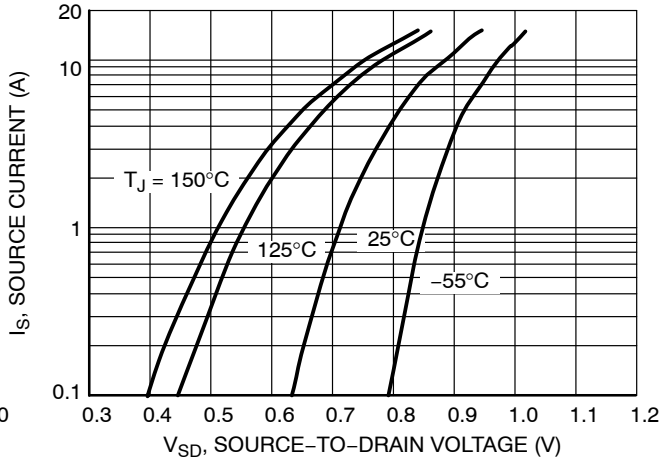


Figure 11. Diode Forward Voltage versus Current

TYPICAL CHARACTERISTICS

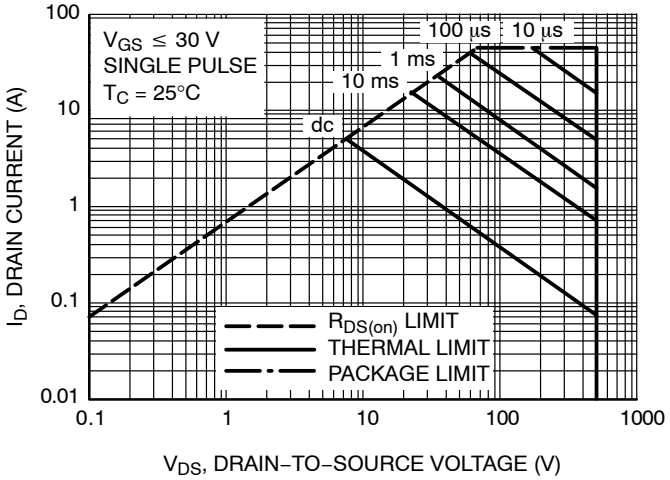


Figure 12. Maximum Rated Forward Biased Safe Operating Area NDF11N50Z

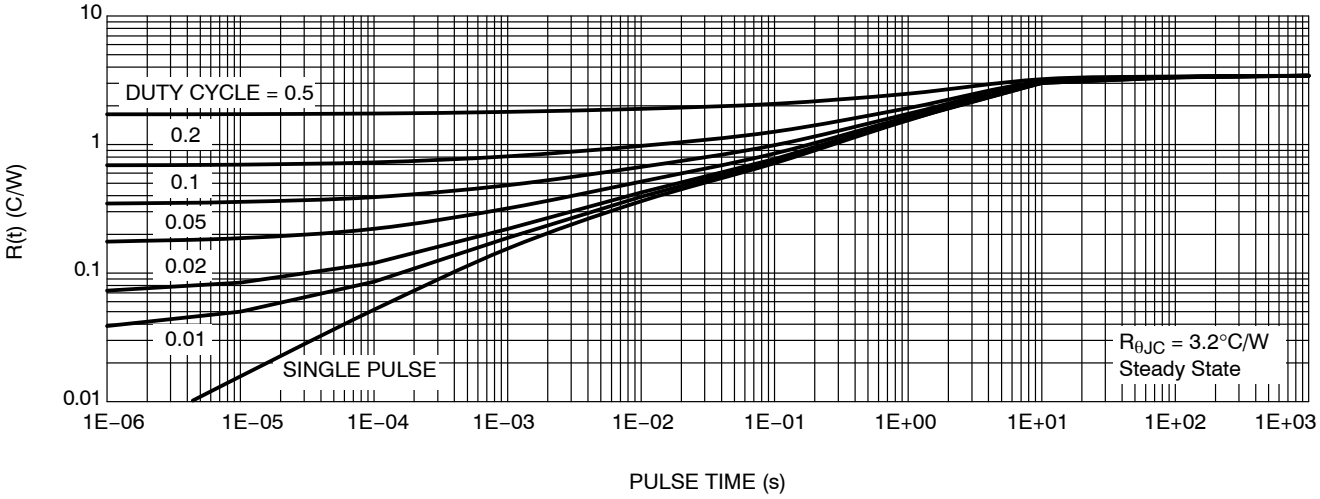


Figure 13. Thermal Impedance (Junction−to−Case) for NDF11N50Z

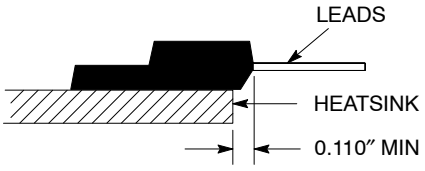


Figure 14. Isolation Test Diagram

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

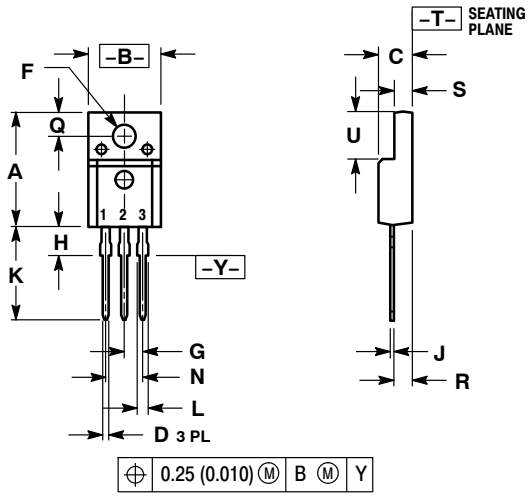
*For additional mounting information, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

ORDERING INFORMATION

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

PACKAGE DIMENSIONS

TO−220FP
CASE 221D−03
ISSUE K

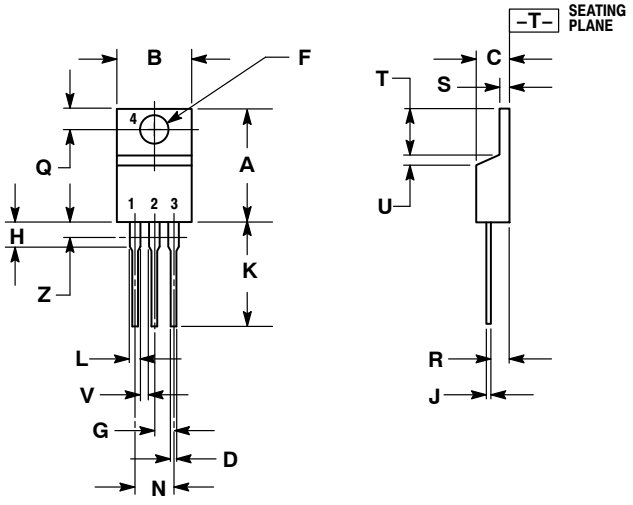


NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH
3. 221D−01 THRU 221D−02 OBSOLETE, NEW STANDARD 221D−03.

	INCHES		MILLIMETERS	
DIM	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−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.

	INCHES		MILLIMETERS	
DIM	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

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:
Literature Distribution Center for ON Semiconductor
P.O. Box 5163, Denver, Colorado 80217 USA
Phone: 303−675−2175 or 800−344−3860 Toll Free USA/Canada
Fax: 303−675−2176 or 800−344−3867 Toll Free USA/Canada
Email: orderlit@onsemi.com

N. American Technical Support: 800−282−9855 Toll Free USA/Canada
Europe, Middle East and Africa Technical Support:
Phone: 421 33 790 2910
Japan Customer Focus Center
Phone: 81−3−5773−3850

ON Semiconductor Website: **www.onsemi.com**

Order Literature: http://www.onsemi.com/orderlit

For additional information, please contact your local Sales Representative