

NDF06N60Z, NDP06N60Z

N-Channel Power MOSFET 0.98 Ω, 600 Volts

Features

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

Applications

- Adapter (Notebook, Printer, Gaming)
- LCD Panel Power
- Lighting Ballasts

ABSOLUTE MAXIMUM RATINGS (T_C = 25°C unless otherwise noted)

Rating	Symbol	NDF06N60Z	NDP06N60Z	Unit
Drain-to-Source Voltage	V _{DSS}	600		V
Continuous Drain Current, R _{θJC}	I _D	6.0 (Note 2)		A
Continuous Drain Current T _A = 100°C, R _{θJC}	I _D	3.8 (Note 2)		A
Pulsed Drain Current, V _{GS} @ 10 V	I _{DM}	20 (Note 2)		A
Power Dissipation, R _{θJC} (Note 1)	P _D	31	113	W
Gate-to-Source Voltage	V _{GS}	±30		V
Single Pulse Avalanche Energy, L = 6.3 mH, I _D = 6.0 A	E _{AS}	113		mJ
ESD (HBM) (JESD22-A114)	V _{esd}	3000		V
RMS Isolation Voltage (t = 0.3 sec., R.H. ≤ 30%, T _A = 25°C) (Figure 13)	V _{ISO}	4500	-	V
Peak Diode Recovery	dv/dt	4.5 (Note 3)		V/ns
Continuous Source Current (Body Diode)	I _S	6.0		A
Maximum Temperature for Soldering Leads, 0.063" (1.6 mm) from Case for 10 s Package Body for 10 s	T _L T _{PKG}	300 260		°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.

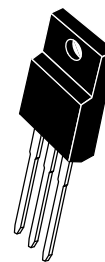
1. Surface mounted on FR4 board using 1" sq. pad size, 1 oz cu
2. Limited by maximum junction temperature
3. I_{SD} = 6.0 A, di/dt ≤ 100 A/μs, V_{DD} ≤ BV_{DSS}, T_J = +150°C



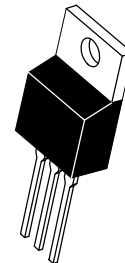
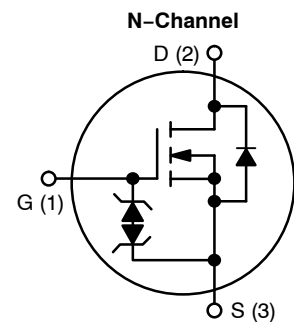
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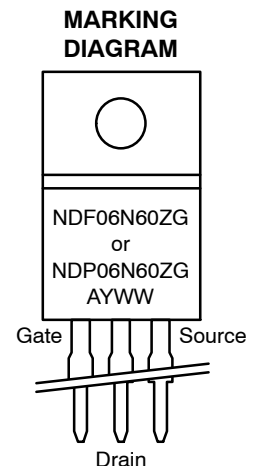
V _{DSS}	R _{DS(ON)} (TYP) @ 3 A
600 V	0.98 Ω



TO-220FP
CASE 221D
STYLE 1



TO-220AB
CASE 221A
STYLE 5



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

ORDERING INFORMATION

Device	Package	Shipping
NDF06N60ZG	TO-220FP	50 Units/Rail
NDP06N60ZG	TO-220AB	In Development

NDF06N60Z, NDP06N60Z

THERMAL RESISTANCE

Parameter	Symbol	NDF06N60Z	NDP06N60Z	Unit
Junction-to-Case (Drain)	$R_{\theta JC}$	4.0	1.1	°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}	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}			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	$V_{GS} = 10\text{ V}, I_D = 3.0\text{ A}$	$R_{DS(on)}$		0.98	1.2	Ω
Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 100\ \mu\text{A}$	$V_{GS(th)}$	3.0		4.5	V
Forward Transconductance	$V_{DS} = 15\text{ V}, I_D = 3.0\text{ A}$	g_{FS}		5.0		S

DYNAMIC CHARACTERISTICS

Input Capacitance	$V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V},$ $f = 1.0\text{ MHz}$	C_{iss}		923		pF
Output Capacitance		C_{oss}		106		
Reverse Transfer Capacitance		C_{rss}		23		
Total Gate Charge	$V_{DD} = 300\text{ V}, I_D = 6.0\text{ A},$ $V_{GS} = 10\text{ V}$	Q_g		31		nC
Gate-to-Source Charge		Q_{gs}		6.3		
Gate-to-Drain ("Miller") Charge		Q_{gd}		17		
Gate Resistance		R_g		3.2		Ω

RESISTIVE SWITCHING CHARACTERISTICS

Turn-On Delay Time	$V_{DD} = 300\text{ V}, I_D = 6.0\text{ A},$ $V_{GS} = 10\text{ V}, R_G = 5\ \Omega$	$t_{d(on)}$		13		ns
Rise Time		t_r		17		
Turn-Off Delay Time		$t_{d(off)}$		30		
Fall Time		t_f		28		

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

Diode Forward Voltage	$I_S = 6.0\text{ A}, V_{GS} = 0\text{ V}$	V_{SD}			1.6	V
Reverse Recovery Time	$V_{GS} = 0\text{ V}, V_{DD} = 30\text{ V}$ $I_S = 6.0\text{ A}, di/dt = 100\text{ A}/\mu\text{s}$	t_{rr}		338		ns
Reverse Recovery Charge		Q_{rr}		2.0		μC

4. Insertion mounted

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

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TYPICAL CHARACTERISTICS

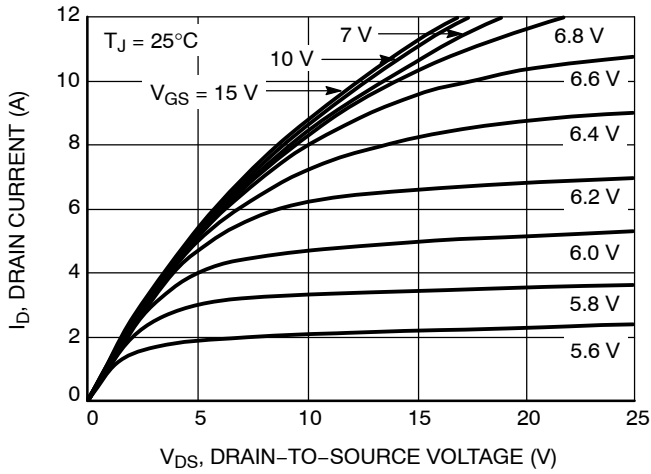


Figure 1. On-Region Characteristics

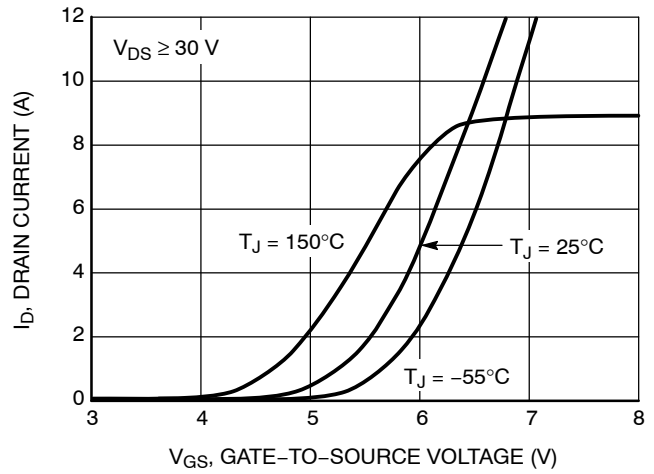


Figure 2. Transfer Characteristics

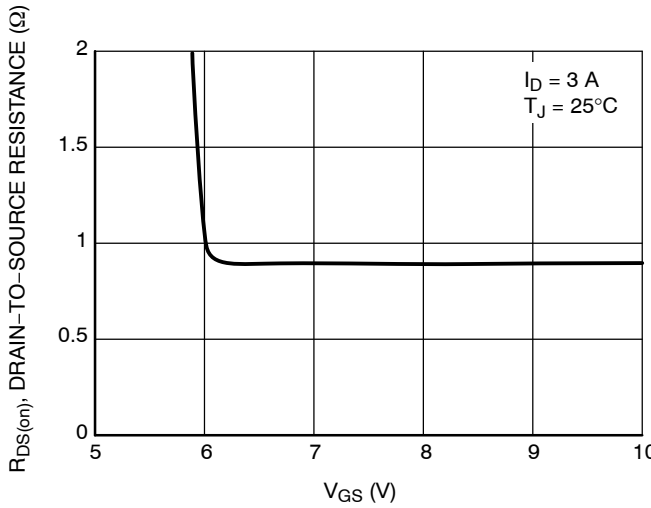


Figure 3. On-Resistance vs. V_{GS}

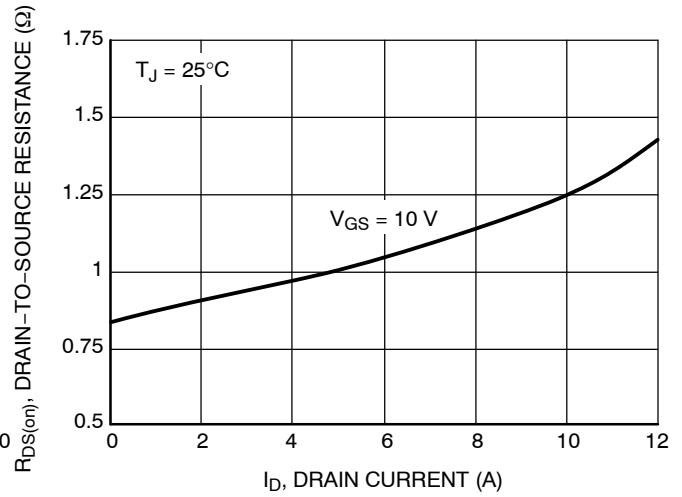


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

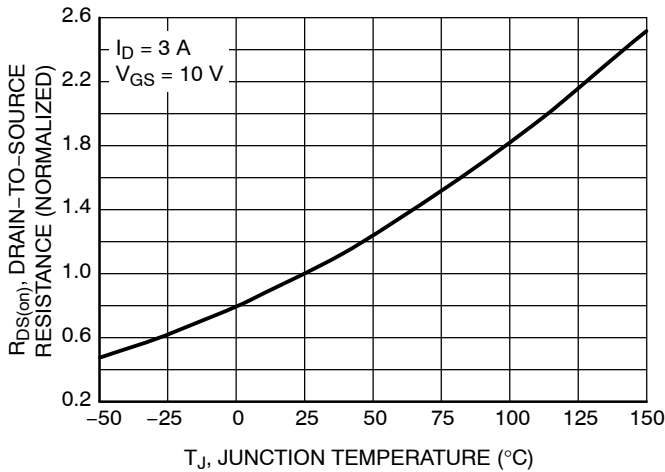


Figure 5. On-Resistance Variation with Temperature

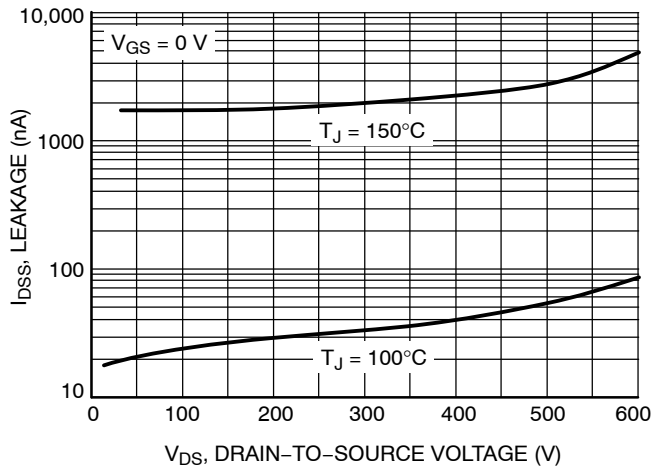


Figure 6. Drain-to-Source Leakage Current vs. Voltage

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TYPICAL CHARACTERISTICS

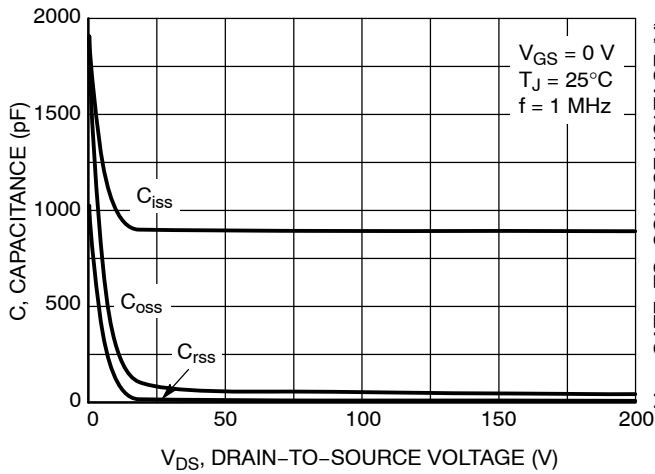


Figure 7. Capacitance Variation

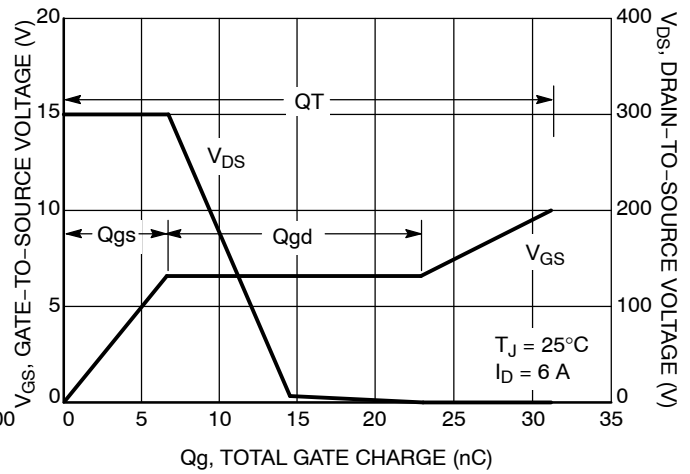


Figure 8. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge

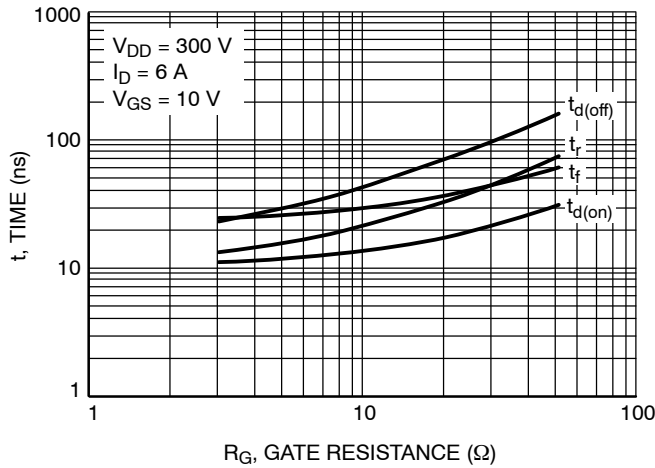


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

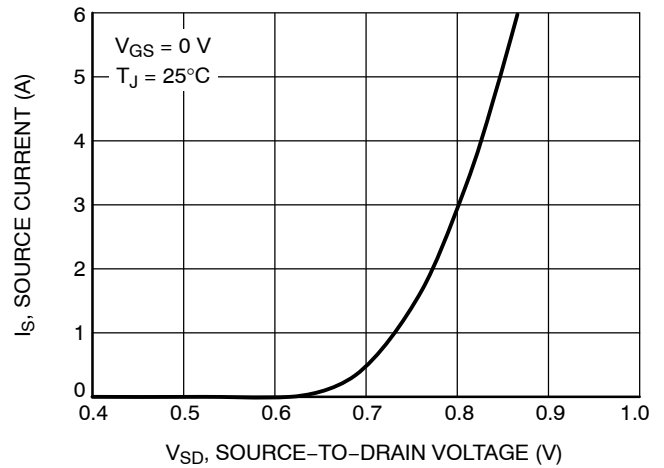


Figure 10. Diode Forward Voltage vs. Current

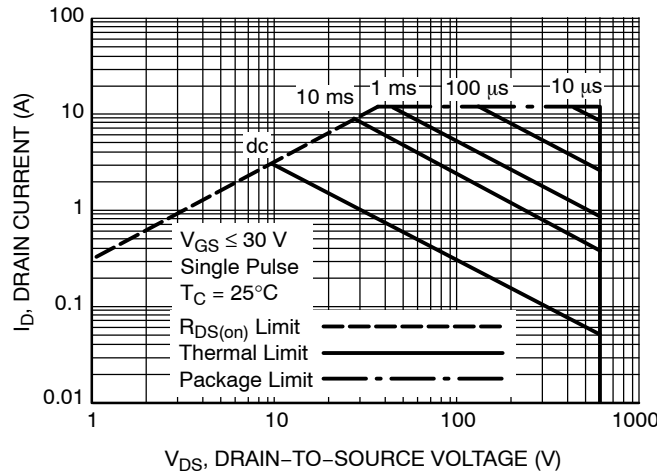


Figure 11. Maximum Rated Forward Biased Safe Operating Area for NDF06N60Z

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TYPICAL CHARACTERISTICS

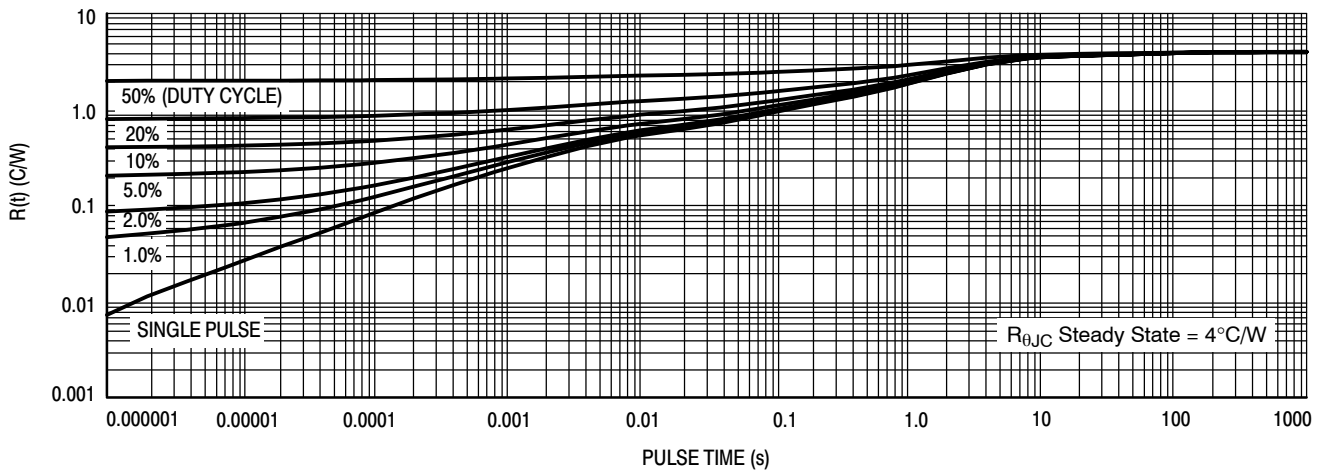


Figure 12. Thermal Impedance for NDF06N60Z

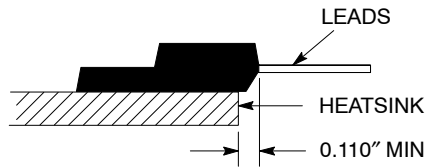


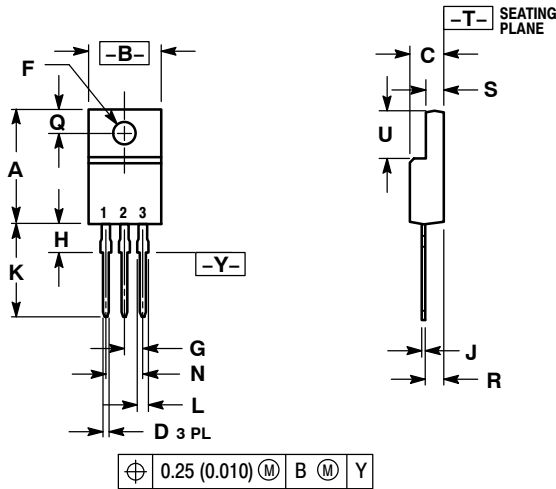
Figure 13. Mounting Position for Isolation Test

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

NDF06N60Z, NDP06N60Z

PACKAGE DIMENSIONS

TO-220 FULLPAK CASE 221D-03 ISSUE J



NOTES:

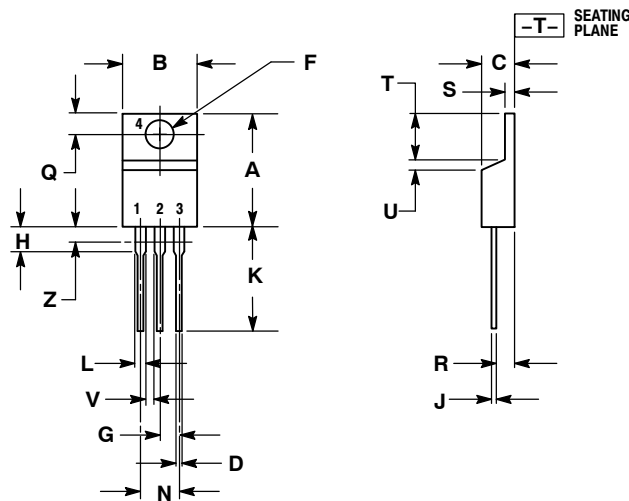
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH
3. 221D-01 THRU 221D-02 OBSOLETE, NEW STANDARD 221D-03.

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:

1. GATE
2. DRAIN
3. SOURCE

TO-220AB CASE 221A-09 ISSUE AE



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:

1. GATE
2. DRAIN
3. SOURCE
4. DRAIN

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