

# NDF08N50Z

## N-Channel Power MOSFET 500 V, 0.85 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<sub>C</sub> = 25°C unless otherwise noted)

Rating	Symbol	NDF08N50Z	Unit
Drain-to-Source Voltage	V <sub>DSS</sub>	500	V
Continuous Drain Current R <sub>θJC</sub> (Note 1)	I <sub>D</sub>	8.5	A
Continuous Drain Current R <sub>θJC</sub> T <sub>A</sub> = 100°C (Note 1)	I <sub>D</sub>	5.4	A
Pulsed Drain Current, V <sub>GS</sub> @ 10 V	I <sub>DM</sub>	34	A
Power Dissipation	P <sub>D</sub>	35	W
Gate-to-Source Voltage	V <sub>GS</sub>	±30	V
Single Pulse Avalanche Energy, I <sub>D</sub> = 7.5 A	E <sub>AS</sub>	190	mJ
ESD (HBM) (JESD 22-A114)	V <sub>esd</sub>	3500	V
RMS Isolation Voltage (t = 0.3 sec., R.H. ≤ 30%, T <sub>A</sub> = 25°C) (Figure 14)	V <sub>ISO</sub>	4500	V
Peak Diode Recovery (Note 2)	dV/dt	4.5	V/ns
MOSFET dV/dt	dV/dt	60	V/ns
Continuous Source Current (Body Diode)	I <sub>S</sub>	7.5	A
Maximum Temperature for Soldering Leads	T <sub>L</sub>	260	°C
Operating Junction and Storage Temperature Range	T <sub>J</sub> , T <sub>stg</sub>	-55 to 150	°C

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

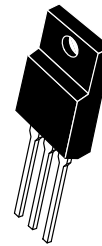
1. Limited by maximum junction temperature
2. I<sub>SD</sub> = 7.5 A, di/dt ≤ 100 A/μs, V<sub>DD</sub> ≤ BV<sub>DSS</sub>, T<sub>J</sub> = +150°C



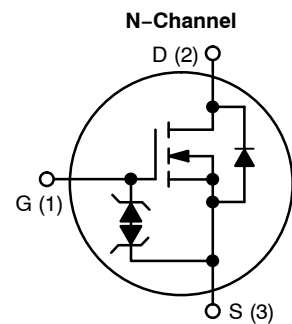
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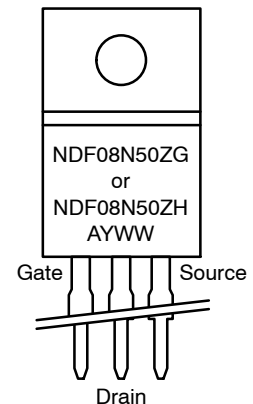
V <sub>DSS</sub>	R <sub>DS(ON)</sub> (MAX) @ 3.6 A
500 V	0.85 Ω



**NDF08N50ZG,  
NDF08N50ZH  
TO-220FP  
CASE 221AH**



### MARKING DIAGRAM



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

### ORDERING INFORMATION

Device	Package	Shipping
NDF08N50ZG	TO-220FP (Pb-Free, Halogen-Free)	50 Units / Rail
NDF08N50ZH	TO-220FP (Pb-Free, Halogen-Free)	50 Units / Rail

# NDF08N50Z

## THERMAL RESISTANCE

Parameter	Symbol	NDF08N50Z	Unit
Junction-to-Case (Drain)	$R_{\theta JC}$	3.6	°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	$V_{GS} = 0\text{ V}, I_D = 1\text{ mA}$	$BV_{DSS}$	500			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	$V_{DS} = 500\text{ V}, V_{GS} = 0\text{ V}$	$I_{DSS}$	25°C		1	μA
			150°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	$V_{GS} = 10\text{ V}, I_D = 3.6\text{ A}$	$R_{DS(on)}$		0.69	0.85	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	$V_{DS} = 15\text{ V}, I_D = 3.75\text{ A}$	$g_{FS}$		6.0		S

### DYNAMIC CHARACTERISTICS

Input Capacitance (Note 5)	$V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V},$ $f = 1.0\text{ MHz}$	$C_{iss}$	730	912	1095	pF
Output Capacitance (Note 5)		$C_{oss}$	95	120	140	
Reverse Transfer Capacitance (Note 5)		$C_{rss}$	15	27	35	
Total Gate Charge (Note 5)	$V_{DD} = 250\text{ V}, I_D = 7.5\text{ A},$ $V_{GS} = 10\text{ V}$	$Q_g$	16	31	46	nC
Gate-to-Source Charge (Note 5)		$Q_{gs}$	3	6.2	9	
Gate-to-Drain ("Miller") Charge (Note 5)		$Q_{gd}$	8	17	25	
Plateau Voltage		$V_{GP}$		6.3		V
Gate Resistance		$R_g$		3.0		Ω

### RESISTIVE SWITCHING CHARACTERISTICS

Turn-On Delay Time	$V_{DD} = 250\text{ V}, I_D = 7.5\text{ A},$ $V_{GS} = 10\text{ V}, R_G = 5\text{ }\Omega$	$t_{d(on)}$		13		ns
Rise Time		$t_r$		23		
Turn-Off Delay Time		$t_{d(off)}$		31		
Fall Time		$t_f$		29		

### 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	$V_{GS} = 0\text{ V}, V_{DD} = 30\text{ V}$ $I_S = 7.5\text{ A}, di/dt = 100\text{ A}/\mu\text{s}$	$t_{rr}$		295		ns
Reverse Recovery Charge		$Q_{rr}$		1.85		μC

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

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

5. Guaranteed by design.

TYPICAL CHARACTERISTICS

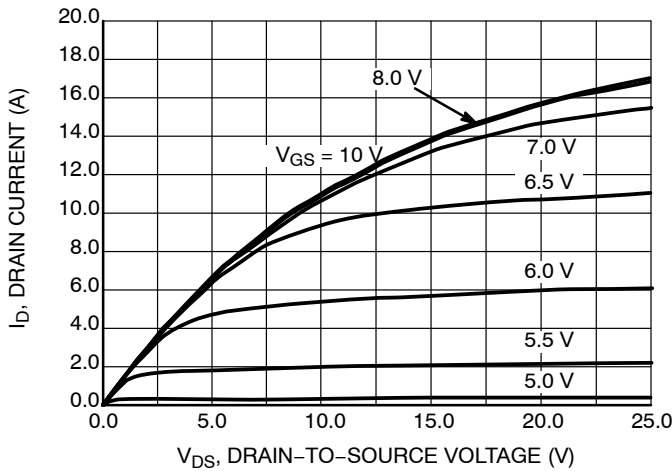


Figure 1. On-Region Characteristics

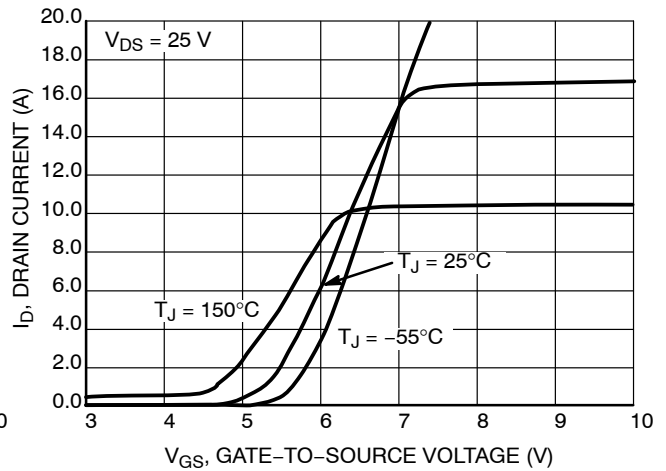


Figure 2. Transfer Characteristics

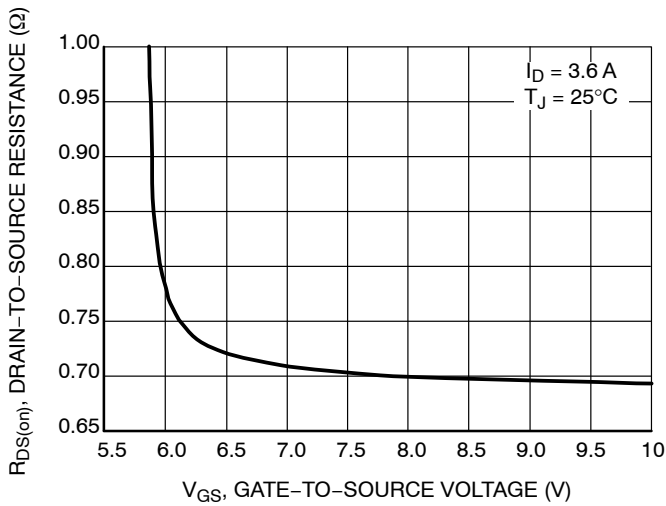


Figure 3. On-Region versus Gate-to-Source Voltage

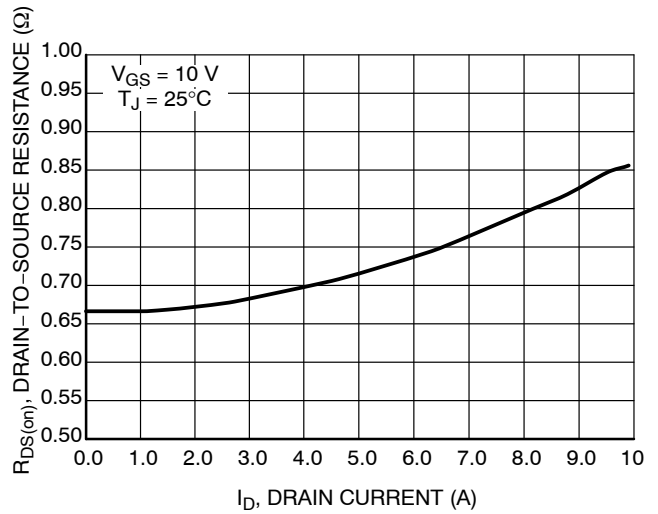


Figure 4. On-Resistance versus Drain Current and Gate Voltage

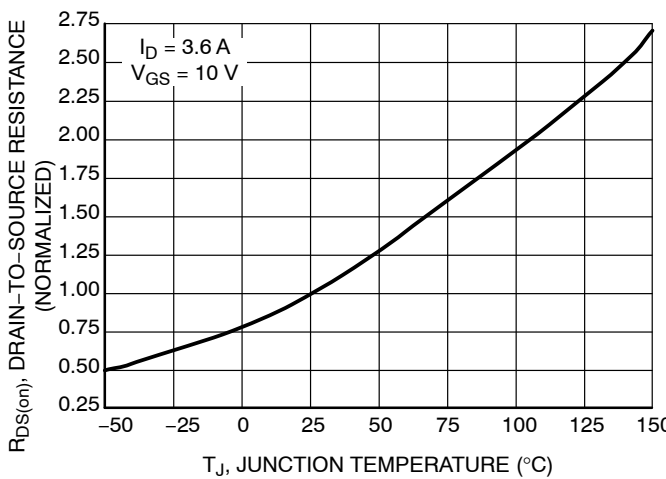


Figure 5. On-Resistance Variation with Temperature

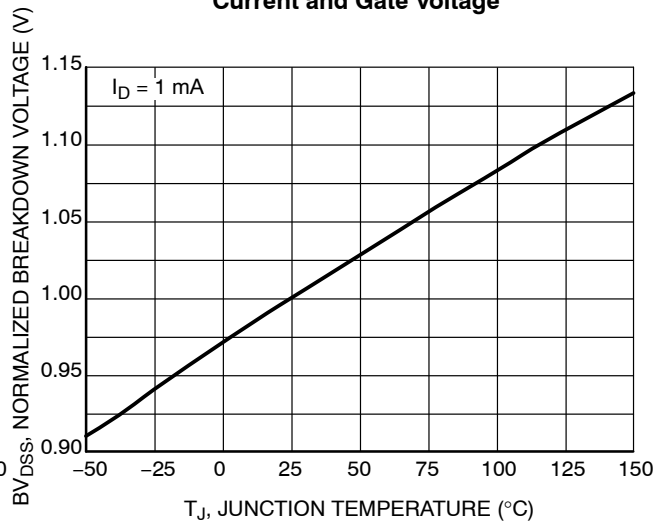
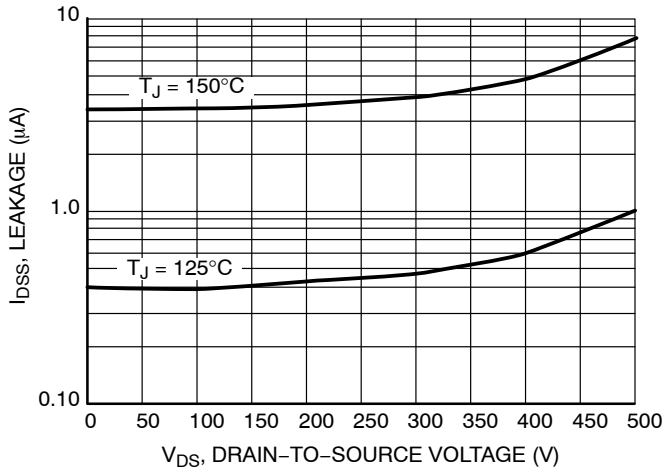


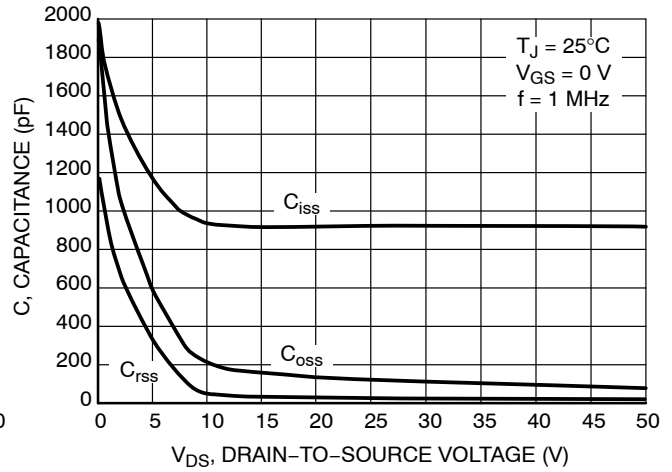
Figure 6.  $BV_{DSS}$  Variation with Temperature

# NDF08N50Z

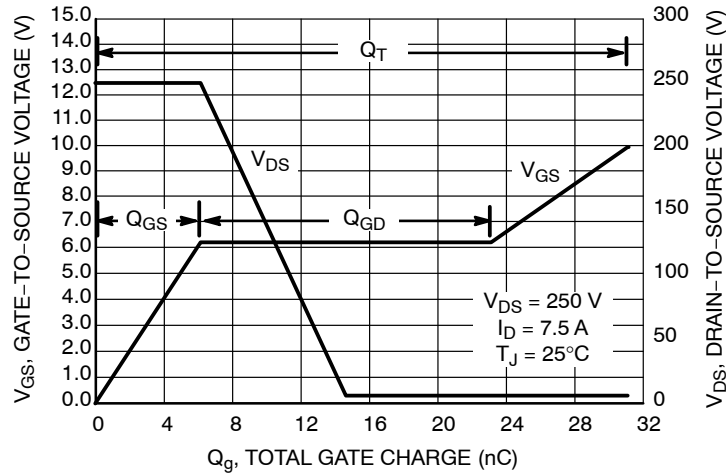
## TYPICAL CHARACTERISTICS



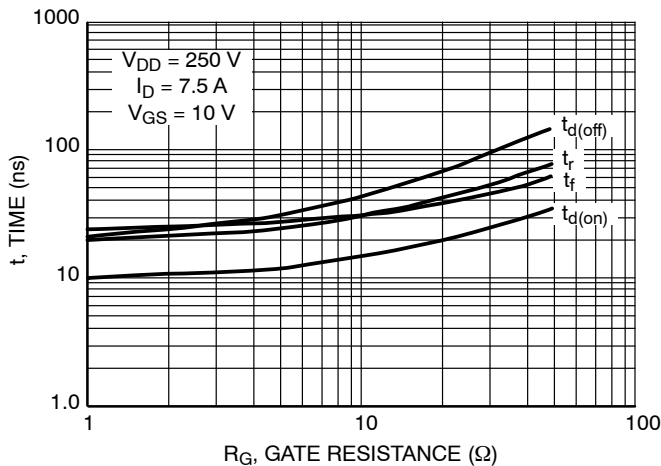
**Figure 7. Drain-to-Source Leakage Current versus Voltage**



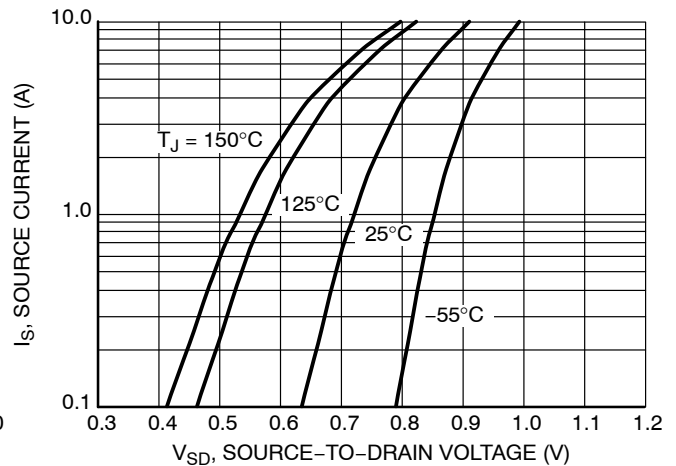
**Figure 8. Capacitance Variation**



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



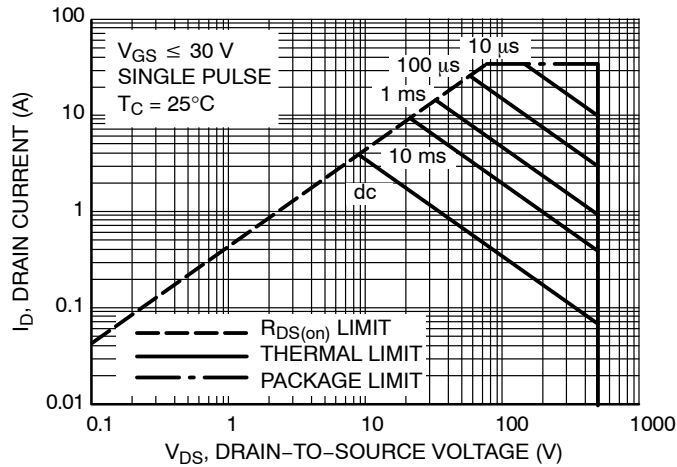
**Figure 10. Resistive Switching Time Variation versus Gate Resistance**



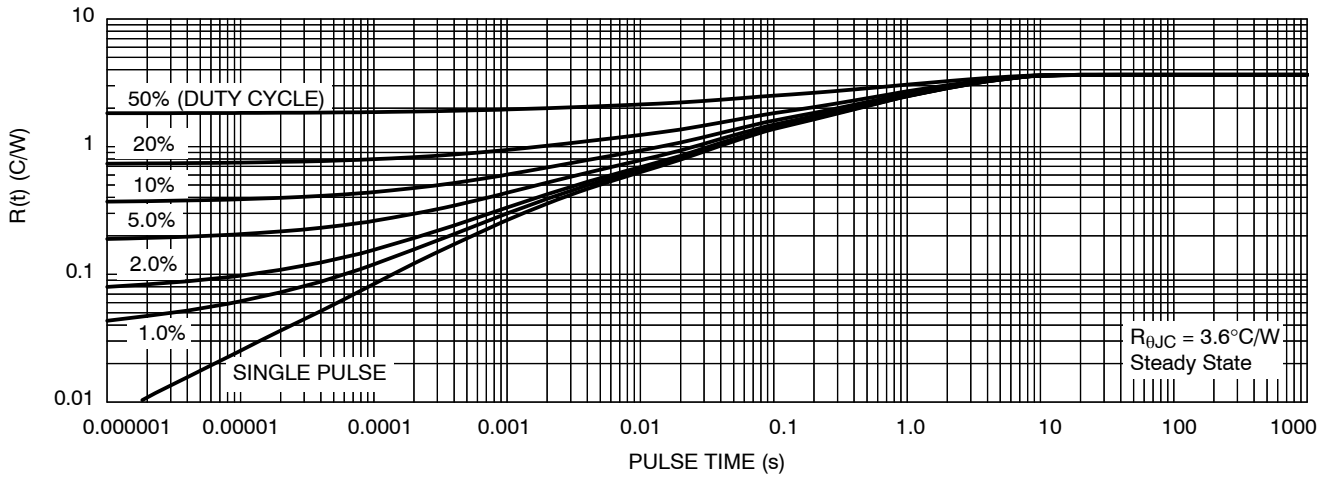
**Figure 11. Diode Forward Voltage versus Current**

# NDF08N50Z

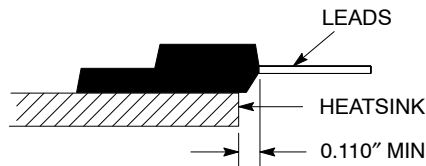
## TYPICAL CHARACTERISTICS



**Figure 12. Maximum Rated Forward Biased Safe Operating Area NDF08N50Z**



**Figure 13. Thermal Impedance (Junction-to-Case) for NDF08N50Z**



**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.

# MECHANICAL CASE OUTLINE

## PACKAGE DIMENSIONS

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### TO-220 FULLPACK, 3-LEAD CASE 221AH ISSUE F

DATE 30 SEP 2014



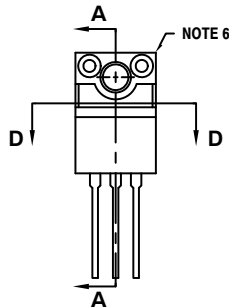
SCALE 1:1



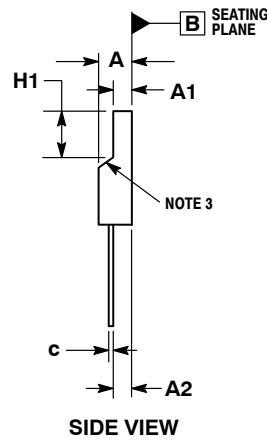
FRONT VIEW



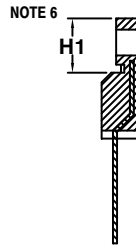
SECTION D-D



ALTERNATE CONSTRUCTION



SIDE VIEW



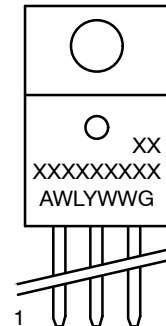
SECTION A-A

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.
6. CONTOURS AND FEATURES OF THE MOLDED PACKAGE BODY MAY VARY WITHIN THE ENVELOPE DEFINED BY DIMENSIONS A1 AND H1 FOR MANUFACTURING PURPOSES.

MILLIMETERS		
DIM	MIN	MAX
A	4.30	4.70
A1	2.50	2.90
A2	2.50	2.90
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	6.60	7.10
L	12.50	14.73
L1	---	2.80
P	3.00	3.40
Q	2.80	3.20

### GENERIC MARKING DIAGRAM\*



- A = Assembly Location
- WL = Wafer Lot
- Y = Year
- WW = Work Week
- G = Pb-Free Package

\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "▪", may or may not be present.

STYLE 1:

1. MAIN TERMINAL 1
2. MAIN TERMINAL 2
3. GATE

STYLE 2:

1. CATHODE
2. ANODE
3. GATE

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DESCRIPTION:	TO-220 FULLPACK, 3-LEAD	PAGE 1 OF 1

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