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, $R_{\theta JC}$ (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	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
MOSFET dV/dt	dV/dt	60	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 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_d ≤ 10.5 A, di/dt ≤ 200 A/μs, V_{DD} ≤ BV_{DSS}, T_J ≤ 150°C.

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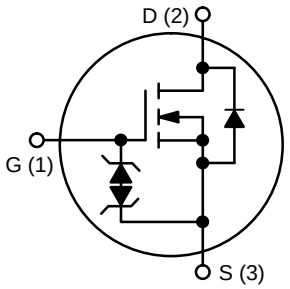
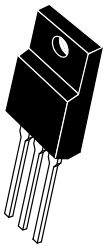
V_{DSS}	$R_{DS(ON)}$ (MAX) @ 4.5 A
500 V	0.52 Ω

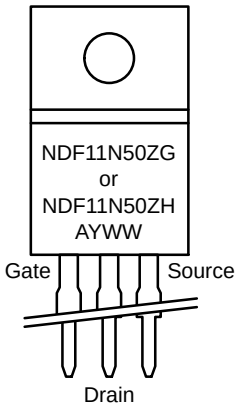
N−Channel





NDF11N50ZG
NDF11N50ZH
TO−220FP
CASE 221AH

MARKING DIAGRAM



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

ORDERING INFORMATION

See detailed ordering and shipping information on page 6 of this data sheet.

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°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	3.9	4.5	V
Forward Transconductance	V_{DS} = 15 V, I_D = 4.5 A		g_{FS}		7.7		S
DYNAMIC CHARACTERISTICS							
Input Capacitance (Note 5)	V_{DS} = 25 V, V_{GS} = 0 V, f = 1.0 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 V, I_D = 10.5 A, V_{GS} = 10 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 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

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.

3. Insertion mounted
4. Pulse Width ≤ 380 μs, Duty Cycle ≤ 2%.
5. Guaranteed by design.

TYPICAL CHARACTERISTICS

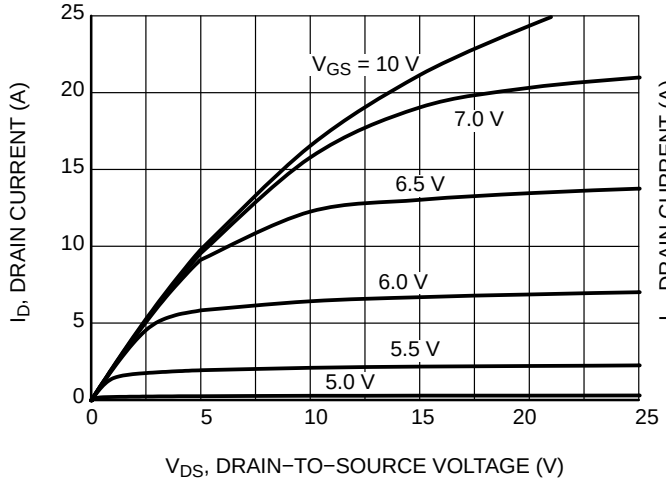


Figure 1. On−Region Characteristics

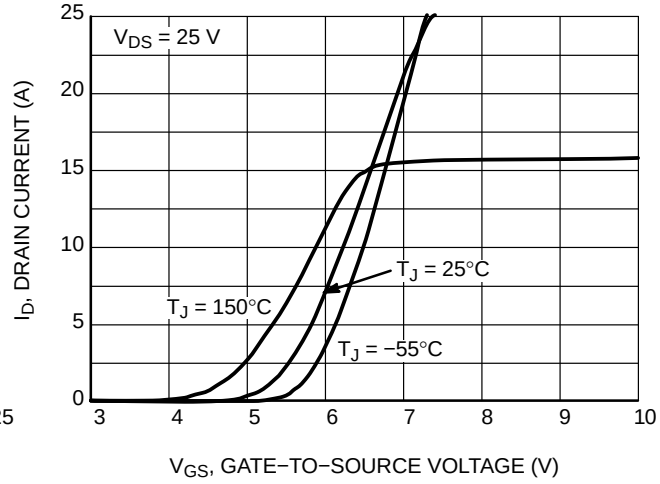


Figure 2. Transfer Characteristics

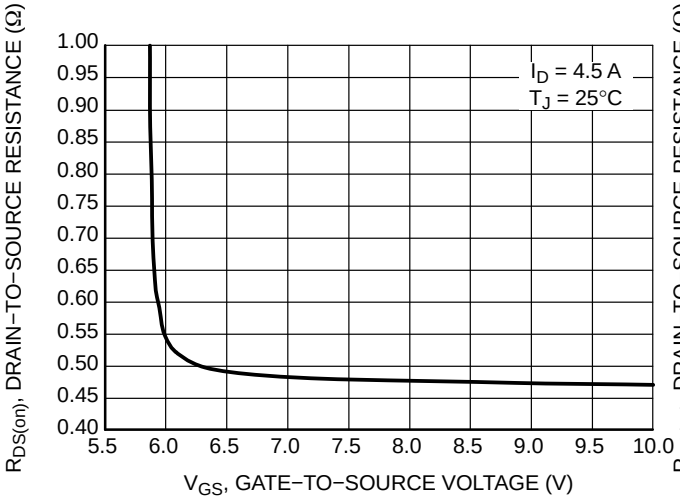


Figure 3. On−Region versus Gate−to−Source Voltage

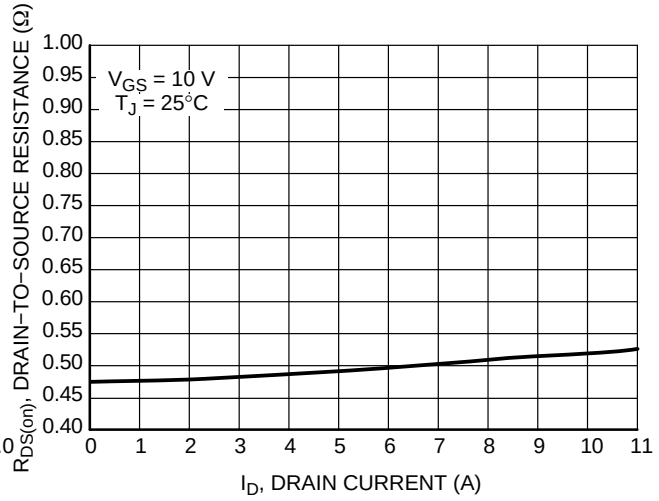


Figure 4. On−Resistance versus Drain Current and Gate Voltage

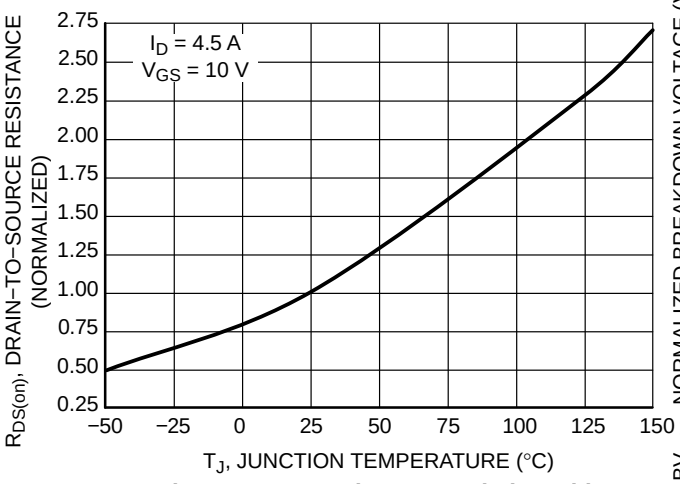


Figure 5. On−Resistance Variation with Temperature

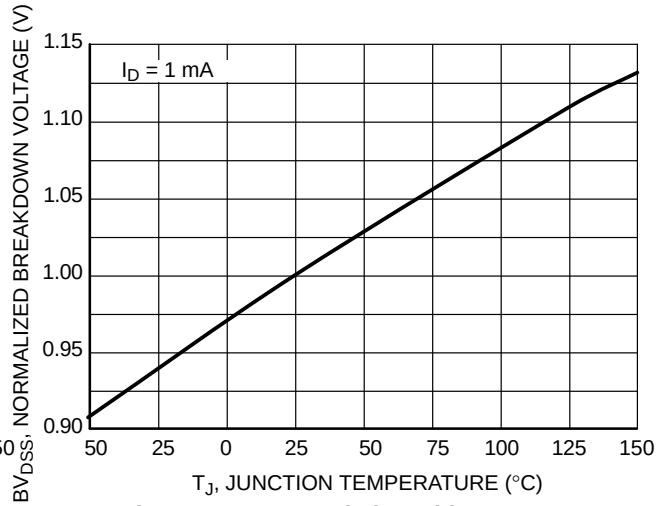


Figure 6. BV_{DSS} Variation with Temperature

TYPICAL CHARACTERISTICS

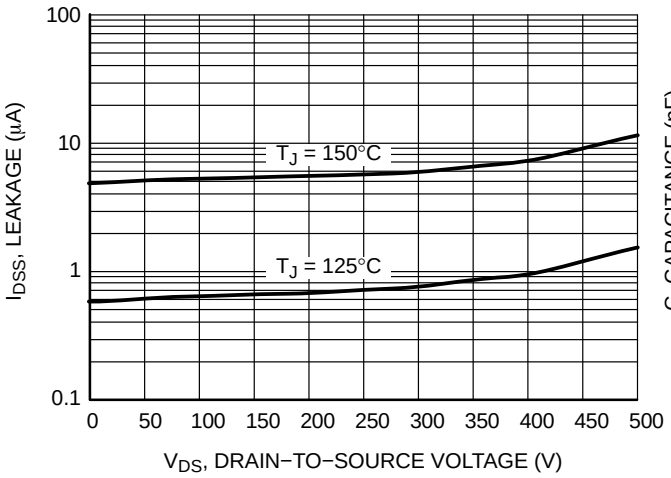


Figure 7. Drain−to−Source Leakage Current versus Voltage

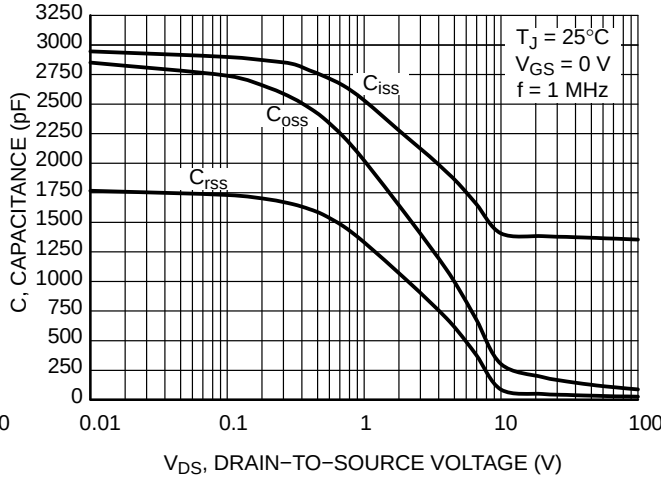


Figure 8. Capacitance Variation

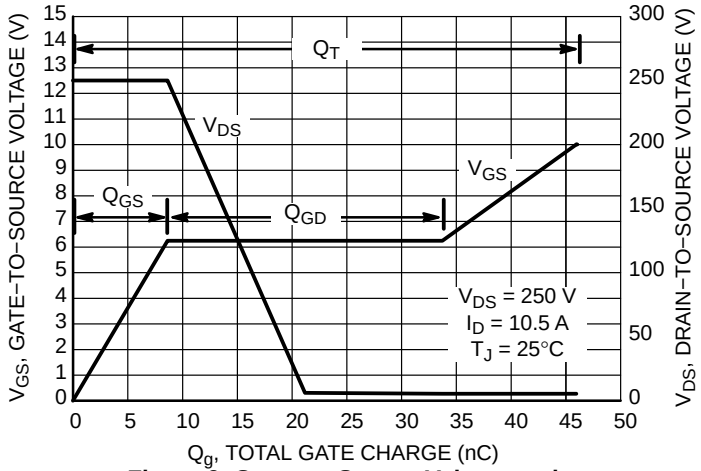


Figure 9. Gate−to−Source Voltage and Drain−to−Source Voltage versus Total Charge

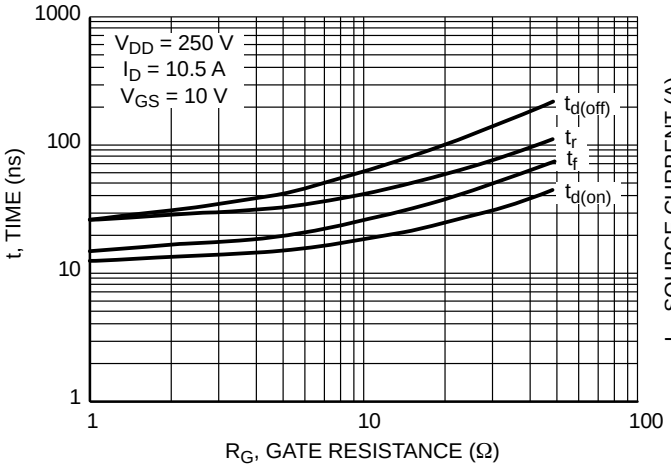


Figure 10. Resistive Switching Time Variation versus Gate Resistance

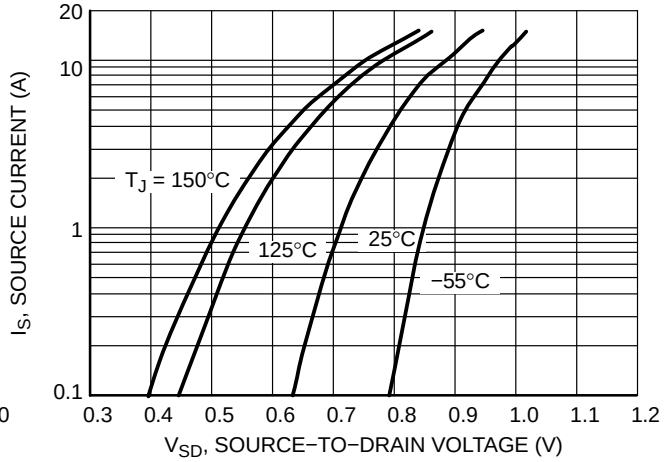


Figure 11. Diode Forward Voltage versus Current

TYPICAL CHARACTERISTICS

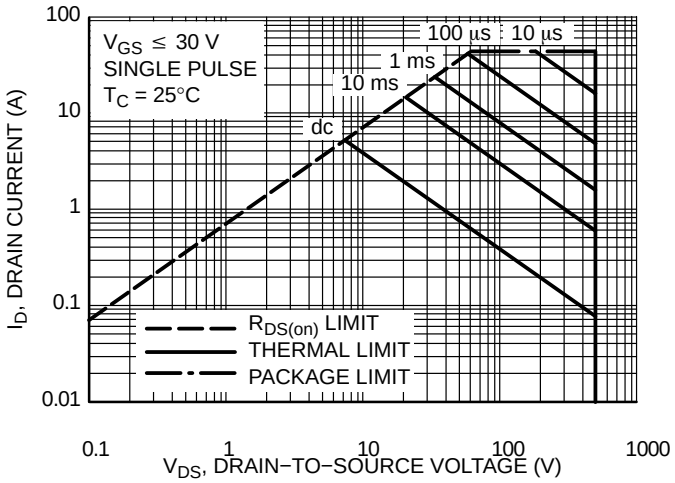


Figure 12. Maximum Rated Forward Biased Safe Operating Area NDF11N50Z

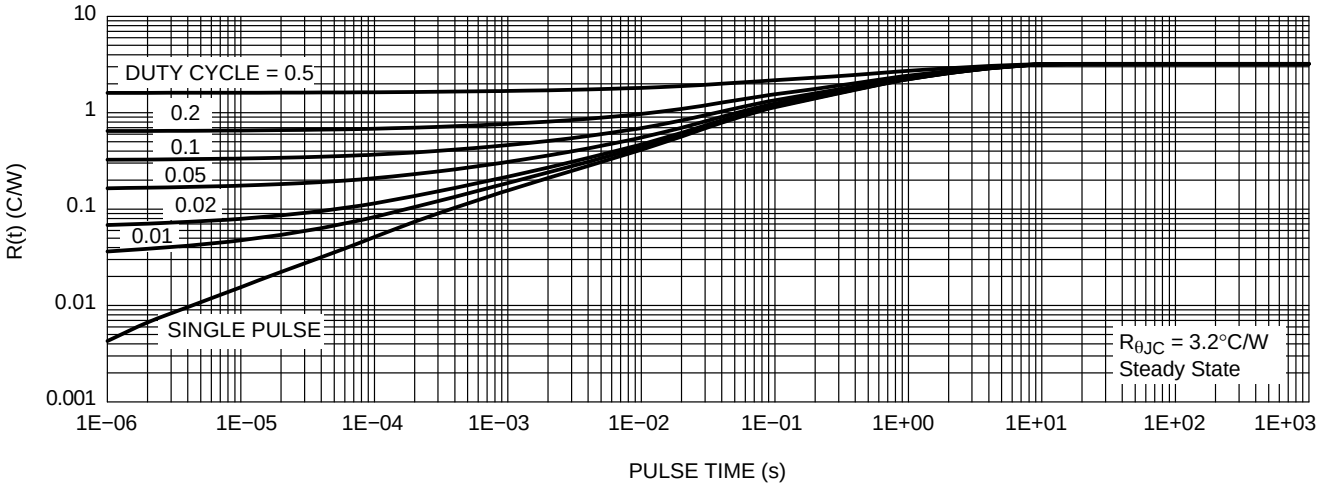


Figure 13. Thermal Impedance (Junction−to−Case) for NDF11N50Z

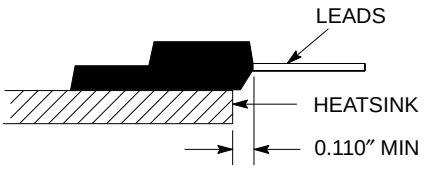


Figure 14. Isolation Test Diagram

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

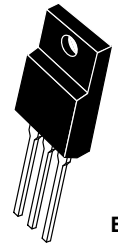
*For additional mounting information, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

ORDERING INFORMATION

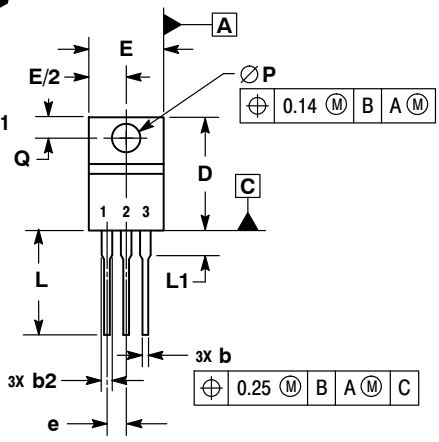
Order Number	Package	Shipping
NDF11N50ZG	TO−220FP (Pb−Free, Halogen−Free)	50 Units / Rail
NDF11N50ZH	TO−220FP (Pb−Free, Halogen−Free)	50 Units / Rail

TO−220 FULLPACK, 3−LEAD
CASE 221AH
ISSUE F

DATE 30 SEP 2014

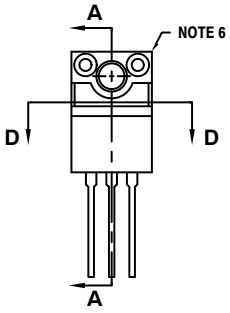


SCALE 1:1

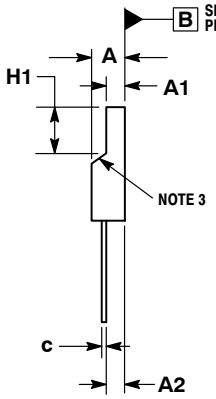


FRONT VIEW

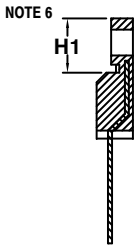
SECTION D−D



ALTERNATE CONSTRUCTION



SIDE VIEW

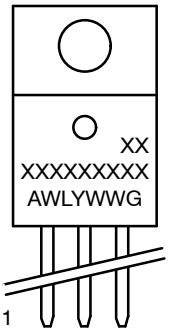


SECTION A−A

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 ENVELOP 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:
PIN 1. MAIN TERMINAL 1
2. MAIN TERMINAL 2
3. GATE

STYLE 2:
PIN 1. CATHODE
2. ANODE
3. GATE

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DESCRIPTION:	**TO−220 FULLPACK, 3−LEAD**		**PAGE 1 OF 1**

ADDITIONAL INFORMATION

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