NTB6413AN, NTP6413AN

N-Channel Power MOSFET 100 V, 42 A, 28 mΩ

Features

- Low $R_{DS(on)}$
- High Current Capability
- 100% Avalanche Tested
- These are Pb−Free Devices

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$V_{(BR)DSS}$	$R_{DS(ON)}$ MAX	I_D MAX (Note 1)
100 V	28 mΩ @ 10 V	42 A

MAXIMUM RATINGS (T_J = 25°C Unless otherwise specified)

Parameter			Symbol	Value	Unit
Drain−to−Source Voltage			V_{DSS}	100	V
Gate−to−Source Voltage − Continuous			V_{GS}	±20	V
Continuous Drain Current $R_{\theta JC}$	Steady State	T_C = 25°C	I_D	42	A
		T_C = 100°C		28	
Power Dissipation $R_{\theta JC}$	Steady State	T_C = 25°C	P_D	136	W
Pulsed Drain Current	t_p = 10 μs		I_{DM}	178	A
Operating Junction and Storage Temperature Range			T_J, T_{stg}	−55 to +175	°C
Source Current (Body Diode)			I_S	42	A
Single Pulse Drain−to−Source Avalanche Energy (V_{DD} = 50 Vdc, V_{GS} = 10 Vdc, $I_{L(pk)}$ = 36.5 A, L = 0.3 mH, R_G = 25 Ω)			E_{AS}	200	mJ
Lead Temperature for Soldering Purposes, 1/8″ from Case for 10 Seconds			T_L	260	°C

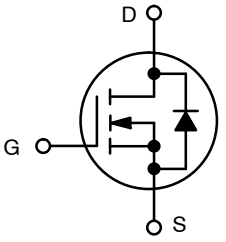
THERMAL RESISTANCE RATINGS

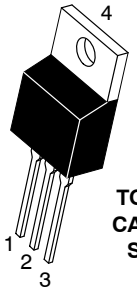
Parameter	Symbol	Max	Unit
Junction−to−Case (Drain) Steady State	$R_{\theta JC}$	1.1	°C/W
Junction−to−Ambient (Note 1)	$R_{\theta JA}$	35	

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.

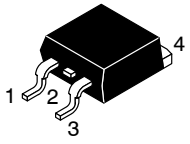
1. Surface mounted on FR4 board using 1 sq in pad size, (Cu Area 1.127 sq in [2 oz] including traces).

N−Channel



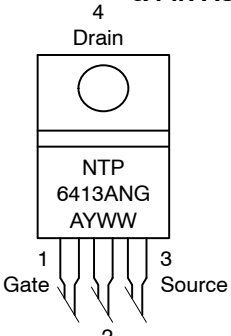


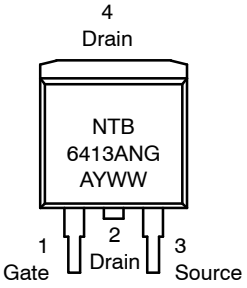
TO−220AB
CASE 221A
STYLE 5



D²PAK
CASE 418B
STYLE 2

MARKING DIAGRAM & PIN ASSIGNMENT





6413AN = Specific Device Code
G = Pb−Free Device
A = Assembly Location
Y = Year
WW = Work Week

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 5 of this data sheet.

ELECTRICAL CHARACTERISTICS (T_J = 25°C Unless otherwise specified)

Characteristics	Symbol	Test Condition		Min	Typ	Max	Unit
OFF CHARACTERISTICS							
Drain−to−Source Breakdown Voltage	$V_{(BR)DSS}$	V_{GS} = 0 V, I_D = 250 μA		100			V
Drain−to−Source Breakdown Voltage Temperature Coefficient	$V_{(BR)DSS}/T_J$				115		mV/°C
Zero Gate Voltage Drain Current	I_{DSS}	V_{GS} = 0 V, V_{DS} = 100 V	T_J = 25°C			1.0	μA
			T_J = 125°C			100	
Gate−to−Source Leakage Current	I_{GSS}	V_{DS} = 0 V, V_{GS} = ±20 V				±100	nA
ON CHARACTERISTICS (Note 2)							
Gate Threshold Voltage	$V_{GS(th)}$	V_{GS} = V_{DS}, I_D = 250 μA		2.0		4.0	V
Negative Threshold Temperature Coefficient	$V_{GS(th)}/T_J$				8.1		mV/°C
Drain−to−Source On−Resistance	$R_{DS(on)}$	V_{GS} = 10 V, I_D = 42 A			25.6	28	mΩ
Forward Transconductance	g_{FS}	V_{GS} = 5 V, I_D = 20 A			17.9		S
CHARGES, CAPACITANCES & GATE RESISTANCE							
Input Capacitance	C_{iss}	V_{DS} = 25 V, V_{GS} = 0 V, f = 1 MHz			1800		pF
Output Capacitance	C_{oss}				280		
Reverse Transfer Capacitance	C_{rss}				100		
Total Gate Charge	$Q_{G(TOT)}$	V_{GS} = 10 V, V_{DS} = 80 V, I_D = 42 A			51		nC
Threshold Gate Charge	$Q_{G(TH)}$				2.0		
Gate−to−Source Charge	Q_{GS}				10		
Gate−to−Drain Charge	Q_{GD}				26		
Plateau Voltage	V_{GP}				5.8		V
Gate Resistance	R_G				2.4		Ω
SWITCHING CHARACTERISTICS, V_{GS} = 10 V (Note 3)							
Turn−On Delay Time	$t_{d(on)}$	V_{GS} = 10 V, V_{DD} = 80 V, I_D = 42 A, R_G = 6.2 Ω			13		ns
Rise Time	t_r				84		
Turn−Off Delay Time	$t_{d(off)}$				52		
Fall Time	t_f				71		
DRAIN−SOURCE DIODE CHARACTERISTICS							
Forward Diode Voltage	V_{SD}	I_S = 42 A	T_J = 25°C		0.92	1.3	V
			T_J = 125°C		0.83		
Reverse Recovery Time	t_{rr}	V_{GS} = 0 V, I_S = 42 A, dI_{SD}/dt = 100 A/μs			73		ns
Charge Time	t_a				56		
Discharge Time	t_b				17		
Reverse Recovery Charge	Q_{RR}				230		nC

2. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2%.
3. Switching characteristics are independent of operating junction temperatures.

TYPICAL CHARACTERISTICS

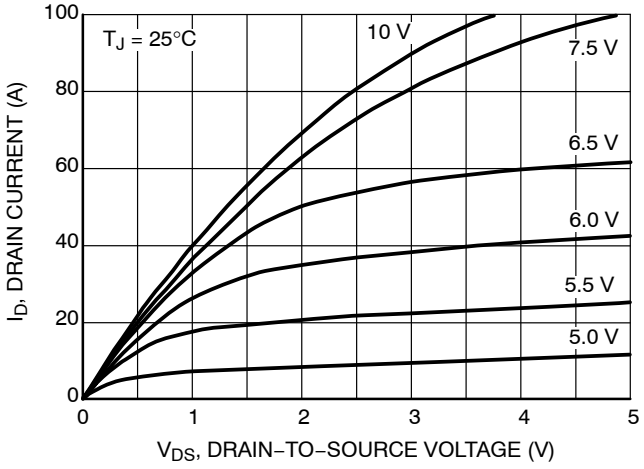


Figure 1. On−Region Characteristics

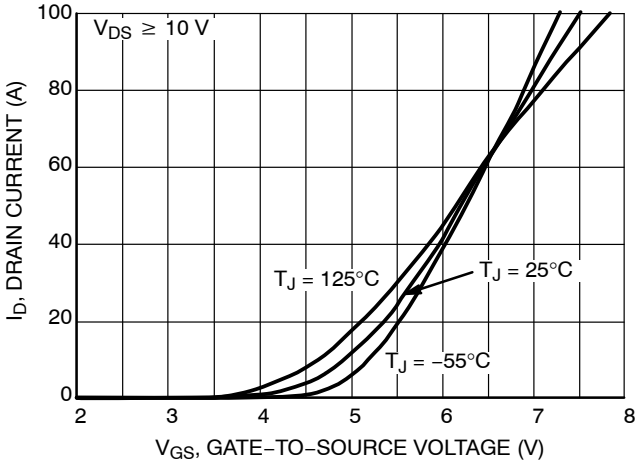


Figure 2. Transfer Characteristics

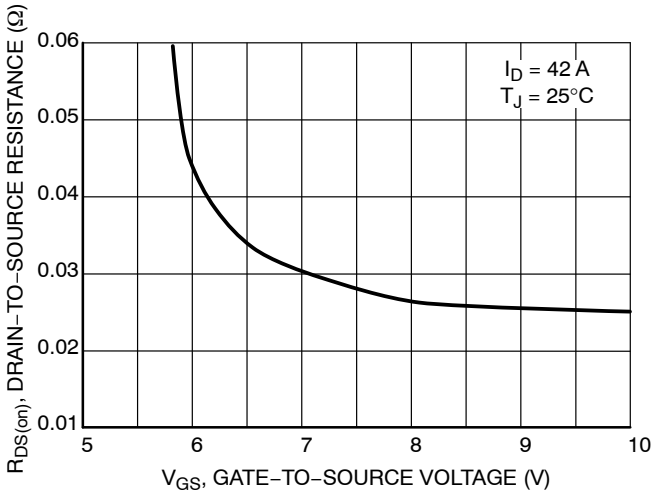


Figure 3. On−Region versus Gate Voltage

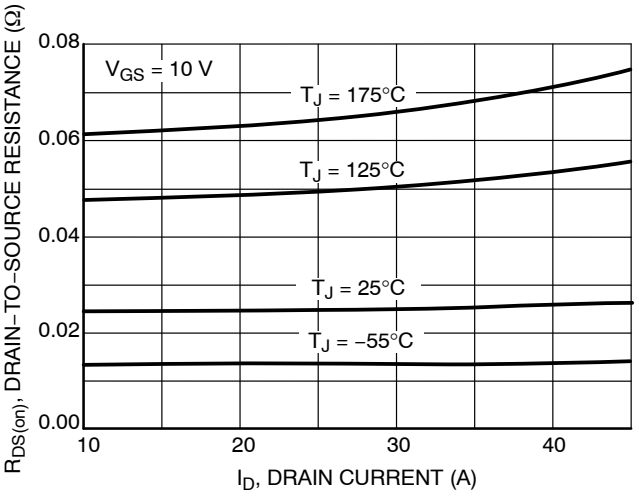


Figure 4. On−Resistance versus Drain Current and Gate Voltage

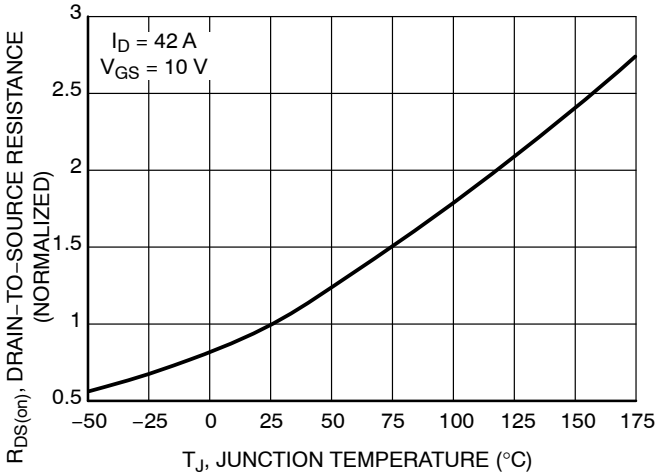


Figure 5. On−Resistance Variation with Temperature

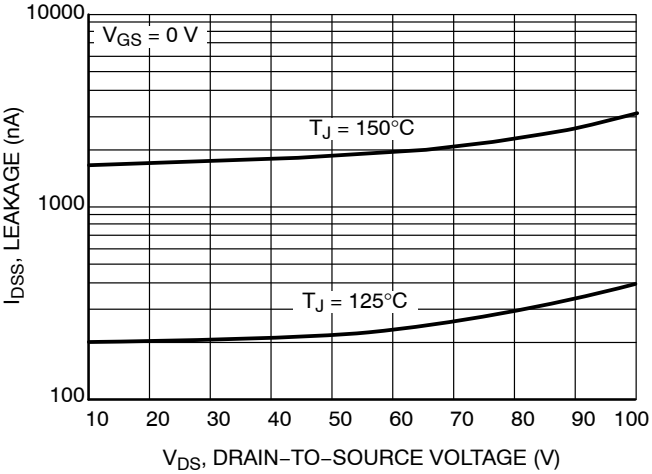


Figure 6. Drain−to−Source Leakage Current versus Voltage

TYPICAL CHARACTERISTICS

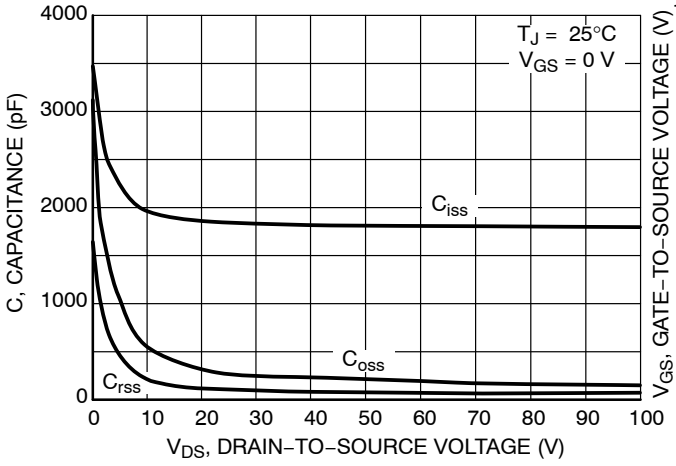


Figure 7. Capacitance Variation

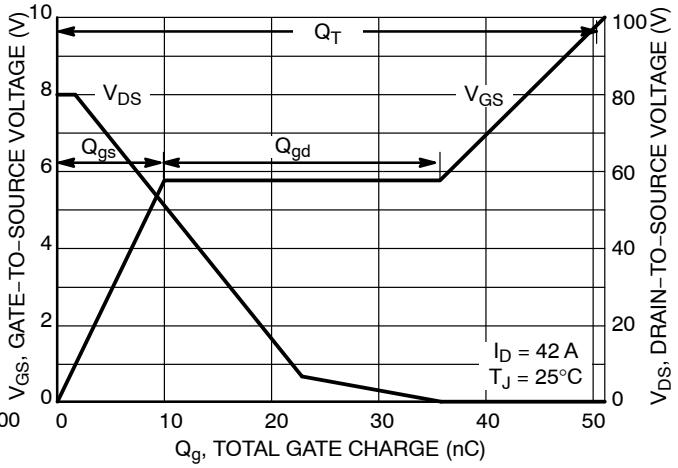


Figure 8. Gate−to−Source Voltage and Drain−to−Source Voltage versus Total Charge

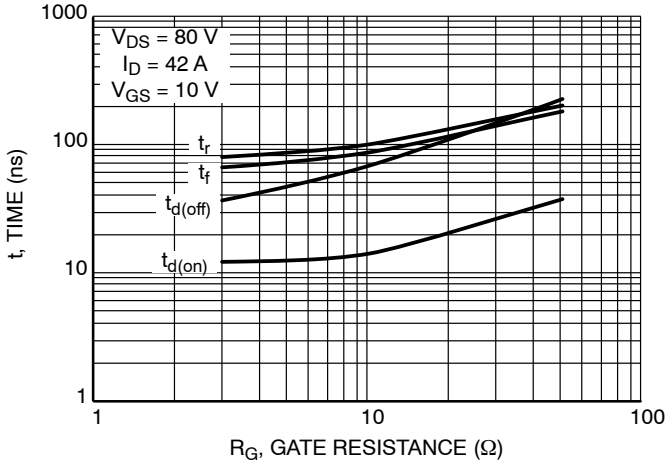


Figure 9. Resistive Switching Time Variation versus Gate Resistance

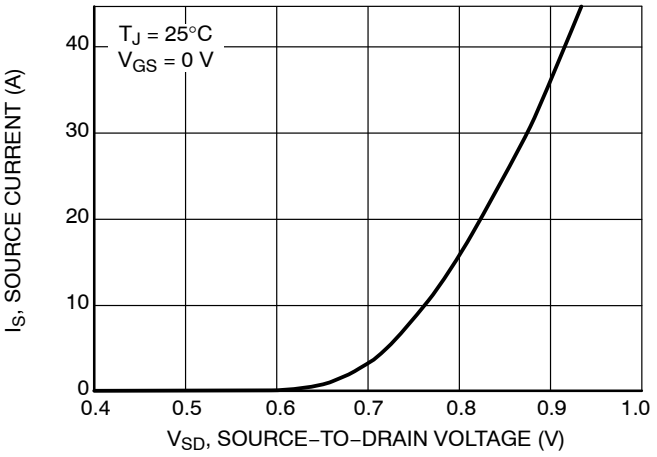


Figure 10. Diode Forward Voltage versus Current

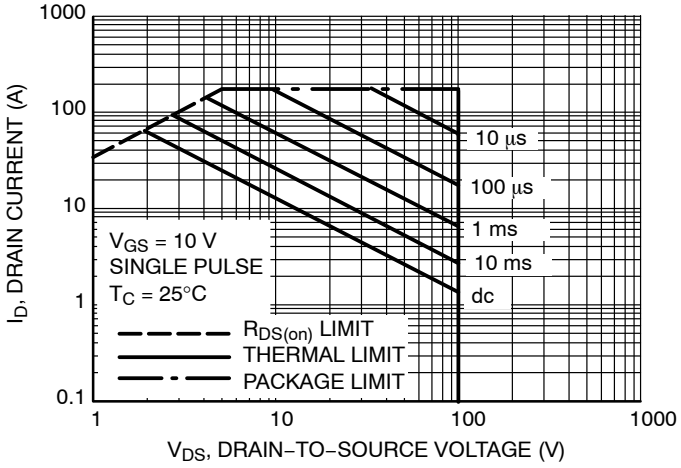


Figure 11. Maximum Rated Forward Biased Safe Operating Area

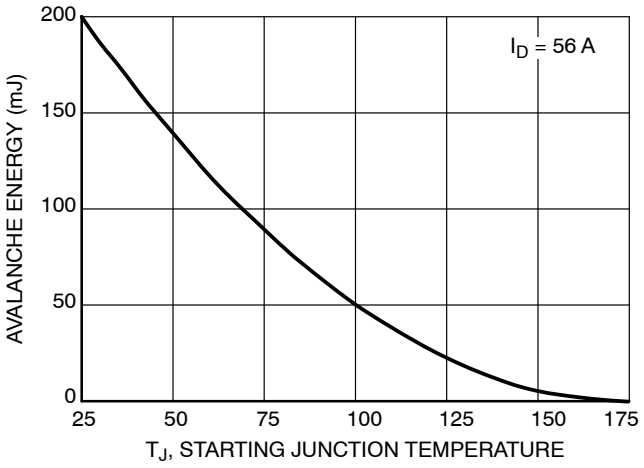


Figure 12. Maximum Avalanche Energy versus Starting Junction Temperature

TYPICAL CHARACTERISTICS

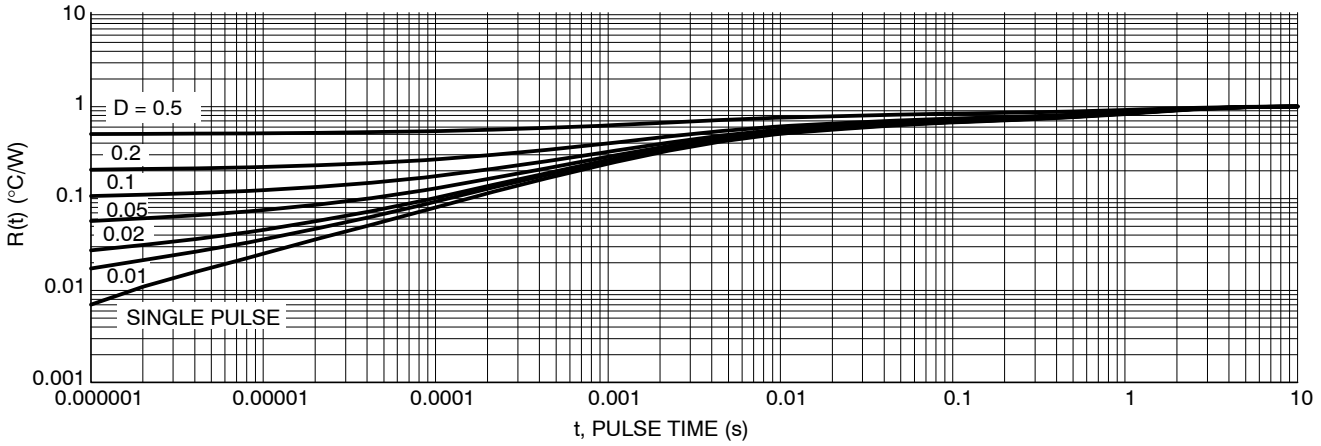


Figure 13. Thermal Response

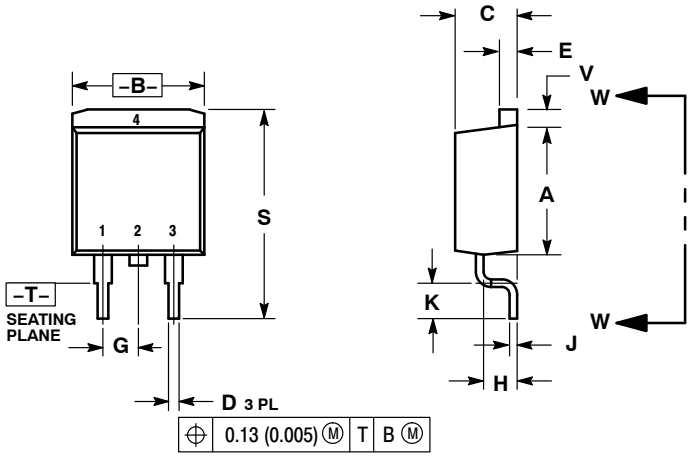
ORDERING INFORMATION

Device	Package	Shipping†
NTB6413ANG	D^2PAK (Pb−Free)	50 Units / Rail
NTB6413ANT4G	D^2PAK (Pb−Free)	800 / Tape & Reel
NTP6413ANG	TO−220 (Pb−Free)	50 Units / Rail

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

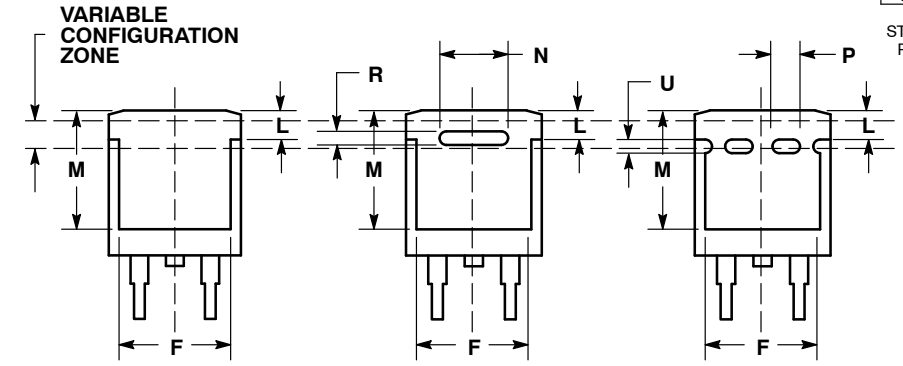
PACKAGE DIMENSIONS

D²PAK 3
CASE 418B−04
ISSUE K



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. 418B−01 THRU 418B−03 OBSOLETE, NEW STANDARD 418B−04.

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	0.340	0.380	8.64	9.65
B	0.380	0.405	9.65	10.29
C	0.160	0.190	4.06	4.83
D	0.020	0.035	0.51	0.89
E	0.045	0.055	1.14	1.40
F	0.310	0.350	7.87	8.89
G	0.100 BSC		2.54 BSC	
H	0.080	0.110	2.03	2.79
J	0.018	0.025	0.46	0.64
K	0.090	0.110	2.29	2.79
L	0.052	0.072	1.32	1.83
M	0.280	0.320	7.11	8.13
N	0.197 REF		5.00 REF	
P	0.079 REF		2.00 REF	
R	0.039 REF		0.99 REF	
S	0.575	0.625	14.60	15.88
V	0.045	0.055	1.14	1.40



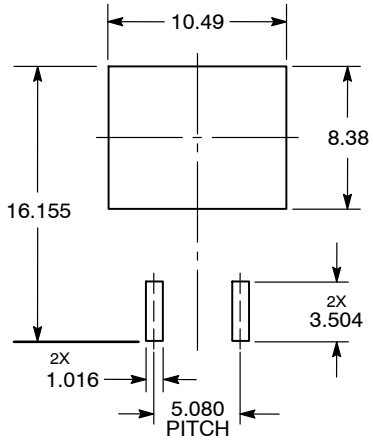
VIEW W−W
1

VIEW W−W
2

VIEW W−W
3

STYLE 2:
PIN 1. GATE
2. DRAIN
3. SOURCE
4. DRAIN

SOLDERING FOOTPRINT*

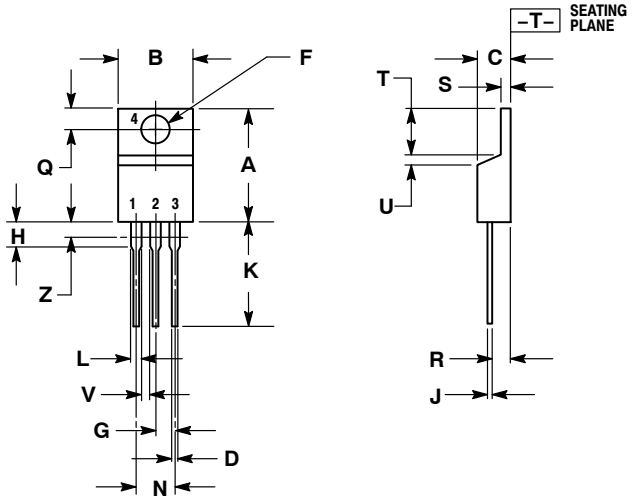


DIMENSIONS: MILLIMETERS

*For additional information on our Pb−Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

PACKAGE DIMENSIONS

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:
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Fax: 303−675−2176 or 800−344−3867 Toll Free USA/Canada
Email: orderlit@onsemi.com

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