MOSFET – Power, N-Channel

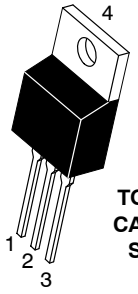
100 V, 42 A, 28 mΩ

NTB6413AN, NTP6413AN, NVB6413AN

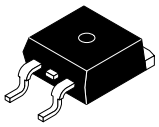
$V_{(BR)DSS}$	$R_{DS(ON)}$ MAX	I_D MAX (Note 1)
100 V	28 mΩ @ 10 V	42 A

Features

- Low $R_{DS(on)}$
- High Current Capability
- 100% Avalanche Tested
- NVB Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC−Q101 Qualified and PPAP Capable
- These Devices are Pb−Free and are RoHS Compliant

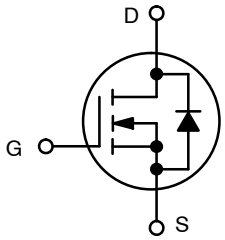


TO−220AB
CASE 221A
STYLE 5



D²PAK
CASE 418AJ
STYLE 2

N−Channel



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

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

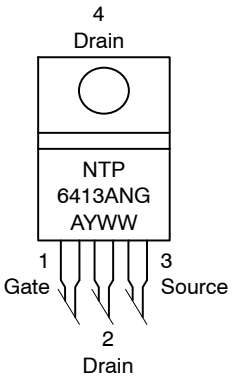
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

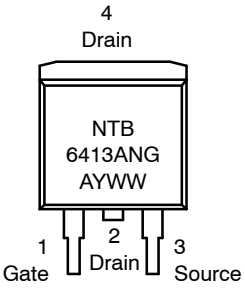
THERMAL RESISTANCE RATINGS

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

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

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.

NOTE: Some of the devices on this data sheet have been **DISCONTINUED**. Please refer to the table on page 5.

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

Symbol	Characteristics	Test Condition		Min	Typ	Max	Unit
OFF CHARACTERISTICS							
$V_{(BR)DSS}$	Drain−to−Source Breakdown Voltage	V_{GS} = 0 V, I_D = 250 μA		100			V
$V_{(BR)DSS}/T_J$	Drain−to−Source Breakdown Voltage Temperature Coefficient				115		mV/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{GS} = 0 V, V_{DS} = 100 V	T_J = 25°C			1.0	μA
			T_J = 125°C			100	
I_{GSS}	Gate−to−Source Leakage Current	V_{DS} = 0 V, V_{GS} = ±20 V				±100	nA
ON CHARACTERISTICS (Note 4)							
$V_{GS(th)}$	Gate Threshold Voltage	V_{GS} = V_{DS}, I_D = 250 μA		2.0		4.0	V
$V_{GS(th)}/T_J$	Negative Threshold Temperature Coefficient				8.1		mV/°C
$R_{DS(on)}$	Drain−to−Source On−Resistance	V_{GS} = 10 V, I_D = 42 A			25.6	28	mΩ
g_{FS}	Forward Transconductance	V_{GS} = 5 V, I_D = 20 A			17.9		S
CHARGES, CAPACITANCES & GATE RESISTANCE							
C_{iss}	Input Capacitance	V_{DS} = 25 V, V_{GS} = 0 V, f = 1 MHz			1800		pF
C_{oss}	Output Capacitance				280		
C_{rss}	Reverse Transfer Capacitance				100		
$Q_{G(TOT)}$	Total Gate Charge	V_{GS} = 10 V, V_{DS} = 80 V, I_D = 42 A			51		nC
$Q_{G(TH)}$	Threshold Gate Charge				2.0		
Q_{GS}	Gate−to−Source Charge				10		
Q_{GD}	Gate−to−Drain Charge				26		
V_{GP}	Plateau Voltage				5.8		V
R_G	Gate Resistance				2.4		Ω
SWITCHING CHARACTERISTICS, V_{GS} = 10 V (Note 5)							
$t_{d(on)}$	Turn−On Delay Time	V_{GS} = 10 V, V_{DD} = 80 V, I_D = 42 A, R_G = 6.2 Ω			13		ns
t_r	Rise Time				84		
$t_{d(off)}$	Turn−Off Delay Time				52		
t_f	Fall Time				71		
DRAIN−SOURCE DIODE CHARACTERISTICS							
V_{SD}	Forward Diode Voltage	I_S = 42 A	T_J = 25°C		0.92	1.3	V
			T_J = 125°C		0.83		
t_{rr}	Reverse Recovery Time	V_{GS} = 0 V, I_S = 42 A, dI_{SD}/dt = 100 A/μs			73		ns
t_a	Charge Time				56		
t_b	Discharge Time				17		
Q_{RR}	Reverse Recovery Charge				230		nC

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

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TYPICAL CHARACTERISTICS

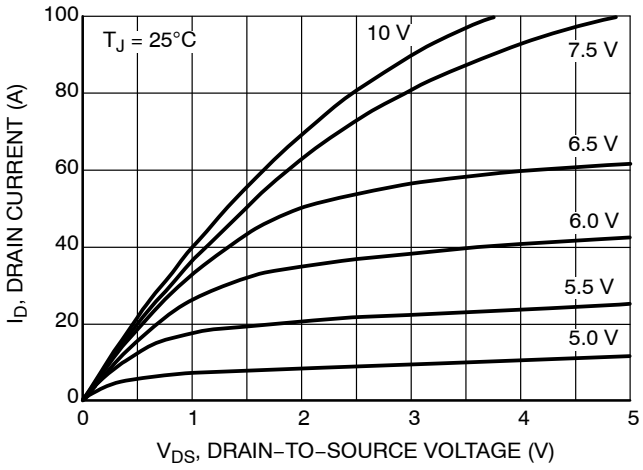


Figure 1. On−Region Characteristics

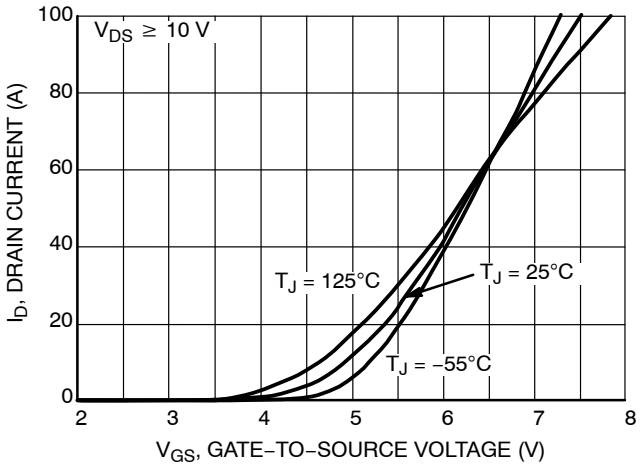


Figure 2. Transfer Characteristics

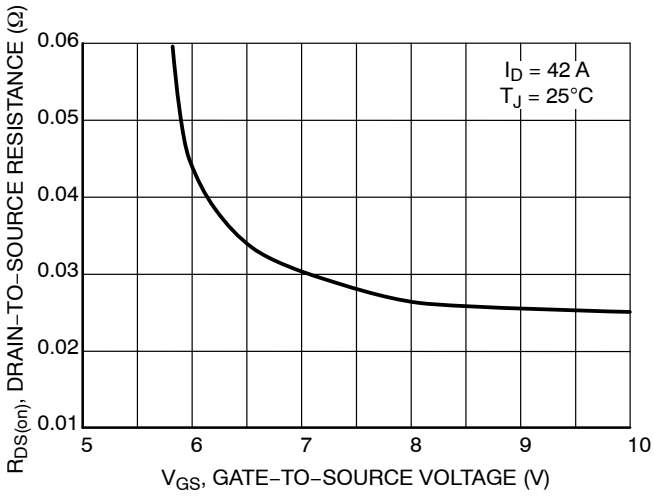


Figure 3. On−Region versus Gate Voltage

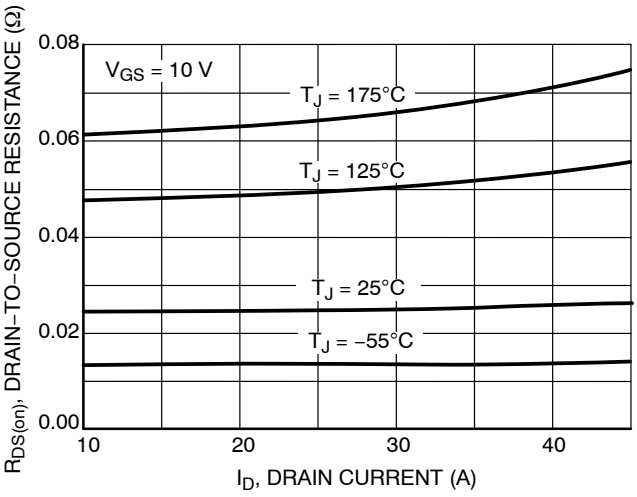


Figure 4. On−Resistance versus Drain Current and Gate Voltage

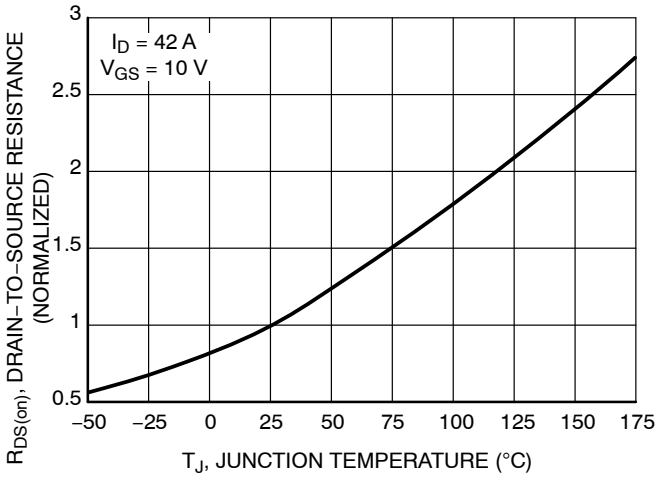


Figure 5. On−Resistance Variation with Temperature

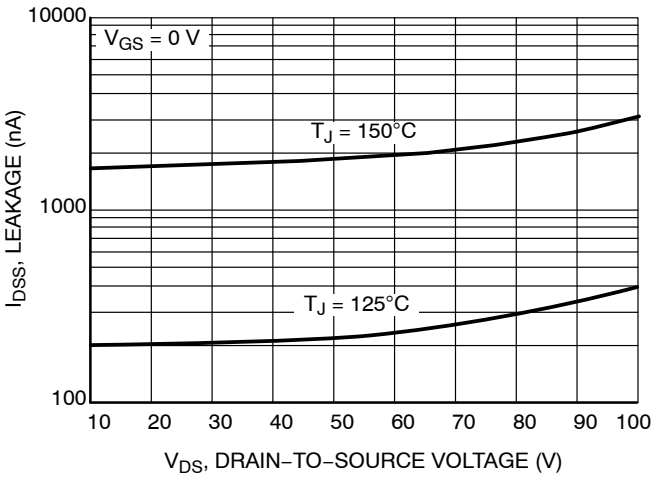


Figure 6. Drain−to−Source Leakage Current versus Voltage

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TYPICAL CHARACTERISTICS (continued)

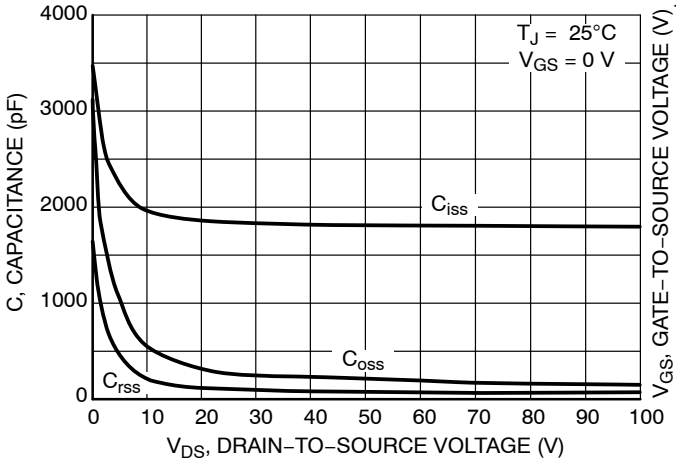


Figure 7. Capacitance Variation

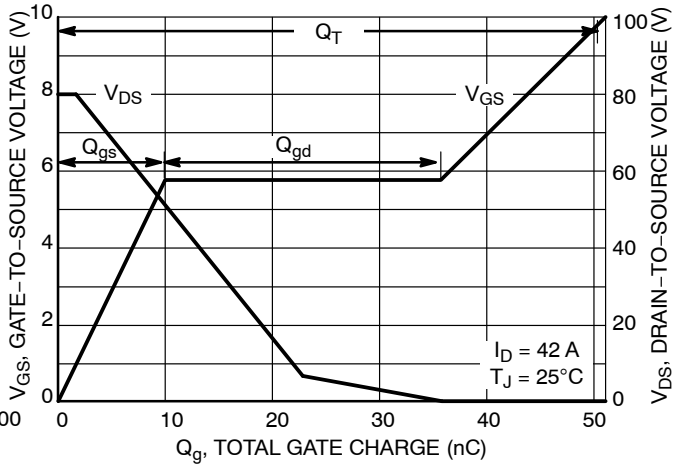


Figure 8. Gate−to−Source Voltage and Drain−to−Source Voltage versus Total Charge

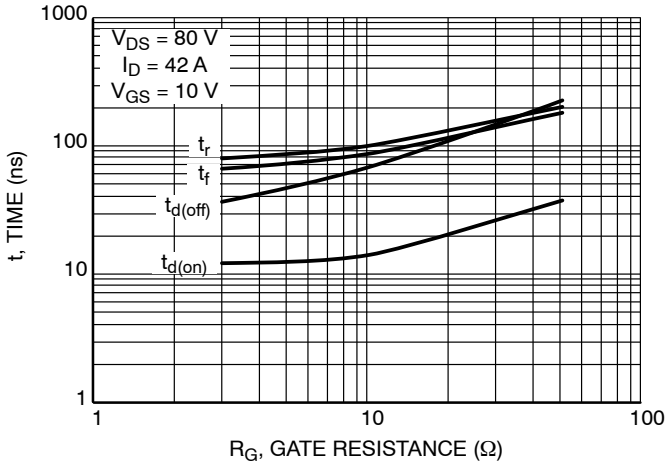


Figure 9. Resistive Switching Time Variation versus Gate Resistance

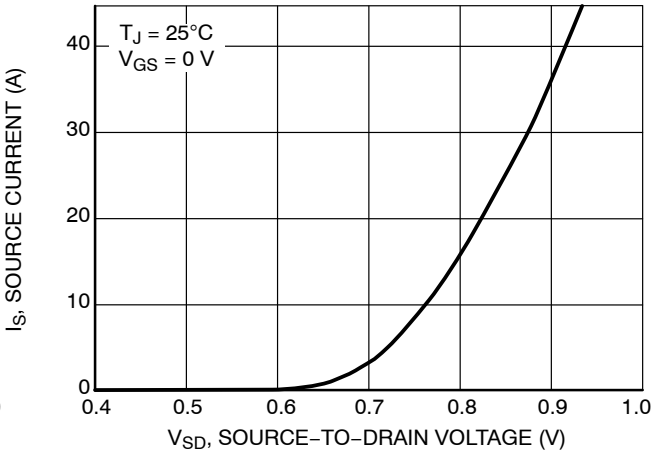


Figure 10. Diode Forward Voltage versus Current

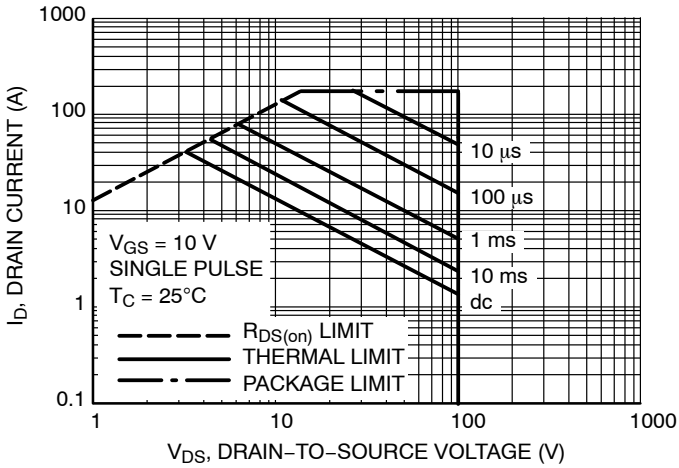


Figure 11. Maximum Rated Forward Biased Safe Operating Area

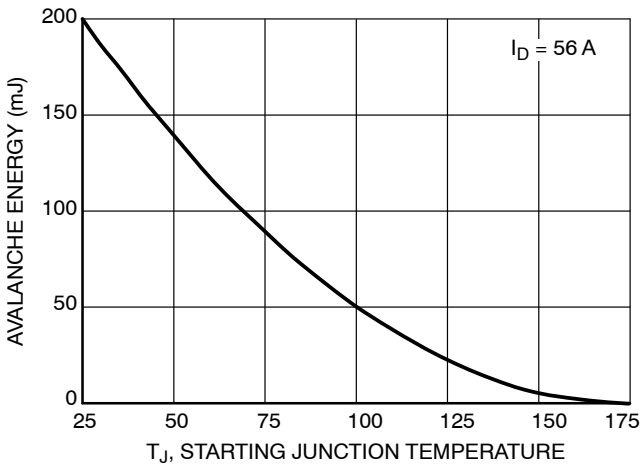


Figure 12. Maximum Avalanche Energy versus Starting Junction Temperature

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TYPICAL CHARACTERISTICS (continued)

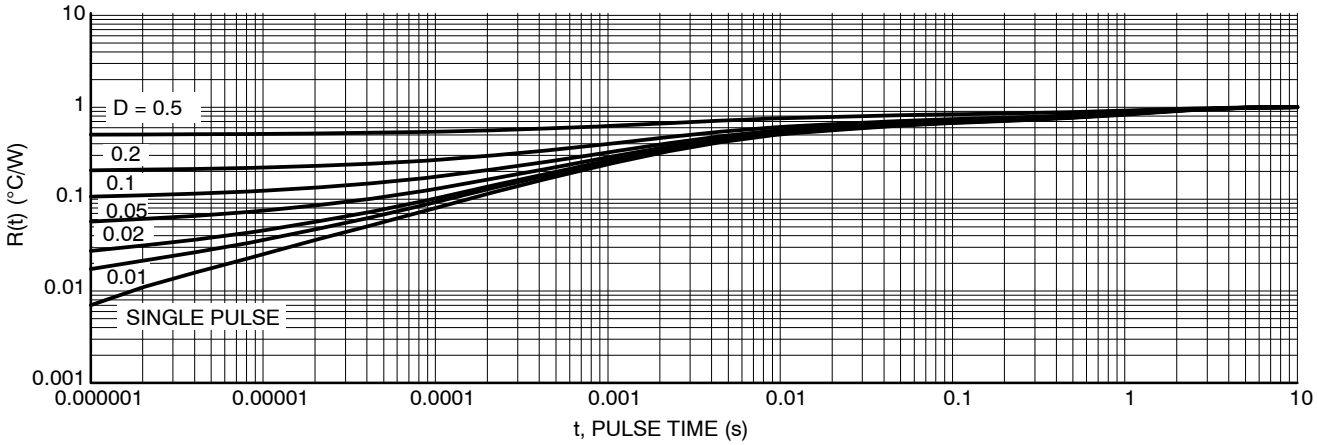


Figure 13. Thermal Response

ORDERING INFORMATION

Device	Package	Shipping†
NTB6413ANT4G	D^2PAK (Pb−Free)	800 / Tape & Reel

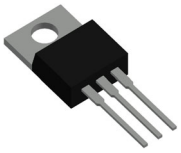
DISCONTINUED (Note 6)

NTB6413ANG	D^2PAK (Pb−Free)	50 Units / Rail
NTP6413ANG	TO−220 (Pb−Free)	50 Units / Rail
NVB6413ANT4G	D^2PAK (Pb−Free)	800 / Tape & Reel

†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.

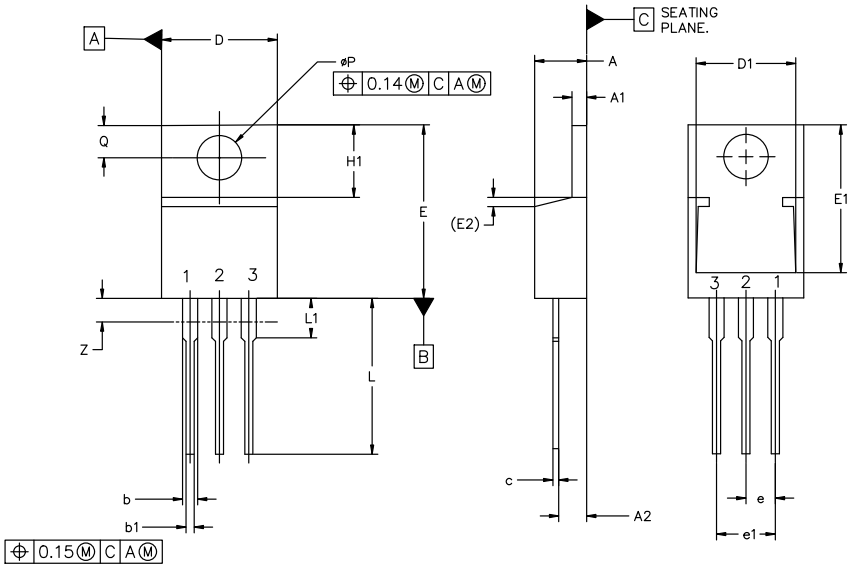
6. **DISCONTINUED:** These devices are not recommended for new design. Please contact your **onsemi** representative for information. The most current information on these devices may be available on www.onsemi.com.

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TO−220−3 10.10x15.12x4.45, 2.54P
CASE 221A
ISSUE AL

DATE 05 FEB 2025



MILLIMETERS			
DIM	MIN	NOM	MAX
A	4.07	4.45	4.83
A1	1.15	1.28	1.41
A2	2.04	2.42	2.79
b	1.15	1.34	1.52
b1	0.64	0.80	0.96
c	0.36	0.49	0.61
D	9.66	10.10	10.53
D1	8.43	8.63	8.83
E	14.48	15.12	15.75
E1	12.58	12.78	12.98
E2	1.27 REF		

MILLIMETERS			
DIM	MIN	NOM	MAX
e	2.42	2.54	2.66
e1	4.83	5.08	5.33
H1	5.97	6.22	6.47
L	12.70	13.49	14.27
L1	2.80	3.45	4.10
Q	2.54	2.79	3.04
øP	3.60	3.85	4.09
Z	−.−−	−.−−	3.48

NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2018.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSION Z DEFINES A ZONE WHERE ALL BODY AND LEAD IRREGULARITIES ARE ALLOWED.

STYLE 1:
PIN 1. BASE
2. COLLECTOR
3. EMITTER
4. COLLECTOR

STYLE 2:
PIN 1. BASE
2. EMITTER
3. COLLECTOR
4. EMITTER

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

STYLE 4:
PIN 1. MAIN TERMINAL 1
2. MAIN TERMINAL 2
3. GATE
4. MAIN TERMINAL 2

STYLE 5:
PIN 1. GATE
2. DRAIN
3. SOURCE
4. DRAIN

STYLE 6:
PIN 1. ANODE
2. CATHODE
3. ANODE
4. CATHODE

STYLE 7:
PIN 1. CATHODE
2. ANODE
3. CATHODE
4. ANODE

STYLE 8:
PIN 1. CATHODE
2. ANODE
3. EXTERNAL TRIP/DELAY
4. ANODE

STYLE 9:
PIN 1. GATE
2. COLLECTOR
3. EMITTER
4. COLLECTOR

STYLE 10:
PIN 1. GATE
2. SOURCE
3. DRAIN
4. SOURCE

STYLE 11:
PIN 1. DRAIN
2. SOURCE
3. GATE
4. SOURCE

STYLE 12:
PIN 1. MAIN TERMINAL 1
2. MAIN TERMINAL 2
3. GATE
4. NOT CONNECTED

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DESCRIPTION:	**TO−220−3 10.10x15.12x4.45, 2.54P**	**PAGE 1 OF 1**

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