

# NTD6416AN, NVD6416AN

## N-Channel Power MOSFET 100 V, 17 A, 81 mΩ

### Features

- Low  $R_{DS(on)}$
- High Current Capability
- 100% Avalanche Tested
- AEC Q101 Qualified – NVD616AN
- These Devices are Pb-Free and are RoHS Compliant

### MAXIMUM RATINGS ( $T_J = 25^\circ\text{C}$ unless otherwise noted)

Parameter		Symbol	Value	Unit	
Drain-to-Source Voltage		$V_{DSS}$	100	V	
Gate-to-Source Voltage – Continuous		$V_{GS}$	$\pm 20$	V	
Continuous Drain Current	Steady State	$I_D$	$T_C = 25^\circ\text{C}$	17	A
			$T_C = 100^\circ\text{C}$	11	
Power Dissipation	Steady State	$P_D$	71	W	
Pulsed Drain Current	$t_p = 10 \mu\text{s}$	$I_{DM}$	62	A	
Operating and Storage Temperature Range		$T_J, T_{stg}$	-55 to +175	$^\circ\text{C}$	
Source Current (Body Diode)		$I_S$	17	A	
Single Pulse Drain-to-Source Avalanche Energy ( $V_{DD} = 50 \text{ Vdc}$ , $V_{GS} = 10 \text{ Vdc}$ , $I_{L(pk)} = 17 \text{ A}$ , $L = 0.3 \text{ mH}$ , $R_G = 25 \Omega$ )		$E_{AS}$	43	mJ	
Lead Temperature for Soldering Purposes, 1/8" from Case for 10 Seconds		$T_L$	260	$^\circ\text{C}$	

### THERMAL RESISTANCE RATINGS

Parameter	Symbol	Max	Unit
Junction-to-Case (Drain) Steady State	$R_{\theta JC}$	2.1	$^\circ\text{C/W}$
Junction-to-Ambient (Note 1)	$R_{\theta JA}$	40	

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.

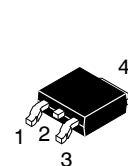
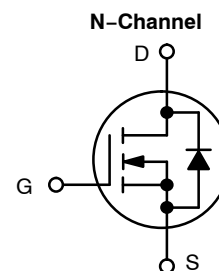
1. Surface mounted on FR4 board using 1 sq in pad size, (Cu Area 1.127 sq in [2 oz] including traces).



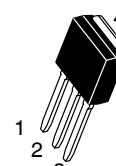
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$V_{(BR)DSS}$	$R_{DS(on)}$ MAX	$I_D$ MAX (Note 1)
100 V	81 mΩ @ 10 V	17 A

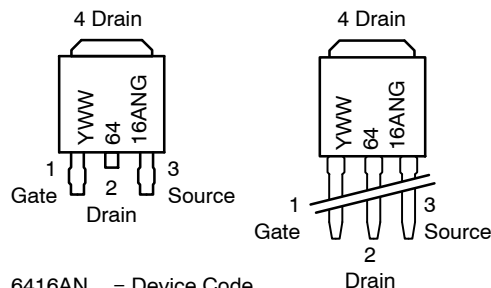


DPAK  
CASE 369AA  
STYLE 2



IPAK  
CASE 369D  
STYLE 2

### MARKING DIAGRAM & PIN ASSIGNMENTS



6416AN = Device Code  
Y = Year  
WW = Work Week  
G = Pb-Free Package

### ORDERING INFORMATION

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

# NTD6416AN, NVD6416AN

## ELECTRICAL CHARACTERISTICS ( $T_J = 25^\circ\text{C}$ unless otherwise noted)

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
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### OFF CHARACTERISTICS

Drain-to-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}$	100			V	
Drain-to-Source Breakdown Voltage Temperature Coefficient	$V_{(BR)DSS}/T_J$			112		mV/ $^\circ\text{C}$	
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{GS} = 0\text{ V}, V_{DS} = 100\text{ V}$	$T_J = 25^\circ\text{C}$			1.0	$\mu\text{A}$
			$T_J = 125^\circ\text{C}$			10	
Gate-to-Source Leakage Current	$I_{GSS}$	$V_{DS} = 0\text{ V}, V_{GS} = \pm 20\text{ V}$				$\pm 100$	nA

### ON CHARACTERISTICS (Note 3)

Gate Threshold Voltage	$V_{GS(TH)}$	$V_{GS} = V_{DS}, I_D = 250\ \mu\text{A}$	2.0		4.0	V
Negative Threshold Temperature Coefficient	$V_{GS(TH)}/T_J$			7.7		mV/ $^\circ\text{C}$
Drain-to-Source On-Resistance	$R_{DS(on)}$	$V_{GS} = 10\text{ V}, I_D = 17\text{ A}$		73	81	m $\Omega$
Forward Transconductance	$g_{FS}$	$V_{DS} = 5\text{ V}, I_D = 10\text{ A}$		12		S

### CHARGES, CAPACITANCES AND GATE RESISTANCE

Input Capacitance	$C_{ISS}$	$V_{GS} = 0\text{ V}, f = 1.0\text{ MHz}, V_{DS} = 25\text{ V}$		620		pF	
Output Capacitance	$C_{OSS}$			110			
Reverse Transfer Capacitance	$C_{RSS}$			50			
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = 10\text{ V}, V_{DS} = 80\text{ V}, I_D = 17\text{ A}$		20		nC	
Threshold Gate Charge	$Q_{G(TH)}$			1.0			
Gate-to-Source Charge	$Q_{GS}$			3.6			
Gate-to-Drain Charge	$Q_{GD}$			10			
Plateau Voltage	$V_{GP}$			5.8			V
Gate Resistance	$R_G$			2.4			$\Omega$

### SWITCHING CHARACTERISTICS (Note 4)

Turn-On Delay Time	$t_{d(on)}$	$V_{GS} = 10\text{ V}, V_{DD} = 80\text{ V}, I_D = 17\text{ A}, R_G = 6.1\ \Omega$		9.2		ns
Rise Time	$t_r$			22		
Turn-Off Delay Time	$t_{d(off)}$			24		
Fall Time	$t_f$			20		

### DRAIN-SOURCE DIODE CHARACTERISTICS

Forward Diode Voltage	$V_{SD}$	$V_{GS} = 0\text{ V}, I_S = 17\text{ A}$	$T_J = 25^\circ\text{C}$	0.85	1.2	V
			$T_J = 125^\circ\text{C}$	0.7		
Reverse Recovery Time	$t_{rr}$	$V_{GS} = 0\text{ V}, di_S/dt = 100\text{ A}/\mu\text{s}, I_S = 17\text{ A}$		56		ns
Charge Time	$t_a$			41		
Discharge Time	$t_b$			15		
Reverse Recovery Charge	$Q_{RR}$			135		

2. Surface mounted on FR4 board using 1 in sq pad size (Cu area = 1.127 in sq [1 oz] including traces).
3. Pulse Test: Pulse Width  $\leq 300\ \mu\text{s}$ , Duty Cycle  $\leq 2\%$ .
4. Switching characteristics are independent of operating junction temperatures.

# NTD6416AN, NVD6416AN

## TYPICAL CHARACTERISTICS

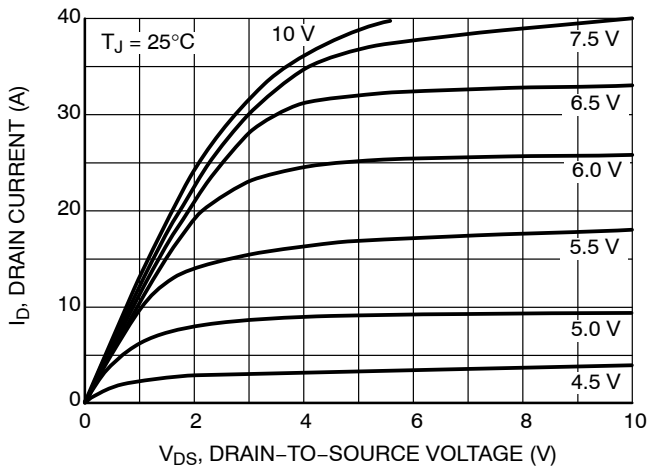


Figure 1. On-Region Characteristics

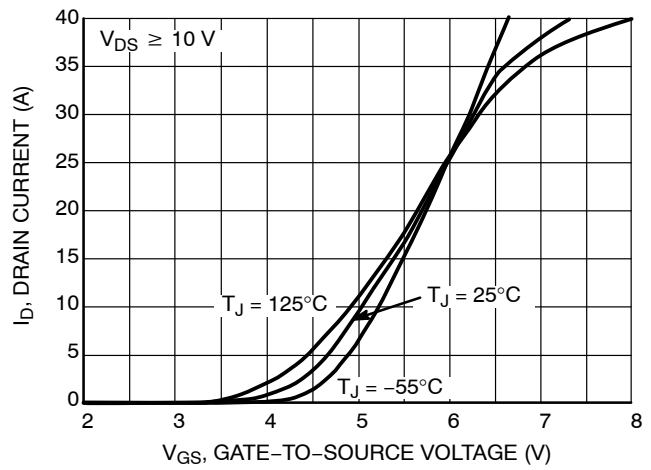


Figure 2. Transfer Characteristics

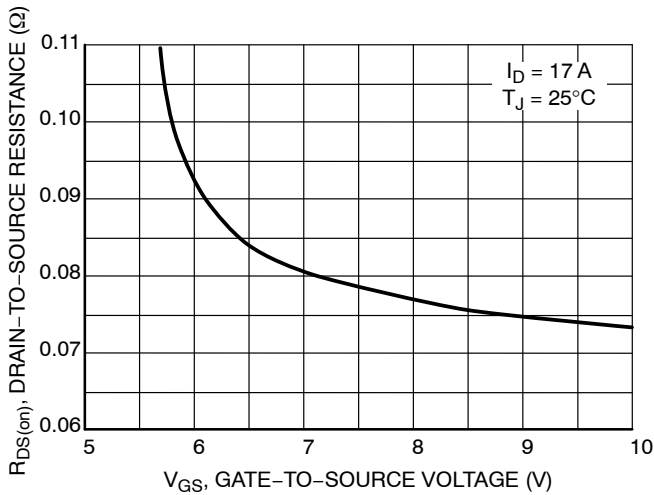


Figure 3. On-Region versus Gate Voltage

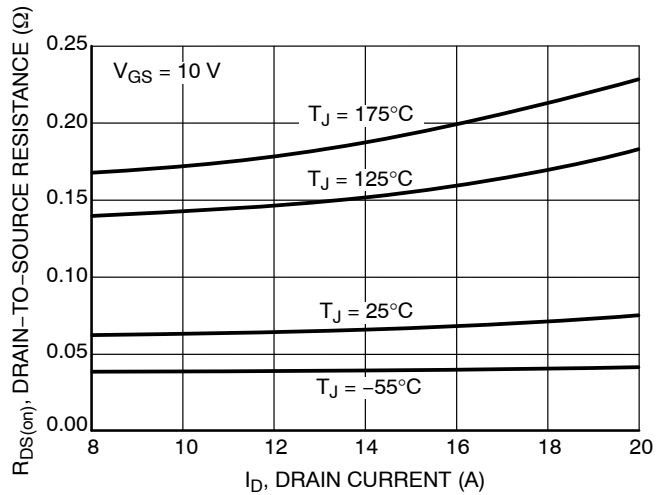


Figure 4. On-Resistance versus Drain Current and Gate Voltage

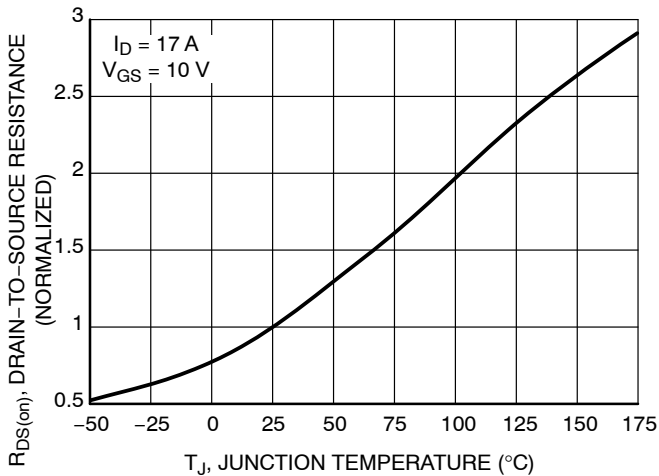


Figure 5. On-Resistance Variation with Temperature

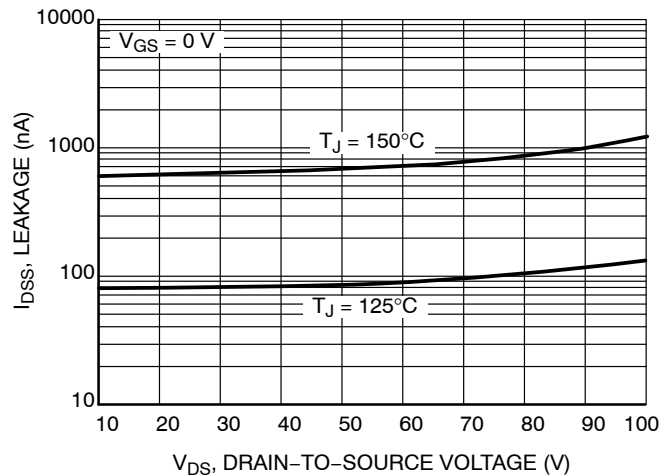


Figure 6. Drain-to-Source Leakage Current versus Voltage

# NTD6416AN, NVD6416AN

## TYPICAL CHARACTERISTICS

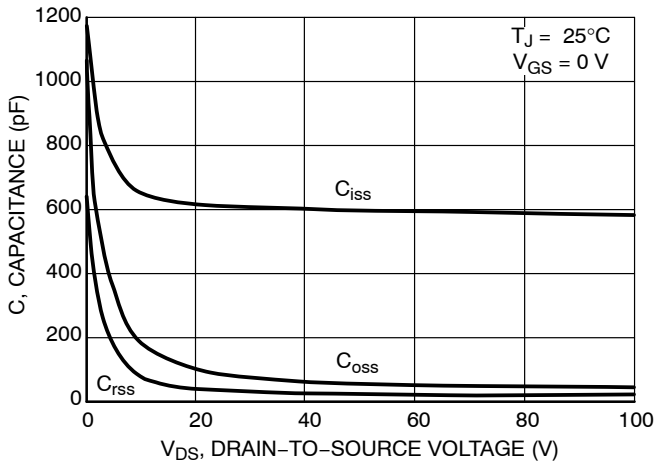


Figure 7. Capacitance Variation

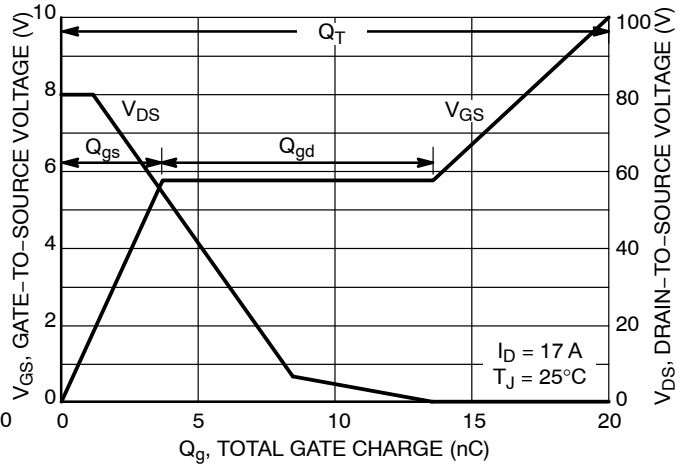


Figure 8. Gate-to-Source Voltage and Drain-to-Source Voltage versus Total Charge

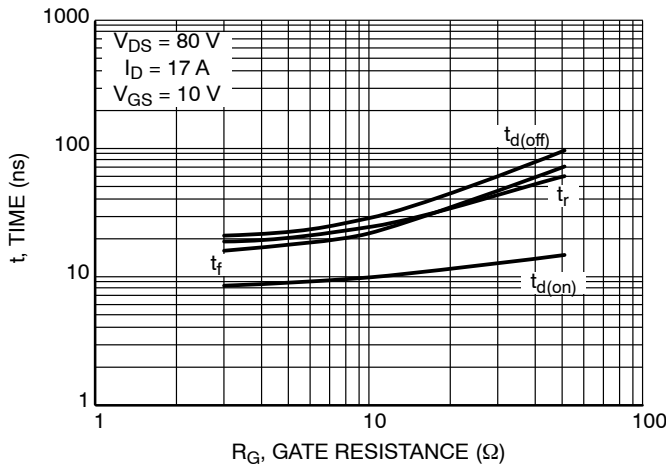


Figure 9. Resistive Switching Time Variation versus Gate Resistance

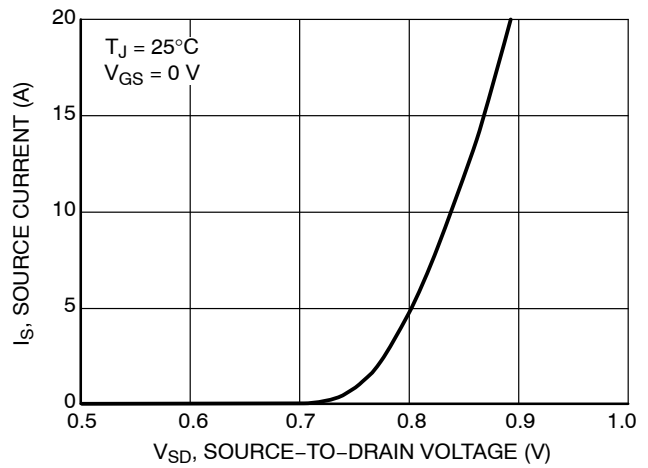


Figure 10. Diode Forward Voltage versus Current

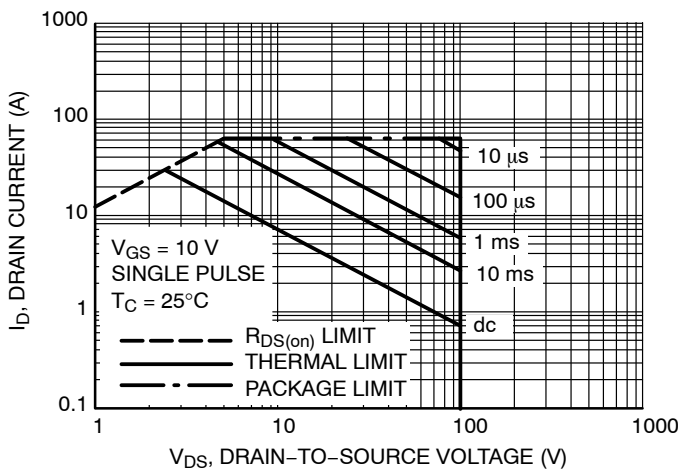


Figure 11. Maximum Rated Forward Biased Safe Operating Area

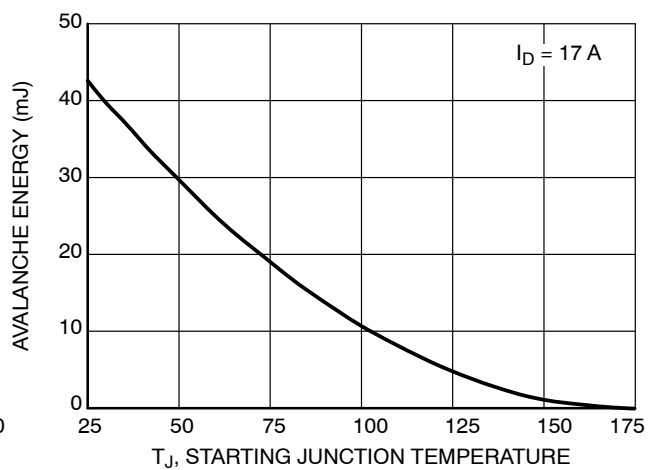


Figure 12. Maximum Avalanche Energy versus Starting Junction Temperature

# NTD6416AN, NVD6416AN

## TYPICAL CHARACTERISTICS

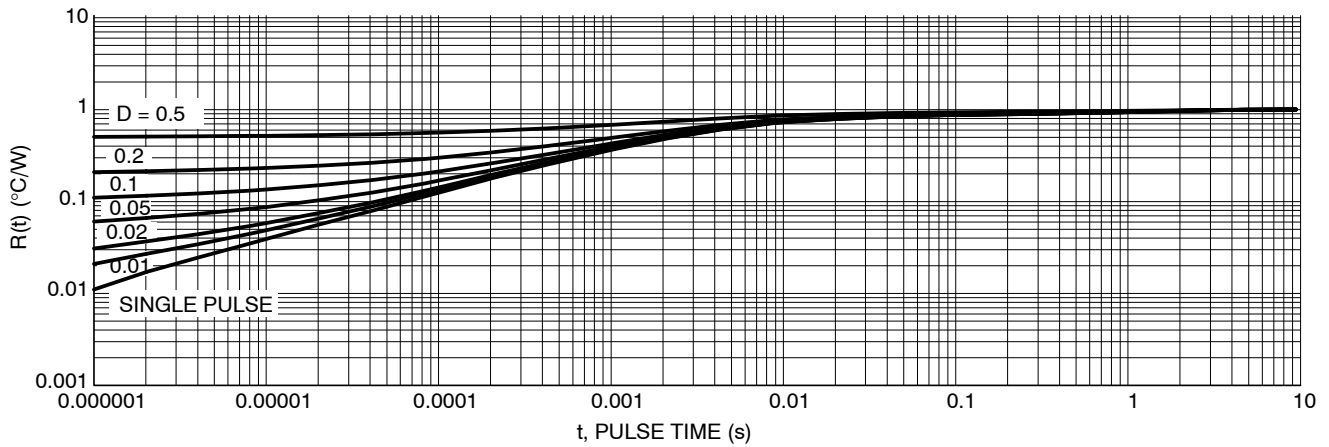


Figure 13. Thermal Response

### ORDERING INFORMATION

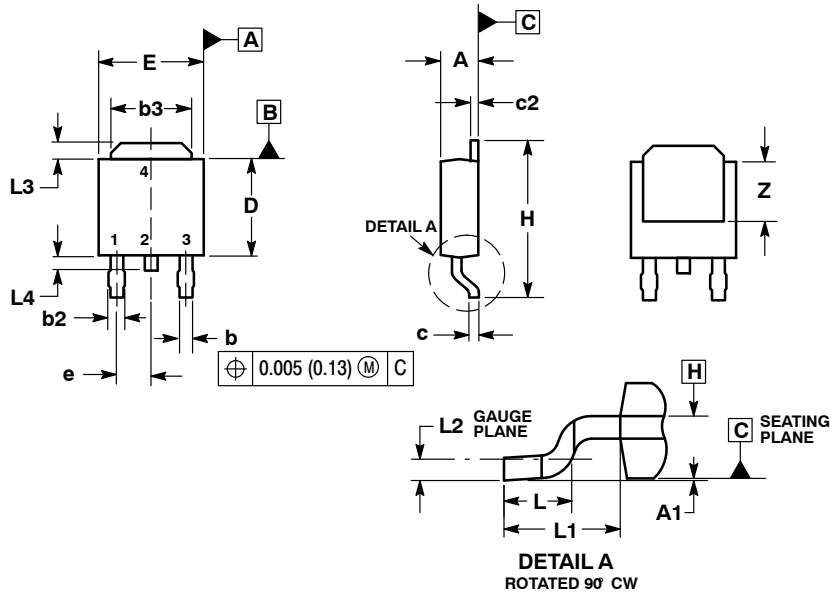
Device	Package	Shipping†
NTD6416ANT4G	DPAK (Pb-Free)	2500 / Tape & Reel
NTD6416AN-1G	IPAK (Pb-Free)	75 Units / Rail
NVD6416ANT4G	DPAK (Pb-Free)	2500 / Tape & Reel

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

# NTD6416AN, NVD6416AN

## PACKAGE DIMENSIONS

### DPAK (SINGLE GAUGE) CASE 369AA-01 ISSUE B

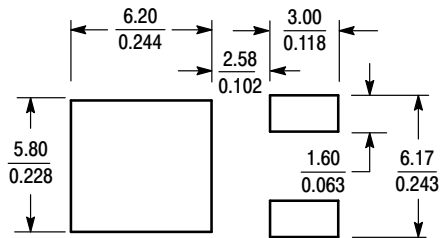


**NOTES:**

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: INCHES.
3. THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSIONS b3, L3 and Z.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.006 INCHES PER SIDE.
5. DIMENSIONS D AND E ARE DETERMINED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY.
6. DATUMS A AND B ARE DETERMINED AT DATUM PLANE H.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.086	0.094	2.18	2.38
A1	0.000	0.005	0.00	0.13
b	0.025	0.035	0.63	0.89
b2	0.030	0.045	0.76	1.14
b3	0.180	0.215	4.57	5.46
c	0.018	0.024	0.46	0.61
c2	0.018	0.024	0.46	0.61
D	0.235	0.245	5.97	6.22
E	0.250	0.265	6.35	6.73
e	0.090 BSC		2.29 BSC	
H	0.370	0.410	9.40	10.41
L	0.055	0.070	1.40	1.78
L1	0.108 REF		2.74 REF	
L2	0.020 BSC		0.51 BSC	
L3	0.035	0.050	0.89	1.27
L4	---		---	
Z	0.155	---	3.93	---

### SOLDERING FOOTPRINT\*



SCALE 3:1  $\left(\frac{\text{mm}}{\text{inches}}\right)$

**STYLE 2:**

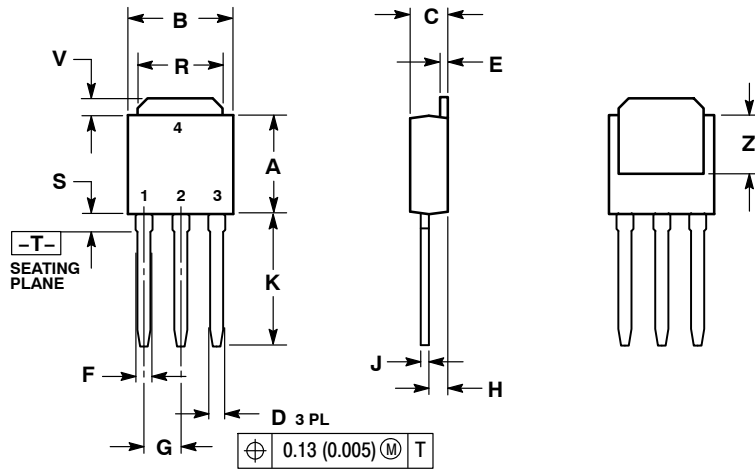
- PIN 1. GATE
- DRAIN
- SOURCE
- DRAIN

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

# NTD6416AN, NVD6416AN

## PACKAGE DIMENSIONS

### IPAK CASE 369D-01 ISSUE C




#### NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.235	0.245	5.97	6.35
B	0.250	0.265	6.35	6.73
C	0.086	0.094	2.19	2.38
D	0.027	0.035	0.69	0.88
E	0.018	0.023	0.46	0.58
F	0.037	0.045	0.94	1.14
G	0.090 BSC		2.29 BSC	
H	0.034	0.040	0.87	1.01
J	0.018	0.023	0.46	0.58
K	0.350	0.380	8.89	9.65
R	0.180	0.215	4.45	5.45
S	0.025	0.040	0.63	1.01
V	0.035	0.050	0.89	1.27
Z	0.155	---	3.93	---

#### STYLE 2:

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

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