

# NTD6416ANL

## N-Channel Power MOSFET 100 V, 19 A, 74 mΩ

### Features

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

### 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	$T_C = 25^\circ\text{C}$	19	A
		$T_C = 100^\circ\text{C}$	13	
Power Dissipation	Steady State	$T_C = 25^\circ\text{C}$	71	W
Pulsed Drain Current	$t_p = 10 \mu\text{s}$	$I_{DM}$	70	A
Operating and Storage Temperature Range	$T_J, T_{stg}$	-55 to +175	$^\circ\text{C}$	
Source Current (Body Diode)	$I_S$	19	A	
Single Pulse Drain-to-Source Avalanche Energy ( $V_{DD} = 50 \text{ Vdc}$ , $V_{GS} = 10 \text{ Vdc}$ , $I_{L(pk)} = 18.2 \text{ A}$ , $L = 0.3 \text{ mH}$ , $R_G = 25 \Omega$ )	$E_{AS}$	50	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 – Steady State (Note 1)	$R_{\theta JA}$	47	

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.

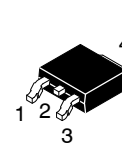
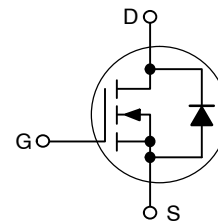
1. Surface mounted on FR4 board using 1 sq in pad size, (Cu Area 1.127 sq in [2 oz] including traces).



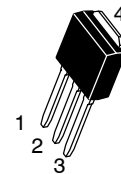
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$V_{(BR)DSS}$	$R_{DS(on)}$ MAX	$I_D$ MAX
100 V	74 mΩ @ 10 V	19 A

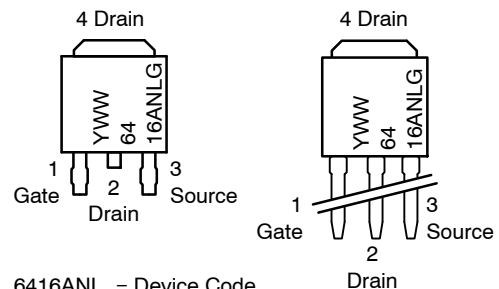


DPAK  
CASE 369AA  
STYLE 2



IPAK  
CASE 369D  
STYLE 2

### MARKING DIAGRAM & PIN ASSIGNMENTS



6416ANL = 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.

# NTD6416ANL

## 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	$V_{(BR)DSS}/T_J$			120		mV/°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	$\mu\text{A}$
			$T_J = 125^\circ\text{C}$			100	
Gate-to-Source Leakage Current	$I_{GSS}$	$V_{DS} = 0\text{ V}, V_{GS} = \pm 20\text{ V}$			$\pm 100$	nA	

### ON CHARACTERISTICS (Note 2)

Gate Threshold Voltage	$V_{GS(TH)}$	$V_{GS} = V_{DS}, I_D = 250\ \mu\text{A}$	1.0		2.2	V
Negative Threshold Temperature Coefficient	$V_{GS(TH)}/T_J$			5.4		mV/°C
Drain-to-Source On-Resistance	$R_{DS(on)}$	$V_{GS} = 4.5\text{ V}, I_D = 10\text{ A}$		70	80	m $\Omega$
		$V_{GS} = 10\text{ V}, I_D = 10\text{ A}$		62	74	
		$V_{GS} = 10\text{ V}, I_D = 19\text{ A}$		68	74	
Forward Transconductance	$g_{FS}$	$V_{DS} = 5\text{ V}, I_D = 10\text{ A}$		18		S

### CHARGES, CAPACITANCES AND GATE RESISTANCE

Input Capacitance	$C_{ISS}$	$V_{GS} = 0\text{ V}, f = 1.0\text{ MHz}, V_{DS} = 25\text{ V}$		700	1000	pF	
Output Capacitance	$C_{OSS}$			110			
Reverse Transfer Capacitance	$C_{RSS}$			50			
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = 10\text{ V}, V_{DS} = 80\text{ V}, I_D = 19\text{ A}$		25	40	nC	
Threshold Gate Charge	$Q_{G(TH)}$			0.7			
Gate-to-Source Charge	$Q_{GS}$			2.4			
Gate-to-Drain Charge	$Q_{GD}$			9.6			
Plateau Voltage	$V_{GP}$			3.2			V
Gate Resistance	$R_G$			2.4			$\Omega$

### SWITCHING CHARACTERISTICS (Note 3)

Turn-On Delay Time	$t_{d(on)}$	$V_{GS} = 10\text{ V}, V_{DD} = 80\text{ V}, I_D = 19\text{ A}, R_G = 6.1\ \Omega$		7.0		ns
Rise Time	$t_r$			16		
Turn-Off Delay Time	$t_{d(off)}$			35		
Fall Time	$t_f$			40		

### DRAIN-SOURCE DIODE CHARACTERISTICS

Forward Diode Voltage	$V_{SD}$	$V_{GS} = 0\text{ V}, I_S = 19\text{ A}$	$T_J = 25^\circ\text{C}$		0.9	1.2	V
			$T_J = 125^\circ\text{C}$		0.72		
Reverse Recovery Time	$t_{RR}$	$V_{GS} = 0\text{ V}, dI_S/dt = 100\text{ A}/\mu\text{s}, I_S = 19\text{ A}$		50		ns	
Charge Time	$T_a$			38			
Discharge Time	$T_b$			14			
Reverse Recovery Charge	$Q_{RR}$			112			nC

2. Pulse Test: Pulse Width  $\leq 300\ \mu\text{s}$ , Duty Cycle  $\leq 2\%$ .

3. Switching characteristics are independent of operating junction temperatures.

# NTD6416ANL

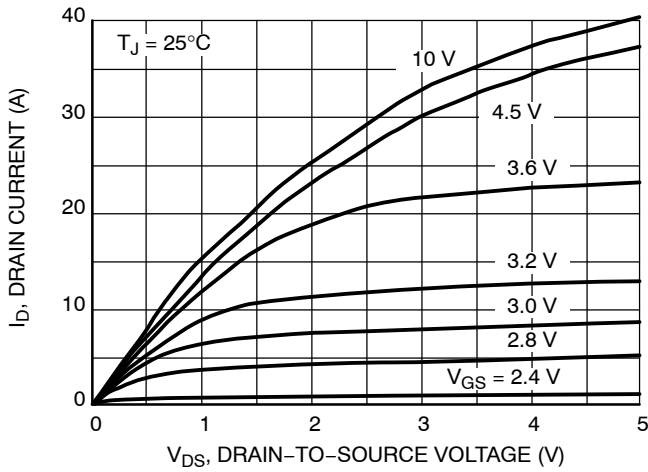


Figure 1. On-Region Characteristics

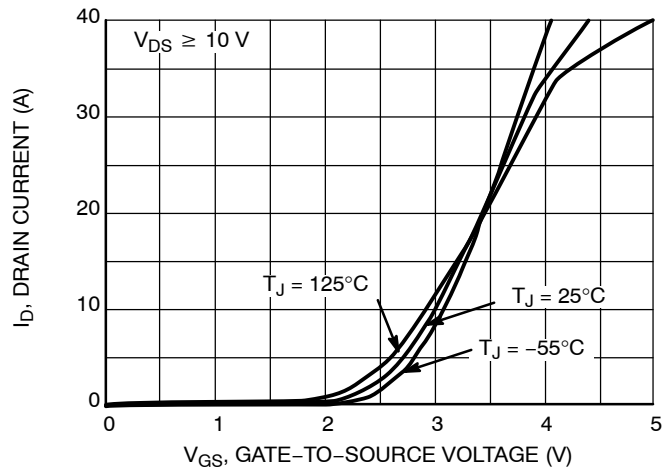


Figure 2. Transfer Characteristics

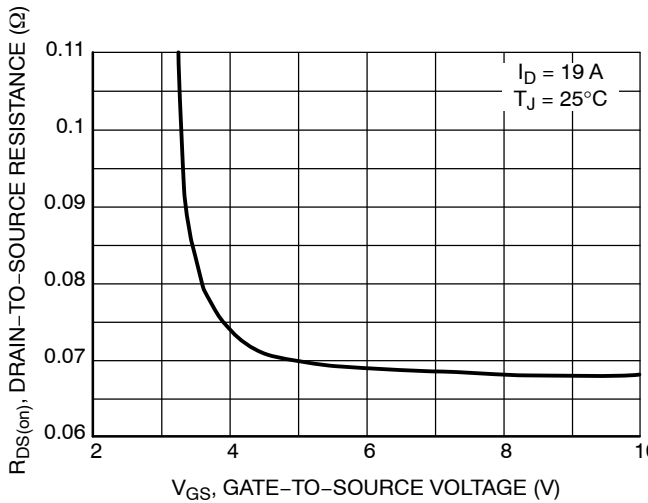


Figure 3. On-Region versus Gate-to-Source Voltage

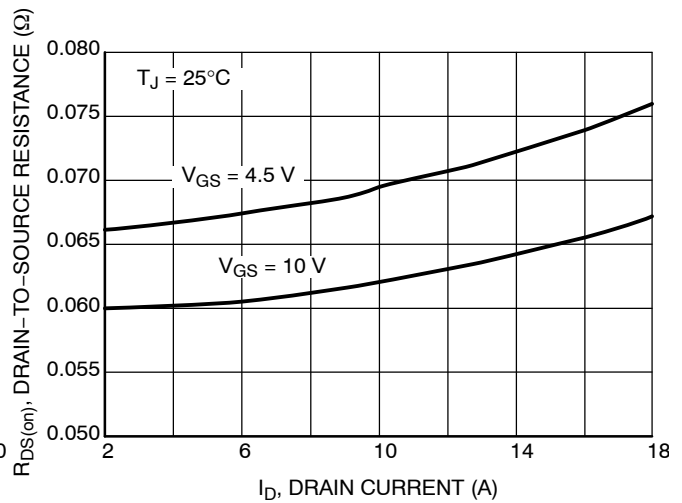


Figure 4. On-Region versus Drain Current and Gate-to-Source Voltage

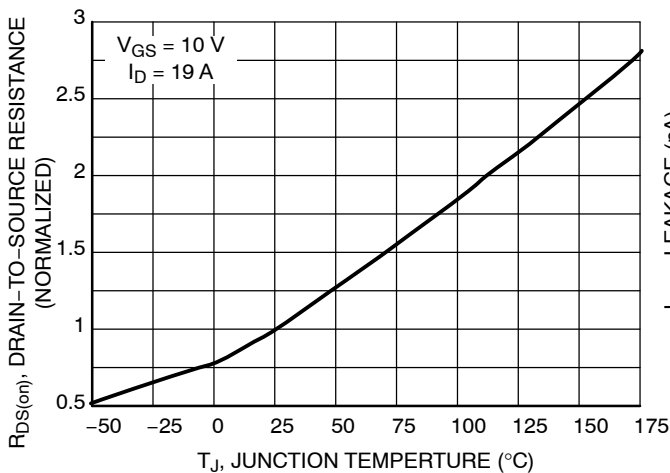


Figure 5. On-Resistance Variation with Temperature

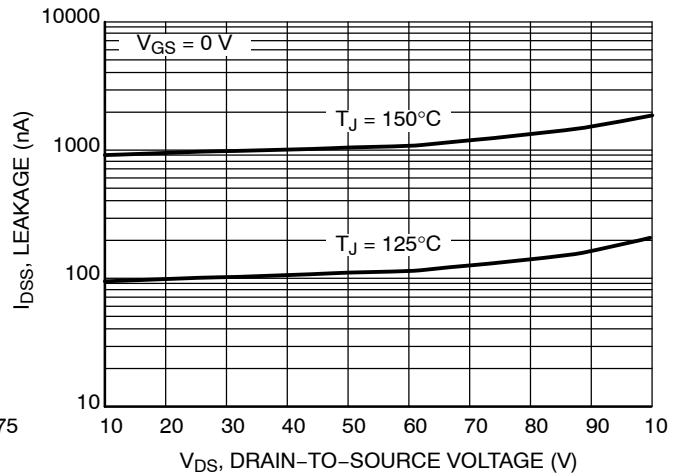


Figure 6. Drain-to-Source Leakage Current versus Voltage

# NTD6416ANL

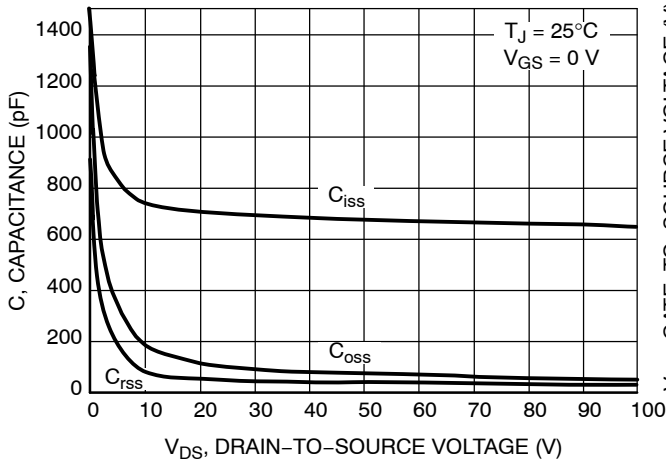


Figure 7. Capacitance Variation

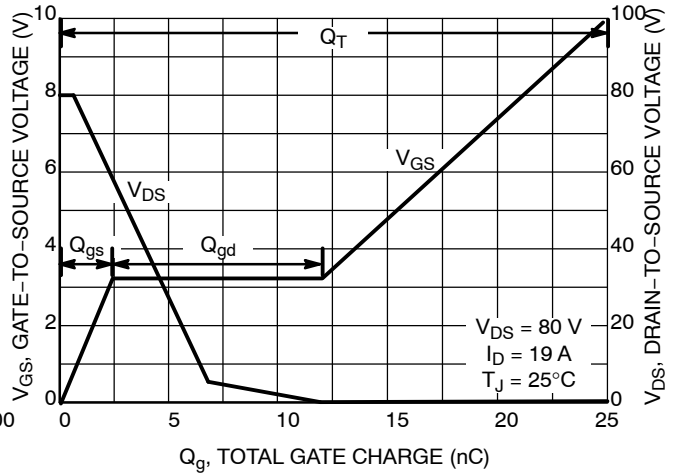


Figure 8. Gate-to-Source Voltage and Drain-to-Source Voltage versus Total Charge

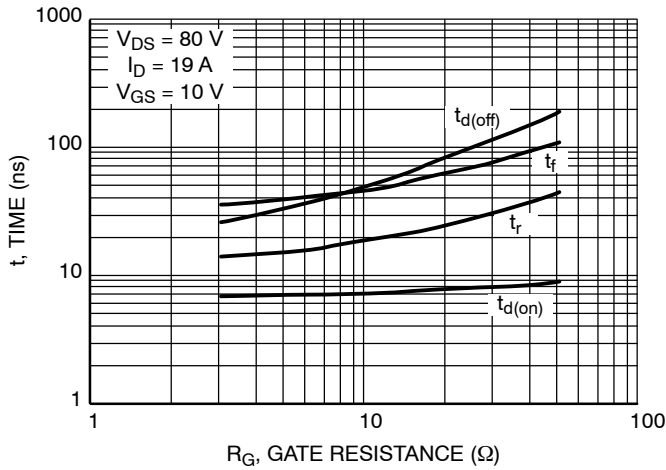


Figure 9. Resistive Switching Time Variation versus Gate Resistance

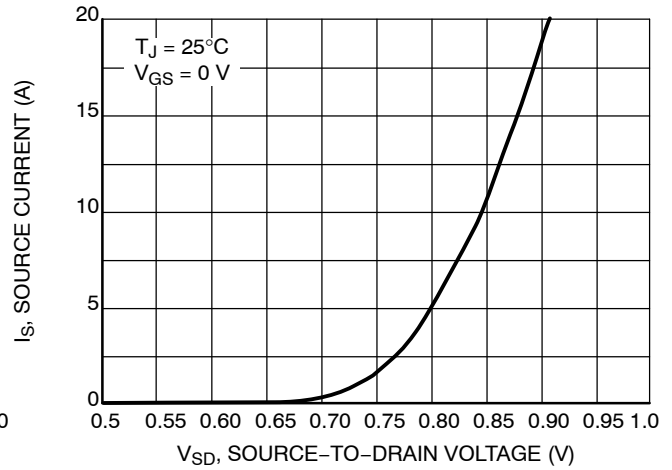


Figure 10. Diode Forward Voltage versus Current

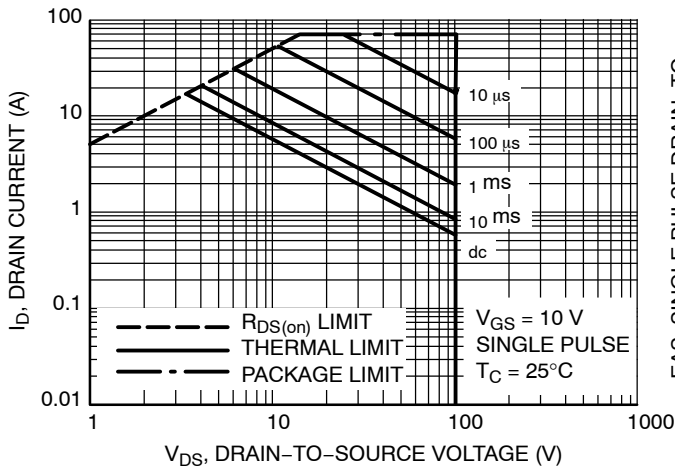


Figure 11. Resistive Switching Time Variation versus Gate Resistance

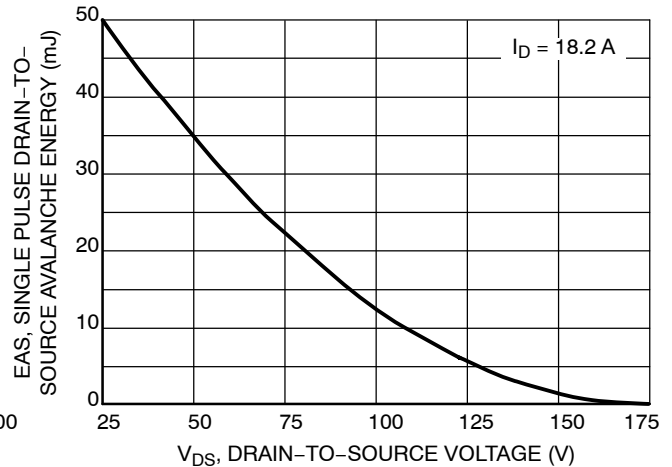


Figure 12. Resistive Switching Time Variation versus Gate Resistance

# NTD6416ANL

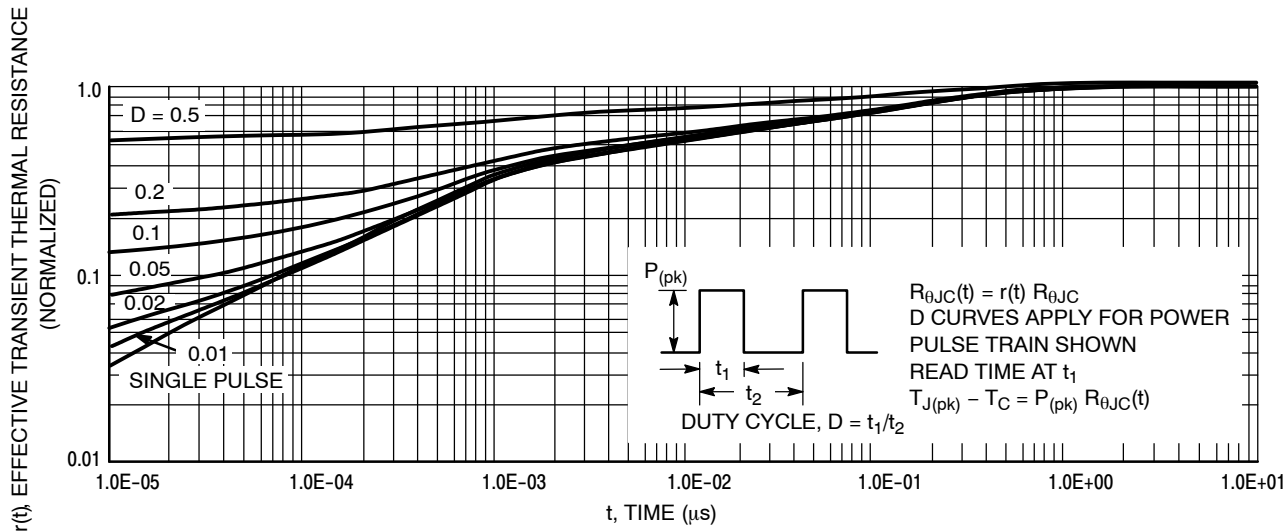


Figure 13. Thermal Response

## ORDERING INFORMATION

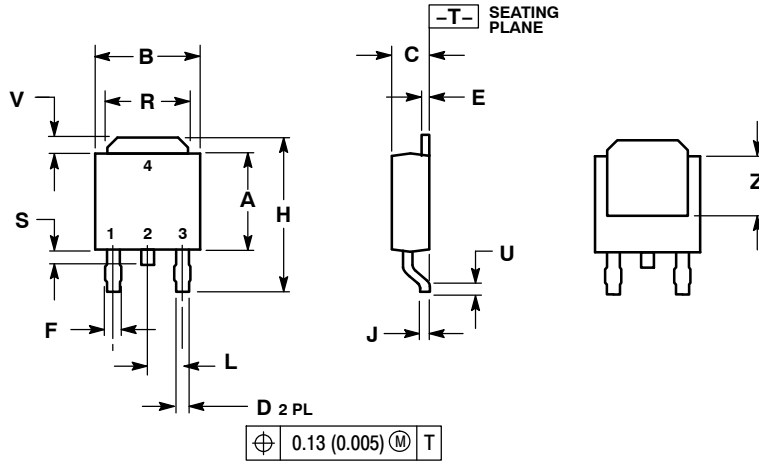
Device	Package	Shipping <sup>†</sup>
NTD6416ANLT4G	DPAK (Pb-Free)	2500 / Tape & Reel
NTD6416ANL-1G	IPAK (Pb-Free)	75 Units / Rail

<sup>†</sup>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.

# NTD6416ANL

## PACKAGE DIMENSIONS

### DPAK (SINGLE GUAGE) CASE 369AA-01 ISSUE A

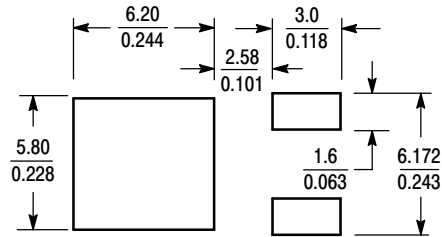


- NOTES:  
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.  
2. CONTROLLING DIMENSION: INCH.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.235	0.245	5.97	6.22
B	0.250	0.265	6.35	6.73
C	0.086	0.094	2.19	2.38
D	0.025	0.035	0.63	0.89
E	0.018	0.024	0.46	0.61
F	0.030	0.045	0.77	1.14
H	0.386	0.410	9.80	10.40
J	0.018	0.023	0.46	0.58
L	0.090 BSC		2.29 BSC	
R	0.180	0.215	4.57	5.45
S	0.024	0.040	0.60	1.01
U	0.020	---	0.51	---
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

### SOLDERING FOOTPRINT\*



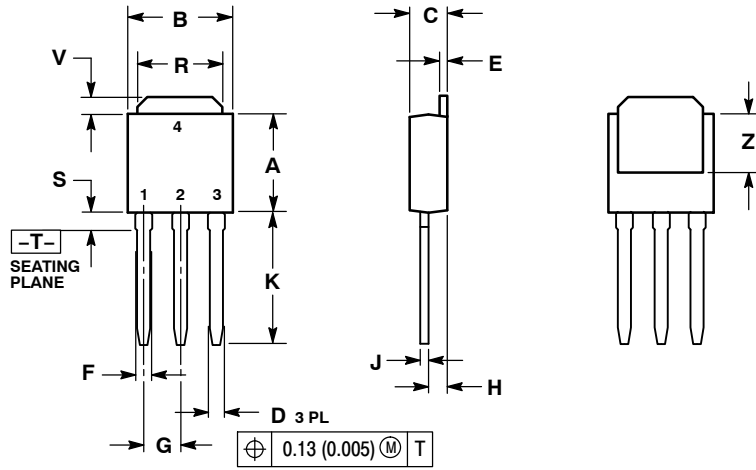
SCALE 3:1  $\left(\frac{\text{mm}}{\text{inches}}\right)$

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

# NTD6416ANL

## PACKAGE DIMENSIONS

### DPAK CASE 369D-01 ISSUE B




**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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