

# NTD6415AN

## N-Channel Power MOSFET 100 V, 23 A, 55 mΩ

### Features

- Low  $R_{DS(on)}$
- High Current Capability
- 100% Avalanche Tested
- 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 $R_{\theta JC}$	$I_D$	$T_C = 25^\circ\text{C}$	23
		$T_C = 100^\circ\text{C}$	16
Power Dissipation $R_{\theta JC}$	$P_D$	83	W
Pulsed Drain Current	$t_p = 10 \mu\text{s}$	$I_{DM}$	89
Operating and Storage Temperature Range	$T_J, T_{stg}$	-55 to +175	$^\circ\text{C}$
Source Current (Body Diode)	$I_S$	23	A
Single Pulse Drain-to-Source Avalanche Energy ( $V_{DD} = 50 \text{ Vdc}$ , $V_{GS} = 10 \text{ Vdc}$ , $I_{L(pk)} = 23 \text{ A}$ , $L = 0.3 \text{ mH}$ , $R_G = 25 \Omega$ )	$E_{AS}$	79	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	$R_{\theta JC}$	1.8	$^\circ\text{C/W}$
Junction-to-Ambient (Note 1)	$R_{\theta JA}$	39	

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.

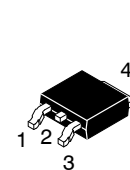
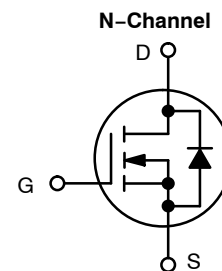
1. Surface mounted on FR4 board using 1 sq in pad size, (Cu Area 1.127 sq in [2 oz] including traces).



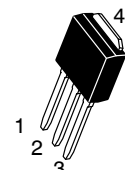
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$V_{(BR)DSS}$	$R_{DS(on)}$ MAX	$I_D$ MAX (Note 1)
100 V	55 mΩ @ 10 V	23 A

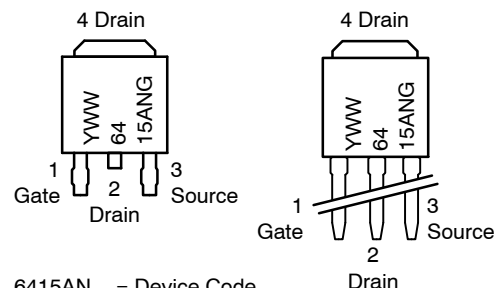


DPAK  
CASE 369AA  
STYLE 2



IPAK  
CASE 369D  
STYLE 2

### MARKING DIAGRAM & PIN ASSIGNMENTS



6415AN = 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 2 of this data sheet.

# NTD6415AN

## ELECTRICAL CHARACTERISTICS (T<sub>J</sub> = 25°C unless otherwise noted)

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

Drain-to-Source Breakdown Voltage	V <sub>(BR)DSS</sub>	V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA	100			V
Drain-to-Source Breakdown Voltage Temperature Coefficient	V <sub>(BR)DSS</sub> /T <sub>J</sub>			113		mV/°C
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 100 V	T <sub>J</sub> = 25°C		1.0	μA
			T <sub>J</sub> = 125°C		100	
Gate-to-Source Leakage Current	I <sub>GSS</sub>	V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ±20 V			±100	nA

### ON CHARACTERISTICS (Note 3)

Gate Threshold Voltage	V <sub>GS(TH)</sub>	V <sub>GS</sub> = V <sub>DS</sub> , I <sub>D</sub> = 250 μA	2.0		4.0	V
Negative Threshold Temperature Coefficient	V <sub>GS(TH)</sub> /T <sub>J</sub>			7.6		mV/°C
Drain-to-Source On-Resistance	R <sub>DS(on)</sub>	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 23 A		47	55	mΩ
Forward Transconductance	g <sub>FS</sub>	V <sub>GS</sub> = 5 V, I <sub>D</sub> = 10 A		13		S

### CHARGES, CAPACITANCES AND GATE RESISTANCE

Input Capacitance	C <sub>ISS</sub>	V <sub>GS</sub> = 0 V, f = 1.0 MHz, V <sub>DS</sub> = 25 V		700		pF
Output Capacitance	C <sub>OSS</sub>			110		
Reverse Transfer Capacitance	C <sub>RSS</sub>			52		
Total Gate Charge	Q <sub>G(TOT)</sub>	V <sub>GS</sub> = 10 V, V <sub>DS</sub> = 80 V, I <sub>D</sub> = 23 A		29		nC
Threshold Gate Charge	Q <sub>G(TH)</sub>			1.2		
Gate-to-Source Charge	Q <sub>GS</sub>			5		
Gate-to-Drain Charge	Q <sub>GD</sub>			14.6		
Plateau Voltage	V <sub>GP</sub>			5.7		
Gate Resistance	R <sub>G</sub>			2.3		Ω

### SWITCHING CHARACTERISTICS (Note 4)

Turn-On Delay Time	t <sub>d(on)</sub>	V <sub>GS</sub> = 10 V, V <sub>DD</sub> = 80 V, I <sub>D</sub> = 23 A, R <sub>G</sub> = 6.1 Ω		10		ns
Rise Time	t <sub>r</sub>			37		
Turn-Off Delay Time	t <sub>d(off)</sub>			30		
Fall Time	t <sub>f</sub>			37		

### DRAIN-SOURCE DIODE CHARACTERISTICS

Forward Diode Voltage	V <sub>SD</sub>	V <sub>GS</sub> = 0 V, I <sub>S</sub> = 23 A	T <sub>J</sub> = 25°C	0.83	1.2	V
			T <sub>J</sub> = 125°C	0.68		
Reverse Recovery Time	t <sub>RR</sub>	V <sub>GS</sub> = 0 V, dI <sub>S</sub> /dt = 100 A/μs, I <sub>S</sub> = 23 A		65		ns
Charge Time	T <sub>a</sub>			46		
Discharge Time	T <sub>b</sub>			19		
Reverse Recovery Charge	Q <sub>RR</sub>			176		

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 ≤ 300 μs, Duty Cycle ≤ 2%.

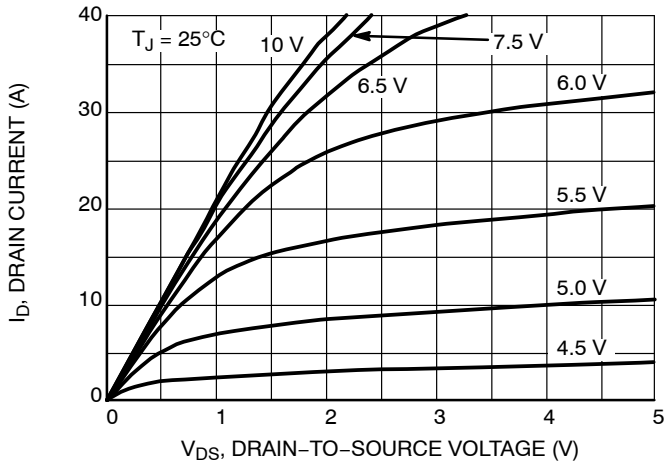
4. Switching characteristics are independent of operating junction temperatures.

### ORDERING INFORMATION

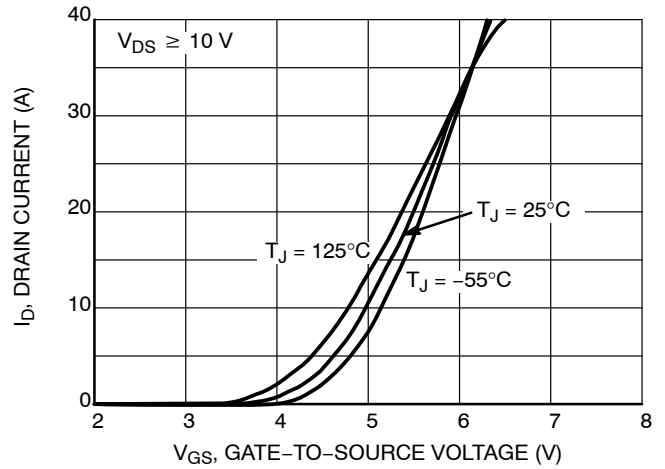
Device	Package	Shipping†
NTD6415ANT4G	DPAK (Pb-Free)	2500 / Tape & Reel
NTD6415AN-1G	IPAK (Pb-Free)	75 Units / Rail

†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.

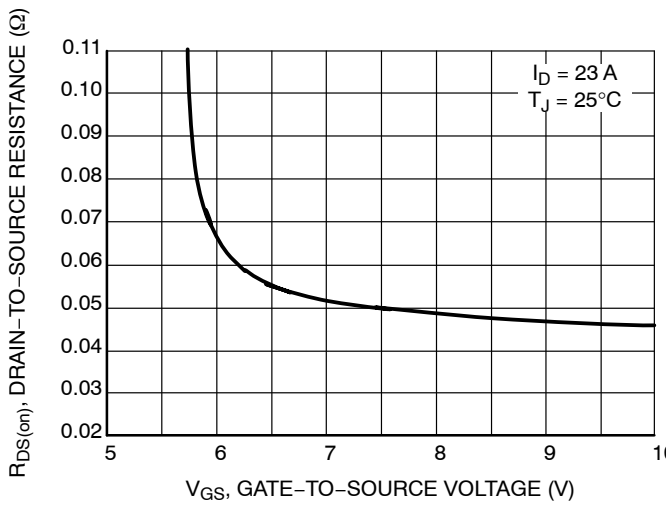
# NTD6415AN



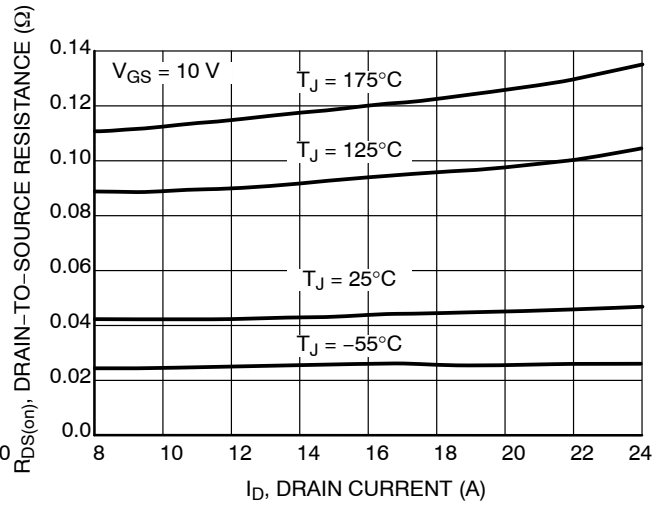
**Figure 1. On-Region Characteristics**



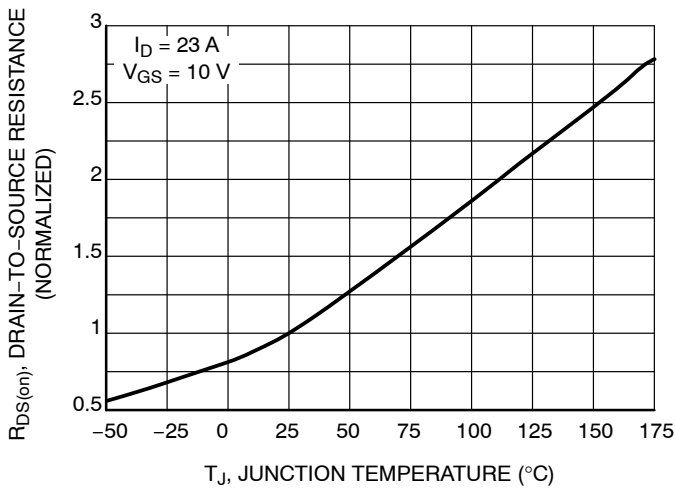
**Figure 2. Transfer Characteristics**



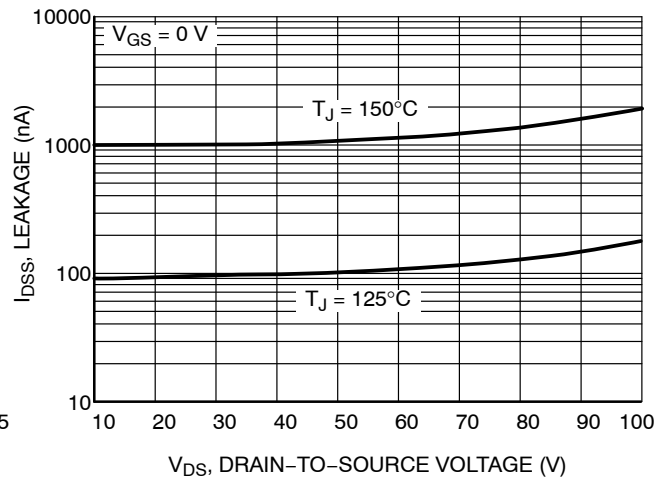
**Figure 3. On-Region versus Gate Voltage**



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

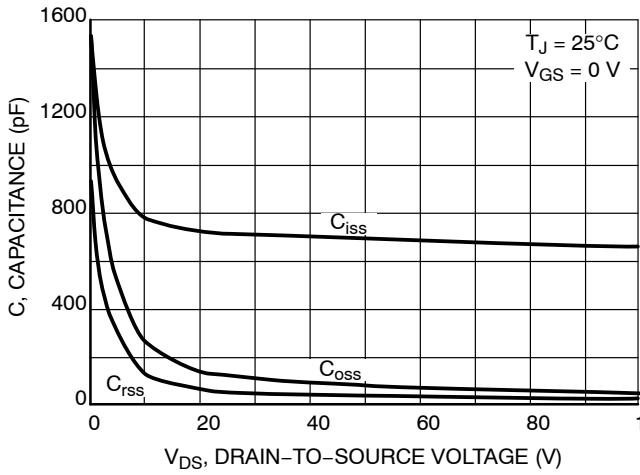


**Figure 5. On-Resistance Variation with Temperature**

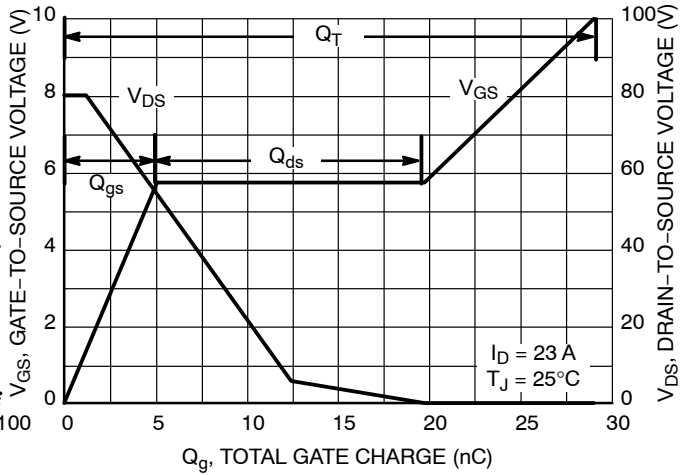


**Figure 6. Drain-to-Source Leakage Current versus Voltage**

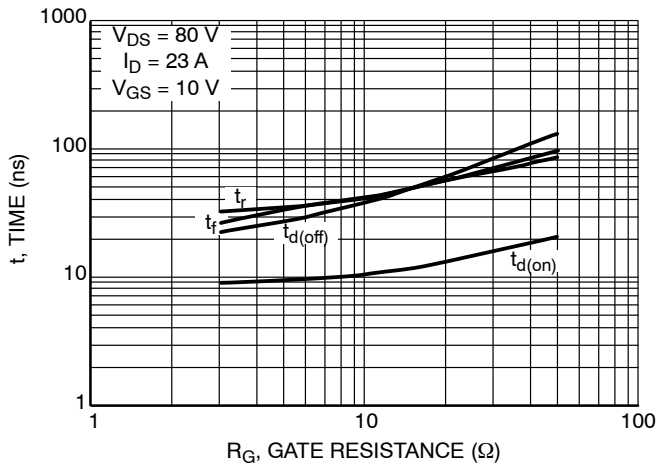
# NTD6415AN



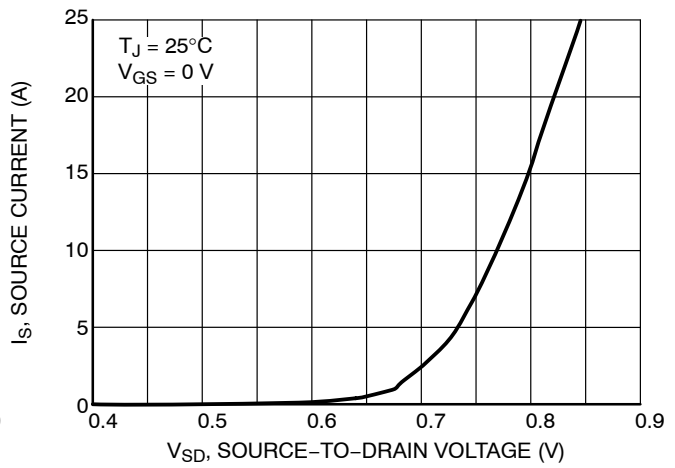
**Figure 7. Capacitance Variation**



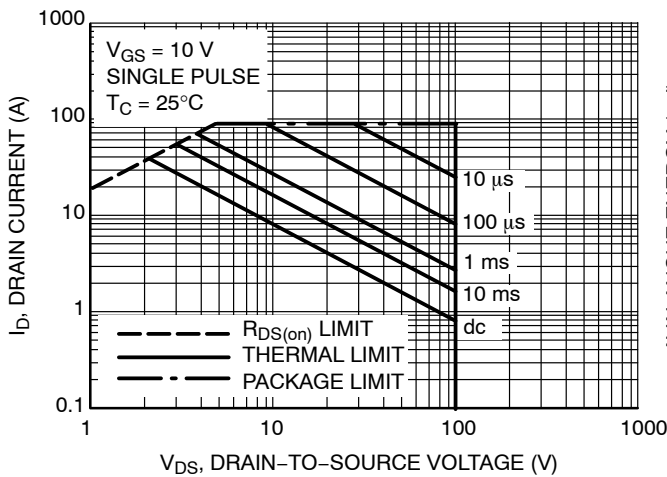
**Figure 8. Gate-to-Source Voltage and Drain-to-Source Voltage versus Total Charge**



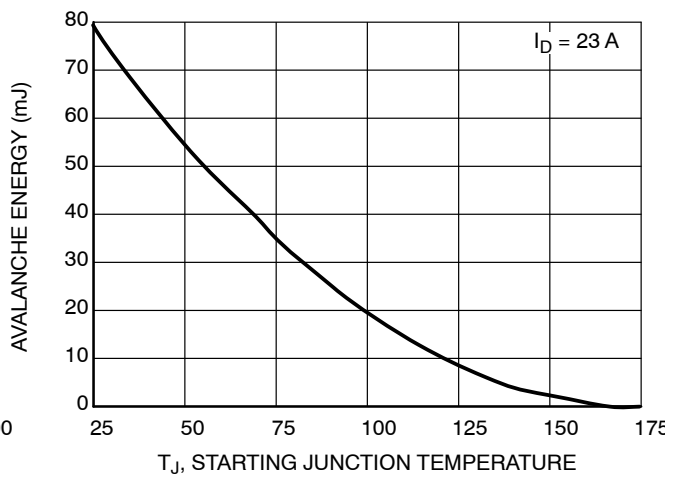
**Figure 9. Resistive Switching Time Variation versus Gate Resistance**



**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**

# NTD6415AN

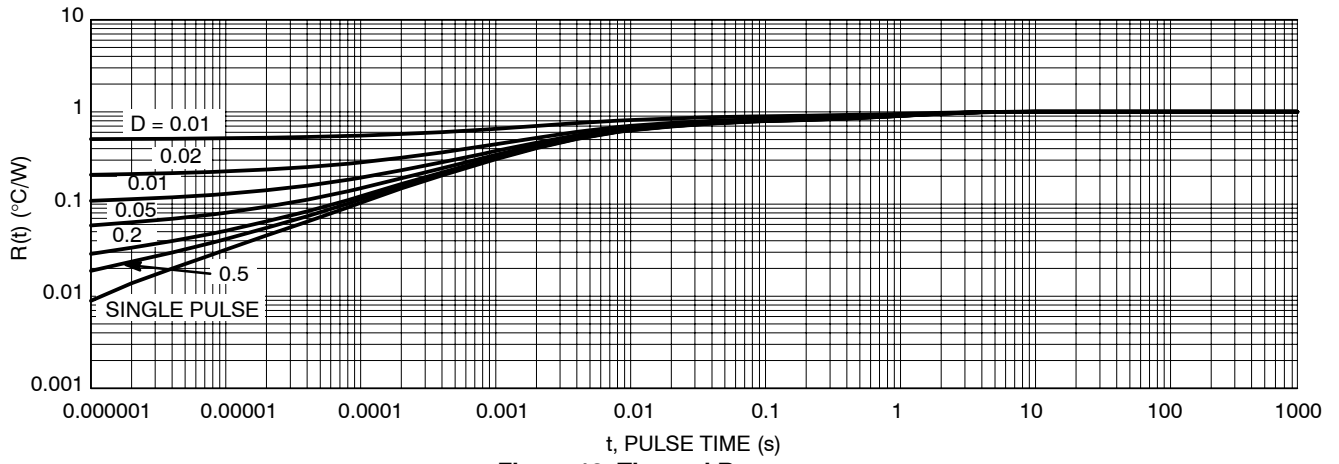
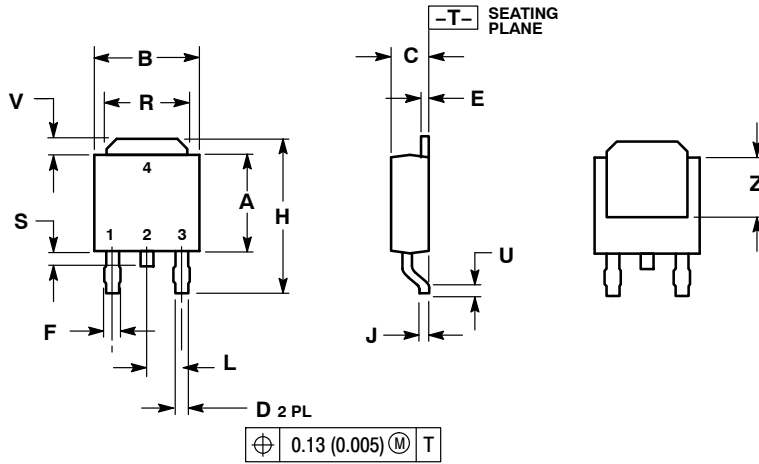


Figure 13. Thermal Response

# NTD6415AN

## PACKAGE DIMENSIONS

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

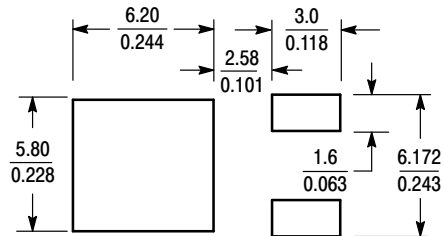


- NOTES:  
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.  
2. CONTROLLING DIMENSION: INCH.

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\*



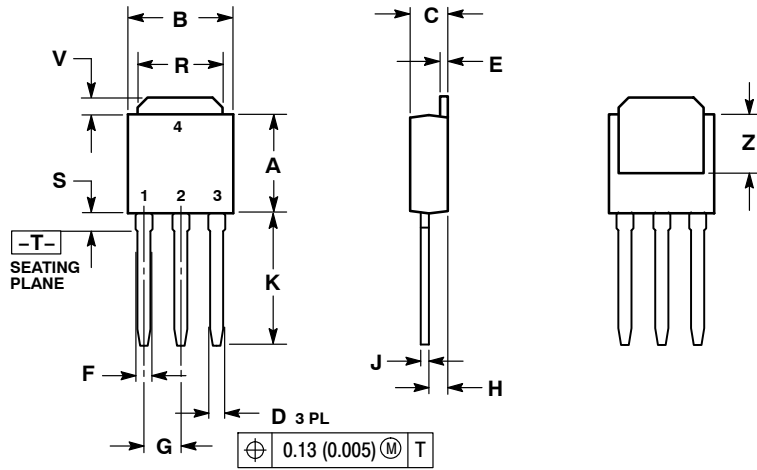
SCALE 3:1  $\left(\frac{\text{mm}}{\text{inches}}\right)$

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

# NTD6415AN

## 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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