



**THE DATASHEET OF  
NTD4813NH-1G**



# NTD4813NH, NVD4813NH

## MOSFET – Power, Single, N-Channel, DPAK/IPAK 30 V, 40 A

### Features

- Low  $R_{DS(on)}$  to Minimize Conduction Losses
- Low Capacitance to Minimize Driver Losses
- Optimized Gate Charge to Minimize Switching Losses
- Low  $R_G$
- NVD 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

### Applications

- CPU Power Delivery
- DC-DC Converters
- High Side Switching

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

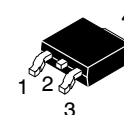
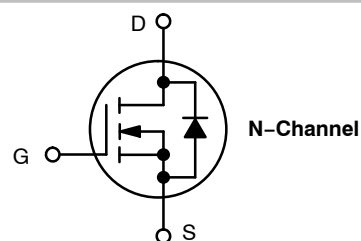
Parameter	Symbol	Value	Unit		
Drain-to-Source Voltage	$V_{DSS}$	30	V		
Gate-to-Source Voltage	$V_{GS}$	$\pm 20$	V		
Continuous Drain Current $R_{\theta JA}$ (Note 1)	$I_D$	$T_A = 25^\circ\text{C}$	9.0	A	
		$T_A = 85^\circ\text{C}$	7.0		
Power Dissipation $R_{\theta JA}$ (Note 1)	$P_D$	1.94	W		
Continuous Drain Current $R_{\theta JA}$ (Note 2)	Steady State	$T_A = 25^\circ\text{C}$	7.6	A	
		$T_A = 85^\circ\text{C}$	5.9		
Power Dissipation $R_{\theta JA}$ (Note 2)	$P_D$	1.27	W		
Continuous Drain Current $R_{\theta JC}$ (Note 1)	Steady State	$T_C = 25^\circ\text{C}$	40	A	
		$T_C = 85^\circ\text{C}$	31		
Power Dissipation $R_{\theta JC}$ (Note 1)	$P_D$	35.3	W		
Pulsed Drain Current	$t_p = 10\mu\text{s}$	$T_A = 25^\circ\text{C}$	$I_{DM}$	90	A
Current Limited by Package	$T_A = 25^\circ\text{C}$	$I_{DmaxPkg}$	35	A	
Operating Junction and Storage Temperature	$T_J$	-55 to	$^\circ\text{C}$		
	$T_{STG}$	+175			
Source Current (Body Diode)	$I_S$	29	A		
Drain to Source $dV/dt$	$dV/dt$	6	V/ns		



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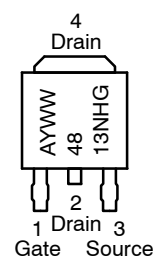
<http://onsemi.com>

$V_{(BR)DSS}$	$R_{DS(ON)} \text{ MAX}$	$I_D \text{ MAX}$
30 V	13 m $\Omega$ @ 10 V	40 A
	25.9 m $\Omega$ @ 4.5 V	



DPAK  
CASE 369AA  
(Bent Lead)  
STYLE 2

### MARKING DIAGRAM & PIN ASSIGNMENT



A = Assembly Location\*  
Y = Year  
WW = Work Week  
4813NH = Device Code  
G = Pb-Free Package

\* The Assembly Location code (A) is front side optional. In cases where the Assembly Location is stamped in the package, the front side assembly code may be blank.

### ORDERING INFORMATION

See detailed ordering and shipping information on page 7 of this data sheet.

## NTD4813NH, NVD4813NH

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

Parameter	Symbol	Value	Unit
Single Pulse Drain-to-Source Avalanche Energy ( $V_{DD} = 24\text{ V}$ , $V_{GS} = 10\text{ V}$ , $I_L = 17.2\text{ A}_{pk}$ , $L = 0.3\text{ mH}$ , $R_G = 25\ \Omega$ )	EAS	44.4	mJ
Lead Temperature for Soldering Purposes (1/8" from case for 10 s)	$T_L$	260	$^\circ\text{C}$

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.

# NTD4813NH, NVD4813NH

## THERMAL RESISTANCE MAXIMUM RATINGS

Parameter	Symbol	Value	Unit
Junction-to-Case (Drain)	$R_{\theta JC}$	4.25	°C/W
Junction-to-TAB (Drain)	$R_{\theta JC-TAB}$	3.5	
Junction-to-Ambient – Steady State (Note 1)	$R_{\theta JA}$	77.5	
Junction-to-Ambient – Steady State (Note 2)	$R_{\theta JA}$	118.5	

- Surface-mounted on FR4 board using 1 sq-in pad, 1 oz Cu.
- Surface-mounted on FR4 board using the minimum recommended pad size.

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

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

Drain-to-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}$	30			V
Drain-to-Source Breakdown Voltage Temperature Coefficient	$V_{(BR)DSS}/T_J$			24.5		mV/°C
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{GS} = 0\text{ V}, V_{DS} = 24\text{ V}$	$T_J = 25^\circ\text{C}$		1	$\mu\text{A}$
			$T_J = 125^\circ\text{C}$		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	$V_{GS(TH)}$	$V_{GS} = V_{DS}, I_D = 250\ \mu\text{A}$	1.5		2.5	V	
Negative Threshold Temperature Coefficient	$V_{GS(TH)}/T_J$			5.4		mV/°C	
Drain-to-Source On Resistance	$R_{DS(on)}$	$V_{GS} = 10\text{ V to } 11.5\text{ V}$	$I_D = 30\text{ A}$		10.9	13	m $\Omega$
			$I_D = 15\text{ A}$		10.7		
		$V_{GS} = 4.5\text{ V}$	$I_D = 30\text{ A}$		20.9	25.9	
			$I_D = 15\text{ A}$		18.5		
Forward Transconductance	$g_{FS}$	$V_{DS} = 15\text{ V}, I_D = 10\text{ A}$		6.7		S	

### CHARGES AND CAPACITANCES

Input Capacitance	$C_{ISS}$	$V_{GS} = 0\text{ V}, f = 1.0\text{ MHz}, V_{DS} = 12\text{ V}$		940		pF
Output Capacitance	$C_{OSS}$			201		
Reverse Transfer Capacitance	$C_{RSS}$			115		
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = 4.5\text{ V}, V_{DS} = 15\text{ V}; I_D = 30\text{ A}$		7.1	10	nC
Threshold Gate Charge	$Q_{G(TH)}$			1.6		
Gate-to-Source Charge	$Q_{GS}$			3.4		
Gate-to-Drain Charge	$Q_{GD}$			3.0		
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = 11.5\text{ V}, V_{DS} = 15\text{ V}; I_D = 30\text{ A}$		18.2		nC

### SWITCHING CHARACTERISTICS (Note 4)

Turn-On Delay Time	$t_{d(ON)}$	$V_{GS} = 4.5\text{ V}, V_{DS} = 15\text{ V}, I_D = 15\text{ A}, R_G = 3.0\ \Omega$		10		ns
Rise Time	$t_r$			19.5		
Turn-Off Delay Time	$t_{d(OFF)}$			10.3		
Fall Time	$t_f$			2.9		

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

- Pulse Test: pulse width  $\leq 300\ \mu\text{s}$ , duty cycle  $\leq 2\%$ .
- Switching characteristics are independent of operating junction temperatures.

# NTD4813NH, NVD4813NH

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

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
<b>SWITCHING CHARACTERISTICS</b> (Note 4)						
Turn-On Delay Time	$t_{d(ON)}$	$V_{GS} = 11.5\text{ V}, V_{DS} = 15\text{ V},$ $I_D = 15\text{ A}, R_G = 3.0\ \Omega$		5.1		ns
Rise Time	$t_r$			16.1		
Turn-Off Delay Time	$t_{d(OFF)}$			17.2		
Fall Time	$t_f$			1.8		

## DRAIN-SOURCE DIODE CHARACTERISTICS

Forward Diode Voltage	$V_{SD}$	$V_{GS} = 0\text{ V},$ $I_S = 30\text{ A}$	$T_J = 25^\circ\text{C}$		0.95	1.2	V
			$T_J = 125^\circ\text{C}$		0.9		
Reverse Recovery Time	$t_{RR}$	$V_{GS} = 0\text{ V}, dI_S/dt = 100\text{ A}/\mu\text{s},$ $I_S = 30\text{ A}$		15		ns	
Charge Time	$t_a$			9.9			
Discharge Time	$t_b$			5.1			
Reverse Recovery Charge	$Q_{RR}$			7.0		nC	

## PACKAGE PARASITIC VALUES

Source Inductance	$L_S$	$T_A = 25^\circ\text{C}$		2.49		nH
Drain Inductance, DPAK	$L_D$			0.0164		
Drain Inductance, IPAK	$L_D$			1.88		
Gate Inductance	$L_G$			3.46		
Gate Resistance	$R_G$			0.55		

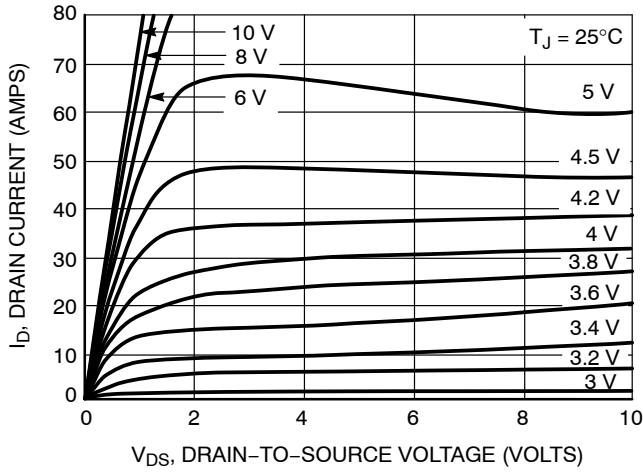
Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

3. Pulse Test: pulse width  $\leq 300\ \mu\text{s}$ , duty cycle  $\leq 2\%$ .

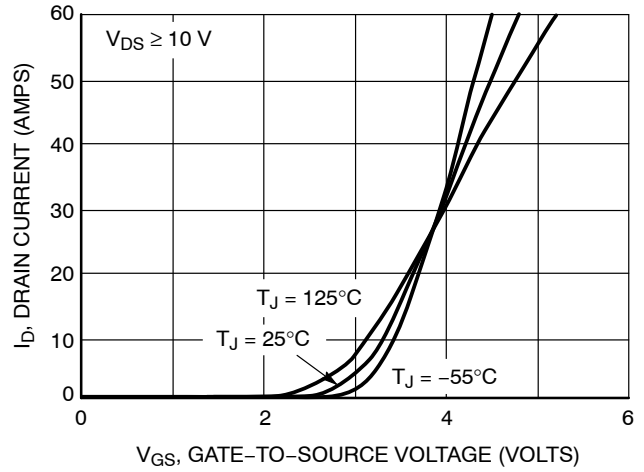
4. Switching characteristics are independent of operating junction temperatures.

# NTD4813NH, NVD4813NH

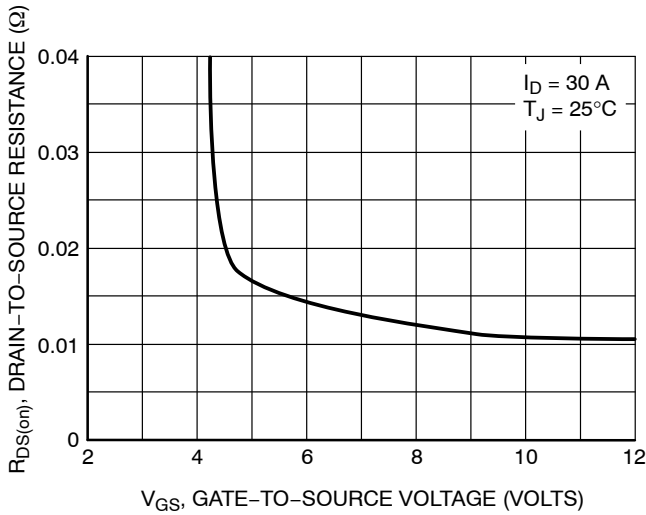
## TYPICAL PERFORMANCE CURVES



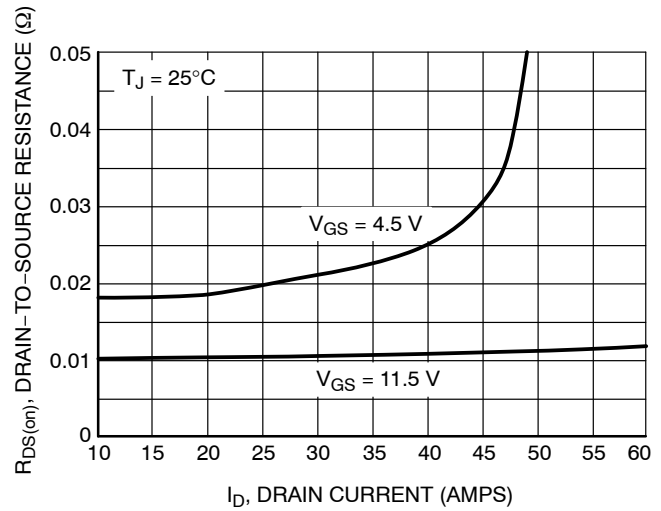
**Figure 1. On-Region Characteristics**



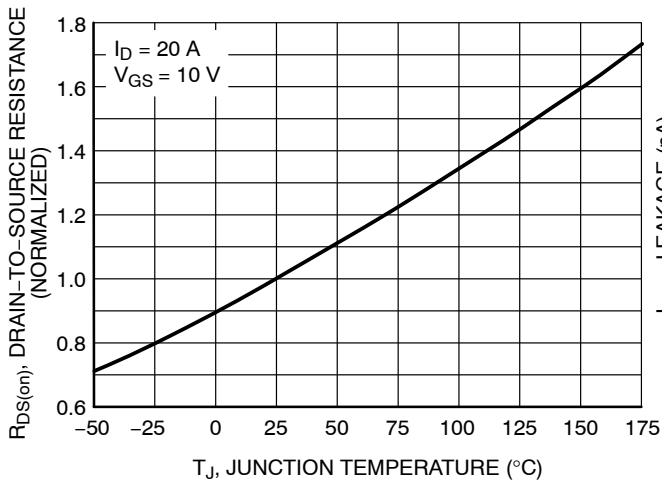
**Figure 2. Transfer Characteristics**



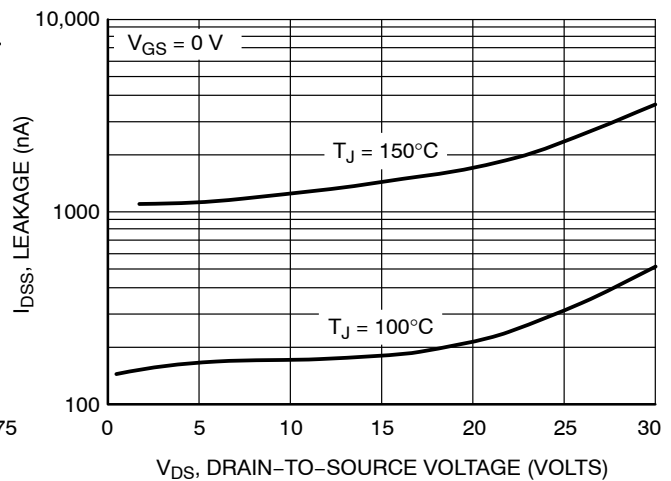
**Figure 3. On-Resistance vs. Gate-to-Source Voltage**



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



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



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

# NTD4813NH, NVD4813NH

## TYPICAL PERFORMANCE CURVES

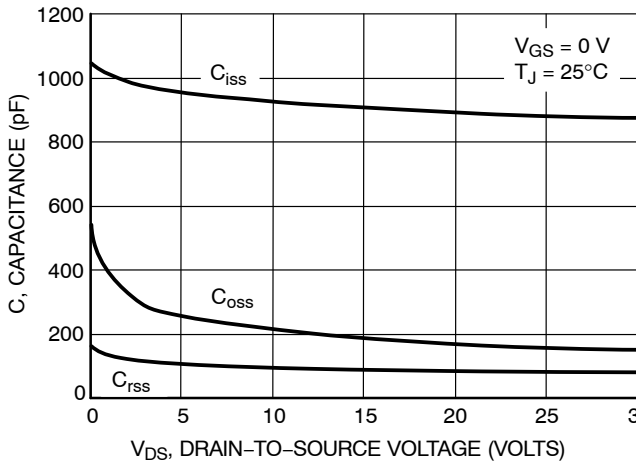


Figure 7. Capacitance Variation

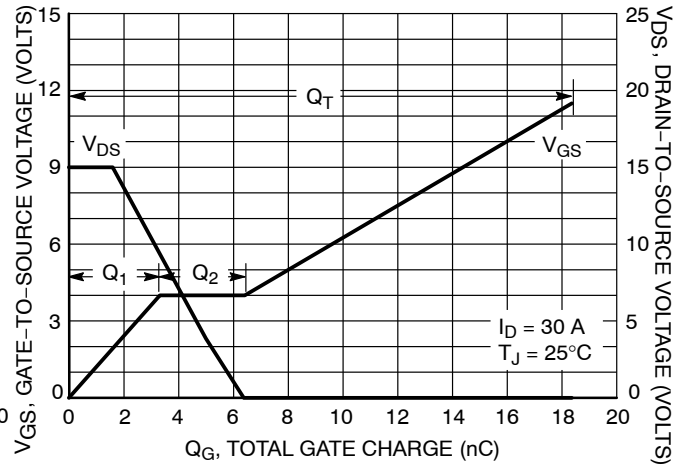


Figure 8. Gate-To-Source and Drain-To-Source Voltage vs. Total Charge

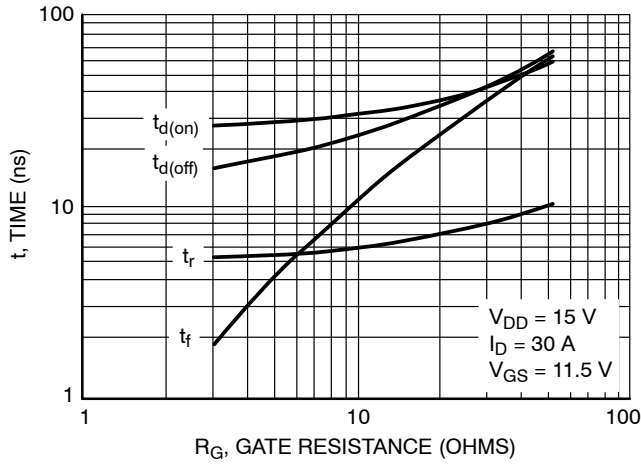


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

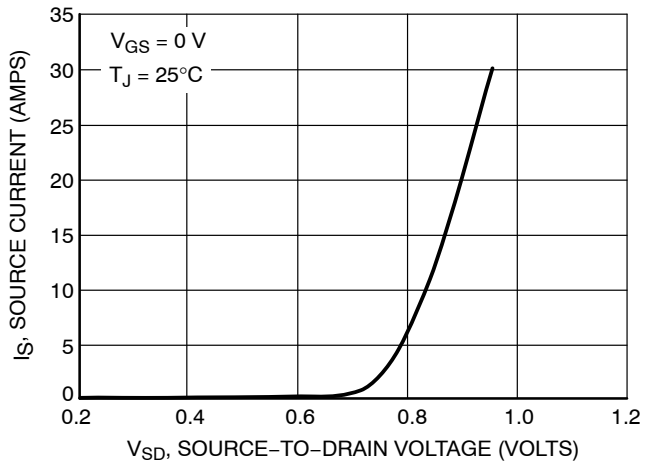


Figure 10. Diode Forward Voltage vs. Current

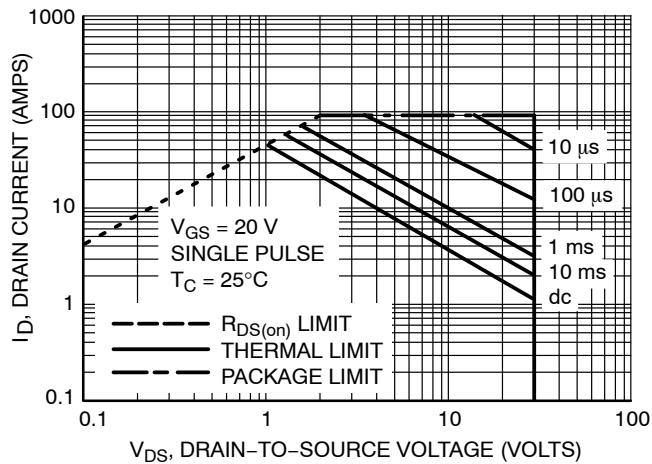


Figure 11. Maximum Rated Forward Biased Safe Operating Area

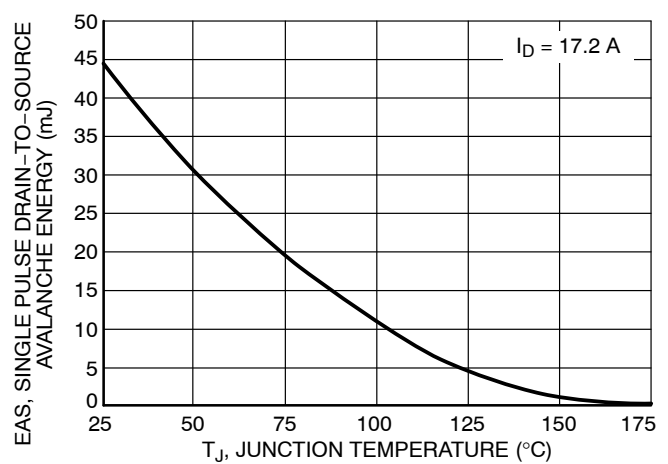


Figure 12. Maximum Avalanche Energy vs. Starting Junction Temperature

# NTD4813NH, NVD4813NH

## TYPICAL PERFORMANCE CURVES

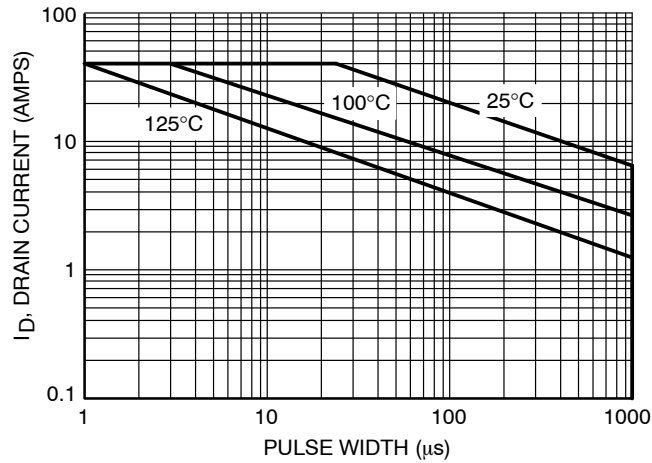


Figure 13. Avalanche Characteristics

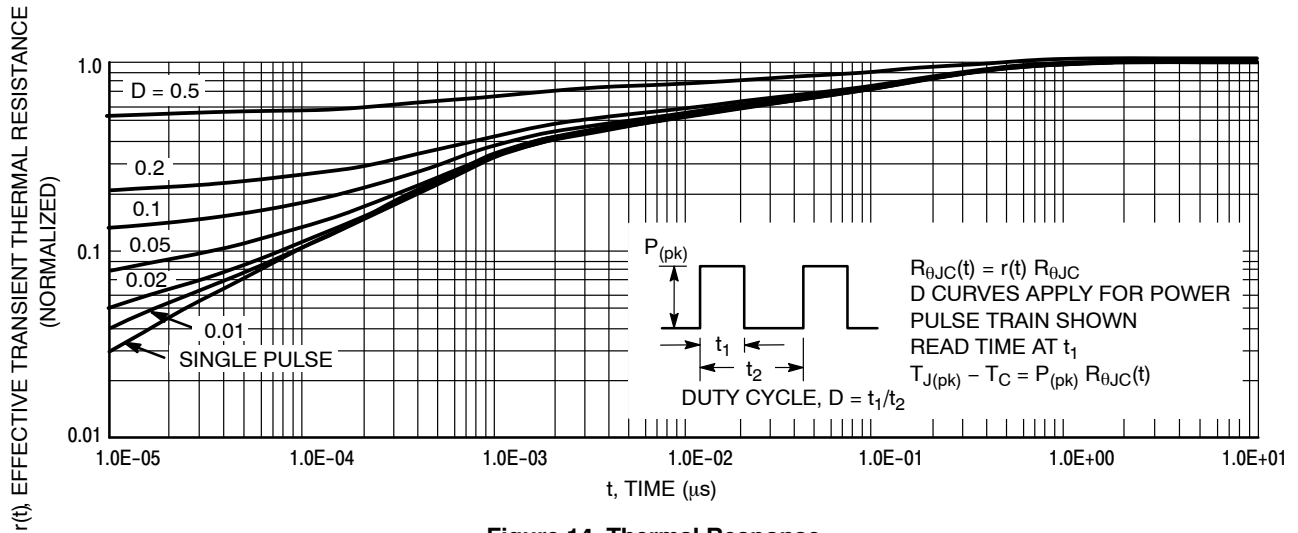


Figure 14. Thermal Response

### ORDERING INFORMATION

Device	Package	Shipping <sup>†</sup>
NTD4813NHT4G	DPAK (Pb-Free)	2500 / Tape & Reel
NVD4813NHT4G*	DPAK (Pb-Free)	2500 / Tape & Reel

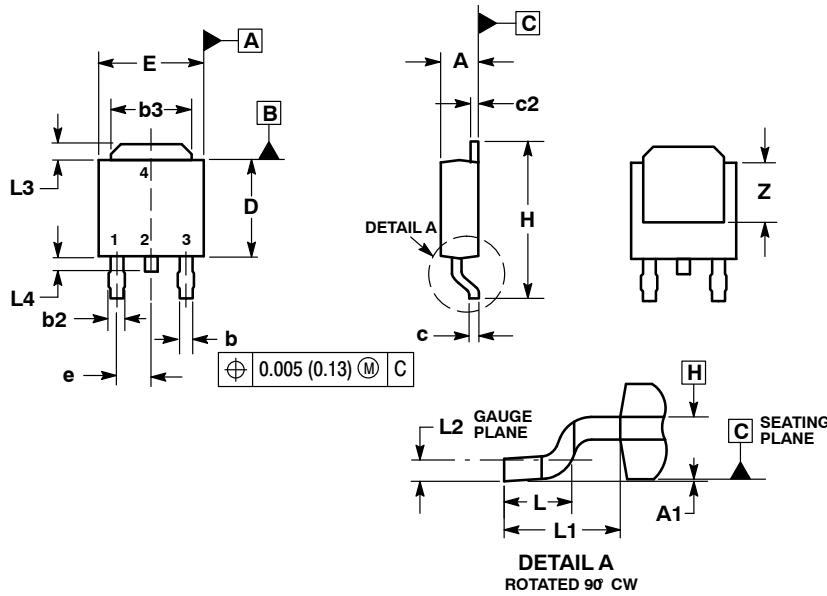
<sup>†</sup>For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

\*NVD Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q101 Qualified and PPAP Capable.

# NTD4813NH, NVD4813NH

## PACKAGE DIMENSIONS

### DPAK (SINGLE GUAGE) CASE 369AA ISSUE B

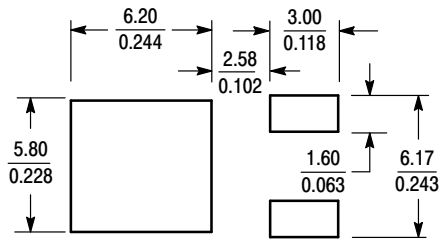


**NOTES:**

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	---	0.040	---	1.01
Z	0.155	---	3.93	---

### SOLDERING FOOTPRINT\*




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

**STYLE 2:**

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

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