NTD4860N

Power MOSFET
25 V, 65 A, Single N−Channel, DPAK/IPAK

Features

- Trench Technology
- Low $R_{DS(on)}$ to Minimize Conduction Losses
- Low Capacitance to Minimize Driver Losses
- Optimized Gate Charge to Minimize Switching Losses
- These are Pb−Free Devices

Applications

- VCORE Applications
- DC−DC Converters
- High/Low Side Switching

MAXIMUM RATINGS (T_J = 25°C unless otherwise stated)

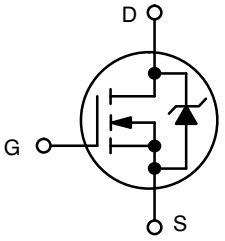
Parameter			Symbol	Value	Unit
Drain−to−Source Voltage			V_{DSS}	25	V
Gate−to−Source Voltage			V_{GS}	±20	V
Continuous Drain Current $R_{\theta JA}$ (Note 1)	Steady State	T_A = 25°C	I_D	13	A
		T_A = 85°C		10	
Power Dissipation $R_{\theta JA}$ (Note 1)		T_A = 25°C	P_D	2.0	W
Continuous Drain Current $R_{\theta JA}$ (Note 2)		T_A = 25°C	ID	10.4	A
		T_A = 85°C		8.0	
Power Dissipation $R_{\theta JA}$ (Note 2)		T_A = 25°C	P_D	1.28	W
Continuous Drain Current $R_{\theta JC}$ (Note 1)		T_C = 25°C	I_D	65	A
		T_C = 85°C		50	
Power Dissipation $R_{\theta JC}$ (Note 1)		T_C = 25°C	P_D	50	W
Pulsed Drain Current	t_p=10μs	T_A = 25°C	I_{DM}	130	A
Current Limited by Package		T_A = 25°C	$I_{DmaxPkg}$	45	A
Operating Junction and Storage Temperature			T_J, T_{STG}	−55 to +175	°C
Source Current (Body Diode)			I_S	42	A
Drain to Source dV/dt			dV/dt	6	V/ns
Single Pulse Drain−to−Source Avalanche Energy (T_J = 25°C, V_{DD} = 50 V, V_{GS} = 10 V, I_L = 13 A_{pk}, L = 1.0 mH, R_G = 25 Ω)			EAS	84.5	mJ
Lead Temperature for Soldering Purposes (1/8" from case for 10 s)			T_L	260	°C

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.

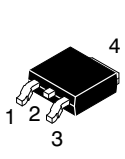
ON Semiconductor®

http://onsemi.com

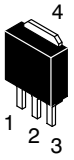
$V_{(BR)DSS}$	$R_{DS(ON)}$ MAX	I_D MAX
25 V	7.5 mΩ @ 10 V	65 A
	11.1 mΩ @ 4.5 V	



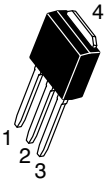
N−CHANNEL MOSFET



CASE 369AA DPAK (Bent Lead) STYLE 2

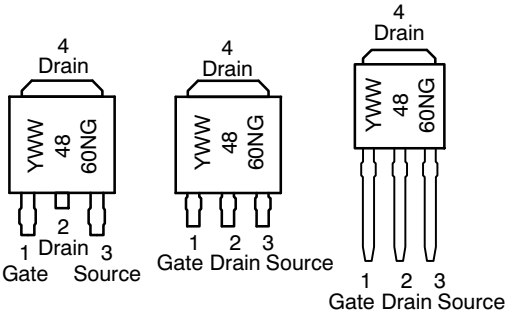


CASE 369AC 3 IPAK (Straight Lead)



CASE 369D IPAK (Straight Lead DPAK)

MARKING DIAGRAMS & PIN ASSIGNMENTS



Y = Year
WW = Work Week
4860N = Device Code
G = Pb−Free Package

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 6 of this data sheet.

THERMAL RESISTANCE MAXIMUM RATINGS

Parameter	Symbol	Value	Unit
Junction−to−Case (Drain)	$R_{\theta JC}$	3	°C/W
Junction−to−TAB (Drain)	$R_{\theta JC-TAB}$	3.5	
Junction−to−Ambient − Steady State (Note 1)	$R_{\theta JA}$	75	
Junction−to−Ambient − Steady State (Note 2)	$R_{\theta JA}$	117	

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

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

Parameter	Symbol	Test Condition		Min	Typ	Max	Unit
OFF CHARACTERISTICS							
Drain−to−Source Breakdown Voltage	$V_{(BR)DSS}$	V_{GS} = 0 V, I_D = 250 μA		25			V
Drain−to−Source Breakdown Voltage Temperature Coefficient	$V_{(BR)DSS}/T_J$				21		mV/°C
Zero Gate Voltage Drain Current	I_{DSS}	V_{GS} = 0 V, V_{DS} = 20 V	T_J = 25°C			1.0	μA
			T_J = 125°C			10	
Gate−to−Source Leakage Current	I_{GSS}	V_{DS} = 0 V, V_{GS} = ±20 V				±100	nA
ON CHARACTERISTICS (Note 3)							
Gate Threshold Voltage	$V_{GS(TH)}$	V_{GS} = V_{DS}, I_D = 250 μA		1.45		2.5	V
Negative Threshold Temperature Coefficient	$V_{GS(TH)}/T_J$				5.2		mV/°C
Drain−to−Source On Resistance	$R_{DS(on)}$	V_{GS} = 10 V	I_D = 30 A		6.1	7.5	mΩ
		V_{GS} = 4.5 V	I_D = 30 A		8.9	11.1	
Forward Transconductance	g_{FS}	V_{DS} = 1.5 V, I_D = 15 A			48		S
CHARGES AND CAPACITANCES							
Input Capacitance	C_{ISS}	V_{GS} = 0 V, f = 1.0 MHz, V_{DS} = 12 V			1308		pF
Output Capacitance	C_{OSS}				342		
Reverse Transfer Capacitance	C_{RSS}				169		
Total Gate Charge	$Q_{G(TOT)}$	V_{GS} = 4.5 V, V_{DS} = 15 V, I_D = 30 A			11	16.5	nC
Threshold Gate Charge	$Q_{G(TH)}$				1.2		
Gate−to−Source Charge	Q_{GS}				3.9		
Gate−to−Drain Charge	Q_{GD}				4.7		
Total Gate Charge	$Q_{G(TOT)}$	V_{GS} = 10 V, V_{DS} = 15 V, I_D = 30 A			21.8		nC
SWITCHING CHARACTERISTICS (Note 4)							
Turn−On Delay Time	$t_{d(ON)}$	V_{GS} = 4.5 V, V_{DS} = 15 V, I_D = 15 A, R_G = 3.0 Ω			12.2		ns
Rise Time	t_r				20.1		
Turn−Off Delay Time	$t_{d(OFF)}$				15.2		
Fall Time	t_f				4.3		
Turn−On Delay Time	$t_{d(ON)}$	V_{GS} = 11.5 V, V_{DS} = 15 V, I_D = 15 A, R_G = 3.0 Ω			7.1		ns
Rise Time	t_r				17		
Turn−Off Delay Time	$t_{d(OFF)}$				22		
Fall Time	t_f				2.3		

3. Pulse Test: pulse width ≤ 300 μs, duty cycle ≤ 2%.
4. Switching characteristics are independent of operating junction temperatures.

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

Parameter	Symbol	Test Condition		Min	Typ	Max	Unit
DRAIN−SOURCE DIODE CHARACTERISTICS							
Forward Diode Voltage	V_{SD}	V_{GS} = 0 V, I_S = 30 A	T_J = 25°C		0.9	1.2	V
			T_J = 125°C		0.76		
Reverse Recovery Time	t_{RR}	V_{GS} = 0 V, dIS/dt = 100 A/μs, I_S = 30 A			12.7		ns
Charge Time	t_a				7.0		
Discharge Time	t_b				5.7		
Reverse Recovery Charge	Q_{RR}				3.5		nC
PACKAGE PARASITIC VALUES							
Source Inductance	L_S	T_A = 25°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				0.75		Ω

3. Pulse Test: pulse width ≤ 300 μs, duty cycle ≤ 2%.
4. Switching characteristics are independent of operating junction temperatures.

TYPICAL PERFORMANCE CURVES

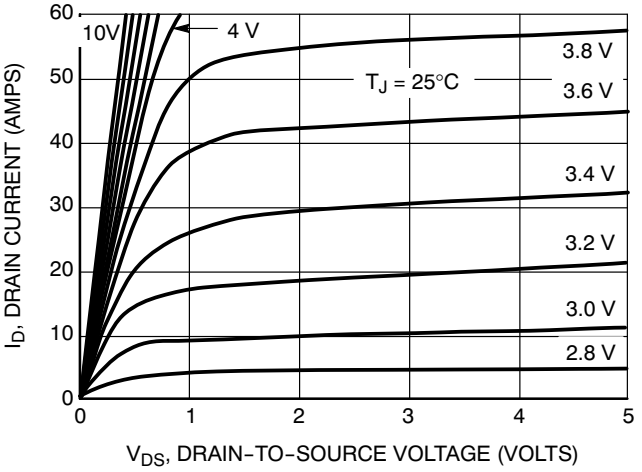


Figure 1. On−Region Characteristics

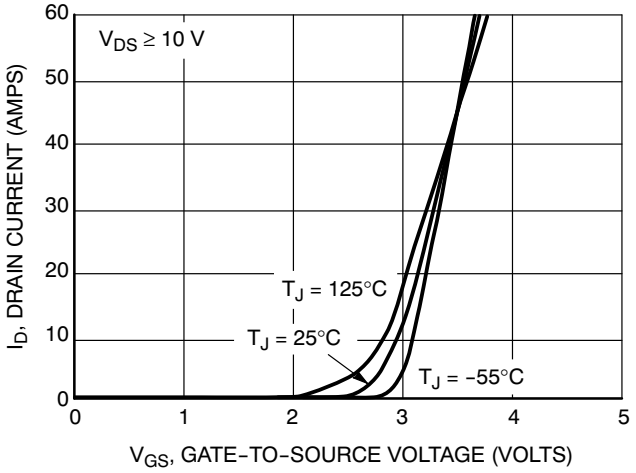


Figure 2. Transfer Characteristics

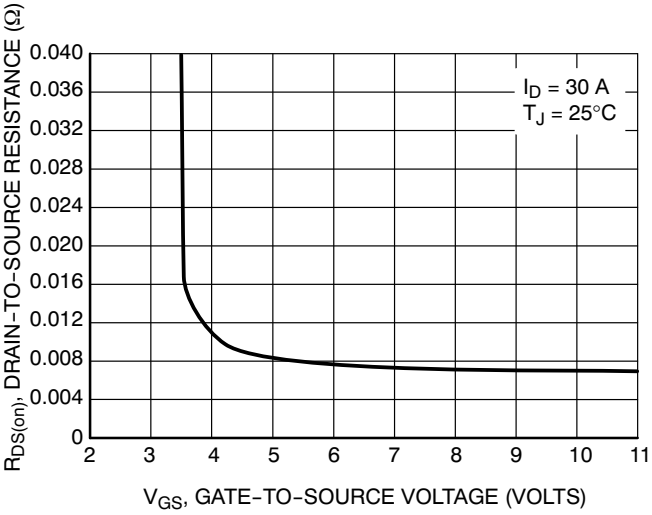


Figure 3. On−Resistance vs. Gate−to−Source Voltage

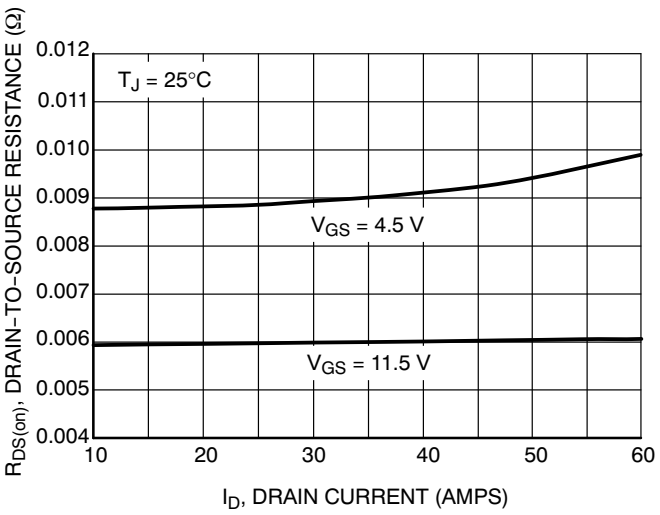


Figure 4. On−Resistance vs. Drain Current and Gate Voltage

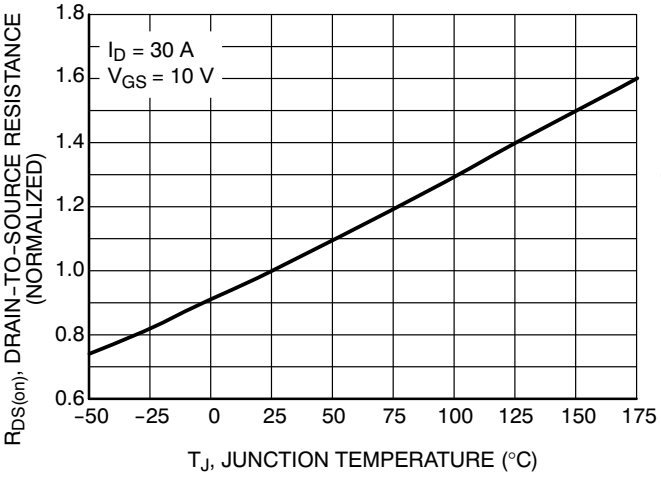


Figure 5. On−Resistance Variation with Temperature

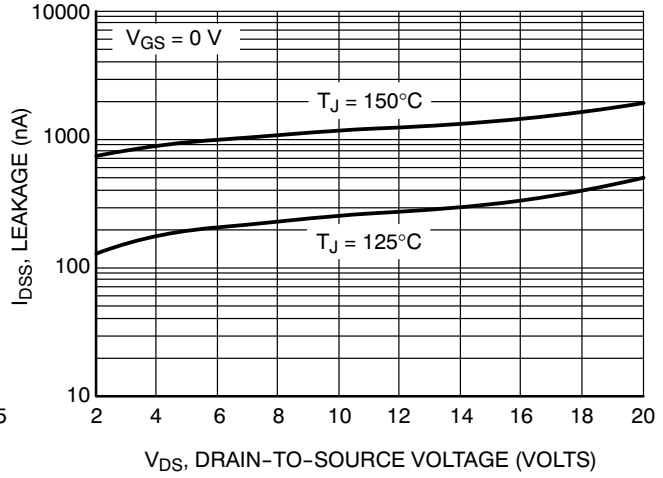


Figure 6. Drain−to−Source Leakage Current vs. Drain Voltage

TYPICAL PERFORMANCE CURVES

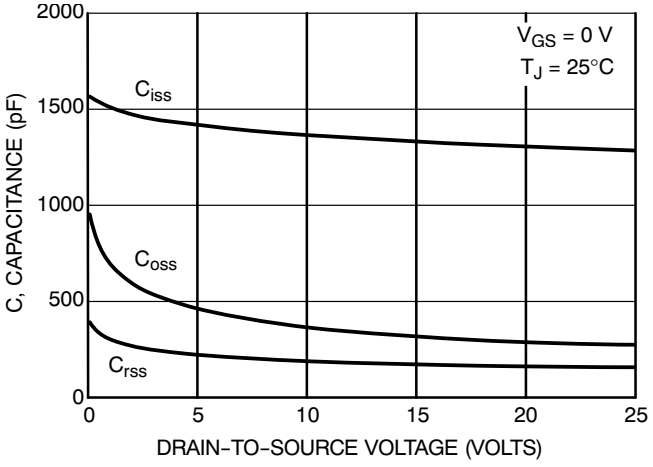


Figure 7. Capacitance Variation

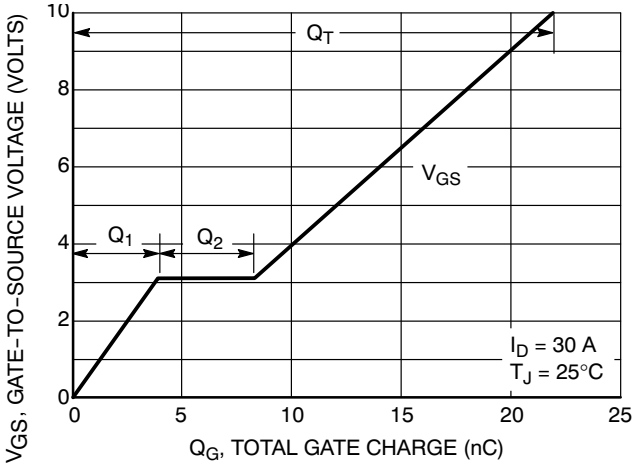


Figure 8. Gate−To−Source and Drain−To−Source Voltage vs. Total Charge

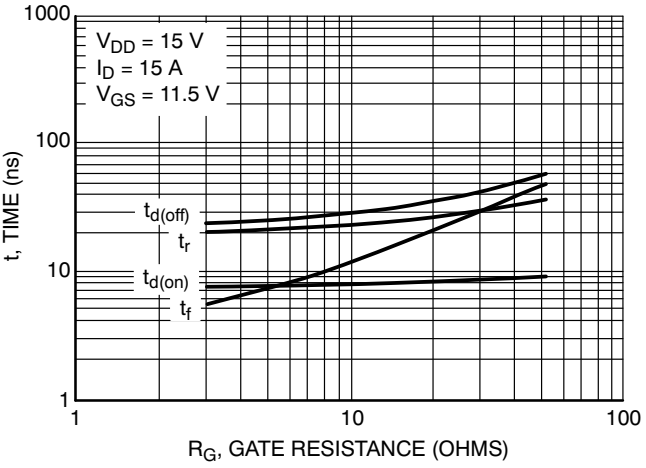


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

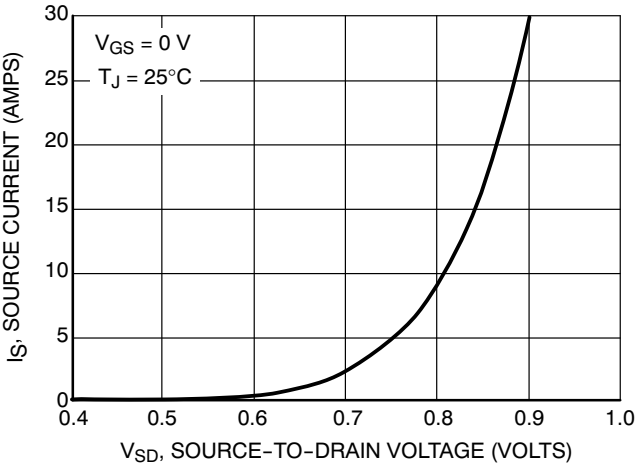


Figure 10. Diode Forward Voltage vs. Current

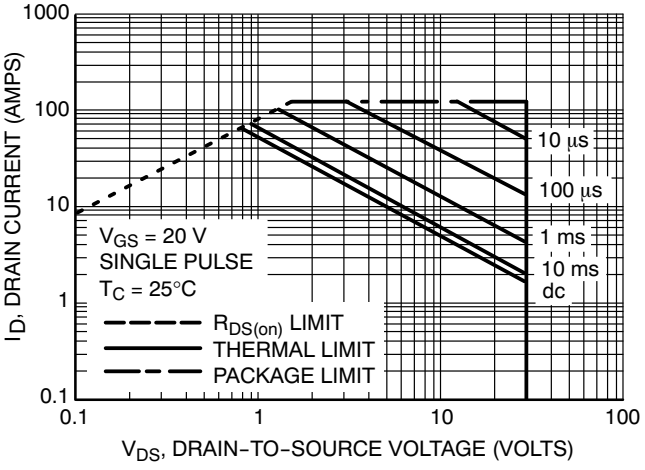


Figure 11. Maximum Rated Forward Biased Safe Operating Area

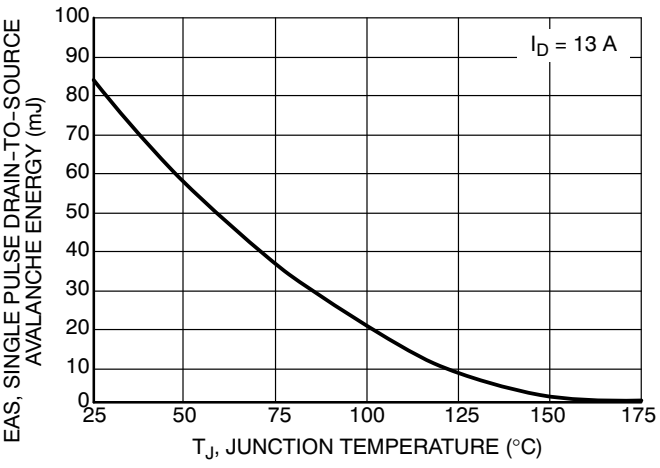


Figure 12. Maximum Avalanche Energy vs. Starting Junction Temperature

TYPICAL PERFORMANCE CURVES

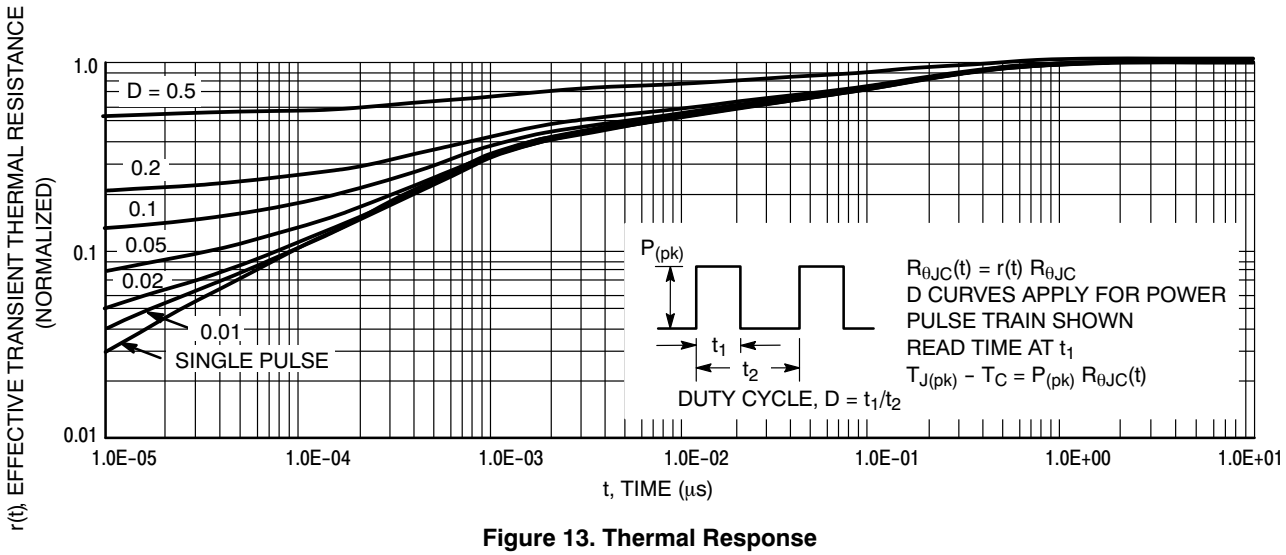


Figure 13. Thermal Response

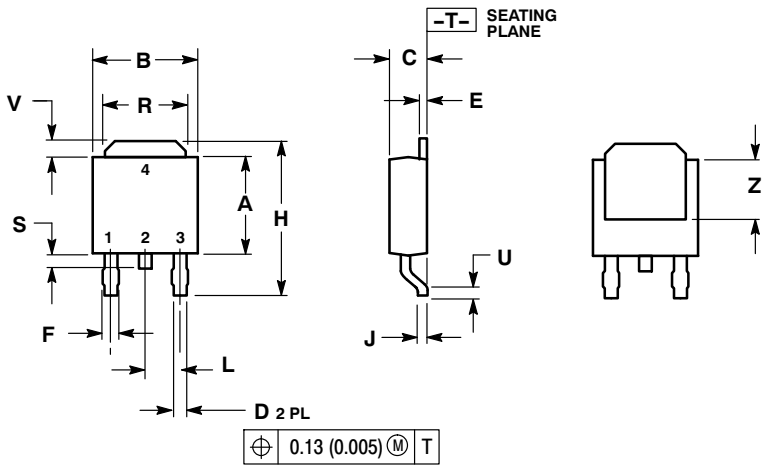
ORDERING INFORMATION

Device	Package	Shipping†
NTD4860NT4G	DPAK (Pb−Free)	2500 / Tape & Reel
NTD4860N−1G	IPAK (Pb−Free)	75 Units / Rail
NTD4860N−35G	IPAK Trimmed Lead (3.5 ± 0.15 mm) (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 Specifications Brochure, BRD8011/D.

PACKAGE DIMENSIONS

DPAK (SINGLE GAUGE)
CASE 369AA−01
ISSUE A

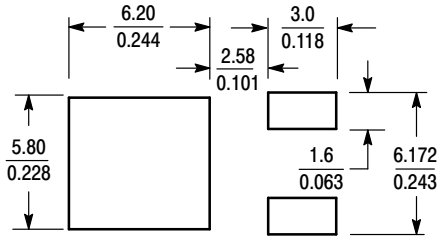


NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.

	INCHES		MILLIMETERS	
DIM	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*

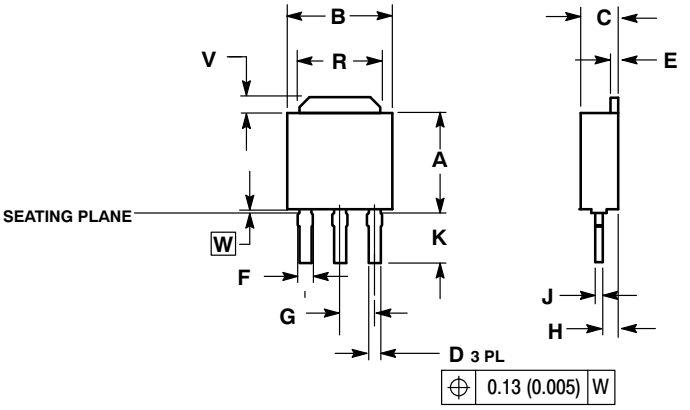


SCALE 3:1 $\left(\frac{mm}{inches}\right)$

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

PACKAGE DIMENSIONS

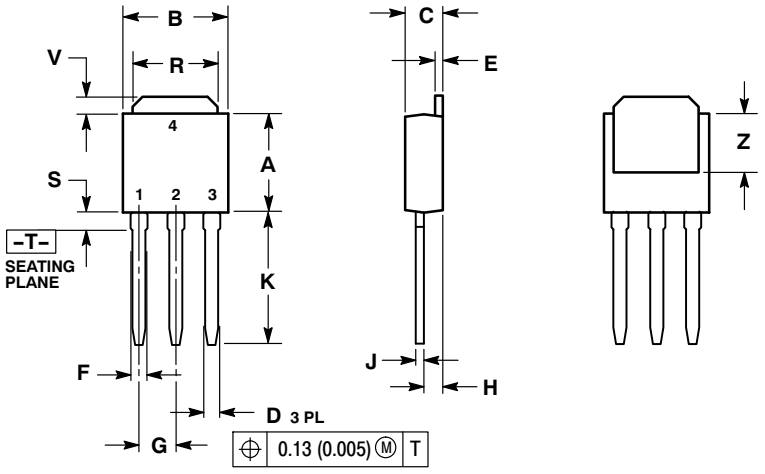
3 IPAK, STRAIGHT LEAD
CASE 369AC−01
ISSUE O



NOTES:
1.. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2.. CONTROLLING DIMENSION: INCH.
3. SEATING PLANE IS ON TOP OF DAMBAR POSITION.
4. DIMENSION A DOES NOT INCLUDE DAMBAR POSITION OR MOLD GATE.

	INCHES		MILLIMETERS	
DIM	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	0.027	0.035	0.69	0.88
E	0.018	0.023	0.46	0.58
F	0.037	0.043	0.94	1.09
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	0.134	0.142	3.40	3.60
R	0.180	0.215	4.57	5.46
V	0.035	0.050	0.89	1.27
W	0.000	0.010	0.000	0.25

IPAK (STRAIGHT LEAD DPAK)
CASE 369D−01
ISSUE B



NOTES:
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2. CONTROLLING DIMENSION: INCH.

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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

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:
Literature Distribution Center for ON Semiconductor
P.O. Box 5163, Denver, Colorado 80217 USA
Phone: 303−675−2175 or 800−344−3860 Toll Free USA/Canada
Fax: 303−675−2176 or 800−344−3867 Toll Free USA/Canada
Email: orderlit@onsemi.com

N. American Technical Support: 800−282−9855 Toll Free USA/Canada
Europe, Middle East and Africa Technical Support:
Phone: 421 33 790 2910
Japan Customer Focus Center
Phone: 81−3−5773−3850

ON Semiconductor Website: **www.onsemi.com**

Order Literature: http://www.onsemi.com/orderlit

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NTD4860N/D