NTD4904N

Power MOSFET
30 V, 79 A, Single N−Channel, DPAK/IPAK

Features

- 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

- CPU Power Delivery
- DC−DC Converters

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

Parameter			Symbol	Value	Unit
Drain−to−Source Voltage			V_{DSS}	30	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	17.8	A
		T_A = 100°C		12.6	
Power Dissipation ($R_{\theta JA}$) (Note 1)		T_A = 25°C	P_D	2.6	W
Continuous Drain Current ($R_{\theta JA}$) (Note 2)		T_A = 25°C	I_D	13	A
		T_A = 100°C		9.2	
Power Dissipation ($R_{\theta JA}$) (Note 2)		T_A = 25°C	P_D	1.4	W
Continuous Drain Current ($R_{\theta JC}$) (Note 1)		T_C = 25°C	I_D	79	A
		T_C = 100°C		56	
Power Dissipation ($R_{\theta JC}$) (Note 1)		T_C = 25°C	P_D	52	W
Pulsed Drain Current	t_p=10μs	T_A = 25°C	I_{DM}	316	A
Current Limited by Package		T_A = 25°C	$I_{DmaxPkg}$	90	A
Operating Junction and Storage Temperature			T_J, T_{stg}	−55 to 175	°C
Source Current (Body Diode)			I_S	47	A
Drain to Source dV/dt			dV/dt	6.0	V/ns
Single Pulse Drain−to−Source Avalanche Energy (T_J = 25°C, V_{DD} = 50 V, V_{GS} = 10 V, L = 0.1 mH, $I_{L(pk)}$ = 37 A, R_G = 25 Ω)			E_{AS}	68.4	mJ
Lead Temperature for Soldering Purposes (1/8″ from case for 10 s)			T_L	260	°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.

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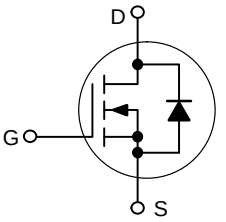
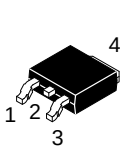
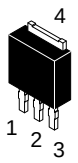
$V_{(BR)DSS}$	$R_{DS(on)}$ MAX	I_D MAX
30 V	3.7 mΩ @ 10 V	79 A
	5.5 mΩ @ 4.5 V	



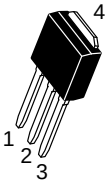
N−Channel



CASE 369AA DPAK (Bent Lead) STYLE 2

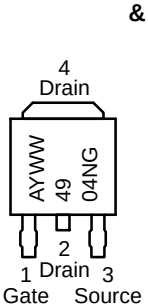


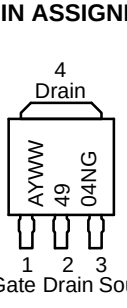
CASE 369AD IPAK (Straight Lead)

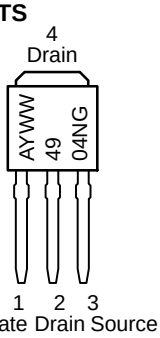


CASE 369D IPAK (Straight Lead DPAK)

MARKING DIAGRAMS & PIN ASSIGNMENTS







A	= Assembly Location
Y	= Year
WW	= Work Week
4904N	= 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)	$R_{\theta JC}$	2.9	°C/W
Junction−to−Tab (Drain)	$R_{\theta JC-TAB}$	4.3	
Junction−to−Ambient − Steady State (Note 1)	$R_{\theta JA}$	57	
Junction−to−Ambient − Steady State (Note 2)	$R_{\theta JA}$	108	

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

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

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		30			V
Drain−to−Source Breakdown Voltage Temperature Coefficient	$V_{(BR)DSS}/T_J$				15		mV/°C
Zero Gate Voltage Drain Current	I_{DSS}	V_{GS} = 0 V, V_{DS} = 24 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		1.0	1.6	2.2	V
Negative Threshold Temperature Coefficient	$V_{GS(TH)}/T_J$				4.0		mV/°C
Drain−to−Source On Resistance	$R_{DS(on)}$	V_{GS} = 10 V	I_D = 30 A		3.0	3.7	mΩ
			I_D = 15 A		3.0		
		V_{GS} = 4.5 V	I_D = 30 A		4.0	5.5	
			I_D = 15 A		4.0		
Forward Transconductance	gFS	V_{DS} = 1.5 V, I_D = 30 A			76		S
CHARGES AND CAPACITANCES							
Input Capacitance	C_{iss}	V_{GS} = 0 V, f = 1.0 MHz, V_{DS} = 15 V			3052		pF
Output Capacitance	C_{oss}				976		
Reverse Transfer Capacitance	C_{rss}				23		
Total Gate Charge	$Q_{G(TOT)}$	V_{GS} = 4.5 V, V_{DS} = 15 V, I_D = 30 A			16.8		nC
Threshold Gate Charge	$Q_{G(TH)}$				4.4		
Gate−to−Source Charge	Q_{GS}				8.2		
Gate−to−Drain Charge	Q_{GD}				3.0		
Total Gate Charge	$Q_{G(TOT)}$	V_{GS} = 10 V, V_{DS} = 15 V, I_D = 30 A			41		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			15.3		ns
Rise Time	t_r				19.8		
Turn−Off Delay Time	$t_{d(off)}$				23.4		
Fall Time	t_f				7.5		
Turn−On Delay Time	$t_{d(on)}$	V_{GS} = 10 V, V_{DS} = 15 V, I_D = 15 A, R_G = 3.0 Ω			10.3		ns
Rise Time	t_r				20		
Turn−Off Delay Time	$t_{d(off)}$				28.7		
Fall Time	t_f				8.0		

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 noted)

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		0.84	1.1	V
			T_J = 125°C		0.7		
Reverse Recovery Time	t_{RR}	V_{GS} = 0 V, dIs/dt= 100 A/μs, I_S = 30 A			40.4		ns
Charge Time	ta				20.5		
Discharge Time	tb				19.9		
Reverse Recovery Time	Q_{RR}				35		nC
PACKAGE PARASITIC VALUES							
Source Inductance (Note 5)	L_S	T_A = 25°C			2.48		nH
Drain Inductance, DPAK	L_D				0.0164		
Drain Inductance, IPAK (Note 5)	L_D				1.88		
Gate Inductance (Note 5)	L_G				4.9		
Gate Resistance	R_G				1.0	2.0	Ω

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.

5. Assume terminal length of 110 mils.

TYPICAL PERFORMANCE CURVES

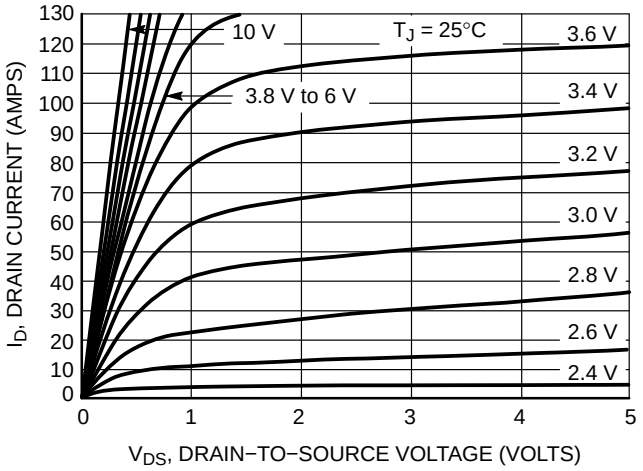


Figure 1. On−Region Characteristics

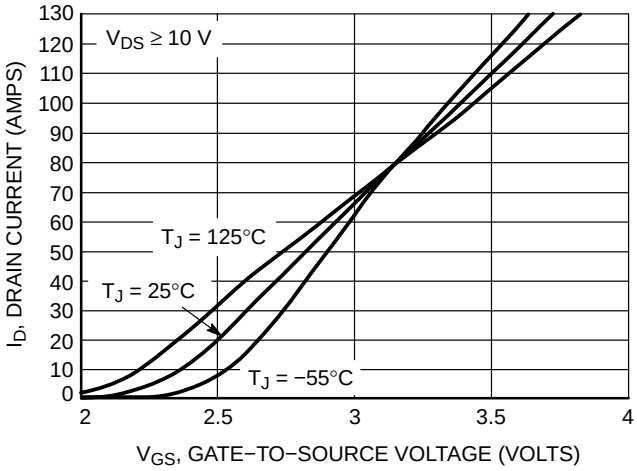


Figure 2. Transfer Characteristics

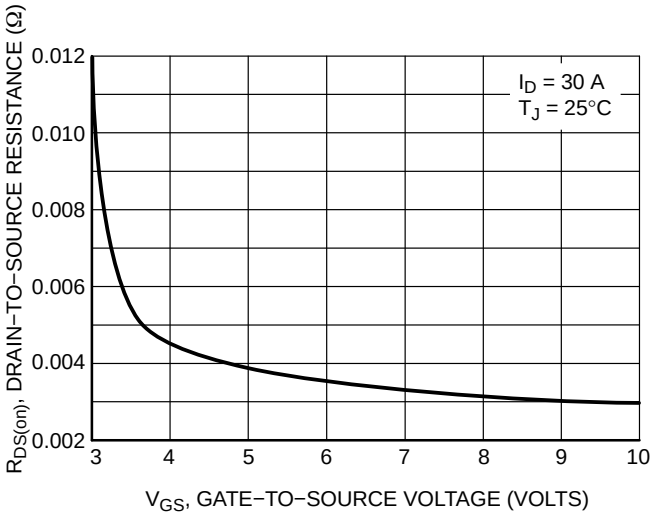


Figure 3. On−Resistance vs. Gate−to−Source Voltage

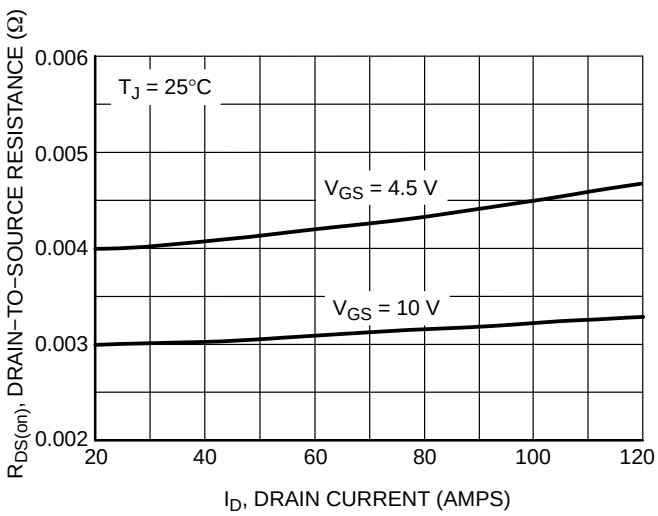


Figure 4. On−Resistance vs. Drain Current and Gate Voltage

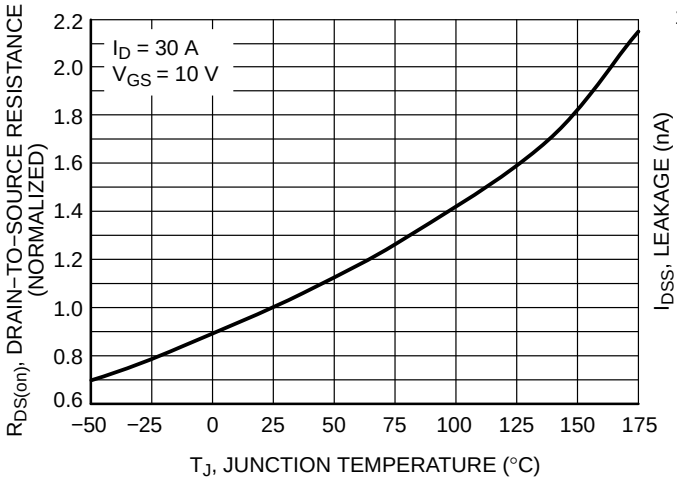


Figure 5. On−Resistance Variation with Temperature

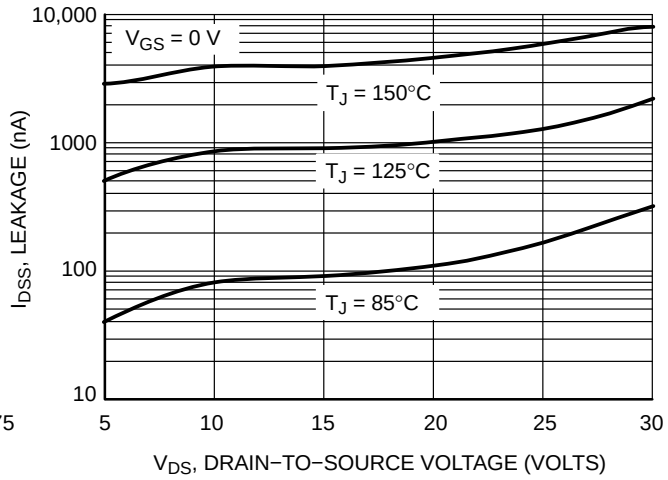


Figure 6. Drain−to−Source Leakage Current vs. Drain Voltage

TYPICAL PERFORMANCE CURVES

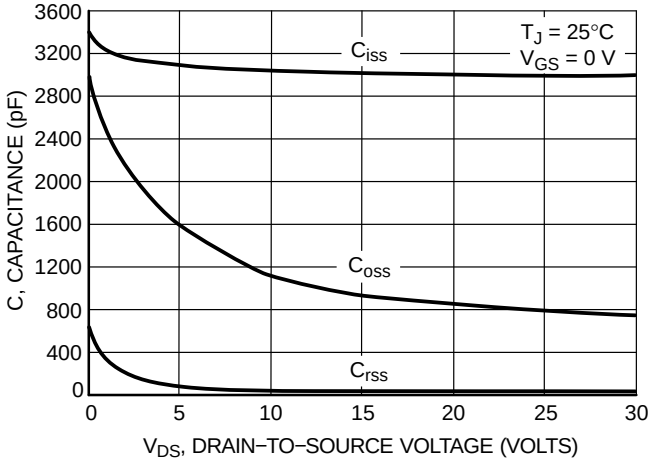


Figure 7. Capacitance Variation

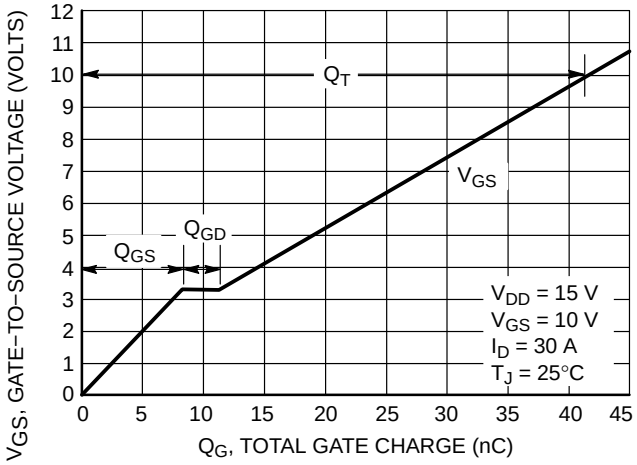


Figure 8. Gate−To−Source and Drain−To−Source Voltage vs. Total Charge

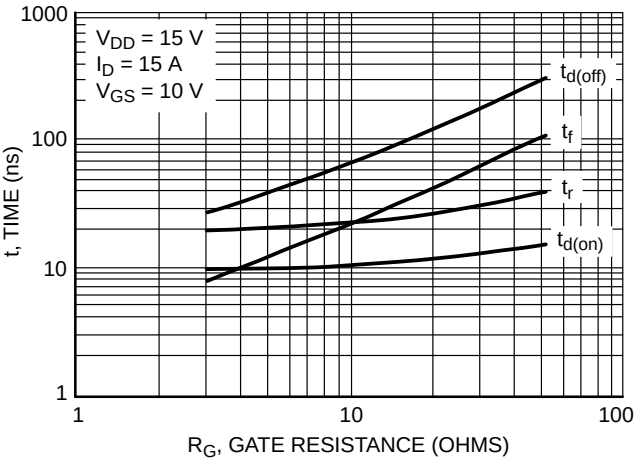


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

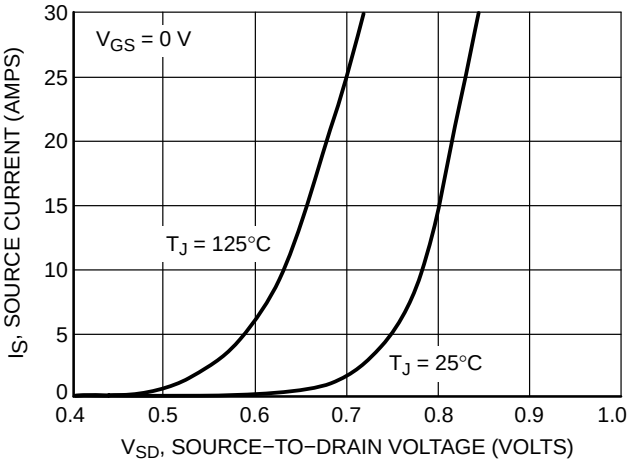


Figure 10. Diode Forward Voltage vs. Current

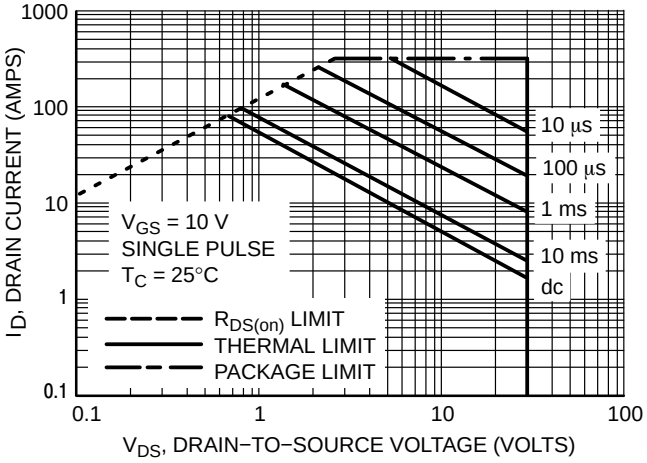


Figure 11. Maximum Rated Forward Biased Safe Operating Area

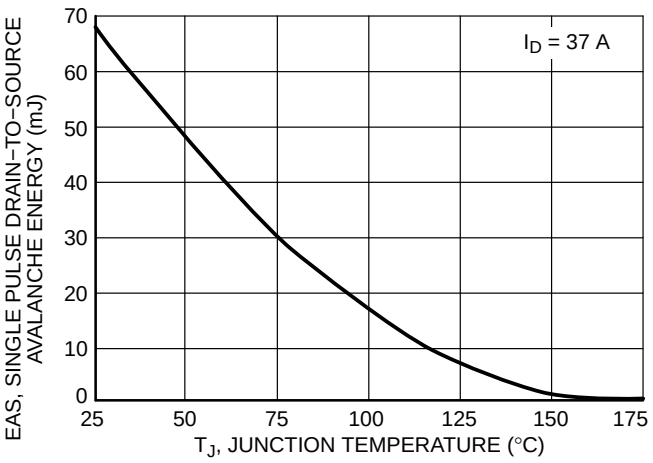


Figure 12. Maximum Avalanche Energy vs. Starting Junction Temperature

TYPICAL PERFORMANCE CURVES

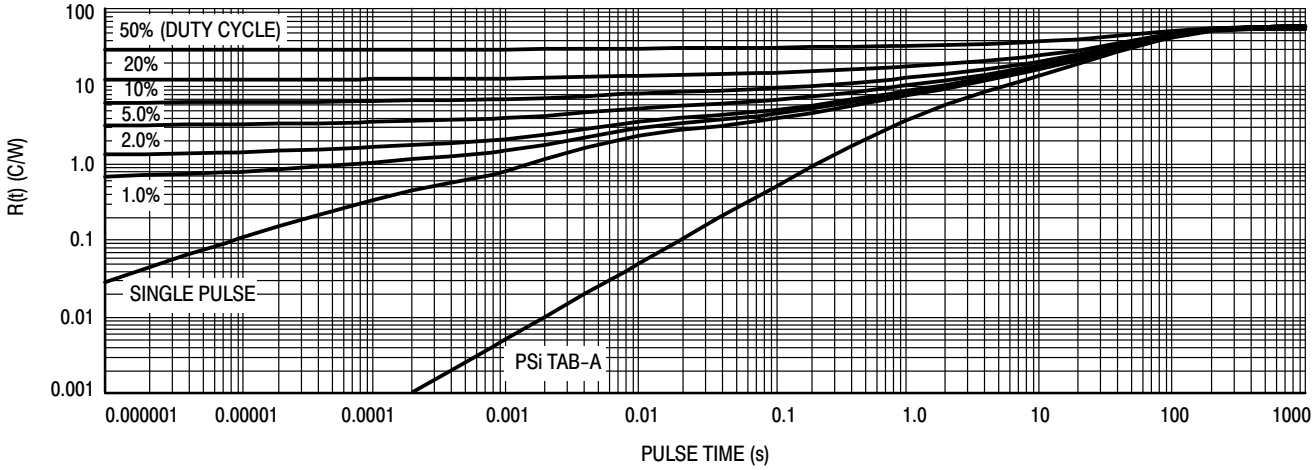


Figure 13. FET Thermal Response

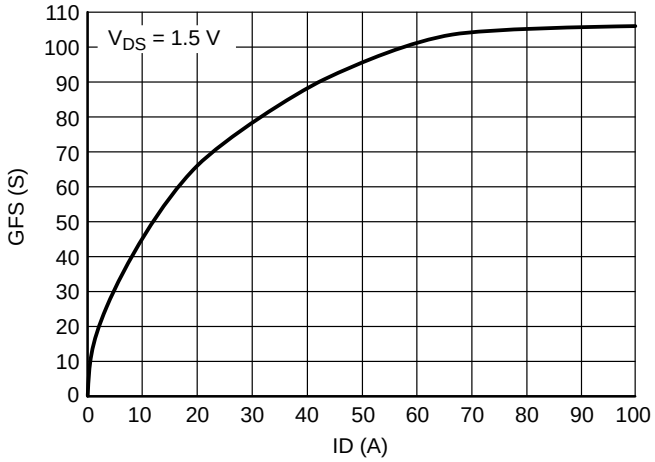


Figure 14. GFS vs ID

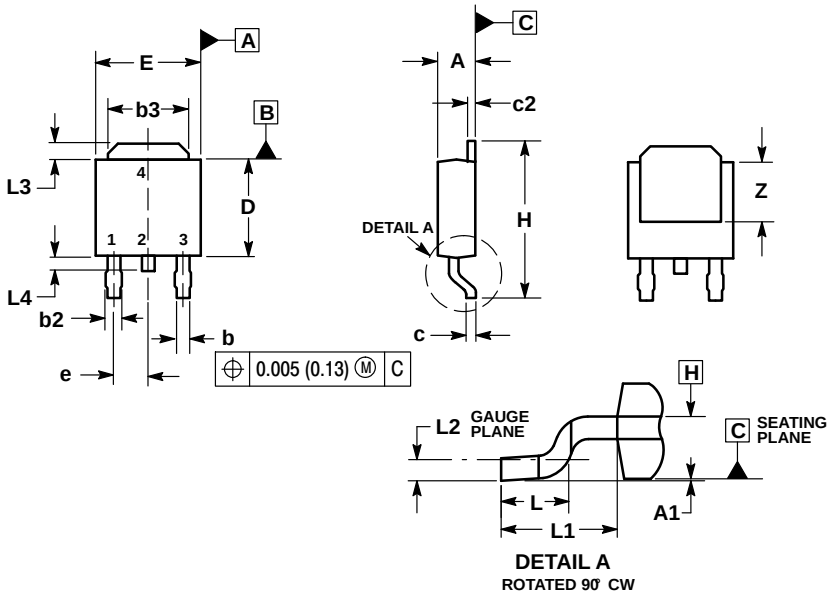
ORDERING INFORMATION

Order Number	Package	Shipping†
NTD4904NT4G	DPAK (Pb−Free)	2500 / Tape & Reel
NTD4904N−1G	IPAK (Pb−Free)	75 Units / Rail
NTD4904N−35G	IPAK Trimmed Lead (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 GUAGE)
CASE 369AA
ISSUE B

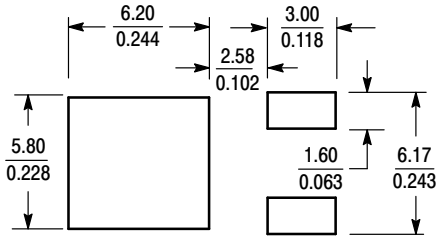


NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: INCHES.
3. THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSIONS b3, L3 and Z.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.006 INCHES 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.

	INCHES		MILLIMETERS	
DIM	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	−−−

STYLE 2:
PIN 1. GATE
2. DRAIN
3. SOURCE
4. DRAIN

SOLDERING FOOTPRINT*

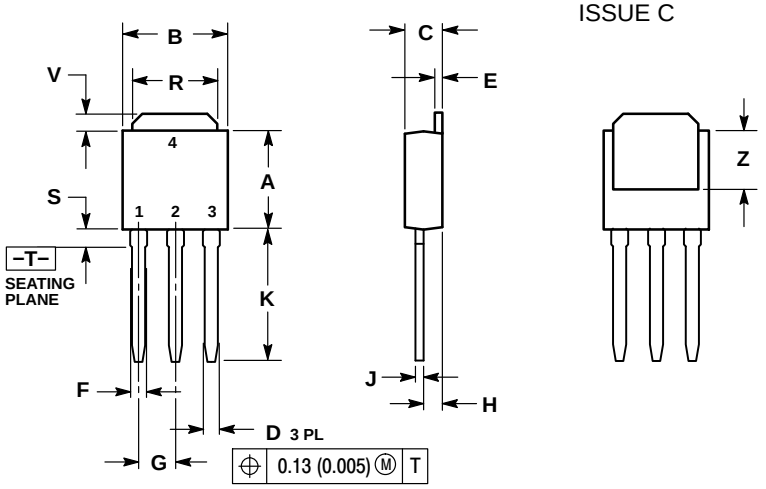


SCALE 3:1 $\left(\frac{mm}{inches}\right)$

*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

IPAK (STRAIGHT LEAD DPAK)
CASE 369D
ISSUE C

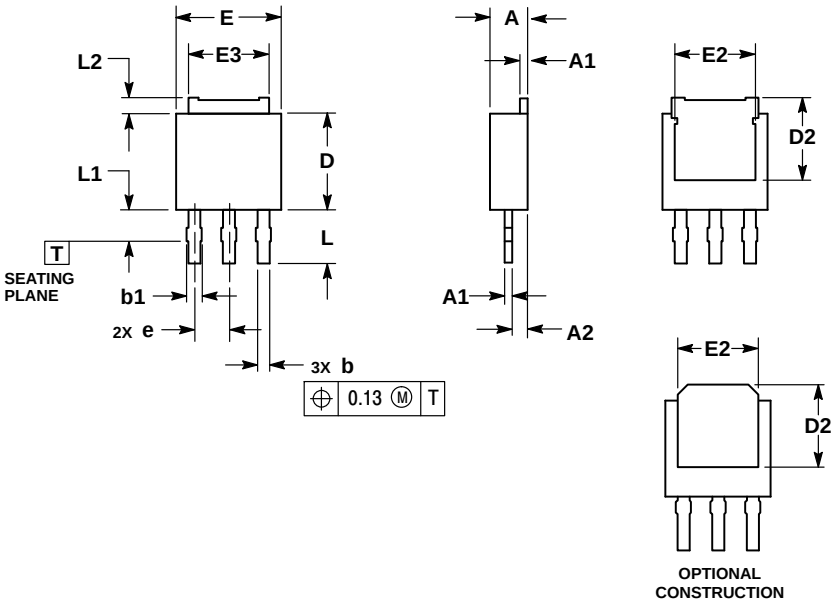


NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	0.235	0.245	5.97	6.35
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

3.5 MM IPAK, STRAIGHT LEAD
CASE 369AD
ISSUE B



NOTES:
1.. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2.. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSION b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.15 AND 0.30mm FROM TERMINAL TIP.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD GATE OR MOLD FLASH.

	MILLIMETERS	
DIM	MIN	MAX
A	2.19	2.38
A1	0.46	0.60
A2	0.87	1.10
b	0.69	0.89
b1	0.77	1.10
D	5.97	6.22
D2	4.80	−−−
E	6.35	6.73
E2	4.57	5.45
E3	4.45	5.46
e	2.28 BSC	
L	3.40	3.60
L1	−−−	2.10
L2	0.89	1.27

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:
Literature Distribution Center for ON Semiconductor
P.O. Box 5163, Denver, Colorado 80217 USA
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