

NTD4909N

MOSFET – Power, Single, N-Channel, DPAK/IPAK 30 V, 41 A

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 ($T_J = 25^\circ\text{C}$ 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)	I_D	$T_A = 25^\circ\text{C}$	12.1	A	
		$T_A = 100^\circ\text{C}$	8.6		
Power Dissipation ($R_{\theta JA}$) (Note 1)	P_D	$T_A = 25^\circ\text{C}$	2.6	W	
		$T_A = 100^\circ\text{C}$			
Continuous Drain Current ($R_{\theta JA}$) (Note 2)	I_D	$T_A = 25^\circ\text{C}$	8.8	A	
		$T_A = 100^\circ\text{C}$	6.2		
Power Dissipation ($R_{\theta JA}$) (Note 2)	P_D	$T_A = 25^\circ\text{C}$	1.37	W	
		$T_A = 100^\circ\text{C}$			
Continuous Drain Current ($R_{\theta JC}$) (Note 1)	I_D	$T_C = 25^\circ\text{C}$	41	A	
		$T_C = 100^\circ\text{C}$	29		
Power Dissipation ($R_{\theta JC}$) (Note 1)	P_D	$T_C = 25^\circ\text{C}$	29.4	W	
		$T_C = 100^\circ\text{C}$			
Pulsed Drain Current	$t_p = 10\mu\text{s}$	$T_A = 25^\circ\text{C}$	I_{DM}	167	A
Current Limited by Package		$T_A = 25^\circ\text{C}$	$I_{DmaxPkg}$	60	A
Operating Junction and Storage Temperature	T_J, T_{stg}	-55 to 175		$^\circ\text{C}$	
Source Current (Body Diode)	I_S	27		A	
Drain to Source dV/dt	dV/dt	7.0		V/ns	
Single Pulse Drain-to-Source Avalanche Energy ($T_J = 25^\circ\text{C}$, $V_{DD} = 50\text{ V}$, $V_{GS} = 10\text{ V}$, $L = 0.1\text{ mH}$, $I_{L(pk)} = 24\text{ A}$, $R_G = 25\ \Omega$)	E_{AS}	28		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.

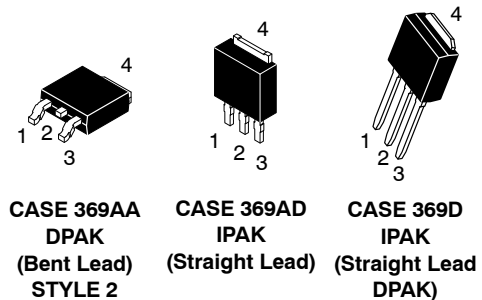
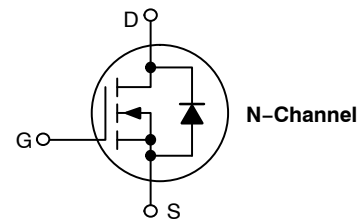
1. Surface-mounted on FR4 board using 1 in sq pad size, 1 oz Cu.
2. Surface-mounted on FR4 board using the minimum recommended pad size.



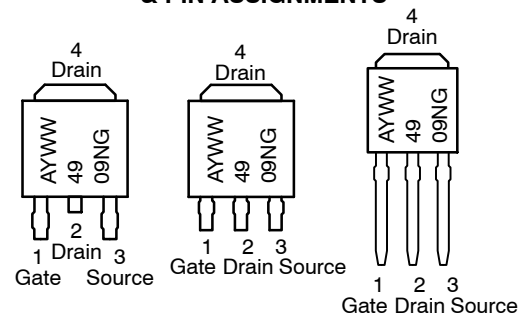
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$V_{(BR)DSS}$	$R_{DS(on)}$ MAX	I_D MAX
30 V	8.0 m Ω @ 10 V	41 A
	12 m Ω @ 4.5 V	



MARKING DIAGRAMS & PIN ASSIGNMENTS



- A = Assembly Location
- Y = Year
- WW = Work Week
- 4909N = Device Code
- G = Pb-Free Package

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 3 of this data sheet.

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THERMAL RESISTANCE MAXIMUM RATINGS

Parameter	Symbol	Value	Unit
Junction-to-Case (Drain)	$R_{\theta JC}$	5.1	°C/W
Junction-to-TAB (Drain)	$R_{\theta JC-TAB}$	4.3	
Junction-to-Ambient - Steady State (Note 3)	$R_{\theta JA}$	58.2	
Junction-to-Ambient - Steady State (Note 4)	$R_{\theta JA}$	110	

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

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	$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}$	30			V	
Drain-to-Source Breakdown Voltage Temperature Coefficient	$V_{(BR)DSS}/T_J$			15		mV/°C	
Zero Gate Voltage Drain Current	I_{DSS}	$V_{GS} = 0\text{ V}, V_{DS} = 24\text{ V}$	$T_J = 25^\circ\text{C}$			1.0	μA
			$T_J = 125^\circ\text{C}$			10	
Gate-to-Source Leakage Current	I_{GSS}	$V_{DS} = 0\text{ V}, V_{GS} = \pm 20\text{ V}$				± 100	nA

ON CHARACTERISTICS (Note 5)

Gate Threshold Voltage	$V_{GS(TH)}$	$V_{GS} = V_{DS}, I_D = 250\ \mu\text{A}$	1.0	1.7	2.2	V	
Negative Threshold Temperature Coefficient	$V_{GS(TH)}/T_J$			4.0		mV/°C	
Drain-to-Source On Resistance	$R_{DS(on)}$	$V_{GS} = 10\text{ V}$	$I_D = 30\text{ A}$		6.5	8.0	m Ω
			$I_D = 15\text{ A}$		6.5		
		$V_{GS} = 4.5\text{ V}$	$I_D = 30\text{ A}$		9.5	12	
			$I_D = 15\text{ A}$		9.5		
Forward Transconductance	g_{FS}	$V_{DS} = 1.5\text{ V}, I_D = 30\text{ A}$		52		S	

CHARGES AND CAPACITANCES

Input Capacitance	C_{iss}	$V_{GS} = 0\text{ V}, f = 1.0\text{ MHz}, V_{DS} = 15\text{ V}$		1314		pF
Output Capacitance	C_{oss}			487		
Reverse Transfer Capacitance	C_{rss}			17.4		
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = 4.5\text{ V}, V_{DS} = 15\text{ V}, I_D = 30\text{ A}$		7.6		nC
Threshold Gate Charge	$Q_{G(TH)}$			2.1		
Gate-to-Source Charge	Q_{GS}			4.3		
Gate-to-Drain Charge	Q_{GD}			1.3		
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = 10\text{ V}, V_{DS} = 15\text{ V}, I_D = 30\text{ A}$		17.5		nC

SWITCHING CHARACTERISTICS (Note 6)

Turn-On Delay Time	$t_{d(on)}$	$V_{GS} = 4.5\text{ V}, V_{DS} = 15\text{ V}, I_D = 15\text{ A}, R_G = 3.0\ \Omega$		11		ns
Rise Time	t_r			21		
Turn-Off Delay Time	$t_{d(off)}$			17		
Fall Time	t_f			2.7		

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.
- Assume terminal length of 110 mils.

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

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
Turn-On Delay Time	t _{d(on)}	V _{GS} = 10 V, V _{DS} = 15 V, I _D = 15 A, R _G = 3.0 Ω		8.0		ns
Rise Time	t _r			19		
Turn-Off Delay Time	t _{d(off)}			21		
Fall Time	t _f			2.3		

DRAIN-SOURCE DIODE CHARACTERISTICS

Forward Diode Voltage	V _{SD}	V _{GS} = 0 V, I _S = 30 A	T _J = 25°C		0.9	1.1	V
			T _J = 125°C		0.8		
Reverse Recovery Time	t _{RR}	V _{GS} = 0 V, dI _S /dt = 100 A/μs, I _S = 30 A			30		ns
Charge Time	t _a				16		
Discharge Time	t _b				14		
Reverse Recovery Time	Q _{RR}				20		nC

PACKAGE PARASITIC VALUES

Source Inductance (Note 7)	L _S	T _A = 25°C		2.99		nH
Drain Inductance, DPAK	L _D			0.0164		
Drain Inductance, IPAK (Note 7)	L _D			1.88		
Gate Inductance (Note 7)	L _G			4.9		
Gate Resistance	R _G			1.0	2.0	

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. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2%.
6. Switching characteristics are independent of operating junction temperatures.
7. Assume terminal length of 110 mils.

ORDERING INFORMATION

Order Number	Package	Shipping [†]
NTD4909NT4G	DPAK (Pb-Free)	2500 / Tape & Reel
NTD4909N-1G	IPAK (Pb-Free)	75 Units / Rail
NTD4909N-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.

TYPICAL CHARACTERISTICS

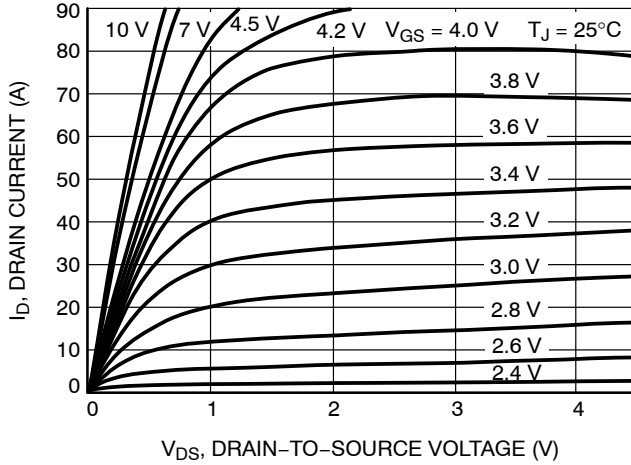


Figure 1. On-Region Characteristics

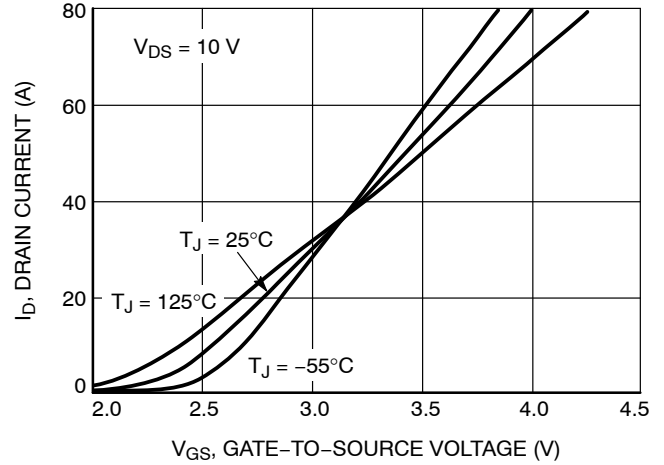


Figure 2. Transfer Characteristics

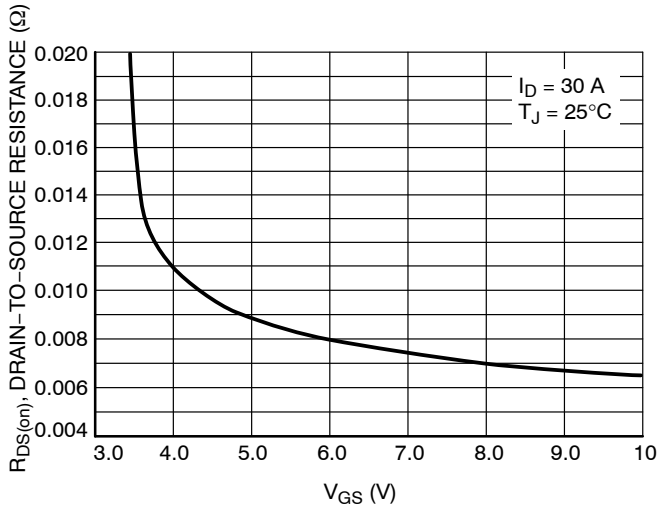


Figure 3. On-Resistance vs. VGS

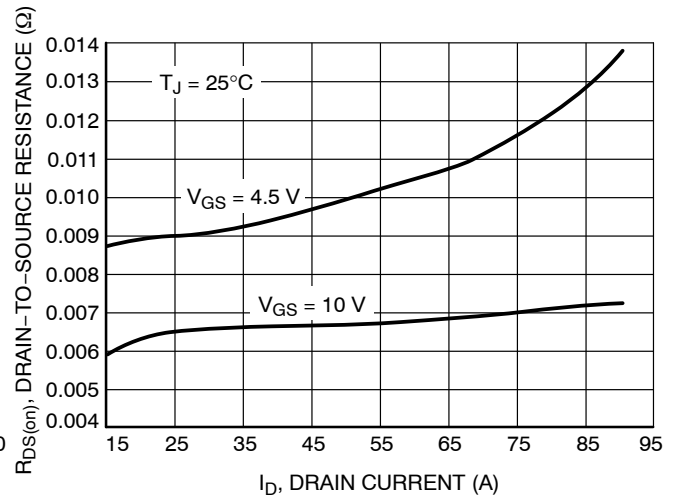


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

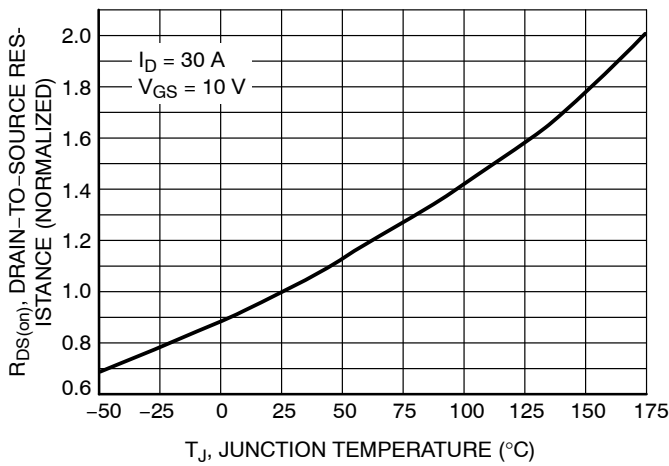


Figure 5. On-Resistance Variation with Temperature

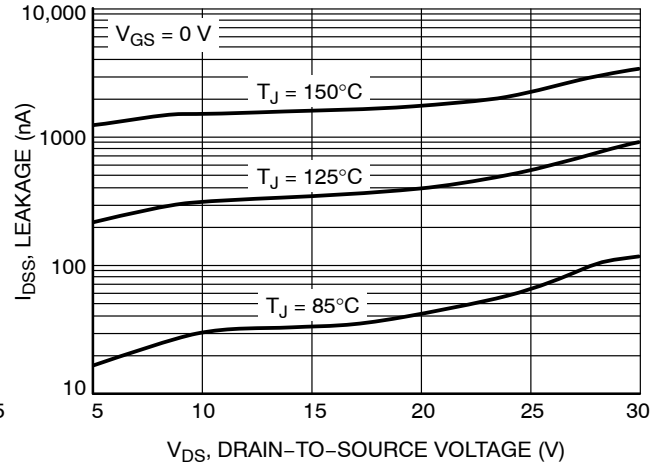


Figure 6. Drain-to-Source Leakage Current vs. Voltage

NTD4909N

TYPICAL CHARACTERISTICS

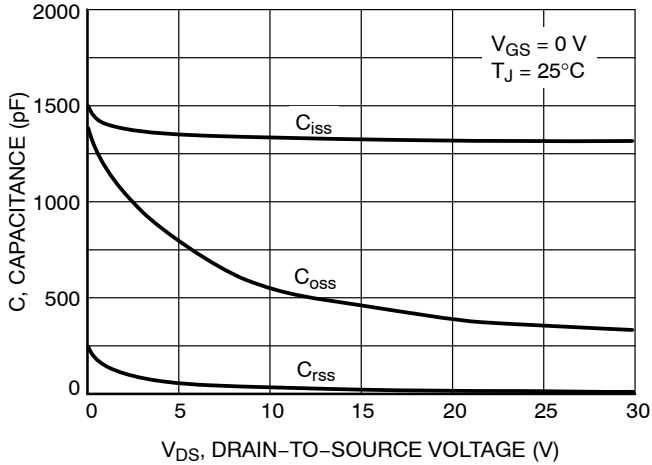


Figure 7. Capacitance Variation

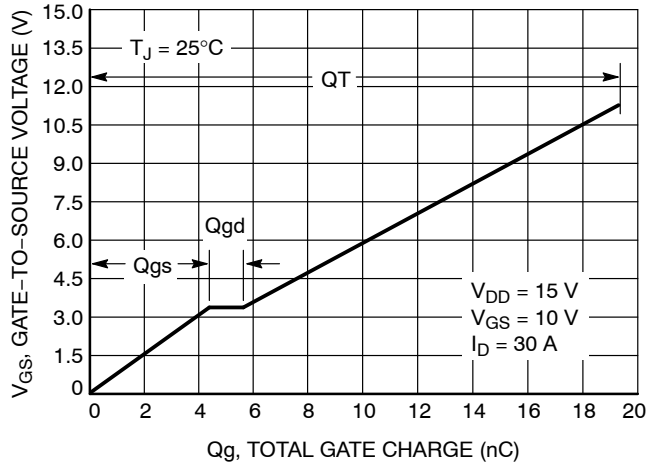


Figure 8. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge

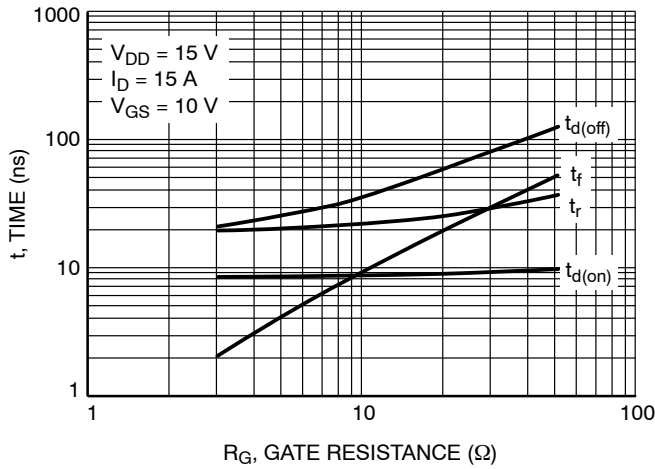


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

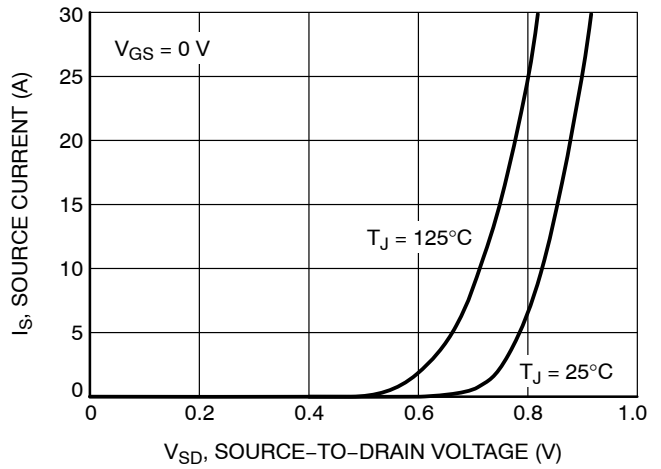


Figure 10. Diode Forward Voltage vs. Current

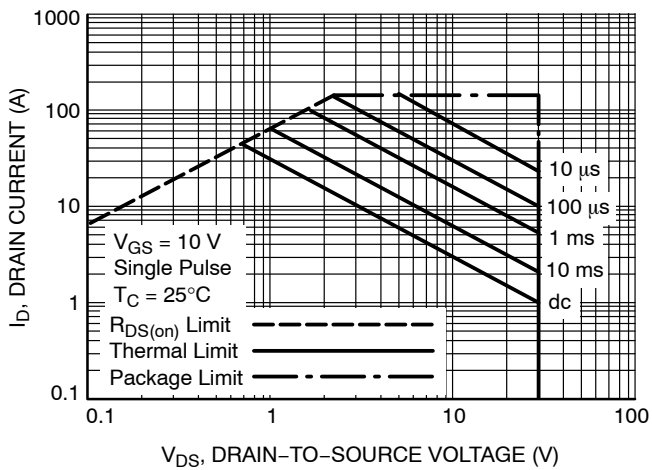


Figure 11. Maximum Rated Forward Biased Safe Operating Area

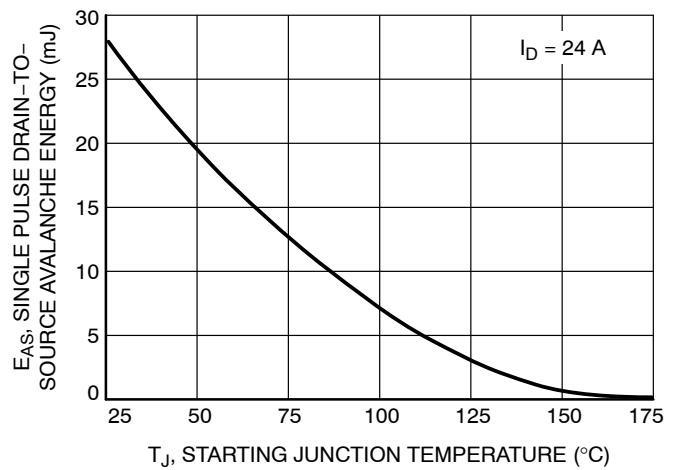


Figure 12. Maximum Avalanche Energy vs. Starting Junction Temperature

NTD4909N

TYPICAL CHARACTERISTICS

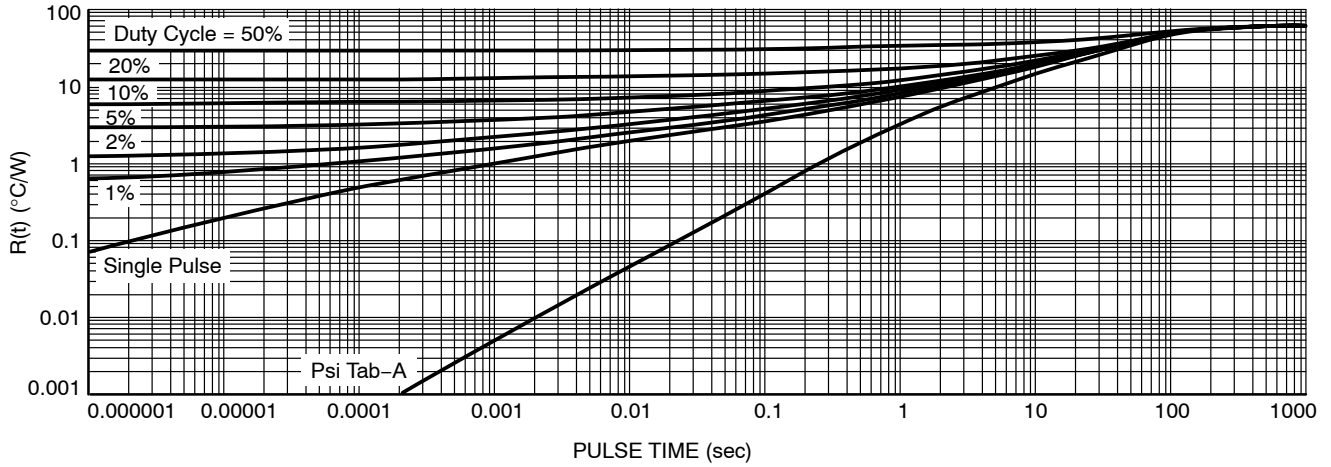


Figure 13. FET Thermal Response

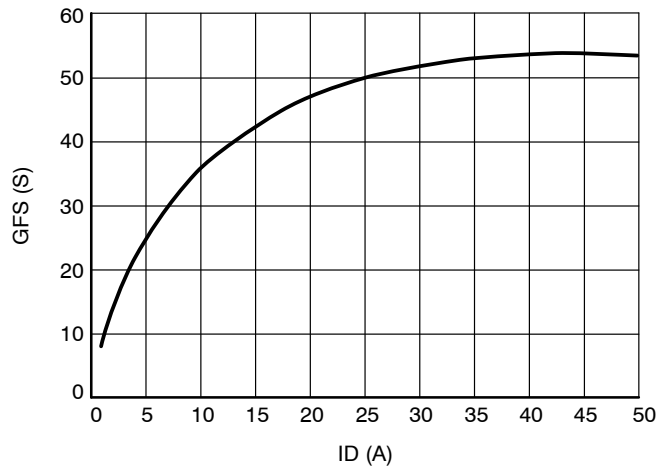
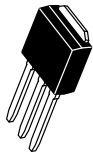


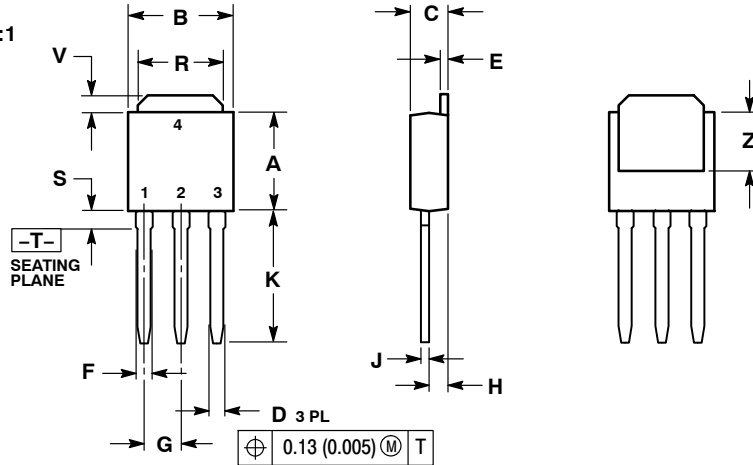
Figure 14. GFS vs. ID



IPAK
CASE 369D
ISSUE C

DATE 15 DEC 2010

SCALE 1:1

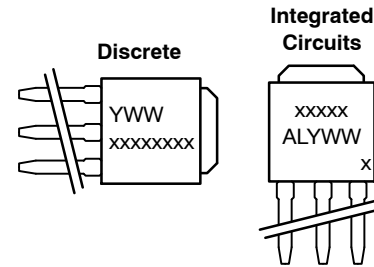


- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
 2. CONTROLLING DIMENSION: INCH.

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	---

GENERIC MARKING
DIAGRAMS

- | | | | |
|--|---|--|--|
| <p>STYLE 1:
PIN 1. BASE
2. COLLECTOR
3. EMITTER
4. COLLECTOR</p> | <p>STYLE 2:
PIN 1. GATE
2. DRAIN
3. SOURCE
4. DRAIN</p> | <p>STYLE 3:
PIN 1. ANODE
2. CATHODE
3. ANODE
4. CATHODE</p> | <p>STYLE 4:
PIN 1. CATHODE
2. ANODE
3. GATE
4. ANODE</p> |
| <p>STYLE 5:
PIN 1. GATE
2. ANODE
3. CATHODE
4. ANODE</p> | <p>STYLE 6:
PIN 1. MT1
2. MT2
3. GATE
4. MT2</p> | <p>STYLE 7:
PIN 1. GATE
2. COLLECTOR
3. EMITTER
4. COLLECTOR</p> | |

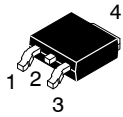


- xxxxxxxxx = Device Code
- A = Assembly Location
- IL = Wafer Lot
- Y = Year
- WW = Work Week

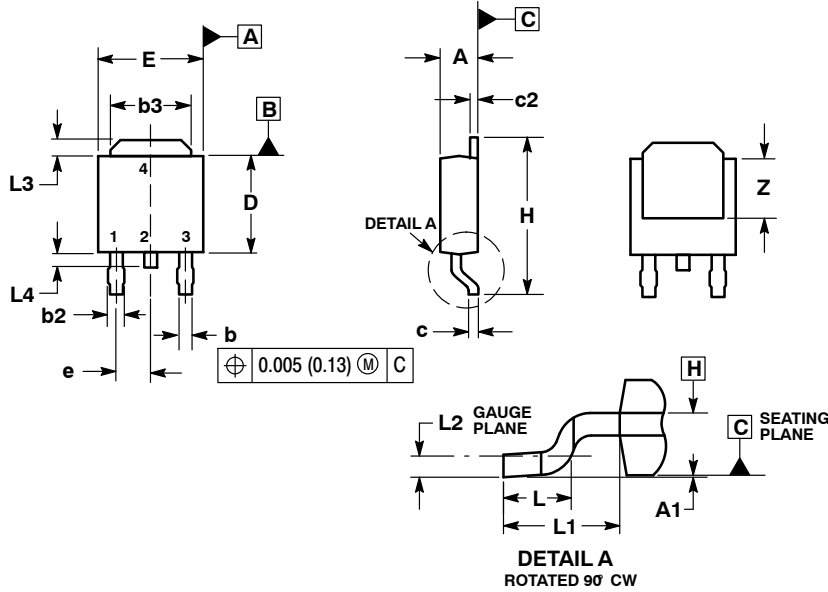
*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "•", may or may not be present. Some products may not follow the Generic Marking.

DOCUMENT NUMBER:	98AON10528D	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.
DESCRIPTION:	IPAK (DPAK INSERTION MOUNT)	PAGE 1 OF 1

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SCALE 1:1



DPAK (SINGLE GAUGE)
CASE 369AA
ISSUE B

DATE 03 JUN 2010

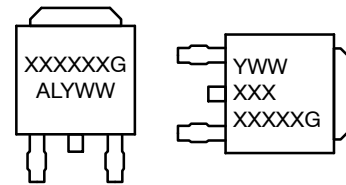
NOTES:

- DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
- CONTROLLING DIMENSION: INCHES.
- THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSIONS b₃, L₃ and Z.
- 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.
- DIMENSIONS D AND E ARE DETERMINED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY.
- 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
b ₂	0.030	0.045	0.76	1.14
b ₃	0.180	0.215	4.57	5.46
c	0.018	0.024	0.46	0.61
c ₂	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
L ₁	0.108 REF		2.74 REF	
L ₂	0.020 BSC		0.51 BSC	
L ₃	0.035	0.050	0.89	1.27
L ₄	---	0.040	---	1.01
Z	0.155	---	3.93	---

- STYLE 1:
PIN 1. BASE
2. COLLECTOR
3. EMITTER
4. COLLECTOR
- STYLE 2:
PIN 1. GATE
2. DRAIN
3. SOURCE
4. DRAIN
- STYLE 3:
PIN 1. ANODE
2. CATHODE
3. ANODE
4. CATHODE
- STYLE 4:
PIN 1. CATHODE
2. ANODE
3. GATE
4. ANODE
- STYLE 5:
PIN 1. GATE
2. ANODE
3. CATHODE
4. ANODE
- STYLE 6:
PIN 1. MT1
2. MT2
3. GATE
4. MT2
- STYLE 7:
PIN 1. GATE
2. COLLECTOR
3. EMITTER
4. COLLECTOR

GENERIC MARKING DIAGRAM*

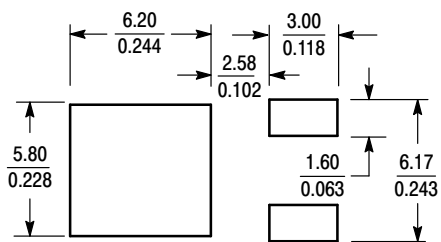


IC Discrete

- XXXXXX = Device Code
- A = Assembly Location
- L = Wafer Lot
- Y = Year
- WW = Work Week
- G = Pb-Free Package

*This information is generic. Please refer to device data sheet for actual part marking.

SOLDERING FOOTPRINT*

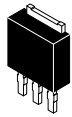


SCALE 3:1 (mm/inches)

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

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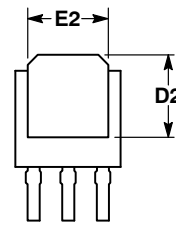
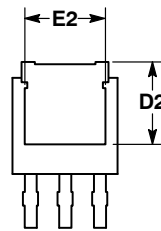
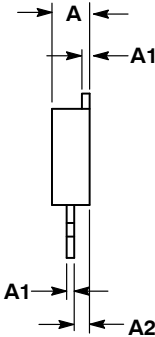
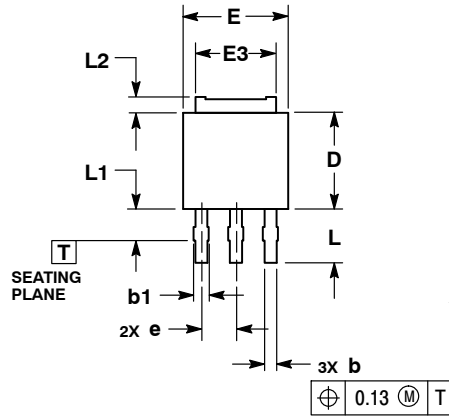
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3.5 MM IPAK, STRAIGHT LEAD
CASE 369AD
ISSUE B

DATE 18 APR 2013

SCALE 1:1



OPTIONAL CONSTRUCTION

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.

DIM	MILLIMETERS	
	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

GENERIC MARKING DIAGRAMS*

STYLE 1:
PIN 1. BASE
2. COLLECTOR
3. EMITTER
4. COLLECTOR

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

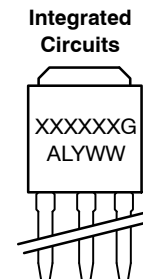
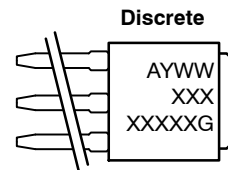
STYLE 3:
PIN 1. ANODE
2. CATHODE
3. ANODE
4. CATHODE

STYLE 4:
PIN 1. CATHODE
2. ANODE
3. GATE
4. ANODE

STYLE 5:
PIN 1. GATE
2. ANODE
3. CATHODE
4. ANODE

STYLE 6:
PIN 1. MT1
2. MT2
3. GATE
4. MT2

STYLE 7:
PIN 1. GATE
2. COLLECTOR
3. EMITTER
4. COLLECTOR



- XXXXXX = Device Code
- A = Assembly Location
- L = Wafer Lot
- Y = Year
- WW = Work Week
- G = Pb-Free Package

*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "▪", may or may not be present.

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DESCRIPTION:	3.5 MM IPAK, STRAIGHT LEAD	PAGE 1 OF 1

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