

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)	$T_A = 25^\circ\text{C}$	I_D	12.1	A
	$T_A = 100^\circ\text{C}$		8.6	
Power Dissipation ($R_{\theta JA}$) (Note 1)	$T_A = 25^\circ\text{C}$	P_D	2.6	W
	$T_A = 100^\circ\text{C}$			
Continuous Drain Current ($R_{\theta JA}$) (Note 2)	$T_A = 25^\circ\text{C}$	I_D	8.8	A
	$T_A = 100^\circ\text{C}$		6.2	
Power Dissipation ($R_{\theta JA}$) (Note 2)	$T_A = 25^\circ\text{C}$	P_D	1.37	W
Continuous Drain Current ($R_{\theta JC}$) (Note 1)	$T_C = 25^\circ\text{C}$	I_D	41	A
	$T_C = 100^\circ\text{C}$		29	
Power Dissipation ($R_{\theta JC}$) (Note 1)	$T_C = 25^\circ\text{C}$	P_D	29.4	W
Pulsed Drain Current	$t_p = 10\mu\text{s}$	I_{DM}	167	A
Current Limited by Package		$I_{DmaxPkg}$	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.

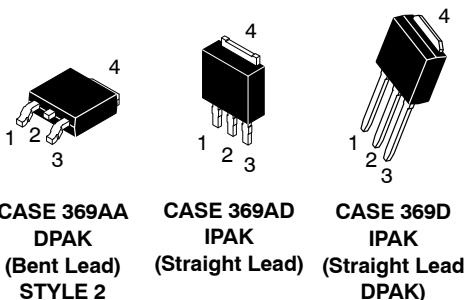
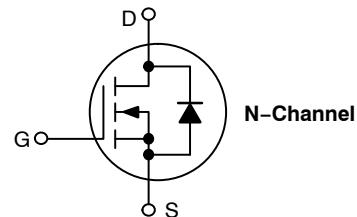
1. Surface-mounted on FR4 board using 1 in sq pad size, 1 oz Cu.
2. Surface-mounted on FR4 board using the minimum recommended pad size.

ON

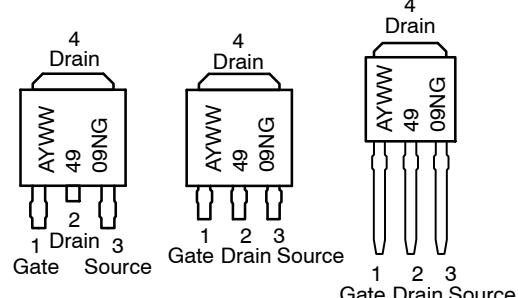
ON Semiconductor®

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



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.

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	

3. Surface-mounted on FR4 board using 1 in sq pad size, 1 oz Cu.
 4. 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	$V_{(\text{BR})DSS}$	$V_{GS} = 0 \text{ V}$, $I_D = 250 \mu\text{A}$	30			V
Drain-to-Source Breakdown Voltage Temperature Coefficient	$V_{(\text{BR})DSS}/T_J$			15		$\text{mV}/^\circ\text{C}$
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	$V_{GS(\text{TH})}$	$V_{GS} = V_{DS}$, $I_D = 250 \mu\text{A}$	1.0	1.7	2.2	V	
Negative Threshold Temperature Coefficient	$V_{GS(\text{TH})}/T_J$			4.0		$\text{mV}/^\circ\text{C}$	
Drain-to-Source On Resistance	$R_{DS(\text{on})}$	$V_{GS} = 10 \text{ V}$	$I_D = 30 \text{ A}$		6.5	8.0	$\text{m}\Omega$
			$I_D = 15 \text{ A}$		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	$Q_{G(\text{TOT})}$	$V_{GS} = 4.5 \text{ V}$, $V_{DS} = 15 \text{ V}$, $I_D = 30 \text{ A}$		7.6		nC
Threshold Gate Charge	$Q_{G(\text{TH})}$			2.1		
Gate-to-Source Charge	Q_{GS}			4.3		
Gate-to-Drain Charge	Q_{GD}			1.3		
Total Gate Charge	$Q_{G(\text{TOT})}$	$V_{GS} = 10 \text{ V}$, $V_{DS} = 15 \text{ V}$, $I_D = 30 \text{ A}$		17.5		nC

SWITCHING CHARACTERISTICS (Note 6)

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

5. Pulse Test: Pulse Width $\leq 300 \mu\text{s}$, Duty Cycle $\leq 2\%$.
 6. Switching characteristics are independent of operating junction temperatures.
 7. Assume terminal length of 110 mils.

NTD4909N

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

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
Turn-On Delay Time	$t_{d(on)}$	$V_{GS} = 10\text{ V}$, $V_{DS} = 15\text{ V}$, $I_D = 15\text{ A}$, $R_G = 3.0\ \Omega$	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}	$V_{GS} = 0\text{ V}$, $I_S = 30\text{ A}$	$T_J = 25^\circ\text{C}$		0.9	1.1	V
Reverse Recovery Time	t_{RR}	$V_{GS} = 0\text{ V}$, $dI_S/dt = 100\text{ A}/\mu\text{s}$, $I_S = 30\text{ A}$	$T_J = 125^\circ\text{C}$		0.8		ns
Charge Time	t_a				30		
Discharge Time	t_b				16		
Reverse Recovery Time	Q_{RR}				14		
					20		nC

PACKAGE PARASITIC VALUES

Source Inductance (Note 7)	L_S	$T_A = 25^\circ\text{C}$		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	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. Pulse Test: Pulse Width $\leq 300\ \mu\text{s}$, Duty Cycle $\leq 2\%$.
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

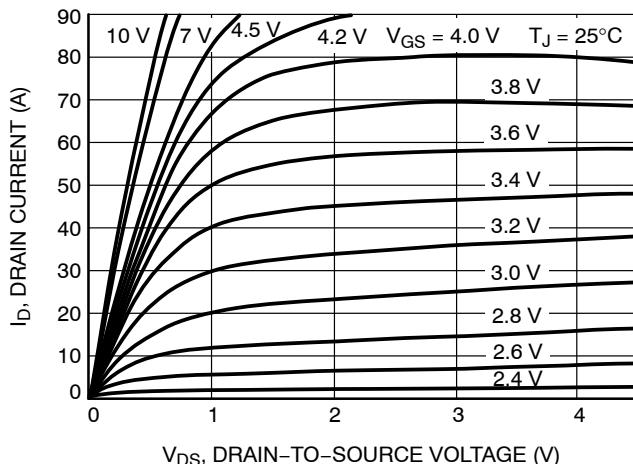


Figure 1. On-Region Characteristics

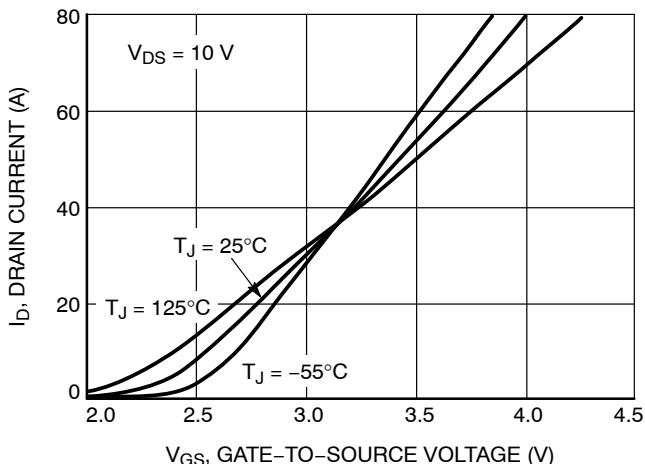


Figure 2. Transfer Characteristics

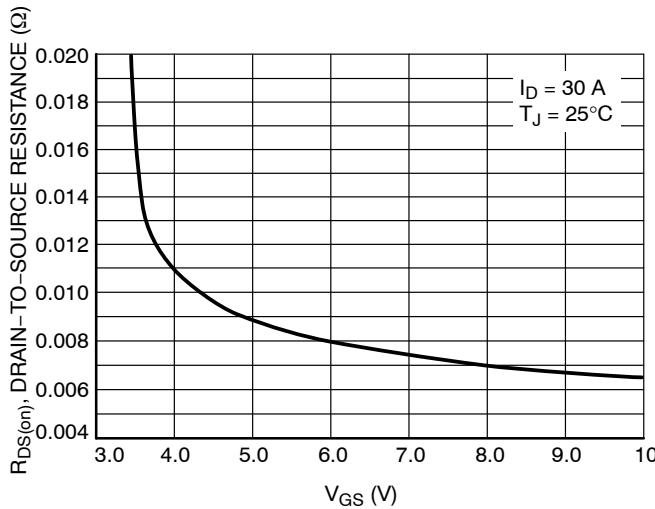
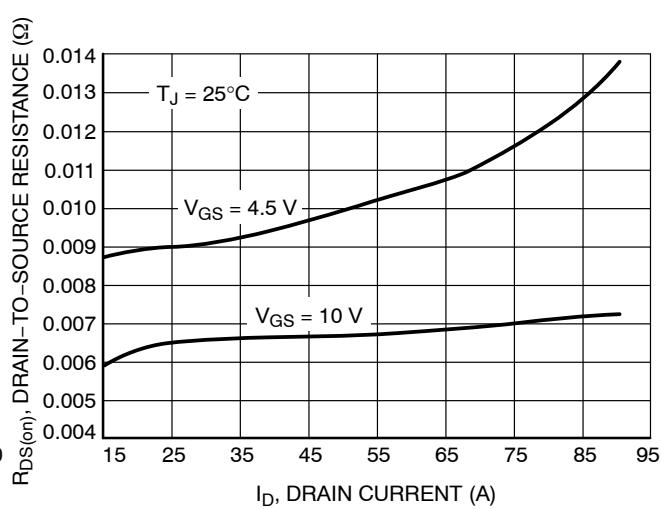
Figure 3. On-Resistance vs. V_{GS} 

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

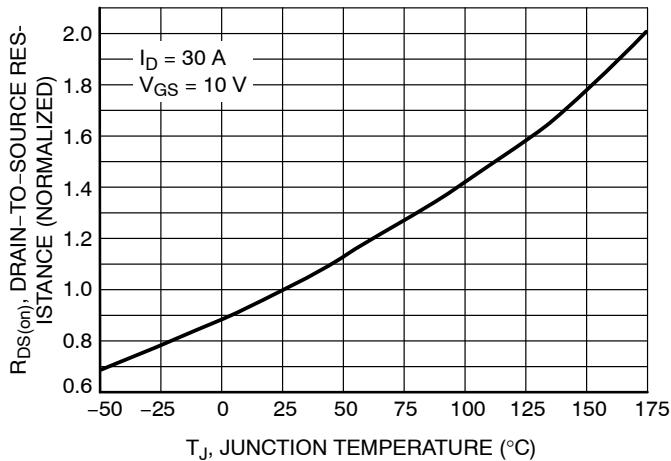


Figure 5. On-Resistance Variation with Temperature

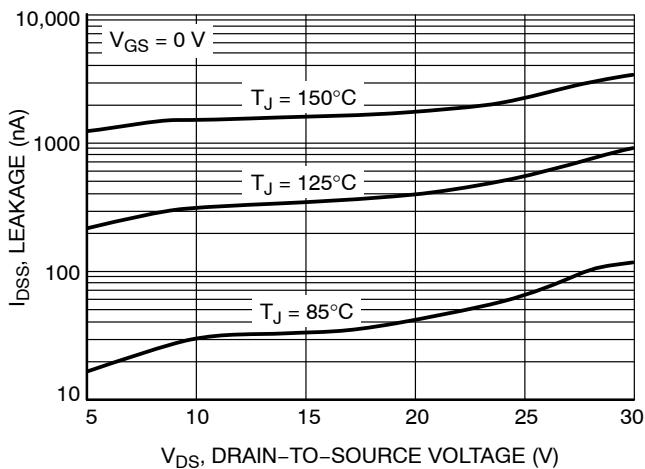


Figure 6. Drain-to-Source Leakage Current vs. Voltage

TYPICAL CHARACTERISTICS

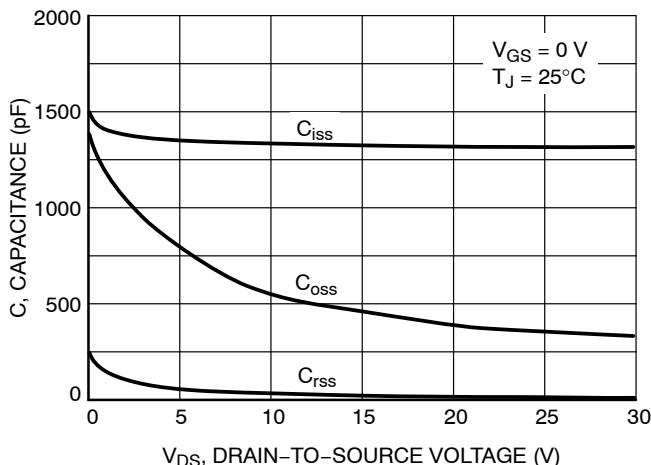


Figure 7. Capacitance Variation

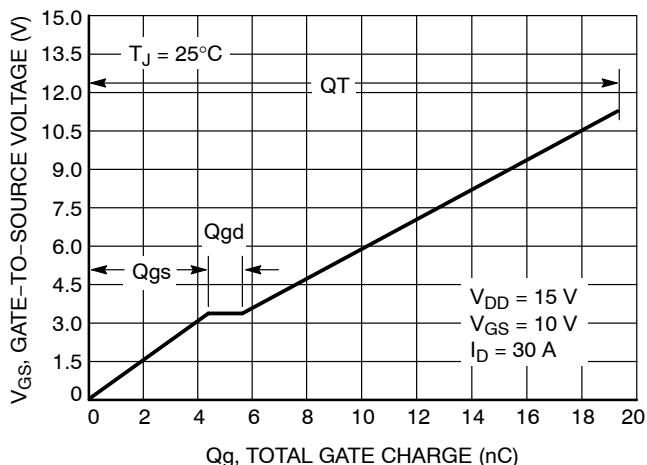


Figure 8. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge

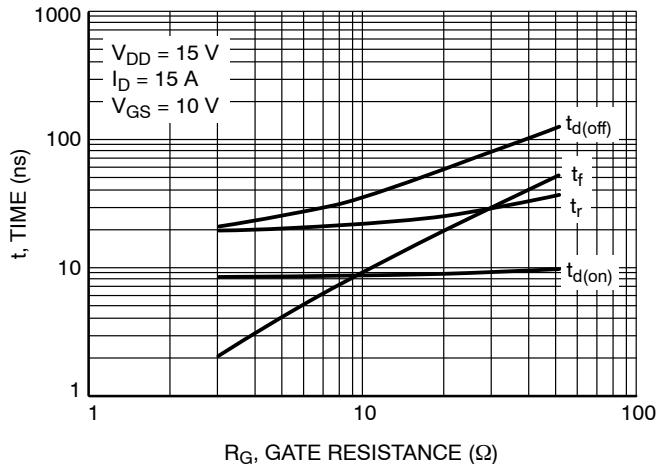


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

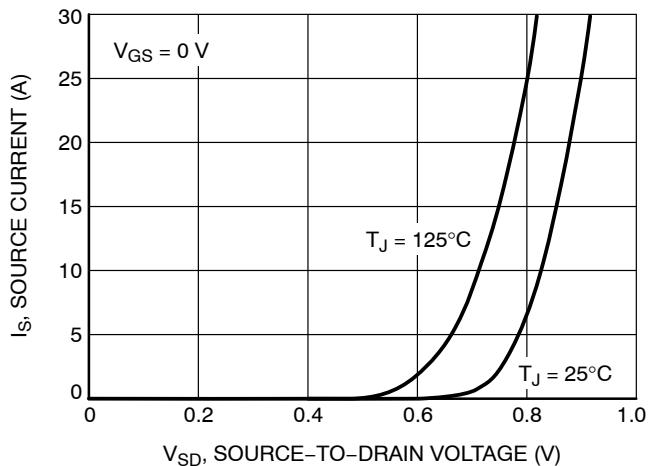


Figure 10. Diode Forward Voltage vs. Current

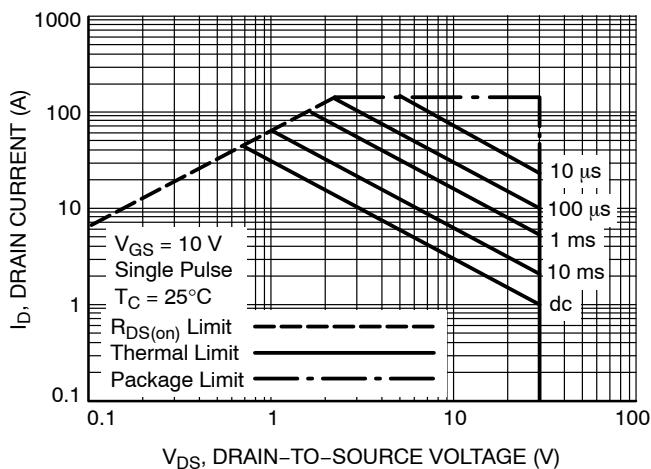


Figure 11. Maximum Rated Forward Biased Safe Operating Area

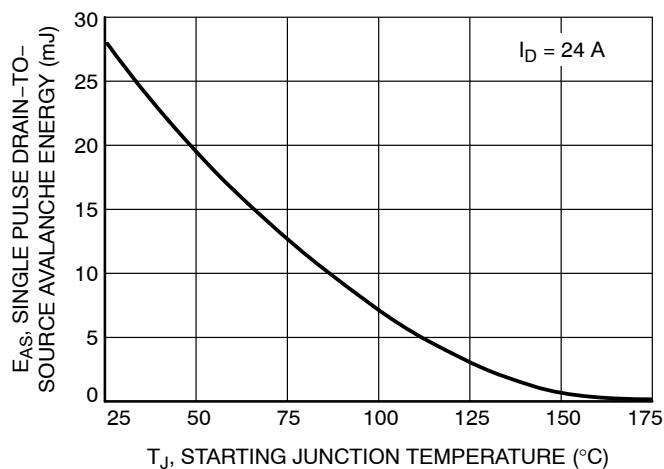
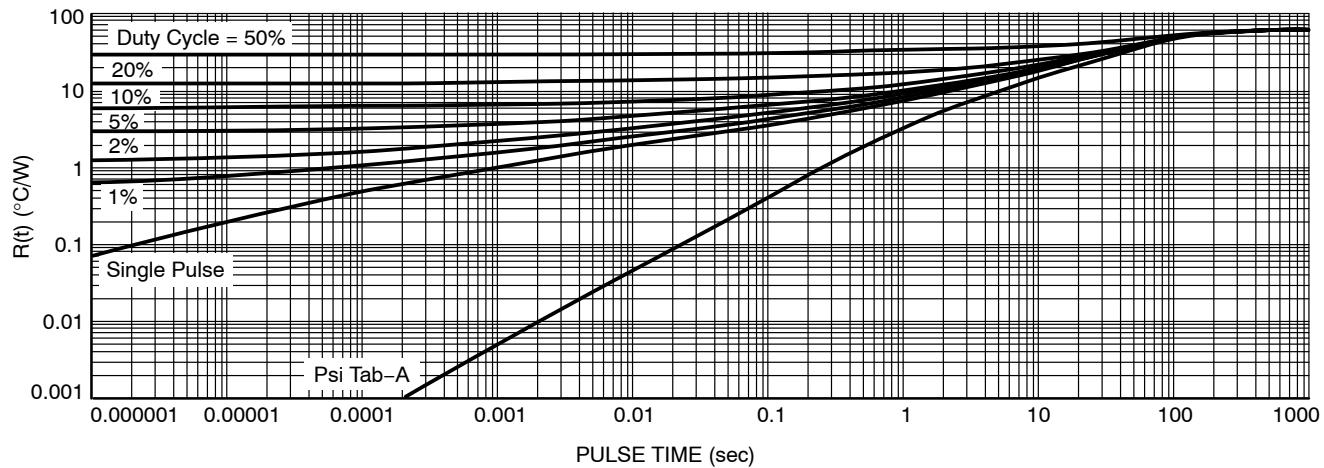
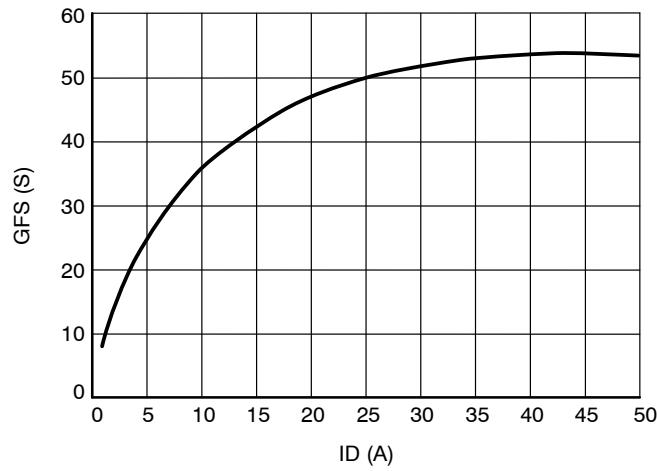
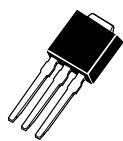


Figure 12. Maximum Avalanche Energy vs. Starting Junction Temperature

TYPICAL CHARACTERISTICS**Figure 13. FET Thermal Response****Figure 14. GFS vs. ID**

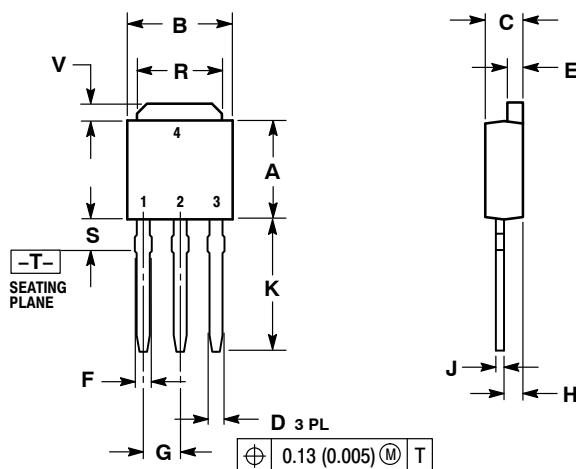


DPAK INSERTION MOUNT

CASE 369
ISSUE O

DATE 02 JAN 2000

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	0.250	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	0.033	0.040	0.84	1.01
F	0.037	0.047	0.94	1.19
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	0.175	0.215	4.45	5.46
S	0.050	0.090	1.27	2.28
V	0.030	0.050	0.77	1.27

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

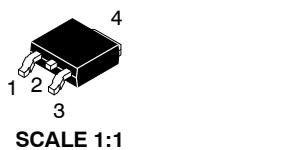
STYLE 4:
PIN 1. CATHODE
2. ANODE
3. GATE
4. ANODE

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

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

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DESCRIPTION:	DPAK INSERTION MOUNT	PAGE 1 OF 1

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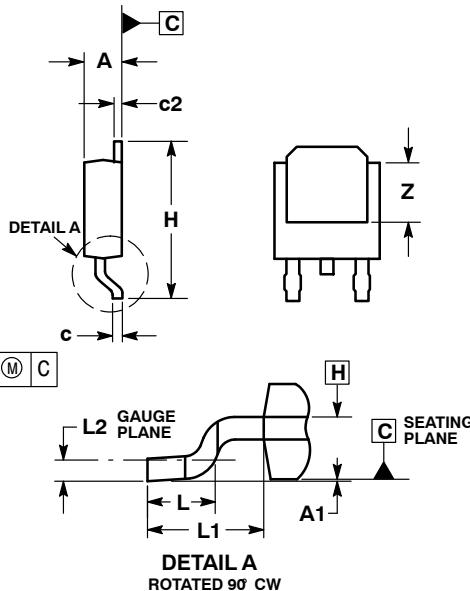
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DPAK (SINGLE GAUGE)
CASE 369AA
ISSUE B

DATE 03 JUN 2010

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	---

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

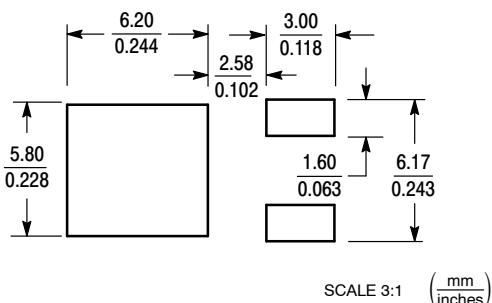
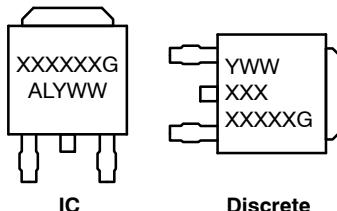
STYLE 4:
PIN 1. CATHODE
2. ANODE
3. GATE
4. ANODE

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

SOLDERING FOOTPRINT*

mm
inchesmm
inches
**GENERIC
MARKING DIAGRAM***


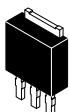
XXXXXX = Device Code
A = Assembly Location
L = Wafer Lot
Y = Year
WW = Work Week
G = Pb-Free Package

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

*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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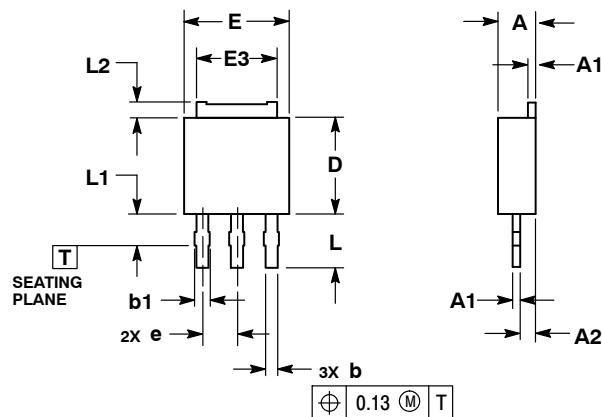
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3.5 MM IPAK, STRAIGHT LEAD
CASE 369AD
ISSUE B

DATE 18 APR 2013

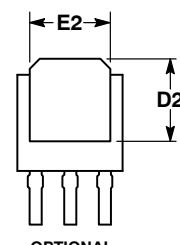
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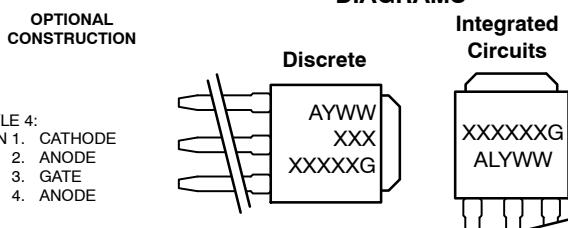
NOTES:

- 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



**GENERIC MARKING
DIAGRAMS***



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.

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	

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