

NVD5890NL

Power MOSFET

40 V, 3.7 mΩ, 123 A, Single N-Channel
DPAK

Features

- Low $R_{DS(on)}$ to Minimize Conduction Losses
- MSL 1 @ 260°C
- 100% Avalanche Tested
- AEC Q101 Qualified and PPAP Capable
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

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

Parameter	Symbol	Value	Unit		
Drain-to-Source Voltage	V_{DSS}	40	V		
Gate-to-Source Voltage	V_{GS}	± 20	V		
Continuous Drain Current ($R_{\theta JC}$) (Notes 1 & 3)	I_D	$T_C = 25^\circ\text{C}$	123	A	
		$T_C = 85^\circ\text{C}$	95		
Power Dissipation ($R_{\theta JC}$) (Note 1)	P_D	$T_C = 25^\circ\text{C}$	107	W	
		$T_A = 25^\circ\text{C}$	24		
Continuous Drain Current ($R_{\theta JA}$) (Notes 1, 2, 3)	I_D	$T_A = 25^\circ\text{C}$	24	A	
		$T_A = 85^\circ\text{C}$	18.5		
Power Dissipation ($R_{\theta JA}$) (Notes 1 & 2)	P_D	$T_A = 25^\circ\text{C}$	4.0	W	
		$T_A = 25^\circ\text{C}$	4.0		
Pulsed Drain Current	$t_p=10\mu\text{s}$	$T_A = 25^\circ\text{C}$	I_{DM}	400	A
Current Limited by Package (Note 3)		$T_A = 25^\circ\text{C}$	$I_{DmaxPkg}$	100	A
Operating Junction and Storage Temperature	T_J, T_{stg}	-55 to 175			$^\circ\text{C}$
Source Current (Body Diode)	I_S	100			A
Single Pulse Drain-to-Source Avalanche Energy ($V_{GS} = 10\text{ V}$, $L = 0.3\text{ mH}$, $I_{L(pk)} = 46.2\text{ A}$, $R_G = 25\ \Omega$)	E_{AS}	320			mJ
Lead Temperature for Soldering Purposes (1/8" from case for 10 s)	T_L	260			$^\circ\text{C}$

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.

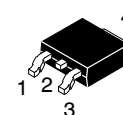
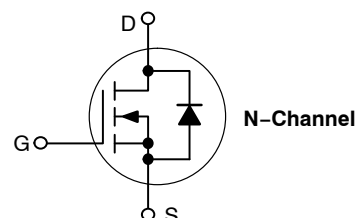
1. The entire application environment impacts the thermal resistance values shown, they are not constants and are only valid for the particular conditions noted.
2. Surface-mounted on FR4 board using a 650 mm², 2 oz. Cu pad.
3. Maximum current for pulses as long as 1 second is higher but is dependent on pulse duration and duty cycle.



ON Semiconductor®

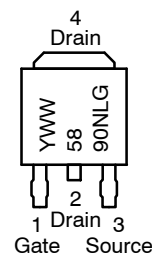
<http://onsemi.com>

$V_{(BR)DSS}$	$R_{DS(ON)} \text{ MAX}$	$I_D \text{ MAX}$
40 V	3.7 mΩ @ 10 V	123 A
	5.5 mΩ @ 4.5 V	



CASE 369C
DPAK
(Bent Lead)
STYLE 2

MARKING DIAGRAMS & PIN ASSIGNMENT



Y = Year
WW = Work Week
5890NL = 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.

NVD5890NL

THERMAL RESISTANCE MAXIMUM RATINGS

Parameter	Symbol	Value	Unit
Junction-to-Case (Drain)	$R_{\theta JC}$	1.4	°C/W
Junction-to-Ambient - Steady State (Note 2)	$R_{\theta JA}$	37	

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

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
-----------	--------	----------------	-----	-----	-----	------

OFF CHARACTERISTICS

Drain-to-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}$	40			V
Drain-to-Source Breakdown Voltage Temperature Coefficient	$V_{(BR)DSS}/T_J$			40		mV/°C
Zero Gate Voltage Drain Current	I_{DSS}	$V_{GS} = 0\text{ V}, V_{DS} = 40\text{ V}$	$T_J = 25^\circ\text{C}$		1.0	μA
			$T_J = 150^\circ\text{C}$		100	
Gate-to-Source Leakage Current	I_{GSS}	$V_{DS} = 0\text{ V}, V_{GS} = \pm 20\text{ V}$			± 100	nA

ON CHARACTERISTICS (Note 4)

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	$V_{GS(TH)}/T_J$			7.4		mV/°C
Drain-to-Source On Resistance	$R_{DS(on)}$	$V_{GS} = 10\text{ V}, I_D = 50\text{ A}$		2.9	3.7	m Ω
		$V_{GS} = 4.5\text{ V}, I_D = 50\text{ A}$		4.4	5.5	
Forward Transconductance	g_{FS}	$V_{DS} = 15\text{ V}, I_D = 15\text{ A}$		16.3		S

CHARGES AND CAPACITANCES

Input Capacitance	C_{iss}	$V_{GS} = 0\text{ V}, f = 1.0\text{ MHz}, V_{DS} = 25\text{ V}$		4760		pF
Output Capacitance	C_{oss}			580		
Reverse Transfer Capacitance	C_{rss}			385		
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = 10\text{ V}, V_{DS} = 15\text{ V}, I_D = 50\text{ A}$		84		nC
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = 4.5\text{ V}, V_{DS} = 15\text{ V}, I_D = 50\text{ A}$		42		nC
Threshold Gate Charge	$Q_{G(TH)}$			4.2		
Gate-to-Source Charge	Q_{GS}			13.7		
Gate-to-Drain Charge	Q_{GD}			18.8		

SWITCHING CHARACTERISTICS (Note 5)

Turn-On Delay Time	$t_{d(on)}$	$V_{GS} = 10\text{ V}, V_{DS} = 20\text{ V}, I_D = 50\text{ A}, R_G = 2.0\ \Omega$		12		ns
Rise Time	t_r			35		
Turn-Off Delay Time	$t_{d(off)}$			38		
Fall Time	t_f			11		

4. Pulse Test: Pulse Width $\leq 300\ \mu\text{s}$, Duty Cycle $\leq 2\%$.

5. Switching characteristics are independent of operating junction temperatures.

NVD5890NL

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 = 50 A	T _J = 25°C		0.86	1.2	V
		V _{GS} = 0 V, I _S = 20 A	T _J = 25°C		0.78	1.0	
Reverse Recovery Time	t _{RR}	V _{GS} = 0 V, dI _S /dt = 100 A/μs, I _S = 50 A			35	ns	
Charge Time	t _a				19		
Discharge Time	t _b				16		
Reverse Recovery Charge	Q _{RR}				34		nC

TYPICAL PERFORMANCE CURVES

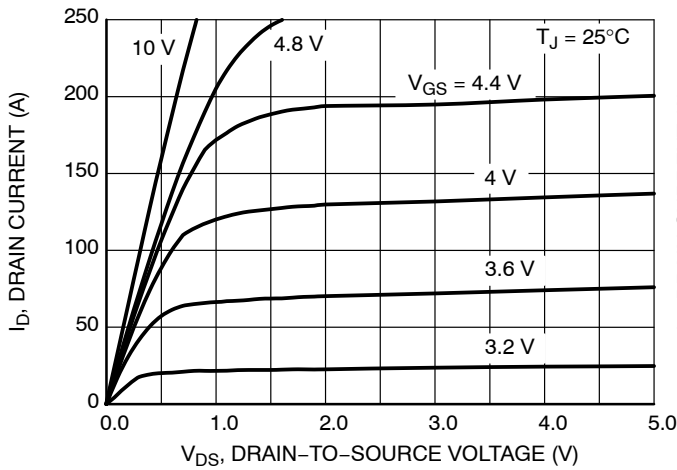


Figure 1. On-Region Characteristics

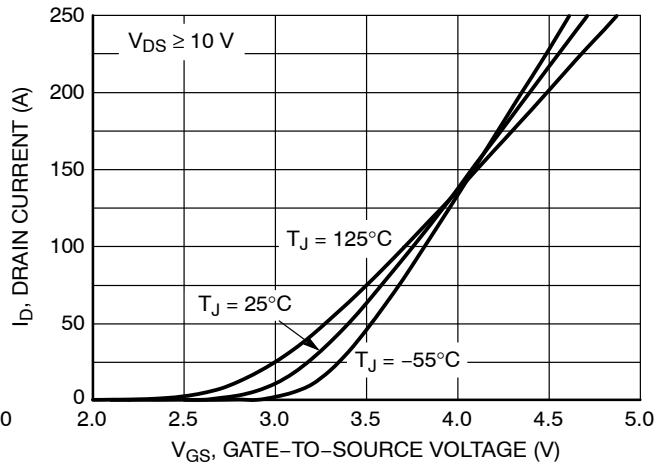


Figure 2. Transfer Characteristics

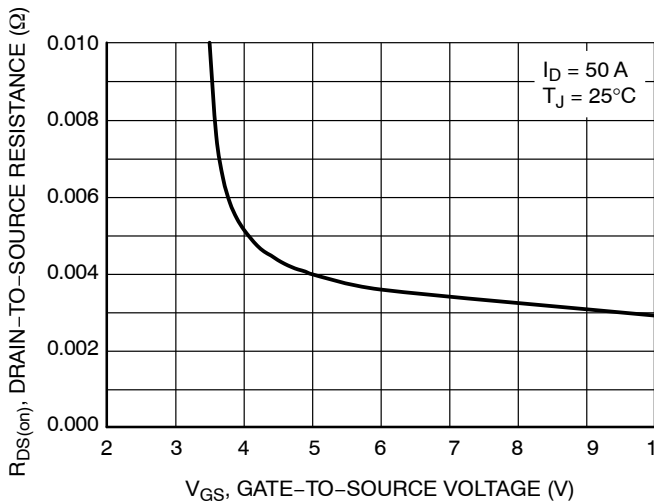


Figure 3. On-Resistance vs. Gate-to-Source Voltage

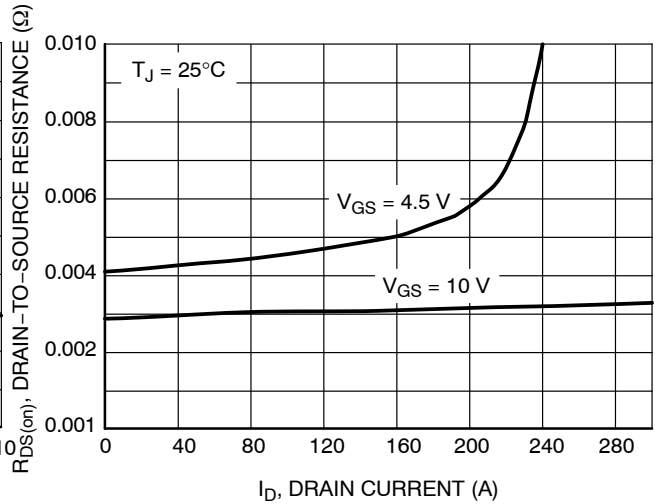


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

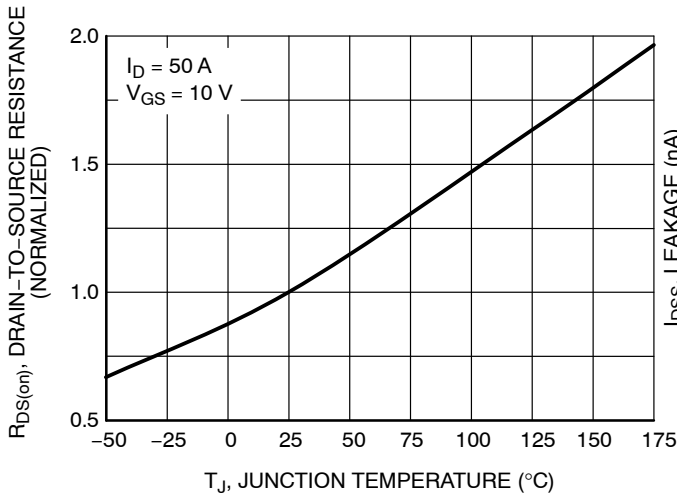


Figure 5. On-Resistance Variation with Temperature

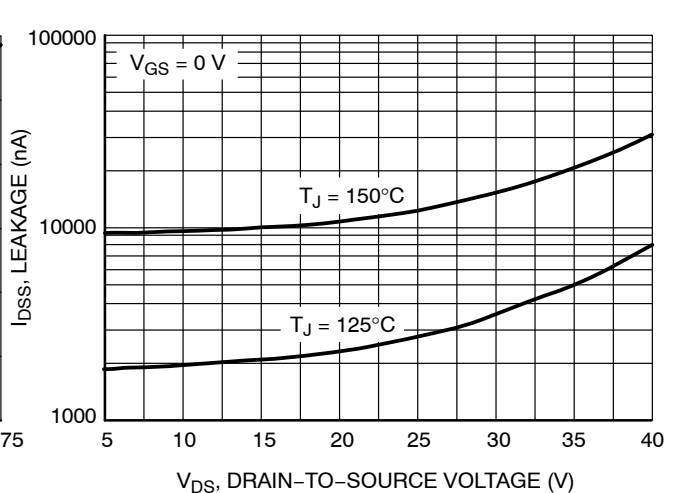


Figure 6. Drain-to-Source Leakage Current vs. Drain Voltage

TYPICAL PERFORMANCE CURVES

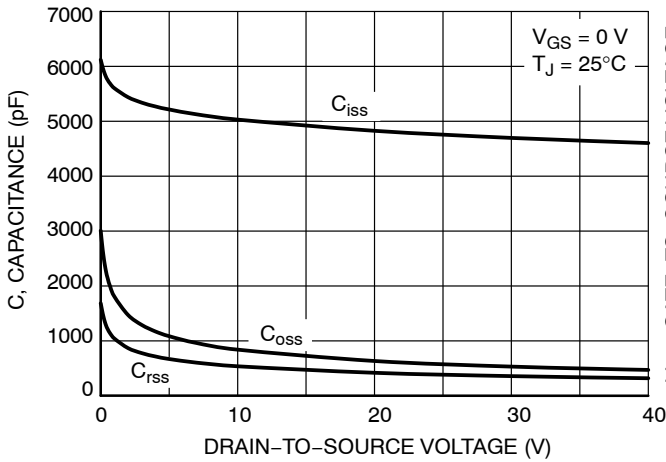


Figure 7. Capacitance Variation

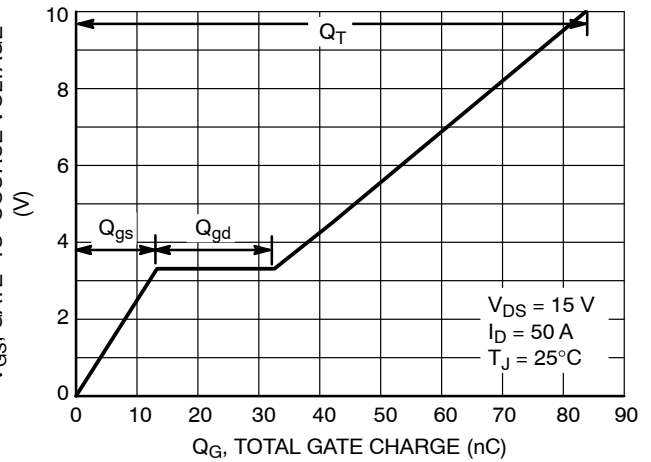


Figure 8. Gate-To-Source Voltage vs. Total Charge

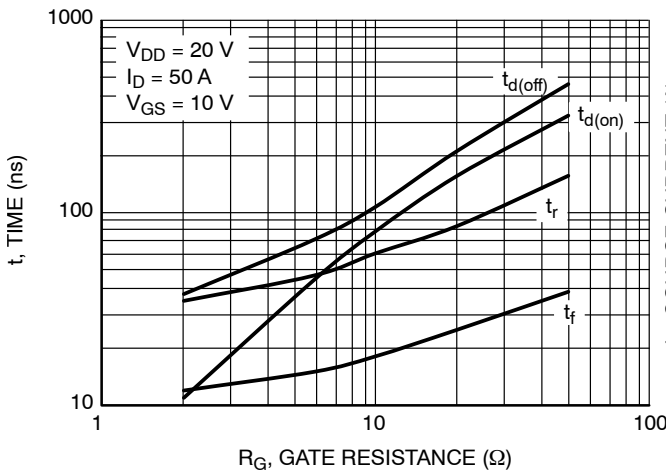


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

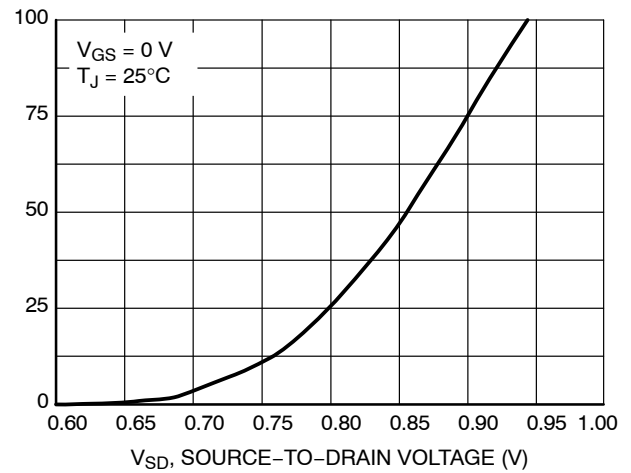


Figure 10. Diode Forward Voltage vs. Current

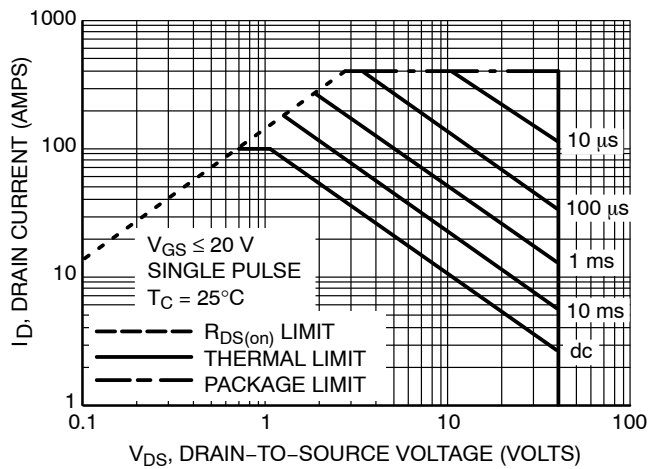


Figure 11. Maximum Rated Forward Biased Safe Operating Area

NVD5890NL

TYPICAL PERFORMANCE CURVES

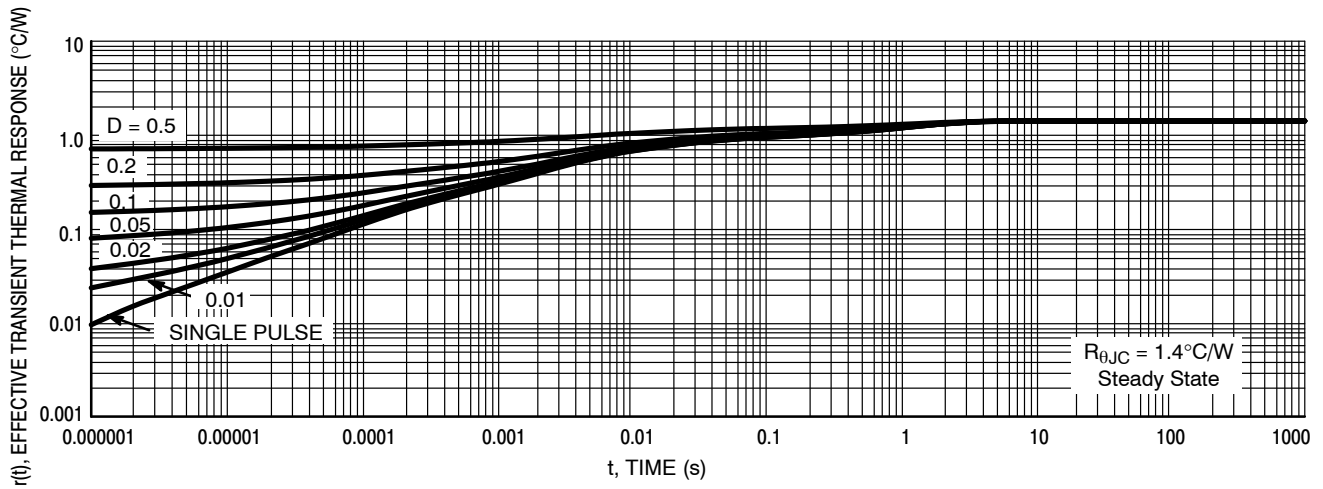


Figure 12. Thermal Response

ORDERING INFORMATION

Order Number	Package	Shipping [†]
NVD5890NLT4G	DPAK (Pb-Free)	2500/Tape & Reel

[†]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.

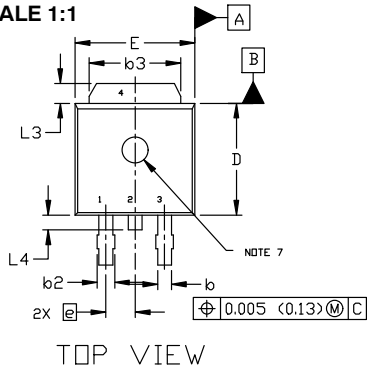
MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS



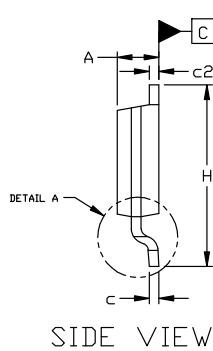
DPAK (SINGLE GAUGE) CASE 369C ISSUE G

DATE 31 MAY 2023

SCALE 1:1



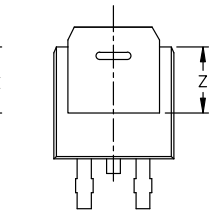
TOP VIEW



SIDE VIEW



BOTTOM VIEW



BOTTOM VIEW

ALTERNATE CONSTRUCTIONS



RECOMMENDED MOUNTING FOOTPRINT*

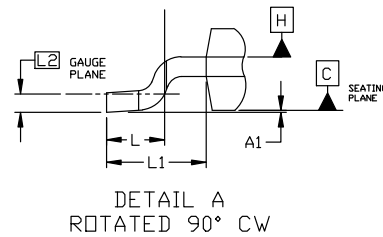
*FOR ADDITIONAL INFORMATION ON OUR Pb-FREE STRATEGY AND SOLDERING DETAILS, PLEASE DOWNLOAD THE ON SEMICONDUCTOR SOLDERING AND MOUNTING TECHNIQUES REFERENCE MANUAL, SOLDERM/D.

- | | | | | |
|--|--|---|---|--|
| 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 | STYLE 8:
PIN 1. N/C
2. CATHODE
3. ANODE
4. CATHODE | STYLE 9:
PIN 1. ANODE
2. CATHODE
3. RESISTOR ADJUST
4. CATHODE | STYLE 10:
PIN 1. CATHODE
2. ANODE
3. CATHODE
4. ANODE |

NOTES:

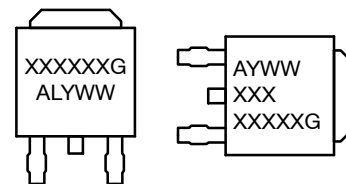
- DIMENSIONING AND TOLERANCING ASME Y14.5M, 1994.
- CONTROLLING DIMENSION: INCHES
- THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSIONS b3, L3, AND Z.
- DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.006 INCHES PER SIDE.
- DIMENSIONS D AND E ARE DETERMINED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY.
- DATUMS A AND B ARE DETERMINED AT DATUM PLANE H.
- OPTIONAL MOLD FEATURE.

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	0.028	0.045	0.72	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	0.114	REF	2.90	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	---



DETAIL A
ROTATED 90° CW

GENERIC MARKING DIAGRAM*



- IC**
 XXXXXX = Device Code
 A = Assembly Location
 L = Wafer Lot
 Y = Year
 WW = Work Week
 G = Pb-Free Package
- Discrete**
 AYWW
 XXX
 XXXXXG

*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:	98AON10527D	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.
DESCRIPTION:	DPAK (SINGLE GAUGE)	PAGE 1 OF 1

onsemi and onsemi are trademarks of Semiconductor Components Industries, LLC dba onsemi or its subsidiaries in the United States and/or other countries. onsemi reserves the right to make changes without further notice to any products herein. onsemi makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does onsemi assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. onsemi does not convey any license under its patent rights nor the rights of others.

onsemi, **Onsemi**, and other names, marks, and brands are registered and/or common law trademarks of Semiconductor Components Industries, LLC dba "**onsemi**" or its affiliates and/or subsidiaries in the United States and/or other countries. **onsemi** owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of **onsemi**'s product/patent coverage may be accessed at www.onsemi.com/site/pdf/Patent-Marking.pdf. **onsemi** reserves the right to make changes at any time to any products or information herein, without notice. The information herein is provided "as-is" and **onsemi** makes no warranty, representation or guarantee regarding the accuracy of the information, product features, availability, functionality, or suitability of its products for any particular purpose, nor does **onsemi** assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using **onsemi** products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by **onsemi**. "Typical" parameters which may be provided in **onsemi** data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. **onsemi** does not convey any license under any of its intellectual property rights nor the rights of others. **onsemi** products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use **onsemi** products for any such unintended or unauthorized application, Buyer shall indemnify and hold **onsemi** and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that **onsemi** was negligent regarding the design or manufacture of the part. **onsemi** is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

ADDITIONAL INFORMATION

TECHNICAL PUBLICATIONS:

Technical Library: www.onsemi.com/design/resources/technical-documentation
onsemi Website: www.onsemi.com

ONLINE SUPPORT: www.onsemi.com/support

For additional information, please contact your local Sales Representative at www.onsemi.com/support/sales