

# NTMFS5113PL

## Power MOSFET

-60 V, 14 mΩ, -64 A, Single P-Channel

### Features

- Low  $R_{DS(on)}$  to Minimize Conduction Losses
- High Current Capability
- Avalanche Energy Specified
- 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	$V_{DSS}$	-60	V	
Gate-to-Source Voltage	$V_{GS}$	$\pm 20$	V	
Continuous Drain Current $R_{\theta JC}$ (Notes 1, 2, 3)	Steady State	$T_C = 25^\circ\text{C}$	$I_D$ -64	A
		$T_C = 100^\circ\text{C}$	-45	
Power Dissipation $R_{\theta JC}$ (Notes 1, 2)	Steady State	$T_C = 25^\circ\text{C}$	$P_D$ 150	W
		$T_C = 100^\circ\text{C}$	75	
Continuous Drain Current $R_{\theta JA}$ (Notes 1, 2, 3)	Steady State	$T_A = 25^\circ\text{C}$	$I_D$ -10	A
		$T_A = 100^\circ\text{C}$	-7	
Power Dissipation $R_{\theta JA}$ (Notes 1, 2)	Steady State	$T_A = 25^\circ\text{C}$	$P_D$ 3.8	W
		$T_A = 100^\circ\text{C}$	1.9	
Pulsed Drain Current	$T_A = 25^\circ\text{C}, t_p = 10 \mu\text{s}$	$I_{DM}$ -415	A	
Operating Junction and Storage Temperature	$T_J, T_{stg}$	-55 to 175	$^\circ\text{C}$	
Source Current (Body Diode)	$I_S$	-150	A	
Single Pulse Drain-to-Source Avalanche Energy ( $T_J = 25^\circ\text{C}, V_{DD} = 50 \text{ V}, V_{GS} = 10 \text{ V}, I_{L(pk)} = 46 \text{ A}, L = 0.3 \text{ mH}, R_G = 25 \Omega$ )	$E_{AS}$	315	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.

### THERMAL RESISTANCE MAXIMUM RATINGS

Parameter	Symbol	Value	Unit
Junction-to-Case - Steady State (Drain) (Note 2)	$R_{\theta JC}$	1.0	$^\circ\text{C/W}$
Junction-to-Ambient - Steady State (Note 2)	$R_{\theta JA}$	39	$^\circ\text{C/W}$

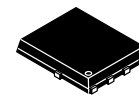
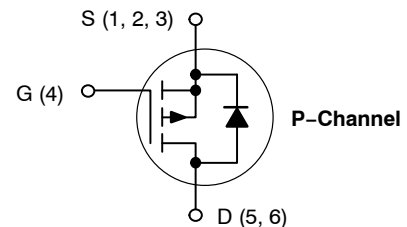
1. The entire application environment impacts the thermal resistance values shown, they are not constants and are only valid for the particular conditions noted.
2. Surface-mounted on FR4 board using a 650 mm<sup>2</sup>, 2 oz. Cu pad.
3. Continuous DC current rating. Maximum current for pulses as long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



ON Semiconductor®

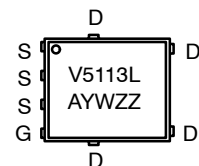
[www.onsemi.com](http://www.onsemi.com)

$V_{(BR)DSS}$	$R_{DS(on)}$	$I_D$
-60 V	14 mΩ @ -10 V	-64 A
	22 mΩ @ -4.5 V	



DFN5  
CASE 488AA  
STYLE 1

### MARKING DIAGRAM



A = Assembly Location  
Y = Year  
W = Work Week  
ZZ = Lot Traceability

### ORDERING INFORMATION

See detailed ordering, marking and shipping information on page 5 of this data sheet.

# NTMFS5113PL

## ELECTRICAL CHARACTERISTICS (T<sub>J</sub> = 25°C unless otherwise noted)

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

### OFF CHARACTERISTICS

Drain-to-Source Breakdown Voltage	V <sub>(BR)DSS</sub>	V <sub>GS</sub> = 0 V, I <sub>D</sub> = -250 μA	-60			V
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>GS</sub> = 0 V, V <sub>DS</sub> = -60 V		T <sub>J</sub> = 25°C		-1.0
				T <sub>J</sub> = 125°C		-100
Gate-to-Source Leakage Current	I <sub>GSS</sub>	V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ±20 V			±100	nA

### ON CHARACTERISTICS (Note 4)

Gate Threshold Voltage	V <sub>GS(TH)</sub>	V <sub>GS</sub> = V <sub>DS</sub> , I <sub>D</sub> = -250 μA	-1.5		-2.5	V
Drain-to-Source On Resistance	R <sub>DS(on)</sub>	V <sub>GS</sub> = -10 V, I <sub>D</sub> = -17 A		10.5	14	mΩ
				16	22	
Forward Transconductance	g <sub>FS</sub>	V <sub>DS</sub> = -15 V, I <sub>D</sub> = -15 A		43		S

### CHARGES AND CAPACITANCES

Input Capacitance	C <sub>iss</sub>	V <sub>GS</sub> = 0 V, f = 1.0 MHz, V <sub>DS</sub> = -25 V		4400		pF
Output Capacitance	C <sub>oss</sub>			505		
Reverse Transfer Capacitance	C <sub>rss</sub>			319		
Total Gate Charge	Q <sub>G(TOT)</sub>	V <sub>DS</sub> = -48 V, I <sub>D</sub> = -17 A		V <sub>GS</sub> = -4.5 V	45	nC
				V <sub>GS</sub> = -10 V	83	
Threshold Gate Charge	Q <sub>G(TH)</sub>	V <sub>GS</sub> = -10 V, V <sub>DS</sub> = -48 V, I <sub>D</sub> = -17 A		4		
Gate-to-Source Charge	Q <sub>GS</sub>			13		
Gate-to-Drain Charge	Q <sub>GD</sub>			27		
Plateau Voltage	V <sub>GP</sub>			3.5		

### SWITCHING CHARACTERISTICS (Notes 4)

Turn-On Delay Time	t <sub>d(on)</sub>	V <sub>GS</sub> = -10 V, V <sub>DS</sub> = -48 V, I <sub>D</sub> = -17 A, R <sub>G</sub> = 2.5 Ω		15		ns
Rise Time	t <sub>r</sub>			37		
Turn-Off Delay Time	t <sub>d(off)</sub>			54		
Fall Time	t <sub>f</sub>			77		

### DRAIN-SOURCE DIODE CHARACTERISTICS

Forward Diode Voltage	V <sub>SD</sub>	V <sub>GS</sub> = 0 V, I <sub>S</sub> = -17 A		T <sub>J</sub> = 25°C	-0.79	-1.0	V
				T <sub>J</sub> = 125°C	-0.65		
Reverse Recovery Time	t <sub>RR</sub>	V <sub>GS</sub> = 0 V, di/dt = 100 A/μs, I <sub>S</sub> = -17 A		41		ns	
Charge Time	t <sub>a</sub>			22			
Discharge Time	t <sub>b</sub>			19			
Reverse Recovery Charge	Q <sub>RR</sub>			50			nC

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.

4. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2%.

TYPICAL CHARACTERISTICS

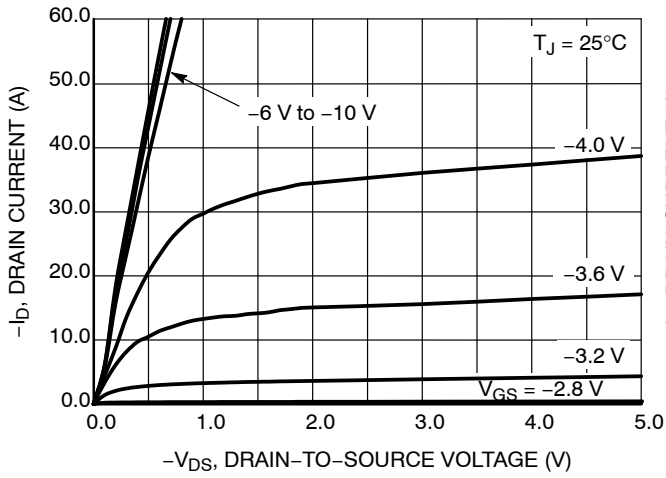


Figure 1. On-Region Characteristics

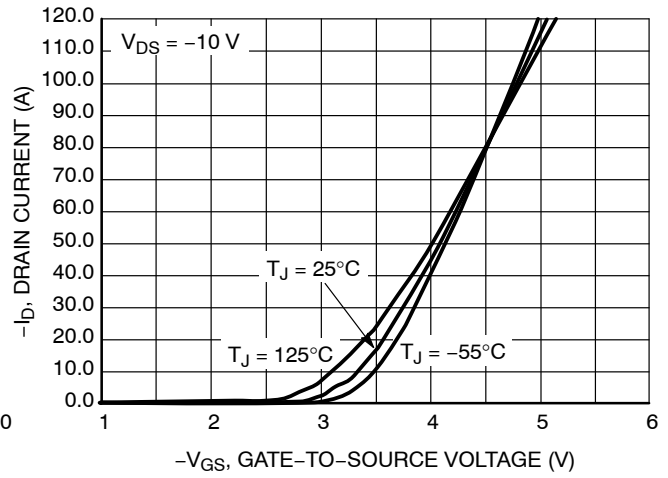


Figure 2. Transfer Characteristics

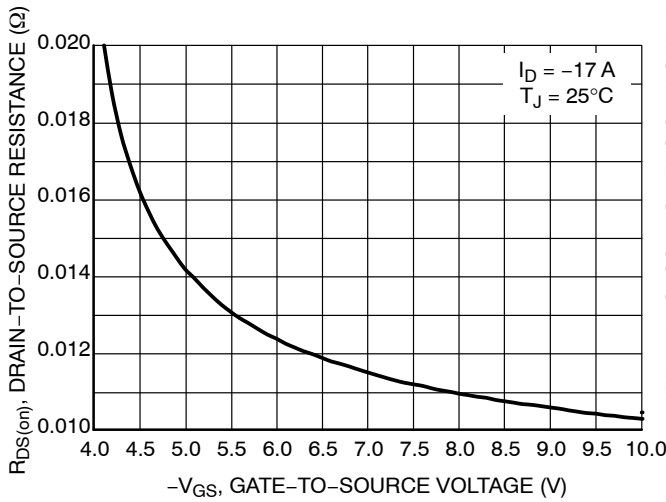


Figure 3. On-Resistance vs. Gate-to-Source Voltage

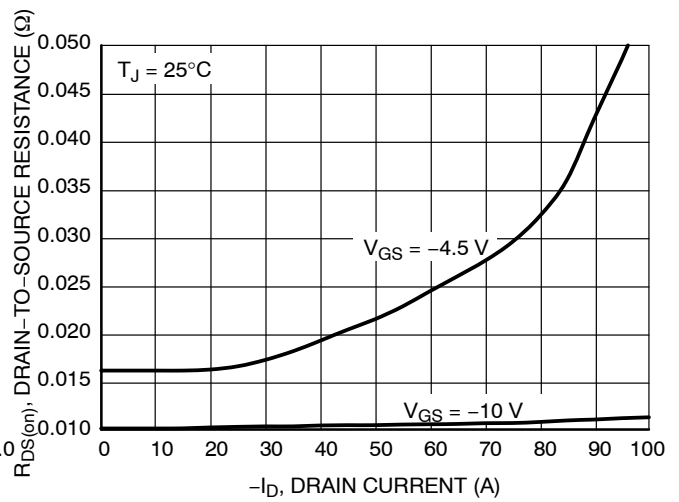


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

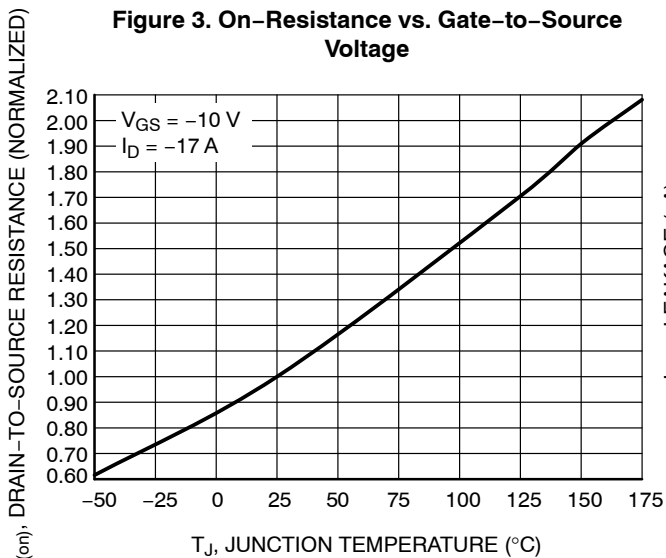


Figure 5. On-Resistance Variation with Temperature

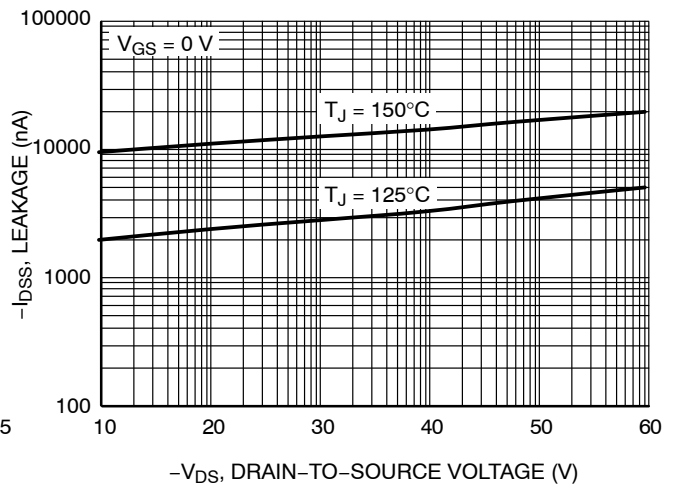


Figure 6. Drain-to-Source Leakage Current vs. Voltage

# NTMFS5113PL

## TYPICAL CHARACTERISTICS

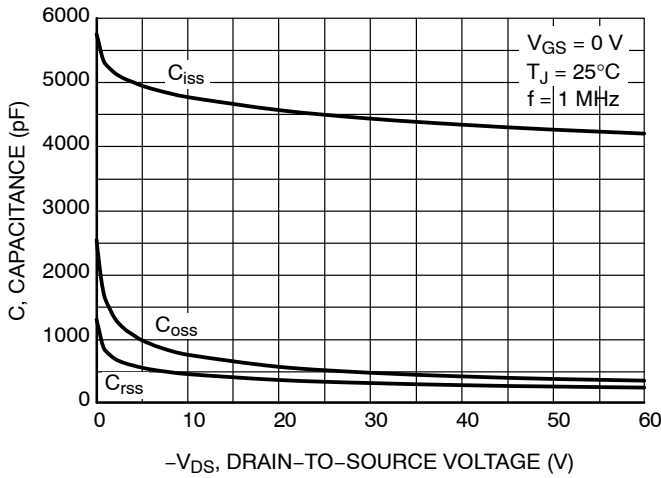


Figure 7. Capacitance Variation

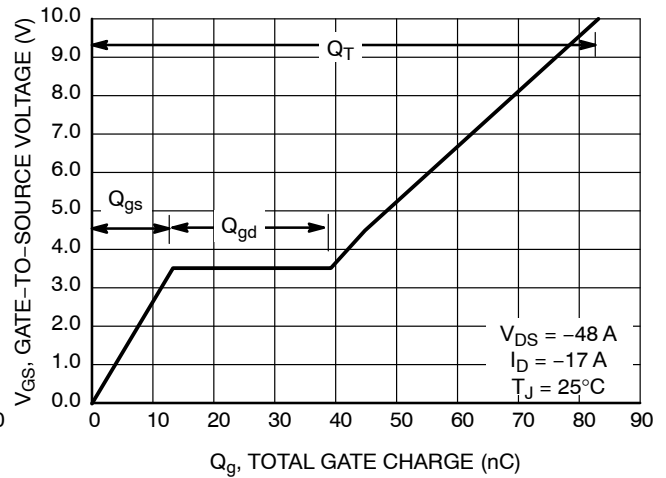


Figure 8. Gate-to-Source Voltage vs. Total Charge

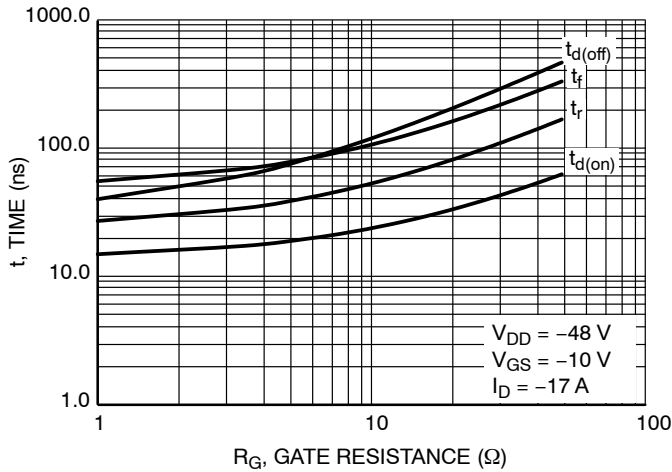


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

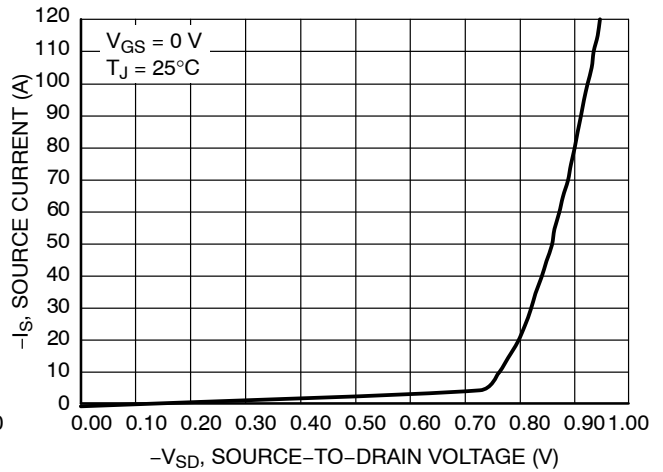


Figure 10. Diode Forward Voltage vs. Current

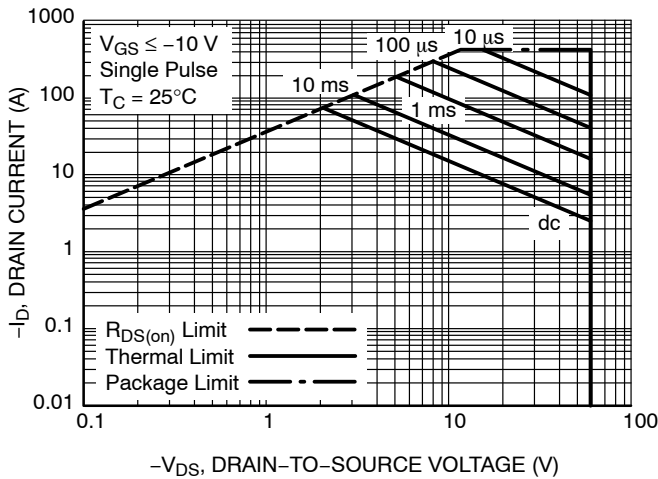


Figure 11. Maximum Rated Forward Biased Safe Operating Area

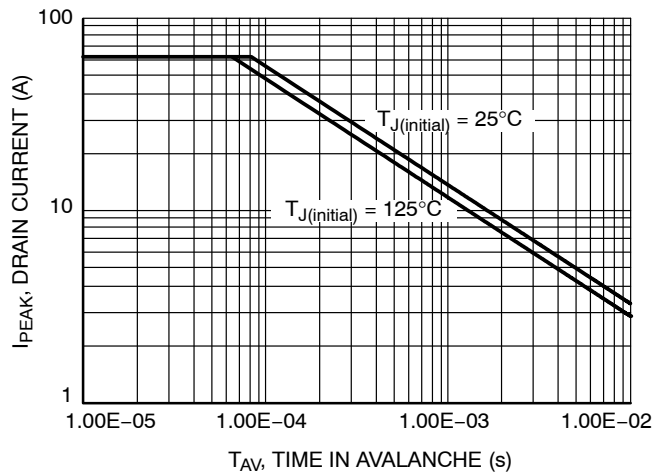


Figure 12. Avalanche Characteristics

# NTMFS5113PL

## TYPICAL CHARACTERISTICS

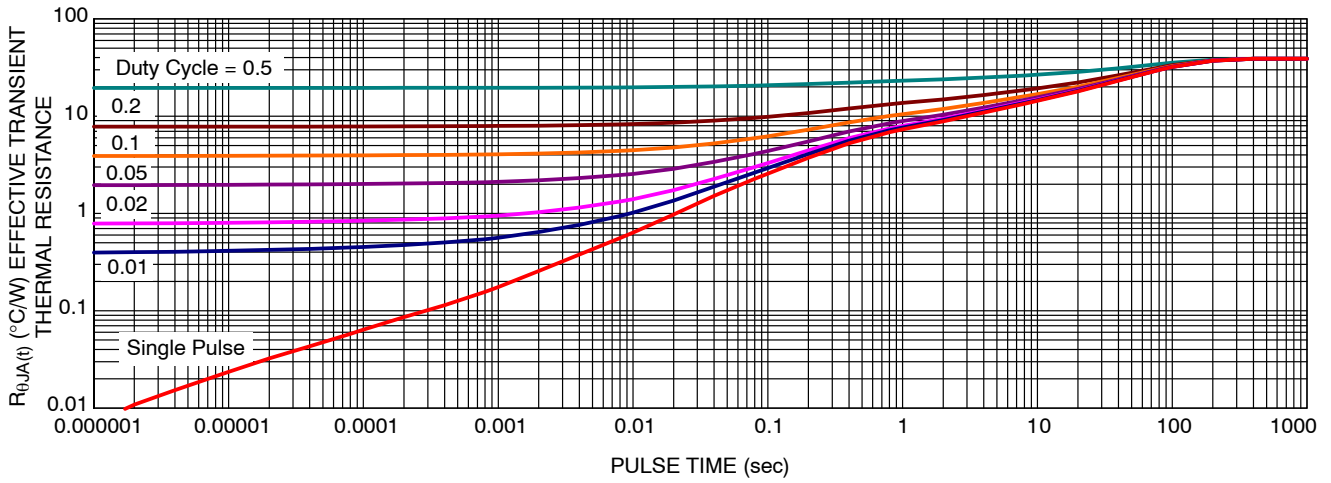


Figure 13. Thermal Response

### DEVICE ORDERING INFORMATION

Device	Marking	Package	Shipping†
NTMFS5113PLT1G	V5113L	DFN5 (Pb-Free)	1500 / 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.

# NTMFS5113PL

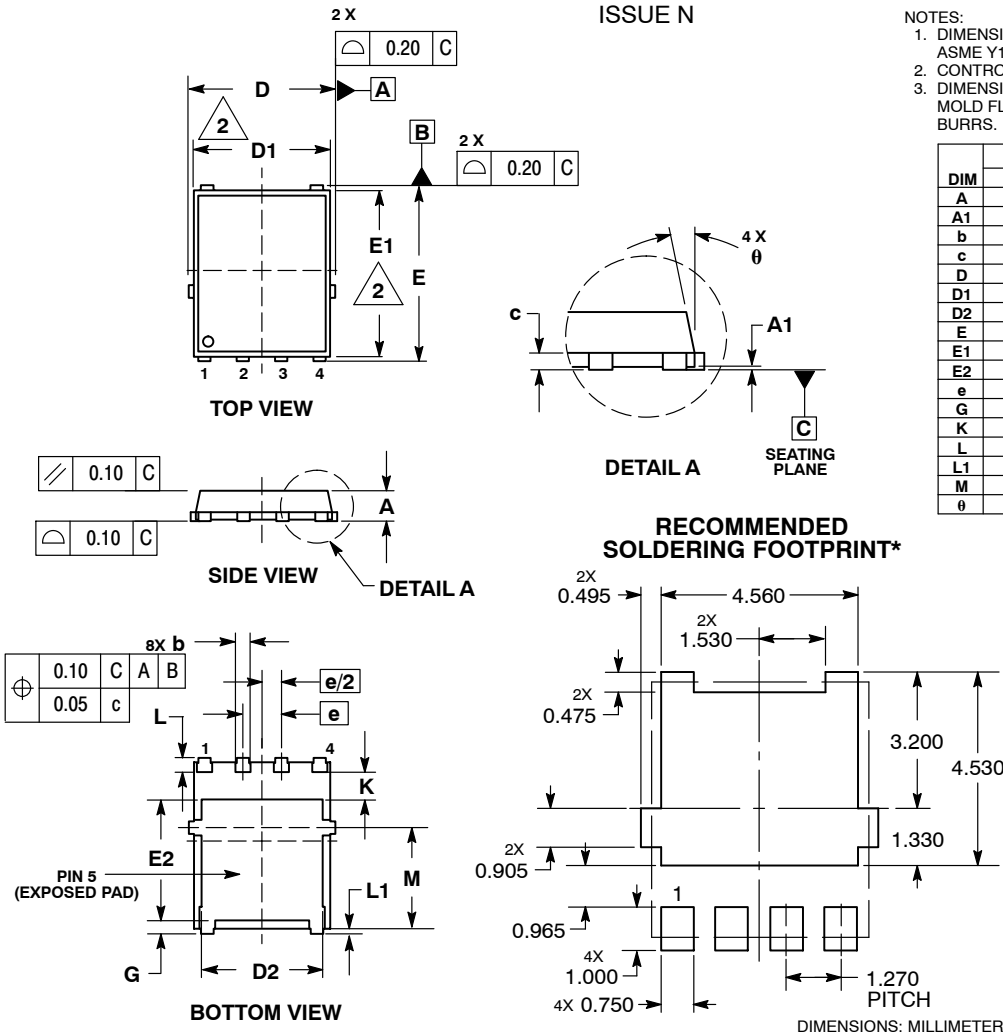
## PACKAGE DIMENSIONS

DFN5 5x6, 1.27P  
(SO-8FL)  
CASE 488AA  
ISSUE N

- NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
  2. CONTROLLING DIMENSION: MILLIMETER.
  3. DIMENSION D1 AND E1 DO NOT INCLUDE MOLD FLASH PROTRUSIONS OR GATE BURRS.

MILLIMETERS			
DIM	MIN	NOM	MAX
A	0.90	1.00	1.10
A1	0.00	---	0.05
b	0.33	0.41	0.51
c	0.23	0.28	0.33
D	5.00	5.15	5.30
D1	4.70	4.90	5.10
D2	3.80	4.00	4.20
E	6.00	6.15	6.30
E1	5.70	5.90	6.10
E2	3.45	3.65	3.85
e	1.27 BSC		
G	0.51	0.575	0.71
K	1.20	1.35	1.50
L	0.51	0.575	0.71
L1	0.125 REF		
M	3.00	3.40	3.80
θ	0°	---	12°

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



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

ON Semiconductor and are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of ON Semiconductor's product/patent coverage may be accessed at [www.onsemi.com/site/pdf/Patent-Marking.pdf](http://www.onsemi.com/site/pdf/Patent-Marking.pdf). ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor 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 ON Semiconductor products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by ON Semiconductor. "Typical" parameters which may be provided in ON Semiconductor 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. ON Semiconductor does not convey any license under its patent rights nor the rights of others. ON Semiconductor 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 ON Semiconductor products for any such unintended or unauthorized application, Buyer shall indemnify and hold ON Semiconductor 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 ON Semiconductor was negligent regarding the design or manufacture of the part. ON Semiconductor is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

### PUBLICATION ORDERING INFORMATION

**LITERATURE FULFILLMENT:**  
Literature Distribution Center for ON Semiconductor  
19521 E. 32nd Pkwy, Aurora, Colorado 80011 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](mailto: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

**ON Semiconductor Website:** [www.onsemi.com](http://www.onsemi.com)  
**Order Literature:** <http://www.onsemi.com/orderlit>

For additional information, please contact your local Sales Representative