

# NTHS5441

## MOSFET – Power, P-Channel, ChipFET

**-20 V, -5.3 A**



**ON Semiconductor®**

<http://onsemi.com>

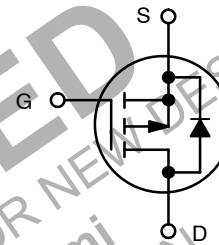
### Features

- Low  $R_{DS(on)}$
- Higher Efficiency Extending Battery Life
- Logic Level Gate Drive
- Miniature ChipFET Surface Mount Package
- Pb-Free Package is Available

### Applications

- Power Management in Portable and Battery-Powered Products; i.e., Cellular and Cordless Telephones and PCMCIA Cards

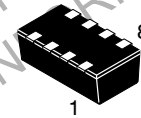
$V_{(BR)DSS}$	$R_{DS(on)}$ TYP	$I_D$ MAX
-20 V	46 mΩ @ -4.5 V	-5.3 A



P-Channel MOSFET

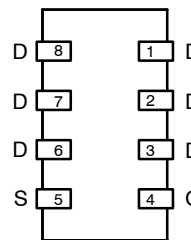
### MAXIMUM RATINGS ( $T_A = 25^\circ\text{C}$ unless otherwise noted)

Rating	Symbol	5 sec	Steady State	Unit
Drain-Source Voltage	$V_{DS}$	-20		V
Gate-Source Voltage	$V_{GS}$	$\pm 12$		V
Continuous Drain Current ( $T_J = 150^\circ\text{C}$ ) (Note 1) $T_A = 25^\circ\text{C}$ $T_A = 85^\circ\text{C}$	$I_D$	-5.3 -3.8	-3.9 -2.8	A
Pulsed Drain Current	$I_{DM}$	$\pm 20$		A
Continuous Source Current (Note 1)	$I_S$	-5.3	-3.9	A
Maximum Power Dissipation (Note 1) $T_A = 25^\circ\text{C}$ $T_A = 85^\circ\text{C}$	$P_D$	2.5 1.3	1.3 0.7	W
Operating Junction and Storage Temperature Range	$T_J, T_{stg}$	-55 to +150		$^\circ\text{C}$

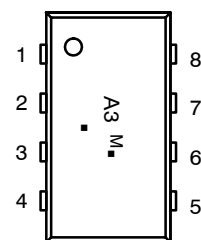


ChipFET  
CASE 1206A  
STYLE 1

### PIN CONNECTIONS



### MARKING DIAGRAM



A3 = Specific Device Code

M = Month Code

▪ = Pb-Free Package

(Note: Microdot may be in either location)

Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur and reliability may be affected.

1. Surface Mounted on FR4 Board using 1 in sq pad size (Cu area = 1.27 in sq [1 oz] including traces).

### ORDERING INFORMATION

Device	Package	Shipping†
NTHS5441T1	ChipFET	3000/Tape & Reel
NTHS5441T1G	ChipFET (Pb-Free)	3000/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.

# NTHS5441

## THERMAL CHARACTERISTICS

Characteristic	Symbol	Typ	Max	Unit
Maximum Junction-to-Ambient (Note 2) $t \leq 5$ sec Steady State	$R_{\theta JA}$	40 80	50 95	$^{\circ}\text{C}/\text{W}$
Maximum Junction-to-Foot (Drain) Steady State	$R_{\theta JF}$	15	20	$^{\circ}\text{C}/\text{W}$

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

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

### Static

Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = -250 \mu\text{A}$	-0.6		-1.2	V
Gate-Body Leakage	$I_{GSS}$	$V_{DS} = 0 \text{ V}, V_{GS} = \pm 12 \text{ V}$			$\pm 100$	nA
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = -16 \text{ V}, V_{GS} = 0 \text{ V}$			-1.0	$\mu\text{A}$
		$V_{DS} = -16 \text{ V}, V_{GS} = 0 \text{ V}, T_J = 85^{\circ}\text{C}$			-5.0	
On-State Drain Current (Note 3)	$I_{D(on)}$	$V_{DS} \leq -5.0 \text{ V}, V_{GS} = -4.5 \text{ V}$	-20			A
Drain-Source On-State Resistance (Note 3)	$r_{DS(on)}$	$V_{GS} = -3.6 \text{ V}, I_D = -3.7 \text{ A}$	-	0.050	0.06	$\Omega$
		$V_{GS} = -4.5 \text{ V}, I_D = -3.9 \text{ A}$	-	0.046	-	
		$V_{GS} = -2.5 \text{ V}, I_D = -3.1 \text{ A}$		0.070	0.083	
Forward Transconductance (Note 3)	$g_{fs}$	$V_{DS} = -10 \text{ V}, I_D = -3.9 \text{ A}$		12		mhos
Diode Forward Voltage (Note 3)	$V_{SD}$	$I_S = -2.1 \text{ A}, V_{GS} = 0 \text{ V}$		-0.8	-1.2	V

### Dynamic (Note 4)

Total Gate Charge	$Q_G$	$V_{DS} = -10 \text{ V}, V_{GS} = -4.5 \text{ V}, I_D = -3.9 \text{ A}$		9.7	22	nC	
Gate-Source Charge	$Q_{GS}$			1.2			
Gate-Drain Charge	$Q_{GD}$			3.6			
Input Capacitance	$C_{iss}$	$V_{DS} = -5.0 \text{ Vdc}, V_{GS} = 0 \text{ Vdc}, f = 1.0 \text{ MHz}$		710		pF	
Output Capacitance	$C_{oss}$			400			
Reverse Transfer Capacitance	$C_{rss}$			140			
Turn-On Delay Time	$t_{d(on)}$		$V_{DD} = -10 \text{ V}, R_L = 10 \Omega, I_D \cong -1.0 \text{ A}, V_{GEN} = -4.5 \text{ V}, R_G = 6 \Omega$		14	30	ns
Rise Time	$t_r$				22	55	
Turn-Off Delay Time	$t_{d(off)}$			42	100		
Fall Time	$t_f$			35	70		
Source-Drain Reverse Recovery Time	$t_{rr}$	$I_F = -1.1 \text{ A}, di/dt = 100 \text{ A}/\mu\text{s}$		30	60		

- Surface Mounted on FR4 Board using 1 in sq pad size (Cu area = 1.27 in sq [1 oz] including traces).
- Pulse Test: Pulse Width  $\leq 300 \mu\text{s}$ , Duty Cycle  $\leq 2\%$ .
- Guaranteed by design, not subject to production testing.

TYPICAL ELECTRICAL CHARACTERISTICS

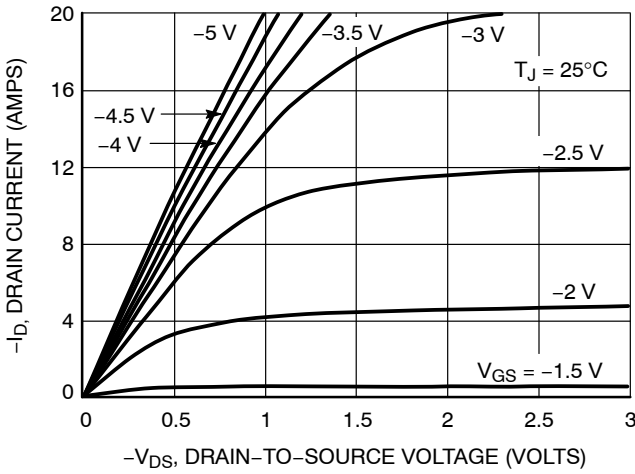


Figure 1. On-Region Characteristics

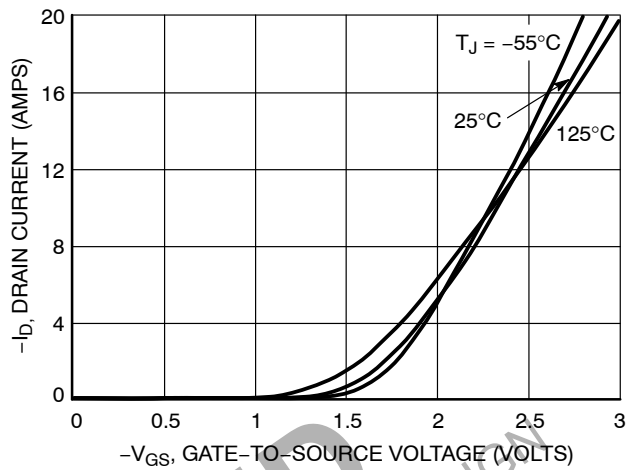


Figure 2. Transfer Characteristics

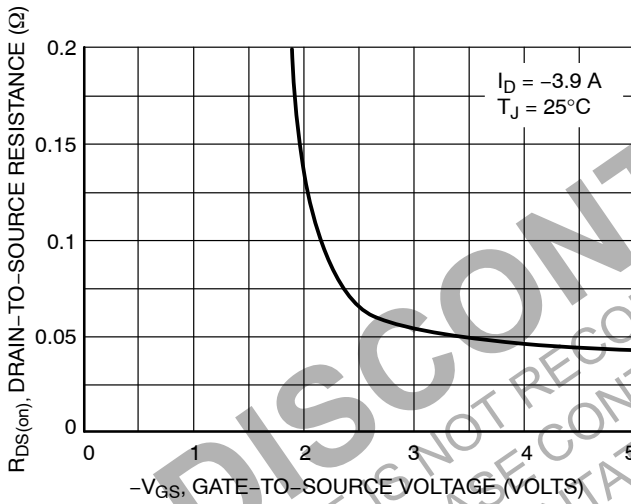


Figure 3. On-Resistance versus Gate-to-Source Voltage

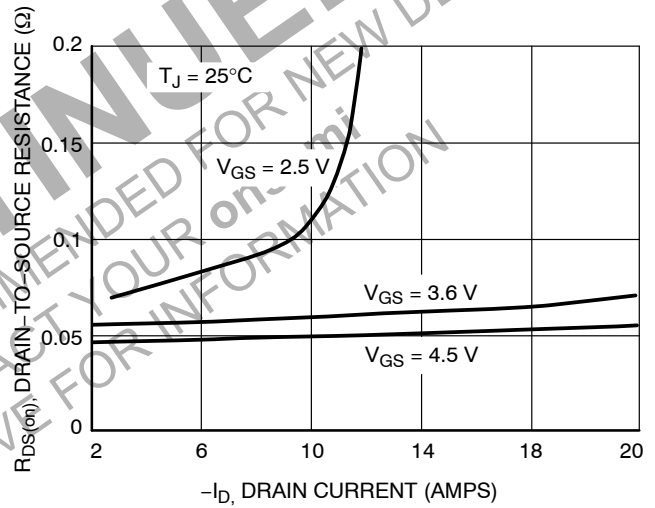


Figure 4. On-Resistance versus Drain Current and Gate Voltage

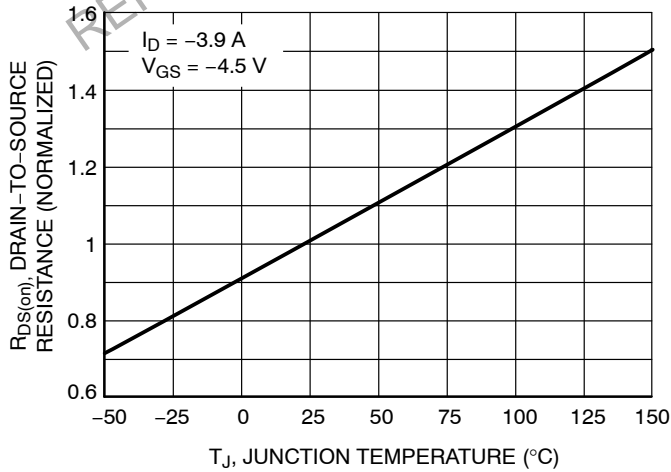


Figure 5. On-Resistance Variation with Temperature

TYPICAL ELECTRICAL CHARACTERISTICS

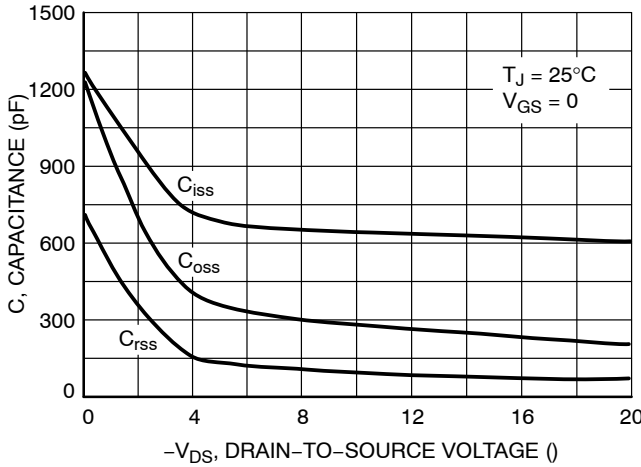


Figure 6. Capacitance Variation

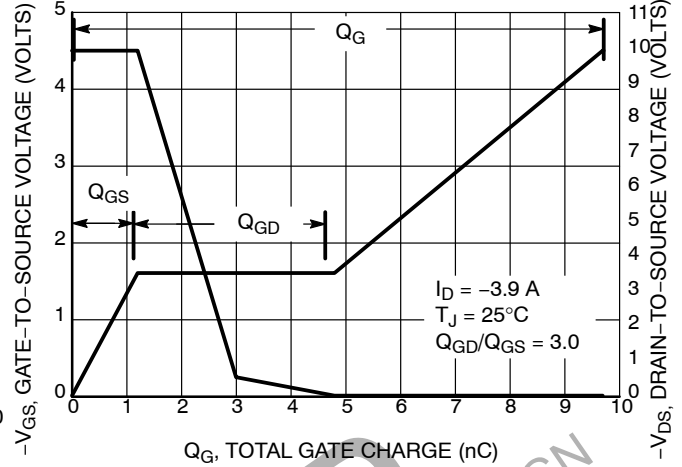


Figure 7. Gate-to-Source and Drain-to-Source Voltage versus Total Charge

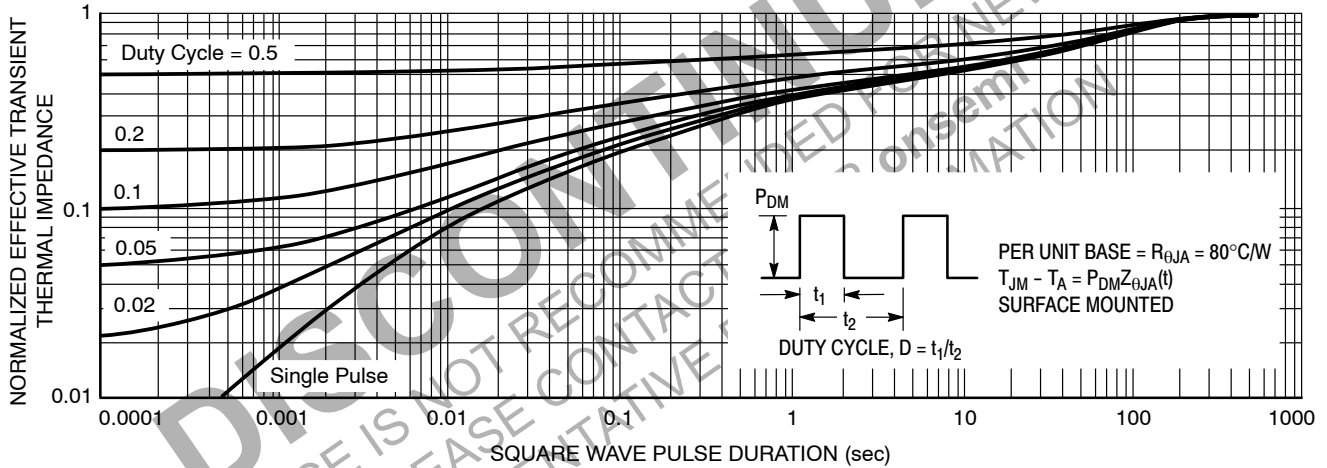


Figure 8. Normalized Thermal Transient Impedance, Junction-to-Ambient

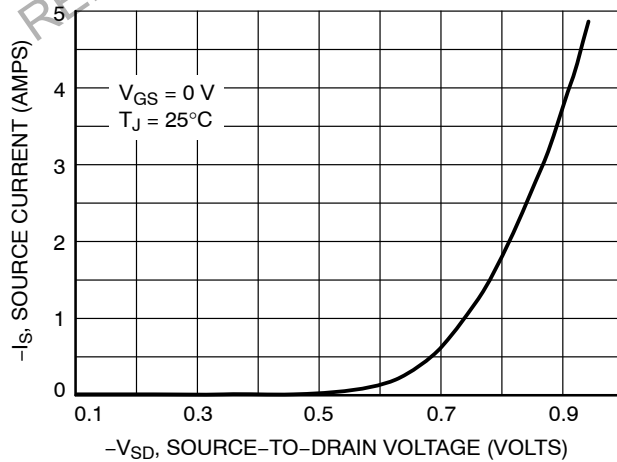


Figure 9. Diode Forward Voltage versus Current

# MECHANICAL CASE OUTLINE

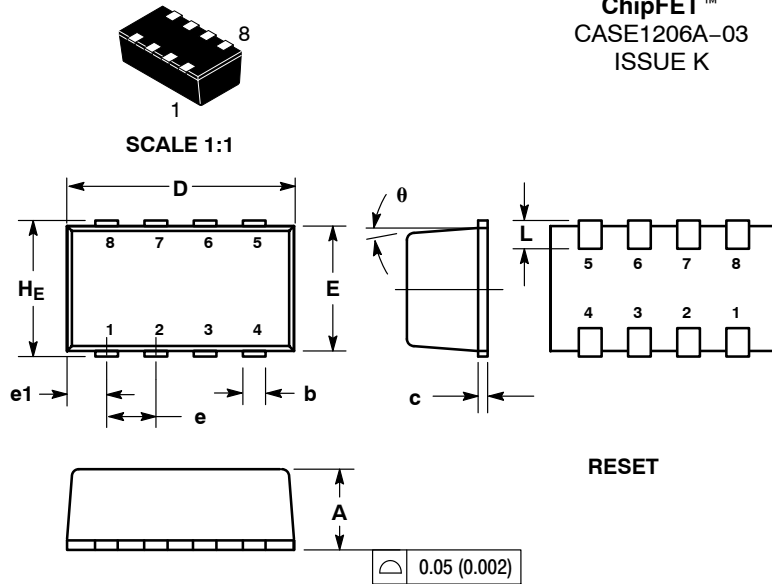
## PACKAGE DIMENSIONS

ON Semiconductor®



### ChipFET™ CASE1206A-03 ISSUE K

DATE 19 MAY 2009



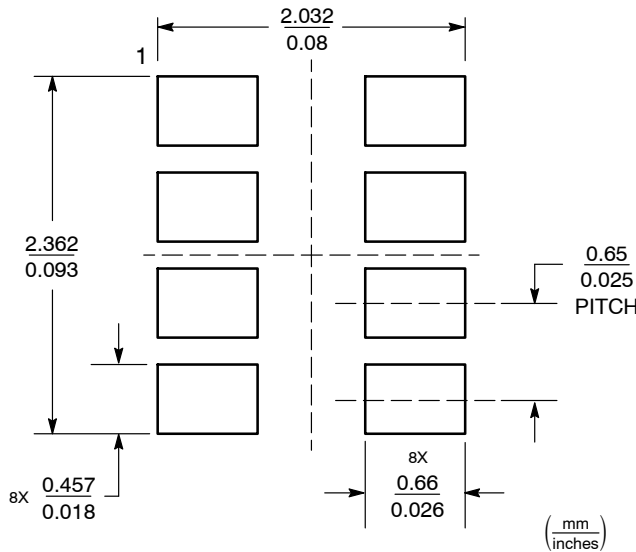
**NOTES:**

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. MOLD GATE BURRS SHALL NOT EXCEED 0.13 MM PER SIDE.
4. LEADFRAME TO MOLDED BODY OFFSET IN HORIZONTAL AND VERTICAL SHALL NOT EXCEED 0.08 MM.
5. DIMENSIONS A AND B EXCLUSIVE OF MOLD GATE BURRS.
6. NO MOLD FLASH ALLOWED ON THE TOP AND BOTTOM LEAD SURFACE.

DIM	MILLIMETERS			INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	1.00	1.05	1.10	0.039	0.041	0.043
b	0.25	0.30	0.35	0.010	0.012	0.014
c	0.10	0.15	0.20	0.004	0.006	0.008
D	2.95	3.05	3.10	0.116	0.120	0.122
E	1.55	1.65	1.70	0.061	0.065	0.067
e	0.65 BSC			0.025 BSC		
e1	0.55 BSC			0.022 BSC		
L	0.28	0.35	0.42	0.011	0.014	0.017
HE	1.80	1.90	2.00	0.071	0.075	0.079
θ	5° NOM			5° NOM		

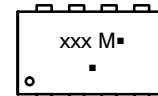
- |                                                                                                                     |                                                                                                                                     |                                                                                                                         |                                                                                                                                              |                                                                                                                         |                                                                                                                               |
|---------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|
| <b>STYLE 1:</b><br>PIN 1. DRAIN<br>2. DRAIN<br>3. DRAIN<br>4. GATE<br>5. SOURCE<br>6. DRAIN<br>7. DRAIN<br>8. DRAIN | <b>STYLE 2:</b><br>PIN 1. SOURCE 1<br>2. GATE 1<br>3. SOURCE 2<br>4. GATE 2<br>5. DRAIN 2<br>6. DRAIN 2<br>7. DRAIN 1<br>8. DRAIN 1 | <b>STYLE 3:</b><br>PIN 1. ANODE<br>2. ANODE<br>3. SOURCE<br>4. GATE<br>5. DRAIN<br>6. DRAIN<br>7. CATHODE<br>8. CATHODE | <b>STYLE 4:</b><br>PIN 1. COLLECTOR<br>2. COLLECTOR<br>3. COLLECTOR<br>4. BASE<br>5. EMITTER<br>6. COLLECTOR<br>7. COLLECTOR<br>8. COLLECTOR | <b>STYLE 5:</b><br>PIN 1. ANODE<br>2. ANODE<br>3. DRAIN<br>4. DRAIN<br>5. SOURCE<br>6. GATE<br>7. CATHODE<br>8. CATHODE | <b>STYLE 6:</b><br>PIN 1. ANODE<br>2. DRAIN<br>3. DRAIN<br>4. GATE<br>5. SOURCE<br>6. DRAIN<br>7. DRAIN<br>8. CATHODE / DRAIN |
|---------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|

### SOLDERING FOOTPRINT



Basic Style

### GENERIC MARKING DIAGRAM\*



- xxx = Specific Device Code
  - M = Month Code
  - = Pb-Free Package
- (Note: Microdot may be in either location)

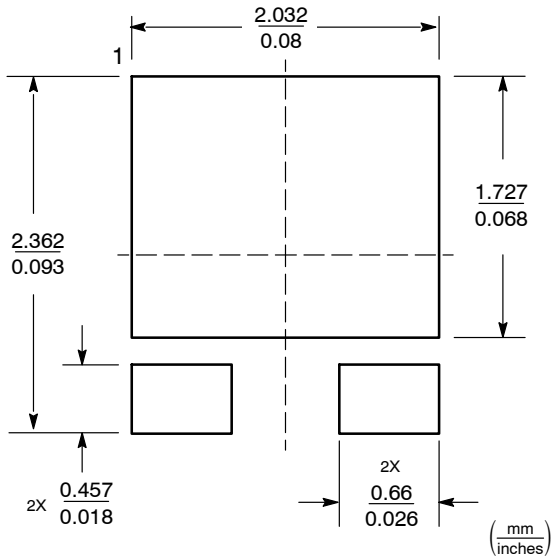
\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "▪", may or may not be present.

### OPTIONAL SOLDERING FOOTPRINTS ON PAGE 2

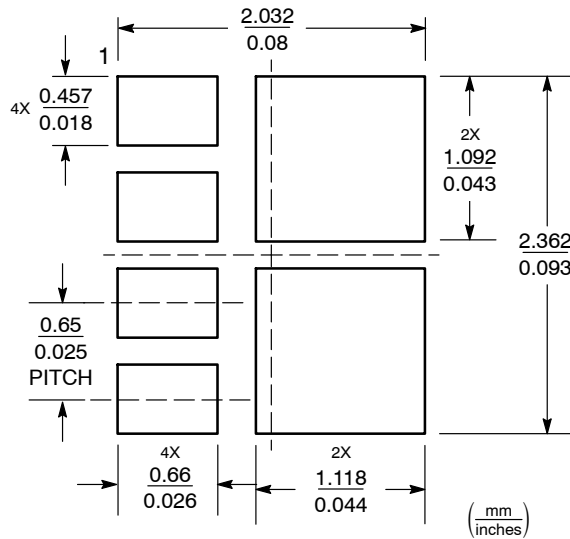
<b>DOCUMENT NUMBER:</b>	<b>98AON03078D</b>	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.
<b>DESCRIPTION:</b>	<b>ChipFET</b>	<b>PAGE 1 OF 2</b>

ON Semiconductor and ON are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. 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. ON Semiconductor does not convey any license under its patent rights nor the rights of others.

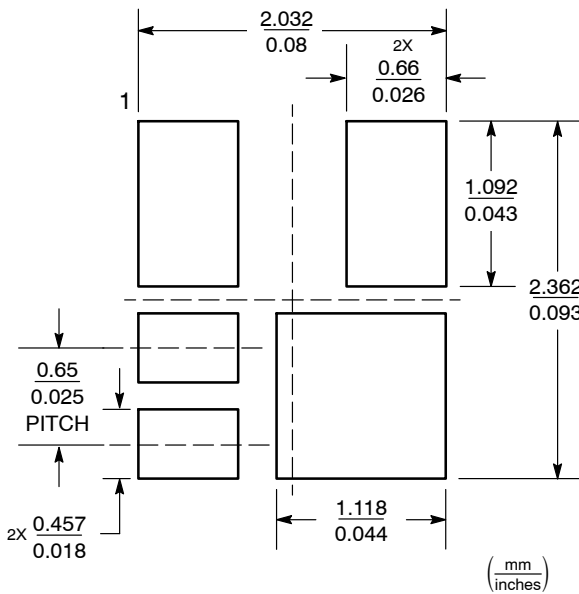
ADDITIONAL SOLDERING FOOTPRINTS\*



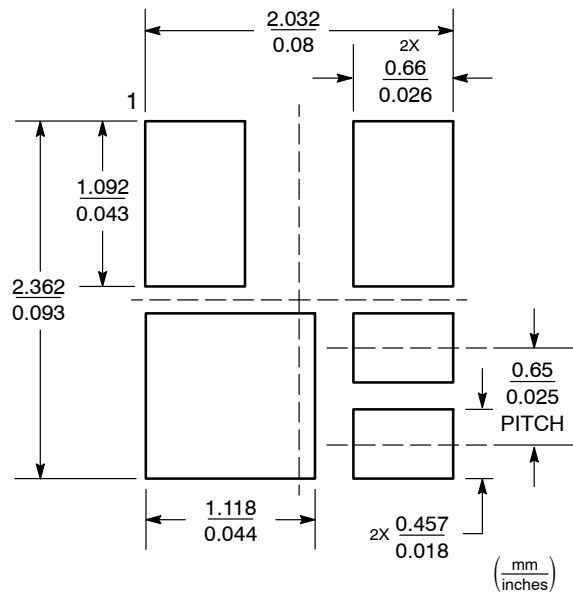
Styles 1 and 4



Style 2



Style 3



Style 5

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

DOCUMENT NUMBER:	98AON03078D	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.
DESCRIPTION:	ChipFET	PAGE 2 OF 2

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 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. ON Semiconductor 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](http://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](http://www.onsemi.com/design/resources/technical-documentation)  
onsemi Website: [www.onsemi.com](http://www.onsemi.com)

### ONLINE SUPPORT: [www.onsemi.com/support](http://www.onsemi.com/support)

For additional information, please contact your local Sales Representative at [www.onsemi.com/support/sales](http://www.onsemi.com/support/sales)