



**THE DATASHEET OF  
NTHD4502NT1**



# NTHD4502N

## MOSFET – Power, Dual, N-Channel, ChipFET 30 V, 3.9 A

### Features

- Planar Technology Device Offers Low  $R_{DS(on)}$  and Fast Switching Speed
- Leadless ChipFET Package has 40% Smaller Footprint than TSOP-6. Ideal Device for Applications Where Board Space is at a Premium.
- ChipFET Package Exhibits Excellent Thermal Capabilities. Ideal for Applications Where Heat Transfer is Required.
- These Devices are Pb-Free and are RoHS Compliant

### Applications

- DC-DC Buck or Boost Converters
- Low Side Switching
- Optimized for Battery and Low Side Switching Applications in Computing and Portable Equipment

### 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	$V_{GS}$	$\pm 20$	V	
Continuous Drain Current (Note 1)	Steady State	$T_A = 25^\circ\text{C}$	2.9	A
		$T_A = 85^\circ\text{C}$	2.1	
		$t \leq 5\text{ s}$ , $T_A = 25^\circ\text{C}$	3.9	
Power Dissipation (Note 1)	Steady State	$T_A = 25^\circ\text{C}$	1.13	W
		$t \leq 5\text{ s}$	2.1	
Continuous Drain Current (Note 2)	Steady State	$T_A = 25^\circ\text{C}$	2.2	A
		$T_A = 85^\circ\text{C}$	1.6	
Power Dissipation (Note 2)	Steady State	$T_A = 25^\circ\text{C}$	0.64	W
Pulsed Drain Current	$t_p = 10\ \mu\text{s}$	$I_{DM}$	12	A
ESD Capability (Note 3)	$C = 100\ \text{pF}$ , $R_S = 1500\ \Omega$	ESD-HBM	125	V
Operating Junction and Storage Temperature	$T_J$ , $T_{STG}$	-55 to 150	$^\circ\text{C}$	
Source Current (Body Diode)	$I_S$	2.5	A	
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.

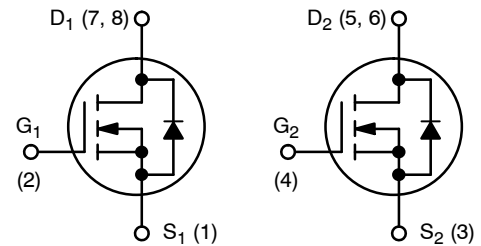
- Surface Mounted on FR4 Board using 1 in sq pad size (Cu area = 1.127 in sq [1 oz] including traces).
- Surface Mounted on FR4 Board using the minimum recommended pad size (Cu area = 0.214 in sq).
- ESD Rating Information: HBM Class 0.



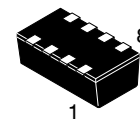
ON Semiconductor®

<http://onsemi.com>

$V_{(BR)DSS}$	$R_{DS(on)}$ TYP	$I_D$ MAX
30 V	80 m $\Omega$ @ 10 V	3.9 A
	110 m $\Omega$ @ 4.5 V	

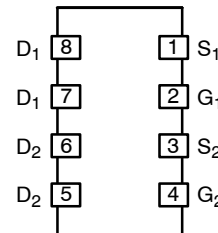


N-Channel MOSFET

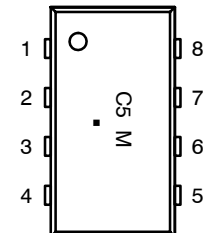


ChipFET  
CASE 1206A  
STYLE 2

### PIN CONNECTIONS



### MARKING DIAGRAM



- C5 = Specific Device Code
- M = Month Code
- = Pb-Free Package

### ORDERING INFORMATION

Device	Package	Shipping†
NTHD4502NT1G	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 Specification Brochure, BRD8011/D.

# NTHD4502N

## THERMAL RESISTANCE RATINGS

Parameter	Symbol	Max	Unit
Junction-to-Ambient – Steady State (Note 4)	$R_{\theta JA}$	110	°C/W
Junction-to-Ambient – $t \leq 5$ s (Note 4)	$R_{\theta JA}$	60	
Junction-to-Ambient – Steady State (Note 5)	$R_{\theta JA}$	195	
Junction-to-Foot – Steady State (Note 5)	$R_{\theta JF}$	40	

4. Surface Mounted on FR4 Board using 1 in sq pad size (Cu area = 1.127 in sq [1 oz] including traces).

5. Surface Mounted on FR4 Board using the minimum recommended pad size (Cu area = 0.214 in sq).

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

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
-----------	--------	-----------------	-----	-----	-----	-------

### OFF CHARACTERISTICS

Drain-to-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0$ V, $I_D = 250$ $\mu$ A	30	36		V
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{GS} = 0$ V, $V_{DS} = 24$ V			1.0	$\mu$ A
		$V_{GS} = 0$ V, $V_{DS} = 24$ V, $T_J = 125^\circ\text{C}$			10	
Gate-to-Source Leakage Current	$I_{GSS}$	$V_{DS} = 0$ V, $V_{GS} = \pm 20$ V			$\pm 100$	nA

### ON CHARACTERISTICS (Note 6)

Gate Threshold Voltage	$V_{GS(TH)}$	$V_{GS} = V_{DS}$ , $I_D = 250$ $\mu$ A	1.0	1.65	3.0	V
Drain-to-Source On-Resistance	$R_{DS(on)}$	$V_{GS} = 10$ V, $I_D = 2.9$ A		78	85	m $\Omega$
		$V_{GS} = 4.5$ V, $I_D = 2.2$ A		105	140	
Forward Transconductance	$g_{FS}$	$V_{DS} = 15$ V, $I_D = 2.9$ A		3.8		S

### CHARGES AND CAPACITANCES

Input Capacitance	$C_{ISS}$	$V_{GS} = 0$ V, $f = 1.0$ MHz, $V_{DS} = 15$ V		140		pF
Output Capacitance	$C_{OSS}$			53		
Reverse Transfer Capacitance	$C_{RSS}$			16		
Input Capacitance	$C_{ISS}$	$V_{GS} = 0$ V, $f = 1.0$ MHz, $V_{DS} = 24$ V		135	250	pF
Output Capacitance	$C_{OSS}$			42	75	
Reverse Transfer Capacitance	$C_{RSS}$			13	25	
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = 10$ V, $V_{DS} = 15$ V, $I_D = 2.9$ A		3.6	7.0	nC
Threshold Gate Charge	$Q_{G(TH)}$			0.3		
Gate-to-Source Charge	$Q_{GS}$			0.6		
Gate-to-Drain Charge	$Q_{GD}$			0.7		
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = 4.5$ V, $V_{DS} = 24$ V, $I_D = 2.9$ A		1.9		nC
Threshold Gate Charge	$Q_{G(TH)}$			0.3		
Gate-to-Source Charge	$Q_{GS}$			0.6		
Gate-to-Drain Charge	$Q_{GD}$			0.9		

6. Pulse Test: Pulse Width  $\leq 300$   $\mu$ s, Duty Cycle  $\leq 2\%$ .

# NTHD4502N

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

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
<b>DRAIN-SOURCE DIODE CHARACTERISTICS</b>						
Forward Diode Voltage	$V_{SD}$	$V_{GS} = 0\text{ V}, I_S = 2.5\text{ A}$		0.85	1.2	V
Reverse Recovery Time	$t_{RR}$	$V_{GS} = 0\text{ V}, I_S = 2.9\text{ A},$ $dI_S/dt = 100\text{ A}/\mu\text{s}$		8.6		ns
Reverse Recovery Charge	$Q_{RR}$			4.0		nC
Reverse Recovery Time	$t_{RR}$	$V_{GS} = 0\text{ V}, I_S = 1.0\text{ A},$ $dI_S/dt = 100\text{ A}/\mu\text{s}$		8.4		ns
Reverse Recovery Charge	$Q_{RR}$			4.0		nC

## SWITCHING CHARACTERISTICS (Note 7)

Turn-On Delay Time	$t_{d(ON)}$	$V_{GS} = 10\text{ V}, V_{DD} = 24\text{ V},$ $I_D = 1\text{ A}, R_G = 6\ \Omega$		6.5	12	ns
Rise Time	$t_r$			5.4	10	
Turn-Off Delay Time	$t_{d(OFF)}$			14.9	25	
Fall Time	$t_f$			1.8	5.0	
Turn-On Delay Time	$t_{d(ON)}$	$V_{GS} = 4.5\text{ V}, V_{DD} = 24\text{ V},$ $I_D = 2.9\text{ A}, R_G = 2.5\ \Omega$		7.8		ns
Rise Time	$t_r$			12.6		
Turn-Off Delay Time	$t_{d(OFF)}$			9.6		
Fall Time	$t_f$			2.8		

7. Switching characteristics are independent of operating junction temperatures.

TYPICAL PERFORMANCE CURVES

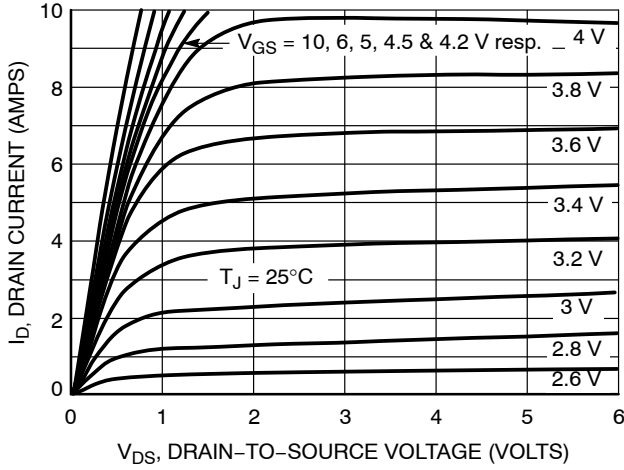


Figure 1. On-Region Characteristics

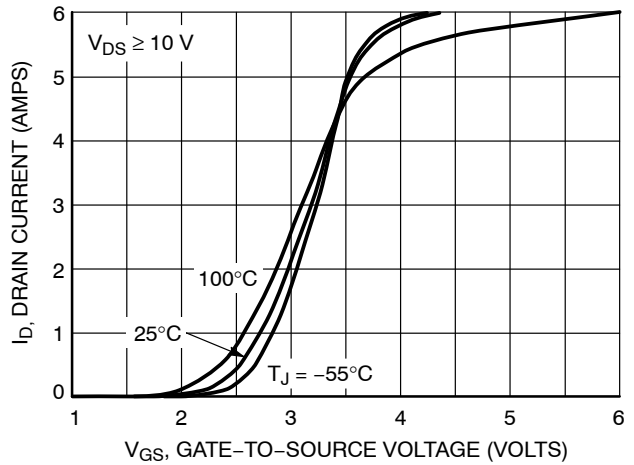


Figure 2. Transfer Characteristics

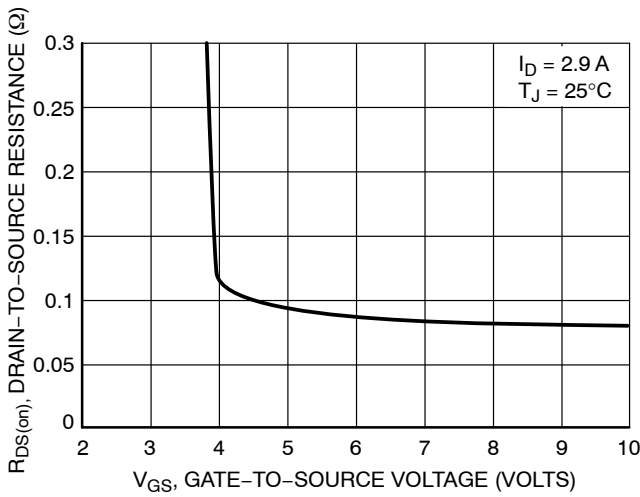


Figure 3. On-Resistance vs. Gate-to-Source Voltage

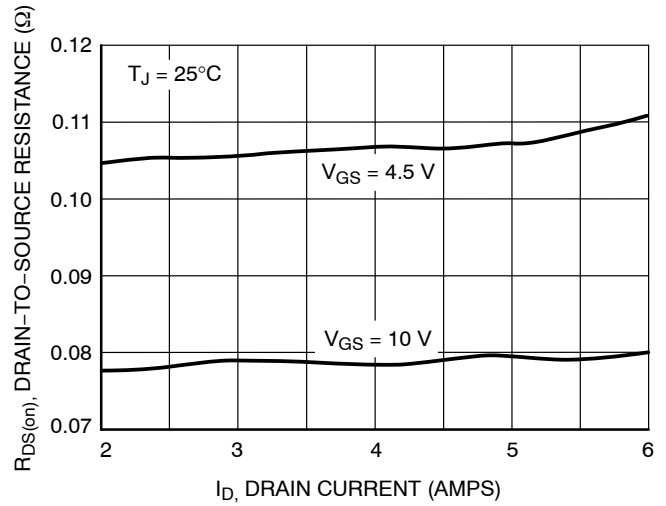


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

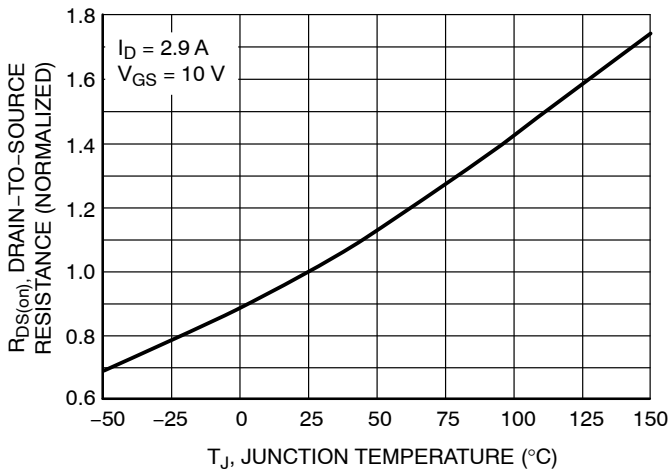


Figure 5. On-Resistance Variation with Temperature

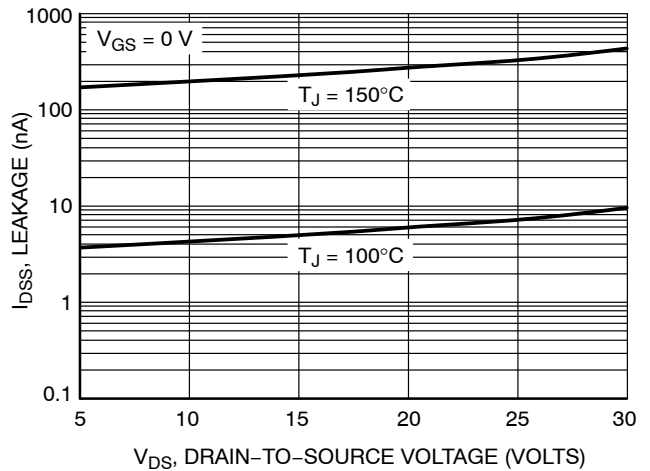


Figure 6. Drain-to-Source Leakage Current vs. Voltage

TYPICAL PERFORMANCE CURVES

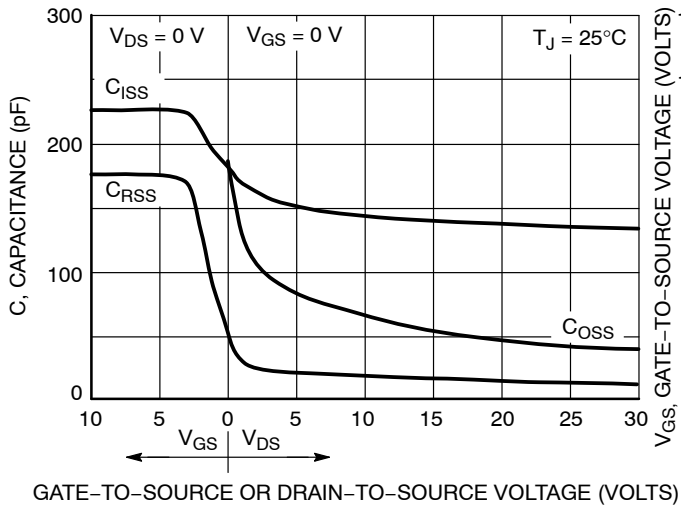


Figure 7. Capacitance Variation

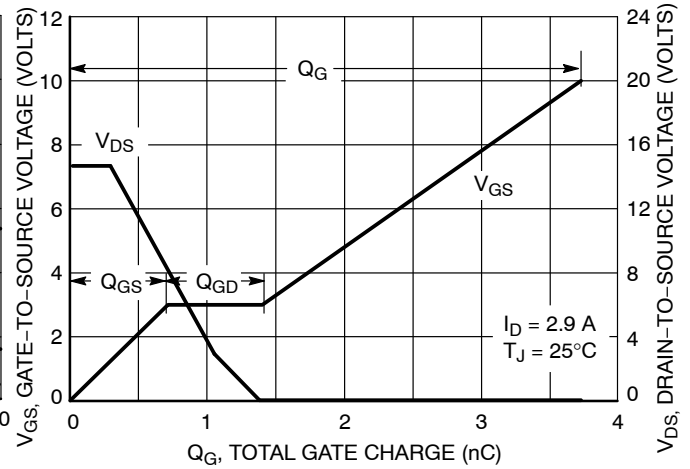


Figure 8. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge

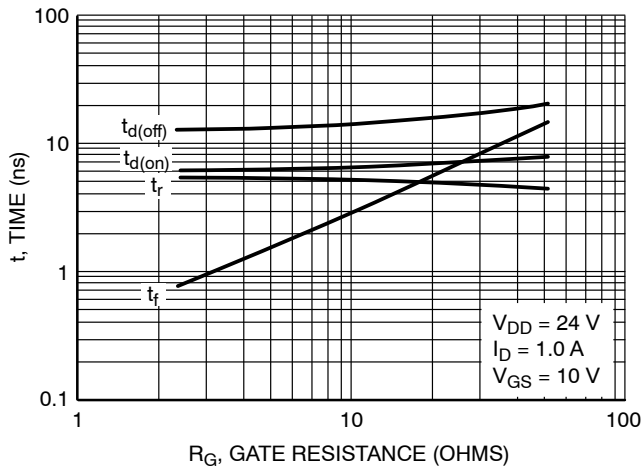


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

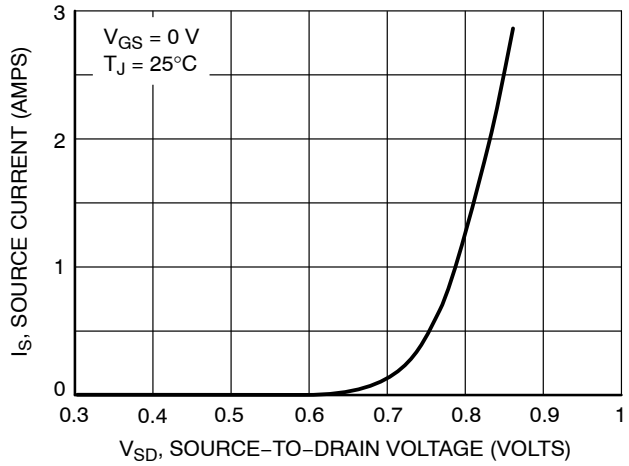


Figure 10. Diode Forward Voltage vs. Current

# MECHANICAL CASE OUTLINE

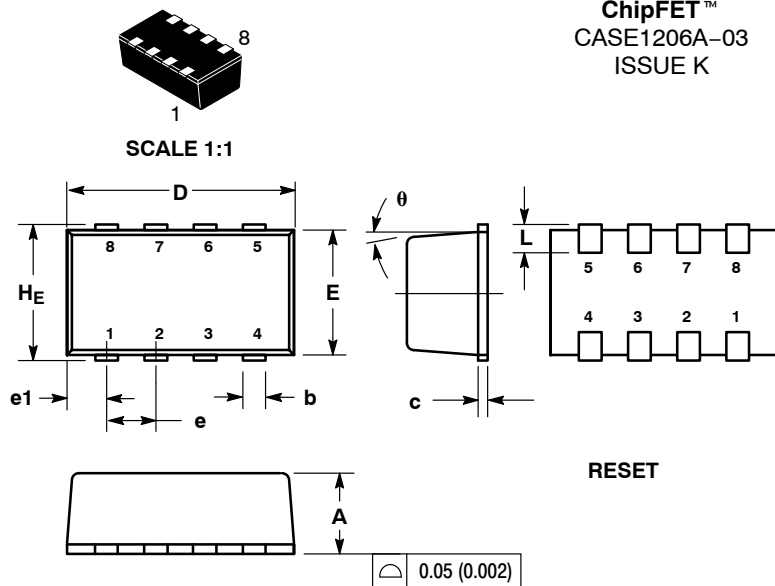
## PACKAGE DIMENSIONS

ON Semiconductor®



ChipFET™  
CASE1206A-03  
ISSUE K

DATE 19 MAY 2009

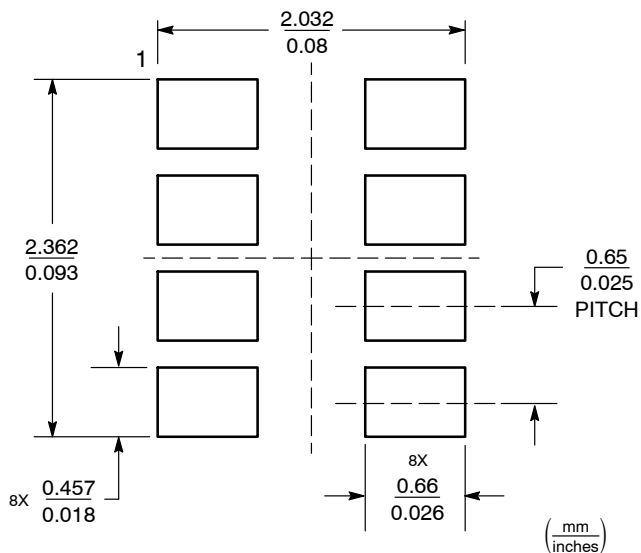


- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: MILLIMETER.
  3. MOLD GATE BURRS SHALL NOT EXCEED 0.13 MM PER SIDE.
  4. LEADFRAME TO MOLDED BODY OFFSET IN HORIZONTAL AND VERTICAL SHALL NOT EXCEED 0.08 MM.
  5. DIMENSIONS A AND B EXCLUSIVE OF MOLD GATE BURRS.
  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		

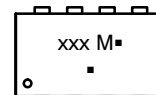
- |   |   |   |  |   |   |
|---|---|---|--|---|---|
| <p>STYLE 1:<br/>PIN 1. DRAIN<br/>2. DRAIN<br/>3. DRAIN<br/>4. GATE<br/>5. SOURCE<br/>6. DRAIN<br/>7. DRAIN<br/>8. DRAIN</p> | <p>STYLE 2:<br/>PIN 1. SOURCE 1<br/>2. GATE 1<br/>3. SOURCE 2<br/>4. GATE 2<br/>5. DRAIN 2<br/>6. DRAIN 2<br/>7. DRAIN 1<br/>8. DRAIN 1</p> | <p>STYLE 3:<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</p> | <p>STYLE 4:<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</p> | <p>STYLE 5:<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</p> | <p>STYLE 6:<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</p> |
|---|---|---|--|---|---|

### SOLDERING FOOTPRINT



Basic Style

### GENERIC MARKING DIAGRAM\*



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

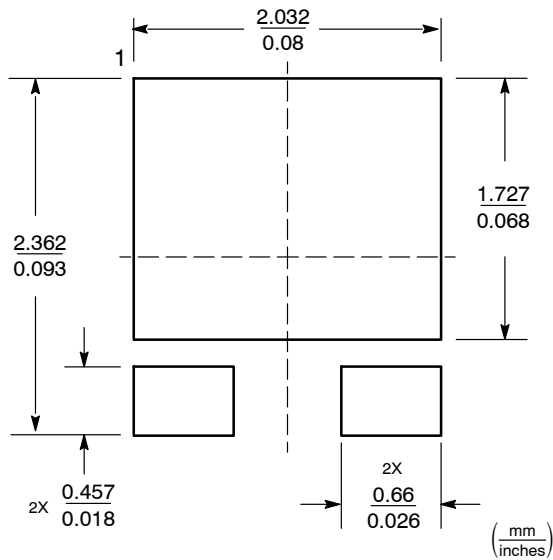
\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "▪", may or may not be present.

### OPTIONAL SOLDERING FOOTPRINTS ON PAGE 2

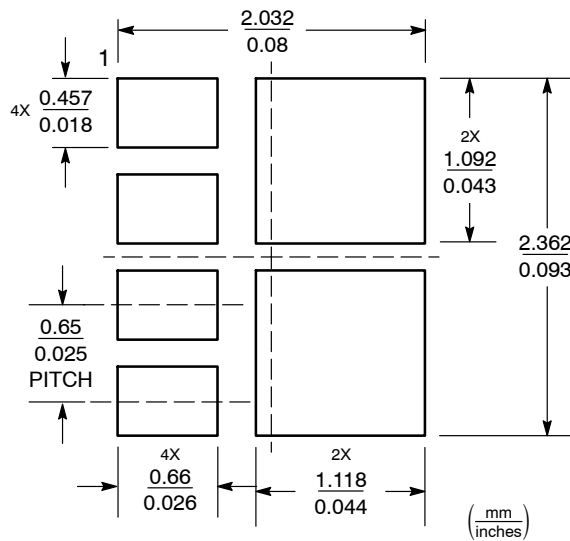
DOCUMENT NUMBER:	98AON03078D	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.
DESCRIPTION:	ChipFET	PAGE 1 OF 2

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.

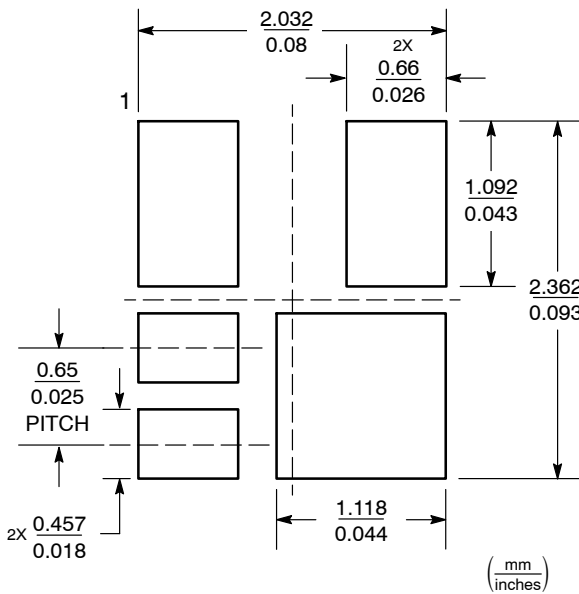
ADDITIONAL SOLDERING FOOTPRINTS\*



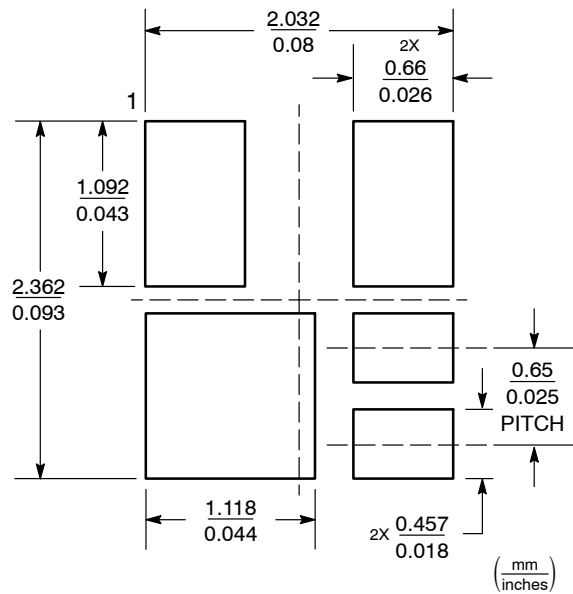
Styles 1 and 4



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)



## Looking for pricing, stock, or lifecycle information?

Click below to explore more details on WIN SOURCE:

 [View NTHD4502NT1](#) on WIN SOURCE

 [ON Semiconductor](#) Information

## Optimize Your Supply Chain with WIN SOURCE Solutions

-  Global Sourcing Solution
-  Obsolete Management
-  Cost Control Management
-  Shortage Management
-  Alternative Solution
-  Excess Inventory Management