

# NTHD4102P

## MOSFET – Dual, P-Channel, ChipFET

**-20 V, -4.1 A**

### Features

- Offers an Ultra Low  $R_{DS(ON)}$  Solution in the ChipFET Package
- Miniature ChipFET Package 40% Smaller Footprint than TSOP-6
- Low Profile (<1.1 mm) Allows it to Fit Easily into Extremely Thin Environments such as Portable Electronics
- Simplifies Circuit Design since Additional Boost Circuits for Gate Voltages are not Required
- Operated at Standard Logic Level Gate Drive, Facilitating Future Migration to Lower Levels using the same Basic Topology
- Pb-Free Package is Available

### Applications

- Optimized for Battery and Load Management Applications in Portable Equipment such as MP3 Players, Cell Phones, and PDAs
- Charge Control in Battery Chargers
- Buck and Boost Converters

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

Parameter	Symbol	Value	Unit	
Drain-to-Source Voltage	$V_{DSS}$	-20	V	
Gate-to-Source Voltage	$V_{GS}$	$\pm 8.0$	V	
Continuous Drain Current (Note 1)	Steady State	$T_A = 25^\circ\text{C}$	$I_D$ -2.9	A
		$T_A = 85^\circ\text{C}$	-2.1	
	$t \leq 10$ s	$T_A = 25^\circ\text{C}$	-4.1	
Power Dissipation (Note 1)	Steady State	$T_A = 25^\circ\text{C}$	$P_D$ 1.1	W
		$t \leq 10$ s	2.1	
Pulsed Drain Current	$t_p = 10$ $\mu\text{s}$	$I_{DM}$ -16	A	
Operating Junction and Storage Temperature	$T_J, T_{STG}$	-55 to 150	$^\circ\text{C}$	
Source Current (Body Diode)	$I_S$	-1.1	A	
Lead Temperature for Soldering Purposes (1/8" from case for 10 s)	$T_L$	260	$^\circ\text{C}$	

### THERMAL RESISTANCE RATINGS

Parameter	Symbol	Max	Unit
Junction-to-Ambient, Steady State (Note 1)	$R_{\theta JA}$	113	$^\circ\text{C/W}$
Junction-to-Ambient, $t \leq 10$ s (Note 1)		60	

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.

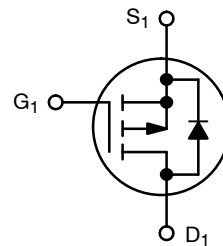
1. Surface mounted on FR4 board using 1 in sq pad size (Cu area = 1.127 in sq [1 oz] including traces)



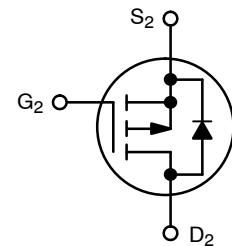
**ON Semiconductor®**

<http://onsemi.com>

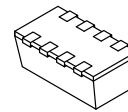
$V_{(BR)DSS}$	$R_{DS(ON)}$ TYP	$I_D$ MAX
-20 V	64 m $\Omega$ @ -4.5 V	-4.1 A
	85 m $\Omega$ @ -2.5 V	
	120 m $\Omega$ @ -1.8 V	



P-Channel MOSFET

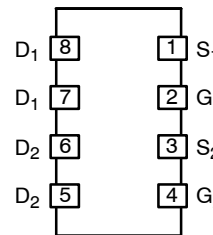


P-Channel MOSFET

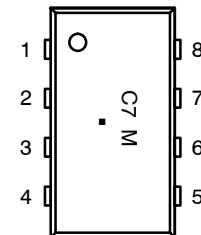


ChipFET  
CASE 1206A  
STYLE 2

### PIN CONNECTIONS



### MARKING DIAGRAM



C7 = Specific Device Code  
M = Month Code  
▪ = Pb-Free Package

### ORDERING INFORMATION

Device	Package	Shipping†
NTHD4102PT1	ChipFET	3000/Tape & Reel
NTHD4102PT1G	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.

# NTHD4102P

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

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

### OFF CHARACTERISTICS

Drain-to-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}, I_D = -250\ \mu\text{A}$	-20			V
Drain-to-Source Breakdown Voltage Temperature Coefficient	$V_{(BR)DSS}/T_J$			-15		mV/°C
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{GS} = 0\text{ V}$ $V_{DS} = -16\text{ V}$	$T_J = 25^\circ\text{C}$		-1.0	$\mu\text{A}$
			$T_J = 85^\circ\text{C}$		-5.0	
Gate-to-Source Leakage Current	$I_{GSS}$	$V_{DS} = 0\text{ V}, V_{GS} = \pm 8.0\text{ V}$			$\pm 100$	nA

### ON CHARACTERISTICS (Note 2)

Gate Threshold Voltage	$V_{GS(TH)}$	$V_{GS} = V_{DS}, I_D = -250\ \mu\text{A}$	-0.45		-1.5	V
Gate Threshold Temperature Coefficient	$V_{GS(TH)}/T_J$			2.7		mV/°C
Drain-to-Source On Resistance	$R_{DS(ON)}$	$V_{GS} = -4.5\text{ V}, I_D = -2.9\text{ A}$		64	80	m $\Omega$
		$V_{GS} = -2.5\text{ V}, I_D = -2.2\text{ A}$		85	110	
		$V_{DS} = -1.8\text{ V}, I_D = -1.0\text{ A}$		120	170	
Forward Transconductance	$g_{FS}$	$V_{DS} = -10\text{ V}, I_D = -2.9\text{ A}$		7.0		S

### CHARGES, CAPACITANCES, AND GATE RESISTANCE

Input Capacitance	$C_{ISS}$	$V_{GS} = 0\text{ V}, f = 1.0\text{ MHz},$ $V_{DS} = -16\text{ V}$		750		pF
Output Capacitance	$C_{OSS}$			100		
Reverse Transfer Capacitance	$C_{RSS}$			45		
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = -4.5\text{ V}, V_{DS} = -16\text{ V},$ $I_D = -2.6\text{ A}$		7.6	8.6	nC
Gate-to-Source Charge	$Q_{GS}$			1.3		
Gate-to-Drain Charge	$Q_{GD}$			2.6		

### SWITCHING CHARACTERISTICS (Note 3)

Turn-On Delay Time	$t_{d(ON)}$	$V_{GS} = -4.5\text{ V}, V_{DD} = -16\text{ V},$ $I_D = -2.6\text{ A}, R_G = 2.0\ \Omega$		5.5	10	ns
Rise Time	$t_r$			12	25	
Turn-Off Delay Time	$t_{d(OFF)}$			32	40	
Fall Time	$t_f$			23	35	

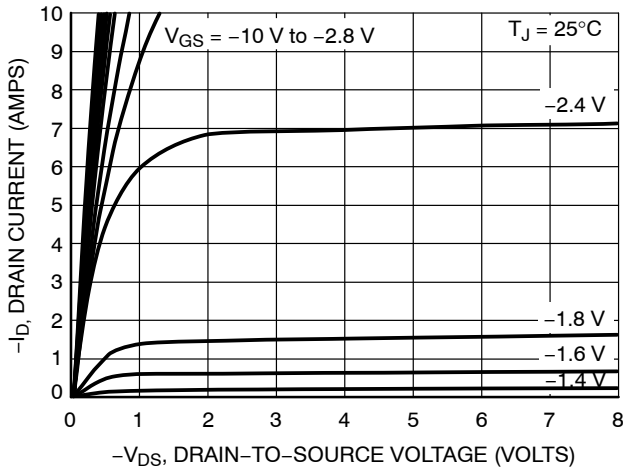
### DRAIN-SOURCE DIODE CHARACTERISTICS

Forward Diode Voltage	$V_{SD}$	$V_{GS} = 0\text{ V}, I_S = -1.1\text{ A}$		-0.8	-1.2	V
Reverse Recovery Time	$t_{RR}$	$V_{GS} = 0\text{ V}, di_S/dt = 100\text{ A}/\mu\text{s},$ $I_S = 1.0\text{ A}$		20	40	ns
Charge Time	$t_a$			15		
Discharge Time	$t_b$			5		
Reverse Recovery Charge	$Q_{RR}$			0.01		

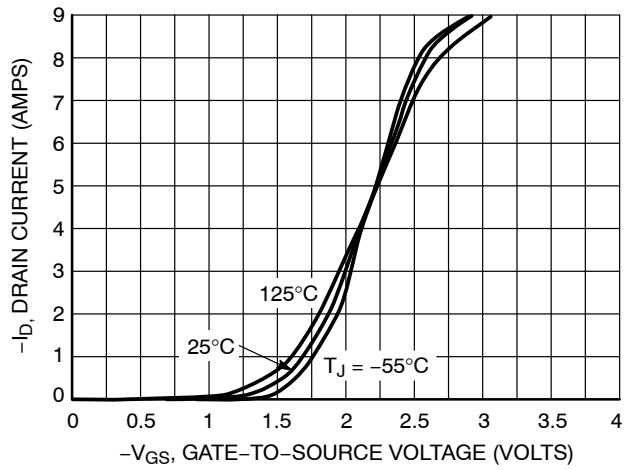
2. Pulse test: pulse width  $\leq 300\ \mu\text{s}$ , duty cycle  $\leq 2\%$
3. Switching characteristics are independent of operating junction temperatures

# NTHD4102P

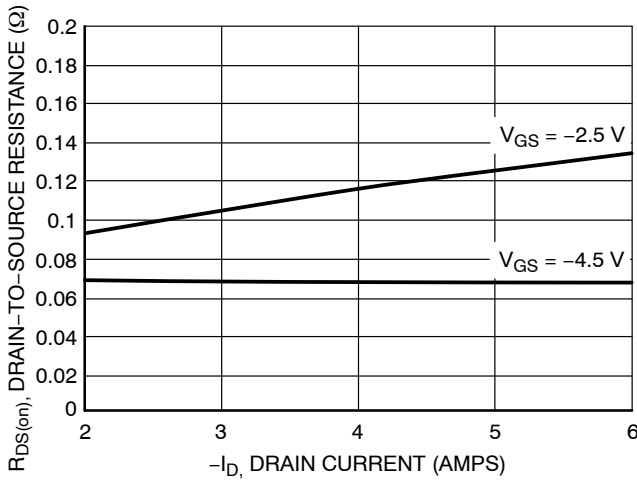
## TYPICAL PERFORMANCE CURVES ( $T_J = 25^\circ\text{C}$ unless otherwise noted)



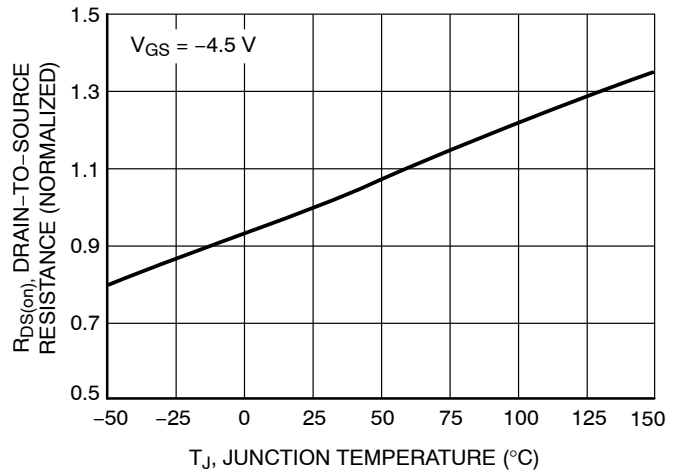
**Figure 1. On-Region Characteristics**



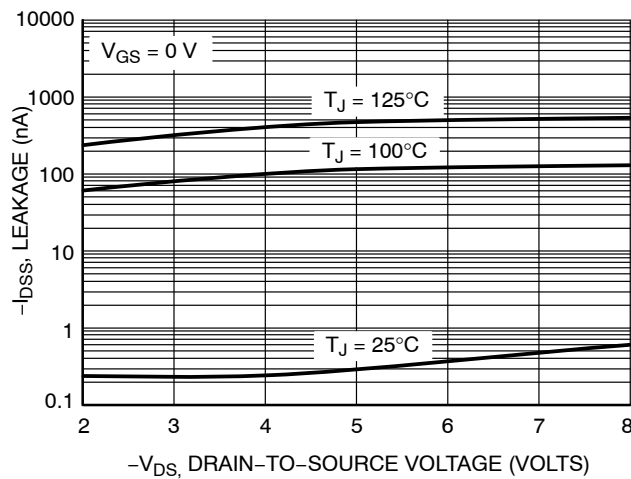
**Figure 2. Transfer Characteristics**



**Figure 3. On-Resistance vs. Drain Current and Gate Voltage**



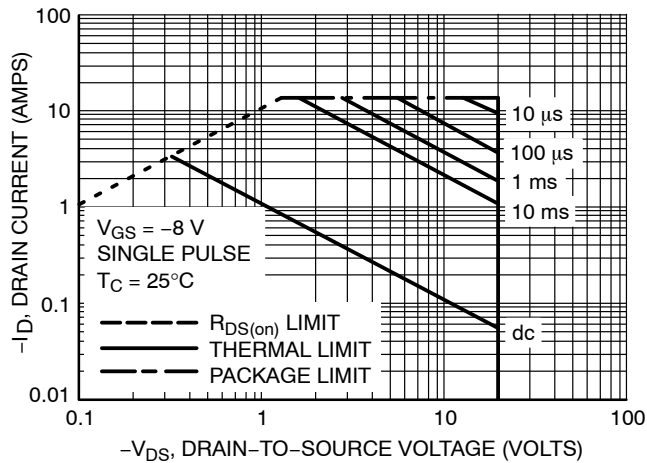
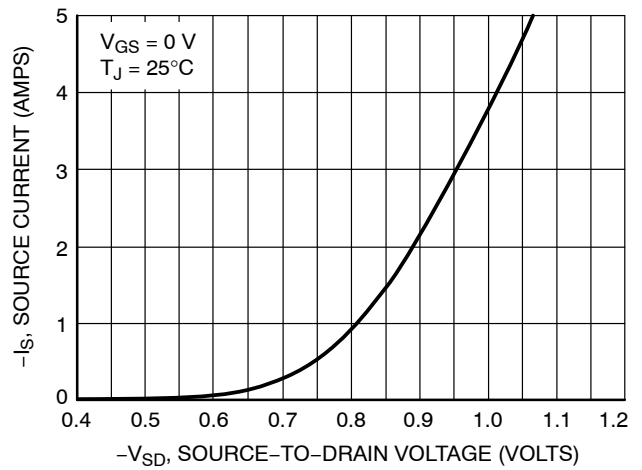
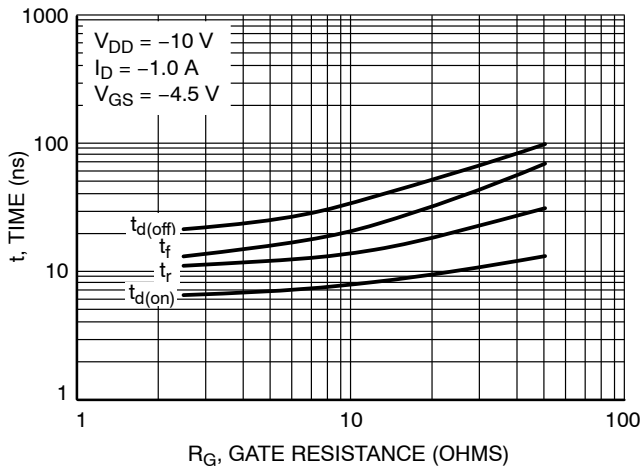
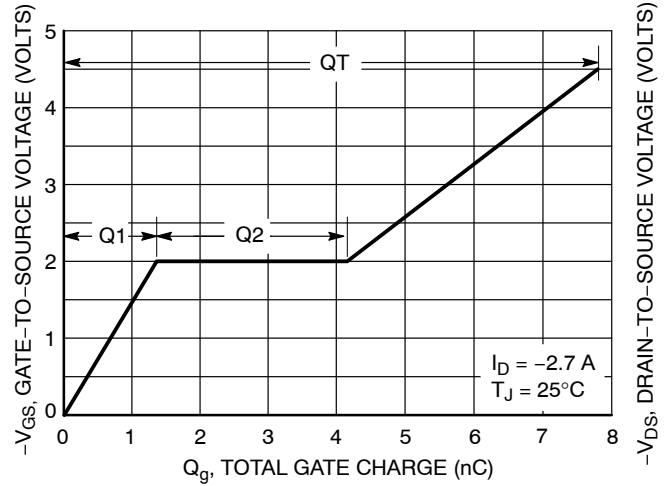
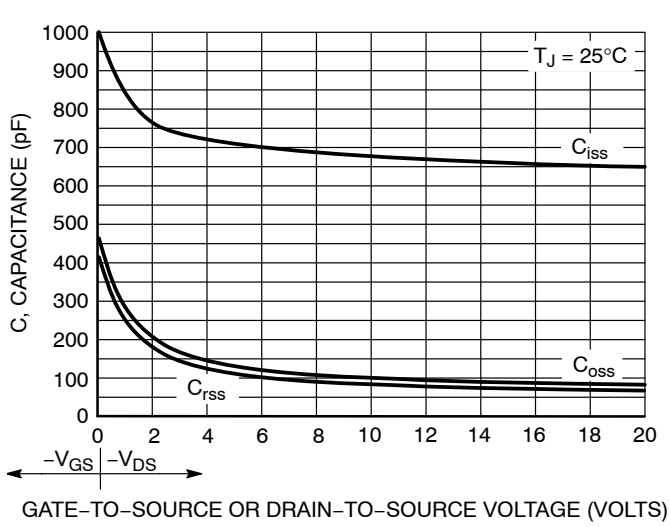
**Figure 4. On-Resistance Variation with Temperature**

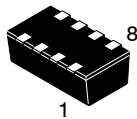


**Figure 5. Drain-to-Source Leakage Current vs. Voltage**

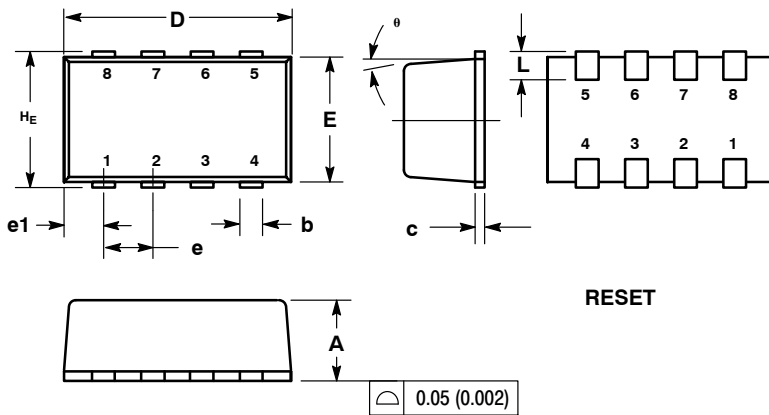
# NTHD4102P

## TYPICAL PERFORMANCE CURVES ( $T_J = 25^\circ\text{C}$ unless otherwise noted)





SCALE 1:1



ChipFET™  
CASE1206A-03  
ISSUE K

DATE 19 MAY 2009

NOTES:

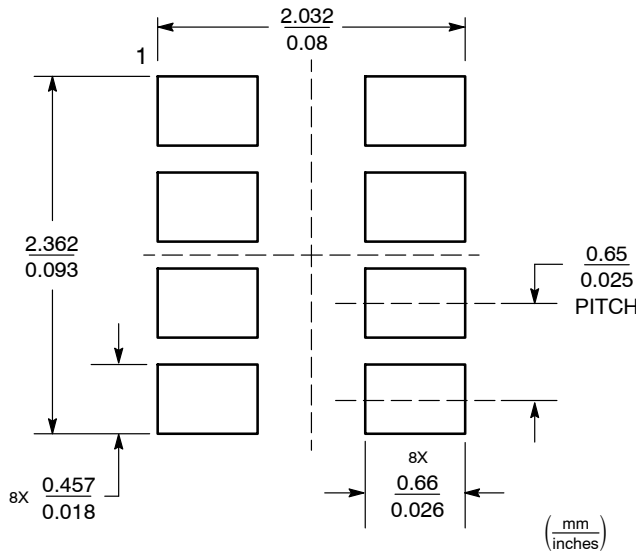
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. MOLD GATE BURRS SHALL NOT EXCEED 0.13 MM PER SIDE.
4. LEADFRAME TO MOLDED BODY OFFSET IN HORIZONTAL AND VERTICAL SHALL NOT EXCEED 0.08 MM.
5. DIMENSIONS A AND B EXCLUSIVE OF MOLD GATE BURRS.
6. NO MOLD FLASH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

RESET

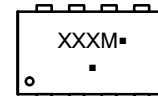
- |   |   |   |  |   |   |
|---|---|---|--|---|---|
| <p>STYLE 1:<br/>PIN 1. DRAIN<br/>2. DRAIN<br/>3. DRAIN<br/>4. GATE<br/>5. SOURCE<br/>6. DRAIN<br/>7. DRAIN<br/>8. DRAIN</p> | <p>STYLE 2:<br/>PIN 1. SOURCE 1<br/>2. GATE 1<br/>3. SOURCE 2<br/>4. GATE 2<br/>5. DRAIN 2<br/>6. DRAIN 2<br/>7. DRAIN 1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

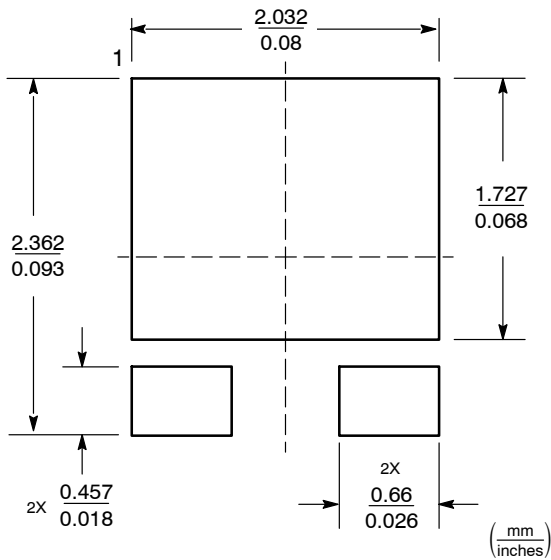
\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "▪", may or may not be present. Some products may not follow the Generic Marking.

OPTIONAL SOLDERING FOOTPRINTS ON PAGE 2

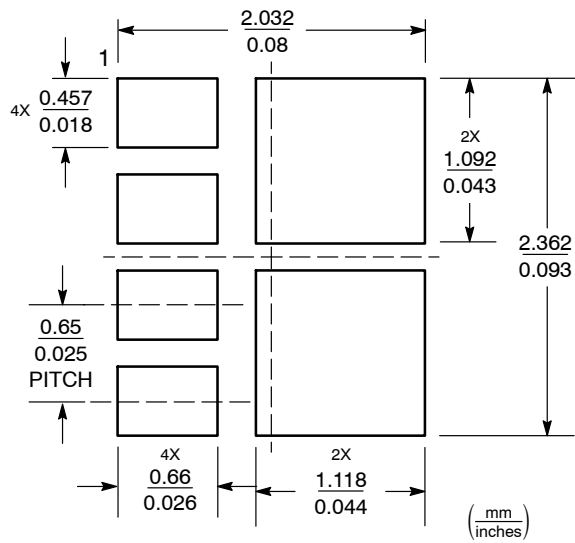
DOCUMENT NUMBER:	98AON03078D	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.
DESCRIPTION:	ChipFET	PAGE 1 OF 2

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.

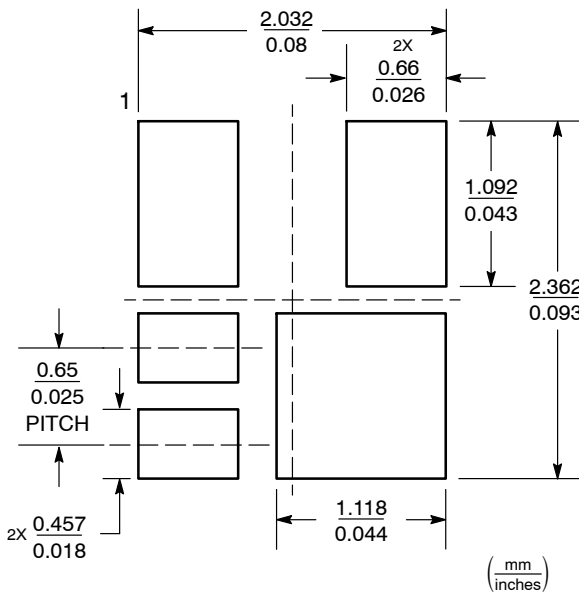
ADDITIONAL SOLDERING FOOTPRINTS\*



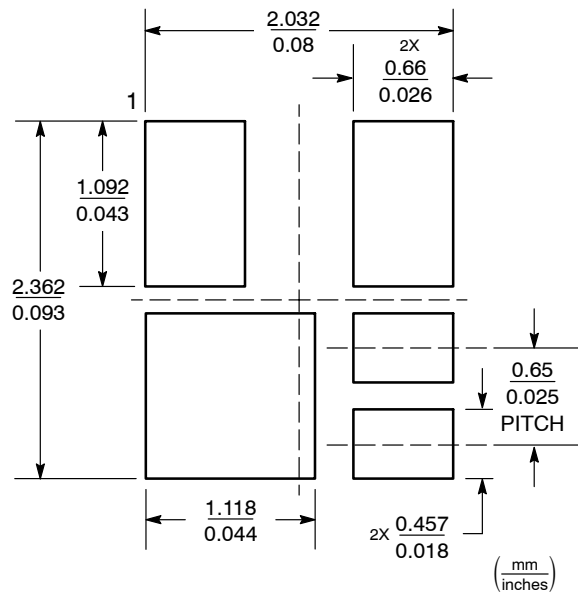
Styles 1 and 4



Style 2



Style 3



Style 5

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

<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 2 OF 2</b>

**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](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)