

# 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.

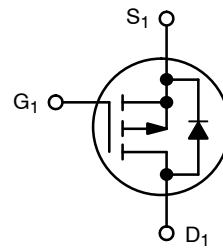
1. Surface mounted on FR4 board using 1 in sq pad size (Cu area = 1.127 in sq [1 oz] including traces)



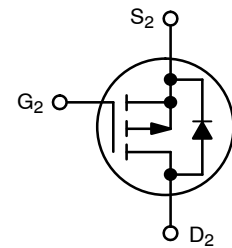
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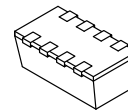
$V_{(BR)DSS}$	$R_{DS(ON)}$ TYP	$I_D$ MAX
-20 V	64 m $\Omega$ @ -4.5 V	-4.1 A
	85 m $\Omega$ @ -2.5 V	
	120 m $\Omega$ @ -1.8 V	



P-Channel MOSFET

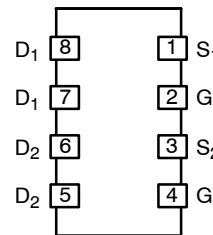


P-Channel MOSFET

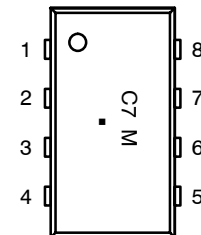


ChipFET  
CASE 1206A  
STYLE 2

### 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
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### 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	μA
			$T_J = 85^\circ\text{C}$		-5.0	
Gate-to-Source Leakage Current	$I_{GSS}$	$V_{DS} = 0\text{ V}, V_{GS} = \pm 8.0\text{ V}$			± 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	$R_{DS(ON)}$	$V_{GS} = -4.5\text{ V}, I_D = -2.9\text{ A}$ $V_{GS} = -2.5\text{ V}, I_D = -2.2\text{ A}$ $V_{DS} = -1.8\text{ V}, I_D = -1.0\text{ A}$		64	80	mΩ
				85	110	
				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	$C_{ISS}$	$V_{GS} = 0\text{ V}, f = 1.0\text{ MHz},$ $V_{DS} = -16\text{ V}$				pF
Output Capacitance	$C_{OSS}$			750		
Reverse Transfer Capacitance	$C_{RSS}$			100		
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	$t_{d(ON)}$	$V_{GS} = -4.5\text{ V}, V_{DD} = -16\text{ V},$ $I_D = -2.6\text{ A}, R_G = 2.0\ \Omega$				ns
Rise Time	$t_r$			5.5	10	
Turn-Off Delay Time	$t_{d(OFF)}$			12	25	
Fall Time	$t_f$			32	40	
				23	35	

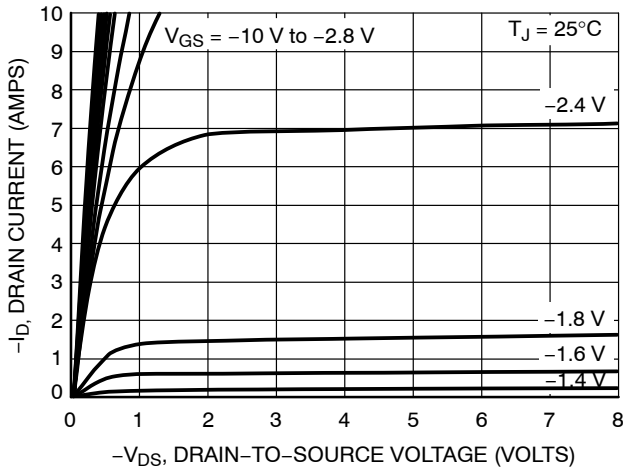
### DRAIN-SOURCE DIODE CHARACTERISTICS

Forward Diode Voltage	$V_{SD}$	$V_{GS} = 0\text{ V}, I_S = -1.1\text{ A}$				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		

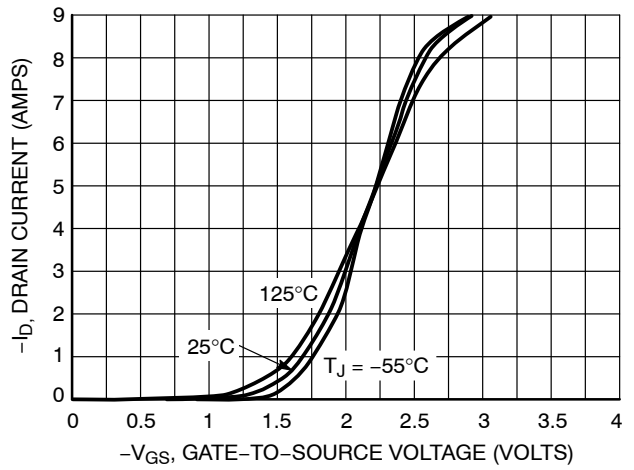
2. Pulse test: pulse width  $\leq 300\ \mu\text{s}$ , duty cycle  $\leq 2\%$
3. Switching characteristics are independent of operating junction temperatures

# NTHD4102P

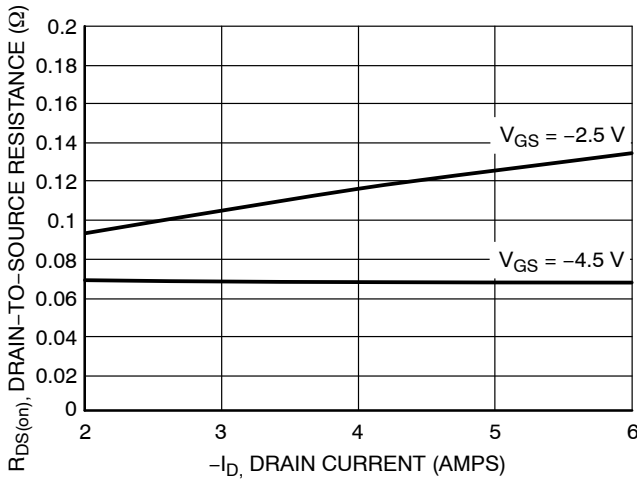
## TYPICAL PERFORMANCE CURVES ( $T_J = 25^\circ\text{C}$ unless otherwise noted)



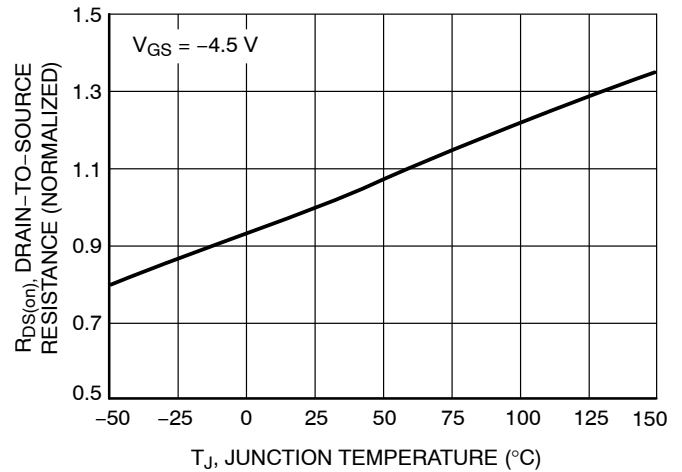
**Figure 1. On-Region Characteristics**



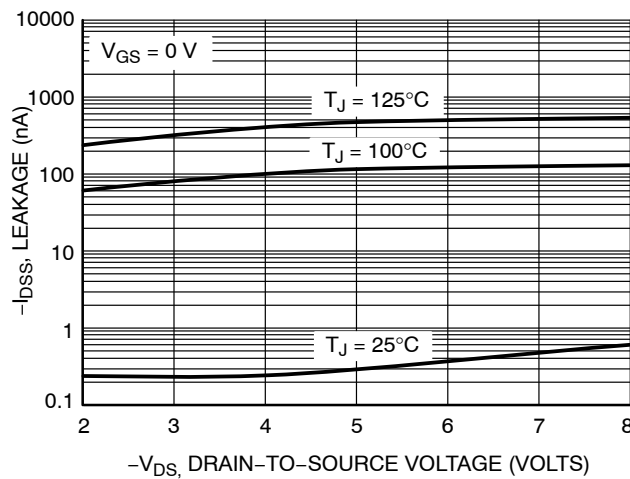
**Figure 2. Transfer Characteristics**



**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**

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

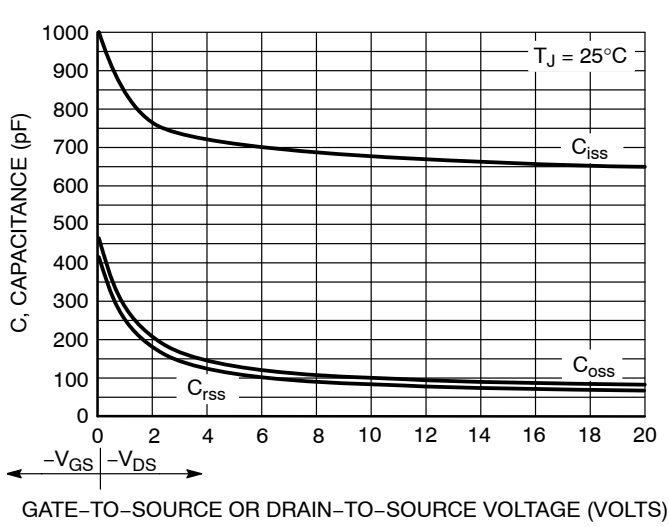


Figure 6. Capacitance Variation

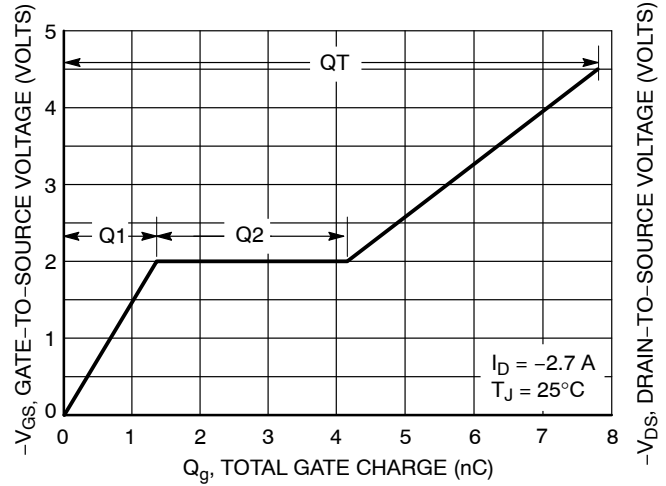


Figure 7. Gate-to-Source and Drain-to-Source Voltage vs. Total Gate Charge

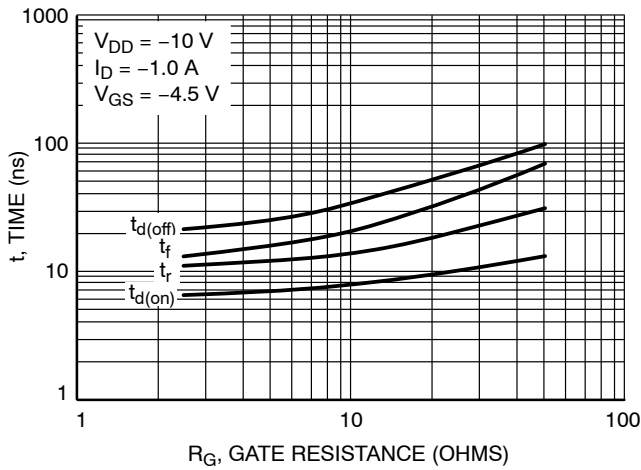


Figure 8. Resistive Switching Time Variation vs. Gate Resistance

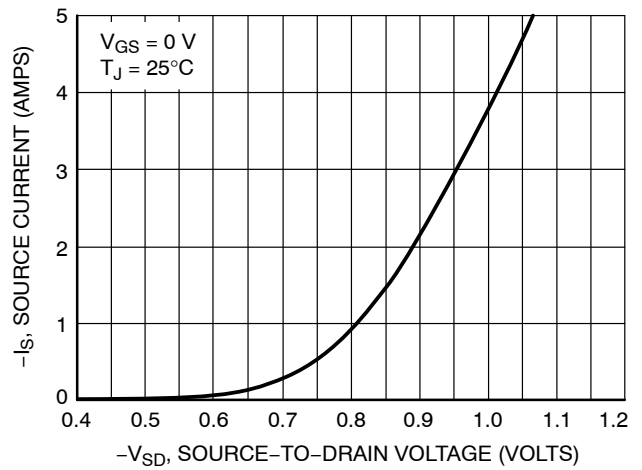


Figure 9. Diode Forward Voltage vs. Current

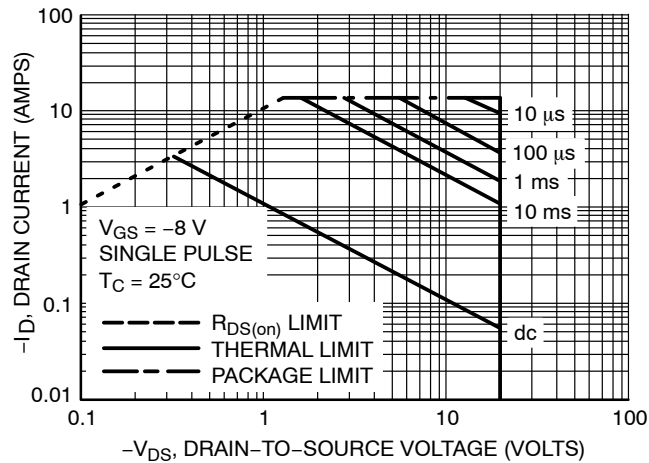


Figure 10. Maximum Rated Forward Biased Safe Operating Area

# 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)

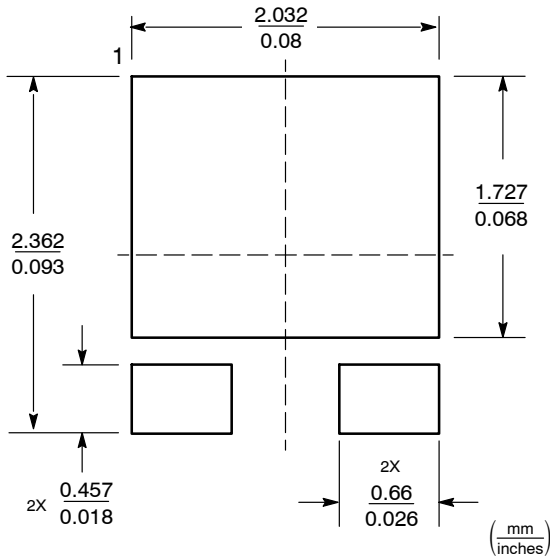
\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "▪", may or may not be present.

### OPTIONAL SOLDERING FOOTPRINTS ON PAGE 2

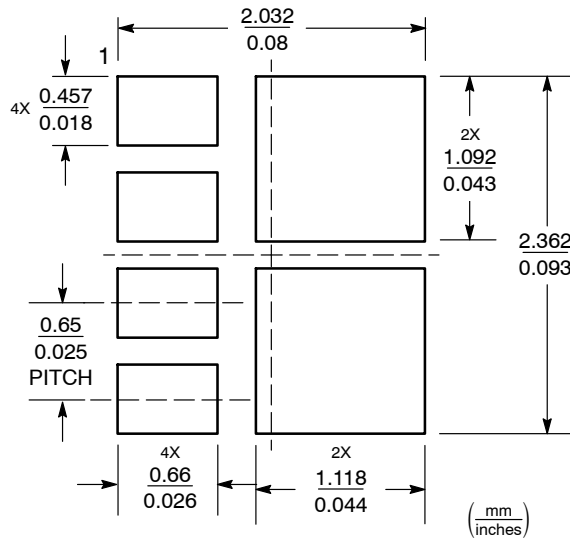
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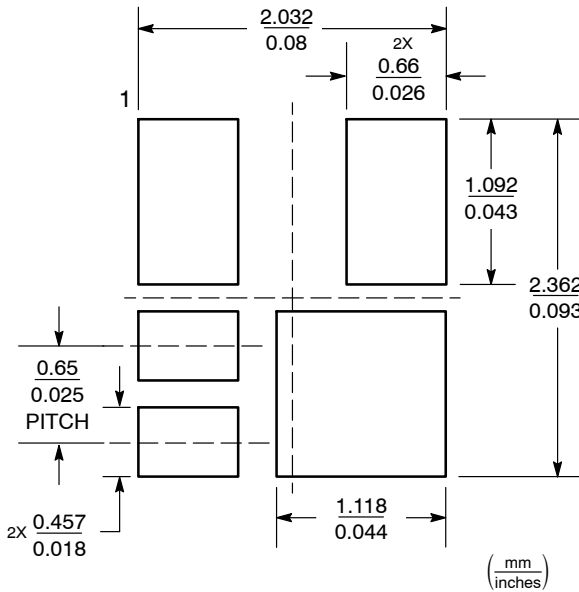
ADDITIONAL SOLDERING FOOTPRINTS\*



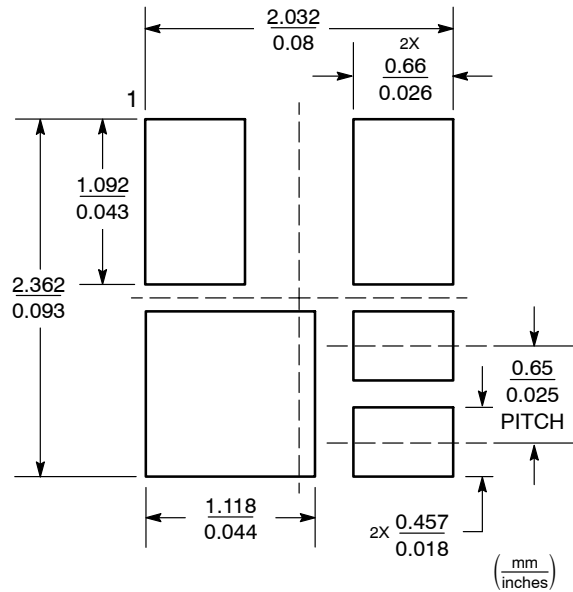
Styles 1 and 4



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.

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