

# 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	
		$t \leq 5\text{ s}$	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.

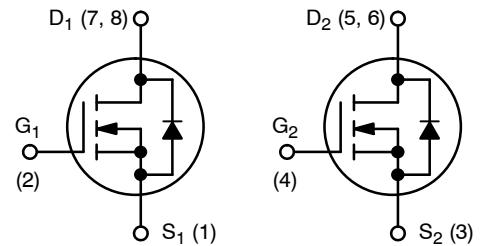
1. Surface Mounted on FR4 Board using 1 in sq pad size (Cu area = 1.127 in sq [1 oz] including traces).
2. Surface Mounted on FR4 Board using the minimum recommended pad size (Cu area = 0.214 in sq).
3. ESD Rating Information: HBM Class 0.



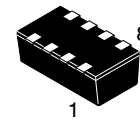
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$V_{(BR)DSS}$	$R_{DS(on)}$ TYP	$I_D$ MAX
30 V	80 m $\Omega$ @ 10 V	3.9 A
	110 m $\Omega$ @ 4.5 V	

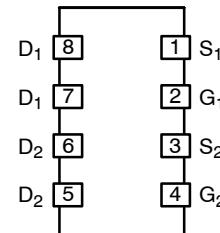


N-Channel MOSFET

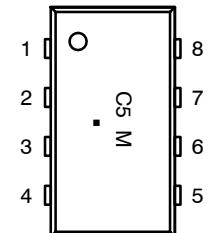


ChipFET  
CASE 1206A  
STYLE 2

### 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
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### OFF CHARACTERISTICS

Drain-to-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0$ V, $I_D = 250$ $\mu\text{A}$	30	36		V
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{GS} = 0$ V, $V_{DS} = 24$ V			1.0	$\mu\text{A}$
		$V_{GS} = 0$ 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	$V_{GS(TH)}$	$V_{GS} = V_{DS}$ , $I_D = 250$ $\mu\text{A}$	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  $\leq 300$   $\mu\text{s}$ , 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

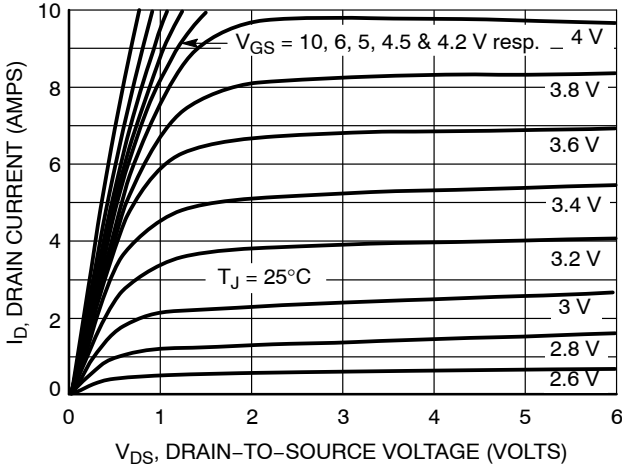


Figure 1. On-Region Characteristics

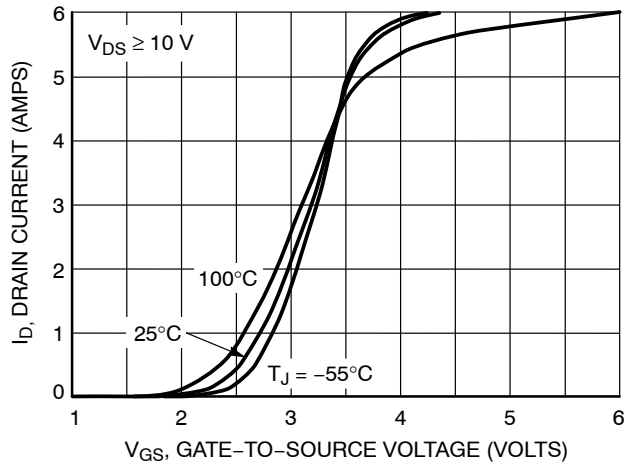


Figure 2. Transfer Characteristics

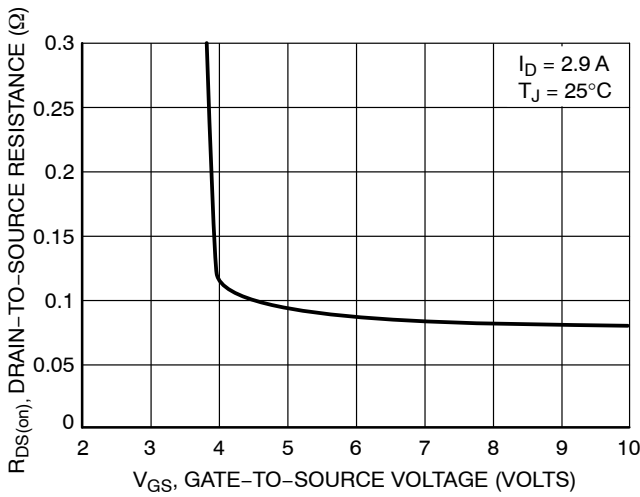


Figure 3. On-Resistance vs. Gate-to-Source Voltage

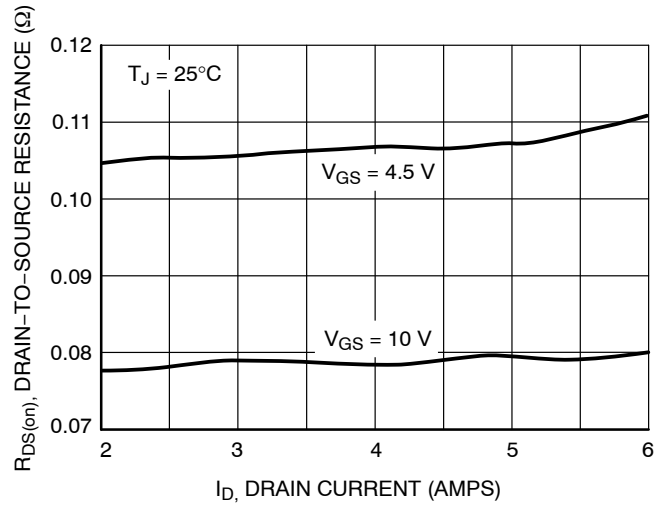


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

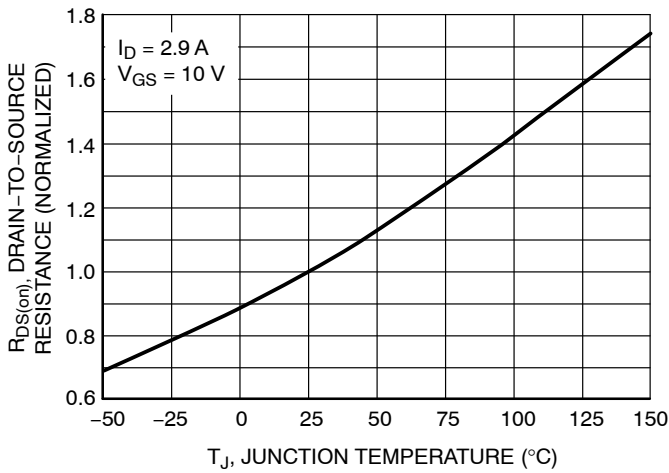


Figure 5. On-Resistance Variation with Temperature

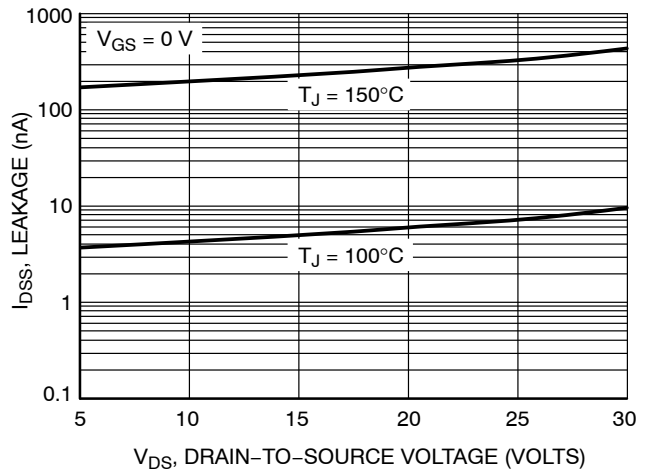


Figure 6. Drain-to-Source Leakage Current vs. Voltage

TYPICAL PERFORMANCE CURVES

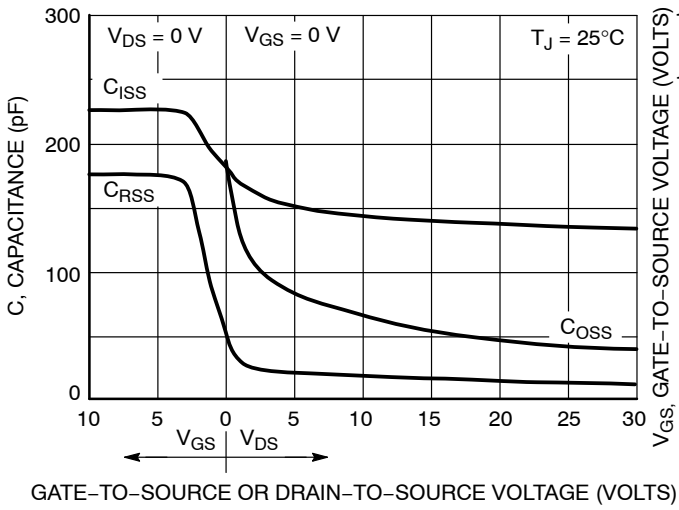


Figure 7. Capacitance Variation

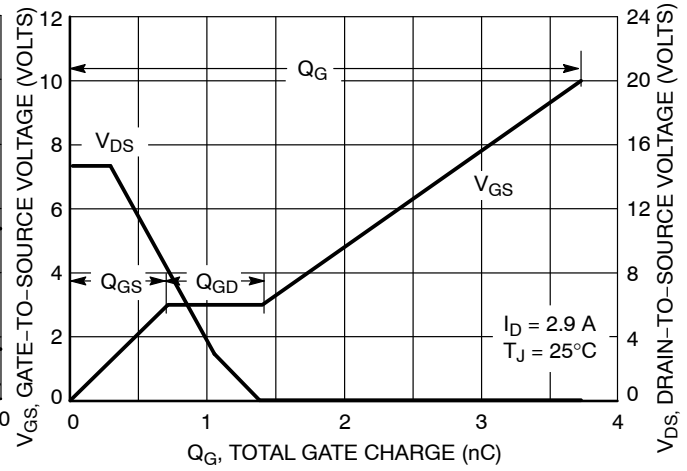


Figure 8. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge

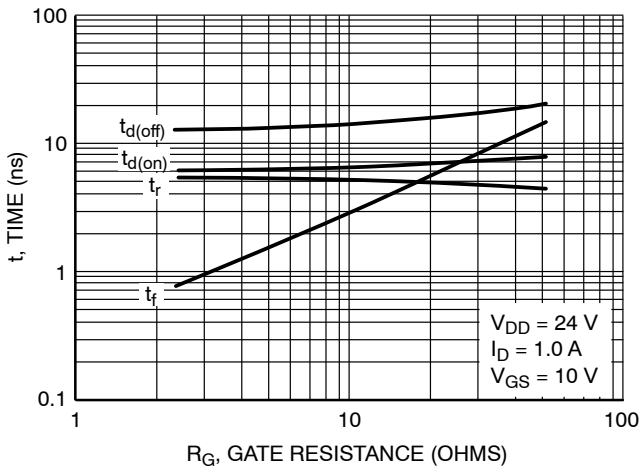


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

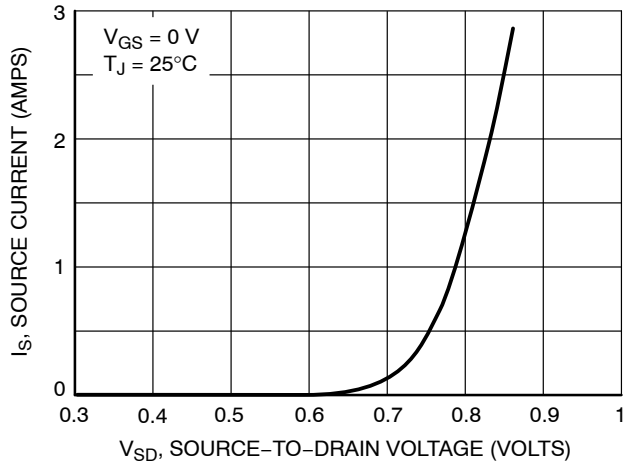


Figure 10. Diode Forward Voltage vs. Current

# 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		

- |   |   |   |  |   |   |
|---|---|---|--|---|---|
| <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)

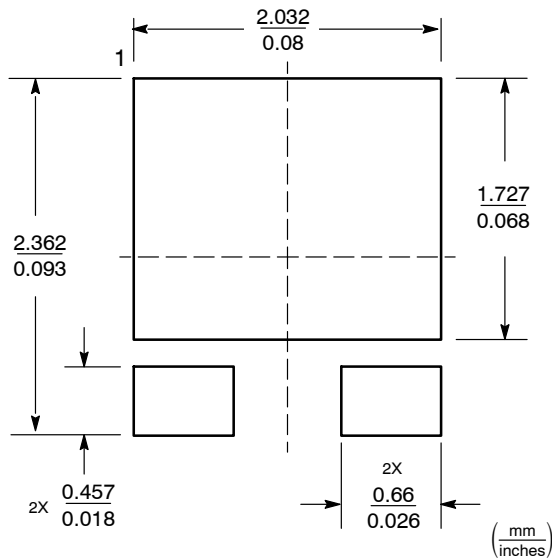
\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "▪", may or may not be present.

### OPTIONAL SOLDERING FOOTPRINTS ON PAGE 2

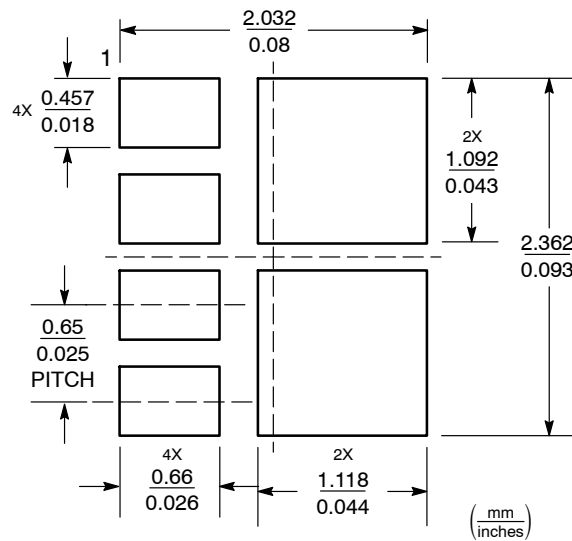
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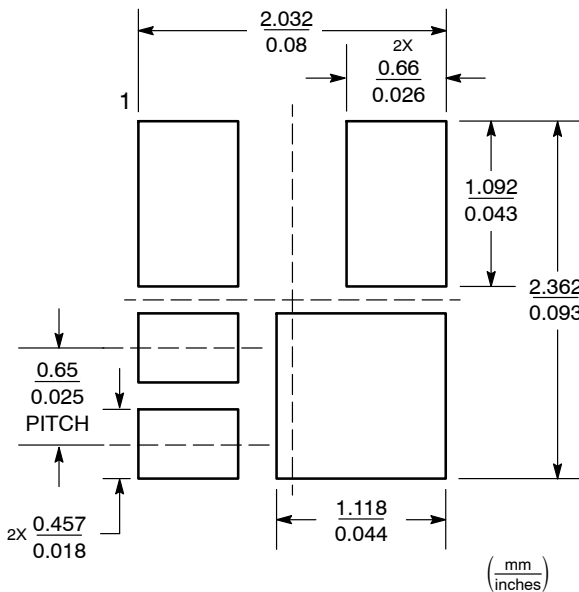
ADDITIONAL SOLDERING FOOTPRINTS\*



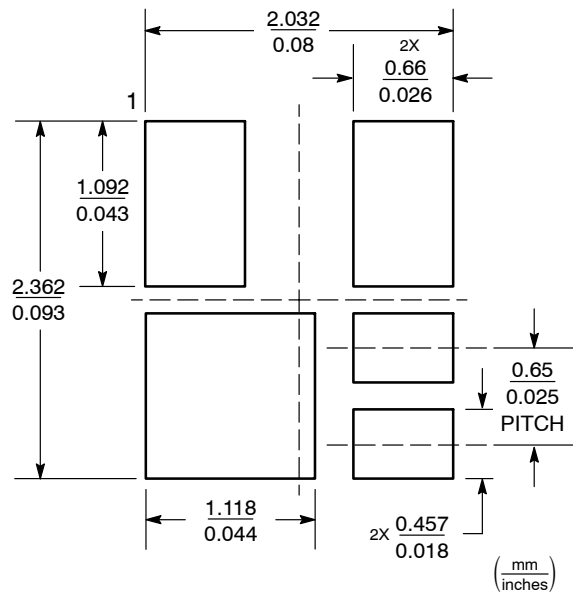
Styles 1 and 4



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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