

# NTHD4508N

## MOSFET – Power, Dual, N-Channel, ChipFET 20 V, 4.1 A

### Features

- Low  $R_{DS(on)}$  and Fast Switching Speed
- Leadless ChipFET Package has 40% Smaller Footprint than TSOP-6
- Excellent Thermal Capabilities Where Heat Transfer is Required
- Pb-Free Package is Available

### Applications

- DC-DC Buck/Boost Converters
- Battery and Low Side Switching in Portable Equipment Such as MP3 Players, Cell Phones, DSCs and PDAs
- Level Shifting

### 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		$V_{GS}$	$\pm 12$	V	
Continuous Drain Current	Steady State	$T_J = 25^\circ\text{C}$	$I_D$	3.0	A
		$T_J = 85^\circ\text{C}$		2.2	
	$t \leq 5\text{ s}$	$T_J = 25^\circ\text{C}$		4.1	
Power Dissipation	Steady State	$T_J = 25^\circ\text{C}$	$P_D$	1.13	W
		$T_J = 85^\circ\text{C}$		0.59	
	$t \leq 5\text{ s}$	$T_J = 25^\circ\text{C}$		2.1	
Pulsed Drain Current	$t_p = 10\ \mu\text{s}$	$I_{DM}$	12	A	
Operating Junction and Storage Temperature		$T_J, T_{STG}$	-55 to 150	$^\circ\text{C}$	
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)	$R_{\theta JA}$	110	$^\circ\text{C}/\text{W}$

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.

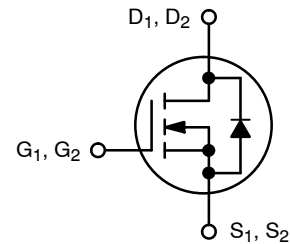
1. Surface Mounted on FR4 Board using 1 in sq pad size (Cu area = 1.27 in sq [1 oz] including traces).



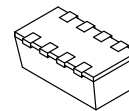
ON Semiconductor®

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$V_{(BR)DSS}$	$R_{DS(on)}$ TYP	$I_D$ MAX
20 V	60 m $\Omega$ @ 4.5 V	4.1 A
	80 m $\Omega$ @ 2.5 V	

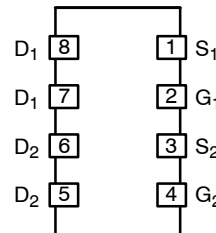


N-Channel MOSFET

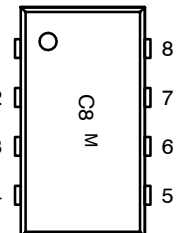


ChipFET  
CASE 1206A  
STYLE 2

### PIN CONNECTIONS



### MARKING DIAGRAM



C8 = Specific Device Code  
M = Month Code

### ORDERING INFORMATION

Device	Package	Shipping†
NTHD4508NT1	ChipFET	3000/Tape & Reel
NTHD4508NT1G	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.

# NTHD4508N

## ELECTRICAL CHARACTERISTICS (T<sub>J</sub> = 25°C unless otherwise noted)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
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### OFF CHARACTERISTICS

Drain-to-Source Breakdown Voltage	V <sub>(BR)DSS</sub>	V <sub>GS</sub> = 0 V	20			V
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 16 V			1.0	μA
		V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 16 V, T <sub>J</sub> = 125°C			10	
Gate-to-Source Leakage Current	I <sub>GSS</sub>	V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ±12 V			±100	nA

### ON CHARACTERISTICS (Note 2)

Gate Threshold Voltage	V <sub>GS(TH)</sub>	V <sub>GS</sub> = V <sub>DS</sub> , I <sub>D</sub> = 250 μA	0.6		1.2	V
Drain-to-Source On-Resistance	R <sub>DS(on)</sub>	V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 3.1 A		60	75	mΩ
		V <sub>GS</sub> = 2.5 V, I <sub>D</sub> = 2.3 A		80	115	
Forward Transconductance	g <sub>FS</sub>	V <sub>DS</sub> = 10 V, I <sub>D</sub> = 3.1 A		6.0		S

### CHARGES AND CAPACITANCES

Input Capacitance	C <sub>ISS</sub>	V <sub>GS</sub> = 0 V, f = 1.0 MHz, V <sub>DS</sub> = 10 V		180		pF
Output Capacitance	C <sub>OSS</sub>			80		
Reverse Transfer Capacitance	C <sub>RSS</sub>			25		
Total Gate Charge	Q <sub>G(TOT)</sub>	V <sub>GS</sub> = 4.5 V, V <sub>DS</sub> = 10 V, I <sub>D</sub> = 3.1 A		2.6	4.0	nC
Threshold Gate Charge	Q <sub>G(TH)</sub>			0.5		
Gate-to-Source Charge	Q <sub>GS</sub>			0.6		
Gate-to-Drain Charge	Q <sub>GD</sub>			0.7		

### SWITCHING CHARACTERISTICS (Note 3)

Turn-On Delay Time	t <sub>d(ON)</sub>	V <sub>GS</sub> = 4.5 V, V <sub>DS</sub> = 16 V, I <sub>D</sub> = 3.1 A, R <sub>G</sub> = 2.5 Ω		5.0	10	ns
Rise Time	t <sub>r</sub>			15	30	
Turn-Off Delay Time	t <sub>d(OFF)</sub>			10	20	
Fall Time	t <sub>f</sub>			3.0	6.0	

### DRAIN-SOURCE DIODE CHARACTERISTICS

Forward Diode Voltage	V <sub>SD</sub>	V <sub>GS</sub> = 0 V, I <sub>S</sub> = 3.1 A		0.75	1.15	V
Reverse Recovery Time	t <sub>RR</sub>	V <sub>GS</sub> = 0 V, I <sub>S</sub> = 1.5 A, di <sub>S</sub> /dt = 100 A/μs		12.5		ns
Charge Time	t <sub>a</sub>			9.0		
Discharge Time	t <sub>b</sub>			3.5		
Reverse Recovery Charge	Q <sub>RR</sub>			6.0		nC

2. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2%.

3. Switching characteristics are independent of operating junction temperatures.

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

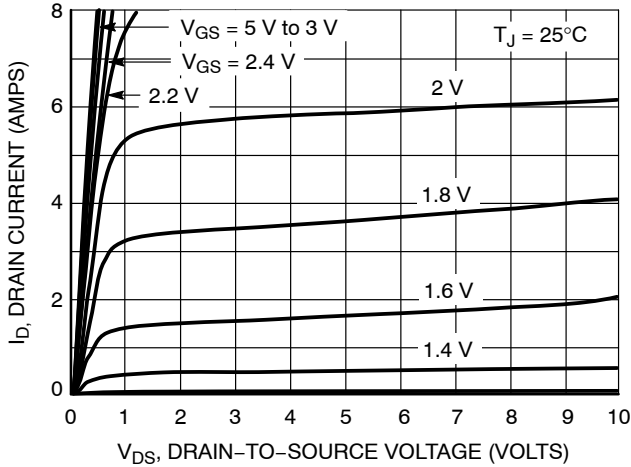


Figure 1. On-Region Characteristics

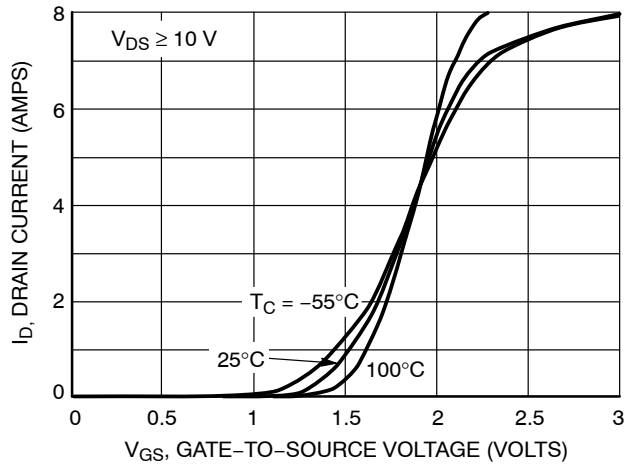


Figure 2. Transfer Characteristics

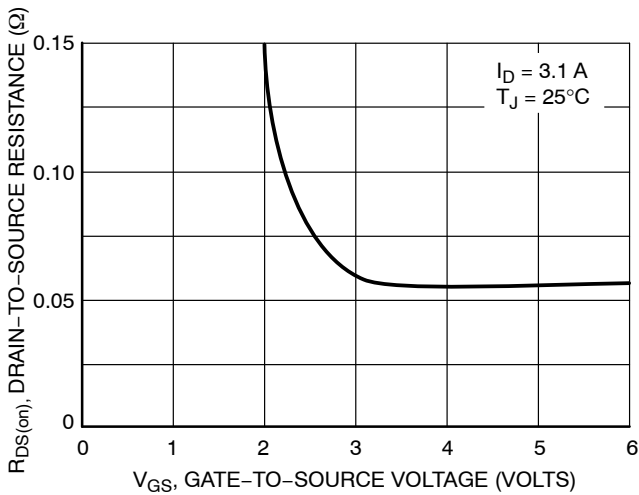


Figure 3. On-Resistance vs. Gate-to-Source Voltage

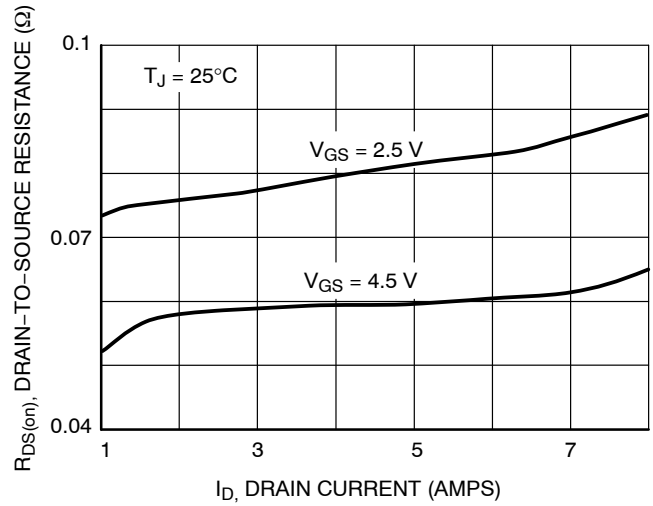


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

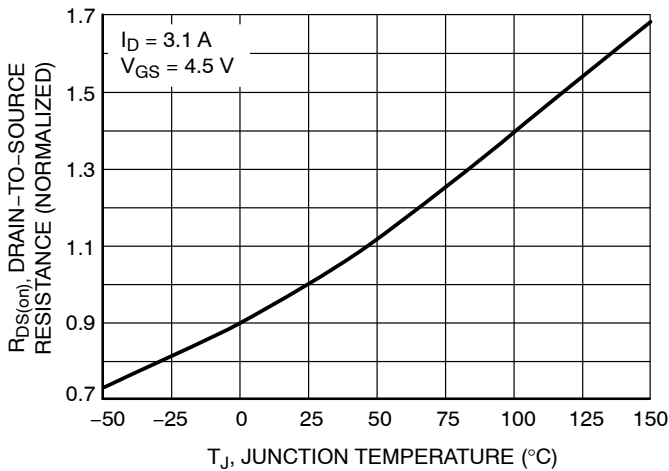


Figure 5. On-Resistance Variation with Temperature

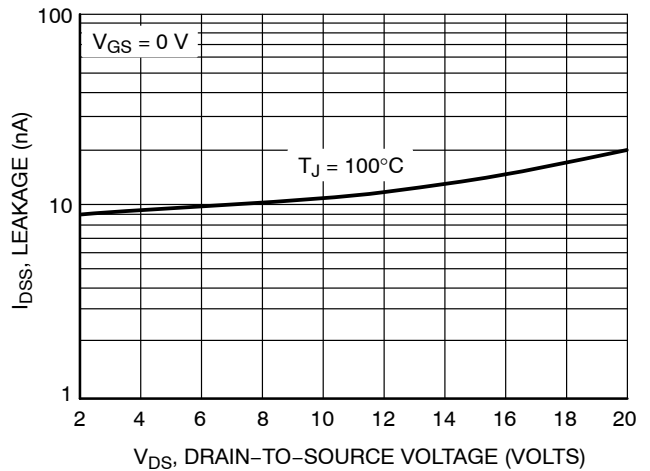


Figure 6. Drain-to-Source Leakage Current vs. Voltage

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

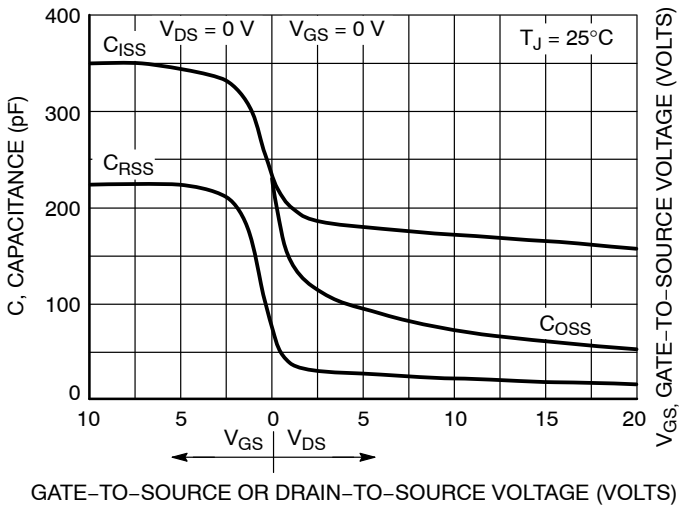


Figure 7. Capacitance Variation

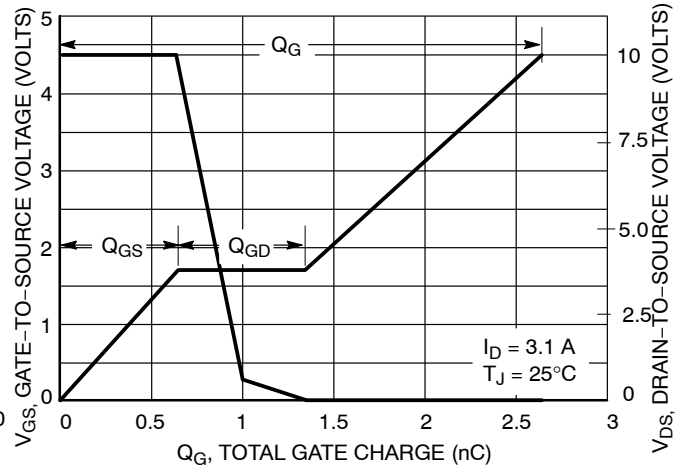


Figure 8. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge

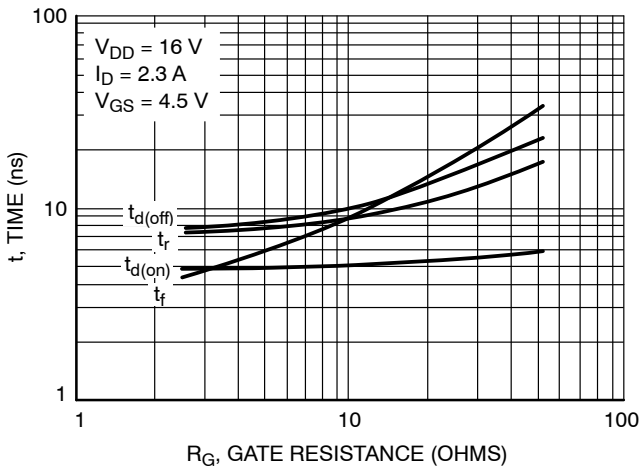


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

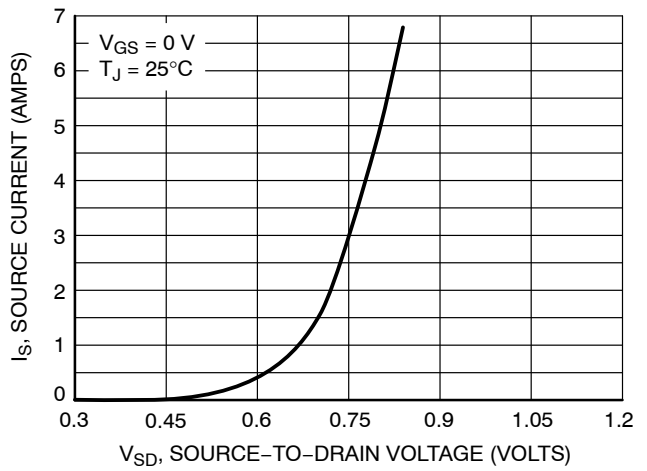


Figure 10. Diode Forward Voltage vs. Current

# NTHD4508N

## SOLDERING FOOTPRINTS\*

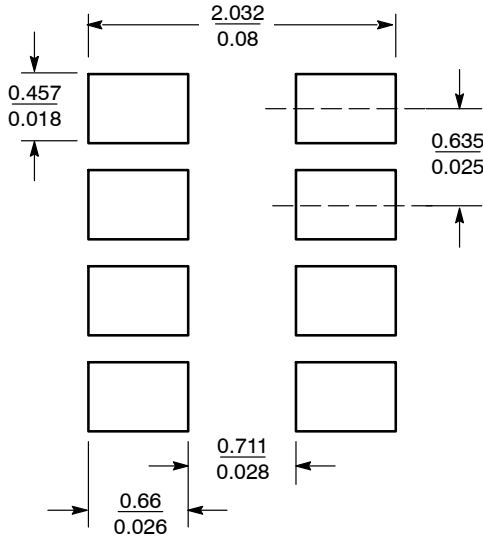


Figure 11. Basic

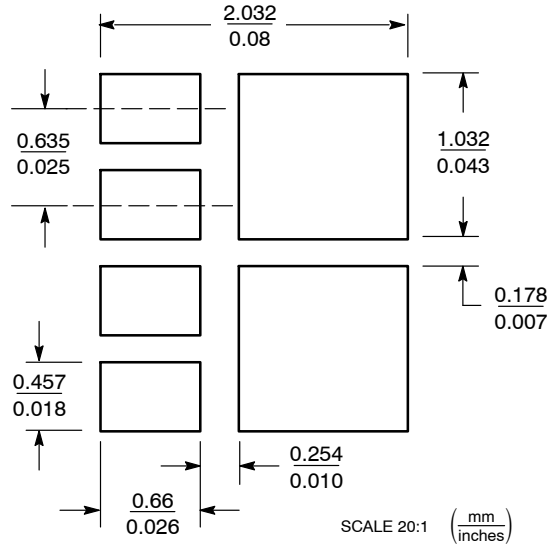


Figure 12. Style 2

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

## BASIC PAD PATTERNS

The basic pad layout with dimensions is shown in Figure 11. This is sufficient for low power dissipation MOSFET applications, but power semiconductor performance requires a greater copper pad area, particularly for the drain leads.

The minimum recommended pad pattern shown in Figure 12 improves the thermal area of the drain connections (pins 5, 6, 7, 8) while remaining within the confines of the basic

footprint. The drain copper area is 0.0019 sq. in. (or 1.22 sq. mm). This will assist the power dissipation path away from the device (through the copper lead-frame) and into the board and exterior chassis (if applicable) for the single device. The addition of a further copper area and/or the addition of vias to other board layers will enhance the performance still further.

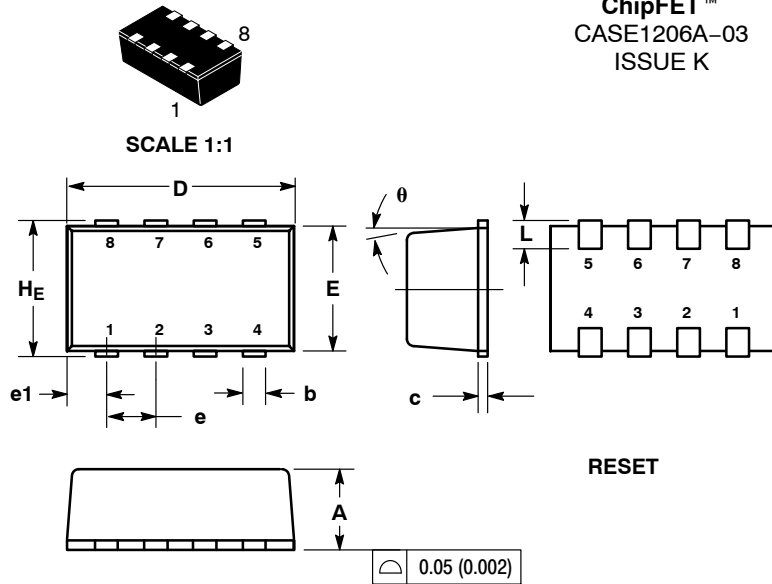
# MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS

ON Semiconductor®



## ChipFET™ CASE1206A-03 ISSUE K

DATE 19 MAY 2009



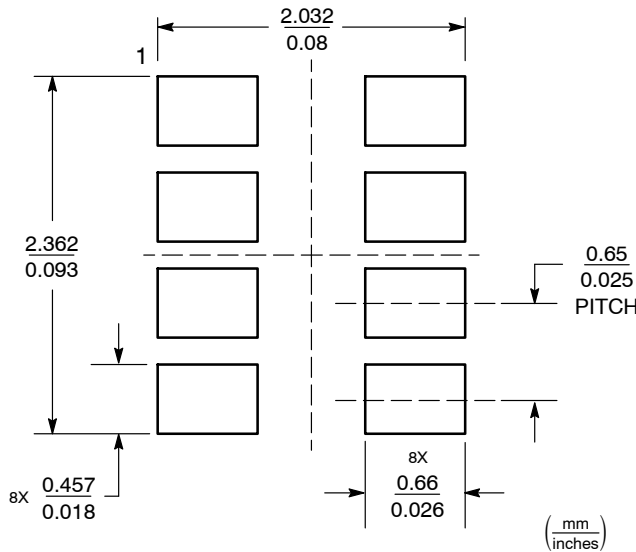
NOTES:

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
H <sub>E</sub>	1.80	1.90	2.00	0.071	0.075	0.079
θ	5° NOM			5° NOM		

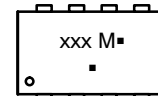
- |   |   |   |  |   |   |
|---|---|---|--|---|---|
| <b>STYLE 1:</b><br>PIN 1. DRAIN<br>2. DRAIN<br>3. DRAIN<br>4. GATE<br>5. SOURCE<br>6. DRAIN<br>7. DRAIN<br>8. DRAIN | <b>STYLE 2:</b><br>PIN 1. SOURCE 1<br>2. GATE 1<br>3. SOURCE 2<br>4. GATE 2<br>5. DRAIN 2<br>6. DRAIN 2<br>7. DRAIN 1<br>8. DRAIN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

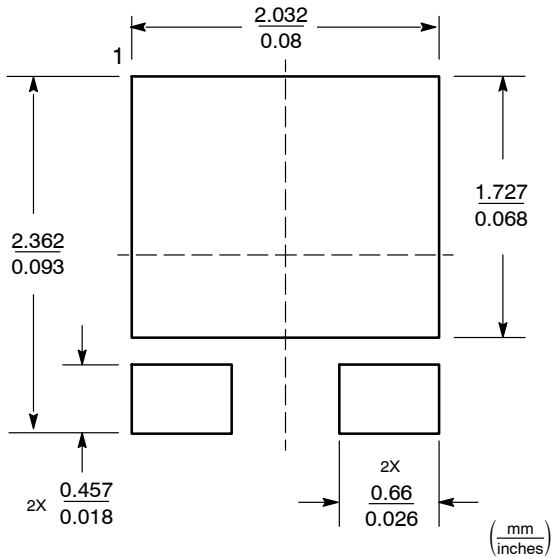
\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "▪", may or may not be present.

### OPTIONAL SOLDERING FOOTPRINTS ON PAGE 2

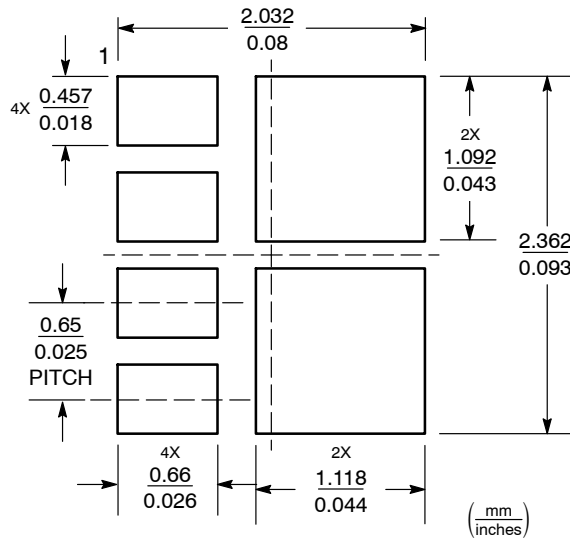
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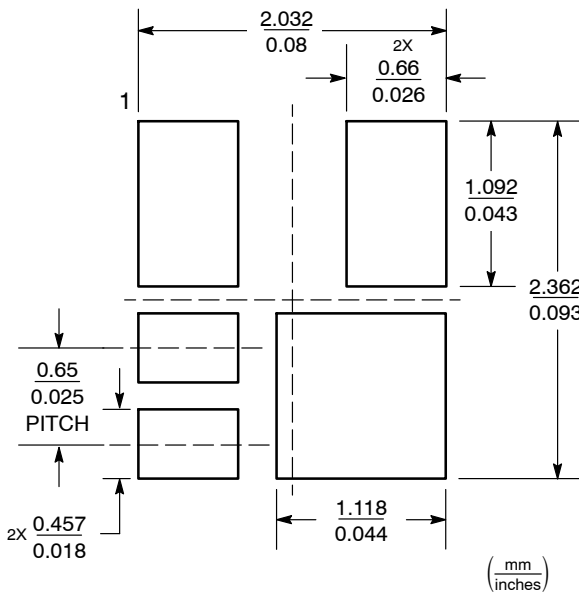
ADDITIONAL SOLDERING FOOTPRINTS\*



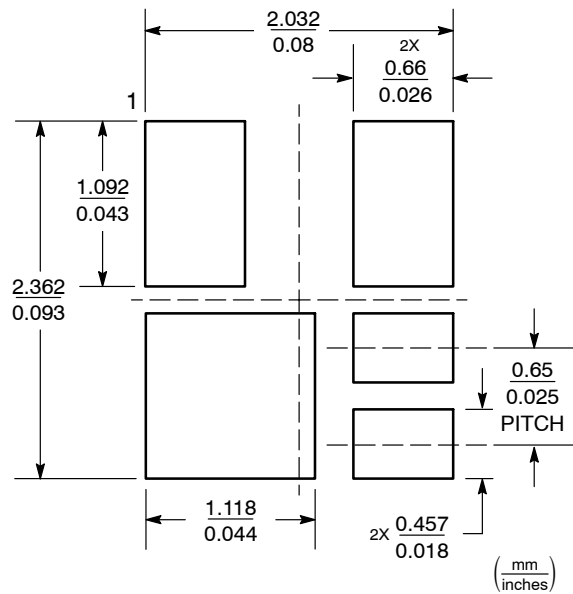
Styles 1 and 4



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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