

# NTHS5441

## MOSFET – Power, P-Channel, ChipFET

**-20 V, -5.3 A**

### Features

- Low  $R_{DS(on)}$
- Higher Efficiency Extending Battery Life
- Logic Level Gate Drive
- Miniature ChipFET Surface Mount Package
- Pb-Free Package is Available

### Applications

- Power Management in Portable and Battery-Powered Products; i.e., Cellular and Cordless Telephones and PCMCIA Cards

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

| Rating   | Symbol         | 5 sec        | Steady State | Unit             |
|--|----------------|--------------|--------------|------------------|
| Drain-Source Voltage   | $V_{DS}$       | -20          |              | V                |
| Gate-Source Voltage  | $V_{GS}$       | $\pm 12$     |              | V                |
| Continuous Drain Current<br>( $T_J = 150^\circ\text{C}$ ) (Note 1)<br>$T_A = 25^\circ\text{C}$<br>$T_A = 85^\circ\text{C}$ | $I_D$          | -5.3<br>-3.8 | -3.9<br>-2.8 | A                |
| Pulsed Drain Current   | $I_{DM}$       | $\pm 20$     |              | A                |
| Continuous Source Current<br>(Note 1)  | $I_S$          | -5.3         | -3.9         | A                |
| Maximum Power Dissipation<br>(Note 1)<br>$T_A = 25^\circ\text{C}$<br>$T_A = 85^\circ\text{C}$                              | $P_D$          | 2.5<br>1.3   | 1.3<br>0.7   | W                |
| Operating Junction and Storage<br>Temperature Range  | $T_J, T_{stg}$ | -55 to +150  |              | $^\circ\text{C}$ |

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.

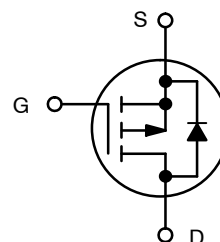
1. Surface Mounted on FR4 Board using 1 in sq pad size (Cu area = 1.27 in sq [1 oz] including traces).



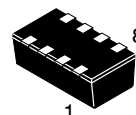
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| $V_{(BR)DSS}$ | $R_{DS(on)}$ TYP       | $I_D$ MAX |
|---------------|------------------------|-----------|
| -20 V         | 46 m $\Omega$ @ -4.5 V | -5.3 A    |

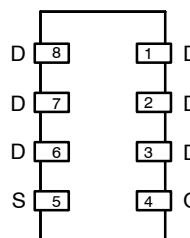


**P-Channel MOSFET**

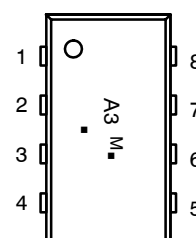


**ChipFET  
CASE 1206A  
STYLE 1**

### PIN CONNECTIONS



### MARKING DIAGRAM



A3 = Specific Device Code

M = Month Code

■ = Pb-Free Package

(Note: Microdot may be in either location)

### ORDERING INFORMATION

| Device      | Package           | Shipping†        |
|-------------|-------------------|------------------|
| NTHS5441T1  | ChipFET           | 3000/Tape & Reel |
| NTHS5441T1G | 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.

# THERMAL CHARACTERISTICS

| Characteristic   | Symbol          | Typ      | Max      | Unit                 |
|--|-----------------|----------|----------|----------------------|
| Maximum Junction-to-Ambient (Note 2)<br>$t \leq 5$ sec<br>Steady State | $R_{\theta JA}$ | 40<br>80 | 50<br>95 | $^{\circ}\text{C/W}$ |
| Maximum Junction-to-Foot (Drain)<br>Steady State                       | $R_{\theta JF}$ | 15       | 20       | $^{\circ}\text{C/W}$ |

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

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

## Static

|   |              |  |        |                |           |               |
|---|--------------|--|--------|----------------|-----------|---------------|
| Gate Threshold Voltage                    | $V_{GS(th)}$ | $V_{DS} = V_{GS}, I_D = -250 \mu\text{A}$  | -0.6   |                | -1.2      | V             |
| Gate-Body Leakage                         | $I_{GSS}$    | $V_{DS} = 0 \text{ V}, V_{GS} = \pm 12 \text{ V}$  |        |                | $\pm 100$ | nA            |
| Zero Gate Voltage Drain Current           | $I_{DSS}$    | $V_{DS} = -16 \text{ V}, V_{GS} = 0 \text{ V}$   |        |                | -1.0      | $\mu\text{A}$ |
|   |              | $V_{DS} = -16 \text{ V}, V_{GS} = 0 \text{ V}, T_J = 85^{\circ}\text{C}$                           |        |                | -5.0      |               |
| On-State Drain Current (Note 3)           | $I_{D(on)}$  | $V_{DS} \leq -5.0 \text{ V}, V_{GS} = -4.5 \text{ V}$  | -20    |                |           | A             |
| Drain-Source On-State Resistance (Note 3) | $r_{DS(on)}$ | $V_{GS} = -3.6 \text{ V}, I_D = -3.7 \text{ A}$<br>$V_{GS} = -4.5 \text{ V}, I_D = -3.9 \text{ A}$ | -<br>- | 0.050<br>0.046 | 0.06<br>- | $\Omega$      |
|   |              | $V_{GS} = -2.5 \text{ V}, I_D = -3.1 \text{ A}$  |        | 0.070          | 0.083     |               |
| Forward Transconductance (Note 3)         | $g_{fs}$     | $V_{DS} = -10 \text{ V}, I_D = -3.9 \text{ A}$   |        | 12             |           | mhos          |
| Diode Forward Voltage (Note 3)            | $V_{SD}$     | $I_S = -2.1 \text{ A}, V_{GS} = 0 \text{ V}$   |        | -0.8           | -1.2      | V             |

## Dynamic (Note 4)

|                                    |              |   |  |     |     |    |
|------------------------------------|--------------|---|--|-----|-----|----|
| Total Gate Charge                  | $Q_G$        | $V_{DS} = -10 \text{ V}, V_{GS} = -4.5 \text{ V}, I_D = -3.9 \text{ A}$   |  | 9.7 | 22  | nC |
| Gate-Source Charge                 | $Q_{GS}$     |   |  | 1.2 |     |    |
| Gate-Drain Charge                  | $Q_{GD}$     |   |  | 3.6 |     |    |
| Input Capacitance                  | $C_{iss}$    | $V_{DS} = -5.0 \text{ Vdc}, V_{GS} = 0 \text{ Vdc}, f = 1.0 \text{ MHz}$  |  | 710 |     | pF |
| Output Capacitance                 | $C_{oss}$    |   |  | 400 |     |    |
| Reverse Transfer Capacitance       | $C_{rss}$    |   |  | 140 |     |    |
| Turn-On Delay Time                 | $t_{d(on)}$  | $V_{DD} = -10 \text{ V}, R_L = 10 \Omega$<br>$I_D \cong -1.0 \text{ A}, V_{GEN} = -4.5 \text{ V}, R_G = 6 \Omega$ |  | 14  | 30  | ns |
| Rise Time                          | $t_r$        |   |  | 22  | 55  |    |
| Turn-Off Delay Time                | $t_{d(off)}$ |   |  | 42  | 100 |    |
| Fall Time                          | $t_f$        |   |  | 35  | 70  |    |
| Source-Drain Reverse Recovery Time | $t_{rr}$     | $I_F = -1.1 \text{ A}, di/dt = 100 \text{ A}/\mu\text{s}$   |  | 30  | 60  |    |

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

3. Pulse Test: Pulse Width  $\leq 300 \mu\text{s}$ , Duty Cycle  $\leq 2\%$ .

4. Guaranteed by design, not subject to production testing.

Typical Electrical Characteristics

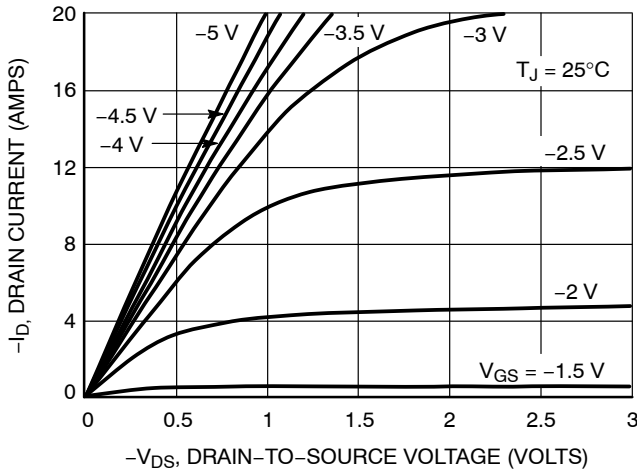


Figure 1. On-Region Characteristics

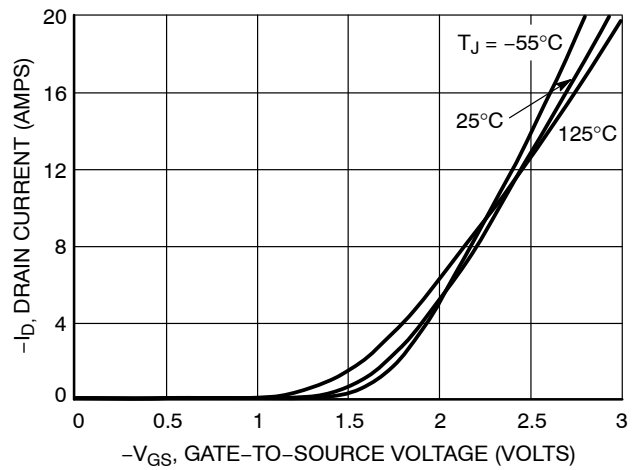


Figure 2. Transfer Characteristics

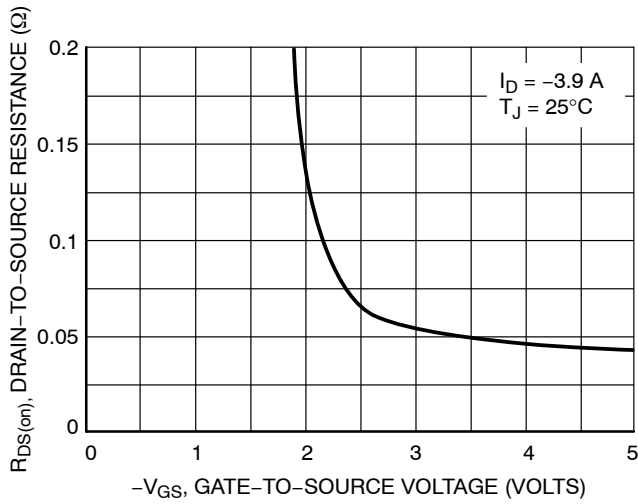


Figure 3. On-Resistance versus Gate-to-Source Voltage

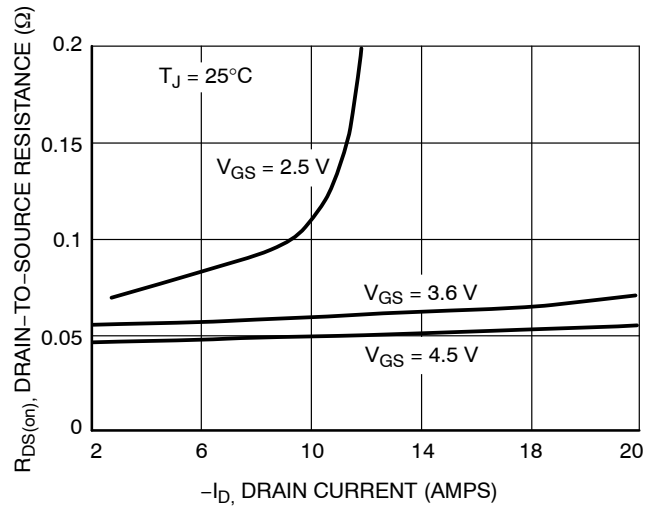


Figure 4. On-Resistance versus Drain Current and Gate Voltage

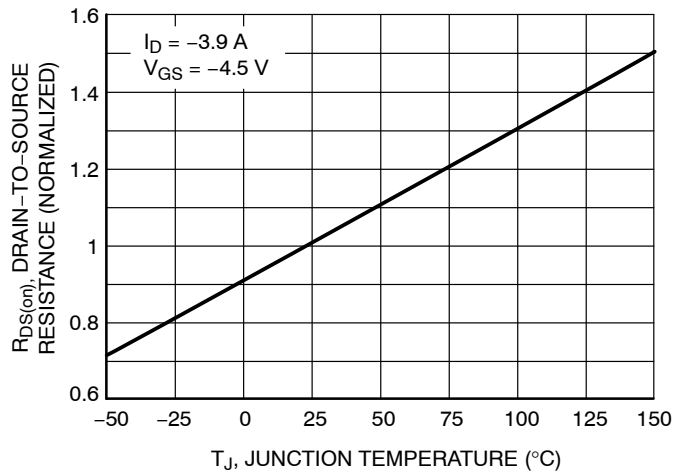


Figure 5. On-Resistance Variation with Temperature

TYPICAL ELECTRICAL CHARACTERISTICS

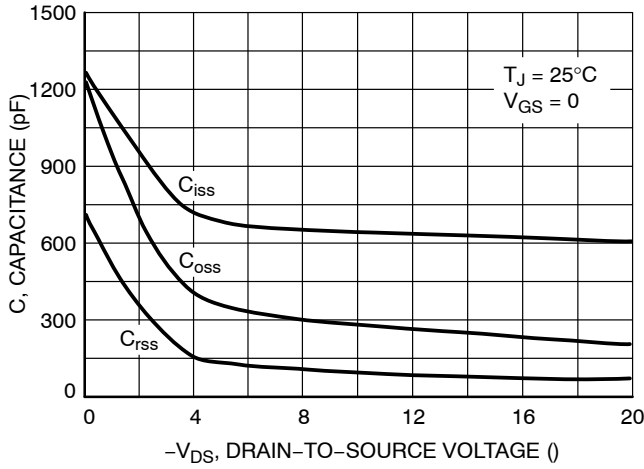


Figure 6. Capacitance Variation

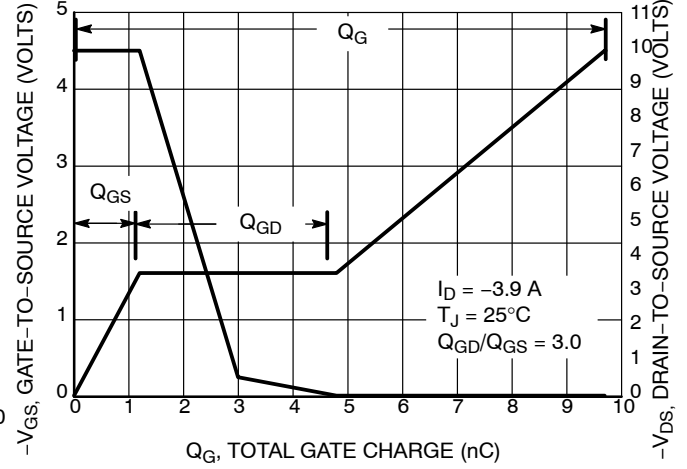


Figure 7. Gate-to-Source and Drain-to-Source Voltage versus Total Charge

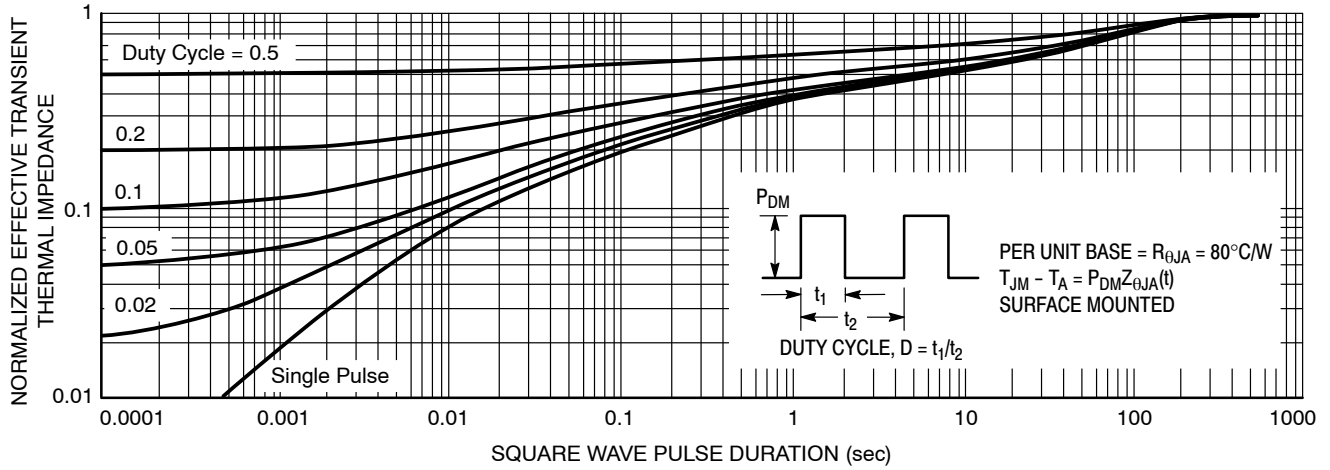


Figure 8. Normalized Thermal Transient Impedance, Junction-to-Ambient

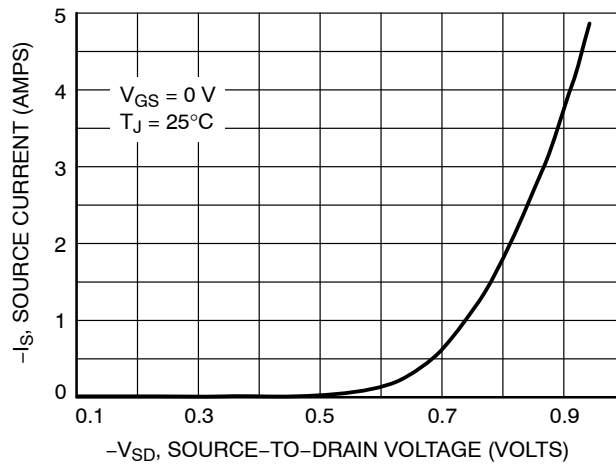


Figure 9. Diode Forward Voltage versus Current

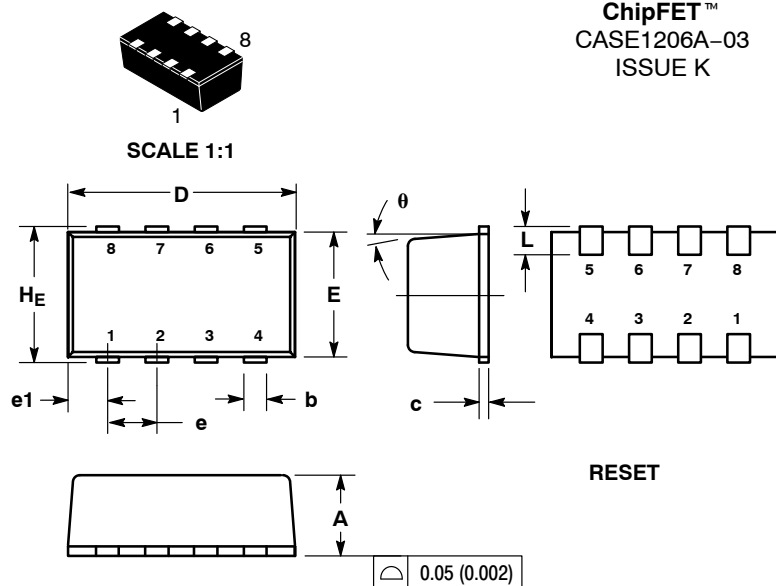
# MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS

ON Semiconductor®



ChipFET™  
CASE1206A-03  
ISSUE K

DATE 19 MAY 2009

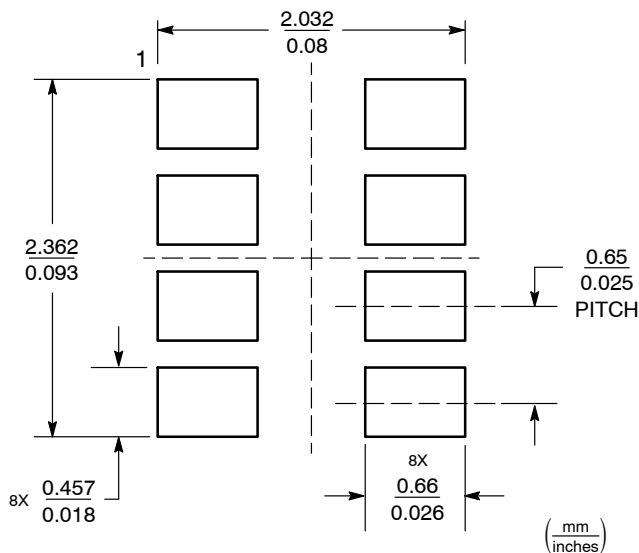


- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: MILLIMETER.
  3. MOLD GATE BURRS SHALL NOT EXCEED 0.13 MM PER SIDE.
  4. LEADFRAME TO MOLDED BODY OFFSET IN HORIZONTAL AND VERTICAL SHALL NOT EXCEED 0.08 MM.
  5. DIMENSIONS A AND B EXCLUSIVE OF MOLD GATE BURRS.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

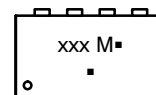
|  |  |  |   |  |  |
|--|--|--|---|--|--|
| STYLE 1:<br>PIN 1. DRAIN<br>2. DRAIN<br>3. DRAIN<br>4. GATE<br>5. SOURCE<br>6. DRAIN<br>7. DRAIN<br>8. DRAIN | STYLE 2:<br>PIN 1. SOURCE 1<br>2. GATE 1<br>3. SOURCE 2<br>4. GATE 2<br>5. DRAIN 2<br>6. DRAIN 2<br>7. DRAIN 1<br>8. DRAIN 1 | STYLE 3:<br>PIN 1.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

## SOLDERING FOOTPRINT



Basic Style

## GENERIC MARKING DIAGRAM\*



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

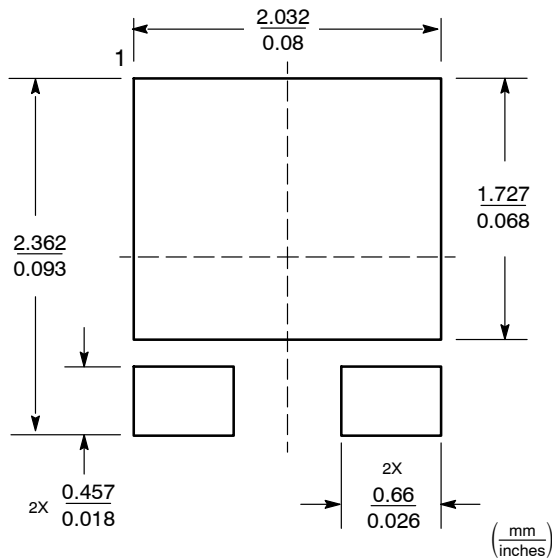
\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "▪", may or may not be present.

## OPTIONAL SOLDERING FOOTPRINTS ON PAGE 2

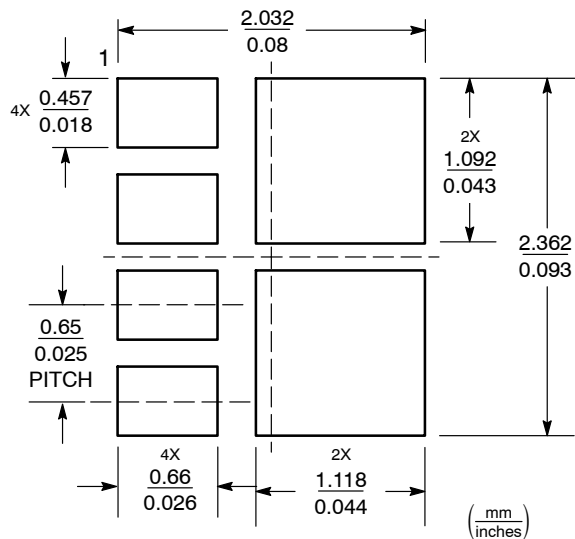
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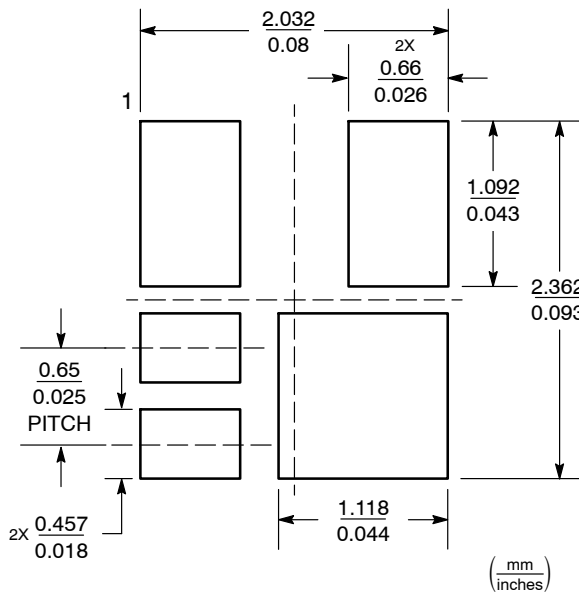
ADDITIONAL SOLDERING FOOTPRINTS\*



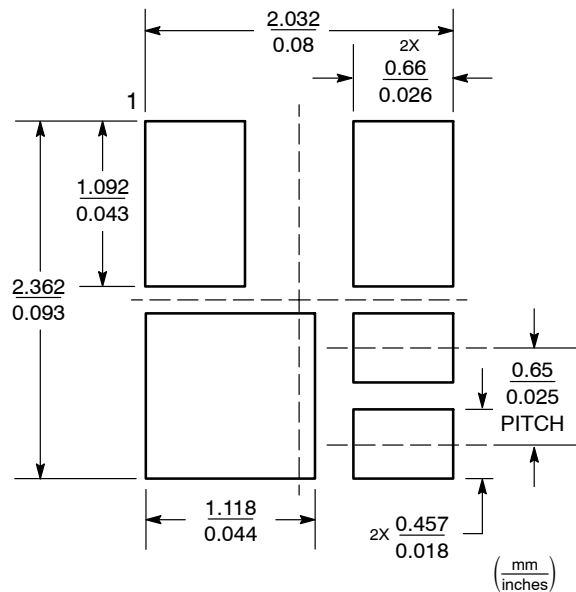
Styles 1 and 4



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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