NTHS5404T1

MOSFET – Power, N-Channel, ChipFET

20 V, 7.2 A

Features
- Low $R_{DS(on)}$ for Higher Efficiency
- Logic Level Gate Drive
- Miniature ChipFET Surface Mount Package Saves Board Space
- 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°C unless otherwise noted)

Rating	Symbol	5 Secs	Steady State	Unit
Drain−Source Voltage	V_{DS}	20		V
Gate−Source Voltage	V_{GS}	± 12		V
Continuous Drain Current (T_J = 150°C) (Note 1) T_A = 25°C T_A = 85°C	I_D	 7.2 5.2	 5.2 3.8	A
Pulsed Drain Current	I_{DM}	± 20		A
Continuous Source Current (Diode Conduction) (Note 1)	I_S	7.2	5.2	A
Maximum Power Dissipation (Note 1) T_A = 25°C T_A = 85°C	P_D	 2.5 1.3	 1.3 0.7	W
Operating Junction and Storage Temperature Range	T_J, T_{stg}	−55 to +150		°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.
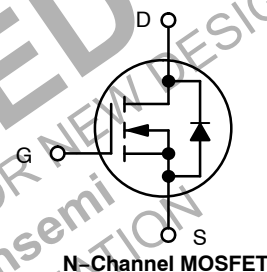
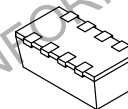1. Surface Mounted on FR4 board using 1 in sq pad size (Cu area = 1.127 in sq [1 oz] including traces).

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$V_{(BR)DSS}$	$R_{DS(on)}$ TYP	I_D MAX
20 V	25 mΩ @ 4.5 V	7.2 A

N−Channel MOSFET

ChipFET CASE 1206A STYLE 1

PIN CONNECTIONS

D [8]	[1] D
D [7]	[2] D
D [6]	[3] D
S [5]	[4] G
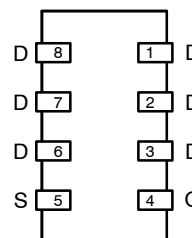
MARKING DIAGRAM

A2 M
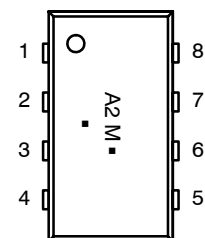
A2 = Specific Device Code
M = Month Code
■ = Pb−Free Package
(Note: Microdot may be in either location)

ORDERING INFORMATION

Device	Package	Shipping†
NTHS5404T1	ChipFET	3000/Tape & Reel
NTHS5404T1G	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.

Publication Order Number:
NTHS5404T1/D

NTHS5404T1

THERMAL CHARACTERISTICS

Characteristic	Symbol	Typ	Max	Unit
Maximum Junction−to−Ambient (Note 2) t ≤ 5 sec Steady State	$R_{\theta JA}$	40 80	50 95	°C/W
Maximum Junction−to−Foot (Drain) Steady State	$R_{\theta JF}$	15	20	°C/W

ELECTRICAL CHARACTERISTICS (T_J = 25°C unless otherwise noted)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
DYNAMIC (Note 4)						
Total Gate Charge	Q_G	V_{DS} = 10 V, V_{GS} = 4.5 V, I_D = 5.2 A		12	18	nC
Gate−Source Charge	Q_{GS}			2.4		
Gate−Drain Charge	Q_{GD}			3.2		
Input Capacitance	C_{ISS}	V_{DS} = 16 V, V_{GS} = 0 V, f = 1.0 MHz		740		pF
Output Capacitance	C_{OSS}			337		
Reverse Transfer Capacitance	C_{RSS}			88		
Turn−On Delay Time	$t_{d(on)}$	V_{DD} = 10 V, R_L = 10 Ω I_D ≅ 1.0 A, V_{GEN} = 4.5 V, R_G = 6 Ω		8.0	15	ns
Rise Time	t_r			7.0	15	
Turn−Off Delay Time	$t_{d(off)}$			50	60	
Fall Time	t_f			28	40	
STATIC						
Drain−to−Source Breakdown Voltage (Note 3)	$V_{(BR)DSS}$	V_{DS} = V_{GS}, I_D = 250 μA	20	25.1		V
Drain−to−Source Breakdown Voltage Temperature Coefficient	$V_{(BR)DSS}/T_J$			18.4		mV/°C
Gate Threshold Voltage	$V_{GS(th)}$	V_{DS} = V_{GS}, I_D = 250 μA	0.6			V
Gate−Body Leakage	I_{GSS}	V_{DS} = 0 V, V_{GS} = ±12 V			±100	nA
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS} = 16 V, V_{GS} = 0 V			1.0	μA
		V_{DS} = 16 V, V_{GS} = 0 V, T_J = 85°C			5.0	
On−State Drain Current (Note 3)	$I_{D(on)}$	V_{DS} ≥ 5.0 V, V_{GS} = 4.5 V	20			A
Drain−Source On−State Resistance (Note 3)	$r_{DS(on)}$	V_{GS} = 4.5 V, I_D = 5.2 A		0.025	0.030	Ω
		V_{GS} = 2.5 V, I_D = 4.3 A		0.038	0.045	
Forward Transconductance (Note 3)	g_{fs}	V_{DS} = 10 V, I_D = 5.2 A		20		S
DRAIN−SOURCE DIODE CHARACTERISTICS						
Forward Diode Voltage (Note 3)	V_{SD}	V_{GS} = 0 V, I_S = 5.2 A		0.8	1.2	V
Reverse Recovery Time	t_{rr}	V_{GS} = 0 V, I_S = 5.2 A, di_S/dt = 100 A/μs		20.9		ns
Charge Time	t_a			10.2		
Discharge Time	t_b			10.6		
Reverse Recovery Time	Q_{rr}			11		nC

2. Surface Mounted on FR4 board using 1 in sq pad size (Cu area = 1.127 in sq [1 oz] including traces).
3. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2%.
4. Guaranteed by design, not subject to production testing.
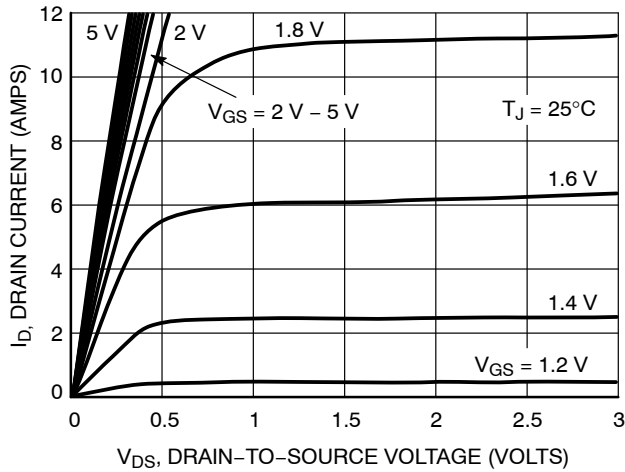
TYPICAL ELECTRICAL CHARACTERISTICS
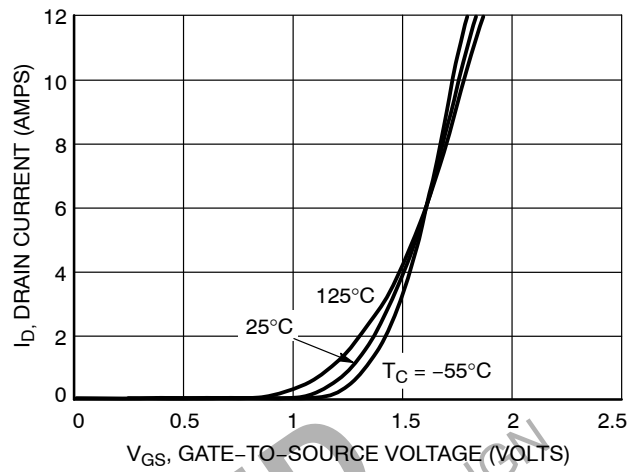

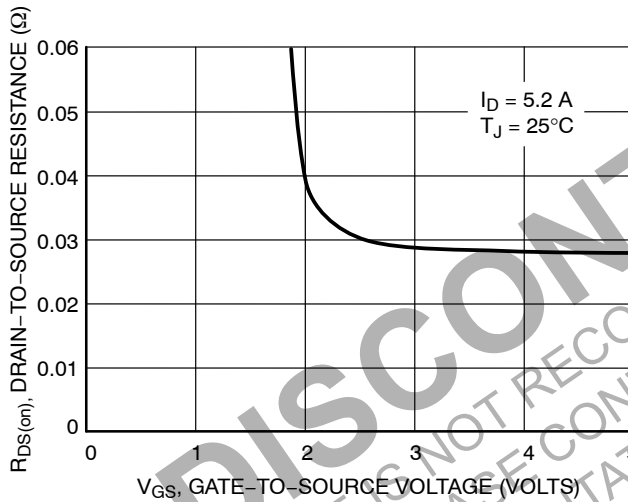**Figure 1. On−Region Characteristics**

Figure 2. Transfer Characteristics

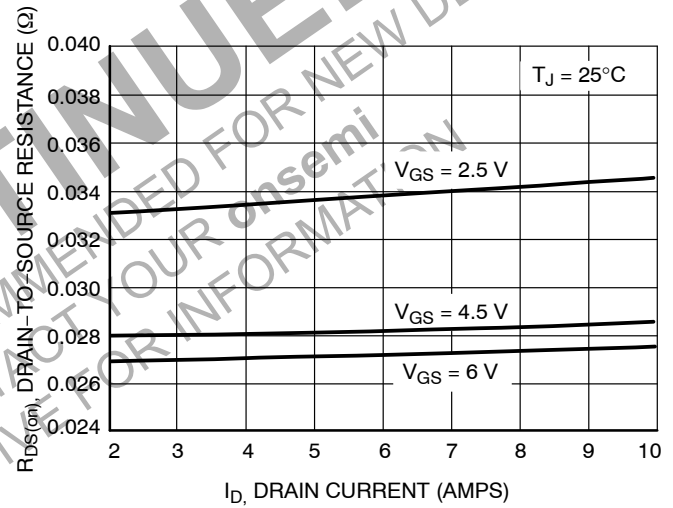**Figure 3. On−Resistance versus
Gate−to−Source Voltage**
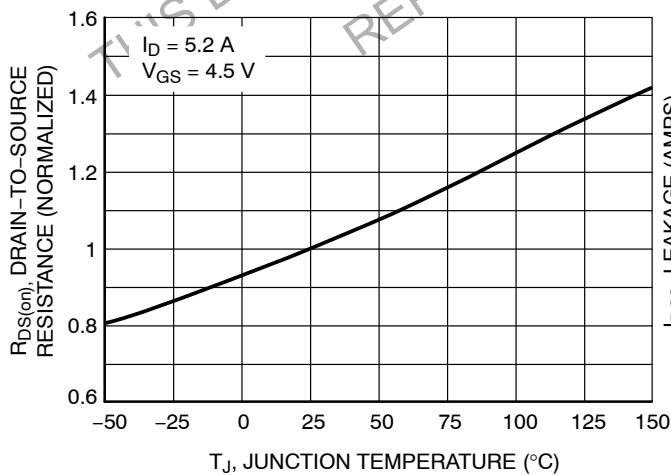

**Figure 4. On−Resistance versus Drain Current
and Gate Voltage**

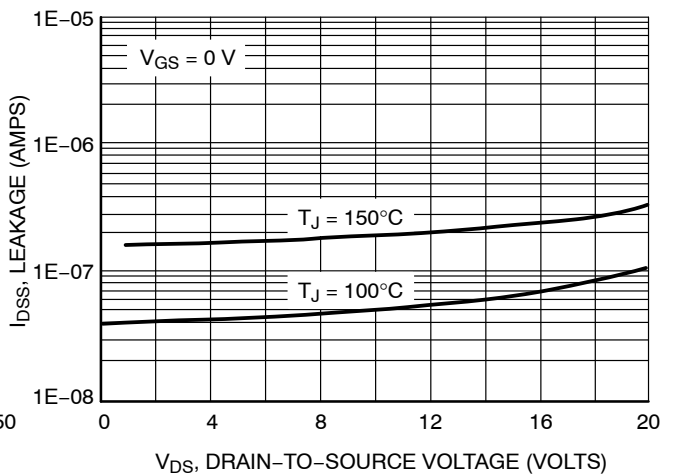**Figure 5. On−Resistance Variation with
Temperature**

**Figure 6. Drain−to−Source Leakage Current
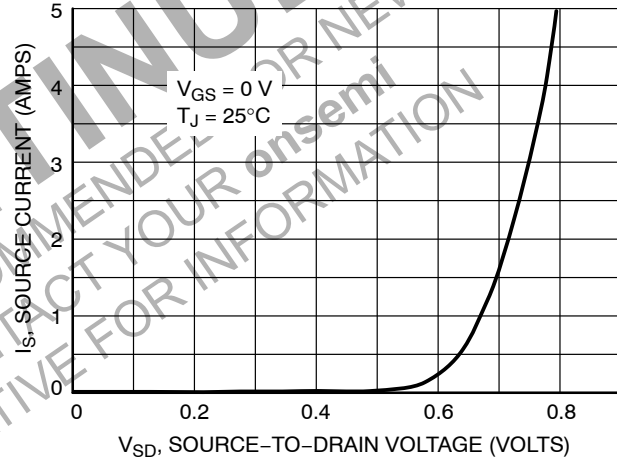versus Voltage**

NTHS5404T1

TYPICAL ELECTRICAL CHARACTERISTICS

Figure 7. Capacitance Variation

Figure 8. Gate−to−Source and Drain−to−Source Voltage versus Total Charge

Figure 9. Resistive Switching Time Variation versus Gate Resistance

Figure 10. Diode Forward Voltage versus Current

Figure 11. Normalized Thermal Transient Impedance, Junction−to−Ambient

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
Downloaded from Arrow.com.

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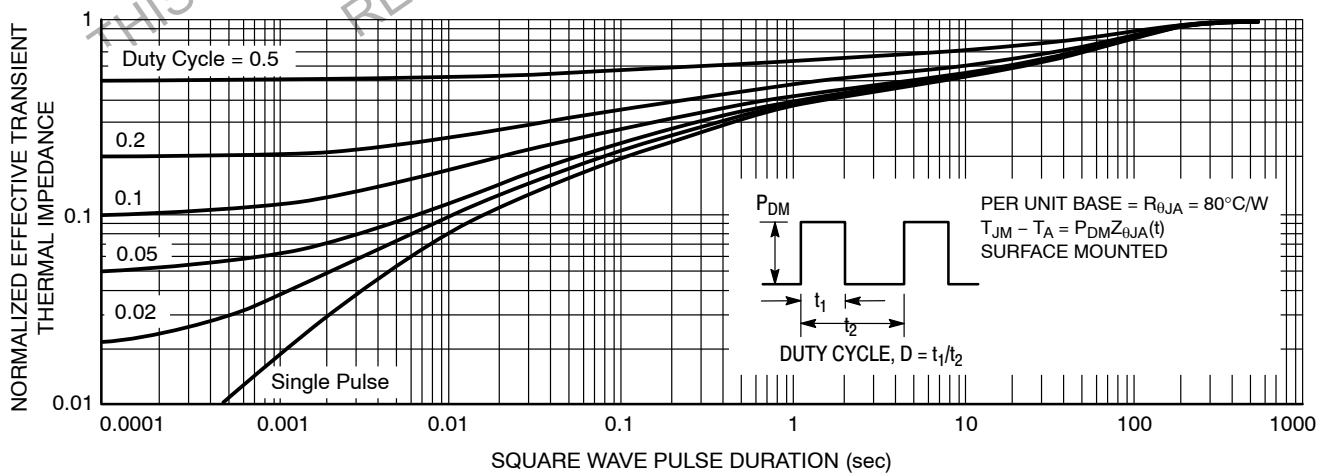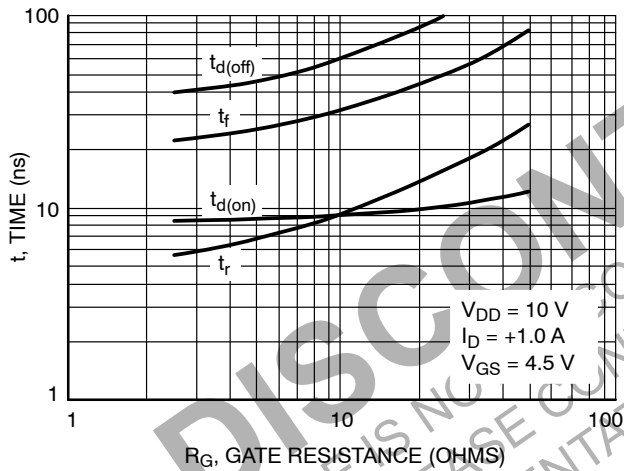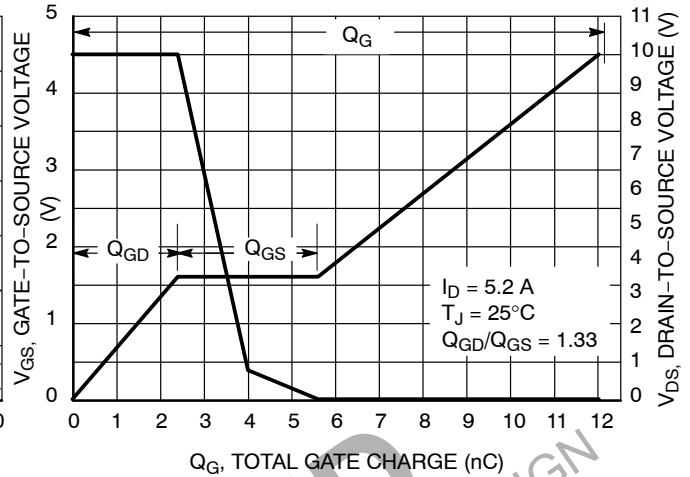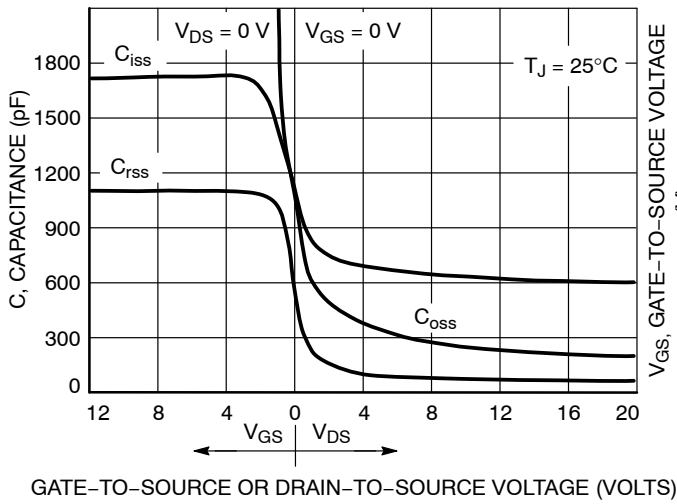
SOLDERING FOOTPRINT*
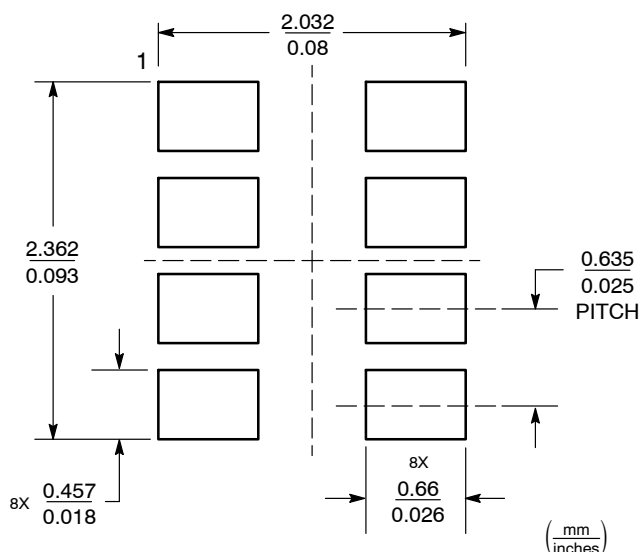
Figure 12. Basic
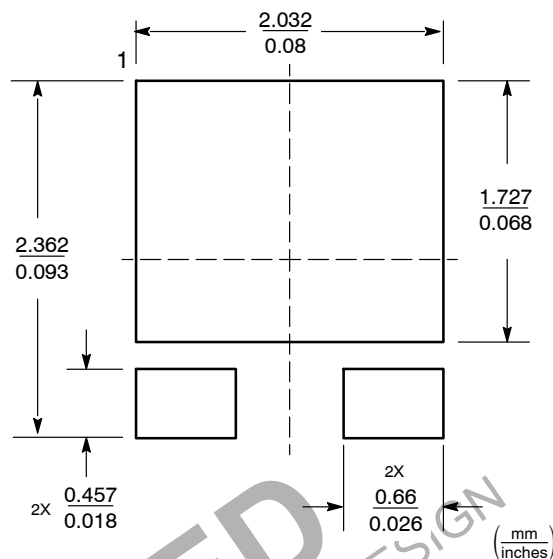
Figure 13. Style 1 and 4

ADDITIONAL SOLDERING FOOTPRINTS*
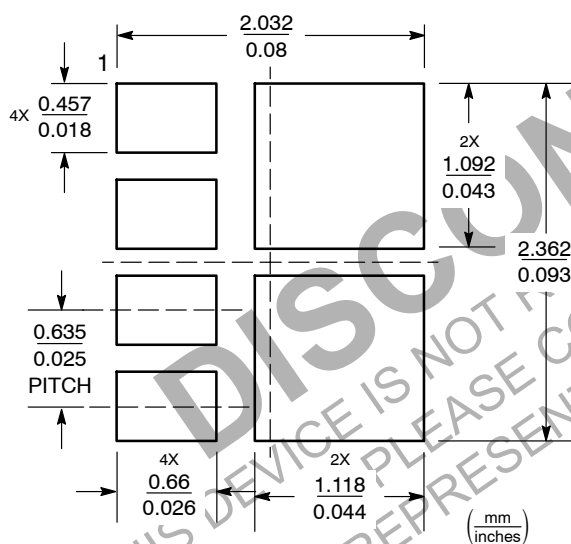
Style 2
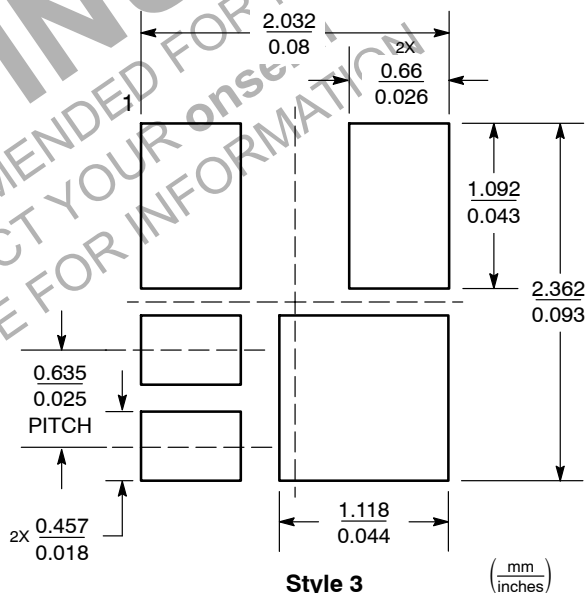
Style 3

*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 12. 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 13 improves the thermal area of the drain connections (pins 1, 2, 3, 6, 7, 8) while remaining within the confines of the basic footprint. The drain copper area is 0.0054 sq. in. (or 3.51 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.

ChipFET™
CASE1206A−03
ISSUE K

DATE 19 MAY 2009

SCALE 1:1

RESET
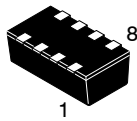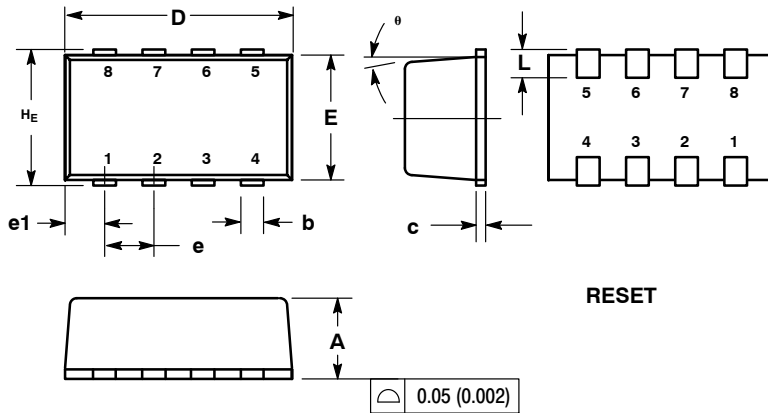
NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. MOLD GATE BURRS SHALL NOT EXCEED 0.13 MM PER SIDE.
4. LEADFRAME TO MOLDED BODY OFFSET IN HORIZONTAL AND VERTICAL SHALL NOT EXCEED 0.08 MM.
5. DIMENSIONS A AND B EXCLUSIVE OF MOLD GATE BURRS.
6. NO MOLD 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_E	1.80	1.90	2.00	0.071	0.075	0.079
θ	5° NOM			5° NOM		

	0.05 (0.002)

STYLE 1:
PIN 1. DRAIN
2. DRAIN
3. DRAIN
4. GATE
5. SOURCE
6. DRAIN
7. DRAIN
8. DRAIN

STYLE 2:
PIN 1. SOURCE 1
2. GATE 1
3. SOURCE 2
4. GATE 2
5. DRAIN 2
6. DRAIN 2
7. DRAIN 1
8. DRAIN 1

STYLE 3:
PIN 1. ANODE
2. ANODE
3. SOURCE
4. GATE
5. DRAIN
6. DRAIN
7. CATHODE
8. CATHODE

STYLE 4:
PIN 1. COLLECTOR
2. COLLECTOR
3. COLLECTOR
4. BASE
5. EMITTER
6. COLLECTOR
7. COLLECTOR
8. COLLECTOR

STYLE 5:
PIN 1. ANODE
2. ANODE
3. DRAIN
4. DRAIN
5. SOURCE
6. GATE
7. CATHODE
8. CATHODE

STYLE 6:
PIN 1. ANODE
2. DRAIN
3. DRAIN
4. GATE
5. SOURCE
6. DRAIN
7. DRAIN
8. CATHODE / DRAIN

SOLDERING FOOTPRINT

2.032 / 0.08

2.362 / 0.093

0.65 / 0.025 PITCH

8X 0.457 / 0.018

8X 0.66 / 0.026

(mm / inches)

Basic Style

GENERIC MARKING DIAGRAM*

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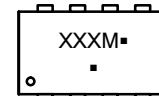
XXX = Specific Device Code
M = Month Code
▪ = Pb−Free Package
(Note: Microdot may be in either location)

*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

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DESCRIPTION:	ChipFET		PAGE 1 OF 2

ChipFET™
CASE 1206A−03
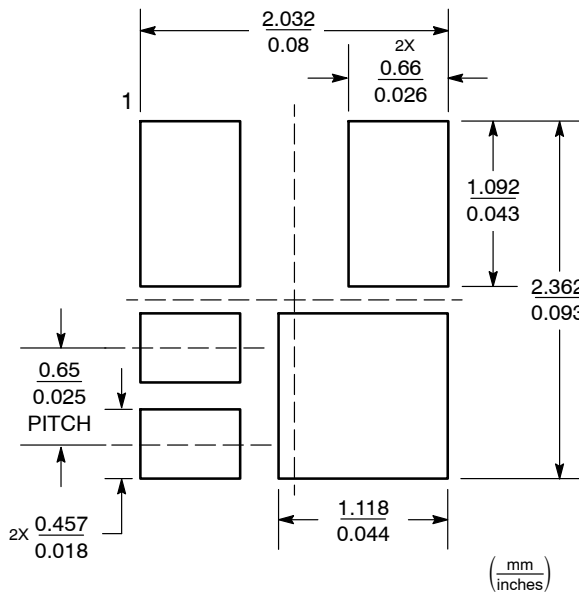ISSUE K

DATE 19 MAY 2009

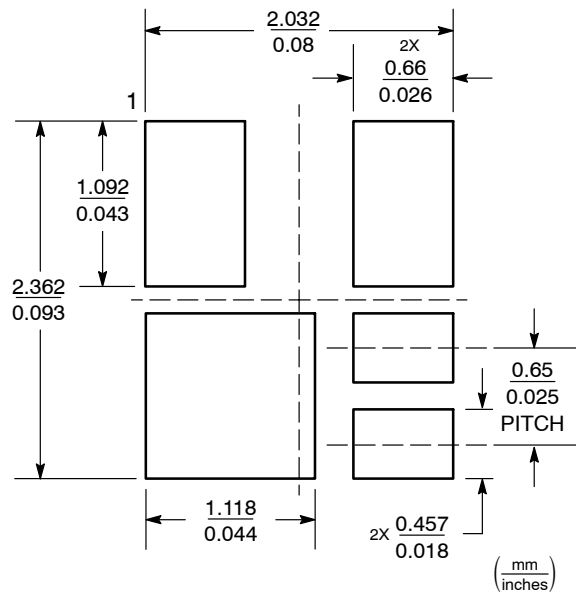## ADDITIONAL SOLDERING FOOTPRINTS*

Styles 1 and 4
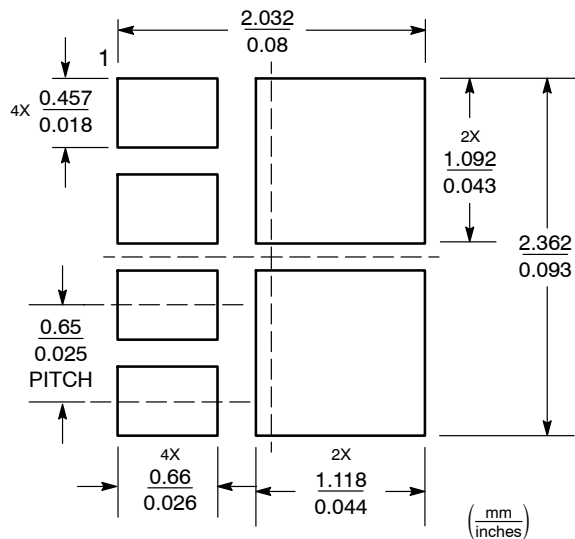
Style 2

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.

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DESCRIPTION:	ChipFET		PAGE 2 OF 2

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