NTHS5404T1

MOSFET – Power, N-Channel, ChipFET

20 V, 7.2 A

ON Semiconductor®

http://onsemi.com

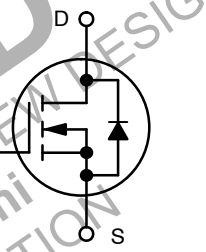
$V_{(BR)DSS}$	$R_{DS(on)}$ TYP	I_D MAX
20 V	25 mΩ @ 4.5 V	7.2 A

Features

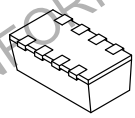
- Low $R_{DS(on)}$ for Higher Efficiency
- Logic Level Gate Drive
- Miniature ChipFET Surface Mount Package Saves Board Space
- Pb−Free Package is Available

Applications

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



N−Channel MOSFET



ChipFET
CASE 1206A
STYLE 1

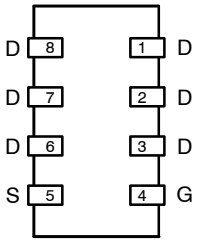
MAXIMUM RATINGS (T_A = 25°C unless otherwise noted)

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

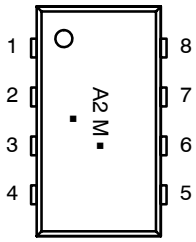
Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

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

PIN CONNECTIONS



MARKING DIAGRAM



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.

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THERMAL CHARACTERISTICS

Characteristic	Symbol	Typ	Max	Unit
Maximum Junction−to−Ambient (Note 2) $t \leq 5$ 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, $I_D \cong$ 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)	$I_{D(on)}$	$V_{DS} \geq$ 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.

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TYPICAL ELECTRICAL CHARACTERISTICS

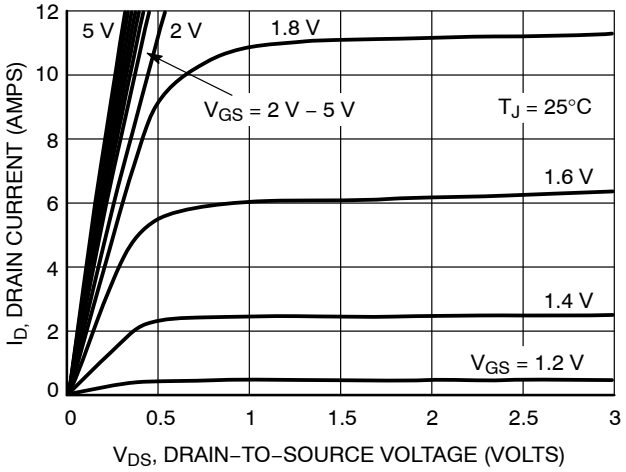

Figure 1. On–Region Characteristics

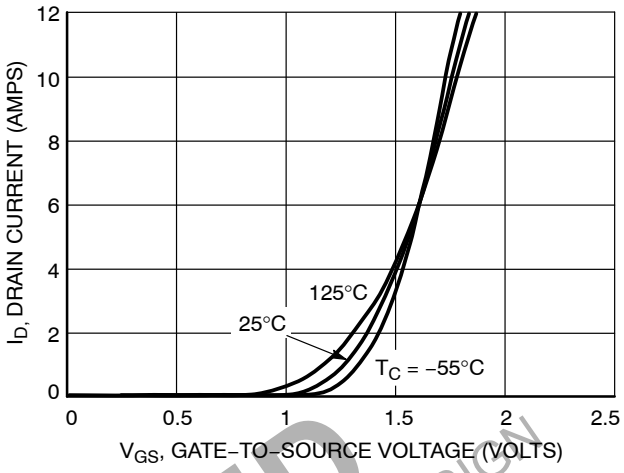

Figure 2. Transfer Characteristics

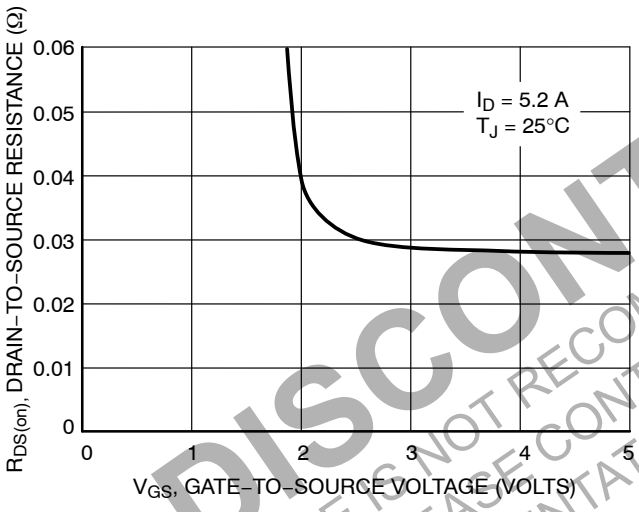

Figure 3. On–Resistance versus Gate–to–Source Voltage

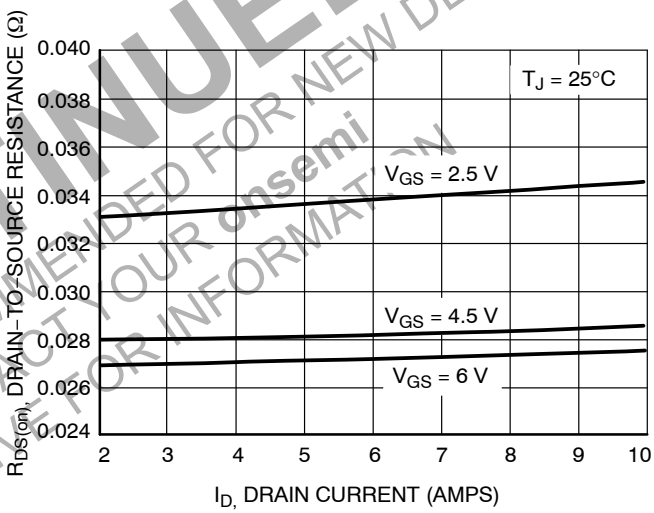

Figure 4. On–Resistance versus Drain Current and Gate Voltage

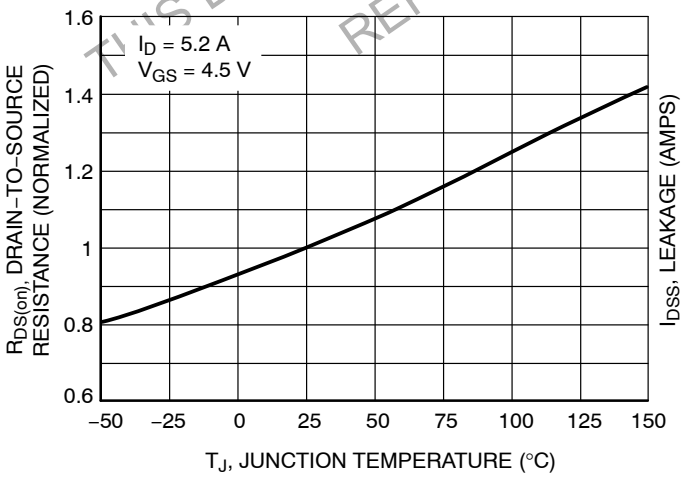

Figure 5. On–Resistance Variation with Temperature

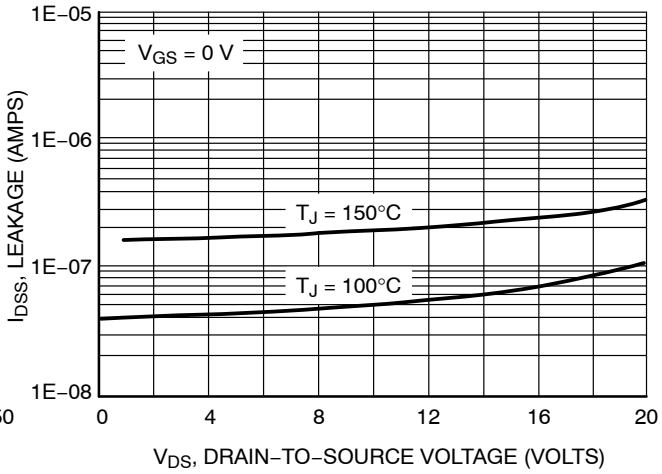

Figure 6. Drain–to–Source Leakage Current versus Voltage

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TYPICAL ELECTRICAL CHARACTERISTICS

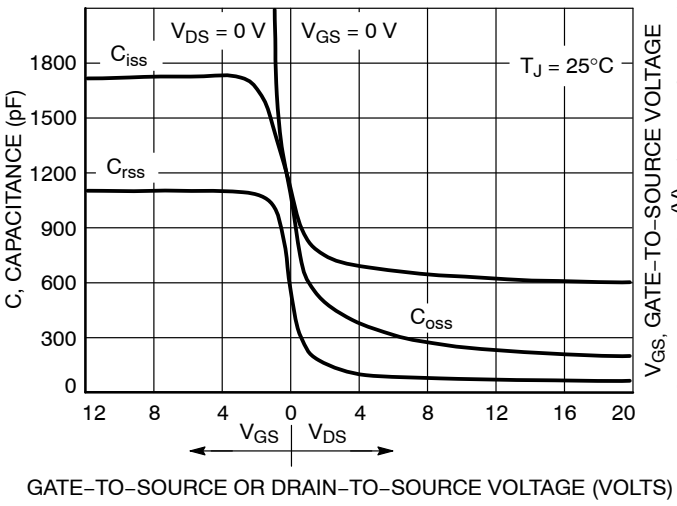

Figure 7. Capacitance Variation

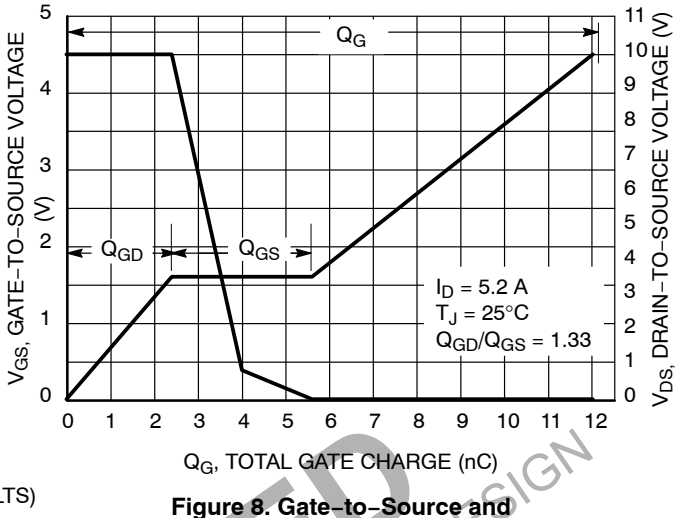

Figure 8. Gate−to−Source and Drain−to−Source Voltage versus Total Charge

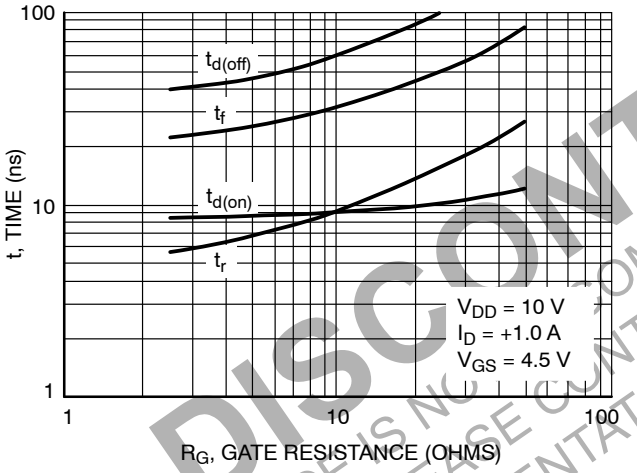

Figure 9. Resistive Switching Time Variation versus Gate Resistance

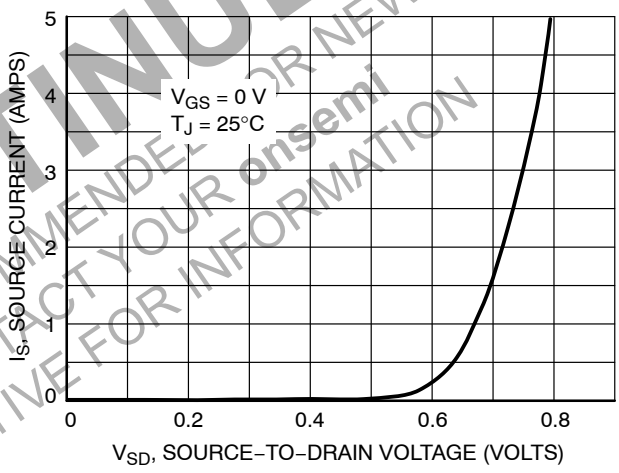

Figure 10. Diode Forward Voltage versus Current

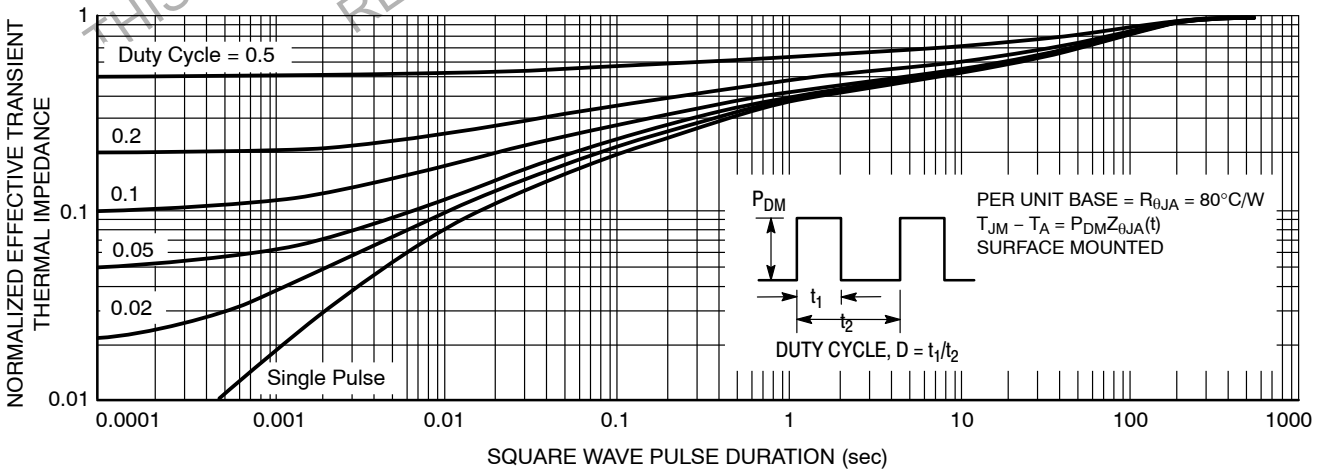

Figure 11. Normalized Thermal Transient Impedance, Junction−to−Ambient

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SOLDERING FOOTPRINT*

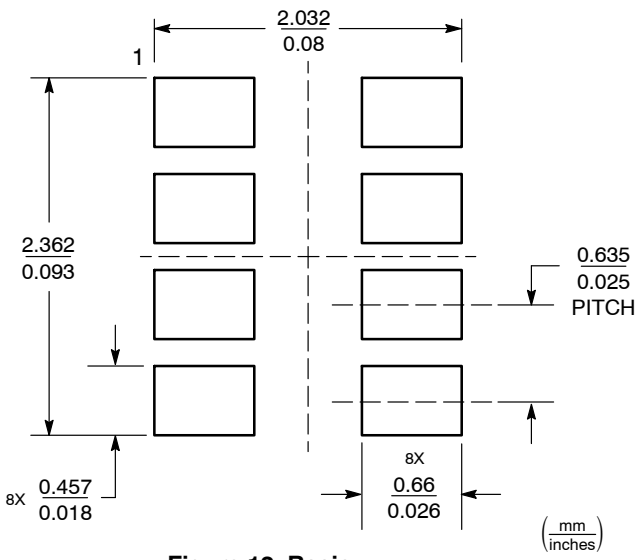


Figure 12. Basic

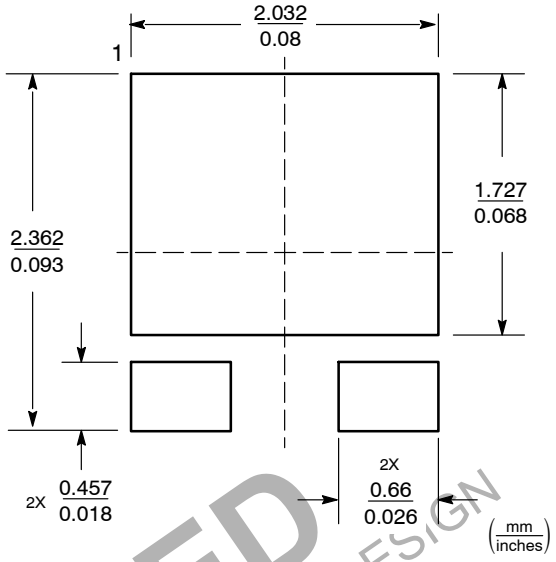
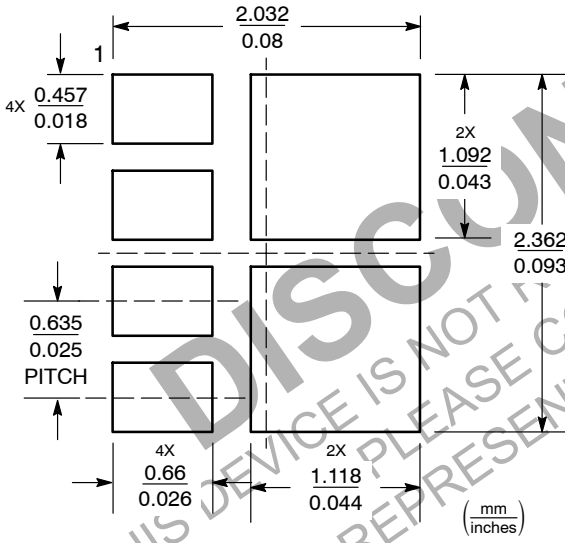
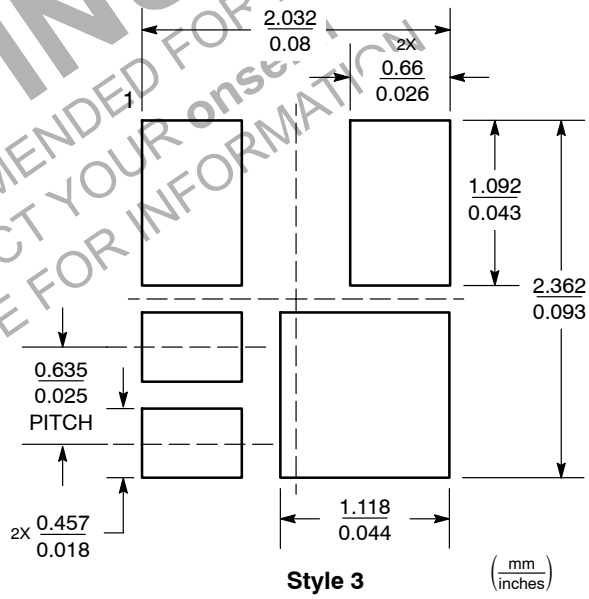


Figure 13. Style 1 and 4

ADDITIONAL SOLDERING FOOTPRINTS*



Style 2



Style 3

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*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.

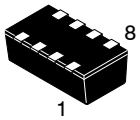
The minimum recommended pad pattern shown in Figure 13 improves the thermal area of the drain connections (pins 1, 2, 3, 6, 7, 8) while remaining within the confines of the basic footprint. The drain copper area is 0.0054 sq. in. (or 3.51 sq. mm). This will assist the power dissipation path away from 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.

MECHANICAL CASE OUTLINE
PACKAGE DIMENSIONS

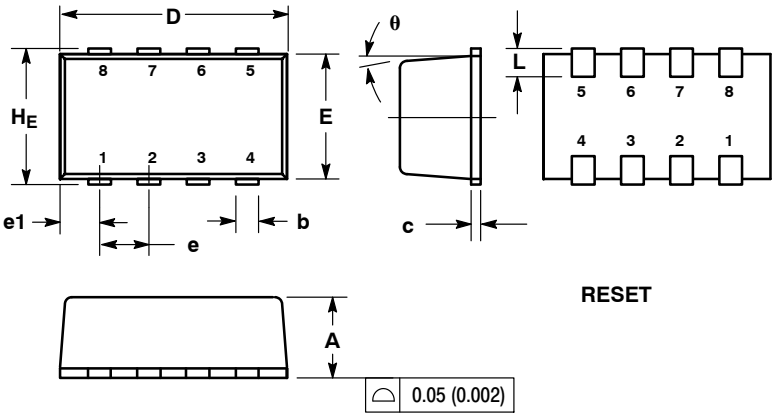
ON Semiconductor®

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.

	MILLIMETERS			INCHES		
DIM	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		

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

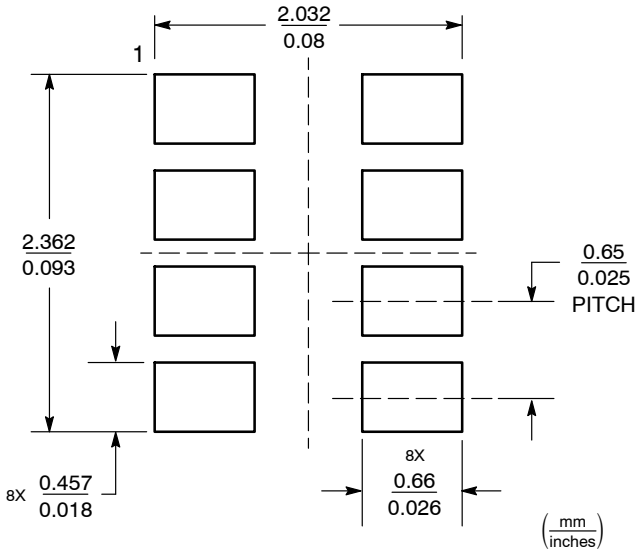
STYLE 3:
PIN 1. ANODE
2. ANODE
3. SOURCE
4. GATE
5. DRAIN
6. DRAIN
7. CATHODE
8. CATHODE

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

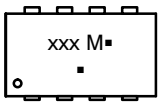
STYLE 6:
PIN 1. ANODE
2. DRAIN
3. DRAIN
4. GATE
5. SOURCE
6. DRAIN
7. DRAIN
8. CATHODE / DRAIN

SOLDERING FOOTPRINT



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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ChipFET™
CASE 1206A−03
ISSUE K

DATE 19 MAY 2009

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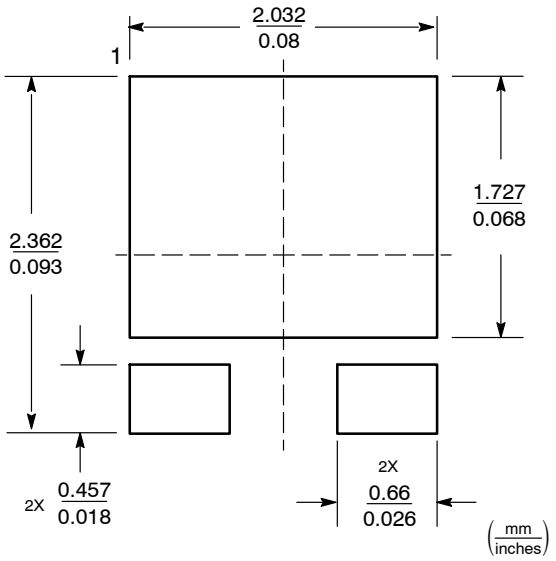
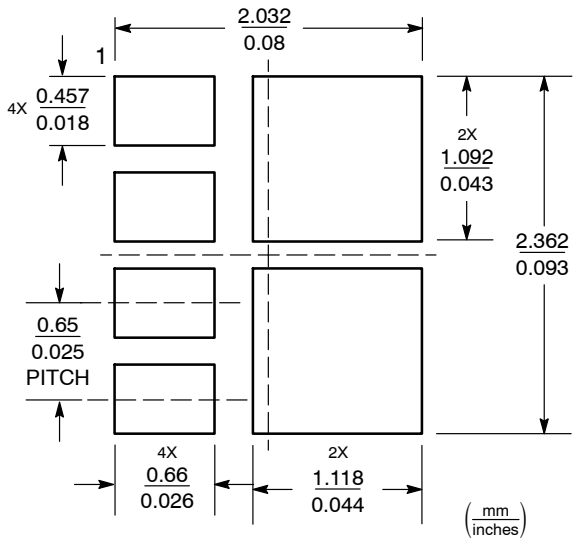
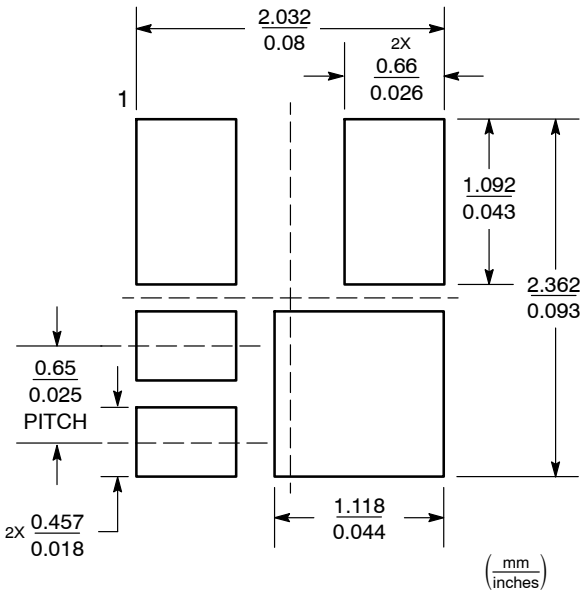


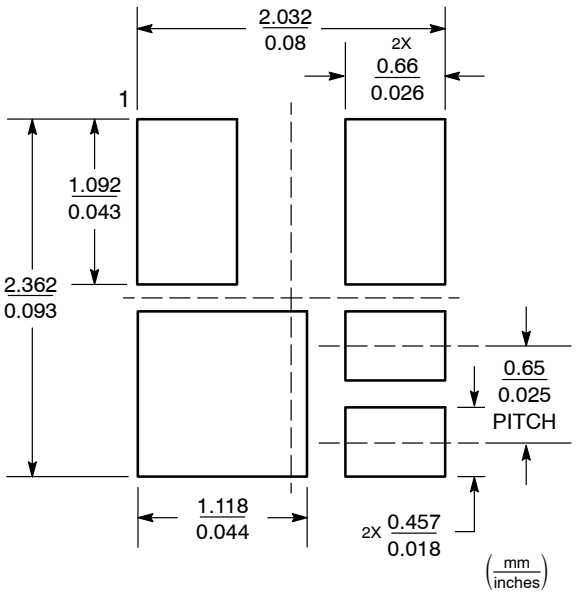
Styles 1 and 4



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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