NTHS4166N

MOSFET – Power, Single, N-Channel, ChipFET Package

30 V, 8.2 A

Features

- Trench Technology
- Low $R_{DS(on)}$ to Minimize Conduction Losses
- Leadless ChipFET Package has 40% Smaller Footprint than TSOP–6
- Excellent Thermal Capabilities

This is a Pb–Free Device

Applications

- Load Switching
- DC–DC Converters
- Low Side Switching

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

Parameter			Symbol	Value	Unit
Drain–to–Source Voltage			V_{DSS}	30	V
Gate–to–Source Voltage			V_{GS}	±20	V
Continuous Drain Current $R_{\theta JA}$ (Note 1)	Steady State	T_A = 25°C	I_D	6.6	A
		T_A = 85°C		4.8	
Power Dissipation $R_{\theta JA}$ (Note 1)		T_A = 25°C	P_D	1.5	W
Continuous Drain Current $R_{\theta JA}$ (Note 2)		T_A = 25°C	I_D	4.9	A
		T_A = 85°C		3.6	
Power Dissipation $R_{\theta JA}$ (Note 2)		T_A = 25°C	P_D	0.8	W
Continuous Drain Current $R_{\theta JA}$, t ≤ 5 s (Note 1)	Steady State	T_A = 25°C	I_D	8.2	A
		T_A = 85°C		5.9	
Power Dissipation $R_{\theta JA}$ (Note 1)		T_A = 25°C	P_D	2.2	W
Pulsed Drain Current	TA = 25°C, t_p = 10 μs		I_{DM}	32	A
Operating Junction and Storage Temperature			T_J, T_{STG}	–55 to 150	°C
Source Current (Body Diode) $R_{\theta JF}$			I_S	2.6	A
Single Pulse Drain–to–Source Avalanche Energy T_J = 25°C, V_{DD} = 50 V, V_{GS} = 10 V, I_L = 20 A_{pk}, L = 0.1 mH, R_G = 25 Ω			EAS	20	mJ
Lead Temperature for Soldering Purposes (1/8" from case for 10 s)			T_L	260	°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.

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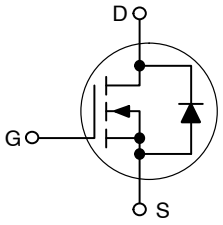
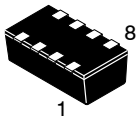
$V_{(BR)DSS}$	$R_{DS(on)}$ Max	I_D Max
30 V	22 mΩ @ 10 V	8.2 A
	27 mΩ @ 4.5 V	

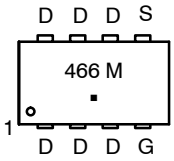


N–Channel MOSFET

MARKING DIAGRAM AND PIN ASSIGNMENT



ChipFET
CASE 1206A
STYLE 1



466 = Specific Device Code
M = Month Code
▪ = Pb–Free Package

ORDERING INFORMATION

Device	Package	Shipping†
NTHS4166NT1G	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.

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1. Surface Mounted on FR4 Board using 1 in sq. pad, 1 oz Cu.
2. Surface Mounted on FR4 Board using the minimum recommended pad size.

THERMAL RESISTANCE RATINGS

Parameter	Symbol	Max	Unit
Junction−to−Ambient − Steady State (Note 3)	$R_{\theta JA}$	86	°C/W
Junction−to−Ambient − t ≤ 5 s (Note 3)	$R_{\theta JA}$	57	
Junction−to−Ambient − t ≤ 5 s (Note 4)	$R_{\theta JA}$	155	
Junction−to−Foot (Drain) Steady State (Note 3)	$R_{\theta JF}$	20	

3. Surface Mounted on FR4 Board using 1 in sq. pad, 1 oz Cu.
4. Surface Mounted on FR4 Board using the minimum recommended pad size.

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

Parameter	Symbol	Test Conditions		Min	Typ	Max	Units
OFF CHARACTERISTICS							
Drain−to−Source Breakdown Voltage	$V_{(BR)DSS}$	V_{GS} = 0 V, I_D = 250 μA		30			V
Drain−to−Source Breakdown Voltage Temperature Coefficient	$V_{(BR)DSS}/T_J$				18.3		mV/°C
Zero Gate Voltage Drain Current	I_{DSS}	V_{GS} = 0 V, V_{DS} = 30 V	T_J = 25°C			1.0	μA
			T_J = 125°C			10	
Gate−to−Source Leakage Current	I_{GSS}	V_{DS} = 0 V, V_{GS} = ±20 V				±100	nA
ON CHARACTERISTICS (Note 5)							
Gate Threshold Voltage	$V_{GS(TH)}$	V_{GS} = V_{DS}, I_D = 250 μA		1.1		2.3	V
Negative Threshold Temperature Coefficient	$V_{GS(TH)}/T_J$				5.5		mV/°C
Drain−to−Source On−Resistance	$R_{DS(on)}$	V_{GS} = 10 V, I_D = 4.9 A			18	22	mΩ
		V_{GS} = 4.5 V, I_D = 3.7 A			23	27	
Forward Transconductance	g_{FS}	V_{DS} = 5 V, I_D = 4.9 A			9.0		S
CHARGES AND CAPACITANCES							
Input Capacitance	C_{ISS}	V_{GS} = 0 V, f = 1.0 MHz, V_{DS} = 15 V			900		pF
Output Capacitance	C_{OSS}				210		
Reverse Transfer Capacitance	C_{RSS}				140		
Total Gate Charge	$Q_{G(TOT)}$	V_{GS} = 4.5 V, V_{DS} = 15 V, I_D = 4.9 A			9.2		nC
Threshold Gate Charge	$Q_{G(TH)}$				0.85		
Gate−to−Source Charge	Q_{GS}				2.86		
Gate−to−Drain Charge	Q_{GD}				3.84		
Total Gate Charge	$Q_{G(TOT)}$	V_{GS} = 10 V, V_{DS} = 15 V, I_D = 4.9 A			18		nC
Gate Resistance	R_G				1.6		
SWITCHING CHARACTERISTICS (Note 6)							
Turn−On Delay Time	$t_{d(on)}$	V_{GS} = 4.5 V, V_{DS} = 15 V, I_D = 4.9 A, R_G = 3.0 Ω			12		ns
Rise Time	t_r				13		
Turn−Off Delay Time	$t_{d(off)}$				16		
Fall Time	t_f				5.0		
Turn−On Delay Time	$t_{d(on)}$	V_{GS} = 10 V, V_{DS} = 15 V, I_D = 4.9 A, R_G = 3.0 Ω			8.0		ns
Rise Time	t_r				11		
Turn−Off Delay Time	$t_{d(off)}$				20		
Fall Time	t_f				4.0		

5. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2%.
6. Switching characteristics are independent of operating junction temperatures.

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

Parameter	Symbol	Test Conditions		Min	Typ	Max	Units
DRAIN−SOURCE DIODE CHARACTERISTICS							
Forward Diode Voltage	V_{SD}	V_{GS} = 0 V, I_S = 5.2 A	T_J = 25°C		0.83	1.0	V
			T_J = 125°C		0.7		
Reverse Recovery Time	t_{RR}	V_{GS} = 0 V, I_S = 5.2 A, dI_S/dt = 100 A/μs			16		ns
Charge Time	t_a				7.5		
Discharge Time	t_b				8.5		
Reverse Recovery Charge	Q_{RR}				6.0		nC

5. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2%.
6. Switching characteristics are independent of operating junction temperatures.

TYPICAL PERFORMANCE CURVES

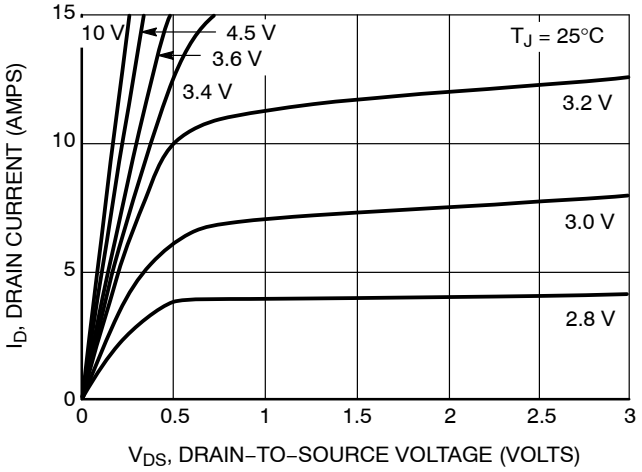

Figure 1. On−Region Characteristics

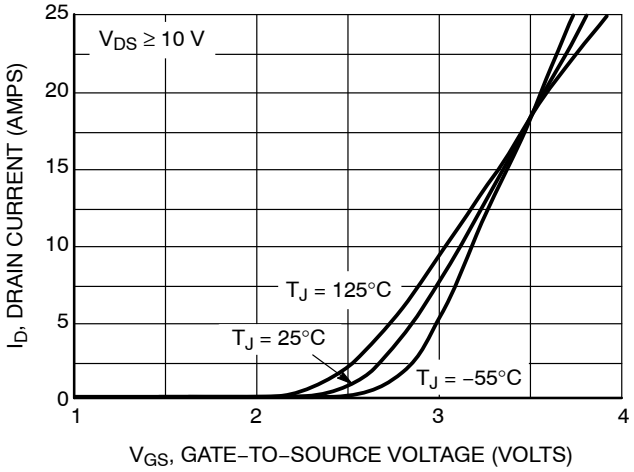

Figure 2. Transfer Characteristics

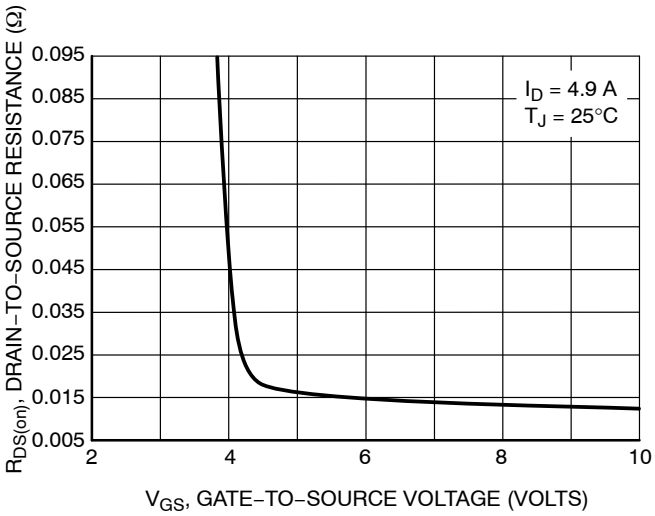

Figure 3. On−Resistance vs. Gate−to−Source Voltage

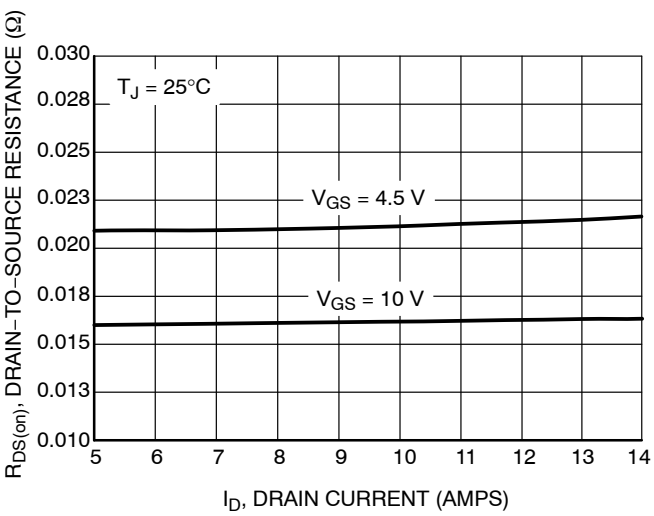

Figure 4. On−Resistance vs. Drain Current and Gate Voltage

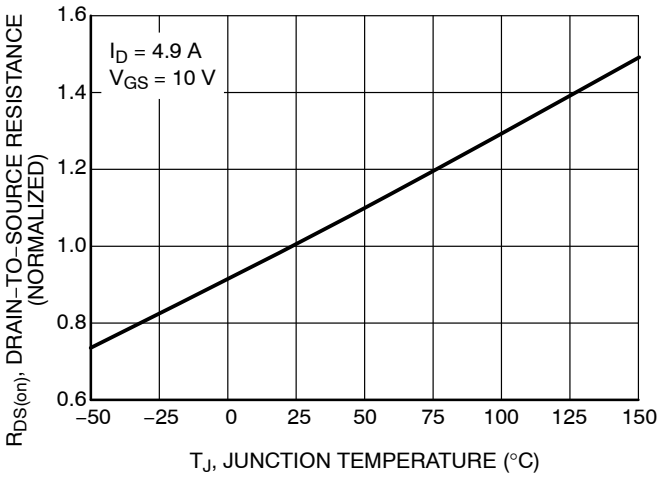

Figure 5. On−Resistance Variation with Temperature

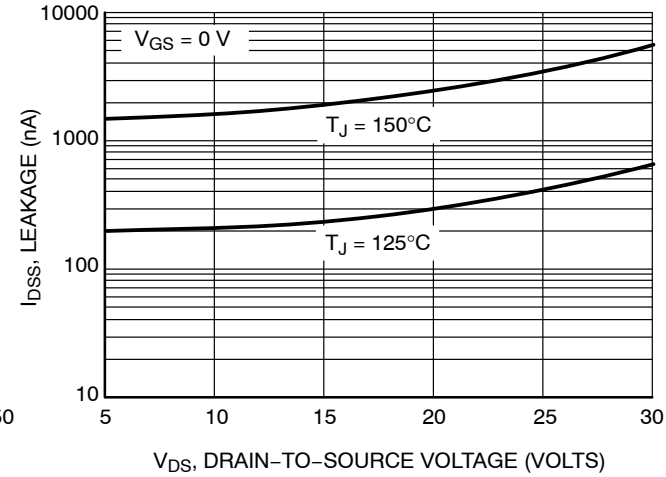

Figure 6. Drain−to−Source Leakage Current vs. Drain Voltage

TYPICAL PERFORMANCE CURVES

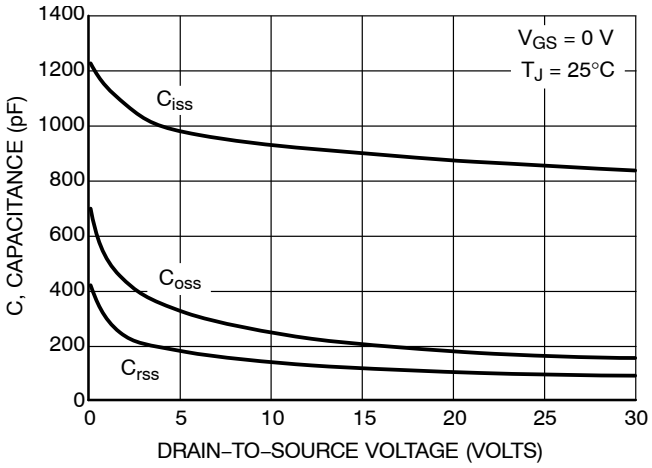

Figure 7. Capacitance Variation

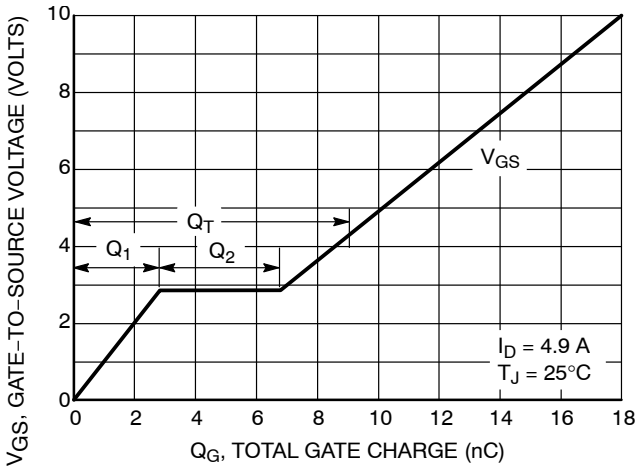

Figure 8. Gate−To−Source and Drain−To−Source Voltage vs. Total Charge

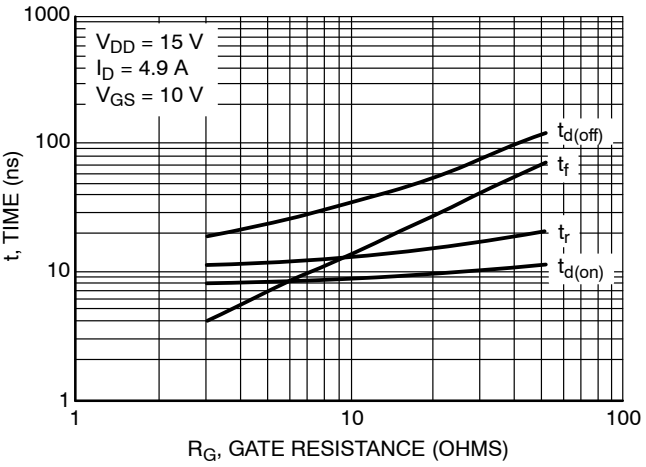

Figure 9. Resistive Switching Time Variation vs. Gate Resistance

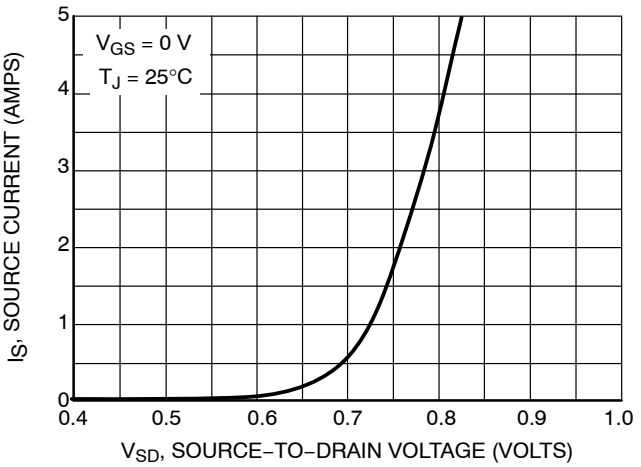

Figure 10. Diode Forward Voltage vs. Current

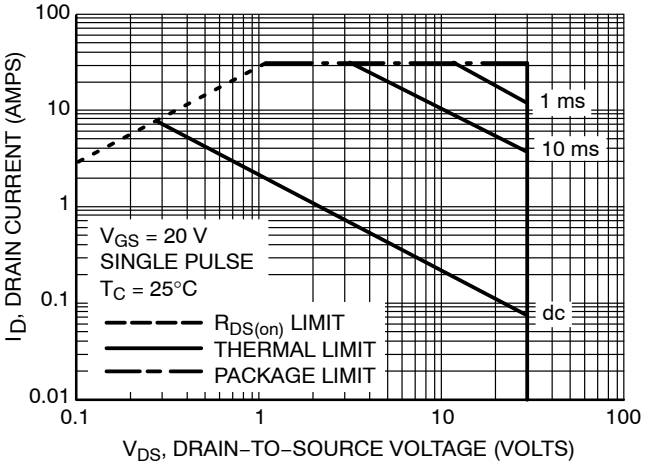

Figure 11. Maximum Rated Forward Biased Safe Operating Area

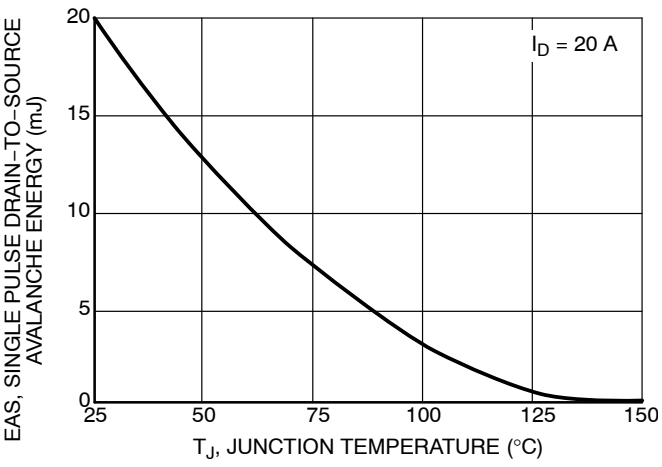

Figure 12. Maximum Avalanche Energy vs. Starting Junction Temperature

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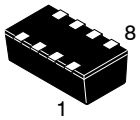
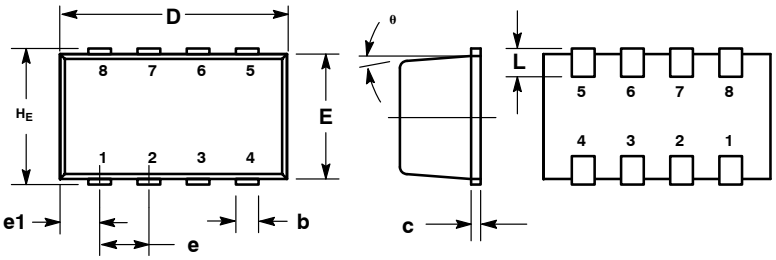
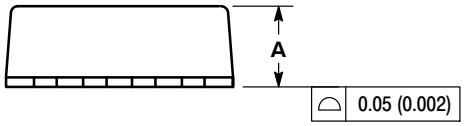
CASE1206A−03
ISSUE K

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

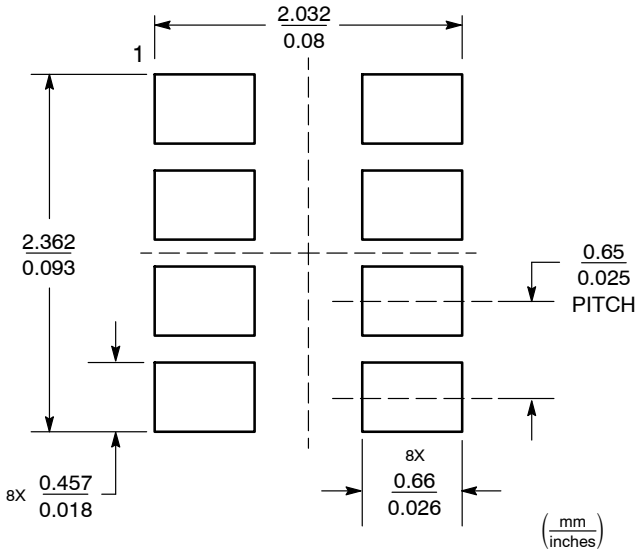
STYLE 3:
PIN 1. ANODE
2. ANODE
3. SOURCE
4. GATE
5. DRAIN
6. DRAIN
7. CATHODE
8. CATHODE

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. Some products may not follow the Generic Marking.

OPTIONAL SOLDERING FOOTPRINTS ON PAGE 2

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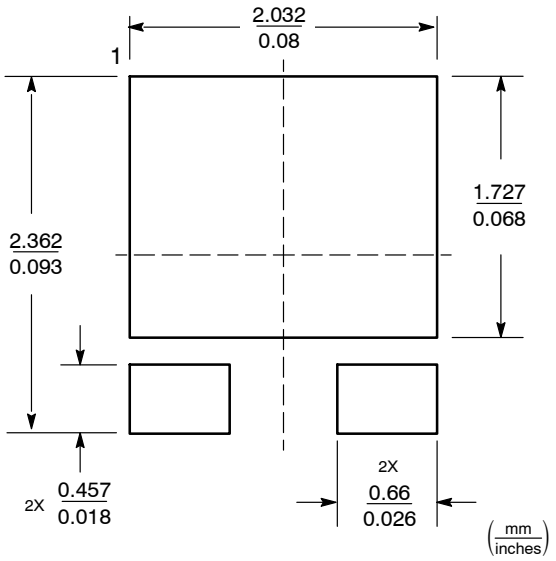
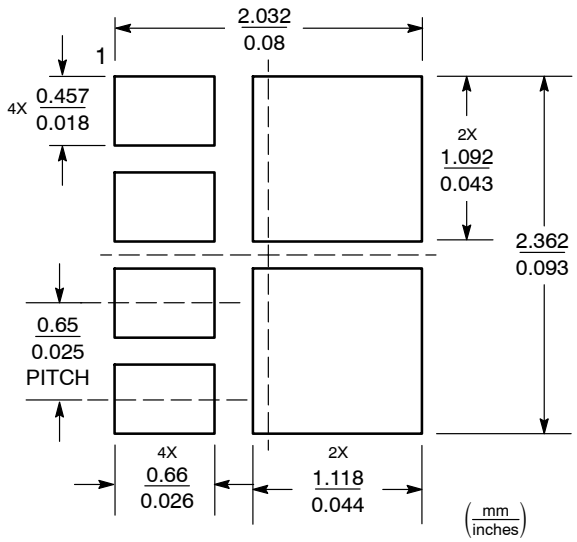
ChipFET™
CASE 1206A−03
ISSUE K

DATE 19 MAY 2009

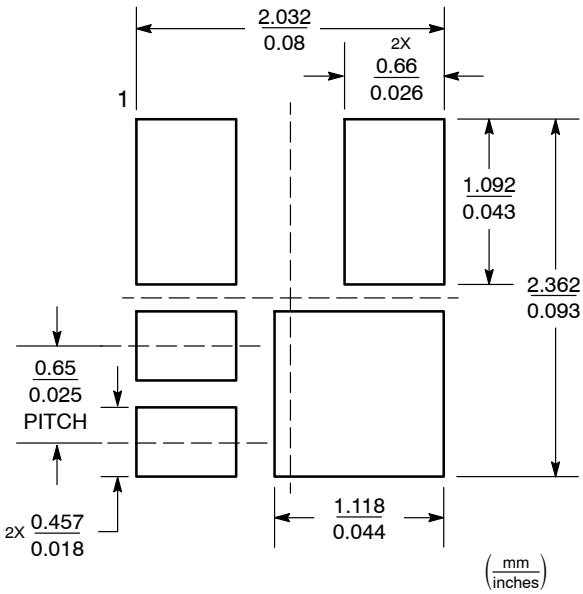
ADDITIONAL SOLDERING FOOTPRINTS*



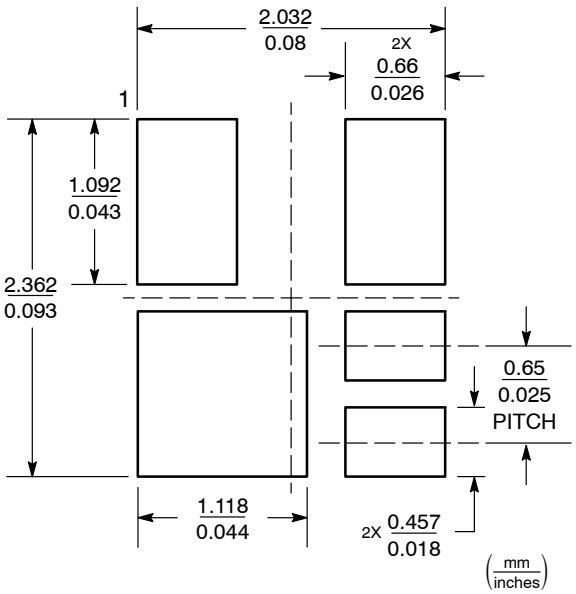
Styles 1 and 4



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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