NTHD3100C

MOSFET – Power, Complementary, ChipFET

20 V, +3.9 A /-4.4 A

Features

- Complementary N−Channel and P−Channel MOSFET
- Small Size, 40% Smaller than TSOP−6 Package
- Leadless SMD Package Provides Great Thermal Characteristics
- Trench P−Channel for Low On Resistance
- Low Gate Charge N−Channel for Test Switching
- Pb−Free Packages are Available

Applications

- DC−DC Conversion Circuits
- Load Switch Applications Requiring Level Shift
- Drive Small Brushless DC Motors
- Ideal for Power Management Applications in Portable, Battery Powered Products

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

Parameter			Symbol	Value	Unit
Drain−to−Source Voltage			V_{DSS}	20	V
Gate−to−Source Voltage	N−Ch		V_{GS}	±12	V
	P−Ch			±8.0	
N−Channel Continuous Drain Current (Note 1)	Steady State	T_A = 25°C	I_D	2.9	A
		T_A = 85°C		2.1	
	t ≤ 10 s	T_A = 25°C		3.9	
P−Channel Continuous Drain Current (Note 1)	Steady State	T_A = 25°C	I_D	−3.2	A
		T_A = 85°C		−2.3	
	t ≤ 10 s	T_A = 25°C		−4.4	
Power Dissipation (Note 1)	Steady State	T_A = 25°C	P_D	1.1	W
	t ≤ 5 s			3.1	
Pulsed Drain Current (Note 1)	N−Ch	t = 10 μs	I_{DM}	12	A
	P−Ch	t = 10 μs		−13	
Operating Junction and Storage Temperature			T_J, T_{STG}	−55 to 150	°C
Source Current (Body Diode)			I_S	2.5	A
Lead Temperature for Soldering Purposes (1/8″ from case for 10 seconds)			T_L	260	°C

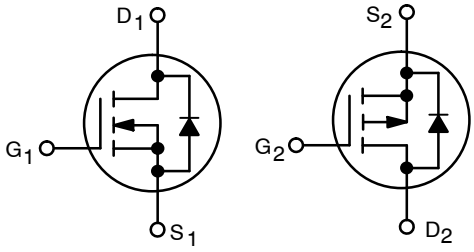
Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

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

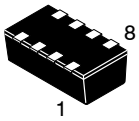
ON Semiconductor®

http://onsemi.com

$V_{(BR)DSS}$	$R_{DS(on)}$ Typ	I_D MAX
N−Channel 20 V	58 mΩ @ 4.5 V	3.9 A
	77 mΩ @ 2.5 V	
P−Channel −20 V	64 mΩ @ −4.5 V	−4.4 A
	85 mΩ @ −2.5 V	

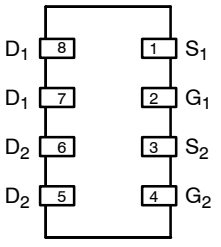


N−Channel MOSFET **P−Channel MOSFET**

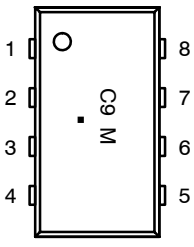


ChipFET
CASE 1206A
STYLE 2

PIN CONNECTIONS



MARKING DIAGRAM



C9 = Specific Device Code
M = Month Code
▪ = Pb−Free Package

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 7 of this data sheet.

THERMAL RESISTANCE RATINGS

Parameter	Symbol	Max	Unit
Junction−to−Ambient − Steady State (Note 2)	$R_{\theta JA}$	113	°C/W
Junction−to−Ambient − t ≤ 10 s (Note 2)	$R_{\theta JA}$	60	°C/W

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

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

Parameter	Symbol	N/P	Test Conditions		Min	Typ	Max	Unit
OFF CHARACTERISTICS (Note 3)								
Drain−to−Source Breakdown Voltage	$V_{(BR)DSS}$	N	V_{GS} = 0 V	I_D = 250 μA	20			V
		P		I_D = −250 μA	−20			
Zero Gate Voltage Drain Current	I_{DSS}	N	V_{GS} = 0 V, V_{DS} = 16 V	T_J = 25 °C			1.0	μA
		P	V_{GS} = 0 V, V_{DS} = −16 V				−1.0	
		N	V_{GS} = 0 V, V_{DS} = 16 V	T_J = 125 °C			5.0	
		P	V_{GS} = 0 V, V_{DS} = −16 V				−5.0	
Gate−to−Source Leakage Current	I_{GSS}	N	V_{DS} = 0 V, V_{GS} = ±12 V				±100	nA
		P	V_{DS} = 0 V, V_{GS} = ±8.0 V				±100	
ON CHARACTERISTICS (Note 3)								
Gate Threshold Voltage	$V_{GS(TH)}$	N	V_{GS} = V_{DS}	I_D = 250 μA	0.6		1.2	V
		P		I_D = −250 μA	−.45		−1.5	
Drain−to−Source On Resistance	$R_{DS(on)}$	N	V_{GS} = 4.5 V , I_D = 2.9 A			58	80	mΩ
		P	V_{GS} = −4.5 V , I_D = −3.2 A			64	80	
		N	V_{GS} = 2.5 V , I_D = 2.3 A			77	115	
		P	V_{GS} = −2.5 V, I_D = −2.2 A			85	110	
Forward Transconductance	g_{FS}	N	V_{DS} = 10 V, I_D = 2.9 A			6.0		S
		P	V_{DS} = −10 V , I_D = −3.2 A			8.0		
CHARGES AND CAPACITANCES								
Input Capacitance	C_{ISS}	N	f = 1 MHz, V_{GS} = 0 V	V_{DS} = 10 V		165		pF
		P		V_{DS} = −10 V		680		
Output Capacitance	C_{OSS}	N		V_{DS} = 10 V		80		
		P		V_{DS} = −10 V		100		
Reverse Transfer Capacitance	C_{RSS}	N		V_{DS} = 10 V		25		
		P		V_{DS} = −10 V		70		
Total Gate Charge	$Q_{G(TOT)}$	N	V_{GS} = 4.5 V, V_{DS} = 10 V, I_D = 2.9 A			2.3		nC
		P	V_{GS} = −4.5 V, V_{DS} = −10 V, I_D = −3.2 A			7.4		
Threshold Gate Charge	$Q_{G(TH)}$	N	V_{GS} = 4.5 V, V_{DS} = 10 V, I_D = 2.9 A			0.2		
		P	V_{GS} = −4.5 V, V_{DS} = −10 V, I_D = −3.2 A			0.6		
Gate−to−Source Gate Charge	Q_{GS}	N	V_{GS} = 4.5 V, V_{DS} = 10 V, I_D = 2.9 A			0.4		
		P	V_{GS} = −4.5 V, V_{DS} = −10 V, I_D = −3.2 A			1.4		
Gate−to−Drain “Miller” Charge	Q_{GD}	N	V_{GS} = 4.5 V, V_{DS} = 10 V, I_D = 2.9 A			0.7		
		P	V_{GS} = −4.5 V, V_{DS} = −10 V, I_D = −3.2 A			2.5		

3. Pulse Test: pulse width ≤ 250 μs, duty cycle ≤ 2%.

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

Parameter	Symbol	N/P	Test Conditions	Min	Typ	Max	Unit
SWITCHING CHARACTERISTICS (Note 4)							
Turn−On Delay Time	$t_{d(ON)}$	N	V_{GS} = 4.5 V, V_{DD} = 10 V, I_D = 2.9 A, R_G = 2.5 Ω		6.3		ns
Rise Time	t_r				10.7		
Turn−Off Delay Time	$t_{d(OFF)}$				9.6		
Fall Time	t_f				1.5		
Turn−On Delay Time	$t_{d(ON)}$	P	V_{GS} = −4.5 V, V_{DD} = −10 V, I_D = −3.2 A, R_G = 2.5 Ω		5.8		
Rise Time	t_r				11.7		
Turn−Off Delay Time	$t_{d(OFF)}$				16		
Fall Time	t_f				12.4		
DRAIN−SOURCE DIODE CHARACTERISTICS							
Forward Diode Voltage	V_{SD}	N	V_{GS} = 0 V, T_J = 25 °C	I_S = 2.5 A		0.8	1.15	V
		P		I_S = −2.5 A		−0.8	−1.2	
Reverse Recovery Time	t_{RR}	N	V_{GS} = 0 V, dI_S / dt = 100 A/μs	I_S = 1.5 A		12.5		ns
		P		I_S = −1.5 A		13.5		
Charge Time	t_a	N		I_S = 1.5 A		9.0		
		P		I_S = −1.5 A		9.5		
Discharge Time	t_b	N		I_S = 1.5 A		3.5		
		P		I_S = −1.5 A		4.0		
Reverse Recovery Charge	Q_{RR}	N		I_S = 1.5 A		6.0		nC
		P		I_S = −1.5 A		6.5		

4. Switching characteristics are independent of operating junction temperatures.

TYPICAL N−CHANNEL PERFORMANCE CURVES

(T_J = 25°C unless otherwise noted)

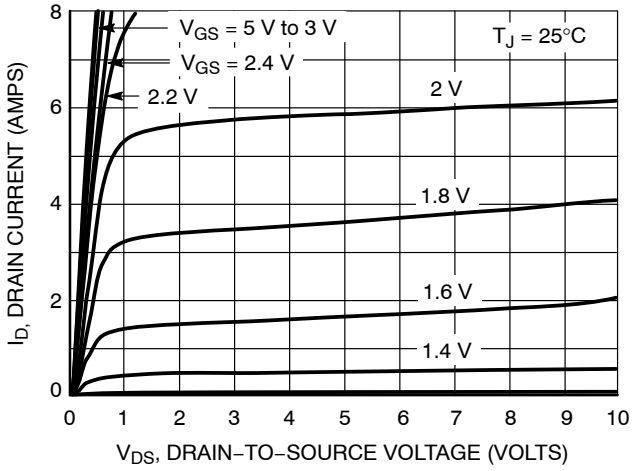


Figure 1. On−Region Characteristics

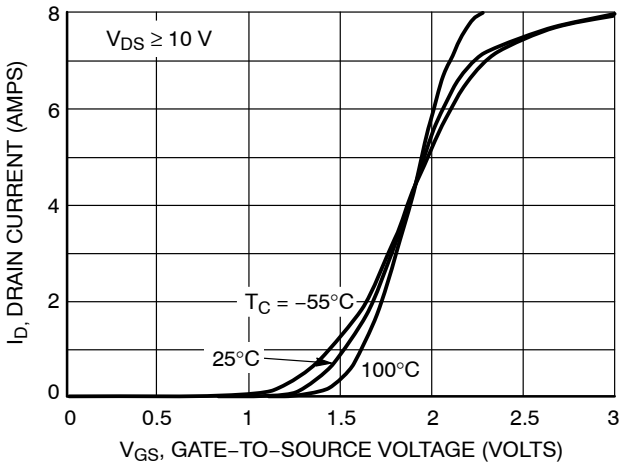


Figure 2. Transfer Characteristics

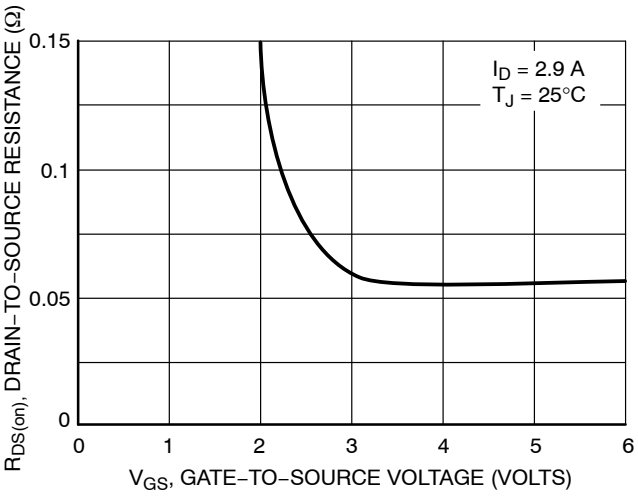


Figure 3. On−Resistance vs. Gate−to−Source Voltage

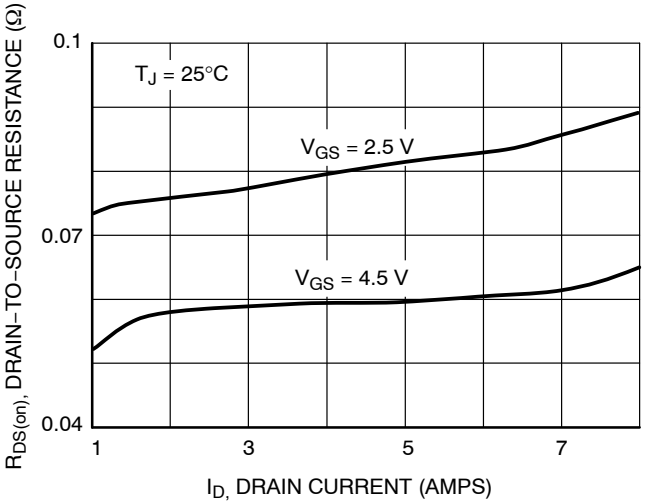


Figure 4. On−Resistance vs. Drain Current and Gate Voltage

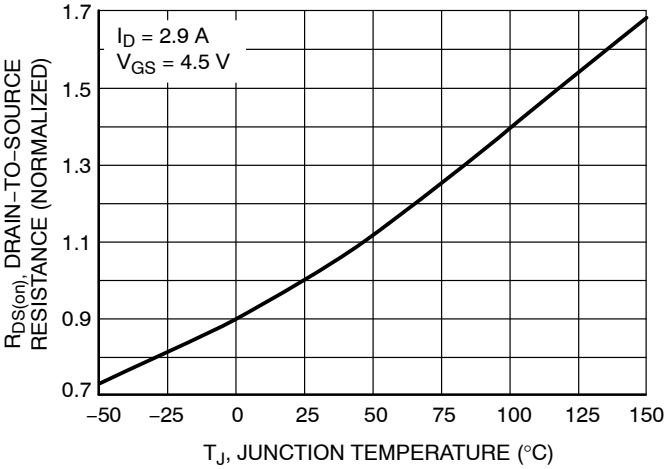


Figure 5. On−Resistance Variation with Temperature

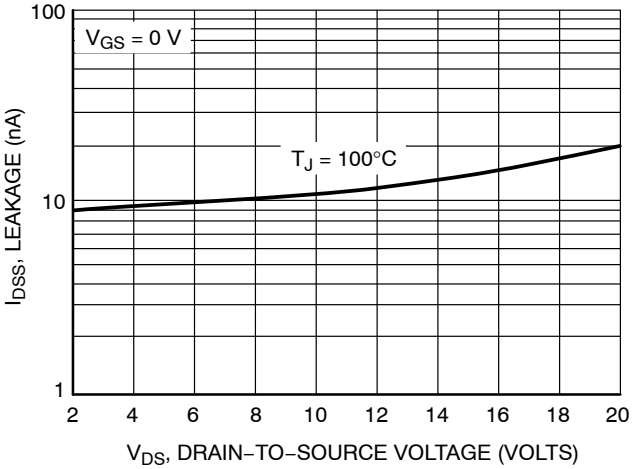


Figure 6. Drain−to−Source Leakage Current vs. Voltage

TYPICAL N−CHANNEL PERFORMANCE CURVES

(T_J = 25°C unless otherwise noted)

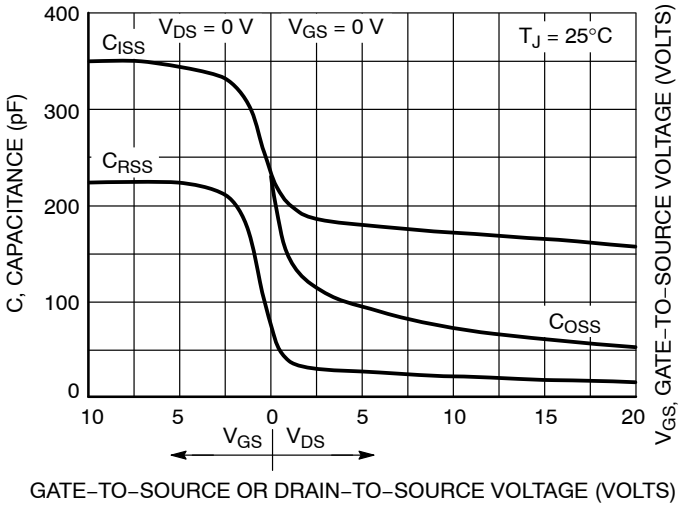


Figure 7. Capacitance Variation

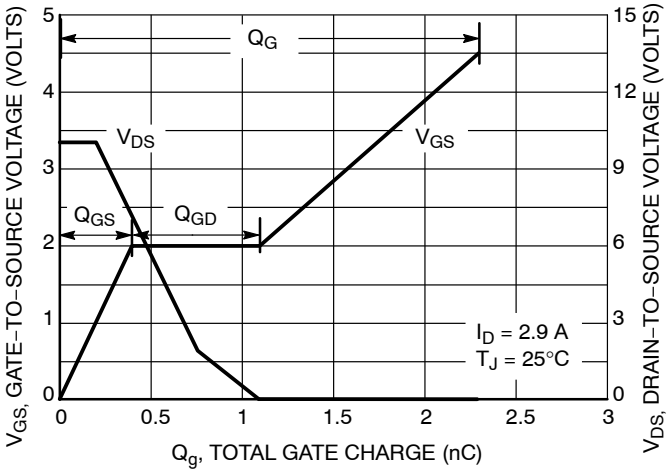


Figure 8. Gate−to−Source and Drain−to−Source Voltage vs. Total Charge

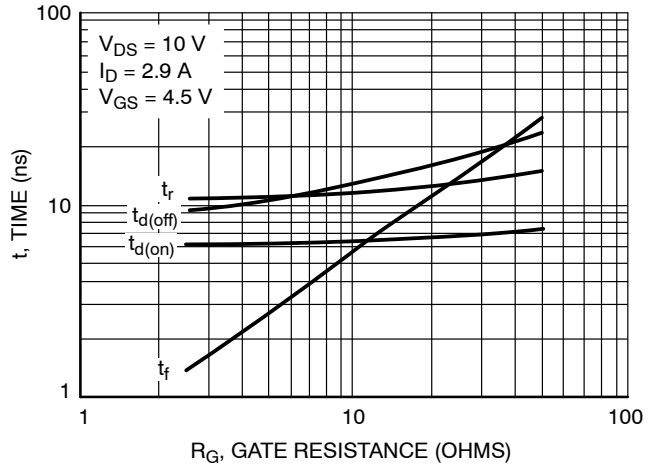


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

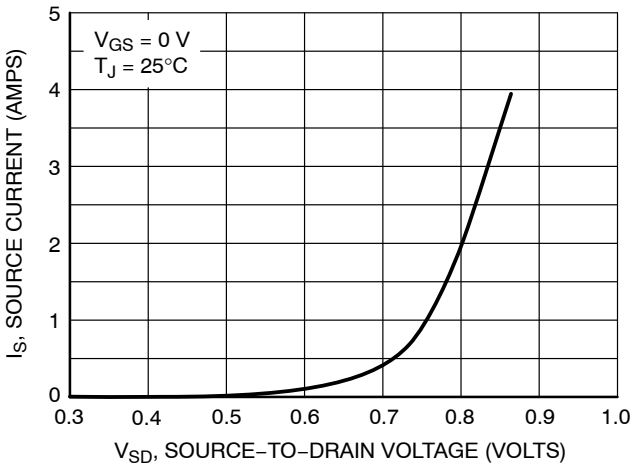


Figure 10. Diode Forward Voltage vs. Current

TYPICAL P−CHANNEL PERFORMANCE CURVES

(T_J = 25°C unless otherwise noted)

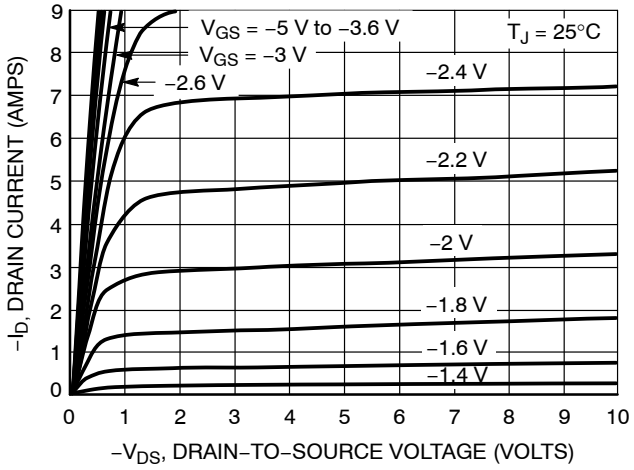


Figure 11. On−Region Characteristics

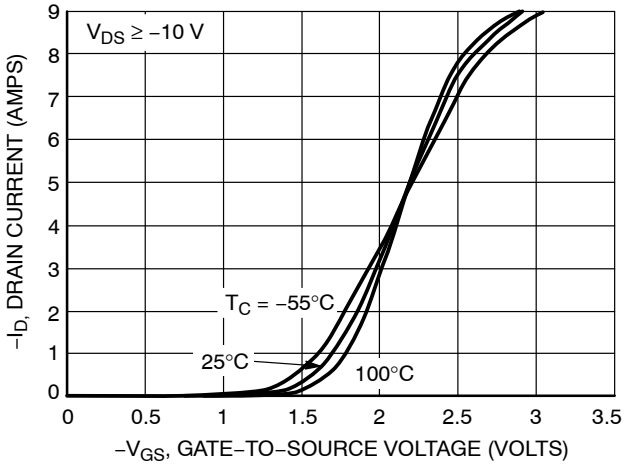


Figure 12. Transfer Characteristics

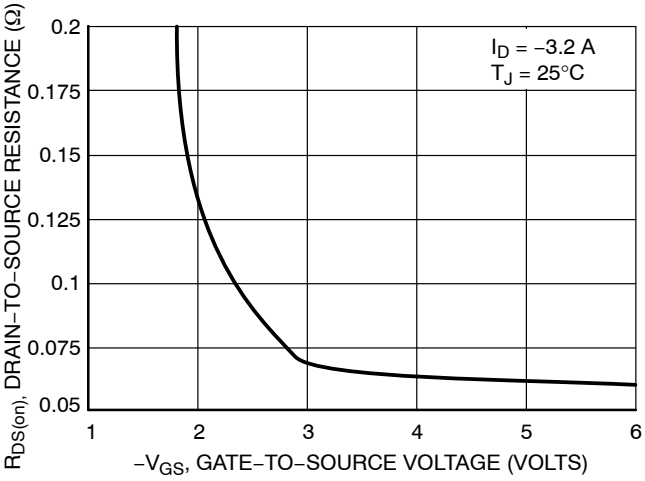


Figure 13. On−Resistance vs. Gate−to−Source Voltage

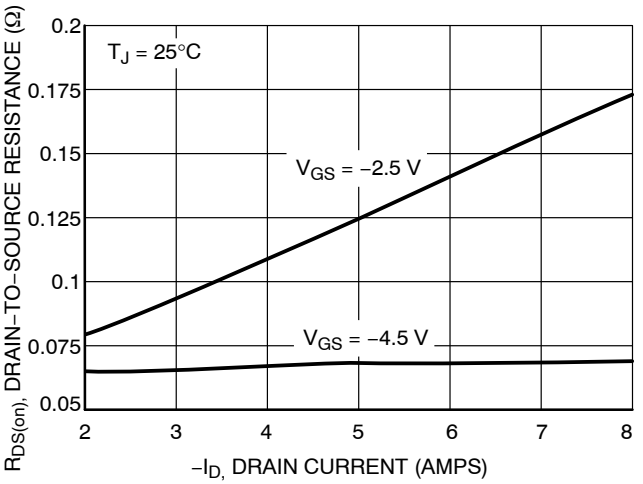


Figure 14. On−Resistance vs. Drain Current and Gate Voltage

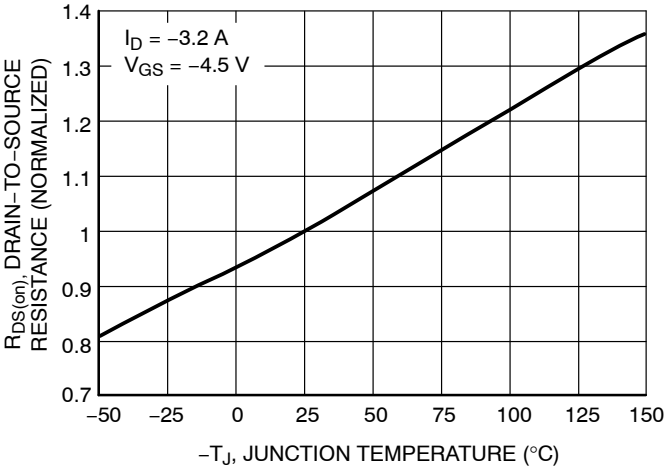


Figure 15. On−Resistance Variation with Temperature

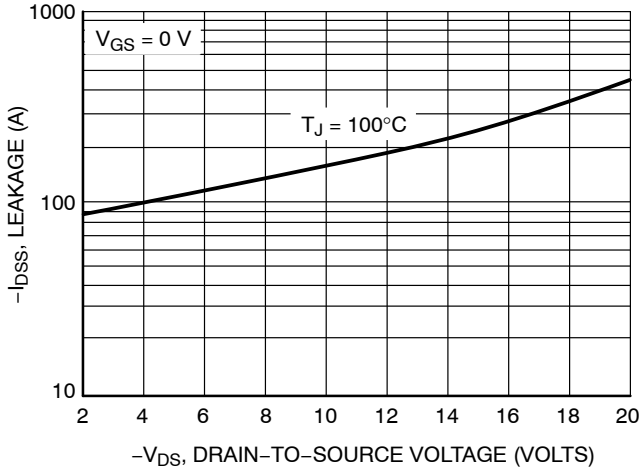


Figure 16. Drain−to−Source Leakage Current vs. Voltage

TYPICAL P−CHANNEL PERFORMANCE CURVES

(T_J = 25°C unless otherwise noted)

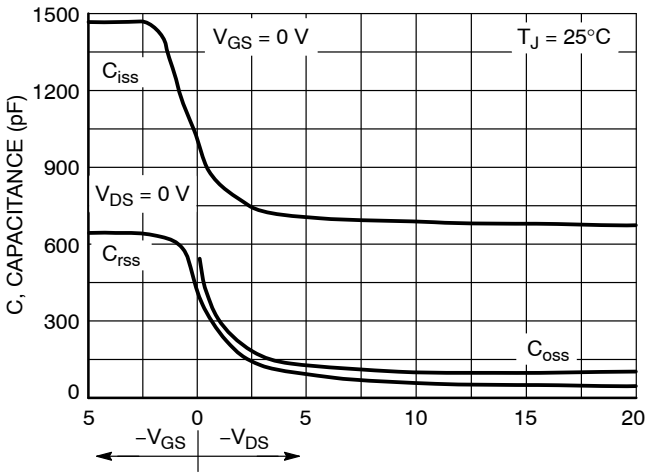


Figure 17. Capacitance Variation

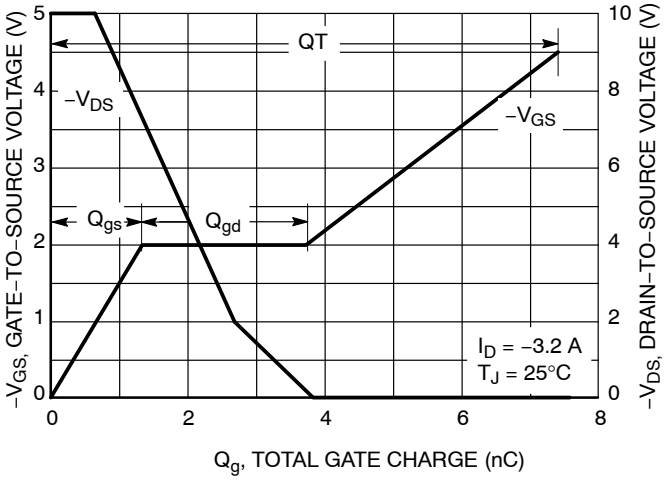


Figure 18. Gate−to−Source and Drain−to−Source Voltage vs. Total Charge

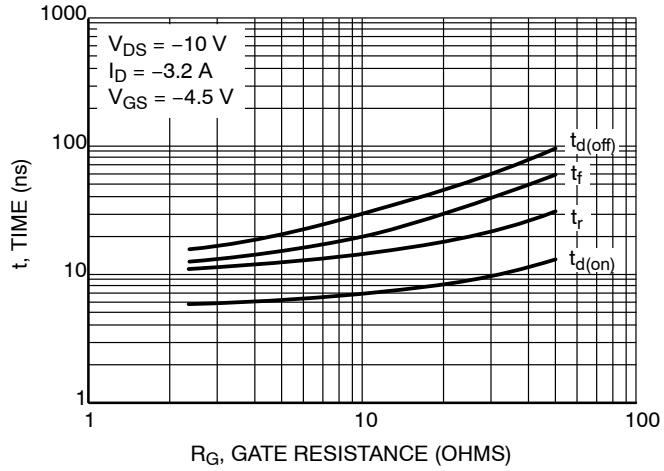


Figure 19. Resistive Switching Time Variation vs. Gate Resistance

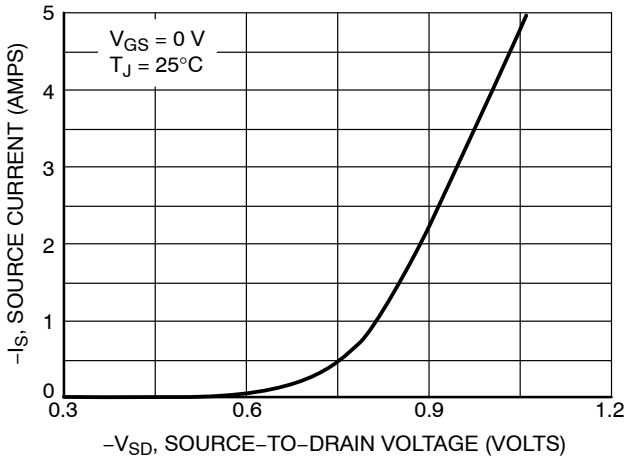


Figure 20. Diode Forward Voltage vs. Current

DEVICE ORDERING INFORMATION

Device	Package	Shipping†
NTHD3100CT1	ChipFET	3000 / Tape & Reel
NTHD3100CT1G	ChipFET (Pb−Free)	3000 / Tape & Reel
NTHD3100CT3	ChipFET	10000 / Tape & Reel
NTHD3100CT3G	ChipFET (Pb−Free)	10000 / 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.

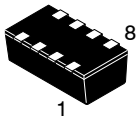
ChipFET is a trademark of Vishay Siliconix.

MECHANICAL CASE OUTLINE
PACKAGE DIMENSIONS

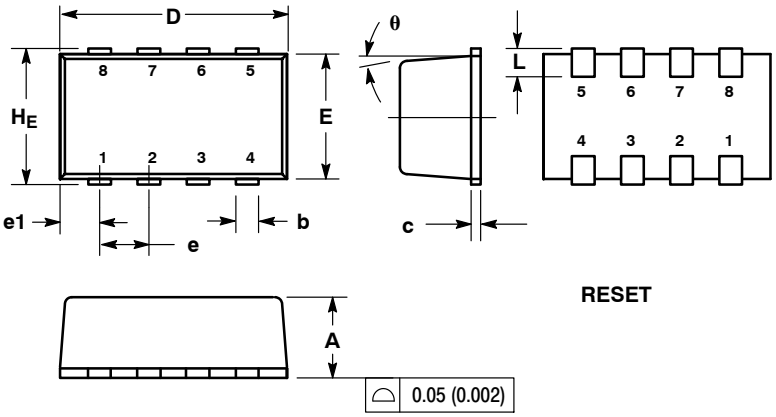
ON Semiconductor®

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

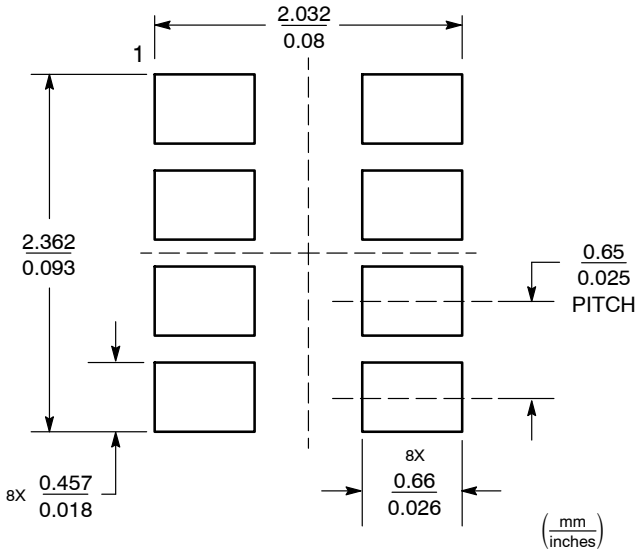
STYLE 3:
PIN 1. ANODE
2. ANODE
3. SOURCE
4. GATE
5. DRAIN
6. DRAIN
7. CATHODE
8. CATHODE

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

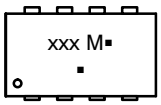
STYLE 6:
PIN 1. ANODE
2. DRAIN
3. DRAIN
4. GATE
5. SOURCE
6. DRAIN
7. DRAIN
8. CATHODE / DRAIN

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.

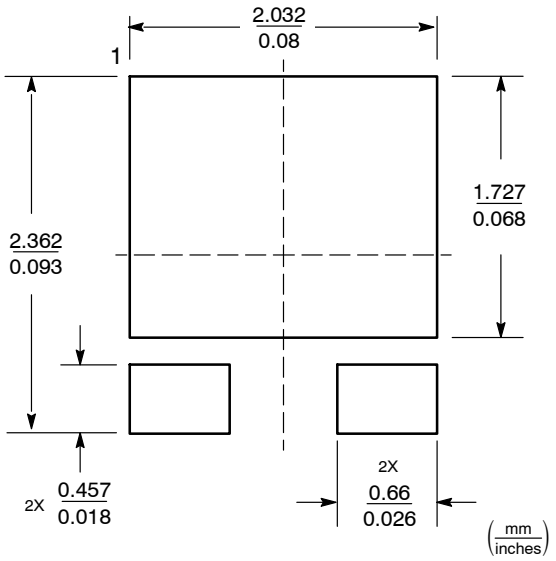
OPTIONAL SOLDERING FOOTPRINTS ON PAGE 2

DOCUMENT NUMBER:	**98AON03078D**	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.
DESCRIPTION:	**ChipFET**	**PAGE 1 OF 2**

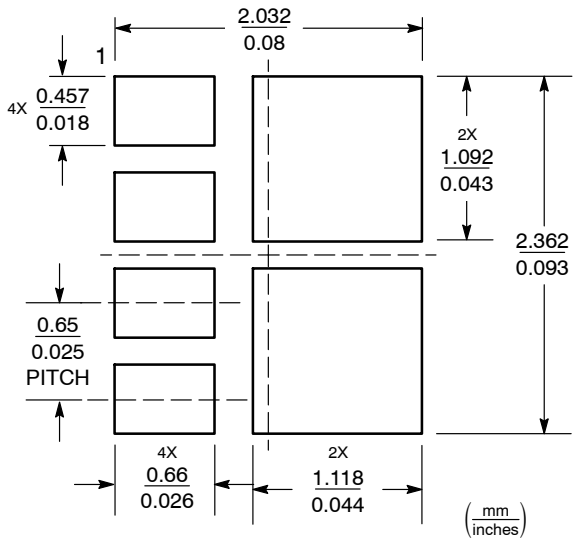
ChipFET™
CASE 1206A−03
ISSUE K

DATE 19 MAY 2009

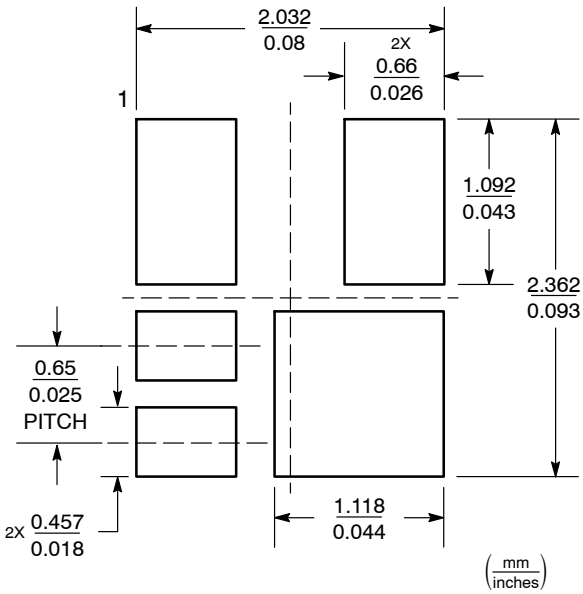
ADDITIONAL SOLDERING FOOTPRINTS*



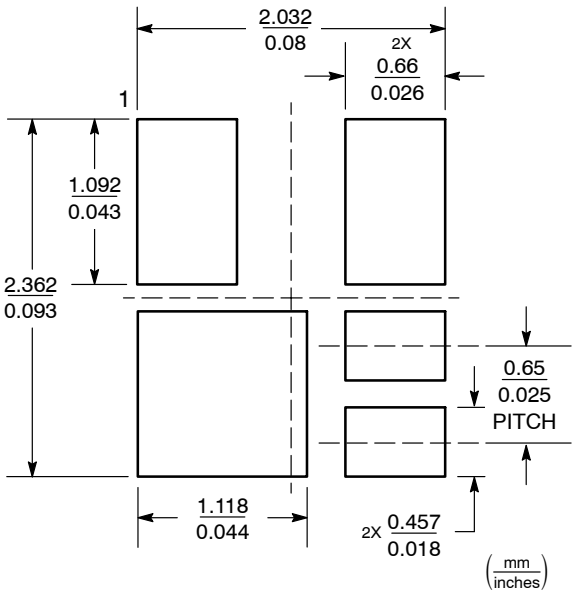
Styles 1 and 4



Style 2



Style 3



Style 5

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

DOCUMENT NUMBER:	**98AON03078D**	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.
DESCRIPTION:	**ChipFET**	**PAGE 2 OF 2**

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:
Email Requests to: orderlit@onsemi.com

onsemi Website: www.onsemi.com

TECHNICAL SUPPORT
North American Technical Support:
Voice Mail: 1 800−282−9855 Toll Free USA/Canada
Phone: 011 421 33 790 2910

Europe, Middle East and Africa Technical Support:
Phone: 00421 33 790 2910
For additional information, please contact your local Sales Representative

◊