

NTHD3101F

Power MOSFET and Schottky Diode

-20 V, FETKY™, P-Channel, -4.4 A, with 4.1 A Schottky Barrier Diode, ChipFET™



ON Semiconductor®

<http://onsemi.com>

Features

- Leadless SMD Package Featuring a MOSFET and Schottky Diode
- 40% Smaller than TSOP-6 Package
- Leadless SMD Package Provides Great Thermal Characteristics
- Independent Pinout to each Device to Ease Circuit Design
- Trench P-Channel for Low On Resistance
- Ultra Low V_F Schottky
- Pb-Free Packages are Available

Applications

- Li-Ion Battery Charging
- High Side DC-DC Conversion Circuits
- High Side Drive for Small Brushless DC Motors
- Power Management in Portable, Battery Powered Products

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

Parameter		Symbol	Value	Units	
Drain-to-Source Voltage		V_{DS}	-20	V	
Gate-to-Source Voltage		V_{GS}	± 8.0	V	
Continuous Drain Current (Note 1)	Steady State	I_D	$T_J = 25^\circ\text{C}$	-3.2	A
			$T_J = 85^\circ\text{C}$	-2.3	
	$t \leq 5$ s	$T_J = 25^\circ\text{C}$	-4.4		
Power Dissipation (Note 1)	Steady State	P_D	$T_J = 25^\circ\text{C}$	1.1	W
				$t \leq 5$ s	
Pulsed Drain Current	$t_p = 10 \mu\text{s}$	I_{DM}	-13	A	
Operating Junction and Storage Temperature		T_J, T_{STG}	-55 to 150	$^\circ\text{C}$	
Source Current (Body Diode)		I_S	2.5	A	
Lead Temperature for Soldering Purposes (1/8" from case for 10 s)		T_L	260	$^\circ\text{C}$	

SCHOTTKY DIODE MAXIMUM RATINGS

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

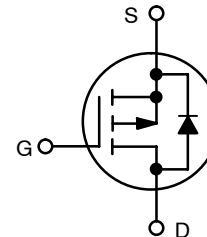
Parameter		Symbol	Value	Units	
Peak Repetitive Reverse Voltage		V_{RRM}	20	V	
DC Blocking Voltage		V_R	20	V	
Average Rectified Forward Current	Steady State	I_F	$T_J = 25^\circ\text{C}$	2.2	V
				$t \leq 5$ s	4.1

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.

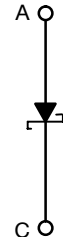
1. Surface Mounted on FR4 Board using 1 in sq pad size (Cu area = 1.127 in sq [1 oz] including traces).

MOSFET		
$V_{(BR)DSS}$	$R_{DS(on)}$ TYP	I_D MAX
-20 V	64 m Ω @ -4.5 V	-4.4 A
	85 m Ω @ -2.5 V	

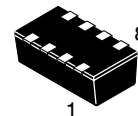
SCHOTTKY DIODE		
V_R MAX	V_F TYP	I_F MAX
20 V	0.510 V	4.1 A



P-Channel MOSFET

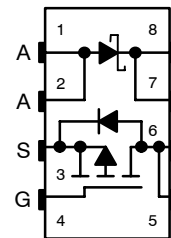


Schottky Diode

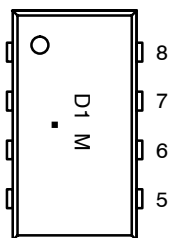


ChipFET
CASE 1206A
STYLE 3

PIN CONNECTIONS



MARKING DIAGRAM



- D1 = Specific Device Code
- M = Month Code
- = Pb-Free Package

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 6 of this data sheet.

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THERMAL RESISTANCE RATINGS

Parameter	Symbol	Max	Units
Junction-to-Ambient – Steady State (Note 2)	$R_{\theta JA}$	113	$^{\circ}\text{C}/\text{W}$
Junction-to-Ambient – $t \leq 10$ s (Note 2)	$R_{\theta JA}$	60	$^{\circ}\text{C}/\text{W}$

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

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

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
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OFF CHARACTERISTICS

Drain-to-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}, I_D = -250\ \mu\text{A}$	-20			V
Drain-to-Source Breakdown Voltage Temperature Coefficient	$V_{(BR)DSS}/T_J$			-15		$\text{mV}/^{\circ}\text{C}$
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = -16\text{ V}, V_{GS} = 0\text{ V}$			-1.0	μA
					-5.0	
Gate-to-Source Leakage Current	I_{GSS}	$V_{DS} = 0\text{ V}, V_{GS} = \pm 8.0\text{ V}$			± 100	nA

ON CHARACTERISTICS (Note 3)

Gate Threshold Voltage	$V_{GS(TH)}$	$V_{GS} = V_{DS}, I_D = -250\ \mu\text{A}$	-0.45		-1.5	V
Gate Threshold Temperature Coefficient	$V_{GS(TH)}/T_J$			2.7		$\text{mV}/^{\circ}\text{C}$
Drain-to-Source On-Resistance	$R_{DS(on)}$	$V_{GS} = -4.5\text{ V}, I_D = -3.2\text{ A}$		64	80	$\text{m}\Omega$
		$V_{GS} = -2.5\text{ V}, I_D = -2.2\text{ A}$		85	110	
		$V_{GS} = -1.8\text{ V}, I_D = -1.0\text{ A}$		120	170	
Forward Transconductance	g_{FS}	$V_{DS} = -10\text{ V}, I_D = -2.9\text{ A}$		8.0		S

CHARGES AND CAPACITANCES

Input Capacitance	C_{ISS}	$V_{GS} = 0\text{ V}, f = 1.0\text{ MHz}, V_{DS} = -10\text{ V}$		680		pF
Output Capacitance	C_{OSS}			100		
Reverse Transfer Capacitance	C_{RSS}			70		
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = -4.5\text{ V}, V_{DS} = -10\text{ V}, I_D = -3.2\text{ A}$		7.4		nC
Threshold Gate Charge	$Q_{G(TH)}$			0.6		
Gate-to-Source Charge	Q_{GS}			1.4		
Gate-to-Drain Charge	Q_{GD}			2.5		

SWITCHING CHARACTERISTICS (Note 4)

Turn-On Delay Time	$t_{d(ON)}$	$V_{GS} = -4.5\text{ V}, V_{DD} = -10\text{ V}, I_D = -3.2\text{ A}, R_G = 2.4\ \Omega$		5.8		ns
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}	$V_{GS} = 0\text{ V}, I_S = -2.5\text{ A}$	$T_J = 25^{\circ}\text{C}$		-0.8	-1.2	V
Reverse Recovery Time	t_{RR}	$V_{GS} = 0\text{ V}, I_S = -1.0\text{ A}, di_S/dt = 100\text{ A}/\mu\text{s}$			13.5		ns
Charge Time	t_a				9.5		
Discharge Time	t_b				4.0		
Reverse Recovery Charge	Q_{RR}				6.5		nC

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

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Maximum Instantaneous Forward Voltage	V_F	$I_F = 0.1\text{ A}$		0.425		V
		$I_F = 1.0\text{ A}$		0.510	0.575	
Maximum Instantaneous Reverse Current	I_R	$V_R = 10\text{ V}$			1.0	μA
		$V_R = 20\text{ V}$			5.0	

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

4. Switching characteristics are independent of operating junction temperatures.

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TYPICAL P-CHANNEL PERFORMANCE CURVES

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

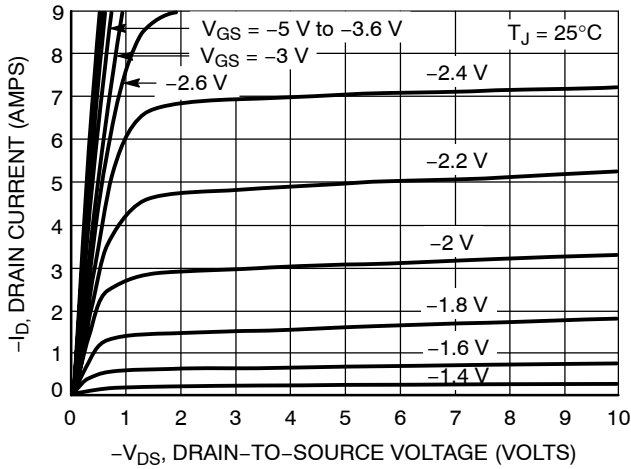


Figure 1. On-Region Characteristics

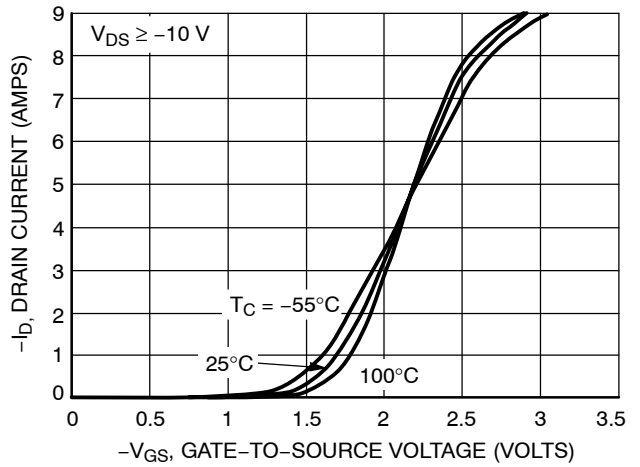


Figure 2. Transfer Characteristics

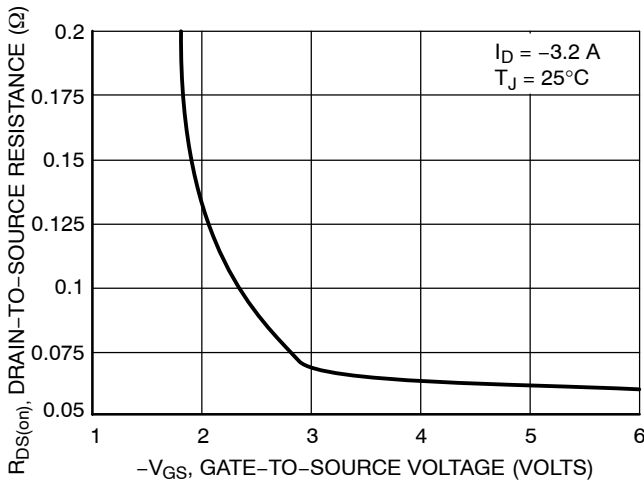


Figure 3. On-Resistance vs. Gate-to-Source Voltage

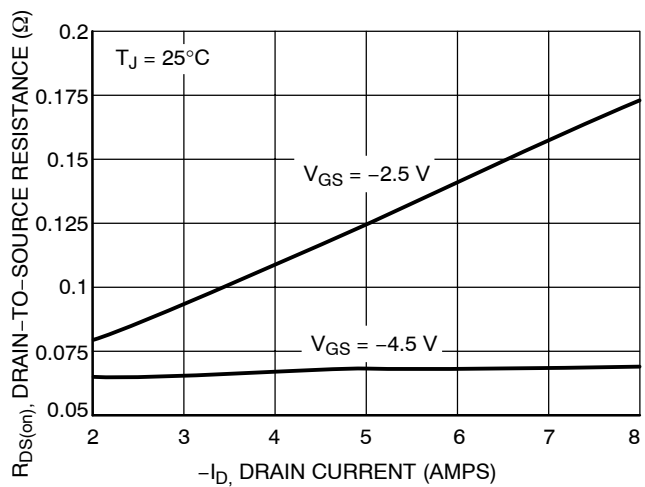


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

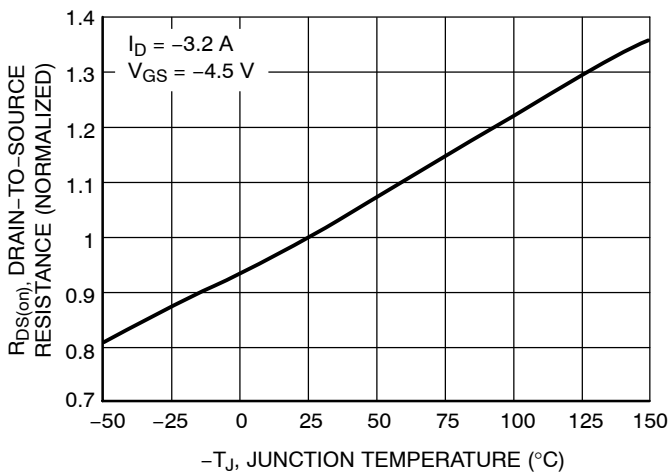


Figure 5. On-Resistance Variation with Temperature

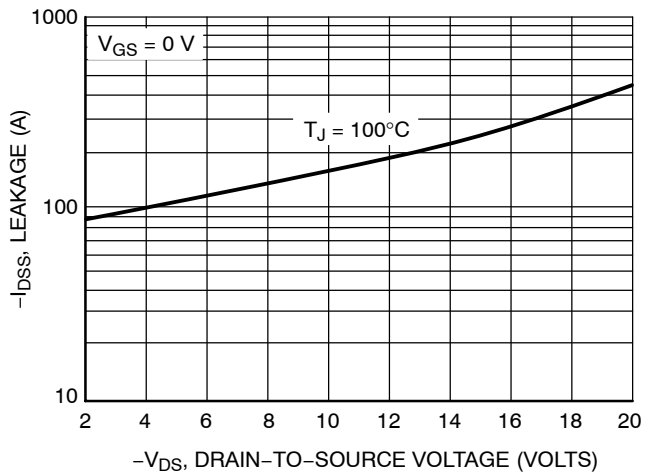


Figure 6. Drain-to-Source Leakage Current vs. Voltage

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TYPICAL P-CHANNEL PERFORMANCE CURVES

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

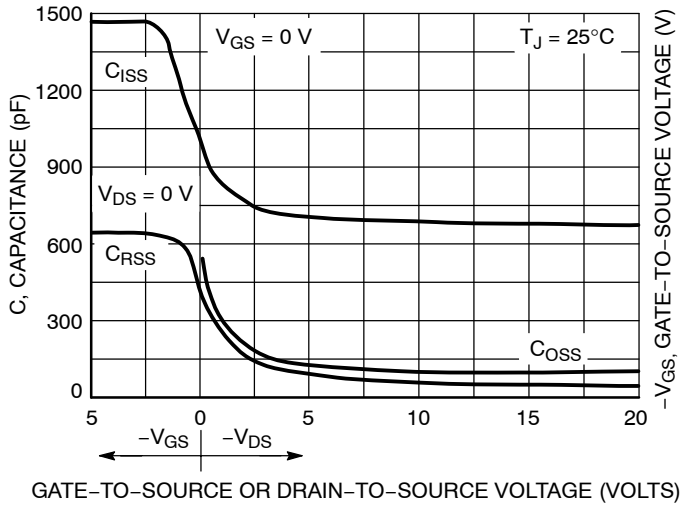


Figure 7. Capacitance Variation

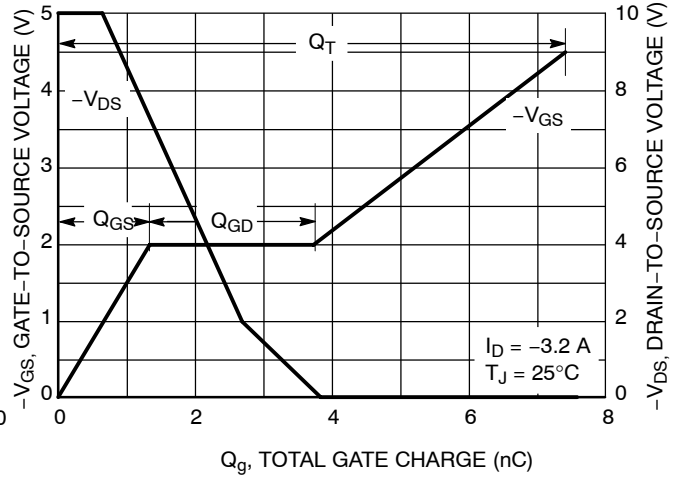


Figure 8. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge

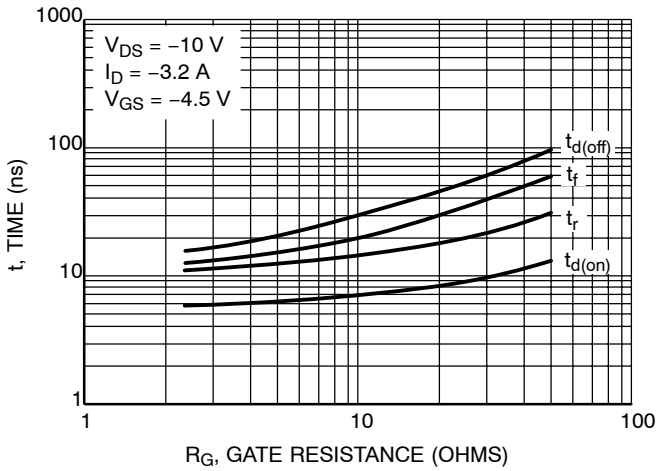


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

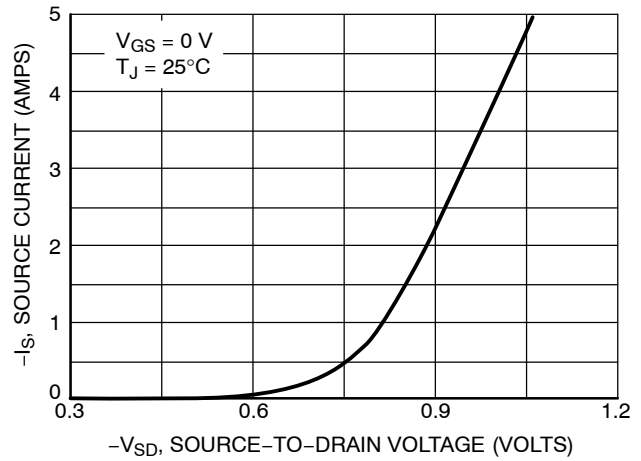


Figure 10. Diode Forward Voltage vs. Current

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TYPICAL SCHOTTKY PERFORMANCE CURVES ($T_J = 25^\circ\text{C}$ unless otherwise noted)

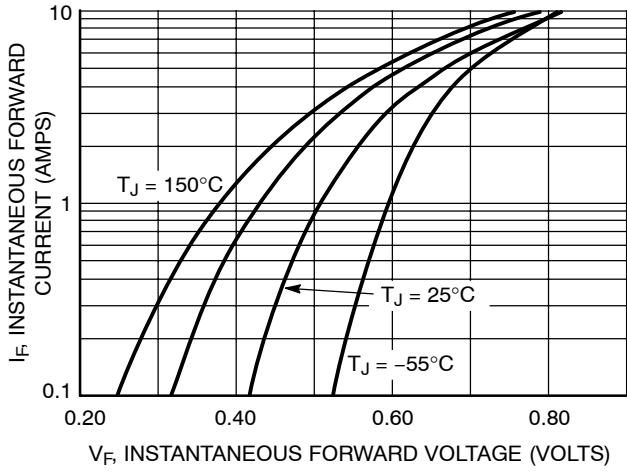


Figure 11. Typical Forward Voltage

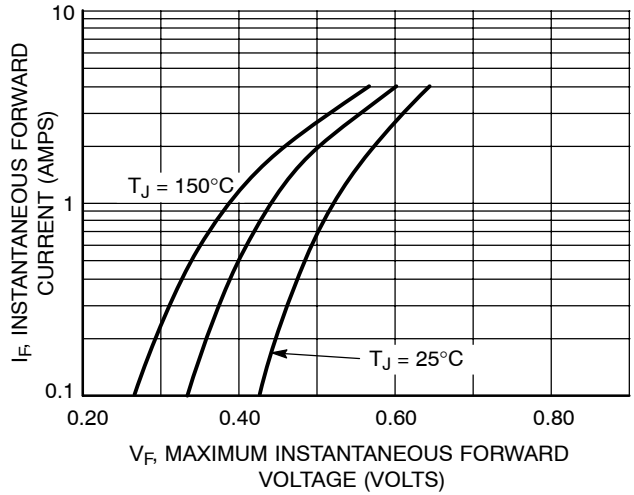


Figure 12. Maximum Forward Voltage

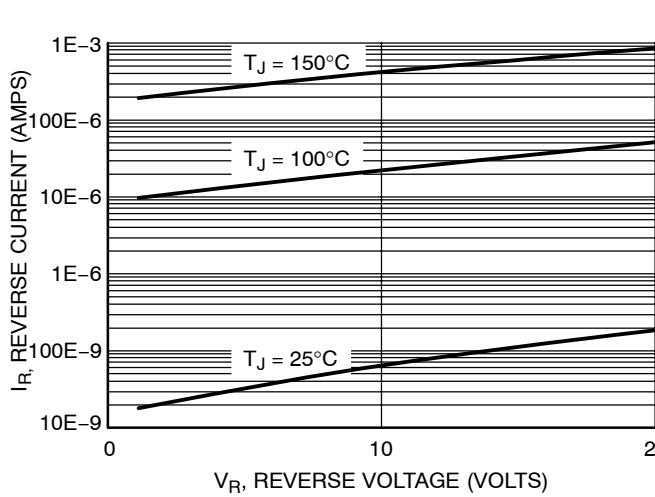


Figure 13. Typical Reverse Current

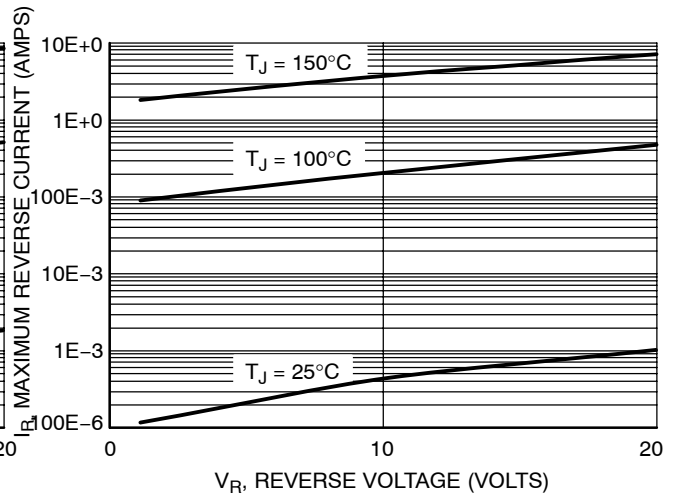


Figure 14. Maximum Reverse Current

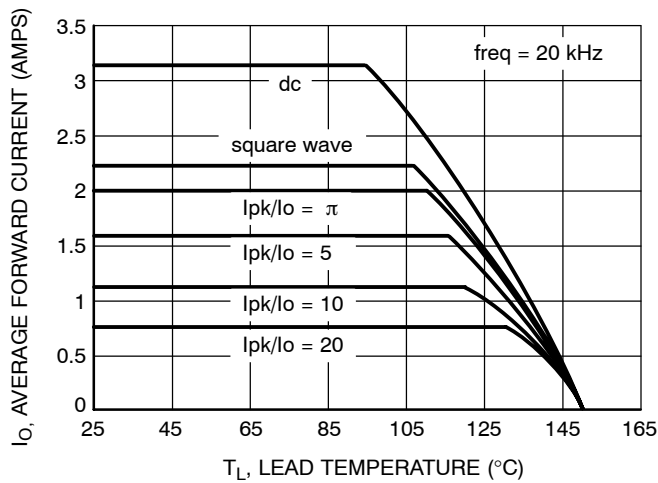


Figure 15. Current Derating

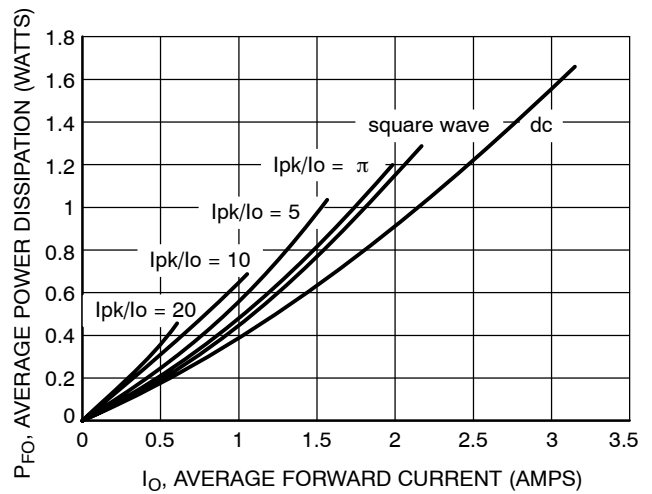


Figure 16. Forward Power Dissipation

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DEVICE ORDERING INFORMATION

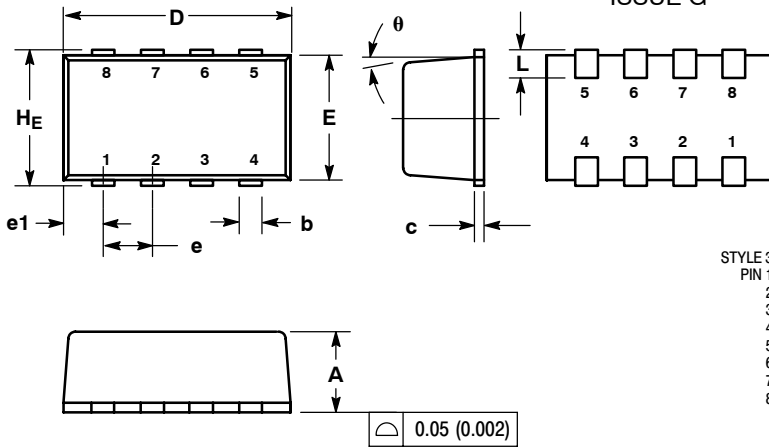
Device	Package	Shipping†
NTHD3101FT1	ChipFET	3000 / Tape & Reel
NTHD3101FT1G	ChipFET (Pb-Free)	3000 / Tape & Reel
NTHD3101FT3	ChipFET	10000 / Tape & Reel
NTHD3101FT3G	ChipFET (Pb-Free)	10000 / Tape & Reel

†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.

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PACKAGE DIMENSIONS

ChipFET CASE 1206A-03 ISSUE G



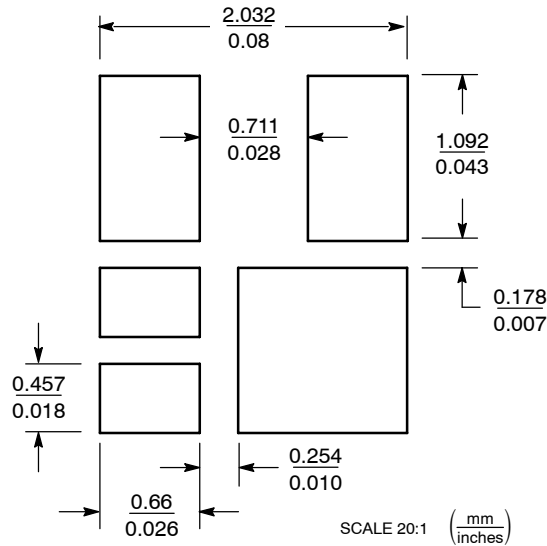
NOTES:

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 3:
PIN 1. A
2. A
3. S
4. G
5. D
6. D
7. C
8. C

SOLDERING FOOTPRINT*



*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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