

# NTHS4101P

## 20 V, P-Channel Power MOSFET ChipFET™ Single Package

### Features

- Offers an Ultra Low  $R_{DS(on)}$  Solution in the ChipFET Package
- Miniature ChipFET Package 40% Smaller Footprint than TSOP-6 making it an Ideal Device for Applications where Board Space is at a Premium
- Low Profile (<1.1 mm) Allows it to Fit Easily into Extremely Thin Environments such as Portable Electronics
- Designed to Provide Low  $R_{DS(on)}$  at Gate Voltage as Low as 1.8 V, the Operating Voltage used in many Logic ICs in Portable Electronics
- Simplifies Circuit Design since Additional Boost Circuits for Gate Voltages are not Required
- Operated at Standard Logic Level Gate Drive, Facilitating Future Migration to Lower Levels using the same Basic Topology

### Applications

- Optimized for Battery and Load Management Applications in Portable Equipment such as MP3 Players, Cell Phones, Digital Cameras, Personal Digital Assistant and other Portable Applications
- Charge Control in Battery Chargers
- Buck and Boost Converters

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

Rating	Symbol	Value	Unit
Drain-to-Source Voltage	$V_{DSS}$	-20	$V_{dc}$
Gate-to-Source Voltage - Continuous	$V_{GS}$	$\pm 8.0$	$V_{dc}$
Drain Current - Continuous - 5 seconds	$I_D$	-4.8	A
	$I_D$	-6.7	A
Total Power Dissipation Continuous @ $T_A = 25^\circ\text{C}$ (5 sec) @ $T_A = 25^\circ\text{C}$ Continuous @ $85^\circ\text{C}$ (5 sec) @ $85^\circ\text{C}$	$P_D$	1.3	W
		2.5	
		0.7	
		1.3	
Continuous Source Current	$I_S$	-4.8	A
Thermal Resistance (Note 1) Junction-to-Ambient, 5 sec Junction-to-Ambient, Continuous	$R_{\theta JA}$ $R_{\theta JA}$	50	$^\circ\text{C/W}$
		95	
Maximum Lead Temperature for Soldering Purposes, 1/8" from case for 10 seconds	$T_L$	260	$^\circ\text{C}$

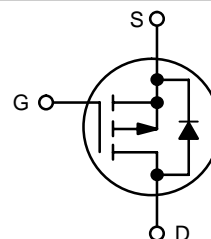
1. When surface mounted to a 1" x 1" FR4 board.



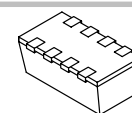
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$V_{(BR)DSS}$	$R_{DS(on)}$ TYP	$I_D$ MAX
-20 V	21 m $\Omega$ @ -4.5 V	-4.8 A
	30 m $\Omega$ @ -2.5 V	
	42 m $\Omega$ @ -1.8 V	

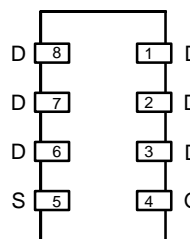


P-Channel MOSFET

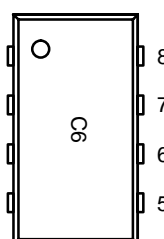


ChipFET  
CASE 1206A  
Style 1

### PIN CONNECTIONS



### MARKING DIAGRAM



C6 = Specific Device Code

### ORDERING INFORMATION

Device	Package	Shipping†
NTHS4101PT1	ChipFET	3000 Tape / Reel
NTHS4101PT1G	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.

# NTHS4101P

## ELECTRICAL CHARACTERISTICS (T<sub>J</sub> = 25°C unless otherwise noted)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
<b>OFF CHARACTERISTICS</b>						
Drain-to-Source Breakdown Voltage (Note 2) Temperature Coefficient (Positive)	V <sub>(Br)DSS</sub>	V <sub>GS</sub> = 0 V <sub>dc</sub> , I <sub>D</sub> = -250 μA <sub>dc</sub>	-20	-	-	V <sub>dc</sub>
Gate-Body Leakage Current Zero	I <sub>GSS</sub>	V <sub>DS</sub> = 0 V <sub>dc</sub> , V <sub>GS</sub> = ±8.0 V <sub>dc</sub>	-	-	±100	nA <sub>dc</sub>
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> = -16 V <sub>dc</sub> , V <sub>GS</sub> = 0 V <sub>dc</sub> V <sub>DS</sub> = -16 V <sub>dc</sub> , V <sub>GS</sub> = 0 V <sub>dc</sub> , T <sub>J</sub> = 85°C	-	-	-1.0 -5.0	μA <sub>dc</sub>

## ON CHARACTERISTICS (Note 2)

Gate Threshold Voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = -250 μA <sub>dc</sub>	-0.45	-	-1.5	V <sub>dc</sub>
Static Drain-to-Source On-Resistance	R <sub>DS(on)</sub>	V <sub>GS</sub> = -4.5 V <sub>dc</sub> , I <sub>D</sub> = -4.8 A <sub>dc</sub>	-	21	34	mΩ
		V <sub>GS</sub> = -2.5 V <sub>dc</sub> , I <sub>D</sub> = -4.2 A <sub>dc</sub>	-	30	40	
		V <sub>GS</sub> = -1.8 V <sub>dc</sub> , I <sub>D</sub> = -1.0 A <sub>dc</sub>	-	42	52	
Forward Transconductance	g <sub>FS</sub>	V <sub>DS</sub> = -5.0 V <sub>dc</sub> , I <sub>D</sub> = -4.8 A <sub>dc</sub>	-	15	-	S
Diode Forward Voltage	V <sub>SD</sub>	I <sub>S</sub> = -4.8 A <sub>dc</sub> , V <sub>GS</sub> = 0 V <sub>dc</sub>	-	-0.8	-1.2	V

## DYNAMIC CHARACTERISTICS

Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> = -16 V <sub>dc</sub> V <sub>GS</sub> = 0 V f = 1.0 MHz	-	2100	-	pF
Output Capacitance	C <sub>oss</sub>		-	290	-	
Transfer Capacitance	C <sub>rss</sub>		-	200	-	

## SWITCHING CHARACTERISTICS (Note 3)

Turn-On Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> = -16 V <sub>dc</sub> V <sub>GS</sub> = -4.5 V <sub>dc</sub> I <sub>D</sub> = -4.5 A <sub>dc</sub> R <sub>G</sub> = 2.5 Ω	-	8.0	-	ns
Rise Time	t <sub>r</sub>		-	28	-	
Turn-Off Delay Time	t <sub>d(off)</sub>		-	75	-	
Fall Time	t <sub>f</sub>		-	60	-	
Gate Charge	Q <sub>g</sub>	V <sub>GS</sub> = -4.5 V <sub>dc</sub> I <sub>D</sub> = -4.5 A <sub>dc</sub> V <sub>DS</sub> = -16 V <sub>dc</sub> (Note 3)	-	25	35	nC
	Q <sub>gs</sub>		-	4.0	-	
	Q <sub>gd</sub>		-	7.0	-	

2. Pulse Test: Pulse Width = 250 μs, Duty Cycle = 2%.
3. Switching characteristics are independent of operating junction temperatures.

# NTHS4101P

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

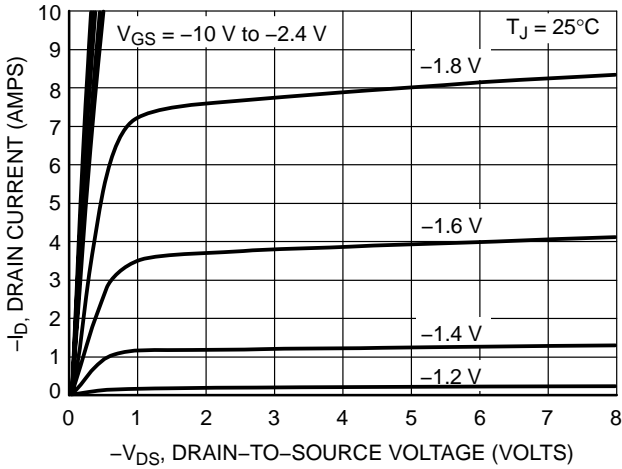


Figure 1. On-Region Characteristics

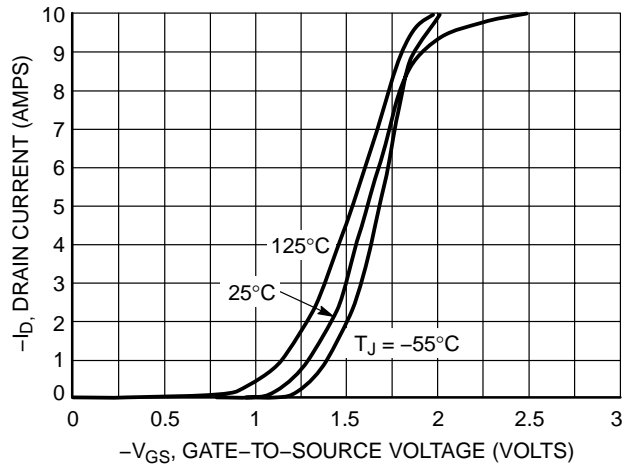


Figure 2. Transfer Characteristics

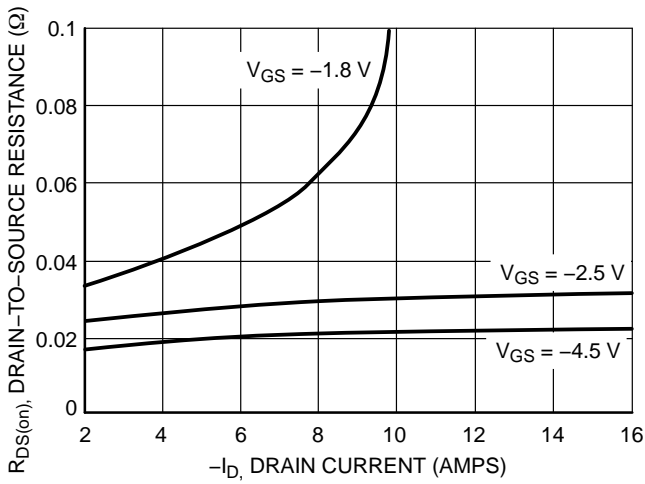


Figure 3. On-Resistance vs. Drain Current and Gate Voltage

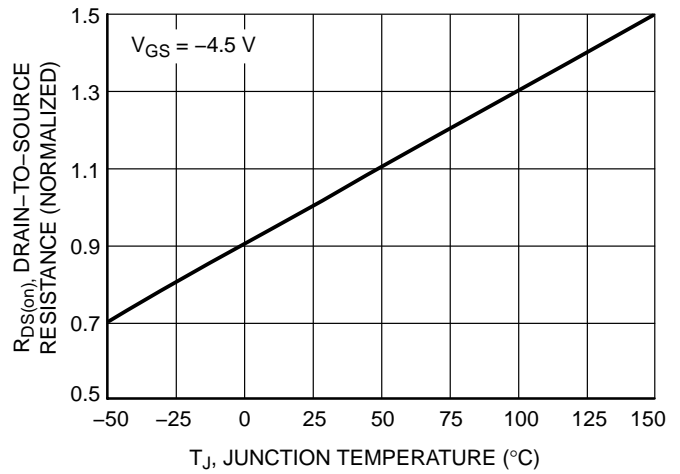


Figure 4. On-Resistance Variation with Temperature

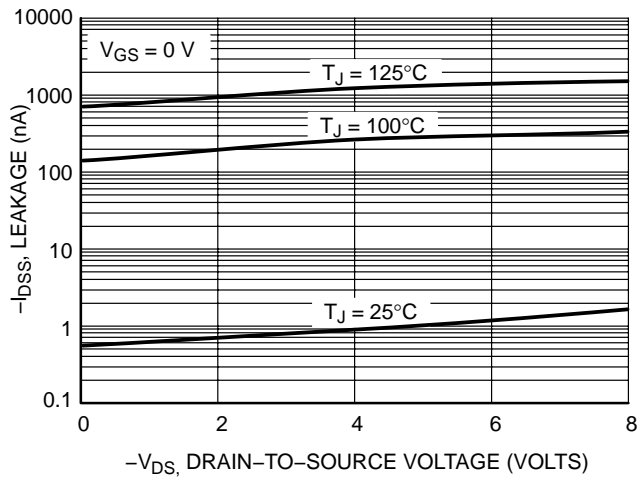


Figure 5. Drain-to-Source Leakage Current vs. Voltage

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

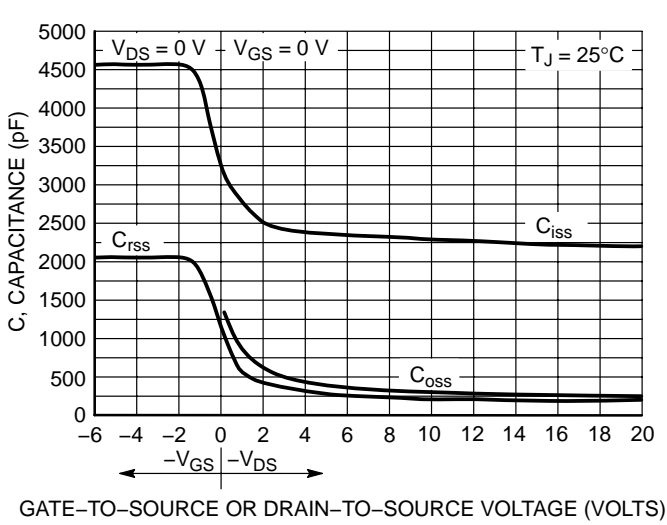


Figure 6. Capacitance Variation

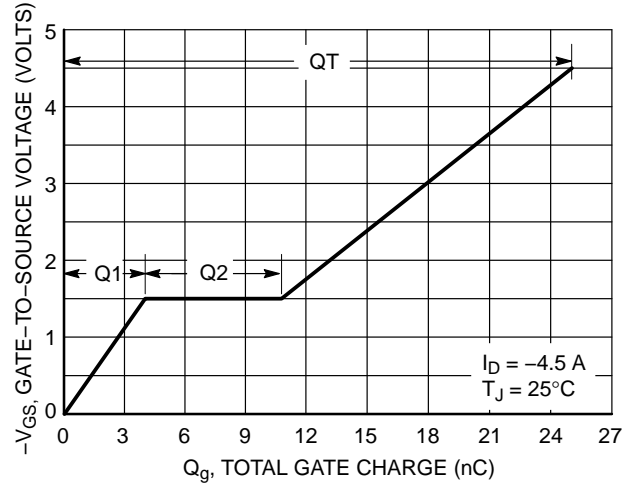


Figure 7. Gate-to-Source and Drain-to-Source Voltage vs. Total Gate Charge

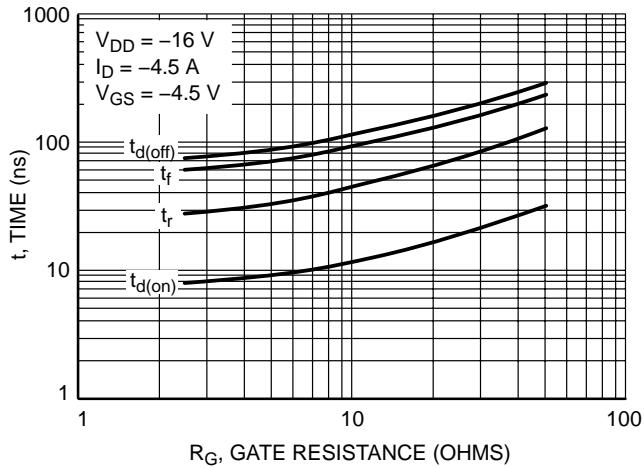


Figure 8. Resistive Switching Time Variation vs. Gate Resistance

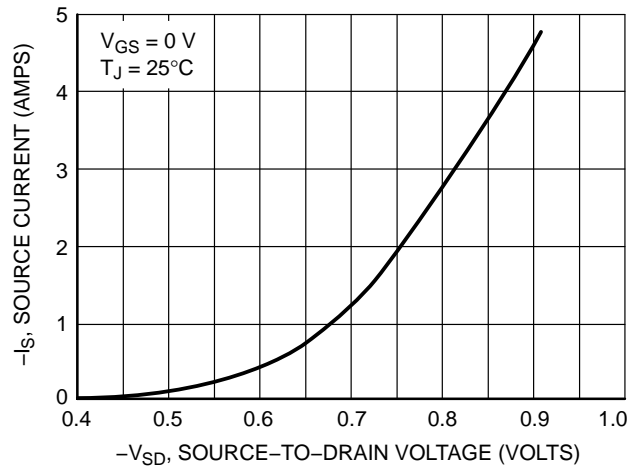


Figure 9. Diode Forward Voltage vs. Current

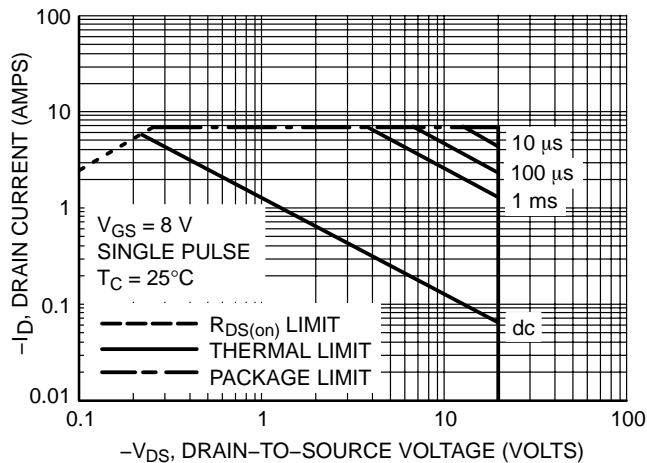
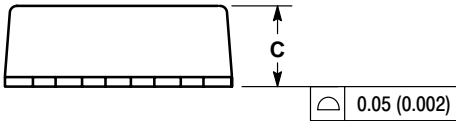
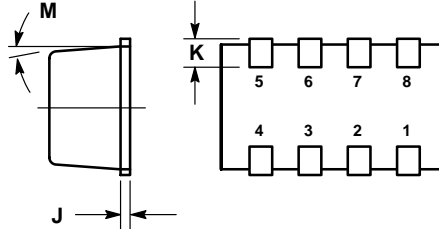
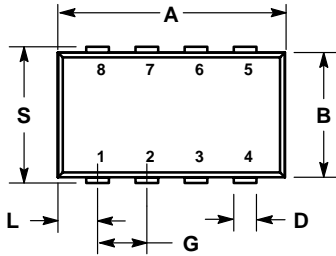


Figure 10. Maximum Rated Forward Biased Safe Operating Area

# NTHS4101P

## PACKAGE DIMENSIONS

ChipFET  
CASE 1206A-03  
ISSUE E



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

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.
7. 1206A-01 AND 1206A-02 OBSOLETE. NEW STANDARD IS 1206A-03.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	2.95	3.10	0.116	0.122
B	1.55	1.70	0.061	0.067
C	1.00	1.10	0.039	0.043
D	0.25	0.35	0.010	0.014
G	0.65 BSC		0.025 BSC	
J	0.10	0.20	0.004	0.008
K	0.28	0.42	0.011	0.017
L	0.55 BSC		0.022 BSC	
M	5° NOM		5° NOM	
S	1.80	2.00	0.072	0.080

### SOLDER FOOTPRINT\*

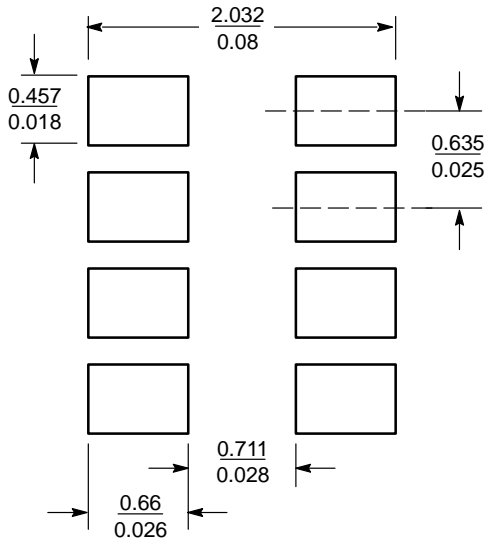


Figure 11. Basic

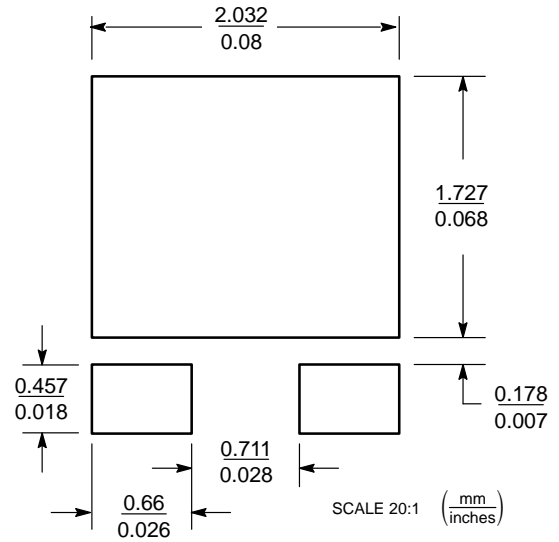



Figure 12. Style 1

\*For information on soldering specifications, please refer to our Soldering Reference Manual, SOLDERRM/D.

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