NTGS4111P

Power MOSFET

−30 V, −4.7 A, Single P−Channel, TSOP−6

Features

- Leading −30 V Trench Process for Low $R_{DS(on)}$
- Low Profile Package Suitable for Portable Applications
- Surface Mount TSOP−6 Package Saves Board Space
- Improved Efficiency for Battery Applications
- Pb−Free Package is Available

Applications

- Battery Management and Switching
- Load Switching
- Battery Protection

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

Rating			Symbol	Value	Unit
Drain−to−Source Voltage			V_{DSS}	−30	V
Gate−to−Source Voltage			V_{GS}	±20	V
Continuous Drain Current (Note 1)	Steady State	T_A = 25°C	I_D	−3.7	A
		T_A = 85°C		−2.7	
	t ≤ 5 s	T_A = 25°C		−4.7	
Power Dissipation (Note 1)	Steady State	T_A = 25°C	P_D	1.25	W
	t ≤ 5 s			2.0	
Continuous Drain Current (Note 2)	Steady State	T_A = 25°C	I_D	−2.6	A
		T_A = 85°C		−1.9	
Power Dissipation (Note 2)		T_A = 25°C	P_D	0.63	W
Pulsed Drain Current	tp = 10 μs		I_{DM}	−15	A
Operating Junction and Storage Temperature			T_J, T_{STG}	−55 to 150	°C
Source Current (Body Diode)			I_S	−1.7	A
Lead Temperature for Soldering Purposes (1/8″ from case for 10 s)			T_L	260	°C

THERMAL RESISTANCE RATINGS

Rating	Symbol	Max	Unit
Junction−to−Ambient – Steady State (Note 1)	$R_{\theta JA}$	100	°C/W
Junction−to−Ambient – t ≤ 5 s (Note 1)	$R_{\theta JA}$	62.5	
Junction−to−Ambient – Steady State (Note 2)	$R_{\theta JA}$	200	

Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur and reliability may be affected.

1. Surface−mounted on FR4 board using 1 in sq pad size (Cu area = 1.127 in sq [1 oz] including traces).
2. Surface−mounted on FR4 board using the minimum recommended pad size (Cu area = 0.006 in sq).

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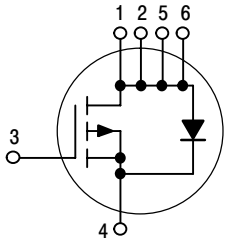
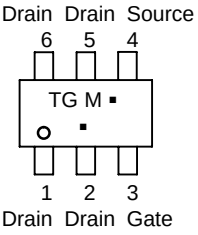
$V_{(BR)DSS}$	$R_{DS(on)}$ TYP	I_D MAX
−30 V	38 mΩ @ −10 V	−4.7 A
	68 mΩ @ −4.5 V	

P−Channel



MARKING DIAGRAM & PIN ASSIGNMENT

TSOP−6
CASE 318G
STYLE 1



TG = Specific Device Code
M = Date Code*
▪ = Pb−Free Package

(Note: Microdot may be in either location)

*Date Code orientation may vary depending upon manufacturing location.

ORDERING INFORMATION

Device	Package	Shipping†
NTGS4111PT1	TSOP−6	3000 / Tape & Reel
NTGS4111PT1G	TSOP−6 (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.

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

Characteristic	Symbol	Test Condition		Min	Typ	Max	Unit
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	$V_{(BR)DSS}/T_J$				−17		mV/°C
Zero Gate Voltage Drain Current	I_{DSS}	V_{GS} = 0 V, V_{DS} = −24 V	T_J = 25°C			−1.0	μA
			T_J = 125°C			−100	
Gate−to−Source Leakage Current	I_{GSS}	V_{DS} = 0 V, V_{GS} = ±20 V				±100	nA
ON CHARACTERISTICS (Note 3)							
Gate Threshold Voltage	$V_{GS(TH)}$	V_{GS} = V_{DS}, I_D = −250 μA		−1.0		−3.0	V
Negative Threshold Temperature Coefficient	$V_{GS(TH)}/T_J$				5.0		mV/°C
Drain−to−Source On Resistance	$R_{DS(on)}$	V_{GS} = −10 V, I_D = −3.7 A			38	60	mΩ
		V_{GS} = −4.5 V, I_D = −2.7 A			68	110	
Forward Transconductance	g_{FS}	V_{DS} = −10 V, I_D = −3.7 A			6.0		S
CHARGES, CAPACITANCES AND GATE RESISTANCE							
Input Capacitance	C_{ISS}	V_{GS} = 0 V, f = 1.0 MHz, V_{DS} = −15 V			750		pF
Output Capacitance	C_{OSS}				140		
Reverse Transfer Capacitance	C_{RSS}				130		
Total Gate Charge	$Q_{G(TOT)}$	V_{GS} = −10 V, V_{DD} = −15 V, I_D = −3.7 A			15.25	32	nC
Threshold Gate Charge	$Q_{G(TH)}$				0.8		
Gate−to−Source Charge	Q_{GS}				2.6		
Gate−to−Drain Charge	Q_{GD}				3.4		
SWITCHING CHARACTERISTICS, VGS = −10 V (Note 4)							
Turn−On Delay Time	$t_{d(ON)}$	V_{GS} = −10 V, V_{DD} = −15 V, I_D = −1.0 A, R_G = 6.0 Ω			9.0	17	ns
Rise Time	t_r				9.0	18	
Turn−Off Delay Time	$t_{d(OFF)}$				38	85	
Fall Time	t_f				22	45	
SWITCHING CHARACTERISTICS, VGS = −4.5 V (Note 4)							
Turn−On Delay Time	$t_{d(ON)}$	V_{GS} = −4.5 V, V_{DD} = −15 V, I_D = −1.0 A, R_G = 6.0 Ω			11	20	ns
Rise Time	t_r				15	28	
Turn−Off Delay Time	$t_{d(OFF)}$				28	56	
Fall Time	t_f				22	50	
DRAIN − SOURCE DIODE CHARACTERISTICS							
Characteristic	**Symbol**	**Test Condition**		**Min**	**Typ**	**Max**	**Unit**
Forward Diode Voltage	V_{DS}	V_{GS} = 0 V, I_S = −1.0 A	T_J = 25°C		−0.76	−1.2	V
			T_J = 125°C		−0.60		
Reverse Recovery Time	t_{RR}	V_{GS} = 0 V, dI_S/dt = 100 A/μs, I_S = −1.0 A			24	60	ns
Charge Time	t_a				9.0		
Discharge Time	t_b				15		
Reverse Recovery Charge	Q_{RR}				12		nC

3. Pulse Test: pulse width ≤ 300 μs, duty cycle ≤ 2%.
4. Switching characteristics are independent of operating junction temperatures.

TYPICAL PERFORMANCE CURVES (T_J = 25°C unless otherwise noted)

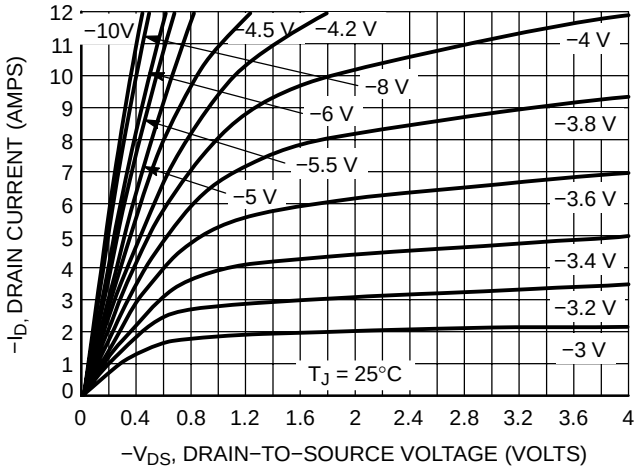


Figure 1. On−Region Characteristics

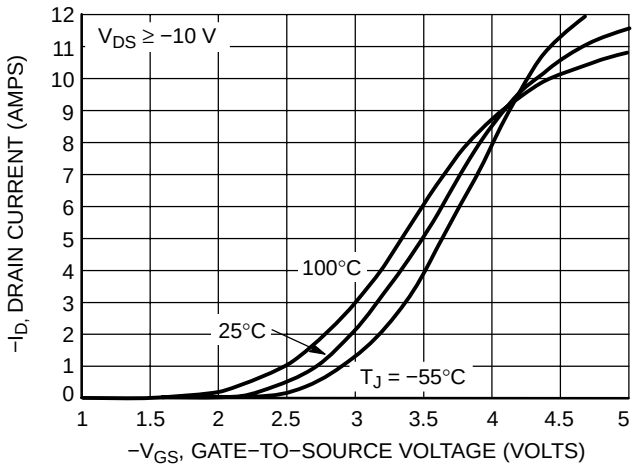


Figure 2. Transfer Characteristics

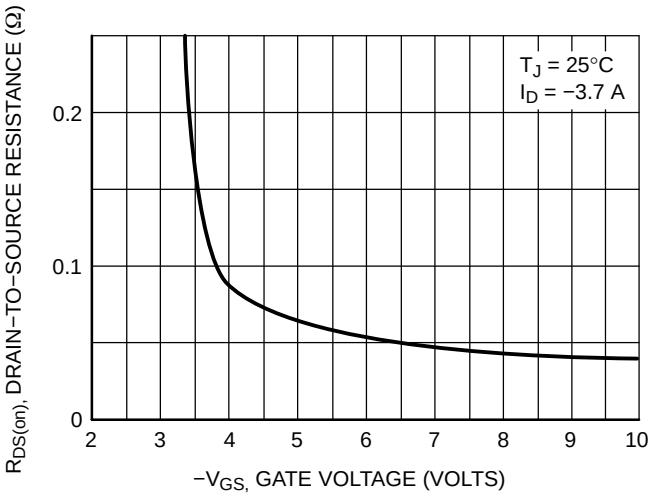


Figure 3. On−Resistance vs. Gate−to−Source Voltage

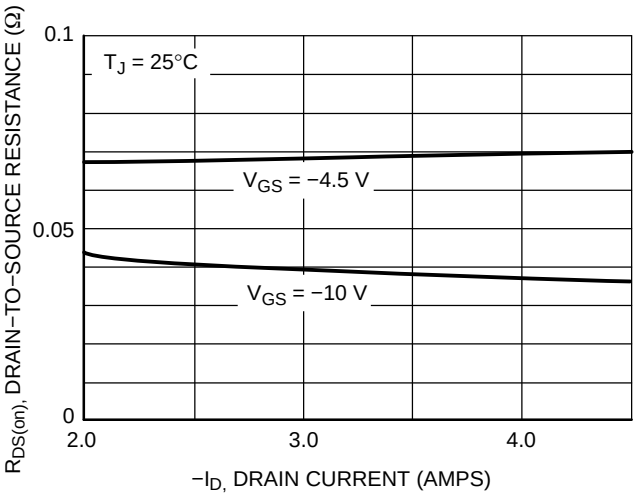


Figure 4. On−Resistance vs. Drain Current and Gate Voltage

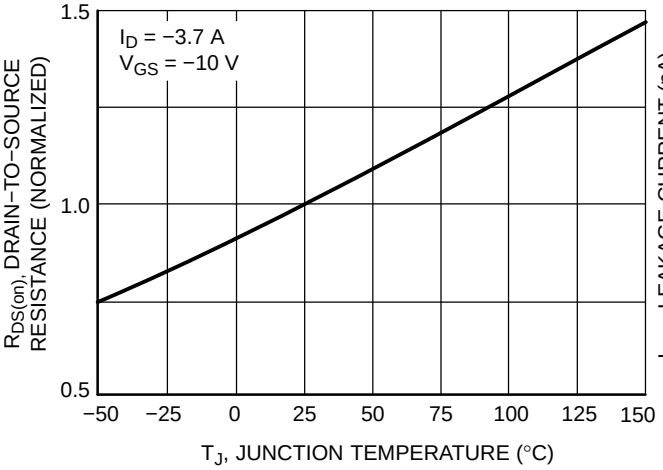


Figure 5. On−Resistance Variation with Temperature

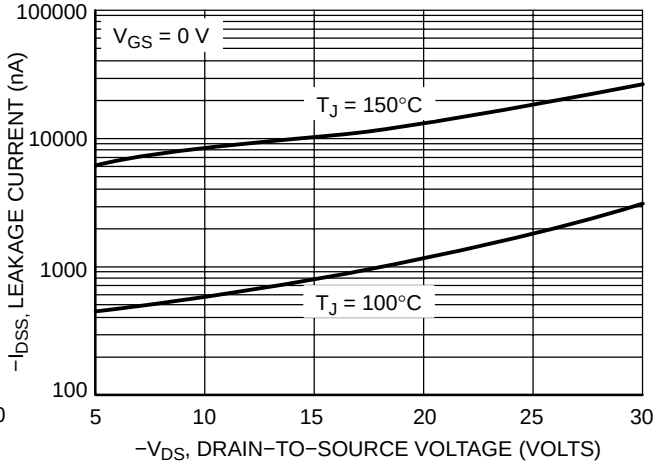


Figure 6. Drain−to−Source Leakage Current vs. Voltage

TYPICAL PERFORMANCE CURVES (T_J = 25°C unless otherwise noted)

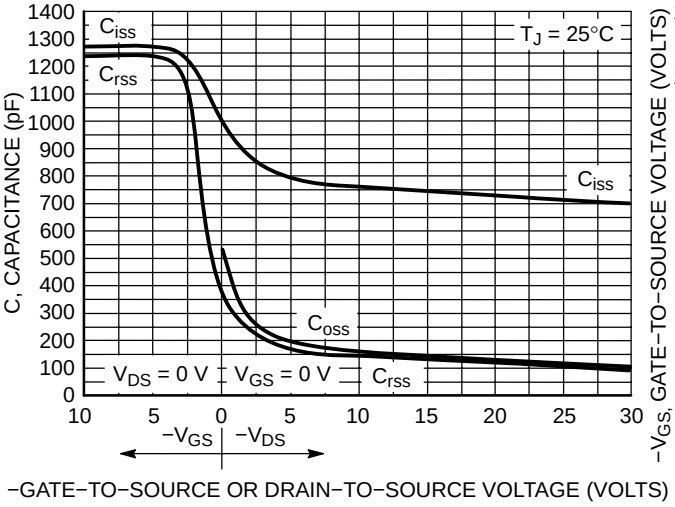


Figure 7. Capacitance Variation

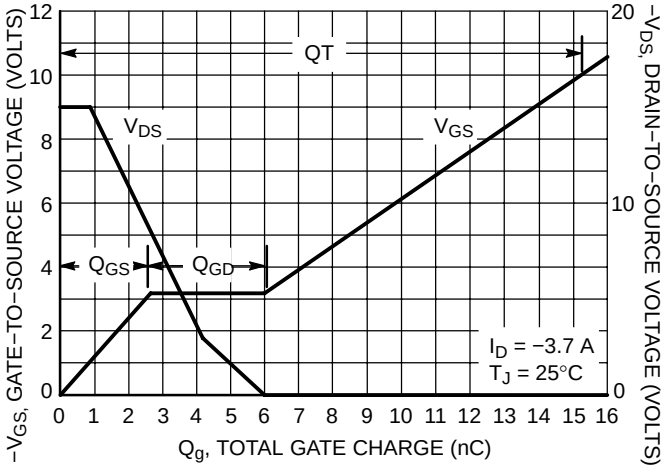


Figure 8. Gate−to−Source Voltage vs. Total Gate Charge

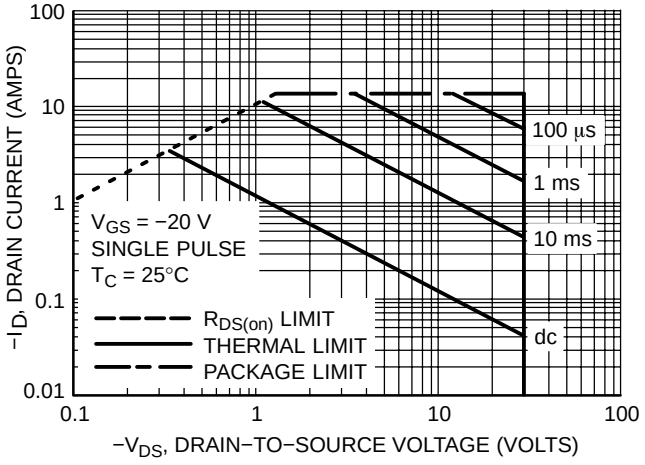


Figure 9. Maximum Rated Forward Biased Safe Operating Area

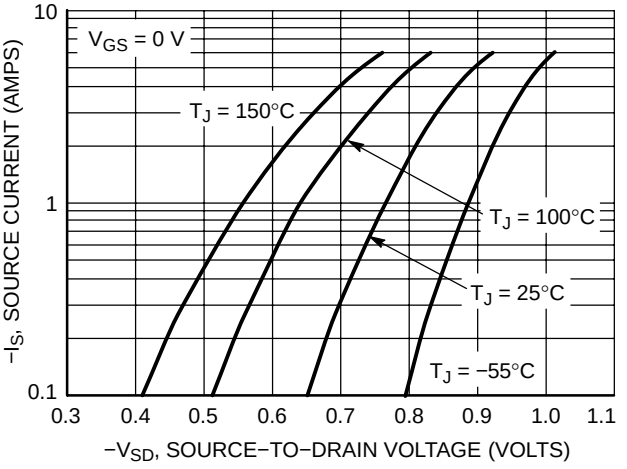


Figure 10. Diode Forward Voltage vs. Current

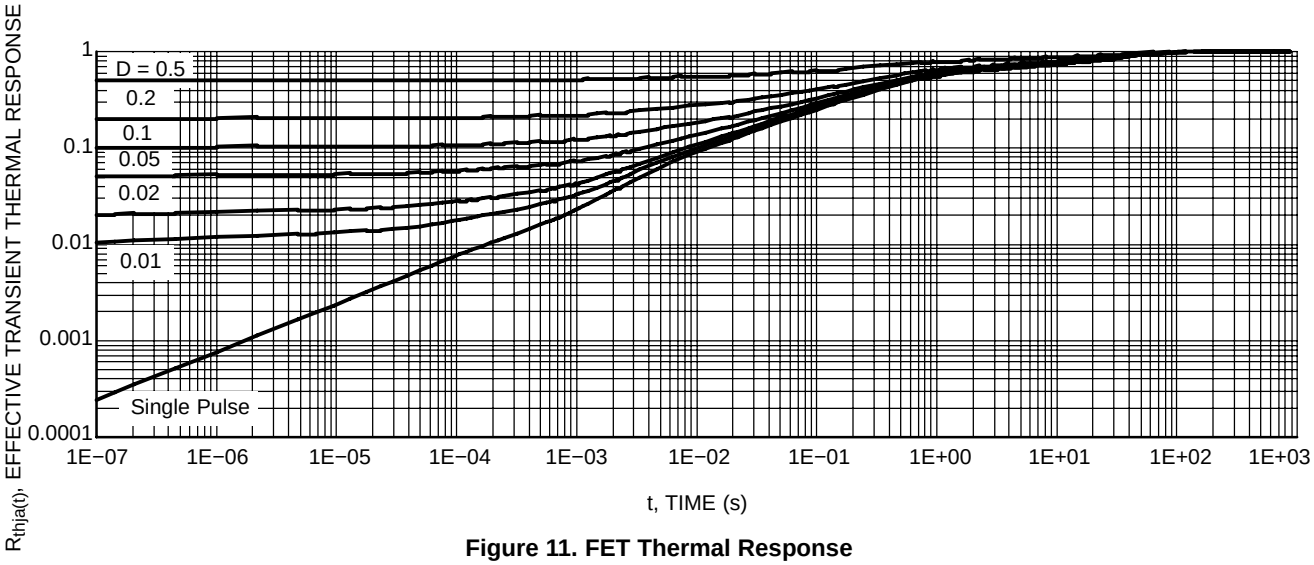
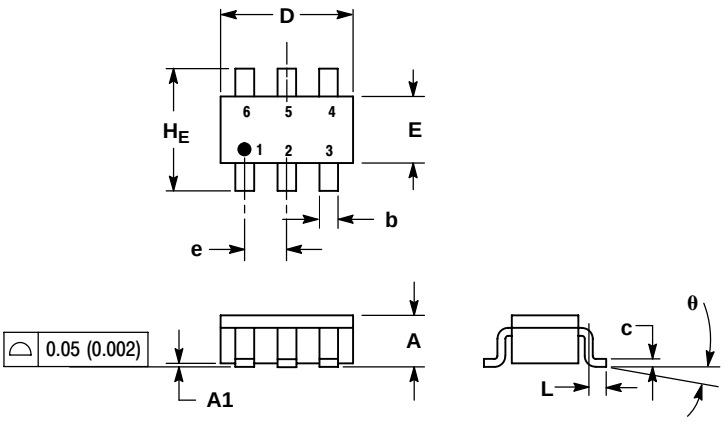


Figure 11. FET Thermal Response

NTGS4111P

PACKAGE DIMENSIONS

TSOP−6
CASE 318G−02
ISSUE P

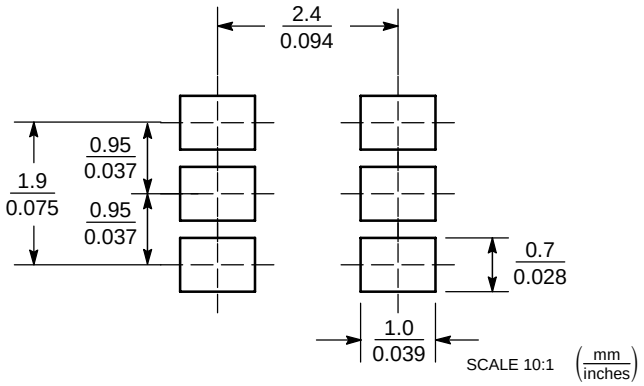


NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
4. DIMENSIONS A AND B DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

	MILLIMETERS			INCHES		
DIM	MIN	NOM	MAX	MIN	NOM	MAX
A	0.90	1.00	1.10	0.035	0.039	0.043
A1	0.01	0.06	0.10	0.001	0.002	0.004
b	0.25	0.38	0.50	0.010	0.014	0.020
c	0.10	0.18	0.26	0.004	0.007	0.010
D	2.90	3.00	3.10	0.114	0.118	0.122
E	1.30	1.50	1.70	0.051	0.059	0.067
e	0.85	0.95	1.05	0.034	0.037	0.041
L	0.20	0.40	0.60	0.008	0.016	0.024
H_E	2.50	2.75	3.00	0.099	0.108	0.118
θ	0°	–	10°	0°	–	10°

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

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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