NTGD4161P

Power MOSFET

−30 V, −2.3 A, Dual P−Channel, TSOP−6

Features

- Fast Switching Speed
- Low Gate Charge
- Low $R_{DS(on)}$
- Independently Connected Devices to Provide Design Flexibility
- This is a Pb−Free Device

Applications

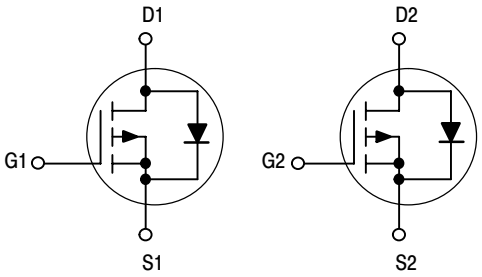
- Load Switch
- Battery Protection
- Portable Devices Like PDAs, Cellular Phones and Hard Drives

ON Semiconductor®

http://onsemi.com

$V_{(BR)DSS}$	$R_{DS(on)}$ Max
−30 V	160 mΩ @ −10 V
	280 mΩ @ −4.5 V

P−Channel (MOSFET1) **P−Channel (MOSFET2)**



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 (Note 1)	Steady State	T_A = 25°C	I_D	−2.1	A
		T_A = 85°C		−1.5	
	t ≤ 5 s	T_A = 25°C		−2.3	
Power Dissipation (Note 1)	Steady State	T_A = 25°C	P_D	1.1	W
	t ≤ 5 s			1.3	
Continuous Drain Current (Note 2)	Steady State	T_A = 25°C	I_D	−1.5	A
		T_A = 85°C		−1.1	
Power Dissipation (Note 2)		T_A = 25°C	P_D	0.6	W
Pulsed Drain Current	t_p = 10 μs		I_{DM}	−10	A
Operating Junction and Storage Temperature			T_J, T_{STG}	−55 to 150	°C
Source Current (Body Diode)			I_S	−0.8	A
Lead Temperature for Soldering Purposes (1/8" from case for 10 s)			T_L	260	°C

THERMAL RESISTANCE RATINGS

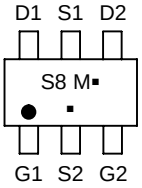
Parameter	Symbol	Max	Unit
Junction−to−Ambient − Steady State (Note 1)	$R_{\theta JA}$	115	°C/W
Junction−to−Ambient − Steady State (Note 2)		225	
Junction−to−Ambient − t ≤ 5 s (Note 1)		95	
Junction−to−Case − Steady State (Note 1)	$R_{\theta JC}$	40	

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. When surface mounted to an FR4 board using 1 in. pad size (Cu. area = 1.2 in^2 [1 oz] including traces)
2. When surface mounted to an FR4 board using minimum recommended pad size (Cu. area = 0.047 in^2)

MARKING DIAGRAM

TSOP−6
CASE 318G
STYLE 13



S8 = 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†
NTGD4161PT1G	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 stated)

Parameter	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	$V_{(BR)DSS}/T_J$				22		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			−10	
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	−1.9	−3.0	V
Gate Threshold Temperature Coefficient	$V_{GS(TH)}/T_J$				−4.7		mV/°C
Drain−to−Source On Resistance	$R_{DS(on)}$	V_{GS} = −10 V, I_D = −2.1 A			105	160	mΩ
		V_{GS} = −4.5 V, I_D = −1.6 A			190	280	
Forward Transconductance	g_{FS}	V_{DS} = −5.0 V, I_D = −2.1 A			2.7		S
CHARGES AND CAPACITANCES							
Input Capacitance	C_{ISS}	V_{DS} = −15 V, f = 1.0 MHz, V_{GS} = 0 V			281		pF
Output Capacitance	C_{OSS}				50		
Reverse Transfer Capacitance	C_{RSS}				28		
Total Gate Charge	$Q_{G(TOT)}$	V_{GS} = −10 V, V_{DS} = −5.0 V, I_D = −2.1A			5.6	7.1	nC
Threshold Gate Charge	$Q_{G(TH)}$				0.65		
Gate−to−Source Charge	Q_{GS}				1.2		
Gate−to−Drain Charge	Q_{GD}				0.90		
SWITCHING CHARACTERISTICS (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			7.6	14	ns
Rise Time	t_r				9.2	23	
Turn−Off Delay Time	$t_{d(off)}$				12.5	20	
Fall Time	t_f				4.5	12	
DRAIN−SOURCE DIODE CHARACTERISTICS							
Forward Diode Voltage	V_{SD}	V_{GS} = 0 V, I_S = −0.8 A	T_J = 25°C		−0.79	−1.2	V
			T_J = 125°C		−0.65		
Reverse Recovery Time	t_{RR}	V_{GS} = 0 V, dI_S/dt = 100 A/μs, I_S = −0.8 A			8.0		ns
Charge Time	t_a				5.7		
Discharge Time	t_b				2.3		
Reverse Recovery Charge	Q_{RR}				3		nC

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

TYPICAL PERFORMANCE CURVES

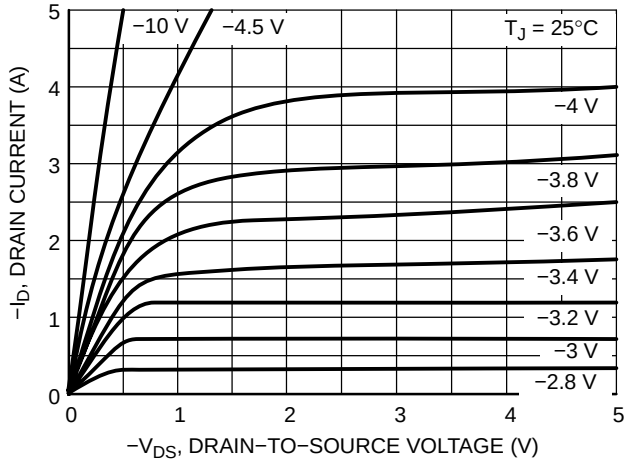


Figure 1. On−Region Characteristics

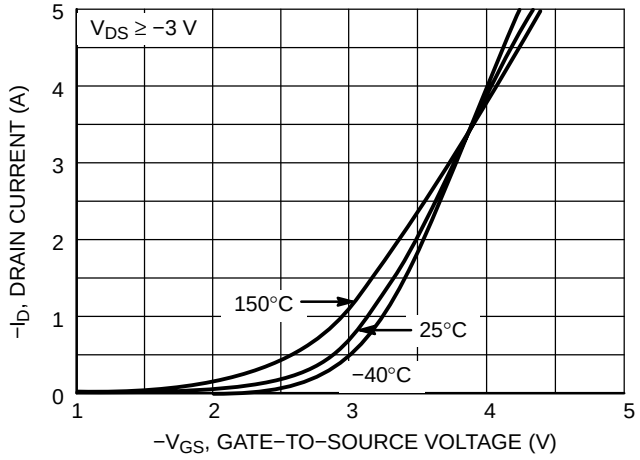


Figure 2. Transfer Characteristics

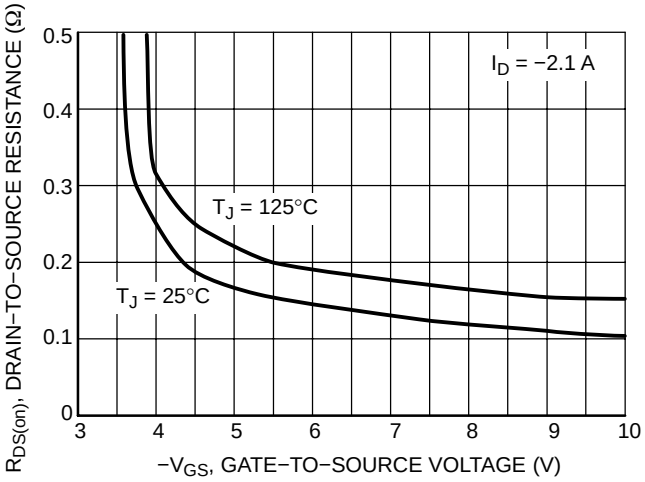


Figure 3. On−Resistance versus Gate−to−Source Voltage

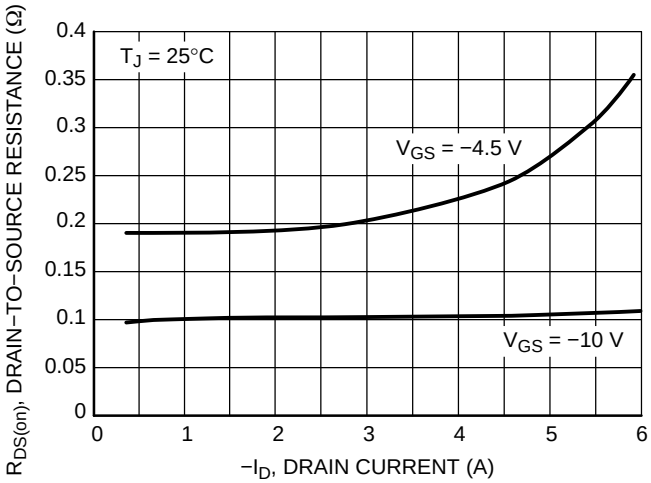


Figure 4. On−Resistance versus Drain Current and Temperature

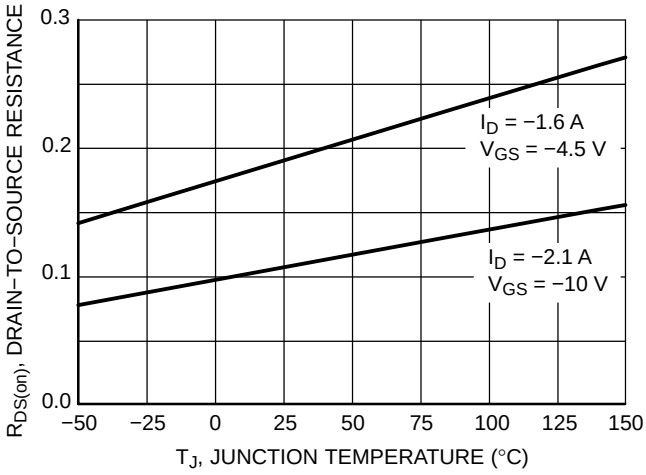


Figure 5. On−Resistance Variation with Temperature

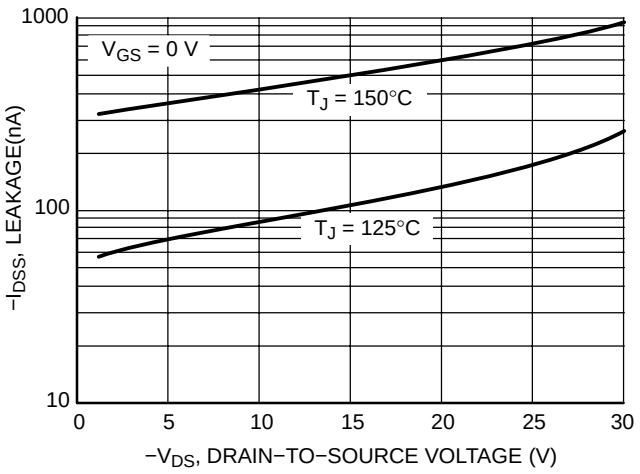


Figure 6. On−Resistance Variation with Temperature

TYPICAL PERFORMANCE CURVES

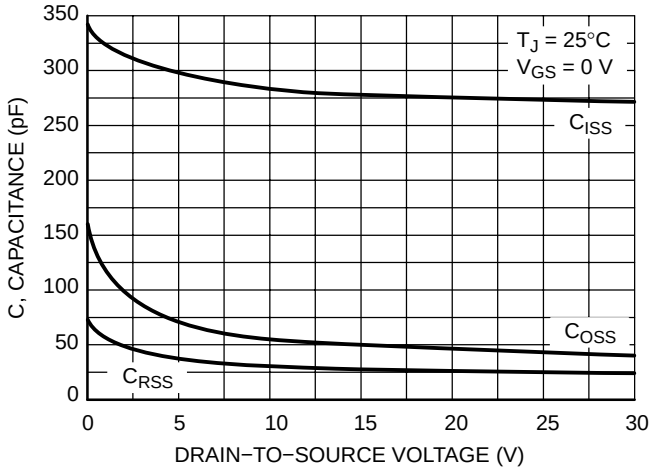


Figure 7. Capacitance Variation

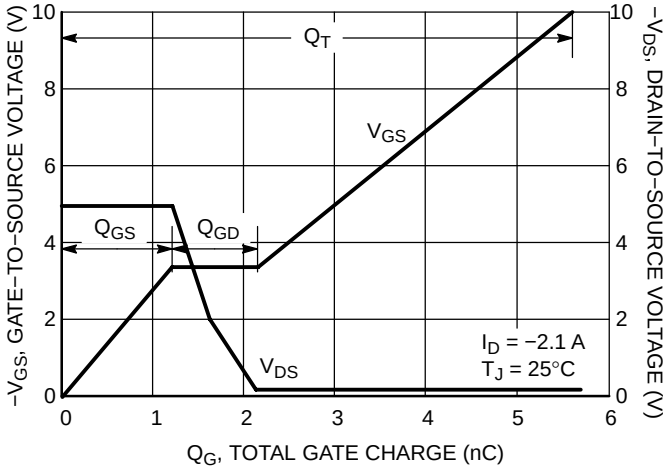


Figure 8. Gate−to−Source and Drain−to−Source Voltage versus Total Charge

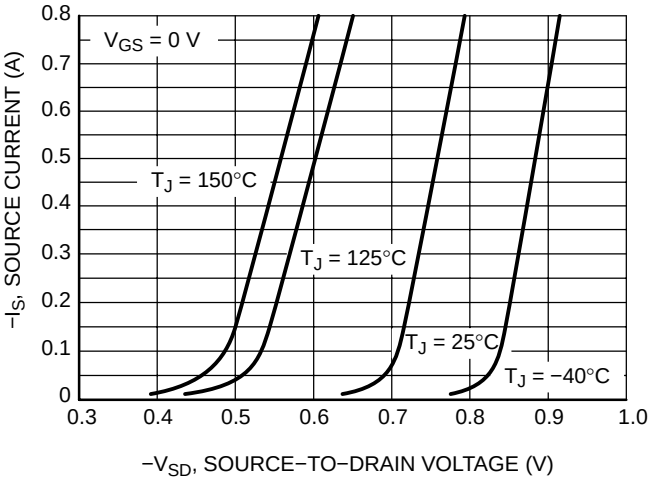


Figure 9. Diode Forward Voltage versus Current

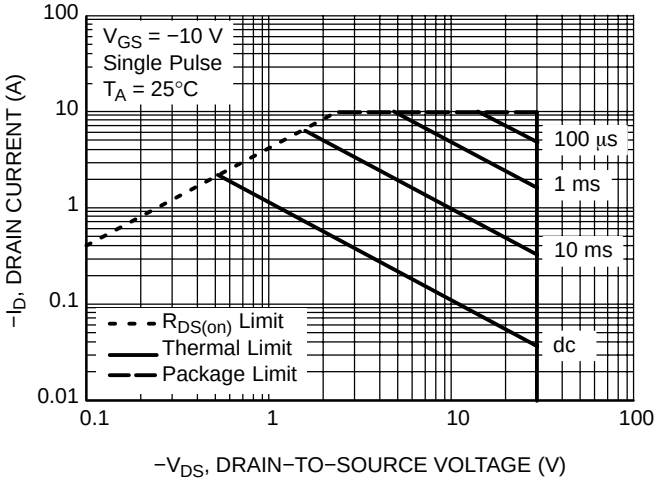


Figure 10. Maximum Rated Forward Biased Safe Operating Area

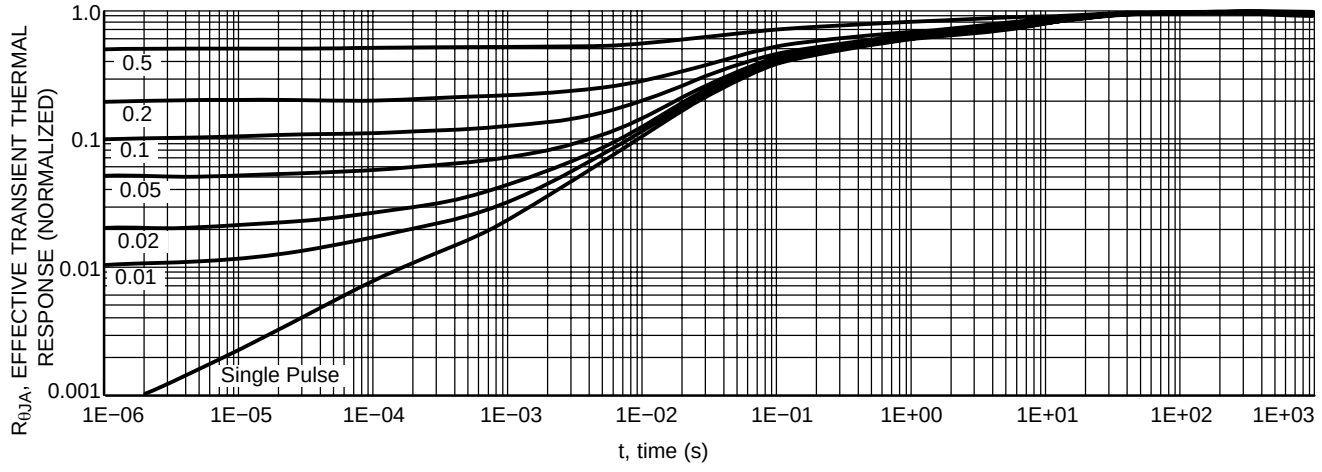
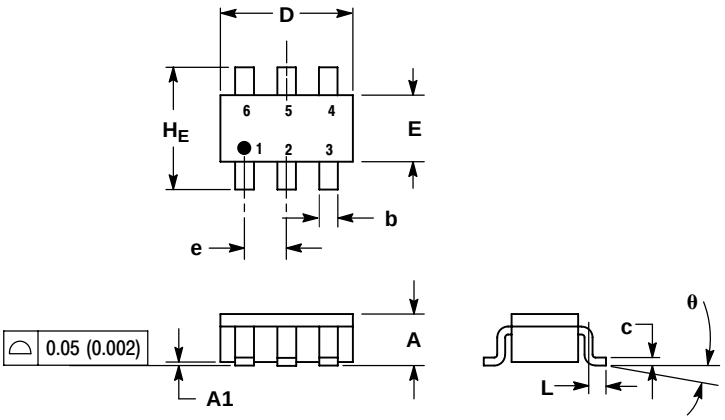


Figure 11. FET Thermal Response

PACKAGE DIMENSIONS

TSOP−6
CASE 318G−02
ISSUE S

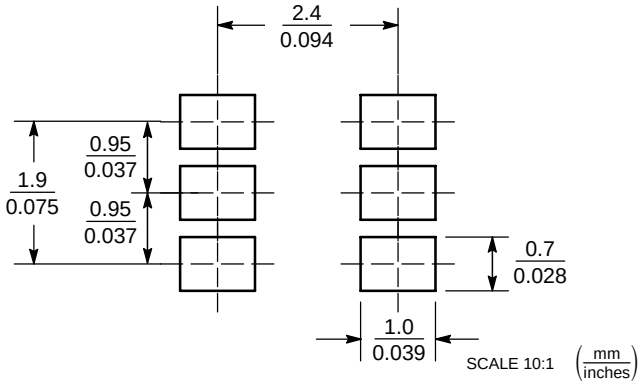


NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
4. DIMENSIONS A AND B DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

	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 13:
PIN 1. GATE 1
2. SOURCE 2
3. GATE 2
4. DRAIN 2
5. SOURCE 1
6. DRAIN 1

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.

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:
Literature Distribution Center for ON Semiconductor
P.O. Box 5163, Denver, Colorado 80217 USA
Phone: 303−675−2175 or 800−344−3860 Toll Free USA/Canada
Fax: 303−675−2176 or 800−344−3867 Toll Free USA/Canada
Email: orderlit@onsemi.com

N. American Technical Support: 800−282−9855 Toll Free USA/Canada
Europe, Middle East and Africa Technical Support:
Phone: 421 33 790 2910
Japan Customer Focus Center
Phone: 81−3−5773−3850

ON Semiconductor Website: **www.onsemi.com**

Order Literature: http://www.onsemi.com/orderlit

For additional information, please contact your local Sales Representative

NTGD4161P/D