

NTGD3133P

Power MOSFET

–20 V, –2.5 A, P–Channel, TSOP–6 Dual

Features

- Reduced Gate Charge for Fast Switching
- –2.5 V Gate Rating
- Leading Edge Trench Technology for Low On Resistance
- Independent Devices to Provide Design Flexibility
- This is a Pb–Free Device

Applications

- Li–Ion Battery Charging
- Load Switch / Power Switching
- DC to DC Conversion
- Portable Devices like PDA's, Cellular Phones, and Hard Drives

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

Parameter		Symbol	Value	Unit
Drain–to–Source Voltage		V_{DS}	–20	V
Gate–to–Source Voltage		V_{GS}	± 12	V
Continuous Drain Current (Note 1)	Steady State	I_D	$T_A = 25^\circ\text{C}$	A
			$T_A = 85^\circ\text{C}$	
	$t \leq 5 \text{ s}$	I_D	$T_A = 25^\circ\text{C}$	A
Power Dissipation (Note 1)	Steady State	P_D	$T_A = 25^\circ\text{C}$	W
	$t \leq 5 \text{ s}$		$T_A = 25^\circ\text{C}$	
Continuous Drain Current (Note 2)	Steady State	I_D	$T_A = 25^\circ\text{C}$	A
			$T_A = 85^\circ\text{C}$	
Power Dissipation (Note 2)	Steady State	P_D	$T_A = 25^\circ\text{C}$	W
Pulsed Drain Current	$t_p = 10 \mu\text{s}$	I_{DM}	± 7.0	A
Operating Junction and Storage Temperature		T_J, T_{STG}	–55 to 150	$^\circ\text{C}$
Source Current (Body Diode)		I_S	–0.8	A
Lead Temperature for Soldering Purposes (1/8" from case for 10 s)		T_L	260	$^\circ\text{C}$

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.

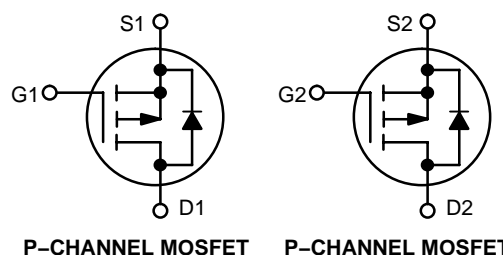
1. Surface Mounted on FR4 Board using 1 in sq pad size (Cu area = 1.127 in sq [2 oz] including traces).
2. Surface Mounted on FR4 Board using the minimum recommended pad size.



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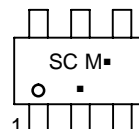
$V_{(BR)DSS}$	$R_{DS(on)} \text{ MAX}$	$I_D \text{ MAX}$
–20 V	145 m Ω @ –4.5 V	–2.5 A
	200 m Ω @ –2.5 V	



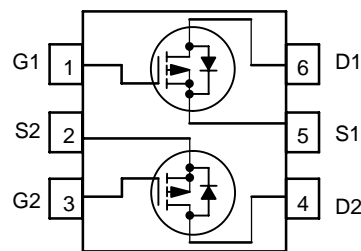
TSOP6
CASE 318G

SC = Specific Device Code
M = Date Code
■ = Pb–Free Package
(Note: Microdot may be in either location)

MARKING DIAGRAM



PIN CONNECTION



(Top View)

ORDERING INFORMATION

Device	Package	Shipping†
NTGD3133PT1G	TSOP6 (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 Specification Brochure, BRD8011/D.

THERMAL RESISTANCE RATINGS

Parameter	Symbol	Max	Unit
Junction-to-Ambient – Steady State (Note 3)	$R_{\theta JA}$	115	°C/W
Junction-to-Ambient – $t \leq 5$ s (Note 3)	$R_{\theta JA}$	95	
Junction-to-Ambient – Steady State Min Pad (Note 4)	$R_{\theta JA}$	225	

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

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

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
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OFF CHARACTERISTICS

Drain-to-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}$	$I_D = -250\text{ }\mu\text{A}$	-20	–	–	V
Drain-to-Source Breakdown Voltage Temperature Coefficient	$V_{(BR)DSS}/T_J$			–	14.4	–	mV/°C
Zero Gate Voltage Drain Current	I_{DSS}	$V_{GS} = 0\text{ V}, V_{DS} = -16\text{ V}$	$T_J = 25^\circ\text{C}$	–	–	-1.0	μA
			$T_J = 85^\circ\text{C}$	–	–	-10	
Gate-to-Source Leakage Current	I_{GSS}	$V_{DS} = 0\text{ V}, V_{GS} = \pm 12\text{ V}$		–	–	100	nA

ON CHARACTERISTICS (Note 5)

Gate Threshold Voltage	$V_{GS(TH)}$	$V_{GS} = V_{DS}$	$I_D = -250\text{ }\mu\text{A}$	-0.6	-0.9	-1.4	V
Drain-to-Source On Resistance	$R_{DS(on)}$	$V_{GS} = -4.5\text{ V}, I_D = -1.9\text{ A}$		–	95	145	m Ω
		$V_{GS} = -2.5\text{ V}, I_D = -1.6\text{ A}$		–	150	200	
Forward Transconductance	g_{FS}	$V_{DS} = -5.0\text{ V}, I_D = -2.5\text{ A}$		–	4.0	–	S

CHARGES, CAPACITANCES & GATE RESISTANCE

Input Capacitance	C_{ISS}	$V_{GS} = 0\text{ V}, V_{DS} = -10\text{ V}, f = 1.0\text{ MHz}$	–	390	–	pF
Output Capacitance	C_{OSS}		–	75	–	
Reverse Transfer Capacitance	C_{RSS}		–	37	–	
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = -4.5\text{ V}, V_{DS} = -10\text{ V}, I_D = -2.2\text{ A}$	–	3.7	5.5	nC
Threshold Gate Charge	$Q_{G(TH)}$		–	0.7	–	
Gate-to-Source Charge	Q_{GS}		–	1.1	–	
Gate-to-Drain Charge	Q_{GD}		–	1.2	–	

SWITCHING CHARACTERISTICS (Note 6)

Turn-On Delay Time	$t_{d(ON)}$	$V_{GS} = -4.5\text{ V}, V_{DD} = -10\text{ V},$ $I_D = -1.0\text{ A}, R_G = 6.0\text{ }\Omega$	–	6.7	–	ns
Rise Time	t_r		–	12.7	–	
Turn-Off Delay Time	$t_{d(OFF)}$		–	13.2	–	
Fall Time	t_f		–	11	–	

DRAIN-SOURCE DIODE CHARACTERISTICS

Forward Diode Voltage	V_{SD}	$V_{GS} = 0\text{ V}, T_J = 25^\circ\text{C}$	$I_S = -0.8\text{ A}$	–	-0.8	-1.2	V
Reverse Recovery Time	t_{RR}	$V_{GS} = 0\text{ V},$ $dI_{SD} / dt = 100\text{ A}/\mu\text{s}, I_S = -1.0\text{ A}$		–	7.4	–	ns
Charge Time	t_a			–	4.8	–	
Discharge Time	t_b			–	2.6	–	
Reverse Recovery Charge	Q_{RR}			–	2.4	–	nC

5. Pulse Test: pulse width $\leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$.
6. Switching characteristics are independent of operating junction temperatures.

NTGD3133P

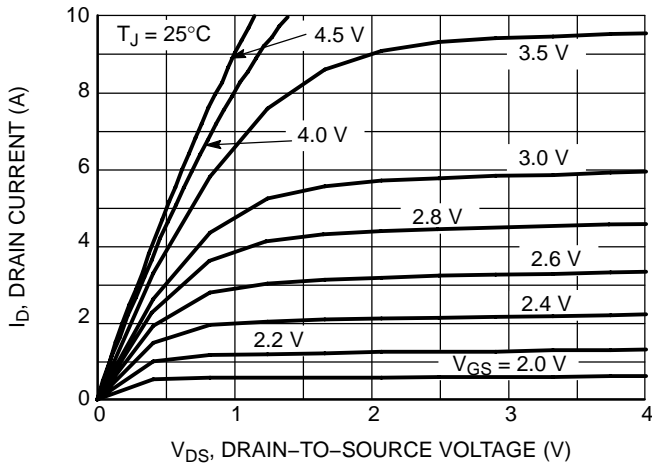


Figure 1. On-Region Characteristics

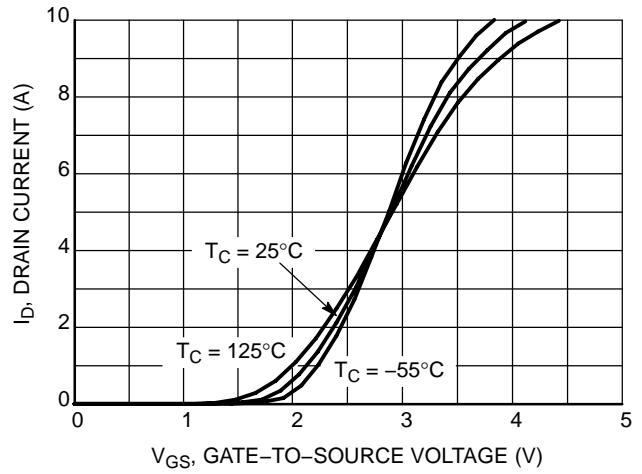


Figure 2. Transfer Characteristics

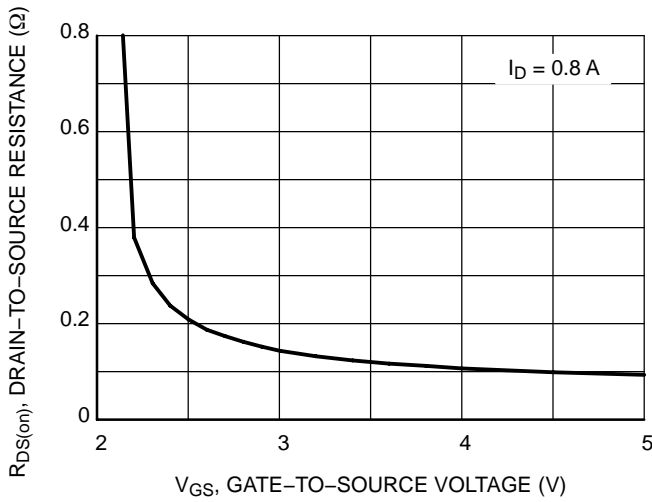


Figure 3. On-Resistance versus Gate-to-Source Voltage

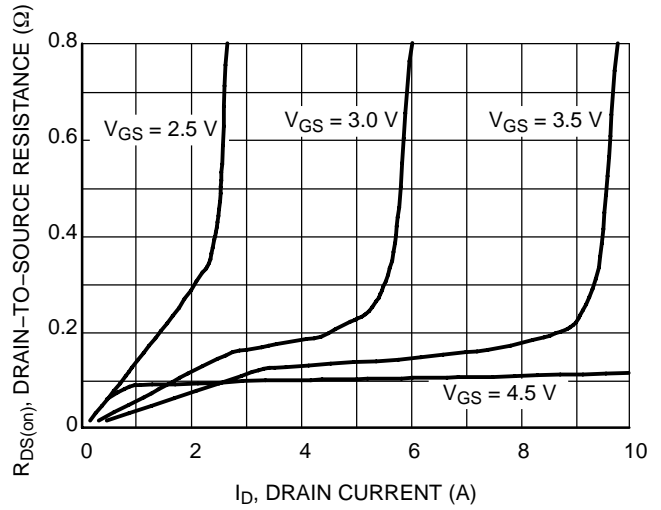


Figure 4. On-Resistance versus Drain Current and Gate Voltage

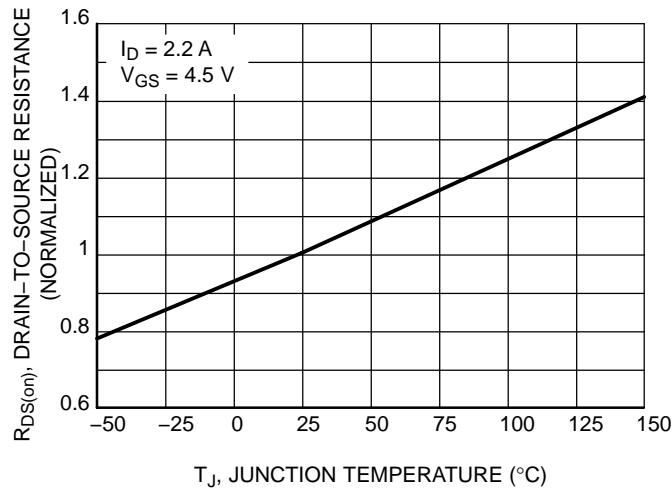


Figure 5. On-Resistance Variation with Temperature

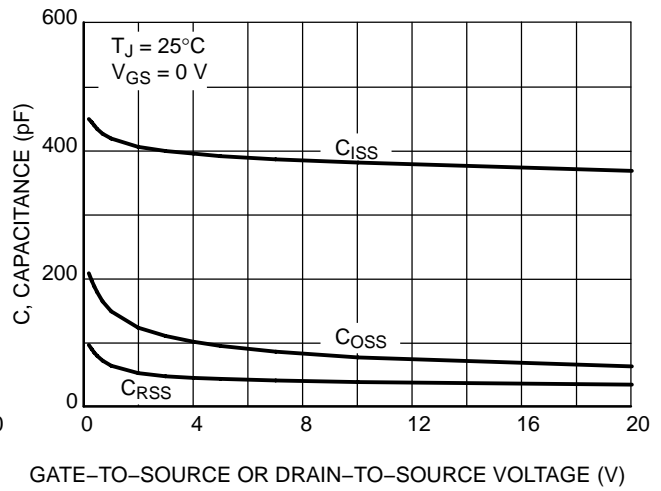


Figure 6. Capacitance Variation

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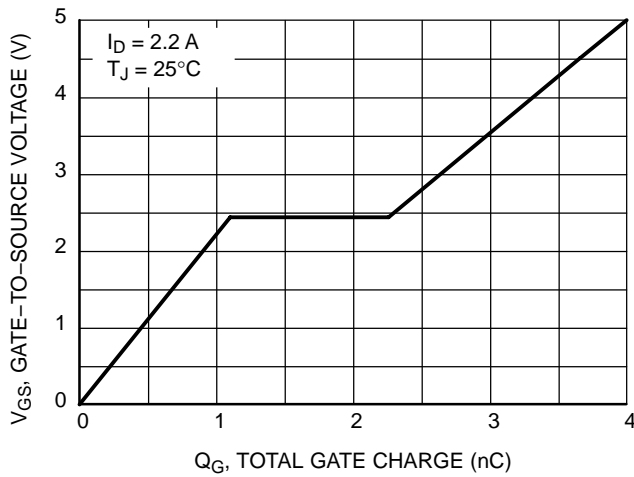


Figure 7. Gate-to-Source and Drain-to-Source Voltage versus Total Charge

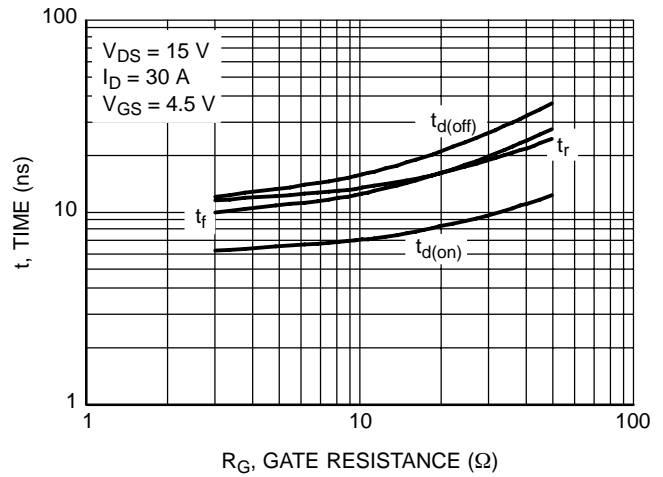


Figure 8. Resistive Switching Time Variation versus Gate Resistance

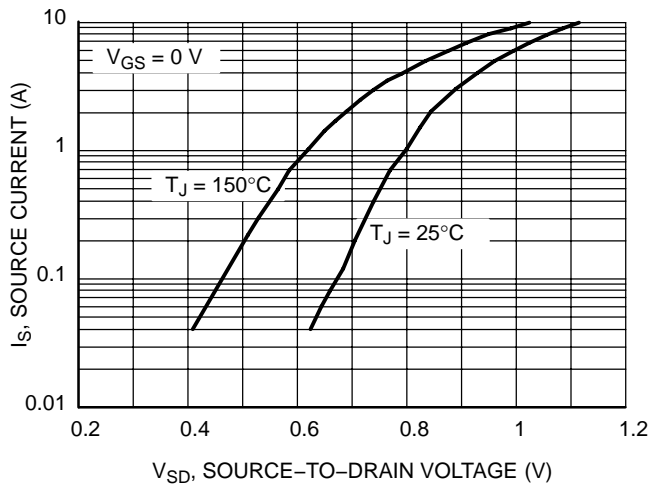


Figure 9. Diode Forward Voltage versus Current

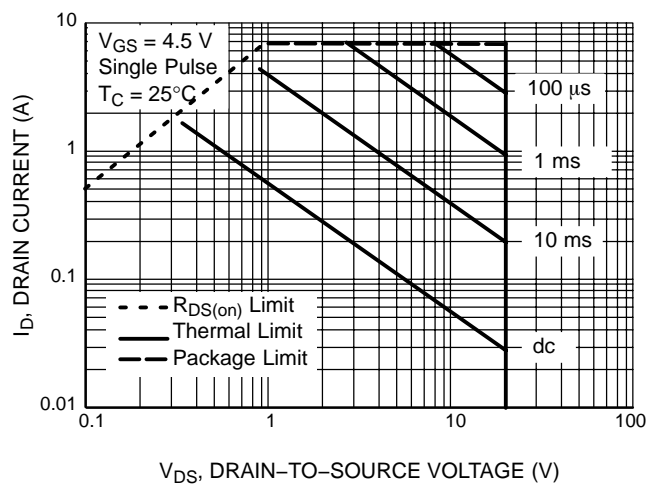


Figure 10. Maximum Rated Forward Biased Safe Operating Area

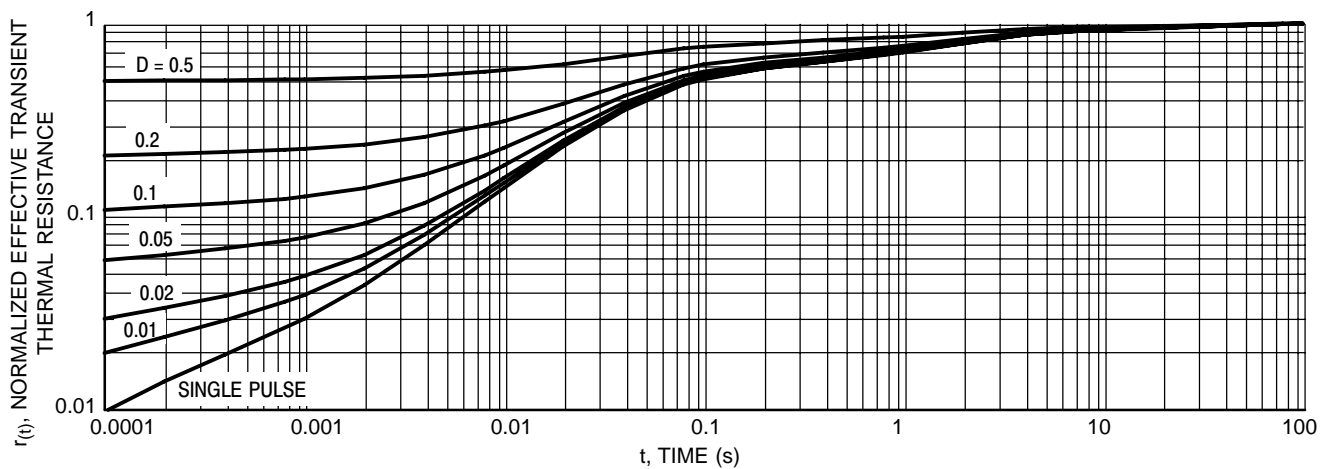
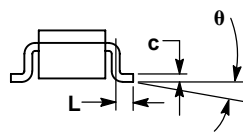
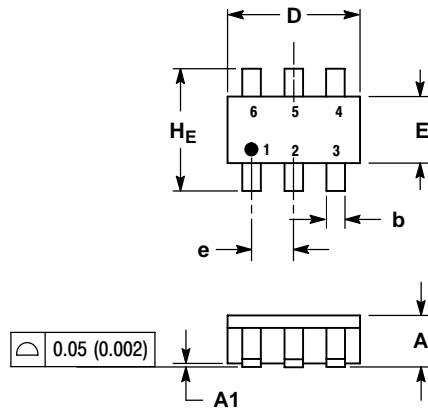


Figure 11. Thermal Response

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PACKAGE DIMENSIONS

TSOP-6 CASE 318G-02 ISSUE S

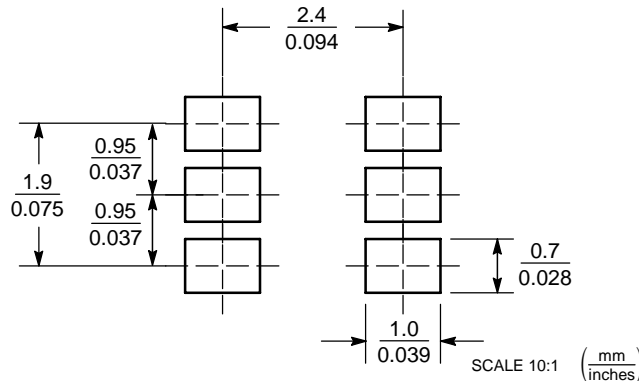


NOTES:


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.

DIM	MILLIMETERS			INCHES		
	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
theta	0°	—	10°	0°	—	10°

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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