

NTGS1135P

Power MOSFET

-8 V, -5.8 A, Single P-Channel, TSOP-6

Features

- Ultra Low $R_{DS(on)}$
- 1.2 V $R_{DS(on)}$ Rating
- This is a Pb-Free Device

Applications

- Load Switch
- Battery Management

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

Parameter	Symbol	Value	Unit	
Drain-to-Source Voltage	V_{DS}	-8.0	V	
Gate-to-Source Voltage	V_{GS}	± 6.0	V	
Continuous Drain Current (Note 1)	Steady State	$T_A = 25^\circ\text{C}$	-4.6	A
		$T_A = 85^\circ\text{C}$	-3.3	
		$t \leq 5 \text{ s}$	$T_A = 25^\circ\text{C}$	
Power Dissipation (Note 1)	Steady State	$T_A = 25^\circ\text{C}$	0.97	W
			$t \leq 5 \text{ s}$	
Pulsed Drain Current	$t_p = 10 \mu\text{s}$	I_{DM}	-9.2	A
Operating Junction and Storage Temperature	T_J, T_{STG}	-55 to 150		$^\circ\text{C}$
Source Current (Body Diode)	I_S	-1.0		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 in sq [2 oz] including traces)
2. Surface-mounted on FR4 board using the minimum recommended pad size. (Cu area = 0.0751 in sq)

THERMAL RESISTANCE MAXIMUM RATINGS

Parameter	Symbol	Value	Unit
Junction-to-Ambient - Steady State (Note 1)	$R_{\theta JA}$	128	$^\circ\text{C/W}$
Junction-to-Ambient - $t = 5 \text{ s}$ (Note 1)	$R_{\theta JA}$	78	
Junction-to-Ambient - Steady State (Note 2)	$R_{\theta JA}$	188	

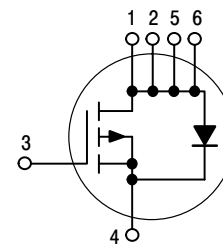


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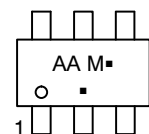
$V_{(BR)DSS}$	$R_{DS(ON)} \text{ MAX}$	$I_D \text{ MAX}$
-8 V	31 m Ω @ -4.5 V	-4.6 A
	38 m Ω @ -2.5 V	
	57 m Ω @ -1.8 V	
	300 m Ω @ -1.2 V	

P-Channel



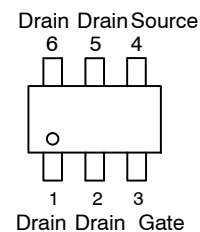
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TSOP-6
CASE 318G
STYLE 1

MARKING DIAGRAM



AA = Device Code
M = Date Code
▪ = Pb-Free Package
(Note: Microdot may be in either location)

PIN ASSIGNMENT



ORDERING INFORMATION

Device	Package	Shipping†
NTGS1135PT1G	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.

NTGS1135P

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

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
OFF CHARACTERISTICS						
Drain-to-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}, I_D = -250\ \mu\text{A}$	-8.0			V
Drain-to-Source Breakdown Voltage Temperature Coefficient	$V_{(BR)DSS}/T_J$	$I_D = -250\ \mu\text{A}$, Ref to 25°C		-8.4		mV/ $^\circ\text{C}$
Zero Gate Voltage Drain Current	I_{DSS}	$V_{GS} = 0\text{ V}, V_{DS} = -6\text{ V}$			-1.0	μA
Gate-to-Source Leakage Current	I_{GSS}	$V_{DS} = 0\text{ V}, V_{GS} = \pm 6\text{ V}$			± 100	nA

ON CHARACTERISTICS (Note 3)

Gate Threshold Voltage	$V_{GS(TH)}$	$V_{GS} = V_{DS}, I_D = -250\ \mu\text{A}$	-0.35	-0.57	-0.85	V
Negative Threshold Temperature Coefficient	$V_{GS(TH)}/T_J$			2.8		mV/ $^\circ\text{C}$
Drain-to-Source On Resistance	$R_{DS(on)}$	$V_{GS} = -4.5\text{ V}, I_D = -4.6\text{ A}$		22	31	m Ω
		$V_{GS} = -2.5\text{ V}, I_D = -2.5\text{ A}$		28	38	
		$V_{GS} = -1.8\text{ V}, I_D = -2.0\text{ A}$		37	57	
		$V_{GS} = -1.5\text{ V}, I_D = -1.0\text{ A}$		47	73	
		$V_{GS} = -1.2\text{ V}, I_D = -0.1\text{ A}$		100	300	
Forward Transconductance	g_{FS}	$V_{DS} = -4.0\text{ V}, I_D = -3.0\text{ A}$		1.2		S

CHARGES, CAPACITANCES AND GATE RESISTANCE

Input Capacitance	C_{ISS}	$V_{GS} = 0\text{ V}, f = 1\text{ MHz}, V_{DS} = -6.0\text{ V}$		2200		pF
Output Capacitance	C_{OSS}			400		
Reverse Transfer Capacitance	C_{RSS}			200		
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = -4.5\text{ V}, V_{DS} = -8.0\text{ V};$ $I_D = -2.5\text{ A}$		21		nC
Threshold Gate Charge	$Q_{G(TH)}$			0.9		
Gate-to-Source Charge	Q_{GS}			2.8		
Gate-to-Drain Charge	Q_{GD}			3.9		

SWITCHING CHARACTERISTICS (Note 4)

Turn-On Delay Time	$t_{d(ON)}$	$V_{GS} = -4.5\text{ V}, V_{DS} = -8.0\text{ V},$ $I_D = -2.5\text{ A}, R_G = 6.2\ \Omega$		10		ns
Rise Time	t_r			16		
Turn-Off Delay Time	$t_{d(OFF)}$			128		
Fall Time	t_f			71		

DRAIN-SOURCE DIODE CHARACTERISTICS

Forward Diode Voltage	V_{SD}	$V_{GS} = 0\text{ V},$ $I_S = -1.0\text{ A}$	$T_J = 25^\circ\text{C}$		-0.6	-1.0	V
Reverse Recovery Time	t_{RR}	$V_{GS} = 0\text{ V}, dI_S/dt = 100\text{ A}/\mu\text{s},$ $I_S = -1.0\text{ A}$			25		ns
Charge Time	t_a				11		
Discharge Time	t_b				14		
Reverse Recovery Charge	Q_{RR}				13		nC

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

NTGS1135P

TYPICAL CHARACTERISTICS

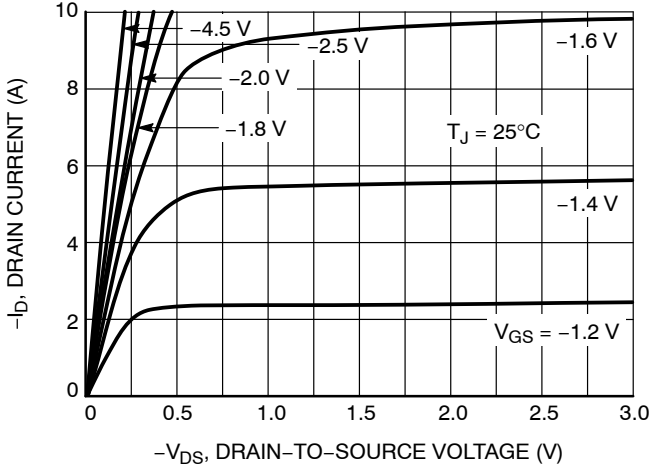


Figure 1. On-Region Characteristics

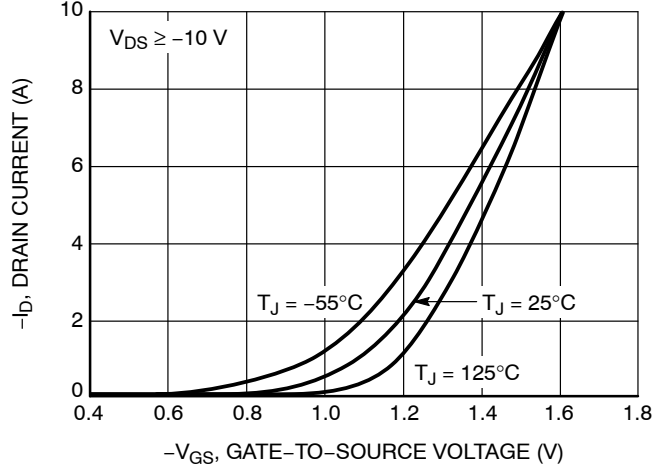


Figure 2. Transfer Characteristics

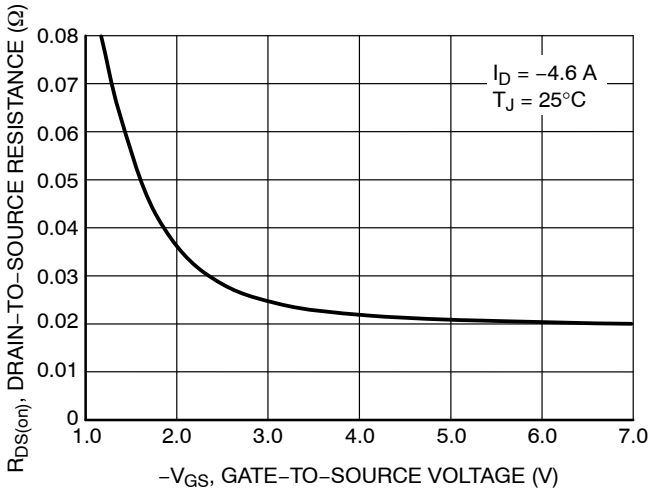


Figure 3. On-Resistance vs. Gate Voltage

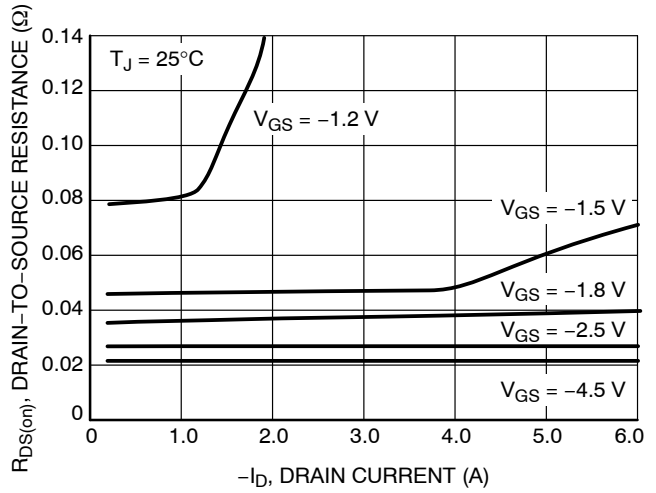


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

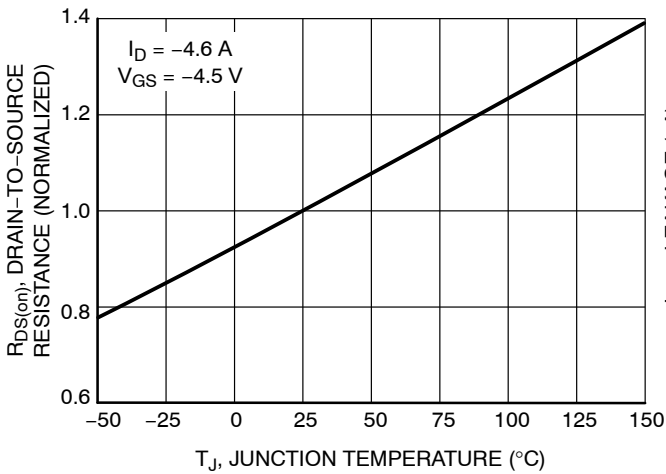


Figure 5. On-Resistance Variation with Temperature

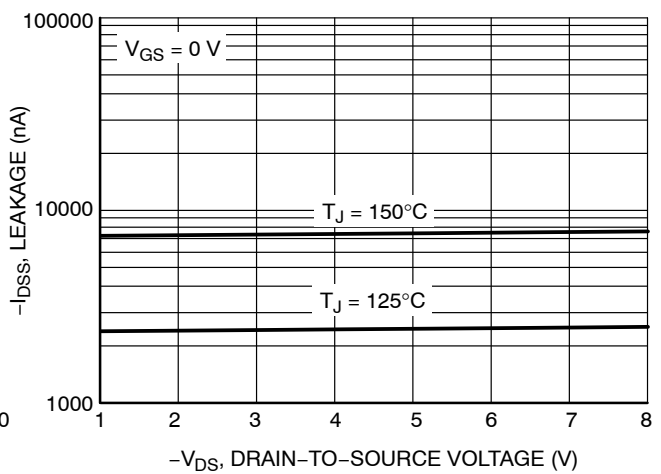


Figure 6. Drain-to-Source Leakage Current vs. Voltage

TYPICAL CHARACTERISTICS

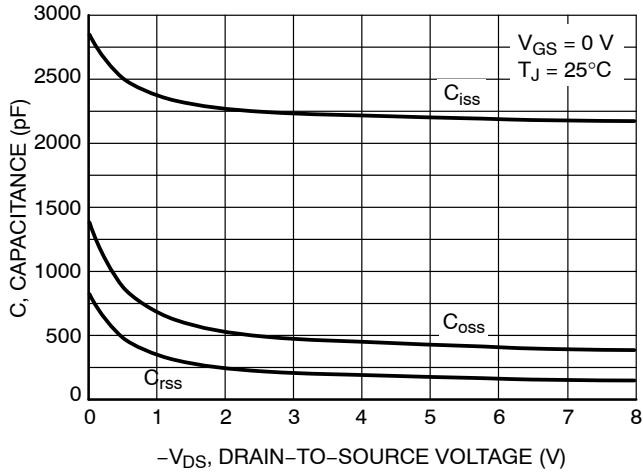


Figure 7. Capacitance Variation

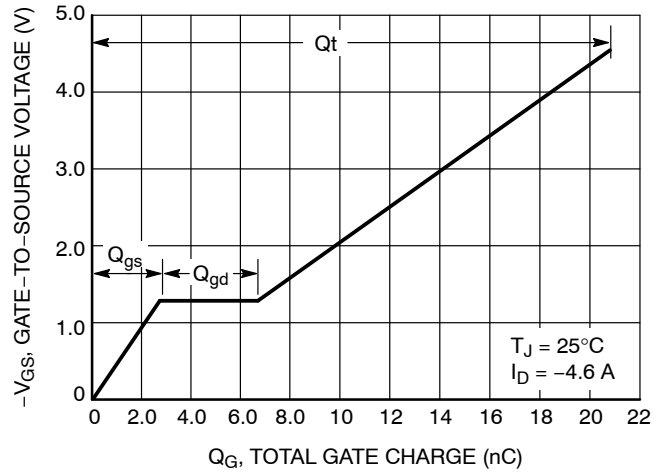


Figure 8. Gate-to-Source Voltage vs. Total Charge

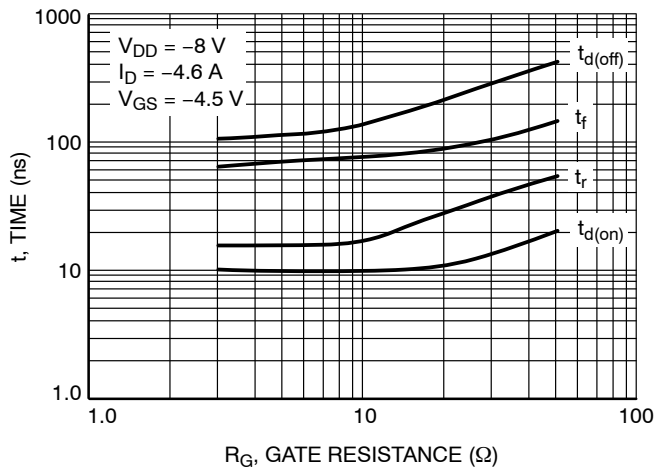


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

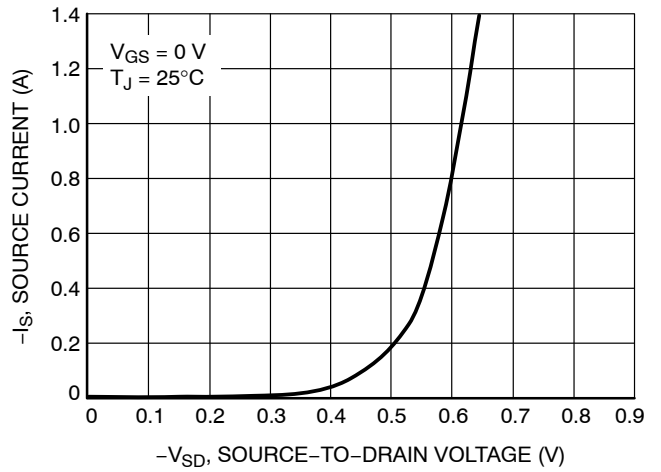


Figure 10. Diode Forward Voltage vs. Current

MECHANICAL CASE OUTLINE

PACKAGE DIMENSIONS

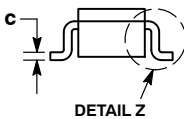
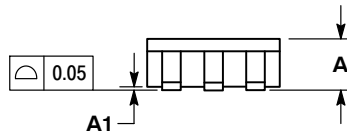
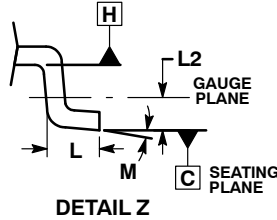
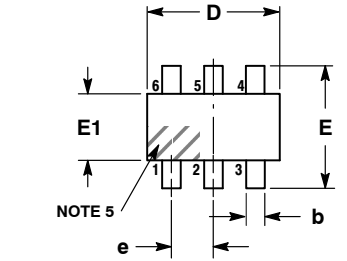
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SCALE 2:1

TSOP-6 CASE 318G-02 ISSUE V

DATE 12 JUN 2012



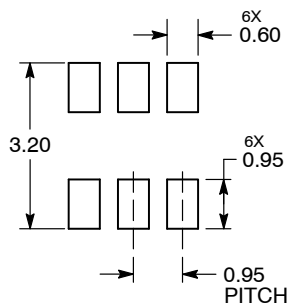
NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
4. DIMENSIONS D AND E1 DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.15 PER SIDE. DIMENSIONS D AND E1 ARE DETERMINED AT DATUM H.
5. PIN ONE INDICATOR MUST BE LOCATED IN THE INDICATED ZONE.

DIM	MILLIMETERS		
	MIN	NOM	MAX
A	0.90	1.00	1.10
A1	0.01	0.06	0.10
b	0.25	0.38	0.50
c	0.10	0.18	0.26
D	2.90	3.00	3.10
E	2.50	2.75	3.00
E1	1.30	1.50	1.70
e	0.85	0.95	1.05
L	0.20	0.40	0.60
L2	0.25 BSC		
M	0°	-	10°

- | | | | | | |
|--|--|---|---|---|--|
| <p>STYLE 1:
PIN 1. DRAIN
2. DRAIN
3. GATE
4. SOURCE
5. DRAIN
6. DRAIN</p> | <p>STYLE 2:
PIN 1. EMITTER 2
2. BASE 1
3. COLLECTOR 1
4. EMITTER 1
5. BASE 2
6. COLLECTOR 2</p> | <p>STYLE 3:
PIN 1. ENABLE
2. N/C
3. R BOOST
4. Vz
5. V in
6. V out</p> | <p>STYLE 4:
PIN 1. N/C
2. V in
3. NOT USED
4. GROUND
5. ENABLE
6. LOAD</p> | <p>STYLE 5:
PIN 1. EMITTER 2
2. BASE 2
3. COLLECTOR 1
4. EMITTER 1
5. BASE 1
6. COLLECTOR 2</p> | <p>STYLE 6:
PIN 1. COLLECTOR
2. COLLECTOR
3. BASE
4. EMITTER
5. COLLECTOR
6. COLLECTOR</p> |
| <p>STYLE 7:
PIN 1. COLLECTOR
2. COLLECTOR
3. BASE
4. N/C
5. COLLECTOR
6. EMITTER</p> | <p>STYLE 8:
PIN 1. Vbus
2. D(in)
3. D(in)+
4. D(out)+
5. D(out)
6. GND</p> | <p>STYLE 9:
PIN 1. LOW VOLTAGE GATE
2. DRAIN
3. SOURCE
4. DRAIN
5. DRAIN
6. HIGH VOLTAGE GATE</p> | <p>STYLE 10:
PIN 1. D(OUT)+
2. GND
3. D(OUT)-
4. D(IN)-
5. VBUS
6. D(IN)+</p> | <p>STYLE 11:
PIN 1. SOURCE 1
2. DRAIN 2
3. DRAIN 2
4. SOURCE 2
5. GATE 1
6. DRAIN 1/GATE 2</p> | <p>STYLE 12:
PIN 1. I/O
2. GROUND
3. I/O
4. I/O
5. VCC
6. I/O</p> |
| <p>STYLE 13:
PIN 1. GATE 1
2. SOURCE 2
3. GATE 2
4. DRAIN 2
5. SOURCE 1
6. DRAIN 1</p> | <p>STYLE 14:
PIN 1. ANODE
2. SOURCE
3. GATE
4. CATHODE/DRAIN
5. CATHODE/DRAIN
6. CATHODE/DRAIN</p> | <p>STYLE 15:
PIN 1. ANODE
2. SOURCE
3. GATE
4. DRAIN
5. N/C
6. CATHODE</p> | <p>STYLE 16:
PIN 1. ANODE/CATHODE
2. BASE
3. EMITTER
4. COLLECTOR
5. ANODE
6. CATHODE</p> | <p>STYLE 17:
PIN 1. EMITTER
2. BASE
3. ANODE/CATHODE
4. ANODE
5. CATHODE
6. COLLECTOR</p> | |

RECOMMENDED SOLDERING FOOTPRINT*



DIMENSIONS: MILLIMETERS

GENERIC MARKING DIAGRAM*



- | | |
|----------------------------|----------------------------|
| XXX = Specific Device Code | XXX = Specific Device Code |
| A = Assembly Location | M = Date Code |
| Y = Year | ▪ = Pb-Free Package |
| W = Work Week | |
| ▪ = Pb-Free Package | |

*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "▪", may or may not be present.

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