

# NTGS3446

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## Power MOSFET 20 V, 5.1 A Single N-Channel, TSOP6

### Features

- Ultra Low  $R_{DS(on)}$
- Higher Efficiency Extending Battery Life
- Logic Level Gate Drive
- Diode Exhibits High Speed, Soft Recovery
- Avalanche Energy Specified
- $I_{DSS}$  Specified at Elevated Temperature
- Pb-Free Package is Available

### Applications

- Power Management in portable and battery-powered products, i.e. computers, printers, PCMCIA cards, cellular and cordless
- Lithium Ion Battery Applications
- Notebook PC

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

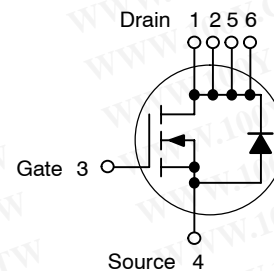
Rating	Symbol	Value	Unit
Drain-to-Source Voltage	$V_{DSS}$	20	V
Gate-to-Source Voltage	$V_{GS}$	$\pm 12$	V
Thermal Resistance Junction-to-Ambient (Note 1) Total Power Dissipation @ $T_A = 25^\circ\text{C}$	$R_{\theta JA}$ $P_d$	244 0.5	$^\circ\text{C}/\text{W}$ W
Drain Current - Continuous @ $T_A = 25^\circ\text{C}$ - Pulsed Drain Current ( $t_p < 10 \mu\text{s}$ )	$I_D$ $I_{DM}$	2.5 10	A A
Thermal Resistance Junction-to-Ambient (Note 2) Total Power Dissipation @ $T_A = 25^\circ\text{C}$	$R_{\theta JA}$ $P_d$	128 1.0	$^\circ\text{C}/\text{W}$ W
Drain Current - Continuous @ $T_A = 25^\circ\text{C}$ - Pulsed Drain Current ( $t_p < 10 \mu\text{s}$ )	$I_D$ $I_{DM}$	3.6 14	A A
Thermal Resistance Junction-to-Ambient (Note 3) Total Power Dissipation @ $T_A = 25^\circ\text{C}$	$R_{\theta JA}$ $P_d$	62.5 2.0	$^\circ\text{C}/\text{W}$ W
Drain Current - Continuous @ $T_A = 25^\circ\text{C}$ - Pulsed Drain Current ( $t_p < 10 \mu\text{s}$ )	$I_D$ $I_{DM}$	5.1 20	A A
Source Current (Body Diode)	$I_S$	5.1	A
Operating and Storage Temperature Range	$T_J, T_{stg}$	-55 to 150	$^\circ\text{C}$
Maximum Lead Temperature for Soldering Purposes for 10 seconds	$T_L$	260	$^\circ\text{C}$

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. Minimum FR-4 or G-10PCB, operating to steady state.
2. Mounted onto a 2" square FR-4 board (1" sq. 2 oz. cu. 0.06" thick single-sided), operating to steady state.
3. Mounted onto a 2" square FR-4 board (1" sq. 2 oz. cu. 0.06" thick single-sided),  $t < 5.0$  seconds.

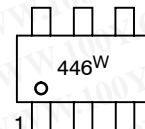
$V_{(BR)DSS}$	$R_{DS(on)}$ TYP	$I_D$ MAX
20 V	36 m $\Omega$ @ 4.5 V	5.1 A

### N-Channel



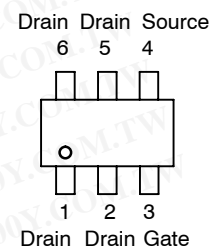
**TSOP-6  
 CASE 318G  
 STYLE 1**

### MARKING DIAGRAM



446 = Device Code  
 W = Work Week

### PIN ASSIGNMENT



### ORDERING INFORMATION

Device	Package	Shipping†
NTGS3446T1	TSOP-6	3000/Tape & Reel
NTGS3446T1G	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 Specification Brochure, BRD8011/D.

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

Characteristic	Symbol	Min	Typ	Max	Unit
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**OFF CHARACTERISTICS**

Drain-to-Source Breakdown Voltage ( $V_{GS} = 0\text{ Vdc}$ , $I_D = 0.25\text{ mAdc}$ ) Temperature Coefficient (Positive)	$V_{(BR)DSS}$	20 -	- 22	- -	Vdc mV/°C
Zero Gate Voltage Collector Current ( $V_{DS} = 20\text{ Vdc}$ , $V_{GS} = 0\text{ Vdc}$ ) ( $V_{DS} = 20\text{ Vdc}$ , $V_{GS} = 0\text{ Vdc}$ , $T_J = 85^\circ\text{C}$ )	$I_{DSS}$	- -	- -	1.0 25	$\mu\text{Adc}$
Gate-Body Leakage Current ( $V_{GS} = \pm 12\text{ Vdc}$ , $V_{DS} = 0$ )	$I_{GSS(f)}$ $I_{GSS(r)}$	- -	- -	100 -100	nAdc

**ON CHARACTERISTICS** (Note 4)

Gate Threshold Voltage $I_D = 0.25\text{ mA}$ , $V_{DS} = V_{GS}$ Temperature Coefficient (Negative)	$V_{GS(th)}$	0.6 -	0.85 -2.5	1.2 -	Vdc mV/°C
Static Drain-to-Source On-Resistance ( $V_{GS} = 4.5\text{ Vdc}$ , $I_D = 5.1\text{ Adc}$ ) ( $V_{GS} = 2.5\text{ Vdc}$ , $I_D = 4.4\text{ Adc}$ )	$R_{DS(on)}$	- -	36 44	45 55	m $\Omega$
Forward Transconductance ( $V_{DS} = 10\text{ Vdc}$ , $I_D = 5.1\text{ Adc}$ )	$g_{FS}$	-	12	-	mhos

**DYNAMIC CHARACTERISTICS**

Input Capacitance	$(V_{DS} = 10\text{ Vdc}$ , $V_{GS} = 0\text{ Vdc}$ , $f = 1.0\text{ MHz}$ )	$C_{iss}$	-	510	750	pF
Output Capacitance		$C_{oss}$	-	200	350	
Transfer Capacitance		$C_{rss}$	-	60	100	

**SWITCHING CHARACTERISTICS** (Note 5)

Turn-On Delay Time	$(V_{DD} = 10\text{ Vdc}$ , $I_D = 1.0\text{ Adc}$ , $V_{GS} = 4.5\text{ Vdc}$ , $R_G = 6.0\ \Omega$ )	$t_{d(on)}$	-	9.0	16	ns
Rise Time		$t_r$	-	12	20	
Turn-Off Delay Time		$t_{d(off)}$	-	35	60	
Fall Time		$t_f$	-	20	35	
Gate Charge	$(V_{DS} = 10\text{ Vdc}$ , $I_D = 5.1\text{ Adc}$ , $V_{GS} = 4.5\text{ Vdc}$ )	$Q_T$	-	8.0	15	nC
		$Q_{gs}$	-	2.0	-	
		$Q_{gd}$	-	2.0	-	

**SOURCE-DRAIN DIODE CHARACTERISTICS**

Forward On-Voltage (Note 4)	$(I_S = 1.7\text{ Adc}$ , $V_{GS} = 0\text{ Vdc}$ ) ( $I_S = 1.7\text{ Adc}$ , $V_{GS} = 0\text{ Vdc}$ , $T_J = 85^\circ\text{C}$ )	$V_{SD}$	- -	0.74 0.66	1.1 -	Vdc
Reverse Recovery Time		$(I_S = 1.7\text{ Adc}$ , $V_{GS} = 0\text{ Vdc}$ , $di_S/dt = 100\text{ A}/\mu\text{s}$ )	$t_{rr}$	-	20	-
	$t_a$		-	11	-	
	$t_b$		-	9.0	-	
Reverse Recovery Stored Charge		$Q_{RR}$	-	0.01	-	$\mu\text{C}$

- Pulse Test: Pulse Width  $\leq 300\ \mu\text{s}$ , Duty Cycle  $\leq 2\%$ .
- Switching characteristics are independent of operating junction temperature.

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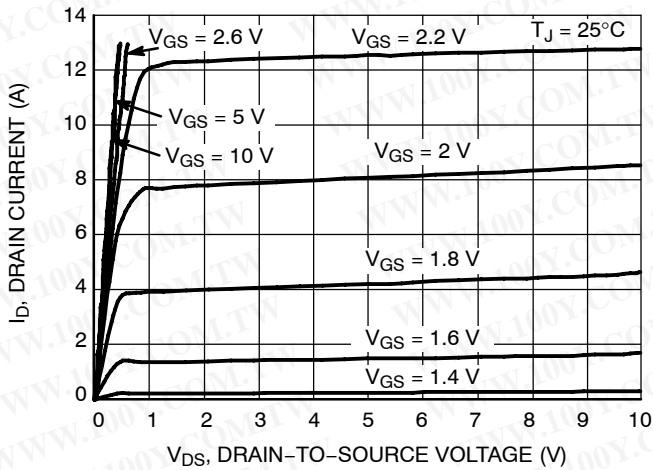


Figure 1. On-Region Characteristics

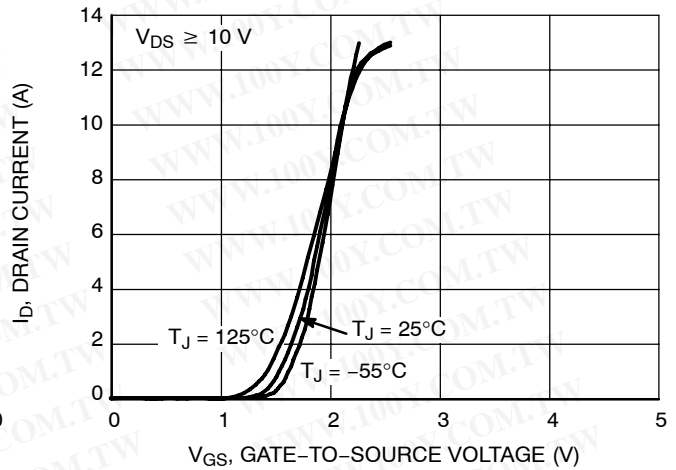


Figure 2. Transfer Characteristics

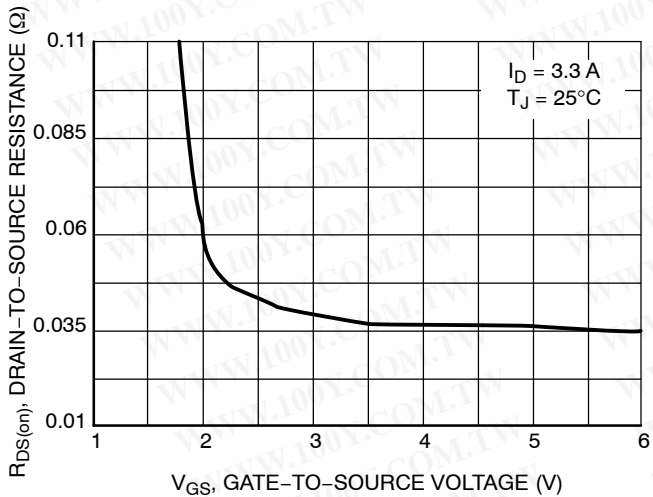


Figure 3. On-Resistance versus Gate-to-Source Voltage

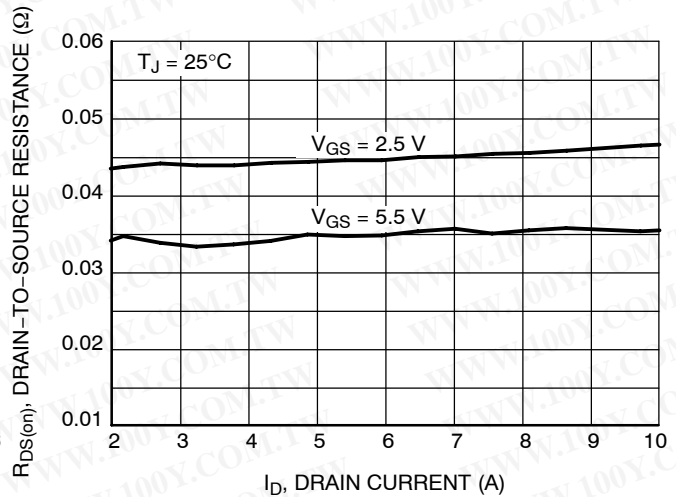


Figure 4. On-Resistance versus Drain Current and Gate Voltage

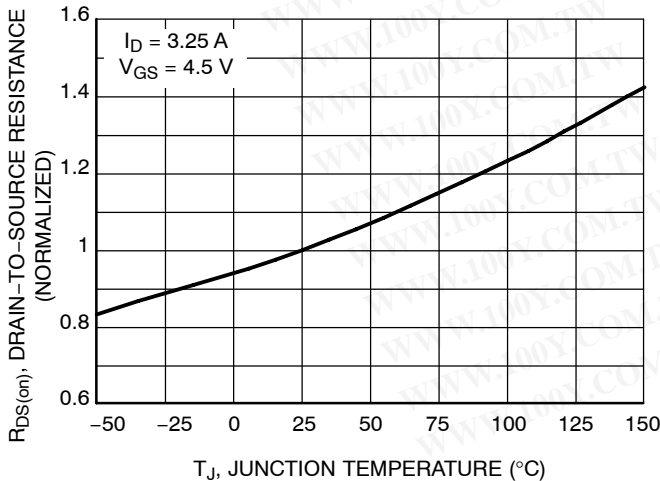


Figure 5. On-Resistance Variation with Temperature

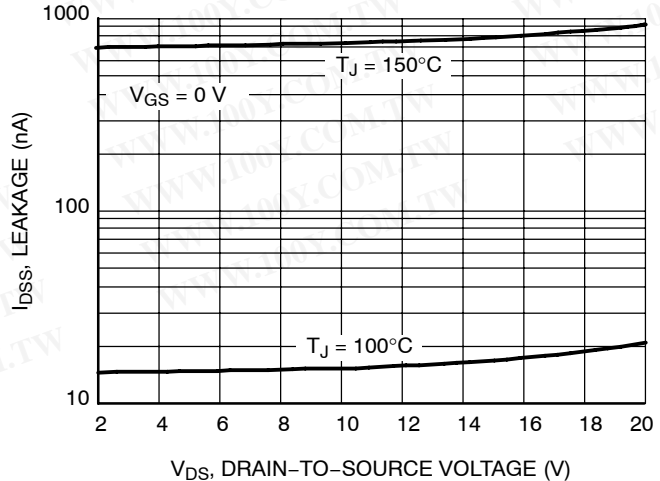
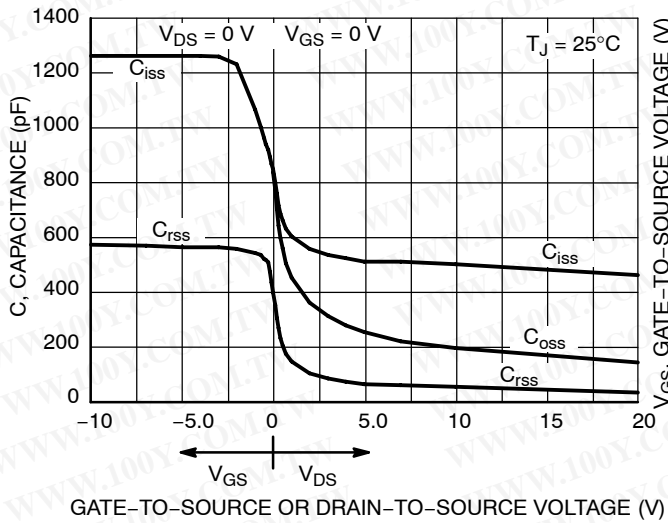
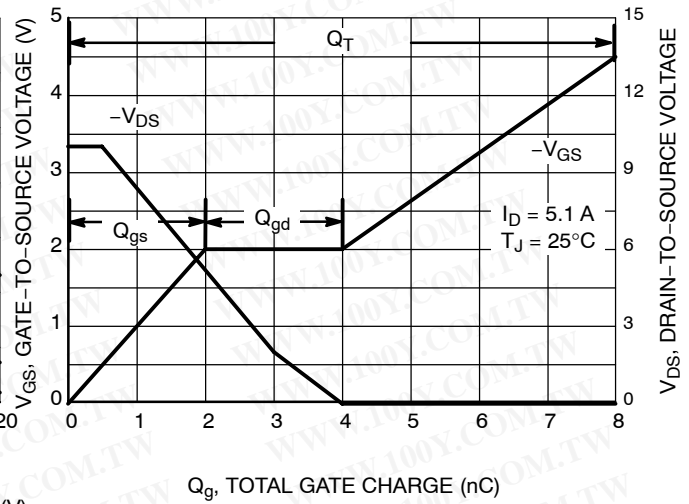


Figure 6. Drain-to-Source Leakage Current versus Voltage

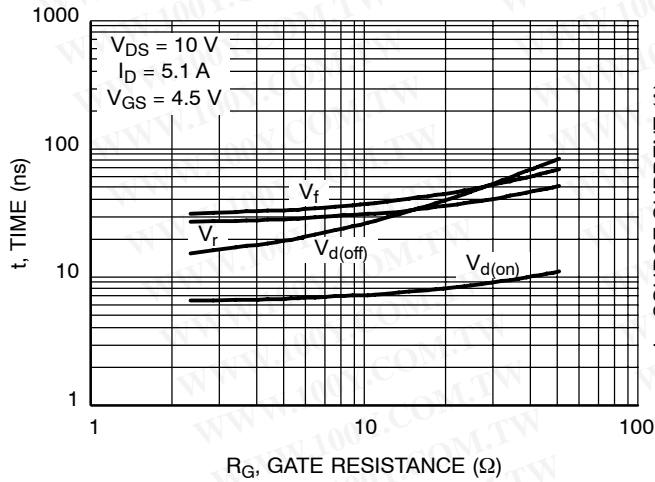
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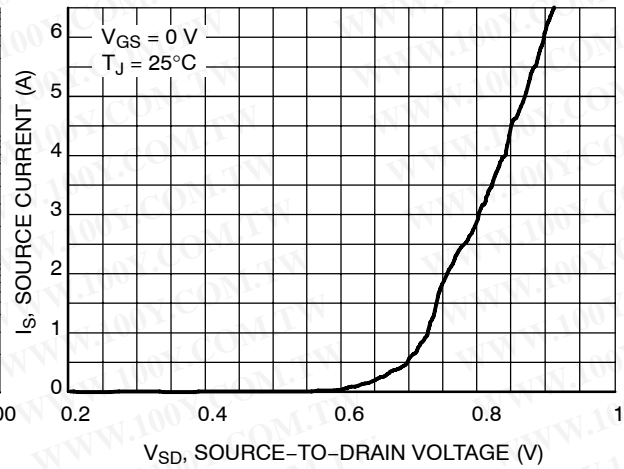
**Figure 7. Capacitance Variation**



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



**Figure 9. Resistive Switching Time Variation versus Gate Resistance**



**Figure 10. Diode Forward Voltage versus Current**

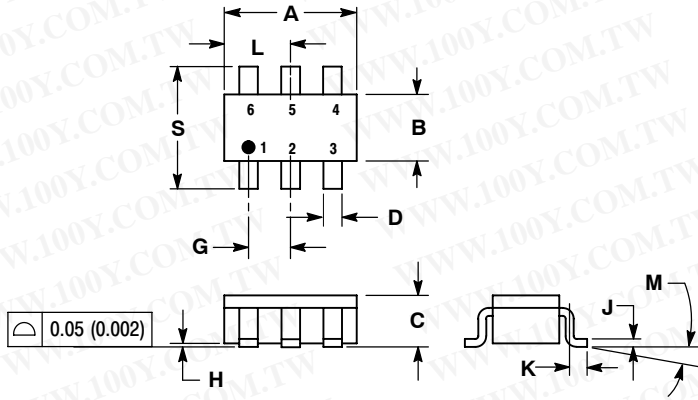
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## PACKAGE DIMENSIONS

TSOP-6  
CASE 318G-02  
ISSUE N

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**NOTES:**

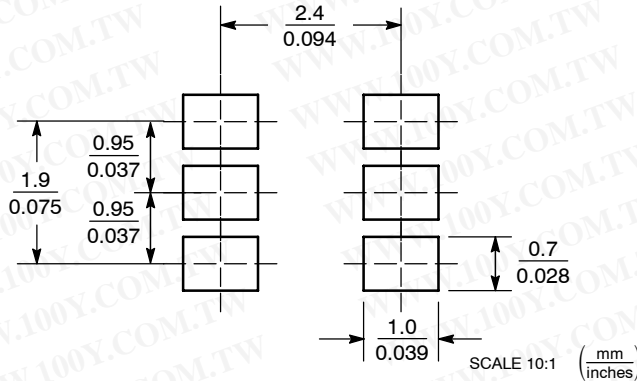
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
4. DIMENSIONS A AND B DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	2.90	3.10	0.1142	0.1220
B	1.30	1.70	0.0512	0.0669
C	0.90	1.10	0.0354	0.0433
D	0.25	0.50	0.0098	0.0197
G	0.85	1.05	0.0335	0.0413
H	0.013	0.100	0.0005	0.0040
J	0.10	0.26	0.0040	0.0102
K	0.20	0.60	0.0079	0.0236
L	1.25	1.55	0.0493	0.0610
M	0°	10°	0°	10°
S	2.50	3.00	0.0985	0.1181

**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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