

# NTR4503N

## Power MOSFET

### 30 V, 2.5 A, Single N-Channel, SOT-23

#### Features

- Leading Planar Technology for Low Gate Charge / Fast Switching
- 4.5 V Rated for Low Voltage Gate Drive
- SOT-23 Surface Mount for Small Footprint (3 x 3 mm)
- Pb-Free Package for Green Manufacturing

#### Applications

- DC-DC Conversion
- Load/Power Switch for Portables
- Load/Power Switch for Computing

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

Parameter			Symbol	Value	Unit
Drain-to-Source Voltage			$V_{DS}$	30	V
Gate-to-Source Voltage			$V_{GS}$	$\pm 20$	V
Continuous Drain Current (Note 1)	Steady State	$T_A = 25^{\circ}\text{C}$	$I_D$	2.0	A
		$T_A = 85^{\circ}\text{C}$		1.5	
	$t \leq 10\text{ s}$	$T_A = 25^{\circ}\text{C}$		2.5	
Power Dissipation (Note 1)	Steady State	$T_A = 25^{\circ}\text{C}$	$P_D$	0.73	W
Continuous Drain Current (Note 2)	Steady State	$T_A = 25^{\circ}\text{C}$	$I_D$	1.5	A
		$T_A = 85^{\circ}\text{C}$		1.1	
Power Dissipation (Note 2)		$T_A = 25^{\circ}\text{C}$	$P_D$	0.42	W
Pulsed Drain Current	$t_p = 10\text{ }\mu\text{s}$		$I_{DM}$	6.0	A
ESD Capability (Note 3)	C = 100 pF, RS = 1500 $\Omega$		ESD	125	V
Operating Junction and Storage Temperature			$T_J$ , $T_{STG}$	-55 to 150	$^{\circ}\text{C}$
Source Current (Body Diode)			$I_S$	2.0	A
Lead Temperature for Soldering Purposes (1/8" from case for 10 s)			$T_L$	260	$^{\circ}\text{C}$

#### THERMAL RESISTANCE RATINGS

Parameter	Symbol	Max	Unit
Junction-to-Ambient – Steady State (Note 1)	$R_{\theta JA}$	170	$^\circ\text{C/W}$
Junction-to-Ambient – $t < 10\text{ s}$ (Note 1)	$R_{\theta JA}$	100	
Junction-to-Ambient – Steady State (Note 2)	$R_{\theta JA}$	300	

1. Surface-mounted on FR4 board using 1 in sq pad size.
2. Surface-mounted on FR4 board using the minimum recommended pad size.
3. ESD Rating Information: HBM Class 0.

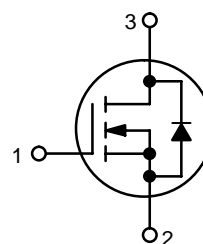


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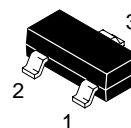
<http://onsemi.com>

$V_{(BR)DSS}$	$R_{DS(on)}$ TYP	$I_D$ MAX
30 V	85 m $\Omega$ @ 10 V	2.5 A
	105 m $\Omega$ @ 4.5 V	

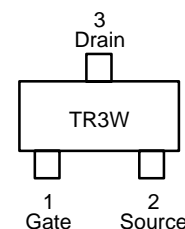
#### N-Channel



#### MARKING DIAGRAM/ PIN ASSIGNMENT



SOT-23  
CASE 318  
STYLE 21



TR3 = Specific Device Code  
W = Work Week

#### ORDERING INFORMATION

Device	Package	Shipping†
NTR4503NT1	SOT-23	3000/Tape & Reel
NTR4503NT1G	SOT-23 (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.

# NTR4503N

## ELECTRICAL CHARACTERISTICS (T<sub>J</sub> = 25°C unless otherwise noted)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
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### OFF CHARACTERISTICS

Drain-to-Source Breakdown Voltage	V <sub>(BR)DSS</sub>	V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA	30	36		V
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 24 V			1.0	μA
		V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 24 V, T <sub>J</sub> = 125°C			10	
Gate-to-Source Leakage Current	I <sub>GSS</sub>	V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ±20 V			±100	nA

### ON CHARACTERISTICS (Note 4)

Gate Threshold Voltage	V <sub>GS(TH)</sub>	V <sub>GS</sub> = V <sub>DS</sub> , I <sub>D</sub> = 250 μA	1.0	1.75	3.0	V
Drain-to-Source On-Resistance	R <sub>DS(on)</sub>	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 2.5 A		85	110	mΩ
		V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 2.0 A		105	140	
Forward Transconductance	g <sub>FS</sub>	V <sub>DS</sub> = 4.5 V, I <sub>D</sub> = 2.5 A		5.3		S

### CHARGES AND CAPACITANCES

Input Capacitance	C <sub>ISS</sub>	V <sub>GS</sub> = 0 V, f = 1.0 MHz, V <sub>DS</sub> = 15 V		135		pF
Output Capacitance	C <sub>OSS</sub>			52		
Reverse Transfer Capacitance	C <sub>RSS</sub>			15		
Input Capacitance	C <sub>ISS</sub>	V <sub>GS</sub> = 0 V, f = 1.0 MHz, V <sub>DS</sub> = 24 V		130	250	pF
Output Capacitance	C <sub>OSS</sub>			42	75	
Reverse Transfer Capacitance	C <sub>RSS</sub>			13	25	
Total Gate Charge	Q <sub>G(TOT)</sub>	V <sub>GS</sub> = 10 V, V <sub>DS</sub> = 15 V, I <sub>D</sub> = 2.5 A		3.6	7.0	nC
Threshold Gate Charge	Q <sub>G(TH)</sub>			0.3		
Gate-to-Source Charge	Q <sub>GS</sub>			0.6		
Gate-to-Drain Charge	Q <sub>GD</sub>			0.7		
Total Gate Charge	Q <sub>G(TOT)</sub>	V <sub>GS</sub> = 4.5 V, V <sub>DS</sub> = 24 V, I <sub>D</sub> = 2.5 A		1.9		nC
Threshold Gate Charge	Q <sub>G(TH)</sub>			0.3		
Gate-to-Source Charge	Q <sub>GS</sub>			0.6		
Gate-to-Drain Charge	Q <sub>GD</sub>			0.9		

### SWITCHING CHARACTERISTICS (Note 5)

Turn-On Delay Time	t <sub>d(ON)</sub>	V <sub>GS</sub> = 10 V, V <sub>DD</sub> = 15 V, I <sub>D</sub> = 1 A, R <sub>G</sub> = 6 Ω		5.8	12	ns
Rise Time	t <sub>r</sub>			5.8	10	
Turn-Off Delay Time	t <sub>d(OFF)</sub>			14	25	
Fall Time	t <sub>f</sub>			1.6	5.0	
Turn-On Delay Time	t <sub>d(ON)</sub>	V <sub>GS</sub> = 10 V, V <sub>DD</sub> = 24 V, I <sub>D</sub> = 2.5 A, R <sub>G</sub> = 2.5 Ω		4.8		ns
Rise Time	t <sub>r</sub>			6.7		
Turn-Off Delay Time	t <sub>d(OFF)</sub>			13.6		
Fall Time	t <sub>f</sub>			1.8		

### DRAIN-SOURCE DIODE CHARACTERISTICS

Forward Diode Voltage	V <sub>SD</sub>	V <sub>GS</sub> = 0 V, I <sub>S</sub> = 2.0 A		0.85	1.2	V
Reverse Recovery Time	t <sub>RR</sub>	V <sub>GS</sub> = 0 V, I <sub>S</sub> = 2.0 A, dI <sub>S</sub> /dt = 100 A/μs		9.2		ns
Reverse Recovery Charge	Q <sub>RR</sub>			4.0		nC

4. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2%.

5. Switching characteristics are independent of operating junction temperatures.

TYPICAL PERFORMANCE CURVES

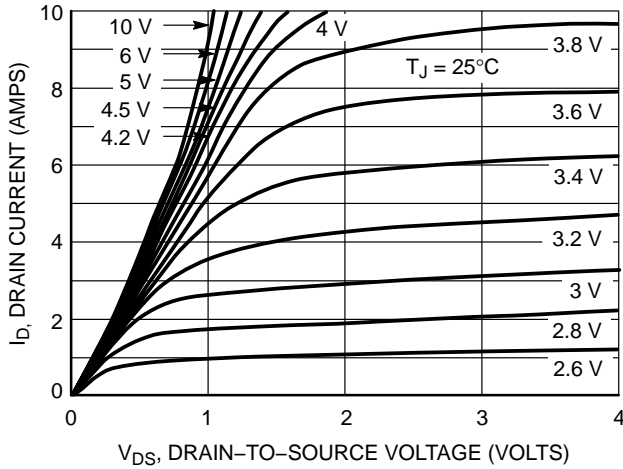


Figure 1. On-Region Characteristics

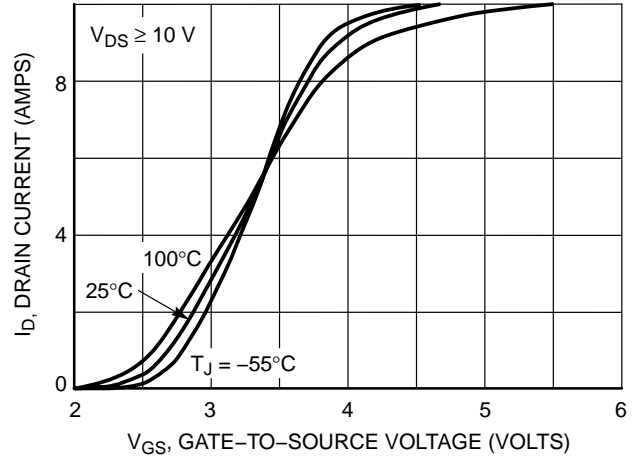


Figure 2. Transfer Characteristics

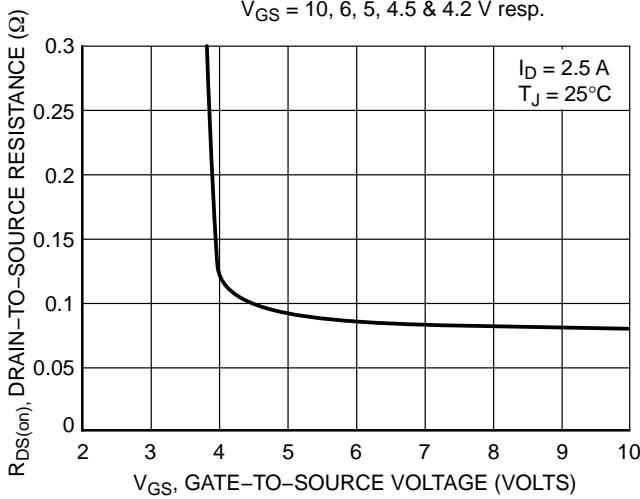


Figure 3. On-Resistance vs. Gate-to-Source Voltage

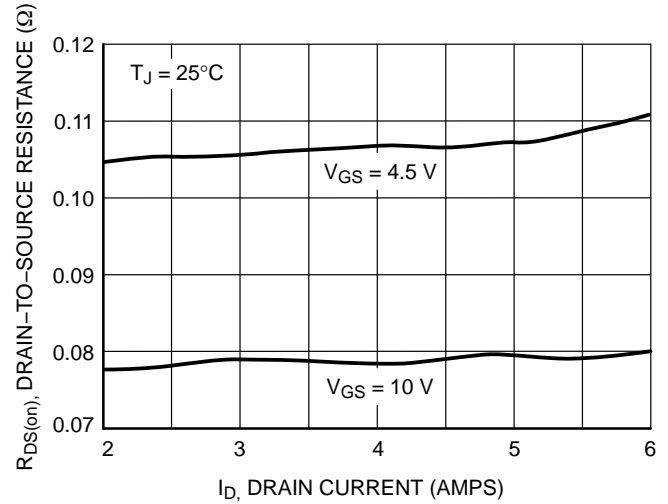


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

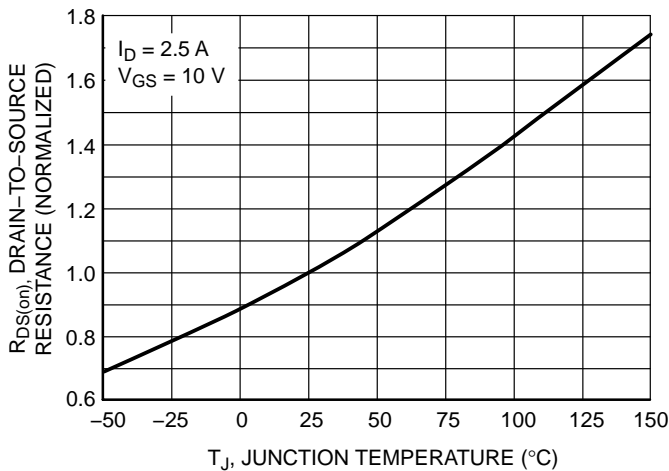


Figure 5. On-Resistance Variation with Temperature

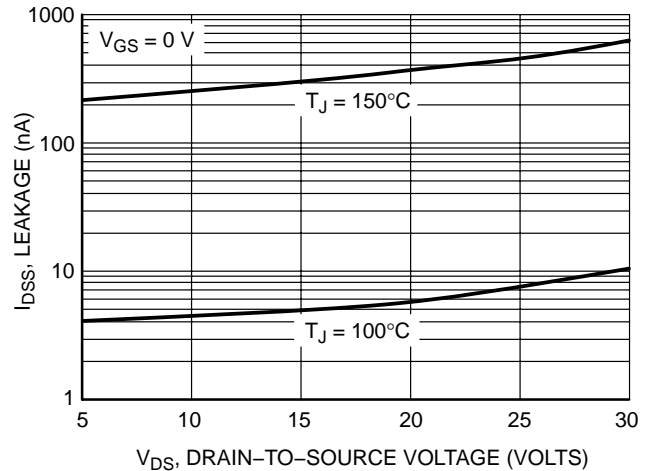


Figure 6. Drain-to-Source Leakage Current vs. Voltage

TYPICAL PERFORMANCE CURVES

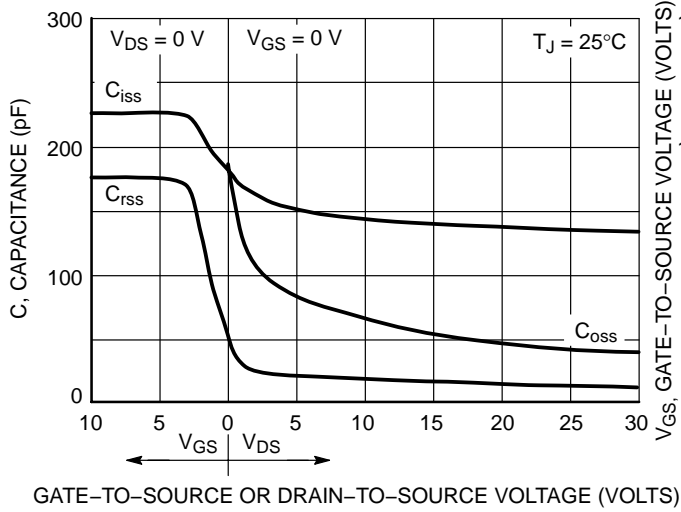


Figure 7. Capacitance Variation

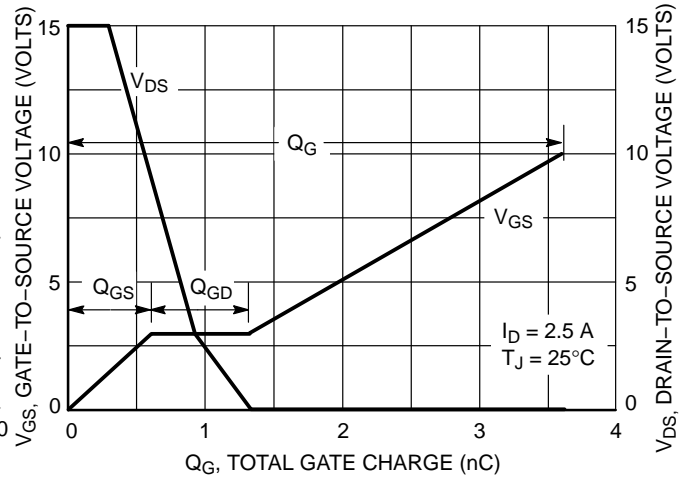


Figure 8. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge

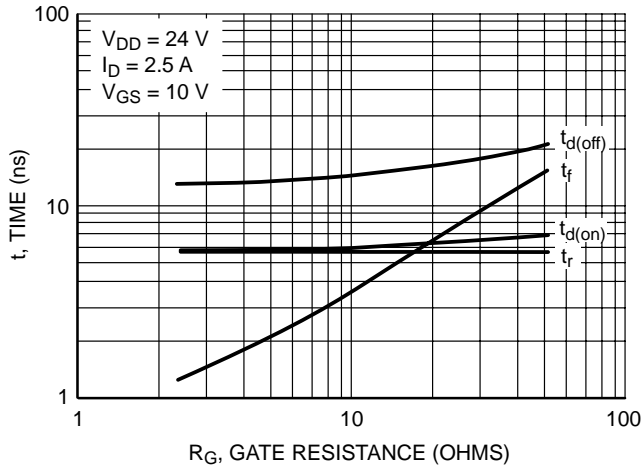


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

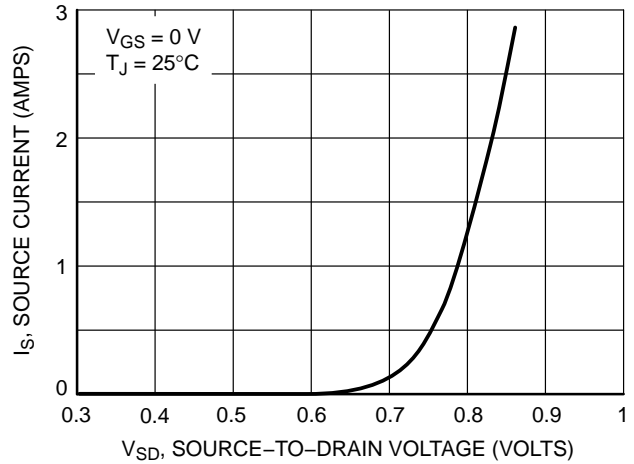
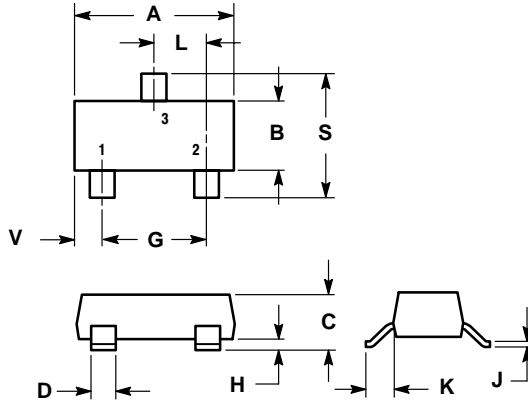


Figure 10. Diode Forward Voltage vs. Current

# NTR4503N

## PACKAGE DIMENSIONS

**SOT-23**  
CASE 318-09  
ISSUE AH




### NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
4. 318-01, -02, AND -06 OBSOLETE, NEW STANDARD 318-09.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.1102	0.1197	2.80	3.04
B	0.0472	0.0551	1.20	1.40
C	0.0385	0.0498	0.99	1.26
D	0.0140	0.0200	0.36	0.50
G	0.0670	0.0826	1.70	2.10
H	0.0040	0.0098	0.10	0.25
J	0.0034	0.0070	0.085	0.177
K	0.0180	0.0236	0.45	0.60
L	0.0350	0.0401	0.89	1.02
S	0.0830	0.0984	2.10	2.50
V	0.0177	0.0236	0.45	0.60

### STYLE 21:

- PIN 1. GATE
- SOURCE
- DRAIN

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