

# 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 is Available

#### Applications

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

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

Parameter	Symbol	Value	Unit	
Drain-to-Source Voltage	V <sub>DSS</sub>	30	V	
Gate-to-Source Voltage	V <sub>GS</sub>	±20	V	
Continuous Drain Current (Note 1)	Steady State	T <sub>A</sub> = 25°C	I <sub>D</sub> = 2.0	A
		T <sub>A</sub> = 85°C	1.5	
		t ≤ 10 s, T <sub>A</sub> = 25°C	2.5	
Power Dissipation (Note 1)	Steady State	T <sub>A</sub> = 25°C	P <sub>D</sub> = 0.73	W
Continuous Drain Current (Note 2)	Steady State	T <sub>A</sub> = 25°C	I <sub>D</sub> = 1.5	A
		T <sub>A</sub> = 85°C	1.1	
Power Dissipation (Note 2)		T <sub>A</sub> = 25°C	P <sub>D</sub> = 0.42	W
Pulsed Drain Current	t <sub>p</sub> = 10 μs	I <sub>DM</sub>	6.0	A
ESD Capability (Note 3)	C = 100 pF, RS = 1500 Ω	ESD	125	V
Operating Junction and Storage Temperature	T <sub>J</sub> , T <sub>stg</sub>	-55 to 150	°C	
Source Current (Body Diode)	I <sub>S</sub>	2.0	A	
Lead Temperature for Soldering Purposes (1/8" from case for 10 s)	T <sub>L</sub>	260	°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.

#### THERMAL RESISTANCE RATINGS

Parameter	Symbol	Max	Unit
Junction-to-Ambient – Steady State (Note 1)	R <sub>θJA</sub>	170	°C/W
Junction-to-Ambient – t < 10 s (Note 1)	R <sub>θJA</sub>	100	
Junction-to-Ambient – Steady State (Note 2)	R <sub>θJA</sub>	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.

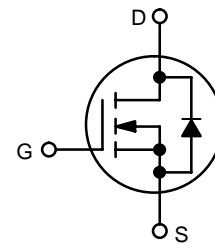


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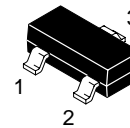
<http://onsemi.com>

V <sub>(BR)DSS</sub>	R <sub>DS(on)</sub> TYP	I <sub>D</sub> MAX
30 V	85 mΩ @ 10 V	2.5 A
	105 mΩ @ 4.5 V	

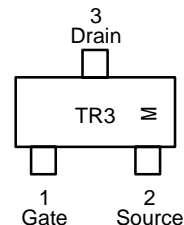
#### N-Channel



#### MARKING DIAGRAM/ PIN ASSIGNMENT



SOT-23  
CASE 318  
STYLE 21



TR3 = Specific Device Code  
M = Date Code

#### ORDERING INFORMATION

Device	Package	Shipping†
NTR4503NT1	SOT-23	3000/Tape & Reel
NTR4503NT1G	SOT-23 (Pb-Free)	3000/Tape & Reel
NTR4503NT3G	SOT-23 (Pb-Free)	10000/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
<b>OFF CHARACTERISTICS</b>						
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

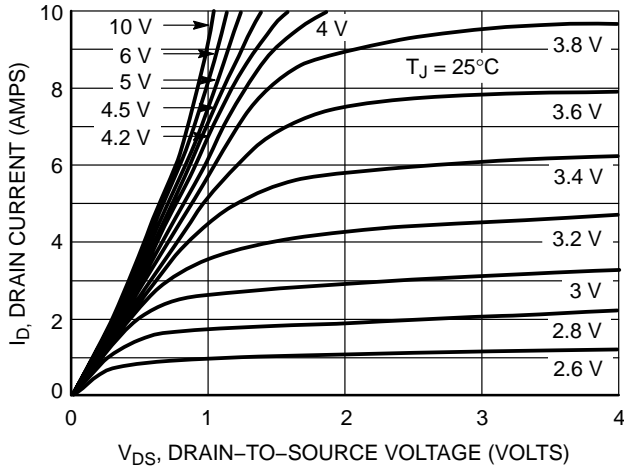


Figure 1. On-Region Characteristics

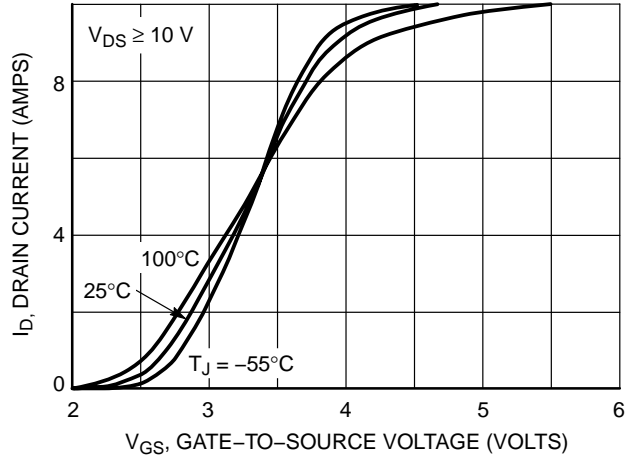


Figure 2. Transfer Characteristics

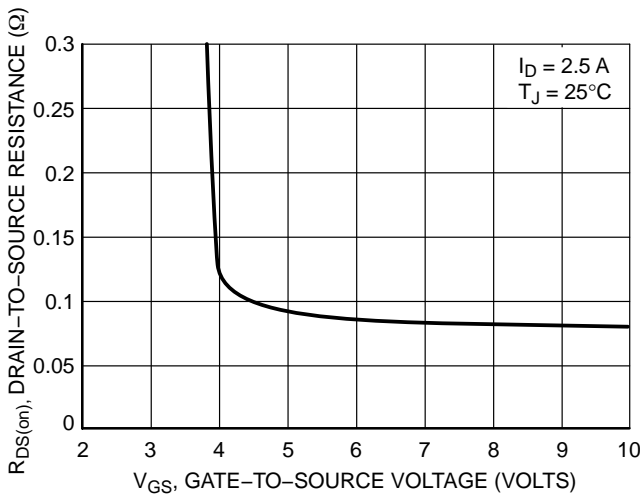


Figure 3. On-Resistance vs. Gate-to-Source Voltage

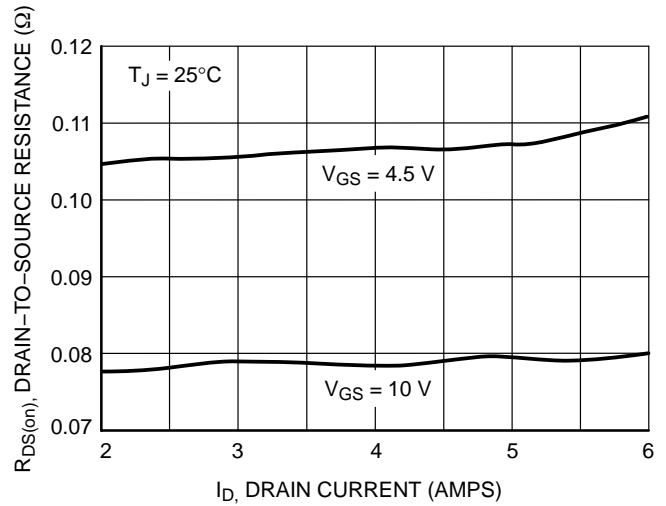


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

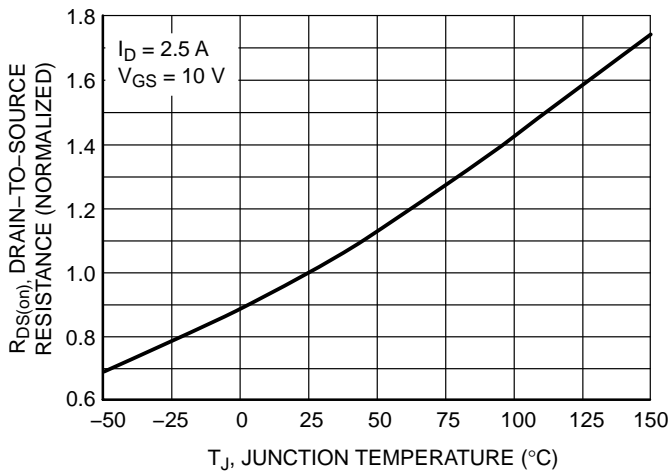


Figure 5. On-Resistance Variation with Temperature

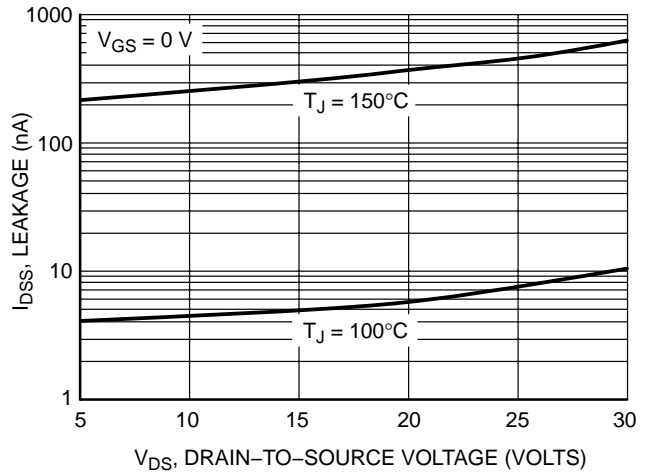


Figure 6. Drain-to-Source Leakage Current vs. Voltage

TYPICAL PERFORMANCE CURVES

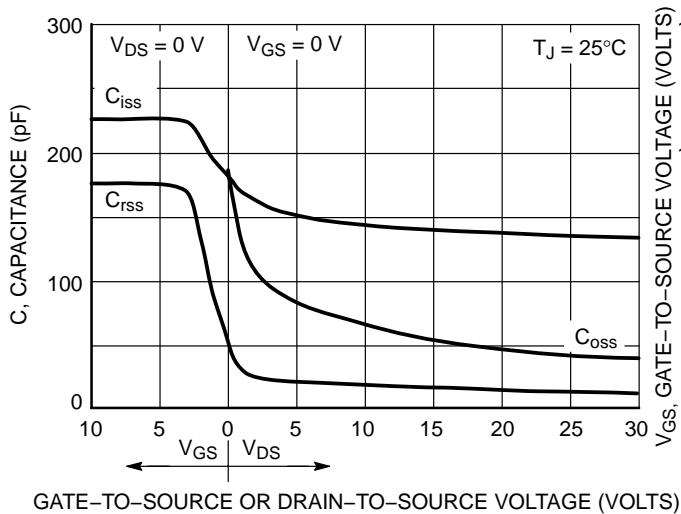


Figure 7. Capacitance Variation

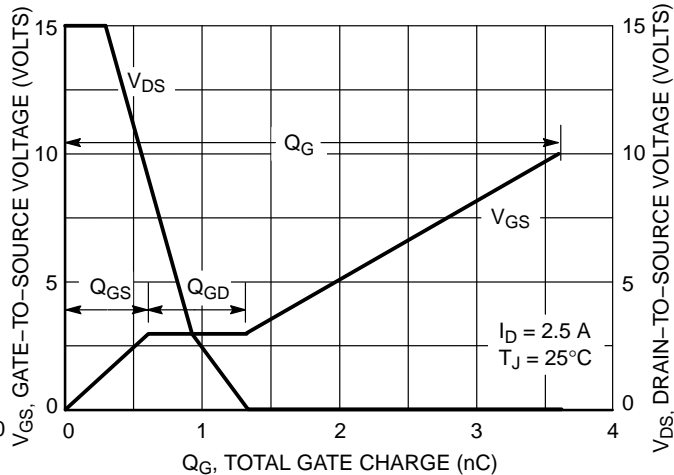


Figure 8. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge

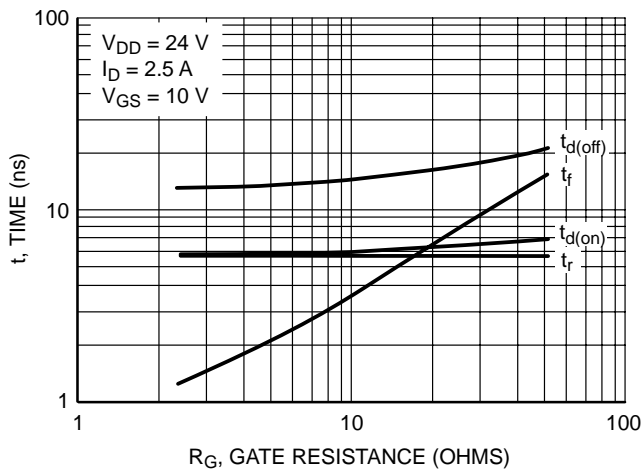


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

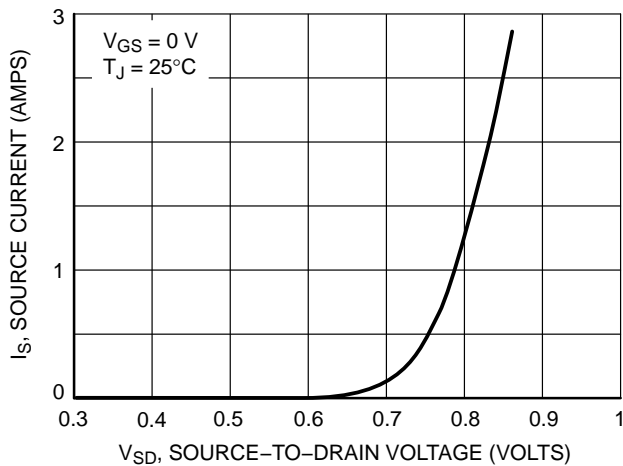
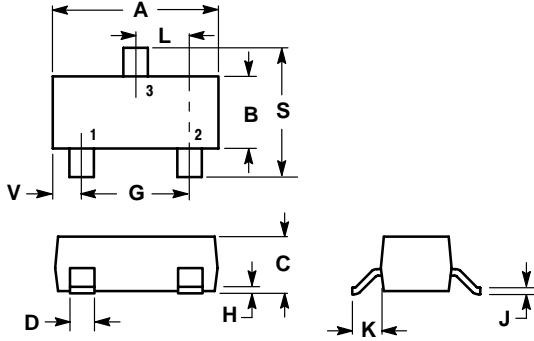


Figure 10. Diode Forward Voltage vs. Current

# NTR4503N

## PACKAGE DIMENSIONS

**SOT-23  
(TO-236)  
CASE 318-08  
ISSUE AK**



**NOTES:**

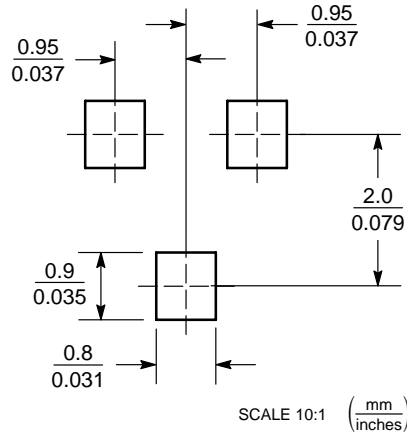
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
4. 318-01 THRU -07 AND -09 OBSOLETE, NEW STANDARD 318-08.

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	0.0350	0.0440	0.89	1.11
D	0.0150	0.0200	0.37	0.50
G	0.0701	0.0807	1.78	2.04
H	0.0005	0.0040	0.013	0.100
J	0.0034	0.0070	0.085	0.177
K	0.0140	0.0285	0.35	0.69
L	0.0350	0.0401	0.89	1.02
S	0.0830	0.1039	2.10	2.64
V	0.0177	0.0236	0.45	0.60

**STYLE 21:**

- PIN 1. GATE
2. SOURCE
3. 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.

# NTR4503N

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