NTR4503N, NVTR4503N
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)
- AEC Q101 Qualified − NVTR4503N
- These Devices are Pb−Free and are RoHS Compliant

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

ON Semiconductor®

http://onsemi.com

$V_{(BR)DSS}$	$R_{DS(on)}$ TYP	I_D 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
▪	= Pb−Free Package

(Note: Microdot may be in either location)

MAXIMUM RATINGS (T_J = 25°C unless otherwise noted)

Parameter			Symbol	Value	Unit
Drain−to−Source Voltage			V_{DSS}	30	V
Gate−to−Source Voltage			V_{GS}	±20	V
Continuous Drain Current (Note 1)	Steady State	T_A = 25°C	I_D	2.0	A
		T_A = 85°C		1.5	
	t ≤ 10 s	T_A = 25°C		2.5	
Power Dissipation (Note 1)	Steady State	T_A = 25°C	P_D	0.73	W
Continuous Drain Current (Note 2)	Steady State	T_A = 25°C	I_D	1.5	A
		T_A = 85°C		1.1	
Power Dissipation (Note 2)		T_A = 25°C	P_D	0.42	W
Pulsed Drain Current	t_p = 10 μs		I_{DM}	10	A
ESD Capability (Note 3)	C = 100 pF, RS = 1500 Ω		ESD	125	V
Operating Junction and Storage Temperature			T_J, T_{stg}	−55 to 150	°C
Source Current (Body Diode)			I_S	2.0	A
Peak Source Current (Diode Forward)	t_p = 10 μs		I_{SM}	4.0	A
Lead Temperature for Soldering Purposes (1/8" from case for 10 s)			T_L	260	°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.

THERMAL RESISTANCE RATINGS

Parameter	Symbol	Max	Unit
Junction−to−Ambient − Steady State (Note 1)	$R_{\theta JA}$	170	°C/W
Junction−to−Ambient − t < 10 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.
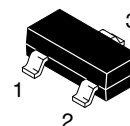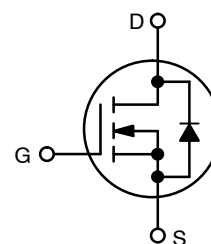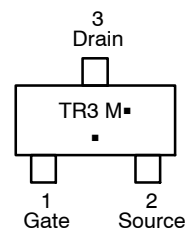3. ESD Rating Information: HBM Class 0.

ORDERING INFORMATION

Device	Package	Shipping†
NTR4503NT1G	SOT−23 (Pb−Free)	3000 / Tape & Reel
NVTR4503NT1G	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, NVTR4503N

ELECTRICAL CHARACTERISTICS ($T_J = 25°C$ unless otherwise noted)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
OFF CHARACTERISTICS						
Drain−to−Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0$ V, $I_D = 250$ μA	30	36		V
Zero Gate Voltage Drain Current	I_{DSS}	$V_{GS} = 0$ V, $V_{DS} = 24$ V			1.0	μA
		$V_{GS} = 0$ V, $V_{DS} = 24$ V, $T_J = 125°C$			10	
Gate−to−Source Leakage Current	I_{GSS}	$V_{DS} = 0$ V, $V_{GS} = \pm 20$ V			± 100	nA
ON CHARACTERISTICS (Note 4)						
Gate Threshold Voltage	$V_{GS(TH)}$	$V_{GS} = V_{DS}$, $I_D = 250$ μA	1.0	1.75	3.0	V
Drain−to−Source On−Resistance	$R_{DS(on)}$	$V_{GS} = 10$ V, $I_D = 2.5$ A		85	110	mΩ
		$V_{GS} = 4.5$ V, $I_D = 2.0$ A		105	140	
Forward Transconductance	g_{FS}	$V_{DS} = 4.5$ V, $I_D = 2.5$ A		5.3		S
CHARGES AND CAPACITANCES						
Input Capacitance	C_{iss}	$V_{GS} = 0$ V, f = 1.0 MHz, $V_{DS} = 15$ V		135		pF
Output Capacitance	C_{oss}			52		
Reverse Transfer Capacitance	C_{rss}			15		
Input Capacitance	C_{iss}	$V_{GS} = 0$ V, f = 1.0 MHz, $V_{DS} = 24$ V		130	250	pF
Output Capacitance	C_{oss}			42	75	
Reverse Transfer Capacitance	C_{rss}			13	25	
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = 10$ V, $V_{DS} = 15$ V, $I_D = 2.5$ A		3.6	7.0	nC
Threshold Gate Charge	$Q_{G(TH)}$			0.3		
Gate−to−Source Charge	Q_{GS}			0.6		
Gate−to−Drain Charge	Q_{GD}			0.7		
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = 4.5$ V, $V_{DS} = 24$ V, $I_D = 2.5$ A		1.9		nC
Threshold Gate Charge	$Q_{G(TH)}$			0.3		
Gate−to−Source Charge	Q_{GS}			0.6		
Gate−to−Drain Charge	Q_{GD}			0.9		
SWITCHING CHARACTERISTICS (Note 5)						
Turn−On Delay Time	$t_{d(on)}$	$V_{GS} = 10$ V, $V_{DD} = 15$ V, $I_D = 1$ A, $R_G = 6$ Ω		5.8	12	ns
Rise Time	t_r			5.8	10	
Turn−Off Delay Time	$t_{d(off)}$			14	25	
Fall Time	t_f			1.6	5.0	
Turn−On Delay Time	$t_{d(on)}$	$V_{GS} = 10$ V, $V_{DD} = 24$ V, $I_D = 2.5$ A, $R_G = 2.5$ Ω		4.8		ns
Rise Time	t_r			6.7		
Turn−Off Delay Time	$t_{d(off)}$			13.6		
Fall Time	t_f			1.8		
DRAIN−SOURCE DIODE CHARACTERISTICS						
Forward Diode Voltage	V_{SD}	$V_{GS} = 0$ V, $I_S = 2.0$ A		0.85	1.2	V
Reverse Recovery Time	t_{RR}	$V_{GS} = 0$ V, $I_S = 2.0$ A, $dI_S/dt = 100$ A/μs		9.2		ns
Reverse Recovery Charge	Q_{RR}			4.0		nC

4. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle $\leq 2\%$.
5. Switching characteristics are independent of operating junction temperatures.
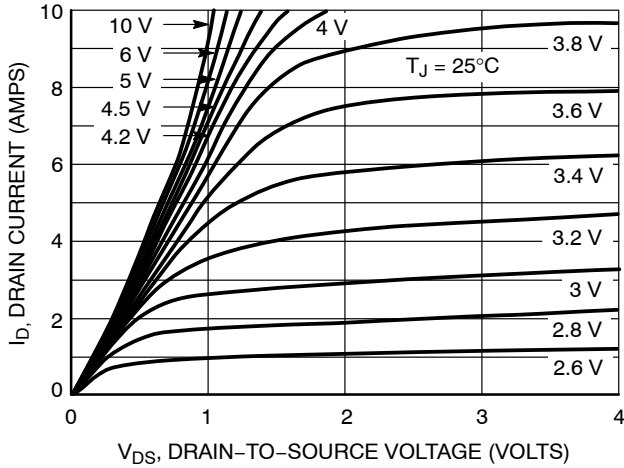
TYPICAL PERFORMANCE CURVES

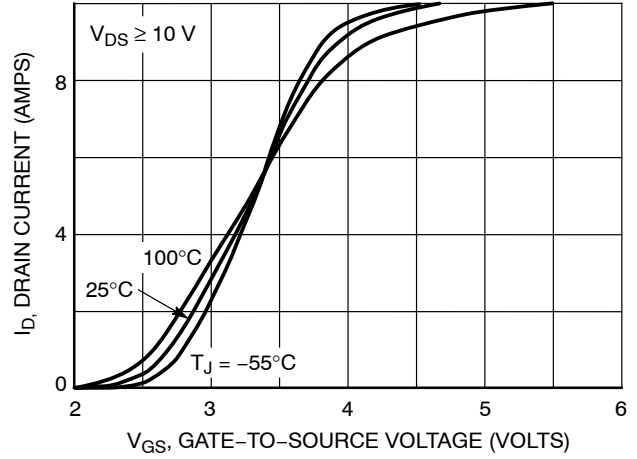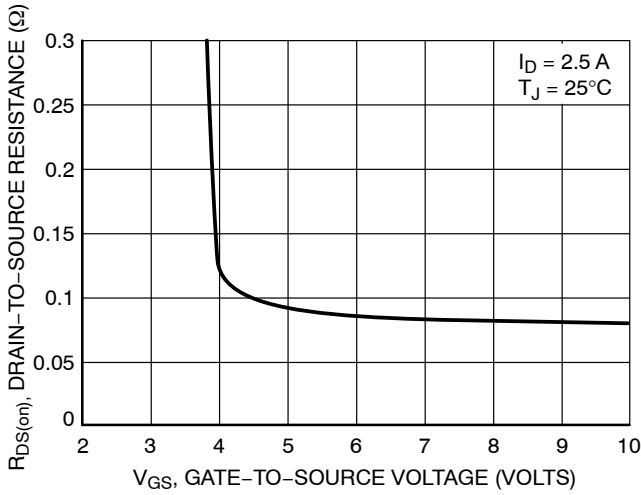Figure 1. On−Region Characteristics

Figure 2. Transfer Characteristics

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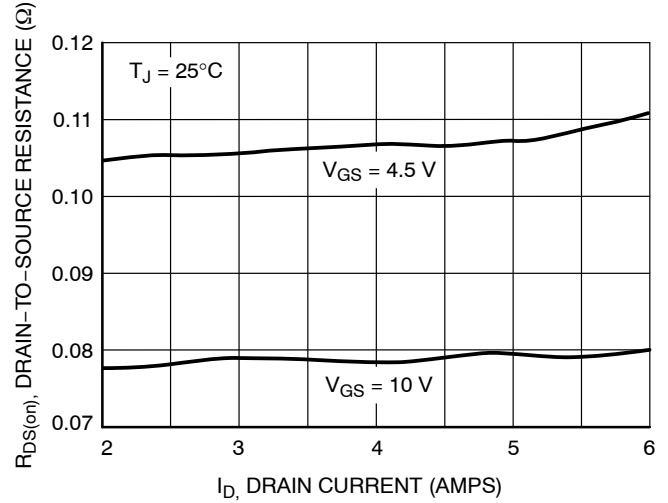Voltage

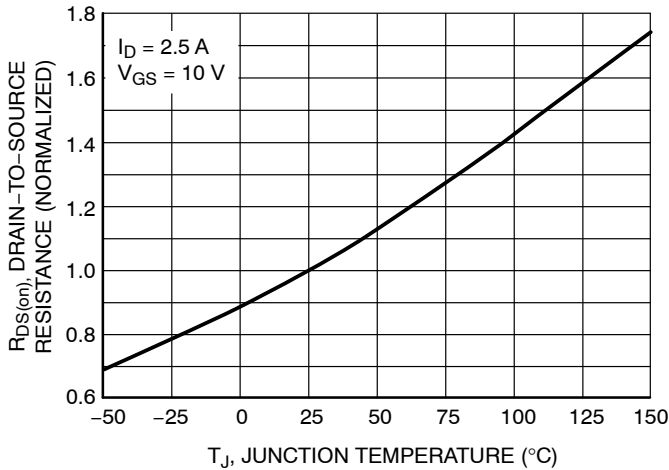
Figure 4. On−Resistance vs. Drain Current and
Gate Voltage

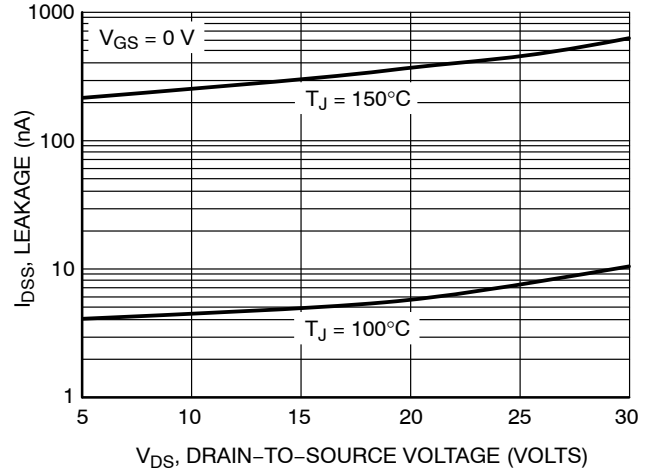Figure 5. On−Resistance Variation with
Temperature

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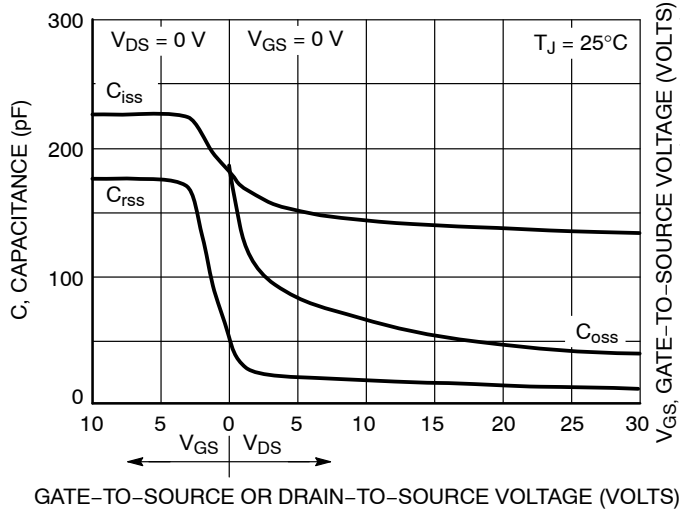vs. Voltage

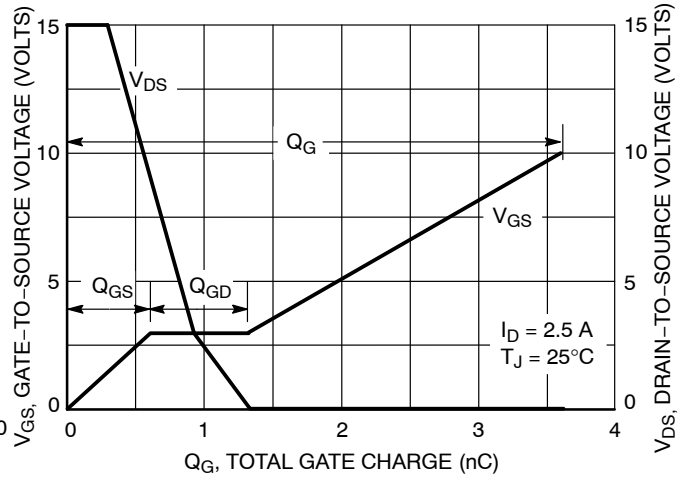## TYPICAL PERFORMANCE CURVES

Figure 7. Capacitance Variation

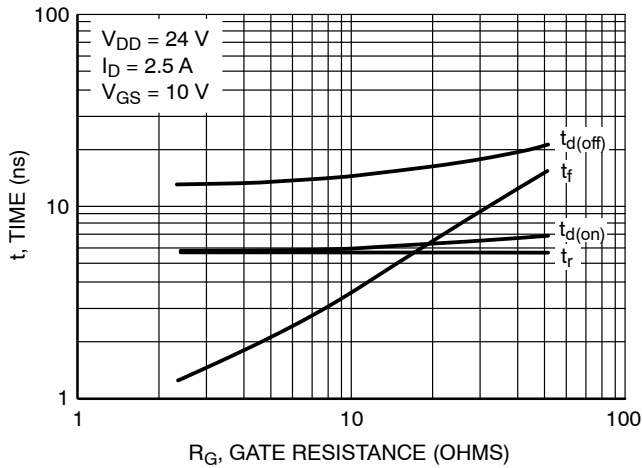
Figure 8. Gate−to−Source and Drain−to−Source Voltage vs. Total Charge

Figure 9. Resistive Switching Time Variation vs. Gate Resistance
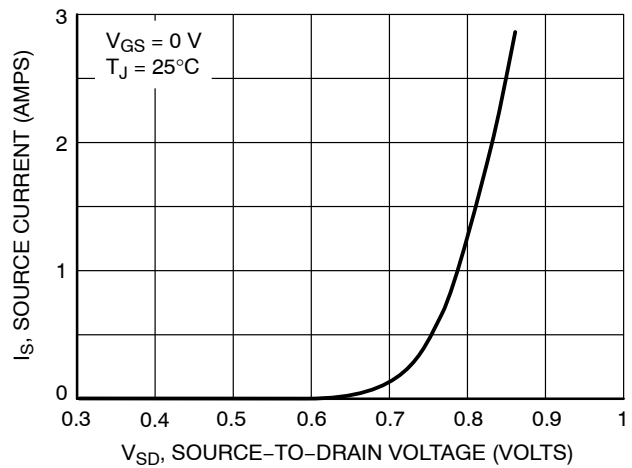
Figure 10. Diode Forward Voltage vs. Current

NTR4503N, NVTR4503N

PACKAGE DIMENSIONS

SOT−23 (TO−236)
CASE 318−08
ISSUE AP
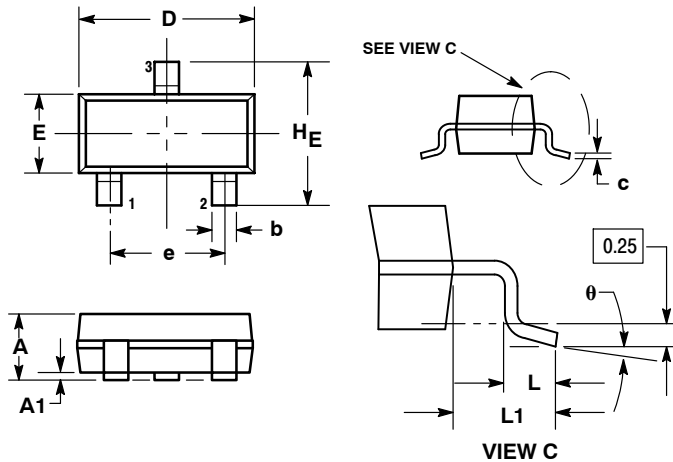
NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

DIM	MILLIMETERS			INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	0.89	1.00	1.11	0.035	0.040	0.044
A1	0.01	0.06	0.10	0.001	0.002	0.004
b	0.37	0.44	0.50	0.015	0.018	0.020
c	0.09	0.13	0.18	0.003	0.005	0.007
D	2.80	2.90	3.04	0.110	0.114	0.120
E	1.20	1.30	1.40	0.047	0.051	0.055
e	1.78	1.90	2.04	0.070	0.075	0.081
L	0.10	0.20	0.30	0.004	0.008	0.012
L1	0.35	0.54	0.69	0.014	0.021	0.029
H$_E$	2.10	2.40	2.64	0.083	0.094	0.104
θ	0°	−−−	10°	0°	−−−	10°

STYLE 21:
PIN 1. GATE
2. SOURCE
3. DRAIN

SOLDERING FOOTPRINT*

SCALE 10:1 $\left(\dfrac{mm}{inches}\right)$
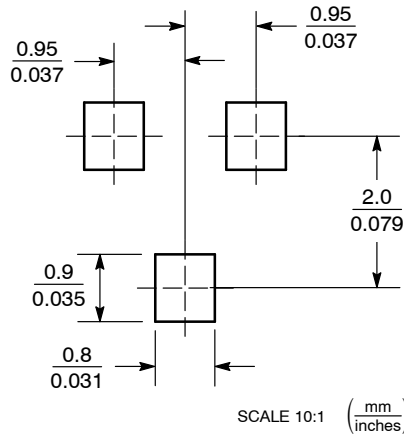
*For additional information on our Pb−Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

NTR4503N/D