

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

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} | ± 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} | 10 | A |
| ESD Capability (Note 3) | $C = 100\text{ pF}$, $R_S = 1500\text{ }\Omega$ | | 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 | $^{\circ}\text{C}$ |

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 | $^\circ\text{C/W}$ |
| 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.

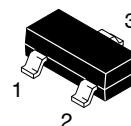
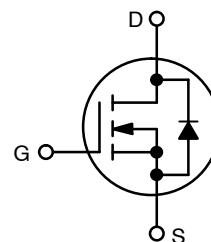


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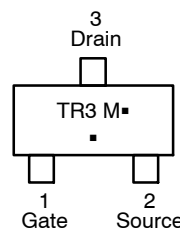
| $V_{(BR)DSS}$ | $R_{DS(on)}$ TYP | I_D MAX |
|---------------|------------------------|-----------|
| 30 V | 85 m Ω @ 10 V | 2.5 A |
| | 105 m Ω @ 4.5 V | |

N-Channel



SOT-23
CASE 318
STYLE 21

MARKING DIAGRAM/ PIN ASSIGNMENT



TR3 = Specific Device Code
M = Date Code
▪ = Pb-Free Package

(Note: Microdot may be in either location)

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.

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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} = ±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 ≤ 2%.

5. Switching characteristics are independent of operating junction temperatures.

TYPICAL PERFORMANCE CURVES

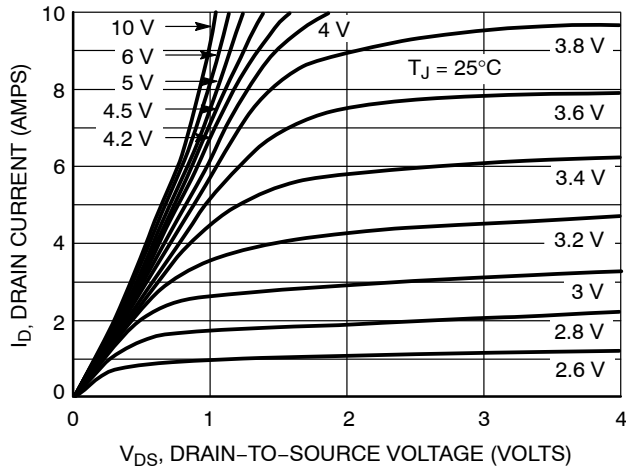


Figure 1. On-Region Characteristics

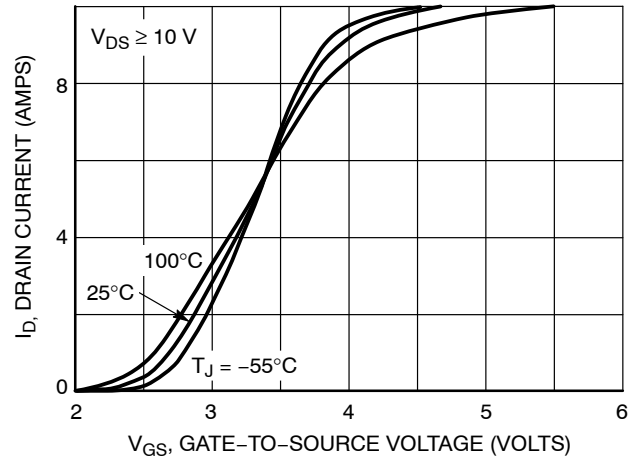


Figure 2. Transfer Characteristics

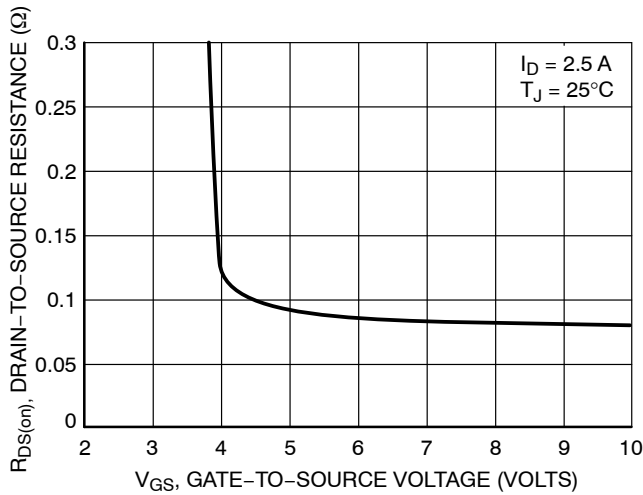


Figure 3. On-Resistance vs. Gate-to-Source Voltage

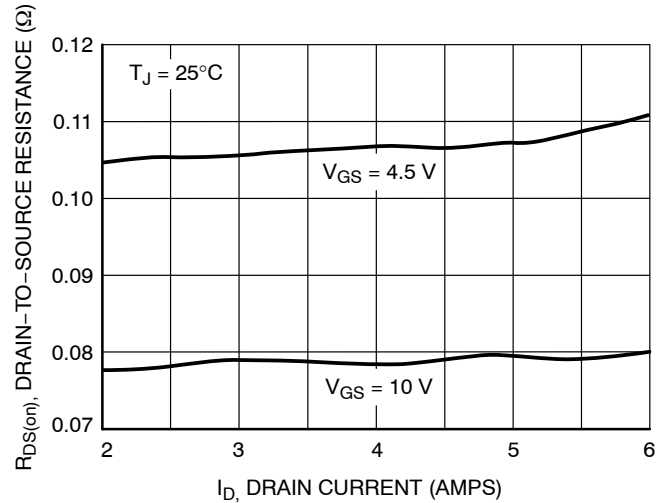


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

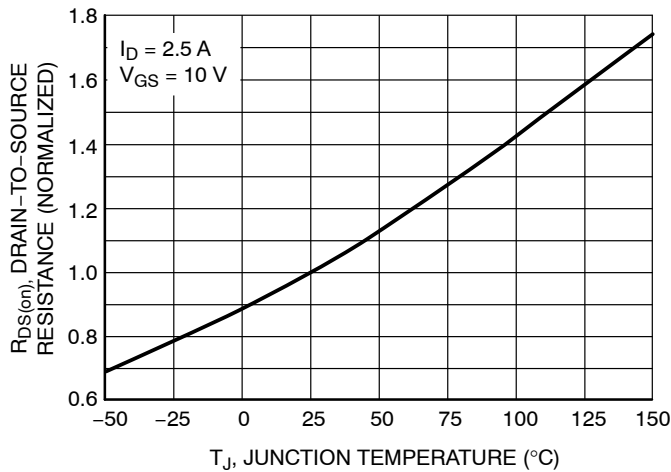


Figure 5. On-Resistance Variation with Temperature

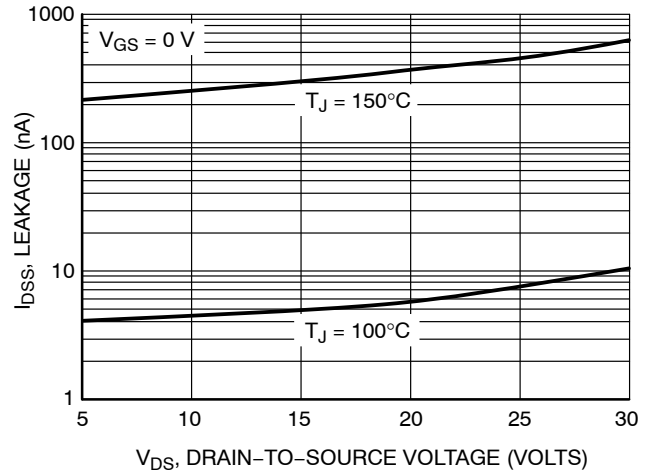


Figure 6. Drain-to-Source Leakage Current vs. Voltage

TYPICAL PERFORMANCE CURVES

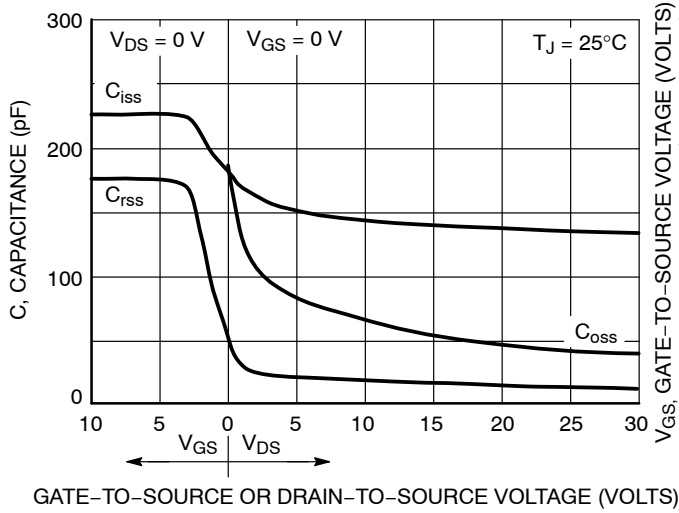


Figure 7. Capacitance Variation

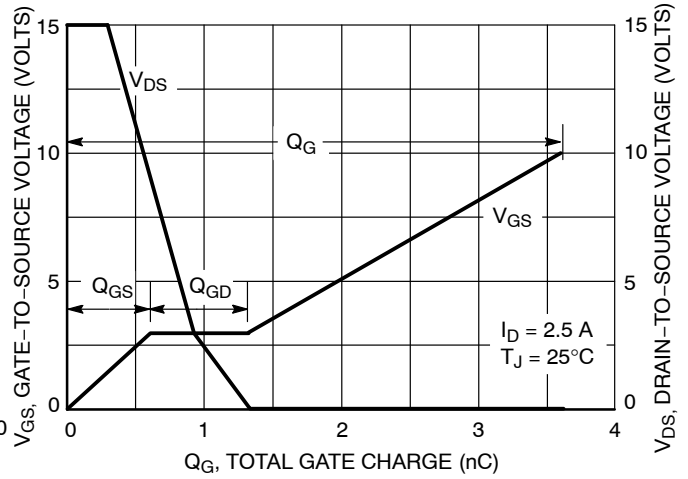


Figure 8. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge

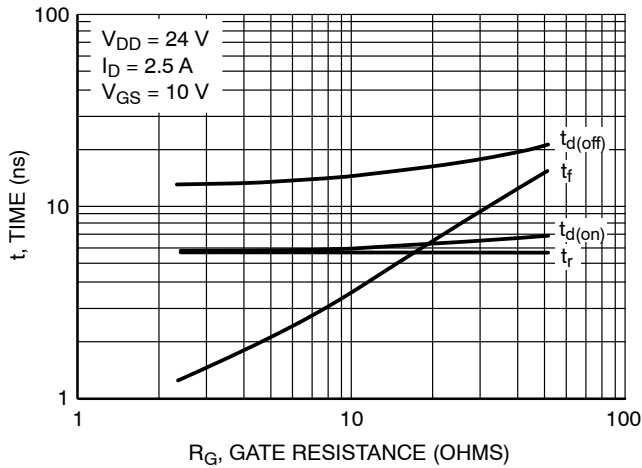


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

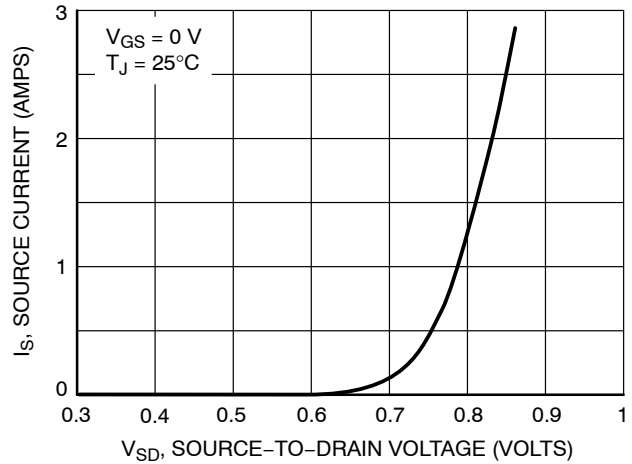
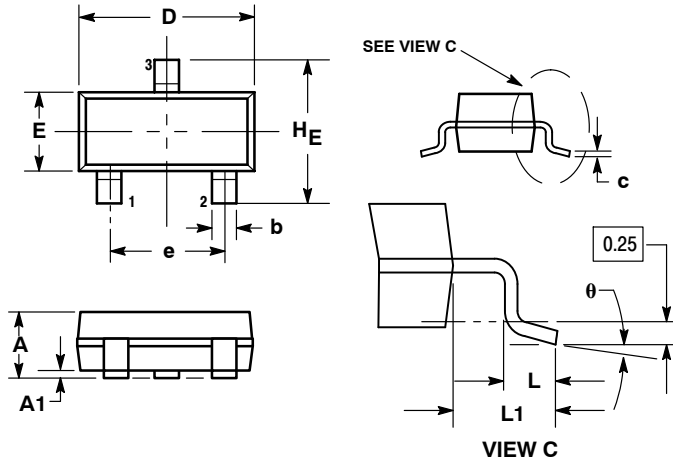


Figure 10. Diode Forward Voltage vs. Current

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PACKAGE DIMENSIONS

SOT-23 (TO-236) CASE 318-08 ISSUE AP



NOTES:

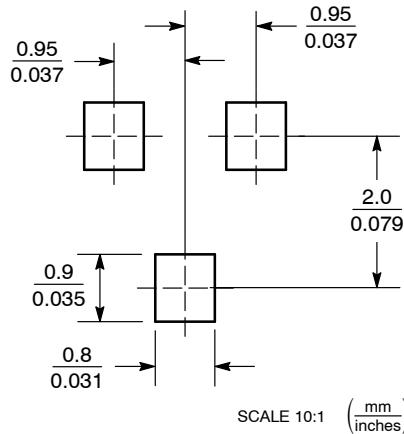
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

| 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 |
| HE | 2.10 | 2.40 | 2.64 | 0.083 | 0.094 | 0.104 |
| θ | 0° | --- | 10° | 0° | --- | 10° |


STYLE 21:

- PIN 1. GATE
- SOURCE
- 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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