Chipsmall Limited consists of a professional team with an average of over 10 year of expertise in the distribution of electronic components. Based in Hongkong, we have already established firm and mutual-benefit business relationships with customers from,Europe,America and south Asia,supplying obsolete and hard-to-find components to meet their specific needs.

With the principle of “Quality Parts,Customers Priority,Honest Operation,and Considerate Service”,our business mainly focus on the distribution of electronic components. Line cards we deal with include Microchip,ALPS,ROHM,Xilinx,Pulse,ON,Everlight and Freescale. Main products comprise IC,Modules,Potentiometer,IC Socket,Relay,Connector.Our parts cover such applications as commercial,industrial, and automotives areas.

We are looking forward to setting up business relationship with you and hope to provide you with the best service and solution. Let us make a better world for our industry!


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Address: A1208, Overseas Decoration Building, #122 Zhenhua RD., Futian, Shenzhen, China

# NTR4003N, NVR4003N

# Small Signal MOSFET

## 30 V, 0.56 A, Single N−Channel, SOT−23

### Features

- Low Gate Voltage Threshold ($V_{GS(TH)}$) to Facilitate Drive Circuit Design
- Low Gate Charge for Fast Switching
- ESD Protected Gate
- SOT−23 Package Provides Excellent Thermal Performance
- Minimum Breakdown Voltage Rating of 30 V
- NVR Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC−Q101 Qualified and PPAP Capable
- These Devices are Pb−Free and are RoHS Compliant

### Applications

- Notebooks:
  - Level Shifters
  - Logic Switches
  - Low Side Load Switches
- Portable Applications

**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 | $I_D$ | 0.5 | A |
| | | $T_A$ = 85°C | | 0.37 | |
| Power Dissipation (Note 1) | Steady State | | $P_D$ | 0.69 | W |
| Continuous Drain Current (Note 1) | t < 10 s | $T_A$ = 25°C | $I_D$ | 0.56 | A |
| | | $T_A$ = 85°C | | 0.40 | |
| Power Dissipation (Note 1) | t < 5 s | | $P_D$ | 0.83 | W |
| Pulsed Drain Current | $t_p$ = 10 μs | | $I_{DM}$ | 1.7 | A |
| Operating Junction and Storage Temperature | | | $T_J$, Tstg | −55 to 150 | °C |
| Source Current (Body Diode) | | | $I_S$ | 1.0 | A |
| Lead Temperature for Soldering Purposes (1/8" from case for 10 s) | | | $T_L$ | 260 | °C |

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

**THERMAL RESISTANCE RATINGS**

| Parameter | Symbol | Max | Unit |
|---|---|---|---|
| Junction−to−Ambient − Steady State (Note 1) | $R_{\theta JA}$ | 180 | °C/W |
| Junction−to−Ambient − t < 10 s (Note 1) | $R_{\theta JA}$ | 150 | |
| Junction−to−Ambient − Steady State (Note 2) | $R_{\theta JA}$ | 300 | |

1. Surface−mounted on FR4 board using 1 in sq pad size (Cu area = 1.127 in sq [1 oz] including traces).
2. Surface−mounted on FR4 board using the minimum recommended pad size.

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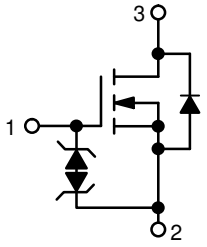
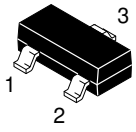
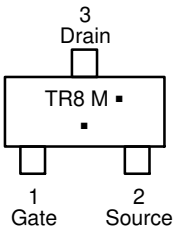
| $V_{(BR)DSS}$ | $R_{DS(on)}$ TYP | $I_D$ MAX |
|---|---|---|
| 30 V | 1.0 Ω @ 4.0 V | 0.56 A |
| | 1.5 Ω @ 2.5 V | |

**N−Channel**




**MARKING DIAGRAM/ PIN ASSIGNMENT**




**SOT−23**
**CASE 318**
**STYLE 21**

TR8 = Specific Device Code
M = Date Code
▪ = Pb−Free Package

(Note: Microdot may be in either location)

*Date Code orientation and overbar may vary depending upon manufacturing location.

**ORDERING INFORMATION**

| Device | Package | Shipping† |
|---|---|---|
| NTR4003NT1G | SOT−23 (Pb−Free) | 3000 / Tape & Reel |
| NTR4003NT3G | SOT−23 (Pb−Free) | 10,000 / Tape & Reel |
| NVR4003NT3G | SOT−23 (Pb−Free) | 10,000 / 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** ($T_J$ = 25°C unless otherwise specified)

| Parameter | Symbol | Test Condition | | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | | | | |
| Drain−to−Source Breakdown Voltage | $V_{(BR)DSS}$ | $V_{GS}$ = 0 V, $I_D$ = 100 μA | | 30 | | | V |
| Drain−to−Source Breakdown Voltage Temperature Coefficient | $V_{(BR)DSS}/T_J$ | | | | 40 | | mV/°C |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | $V_{GS}$ = 0 V, $V_{DS}$ = 30 V | $T_J$ = 25°C | | | 1.0 | μA |
| Gate−to−Source Leakage Current | $I_{GSS}$ | $V_{DS}$ = 0 V, $V_{GS}$ = ±10 V | | | | ±1.0 | μA |
| **ON CHARACTERISTICS** (Note 3) | | | | | | | |
| Gate Threshold Voltage | $V_{GS(TH)}$ | $V_{GS}$ = $V_{DS}$, $I_D$ = 250 μA | | 0.8 | | 1.4 | V |
| Negative Threshold Temperature Coefficient | $V_{GS(TH)}/T_J$ | | | | 3.4 | | mV/°C |
| Drain−to−Source On Resistance | $R_{DS(on)}$ | $V_{GS}$ = 4.0 V, $I_D$ = 10 mA | | | 1.0 | 1.5 | Ω |
| | | $V_{GS}$ = 2.5 V, $I_D$ = 10 mA | | | 1.5 | 2.0 | |
| Forward Transconductance | $g_{FS}$ | $V_{DS}$ = 3.0 V, $I_D$ = 10 mA | | | 0.33 | | S |
| **CHARGES AND CAPACITANCES** | | | | | | | |
| Input Capacitance | $C_{iss}$ | $V_{GS}$ = 0 V, f = 1.0 MHz, $V_{DS}$ = 5.0 V | | | 21 | 42 | pF |
| Output Capacitance | $C_{oss}$ | | | | 19.7 | 40 | |
| Reverse Transfer Capacitance | $C_{rss}$ | | | | 8.1 | 16 | |
| Total Gate Charge | $Q_{G(TOT)}$ | $V_{GS}$ = 5.0 V, $V_{DS}$ = 24 V, $I_D$ = 0.1 A | | | 1.15 | | nC |
| Threshold Gate Charge | $Q_{G(TH)}$ | | | | 0.15 | | |
| Gate−to−Source Gate Charge | $Q_{GS}$ | | | | 0.32 | | |
| Gate−to−Drain Charge | $Q_{GD}$ | | | | 0.23 | | |
| **SWITCHING CHARACTERISTICS** (Note 4) | | | | | | | |
| Turn−On Delay Time | $t_{d(on)}$ | $V_{GS}$ = 4.5 V, $V_{DD}$ = 5.0 V, $I_D$ = 0.1 A, $R_G$ = 50 Ω | | | 16.7 | | ns |
| Rise Time | $t_r$ | | | | 47.9 | | |
| Turn−Off Delay Time | $t_{d(off)}$ | | | | 65.1 | | |
| Fall Time | $t_f$ | | | | 64.2 | | |
| **SOURCE−DRAIN DIODE CHARACTERISTICS** | | | | | | | |
| Forward Diode Voltage | $V_{SD}$ | $V_{GS}$ = 0 V, $I_S$ = 10 mA | $T_J$ = 25°C | | 0.65 | 0.7 | V |
| | | | $T_J$ = 125°C | | 0.45 | | |
| Reverse Recovery Time | $t_{RR}$ | $V_{GS}$ = 0 V, $dI_S/dt$ = 8A/μs, $I_S$ = 10 mA | | | 14 | | ns |

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

3. Pulse Test: pulse width ≤ 300 μs, duty cycle ≤ 2%.
4. Switching characteristics are independent of operating junction temperatures.

## TYPICAL PERFORMANCE CURVES ($T_J$ = 25°C unless otherwise noted)

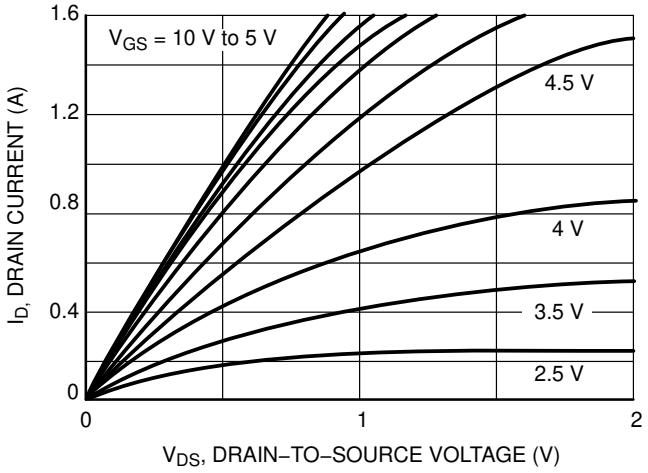



**Figure 1. On−Region Characteristics**

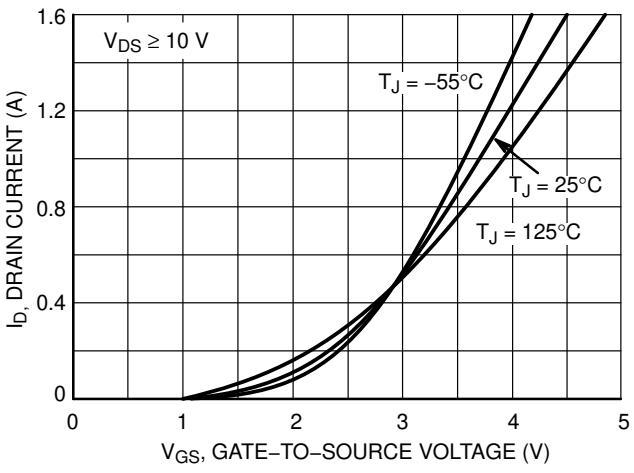



**Figure 2. Transfer Characteristics**

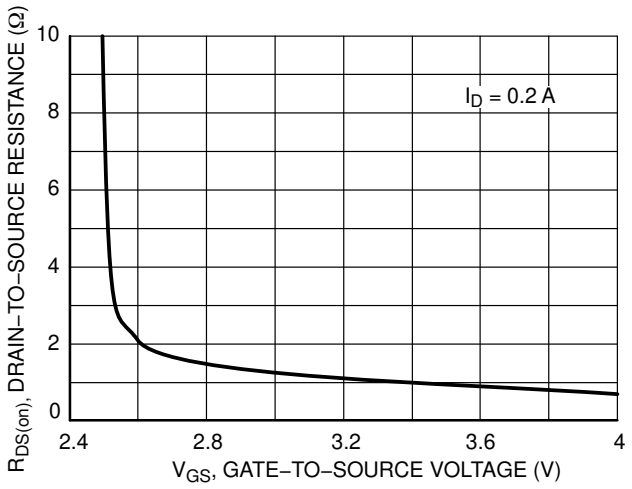



**Figure 3. On−Resistance vs. Gate−to−Source Voltage**

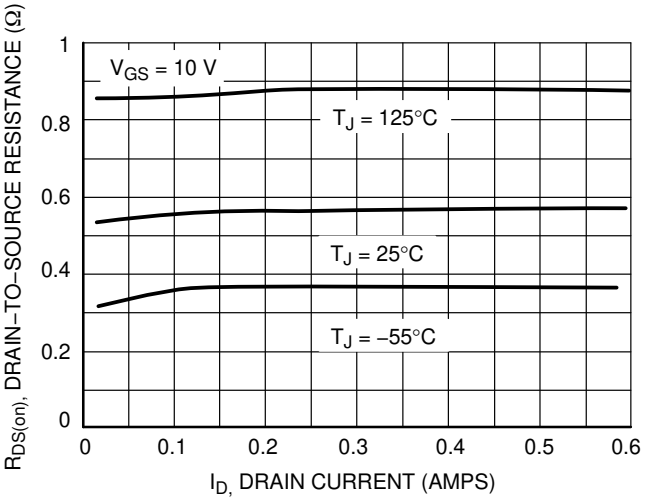



**Figure 4. On−Resistance vs. Drain Current and Temperature**

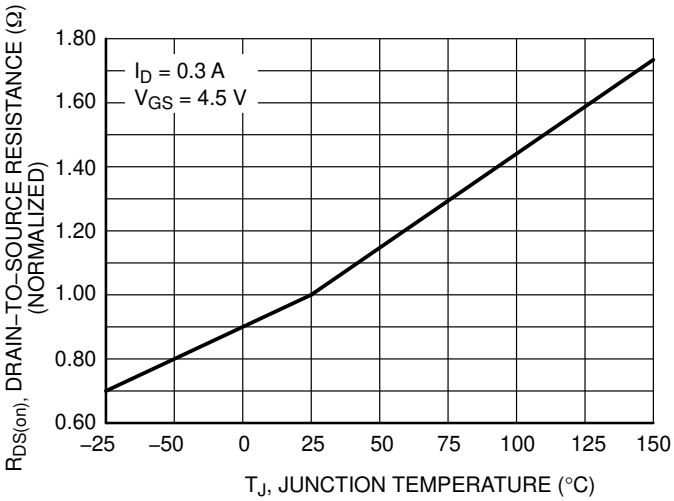



**Figure 5. On−Resistance Variation with Temperature**

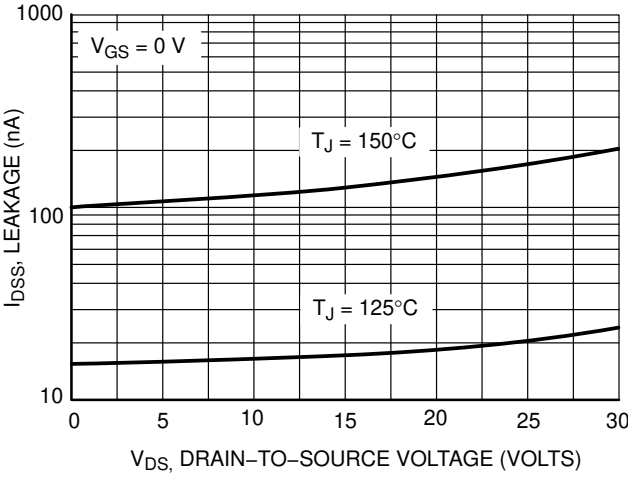



**Figure 6. Drain−to−Source Leakage Current vs. Voltage**

## TYPICAL PERFORMANCE CURVES ($T_J$ = 25°C unless otherwise noted)

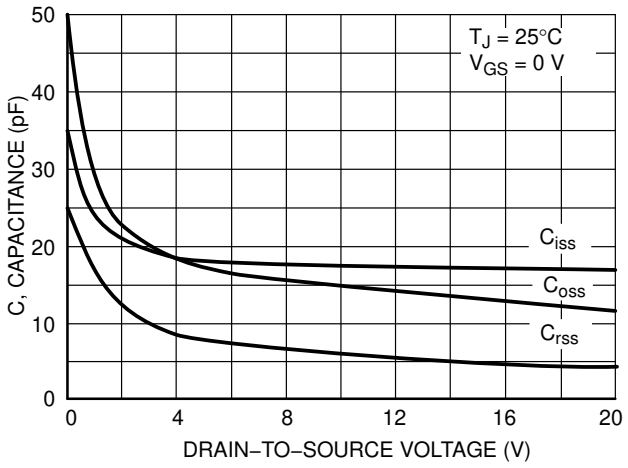



**Figure 7. Capacitance Variation**

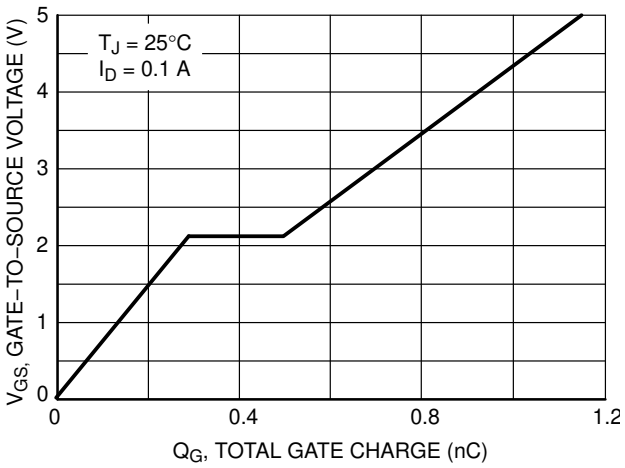



**Figure 8. Gate−to−Source & Drain−to−Source Voltage vs. Total Charge**

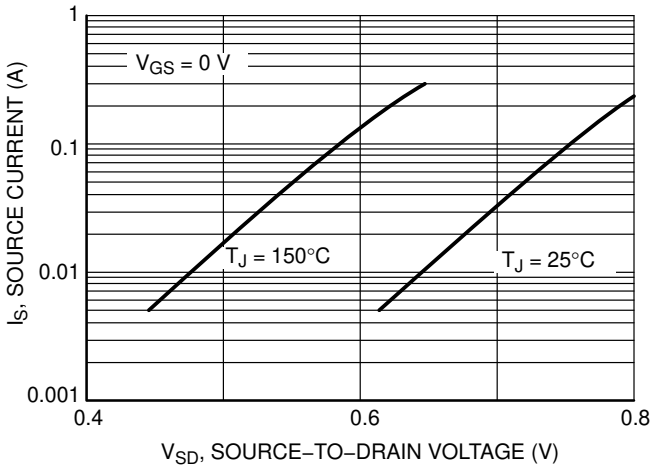
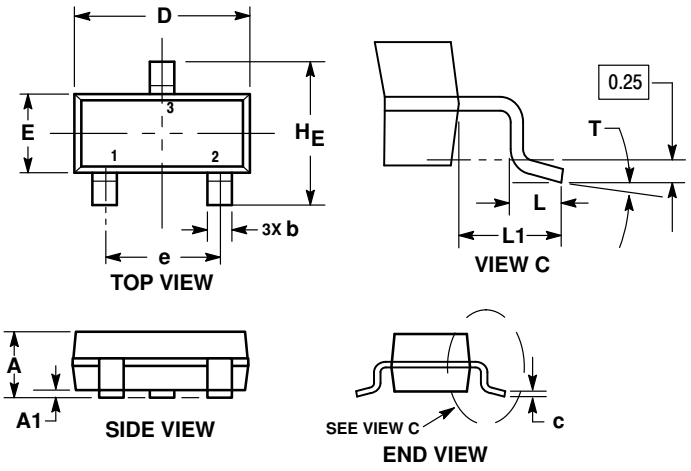



**Figure 9. Diode Forward Voltage vs. Current**

## PACKAGE DIMENSIONS

**SOT−23 (TO−236)**
CASE 318−08
ISSUE AR

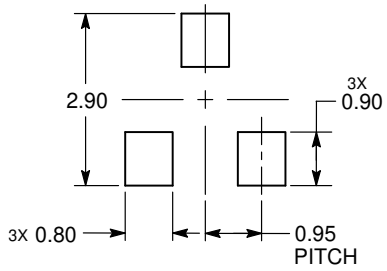



NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF THE BASE MATERIAL.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

| | MILLIMETERS | | | INCHES | | |
|---|---|---|---|---|---|---|
| DIM | MIN | NOM | MAX | MIN | NOM | MAX |
| A | 0.89 | 1.00 | 1.11 | 0.035 | 0.039 | 0.044 |
| A1 | 0.01 | 0.06 | 0.10 | 0.000 | 0.002 | 0.004 |
| b | 0.37 | 0.44 | 0.50 | 0.015 | 0.017 | 0.020 |
| c | 0.08 | 0.14 | 0.20 | 0.003 | 0.006 | 0.008 |
| 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 | 0.080 |
| L | 0.30 | 0.43 | 0.55 | 0.012 | 0.017 | 0.022 |
| L1 | 0.35 | 0.54 | 0.69 | 0.014 | 0.021 | 0.027 |
| $H_E$ | 2.10 | 2.40 | 2.64 | 0.083 | 0.094 | 0.104 |
| T | 0° | ––– | 10° | 0° | ––– | 10° |

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

## RECOMMENDED SOLDERING FOOTPRINT*




DIMENSIONS: MILLIMETERS

*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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