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NTR1P02, NVR1P02

Power MOSFET

-20 V, -1 A, P-Channel SOT-23 Package

Features

- Ultra Low On-Resistance Provides Higher Efficiency and Extends Battery Life
 $R_{DS(on)} = 0.180 \Omega$, $V_{GS} = -10 \text{ V}$
 $R_{DS(on)} = 0.280 \Omega$, $V_{GS} = -4.5 \text{ V}$
- Power Management in Portable and Battery-Powered Products
- Miniature SOT-23 Surface Mount Package Saves Board Space
- Mounting Information for SOT-23 Package Provided
- 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

- DC-DC Converters
- Computers
- Printers
- PCMCIA Cards
- Cellular and Cordless Telephones

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

| Rating | Symbol | Value | Unit |
|--|-----------------|------------|--------------------|
| Drain-to-Source Voltage | V_{DSS} | -20 | V |
| Gate-to-Source Voltage - Continuous | V_{GS} | ± 20 | V |
| Drain Current | | | A |
| - Continuous @ $T_A = 25^\circ\text{C}$ | I_D | -1.0 | |
| - Pulsed Drain Current ($t_p \leq 1 \mu\text{s}$) | I_{DM} | -2.67 | |
| Total Power Dissipation @ $T_A = 25^\circ\text{C}$ | P_D | 400 | mW |
| Operating and Storage Temperature Range | T_J, T_{stg} | -55 to 150 | $^\circ\text{C}$ |
| Thermal Resistance; Junction-to-Ambient | $R_{\theta JA}$ | 300 | $^\circ\text{C/W}$ |
| Maximum Lead Temperature for Soldering Purposes, (1/8" from case for 10 s) | T_L | 260 | $^\circ\text{C}$ |

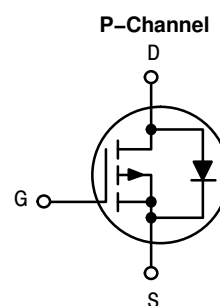
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.



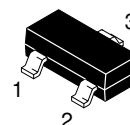
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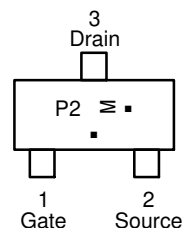
| $V_{(BR)DSS}$ | $R_{DS(on)}$ TYP | I_D MAX |
|---------------|------------------------|-----------|
| -20 V | 148 m Ω @ -10 V | -1.0 A |



MARKING DIAGRAM/ PIN ASSIGNMENT



SOT-23
CASE 318
STYLE 21



P2 = Specific Device Code
M = Date Code
▪ = Pb-Free Package
(Note: Microdot may be in either location)

ORDERING INFORMATION

| Device | Package | Shipping† |
|------------|------------------|---------------------|
| NTR1P02T1G | SOT-23 (Pb-Free) | 3000 / Tape & Reel |
| NTR1P02T3G | SOT-23 (Pb-Free) | 10000 / Tape & Reel |
| NVR1P02T1G | 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.

NTR1P02, NVR1P02

ELECTRICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$ unless otherwise noted)

| Characteristic | Symbol | Min | Typ | Max | Unit |
|----------------|--------|-----|-----|-----|------|
|----------------|--------|-----|-----|-----|------|

OFF CHARACTERISTICS

| | | | | | |
|--|---------------|-----|----|-------------|---------------------------|
| Drain-to-Source Breakdown Voltage ($V_{GS} = 0\text{ V}$, $I_D = -10\ \mu\text{A}$) (Positive Temperature Coefficient) | $V_{(BR)DSS}$ | -20 | 32 | | V mV/ $^\circ\text{C}$ |
| Zero Gate Voltage Drain Current ($V_{DS} = -20\text{ V}$, $V_{GS} = 0\text{ V}$, $T_J = 25^\circ\text{C}$) ($V_{DS} = -20\text{ V}$, $V_{GS} = 0\text{ V}$, $T_J = 150^\circ\text{C}$) | I_{DSS} | | | -1.0 -10 | μA |
| Gate-Body Leakage Current ($V_{GS} = \pm 20\text{ V}$, $V_{DS} = 0\text{ V}$) | I_{GSS} | | | ± 100 | nA |

ON CHARACTERISTICS (Note 1)

| | | | | | |
|--|--------------|------|----------------|----------------|---------------------------|
| Gate Threshold Voltage ($V_{DS} = V_{GS}$, $I_D = -250\ \mu\text{A}$) (Negative Temperature Coefficient) | $V_{GS(th)}$ | -1.1 | -1.9 -4.0 | -2.3 | V mV/ $^\circ\text{C}$ |
| Static Drain-to-Source On-State Resistance ($V_{GS} = -10\text{ V}$, $I_D = -1.5\text{ A}$) ($V_{GS} = -4.5\text{ V}$, $I_D = -0.75\text{ A}$) | $R_{DS(on)}$ | | 0.148 0.235 | 0.180 0.280 | Ω |

DYNAMIC CHARACTERISTICS

| | | | | | |
|---|-----------|--|-----|--|----|
| Input Capacitance ($V_{DS} = -5\text{ V}$, $V_{GS} = 0\text{ V}$, $f = 1.0\text{ MHz}$) | C_{iss} | | 165 | | pF |
| Output Capacitance ($V_{DS} = -5\text{ V}$, $V_{GS} = 0\text{ V}$, $f = 1.0\text{ MHz}$) | C_{oss} | | 110 | | |
| Reverse Transfer Capacitance ($V_{DS} = -5\text{ V}$, $V_{GS} = 0\text{ V}$, $f = 1.0\text{ MHz}$) | C_{rss} | | 35 | | |

SWITCHING CHARACTERISTICS (Note 2)

| | | | | | |
|---|--------------|--|------|--|----|
| Turn-On Delay Time ($V_{DD} = -15\text{ V}$, $I_D = -1\text{ A}$, $V_{GS} = -5\text{ V}$, $R_G = 2.5\ \Omega$) | $t_{d(on)}$ | | 7.0 | | ns |
| Rise Time ($V_{DD} = -15\text{ V}$, $I_D = -1\text{ A}$, $V_{GS} = -5\text{ V}$, $R_G = 2.5\ \Omega$) | t_r | | 9.0 | | |
| Turn-Off Delay Time ($V_{DD} = -15\text{ V}$, $I_D = -1\text{ A}$, $V_{GS} = -5\text{ V}$, $R_G = 2.5\ \Omega$) | $t_{d(off)}$ | | 9.0 | | |
| Fall Time ($V_{DD} = -15\text{ V}$, $I_D = -1\text{ A}$, $V_{GS} = -5\text{ V}$, $R_G = 2.5\ \Omega$) | t_f | | 3.0 | | |
| Total Gate Charge ($V_{DS} = -15\text{ V}$, $V_{GS} = -5\text{ V}$, $I_D = -0.8\text{ A}$) | Q_{tot} | | 2.5 | | nC |
| Gate-Source Charge ($V_{DS} = -15\text{ V}$, $V_{GS} = -5\text{ V}$, $I_D = -0.8\text{ A}$) | Q_{gs} | | 0.75 | | |
| Gate-Drain Charge ($V_{DS} = -15\text{ V}$, $V_{GS} = -5\text{ V}$, $I_D = -0.8\text{ A}$) | Q_{gd} | | 1.0 | | |

BODY-DRAIN DIODE RATINGS (Note 1)

| | | | | | |
|---|----------|--|--------------|------|---------------|
| Diode Forward On-Voltage (Note 2) ($I_S = -0.6\text{ A}$, $V_{GS} = 0\text{ V}$) ($I_S = -0.6\text{ A}$, $V_{GS} = 0\text{ V}$, $T_J = 150^\circ\text{C}$) | V_{SD} | | -0.8 -0.6 | -1.0 | V |
| Reverse Recovery Time ($I_S = -1\text{ A}$, $di_S/dt = 100\text{ A}/\mu\text{s}$, $V_{GS} = 0\text{ V}$) | t_{rr} | | 13.5 | | ns |
| | t_a | | 10.5 | | |
| | t_b | | 3.0 | | |
| Reverse Recovery Stored Charge ($I_S = -1\text{ A}$, $di_S/dt = 100\text{ A}/\mu\text{s}$, $V_{GS} = 0\text{ V}$) | Q_{RR} | | 0.008 | | μC |

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.

1. Pulse Test: Pulse Width $\leq 300\ \mu\text{s}$, Duty Cycle $\leq 2\%$.
2. Switching characteristics are independent of operating junction temperature.

NTR1P02, NVR1P02

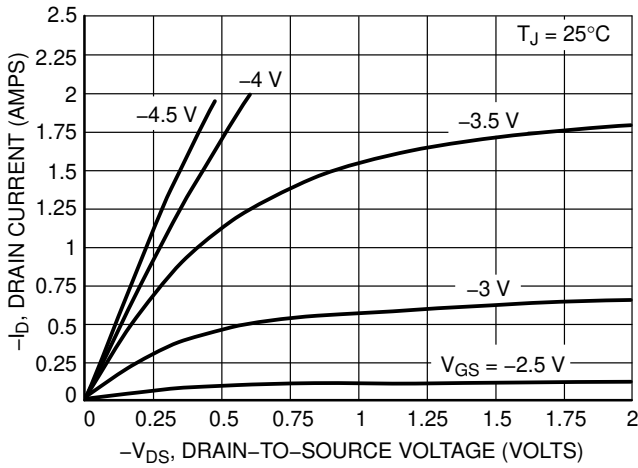


Figure 1. On-Region Characteristics

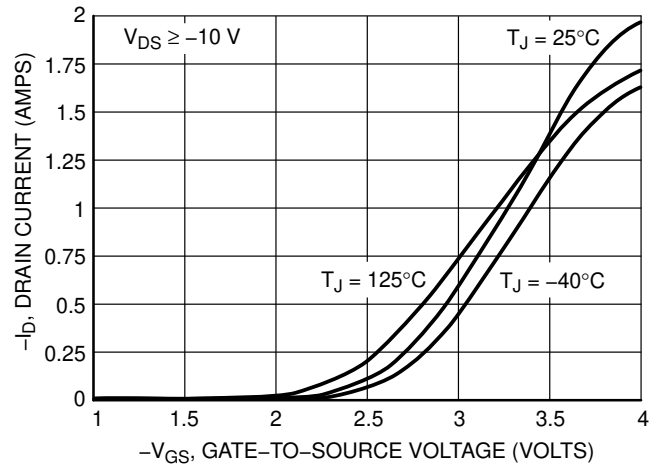


Figure 2. Transfer Characteristics

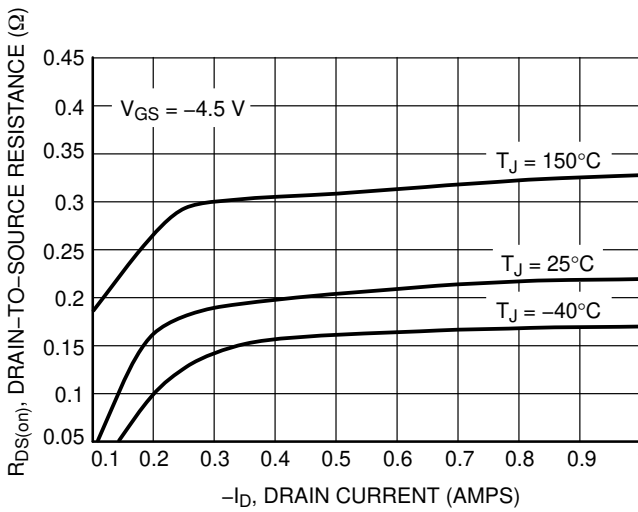


Figure 3. On-Resistance versus Drain Current and Temperature

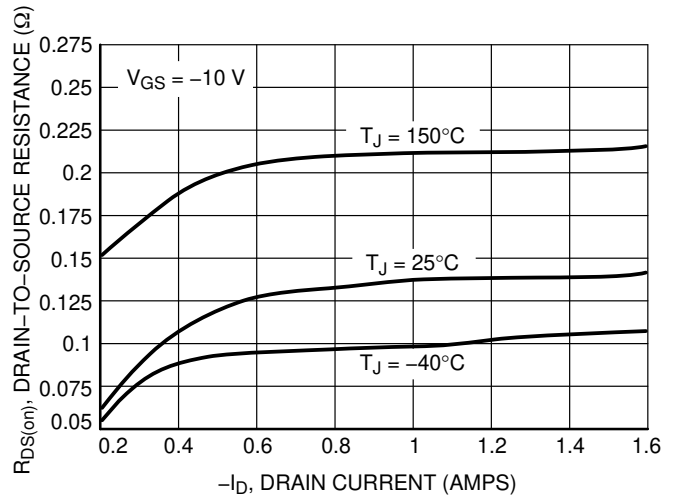


Figure 4. On-Resistance versus Drain Current and Temperature

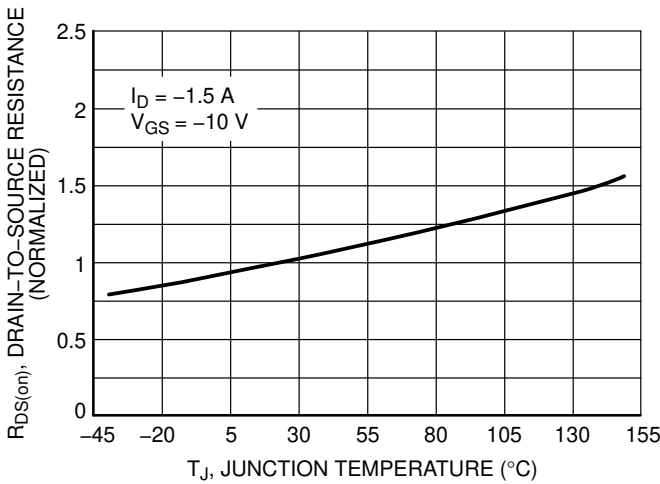


Figure 5. On-Resistance Variation with Temperature

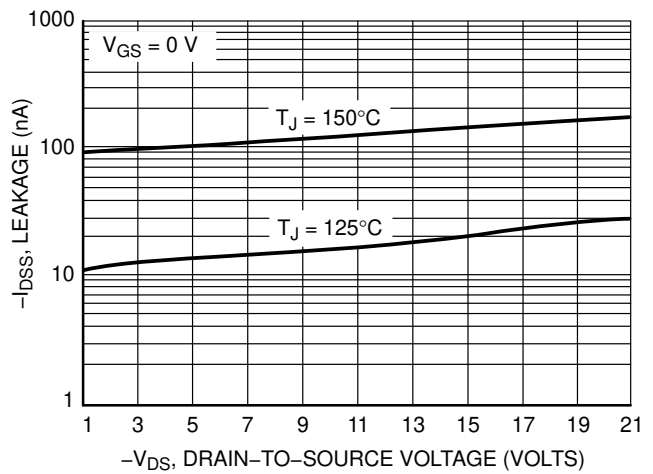


Figure 6. Drain-to-Source Leakage Current versus Voltage

NTR1P02, NVR1P02

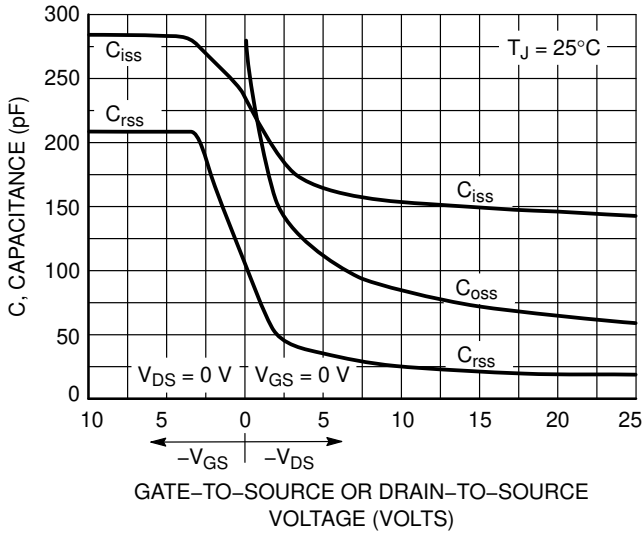


Figure 7. Capacitance Variation

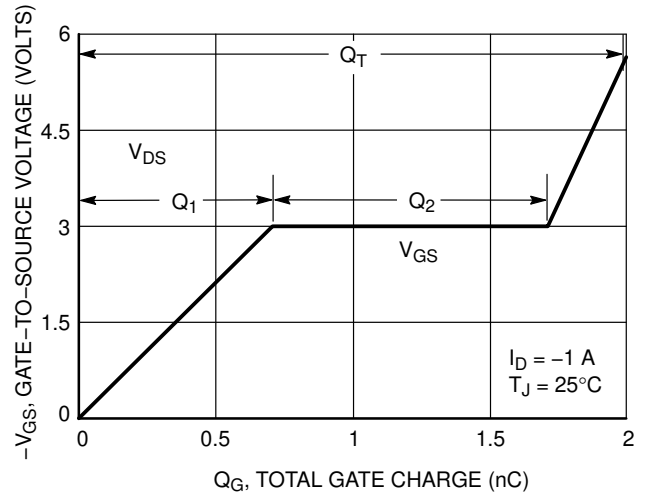


Figure 8. Gate-to-Source and Drain-to-Source Voltage versus Total Charge

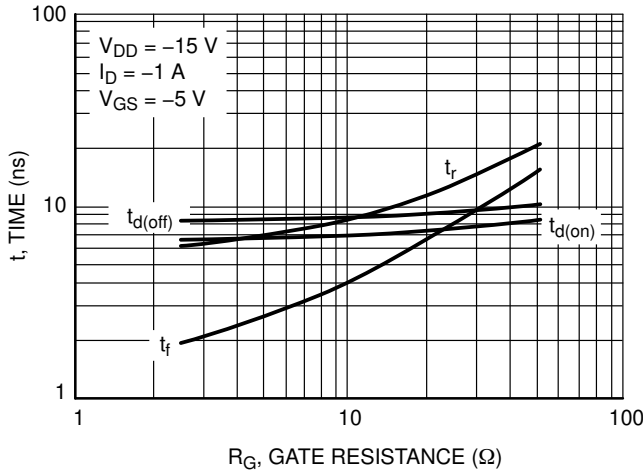


Figure 9. Resistive Switching Time Variation versus Gate Resistance

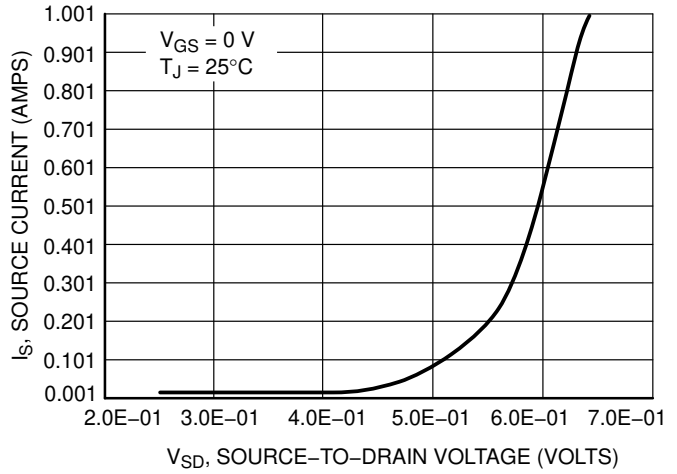


Figure 10. Diode Forward Voltage versus Current

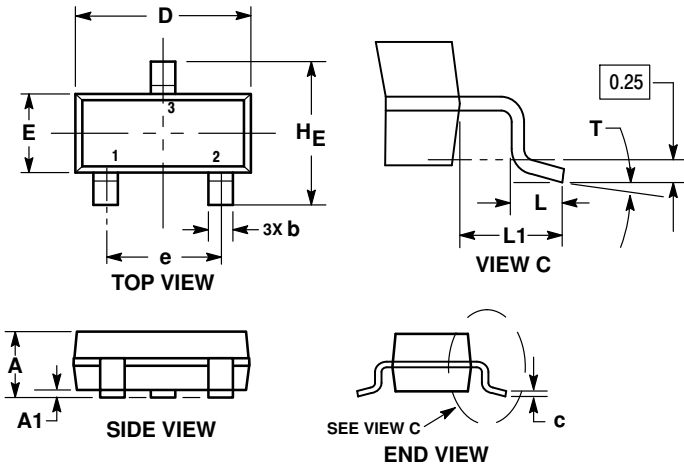
NTR1P02, NVR1P02

PACKAGE DIMENSIONS

SOT-23 (TO-236)

CASE 318-08

ISSUE AR



NOTES:

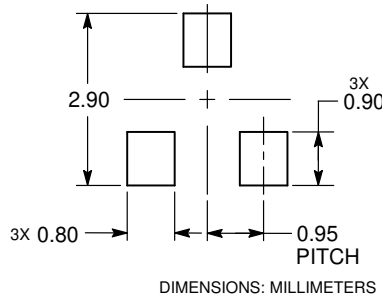
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF THE BASE MATERIAL.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

| DIM | MILLIMETERS | | | INCHES | | |
|-----|-------------|------|------|--------|-------|-------|
| | 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 |
| HE | 2.10 | 2.40 | 2.64 | 0.083 | 0.094 | 0.104 |
| T | 0° | --- | 10° | 0° | --- | 10° |

STYLE 21:

- PIN 1. GATE
- SOURCE
- DRAIN

RECOMMENDED 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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