

# 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	$V_{GS}$	$\pm 20$	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	$^\circ\text{C}$

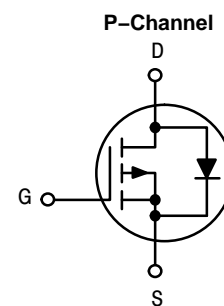
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.



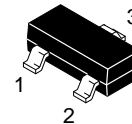
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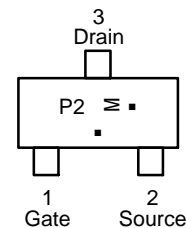
$V_{(BR)DSS}$	$R_{DS(on)}$ TYP	$I_D$ MAX
-20 V	148 m $\Omega$ @ -10 V	-1.0 A



### 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<sub>A</sub> = 25°C unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
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### OFF CHARACTERISTICS

Drain-to-Source Breakdown Voltage (V <sub>GS</sub> = 0 V, I <sub>D</sub> = -10 μA) (Positive Temperature Coefficient)	V <sub>(BR)DSS</sub>	-20	32		V mV/°C
Zero Gate Voltage Drain Current (V <sub>DS</sub> = -20 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 25°C) (V <sub>DS</sub> = -20 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 150°C)	I <sub>DSS</sub>			-1.0 -10	μA
Gate-Body Leakage Current (V <sub>GS</sub> = ±20 V, V <sub>DS</sub> = 0 V)	I <sub>GSS</sub>			±100	nA

### ON CHARACTERISTICS (Note 1)

Gate Threshold Voltage (V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = -250 μA) (Negative Temperature Coefficient)	V <sub>GS(th)</sub>	-1.1	-1.9 -4.0	-2.3	V mV/°C
Static Drain-to-Source On-State Resistance (V <sub>GS</sub> = -10 V, I <sub>D</sub> = -1.5 A) (V <sub>GS</sub> = -4.5 V, I <sub>D</sub> = -0.75 A)	R <sub>DS(on)</sub>		0.148 0.235	0.180 0.280	Ω

### DYNAMIC CHARACTERISTICS

Input Capacitance (V <sub>DS</sub> = -5 V, V <sub>GS</sub> = 0 V, f = 1.0 MHz)	C <sub>iss</sub>		165		pF
Output Capacitance (V <sub>DS</sub> = -5 V, V <sub>GS</sub> = 0 V, f = 1.0 MHz)	C <sub>oss</sub>		110		
Reverse Transfer Capacitance (V <sub>DS</sub> = -5 V, V <sub>GS</sub> = 0 V, f = 1.0 MHz)	C <sub>rss</sub>		35		

### SWITCHING CHARACTERISTICS (Note 2)

Turn-On Delay Time (V <sub>DD</sub> = -15 V, I <sub>D</sub> = -1 A, V <sub>GS</sub> = -5 V, R <sub>G</sub> = 2.5 Ω)	t <sub>d(on)</sub>		7.0		ns
Rise Time (V <sub>DD</sub> = -15 V, I <sub>D</sub> = -1 A, V <sub>GS</sub> = -5 V, R <sub>G</sub> = 2.5 Ω)	t <sub>r</sub>		9.0		
Turn-Off Delay Time (V <sub>DD</sub> = -15 V, I <sub>D</sub> = -1 A, V <sub>GS</sub> = -5 V, R <sub>G</sub> = 2.5 Ω)	t <sub>d(off)</sub>		9.0		
Fall Time (V <sub>DD</sub> = -15 V, I <sub>D</sub> = -1 A, V <sub>GS</sub> = -5 V, R <sub>G</sub> = 2.5 Ω)	t <sub>f</sub>		3.0		
Total Gate Charge (V <sub>DS</sub> = -15 V, V <sub>GS</sub> = -5 V, I <sub>D</sub> = -0.8 A)	Q <sub>tot</sub>		2.5		nC
Gate-Source Charge (V <sub>DS</sub> = -15 V, V <sub>GS</sub> = -5 V, I <sub>D</sub> = -0.8 A)	Q <sub>gs</sub>		0.75		
Gate-Drain Charge (V <sub>DS</sub> = -15 V, V <sub>GS</sub> = -5 V, I <sub>D</sub> = -0.8 A)	Q <sub>gd</sub>		1.0		

### BODY-DRAIN DIODE RATINGS (Note 1)

Diode Forward On-Voltage (Note 2) (I <sub>S</sub> = -0.6 A, V <sub>GS</sub> = 0 V) (I <sub>S</sub> = -0.6 A, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 150°C)	V <sub>SD</sub>		-0.8 -0.6	-1.0	V
Reverse Recovery Time (I <sub>S</sub> = -1 A, dI <sub>S</sub> /dt = 100 A/μs, V <sub>GS</sub> = 0 V)	t <sub>rr</sub>		13.5		ns
	t <sub>a</sub>		10.5		
	t <sub>b</sub>		3.0		
Reverse Recovery Stored Charge (I <sub>S</sub> = -1 A, dI <sub>S</sub> /dt = 100 A/μs, V <sub>GS</sub> = 0 V)	Q <sub>RR</sub>		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 ≤ 300 μs, Duty Cycle ≤ 2%.
2. Switching characteristics are independent of operating junction temperature.

# NTR1P02, NVR1P02

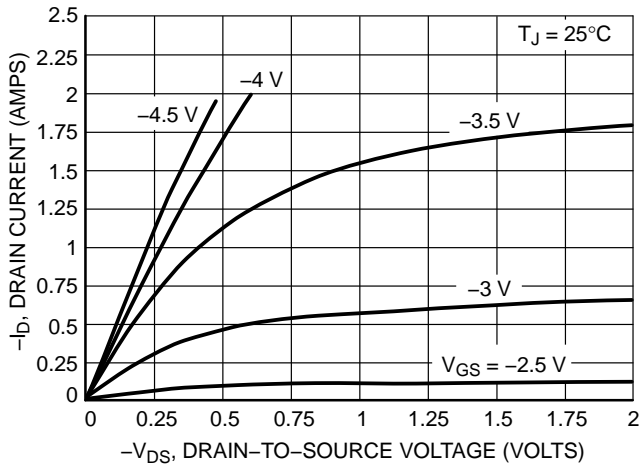


Figure 1. On-Region Characteristics

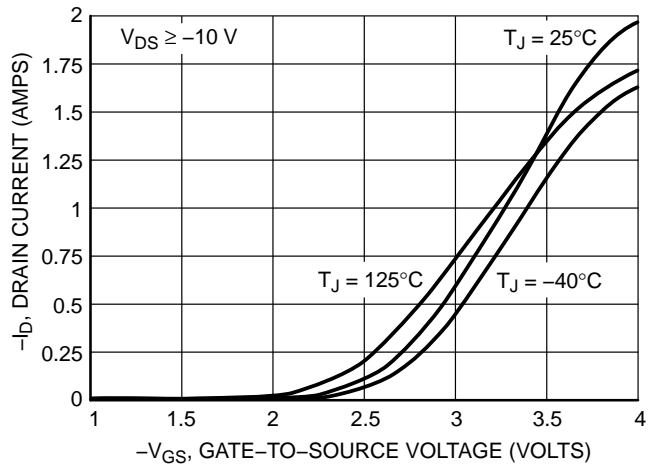


Figure 2. Transfer Characteristics

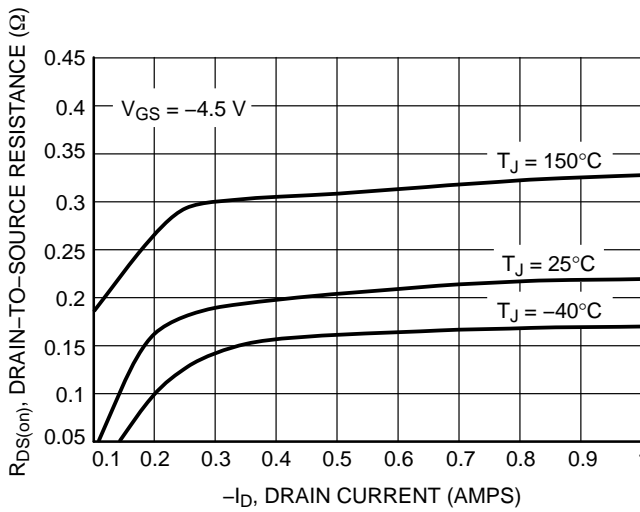


Figure 3. On-Resistance versus Drain Current and Temperature

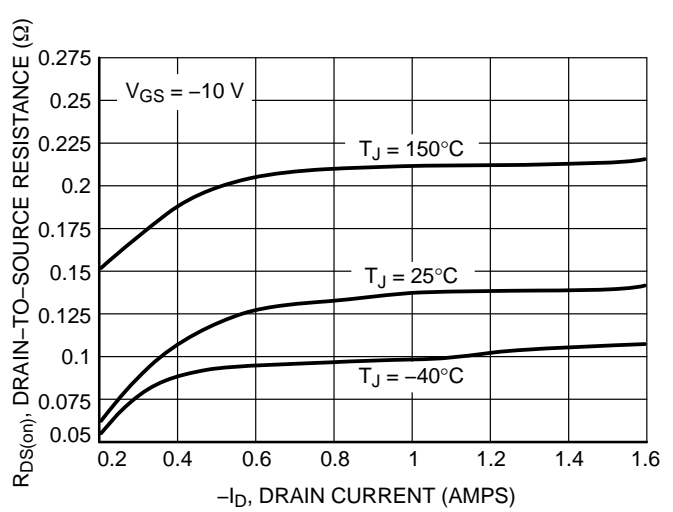


Figure 4. On-Resistance versus Drain Current and Temperature

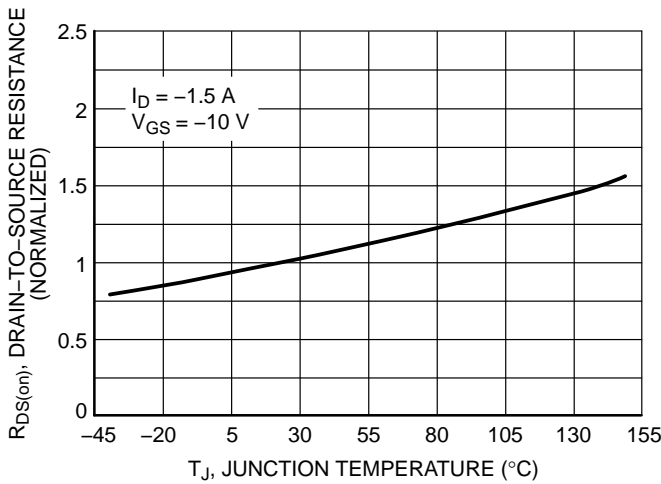


Figure 5. On-Resistance Variation with Temperature

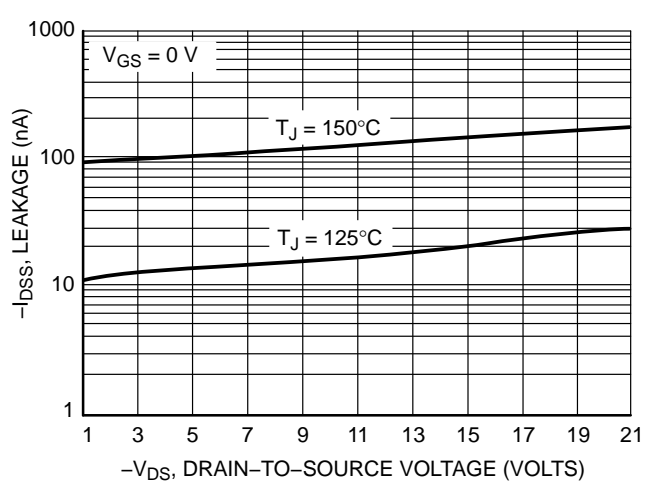
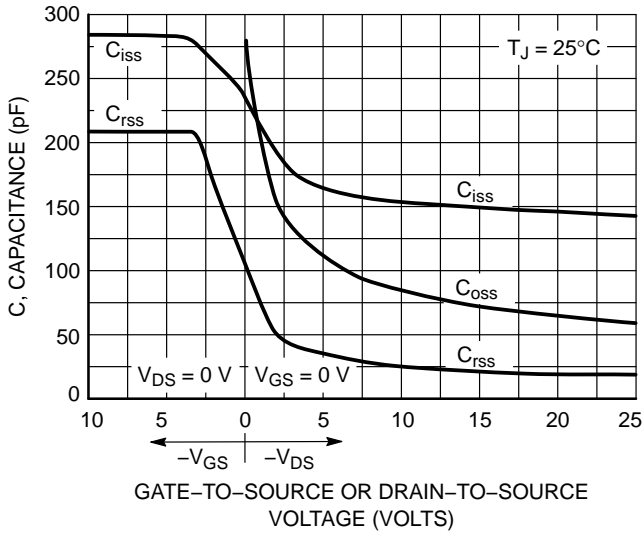
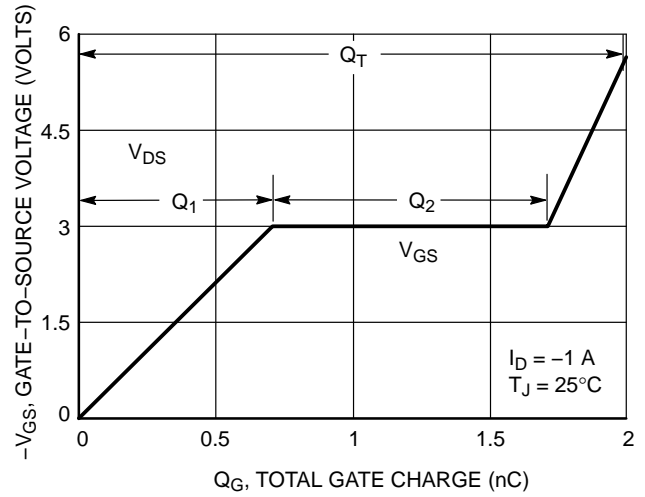


Figure 6. Drain-to-Source Leakage Current versus Voltage

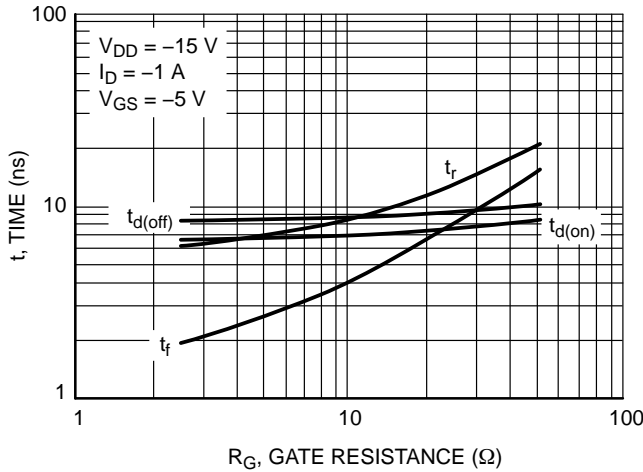
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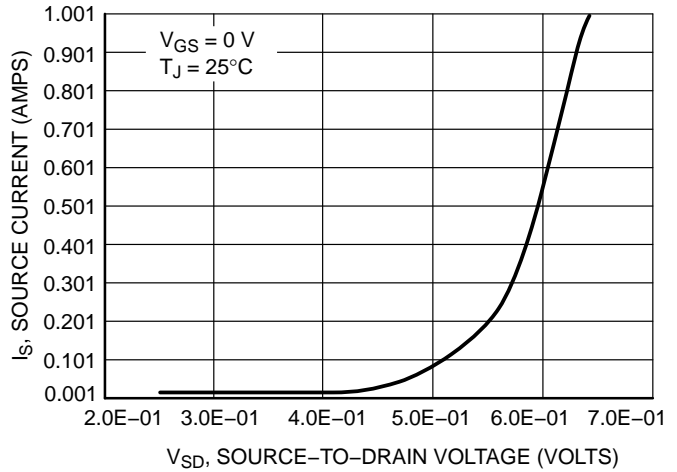
**Figure 7. Capacitance Variation**



**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**

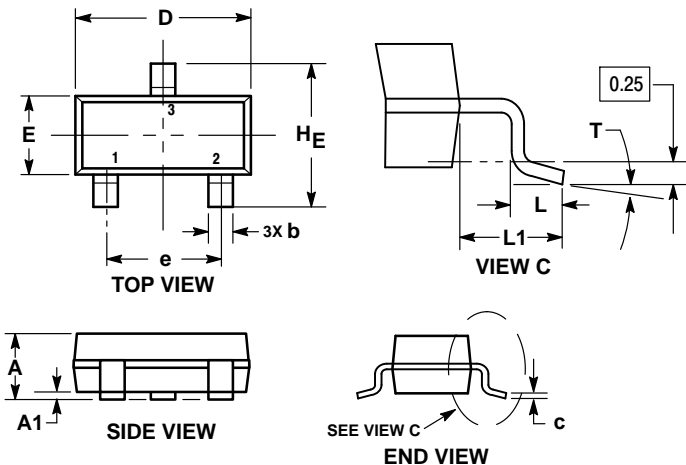
# NTR1P02, NVR1P02

## PACKAGE DIMENSIONS

SOT-23 (TO-236)

CASE 318-08

ISSUE AR



NOTES:

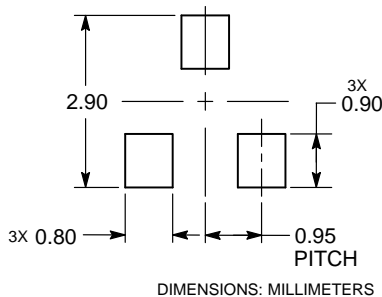
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF THE BASE MATERIAL.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

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:

1. GATE
2. SOURCE
3. 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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