

# NTR0202PL, NVTR0202PL

## Power MOSFET

-20 V, -400 mA, P-Channel  
SOT-23 Package



ON Semiconductor®

[www.onsemi.com](http://www.onsemi.com)

### Features

- Low  $R_{DS(on)}$  Provides Higher Efficiency and Extends Battery Life  
 $R_{DS(on)} = 0.80 \Omega$ ,  $V_{GS} = -10 \text{ V}$   
 $R_{DS(on)} = 1.10 \Omega$ ,  $V_{GS} = -4.5 \text{ V}$
- Miniature SOT-23 Surface Mount Package Saves Board Space
- NVT 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

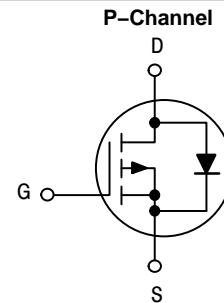
### MAXIMUM RATINGS ( $T_J = 25^\circ\text{C}$ unless otherwise noted)

Rating	Symbol	Value	Unit
Drain-to-Source Voltage	$V_{DSS}$	-20	V
Gate-to-Source Voltage – Continuous	$V_{GS}$	$\pm 20$	V
Continuous Drain Current @ $T_A = 25^\circ\text{C}$ Pulsed Drain Current ( $t_p \leq 10 \mu\text{s}$ )	$I_D$ $I_{DM}$	-0.4 -1.0	A
Total Power Dissipation @ $T_A = 25^\circ\text{C}$ (Note 1)	$P_D$	225	mW
Operating and Storage Temperature Range	$T_J, T_{stg}$	-55 to 150	$^\circ\text{C}$
Thermal Resistance – Junction-to-Ambient	$R_{\theta JA}$	556	$^\circ\text{C/W}$
Source Current (Body Diode)	$I_S$	0.4	A
Maximum Lead Temperature for Soldering Purposes, 1/8" from case for 10 s	$T_L$	260	$^\circ\text{C}$

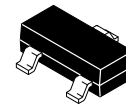
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. Pulse Test: Pulse Width  $\leq 300 \mu\text{s}$ , Duty Cycle  $\leq 2\%$ .

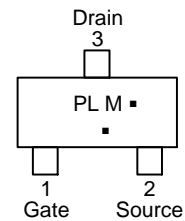
$V_{(BR)DSS}$	$R_{DS(on)}$ Typ	$I_D$ MAX
-20 V	550 m $\Omega$ @ -10 V	-400 mA



### MARKING DIAGRAM & PIN ASSIGNMENT



SOT-23  
CASE 318  
STYLE 21



PL = Specific Device Code  
M = Date Code\*  
▪ = Pb-Free Package

(Note: Microdot may be in either location)

\*Date Code orientation may vary depending upon manufacturing location.

### ORDERING INFORMATION

Device	Package	Shipping†
NTR0202PLT1G	SOT-23 (Pb-Free)	3000 / Tape & Reel
NTR0202PLT3G	SOT-23 (Pb-Free)	10000 / Tape & Reel
NVTR0202PLT1G	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.

# NTR0202PL, NVTR0202PL

## ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25°C unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
<b>OFF CHARACTERISTICS</b>					
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	33		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 2)

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 3.0	-2.3	V mV/°C
Static Drain-to-Source On-Resistance (V <sub>GS</sub> = -10 V, I <sub>D</sub> = -200 mA) (V <sub>GS</sub> = -4.5 V, I <sub>D</sub> = -50 mA)	R <sub>DS(on)</sub>		0.55 0.80	0.80 1.10	Ω
Forward Transconductance (V <sub>DS</sub> = -10 V, I <sub>D</sub> = -200 mA)	g <sub>fs</sub>		0.5		Mhos

## DYNAMIC CHARACTERISTICS

Input Capacitance	(V <sub>DS</sub> = -5.0 V, V <sub>GS</sub> = 0 V, F = 1.0 MHz)	C <sub>iss</sub>	70		pF
Output Capacitance		C <sub>oss</sub>	74		
Reverse Transfer Capacitance		C <sub>rss</sub>	26		

## SWITCHING CHARACTERISTICS (Note 3)

Turn-On Delay Time	(V <sub>DD</sub> = -15 V, I <sub>D</sub> = -200 mA, V <sub>GS</sub> = -10 V, R <sub>G</sub> = 6.0 Ω)	t <sub>d(on)</sub>	3.0		ns
Rise Time		t <sub>r</sub>	6.0		
Turn-Off Delay Time		t <sub>d(off)</sub>	18		
Fall Time		t <sub>f</sub>	4		
Total Gate Charge	(V <sub>DS</sub> = -15 V, I <sub>D</sub> = -200 mA, V <sub>GS</sub> = -10 V)	Q <sub>TOT</sub>	2.18		nC
Gate-Source Charge		Q <sub>GS</sub>	0.41		
Gate-Drain Charge		Q <sub>GD</sub>	0.40		

## BODY-DRAIN DIODE CHARACTERISTICS (Note 2)

Diode Forward Voltage (Note 2) (I <sub>S</sub> = -400 mA, V <sub>GS</sub> = 0 V) (I <sub>S</sub> = -400 mA, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 150°C)	V <sub>SD</sub>		-0.8 -0.65	-1.0	V
Reverse Recovery Time	(I <sub>S</sub> = -1.0 A, V <sub>GS</sub> = 0 V, dI <sub>S</sub> /dt = 100 A/μs)	t <sub>rr</sub>	11.8		ns
		t <sub>a</sub>	9		
		t <sub>b</sub>	3		
Reverse Recovery Stored Charge	(I <sub>S</sub> = -1.0 A, V <sub>GS</sub> = 0 V, dI <sub>S</sub> /dt = 100 A/μs)	Q <sub>RR</sub>	0.007		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.

2. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2%.

3. Switching characteristics are independent of operating junction temperature.

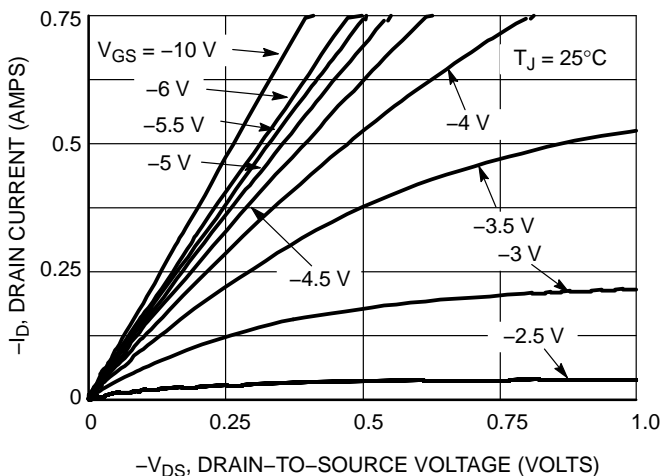


Figure 1. On-Region Characteristics

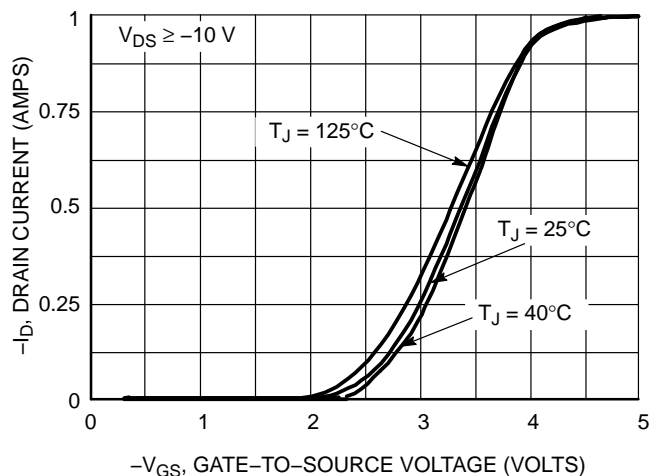


Figure 2. Transfer Characteristics

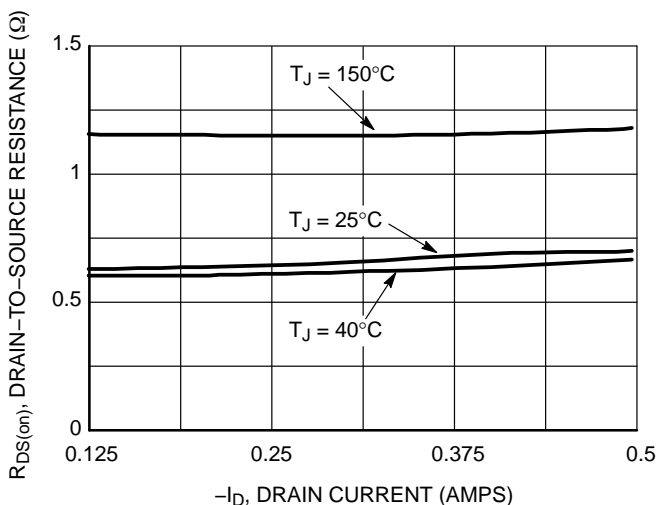


Figure 3. On-Resistance versus Drain Current

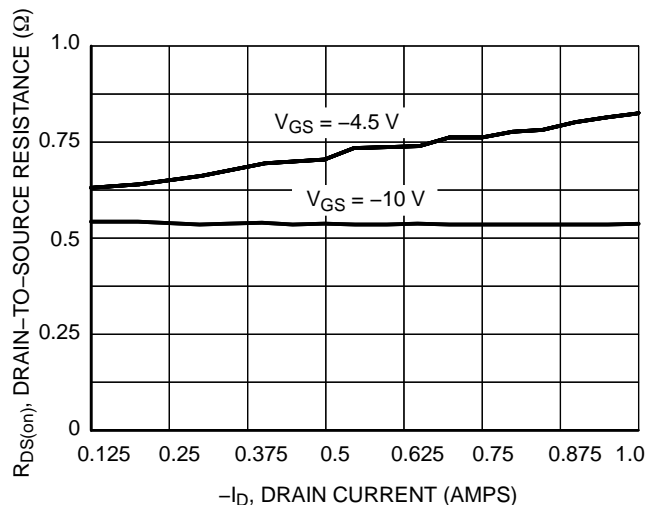


Figure 4. On-Resistance versus Drain Current and Gate Voltage

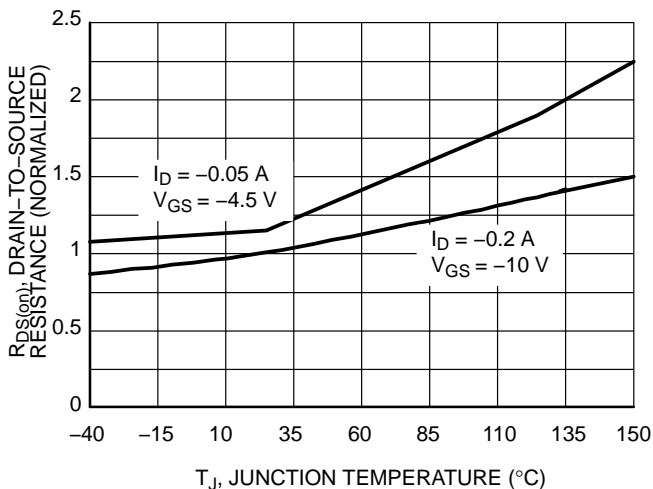


Figure 5. On-Resistance Variation with Temperature

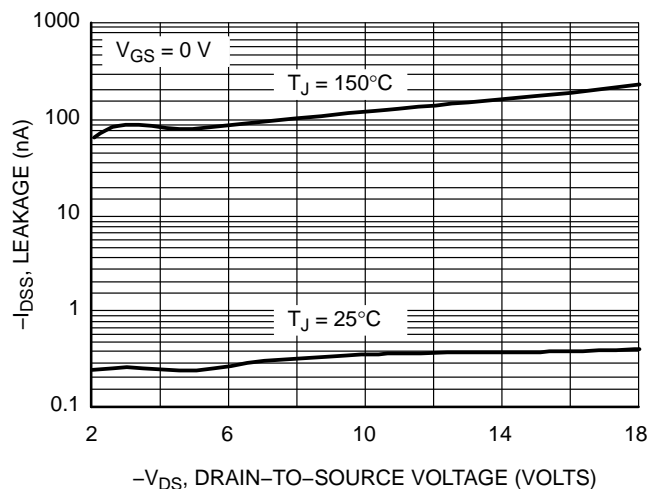


Figure 6. Drain-to-Source Leakage Current versus Voltage

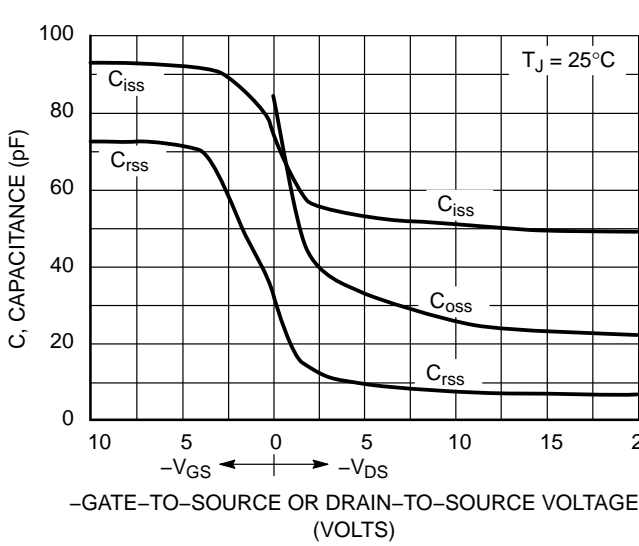


Figure 7. Capacitance Variation

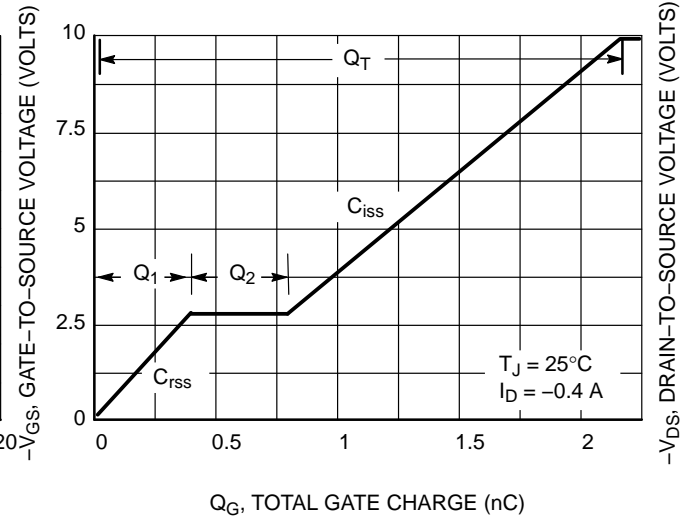


Figure 8. Gate-to-Source and Drain-to-Source Voltage versus Total Charge

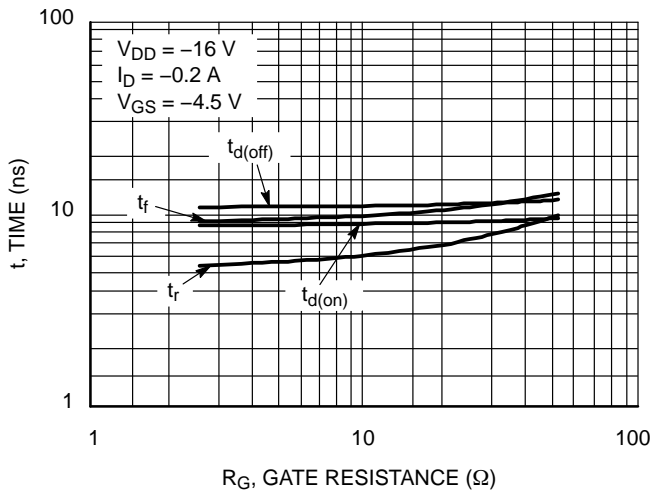


Figure 9. Resistive Switching Time Variation versus Gate Resistance

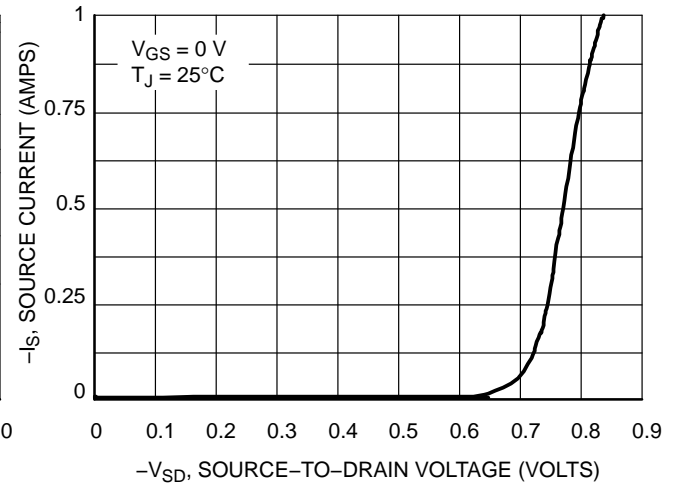


Figure 10. Diode Forward Voltage versus Current

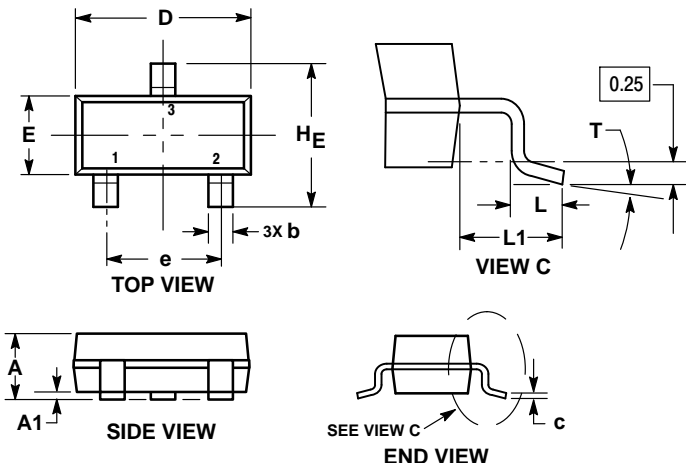
# NTR0202PL, NVTR0202PL

## PACKAGE DIMENSIONS

SOT-23 (TO-236)

CASE 318-08

ISSUE AR



**NOTES:**

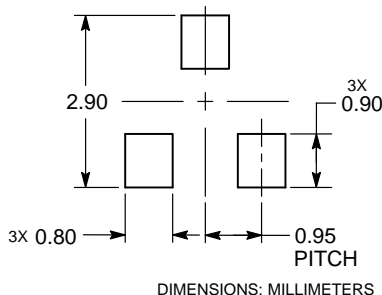
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF THE BASE MATERIAL.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

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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