

# NTR0202PL

## Power MOSFET

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

### 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
- Pb–Free Package is Available

### 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	$^\circ\text{C/W}$
Maximum Lead Temperature for Soldering Purposes, 1/8" from case for 10 s	$T_L$	260	$^\circ\text{C}$

Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur and reliability may be affected.

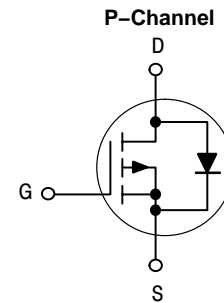
1. Pulse Test: Pulse Width  $\leq 300 \mu\text{s}$ , Duty Cycle  $\leq 2\%$ .



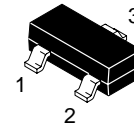
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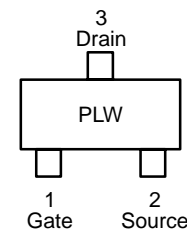
$V_{(BR)DSS}$	$R_{DS(on)}$ TYP	$I_D$ MAX
–20 V	550 m $\Omega$ @ –10 V	–400 mA



### MARKING DIAGRAM/ PIN ASSIGNMENT



SOT–23  
CASE 318  
STYLE 21



PL = Specific Device Code  
W = Work Week

### ORDERING INFORMATION

Device	Package	Shipping†
NTR0202PLT1	SOT–23	3000 Tape & Reel
NTR0202PLT1G	SOT–23 (Pb–Free)	3000 Tape & Reel
NTR0202PLT3	SOT–23	10,000 Tape & Reel
NTR0202PLT3G	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.

# NTR0202PL

## 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
<b>ON CHARACTERISTICS (Note 2)</b>					
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
<b>DYNAMIC CHARACTERISTICS</b>					
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		
<b>SWITCHING CHARACTERISTICS (Note 3)</b>					
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		
<b>BODY-DRAIN DIODE CHARACTERISTICS (Note 2)</b>					
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

2. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2%.
3. Switching characteristics are independent of operating junction temperature.

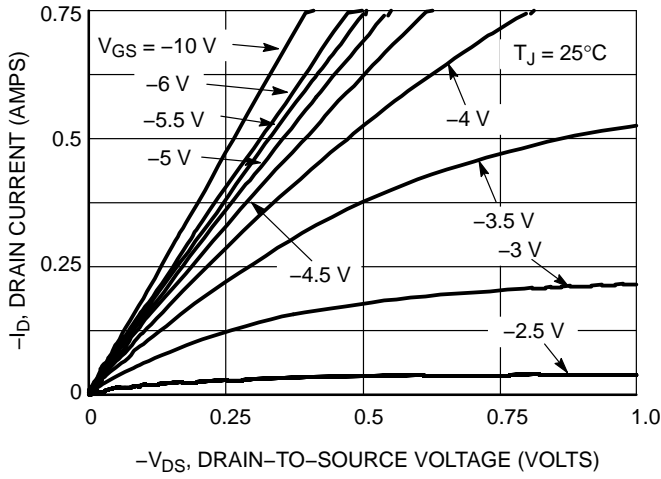


Figure 1. On-Region Characteristics

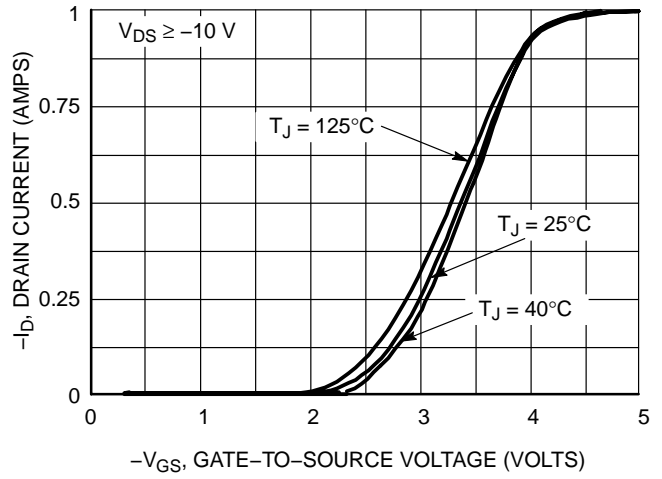


Figure 2. Transfer Characteristics

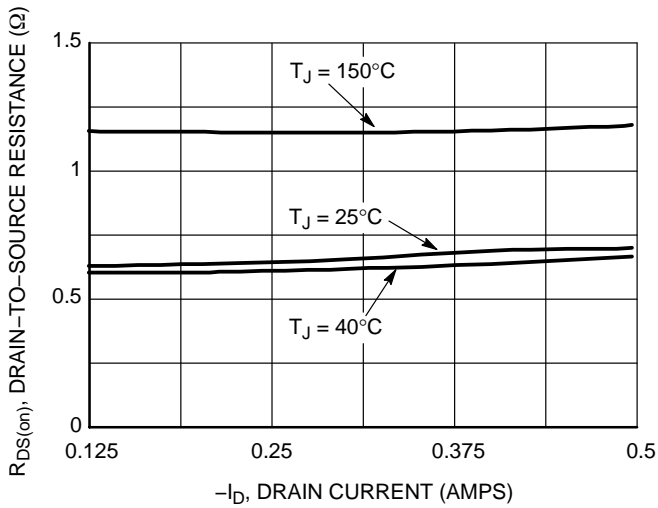


Figure 3. On-Resistance versus Drain Current

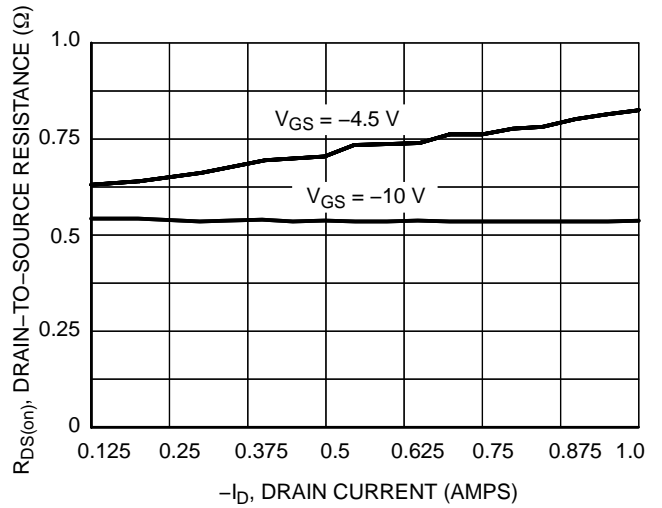


Figure 4. On-Resistance versus Drain Current and Gate Voltage

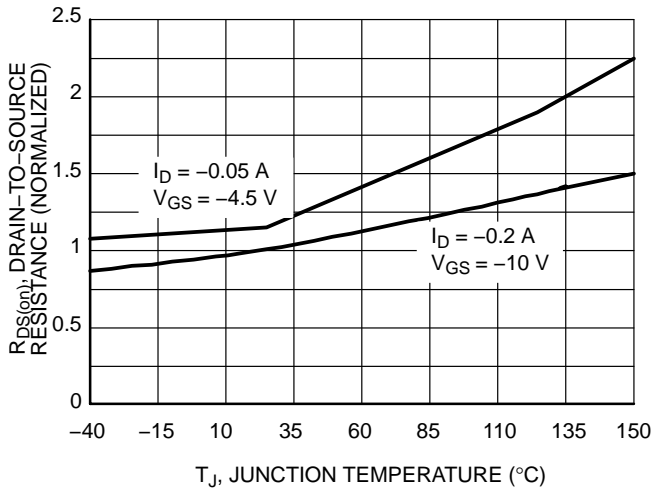


Figure 5. On-Resistance Variation with Temperature

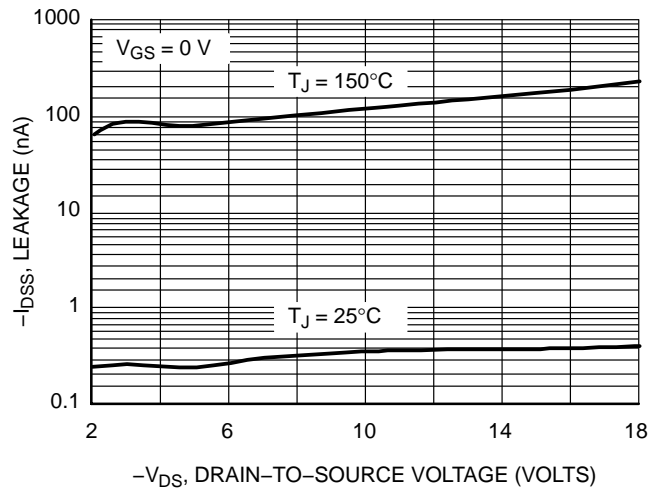


Figure 6. Drain-to-Source Leakage Current versus Voltage

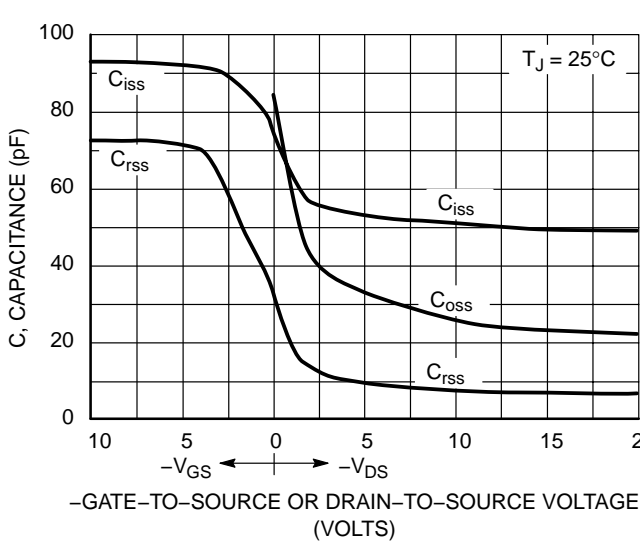


Figure 7. Capacitance Variation

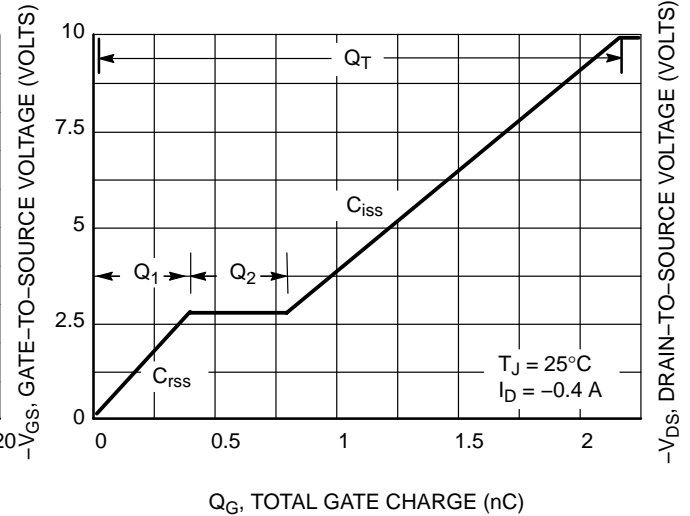


Figure 8. Gate-to-Source and Drain-to-Source Voltage versus Total Charge

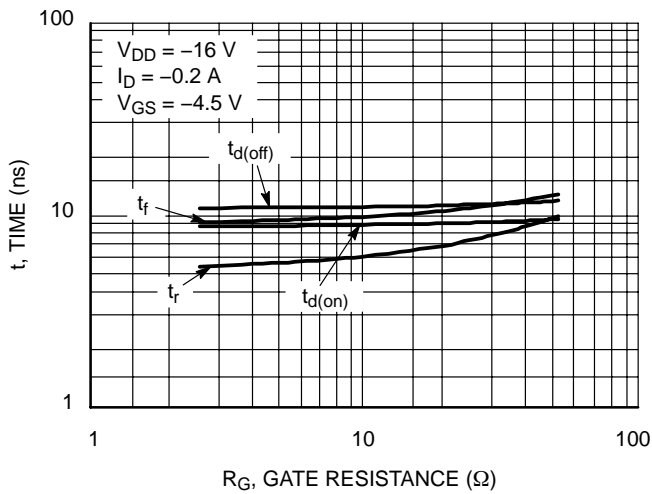


Figure 9. Resistive Switching Time Variation versus Gate Resistance

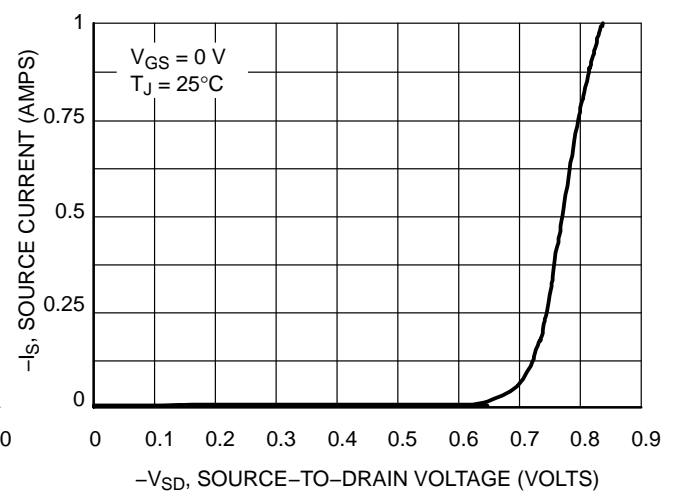
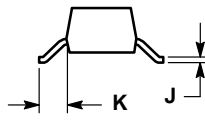
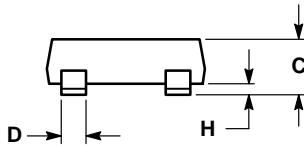
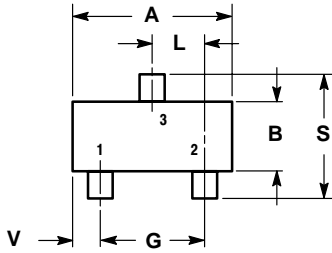


Figure 10. Diode Forward Voltage versus Current

# NTR0202PL

## PACKAGE DIMENSIONS

SOT-23 (TO-236)  
CASE 318-09  
ISSUE AJ



**NOTES:**

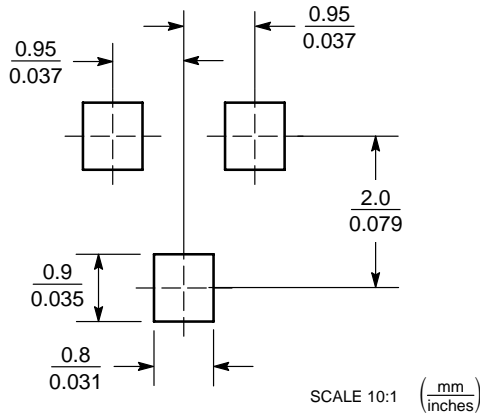
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
4. 318-01, -02, AND -06 OBSOLETE, NEW STANDARD 318-09.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.1102	0.1197	2.80	3.04
B	0.0472	0.0551	1.20	1.40
C	0.0385	0.0498	0.99	1.26
D	0.0140	0.0200	0.36	0.50
G	0.0670	0.0826	1.70	2.10
H	0.0040	0.0098	0.10	0.25
J	0.0034	0.0070	0.085	0.177
K	0.0180	0.0236	0.45	0.60
L	0.0350	0.0401	0.89	1.02
S	0.0830	0.0984	2.10	2.50
V	0.0177	0.0236	0.45	0.60

**STYLE 21:**

1. GATE
2. SOURCE
3. 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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