

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 Packages are 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_{DS}	–20	V
Gate–to–Source Voltage – Continuous	V_{GS}	± 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 Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

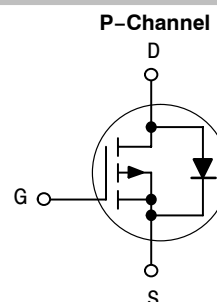
1. Pulse Test: Pulse Width $\leq 300 \mu\text{s}$, Duty Cycle $\leq 2\%$.



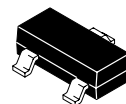
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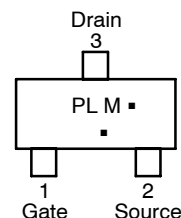
$V_{(BR)DSS}$	$R_{DS(on)}$ Typ	I_D MAX
–20 V	550 m Ω @ –10 V	–400 mA



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†
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.

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

Characteristic	Symbol	Min	Typ	Max	Unit
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OFF CHARACTERISTICS

Drain-to-Source Breakdown Voltage ($V_{GS} = 0\text{ V}$, $I_D = -10\text{ }\mu\text{A}$) (Positive Temperature Coefficient)	$V_{(BR)DSS}$	-20	33		$\frac{\text{V}}{\text{mV}/^\circ\text{C}}$
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 2)

Gate Threshold Voltage ($V_{DS} = V_{GS}$, $I_D = -250\text{ }\mu\text{A}$) (Negative Temperature Coefficient)	$V_{GS(th)}$	-1.1	-1.9 3.0	-2.3	$\frac{\text{V}}{\text{mV}/^\circ\text{C}}$
Static Drain-to-Source On-Resistance ($V_{GS} = -10\text{ V}$, $I_D = -200\text{ mA}$) ($V_{GS} = -4.5\text{ V}$, $I_D = -50\text{ mA}$)	$R_{DS(on)}$		0.55 0.80	0.80 1.10	Ω
Forward Transconductance ($V_{DS} = -10\text{ V}$, $I_D = -200\text{ mA}$)	g_{fs}		0.5		Mhos

DYNAMIC CHARACTERISTICS

Input Capacitance	$(V_{DS} = -5.0\text{ V}$, $V_{GS} = 0\text{ V}$, $F = 1.0\text{ MHz})$	C_{iss}	70		pF
Output Capacitance		C_{oss}	74		
Reverse Transfer Capacitance		C_{rss}	26		

SWITCHING CHARACTERISTICS (Note 3)

Turn-On Delay Time	$(V_{DD} = -15\text{ V}$, $I_D = -200\text{ mA}$, $V_{GS} = -10\text{ V}$, $R_G = 6.0\text{ }\Omega$)	$t_{d(on)}$	3.0		ns
Rise Time		t_r	6.0		
Turn-Off Delay Time		$t_{d(off)}$	18		
Fall Time		t_f	4		
Total Gate Charge	$(V_{DS} = -15\text{ V}$, $I_D = -200\text{ mA}$, $V_{GS} = -10\text{ V})$	Q_{TOT}	2.18		nC
Gate-Source Charge		Q_{GS}	0.41		
Gate-Drain Charge		Q_{GD}	0.40		

BODY-DRAIN DIODE CHARACTERISTICS (Note 2)

Diode Forward Voltage (Note 2) ($I_S = -400\text{ mA}$, $V_{GS} = 0\text{ V}$) ($I_S = -400\text{ mA}$, $V_{GS} = 0\text{ V}$, $T_J = 150^\circ\text{C}$)	V_{SD}		-0.8 -0.65	-1.0	V
Reverse Recovery Time ($I_S = -1.0\text{ A}$, $V_{GS} = 0\text{ V}$, $dI_S/dt = 100\text{ A}/\mu\text{s}$)	t_{rr}		11.8		ns
	t_a		9		
	t_b		3		
Reverse Recovery Stored Charge ($I_S = -1.0\text{ A}$, $V_{GS} = 0\text{ V}$, $dI_S/dt = 100\text{ A}/\mu\text{s}$)	Q_{RR}		0.007		μC

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

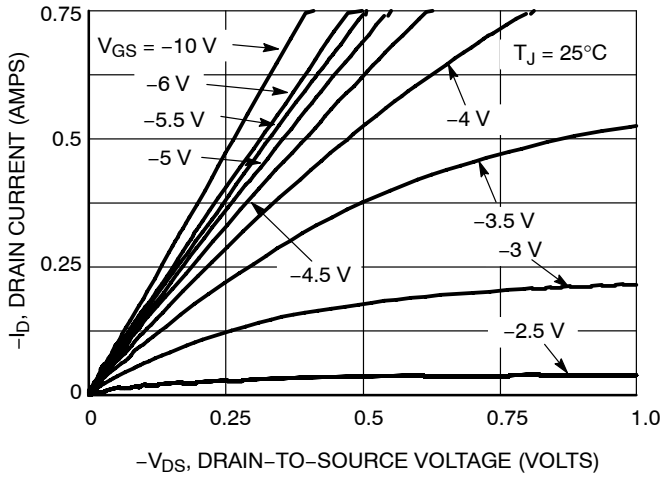


Figure 1. On-Region Characteristics

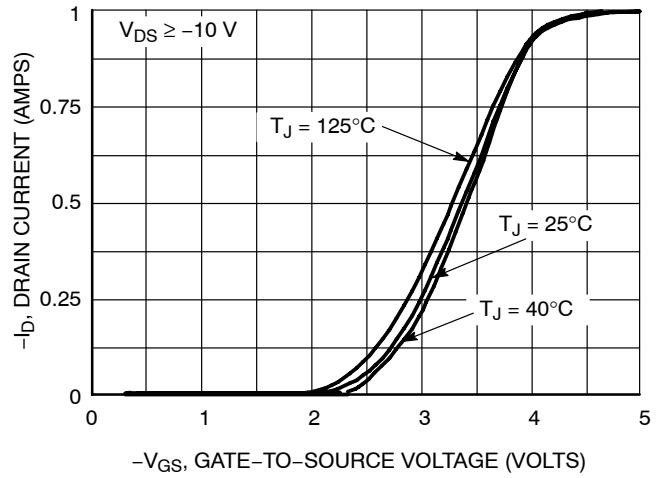


Figure 2. Transfer Characteristics

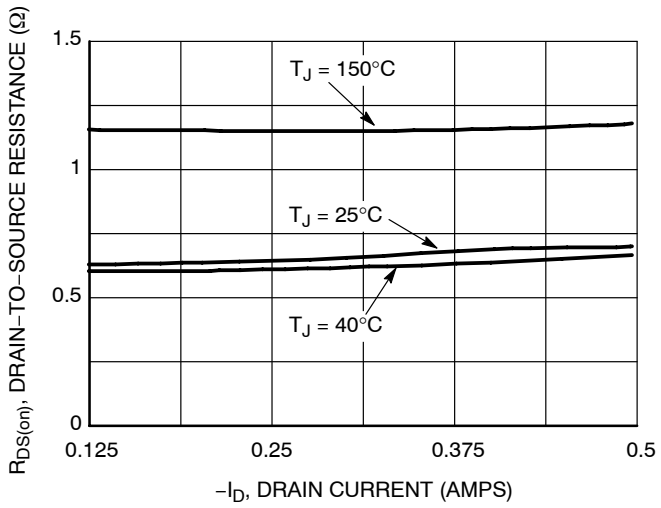


Figure 3. On-Resistance versus Drain Current

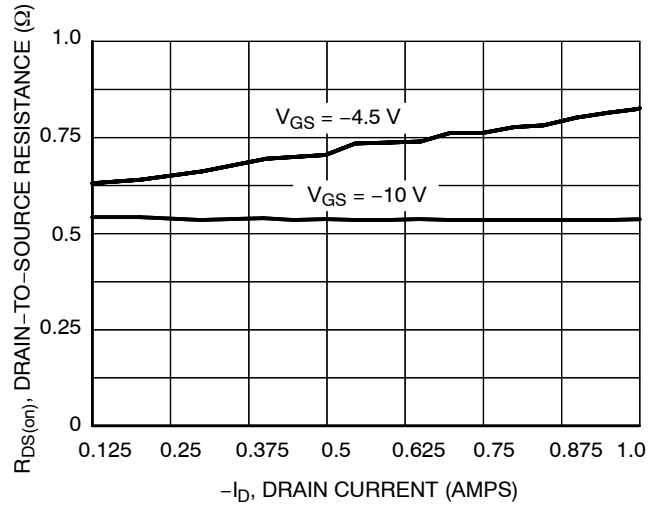


Figure 4. On-Resistance versus Drain Current and Gate Voltage

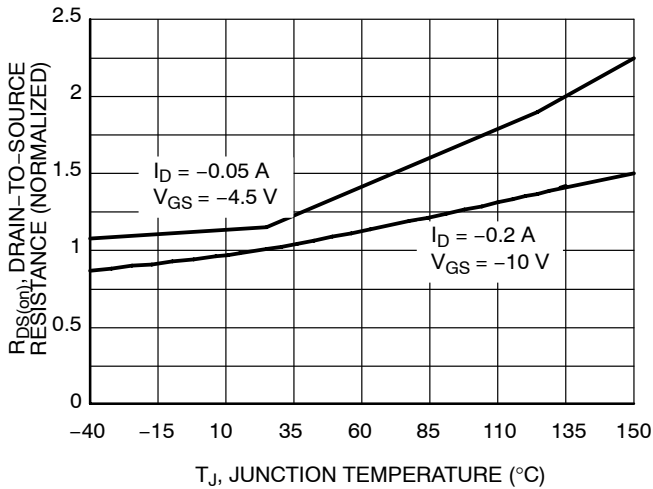


Figure 5. On-Resistance Variation with Temperature

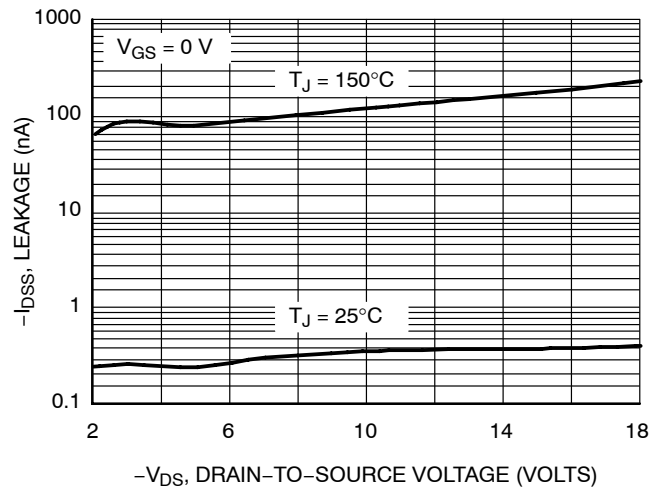


Figure 6. Drain-to-Source Leakage Current versus Voltage

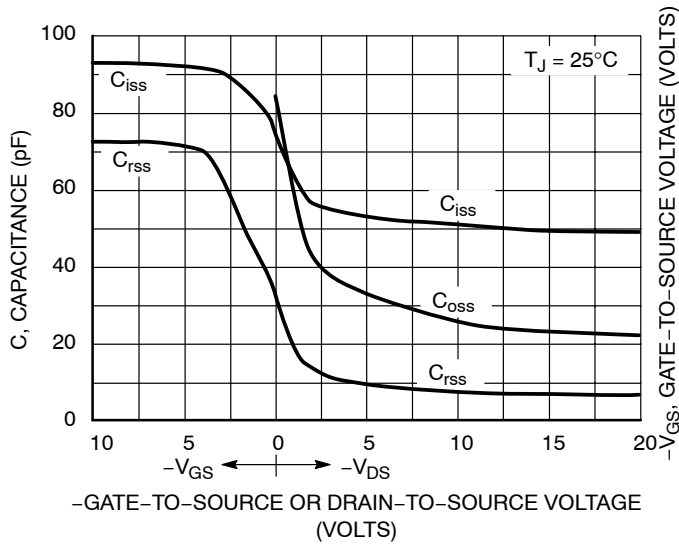


Figure 7. Capacitance Variation

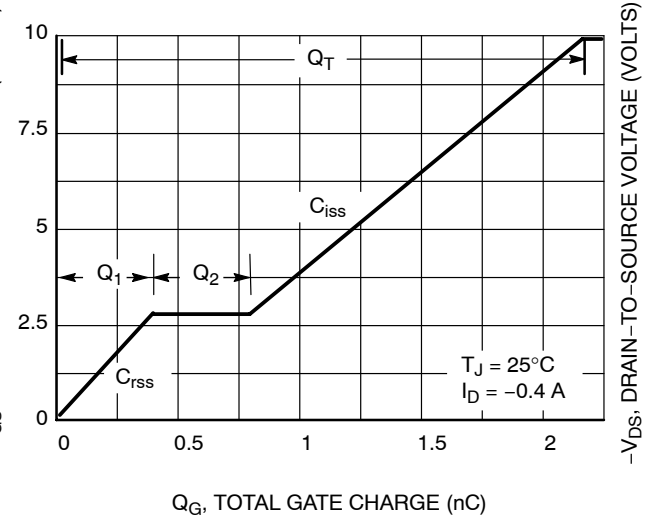


Figure 8. Gate-to-Source and Drain-to-Source Voltage versus Total Charge

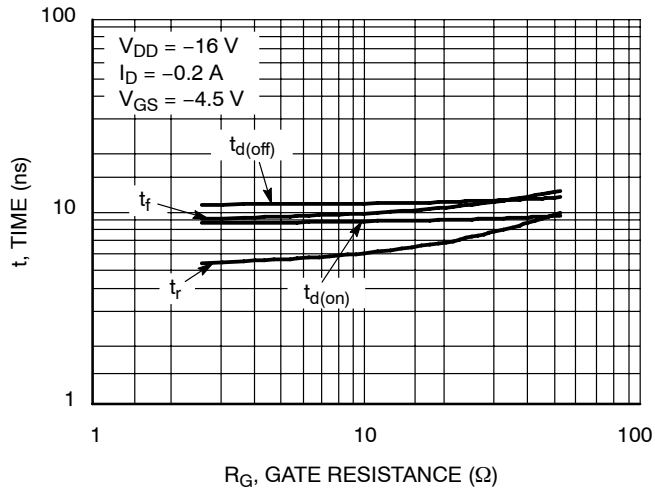


Figure 9. Resistive Switching Time Variation versus Gate Resistance

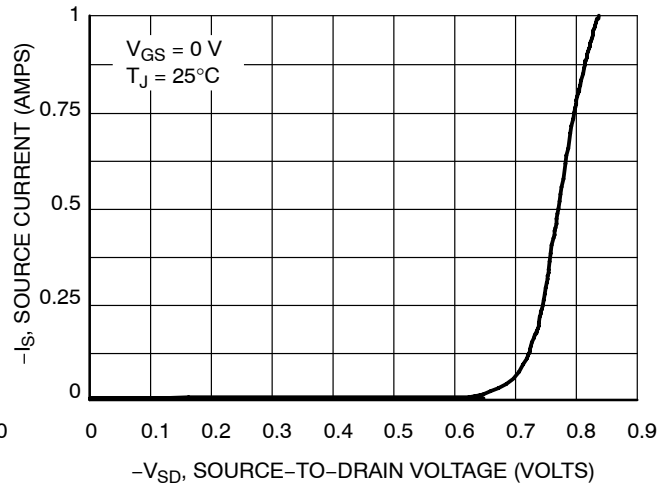
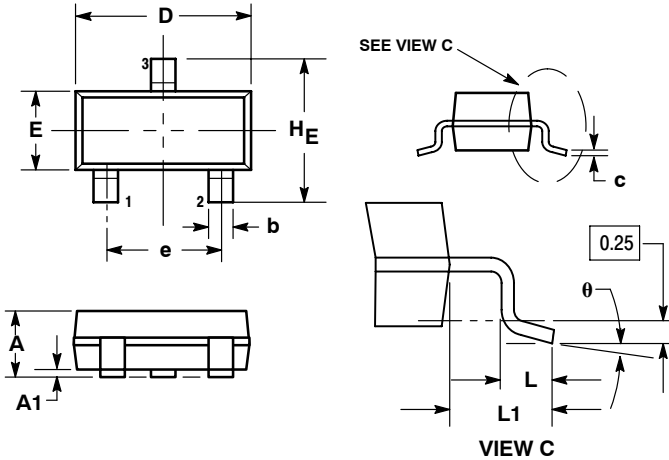


Figure 10. Diode Forward Voltage versus Current

PACKAGE DIMENSIONS

SOT-23 (TO-236)
CASE 318-08
ISSUE AN

NOTES:

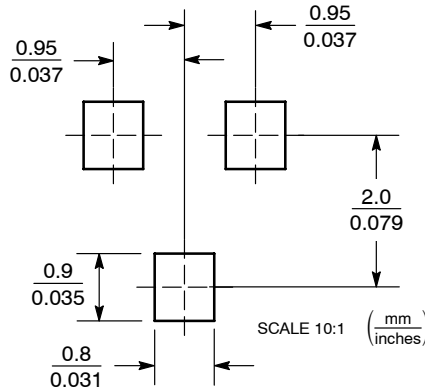
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
4. 318-01 THRU -07 AND -09 OBSOLETE, NEW STANDARD 318-08.

DIM	MILLIMETERS			INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	0.89	1.00	1.11	0.035	0.040	0.044
A1	0.01	0.06	0.10	0.001	0.002	0.004
b	0.37	0.44	0.50	0.015	0.018	0.020
c	0.09	0.13	0.18	0.003	0.005	0.007
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	0.081
L	0.10	0.20	0.30	0.004	0.008	0.012
L1	0.35	0.54	0.69	0.014	0.021	0.029
HE	2.10	2.40	2.64	0.083	0.094	0.104

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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