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NTR1P02LS

Power MOSFET

**-20 V, -1.3 A, P-Channel
SOT-23 Package**

These miniature surface mount MOSFETs low $R_{DS(on)}$ assure minimal power loss and conserve energy, making these devices ideal for use in space sensitive power management circuitry. Typical applications are DC-DC converters and power management in portable and battery-powered products such as computers, printers, PCMCIA cards, cellular and cordless telephones.

Features

- Low $R_{DS(on)}$ Provides Higher Efficiency and Extends Battery Life
- Miniature SOT-23 Surface Mount Package Saves Board Space
- These Devices are Pb-Free and are RoHS Compliant

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}	± 12	V
Drain Current - Continuous @ $T_A = 25^\circ\text{C}$ - Pulsed Drain Current ($t_p \leq 10 \mu\text{s}$)	I_D I_{DM}	-1.3 -4.0	A A
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	$^\circ\text{C}$
Continuous Source Current (Body Diode)	I_S	-0.6	A
Pulse Source Current (Body Diode) (Note 1)	I_{SM}	-0.75	A
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.

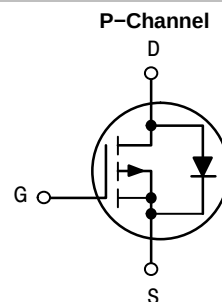
1. Guaranteed by design.



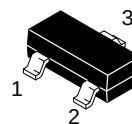
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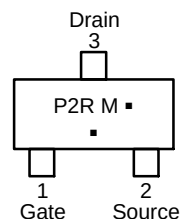
$V_{(BR)DSS}$	$R_{DS(on)} \text{ Max}$	$I_D \text{ Max}$
-20 V	220 m Ω @ -4.5 V	-1.3 A



MARKING DIAGRAM & PIN ASSIGNMENT



**SOT-23
CASE 318
STYLE 21**



P2R = 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†
NTR1P02LST1G	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 Specifications Brochure, BRD8011/D.

NTR1P02LS

THERMAL RESISTANCE MAXIMUM RATINGS

Parameter	Symbol	Typ	Max	Unit
Junction-to-Ambient (Note 2)	$R_{\theta JA}$	282	300	$^{\circ}\text{C/W}$

2. Surface-mounted on FR4 board using the minimum recommended pad size.

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

Parameter	Test Condition	Symbol	Min	Typ	Max	Unit
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OFF CHARACTERISTICS

Drain-to-Source Breakdown Voltage	$(V_{GS} = 0\text{ V}, I_D = -10\text{ }\mu\text{A})$	$V_{(BR)DSS}$	-20			V
Zero Gate Voltage Drain Current	$(V_{DS} = -16\text{ V}, V_{GS} = 0\text{ V})$ $(V_{DS} = -16\text{ V}, V_{GS} = 0\text{ V}, T_J = 125^{\circ}\text{C})$	I_{DSS}			-1.0 -10	μA
Gate-Body Leakage Current	$(V_{GS} = \pm 12\text{ V}, V_{DS} = 0\text{ V})$	I_{GSS}			± 100	nA

ON CHARACTERISTICS (Note 1)

Gate Threshold Voltage	$(V_{DS} = V_{GS}, I_D = -250\text{ }\mu\text{A})$	$V_{GS(th)}$	-0.7	-1.0	-1.25	V
Static Drain-to-Source On-Resistance	$(V_{GS} = -4.5\text{ V}, I_D = -0.75\text{ A})$ $(V_{GS} = -2.5\text{ V}, I_D = -0.5\text{ A})$	$r_{DS(on)}$		0.14 0.20	0.22 0.35	Ω

DYNAMIC CHARACTERISTICS

Input Capacitance	$(V_{DS} = -5.0\text{ V})$	C_{iss}	158	225	293	pF
Output Capacitance	$(V_{DS} = -5.0\text{ V})$	C_{oss}	91	130	169	
Transfer Capacitance	$(V_{DS} = -5.0\text{ V})$	C_{rss}		55	72	
Total Gate Charge	$(V_{DS} = -16\text{ V}, I_D = -1.5\text{ A}, V_{GS} = -4.5\text{ V})$	Q_T	3.9	5.5	7.2	nC

SWITCHING CHARACTERISTICS (Note 2)

Turn-On Delay Time	$(V_{GS} = -4.5\text{ V}, V_{DD} = -5.0\text{ V}, I_D = -1.0\text{ A}, R_L = 5.0\text{ }\Omega, R_G = 6.0\text{ }\Omega)$	$t_{d(on)}$		7.0	9.0	ns
Rise Time		t_r		15	20	
Turn-Off Delay Time		$t_{d(off)}$		18	23	
Fall Time		t_f		9	26	

SOURCE-DRAIN DIODE CHARACTERISTICS

Continuous Current		I_S			-0.6	A
Pulsed Current		I_{SM}			-0.75	
Forward Voltage (Note 2)	$(V_{GS} = 0\text{ V}, I_S = -0.6\text{ A})$	V_{SD}		-0.7	-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}		16	21	ns
		t_a		11		
		t_b		5.5		
Reverse Recovery Stored Charge		Q_{RR}		8.5		nC
Gate Resistance		R_G		9.0	12	Ω

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

TYPICAL CHARACTERISTICS

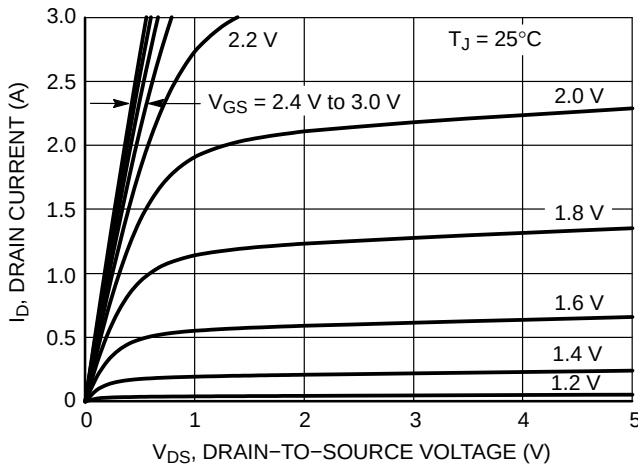


Figure 1. On-Region Characteristics

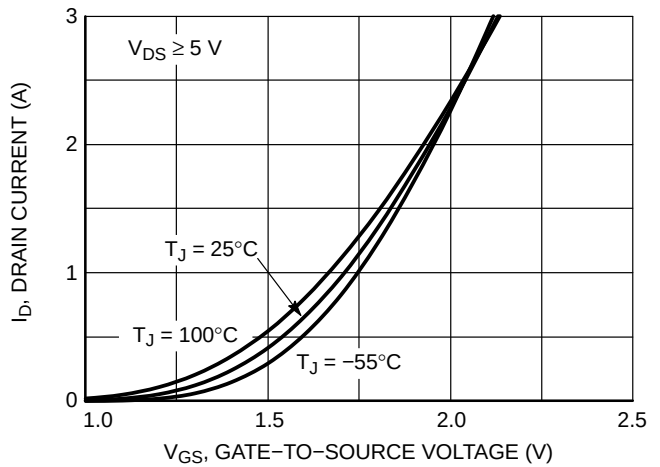


Figure 2. Transfer Characteristics

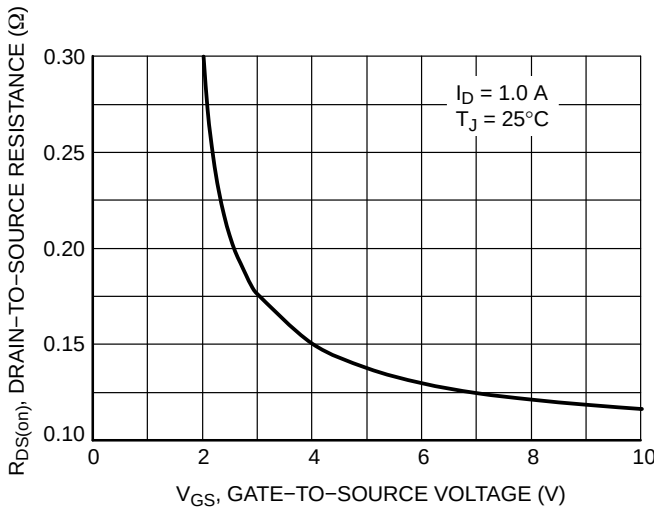


Figure 3. On-Resistance vs. Gate-to-Source Voltage

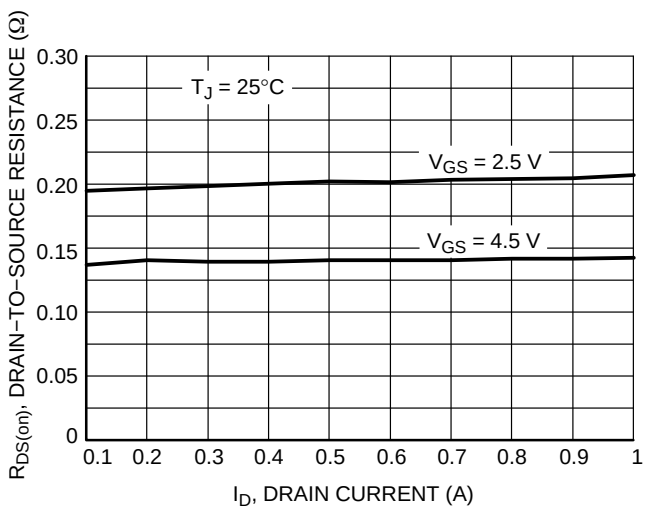


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

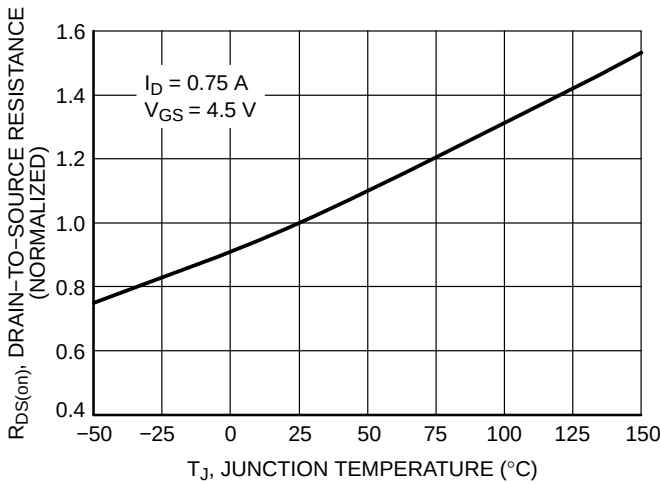


Figure 5. On-Resistance Variation with Temperature

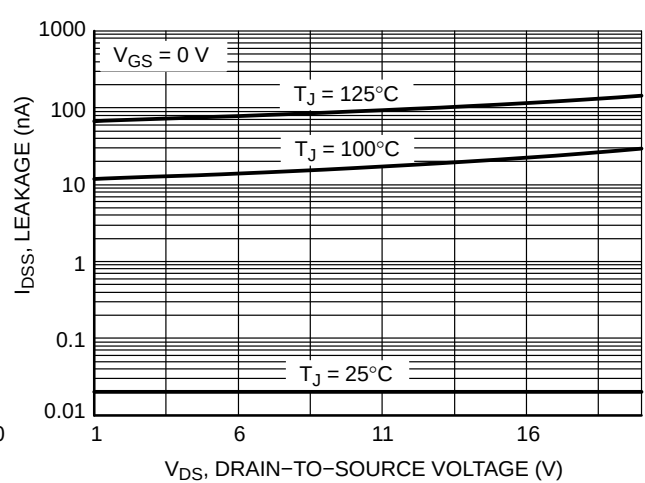


Figure 6. Drain-to-Source Leakage Current vs. Voltage

TYPICAL CHARACTERISTICS

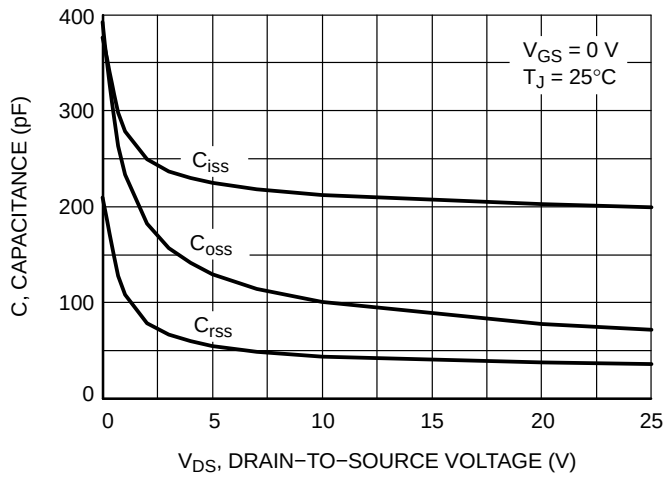


Figure 7. Capacitance Variation

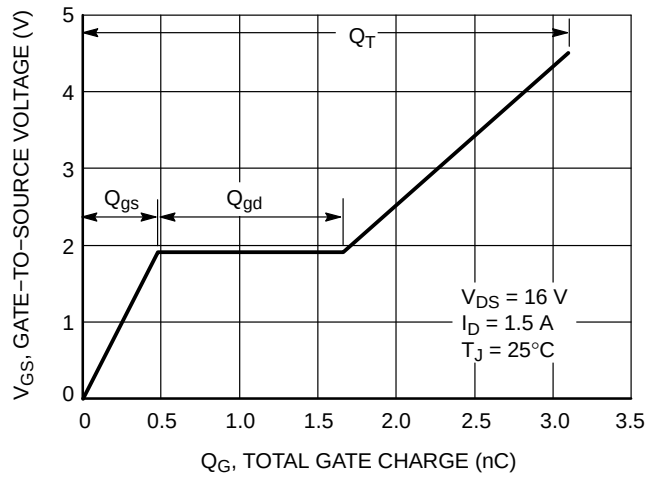


Figure 8. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge

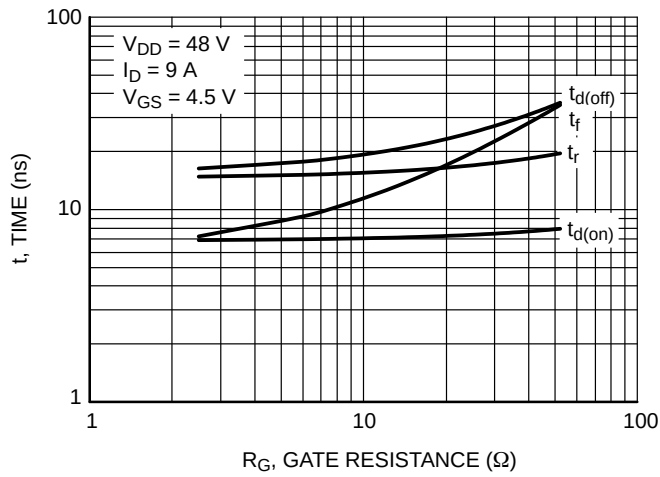


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

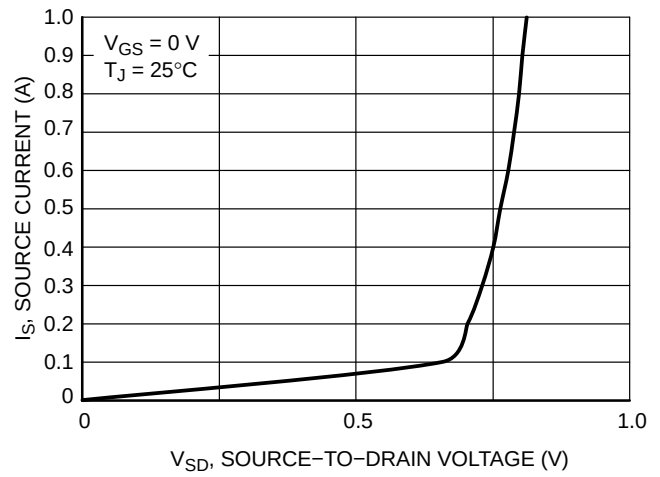


Figure 10. Diode Forward Voltage vs. Current

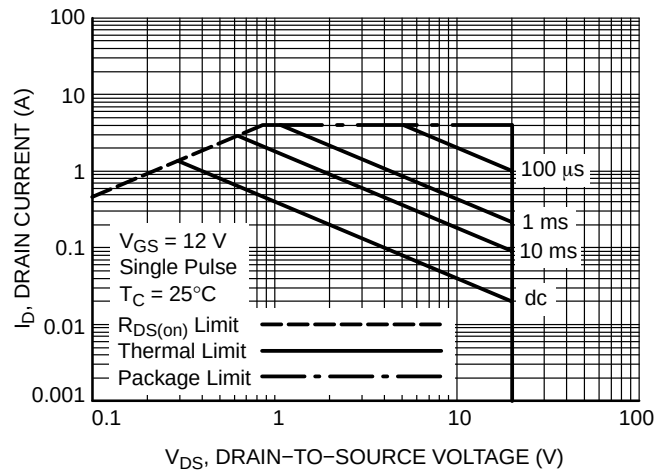
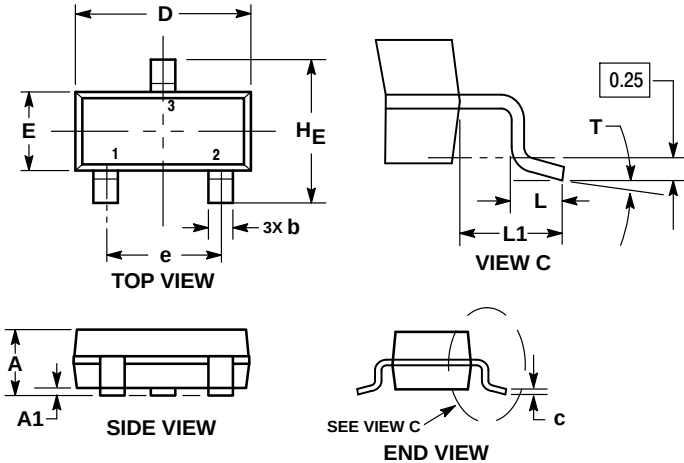


Figure 11. Maximum Rated Forward Biased Safe Operating Area

NTR1P02LS

PACKAGE DIMENSIONS

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

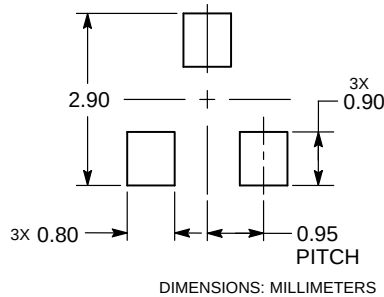


- NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
 2. CONTROLLING DIMENSION: MILLIMETERS.
 3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF THE BASE MATERIAL.
 4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

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
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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