NTR1P02T1

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 Ω, V_{GS} = −10 V
  $R_{DS(on)}$ = 0.280 Ω, V_{GS} = −4.5 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
- Pb−Free Packages are Available

Applications

- DC−DC Converters
- Computers
- Printers
- PCMCIA Cards
- Cellular and Cordless Telephones

MAXIMUM RATINGS (T_J = 25°C unless otherwise noted)

Rating	Symbol	Value	Unit
Drain−to−Source Voltage	V_{DSS}	−20	V
Gate−to−Source Voltage − Continuous	V_{GS}	±20	V
Drain Current − Continuous @ T_A = 25°C − Pulsed Drain Current ($t_p \le 1$ μs)	 I_D I_{DM}	 −1.0 −2.67	A
Total Power Dissipation @ T_A = 25°C	P_D	400	mW
Operating and Storage Temperature Range	T_J, T_{stg}	− 55 to 150	°C
Thermal Resistance; Junction−to−Ambient	$R_{\theta JA}$	300	°C/W
Maximum Lead Temperature for Soldering Purposes, (1/8″ from case for 10 s)	T_L	260	°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.

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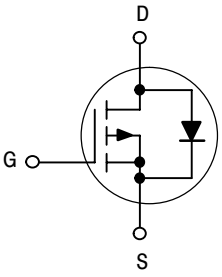
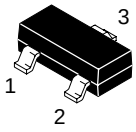
$V_{(BR)DSS}$	$R_{DS(on)}$ TYP	I_D MAX
−20 V	148 mΩ @ −10 V	−1.0 A

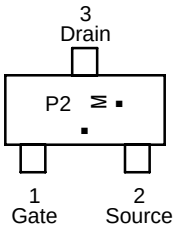
P−Channel



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†
NTR1P02T1	SOT−23	3000/Tape & Reel
NTR1P02T1G	SOT−23 (Pb−Free)	3000/Tape & Reel
NTR1P02T3	SOT−23	10,000/Tape & Reel
NTR1P02T3G	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°C unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS					
Drain−to−Source Breakdown Voltage (V_{GS} = 0 V, I_D = −10 μA) (Positive Temperature Coefficient)	$V_{(BR)DSS}$	−20	 32		 V mV/°C
Zero Gate Voltage Drain Current (V_{DS} = −20 V, V_{GS} = 0 V, T_J = 25°C) (V_{DS} = −20 V, V_{GS} = 0 V, T_J = 150°C)	I_{DSS}			 −1.0 −10	μA
Gate−Body Leakage Current (V_{GS} = ±20 V, V_{DS} = 0 V)	I_{GSS}			±100	nA
ON CHARACTERISTICS (Note 1)					
Gate Threshold Voltage (V_{DS} = V_{GS}, I_D = −250 μA) (Negative Temperature Coefficient)	$V_{GS(th)}$	−1.1	−1.9 −4.0	−2.3	V mV/°C
Static Drain−to−Source On−State Resistance (V_{GS} = −10 V, I_D = −1.5 A) (V_{GS} = −4.5 V, I_D = −0.75 A)	$R_{DS(on)}$		 0.148 0.235	 0.180 0.280	Ω
DYNAMIC CHARACTERISTICS					
Input Capacitance (V_{DS} = −5 V, V_{GS} = 0 V, f = 1.0 MHz)	C_{iss}		165		pF
Output Capacitance (V_{DS} = −5 V, V_{GS} = 0 V, f = 1.0 MHz)	C_{oss}		110		
Reverse Transfer Capacitance (V_{DS} = −5 V, V_{GS} = 0 V, f = 1.0 MHz)	C_{rss}		35		
SWITCHING CHARACTERISTICS (Note 2)					
Turn−On Delay Time (V_{DD} = −15 V, I_D = −1 A, V_{GS} = −5 V, R_G = 2.5 Ω)	$t_{d(on)}$		7.0		ns
Rise Time (V_{DD} = −15 V, I_D = −1 A, V_{GS} = −5 V, R_G = 2.5 Ω)	t_r		9.0		
Turn−Off Delay Time (V_{DD} = −15 V, I_D = −1 A, V_{GS} = −5 V, R_G = 2.5 Ω)	$t_{d(off)}$		9.0		
Fall Time (V_{DD} = −15 V, I_D = −1 A, V_{GS} = −5 V, R_G = 2.5 Ω)	t_f		3.0		
Total Gate Charge (V_{DS} = −15 V, V_{GS} = −5 V, I_D = −0.8 A)	Q_{tot}		2.5		nC
Gate−Source Charge (V_{DS} = −15 V, V_{GS} = −5 V, I_D = −0.8 A)	Q_{gs}		0.75		
Gate−Drain Charge (V_{DS} = −15 V, V_{GS} = −5 V, I_D = −0.8 A)	Q_{gd}		1.0		
BODY−DRAIN DIODE RATINGS (Note 1)					
Diode Forward On−Voltage (Note 2) (I_S = −0.6 A, V_{GS} = 0 V) (I_S = −0.6 A, V_{GS} = 0 V, T_J = 150°C)	V_{SD}		 −0.8 −0.6	−1.0	V
Reverse Recovery Time (I_S = −1 A, dI_S/dt = 100 A/μs, V_{GS} = 0 V)	t_{rr}		13.5		ns
	t_a		10.5		
	t_b		3.0		
Reverse Recovery Stored Charge (I_S = −1 A, dI_S/dt = 100 A/μs, V_{GS} = 0 V)	Q_{RR}		0.008		μC

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

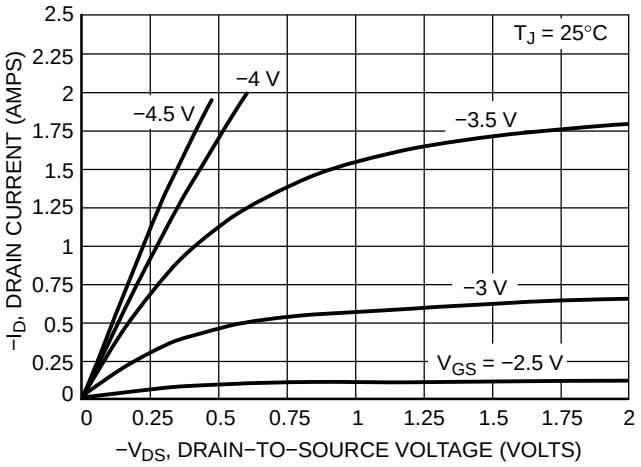


Figure 1. On−Region Characteristics

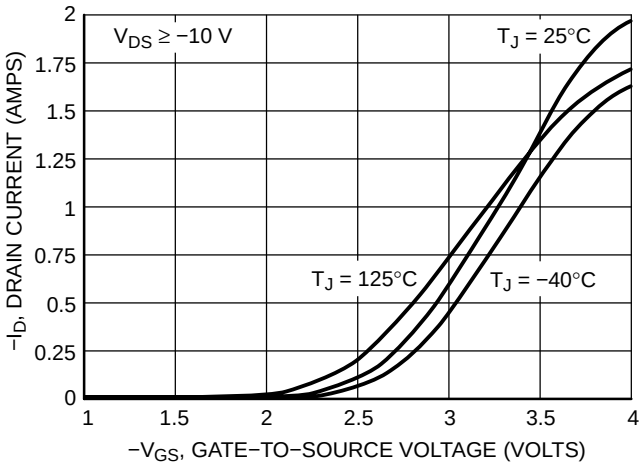


Figure 2. Transfer Characteristics

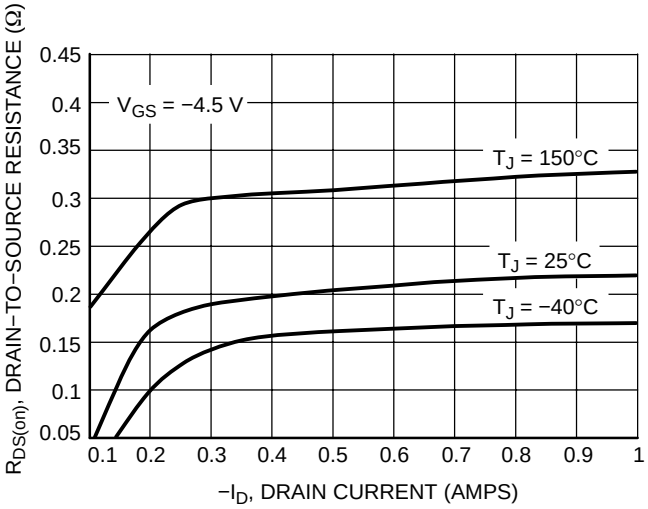


Figure 3. On−Resistance versus Drain Current and Temperature

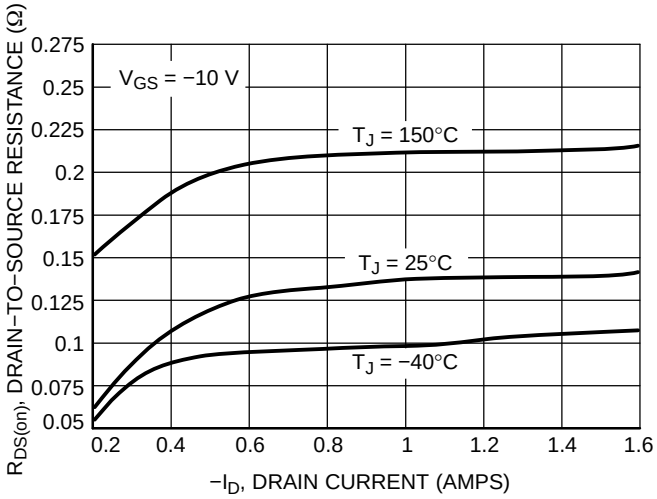


Figure 4. On−Resistance versus Drain Current and Temperature

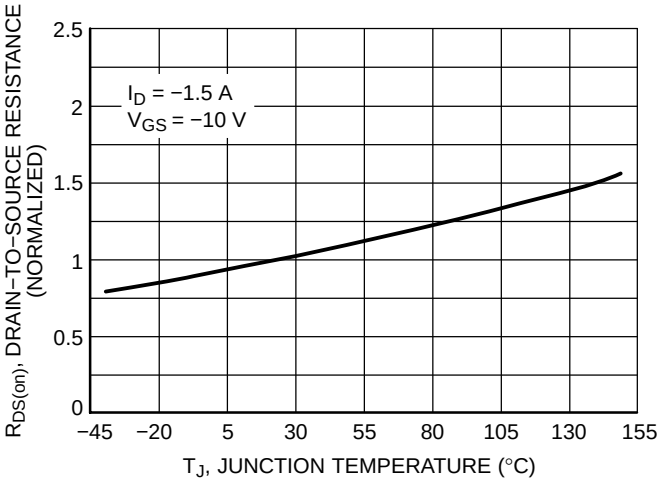


Figure 5. On−Resistance Variation with Temperature

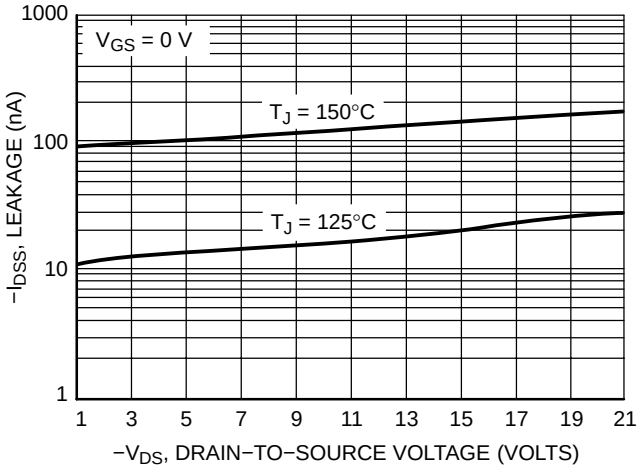


Figure 6. Drain−to−Source Leakage Current versus Voltage

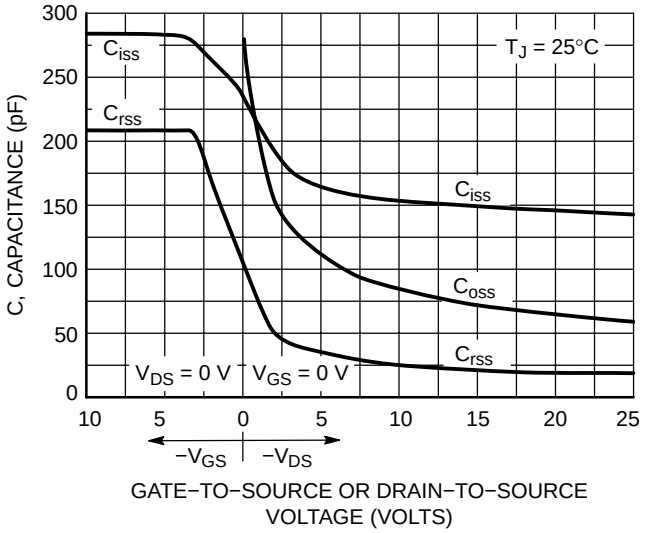


Figure 7. Capacitance Variation

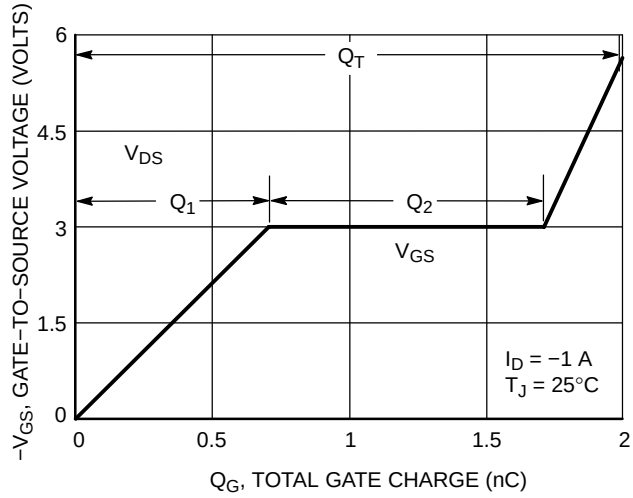


Figure 8. Gate−to−Source and Drain−to−Source Voltage versus Total Charge

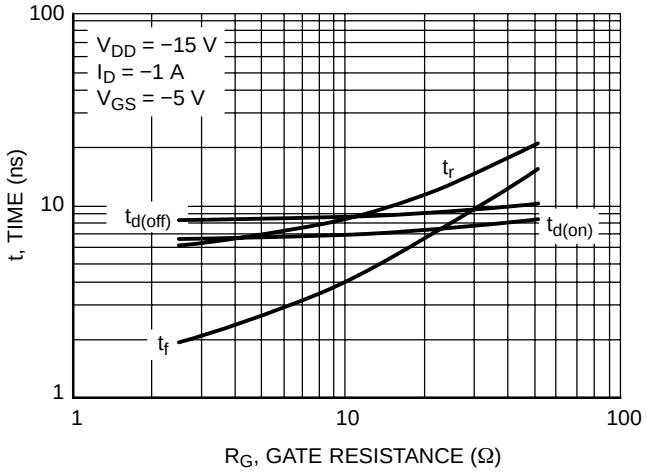


Figure 9. Resistive Switching Time Variation versus Gate Resistance

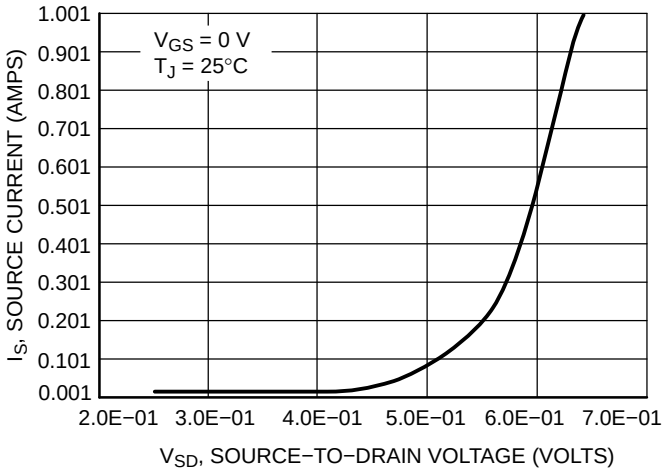
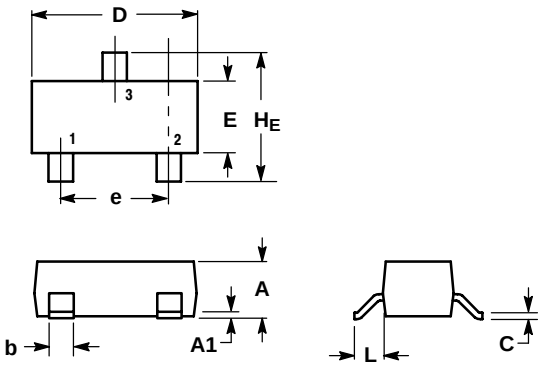


Figure 10. Diode Forward Voltage versus Current

PACKAGE DIMENSIONS

SOT−23
(TO−236)
CASE 318−08
ISSUE AL

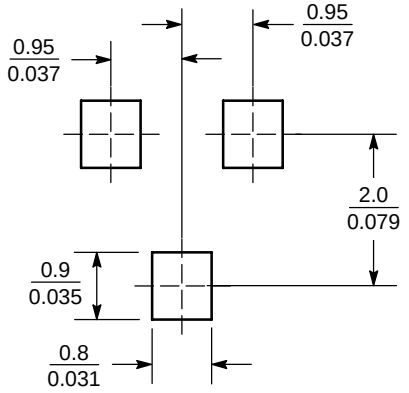


NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
4. 318−01 THRU −07 AND −09 OBSOLETE, NEW STANDARD 318−08.

	MILLIMETERS			INCHES		
DIM	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	0.35	0.54	0.69	0.014	0.021	0.029
H_E	2.10	2.40	2.64	0.083	0.094	0.104

STYLE 21:
PIN 1. GATE
2. SOURCE
3. DRAIN

SOLDERING FOOTPRINT*



SCALE 10:1 $\left(\frac{\text{mm}}{\text{inches}}\right)$

*For additional information on our Pb−Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:
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