NTR3161N

Power MOSFET

20 V, 3.3 A, Single N−Channel, SOT−23

Features

- Low $R_{DS(on)}$
- Low Gate Charge
- Low Threshold Voltage
- Halide−Free
- This is a Pb−Free Device

Applications

- DC−DC Conversion
- Battery Management
- Load/Power Switch

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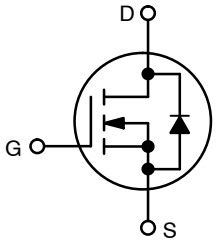
$V_{(BR)DSS}$	$R_{DS(on)}$ MAX	I_D MAX
20 V	50 mΩ @ 4.5 V	3.3 A
	63 mΩ @ 2.5 V	3.0 A
	87 mΩ @ 1.8 V	2.5 A

SIMPLIFIED SCHEMATIC − N−CHANNEL



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

Parameter			Symbol	Value	Unit
Drain−to−Source Voltage			V_{DSS}	20	V
Gate−to−Source Voltage			V_{GS}	±8	V
Continuous Drain Current (Note 1)	t ≤ 30 s	T_A = 25°C	I_D	3.3	A
		T_A = 85°C		2.3	
	t ≤ 10 s	T_A = 25°C		4.0	
Power Dissipation (Note 1)	Steady State	T_A = 25°C	P_D	0.82	W
	t ≤ 10 s			1.25	
Pulsed Drain Current	t_p = 10 μs		I_{DM}	6.4	A
Operating Junction and Storage Temperature			T_J, T_{stg}	−55 to 150	°C
Source Current (Body Diode)			I_S	0.65	A
Lead Temperature for Soldering Purposes (1/8" from case for 10 s)			T_L	260	°C

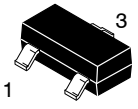
Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

THERMAL RESISTANCE RATINGS

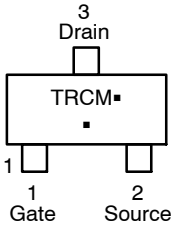
Parameter	Symbol	Max	Unit
Junction−to−Ambient − Steady State (Note 1)	$R_{\theta JA}$	260	°C/W
Junction−to−Ambient − t ≤ 30 s	$R_{\theta JA}$	153	°C/W
Junction−to−Ambient − t < 10 s (Note 1)	$R_{\theta JA}$	100	°C/W

1. Surface−mounted on FR4 board using 1 in sq pad size (Cu area = 1.127 in sq [2 oz] including traces).

MARKING DIAGRAM/ PIN ASSIGNMENT



SOT−23
CASE 318
STYLE 21



TRC = Specific Device Code
M = Date Code
▪ = Pb−Free Package
(Note: Microdot may be in either location)

ORDERING INFORMATION

Device	Package	Shipping†
NTR3161NT1G	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.

ELECTRICAL CHARACTERISTICS (T_J = 25°C unless otherwise noted)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
OFF CHARACTERISTICS						
Drain−to−Source Breakdown Voltage	$V_{(BR)DSS}$	V_{GS} = 0 V, I_D = 250 μA	20			V
Drain−to−Source Breakdown Voltage Temperature Coefficient	$V_{(BR)DSS}$ /T_J	I_D = 250 μA, Reference to 25°C		16.2		mV/°C
Zero Gate Voltage Drain Current	I_{DSS}	V_{GS} = 0 V, V_{DS} = 16 V, T_J = 25°C V_{GS} = 0 V, V_{DS} = 16 V, T_J = 125°C			1.0 10	μA
Gate−to−Source Leakage Current	I_{GSS}	V_{DS} = 0 V, V_{GS} = ±8 V			100	nA
ON CHARACTERISTICS (Note 2)						
Gate Threshold Voltage	$V_{GS(TH)}$	V_{GS} = V_{DS}, I_D = 250 μA	0.4	0.6	1.0	V
Negative Threshold Temperature Coefficient	$V_{GS(TH)}$ /T_J			2.4		mV/°C
Drain−to−Source On−Resistance	$R_{DS(on)}$	V_{GS} = 4.5 V, I_D = 3.3 A		38	50	mΩ
		V_{GS} = 2.5 V, I_D = 3.0 A		44	63	
		V_{GS} = 1.8 V, I_D = 2.5 A		52	87	
Forward Transconductance	g_{FS}	V_{DS} = 5.0 V, I_D = 3.3 A		10.5		S
CHARGES, CAPACITANCES AND GATE RESISTANCE						
Input Capacitance	C_{iss}	V_{GS} = 0 V, f = 1.0 MHz, V_{DS} = 10 V		540		pF
Output Capacitance	C_{oss}			80		
Reverse Transfer Capacitance	C_{rss}			62		
Total Gate Charge	$Q_{G(TOT)}$	V_{GS} = 4.5 V, V_{DS} = 10 V, I_D = 3.3 A		7.3		nC
Threshold Gate Charge	$Q_{G(TH)}$			0.4		
Gate−to−Source Charge	Q_{GS}			0.8		
Gate−to−Drain Charge	Q_{GD}			1.6		
Gate Resistance	R_G			2.4		Ω
SWITCHING CHARACTERISTICS (Note 3)						
Turn−On Delay Time	$t_{d(on)}$	V_{GS} = 4.5 V, V_{DD} = 10 V, I_D = 3.3 A, R_G = 6 Ω		6.7		ns
Rise Time	t_r			11.6		
Turn−Off Delay Time	$t_{d(off)}$			18.6		
Fall Time	t_f			23.2		
DRAIN−SOURCE DIODE CHARACTERISTICS						
Forward Diode Voltage	V_{SD}	V_{GS} = 0 V, I_S = 1.0 A, T_J = 25°C		0.65	1.0	V
Reverse Recovery Time	t_{RR}	V_{GS} = 0 V, I_S = 1.0 A, dI_{SD}/d_t = 100 A/μs		14.7		ns
Charge Time	t_a			5.2		
Discharge Time	t_b			9.5		
Reverse Recovery Charge	Q_{RR}			3.3		nC

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

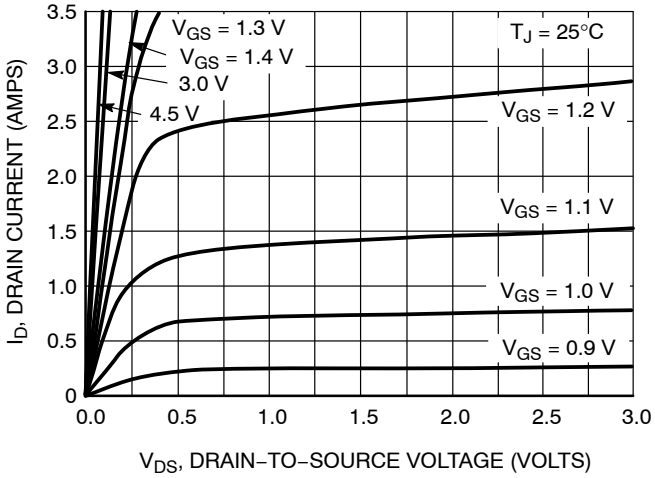


Figure 1. On−Region Characteristics

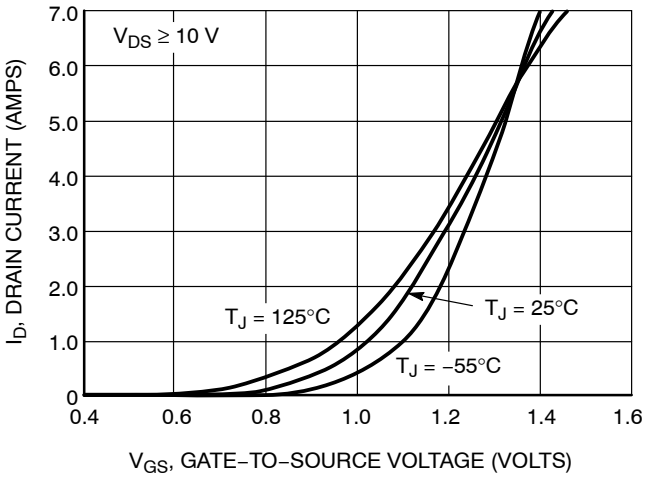


Figure 2. Transfer Characteristics

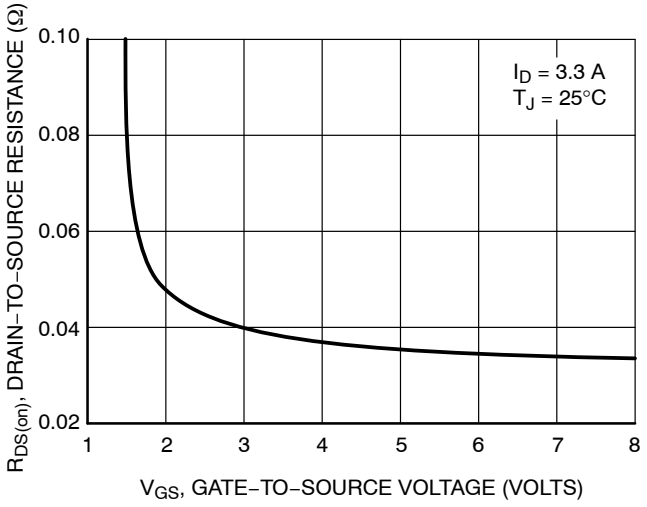


Figure 3. On−Resistance versus Gate−to−Source Voltage

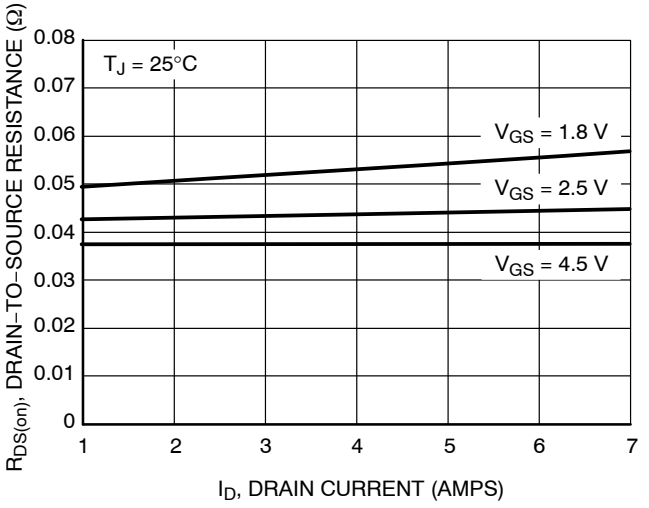


Figure 4. On−Resistance versus Drain Current and Gate Voltage

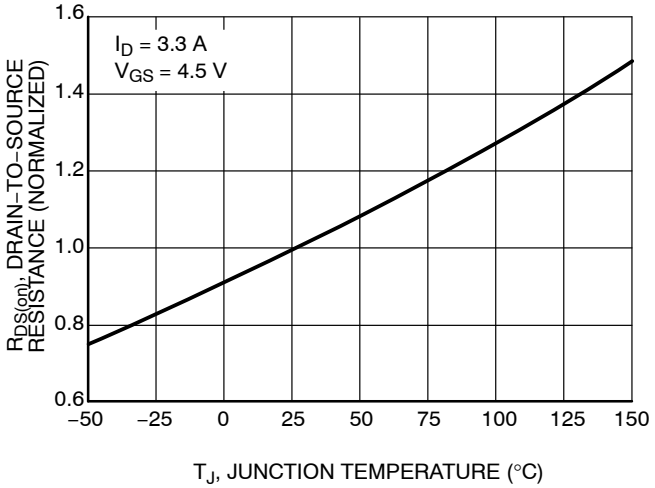


Figure 5. On−Resistance Variation with Temperature

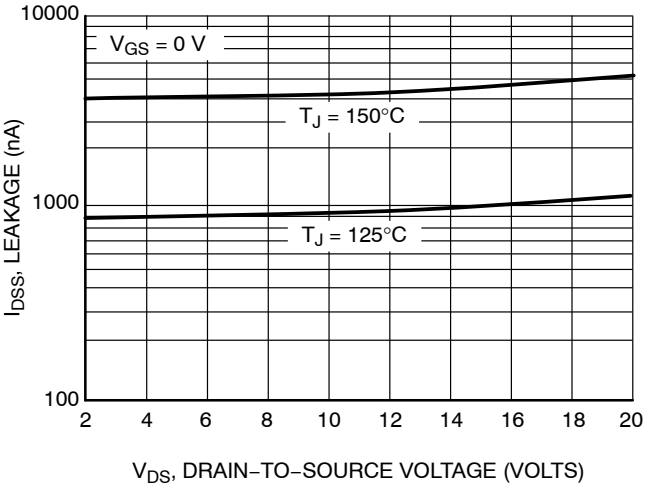


Figure 6. Drain−to−Source Leakage Current versus Voltage

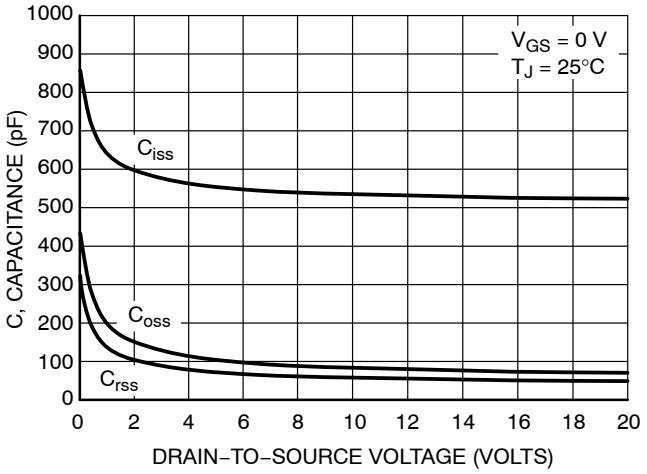


Figure 7. Capacitance Variation

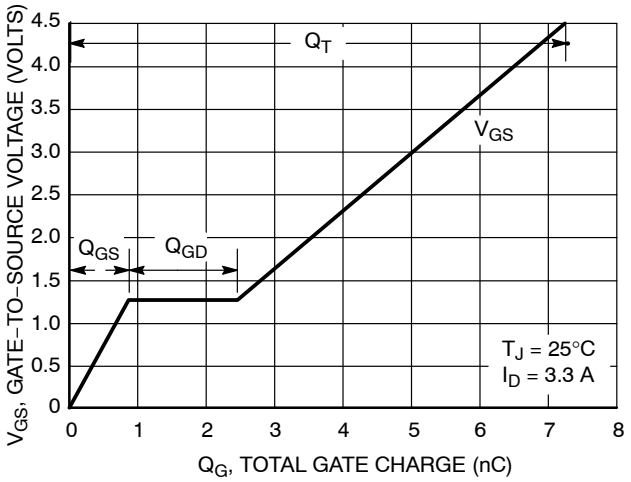


Figure 8. Gate−to−Source and Drain−to−Source Voltage versus Total Charge

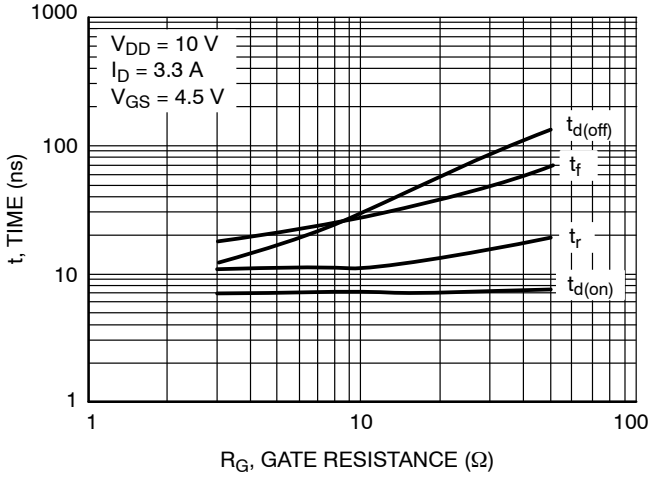


Figure 9. Resistive Switching Time Variation versus Gate Resistance

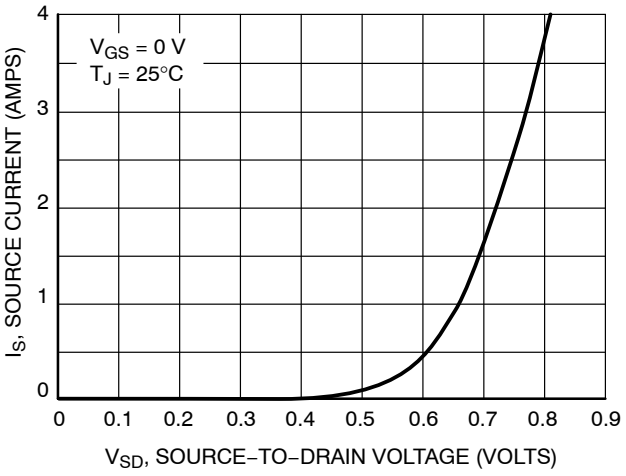
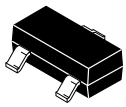


Figure 10. Diode Forward Voltage versus Current

MECHANICAL CASE OUTLINE
PACKAGE DIMENSIONS

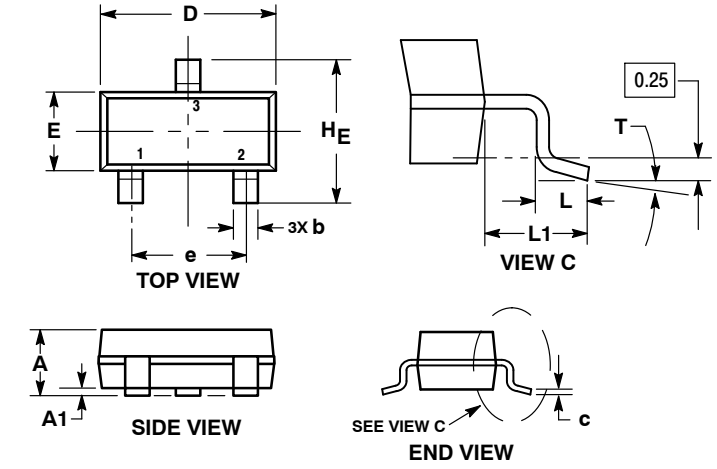
ON Semiconductor®



SOT−23 (TO−236)
CASE 318−08
ISSUE AS

DATE 30 JAN 2018

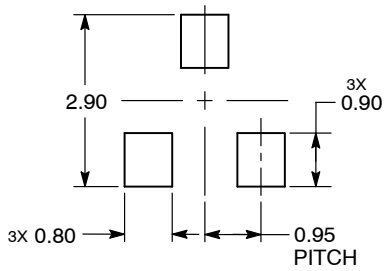
SCALE 4:1



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.

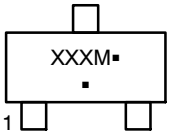
	MILLIMETERS			INCHES		
DIM	MIN	NOM	MAX	MIN	NOM	MAX
A	0.89	1.00	1.11	0.035	0.039	0.044
A1	0.01	0.06	0.10	0.000	0.002	0.004
b	0.37	0.44	0.50	0.015	0.017	0.020
c	0.08	0.14	0.20	0.003	0.006	0.008
D	2.80	2.90	3.04	0.110	0.114	0.120
E	1.20	1.30	1.40	0.047	0.051	0.055
e	1.78	1.90	2.04	0.070	0.075	0.080
L	0.30	0.43	0.55	0.012	0.017	0.022
L1	0.35	0.54	0.69	0.014	0.021	0.027
H_E	2.10	2.40	2.64	0.083	0.094	0.104
T	0°	−−−	10°	0°	−−−	10°

RECOMMENDED SOLDERING FOOTPRINT



DIMENSIONS: MILLIMETERS

GENERIC MARKING DIAGRAM*



XXX = Specific Device Code
M = Date Code
▪ = Pb−Free Package

*This information is generic. Please refer to device data sheet for actual part marking. Pb−Free indicator, “G” or microdot “ ▪”, may or may not be present.

STYLE 1 THRU 5:
CANCELLED

STYLE 6:
PIN 1. BASE
2. EMITTER
3. COLLECTOR

STYLE 7:
PIN 1. EMITTER
2. BASE
3. COLLECTOR

STYLE 8:
PIN 1. ANODE
2. NO CONNECTION
3. CATHODE

STYLE 9:
PIN 1. ANODE
2. ANODE
3. CATHODE

STYLE 10:
PIN 1. DRAIN
2. SOURCE
3. GATE

STYLE 11:
PIN 1. ANODE
2. CATHODE
3. CATHODE−ANODE

STYLE 12:
PIN 1. CATHODE
2. CATHODE
3. ANODE

STYLE 13:
PIN 1. SOURCE
2. DRAIN
3. GATE

STYLE 14:
PIN 1. CATHODE
2. GATE
3. ANODE

STYLE 15:
PIN 1. GATE
2. CATHODE
3. ANODE

STYLE 16:
PIN 1. ANODE
2. CATHODE
3. CATHODE

STYLE 17:
PIN 1. NO CONNECTION
2. ANODE
3. CATHODE

STYLE 18:
PIN 1. NO CONNECTION
2. CATHODE
3. ANODE

STYLE 19:
PIN 1. CATHODE
2. ANODE
3. CATHODE−ANODE

STYLE 20:
PIN 1. CATHODE
2. ANODE
3. GATE

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

STYLE 22:
PIN 1. RETURN
2. OUTPUT
3. INPUT

STYLE 23:
PIN 1. ANODE
2. ANODE
3. CATHODE

STYLE 24:
PIN 1. GATE
2. DRAIN
3. SOURCE

STYLE 25:
PIN 1. ANODE
2. CATHODE
3. GATE

STYLE 26:
PIN 1. CATHODE
2. ANODE
3. NO CONNECTION

STYLE 27:
PIN 1. CATHODE
2. CATHODE
3. CATHODE

STYLE 28:
PIN 1. ANODE
2. ANODE
3. ANODE

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