

MOSFET - Power, Single N-Channel, SOT-23

20 V, 3.2 A

NTR4501N, NVR4501N

Features

- Leading Planar Technology for Low Gate Charge / Fast Switching
- 2.5 V Rated for Low Voltage Gate Drive
- SOT-23 Surface Mount for Small Footprint
- NVR Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q101 Qualified and PPAP Capable
- These Devices are Pb-Free and are RoHS Compliant

Applications

- Load/Power Switch for Portables
- Load/Power Switch for Computing
- DC-DC Conversion

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

Parameter		Symbol	Value	Unit
Drain-to-Source Voltage		V _{DSS}	20	V
Gate-to-Source Voltage		V _{GS}	±12	V
Continuous Drain Current (Note 1)	Steady State	I _D	T _A = 25°C	3.2 A
			T _A = 85°C	2.4 A
Steady State Power Dissipation (Note 1)	Steady State	P _D	1.25	W
Pulsed Drain Current	t _p = 10 μs	I _{DM}	10.0	A
Operating Junction and Storage Temperature Range		T _J , T _{stg}	-55 to +150	°C
Continuous Source Current (Body Diode)		I _S	1.6	A
Lead Temperature for Soldering Purposes (1/8" from case for 10 s)		T _L	260	°C

THERMAL RESISTANCE RATINGS

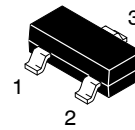
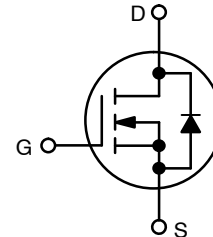
Parameter	Symbol	Max	Unit
Junction-to-Ambient (Note 1)	R _{θJA}	100	°C/W
Junction-to-Ambient (Note 2)	R _{θJA}	300	°C/W

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

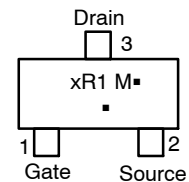
V _{(BR)DSS}	R _{DS(on) Typ}	I _D Max (Note 1)
20 V	70 mΩ @ 4.5 V	3.6 A
	88 mΩ @ 2.5 V	3.1 A

N-Channel



SOT-23
CASE 318
STYLE 21

MARKING DIAGRAM & PIN ASSIGNMENT



- TR1 = Device Code for NTR4501N
- VR1 = Device Code for NVR4501N
- M = Date Code*
- = Pb-Free Package

(Note: Microdot may be in either location)

*Date Code orientation and/or overbar may vary depending upon manufacturing location.

ORDERING INFORMATION

Device	Package	Shipping†
NTR4501NT1G	SOT-23 (Pb-Free)	3000 / Tape & Reel
NVR4501NT1G	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.

NTR4501N, NVR4501N

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

Parameter	Symbol	Test Condition	Min	Typ	Max	Units
OFF CHARACTERISTICS						
Drain-to-Source Breakdown Voltage (Note 3)	$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}$	20	24.5		V
Drain-to-Source Breakdown Voltage Temperature Coefficient	$V_{(BR)DSS}/T_J$			22		mV/°C
Zero Gate Voltage Drain Current	I_{DSS}	$V_{GS} = 0\text{ V}, T_J = 25^\circ\text{C}$			1.5	μA
		$V_{DS} = 16\text{ V}, T_J = 85^\circ\text{C}$			10	μA
Gate-to-Source Leakage Current	I_{GSS}	$V_{DS} = 0\text{ V}, V_{GS} = \pm 12\text{ V}$			± 100	nA

ON CHARACTERISTICS

Gate Threshold Voltage (Note 3)	$V_{GS(TH)}$	$V_{GS} = V_{DS}, I_D = 250\ \mu\text{A}$	0.65		1.2	V
Negative Threshold Temperature Coefficient	$V_{GS(TH)}/T_J$			-2.3		mV/°C
Drain-to-Source On Resistance	$R_{DS(on)}$	$V_{GS} = 4.5\text{ V}, I_D = 3.6\text{ A}$		70	80	m Ω
		$V_{GS} = 2.5\text{ V}, I_D = 3.1\text{ A}$		88	105	
Forward Transconductance	g_{FS}	$V_{DS} = 5.0\text{ V}, I_D = 3.6\text{ A}$		9		S

CHARGES AND CAPACITANCES

Input Capacitance	C_{iss}	$V_{GS} = 0\text{ V}, f = 1.0\text{ MHz}, V_{DS} = 10\text{ V}$		200		pF
Output Capacitance	C_{oss}			80		
Reverse Transfer Capacitance	C_{rss}			50		
Total Gate Charge	$Q_G(TOT)$	$V_{GS} = 4.5\text{ V}, V_{DS} = 10\text{ V}, I_D = 3.6\text{ A}$		2.4	6.0	nC
Gate-to-Source Gate Charge	Q_{GS}			0.5		
Gate-to-Drain Charge	Q_{GD}			0.6		

SWITCHING CHARACTERISTICS (Note 4)

Turn-On Delay Time	$t_{d(on)}$	$V_{GS} = 4.5\text{ V}, V_{DS} = 10\text{ V}, I_D = 3.6\text{ A}, R_G = 6.0\ \Omega$		6.5	13	ns
Rise Time	t_r			12	24	
Turn-Off Delay Time	$t_{d(off)}$			12	24	
Fall Time	t_f			3	6	

SOURCE-DRAIN DIODE CHARACTERISTICS

Forward Diode Voltage	V_{SD}	$V_{GS} = 0\text{ V}, I_{SD} = 1.6\text{ A}$		0.8	1.2	V
Reverse Recovery Time	t_{RR}	$V_{GS} = 0\text{ V}, dI_S/dt = 100\text{ A}/\mu\text{s}, I_S = 1.6\text{ A}$		7.1		ns
Charge Time	t_a			5		
Discharge Time	t_b			1.9		
Reverse Recovery Charge	Q_{RR}			3.0		

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.

3. Pulse Test: Pulse width $\leq 300\ \mu\text{s}$, duty cycle $\leq 2\%$.

4. Switching characteristics are independent of operating junction temperatures.

NTR4501N, NVR4501N

TYPICAL CHARACTERISTICS

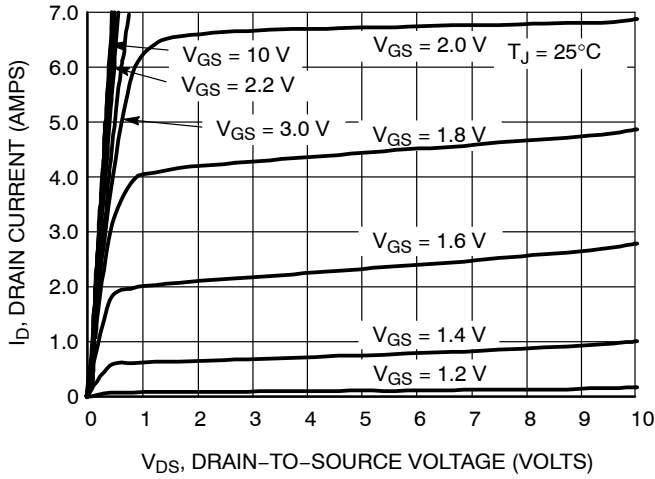


Figure 1. On-Region Characteristics

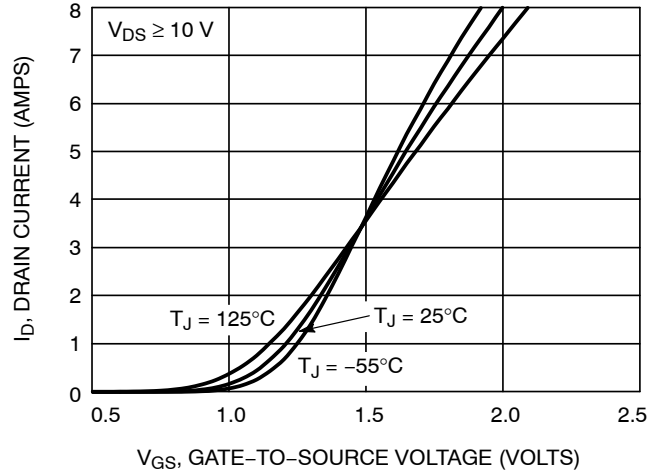


Figure 2. Transfer Characteristics

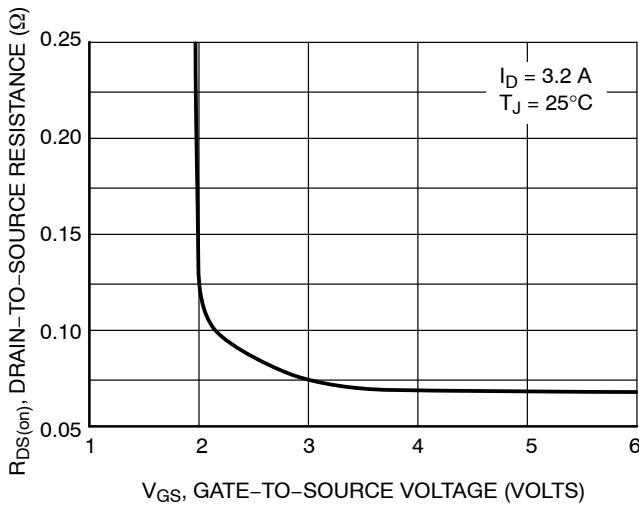


Figure 3. On-Resistance vs. Gate-to-Source Voltage

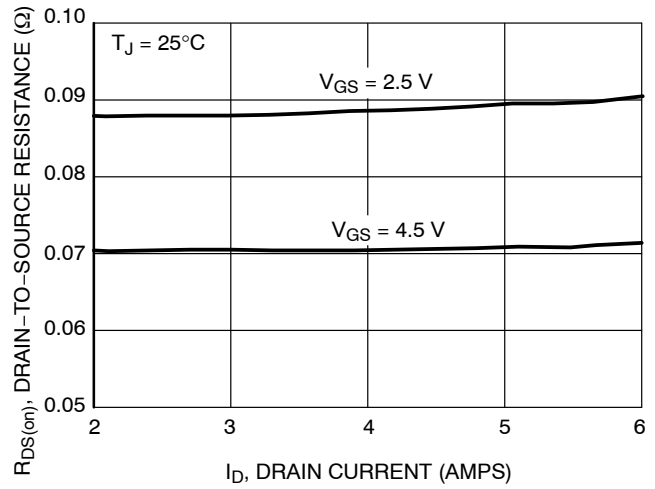


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

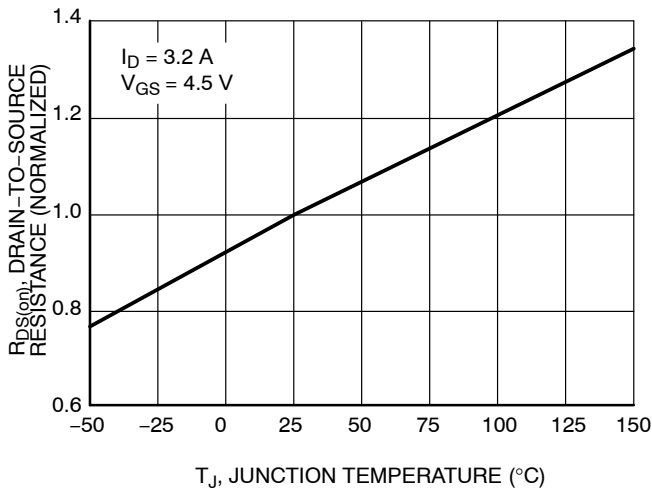


Figure 5. On-Resistance Variation with Temperature

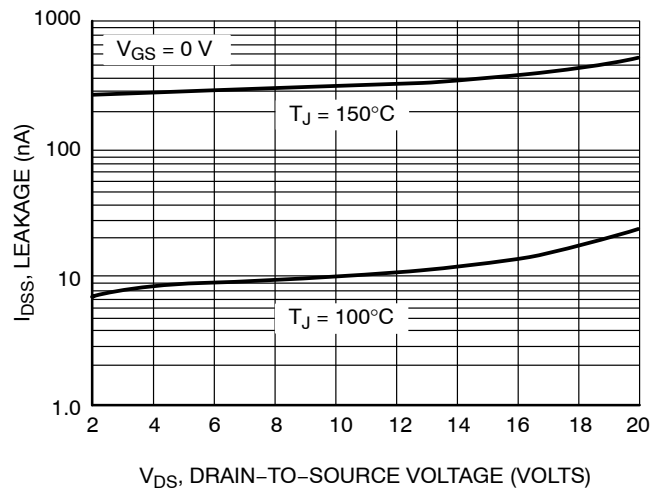


Figure 6. Drain-to-Source Leakage Current vs. Voltage

NTR4501N, NVR4501N

TYPICAL CHARACTERISTICS

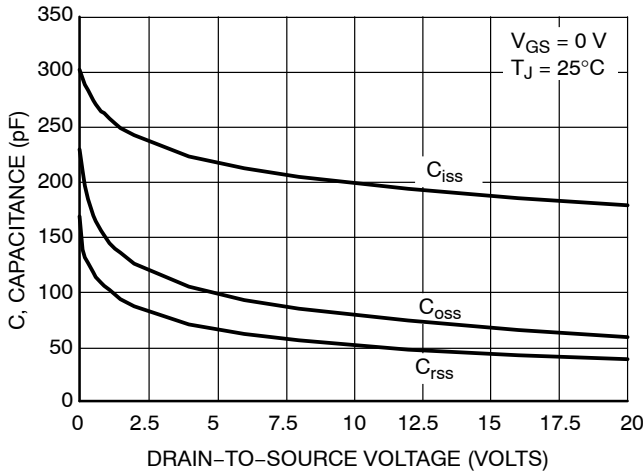


Figure 7. Capacitance Variation

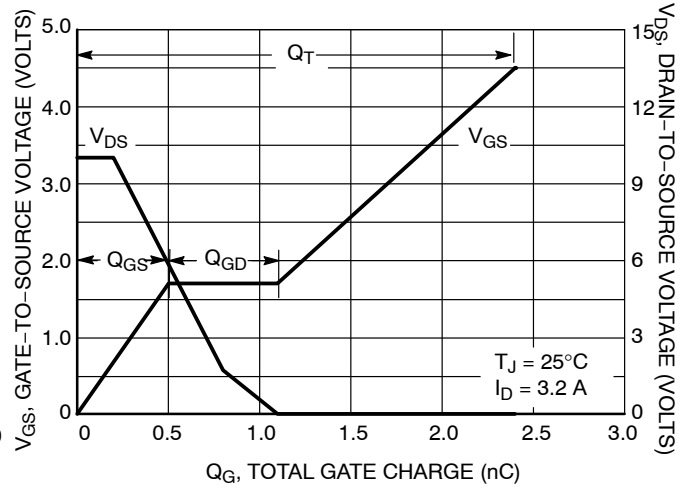


Figure 8. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge

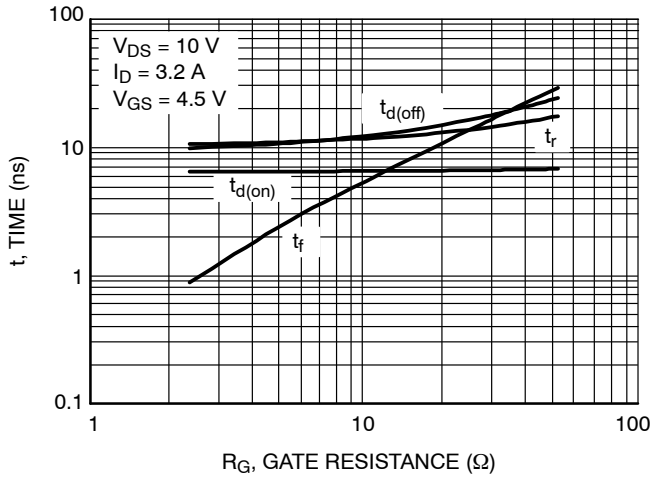


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

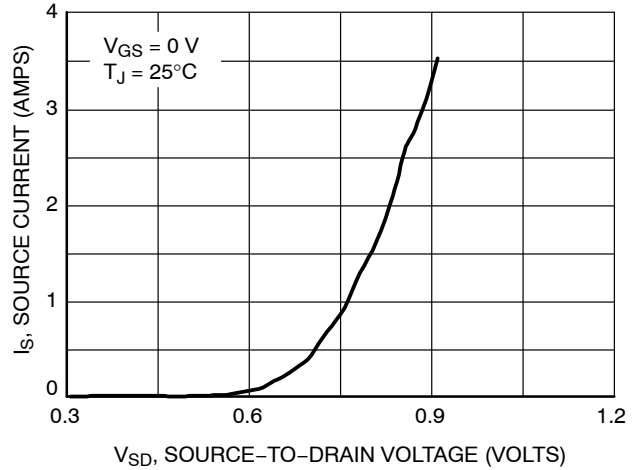


Figure 10. Diode Forward Voltage vs. Current

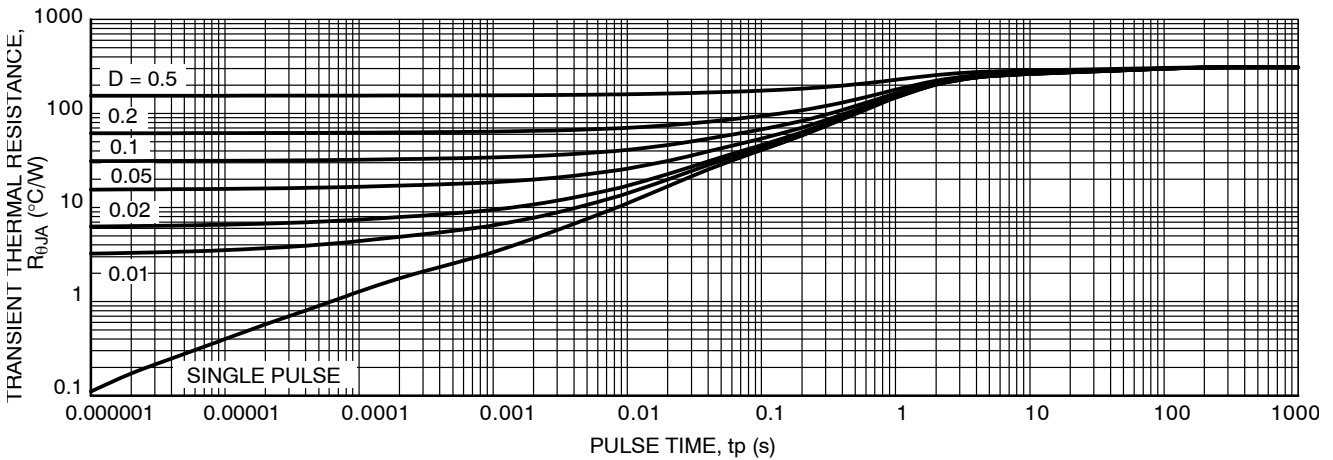


Figure 11. Thermal Response

NTR4501N, NVR4501N

TYPICAL CHARACTERISTICS

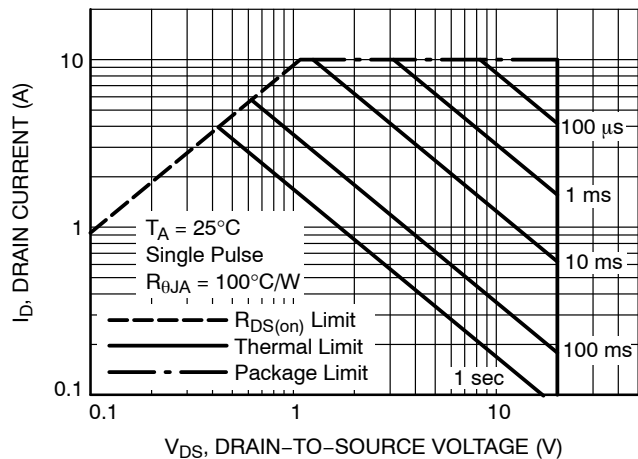


Figure 12. Safe Operating Area (SOA)



SCALE 4:1

SOT-23 (TO-236) 2.90x1.30x1.00 1.90P
CASE 318
ISSUE AU

DATE 14 AUG 2024



MILLIMETERS			
DIM	MIN	NOM	MAX
A	0.89	1.00	1.11
A1	0.01	0.06	0.10
b	0.37	0.44	0.50
c	0.08	0.14	0.20
D	2.80	2.90	3.04
E	1.20	1.30	1.40
e	1.78	1.90	2.04
L	0.30	0.43	0.55
L1	0.35	0.54	0.69
HE	2.10	2.40	2.64
T	0°	---	10°

NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2018.
2. CONTROLLING DIMENSIONS: 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.

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. Some products may not follow the Generic Marking.



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

STYLES ON PAGE 2

DOCUMENT NUMBER:	98ASB42226B	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.
DESCRIPTION:	SOT-23 (TO-236) 2.90x1.30x1.00 1.90P	PAGE 1 OF 2

onsemi and ONSEMI are trademarks of Semiconductor Components Industries, LLC dba onsemi or its subsidiaries in the United States and/or other countries. onsemi reserves the right to make changes without further notice to any products herein. onsemi makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does onsemi assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. onsemi does not convey any license under its patent rights nor the rights of others.

SOT-23 (TO-236) 2.90x1.30x1.00 1.90P
CASE 318
ISSUE AU

DATE 14 AUG 2024

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

DOCUMENT NUMBER:	98ASB42226B	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.
DESCRIPTION:	SOT-23 (TO-236) 2.90x1.30x1.00 1.90P	PAGE 2 OF 2

onsemi and **ONSEMI** are trademarks of Semiconductor Components Industries, LLC dba **onsemi** or its subsidiaries in the United States and/or other countries. **onsemi** reserves the right to make changes without further notice to any products herein. **onsemi** makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does **onsemi** assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. **onsemi** does not convey any license under its patent rights nor the rights of others.

onsemi, **Onsemi**, and other names, marks, and brands are registered and/or common law trademarks of Semiconductor Components Industries, LLC dba "**onsemi**" or its affiliates and/or subsidiaries in the United States and/or other countries. **onsemi** owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of **onsemi**'s product/patent coverage may be accessed at www.onsemi.com/site/pdf/Patent-Marking.pdf. **onsemi** reserves the right to make changes at any time to any products or information herein, without notice. The information herein is provided "as-is" and **onsemi** makes no warranty, representation or guarantee regarding the accuracy of the information, product features, availability, functionality, or suitability of its products for any particular purpose, nor does **onsemi** assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using **onsemi** products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by **onsemi**. "Typical" parameters which may be provided in **onsemi** data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. **onsemi** does not convey any license under any of its intellectual property rights nor the rights of others. **onsemi** products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use **onsemi** products for any such unintended or unauthorized application, Buyer shall indemnify and hold **onsemi** and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that **onsemi** was negligent regarding the design or manufacture of the part. **onsemi** is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

ADDITIONAL INFORMATION

TECHNICAL PUBLICATIONS:

Technical Library: www.onsemi.com/design/resources/technical-documentation
onsemi Website: www.onsemi.com

ONLINE SUPPORT: www.onsemi.com/support

For additional information, please contact your local Sales Representative at www.onsemi.com/support/sales