# MOSFET - Power, Single, N-Channel, Logic Level, SOT-23

60 V, 155 m $\Omega$ 

#### **Features**

- Small Footprint Industry Standard Surface Mount SOT-23 Package
- Low R<sub>DS(on)</sub> for Low Conduction Losses and Improved Efficiency
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

# MAXIMUM RATINGS (T<sub>J</sub> = 25°C unless otherwise noted)

Param	Symbol	Value	Unit		
Drain-to-Source Voltage			V <sub>DSS</sub>	60	٧
Gate-to-Source Voltage			V <sub>GS</sub>	±20	V
Continuous Drain	Steady State	T <sub>A</sub> = 25°C	I <sub>D</sub>	2.2	Α
Current R <sub>ΨJ-mb</sub> (Notes 1, 2, 3, and 4)	State	T <sub>A</sub> = 100°C		1.6	
Power Dissipation		T <sub>A</sub> = 25°C	P <sub>D</sub>	1.5	W
R <sub>ΨJ-mb</sub> (Notes 1 and 3)		T <sub>A</sub> = 100°C		0.6	
Continuous Drain	Steady T <sub>A</sub> = 25°C		I <sub>D</sub>	1.7	Α
Current $R_{\theta JA}$ (Note 1, 2, 3, and 4)	State	T <sub>A</sub> = 100°C		1.2	
Power Dissipation R <sub>θJA</sub>		T <sub>A</sub> = 25°C	P <sub>D</sub>	0.9	W
(Notes 1 and 3)		T <sub>A</sub> = 100°C		0.4	
Pulsed Drain Current	, ,	= 25°C, = 10 μs	I <sub>DM</sub>	27	Α
Operating Junction and Storage Temperature			T <sub>J</sub> , T <sub>stg</sub>	–55 to 150	°C
Source Current (Body Diode)			Is	1.9	Α
Lead Temperature for Soldering Purposes (1/8" from case for 10 s)			TL	260	°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.

- The entire application environment impacts the thermal resistance values shown, they are not constants and are only valid for the particular conditions noted.
- 2. Psi  $(\Psi)$  is used as required per JESD51-12 for packages in which substantially less than 100% of the heat flows to single case surface.
- 3. Surface-mounted on FR4 board using a 650 mm2, 2 oz. Cu pad.
- Maximum current for pulses as long as 1 second is higher but is dependent on pulse duration and duty cycle.

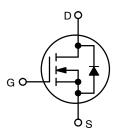


# ON Semiconductor®

#### www.onsemi.com

V <sub>(BR)DSS</sub>	R <sub>DS(on)</sub> TYP	I <sub>D</sub> MAX
60 V	155 mΩ @ 10 V	2.2 A
	205 mΩ @ 4.5 V	

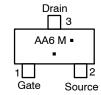
#### N-Channel





# SOT-23 CASE 318 STYLE 21





AA6 = 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 <sup>†</sup>
NTR5198NLT1G	SOT-23 (Pb-Free)	3000 / Tape & Reel
NTR5198NLT3G	SOT-23 (Pb-Free)	10000 / Tape & Reel

<sup>†</sup>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.

# THERMAL RESISTANCE RATINGS

Parameter	Symbol	Max	Unit
Junction-to-Lead #3 - Drain (Notes 2 and 3)	R <sub>ΨJ-mb</sub>	86	°C/W
Junction-to-Ambient - Steady State (Note 3)	$R_{\theta JA}$	139	°C/W

## **ELECTRICAL CHARACTERISTICS** (T<sub>1</sub> = 25°C unless otherwise noted)

Parameter	Symbol	Test Conditions		Min	Тур	Max	Unit
OFF CHARACTERISTICS							
Drain-to-Source Breakdown Voltage	V <sub>(BR)DSS</sub>	V <sub>GS</sub> = 0 V,	I <sub>D</sub> = 250 μA	60			V
Drain-to-Source Breakdown Voltage Temperature Coefficient	V <sub>(BR)DSS</sub> /T <sub>J</sub>	Reference to 25	5°C, I <sub>D</sub> = 250 μA		70		mV/°C
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>GS</sub> = 0 V,	T <sub>J</sub> = 25°C			1.0	μΑ
		$V_{DS} = 60 \text{ V}$	T <sub>J</sub> = 125°C			10	1
Gate-to-Source Leakage Current	I <sub>GSS</sub>	$V_{DS} = 0 \text{ V}, V_{GS} = \pm 20 \text{ V}$				±100	nA
ON CHARACTERISTICS (Note 5)							
Gate Threshold Voltage	V <sub>GS(TH)</sub>	$V_{GS} = V_{DS}$	I <sub>D</sub> = 250 μA	1.5		2.5	V
Threshold Temperature Coefficient	V <sub>GS(TH)</sub> /T <sub>J</sub>	Reference to 25	5°C, I <sub>D</sub> = 250 μA		-6.5		mV/°C
Drain-to-Source On-Resistance	R <sub>DS(on)</sub>	V <sub>GS</sub> = 10	V, I <sub>D</sub> = 1 A		107	155	mΩ
		V <sub>GS</sub> = 4.5	V, I <sub>D</sub> = 1 A		142	205	
Forward Transconductance	9FS	V <sub>DS</sub> = 5.0 V, I <sub>D</sub> = 1 A			3		S
CHARGES, CAPACITANCES & GATE	RESISTANCE						
Input Capacitance	C <sub>iss</sub>	$V_{GS} = 0 \text{ V, f} = 1.0 \text{ MHz,}$ $V_{DS} = 25 \text{ V}$			182		pF
Output Capacitance	C <sub>oss</sub>				25		1
Reverse Transfer Capacitance	C <sub>rss</sub>				16		1
Total Gate Charge	Q <sub>G(TOT)</sub>	V <sub>DS</sub> = 48 V,	V <sub>GS</sub> = 4.5 V		2.8		nC
	,	$I_D = 1 A$	V <sub>GS</sub> = 10 V		5.1		1
Threshold Gate Charge	Q <sub>G(TH)</sub>				0.3		1
Gate-to-Source Charge	Q <sub>GS</sub>	Vne = 48	V, I <sub>D</sub> = 1 A		0.8		1
Gate-to-Drain Charge	$Q_{GD}$	V <sub>GS</sub> =	= 10 V		1.5		1
Plateau Voltage	$V_{GP}$				3.1		V
Gate Resistance	$R_{G}$				8		Ω
SWITCHING CHARACTERISTICS (No	ote 6)			•	-	•	
Turn-On Delay Time	t <sub>d(on)</sub>				5		ns
Rise Time	t <sub>r</sub>	Vpe = 30 V.	Voc = 10 V		7		1
Turn-Off Delay Time	t <sub>d(off)</sub>	$I_D = 1 A, I$	$V_{GS} = 10 \text{ V},$ $R_G = 10 \Omega$		13		1
Fall Time	t <sub>f</sub>				2		1
DRAIN-SOURCE DIODE CHARACTE					•	•	•
Forward Diode Voltage	$V_{SD}$	V <sub>GS</sub> = 0 V,	T <sub>J</sub> = 25°C		0.8	1.2	V
-		I <sub>S</sub> = 1 A	T <sub>J</sub> = 125°C		0.6		1
Reverse Recovery Time	t <sub>rr</sub>		1		12		ns
Charge Time	t <sub>a</sub>	ا م ا A ا ا	$V_{GS} = 0 V_{dc}$		9		1
Discharge Time	t <sub>b</sub>	$dl_S/dt =$	100 A/μs		3		1
Reverse Recovery Stored Charge	Q <sub>RR</sub>				6		nC

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. 5. Pulse Test: Pulse Width  $\leq$  300  $\mu$ s, Duty Cycle  $\leq$  2%.

<sup>6.</sup> Switching characteristics are independent of operating junction temperatures.

## **TYPICAL CHARACTERISTICS**

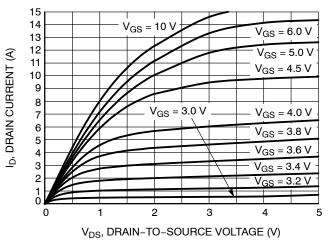


Figure 1. On-Region Characteristics

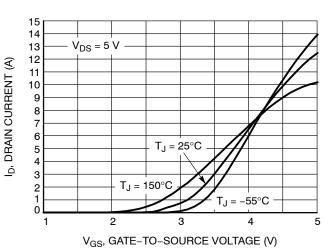


Figure 2. Transfer Characteristics

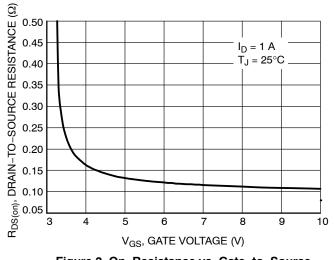


Figure 3. On-Resistance vs. Gate-to-Source Voltage

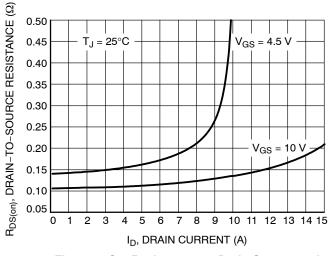
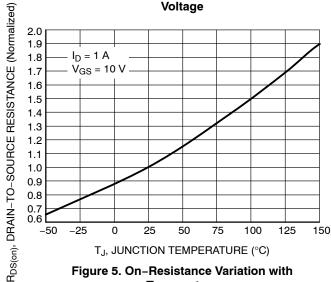


Figure 4. On-Resistance vs. Drain Current and **Gate Voltage** 



**Temperature** 

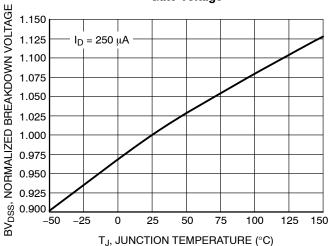


Figure 6. Breakdown Voltage Variation with **Temperature** 

## TYPICAL CHARACTERISTICS

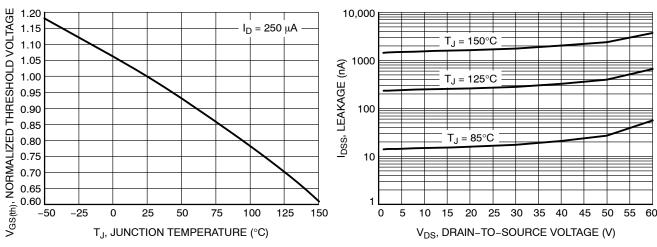


Figure 7. Threshold Voltage Variation with Temperature

Figure 8. Drain-to-Source Leakage Current vs. Voltage

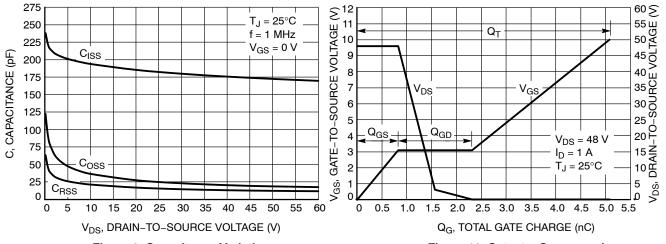


Figure 9. Capacitance Variation

Figure 10. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge

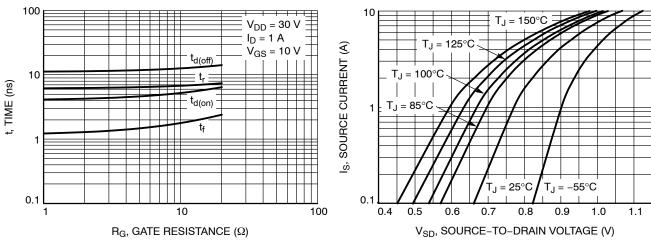


Figure 11. Resistive Switching Time Variation vs. Gate Resistance

Figure 12. Diode Forward Voltage vs. Current

# **TYPICAL CHARACTERISTICS**

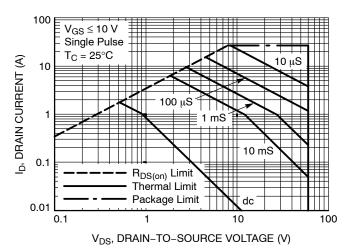


Figure 13. Maximum Rated Forward Biased Safe Operating Area

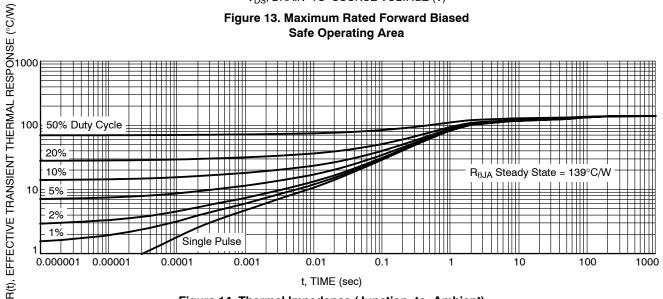


Figure 14. Thermal Impedance (Junction-to-Ambient)



SOT-23 (TO-236) CASE 318-08 **ISSUE AS** 

**DATE 30 JAN 2018** 

# SCALE 4:1 D - 3X b

**TOP VIEW** 







#### **RECOMMENDED SOLDERING FOOTPRINT**



DIMENSIONS: MILLIMETERS

#### NOTES:

- 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,

PROT	RUSIONS, OR GATE BURRS.	
		T

	M	MILLIMETERS			INCHES	
DIM	MIN	NOM	MAX	MIN	NOM	MAX
Α	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
С	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
е	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°

# **GENERIC MARKING DIAGRAM\***



XXX = Specific Device Code

= 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
OT (1 F O			

SOT-23 (TO-236)

STYLE 9:	STYLE 10:	STYLE 11:	STYLE 12:	STYLE 13:	STYLE 14:
PIN 1. ANODE	PIN 1. DRAIN	PIN 1. ANODE	PIN 1. CATHODE	PIN 1. SOURCE	PIN 1. CATHODE
<ol><li>ANODE</li></ol>	<ol><li>SOURCE</li></ol>	<ol><li>CATHODE</li></ol>	<ol><li>CATHODE</li></ol>	2. DRAIN	2. GATE
<ol><li>CATHODE</li></ol>	3. GATE	<ol><li>CATHODE-ANODE</li></ol>	<ol><li>ANODE</li></ol>	3. GATE	<ol><li>ANODE</li></ol>

STYLE 15:	STYLE 16:	STYLE 17:	STYLE 18:	STYLE 19:	STYLE 20:
PIN 1. GATE	PIN 1. ANODE	PIN 1. NO CONNECTION	PIN 1. NO CONNECTION	PIN 1. CATHODE	PIN 1. CATHODE
<ol><li>CATHODE</li></ol>	<ol><li>CATHODE</li></ol>	<ol><li>ANODE</li></ol>	<ol><li>CATHODE</li></ol>	<ol><li>ANODE</li></ol>	<ol><li>ANODE</li></ol>
<ol><li>ANODE</li></ol>	<ol><li>CATHODE</li></ol>	<ol><li>CATHODE</li></ol>	<ol><li>ANODE</li></ol>	<ol><li>CATHODE-ANOD</li></ol>	E 3. GATE

STYLE 21:	STYLE 22:	STYLE 23:	STYLE 24:	STYLE 25:	STYLE 26:
PIN 1. GATE	PIN 1. RETURN	PIN 1. ANODE	PIN 1. GATE	PIN 1. ANODE	PIN 1. CATHODE
<ol><li>SOURCE</li></ol>	<ol><li>OUTPUT</li></ol>	2. ANODE	2. DRAIN	2. CATHODE	2. ANODE
3 DRAIN	3 INPLIT	3 CATHODE	3. SOURCE	3. GATE	<ol><li>NO CONNECTION</li></ol>

STYLE 27: PIN 1. CATHODE 2. CATHODE 3. CATHODE	STYLE 28: PIN 1. ANODE 2. ANODE 3. ANODE	
DOCUMENT N	UMBER: 98ASB42226B	Electronic versions are uncontrolled except when accessed directly from the Document Repository.  Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red

ON Semiconductor and (III) are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor 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. ON Semiconductor does not convey any license under its patent rights nor the rights of others.

**DESCRIPTION:** 

PAGE 1 OF 1

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 <a href="www.onsemi.com/site/pdf/Patent-Marking.pdf">www.onsemi.com/site/pdf/Patent-Marking.pdf</a>. 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 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 EDA 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 pu

#### **PUBLICATION ORDERING INFORMATION**

LITERATURE FULFILLMENT: Email Requests to: orderlit@onsemi.com

onsemi Website: www.onsemi.com

TECHNICAL SUPPORT North American Technical Support: Voice Mail: 1 800-282-9855 Toll Free USA/Canada Phone: 011 421 33 790 2910

Europe, Middle East and Africa Technical Support:

Phone: 00421 33 790 2910

For additional information, please contact your local Sales Representative