

MOSFET – Power, P-Channel, SOT-23

-20 V, -400 mA

NTR0202PL, NVTR0202PL

Features

- Low $R_{DS(on)}$ Provides Higher Efficiency and Extends Battery Life
 $R_{DS(on)} = 0.80 \, \Omega$, $V_{GS} = -10 \, V$
 $R_{DS(on)} = 1.10 \, \Omega$, $V_{GS} = -4.5 \, V$
- Miniature SOT-23 Surface Mount Package Saves Board Space
- NVT 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

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

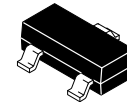
MAXIMUM RATINGS ($T_J = 25^\circ C$ unless otherwise noted)

Symbol	Rating	Value	Unit
V_{DSS}	Drain-to-Source Voltage	-20	V
V_{GS}	Gate-to-Source Voltage – Continuous	± 20	V
I_D I_{DM}	Continuous Drain Current @ $T_A = 25^\circ C$ Pulsed Drain Current ($t_p \leq 10 \, \mu s$)	-0.4 -1.0	A
P_D	Total Power Dissipation @ $T_A = 25^\circ C$ (Note 1)	225	mW
T_J, T_{stg}	Operating and Storage Temperature Range	-55 to 150	$^\circ C$
$R_{\theta JA}$	Thermal Resistance – Junction-to-Ambient	556	$^\circ C/W$
I_S	Source Current (Body Diode)	0.4	A
T_L	Maximum Lead Temperature for Soldering Purposes, 1/8" from case for 10 s	260	$^\circ C$

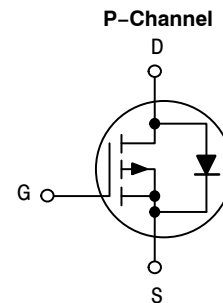
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

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

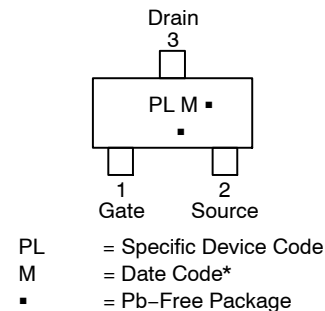
$V_{(BR)DSS}$	$R_{DS(on)}$ Typ	I_D MAX
-20 V	550 m Ω @ -10 V	-400 mA



**SOT-23
CASE 318
STYLE 21**



MARKING DIAGRAM & PIN ASSIGNMENT



(Note: Microdot may be in either location)

*For additional marking information, refer to

Application Note [AND8002/D](#).

See detailed ordering, marking and shipping information in the package dimensions section on page 4 of this data sheet.

NOTE: Some of the devices on this data sheet have been **DISCONTINUED**. Please refer to the table on page 4.

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

Symbol	Characteristic	Min	Typ	Max	Unit
OFF CHARACTERISTICS					
$V_{(BR)DSS}$	Drain-to-Source Breakdown Voltage ($V_{GS} = 0\text{ V}$, $I_D = -10\text{ }\mu\text{A}$) (Positive Temperature Coefficient)	-20	33		$\frac{\text{V}}{\text{mV}/^\circ\text{C}}$
I_{DSS}	Zero Gate Voltage Drain Current ($V_{DS} = -20\text{ V}$, $V_{GS} = 0\text{ V}$, $T_J = 25^\circ\text{C}$) ($V_{DS} = -20\text{ V}$, $V_{GS} = 0\text{ V}$, $T_J = 150^\circ\text{C}$)			-1.0 -10	μA
I_{GSS}	Gate-Body Leakage Current ($V_{GS} = \pm 20\text{ V}$, $V_{DS} = 0\text{ V}$)			± 100	nA

ON CHARACTERISTICS (Note 2)

$V_{GS(th)}$	Gate Threshold Voltage ($V_{DS} = V_{GS}$, $I_D = -250\text{ }\mu\text{A}$) (Negative Temperature Coefficient)	-1.1	-1.9 3.0	-2.3	$\frac{\text{V}}{\text{mV}/^\circ\text{C}}$
$R_{DS(on)}$	Static Drain-to-Source On-Resistance ($V_{GS} = -10\text{ V}$, $I_D = -200\text{ mA}$) ($V_{GS} = -4.5\text{ V}$, $I_D = -50\text{ mA}$)		0.55 0.80	0.80 1.10	Ω
g_{fs}	Forward Transconductance ($V_{DS} = -10\text{ V}$, $I_D = -200\text{ mA}$)		0.5		Mhos

DYNAMIC CHARACTERISTICS

C_{iss}	Input Capacitance	$(V_{DS} = -5.0\text{ V}$, $V_{GS} = 0\text{ V}$, $F = 1.0\text{ MHz}$)	70		pF
C_{oss}	Output Capacitance		74		
C_{rss}	Reverse Transfer Capacitance		26		

SWITCHING CHARACTERISTICS (Note 3)

$t_{d(on)}$	Turn-On Delay Time	$(V_{DD} = -15\text{ V}$, $I_D = -200\text{ mA}$, $V_{GS} = -10\text{ V}$, $R_G = 6.0\text{ }\Omega$)	3.0		ns
t_r	Rise Time		6.0		
$t_{d(off)}$	Turn-Off Delay Time		18		
t_f	Fall Time		4		
Q_{TOT}	Total Gate Charge	$(V_{DS} = -15\text{ V}$, $I_D = -200\text{ mA}$, $V_{GS} = -10\text{ V})$	2.18		nC
Q_{GS}	Gate-Source Charge		0.41		
Q_{GD}	Gate-Drain Charge		0.40		

BODY-DRAIN DIODE CHARACTERISTICS (Note 2)

V_{SD}	Diode Forward Voltage (Note 2) ($I_S = -400\text{ mA}$, $V_{GS} = 0\text{ V}$) ($I_S = -400\text{ mA}$, $V_{GS} = 0\text{ V}$, $T_J = 150^\circ\text{C}$)		-0.8 -0.65	-1.0	V
t_{rr}	Reverse Recovery Time	$(I_S = -1.0\text{ A}$, $V_{GS} = 0\text{ V}$, $dI_S/dt = 100\text{ A}/\mu\text{s}$)	11.8		ns
t_a			9		
t_b			3		
Q_{RR}	Reverse Recovery Stored Charge	$(I_S = -1.0\text{ A}$, $V_{GS} = 0\text{ V}$, $dI_S/dt = 100\text{ A}/\mu\text{s}$)	0.007		μC

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.

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

3. Switching characteristics are independent of operating junction temperature.

TYPICAL CHARACTERISTICS

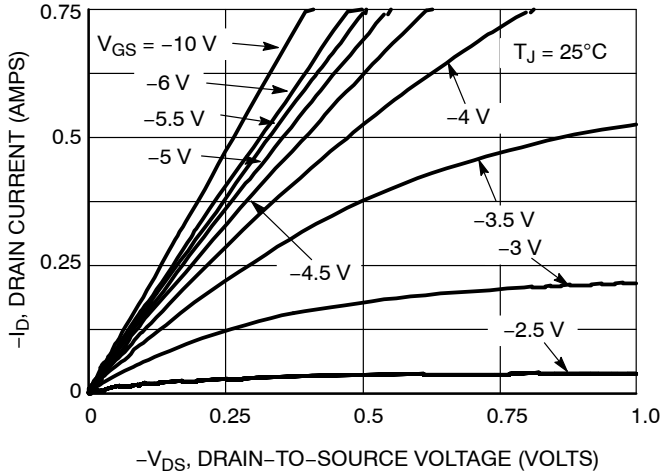


Figure 1. On-Region Characteristics

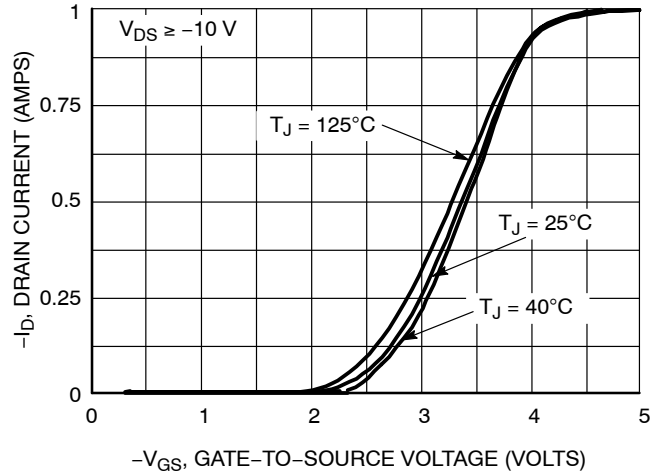


Figure 2. Transfer Characteristics

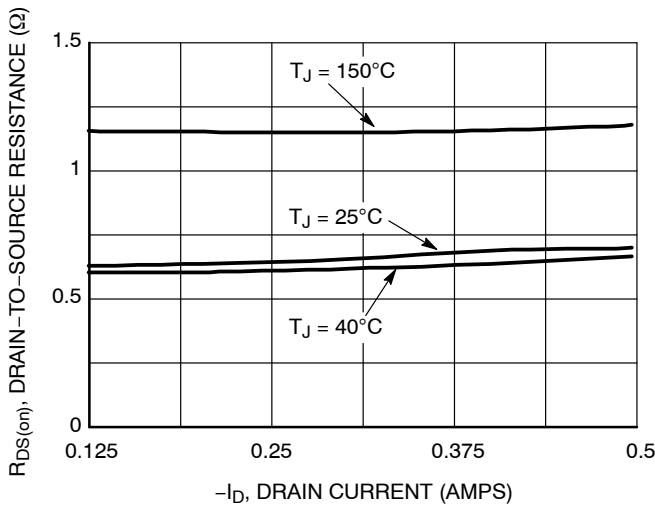


Figure 3. On-Resistance versus Drain Current

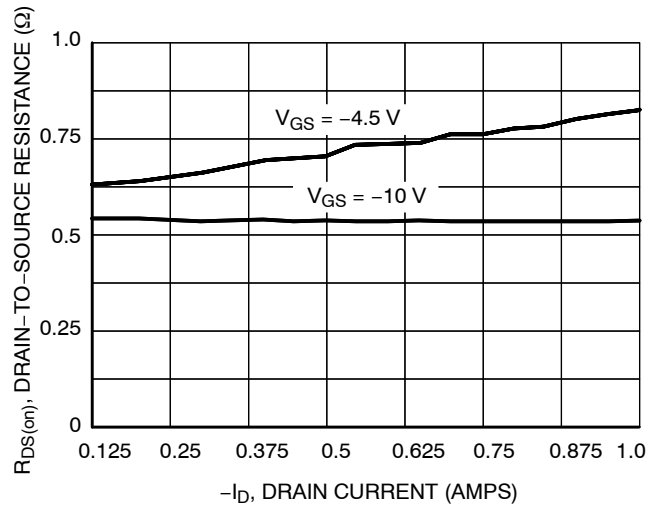


Figure 4. On-Resistance versus Drain Current and Gate Voltage

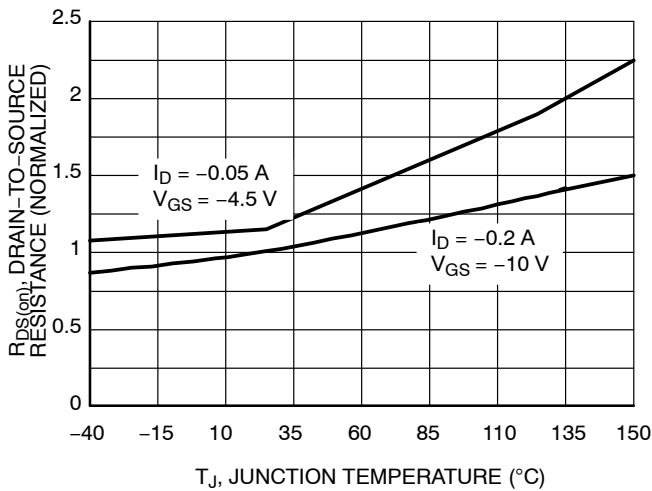


Figure 5. On-Resistance Variation with Temperature

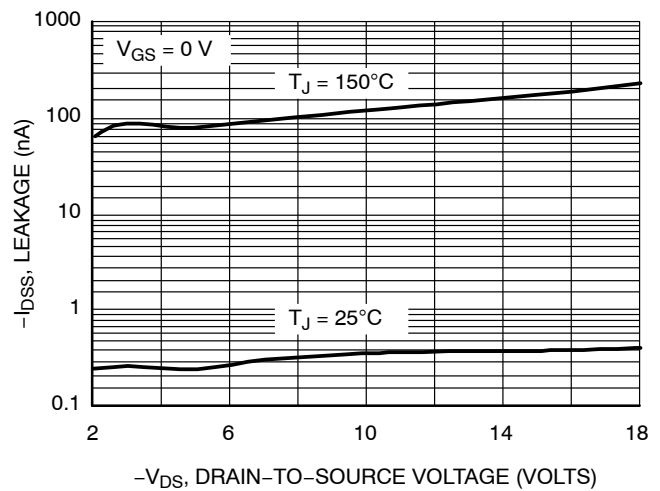


Figure 6. Drain-to-Source Leakage Current versus Voltage

TYPICAL CHARACTERISTICS (continued)

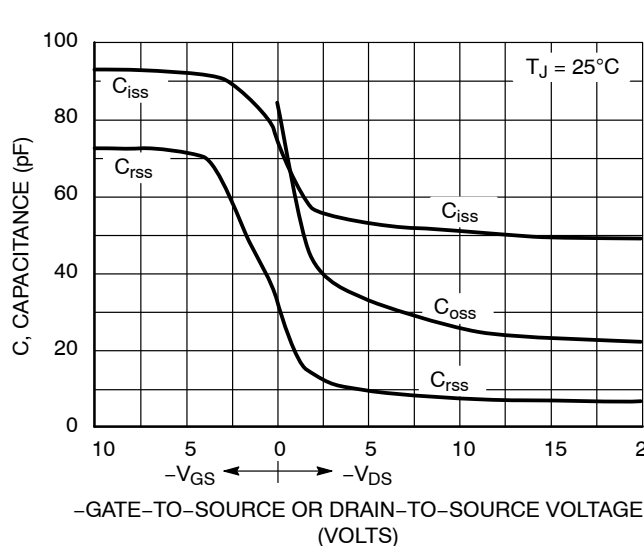


Figure 7. Capacitance Variation

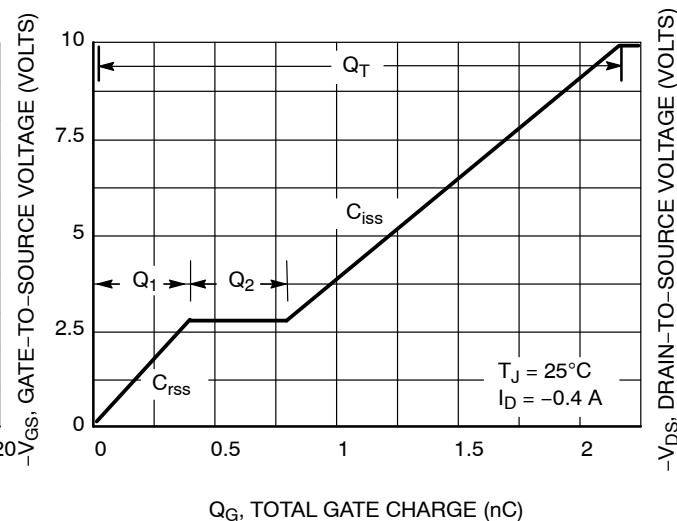


Figure 8. Gate-to-Source and Drain-to-Source Voltage versus Total Charge

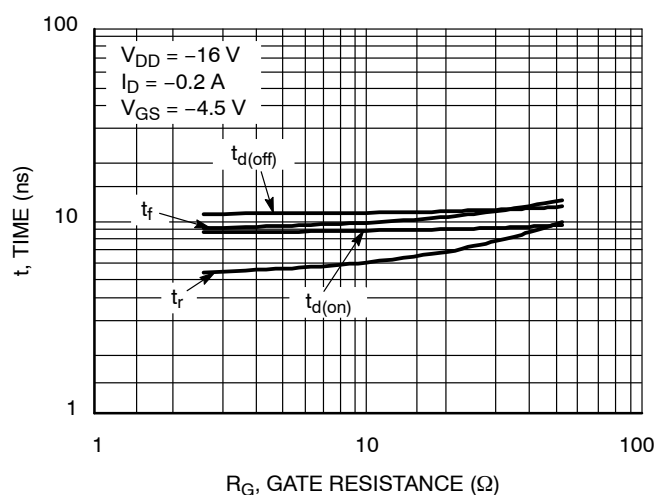


Figure 9. Resistive Switching Time Variation versus Gate Resistance

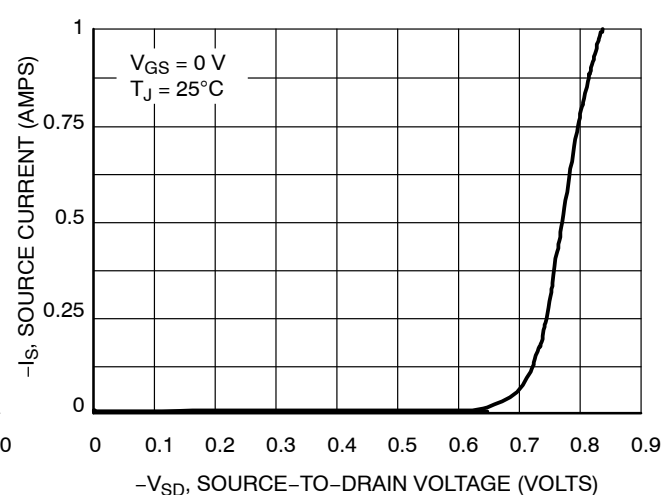


Figure 10. Diode Forward Voltage versus Current

DEVICE ORDERING INFORMATION

Device	Package	Shipping [†]
NTR0202PLT1G	SOT-23 (Pb-Free)	3,000 / Tape & Reel
NVTR0202PLT1G	SOT-23 (Pb-Free)	3,000 / Tape & Reel

DISCONTINUED (Note 4)

NTR0202PLT3G	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 Specifications Brochure, [BRD8011/D](#).

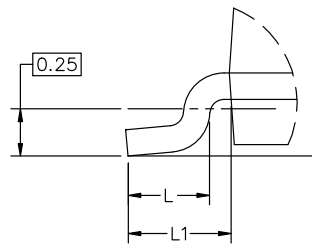
4. **DISCONTINUED:** This device is not recommended for new design. Please contact your onsemi representative for information. The most current information on this device may be available on www.onsemi.com.



SCALE 4:1

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

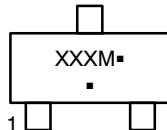
DATE 14 AUG 2024



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.


RECOMMENDED MOUNTING FOOTPRINT

* 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