

NTR1P02, NVR1P02

MOSFET – Power, P-Channel, SOT-23 -20 V, -1 A

Features

- Ultra Low On-Resistance Provides Higher Efficiency and Extends Battery Life
 $R_{DS(on)} = 0.180 \Omega$, $V_{GS} = -10 \text{ V}$
 $R_{DS(on)} = 0.280 \Omega$, $V_{GS} = -4.5 \text{ V}$
- Power Management in Portable and Battery-Powered Products
- Miniature SOT-23 Surface Mount Package Saves Board Space
- Mounting Information for SOT-23 Package Provided
- 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

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

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

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

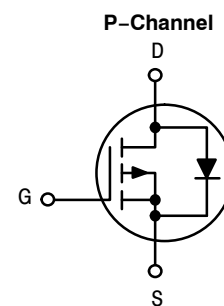
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.



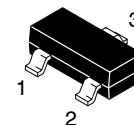
ON Semiconductor®

www.onsemi.com

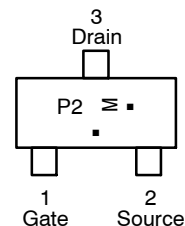
$V_{(BR)DS}$	$R_{DS(on)}$ TYP	I_D MAX
-20 V	148 m Ω @ -10 V	-1.0 A



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†
NTR1P02T1G	SOT-23 (Pb-Free)	3000 / Tape & Reel
NTR1P02T3G	SOT-23 (Pb-Free)	10000 / Tape & Reel
NVR1P02T1G	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.

NTR1P02, NVR1P02

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

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.

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

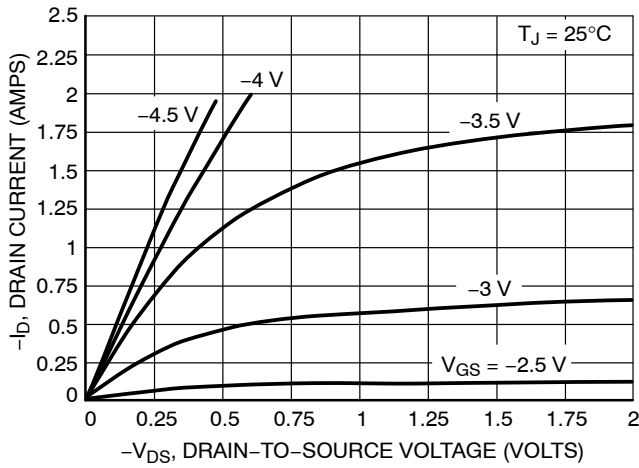


Figure 1. On-Region Characteristics

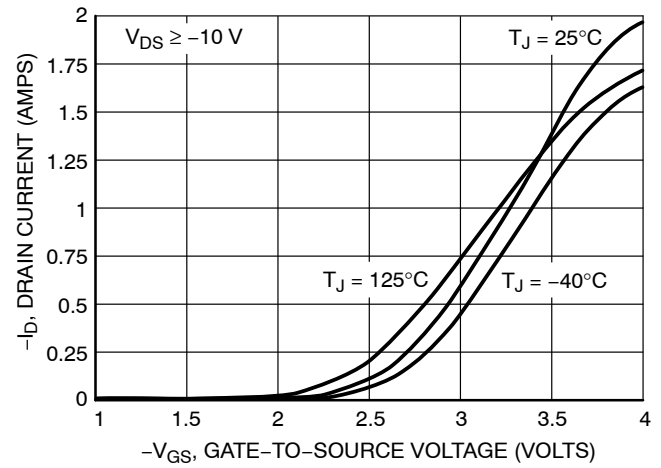


Figure 2. Transfer Characteristics

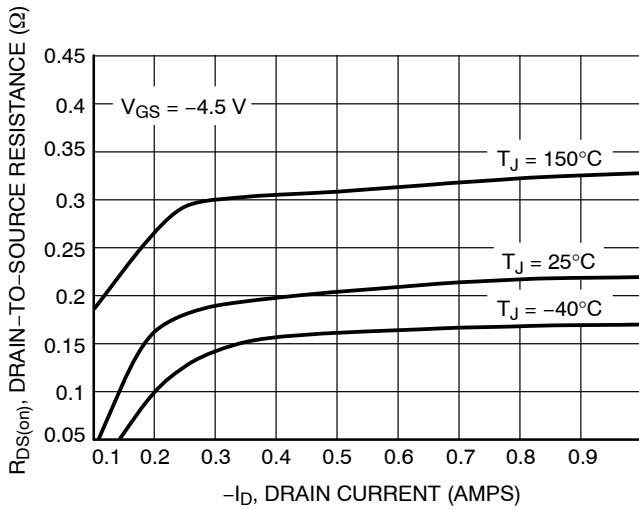


Figure 3. On-Resistance versus Drain Current and Temperature

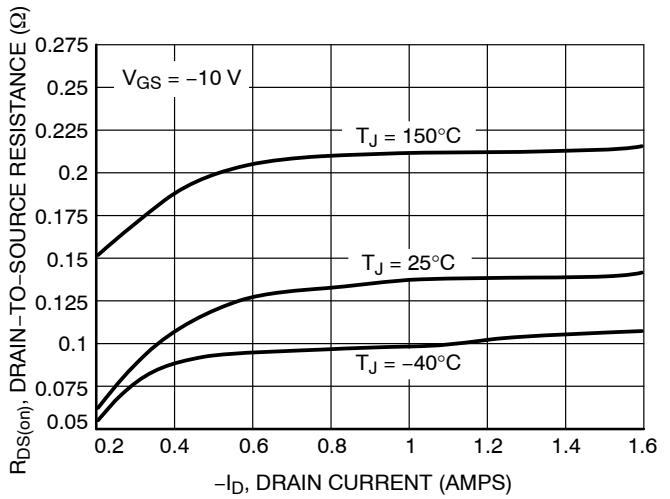


Figure 4. On-Resistance versus Drain Current and Temperature

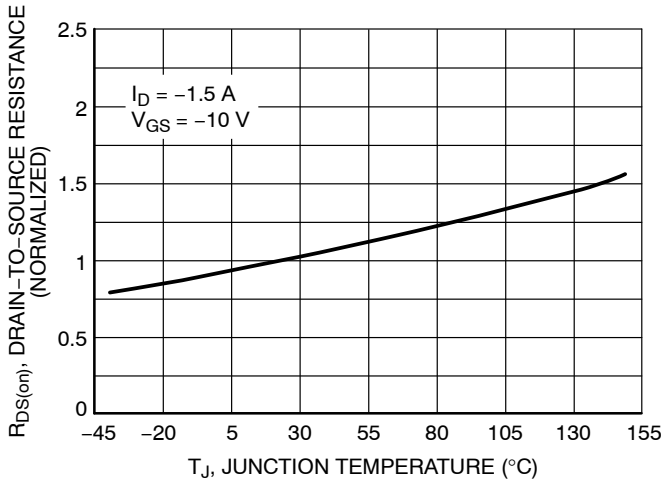


Figure 5. On-Resistance Variation with Temperature

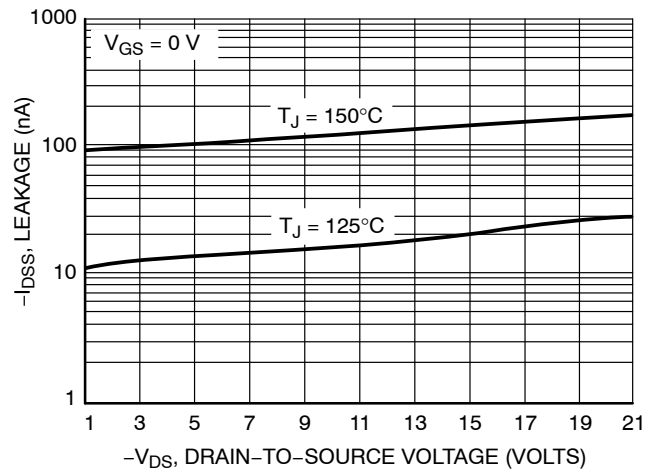
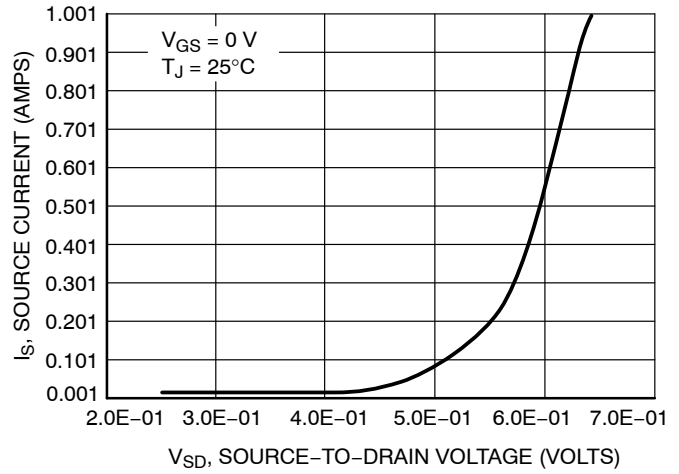
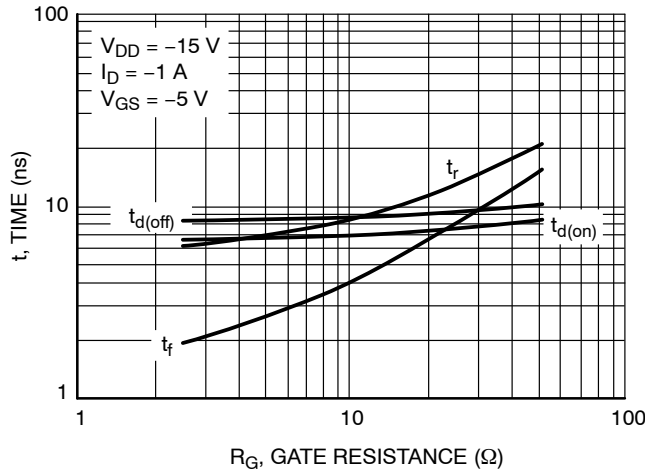
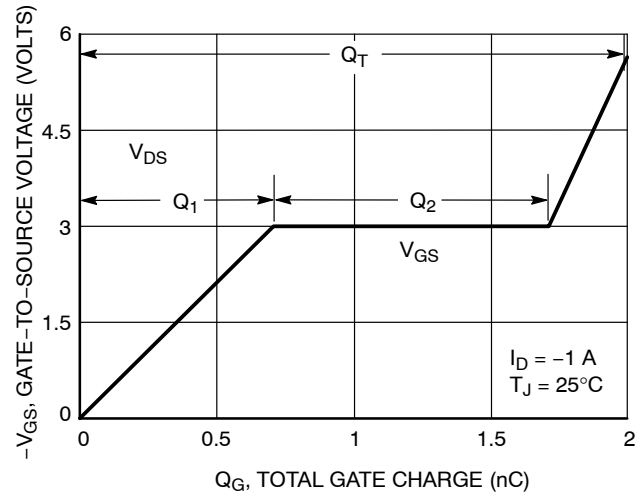
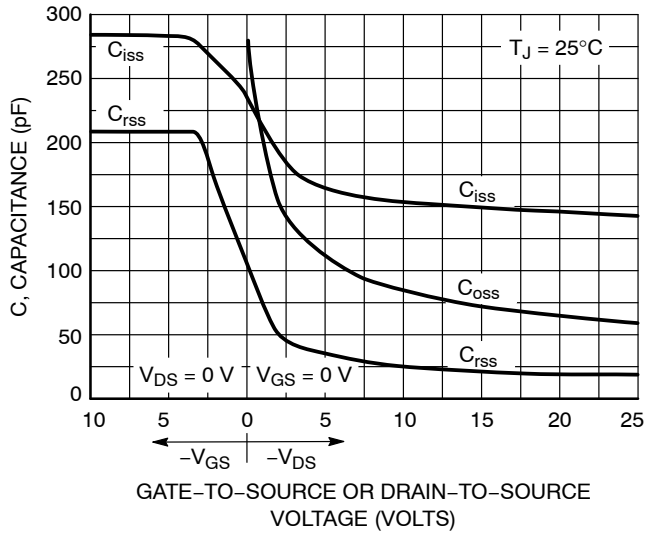
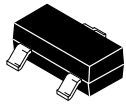


Figure 6. Drain-to-Source Leakage Current versus Voltage

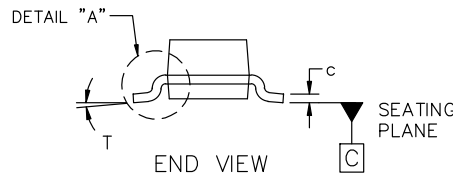
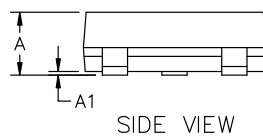
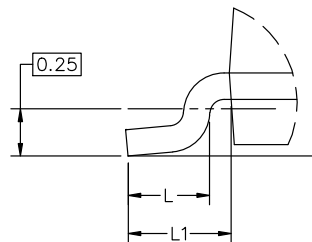
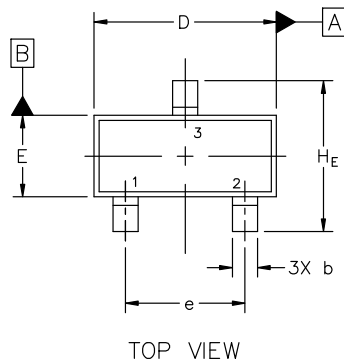




SCALE 4:1

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

DATE 14 AUG 2024

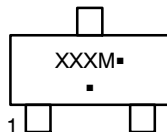


MILLIMETERS			
DIM	MIN	NOM	MAX
A	0.89	1.00	1.11
A1	0.01	0.06	0.10
b	0.37	0.44	0.50
c	0.08	0.14	0.20
D	2.80	2.90	3.04
E	1.20	1.30	1.40
e	1.78	1.90	2.04
L	0.30	0.43	0.55
L1	0.35	0.54	0.69
HE	2.10	2.40	2.64
T	0°	---	10°

NOTES:

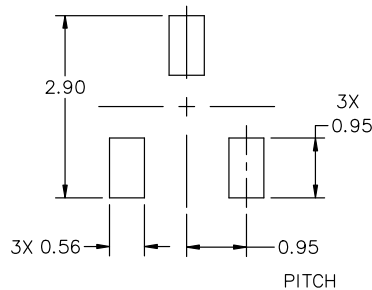
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2018.
2. CONTROLLING DIMENSIONS: MILLIMETERS.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF THE BASE MATERIAL.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

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