

MOSFET – N-Channel, Shielded Gate, POWER TRENCH®

60 V, 2.6 A, 116 mΩ

FDN86501LZ

General Description

This N-Channel MOSFET is produced using onsemi's advanced POWER TRENCH process that incorporates Shielded Gate technology. This process has been optimized for $r_{DS(on)}$, switching performance and ruggedness.

Features

- Shielded Gate MOSFET Technology
- Max $r_{DS(on)}$ = 116 mΩ at V_{GS} = 10 V, I_D = 2.6 A
- Max $r_{DS(on)}$ = 173 mΩ at V_{GS} = 4.5 V, I_D = 2.1 A
- High Performance Trench Technology for Extremely Low $r_{DS(on)}$
- High Power and Current Handling Capability in a Widely Used Surface Mount Package
- Fast Switching Speed
- 100% UIL Tested
- This Device is Pb-Free, Halide Free and is RoHS Compliant

Applications

- Primary DC-DC Switch
- Load Switch

MOSFET MAXIMUM RATINGS (T_A = 25°C, unless otherwise noted)

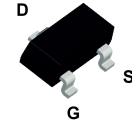
Symbol	Parameter	Ratings	Unit
V_{DS}	Drain to Source Voltage	60	V
V_{GS}	Gate to Source Voltage	±20	V
I_D	Continuous (Note 1a)	2.6	A
	Pulsed (Note 4)	24	
E_{AS}	Single Pulse Avalanche Energy (Note 3)	6	mJ
P_D	Power Dissipation	(Note 1a)	W
		(Note 1b)	
T_J, T_{STG}	Operating and Storage Junction Temperature Range	-55 to 150	°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.

THERMAL CHARACTERISTICS (T_A = 25°C, unless otherwise noted)

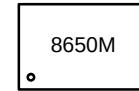
Symbol	Parameter	Ratings	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case (Note 1)	75	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient (Note 1a)	80	°C/W

V_{DS}	$r_{DS(on)}$ MAX	I_D MAX
60 V	116 mΩ @ 10 V	2.6 A
	173 mΩ @ 4.5 V	



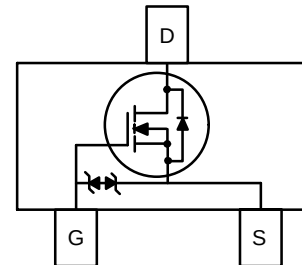
SOT-23/SUPERSOT™-23, 3 LEAD, 1.4x2.9
CASE 527AG

MARKING DIAGRAM



8650 = Specific Device Code
M = Date Code

PIN ASSIGNMENT



ORDERING INFORMATION

See detailed ordering and shipping information on page 5 of this data sheet.

FDN86501LZ

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
OFF CHARACTERISTICS						
BV _{DSS}	Drain to Source Breakdown Voltage	I _D = 250 μA, V _{GS} = 0 V	60	–	–	V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	I _D = 250 μA, referenced to 25°C	–	68	–	mV/°C
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} = 48 V, V _{GS} = 0 V	–	–	1	μA
I _{GSS}	Gate to Source Leakage Current	V _{GS} = ±20 V, V _{DS} = 0 V	–	–	±10	μA

ON CHARACTERISTICS (Note 2)

V _{GS(th)}	Gate to Source Threshold Voltage	V _{GS} = V _{DS} , I _D = 250 μA	1.0	1.9	2.4	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	I _D = 250 μA, referenced to 25°C	–	–5	–	mV/°C
r _{DS(on)}	Static Drain to Source On Resistance	V _{GS} = 10 V, I _D = 2.6 A	–	89	116	mΩ
		V _{GS} = 4.5 V, I _D = 2.1 A	–	121	173	
		V _{GS} = 10 V, I _D = 2.6 A, T _J = 125°C	–	152	198	
g _{FS}	Forward Transconductance	V _{DS} = 10 V, I _D = 2.6 A	–	8	–	S

DYNAMIC CHARACTERISTICS

C _{iss}	Input Capacitance	V _{DS} = 30 V, V _{GS} = 0 V, f = 1 MHz	–	236	335	pF
C _{oss}	Output Capacitance		–	77	110	pF
C _{rss}	Reverse Transfer Capacitance		–	4.9	10	pF
R _g	Gate Resistance		0.1	0.8	2.0	Ω

SWITCHING CHARACTERISTICS (Note 2)

t _{d(on)}	Turn-On Delay Time	V _{DD} = 30 V, I _D = 2.6 A, V _{GS} = 10 V, R _{GEN} = 6 Ω	–	4.4	10	ns
t _r	Rise Time		–	1.2	10	ns
t _{d(off)}	Turn-Off Delay Time		–	9.6	20	ns
t _f	Fall Time		–	1.2	10	ns
Q _g	Total Gate Charge	V _{GS} = 0 V to 10 V V _{DD} = 30 V, I _D = 2.6 A	–	3.8	5.4	nC
Q _g	Total Gate Charge	V _{GS} = 0 V to 4.5 V V _{DD} = 30 V, I _D = 2.6 A	–	1.9	2.7	nC
Q _{gs}	Gate to Source Gate Charge	V _{DD} = 30 V, I _D = 2.6 A	–	0.7	–	nC
Q _{gd}	Gate to Drain "Miller" Charge		–	0.6	–	nC

DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS

V _{SD}	Source to Drain Diode Forward Voltage	V _{GS} = 0 V, I _S = 2.6 A (Note 2)	–	0.9	1.3	V
t _{rr}	Reverse Recovery Time	I _F = 2.6 A, di/dt = 100 A/μs	–	31	50	ns
Q _{rr}	Reverse Recovery Charge		–	19	31	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.

1. R_{θJA} is the sum of the junction-to-case and case-to-ambient thermal resistance where the case thermal reference is defined as the solder mounting surface of the drain pins. R_{θJC} is guaranteed by design while R_{θCA} is determined by the user's board design.



a. 80°C/W when mounted on a 1 in² pad of 2 oz copper.



b. 180°C/W when mounted on a minimum pad.

2. Pulse Test: Pulse Width < 300 μs, Duty Cycle < 2.0%.
3. E_{AS} of 6 mJ is based on starting T_J = 25°C, L = 3 mH, I_{AS} = 2 A, V_{DD} = 60 V, V_{GS} = 10 V. 100% test at L = 0.1 mH, I_{AS} = 9 A.
4. Pulsed I_d please refer to Figure 11 SOA graph for more details.

TYPICAL CHARACTERISTICS

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

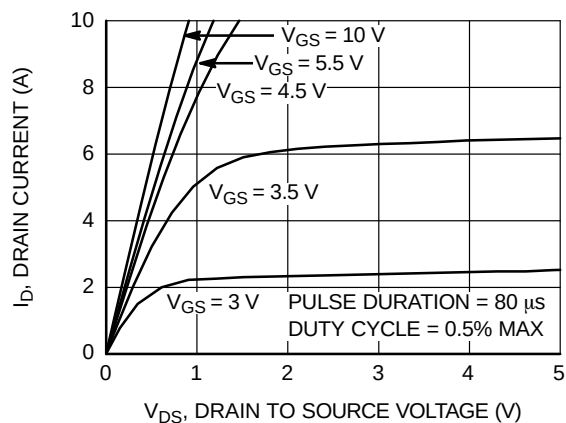


Figure 1. On-Region Characteristics

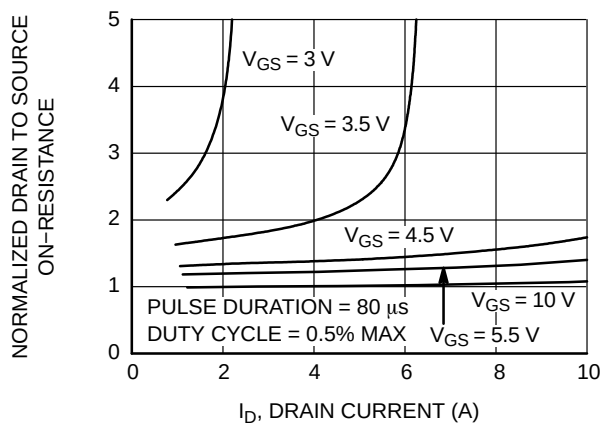


Figure 2. Normalized On-Resistance vs. Drain Current and Gate Voltage

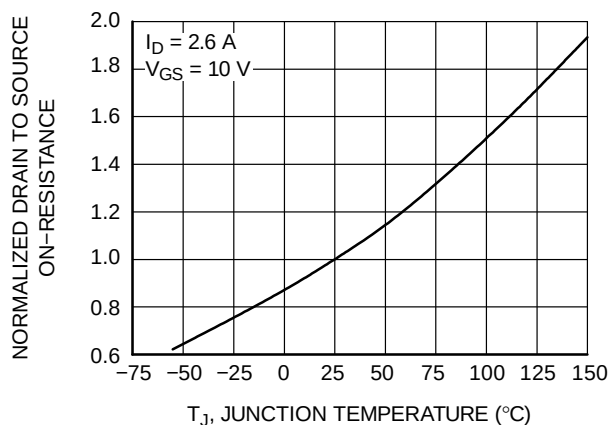


Figure 3. Normalized On-Resistance vs. Junction Temperature

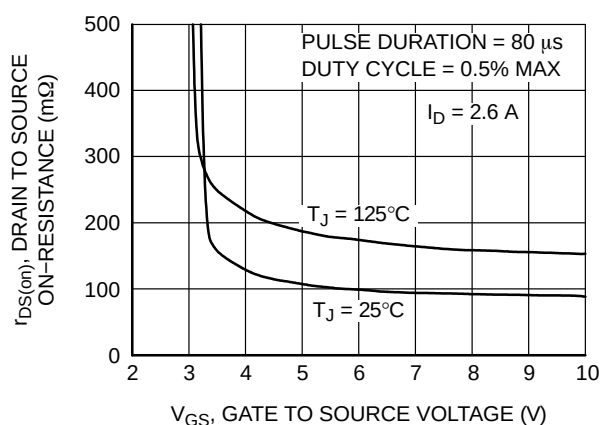


Figure 4. On-Resistance vs. Gate to Source Voltage

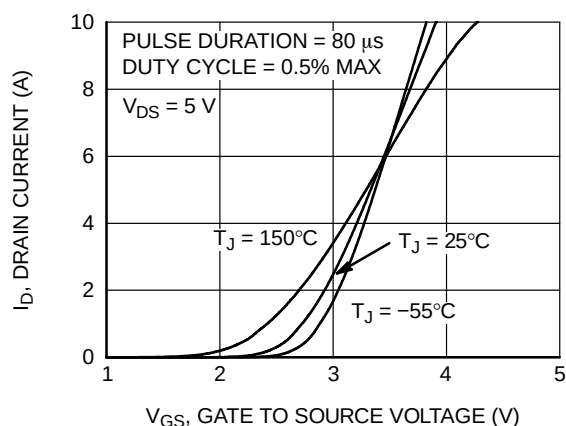


Figure 5. Transfer Characteristics

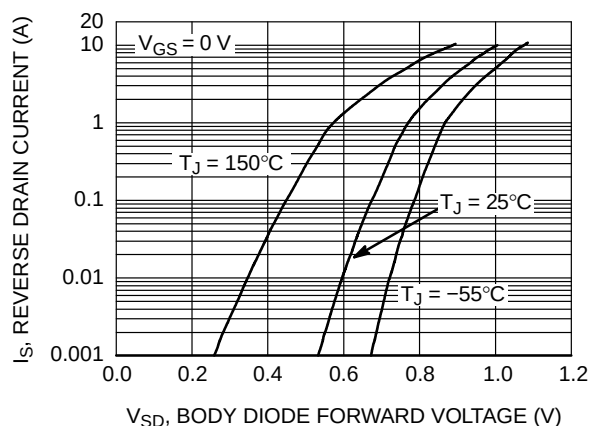


Figure 6. Source to Drain Diode Forward Voltage vs. Source Current

TYPICAL CHARACTERISTICS

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

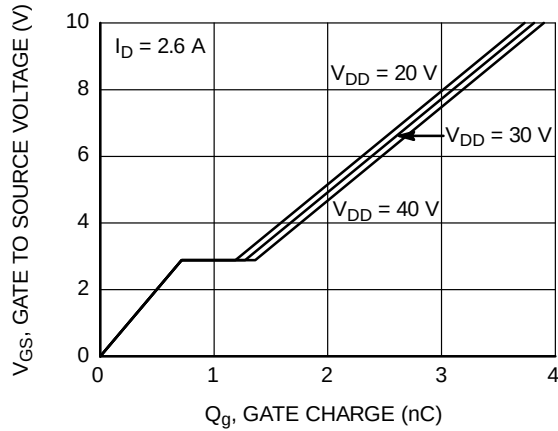


Figure 7. Gate Charge Characteristics

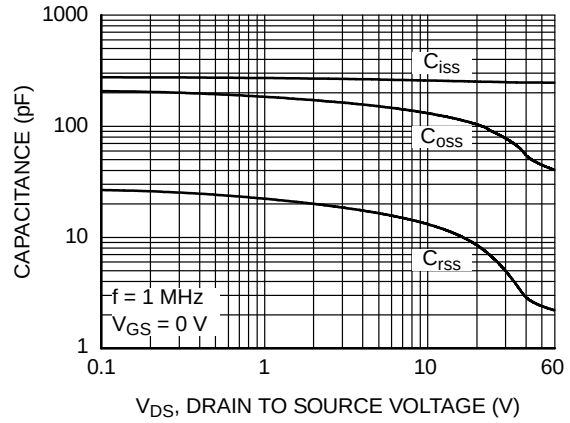


Figure 8. Capacitance vs. Drain to Source Voltage

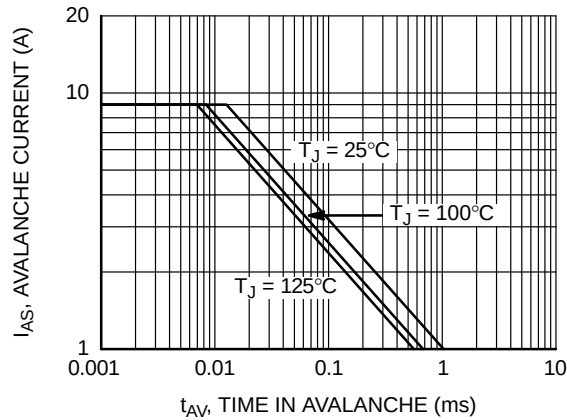


Figure 9. Unclamped Inductive Switching Capability

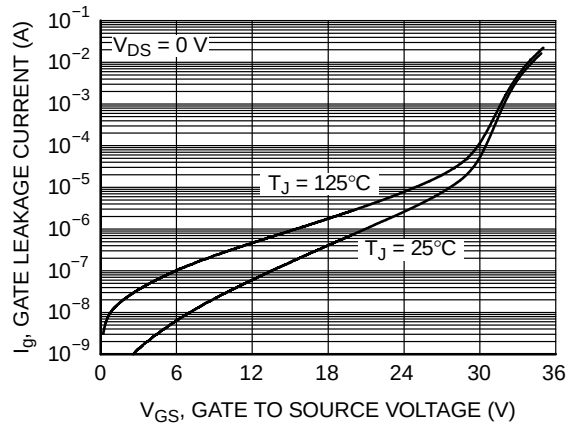


Figure 10. Gate Leakage Current vs. Gate to Source Voltage

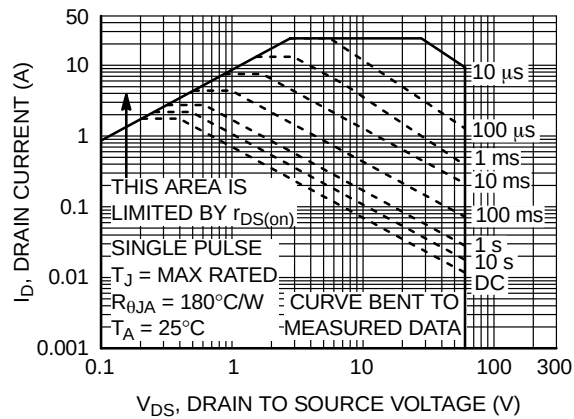


Figure 11. Forward Bias Safe Operating Area

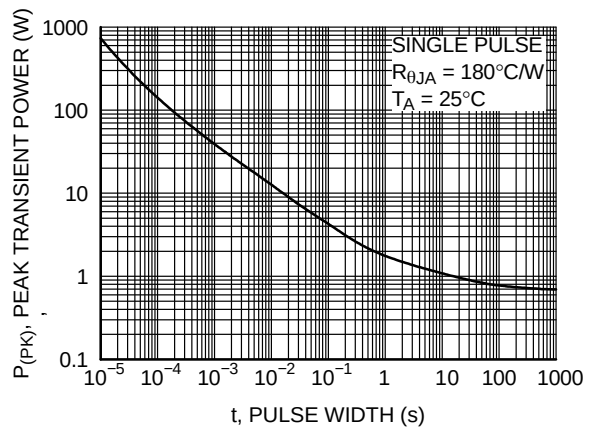


Figure 12. Single Pulse Maximum Power Dissipation

FDN86501LZ

TYPICAL CHARACTERISTICS

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

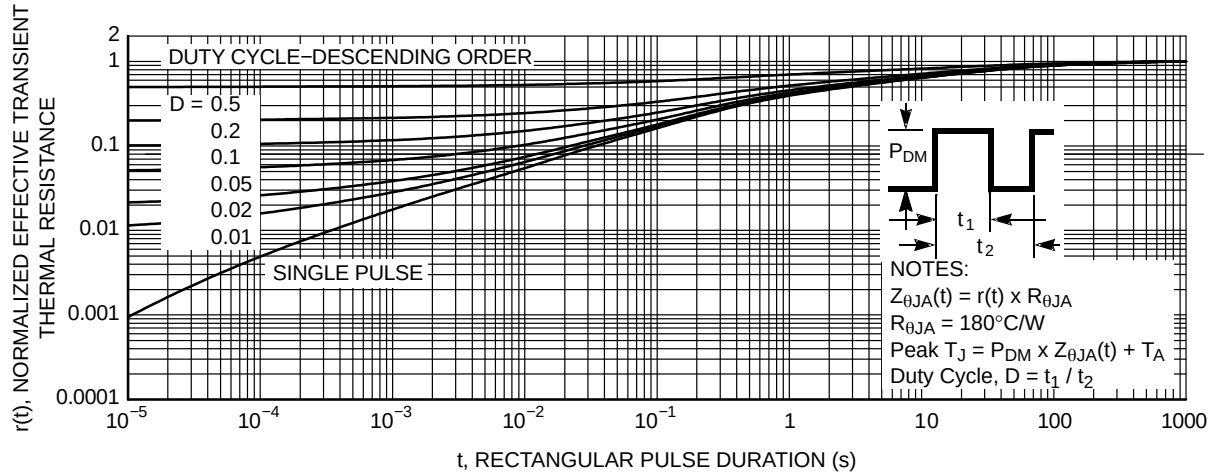


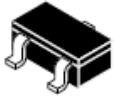
Figure 13. Junction-to-Ambient Transient Thermal Response Curve

PACKAGE MARKING AND ORDERING INFORMATION

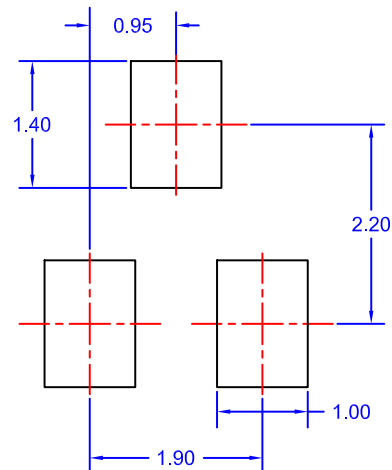
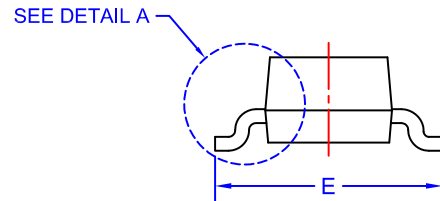
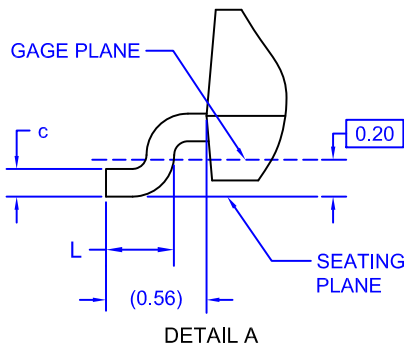
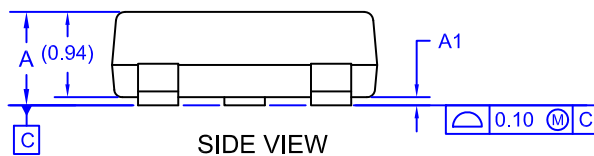
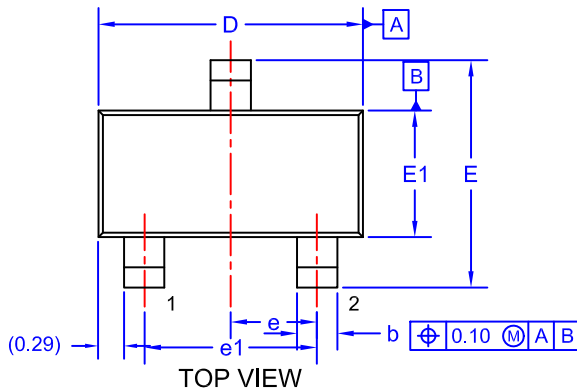
Device	Device Marking	Package	Reel Size	Tape Width	Shipping [†]
FDN86501LZ	8650	SOT-23/SUPERSOT-23, 3 LEAD, 1.4x2.9 (Pb-Free, Halide Free)	7"	8 mm	3000 / Tape & Reel

[†]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.

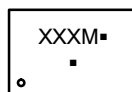
POWERTRENCH is registered trademark of Semiconductor Components Industries, LLC (SCILLC) or its subsidiaries in the United States and/or other countries. SUPERSOT is trademark of Semiconductor Components Industries, LLC dba "onsemi" or its affiliates and/or subsidiaries in the United States and/or other countries.


SOT-23/SUPERSOT™ –23, 3 LEAD, 1.4x2.9
CASE 527AG
ISSUE A

DATE 09 DEC 2019



*FOR ADDITIONAL INFORMATION ON OUR Pb-FREE STRATEGY AND SOLDERING DETAILS, PLEASE DOWNLOAD THE ON SEMICONDUCTOR SOLDERING AND MOUNTING TECHNIQUES REFERENCE MANUAL, SOLDERRM/D.

GENERIC MARKING DIAGRAM*


XXX = Specific Device Code
M = Month Code
▪ = Pb-Free Package

(Note: Microdot may be in either location)

*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.

DOCUMENT NUMBER:	98AON34319E	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/SUPERSOT-23, 3 LEAD, 1.4X2.9	PAGE 1 OF 1

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