5.5V ESD Protection Diodes

Micro−packaged Diodes for ESD Protection

ESDM1051

The ESDM1051 Series is designed to protect voltage sensitive components from ESD. Excellent clamping capability, low leakage, and fast response time provide best in class protection on designs that are exposed to ESD. Because of its small size, it is suited for use in smartphone, smart−watch, or many other portable / wearable applications where board space comes at a premium.

Features

- Low Capacitance (22 pF Typ, I/O to GND)
- Small Body Outline Dimensions − 01005 Size: 0.445 x 0.240 mm
- Protection for the Following IEC Standards:
  IEC 61000−4−2 (Level 4)
- Low ESD Clamping Voltage
- These Devices are Pb−Free, Halogen Free/BFR Free and are RoHS Compliant

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

Rating	Symbol	Value	Unit
Operating Junction Temperature Range	T_J	−55 to +125	°C
Storage Temperature Range	T_{stg}	−55 to +150	°C
Lead Solder Temperature − Maximum (10 Seconds)	T_L	260	°C
ESDM1051: IEC 61000−4−2 Contact IEC 61000−4−2 Air	ESD	 ±30 ±30	 kV kV

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.

See Application Note AND8308/D for further description of survivability specs.

X4DFN2 (01005)
CASE 718AA

MARKING DIAGRAM

L = Specific Device Code
M = Date Code

PIN CONFIGURATION AND SCHEMATIC

ORDERING INFORMATION

See detailed ordering and shipping information on page 2 of this data sheet.

© Semiconductor Components Industries, LLC, 2016

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise specified)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Reverse Working Voltage	V_{RWM}	I/O Pin to GND			5.5	V
Breakdown Voltage	V_{BR}	I_T = 1 mA, I/O Pin to GND	6.1	6.8	8.2	V
Reverse Leakage Current	I_R	V_{RWM} = 5.5 V, I/O Pin to GND			0.1	μA
Clamping Voltage TLP (Note 1)	V_C	I_{PP} = 8 A } IEC 61000−4−2 Level 2 equivalent (±4 kV Contact, ±8 kV Air)		7.5		V
		I_{PP} = 16 A } IEC 61000−4−2 Level 2 equivalent (±8 kV Contact, ±16 kV Air)		8.4		
Reverse Peak Pulse Current	I_{PP}	IEC61000−4−5 (8x20 μs)	11	13		A
Clamping Voltage	V_C	I_{PP} = 11 A, (8/20 μs pulse)		8.0	8.8	V
Dynamic Resistance	R_{DYN}	100 ns TLP Pulse		0.11		Ω
Junction Capacitance	C_J	V_R = 0 V, f = 1 MHz		22	25	pF

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. ANSI/ESD STM5.5.1 − Electrostatic Discharge Sensitivity Testing using Transmission Line Pulse (TLP) Model.
   TLP conditions: Z_0 = 50 Ω, t_p = 100 ns, t_r = 1 ns, averaging window; t_1 = 70 ns to t_2 = 90 ns.

ORDERING INFORMATION

Device	Package	Shipping†
ESDM1051MX4T5G	X4DFN2 (01005) (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.

Share Feedback
Your Opinion Matters

TYPICAL CHARACTERISTICS

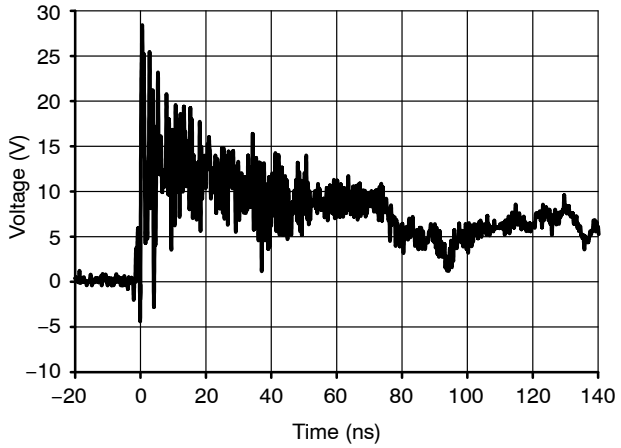


Figure 1. ESD Clamping Voltage Positive 8 kV Contact per IEC61000−4−2

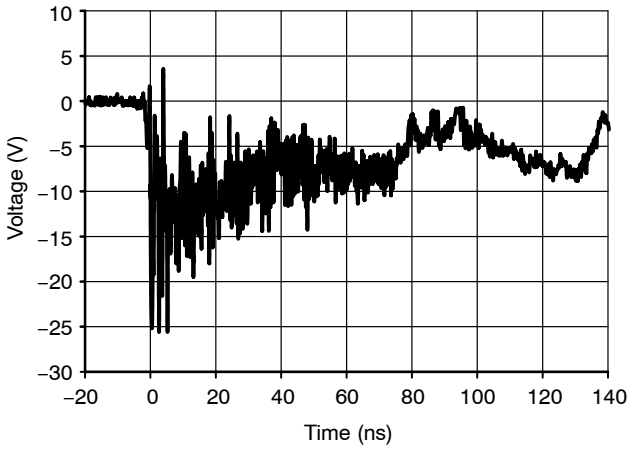


Figure 2. ESD Clamping Voltage Negative 8 kV Contact per IEC61000−4−2

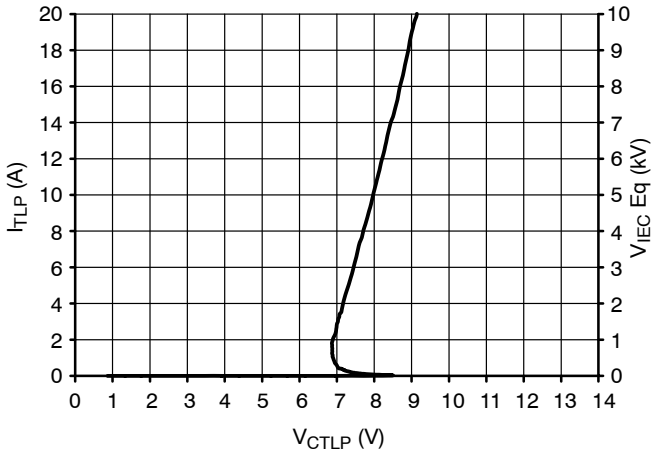


Figure 3. Positive TLP I−V Curve

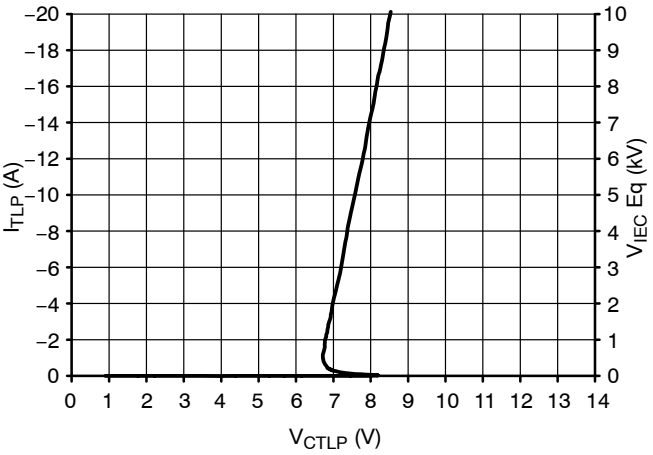


Figure 4. Negative TLP I−V Curve

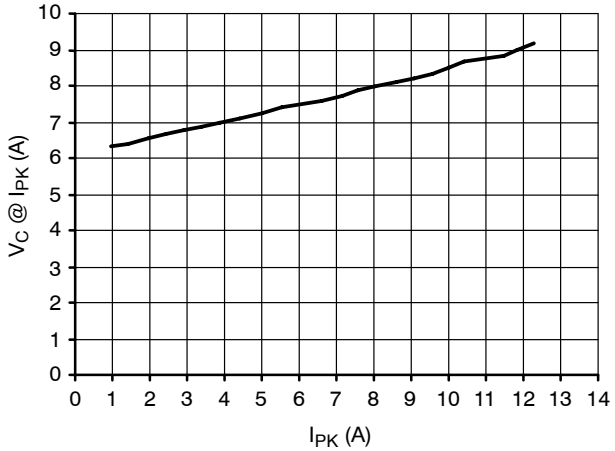


Figure 5. Positive Clamping Voltage vs. Peak Pulse Current (tp = 8/20 μs)

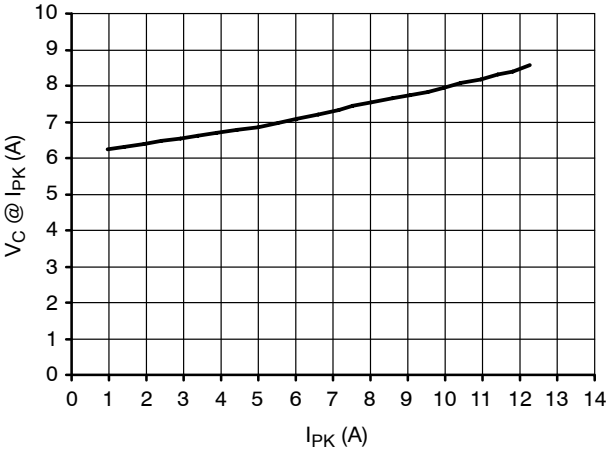


Figure 6. Negative Clamping Voltage vs. Peak Pulse Current (tp = 8/20 μs)

Share Feedback
Your Opinion Matters

TYPICAL CHARACTERISTICS

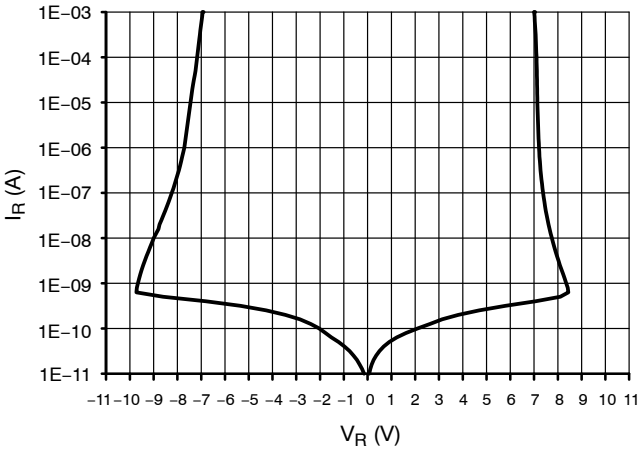


Figure 7. Breakdown Voltage

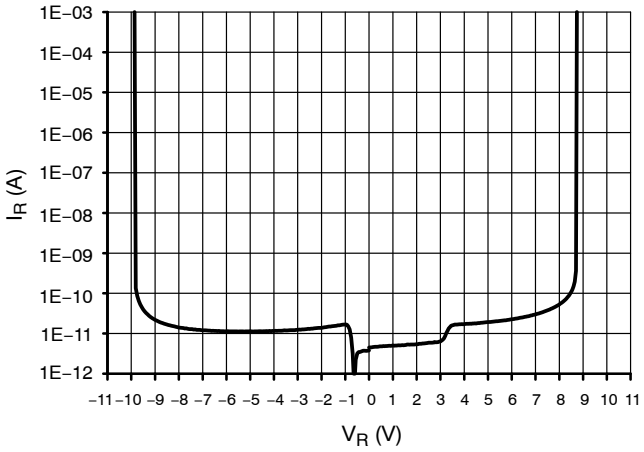


Figure 8. Reverse Leakage Current

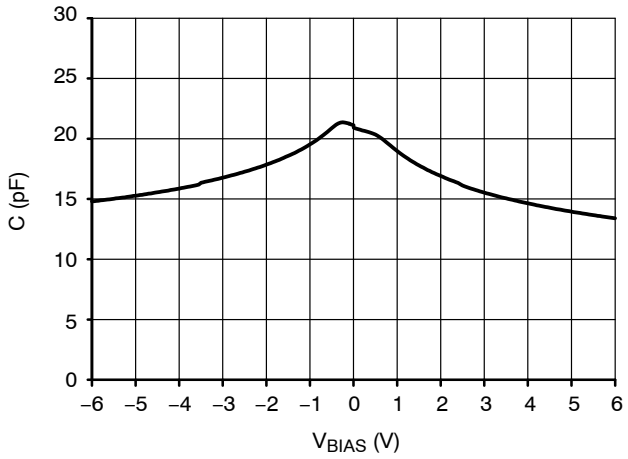


Figure 9. Line Capacitance, f = 1 MHz

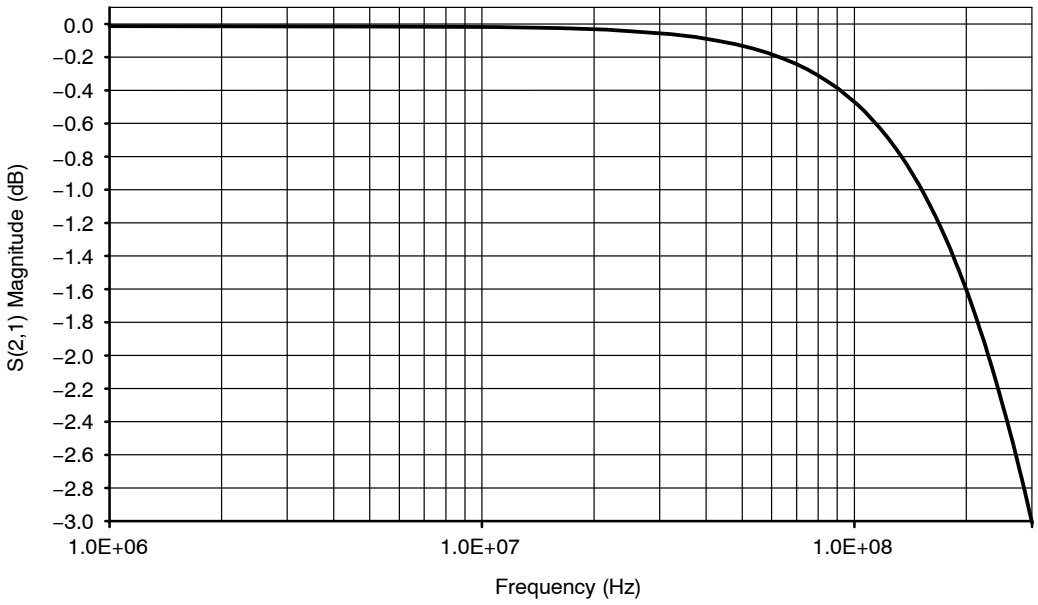


Figure 10. Magnitude vs. Frequency

Share Feedback
Your Opinion Matters

IEC 61000−4−2 Spec.

Level	Test Voltage (kV)	First Peak Current (A)	Current at 30 ns (A)	Current at 60 ns (A)
1	2	7.5	4	2
2	4	15	8	4
3	6	22.5	12	6
4	8	30	16	8

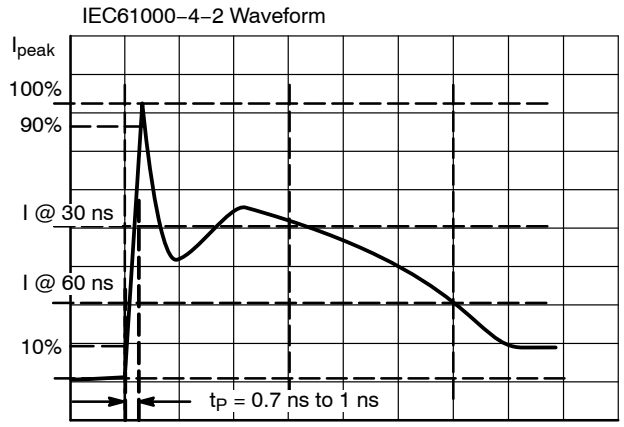


Figure 11. IEC61000−4−2 Spec

Transmission Line Pulse (TLP) Measurement

Transmission Line Pulse (TLP) provides current versus voltage (I−V) curves in which each data point is obtained from a 100 ns long rectangular pulse from a charged transmission line. A simplified schematic of a typical TLP system is shown in Figure 12. TLP I−V curves of ESD protection devices accurately demonstrate the product's ESD capability because the 10s of amps current levels and under 100 ns time scale match those of an ESD event. This is illustrated in Figure 13 where an 8 kV IEC 61000−4−2 current waveform is compared with TLP current pulses at 8 A and 16 A. A TLP I−V curve shows the voltage at which the device turns on as well as how well the device clamps voltage over a range of current levels.

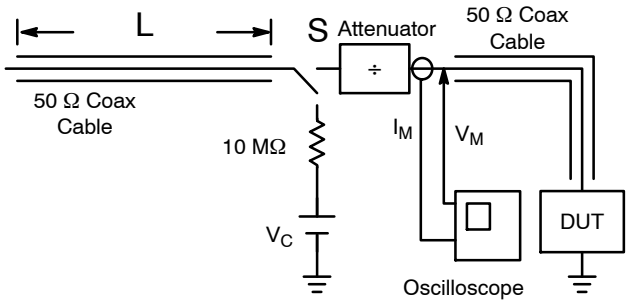


Figure 12. Simplified Schematic of a Typical TLP System

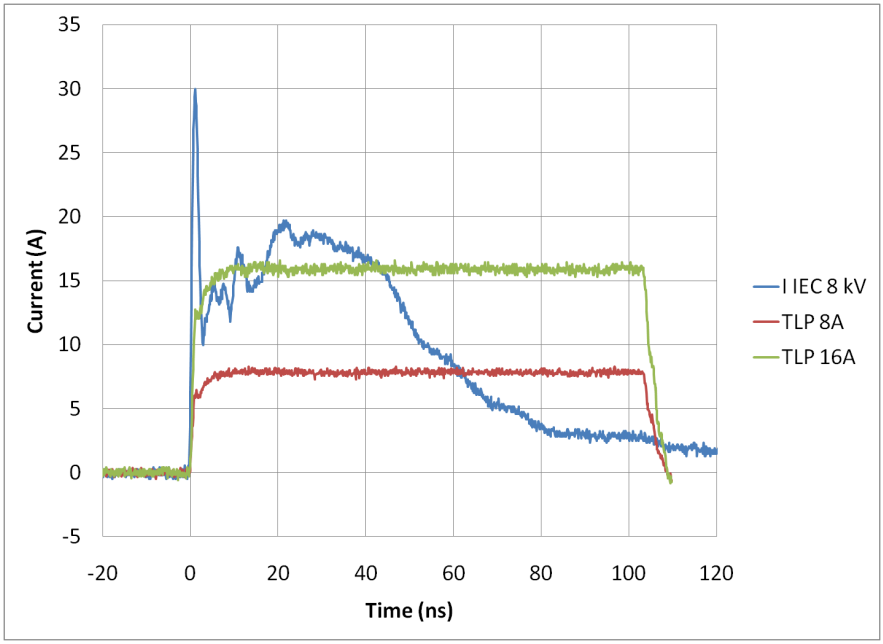
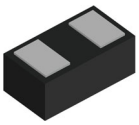


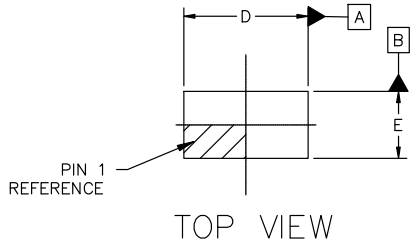
Figure 13. Comparison Between 8 kV IEC 61000−4−2 and 8 A and 16 A TLP Waveforms

Share Feedback
Your Opinion Matters

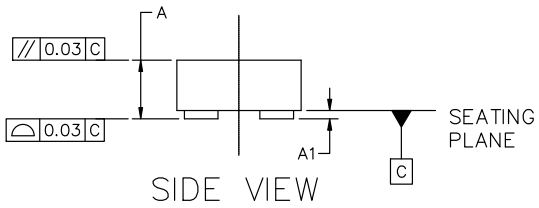


X4DFN2, 0.44x0.24x0.18, 0.27P
CASE 718AA
ISSUE B

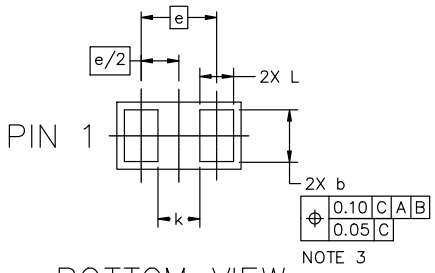
DATE 05 MAR 2025



TOP VIEW



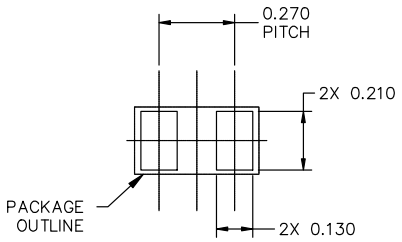
SIDE VIEW



BOTTOM VIEW

NOTES:
1. DIMENSIONING AND TOLERANCING AS PER ASME Y14.5M, 2018.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. EXPOSED COPPER ALLOWED AS SHOWN.

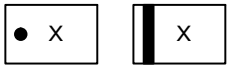
MILLIMETERS			
DIM	MIN	NOM	MAX
A	0.150	0.180	0.210
A1	---	---	0.030
b	0.170	0.185	0.200
D	0.415	0.445	0.475
E	0.210	0.240	0.270
e	0.270 BSC		
k	0.125	---	---
L	0.105	0.120	0.135



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.

GENERIC
MARKING DIAGRAMS*



X = Specific Device Code

*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:	**98AON29067G**	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped “CONTROLLED COPY” in red.	
DESCRIPTION:	**X4DFN2, 0.44x0.24x0.18, 0.27P**		**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.

© Semiconductor Components Industries, LLC, 2017

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