

# SMF05CT1G, SMF12CT1G, SMF15CT1G, SMF24CT1G, SZSMF12CT1G

## ESD Protection Diode Array, 5-Line

This 5-line surge protection array is designed for application requiring transient voltage protection capability. It is intended for use in over-transient voltage and ESD sensitive equipment such as computers, printers, automotive electronics, networking communication and other applications. This device features a monolithic common anode design which protects five independent lines in a single SC-88 package.

### Features

- Protects up to 5-Line in a Single SC-88 Package
- Peak Power Dissipation – 100 W (8 x 20  $\mu$ s Waveform)
- ESD Rating of Class 3B (Exceeding 8 kV) per Human Body Model and Class C (Exceeding 400 V) per Machine Model.
- Compliance with IEC 61000-4-2 (ESD) 15 kV (Air), 8 kV (Contact)
- Flammability Rating of UL 94 V-0
- SZ Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q101 Qualified and PPAP Capable
- Pb-Free Packages are Available\*

### Applications

- Hand-Held Portable Applications
- Networking and Telecom
- Automotive Electronics
- Serial and Parallel Ports
- Notebooks, Desktops, Servers

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

Symbol	Rating	Value	Unit
P <sub>PK 1</sub>	Peak Power Dissipation 8 x 20 $\mu$ s Double Exponential Waveform (Note 1)	100	W
T <sub>J</sub>	Operating Junction Temperature Range	-40 to 125	°C
T <sub>STG</sub>	Storage Temperature Range	-55 to 150	°C
T <sub>L</sub>	Lead Solder Temperature (10 s)	260	°C
ESD	Human Body Model (HBM)	16000	V
	Machine Model (MM)	400	
	IEC 61000-4-2 Air (ESD)	15000	
	IEC 61000-4-2 Contact (ESD)	15000	

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. Nonrepetitive current pulse per Figure 3.

\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.



ON Semiconductor®

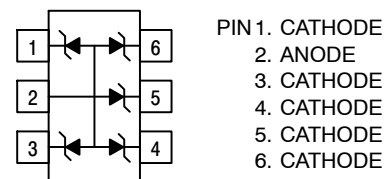
[www.onsemi.com](http://www.onsemi.com)

SC-88 FIVE SURGE  
PROTECTION  
100 W PEAK POWER

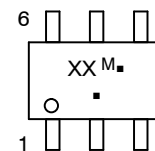


SC-88  
CASE 419B  
STYLE 24

### PIN ASSIGNMENT



### MARKING DIAGRAM



XX = Specific Device Code  
6J = SMF05C  
6K = SZSMF12C/SMF12C  
6L = SMF15C  
6M = SMF24C  
M = Date Code  
■ = Pb-Free Package

### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 3 of this data sheet.

# SMF05CT1G, SMF12CT1G, SMF15CT1G, SMF24CT1G, SZSMF12CT1G

## SMF05CT1G ELECTRICAL CHARACTERISTICS ( $T_J = 25^\circ\text{C}$ unless otherwise specified)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Reverse Working Voltage	$V_{RWM}$	(Note 2)			5.0	V
Breakdown Voltage	$V_{BR}$	$I_T = 1\text{ mA}$ , (Note 3)	6.2		7.2	V
Reverse Leakage Current	$I_R$	$V_{RWM} = 5\text{ V}$		0.07	5.0	$\mu\text{A}$
Clamping Voltage	$V_C$	$I_{PP} = 5\text{ A}$ (8 x 20 $\mu\text{s}$ Waveform)			9.8	V
Clamping Voltage	$V_C$	$I_{PP} = 8\text{ A}$ (8 x 20 $\mu\text{s}$ Waveform)			12.5	V
Maximum Peak Pulse Current	$I_{PP}$	8 x 20 $\mu\text{s}$ Waveform			8.0	A
Capacitance	$C_J$	$V_R = 0\text{ V}$ , $f = 1\text{ MHz}$ (Line to GND)		80	130	pF

## SMF12CT1G ELECTRICAL CHARACTERISTICS ( $T_J = 25^\circ\text{C}$ unless otherwise specified)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Reverse Working Voltage	$V_{RWM}$	(Note 2)			12	V
Breakdown Voltage	$V_{BR}$	$I_T = 1\text{ mA}$ , (Note 3)	13.3		15	V
Reverse Leakage Current	$I_R$	$V_{RWM} = 12\text{ V}$		0.01	0.1	$\mu\text{A}$
Clamping Voltage	$V_C$	$I_{PP} = 3\text{ A}$ (8 x 20 $\mu\text{s}$ Waveform)			21	V
Clamping Voltage	$V_C$	$I_{PP} = 6\text{ A}$ (8 x 20 $\mu\text{s}$ Waveform)			23	V
Maximum Peak Pulse Current	$I_{PP}$	8 x 20 $\mu\text{s}$ Waveform			6.0	A
Capacitance	$C_J$	$V_R = 0\text{ V}$ , $f = 1\text{ MHz}$ (Line to GND)		40	60	pF

## SMF15CT1G ELECTRICAL CHARACTERISTICS ( $T_J = 25^\circ\text{C}$ , unless otherwise specified)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Reverse Working Voltage	$V_{RWM}$	(Note 2)			15	V
Breakdown Voltage	$V_{BR}$	$I_T = 1\text{ mA}$ , (Note 3)	17		19	V
Reverse Leakage Current	$I_R$	$V_{RWM} = 15\text{ V}$		0.01	1.0	$\mu\text{A}$
Clamping Voltage	$V_C$	$I_{PP} = 1\text{ A}$ (8 x 20 $\mu\text{s}$ Waveform)			23	V
Clamping Voltage	$V_C$	$I_{PP} = 5\text{ A}$ (8 x 20 $\mu\text{s}$ Waveform)			29	V
Maximum Peak Pulse Current	$I_{PP}$	8 x 20 $\mu\text{s}$ Waveform			5.0	A
Capacitance	$C_J$	$V_R = 0\text{ V}$ , $f = 1\text{ MHz}$ (Line to GND)		33	45	pF

## SMF24CT1G ELECTRICAL CHARACTERISTICS ( $T_J = 25^\circ\text{C}$ , unless otherwise specified)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Reverse Working Voltage	$V_{RWM}$	(Note 2)			24	V
Breakdown Voltage	$V_{BR}$	$I_T = 1\text{ mA}$ , (Note 3)	26.7		32	V
Reverse Leakage Current	$I_R$	$V_{RWM} = 24\text{ V}$		0.01	1.0	$\mu\text{A}$
Clamping Voltage	$V_C$	$I_{PP} = 1\text{ A}$ (8 x 20 $\mu\text{s}$ Waveform)			40	V
Clamping Voltage	$V_C$	$I_{PP} = 2.5\text{ A}$ (8 x 20 $\mu\text{s}$ Waveform)			44	V
Maximum Peak Pulse Current	$I_{PP}$	8 x 20 $\mu\text{s}$ Waveform			2.5	A
Capacitance	$C_J$	$V_R = 0\text{ V}$ , $f = 1\text{ MHz}$ (Line to GND)		21	25	pF

- Surge protection devices are normally selected according to the working peak reverse voltage ( $V_{RWM}$ ), which should be equal or greater than the DC or continuous peak operating voltage level.
- $V_{BR}$  is measured at pulse test current  $I_T$ .
- Include SZ-prefix devices where applicable.

# SMF05CT1G, SMF12CT1G, SMF15CT1G, SMF24CT1G, SZSMF12CT1G

## TYPICAL PERFORMANCE CURVES

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

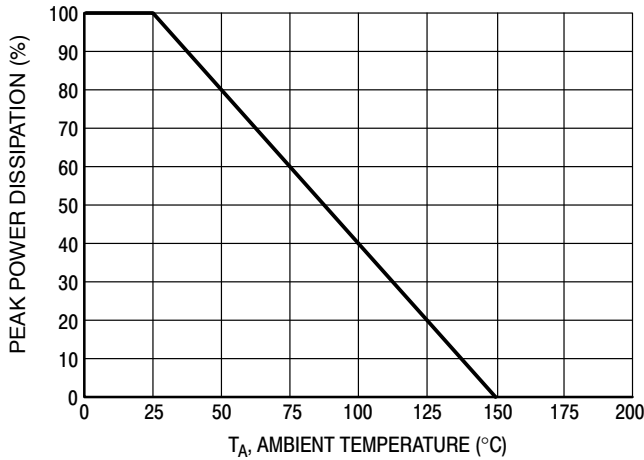


Figure 1. Pulse Derating Curve

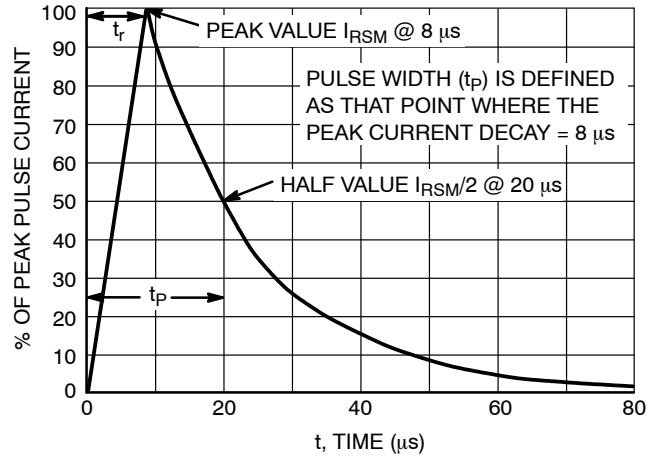


Figure 2.  $8 \times 20 \mu\text{s}$  Pulse Waveform

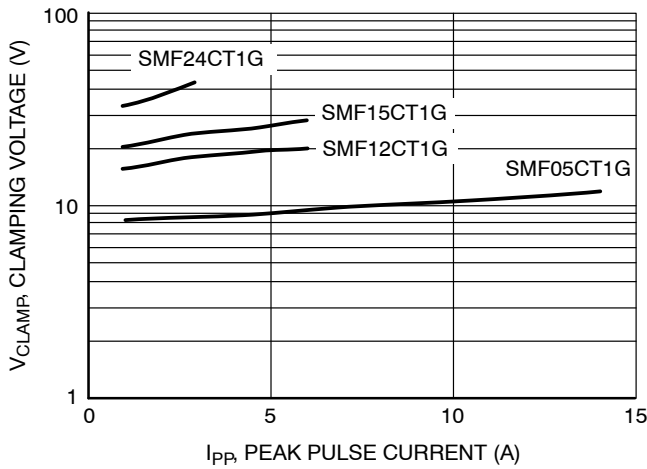


Figure 3. Clamping Voltage vs Peak Pulse Current

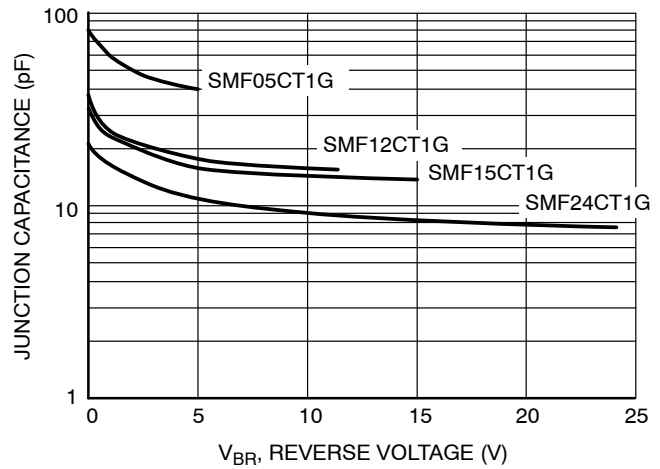


Figure 4. Junction Capacitance vs Reverse Voltage

### ORDERING INFORMATION

Device	Package	Shipping†
SMF05CT1G	SC-88 (Pb-Free)	3,000 / Tape & Reel
SMF05CT2G*	SC-88 (Pb-Free)	3,000 / Tape & Reel
SMF12CT1G	SC-88 (Pb-Free)	3,000 / Tape & Reel
SMF15CT1G	SC-88 (Pb-Free)	3,000 / Tape & Reel
SMF24CT1G	SC-88 (Pb-Free)	3,000 / 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.

\*The "T2" suffix refers to an alternate tape & reel orientation.

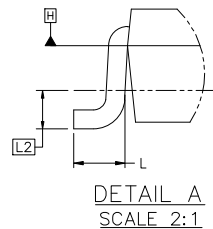
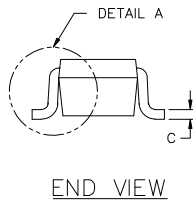
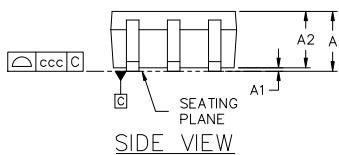
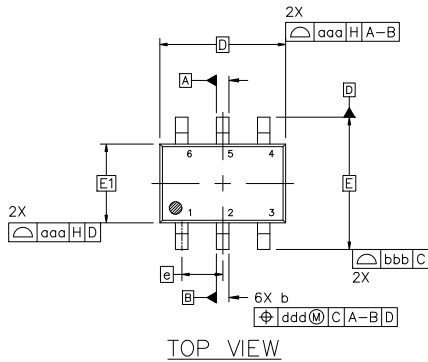


SC-88 2.00x1.25x0.90, 0.65P  
CASE 419B-02  
ISSUE Z

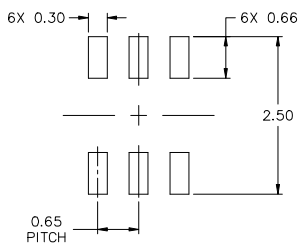
DATE 18 APR 2024

NOTES:

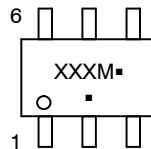
1. DIMENSIONING AND TOLERANCING CONFORM TO ASME Y14.5-2018.
2. ALL DIMENSION ARE IN MILLIMETERS.
3. DIMENSIONS D AND E1 DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.20 PER END.
4. DIMENSIONS D AND E1 AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY AND DATUM H.
5. DATUMS A AND B ARE DETERMINED AT DATUM H.
6. DIMENSIONS b AND c APPLY TO THE FLAT SECTION OF THE LEAD BETWEEN 0.08 AND 0.15 FROM THE TIP.
7. DIMENSION b DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 TOTAL IN EXCESS OF DIMENSION b AT MAXIMUM MATERIAL CONDITION. THE DAMBAR CANNOT BE LOCATED ON THE LOWER RADIUS OF THE FOOT.



DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	---	---	1.10
A1	0.00	---	0.10
A2	0.70	0.90	1.00
b	0.15	0.20	0.25
c	0.08	0.15	0.22
D	2.00 BSC		
E	2.10 BSC		
E1	1.25 BSC		
e	0.65 BSC		
L	0.26	0.36	0.46
L2	0.15 BSC		
aaa	0.15		
bbb	0.30		
ccc	0.10		
ddd	0.10		



GENERIC MARKING DIAGRAM\*



- XXX = Specific Device Code
- M = Date Code\*
- = Pb-Free Package

(Note: Microdot may be in either location)

\*Date Code orientation and/or position may vary depending upon manufacturing 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.

STYLES ON PAGE 2

DOCUMENT NUMBER:	98ASB42985B	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.
DESCRIPTION:	SC-88 2.00x1.25x0.90, 0.65P	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.

**SC-88 2.00x1.25x0.90, 0.65P**  
**CASE 419B-02**  
**ISSUE Z**

DATE 18 APR 2024

<b>STYLE 1:</b> PIN 1. EMITTER 2 2. BASE 2 3. COLLECTOR 1 4. EMITTER 1 5. BASE 1 6. COLLECTOR 2	<b>STYLE 2:</b> CANCELLED	<b>STYLE 3:</b> CANCELLED	<b>STYLE 4:</b> PIN 1. CATHODE 2. CATHODE 3. COLLECTOR 4. EMITTER 5. BASE 6. ANODE	<b>STYLE 5:</b> PIN 1. ANODE 2. ANODE 3. COLLECTOR 4. EMITTER 5. BASE 6. CATHODE	<b>STYLE 6:</b> PIN 1. ANODE 2 2. N/C 3. CATHODE 1 4. ANODE 1 5. N/C 6. CATHODE 2
<b>STYLE 7:</b> PIN 1. SOURCE 2 2. DRAIN 2 3. GATE 1 4. SOURCE 1 5. DRAIN 1 6. GATE 2	<b>STYLE 8:</b> CANCELLED	<b>STYLE 9:</b> PIN 1. EMITTER 2 2. EMITTER 1 3. COLLECTOR 1 4. BASE 1 5. BASE 2 6. COLLECTOR 2	<b>STYLE 10:</b> PIN 1. SOURCE 2 2. SOURCE 1 3. GATE 1 4. DRAIN 1 5. DRAIN 2 6. GATE 2	<b>STYLE 11:</b> PIN 1. CATHODE 2 2. CATHODE 2 3. ANODE 1 4. CATHODE 1 5. CATHODE 1 6. ANODE 2	<b>STYLE 12:</b> PIN 1. ANODE 2 2. ANODE 2 3. CATHODE 1 4. ANODE 1 5. ANODE 1 6. CATHODE 2
<b>STYLE 13:</b> PIN 1. ANODE 2. N/C 3. COLLECTOR 4. EMITTER 5. BASE 6. CATHODE	<b>STYLE 14:</b> PIN 1. VREF 2. GND 3. GND 4. IOUT 5. VEN 6. VCC	<b>STYLE 15:</b> PIN 1. ANODE 1 2. ANODE 2 3. ANODE 3 4. CATHODE 3 5. CATHODE 2 6. CATHODE 1	<b>STYLE 16:</b> PIN 1. BASE 1 2. EMITTER 2 3. COLLECTOR 2 4. BASE 2 5. EMITTER 1 6. COLLECTOR 1	<b>STYLE 17:</b> PIN 1. BASE 1 2. EMITTER 1 3. COLLECTOR 2 4. BASE 2 5. EMITTER 2 6. COLLECTOR 1	<b>STYLE 18:</b> PIN 1. VIN1 2. VCC 3. VOUT2 4. VIN2 5. GND 6. VOUT1
<b>STYLE 19:</b> PIN 1. IOUT 2. GND 3. GND 4. V CC 5. V EN 6. V REF	<b>STYLE 20:</b> PIN 1. COLLECTOR 2. COLLECTOR 3. BASE 4. EMITTER 5. COLLECTOR 6. COLLECTOR	<b>STYLE 21:</b> PIN 1. ANODE 1 2. N/C 3. ANODE 2 4. CATHODE 2 5. N/C 6. CATHODE 1	<b>STYLE 22:</b> PIN 1. D1 (i) 2. GND 3. D2 (i) 4. D2 (c) 5. VBUS 6. D1 (c)	<b>STYLE 23:</b> PIN 1. Vn 2. CH1 3. Vp 4. N/C 5. CH2 6. N/C	<b>STYLE 24:</b> PIN 1. CATHODE 2. ANODE 3. CATHODE 4. CATHODE 5. CATHODE 6. CATHODE
<b>STYLE 25:</b> PIN 1. BASE 1 2. CATHODE 3. COLLECTOR 2 4. BASE 2 5. EMITTER 6. COLLECTOR 1	<b>STYLE 26:</b> PIN 1. SOURCE 1 2. GATE 1 3. DRAIN 2 4. SOURCE 2 5. GATE 2 6. DRAIN 1	<b>STYLE 27:</b> PIN 1. BASE 2 2. BASE 1 3. COLLECTOR 1 4. EMITTER 1 5. EMITTER 2 6. COLLECTOR 2	<b>STYLE 28:</b> PIN 1. DRAIN 2. DRAIN 3. GATE 4. SOURCE 5. DRAIN 6. DRAIN	<b>STYLE 29:</b> PIN 1. ANODE 2. ANODE 3. COLLECTOR 4. EMITTER 5. BASE/ANODE 6. CATHODE	<b>STYLE 30:</b> PIN 1. SOURCE 1 2. DRAIN 2 3. DRAIN 2 4. SOURCE 2 5. GATE 1 6. DRAIN 1

Note: Please refer to datasheet for style callout. If style type is not called out in the datasheet refer to the device datasheet pinout or pin assignment.

<b>DOCUMENT NUMBER:</b>	<b>98ASB42985B</b>	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.
<b>DESCRIPTION:</b>	<b>SC-88 2.00x1.25x0.90, 0.65P</b>	<b>PAGE 2 OF 2</b>

**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](http://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](http://www.onsemi.com/design/resources/technical-documentation)  
onsemi Website: [www.onsemi.com](http://www.onsemi.com)

### ONLINE SUPPORT: [www.onsemi.com/support](http://www.onsemi.com/support)

For additional information, please contact your local Sales Representative at [www.onsemi.com/support/sales](http://www.onsemi.com/support/sales)