

4-Channel Low Capacitance ESD Protection Array

CM1213A-04SO, SZCM1213A-04SO

Product Description

CM1213A-04SO has been designed to provide ESD protection for electronic components or subsystems requiring minimal capacitive loading. This device is ideal for protecting systems with high data and clock rates or for circuits requiring low capacitive loading. Each ESD channel consists of a pair of diodes in series which steer the positive or negative ESD current pulse to either the positive (V_P) or negative (V_N) supply rail. A Zener diode is embedded between V_P and V_N , offering two advantages. First, it protects the V_{CC} rail against ESD strikes, and second, it eliminates the need for a bypass capacitor that would otherwise be needed for absorbing positive ESD strikes to ground. This device will protect against ESD pulses up to 8 kV per the IEC 61000-4-2 standard.

This device is particularly well-suited for protecting systems using high-speed ports such as USB 2.0, IEEE1394 (Firewire[®], iLink[™]), Serial ATA, DVI, HDMI and corresponding ports in removable storage, digital camcorders, DVD-RW drives and other applications where extremely low loading capacitance with ESD protection are required in a small package footprint.

Features

- Four Channels of ESD Protection
- Provides ESD Protection to IEC61000-4-2 Level 4
 - ♦ ± 8 kV Contact Discharge
- Low Channel Input Capacitance of 0.85 pF Typical
- Minimal Capacitance Change with Temperature and Voltage
- Channel Input Capacitance Matching of 0.02 pF Typical is Ideal for Differential Signals
- Zener Diode Protects Supply Rail and Eliminates the Need for External By-pass Capacitors
- Each I/O Pin Can Withstand Over 1000 ESD Strikes*
- SZ 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 RoHS Compliant

Applications

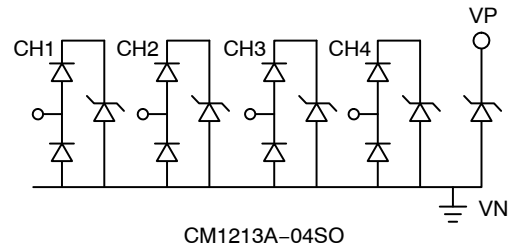
- USB2.0 Ports at 480 Mbps in Desktop PCs, Notebooks and Peripherals
- IEEE1394 Firewire[®] Ports at 400 Mbps/800 Mbps
- DVI Ports, HDMI Ports in Notebooks, Set Top Boxes, Digital TVs, LCD Displays
- Serial ATA Ports in Desktop PCs and Hard Disk Drives
- PCI Express Ports
- General Purpose High-Speed Data Line ESD Protection

*Standard test condition is IEC61000-4-2 level 4 test circuit with each pin subjected to ± 8 kV contact discharge for 1000 pulses. Discharges are timed at 1 second intervals and all 1000 strikes are completed in one continuous test run. The part is then subjected to standard production test to verify that all of the tested parameters are within spec after the 1000 strikes.

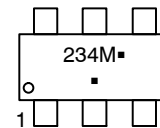


SC-74
SO SUFFIX
CASE 318F

SCHEMATIC



MARKING DIAGRAM



234 = Specific Device Code
M = Date Code
▪ = Pb-Free Package

(Note: Microdot may be in either location)

ORDERING INFORMATION

Device	Package	Shipping [†]
CM1213A-04SO	SC-74 (Pb-Free)	3,000 / Tape & Reel
SZCM1213A-04SO	SC-74 (Pb-Free)	3,000 / Tape & Reel

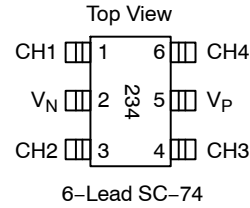
[†]For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specification Brochure, BRD8011/D.

CM1213A-04SO, SZCM1213A-04SO

Table 1. PIN DESCRIPTIONS

Pin	Name	Type	Description
1	CH1	I/O	ESD Channel
2	V _N	GND	Negative Voltage Supply Rail
3	CH2	I/O	ESD Channel
4	CH3	I/O	ESD Channel
5	V _P	PWR	Positive Voltage Supply Rail
6	CH4	I/O	ESD Channel

PACKAGE/PINOUT DIAGRAMS



SPECIFICATIONS

Table 2. ABSOLUTE MAXIMUM RATINGS

Parameter	Rating	Units
Operating Supply Voltage (V _P – V _N)	6.0	V
Junction & Storage Temperature Range	–65 to +150	°C
DC Voltage at any channel input	(V _N – 0.5) to (V _P + 0.5)	V
Package Power Rating	225	mW

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.

Table 3. ELECTRICAL OPERATING CHARACTERISTICS (Note 1)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
V _P	Operating Supply Voltage (V _P –V _N)			3.3	5.5	V
I _P	Operating Supply Current	(V _P –V _N) = 3.3 V			8.0	μA
V _F	Diode Forward Voltage	I _F = 8 mA; T _A = 25°C		0.90		V
I _{LEAK}	Channel Leakage Current	T _A = 25°C; V _P = 5 V, V _N = 0 V		±0.1	±1.0	μA
C _{IN}	Channel Input Capacitance	At 1 MHz, V _{IN} = 0 V (Note 2)			2.0	pF
ΔC _{I/O}	Channel I/O to I/O Capacitance			1.5		pF
ESD	ESD Protection IEC 61000-4-2 Contact IEC 61000-4-2 Air ISO 10605 330 pF/330 Ω Contact	T _A = 25°C (Note 3)	±8 ±8 ±8			kV
V _{CL}	Channel Clamp Voltage Positive Transients Negative Transients	T _A = 25°C, I _{PP} = 1A, t _p = 8/20 μS (Note 2)		+9.9 –1.6		V
R _{DYN}	Dynamic Resistance Positive Transients Negative Transients	T _A = 25°C, I _{PP} = 1A, t _p = 8/20 μS (Note 2)		0.96 0.5		Ω

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. All parameters specified at T_A = –40°C to +85°C unless otherwise noted.
2. V_P = 3.3 V, V_N grounded.
3. These measurements performed with no external capacitor on V_P (V_P floating).

PERFORMANCE INFORMATION

Input Channel Capacitance Performance Curves

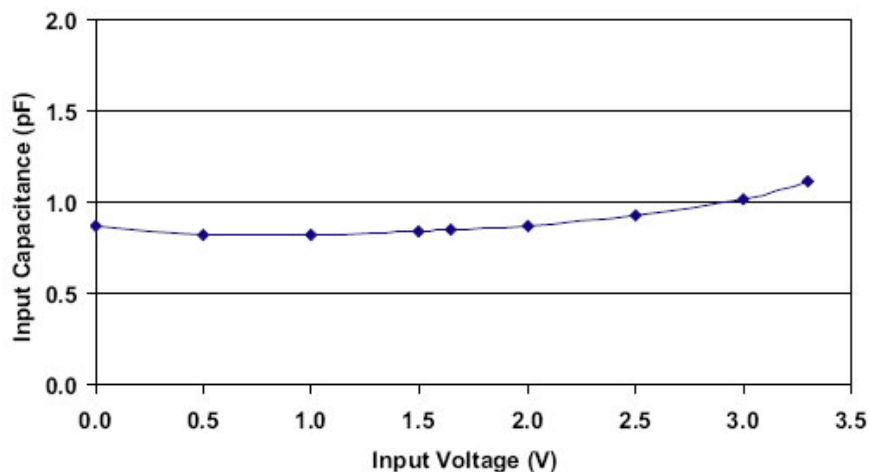


Figure 1. Typical Variation of C_{IN} vs. V_{IN}
($f = 1$ MHz, $V_P = 3.3$ V, $V_N = 0$ V, $0.1 \mu\text{F}$ Chip Capacitor between V_P and V_N , 25°C)

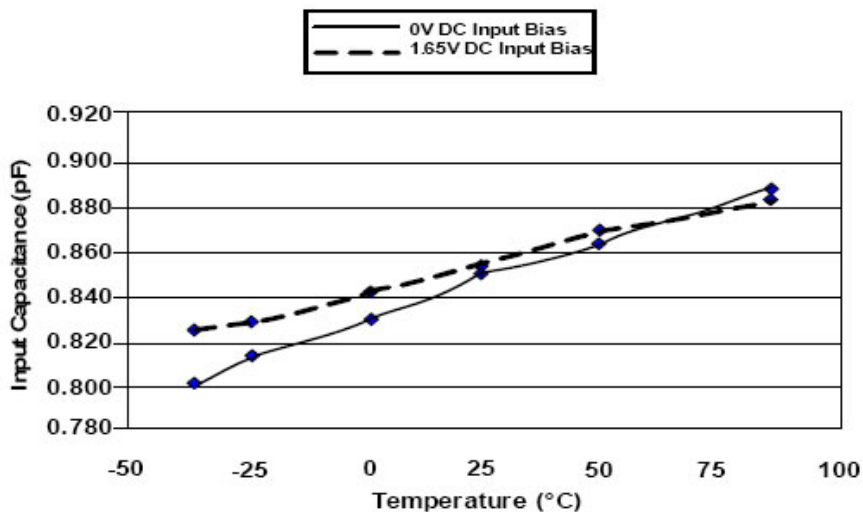


Figure 2. Typical Variation of C_{IN} vs. Temp
($f = 1$ MHz, $V_{IN} = 30$ mV, $V_P = 3.3$ V, $V_N = 0$ V, $0.1 \mu\text{F}$ Chip Capacitor between V_P and V_N)

CM1213A-04SO, SZCM1213A-04SO

PERFORMANCE INFORMATION (CONT'D)

Typical Filter Performance (nominal conditions unless specified otherwise, 50 Ohm Environment)

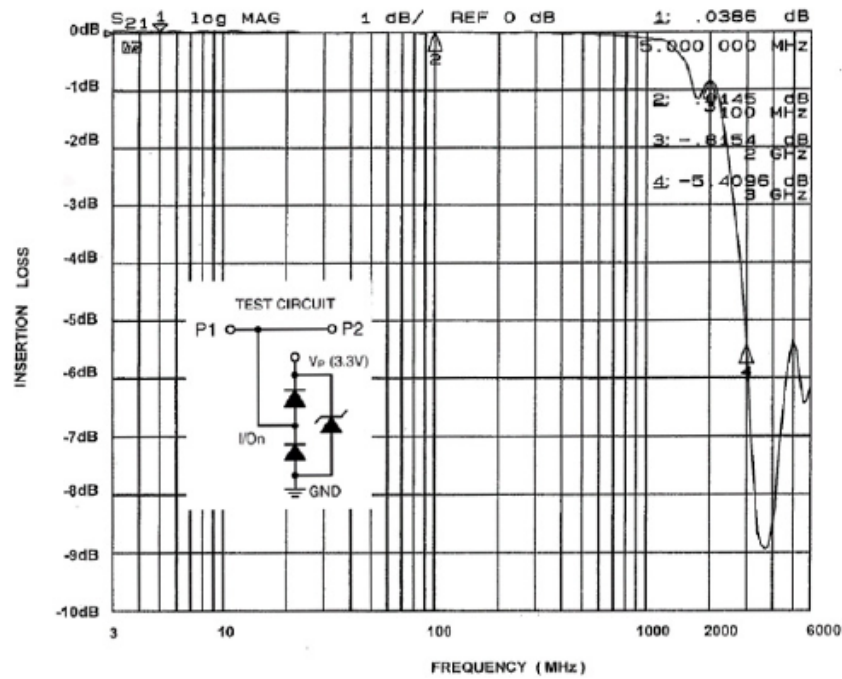


Figure 3. Insertion Loss (S21) vs. Frequency (0 V DC Bias, $V_p = 3.3$ V)

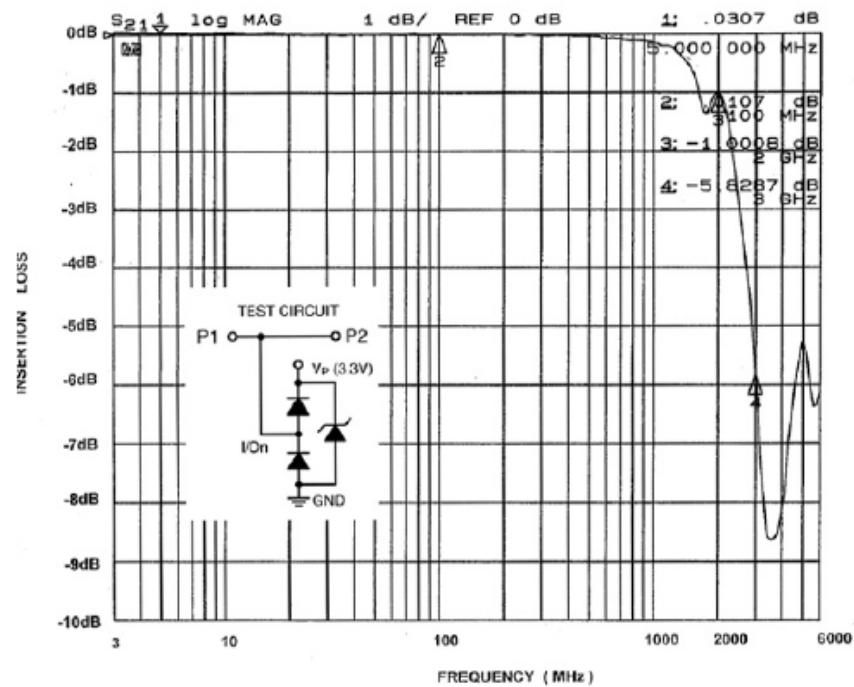


Figure 4. Insertion Loss (S21) vs. Frequency (2.5 V DC Bias, $V_p = 3.3$ V)

APPLICATION INFORMATION

Design Considerations

In order to realize the maximum protection against ESD pulses, care must be taken in the PCB layout to minimize parasitic series inductances on the Supply/Ground rails as well as the signal trace segment between the signal input (typically a connector) and the ESD protection device. Refer to Application of Positive ESD Pulse between Input Channel and Ground, which illustrates an example of a positive ESD pulse striking an input channel. The parasitic series inductance back to the power supply is represented by L_1 and L_2 . The voltage V_{CL} on the line being protected is:

$$V_{CL} = \text{Fwd Voltage Drop of } D_1 + V_{\text{SUPPLY}} + L_1 \times d(I_{\text{ESD}}) / dt + L_2 \times d(I_{\text{ESD}}) / dt$$

where I_{ESD} is the ESD current pulse, and V_{SUPPLY} is the positive supply voltage.

An ESD current pulse can rise from zero to its peak value in a very short time. As an example, a level 4 contact discharge per the IEC61000-4-2 standard results in a current pulse that rises from zero to 30 Amps in 1 ns. Here $d(I_{\text{ESD}})/dt$ can be approximated by $\Delta I_{\text{ESD}}/\Delta t$, or $30/(1 \times 10^{-9})$. So just 10 nH of series inductance (L_1 and L_2 combined) will lead to a 300 V increment in V_{CL} !

Similarly for negative ESD pulses, parasitic series inductance from the V_N pin to the ground rail will lead to drastically increased negative voltage on the line being protected.

The CM1213A has an integrated Zener diode between V_P and V_N . This greatly reduces the effect of supply rail inductance L_2 on V_{CL} by clamping V_P at the breakdown voltage of the Zener diode. However, for the lowest possible V_{CL} , especially when V_P is biased at a voltage significantly below the Zener breakdown voltage, it is recommended that a 0.22 μF ceramic chip capacitor be connected between V_P and the ground plane.

As a general rule, the ESD Protection Array should be located as close as possible to the point of entry of expected electrostatic discharges. The power supply bypass capacitor mentioned above should be as close to the V_P pin of the Protection Array as possible, with minimum PCB trace lengths to the power supply, ground planes and between the signal input and the ESD device to minimize stray series inductance.

Additional Information

See also ON Semiconductor Application Note "Design Considerations for ESD Protection", in the Applications section.

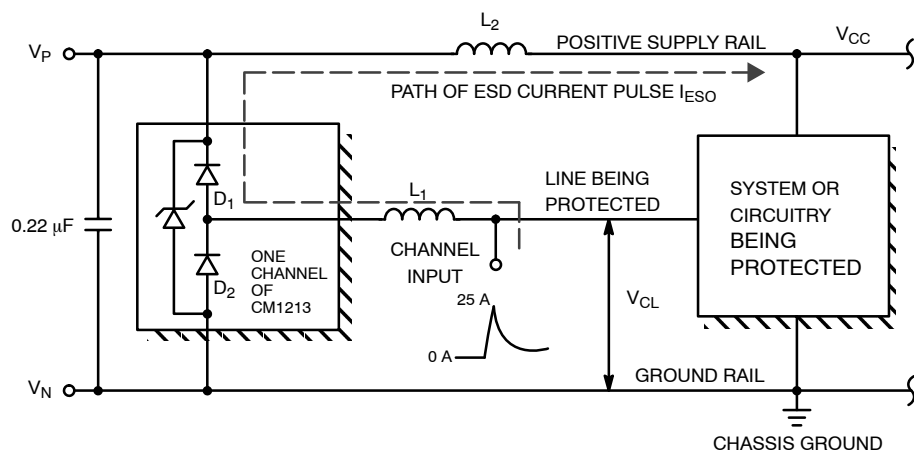


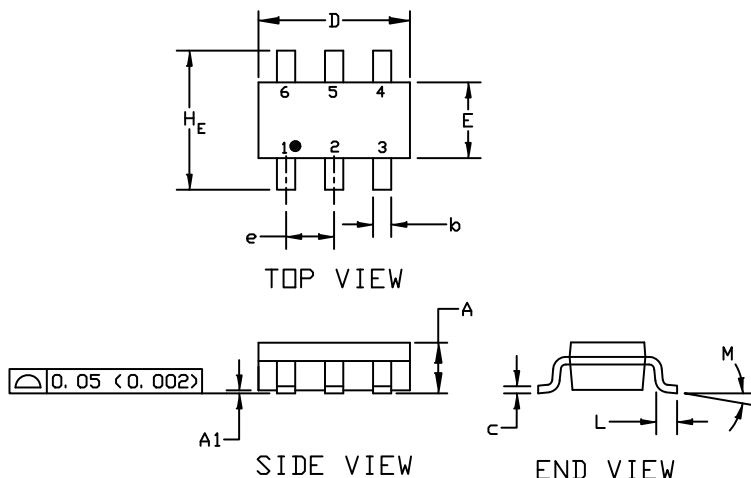
Figure 5. Application of Positive ESD Pulse between Input Channel and Ground



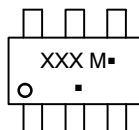
SCALE 2:1

SC-74
CASE 318F
ISSUE P

DATE 07 OCT 2021



GENERIC
MARKING DIAGRAM*



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

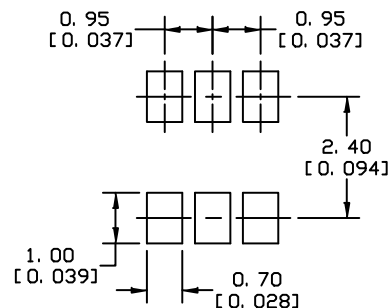
(Note: Microdot may be in either location)

*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.

NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994
2. CONTROLLING DIMENSION: INCHES
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF THE BASE MATERIAL.

DIM	MILLIMETERS			INCHES		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	0.90	1.00	1.10	0.035	0.039	0.043
A1	0.01	0.06	0.10	0.001	0.002	0.004
b	0.25	0.37	0.50	0.010	0.015	0.020
c	0.10	0.18	0.26	0.004	0.007	0.010
D	2.90	3.00	3.10	0.114	0.118	0.122
E	1.30	1.50	1.70	0.051	0.059	0.067
e	0.85	0.95	1.05	0.034	0.037	0.041
H _E	2.50	2.75	3.00	0.099	0.108	0.118
L	0.20	0.40	0.60	0.008	0.016	0.024
M	0*	---	10*	0*	---	10*



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

SOLDERING FOOTPRINT

STYLE 1: PIN 1. CATHODE 2. ANODE 3. CATHODE 4. CATHODE 5. ANODE 6. CATHODE	STYLE 2: PIN 1. NO CONNECTION 2. COLLECTOR 3. EMITTER 4. NO CONNECTION 5. COLLECTOR 6. BASE	STYLE 3: PIN 1. EMITTER 1 2. BASE 1 3. COLLECTOR 2 4. EMITTER 2 5. BASE 2 6. COLLECTOR 1	STYLE 4: PIN 1. COLLECTOR 2 2. EMITTER 1/EMITTER 2 3. COLLECTOR 1 4. EMITTER 3 5. BASE 1/BASE 2/COLLECTOR 3 6. BASE 3	STYLE 5: PIN 1. CHANNEL 1 2. ANODE 3. CHANNEL 2 4. CHANNEL 3 5. CATHODE 6. CHANNEL 4	STYLE 6: PIN 1. CATHODE 2. ANODE 3. CATHODE 4. CATHODE 5. CATHODE 6. CATHODE
STYLE 7: PIN 1. SOURCE 1 2. GATE 1 3. DRAIN 2 4. SOURCE 2 5. GATE 2 6. DRAIN 1	STYLE 8: PIN 1. EMITTER 1 2. BASE 2 3. COLLECTOR 2 4. EMITTER 2 5. BASE 1 6. COLLECTOR 1	STYLE 9: PIN 1. EMITTER 2 2. BASE 2 3. COLLECTOR 1 4. EMITTER 1 5. BASE 1 6. COLLECTOR 2	STYLE 10: PIN 1. ANODE/CATHODE 2. BASE 3. EMITTER 4. COLLECTOR 5. ANODE 6. CATHODE	STYLE 11: PIN 1. EMITTER 2. BASE 3. ANODE/CATHODE 4. ANODE 5. CATHODE 6. COLLECTOR	

DOCUMENT NUMBER:	98ASB42973B	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-74	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