



Product Overview

Single-channel Silicon ESD Protection Devices

TE Connectivity's Silicon ESD devices help to protect electronic circuits against damage from Electrostatic Discharge (ESD), surge and cable discharge events.





KEY FEATURES

- Low Capacitance – at 0.10pF (typ. bi-di 100fF), at 0.20pF (typ. uni-di 200fF)
- Low leakage current – 50nA @ 5V (typ)
- Low clamping voltage – +10.0/-10.0V (typ. bi-di), +9.20/-0.80V (typ. uni-di) @ (tp=8x20µs, Ipp=2A)
- ESD – 20kV contact/air discharge per IEC61000-4-2
- Surge – 2A (max) @ (tp=8x20µs) per IEC61000-4-5
- Small size and low profile XDFN packages
- RoHS Complaint, Pb and Halogen Free (refers to: Br ≤ 900ppm, Cl ≤ 900ppm, Br+Cl ≤ 1500ppm)

The Silicon ESD (SESD) devices help provide protection and improve reliability of applications including but not limited to consumer, portable and mobile electronics. The 0402- and 0201- sized devices have industry leading ultra-low capacitance of 0.10pF for bi-directional devices, and 0.20pF for uni-directional devices with low insertion loss which help provide protection for ultra-high-speed data signals. The single-channel SESD devices provide robust ESD protection with industry-leading 20kV contact and air discharge rating per IEC61000-4-2 standard. The ultra-low capacitance enables signal integrity for today's highest-speed interfaces including USB 3.0/2.0, HDMI, eSATA, DisplayPort, and Thunderbolt.

TE offers the single-channel devices in uni-directional and bi-directional configurations. Bi-directional devices offer the lowest capacitance and insertion loss, allow placement on the PCB without orientation constraint and do not clip signals that swing below ground. Uni-directional devices offer a low negative breakover voltage and help provide protection for high-speed digital interfaces. The 0201-sized XDFN small footprint – measuring a mere 0.6mm x 0.3mm x 0.31mm – offers designers placement flexibility in space-constrained applications.

APPLICATIONS

- Consumer, mobile and portable electronics
- Tablet PC and external storage with high speed interfaces
- Ultra-high speed data lines
- USB 3.0/2.0, HDMI 1.3/1.4, DisplayPort interface, Thunderbolt interface (Light Peak), V-by-One HS, and LVDS interface
- Applications requiring high ESD performance in small packages

BENEFITS

- Industry-leading lowest capacitance; provides lowest insertion loss for high speed data signals
- Provides ESD protection up to 20kV contact and air discharge per IEC61000-4-2
- Small size ESD protection diodes for high speed data signals (0402- and 0201- size devices)
- Helps protect electronic circuits against damage from Electrostatic Discharge (ESD), lightning and cable discharge events
- Assist equipment to pass IEC61000-4-2, level 4 testing

DEVICE ELECTRICAL CHARACTERISTICS

Device Maximum Ratings

Devices	IEC 61000-4-2, level 4 (ESD withstand)		Temperature		Peak Current (tp=8x20µs)
	Contact (kV)	Air (kV)	Operating (°C)	Storage (°C)	Ipp (A)
SESD0201X1BN-0010-098 ⁽¹⁾	20	20	-55 to +125	-55 to +150	2.0
SESD0402X1BN-0010-098 ⁽¹⁾					
SESD0201X1UN-0020-090 ⁽²⁾					
SESD0402X1UN-0020-090 ⁽²⁾					

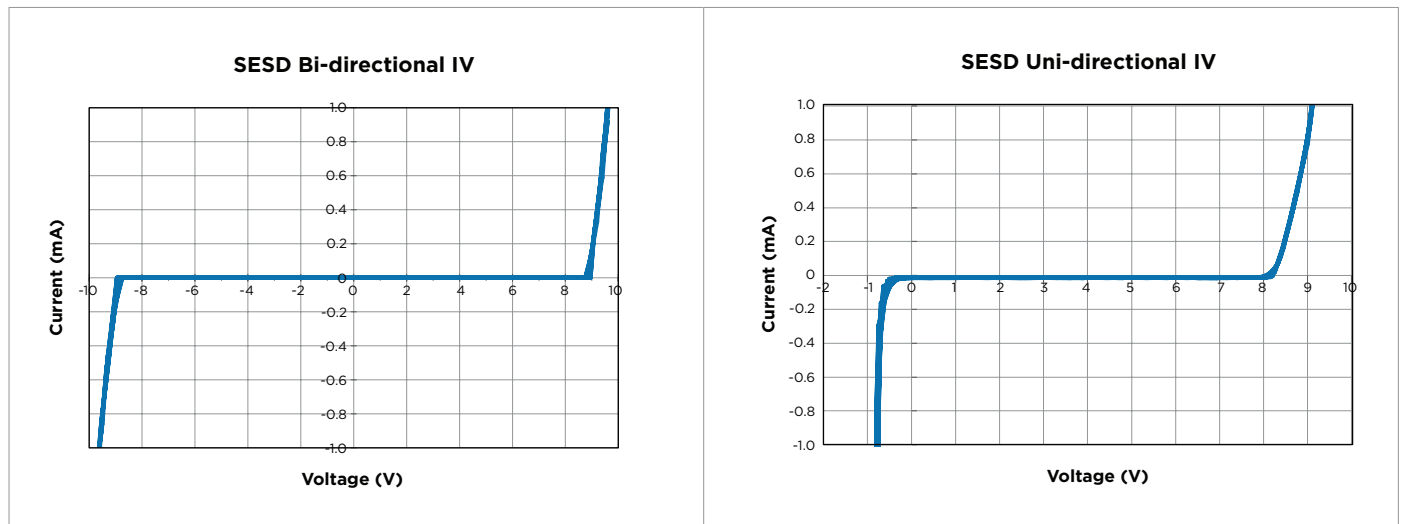
Caution: Stress exceeding Device Maximum Ratings may damage the device.
 Prolong exposure to stresses above the Recommended Operating Conditions may affect device reliability.

Device Electrical Characteristics @ T=25°C

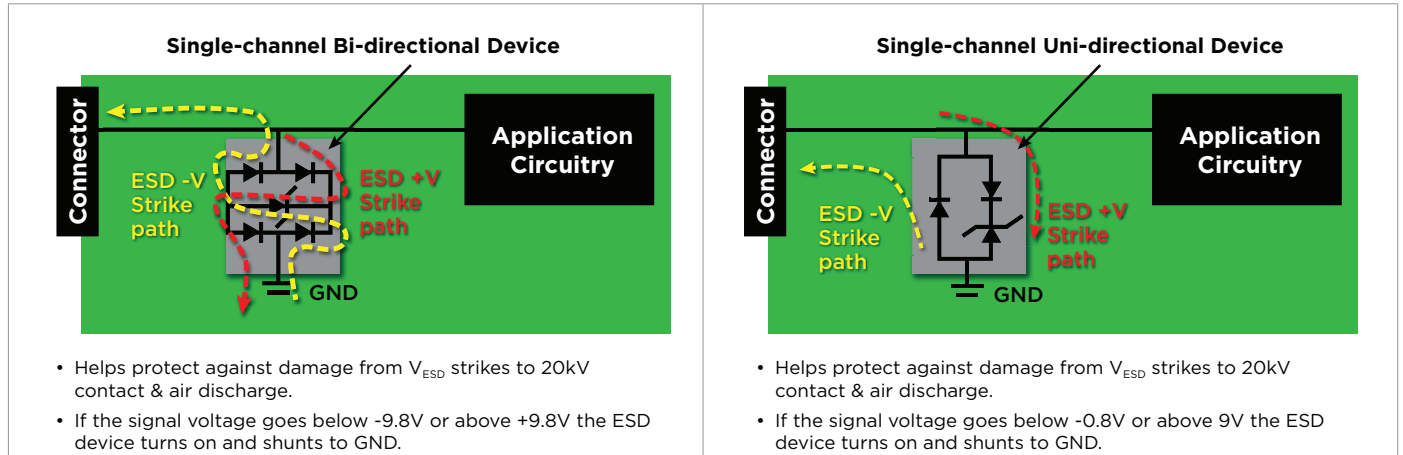
Devices	Input Capacitance ⁽³⁾		Breakdown Voltage (typ)	Reverse Leakage Current (typ)	Clamping Voltage (typ)
	Typical (pF)	Maximun (pF)	V _{br} @ I _t = 1mA (V)	I _L @ V _{RWM} = 5.0V (nA)	V _{CL} @ Ipp = 2.0A (V)
SESD0201X1BN-0010-098 ⁽¹⁾	0.10	0.12	+9.80 / -9.80	50.0	+10.0 / -10.0
SESD0402X1BN-0010-098 ⁽¹⁾					
SESD0201X1UN-0020-090 ⁽²⁾	0.20	0.22	+9.00 / -0.80		+9.20 / -0.80
SESD0402X1UN-0020-090 ⁽²⁾					

⁽¹⁾ Bi-directional ⁽²⁾ Uni-directional ⁽³⁾ @ Vr = 0V, f = 3GHz

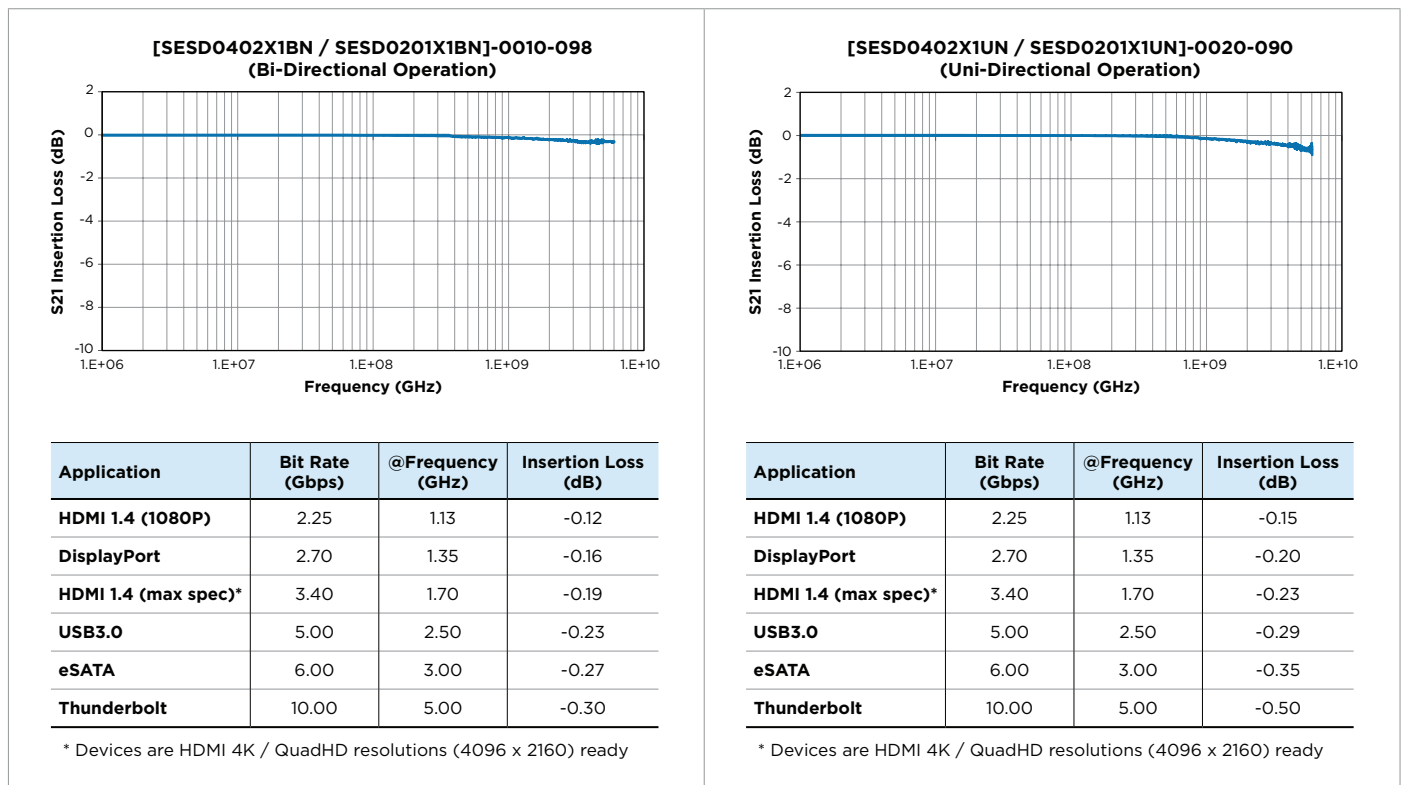
DEVICE IV CHARACTERISTICS



FUNCTIONAL DIAGRAM: BI-DIRECTIONAL AND UNI-DIRECTIONAL OPERATION

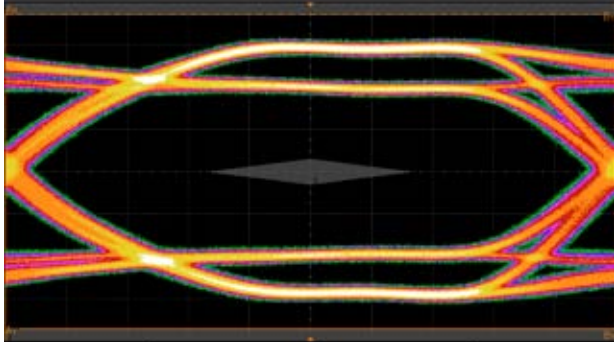


INSERTION LOSS

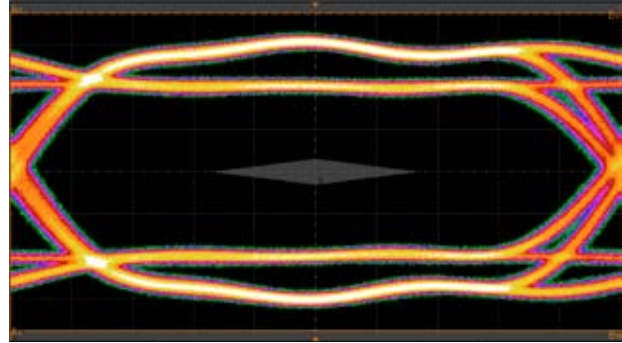


EYE DIAGRAMS

USB3.0 Eye Diagrams
5.0Gb/s, 1000mV differential, CPO Compliant Test Pattern

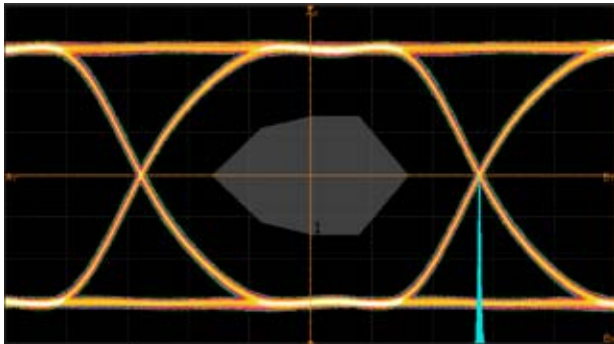


Without SESD Device

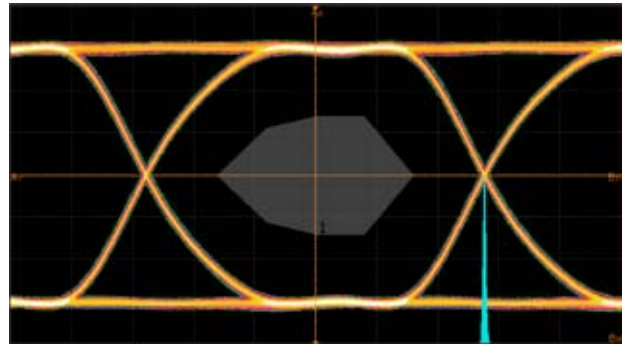


With SESD Device

DisplayPort Eye Diagrams
2.7Gb/s, 800mV differential, PRBS7 Compliant Test Pattern, SSC enabled

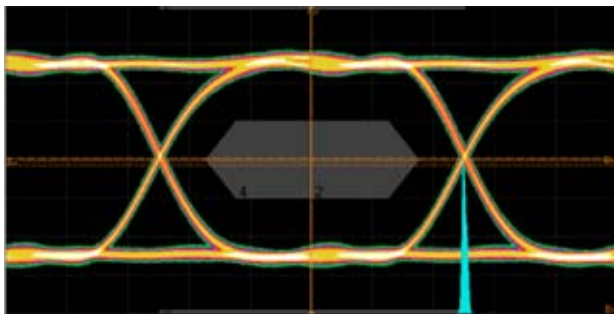


Without SESD Device

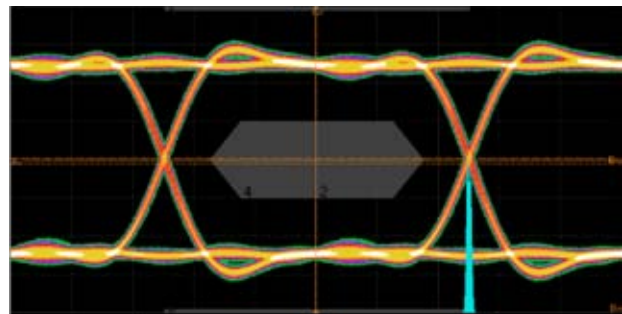


With SESD Device

HDMI Eye Diagrams
3.4Gb/s, 990mV differential, TMDS Data

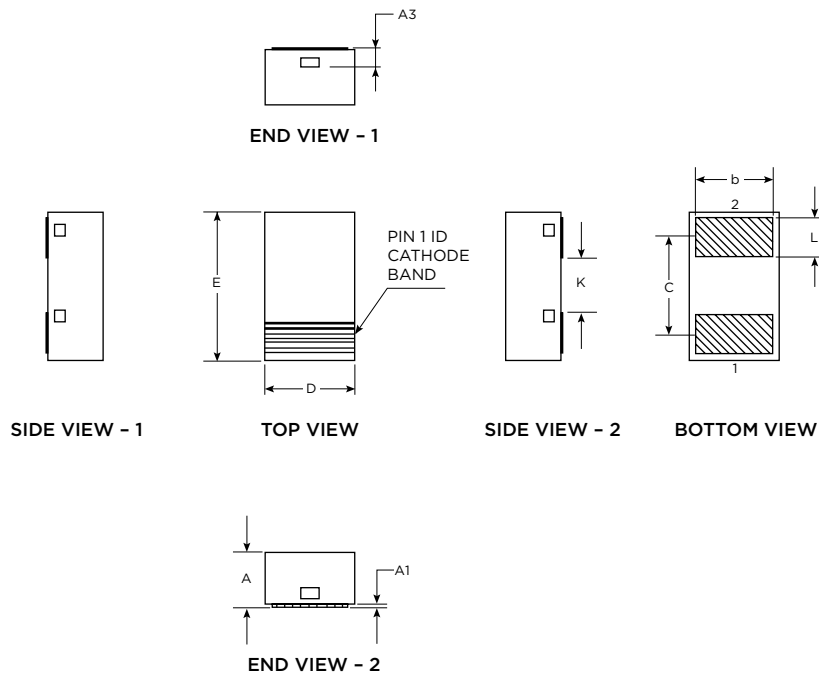


Without SESD Device



With SESD Device

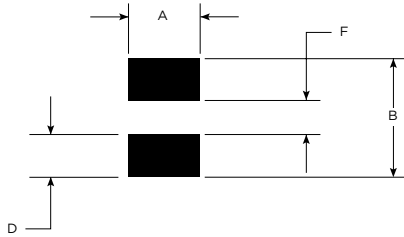
DEVICE DIMENSION



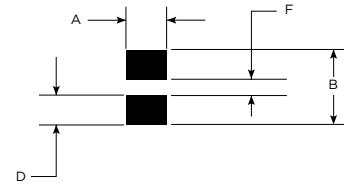
Dim	SESD0402 XDFN						SESD0201 XDFN					
	Millimeters			Inches			Millimeters			Inches		
	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
A	0.330	0.380	0.430	0.0130	0.0150	0.0170	0.30	0.31	0.32	0.0115	0.0122	0.0125
A1	0	-	0.050	0	-	0.0020	0	-	0.05	0	-	0.0020
A3	0.130 ref.			0.005 ref.			0.102 ref.			0.0040 ref.		
D	0.550	0.600	0.650	0.0220	0.0240	0.0260	0.285	0.320	0.355	0.0112	0.0120	0.0139
E	0.950	1.000	1.050	0.0370	0.0390	0.0410	0.585	0.620	0.655	0.0230	0.0244	0.0237
K	0.350	0.400	0.450	0.0140	0.0160	0.0180	0.130	0.155	0.180	0.0052	0.0061	0.0071
b	0.450	0.500	0.550	0.0180	0.0200	0.0220	0.235	0.260	0.285	0.0083	0.0102	0.0112
L	0.200	0.250	0.300	0.0080	0.0100	0.0120	0.175	0.200	0.225	0.0069	0.0079	0.0088
e	0.650 BSC			0.026 BSC			0.355 BSC			0.014 BSC		

RECOMMENDED SOLDER PAD LAYOUT

Single-channel SESD 0402 XDFN Pad Layout



Single-channel SESD 0201 XDFN Pad Layout



SESD Landing Pad Layout 0402 Package		
Symbol	Millimeters	Inches
A	0.60	0.024
B	1.00	0.039
D	0.35	0.014
F	0.30	0.012

SESD Landing Pad Layout 0201 Package		
Symbol	Millimeters	Inches
A	0.32	0.013
B	0.62	0.024
D	0.24	0.009
F	0.14	0.006

MATERIAL INFORMATION

RoHS Compliant

Directive 2000/53/EC
Compliant

ELV Compliant

Directive 2002/95/EC
Compliant

Halogen Free*



Pb-Free



* Halogen Free refers to: Br≤900ppm, Cl≤900ppm, Br+Cl≤1500ppm.

SESD devices meet MSL-1 Requirements
DFN case epoxy meets UL 94 V-0

FOR MORE INFORMATION

TE Circuit Protection

308 Constitution Drive
Menlo Park, CA USA 94025-1164
Tel : (800) 227-7040, (650) 361-6900
Fax : (650) 361-4600

www.circuitprotection.com
www.circuitprotection.com.hk (Chinese)
www.te.com/japan/bu/circuitprotection/ (Japanese)

Brazil

Tel : 55-11-2103-6090
Fax: 55-11-2103-6216

UK / Eire / Benelux / Israel

South Africa / Nordic / Baltic / Others
Tel : 49-89-6089485
Fax: 49-89-6089394

Germany / Austria / Switzerland / Eastern Europe / Russia

Tel : 49-89-6089584
Fax: 49-89-6089394

France / Italy / Iberia / Greece / Turkey

Tel : 33-1-34208455
Fax: 33-1-34208479

Japan

Tel : 81-44-900-5110
Fax: 81-44-900-5140

Korea

Tel : 82-2-3415-4654
Fax: 82-2-3486-1786

Taiwan

Tel : 886-2-8768-2788 x 211
Fax: 886-2-8768-1277

China, Hong Kong

Tel : 852-2738-8181
Fax: 852-2735-1185

China, Beijing

Tel : 86-10-6569-3488 x 16526
Fax: 86-10-6569-3206

China, Shanghai

Tel : 86-21-6106-7379
Fax: 86-21-6485-3255

China, Shenzhen / Guangzhou

Tel : 86-755-2515-4797
Fax: 86-755-2598-0419

Singapore / Indonesia

Tel : 65-6590-5089
Fax: 65-6481-9377

Thailand / Malaysia / Vietnam

Tel : 6-04-217-8112
Fax: 6-04-229-8177

Australia / Philippines

Tel : 63-2-988-9465
Fax: 63-2-848-0205

India

Tel : 91-80-4161-3745
Mobile : 91-99-0248-8886

Part numbers in this brochure are RoHS Compliant*, unless marked otherwise.
*as defined www.te.com/leadfree

te.com

© 2012 Tyco Electronics Corporation, a TE Connectivity Ltd. Company. All Rights Reserved.
RCPO106E 02/2012

TE Connectivity and TE connectivity (logo) are trademarks. Other logos, product and/or company names might be trademarks of their respective owners.

All information, including illustrations, is believed to be accurate and reliable. Users, however, should independently evaluate the suitability of and test each product selected for their application. Tyco Electronics Corporation and/or its Affiliates in the TE Connectivity Ltd. family of companies ("TE") makes no warranties as to the accuracy or completeness of the information, and disclaims any liability regarding its use. TE only obligations are those in the TE Standard Terms and Conditions of Sale and in no case will TE be liable for any incidental, indirect, or consequential damages arising from the sale, resale, use, or misuse of its products. Specifications are subject to change without notice. In addition, TE reserves the right to make changes to materials or processing that do not affect compliance with any applicable specification without notification to Buyer. Without expressed or written consent by an officer of TE, TE does not authorize the use of any of its products as components in nuclear facility applications, aerospace, or in critical life support devices or systems.

