



## ESD Protection Devices

The Raychem PESD electrostatic discharge (ESD) protection devices help protect I/O ports on HDMI 1.3, portable video players, LCD & plasma TVs, USB 2.0, digital visual interface (DVI), and antenna switches. PESD devices shunt ESD away from sensitive circuitry in HDTV equipment, printers, laptops, cellular phones, and other portable devices.

PESD devices offer many advantages over traditional protection devices, such as Zener diodes and multi layer varistors (MLVs), which may degrade or distort the signal in high data rate circuits. Compared to transient voltage suppression (TVS) diodes and miniature gas discharge tubes (GDTs), PESD devices provide a more compact form factor and an economical solution for the shrinking profiles of today's compact information appliances.

PESD protection devices provide low capacitance, and meet transmission line pulse (TLP) testing, as well as IEC61000-4-2 testing.



### Benefits

- ESD protection for high frequency application (HDMI 1.3)
- Smaller form factor for board space savings
- Helps protect sensitive electronic circuits against damage caused by electrostatic discharge (ESD) events
- Assists equipment to pass IEC 61000-4-2, level 4 testing

### Features

- 0.25 pF (typical) capacitance
- Low leakage current
- Low clamping voltage
- Fast response time (< 1ns)
- Capable of withstanding numerous ESD strikes
- Compatible with standard reflow installation procedures
- Thick film technology
- Bidirectional protection

### Applications

- HDMI 1.3 interfaces
- LCD & plasma TV
- Cellular phones
- Antennas
- Portable video players
- Portable devices (PDA, DSC, BlueTooth...)
- Printer ports
- Satellite radios
- USB 2.0 and IEEE 1394 interfaces
- DVI
- GPS systems

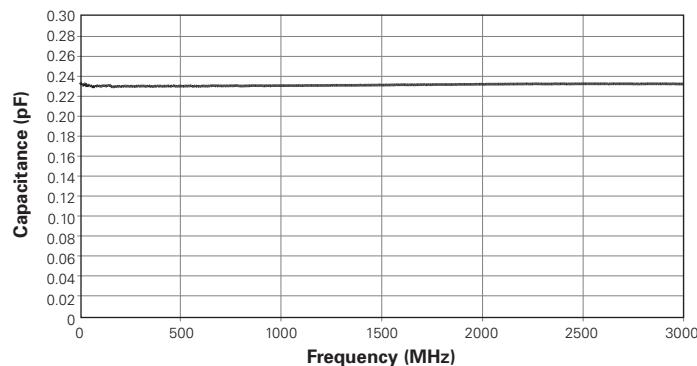
**Table E1** Electrical Characteristics for PESD Devices

	Continuous Max Operating Voltage	Typical Trigger Voltage*	Typical Clamping Voltage†	Typical Capacitance @1 MHz, 1V <sub>RMS</sub>	Typical Leakage Current	Max Leakage Current @ Max V <sub>DC</sub>
Symbol	V <sub>DC</sub>	V <sub>T(TLP)</sub>	V <sub>C(TLP)</sub>	C <sub>P</sub>	I <sub>L(TYP)</sub>	I <sub>L(MAX)</sub>
Unit	V	V	V	pF	µA	µA
PESD0603-240	24	215	45	0.25	< 0.01	10.0
PESD0402-140	14	250	40	0.25	< 0.01	10.0

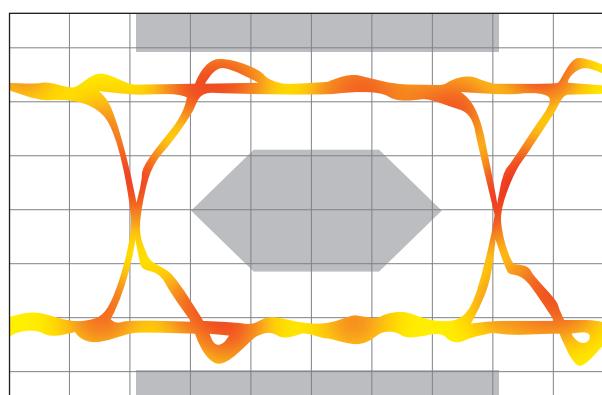
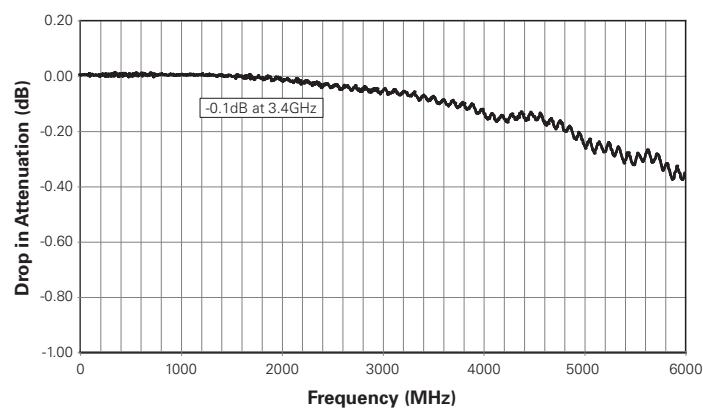
Notes : \* TLP test method at 1kV.

† Measured 30ns after pulse initiation.

Typical capacitance value is at 0V and Max Operating Voltage bias.

**Figure E1** Capacitance vs. Frequency for PESD Devices


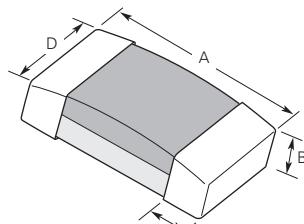
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**Figure E2** Eye Diagram Performance at 3.4 GHz for PESD Devices

**Figure E3** Insertion Loss Diagram for PESD Devices


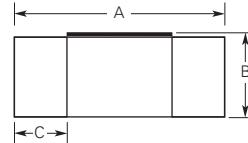
**Table E2 Dimensions for PESD Devices in Millimeters (Inches)\***

Part Number	Length A		Height B		Terminal Width C		Width D	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
0603-240	1.50 (0.059)	1.70 (0.067)	0.45 (0.018)	0.55 (0.022)	0.10 (0.004)	0.50 (0.020)	0.70 (0.028)	1.00 (0.039)
0402-140	0.90 (0.035)	1.10 (0.043)	0.23 (0.009)	0.43 (0.017)	0.10 (0.004)	0.30 (0.012)	0.40 (0.016)	0.60 (0.024)

\*The dimensions in inches are rounded approximations.



(drawing not to scale)



(side view)

**Table E3 Environmental Specifications for PESD Devices**

Test Conditions		Pass / Fail Criteria
Bias humidity test	85°C, 85% RH, $V_{DC\ (max)}$ , 1000 hrs	$I_L \leq 10 \mu A$
Thermal shock	-55°C to 125°C, 30 min dwell, 1000 cycles	$I_L \leq 10 \mu A$
Bias heat test	125°C, $V_{DC\ (max)}$ , 1000 hrs	$I_L \leq 10 \mu A$
Bias low temp test	-55°C, $V_{DC\ (max)}$ , 1000 hrs	$I_L \leq 10 \mu A$
Solderability	250°C $\pm 5^\circ C$ , 3 $\pm 1$ s	95% coverage
Solder heat	260°C, 10s	90% coverage
Vibration	10 to 50Hz, 60s cycle, 2 hrs each in X-Y-Z-direction	No physical damage
Solvent resistance	IPA ultrasonic 300s	No physical damage
Shock	1500G, 0.5ms each, 30 shocks in X-Y-Z-direction	No physical damage

**Table E4 General Characteristics for PESD Devices**
**PESD0603, PESD0402**

Storage temperature	-40°C to +85°C
Operating temperature	-55°C to +125°C
ESD voltage capability (tested per IEC 61000-4-2)	Contact discharge mode : 8kV (typical), 15kV (max) Air discharge mode : 15kV (typical), 25kV (max)
ESD pulse withstand	100 pulses (tested per IEC 61000-4-2, level 4, contact method)

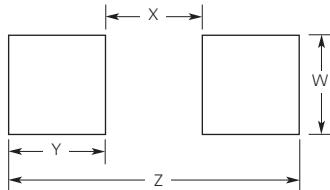
**Table E5 Materials Information for PESD Devices**

RoHS compliant	Directive 2002/95/EC compliant
ELV compliant	Directive 2000/53/EC compliant
Halogen free	Halogen free refers to: Br $\leq$ 900ppm, Cl $\leq$ 900ppm, Br+Cl $\leq$ 1500ppm

**Table E6 Recommended Pad Layout for PESD Devices in Millimeters (Inches)\***

Part Number	W (Ref)		X (Ref)		Y (Ref)		Z (Ref)	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
0603-240	0.90 (0.035)	1.00 (0.039)	0.50 (0.020)	0.60 (0.024)	1.00 (0.039)	1.10 (0.043)	2.70 (0.106)	2.80 (0.110)
0402-140	0.60 (0.024)	0.70 (0.028)	0.30 (0.012)	0.40 (0.016)	0.80 (0.031)	0.90 (0.035)	2.10 (0.083)	2.20 (0.087)

\*The dimensions in inches are rounded approximations.

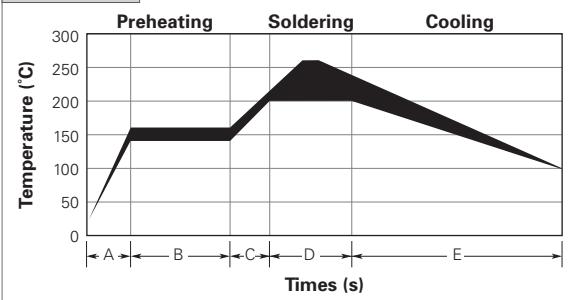
**Figure E4**


**Note:** Solder thickness 0.15 to 0.2 mm

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**Table E7 Solder Reflow Recommendations for PESD Devices**

A	Temperature ramp up 1	From ambient to preheating temperature	30s to 60s
B	Preheating	140°C - 160°C	60s to 120s
C	Temperature ramp up 2	From preheating to main heating temperature	20s to 40s
D	Main heating	at 200°C at 220°C at 240°C at 260°C	60s to 70s 50s to 60s 30s to 40s 5s to 10s
E	Cooling	From main heating temperature to 100°C	4°C/s max

**Figure E5**


## Parameter Definitions for PESD Devices

### Operation Voltage ( $V_{DC}$ )

Defined as DC voltage, under which device is in OFF state and leakage current below certain threshold.

### Leakage Current ( $I_L$ )

Current through device under Operation Voltage  $V_{DC}$ .

### Trigger Voltage ( $V_T$ )

Voltage at which the device switches from the OFF to the ON state, during the IEC waveform or the TLP system.

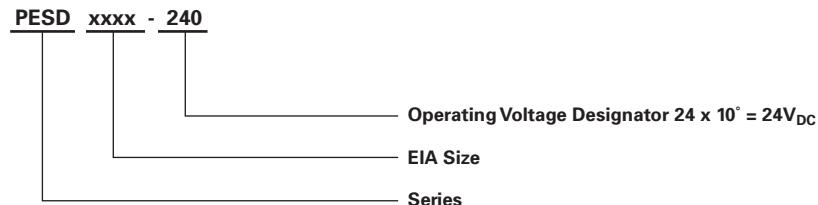
### Clamping Voltage ( $V_C$ )

Voltage across device under 8 kV per IEC or measured by TLP system. Typically measured 30 ns after initiation of the ESD pulse (for TLP, both 30ns and 60ns are sometimes used).

### Capacitance ( $C_P$ )

Capacitance of the device measured at 1 MHz with 0V and max operating voltage bias.

## Part Numbering System for PESD Devices



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### **Warning :**

**Application Limitations for PESD0603-240 and PESD0402-140: These parts are not intended to be used under power bus applications. Users should independently evaluate the suitability of and test each product selected for their own application.**

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