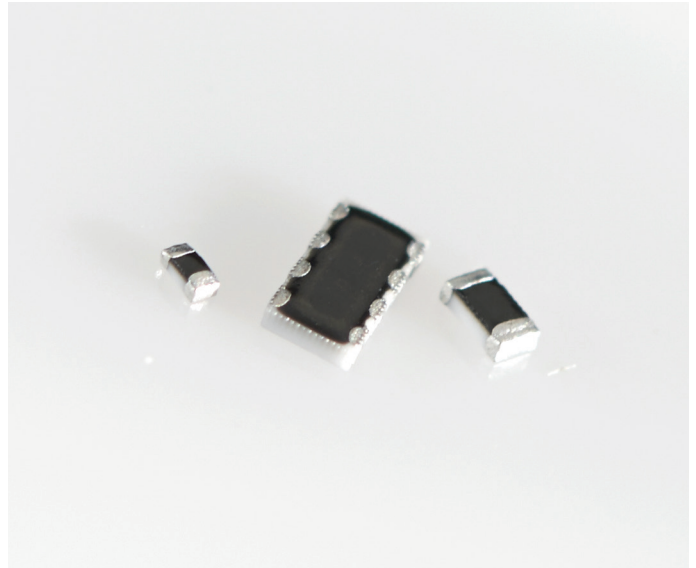


# PESD PROTECTION DEVICES

Littelfuse's Polymer ESD (PESD) line of devices helps protect I/O ports on HDMI 1.3, portable video players, LCD and plasma TVs, USB 2.0, digital visual interface (DVI) and antenna switches. PESD devices shunt electrostatic discharge 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 multi layer varistors (MLVs), which may degrade or distort the signal in high data rate circuits. Compared to 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.

Available in a range of form factors, our 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

- RoHS compliant
- Lead free
- Halogen free (refers to: Br $\geq$ 900ppm, Cl $\geq$ 900ppm, Br+Cl $\geq$ 1500ppm)
- 0.25 pF (typ) 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
- Bi-directional protection

## APPLICATIONS

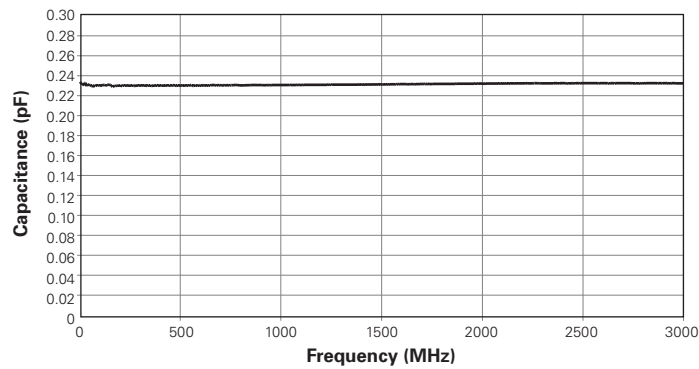
- HDMI 1.3 interfaces
- LCD & plasma TVs
- Cellular phones
- Antennas
- Portable video players
- Portable devices (PDA, DSC, Bluetooth)
- Printer ports
- Satellite radios
- USB 2.0 and IEEE 1394 interfaces
- DVI
- GPS systems

## Table E1 — Electrical Characteristics

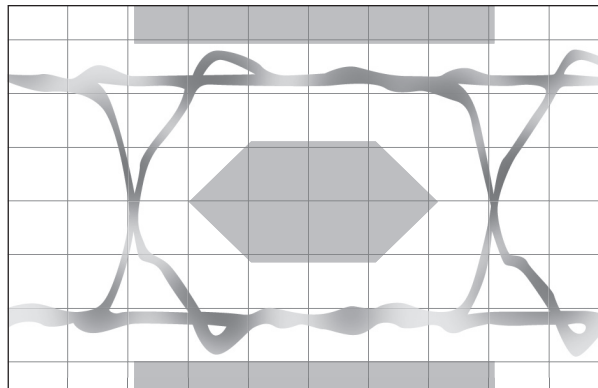
	Continuous Max Operating Voltage	Typ Trigger Voltage*	Typ Clamping Voltage†	Typ Capacitance @ 1 MHz, 1V <sub>RMS</sub>	Typ Leakage Current	Max Leakage Current @ Max V <sub>DC</sub>
Symbol	V <sub>DC</sub>	V <sub>T(TLP)</sub>	V <sub>C(TLP)</sub>	C <sub>P</sub>	I <sub>L(TYP)</sub>	I <sub>L(MAX)</sub>
Unit	V	V	V	pF	μA	μA
PESD0402-140	14	250	40	0.25	< 0.01	10.0
PESD0402-240	24	250	40	0.25	< 0.01	10.0
PESD0603-240	24	215	45	0.25	< 0.01	10.0
PESD1206Q-240	24	250	45	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.

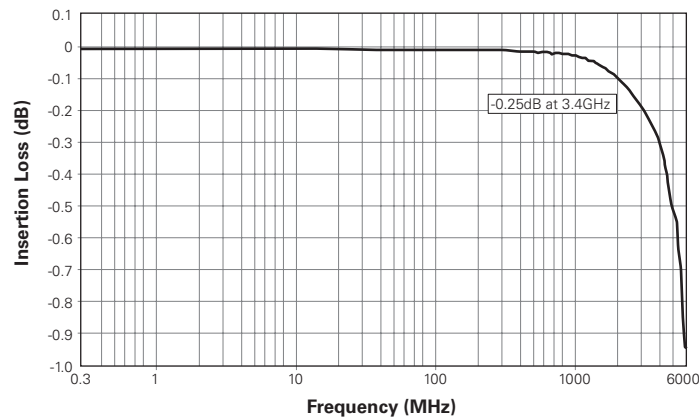
## Figure E1 — Capacitance vs. Frequency



## Figure E2 — Eye Diagram Performance at 3.4 GHz



## Figure E3 — Insertion Loss Diagram



## PESD Protection Devices

Figures E4-E5 – PESD Device Protection for HDMI (PESD devices provide electrostatic discharge protection)

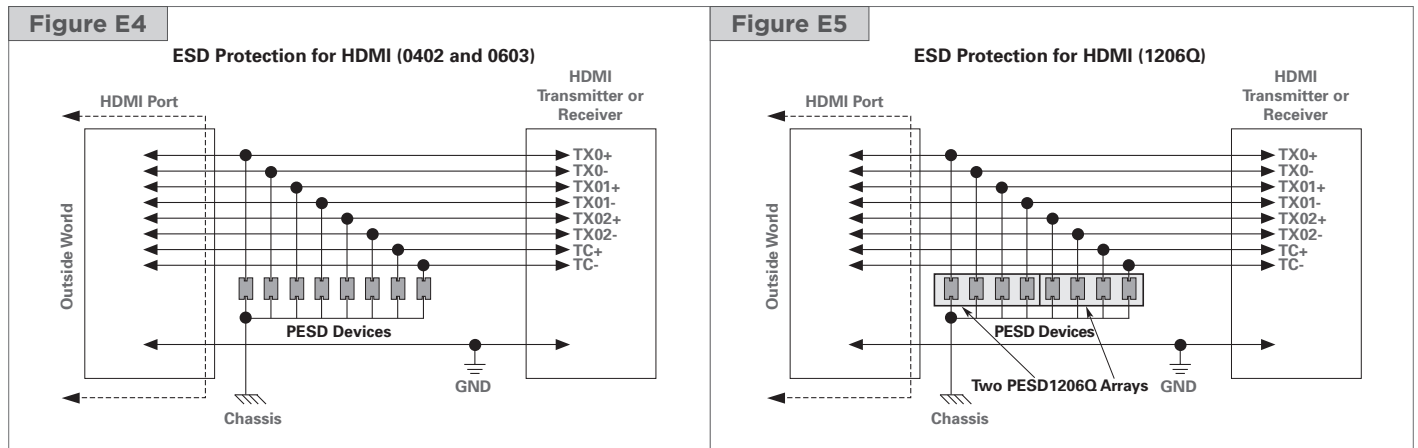


Table E2 – Dimensions in Millimeters (Inches\*)

Part Number	A		B		C		D		E		F		Figure
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	
PESD0402-140	0.90	1.10	0.23	0.43	0.10	0.30	0.40	0.60	—	—	—	—	E6
PESD0402-240	(0.035)	(0.043)	(0.009)	(0.017)	(0.004)	(0.012)	(0.016)	(0.024)					
PESD0603-240	1.50	1.70	0.45	0.55	0.10	0.50	0.70	0.95	—	—	—	—	E6
	(0.059)	(0.067)	(0.018)	(0.022)	(0.004)	(0.020)	(0.028)	(0.037)					
PESD1206Q-240	3.10	3.30	0.40	0.60	0.10	0.30	1.50	1.70	0.20	0.60	0.20	0.60	E7
	(0.122)	(0.130)	(0.016)	(0.024)	(0.004)	(0.012)	(0.059)	(0.067)	(0.008)	(0.024)	(0.008)	(0.024)	

\*The dimensions in inches are rounded approximations.

## Figures E6-E7 – Dimension Figures

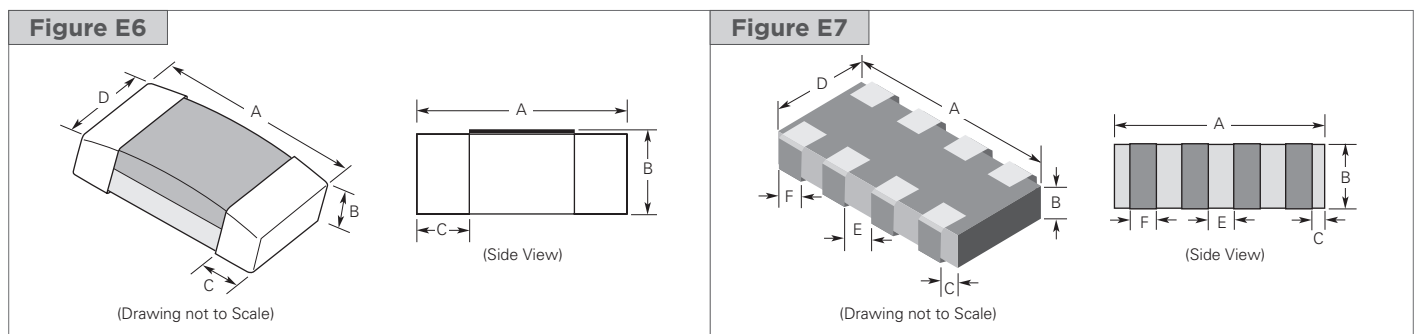


Table E3 – Environmental Specifications

	Test Conditions	Pass / Fail Criteria
Bias Humidity Test	85°C, 85% RH, $V_{DC(max)}$ , 1000 hrs	$I_L$ % 10 $\mu$ A
Thermal Shock	-55°C to 125°C, 30 min Dwell, 1000 Cycles	$I_L$ % 10 $\mu$ A
Bias Heat Test	125°C, $V_{DC(max)}$ , 1000 hrs	$I_L$ % 10 $\mu$ A
Bias Low Temp Test	-55°C, $V_{DC(max)}$ , 1000 hrs	$I_L$ % 10 $\mu$ A
Solderability	250°C $\pm$ 5°C, 3 $\pm$ 1s	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, X-Y-Z Axis 3 Times Each Axis	No Physical Damage

# PESD Protection Devices

## Table E4 – General Characteristics

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 (Typ), 15kV (max) Air Discharge Mode: 15kV (Typ), 25kV (max) [1 Pulse: per Customer Request]
ESD Pulse Withstand	100 Pulses (Tested per IEC 61000-4-2, Level 4, Contact Method)

## Table E5 – Materials Information

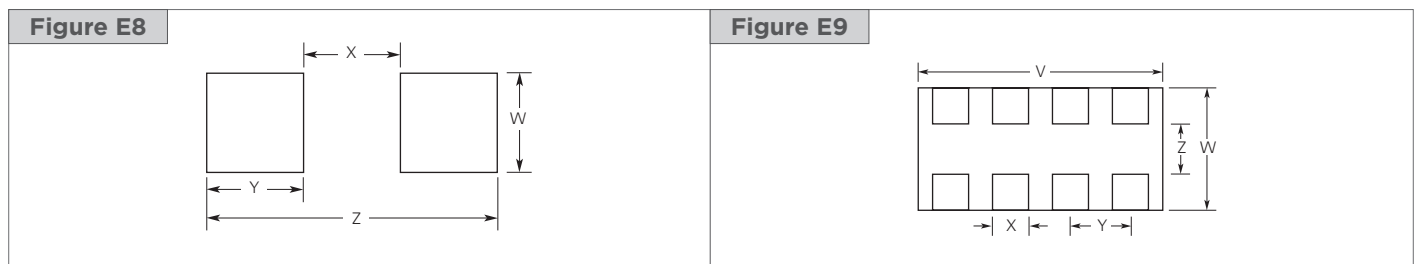
RoHS Compliant	Directive 2002/95/EC Compliant
RoHS 2.0	Directive 2011/65/EU Compliant
ELV Compliant	Directive 2000/53/EC Compliant
Halogen Free	Halogen Free Refers to: Br#900ppm, Cl#900ppm, Br+Cl#1500ppm

## Table E6 – Recommended Pad Layout in Millimeters and (Inches\*)

Part Number	V		W		X		Y		Z		Figure
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	
PESD0402-140	—	—	0.60	0.70	0.30	0.40	0.80	0.90	2.10	2.20	E8
PESD0402-240			(0.024)	(0.028)	(0.012)	(0.016)	(0.031)	(0.035)	(0.083)	(0.087)	
PESD0603-240	—	—	0.90	1.00	0.50	0.60	1.00	1.10	2.70	2.80	E8
			(0.035)	(0.039)	(0.020)	(0.024)	(0.039)	(0.043)	(0.106)	(0.110)	

Part Number	V	W	X	Y	Z	Figure
	Typ	Typ	Typ	Typ	Typ	
PESD1206Q-240	3.20	2.20	0.50	0.80	1.00	E9
	(0.126)	(0.087)	(0.020)	(0.031)	(0.039)	

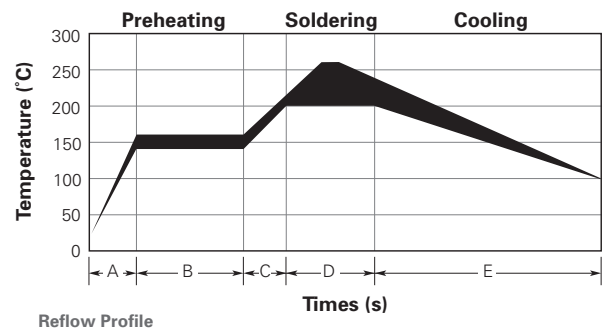
\*The dimensions in inches are rounded approximations.



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

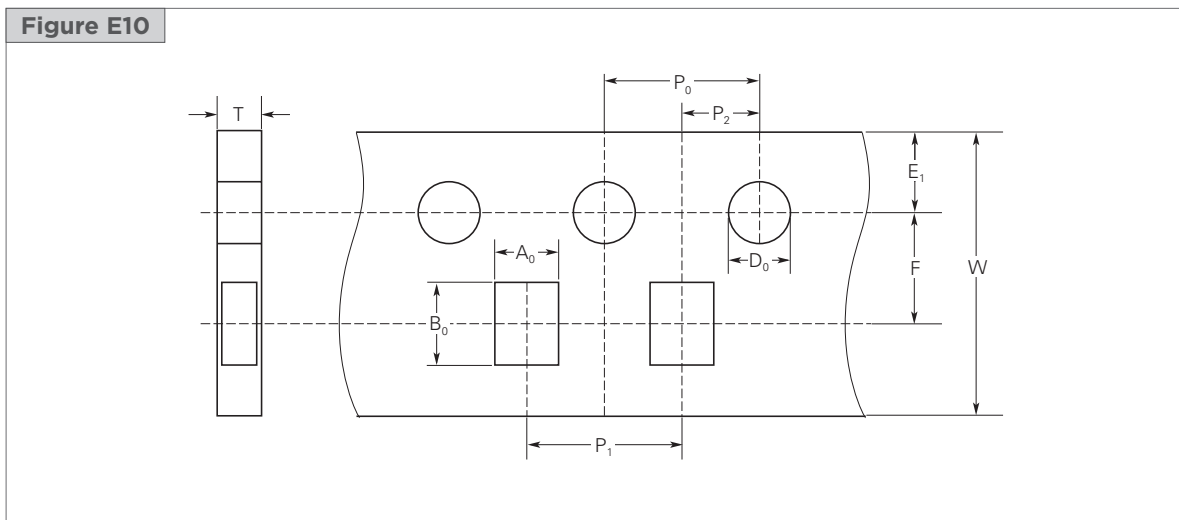
## Table E7 – Solder Reflow Recommendations

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	60s to 70s
		at 220°C	50s to 60s
		at 240°C	30s to 40s
		at 260°C	5s to 10s
E	Cooling	From Main Heating Temperature to 100°C	4°C/s (max)



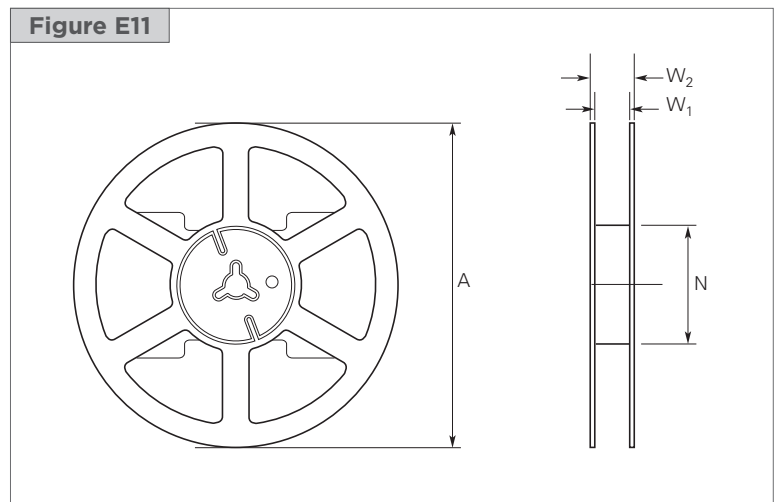
## Table E8 – Tape Specifications

Tape Dimension EIA Mark	0402		0603		1206Q	
	Dimension (mm)	Tolerance	Dimension (mm)	Tolerance	Dimension (mm)	Tolerance
W	8.00	±0.30	8.00	±0.30	8.00	±0.30
P <sub>0</sub>	4.00	±0.10	4.00	±0.10	4.00	±0.10
P <sub>1</sub>	2.00	±0.05	4.00	±0.05	4.00	±0.05
P <sub>2</sub>	2.00	±0.05	2.00	±0.05	2.00	±0.05
A <sub>0</sub>	0.63	±0.03	1.27	±0.15	2.02	±0.20
B <sub>0</sub>	1.13	±0.03	2.02	±0.20	3.62	±0.20
D <sub>0</sub>	1.50	±0.10	1.50	±0.10	1.50	±0.10
F	3.50	±0.05	3.50	±0.05	3.50	±0.05
E <sub>1</sub>	1.75	±0.10	1.75	±0.10	1.75	±0.10
T	0.48	±0.03	0.60	±0.03	0.75	±0.05



## Table E9 – Reel Specifications

Reel Dimensions (0402, 0603 & 1206Q)	
EIA Mark	Dimension (mm)
A max	180.0
N min	60.5
W <sub>1</sub> max	9.5
W <sub>2</sub> max	14.0



# PESD Protection Devices

## Parameter Definitions

### 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.

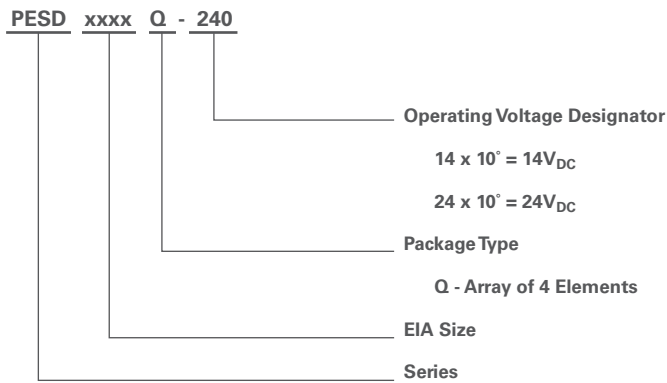
### Clamping Voltage ( $V_C$ )

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

### Capacitance ( $C_P$ )

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

## Part Numbering System



### Warning :

**Application Limitations for PESD0402-140, PESD0402-240, PESD0603-240 and PESD1206Q-240: These parts are not intended to be used on power lines or for power bus applications. Users should independently evaluate the suitability of and test each product selected for their own application.**

### Notice:

Information furnished is believed to be accurate and reliable. However, users should independently evaluate the suitability of and test each product selected for their own applications. Littelfuse products are not designed for, and shall not be used for, any purpose (including, without limitation, military, aerospace, medical, life-saving, life-sustaining or nuclear facility applications, devices intended for surgical implant into the body, or any other application in which the failure or lack of desired operation of the product may result in personal injury, death, or property damage) other than those expressly set forth in applicable Littelfuse product documentation. Warranties granted by Littelfuse shall be deemed void for products used for any purpose not expressly set forth in applicable Littelfuse documentation. Littelfuse shall not be liable for any claims or damages arising out of products used in applications not expressly intended by Littelfuse as set forth in applicable Littelfuse documentation. The sale and use of Littelfuse products is subject to Littelfuse Terms and Conditions of Sale, unless otherwise agreed by Littelfuse.