

ESD9X5VL

**1-Line, Uni-directional, Ultra-low Capacitance
Transient Voltage Suppressor**

Descriptions

The ESD9X5VL is a Uni-directional transient voltage suppressor (TVS) which provide a very high level protection for sensitive electronic components that may be subjected to electrostatic discharge (ESD). It is designed to replace multilayer varistors (MLV) in consumer equipment applications such as mobile phone, notebook, PAD, STB, LCD TV etc.

The ESD9X5VL incorporates one pair of ultra-low capacitance steering diodes plus a TVS diode.

The ESD9X5VL may be used to provide ESD protection up to $\pm 20\text{kV}$ (contact and air discharge) according to IEC61000-4-2, and withstand peak pulse current up to 4A for 8/20 μs pulse according to IEC61000-4-5.

The ESD9X5VL is available in FBP-02C package. Standard products are Pb-free and Halogen-free.

Features

- Stand-off voltage: 5V max.
- Transient protection for each line according to
IEC61000-4-2 (ESD): $\pm 20\text{kV}$ (contact and air discharge)
IEC61000-4-4 (EFT): 40A (5/50ns)
IEC61000-4-5 (surge): 4A (8/20 μs)
- Ultra-low capacitance: $C_J = 1.2\text{pF}$ typ.
- Ultra-low leakage current: $I_R < 1\text{nA}$ typ.
- Low clamping voltage: $V_{CL} = 18\text{V}$ typ. @ $I_{PP} = 16\text{A}$ (TLP)
- Solid-state silicon technology

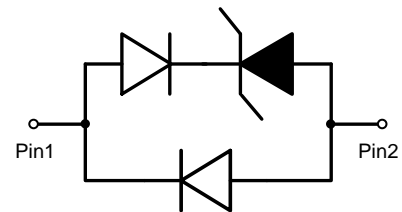
Applications

- USB 2.0 and USB 3.0
- HDMI 1.3 and HDMI 1.4
- SATA and eSATA
- DVI
- IEEE 1394
- PCI Express
- Portable Electronics and Notebooks

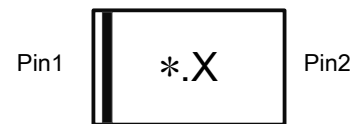
<http://www.sh-willsemi.com>



FBP-02C (Bottom View)



Circuit diagram



* = Month code (A~Z)

.X= Device code

Marking (Top View)

Order information

Device	Package	Shipping
ESD9X5VL-2/TR	FBP-02C	10000/Tape&Reel

Absolute maximum ratings

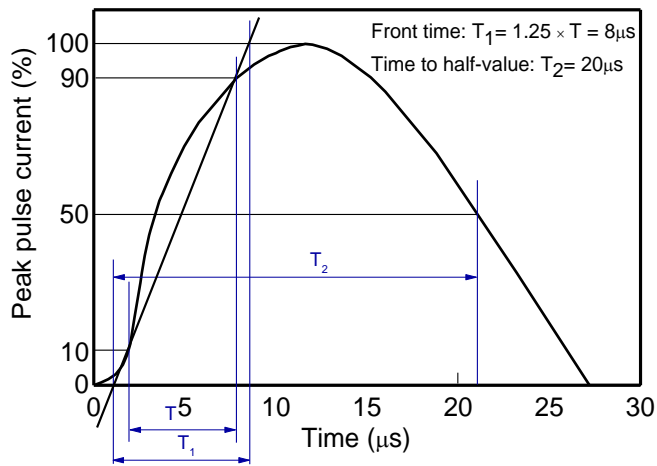
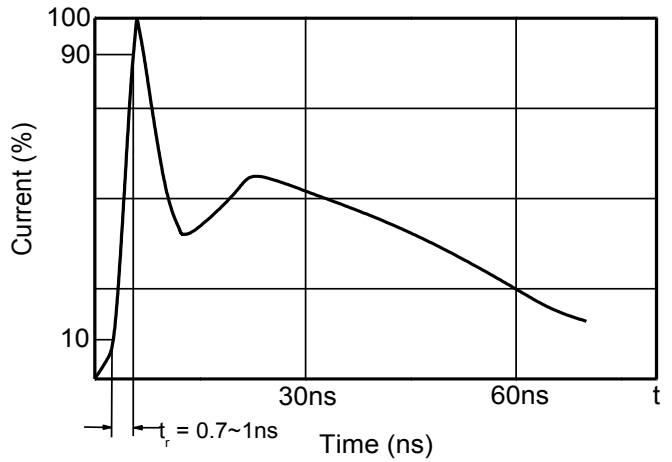
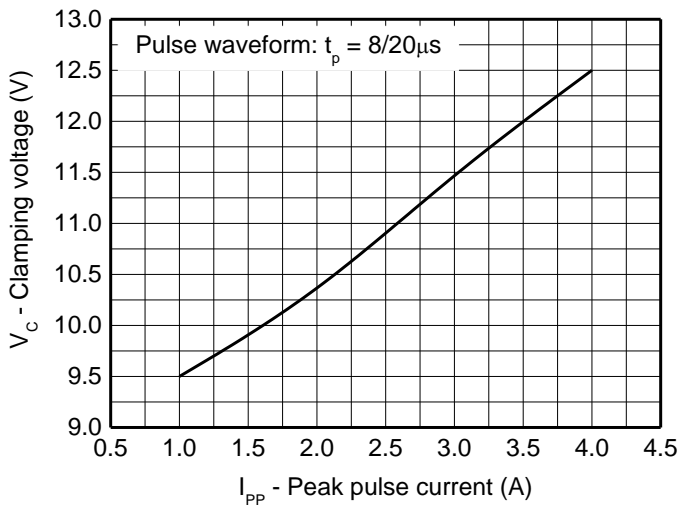
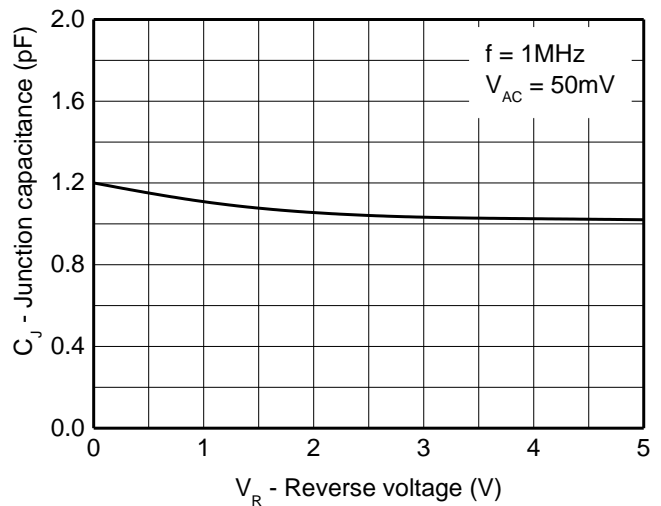
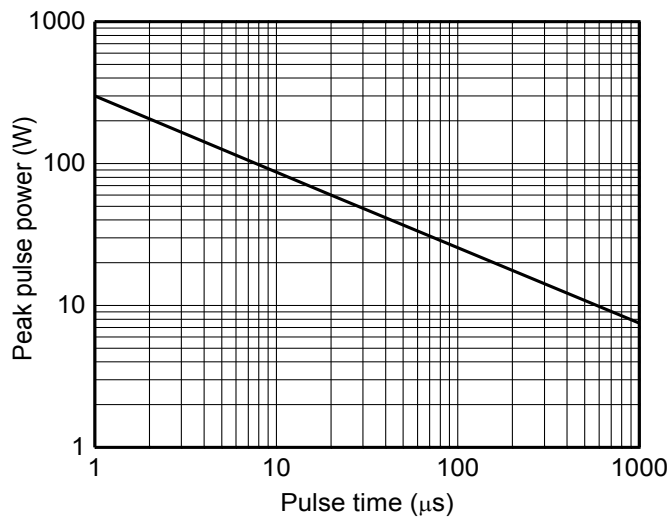
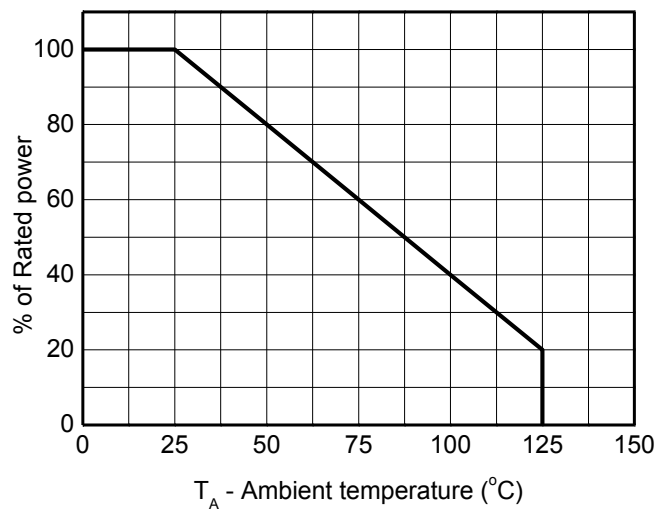
Parameter	Symbol	Rating	Unit
Peak pulse power ($t_p = 8/20\mu\text{s}$)	P_{pk}	60	W
Peak pulse current ($t_p = 8/20\mu\text{s}$)	I_{PP}	4	A
ESD according to IEC61000-4-2 air discharge	V_{ESD}	± 20	kV
ESD according to IEC61000-4-2 contact discharge		± 20	
Junction temperature	T_J	125	$^{\circ}\text{C}$
Operation temperature	T_{OP}	-40~85	$^{\circ}\text{C}$
Lead temperature	T_L	260	$^{\circ}\text{C}$
Storage temperature	T_{STG}	-55~150	$^{\circ}\text{C}$

Electrical characteristics ($T_A = 25^{\circ}\text{C}$, unless otherwise noted)

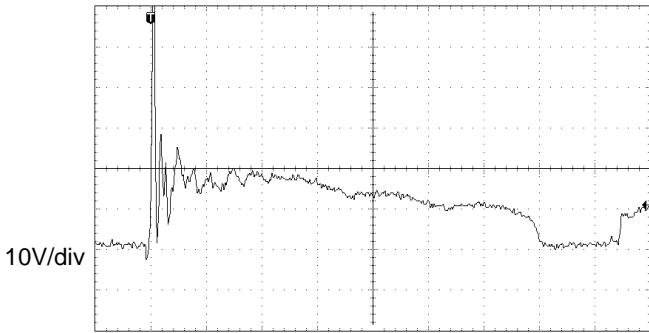
Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Reverse maximum working voltage	V_{RWM}				5.0	V
Reverse leakage current	I_R	$V_{RWM} = 5\text{V}$		<1	100	nA
Reverse breakdown voltage	V_{BR}	$I_{BR} = 1\text{mA}$	7.0	8.0	9.0	V
Forward voltage	V_F	$I_F = 10\text{mA}$	0.6	0.9	1.2	V
Clamping voltage ¹⁾	V_{CL}	$I_{PP} = 16\text{A}$, $t_p = 100\text{ns}$		18.0		V
Dynamic resistance ¹⁾	R_{DYN}			0.59		Ω
Clamping voltage ²⁾	V_{CL}	$I_{PP} = 1\text{A}$, $t_p = 8/20\mu\text{s}$			11.0	V
		$I_{PP} = 4\text{A}$, $t_p = 8/20\mu\text{s}$			15.0	V
Junction capacitance	C_J	$V_R = 0\text{V}$, $f = 1\text{MHz}$		1.2	1.6	pF

Notes:

- 1) TLP parameter: $Z_0 = 50\ \Omega$, $t_p = 100\text{ns}$, $t_r = 2\text{ns}$, averaging window from 60ns to 80ns. R_{DYN} is calculated from 4A to 16A.
- 2) Non-repetitive current pulse, according to IEC61000-4-5.

Typical characteristics ($T_A = 25^\circ\text{C}$, unless otherwise noted)

8/20μs waveform per IEC61000-4-5

Contact discharge current waveform per IEC61000-4-2

Clamping voltage vs. Peak pulse current

Capacitance vs. Reverse voltage

Non-repetitive peak pulse power vs. Pulse time

Power derating vs. Ambient temperature

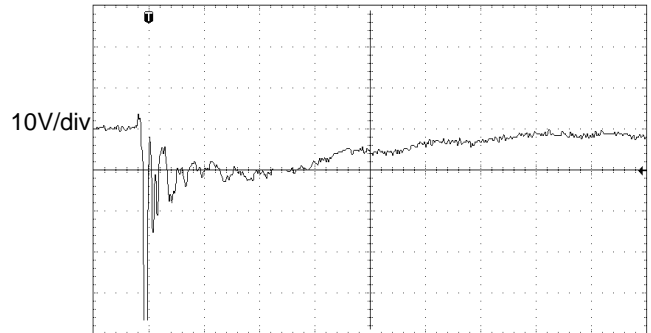
Typical characteristics ($T_A = 25^\circ\text{C}$, unless otherwise noted)



20ns/div

ESD clamping

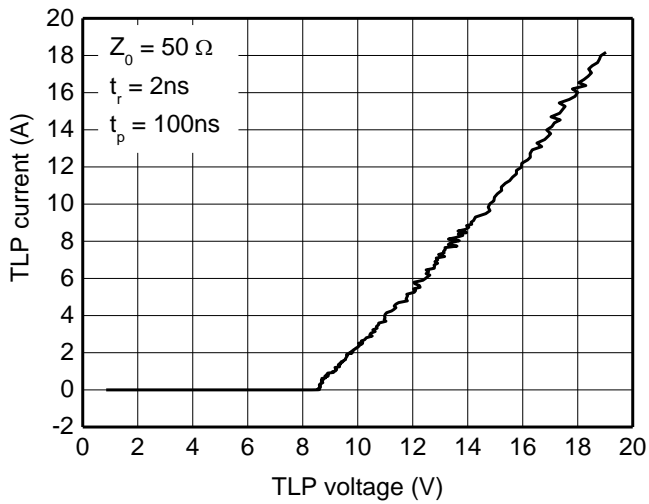
(+8kV contact discharge per IEC61000-4-2)



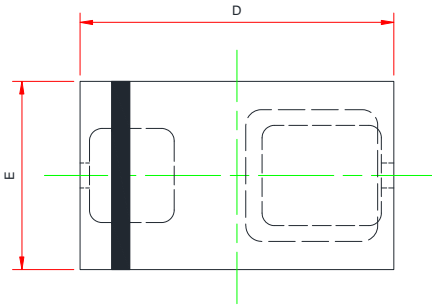
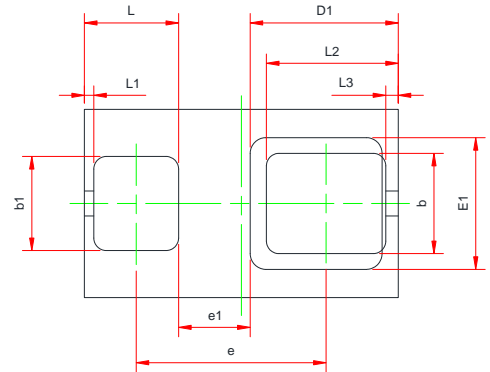
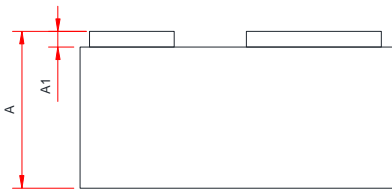
20ns/div

ESD clamping

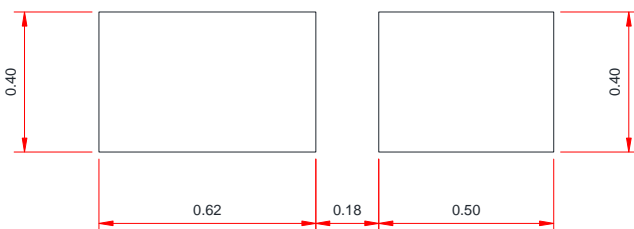
(-8kV contact discharge per IEC61000-4-2)



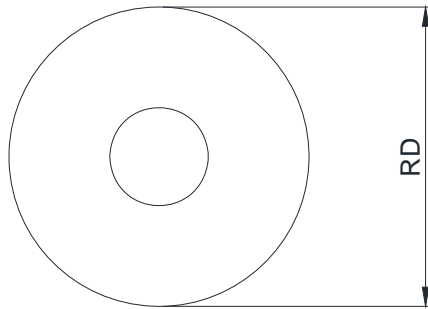
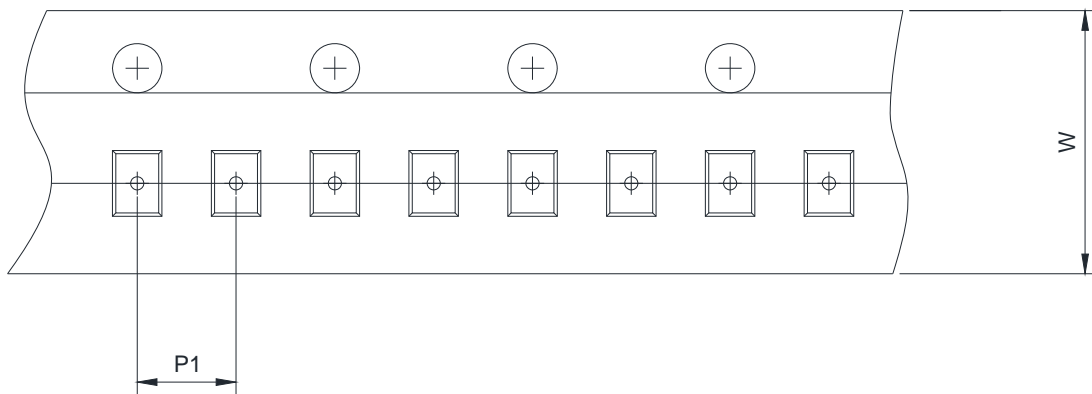
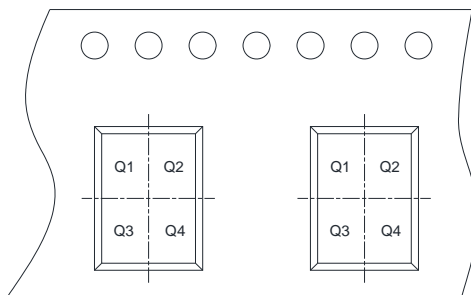
TLP Measurement

Package outline dimensions
FBP-02C

Top View

Bottom View

Side View

Symbol	Dimensions In Millimeters		
	Min.	Typ.	Max.
A	0.450	0.500	0.550
A1	0.010	--	0.100
D	0.950	1.000	1.050
E	0.550	0.600	0.650
D1	0.470 Ref.		
E1	0.420 Ref.		
b	0.270	0.320	0.370
b1	0.250	0.300	0.350
e	0.555	0.605	0.655
e1	0.230 Ref.		
L	0.250	0.300	0.350
L1	0.030 Ref.		
L2	0.370	0.420	0.470
L3	0.040 Ref.		

Recommended land pattern (Unit: mm)

Notes:

This recommended land pattern is for reference purposes only. Please consult your manufacturing group to ensure your PCB design guidelines are met.

TAPE AND REEL INFORMATION
Reel Dimensions

Tape Dimensions

Quadrant Assignments For PIN1 Orientation In Tape



 User Direction of Feed

RD	Reel Dimension	<input checked="" type="checkbox"/> 7inch	<input type="checkbox"/> 13inch
W	Overall width of the carrier tape	<input checked="" type="checkbox"/> 8mm	<input type="checkbox"/> 12mm <input type="checkbox"/> 16mm
P1	Pitch between successive cavity centers	<input checked="" type="checkbox"/> 2mm	<input type="checkbox"/> 4mm <input type="checkbox"/> 8mm
Pin1	Pin1 Quadrant	<input checked="" type="checkbox"/> Q1	<input checked="" type="checkbox"/> Q2 <input type="checkbox"/> Q3 <input type="checkbox"/> Q4