

**ESD9X5VU**

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

**Descriptions**

The ESD9X5VU is a Uni-directional transient voltage suppressor (TVS) which provides 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 ESD9X5VU incorporates one pair of ultra-low capacitance steering diodes plus a TVS diode.

The ESD9X5VU 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 $\mu\text{s}$  pulse according to IEC61000-4-5.

The ESD9X5VU 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 $\mu\text{s}$ )
- Ultra-low capacitance:  $C_J = 0.5\text{pF}$  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

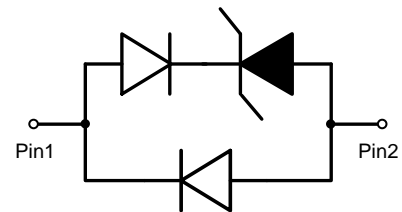
**Applications**

- 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

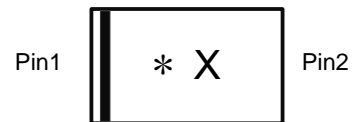
<http://www.sh-willsemi.com>



**FBP-02C (Bottom View)**



**Circuit diagram**



\* = Month code ( A~Z)

X = Device code

**Marking (Top View)**

**Order information**

Device	Package	Shipping
ESD9X5VU-2/TR	FBP-02C	10000/Tape&Reel

**Absolute maximum ratings**

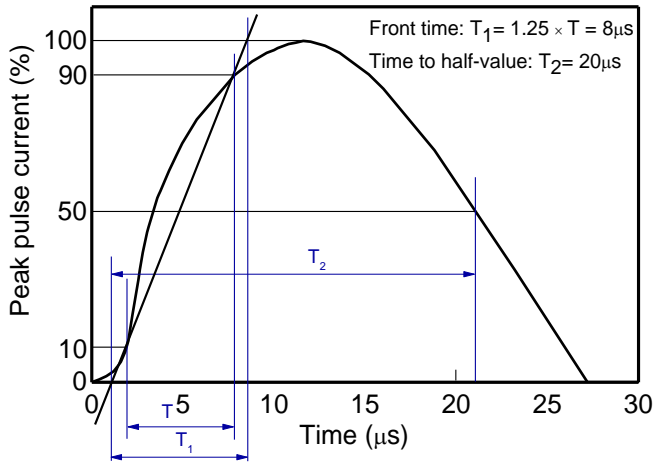
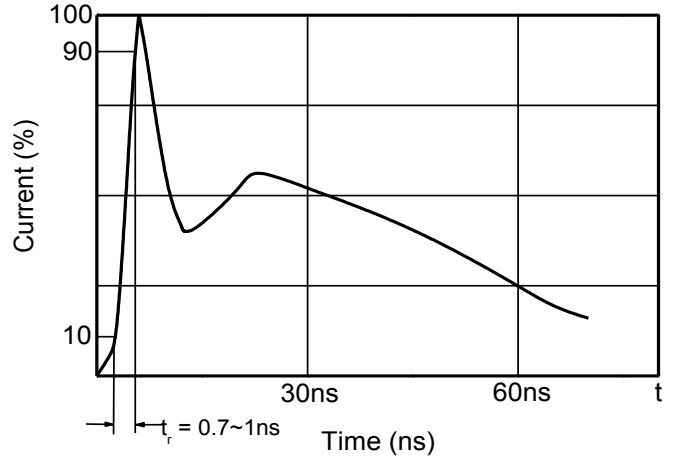
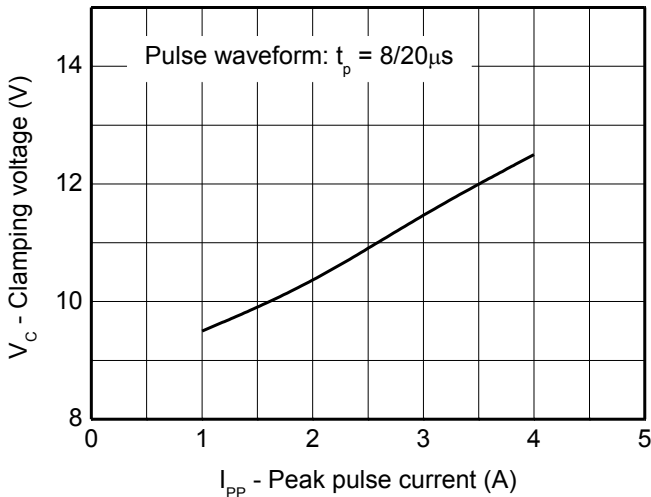
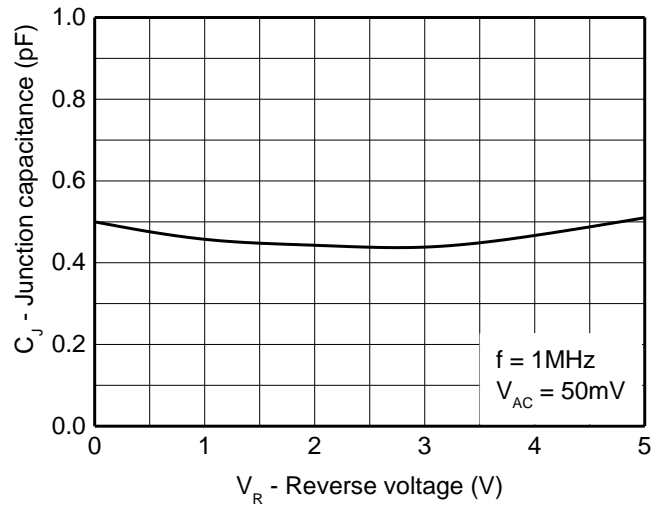
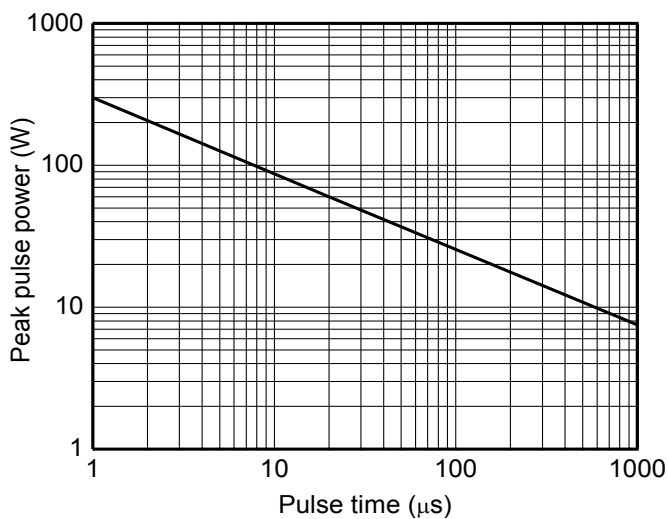
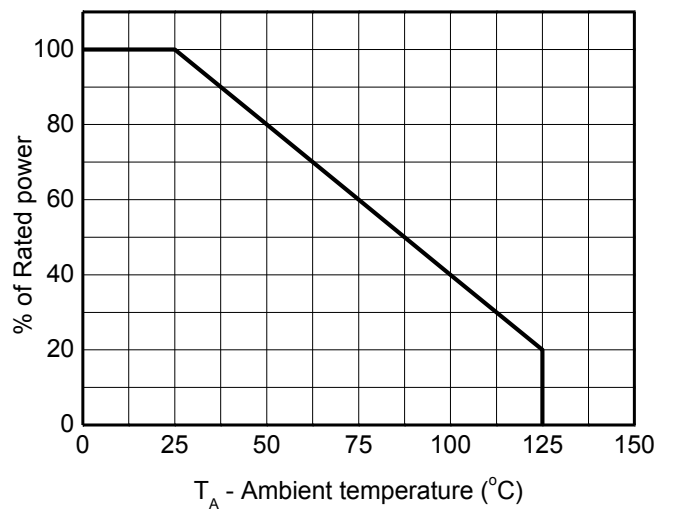
Parameter	Symbol	Rating	Unit
Peak pulse power ( $t_p = 8/20\mu s$ )	$P_{pk}$	60	W
Peak pulse current ( $t_p = 8/20\mu s$ )	$I_{pp}$	4	A
ESD according to IEC61000-4-2 air discharge	$V_{ESD}$	$\pm 20$	kV
ESD according to IEC61000-4-2 contact discharge		$\pm 20$	
Junction temperature	$T_J$	125	$^{\circ}C$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

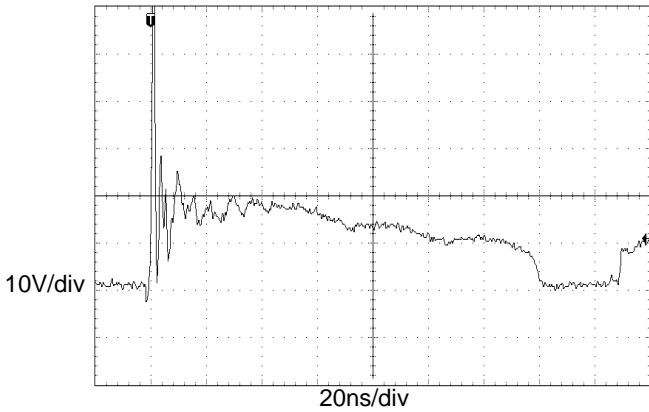
**Electrical characteristics ( $T_A = 25^{\circ}C$ , unless otherwise noted)**

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Reverse stand-off voltage	$V_{RWM}$				5.0	V
Reverse leakage current	$I_R$	$V_{RWM} = 5V$		<1	100	nA
Reverse breakdown voltage	$V_{BR}$	$I_{BR} = 1mA$	7.0	8.0	9.0	V
Forward voltage	$V_F$	$I_F = 10mA$	0.6	0.9	1.2	V
Clamping voltage <sup>1)</sup>	$V_{CL}$	$I_{PP} = 16A, t_p = 100ns$		18.0		V
Dynamic resistance <sup>1)</sup>	$R_{DYN}$			0.57		$\Omega$
Clamping voltage <sup>2)</sup>	$V_{CL}$	$I_{PP} = 1A, t_p = 8/20\mu s$			11	V
		$I_{PP} = 4A, t_p = 8/20\mu s$			15	V
Junction capacitance	$C_J$	$V_R = 0V, f = 1MHz$		0.50	0.90	pF

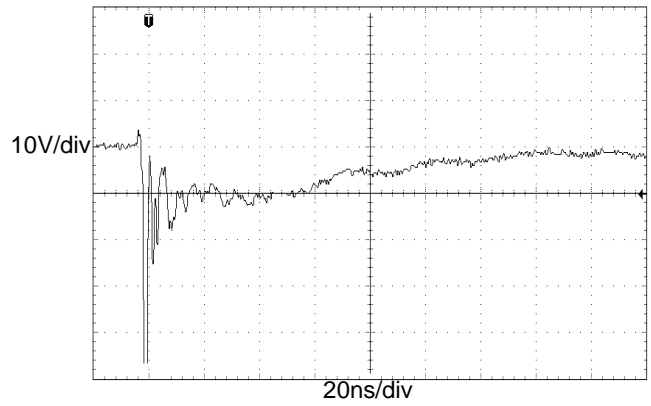
Notes:

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

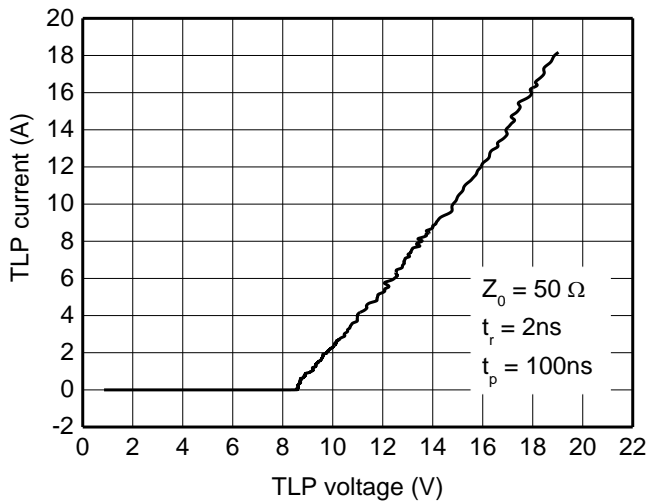
**Typical characteristics ( $T_A = 25^\circ\text{C}$ , unless otherwise noted)**

**8/20 $\mu\text{s}$  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)**


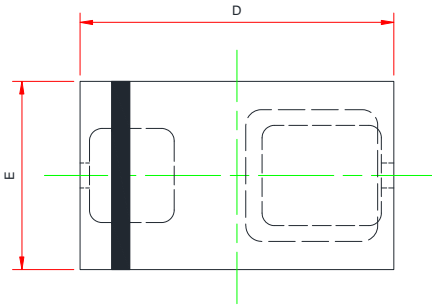
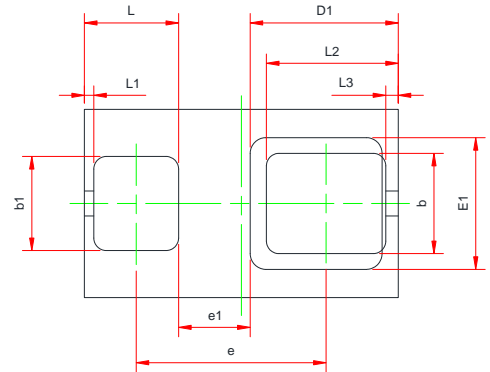
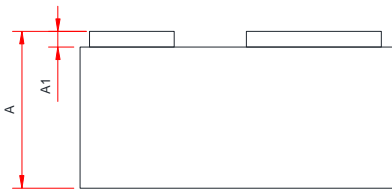
**ESD clamping**  
**(+8kV contact discharge per IEC61000-4-2)**



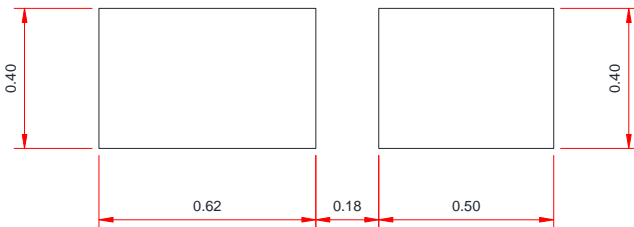
**ESD clamping**  
**(-8kV contact discharge per IEC61000-4-2)**



**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.		

**Recommend 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.