

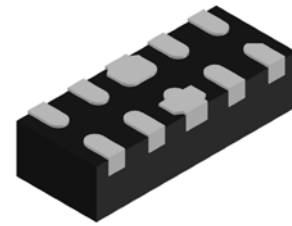
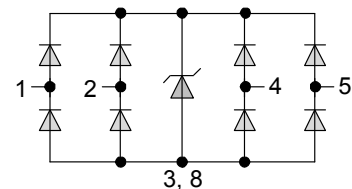
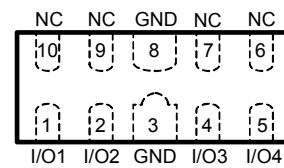
**ESD5304D**
**4-Lines, Uni-directional, Ultra-low Capacitance  
Transient Voltage Suppressors**
<http://www.sh-willsemi.com>
**Descriptions**

The ESD5304D is an ultra-low capacitance TVS (Transient Voltage Suppressor) array designed to protect high speed data interfaces. It has been specifically designed to protect sensitive electronic components which are connected to data and transmission lines from over-stress caused by ESD (Electrostatic Discharge).

The ESD5304D incorporates four pairs of ultra-low capacitance steering diodes plus a TVS diode.

The ESD5304D may be used to provide ESD protection up to  $\pm 20\text{kV}$  (contact discharge) according to IEC61000-4-2, and withstand peak pulse current up to 4A (8/20 $\mu\text{s}$ ) according to IEC61000-4-5.

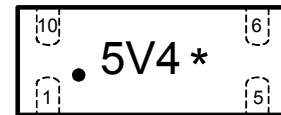
The ESD5304D is available in DFN2510-10L package. Standard products are Pb-free and Halogen-free.


**DFN2510-10L (Bottom view)**

**Pin configuration (Top view)**
**Features**

- Stand-off voltage: 5V max.
- Transient protection for each line according to IEC61000-4-2 (ESD):  $\pm 20\text{kV}$  (contact discharge)  
IEC61000-4-4 (EFT): 40A (5/50ns)  
IEC61000-4-5 (surge): 4A (8/20 $\mu\text{s}$ )
- Ultra-low capacitance:  $C_J = 0.4\text{pF}$  typ.
- Ultra-low leakage current:  $I_R < 1\text{nA}$  typ.
- Low clamping voltage:  $V_{CL} = 14\text{V}$  typ. @  $I_{PP} = 16\text{A}$  (TLP)
- Solid-state silicon technology

**Applications**

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



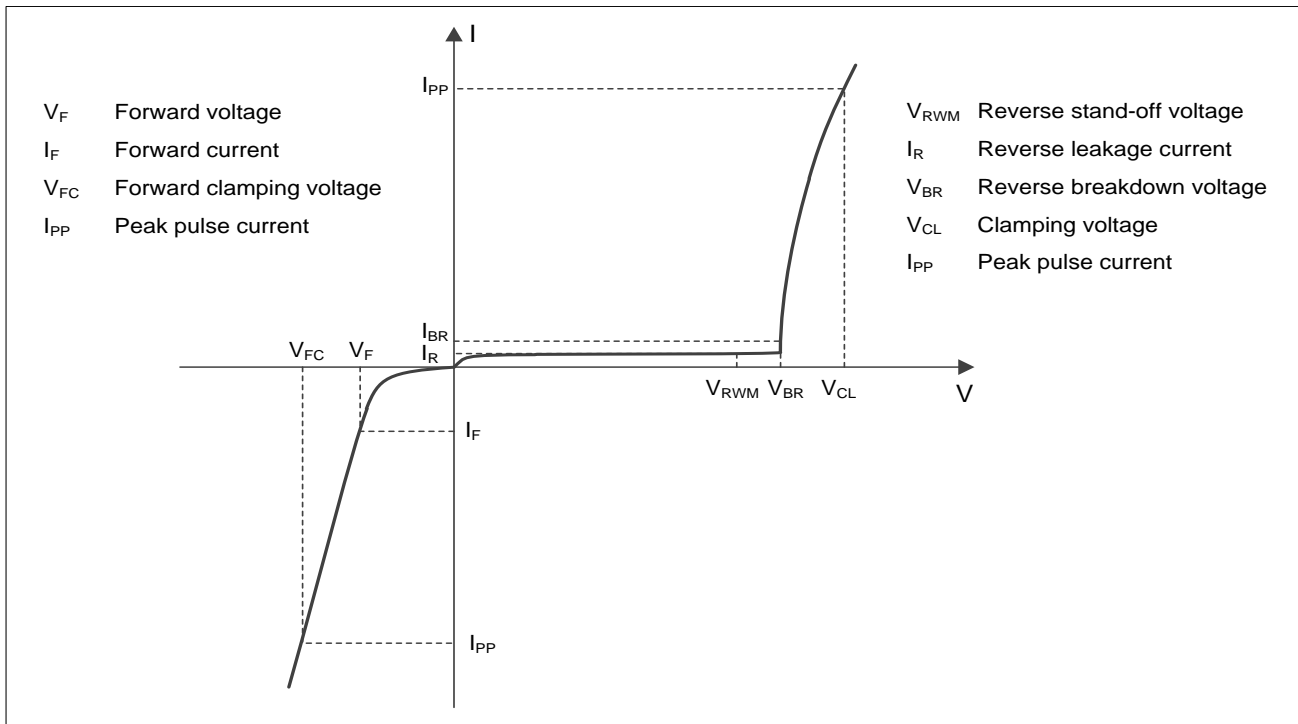
5V4 = Device code  
\* = Month code ( A~Z)

**Marking**
**Order information**

Device	Package	Shipping
ESD5304D-10/TR	DFN2510-10L	3000/Tape&Reel

**Absolute maximum ratings**

Parameter	Symbol	Rating	Unit
Peak pulse power ( $t_p = 8/20\mu s$ )	$P_{pk}$	48	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	$^{\circ}C$
Operating temperature	$T_{OP}$	-40~85	$^{\circ}C$
Lead temperature	$T_L$	260	$^{\circ}C$
Storage temperature	$T_{STG}$	-55~150	$^{\circ}C$

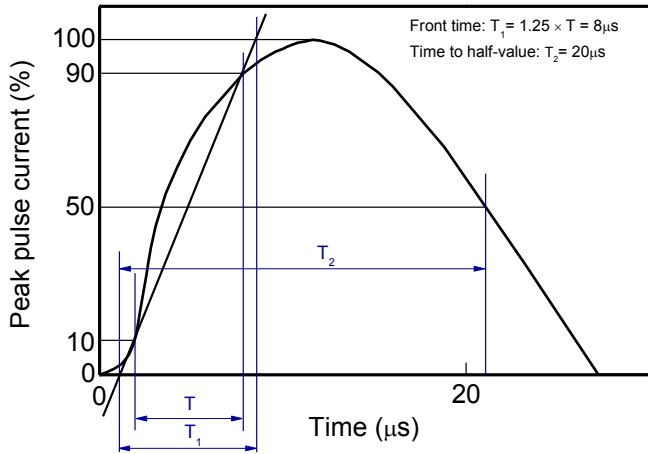
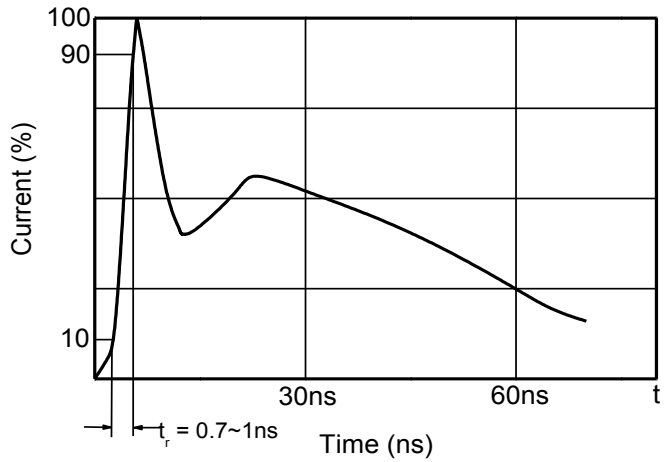
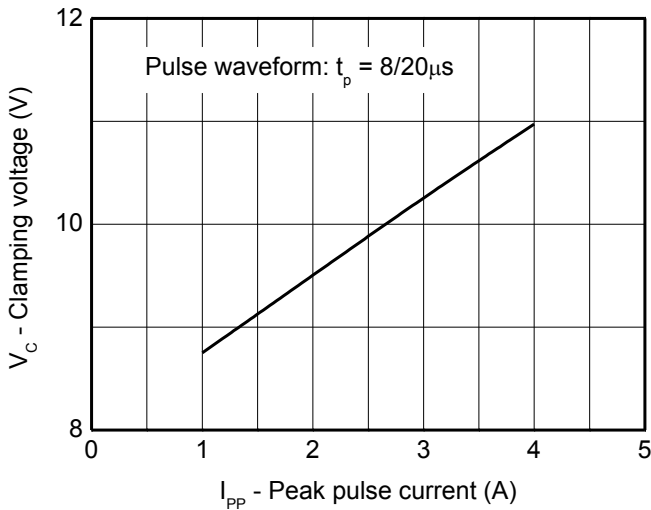
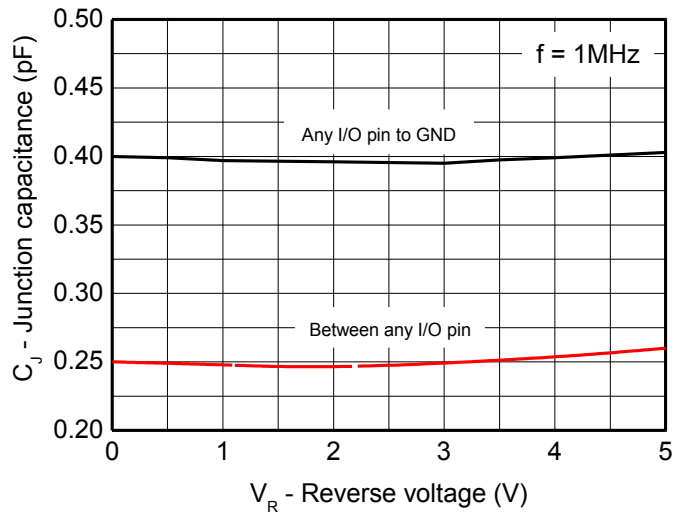
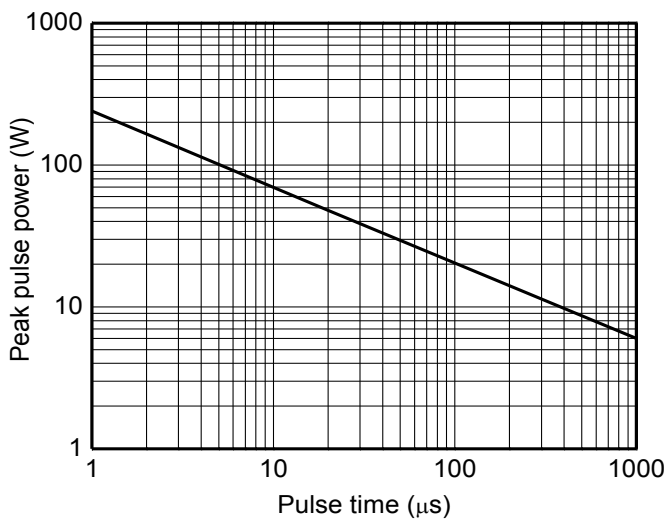
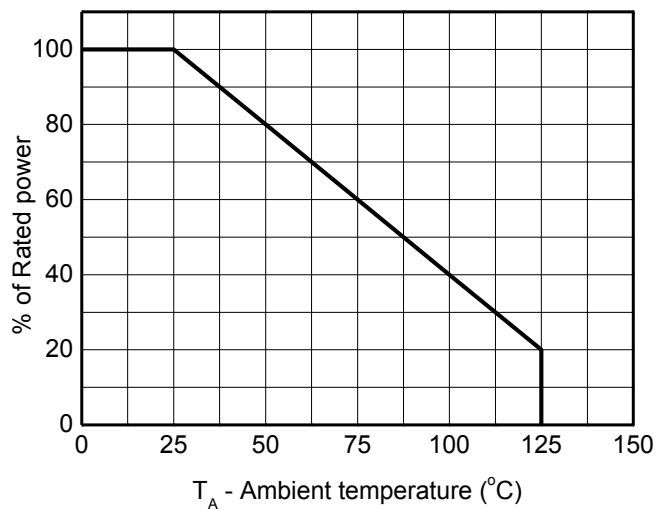
**Electrical characteristics ( $T_A = 25^{\circ}C$ , unless otherwise noted)**

**Definitions of electrical characteristics**

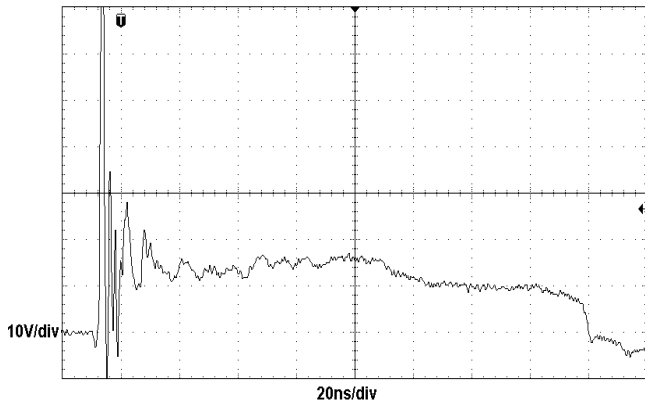
**Electrical characteristics ( $T_A = 25^\circ\text{C}$ , unless otherwise noted)**

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Reverse maximum working voltage	$V_{RWM}$				5.0	V
Reverse leakage current	$I_R$	$V_{RWM} = 5V$		<1	100	nA
Reverse breakdown voltage	$V_{BR}$	$I_T = 1\text{mA}$	7.0	8.0	9.0	V
Forward voltage	$V_F$	$I_T = 10\text{mA}$	0.6	0.9	1.2	V
Clamping voltage <sup>1)</sup>	$V_{CL}$	$I_{PP} = 16A, t_p = 100\text{ns}$		14		V
Clamping voltage <sup>2)</sup>	$V_{CL}$	$V_{ESD} = +8\text{kV}$		14		V
Dynamic resistance <sup>1)</sup>	$R_{DYN}$			0.33		$\Omega$
Clamping voltage <sup>3)</sup>	$V_{CL}$	$I_{PP} = 1A, t_p = 8/20\mu\text{s}$			10	V
		$I_{PP} = 4A, t_p = 8/20\mu\text{s}$			12	V
Junction capacitance	$C_J$	$V_R = 0V, f = 1\text{MHz}$ Any I/O pin to GND		0.40	0.65	pF
		$V_R = 0V, f = 1\text{MHz}$ Between any I/O pin		0.25	0.40	pF

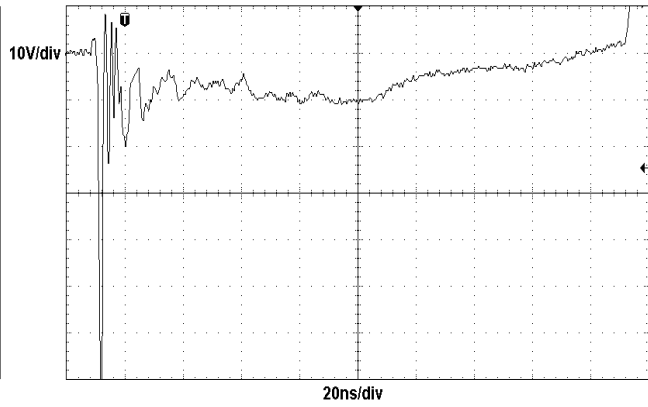
**Notes:**

- 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) Contact discharge mode, according to IEC61000-4-2.
- 3) Non-repetitive current pulse, according to IEC61000-4-5.

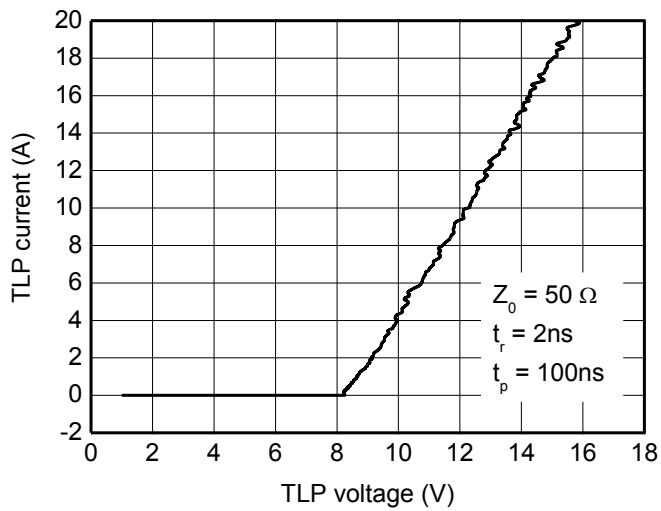
**Typical characteristics ( $T_A = 25^\circ\text{C}$ , unless otherwise noted)**

**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)**


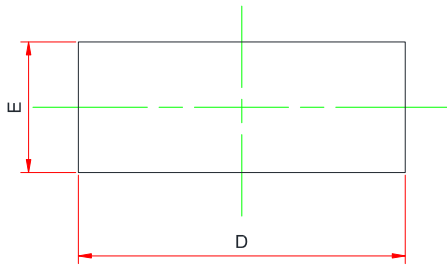
**ESD clamping**  
 (+8kV contact discharge per IEC61000-4-2)



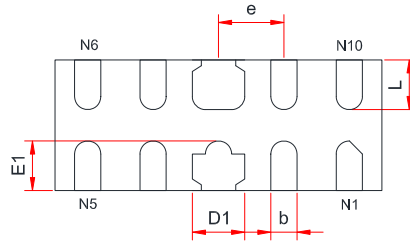
**ESD clamping**  
 (-8kV contact discharge per IEC61000-4-2)



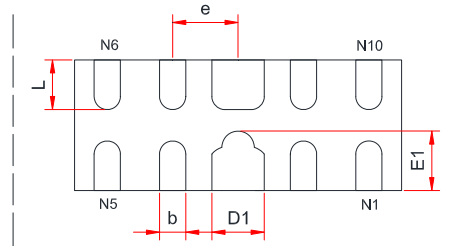
**TLP Measurement**

**PACKAGE OUTLINE DIMENSIONS**
**DFN2510-10L**


Top View

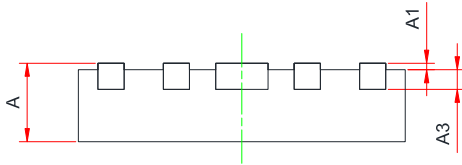


(I)



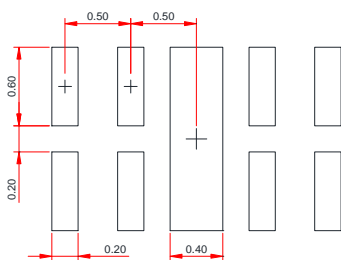
(II)

Bottom View

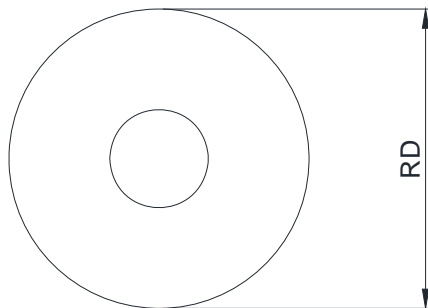
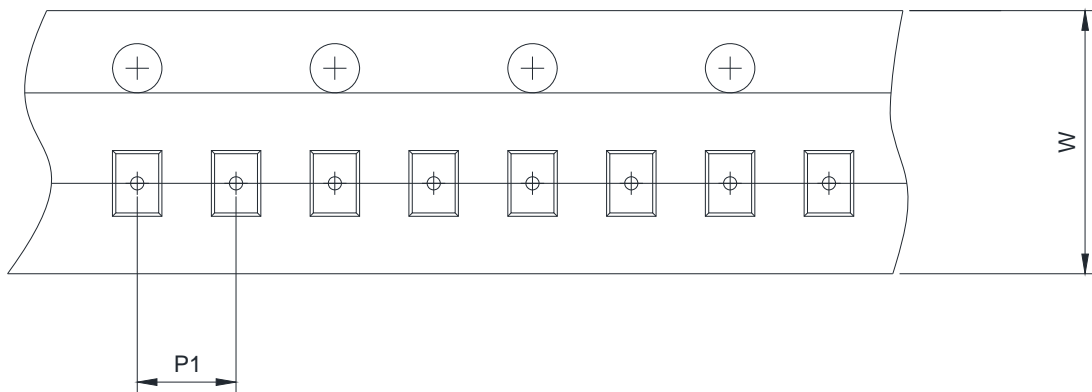
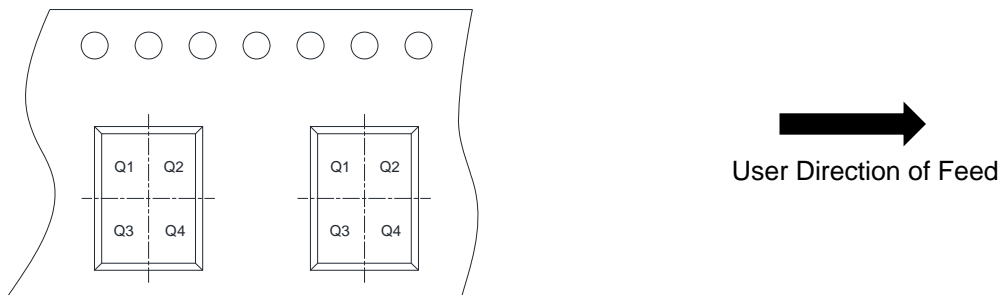


Side View

Symbol	Dimensions in Millimeters		
	Min.	Typ.	Max.
A	0.500	0.575	0.650
A1	0.000	-	0.050
A3	0.150 Ref.		
D	2.400	2.500	2.600
E	0.900	1.000	1.100
D1	0.300	0.400	0.500
E1	0.300	0.455	0.610
b	0.130	0.190	0.250
e	0.500 BSC		
L	0.280	0.390	0.500

**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**


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		
P1	Pitch between successive cavity centers	<input type="checkbox"/> 2mm	<input checked="" type="checkbox"/> 4mm	<input type="checkbox"/> 8mm	
Pin1	Pin1 Quadrant	<input checked="" type="checkbox"/> Q1	<input type="checkbox"/> Q2	<input type="checkbox"/> Q3	<input type="checkbox"/> Q4