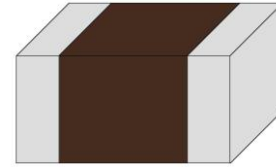
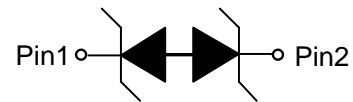


**ESD5451R**
**1-Line, Bi-directional, Transient Voltage Suppressors**
<http://www.sh-willsemi.com>
**Descriptions**

The ESD5451R is a bi-directional TVS (Transient Voltage Suppressor). It is specifically designed to protect sensitive electronic components which are connected to low speed data lines and control lines from over-stress caused by ESD (Electrostatic Discharge), EFT (Electrical Fast Transients) and Lightning.

The ESD5451R may be used to provide ESD protection up to  $\pm 30\text{kV}$  (contact and air discharge) according to IEC61000-4-2, and withstand peak pulse current up to 8A (8/20 $\mu\text{s}$ ) according to IEC61000-4-5.

The ESD5451R is available in DFP1006-2L package. Standard products are Pb-free and Halogen-free.


**DFP1006-2L**

**Circuit diagram**
**Features**

- Reverse stand-off voltage:  $\pm 5\text{V}$  Max
- Transient protection for each line according to  
IEC61000-4-2 (ESD):  $\pm 30\text{kV}$  (contact and air discharge)  
IEC61000-4-4 (EFT): 40A (5/50ns)  
IEC61000-4-5 (surge): 8A (8/20 $\mu\text{s}$ )
- Capacitance:  $C_J = 17.5\text{pF}$  typ.
- Low leakage current:  $I_R < 1\text{nA}$  typ.
- Low clamping voltage:  $V_{CL} = 11\text{V}$  typ. @  $I_{PP} = 16\text{A}$  (TLP)
- Solid-state silicon technology


**Top View**
**Applications**

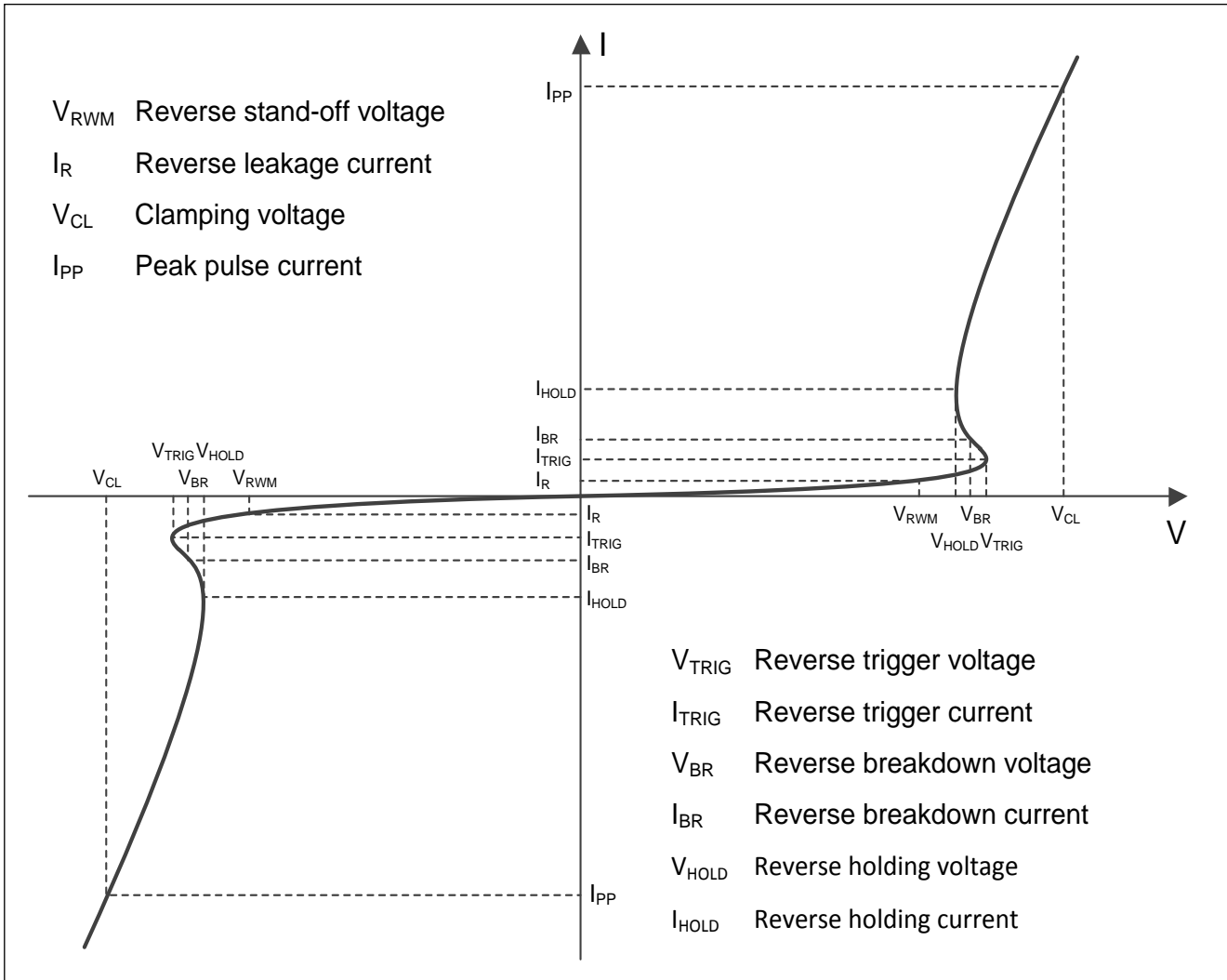
- Cellular handsets
- Tablets
- Laptops
- Other portable devices
- Network communication devices

**Order information**

Device	Package	Shipping
ESD5451R-2/TR	DFP1006-2L	10000/Tape&Reel

**Absolute maximum ratings**

Parameter	Symbol	Rating	Unit
Peak pulse power ( $t_p = 8/20\mu s$ )	$P_{pk}$	80	W
Peak pulse current ( $t_p = 8/20\mu s$ )	$I_{PP}$	8	A
ESD according to IEC61000-4-2 air discharge	$V_{ESD}$	$\pm 30$	kV
ESD according to IEC61000-4-2 contact discharge		$\pm 30$	
Junction temperature	$T_J$	125	$^{\circ}C$
Operation temperature	$T_{OP}$	-40~85	$^{\circ}C$
Lead soldering temperature - SMT	$T_L - SMT$	260	$^{\circ}C$
Lead soldering temperature - manual	$T_L - manual$	<300	$^{\circ}C$
Storage temperature	$T_{STG}$	-55~150	$^{\circ}C$

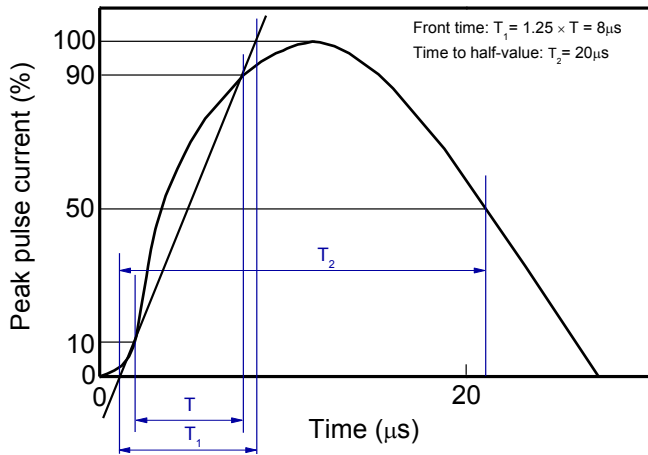
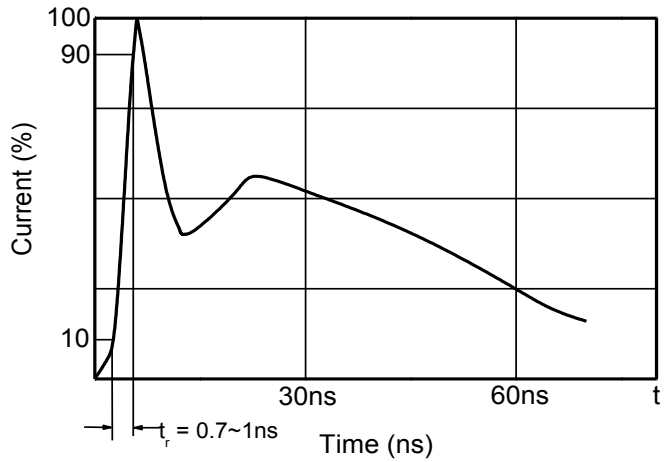
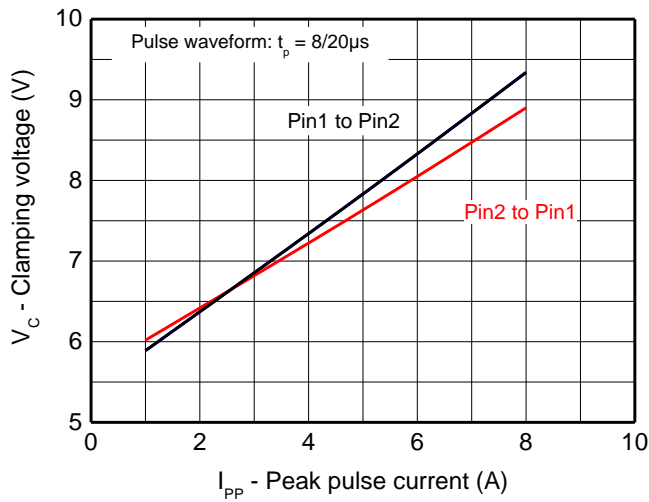
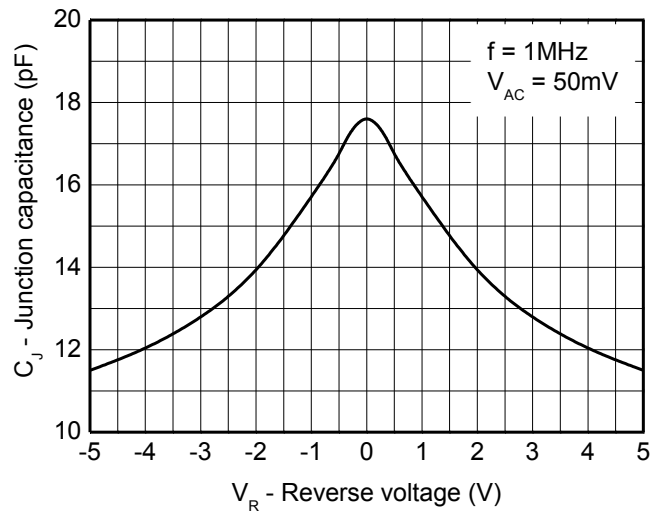
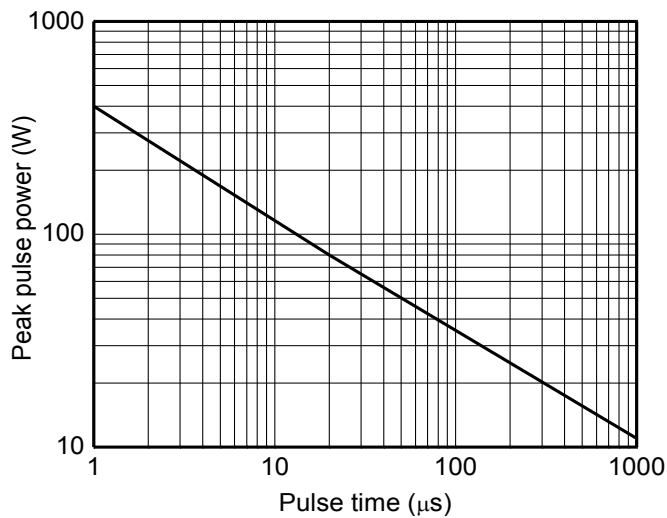
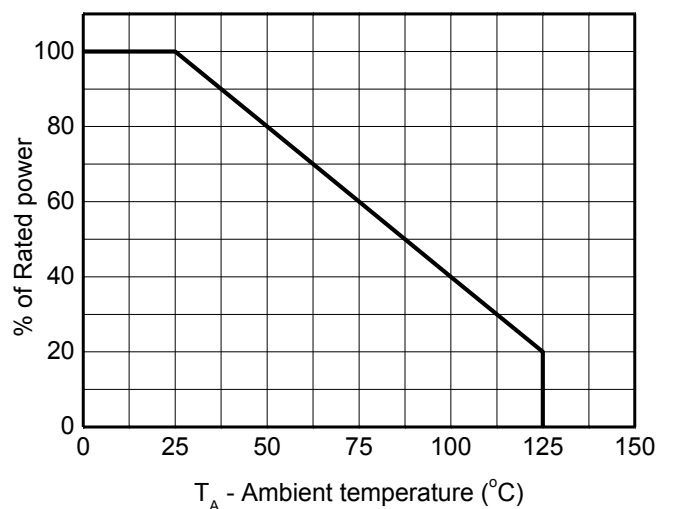
**Electrical characteristics ( $T_A=25^{\circ}C$ , unless otherwise noted)**

**Definitions of electrical characteristics**

**Electrical characteristics (T<sub>A</sub>=25 °C, unless otherwise noted)**

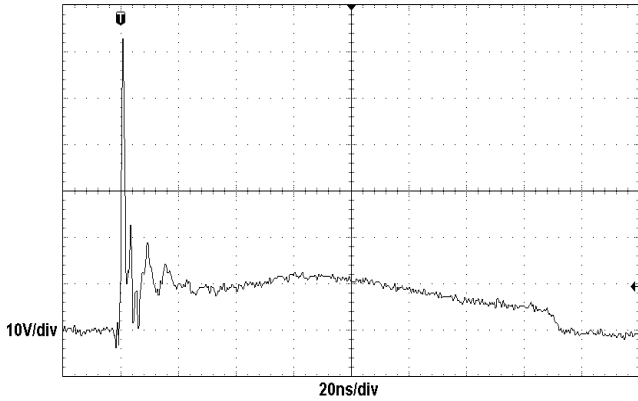
Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Reverse stand-off voltage	V <sub>RWM</sub>				±5	V
Reverse leakage current	I <sub>R</sub>	V <sub>RWM</sub> = 5V		<1	100	nA
Reverse breakdown voltage	V <sub>BR</sub>	I <sub>BR</sub> = 1mA	5.1			V
Reverse holding voltage	V <sub>HOLD</sub>	I <sub>HOLD</sub> = 50mA	5.1			V
Clamping voltage <sup>1)</sup>	V <sub>CL</sub>	I <sub>PP</sub> = 16A, t <sub>p</sub> = 100ns		11		V
Clamping voltage <sup>2)</sup>	V <sub>CL</sub>	V <sub>ESD</sub> = 8kV		12		V
Clamping voltage <sup>3)</sup>	V <sub>CL</sub>	I <sub>PP</sub> = 1A, t <sub>p</sub> = 8/20μs			6.5	V
		I <sub>PP</sub> = 5A, t <sub>p</sub> = 8/20μs			8.5	V
		I <sub>PP</sub> = 8A, t <sub>p</sub> = 8/20μs			10	V
Dynamic resistance <sup>1)</sup>	R <sub>DYN</sub>			0.24		Ω
Junction capacitance	C <sub>J</sub>	V <sub>R</sub> = 0V, f = 1MHz		17.5	22	pF
		V <sub>R</sub> = 5V, f = 1MHz		11.5	16	pF

**Notes:**

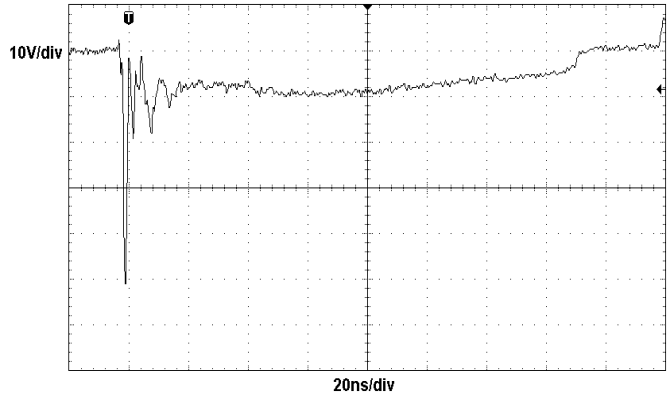
- 1) TLP parameter: Z<sub>0</sub> = 50Ω, t<sub>p</sub> = 100ns, t<sub>r</sub> = 2ns, averaging window from 60ns to 80ns. R<sub>DYN</sub> is calculated from 4A to 16A.
- 2) Contact discharge mode, according to IEC61000-4-2.
- 3) Non-repetitive current pulse, according to IEC61000-4-5.

**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**

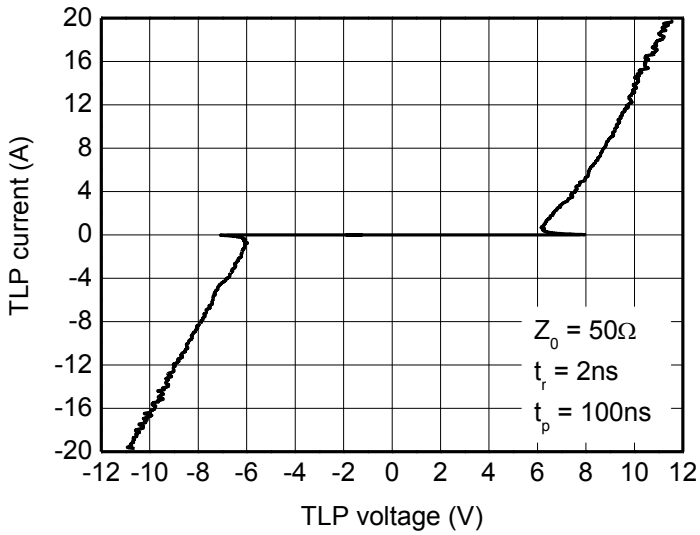
Typical characteristics ( $T_A=25^\circ\text{C}$ , unless otherwise noted)



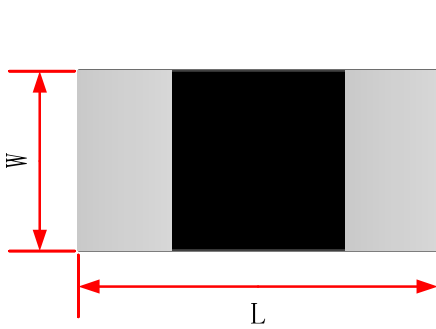
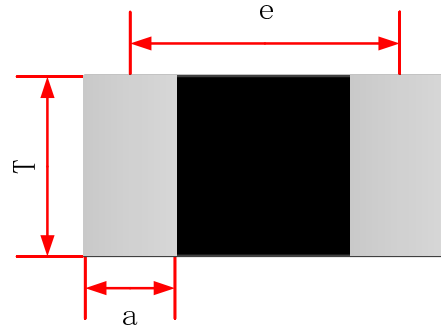
**ESD clamping**  
 (+8kV contact discharge per IEC61000-4-2)



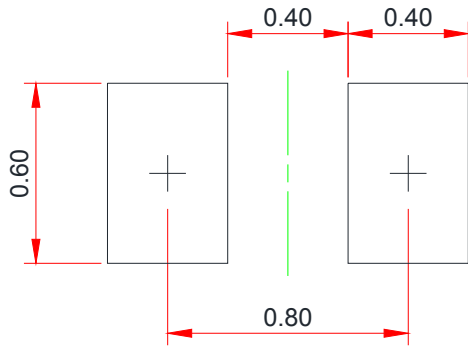
**ESD clamping**  
 (-8kV contact discharge per IEC61000-4-2)



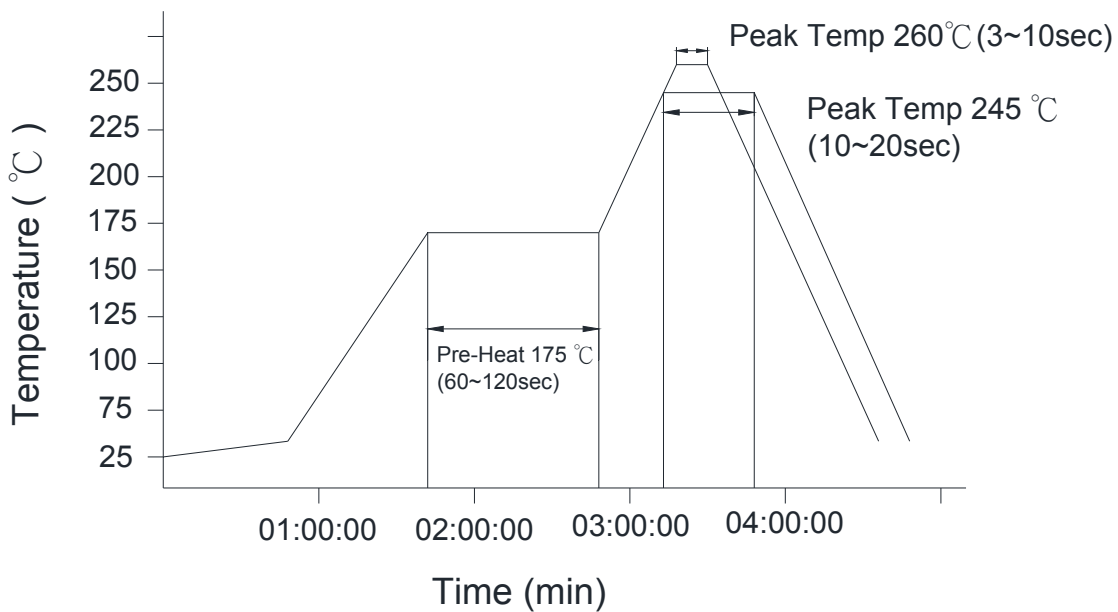
**TLP Measurement**

**Package outline dimensions**
**DFP1006-2L**

**Top View (Bottom View)**

**Side View**

Symbol	Dimensions in millimeter		
	Min.	Typ.	Max.
W	0.40	0.50	0.53
L	0.90	1.00	1.10
T	0.40	0.50	0.53
a	0.15	0.25	0.35
e	0.75 Typ.		

**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.

**he IR reflow and temperature of Soldering for Pb Free**

**IR reflow Pb Free Process suggestion profile**

- (1) The solder recommend is Sn96.5/Ag 3.5 of 120 to 150 $\mu$ m
- (2) Ramp-up rate (217 $^{\circ}$ C to Peak) + 3 $^{\circ}$ C/second max
- (3) Temp. maintain at 175 +/- 25 $^{\circ}$ C 180 seconds max
- (4) Temp. maintain above 217  $^{\circ}$ C 60-150 seconds
- (5) Peak temperature range 245 $^{\circ}$ C +20 $^{\circ}$ C / -10  $^{\circ}$ C time within 5  $^{\circ}$ C of actually peak temperature (tp) 10~20 seconds
- (6) Ramp down rate +6  $^{\circ}$ C/second max
- (7) Steel plate thickness 0.08mm