

## ESD5451Z

### 1-Line, Bi-directional, Transient Voltage Suppressor

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

### Descriptions

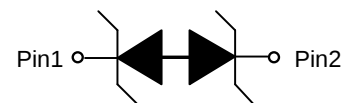
The ESD5451Z is a bi-directional TVS (Transient Voltage Suppressor). It is specifically designed to protect sensitive electronic components which are connected to low speed data lines and control lines from over-stress caused by ESD (Electrostatic Discharge), EFT (Electrical Fast Transients) and Lightning.

The ESD5451Z 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 ESD5451Z is available in DFN0603-2L package. Standard products are Pb-free and Halogen-free.



**DFN0603-2L (Bottom View)**



**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:  $V_{CL} = 9\text{V}$  typ. @  $I_{PP} = 16\text{A}$  (TLP)
- Small package

### Applications

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



E = Device code

\* = Month code

**Marking (Top View)**

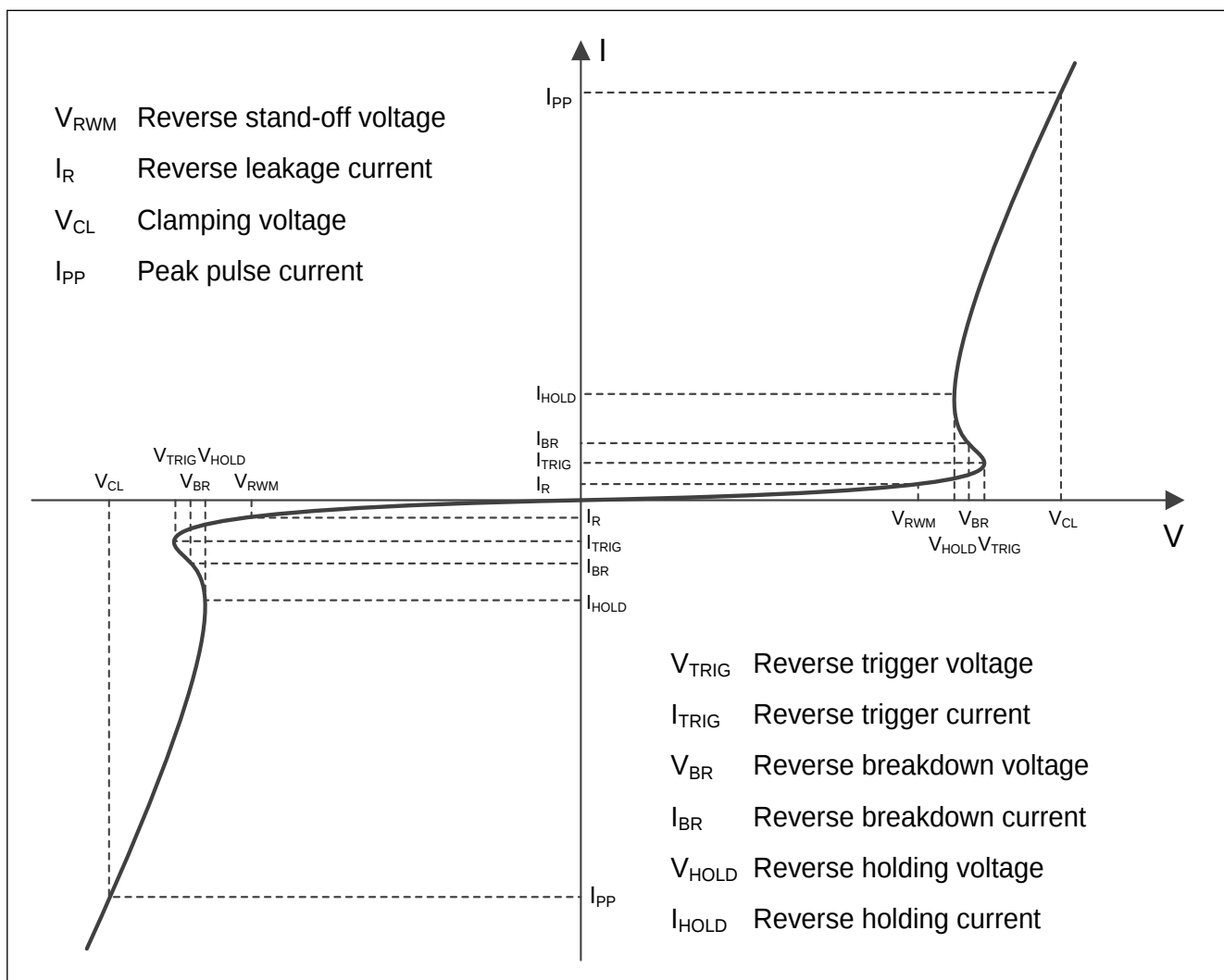
### Order information

| Device        | Package    | Shipping        |
|---------------|------------|-----------------|
| ESD5451Z-2/TR | DFN0603-2L | 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      | $^{\circ}C$ |
| 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)



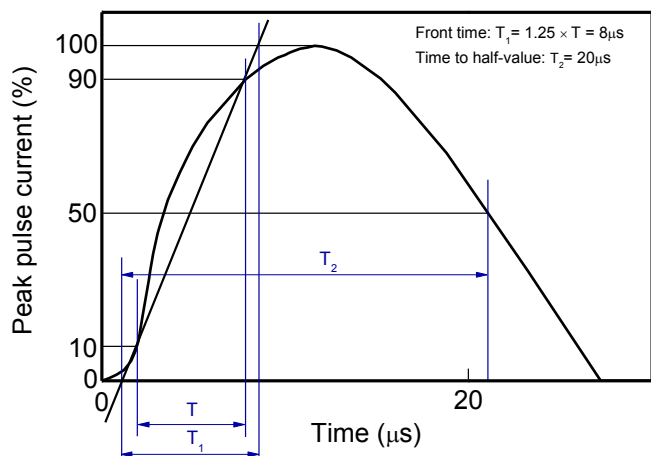
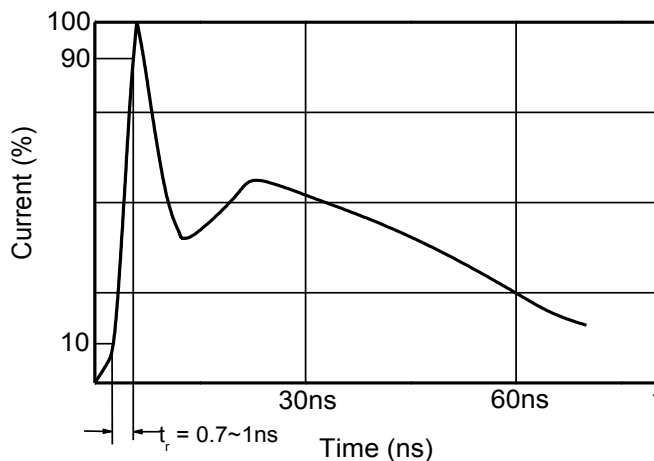
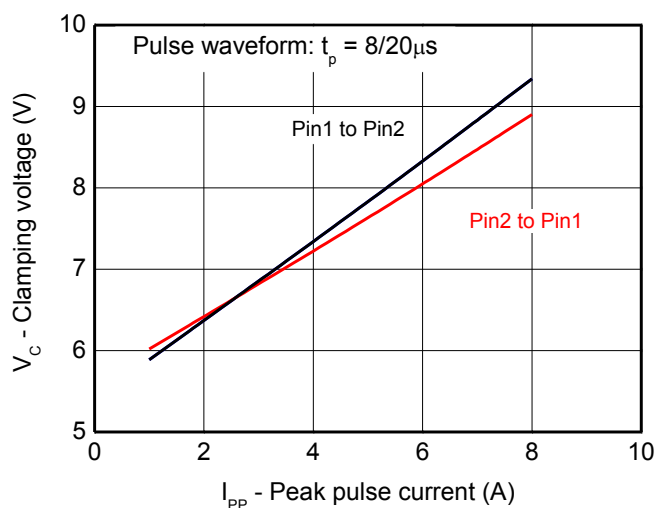
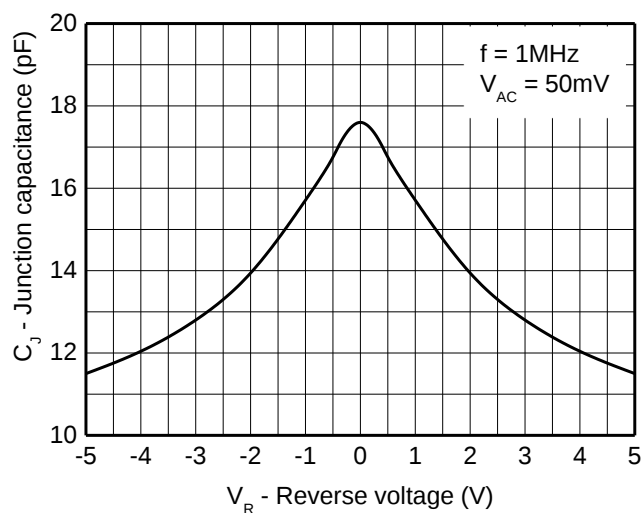
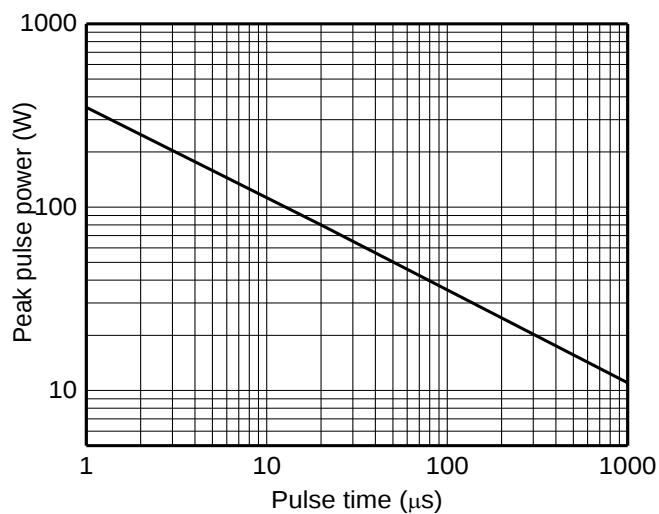
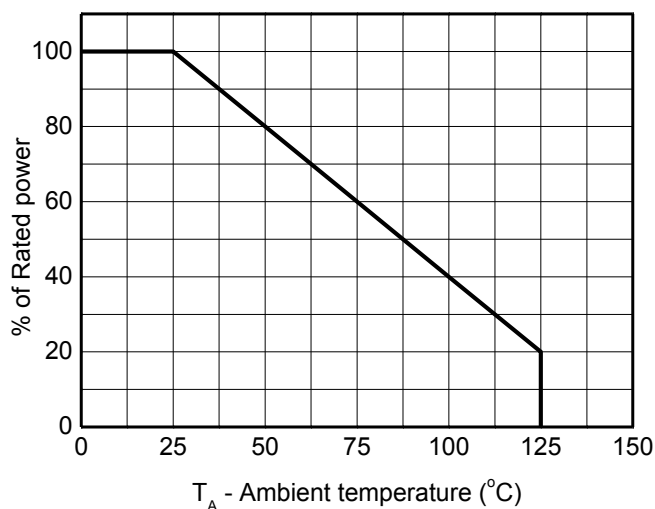
Definitions of electrical characteristics

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

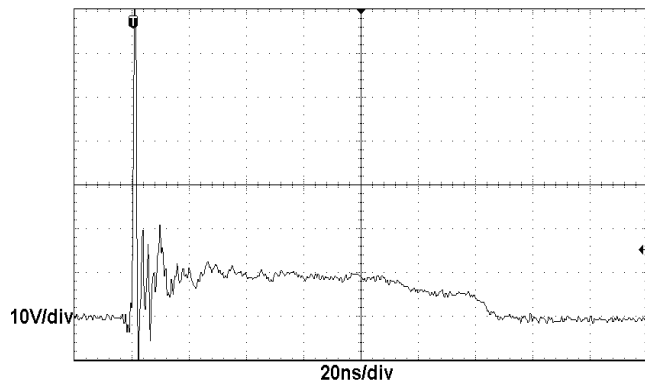
| Parameter                        | Symbol            | Condition                                             | Min. | Typ. | Max.    | Unit     |
|----------------------------------|-------------------|-------------------------------------------------------|------|------|---------|----------|
| Reverse stand-off voltage        | $V_{\text{RWM}}$  |                                                       |      |      | $\pm 5$ | V        |
| Reverse leakage current          | $I_{\text{R}}$    | $V_{\text{RWM}} = 5.0\text{V}$                        |      | $<1$ | 100     | nA       |
| Reverse breakdown voltage        | $V_{\text{BR}}$   | $I_{\text{BR}} = 1\text{mA}$                          | 5.1  |      |         | V        |
| Reverse holding voltage          | $V_{\text{HOLD}}$ | $I_{\text{HOLD}} = 50\text{mA}$                       | 5.1  |      |         | V        |
| Clamping voltage <sup>1)</sup>   | $V_{\text{CL}}$   | $I_{\text{PP}} = 16\text{A}$ , $t_p = 100\text{ns}$   |      | 9    |         | V        |
| Clamping voltage <sup>2)</sup>   | $V_{\text{CL}}$   | $V_{\text{ESD}} = 8\text{kV}$                         |      | 9    |         | V        |
| Clamping voltage <sup>3)</sup>   | $V_{\text{CL}}$   | $I_{\text{PP}} = 1\text{A}$ , $t_p = 8/20\mu\text{s}$ |      |      | 6.5     | V        |
|                                  |                   | $I_{\text{PP}} = 5\text{A}$ , $t_p = 8/20\mu\text{s}$ |      |      | 8.5     | V        |
|                                  |                   | $I_{\text{PP}} = 8\text{A}$ , $t_p = 8/20\mu\text{s}$ |      |      | 10      | V        |
| Dynamic resistance <sup>1)</sup> | $R_{\text{DYN}}$  |                                                       |      | 0.20 |         | $\Omega$ |
| Junction capacitance             | $C_{\text{J}}$    | $V_{\text{R}} = 0\text{V}$ , $f = 1\text{MHz}$        |      | 17.5 | 22      | pF       |
|                                  |                   | $V_{\text{R}} = 5.0\text{V}$ , $f = 1\text{MHz}$      |      | 11.5 | 16      | 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.  $R_{\text{DYN}}$  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.

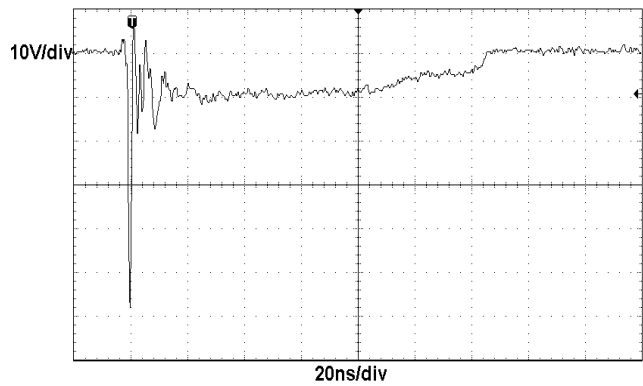
**Typical characteristics ( $T_A=25^\circ\text{C}$ , unless otherwise noted)**

**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)



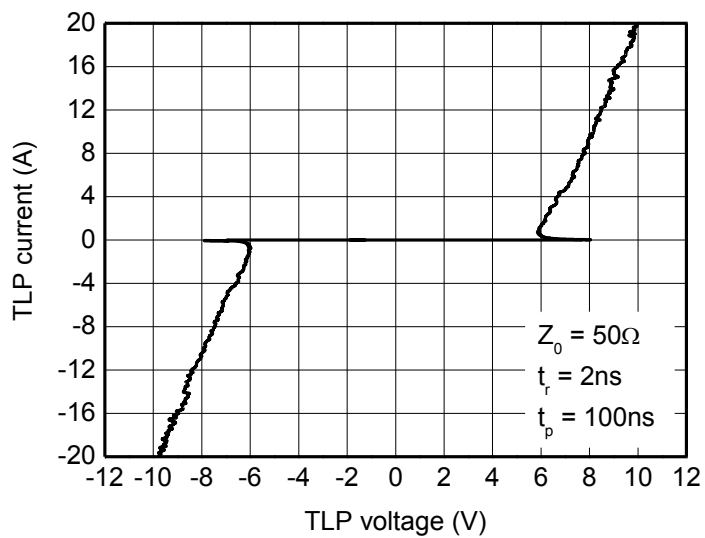
**ESD clamping**

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

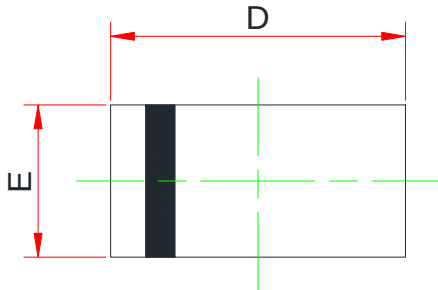
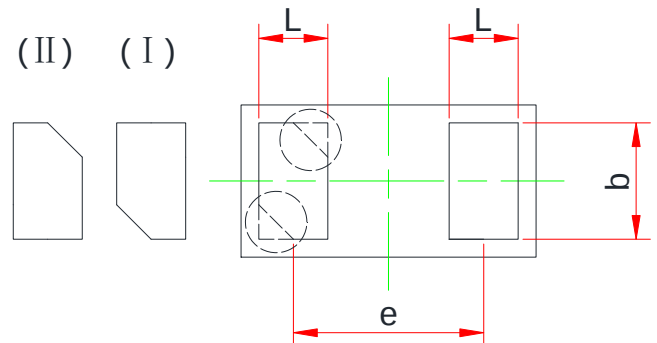
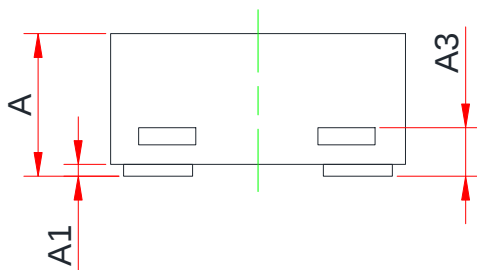
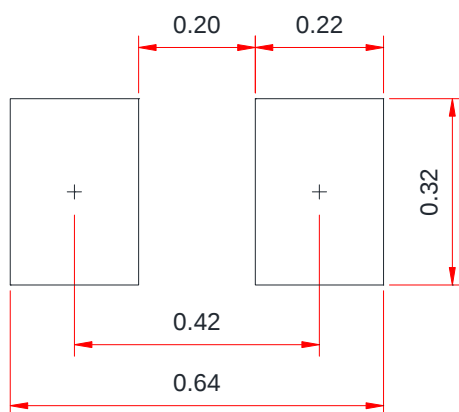


**ESD clamping**

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



**TLP Measurement**

**Package outline dimensions**
**DFN0603-2L**

**Top View**

**Bottom View**

**Side View**
**Recommend land pattern (Unit: mm)**


| Symbol | Dimensions in Millimeters |       |       |
|--------|---------------------------|-------|-------|
|        | Min.                      | Typ.  | Max.  |
| A      | 0.230                     | -     | 0.340 |
| A1     | 0.000                     | -     | 0.050 |
| A3     | 0.102 REF.                |       |       |
| D      | 0.550                     | 0.600 | 0.670 |
| E      | 0.250                     | 0.300 | 0.370 |
| b      | 0.215                     | -     | 0.295 |
| e      | 0.400 BSC                 |       |       |
| L      | 0.115                     | -     | 0.195 |

**Notes:**

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