Find the Right ESD or TVS Diode

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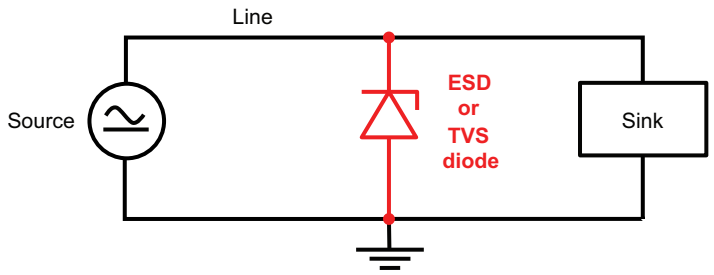
WHAT INFORMATION IS NEEDED TO IDENTIFY THE RIGHT TVS OR ESD PROTECTION DIODE FOR ANY APPLICATION?

TYPICAL PROTECTION CIRCUIT

A typical electronic circuit consists of a current or voltage source and sink, and the lines connecting both. ESD or TVS protection diodes are usually connected in between both to protect electronics from destructive over-voltage transients.



To determine the right protection diode for an application, a number of parameters should be known. The more of these parameters that are known, the easier it is to select the right product. Some of these parameters are listed below.

A PROTECTION DIODE HAS TO BE INVISIBLE

Within the normal working voltage range of an application, an ESD or TVS diode has to be ***"invisible"*** for the application. The normal performance should not be influenced by the presence of a protection diode in a circuit.

Therefore the leakage current and the capacitance have to be low enough. As the diode's parameters are temperature-dependant, the temperature range also has to be considered.

1.	**Positive working voltage range of the application?**	V_{RWM+}	=		V
2.	**Negative working voltage range of the application?**	V_{RWM-}	=		V
3.	**Maximum leakage current?**	I_R	=		µA
4.	**Maximum capacitance?**	C_D max.	=		pF
5.	**Minimum ambient temperature around the diode?**	T_A min.	=		°C
6.	**Maximum ambient temperature around the diode?**	T_A max.	=		°C

TECHNICAL NOTE

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A PROTECTION DIODE HAS TO PROTECT

In the moment when the voltage exceeds the normal voltage operation range of an application, the protection diode has to become conductive, so that the surge current can be bypassed through the protection diode to a solid ground. Thus the transient voltage spike will be clamped. The maximum clamping voltage must be lower than the maximum input voltage the application can withstand.

7. **Maximum positive clamping voltage?** V_C max.+ = _____ V

Maximum negative clamping voltage? V_C max.- = _____ V

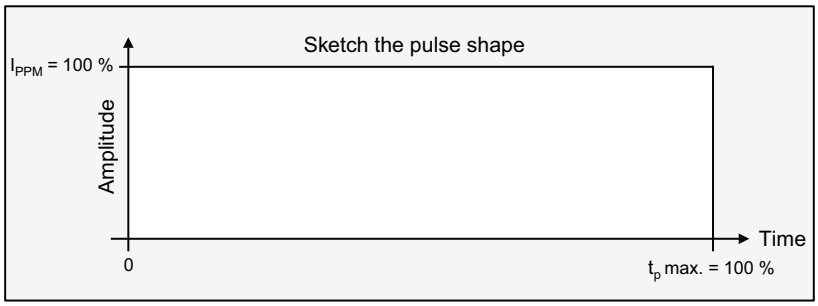
8. **Surge current?**

The surge current, which a protection diode has to conduct to ground, is the most important parameter for the definition of the right diode. It is the intensity (amplitude) and the duration of the current which finally heats the p/n-junction of the diode. And it is the temperature which finally destroys the diode, not the current.

Amplitude? I_{PPM} max. = _____ A

Duration? t_p max. = _____ s

Pulse shape? _____ ?



TYPICAL SURGE TEST PULSES

- Rectangular
- Sine wave
- Saw tooth
- 8 µs / 20 µs (1.5 µs / 50 µs) according to IEC 61000-4-5
- ESD (330 Ω / 150 pF) according to IEC 61000-4-2
- HBM (1500 Ω / 100 pF) according to ESD-STM5.1-1998
- 10 µs / 1000 µs exponential discharge pulse
- Load dump according to ISO 7637-2 and ISO 16750-2