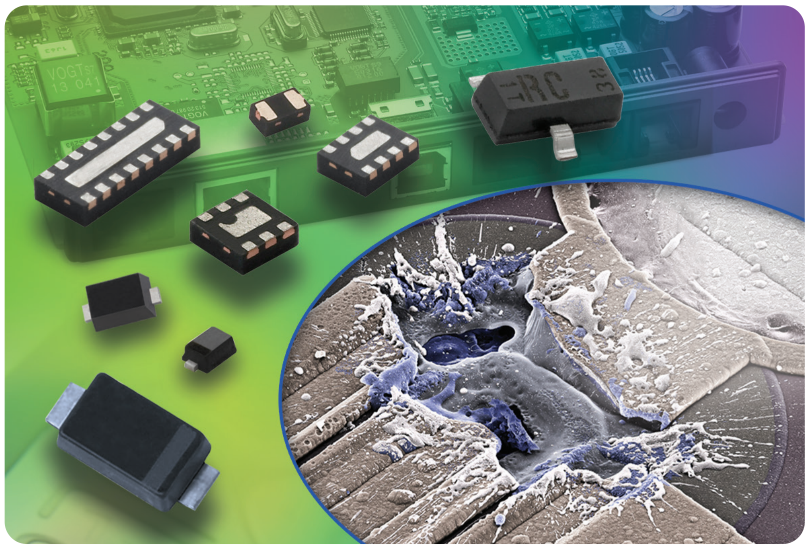
ESD PROTECTION DIODES AND EMI FILTER ARRAYS

Protect Your Circuit



INTRODUCTION

With the increasing use of integrated circuits in mobile and wired communication devices and consumer products, it is more important than ever to protect sensitive electronics from high transient voltages or unintentional frequencies. High voltage spikes with various waveforms and durations can damage or even destroy electronic circuits, and the interference of unintentional frequencies can influence the system in a negative way.

These transient voltages have various sources. One of the most common types is electrostatic discharge (ESD). For example, a person can inadvertently discharge accumulated static electricity on a phone merely by touching the device. A sudden power surge can also occur when lightning strikes a power line, potentially harming devices connected to the line.

ESD protection diodes combined with an electromagnetic interference (EMI) filter network serve as unobtrusive but strong “bodyguards” against these hazards. Protection devices such as very fast Zener and avalanche diodes draw a very low leakage current when placed in front of sensitive electronic gates. But above the defined voltage working range, any transient voltage that approaches the breakdown voltage will be short circuited by the diodes so it cannot reach the gate.

Vishay offers a wide range of surface-mount, plastic packaged protection diodes, arrays, and EMI filters designed especially for space-sensitive electronic products.

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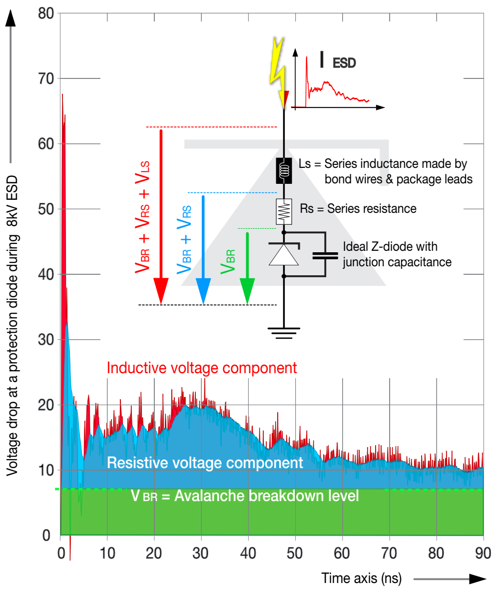
How ESD Protection Diodes Work

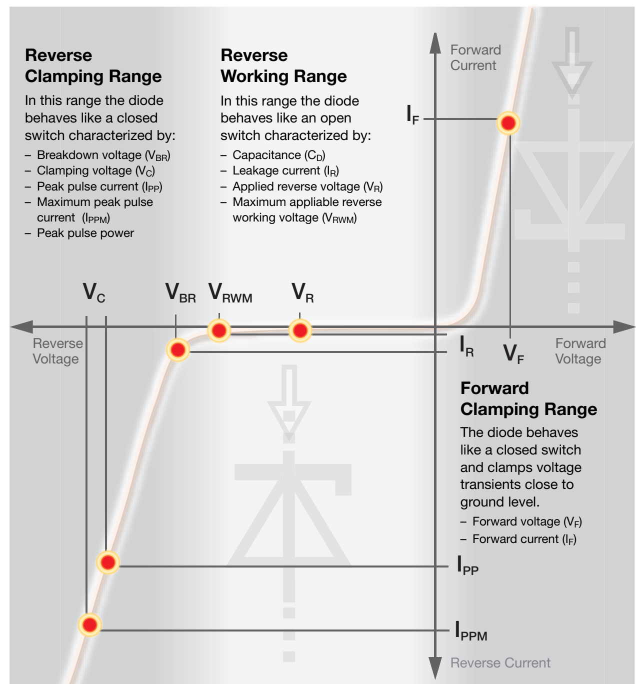
Equivalent Circuitry of an ESD Protection Diode



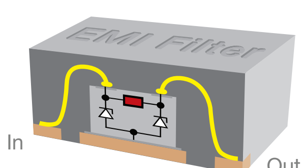
The clamping voltage of an ESD protection diode is determined by three major components:

- Zener or avalanche breakdown voltage level: V_{BR} = defined by chip design
- Voltage drop at the series resistance of the diode: $V_{Rs} = I_{ESD} * R_S$
- Voltage drop at the bondwire and lead inductance: $V_{Ls} = L_S * (dI_{ESD}/dt)$

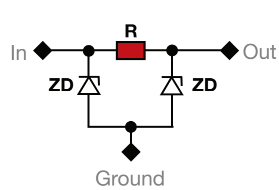
Typical Current Voltage Diagram of an ESD Protection Diode



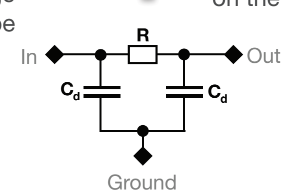
How EMI Filters Work

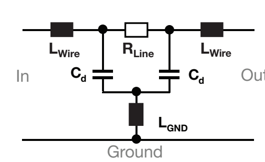


One EMI filter channel is made of a symmetrical π device with two identical Z-diodes and a resistor between the input and output pin.



Within the working voltage range the Z-diodes can be considered as a voltage-dependent capacitance.





For higher frequencies in the GHz range, wire inductances, and particularly the ground inductance, have an influence on the filter performance.

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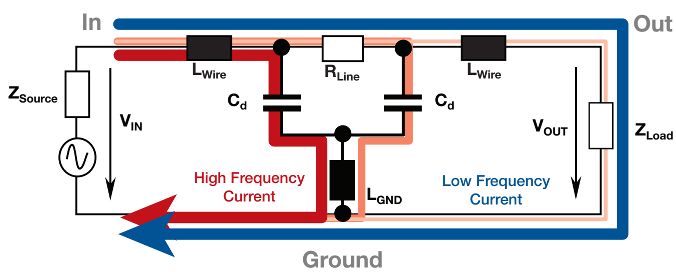
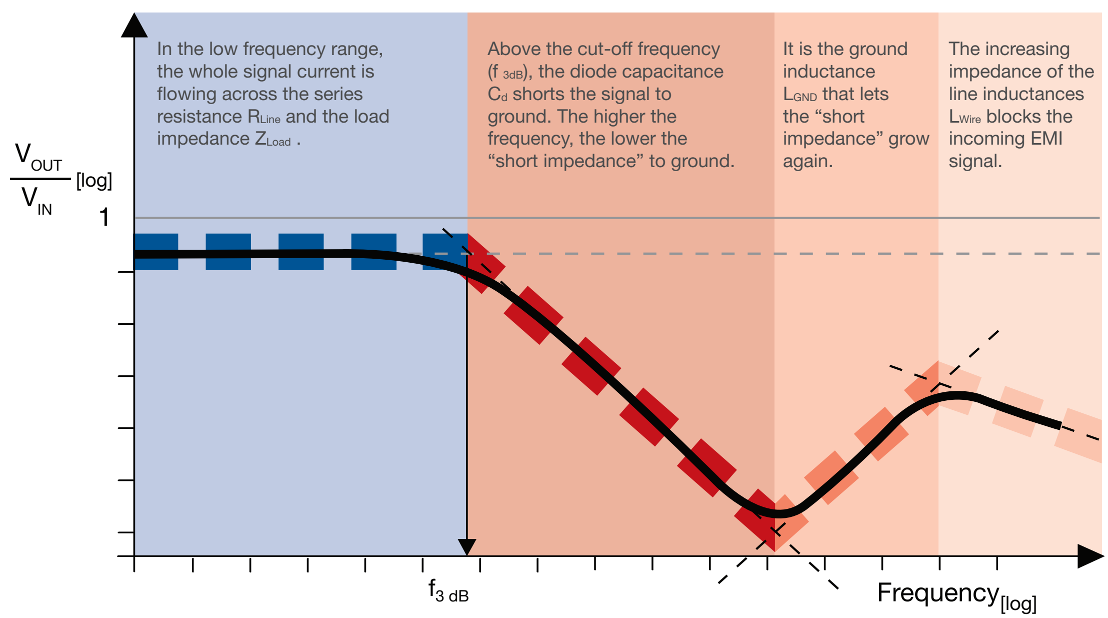
Bode Diagram

The most important characteristics for a filter are its signal attenuation over the frequency and the relation of the output to the input signal. The result depends on the source and load impedances and is usually defined with 50 Ω.





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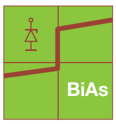
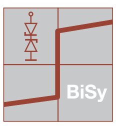
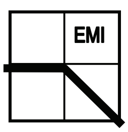
Basic ESD Protection Functions		
	BiAs (Bidirectional Asymmetrical)	ESD protection devices with BiAs clamping characteristics clamp transient voltage signals: • At different voltage levels • In a positive direction just above the Zener or avalanche breakdown levels • In a negative direction just below the ground level • Like a single Z-diode with forward and reverse modes
	BiSy (Bidirectional Symmetrical)	ESD protection devices with BiSy clamping characteristics clamp transient voltage signals: • In positive and negative directions • At the same voltage levels in both directions • Like two equal Z-diodes with a common cathode in series
	EMI Filters	EMI filter devices filter with: • Low pass characteristics • Low attenuation of low frequency data signals • High attenuation of high frequencies • Additional overvoltage protection

For further information

Please contact: ESDProtection@vishay.com,
EMIFilter@vishay.com

Please visit: www.vishay.com/diodes/protection-tvs-esd/esd-protection/,
www.vishay.com/diodes/protection-tvs-esd/emi-filter/