TECH
BRIEF

Selecting an ESD Suppressor

Introduction to ESD suppressor selection

Littelfuse offers three device technologies for the suppression of ESD events and other EMC-related transients. These are the MultiLayer Metal Oxide Varistor, Silicon (SCR/Diode Array and TVS Avalanche Diode Arrays) and Polymeric Voltage Variable Material technologies. Though these products have different characteristics, they have the common goal of protecting sensitive components from transients that threaten their survivability and functionality. Additionally, EMC legislation, or other immunity requirements, may mean that existing products require suppression devices in order to be compliant with the applicable immunity test.

How to use this selection guide

As with all decision-making processes, information is the key when considering the use of ESD suppressors. It is critical that the circuit characteristics are defined. For example, the capacitance value of the ESD suppressor will limit its usage on communication lines. As the speed of the data increases, the capacitance (if it is too large) can distort or attenuate the data. Ideally, the Design Engineer will gather basic circuit information such as data rate, allowable leakage current, line voltage, size constraints, and number of lines that require protection. This information can then be used to compare the circuit conditions to the ESD suppressor characteristics to find the best "match". To help with the "matching" process, a suppressor characteristic table is included below, and a selection flowchart can be found on the next page.

ESD suppressor functional similarities

The table at the bottom of this page shows the details of the ESD suppressor products offered by Littelfuse. The unique features of each product family are used to define the applications (circuit conditions) for which they are best suited. While these technologies have different electrical and physical characteristics, they share many basic traits. In general terms, they:

- Reduce the ESD voltage that is seen by the circuit in order to protect the data/signal/control lines
- Are effective protection against fast rise-time ESD transients, such as those specified in IEC 61000-4-2. They are not applicable to ESD specifications such as Charged Device Model (CDM), Machine Model (MM), or Human Body Model (HBM). These three specifications are used to typify chip survival in the chip foundry and board manufacturing environments and reflect the built-in ESD protection of IC's and ASIC's. They do not guarantee the survival of the chip during its lifetime in the end product (computer, cell phone, PDA, etc.). User-generated ESD events (such as those specified in IEC 61000-4-2) that will be seen by the chip in the end-product are much more severe and typically require the use of supplemental ESD suppression treatments (such as Littelfuse's ESD suppressors).
- Are bi-directional, working in (+) or (-) polarity circuits and suppressing positive and negative transients
- Are rated for the most common board-level operating voltages
- Can often replace TVS Zeners (e.g. "*Transorbs*" or "*Mosorbs*") while saving board space - SP723/SP724 or ML series
- Can often replace diode or Zener arrays

	MultiLayer Varistors	SP72x Arrays	SP05xx Diodes	PulseGuard® suppressors
Product Families	MLA, MLE, MHS, MLN	SP720, SP721, SP723, SP724	SP05xxAA, SP05xxBA, SP05xxBAC, SP05xxBBC, SP05xxCAA, SP05xxCAB	PGB
Device Technology	MultiLayer Metal Oxide Varistor	Silicon SCR/Diode Array	Silicon TVS Avalanche	Polymeric Voltage Variable Material
Package Outlines	EIA 0402, 0603, 1206, 1210	8 or 16 pin JEDEC DIP or SOIC	EIA 0402, JEDEC SOT23, SOT143 TSSOP, MSOP	EIA 0402, 0603, 0805 JEDEC SOT23
Lines of Protection	1, 4	4, 6, 14	1, 2, 3, 4, 5, 6, 8, 16, 18	1, 2, 4
Capacitance	3 - 4,500 pF	3 - 5 pF	3 - 39 pF	0.050 pF
Working Voltage	3.5 - 120 VDC	Up to 35 VDC (except SP724) Up to 20 VDC (SP724)	Up to 5.5 VDC	Up to 24 VDC
Operating Temperature	-40˚C to +125˚C	-40˚C to +105˚C	-40˚C to +85˚C	-65˚C to +125˚C
Protection Method	Clamps transient to ground or common	Clamps transient to power supply rails	Clamps transient to common or supply rails	Clamps transient to ground or common
General Applications	Data, signal, control lines, Power supply lines	Data, signal, control lines	Data, signal, control lines	Data, signal, control lines

Table1. Comparison of Littelfuse ESD suppressor characteristics

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Example Number	Application Desciption	Data Rate Frequency	Form Factor Preferences	Recommended Solution
1	Keypad of wireless device	< 10 Mbps	Array	MLN: SurgeArray™ suppressors SP05x TVS Avalanche
2	Audio Input (Microphone/Speaker)	20 - 20,000 Hz	Single Line	MLA/MLE SP0501x TVS Avalanche
3	USB 2.0 Data Port	480 Mbps	Not Determined	PulseGuard® suppressor: Single line or Array
4	USB 1.1 Data Port	12Mbps	Not Determined	MHS SP724 SP05x - Rail Clamp
5	RS-485	25 Mbps	Single Line	MHS

Table 2. Application examples and recommended Littelfuse ESD suppressor solutions

Selecting an ESD Suppressor

The data protocols and transmission rates that are used in various applications (cell phone, PDA, computer, etc.) will help determine the applicability of ESD suppressors. As data rates increase, the amount of stray capacitance that the circuit can withstand, and still function properly, decreases. In turn the capacitance of ESD suppressors becomes an important characteristic, and can be used as one criterion for their selection. In short, at very low speeds (audio and keypad circuits), capacitance of the ESD suppressor is not an issue. In fact, the capacitance can help minimize EMI noise like a low band pass filter. However, as speeds increase, capacitance plays an important role. Too much capacitance can cause degradation to the data signals and interfere with signal integrity. So lower capacitance devices are necessary. Lastly, keep in mind that other suppressor characteristics (leakage current, clamping level, number of channels, etc.) will also need to be kept in mind when selecting the most appropriate suppressor for your circuit.

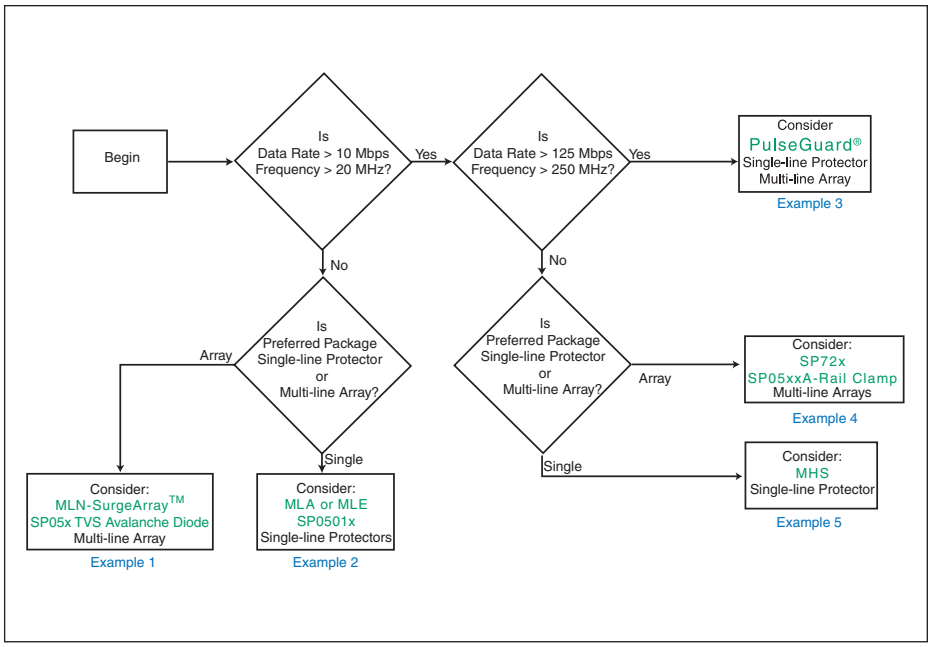

Figure 1. Process flowchart for selecting a Littelfuse ESD suppressor

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