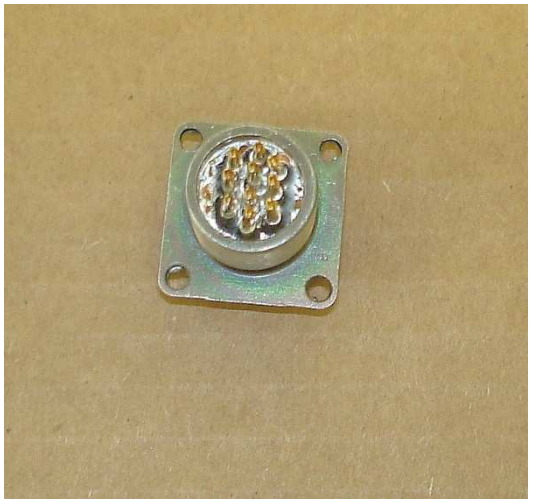
TRUE EMI / RFI / TRANSIENT ENERGY MITIGATION WITHIN THE CONNECTOR.



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INTRODUCTION

We are working in a world today, where we have to reduce our engineering designs into smaller & lighter packages, which in order to sell in the market place, have to comply with the testing requirements set forth by: MIL-STD-461, RTCA-DO-160, FCC Part 15, CISPR, ANSI, IEC, and CE Mark.

Many of the testing requirements today are levied on the design manufacturer, without having the advantage of good shielded cables or even proper faraday cages, to save weight / space; and yet still mitigate EMI, EMP, ESD, or Lightning driven sources.

Five predominant types of Transient Energy

Listed below are the key element types of energy that can produce severe transient surges upon critical circuit paths:

1) Electro Static Discharge
2) System Induced Transient Surge
3) Intense Radiated Frequencies, which in tern induces Radiated Susceptibility into a piece of electronic equipment via for example; swept Radar.
4) Electro Magnetic Pulse
5) Lightning Induced Transients

Any electrical system designed today must address these (4) main issues, before any type of surge protection can be administered.

- **System Signal Stability**
- **System Transient Surge Capabilities**
- **System Control & Protection Methods**
- **System Restoration Capabilities**

What are Transient Energy Events

- "Transient Voltages or Currents" are energy disturbances , carried onto power lines in the form of "surges" or "spikes".

- Transients that "ride" on AC power lines can significantly increase the peak line voltage. Conversely (depending upon the polarity of the transient), they can cause significant sags in the peak line voltage as well.

- Transients are momentary changes in voltage or current levels imposed onto power lines or on a load circuit.

- These events, are generally considered as 'random' occurrences, but may be repetitive, or re-occurring depending upon the transient's coupled energy source.

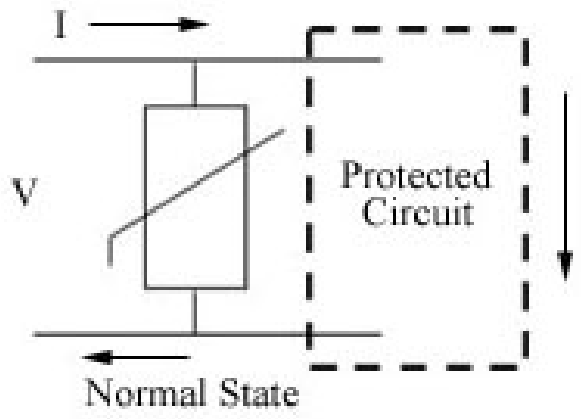
- Transients come in many forms, RF, EMP, Lightning, ESD, plus Internally generated Surge Voltages, that normally last between 10 to 100 microsecond that can reach into the thousands of volts .

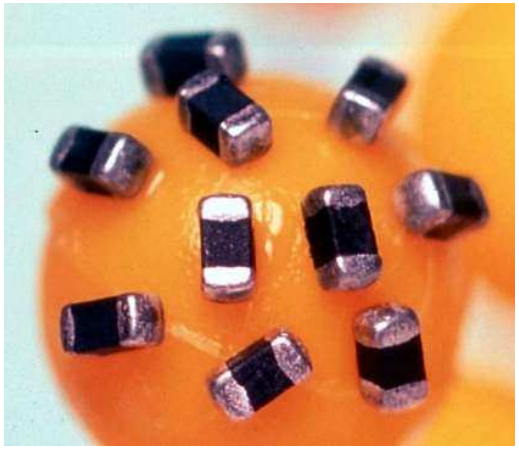
Methods of Transient Energy Suppression

MOV's

Metal Oxide Varistors are a commonly used as transient suppressors, and are typically configured in a circuit to resistively shunt energy to ground, but due to increased temperatures driven by repeated surge events turning weaken quickly. Typically MOV's have an order of magnitude more leakage current than TVS devices (mA verses µA). Functional Note: The resistance of the MOV decreases as the voltage across its terminals increases.

Since an MOV creates a low impedance path to ground or neutral through the load, the surge current during the act of suppression can be quite significant, so, an MOV may be damaged after only one or two transient occurrences.

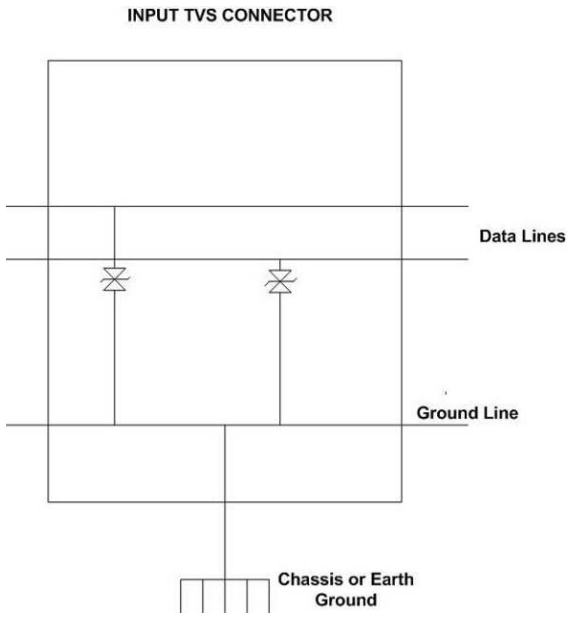




TRANSIENT VOLTAGE SUPPRESSORS

TVS or Avalanche Diodes, switch into energy conduction up to 5 times faster than MOVs, thus, affording significantly faster reaction times to transients.

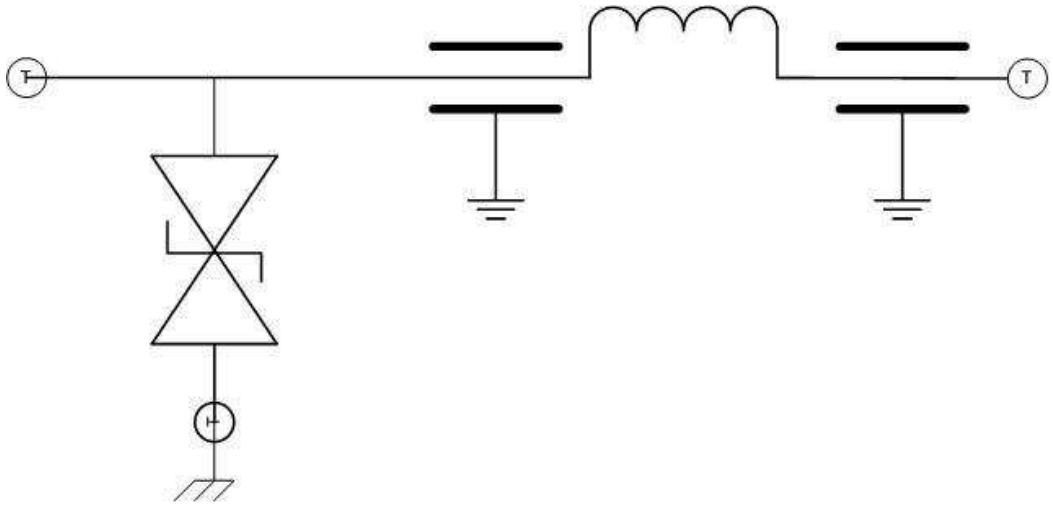
TVS devices can handle thousands of repeated induced energy events, simply due to the fact that they do not turn over voltages into resistive "heat", but rather transfer or channel the over voltage energy directly to ground



WHAT IS A FILTERED or TVS PROTECTED CONNECTOR ?

A filtered connector looks essentially like any other connector, but, additionally contain integrated Capacitive, or PI filtering components; and or, are combined with transient suppression components that suppress and / or attenuate, unwanted high frequency conducted noise and energy. The mating capabilities of for these connectors stay identical to those of their non-filtered counterparts.

Filtered, TVS, and Filtered / TVS combination protective connectors offer numerous advantages over circuit board component placement, including better EMI/ESD/EMP/Transient mitigation performance; with savings in pc-board real estate, costly development time, resources, and a reduction in design implementation time to market, plus they are available in D-Sub, Circular and Custom formats.



TVS & PI Filter Circuit within the connector

WHAT IS A FILTERED or TVS PROTECTED CONNECTOR (continued)

The ground plane is the most important part of any filtered connector; It's primary purpose is to provide a low-impedance path for the filtering elements "ground" back to the inner shell of the connector. The ground plane's main purpose is to prevent radiated energy or high-frequency noise from coupling onto the connector pins; and onto PC board terminations at the engagement ends of the connector.

The filter itself is comprised of either capacitive, or inductive elements that fit directly into the shell of the connector, and is then attached between the pin and the connector case via a proper ground plane.

Why Filter at the connector instead of at the CCA board level

Filtering at the pins of any commercial or military connector provides:

- **Solid Ground Plane Paths to Connector Shell**
- **Increased Filter Performance**
- **Maximum Filter Performance Versus the Filter placed onto the PCB**
- **Increased Shielding Effectiveness**

Additionally, by using filtered connectors as opposed to filtering on the PCB; you eliminate the noise that will be picked up from the contacts/leads between the board filters and the connector's interface, plus free up the board space required to implement the filtering.

The parameters you have to consider when deciding on a filtered connector are as follows:

- **Required Performance**
- **Available Space**
- **Component & PCB add-on Costs**
- **Lead Time**
- **Overall Price**