

## Agency Standards

Littelfuse Varistors have been investigated and evaluated and are certified, recognized or otherwise approved with pertinent safety or standards organizations. Following are descriptions of some of the applicable standards.

### Underwriters Laboratories (UL)

UL writes "Standards" to which products are investigated. Upon completion of the tests, a "Listing" or "Recognition" to the standard with conditions of acceptability is given under a unique file number. All of Littelfuse applicable Varistors are in the "Recognized Components" category to one or more of the following standards:

- **UL1449** Transient Voltage Suppressors.
- **UL1414** Across the Line Capacitors, Antenna Coupling and Line By-Pass Capacitors for Radio and Television Type Appliances.
- **UL497B** Protectors for Data and Communication and Fire Alarm Circuits.

(Note that the terms "Approved" or "Certified" are not correct in referring to devices listed or recognized by UL.)

### VDE (Verband Deutscher Electrotechniker)

Based in Germany, this is the Association of German Engineers who develop specific safety standards and test requirements. VDE tests and certifies devices or products, assigning a license number. Littelfuse Radial Varistors are currently certified under license number 104846-E having successfully met CECC standard 42 201-006 (issue 1/1996).

### CECC (CENELEC Electronic Components Committee)

Based in Brussels, CENELEC is the "European Committee for Electrotechnical Standardization" which provides harmonized standards for the European Community based upon IEC and ISO publications. All Littelfuse Radial Varistor Series are approved to Specification 42201-006.

### CSA (Canadian Standards Association)

Based in Canada, this regulatory agency writes standards to which it conducts product safety tests. Upon successful completion, a file number is established, the product is "Certified" and may display the CSA logo as indication. Specific Littelfuse Varistors have been tested to CSA Standard number 22.2, No.1-94. Littelfuse file number is LR91788.

### NSAI (National Standards Authority of Ireland)

This Irish testing organization is facilitated and authorized to evaluate products to the various Euro Norms CECC specifications thereby granting declarations of conformity.

### Electrostatic Discharge (ESD) Standards

Several industry standards and specifications exist that are used to qualify and quantify ESD events. Since many circuits or systems must demonstrate immunity to ESD, these standards are often incorporated in the testing of ESD capability. Of particular concern is the immunity level for semiconductors. The "standards" include Human Body Model (HBM) to MIL-STD-883, Machine Model (MM) such as EIAJ IC121, and Charged Device Model (CDM) such as US ESD DS 5.3. The Human Body Model, Machine Model and Charged Device Model primarily relate to manufacturing and testing process of an IC.

One of the most severe is IEC 61000-4-2 from the International Electrotechnical Commission (IEC) and referenced in the EMC directive. Level 4 of this test method is the highest level, subjecting the device under test to 8kV contact discharge method (preferred) and/or 15kV air discharge. Each Littelfuse technology is designed for this level. The recommended types are the Silicon based Silicon Protection Array SP05x and SP7X, the polymeric VVM based PulseGuard® Suppressor, and the ML, MLE, MHS or MLN Multilayers.

The designer should be aware of the ESD ratings of the semiconductors used in the circuit. For example, semiconductor manufacturers that rate their devices to MIL-STD-883 to 2kV may not pass 2kV when subjected to the more difficult IEC test method (150pF / 330Ω instead of 100pF / 1500Ω). Additionally, even if semiconductors do meet some level of ESD immunity to IEC standards, that does not imply that additional ESD suppression is not required. Real world ESD transients can exceed the peak currents and voltages as defined by the standards and can have much faster rise times.

IEC 61000-4-2 consists of four test severity levels of ESD immunity using both a Contact Discharge and Air Discharge test method. The EUT or DUT may be subjected to increasing levels of severity until failure. Or, a particular level of immunity may be prescribed for EM compatibility of an end product.

For more information about the IEC 61000-4-2 test method, see Application Note AN9734, "IEC Electromagnetic Compatibility Standards for Industrial Process Measurement and Control Equipment."