WHAT IS THE DIFFERENCE BETWEEN AN ISOLATION WITHSTAND VOLTAGE AND WORKING VOLTAGE FOR AN OPTOCOUPLER?

The UL1577 rating of 3750Vrms per minute or 5000Vrms per minute means that devices can survive and isolate transient (1min) voltage spikes with these values. This is a momentary insulation withstand rating for one minute. The input-output momentary withstand voltage rating should not be interpreted as continuous voltage that can be applied across the optocoupler insulation barrier. In other words, the momentary withstand voltage rating as defined by the UL1577 should not be construed or interpreted as that a part could stand up to a 5kVrms working voltage (ie. steady-state DC or AC voltage throughout the life of the part.) Steady-state working voltage rating is specified by IEC 60747-5-5 rating. The working voltage (VORM) is the voltage that one can continuously apply across the optocoupler insulation barrier. This working voltage rating is certified through the IEC60747-5-5 safety standard.

WHAT ARE THE DIFFERENT POLLUTION DEGREES, AND WHAT OPTOCOUPLER PARAMETER OR PARAMETERS ARE IMPACTED FOR OPTOCOUPLES TO BE USED IN A MORE ADVERSE POLLUTION DEGREE ENVIRONMENT?

For the purposes of evaluating creepage and clearance distances, the IEC 60664 (Insulation coordination safety standard) defines four degrees of pollution degrees. These pollution degrees classifications are primarily based on the extent of dry pollution and condensation present. The primary optocoupler parameters that define if the optocoupler can be used in a particular pollution degree environment are: external creepage/ clearance distances and the material group (ie. CTI or comparative tracking index of the plastic molding compound that encapsulates the optocoupler). The four pollution degrees are defined as follows:

a) Pollution Degree 1: No pollution or only dry, non-conductive pollution occurs, and pollution has no significant impact. Air conditioned office environment, and clean labs are an example of pollution degree 1 environment.

b) Pollution Degree 2: Only non-conductive pollution occurs except that occasionally a temporary conductivity caused by condensation is to be expected. Home environments can be considered pollution degree 2.

c) Pollution Degree 3: Conductive pollution occurs or dry non-conductive pollution occurs which becomes conductive due to condensation which is to be expected. Industrial warehouses, or factory floors, or construction sites may be construed as pollution degree 3 environments.

d) Pollution Degree 4: The pollution generates persistent conductivity caused by conductive dust or by rain or snow or other wet conditions. Areas exposed to outside atmosphere can be classified as pollution degree 4 environments.

WHAT IS THE WORKING VOLTAGE AND HOW IS IT DEFINED BY THE SAFETY STANDARDS?

The IEC 60664 defines the working voltage as the highest rms value of the AC or DC voltage across any particular insulation which can occur when the equipment is supplied at rated voltage, with transients being disregarded, in both open circuit conditions or in normal operating conditions. The optocoupler safety standard falls back on the IEC 60664 for its insulation coordination guidance, and hence the rms value of the AC or DC is construed to be the working voltage across the optocoupler. Also, according to the IEC 60664 standard, rms values are used to calculate the creepage distances, and peak impulse withstand voltages are used to determine the clearance distances.

OTHER THAN THE MAJOR AND SIGNIFICANT INSULATION CAPABILITY DIFFERENCES BETWEEN THE OPTOCOUPLES AND MAGNETIC AND CAPACITIVE ISOLATORS, ARE THERE ANY OTHER ELECTRICAL PERFORMANCE DIFFERENCES BETWEEN THE THREE GALVANIC ISOLATION TECHNOLOGIES?

Alternative technology isolators, particularly magnetic isolators have been found to be sensitive to magnetic field interference issues and power supply latch up issues. The magnetic isolators have also been found to radiate excessive EMI. Both capacitive and magnetic isolators have been found to have relatively poor common mode noise rejection performance. The figure of merit for CMR is not only the min guaranteed dV/dt rating, but also the common mode voltage magnitude at which the CMR has been specified at.

WHAT ARE THE DIFFERENT TYPES OF INSULATIONS AND HOW ARE THEY CLASSIFIED?

The IEC 60664 insulation coordination safety standard defines various levels of insulation as follows:

a) Functional Insulation
Insulation necessary for correct operation of the equipment between parts of different potential or between ELV (extra low voltage) or SELV (safety extra low voltage) circuits and conductive parts

b) Basic Insulation
Insulation needed to provide basic protection against electrical shock between a part and hazardous voltage and an earthen ground

c) Supplementary Insulation
Independent Insulation applied in addition to basic insulation in order to ensure protection against electrical shock in the event of failure of basic insulation

d) Double Insulation
Insulation comprising both basic insulation and supplementary insulation

e) Reinforced Insulation
A Single Insulation system which provides a degree of protection against electric shock equivalent to double insulation.