About This Isolation Glossary

This glossary lists and explains terms, acronyms, and definitions for isolation devices.
1 Isolation Glossary

Primary Circuit — A circuit that is directly connected to an external mains supply for its power needs.

Secondary Circuit — A circuit that has no direct connection to a primary circuit and derives its power from a transformer, converter or equivalent isolation device, or from a battery.

Creepage — The shortest distance between two conductive parts measured along the surface of a solid insulation. The shortest path is typically found around the end of the package body.

Clearance — The shortest distance between two conductive parts measured through air.

Isolation Capacitance ($C_{io}$) — The total capacitance between the terminals on a first side of the isolation barrier connected together and the terminals on a second side of the isolation barrier connected together forming a two-terminal device.

Isolation Resistance ($R_{io}$) — The resistance between the terminals on a first side of the isolation barrier connected together and all the terminals on a second side of the isolation barrier connected together forming a two-terminal device.

Rated Isolation Voltages — The maximum voltage between all input terminals (connected together) and all output terminals (connected together) respectively.

Maximum Rated Working Isolation Voltage ($V_{IOWM}$) — An r.m.s or equivalent d.c. voltage assigned by the manufacturer, characterizing the specified long term withstand capability of its isolation.

Maximum Rated Repetitive Peak Isolation Voltage ($V_{IORM}$) — A peak voltage assigned by the manufacturer, characterizing the specified withstand capability of its isolation against repetitive peak voltages. It includes all repetitive transient voltages, but excludes all non-repetitive transient voltages.

Maximum Rated Transient Isolation Voltage ($V_{IOTM}$) — A peak impulse voltage assigned by the manufacturer, characterizing the specified withstand capability of its isolation against transient overvoltages.

Withstand Isolation Voltage ($V_{ISO}$) — Maximum AC r.m.s. isolation voltage for one minute.

Surge Isolation Voltage ($V_{IOSM}$) — The highest instantaneous value of an isolation voltage pulse with short time duration and of specified wave shape.
Partial Discharge — Localized electrical discharge which occurs in the insulation between all terminals of the first side and all terminals of the second side of the coupler.

Comparative Tracking Index (CTI) — CTI is an index used for electrical insulating materials that is defined as the numerical value of the voltage which causes failure by tracking during standard testing. Tracking is the process that produces a partially conducting path of localized deterioration on or through the surface of an insulating material as a result of the action of electric discharges on or close to an insulation surface -- the higher the CTI value of the insulating material, the smaller the minimum creepage distance required.

Generally, insulation breakdown occurs either through the material, over its surface, or both. Surface failure may arise from flashover or from the progressive degradation of the insulation surface by small localized sparks. Such sparks are the result of the breaking of a surface film of conducting contaminant on the insulation. The resulting break in the leakage current produces an overvoltage at the site of the discontinuity, and an electric spark is generated. These sparks often cause carbonization on insulation material and lead to a carbon track between points of different potential. This process is known as tracking.

Material Groups — Materials are classified into four groups according to their CTI values. These values are determined in accordance with IEC 60112. The groups are as follows:

- Material group I: $600V \leq \text{CTI}$
- Material group II: $400V \leq \text{CTI} < 600$
- Material group IIIa: $175V \leq \text{CTI} < 400$
- Material group IIIb: $100V \leq \text{CTI} < 175$

1.1 Insulation:

Functional insulation — Insulation needed for the correct operation of the equipment.

Basic insulation — Insulation that provides basic protection against electric shock.

Supplementary insulation — Independent insulation applied in addition to basic insulation in order to ensure protection against electric shock in the event of a failure of the basic insulation.

Double insulation — Insulation comprising both basic and supplementary insulation.

Reinforced insulation — A single insulation system which provides a degree of protection against electric shock equivalent to double insulation.

1.2 Pollution Degree:

Pollution is any addition of foreign matter, solid, liquid, or gaseous that can result in a reduction of electric strength or surface resistivity of the insulation. There are four categories of pollution:

Pollution Degree 1 — No pollution or only dry, nonconductive pollution occurs. The pollution has no influence.

Pollution Degree 2 — Only nonconductive pollution occurs. However, a temporary conductivity caused by condensation is to be expected.

Pollution Degree 3 — Conductive pollution occurs or dry non-conductive pollution occurs which becomes conductive due to condensation which is to be expected.

Pollution Degree 4 — Continuous conductivity occurs due to conductive dust, rain, or other wet conditions.
1.3 Overvoltage Categories and Installation Classification:

*Overvoltage Categories* define transient overvoltage conditions. There are four different levels as indicated in IEC 60664.

I: Signal level — Special protected equipment or parts of equipment, for example, circuit board inside a DVD player.

II: Local level — Portable equipment that is supplied from the wall outlet, for example, a DVD player.

III: Distribution level — Equipment in fixed installation such as HVAC system, Washers / Dryers, and so forth.

IV: Primary supply level — Equipment for use at the origin of the installations such as overhead lines, cable systems, and so forth.

Lower level category is subject to smaller transients than the category above.

### Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

<table>
<thead>
<tr>
<th>Changes from Original (October 2014) to A Revision</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Changed <em>Maximum Rated Isolation Working Voltage</em> (<em>V_{IOWM}</em> ) To: <em>Maximum Rated Working Isolation Voltage</em> (<em>V_{IOWM}</em>)</td>
<td>3</td>
</tr>
<tr>
<td>• Changed material group label numbers in the Material Groups bullets</td>
<td>4</td>
</tr>
</tbody>
</table>
IMPORTANT NOTICE FOR TI DESIGN INFORMATION AND RESOURCES

Texas Instruments Incorporated (‘TI”) technical, application or other design advice, services or information, including, but not limited to, reference designs and materials relating to evaluation modules, (collectively, “TI Resources”) are intended to assist designers who are developing applications that incorporate TI products; by downloading, accessing or using any particular TI Resource in any way, you (individually or, if you are acting on behalf of a company, your company) agree to use it solely for this purpose and subject to the terms of this Notice.

TI's provision of TI Resources does not expand or otherwise alter TI's applicable published warranties or warranty disclaimers for TI products, and no additional obligations or liabilities arise from TI providing such TI Resources. TI reserves the right to make corrections, enhancements, improvements and other changes to its TI Resources.

You understand and agree that you remain responsible for using your independent analysis, evaluation and judgment in designing your applications and that you have full and exclusive responsibility to assure the safety of your applications and compliance of your applications (and of all TI products used in or for your applications) with all applicable regulations, laws and other applicable requirements. You represent that, with respect to your applications, you have all the necessary expertise to create and implement safeguards that (1) anticipate dangerous consequences of failures, (2) monitor failures and their consequences, and (3) lessen the likelihood of failures that might cause harm and take appropriate actions. You agree that prior to using or distributing any applications that include TI products, you will thoroughly test such applications and the functionality of such TI products as used in such applications. TI has not conducted any testing other than that specifically described in the published documentation for a particular TI Resource.

You are authorized to use, copy and modify any individual TI Resource only in connection with the development of applications that include the TI product(s) identified in such TI Resource. NO OTHER LICENSE, EXPRESS OR IMPLIED, BY ESTOPPEL OR OTHERWISE TO ANY OTHER TI INTELLECTUAL PROPERTY RIGHT. AND NO LICENSE TO ANY TECHNOLOGY OR INTELLECTUAL PROPERTY RIGHT OF TI OR ANY THIRD PARTY IS GRANTED HEREIN, including but not limited to any patent right, copyright, mask work right, or other intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information regarding or referencing third-party products or services does not constitute a license to use such products or services, or a warranty or endorsement thereof. Use of TI Resources may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

TI RESOURCES ARE PROVIDED “AS IS” AND WITH ALL FAULTS. TI DISCLAIMS ALL OTHER WARRANTIES OR REPRESENTATIONS, EXPRESS OR IMPLIED, REGARDING TI RESOURCES OR USE THEREOF, INCLUDING BUT NOT LIMITED TO ACCURACY OR COMPLETENESS, TITLE, ANY EPIDEMIC FAILURE WARRANTY AND ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, AND NON-INFRINGEMENT OF ANY THIRD PARTY INTELLECTUAL PROPERTY RIGHTS.

TI SHALL NOT BE LIABLE FOR AND SHALL NOT DEFEND OR INDEMNIFY YOU AGAINST ANY CLAIM, INCLUDING BUT NOT LIMITED TO ANY INFRINGEMENT CLAIM THAT RELATES TO OR IS BASED ON ANY COMBINATION OF PRODUCTS EVEN IF DESCRIBED IN TI RESOURCES OR OTHERWISE. IN NO EVENT SHALL TI BE LIABLE FOR ANY ACTUAL, DIRECT, SPECIAL, COLLATERAL, INDIRECT, PUNITIVE, INCIDENTAL, CONSEQUENTIAL OR EXEMPLARY DAMAGES IN CONNECTION WITH OR ARISING OUT OF TI RESOURCES OR USE THEREOF, AND REGARDLESS OF WHETHER TI HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

You agree to fully indemnify TI and its representatives against any damages, costs, losses, and/or liabilities arising out of your non-compliance with the terms and provisions of this Notice.

This Notice applies to TI Resources. Additional terms apply to the use and purchase of certain types of materials, TI products and services. These include, without limitation, TI's standard terms for semiconductor products http://www.ti.com/sc/docs/stdterms.htm), evaluation modules, and samples (http://www.ti.com/sc/docs/sampterms.htm).

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
Copyright © 2017, Texas Instruments Incorporated