

# IEC 61010-1, Edition 3

By Dave Carr

## Introduction

International standard IEC 61010-1 specifies safety requirements for a variety of electrical systems, including test and measurement, industrial process control, and laboratory equipment. The purpose of the standard is to minimize hazards to operators and the surrounding environment and equipment. The first edition was published in 1990, with the most recent third edition having been released in 2010. Many new elements were added in the third edition, including a complete rewrite of the section governing insulation requirements. This note discusses new requirements for thin film insulation and the impact on digital isolators utilizing this material as the isolation barrier.

## IEC 61010-1, Edition 2

The first and second editions of IEC 61010-1 detailed external clearance and creepage requirements based on line voltage, pollution degree, material group, and altitude. In these earlier editions, interior clearance and creepage requirements were specifically excluded. The following text appears in Section 6.7 of the second edition:

"There are no clearance or creepage distance requirements for the interior of void-free moulded parts, including the inner layers of multi-layer printed circuit boards."

Based on the clearance and creepage distances achieved by digital isolator packaging at the time, compliance to IEC 61010-1, Edition 2, was granted by international certification agencies such as CSA, VDE, and TÜV.

## IEC 61010-1, Edition 3

This changed in the third edition with a complete rewrite of Section 6.7. Insulation requirements are now specified based on construction, with separate sections for solid insulation, molded and potted parts, inner layers of printed wiring boards, and thin-film insulation. Two subsections apply to the construction of iCoupler® digital isolators: 6.7.2.2.2 Moulded and Potted Parts and 6.7.2.2.4 Thin Film Insulation.

iCoupler digital isolation products utilize industry-standard surface mount packages that incorporate unique design features in order to meet stringent safety requirements. The need for isolation within the package requires the use of multiple dies with specially designed lead frames that create two or more ground references that are galvanically isolated from one another. Therefore, Section 6.7.2.2.2 applies to any conductors separated along the molding compound interface. This section states:

"For basic insulation, supplementary insulation, and reinforced insulation, conductors located on an interface between the same two layers moulded together shall be separated by at least 0.4 mm (see Figure 6, item L) after the moulding is completed."

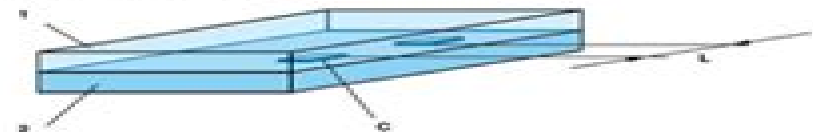


Figure 1. Diagram detailing distance between conductors for molded and potted parts.

Section 6.7.2.2.4 covers thin-film insulation and details new requirements for internal clearance and creepage distances. iCoupler products utilize a high quality polyimide layer as the insulation within chip-scale microtransistors. A figure in this section indicates how conductors on the same layers are now viewed in the context of clearance and creepage distances (see Figure 2).

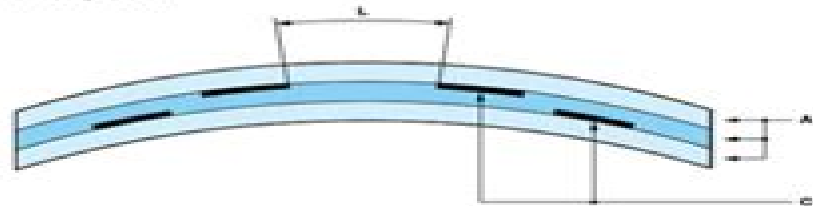


Figure 2. Diagram detailing clearance and creepage distance requirements for thin-film insulation.

For systems with mains voltages up to and including 300 V rms (or 300 V dc), conductors located on the same layer shall be separated by the applicable clearance and creepage distances in Table 1.

Clearance and creepage distance requirements for systems with mains voltages greater than 300 V are covered in Annex K. Internal clearance and creepage requirements remain, and greater distances are specified due to the larger voltages.

Table 1. Internal Clearance and Creepage Distance Requirements for Thin-Film Insulation

| Voltage Line to Neutral or AC, RMS, or DC (V) | Values for Clearance (mm) | Values for Creepage Distance (mm) |                             |                           |                    |                   |                    |                    |                   |
|-----------------------------------------------|---------------------------|-----------------------------------|-----------------------------|---------------------------|--------------------|-------------------|--------------------|--------------------|-------------------|
|                                               |                           | Printed Wiring Board Material     |                             | Other Insulating Material |                    |                   |                    |                    |                   |
|                                               |                           | Pollution Degree 1                | Pollution Degree 2          | Pollution Degree 1        | Pollution Degree 2 |                   |                    | Pollution Degree 3 |                   |
|                                               |                           | All Material Groups               | Material Groups I, II, IIIa | All Material Groups       | Material Group I   | Material Group II | Material Group III | Material Group I   | Material Group II |
| ≤ 150                                         | 0.5                       | 0.5                               | 0.5                         | 0.5                       | 0.8                | 1.1               | 1.6                | 2.0                | 2.5               |
| > 150 to 300                                  | 1.5                       | 1.5                               | 1.5                         | 1.5                       | 1.5                | 2.1               | 3.0                | 3.8                | 4.7               |

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