

# 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*<sup>®</sup> 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.”

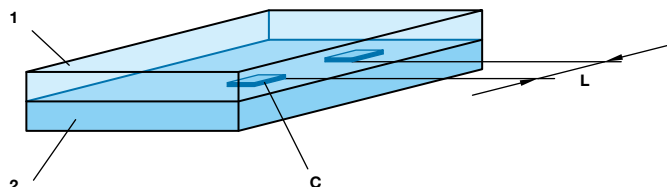


Figure 1. Diagram detailing distance between conductors for molded and potted parts.

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 microtransformers. 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).

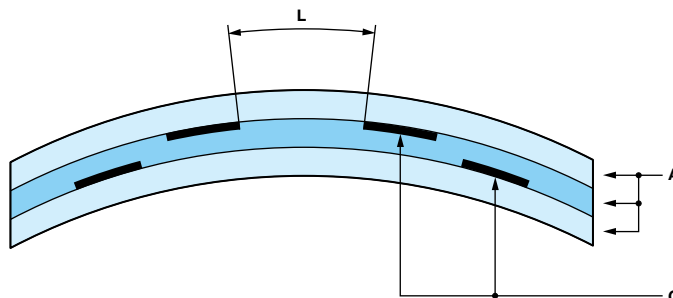


Figure 2. Diagram detailing clearance and creepage distance requirements for thin-film insulation.

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 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	Material Group II	Material Group III
≤150	0.5	0.5	0.5	0.5	0.8	1.1	1.6	2.0	2.2	2.5
>150 ≤ 300	1.5	1.5	1.5	1.5	1.5	2.1	3.0	3.8	4.1	4.7

## Application to Digital Isolators

Based on the construction of *i*Coupler digital isolation products and the new requirements in Edition 3, it would appear that internal clearance and creepage distances of at least 0.4 mm would be required. However, another clause in Edition 3 provides relief from the internal clearance and creepage requirements.

Section 14 deals with components and subassemblies within the overall system being certified. It allows for a component or subassembly to be used if it conforms to applicable safety requirements of a relevant IEC safety standard, or those of a non-IEC standard which are at least as high as those of the relevant IEC standard (provided that the component has been approved to the non-IEC standard by a recognized testing authority).

The vast majority of products in the *i*Coupler digital isolator portfolio are certified to the VDE V 0884-10 component-level standard. Verband der Elektrotechnik (VDE) is recognized as an international testing authority, and the safety requirements of VDE V 0884-10 are applicable to the Edition 3 requirements. Therefore, digital isolators carrying this certification can be used in equipment covered under IEC 61010-1, Edition 3.

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### Analog Devices, Inc. Worldwide Headquarters

Analog Devices, Inc.  
One Technology Way  
P.O. Box 9106  
Norwood, MA 02062-9106  
U.S.A.  
Tel: 781.329.4700  
(800.262.5643,  
U.S.A. only)  
Fax: 781.461.3113

### Analog Devices, Inc. Europe Headquarters

Analog Devices, Inc.  
Wilhelm-Wagenfeld-Str. 6  
80807 Munich  
Germany  
Tel: 49.89.76903.0  
Fax: 49.89.76903.157

### Analog Devices, Inc. Japan Headquarters

Analog Devices, KK  
New Pier Takeshiba  
South Tower Building  
1-16-1 Kaigan, Minato-ku,  
Tokyo, 105-6891  
Japan  
Tel: 813.5402.8200  
Fax: 813.5402.1064

### Analog Devices, Inc. Southeast Asia Headquarters

Analog Devices  
22/F One Corporate Avenue  
222 Hu Bin Road  
Shanghai, 200021  
China  
Tel: 86.21.2320.8000  
Fax: 86.21.2320.8222