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INTERNATIONAL STANDARD

NORME INTERNATIONALE

Optical circuit boards – Part 1: General

Cartes à circuits optiques – Partie 1: Généralités

IEC 62496-1:2008

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OPTICAL CIRCUIT BOARDS –

Part 1: General

FOREWORD

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International Standard IEC 62496-1 has been prepared by IEC technical committee 86: Fibre optics.

The text of this standard is based on the following documents:

FDIS	Report on voting
86/307/FDIS	86/312/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all the parts in the IEC 62496 series, under the general title *Optical circuit boards*, can be found on the IEC website.

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OPTICAL CIRCUIT BOARDS –

Part 1: General

1 Scope

IEC 62496-1 applies to optical circuit boards possessing all of the following general features:

– transmit patterns with straight, cross, bending optical paths and input and output optical ports in plane;
– optical paths consisting of optical fibres and/or optical waveguides;
– controlled lengths of the optical paths, if required;
– may be combined with a printed electric circuit board, the functionality of which is outside the scope of this standard;
– functions to interconnect between optical components and the ability to mount components.

The purpose of this standard is to specify optical circuit board requirements as they relate to

– classification,
– IEC standard system,
– documentation,
– materials,
– workmanship,
– performance,
– identification
– packaging.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60027 (all parts), *Letter symbols to be used in electrical technology*

IEC 60050-731, *International Electrotechnical Vocabulary – Chapter 731: Optical fibre communication*

IEC 60617 (all parts), *Graphical symbols for diagrams*

IEC 60695-11-5, *Fire hazard testing – Part 11-5: Test flames – Needle-flame test method – Apparatus, confirmatory test arrangement and guidance*

IEC 60825-1, *Safety of laser products – Part 1: Equipment classification and requirements*

IEC 60825-2, *Safety of laser products – Part 2: Safety of optical fibre communication systems (OFCS)*

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IEC 61300 (all parts), *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures*

IEC/TR 61930, *Fibre optic graphical symbology*

IEC/TR 61931, *Fibre optics – Terminology*

ISO 129-1, *Technical drawings – Indication of dimensions and tolerances – Part 1: General principles*

ISO 286-1, *ISO system of limits and fits – Part 1: Bases of tolerances, deviations and fits*

ISO 1101, *Geometrical Product Specifications (GPS) – Geometrical tolerancing – Tolerances of form, orientation, location and run-out*

ISO 8601, *Data elements and interchange formats – Information interchange – Representation of dates and times*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60050-731 and IEC/TR 61931, as well as the following terms and definitions, apply.

3.1
optical circuit board
OCB
assembling device having arbitrary optical transmit patterns with straight/cross/bending optical paths which consist of optical fibres and/or optical waveguides with input/output optical ports in plane

NOTE The lengths of optical paths are controlled, if required.

3.2
flexible optical circuit board
optical circuit board that is made of a flexible substrate

3.3
rigid optical circuit board
optical circuit board made of a rigid substrate

3.4
non-planar shape optical circuit board
optical circuit board that re-configures multiple optical fibre ribbons to create a cross-connect

3.5
opto-electric circuit board
composite circuit board composed of optical circuit board and printed circuit board

3.6
input/output optical ports
end of an optical fibre/waveguide where optical signals enter or leave an OCB

3.7
waveguide circuit board
transparent and planar lightguide consisting of a core and a cladding material to transmit light

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NOTE There are several types of waveguides such as slab waveguide, channel waveguide (embedded type) or channel waveguide (ridge type) as shown in Figure 1.

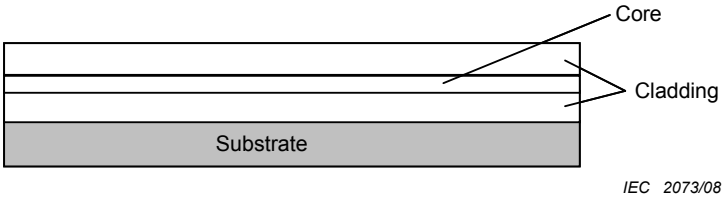

Figure 1a – Example of slab waveguide circuit board

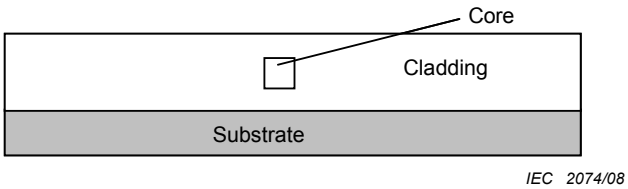

Figure 1b – Example of channel waveguide circuit board – Embedded type

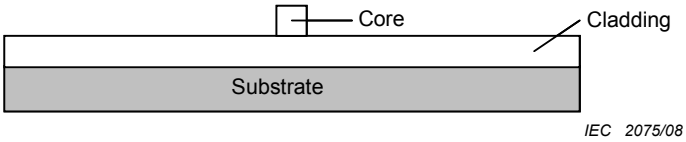

Figure 1c – Example of channel waveguide circuit board – Ridge type

Figure 1 – Schematic views of waveguide circuit boards

3.8
optical fibre circuit board
optical circuit board consisting of fibres to transmit light

NOTE There are two types of fibre circuit boards, embedded and exposed.

3.9
crossing point of optical fibre
position where an optical fibre crosses over the underlying optical fibre in the OCB

3.10
attenuation
a_{ij}
reduction in optical power between an input and an output port of an optical path expressed in decibels and defined as follows:

$$a_{ij} = -10 \log (P_j/P_i)$$

where

P_i is the input optical power introduced into the ith input port;

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P_j is the output optical power attained at the jth output port (the insertion loss depends on the state of the optical circuit board);

i and j are the input and output port numbers, respectively.

3.11
return loss
reflection loss
***RL*$_i$**
fraction of input power returned from the input port of an optical path defined as follows:

$$RL_i = -10 \log (R_i/P_i)$$

where

P_i is the input optical power introduced into the ith input port;

R_i is the optical power received back from the same port;

i is the input port number.

The return loss depends on the state of the optical circuit board.

3.12
isolation
***I*$_{ij}$**
ratio of optical power exiting from the output port corresponding to a given input port, suitably powered, to the optical power exiting from another output port, defined as follows:

$$I_{ij} = -10 \log (P_j/P_i)$$

where

P_i is the optical power exiting the output port corresponding to a given input port, suitably powered;

P_j is the optical power exiting from another output port.

4 Requirements

4.1 General

The requirements for an optical circuit board covered by this clause are used to classify the board.

4.2 Classification

4.2.1 Introductory remark

Optical circuit boards shall be classified as follows:

– type;
– style;
– variant;
– normative reference extensions.

Table 1 is an example of an optical circuit board classification.

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Table 1 – Example of a typical optical circuit board classification

Type:	– Construction: flexible optical circuit board
	– Transmission medium: optical fibre (embedded type)
	– Complexity: optical circuit board without printed circuit board
Style:	– Configuration A
Variants:	– Fibre category: Category B
Normative reference extensions:	.....

4.2.2 Type

Types for optical circuit boards shall be defined by three elements: construction, transmission medium and complexity.

Examples of construction:

– flexible optical circuit board;
– rigid optical circuit board;
– non-planar shape optical circuit board.

Examples of transmission medium:

– optical fibre circuit board (embedded type);
– optical fibre circuit board (exposed type);
– slab waveguide circuit board;
– channel waveguide circuit board (embedded type);
– channel waveguide circuit board (ridge type).

Examples of complexity:

– optical circuit board with printed circuit board (opto-electric circuit board);
– optical circuit board without printed circuit board.

4.2.3 Style

Optical circuit boards may be classified into styles based on types of input and output ports, vertical end type, arbitrary angled mirror type, and dimensions and configuration.

Configuration

The configuration of the optical circuit board ports is classified as follows:

Configuration A

An optical circuit board containing fibres whose ends are outside of the board. A schematic view of Configuration A is shown in Figure 2.

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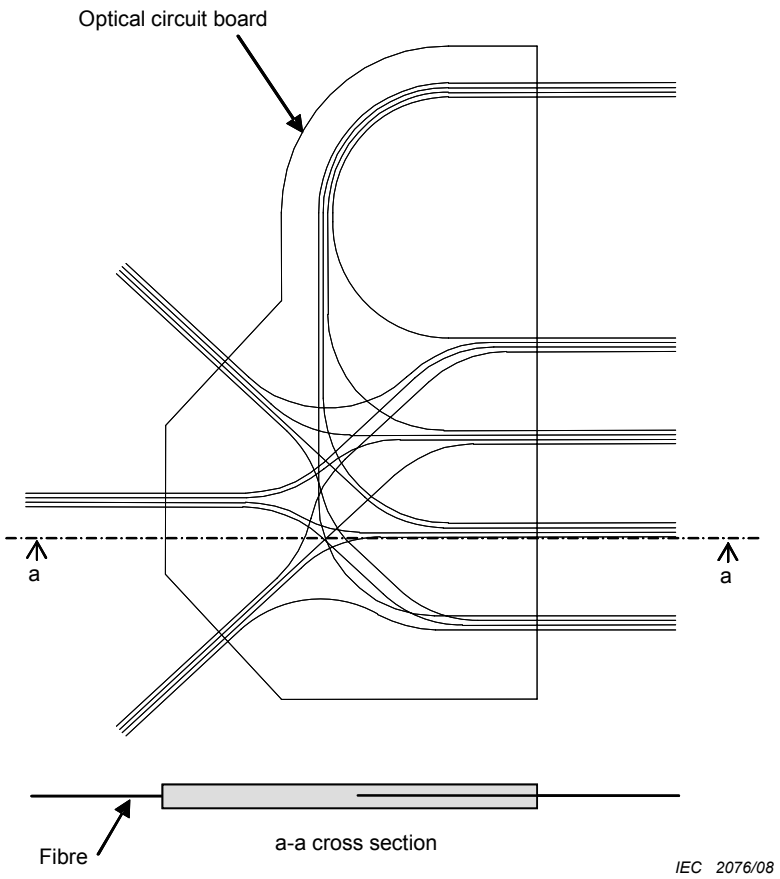

Figure 2 – Configuration A

Configuration B

An optical circuit board containing optical paths with flat ends. A schematic view of Configuration B is shown in Figure 3. Positions of the flat ends are at the board edge. This is made of optical fibre (embedded type), optical fibre (exposed type), channel waveguide (embedded type) and channel waveguide (ridge type).

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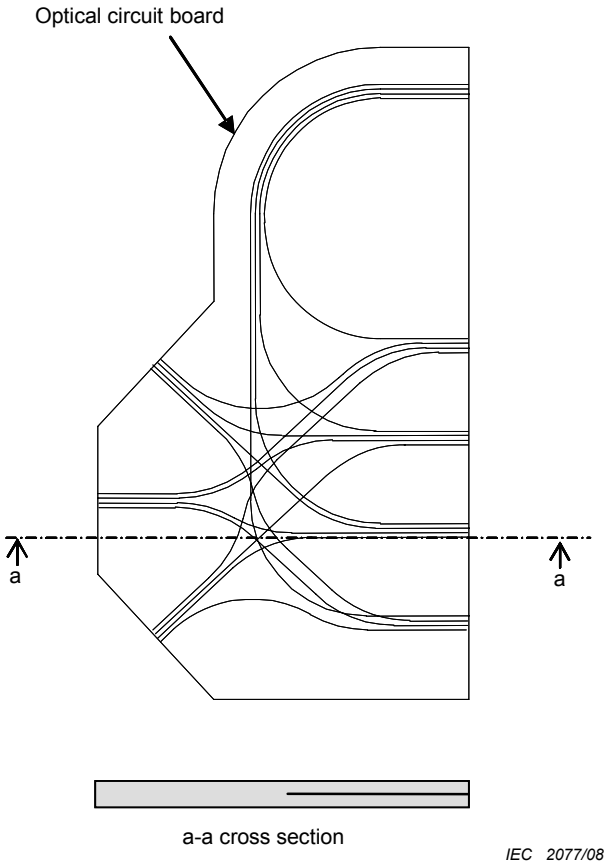

Figure 3 – Configuration B

Configuration C

An optical circuit board containing optical paths with angled end faces.

There exist two types of Configuration C:

– Configuration C-1: this configuration is made of channel waveguide (embedded type) or channel waveguide (ridge type). A schematic view of configuration C-1 is shown in Figure 4.

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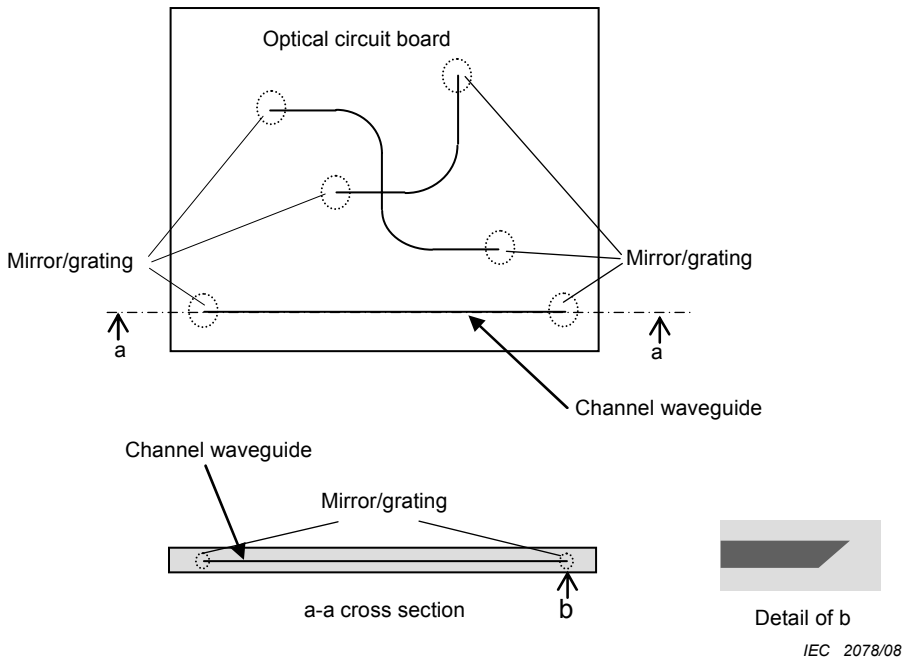

Figure 4 – Configuration C-1

– Configuration C-2: this configuration is made of slab waveguide. A schematic view of Configuration C-2 is shown in Figure 5.

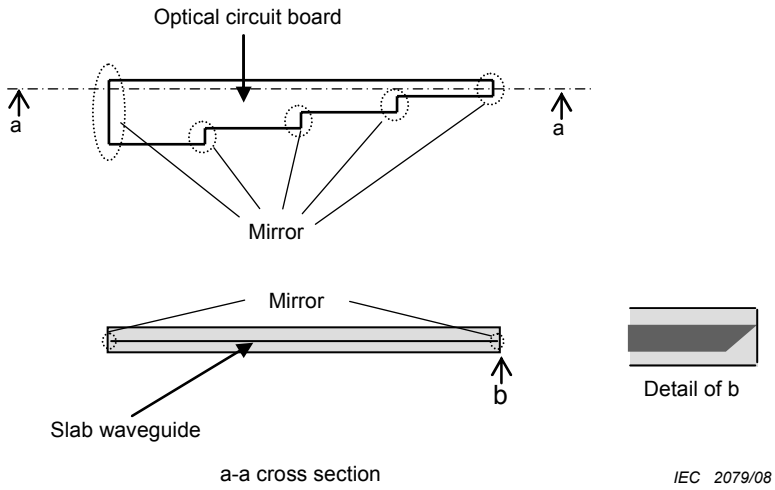

Figure 5 – Configuration C-2

Configuration D

An optical circuit board containing groove and/or via-hole.

There exist two types of Configuration D:

– D-1: this configuration is an optical circuit board in which open grooves or via-holes are formed to insert the connectors into the board for deflection of light to vertical direction. A schematic view of Configuration D-1 is shown in Figure 6.

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