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Flexible Base Dielectrics for Use in Flexible Printed Boards

Supersedes IPC-4202A

April 2010

An international standard developed by IPC

Association Connecting Electronics Industries



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- Include a feedback system on use and problems for future improvement

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Developed by the Flexible Circuits Base Materials Subcommittee (D-13)
of the Flexible Circuits Committee (D-10) of IPC

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Flexible Base Dielectrics for Use in Flexible Printed Boards

1 SCOPE

This standard establishes the classification system, the qualification and quality conformance requirements for flexible base dielectric materials to be used for the fabrication of flexible printed boards. This specification supersedes IPC-4202 which, in turn superseded IPC-FC-231C and the requirements herein meet or exceed the requirements for Class 3 in this superseded document. Note that conformance to Class 3 met or exceeded conformance to Classes 1 and 2. IPC-4202 no longer utilizes the 3-class system.

1.1 Classification System The system described in 1.1.1 through 1.1.2.4 identifies flexible base dielectrics.

1.1.1 Nonspecific Designation A nonspecific designation is intended for use by *designers* on master drawings to designate their material choice. At the end of this standard is a series of material specification sheets identified by specification sheet numbers. Each sheet outlines engineering and performance data for a flexible base dielectric, indicating base material type and method of reinforcement.

Example of nonspecific designation: *IPC-4202/1*, Where “1” refers to the specification sheet detailing unsupported polyimide flexible base dielectrics.

If further material specification details (such as dielectric thickness) are required, they should be highlighted in cross sectional views or notes on the master drawing.

1.1.2 Specific Designation The specific designation should be in the form shown in the following example, and is intended for use on material purchase orders by *fabricators* (see 6.1). The specific designation should not be used by designers on master drawings to indicate their material selection. Master drawings **shall** indicate the material design by designers on master drawings to indicate their material selection, as the designation is lengthy and requires fabricator level knowledge in making the detailed selections.

Example of specific designation:

IPC-4202/1 – E1E2

Where:

IPC-4202/1 – Nonspecific Designation (see 1.1.1), for unsupported polyimide flexible base dielectrics.

E – Base Dielectric Material Type Designation (see 1.1.2.1), specifying polyimide.

1 – Reinforcement Method Designation (see 1.1.2.2), specifying nonreinforced.

E – Reinforcement Type Designation (see 1.1.2.3), specifying nonreinforced film.

2 – Base Dielectric Material Thickness Designation (see 1.1.2.4), specifying 50 μm [1970 μin] thickness.

1.1.2.1 Base Dielectric Material Type The type of dielectric material **shall** be designated per Table 1-1.

Table 1-1 Base Dielectric Type Designation

Designation	Base Dielectric Type
A	Polyvinylfluoride (PVF)
B	Polyethylene Terephthalate Polyester (PET)
C	Fluorinated Ethylene-Propylene Copolymer (FEP)
D	Polytetrafluorethylene (PTFE)
E	Polyimide
F	Aramid
G	Polyamide-imide
H	Epoxy
J	Polyetherimide
K	Polysulfone
L	Polyethylene Naphthalate (PEN)
M	Thermotropic Liquid Crystal Polymer

1.1.2.2 Reinforcement Method The reinforcement method **shall** be designated per Table 1-2.

Table 1-2 Reinforcement Method Designation

Designation	Reinforcement Method
1	Nonreinforced
2	Nonwoven reinforcement
3	Woven reinforcement
4	Combination woven and nonwoven reinforcement

1.1.2.3 Reinforcement Type The reinforcement type **shall** be designated per Table 1-3.

Table 1-3 Reinforcement Type Designation

Designation	Reinforcement Type
A	Glass
B	Polyester
C	Aramid
D	Cellulose
E	Film (nonreinforced)

Note: Combinations will use two letters separated by slash.

1.1.2.4 Base Dielectric Material Thickness The base material thickness **shall** be designated per Table 1-4.

Table 1-4 Nominal Dielectric Thickness Designation

Designator	Thickness*
1	25 μm [980 μin]
2	50 μm [1970 μin]
3	75 μm [2950 μin]
4	100 μm [3940 μin]
5	125 μm [4920 μin]
A	2.5 μm [100 μin]
B	5 μm [200 μin]
C	7.5 μm [300 μin]
D	10 μm [390 μin]
E	12.5 μm [490 μin]
F	15 μm [590 μin]
H	18 μm [710 μin]
J	20 μm [790 μin]
K	23 μm [910 μin]
L	38 μm [1500 μin]
X	Specified on purchase order

*See 3.6.4.

1.2 Qualification The flexible base dielectric materials that meet all the requirements of this standard **shall** be qualified products (see 4.8).

1.3 Quality Conformance This standard establishes a quality conformance system for the suppliers to demonstrate the continual conformance of a flexible base dielectric material to the quality requirements of the standard. See 4.9 for quality conformance inspection requirements.

1.4 Material Characteristics The flexible materials made to this standard use established requirements to enable the material to be applied in a broad range of applications. Materials made to this standard may have characteristics that provide specific enhanced performance. Both the user and supplier should review these enhancements. These enhancements may meet or exceed the specification requirements and will be as designated in the purchasing documentation, AABUS.

1.5 New Materials The flexible base dielectrics contained in this standard represent known materials. As new or revised materials become available, they may be approved and added to this document by committee ballot as an amendment. This amendment would be independent of a full document revision, addition or change. When this occurs, the new or revised specification sheet **shall** become part of the standard. Users and material developers are encouraged to supply information on new flexible materials using the Blank Specification Sheet at end of this standard for review by the IPC Flexible Circuits Base Materials Subcommittee (D-13). Per 6.1, the specification sheet revision date **shall** be specified in the order.

2 APPLICABLE DOCUMENTS

The following documents of the issue currently in effect form a part of this standard to the extent specified herein.

2.1 IPC¹

IPC-T-50 Terms and Definitions for Interconnecting and Packaging Electronic Circuits

IPC-TM-650 Test Methods Manual²

- 2.1.13 Inspection for Inclusions and Voids in Flexible Printed Wiring Materials
- 2.2.4 Dimensional Stability, Flexible Dielectric Materials
- 2.3.2 Chemical Resistance of Flexible Printed Wiring Materials
- 2.4.16 Initiation Tear Strength, Flexible Insulating Materials
- 2.4.17.1 Propagation Tear Strength, Flexible Insulating Material
- 2.4.19 Tensile Strength and Elongation, Flexible Printed Wiring Materials
- 2.5.5.3 Permittivity (Dielectric Constant) and Loss Tangent (Dissipation Factor) of Materials (Two Fluid Cell Method)
- 2.5.5.5 Stripline Test Method for Permittivity and Loss Tangent (Dielectric Constant and Dissipation Factor) at X-Band
- 2.5.5.9 Permittivity and Loss Tangent, Parallel Plate 1 MHz to 1.5 GHz
- 2.5.17 Volume Resistivity and Surface Resistance of Printed Wiring Materials
- 2.6.1 Fungus Resistance Printed Wiring Materials
- 2.6.2 Moisture Absorption, Flexible Printed Wiring

IPC-9191 General Requirements for Implementation of Statistical Process Control

2.2 American Society for Testing and Materials (ASTM)³

ASTM D-149 Standard Test Method for Dielectric Breakdown Voltage and Dielectric Strength of Solid Electrical Insulating Materials at Commercial Power Frequencies

ASTM D-374 Standard Test Methods for Thickness of Solid Electrical Insulation

ASTM D-2520 Standard Test Methods for Complex Permittivity (Dielectric Constant) of Solid Electrical Insulating Materials at Microwave Frequencies and Temperatures to 1650 °C

2.3 Underwriters Laboratories Standards⁴

UL 94 Standard Tests for Flammability of Plastic Materials for Parts in Devices and Appliances

UL 746B Polymeric Materials - Long Term Property Evaluations

2.4 NCSL International⁵

ANSI/NCSL Z 540.1 Calibration Laboratories and Measuring and Test Equipment - General Requirements

2.5 ISO⁶

ISO 10012-1 Quality Assurance Requirements For Measuring Equipment – Part 1: Metrological Confirmation System For Measuring Equipment

1. www.ipc.org

2. Current and revised IPC Test Methods are available on the IPC Web site (www.ipc.org/html/testmethods.htm)

3. www.astm.org

4. www.ul.com

5. www.ncsli.org

6. www.iso.org