



ASSOCIATION CONNECTING  
ELECTRONICS INDUSTRIES®

IPC-4103

# Specification for Base Materials for High Speed/ High Frequency Applications

Developed by the High Speed/High Frequency Base Materials  
Subcommittee (D-23) of the High Speed/High Frequency Committee  
(D-20) of IPC



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Users of this specification are encouraged to participate in the  
development of future revisions.

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# Specification for Base Materials for High Speed/High Frequency Applications

## 1 GENERAL

**1.1 Scope** This specification covers the requirements for high speed/high frequency base materials, herein referred to as laminate or bonding layer, to be used primarily for the fabrication of rigid or multilayer printed boards for high speed/high frequency electrical and electronic circuits. This specification applies to material thickness defined in the specification sheets as measured over the dielectric only.

**1.2 Classification** The system shown below identifies clad and unclad laminate or bonding layer base materials. A cross-reference list, which connects the outlined call-out system in this document to previously used systems, is shown in the specification sheet section.

*Example for laminate base materials where IPC-4103 is referenced:*

4103	-	L	01	C
Specification Number	Specification Revision	Material Designator (see 1.2.1)	Specification Sheet (see 1.2.1)	Dielectric Permittivity Range (see 1.2.2)
1	1500	A	A	C1/C1
Dielectric Permittivity Tolerance (see 1.2.3)	Nominal Laminate Thickness (see 1.2.4)	Thickness Tolerance (see 1.2.5)	Surface Quality (see 1.2.6)	Metal Cladding Type and Nominal Weight/Thickness (see 1.2.7)

*Example for bonding layer base materials where IPC-4103 is referenced:*

4103	-	B	01	C
Specification Number	Specification Revision	Material Designator (see 1.2.1)	Specification Sheet (see 1.2.1)	Dielectric Permittivity Range (see 1.2.2)
E0106	P	TW	RE	VC
Reinforcement Style (see 1.2.8)	Resin Type (see 1.2.9)	Resin Content Column A (see 1.2.10)	Flow Parameter Column B (see 1.2.10)	Optional Bonding Layer Method (see 1.2.10)

**1.2.1 Specification Sheet Description** At the end of this document is a series of specification sheets. Each sheet outlines requirements for both laminate and bonding layers for each product grade. The specification sheets are organized by a specific reinforcement type, resin system, and/or construction and are provided with a Specification Sheet

Number for ordering purposes. The laminate and bonding layer requirements for materials of the like composition are on the same specification sheet for convenience. Material Designator “L” indicates laminate material and Material Designator “B” indicates bonding layer material as shown in the above designation examples. A bonding layer may be a thermoset or thermoplastic film or thermoplastic or thermoset prepreg.

**1.2.2 Dielectric Permittivity** The nominal permittivity is identified by a letter designation (A, B, C, D, E, F or X) as indicated on the applicable specification sheet.

**1.2.3 Dielectric Permittivity Tolerance** The permittivity tolerance is identified by a number designation (1, 2, 3, 4, 5, or X). See 3.11.1.1 and Table 3-8.

**1.2.4 Nominal Laminate Thickness** The nominal thickness is identified by four digits. For all substrates covered by this document, thickness is specified or measured over the dielectric (see 3.8.4.2). For metric specification, the first digit represents whole millimeters, the second represents tenths of millimeters, etc. The four digits indicate the thickness in whole millimeters. In the example shown in 1.2, 1500 is designated for the English usage of 0590.

**1.2.5 Thickness Tolerance, Laminate** The class of thickness tolerance for laminate base material is identified by either A, B, C, D, E, F, G, H, or X as agreed upon between user and supplier (see 3.8.4.2 and Table 3-6).

**1.2.6 Surface Quality Class** The class of surface quality is identified by either A, B, C, D, or X as agreed upon between user and supplier (see 3.8.3.1.1).

**1.2.7 Metal Cladding Type, Nominal Weight** The type and nominal weight or thickness of the metallic cladding for laminate base material is identified by five designators, with the first and fourth designators indicating type of cladding, the third designator being a slash mark to differentiate sides of the base material, and the second and fifth designators indicating the nominal weight or thickness of the metallic cladding.

**1.2.7.1** The types of metallic cladding and the designators representing them are shown in Table 1-1. This table is provided as a reference only. The referee document is the latest version of IPC-CF-148A, IPC-4562, or IPC-CF-152 as appropriate. Cladding types C and R, and H and S,