IPC-4103B

2017 - November

Specification for Base Materials for High Speed/High Frequency Applications

Supersedes IPC-4103A-WAM1
January 2014

An international standard developed by IPC

Association Connecting Electronics Industries

IPC®

The Principles of Standardization

In May 1995 the IPC's Technical Activities Executive Committee (TAEC) adopted Principles of Standardization as a guiding principle of IPC's standardization efforts.

Standards Should:
- Show relationship to Design for Manufacturability (DFM) and Design for the Environment (DFE)
- Minimize time to market
- Contain simple (simplified) language
- Just include spec information
- Focus on end product performance
- Include a feedback system on use and problems for future improvement

Standards Should Not:
- Inhibit innovation
- Increase time-to-market
- Keep people out
- Increase cycle time
- Tell you how to make something
- Contain anything that cannot be defended with data

Notice

IPC Standards and Publications are designed to serve the public interest through eliminating misunderstandings between manufacturers and purchasers, facilitating interchangeability and improvement of products, and assisting the purchaser in selecting and obtaining with minimum delay the proper product for his particular need. Existence of such Standards and Publications shall not in any respect preclude any member or nonmember of IPC from manufacturing or selling products not conforming to such Standards and Publication, nor shall the existence of such Standards and Publications preclude their voluntary use by those other than IPC members, whether the standard is to be used either domestically or internationally.

Recommended Standards and Publications are adopted by IPC without regard to whether their adoption may involve patents on articles, materials, or processes. By such action, IPC does not assume any liability to any patent owner, nor do they assume any obligation whatever to parties adopting the Recommended Standard or Publication. Users are also wholly responsible for protecting themselves against all claims of liabilities for patent infringement.

IPC Position Statement on Specification Revision Change

It is the position of IPC's Technical Activities Executive Committee that the use and implementation of IPC publications is voluntary and is part of a relationship entered into by customer and supplier. When an IPC publication is updated and a new revision is published, it is the opinion of the TAEC that the use of the new revision as part of an existing relationship is not automatic unless required by the contract. The TAEC recommends the use of the latest revision. Adopted October 6, 1998

Why is there a charge for this document?

Your purchase of this document contributes to the ongoing development of new and updated industry standards and publications. Standards allow manufacturers, customers, and suppliers to understand one another better. Standards allow manufacturers greater efficiencies when they can set up their processes to meet industry standards, allowing them to offer their customers lower costs.

IPC spends hundreds of thousands of dollars annually to support IPC's volunteers in the standards and publications development process. There are many rounds of drafts sent out for review and the committees spend hundreds of hours in review and development. IPC's staff attends and participates in committee activities, typesets and circulates document drafts, and follows all necessary procedures to qualify for ANSI approval.

IPC's membership dues have been kept low to allow as many companies as possible to participate. Therefore, the standards and publications revenue is necessary to complement dues revenue. The price schedule offers a 50% discount to IPC members. If your company buys IPC standards and publications, why not take advantage of this and the many other benefits of IPC membership as well? For more information on membership in IPC, please visit www.ipc.org or call 847/597-2872.

Thank you for your continued support.

IPC-4103B

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

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

Contact:

IPC
3000 Lakeside Drive, Suite 105N
Bannockburn, Illinois
60015-1249
Tel 847 615.7100
Fax 847 615.7105

Supersedes:
IPC-4103A-WAM1 -
January 2014
IPC-4103A - December 2011
IPC-4103 - January 2002
IPC-L-125A - July 1992
IPC-L-125

This Page Intentionally Left Blank

Acknowledgment

Any document involving a complex technology draws material from a vast number of sources across many continents. While the principal members of the High Speed/High Frequency Base Materials Subcommittee (D-23) of the High Speed/High Frequency Committee (D-20) are shown below, it is not possible to include all of those who assisted in the evolution of this specification. To each of them, the members of the IPC extend their gratitude.

High Speed/High Frequency Committee

Chair
Lance Auer
Conductor Analysis Technologies, Inc.

Vice-Chair
Don Degroot
Connected Community Networks, Inc.

High Speed/High Frequency Base Materials Subcommittee

Chair
Edward Sandor
Taconic Advanced Dielectric Division

Vice-Chair
Dan Welch
Rogers Corporation

Technical Liaison of the IPC Board of Directors

Bob Neves
Microtek (Changzhou) Laboratories

High Speed/High Frequency Base Materials Subcommittee

David Barrell, Isola Group
Silvio Bertling, Circuit Foil Luxembourg SARL
Byron Case, L-3 Communications
John Coonrod, Rogers Corporation
David Corbett, DLA Land and Maritime
Joseph Davis, Rogers Corporation
Don Degroot, Connected Community Networks, Inc.
Terry Fischer, Hitachi Chemical Co. America, Ltd.
Lionel Fullwood, WKK Distribution Ltd.
Mahendra Gandhi, Northrop Grumman Aerospace Systems
Jason Gretton, Panasonic Industrial Devices Sales Company of America
Geoffrey Hazelett, Polar Instruments Inc.
Todd Henninger, TTM Technologies, Inc.
Scott Herrmann, Dupont
Dr. Michael Janezic, NIST
Brigitte Lawrence, Brigitflex Inc.
Emi Lee, NTS
Minsu Lee, Korea Printed Circuit Association
Doug Leys, Neltec, Inc.
John Marshall, MacDermid Enthone Electronics Solutions
Dr. Jonathan McCartney, Albemarle Corporation
Dr. Thomas McCarthy, Taconic Advanced Dielectric Division
Daniel McCormick, NSWC Crane
Keita Miyasato, Taiyo Industrial Co., Ltd.
Koji Nakajima, Ph.D., Asahi Glass Co., Ltd.
Christopher Olson, Rockwell Collins
Stephen Pierce, SGP Ventures, Inc.
John Radman, NTS
Karl Sauter, Oracle America, Inc.
Rolland Savage, Savage Consulting
Joseph Schmidt, Raytheon Missile Systems
Tony Senese, Panasonic Industrial Devices Sales Company of America
Lowell Sherman, DLA Land and Maritime
Andy Slade, Rogers Corporation
Mike Smith, Arlon Materials for Electronics
Brian Stevens, Rockwell Collins
Ingrid Swenson, TTM Technologies, Inc.
Mamoru Takahashi, Asahi Glass Co., Ltd.
Stephen Tisdale, Tisdale Environmental Consulting, LLC.
Crystal Vanderpan, UL LLC
Steve Vetter, NSWC Crane
Jennet Volden, Rockwell Collins
Matthew Walsh, NSWC Crane
Dr. Kimberly White, Albemarle Corporation
David Wynants, Taconic Advanced Dielectric Division

This Page Intentionally Left Blank

Table of Contents

Figures

Tables

This Page Intentionally Left Blank

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 performance plastic substrates to be used for fabrication of printed boards for microstrip, stripline, and high speed digital electrical and electronic circuits. This specification applies to the plastic substrate thickness defined in the specification sheets as measured over the dielectric only. As a general guideline, laminates controlled by this specification usually have a dissipation factor of less than 0.005.

1.2 Type Designation The following system identifies clad and unclad plastic laminate and bonding layer materials for conventional and enhanced part number call out. Conventional laminate part numbers reflect traditional specification values, and are consistent with the callouts in Table 1-1. Enhanced laminate part numbering would include the conventional part number in Table 1-1 as well as the enhanced information in Table 1-2. Bonding layer part numbers are covered in Table 1-3.

Table 1-1 provides an example for conventional laminate part numbers where IPC-4103 is referenced as follows: 4103AL001C11500C1/C1AA.

Table 1-1 Conventional Laminate Example

4103	A	L	001	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**	**C1/C1**	**A**	**A**
Dielectric Permittivity Tolerance (see 1.2.3)	Nominal Laminate Thickness (see 1.2.4)	Metal Cladding Type and Nominal Weight/Thickness (see 1.2.7)	Thickness Tolerance (see 1.2.5)	Metal Foil Indentations (see 1.2.6)

Table 1-2 provides an example for enhanced laminate part numbers where IPC-4103 is referenced. In addition to the conventional Table 1-2, the following designators could be used to define an enhanced material part number such as: 4103AL001C11500C1/C1AAX1A1A.

Table 1-2 Enhanced Laminate Example

X	1	A	1	A
Test Frequency (see 1.2.8)	Dielectric Loss (see 1.2.9)	Resin (see 1.2.10)	Filler (see 1.2.11)	Reinforcement (see 1.2.12)

Table 1-3 provides an example for bonding layer part numbers where IPC-4103 is referenced as follows: 4103AB520CE1080BRCSCVC1.

Table 1-3 Bonding Layer Example

4103	A	B	520	C
Specification Number	Specification Revision	Material Designator (see 1.2.1)	Specification Sheet (see 1.2.1)	Dielectric Permittivity Range (see 1.2.2)
E	**1080**	**B**	**RC**	**SC**
Reinforcement Type (see 1.2.13)	Reinforcement Style (see 1.2.13)	Resin System (see 1.2.10)	Resin Content Test Method (see 1.2.14)	Flow Parameter (see 1.2.14)
VC	**1**			
Optional Test (see 1.2.14)	Filler (see 1.2.11)			