IPC-2221B

2012 - November

Generic Standard on Printed Board Design

Supersedes IPC-2221A
May 2003

A standard developed by IPC

Association Connecting Electronics Industries

IPC®

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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

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- 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

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IPC-2221B

Generic Standard on Printed Board Design

Developed by the IPC-2221 Task Group (D-31b) of the Rigid Printed Board Committee (D-30) of IPC

Superseded:
IPC-2221A - May 2003
IPC-2221 - February 1998

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

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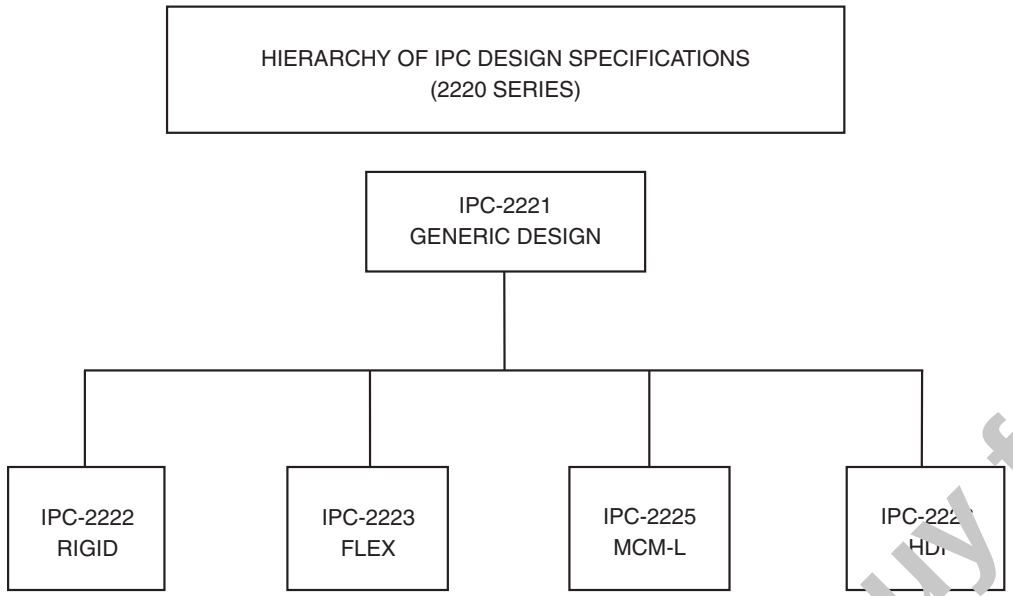

FOREWORD

This standard is intended to provide information on the generic requirements for organic printed board design. All aspects and details of the design requirements are addressed to the extent that they can be applied to the broad spectrum of those designs that use organic materials or organic materials in combination with inorganic materials (metal, glass, ceramic, etc.) to provide the structure for mounting and interconnecting electronic, electromechanical, and mechanical components. It is crucial that a decision pertaining to the choice of product types be made as early as possible. Once a component mounting and interconnecting technology has been selected the user should obtain the sectional document that provides the specific focus on the chosen technology.

It may be more effective to consider alternative printed board construction types for the product being designed. As an example the application of a rigid-flex printed wiring board may be more cost or performance effective than using multiple printed wiring boards, connectors and cables.

IPC's documentation strategy is to provide distinct documents that focus on specific aspect of electronic packaging issues. In this regard document sets are used to provide the total information related to a particular electronic packaging topic. A document set is identified by a four digit number that ends in zero (0).

Included in the set is the generic information which is contained in the first document of the set and identified by the four digit set number. The generic standard is supplemented by one or many sectional documents each of which provide specific focus on one aspect of the topic or the technology selected. The user needs, as a minimum, the generic design document, the sectional of the chosen technology, and the engineering description of the final product.

As technology changes specific focus standards will be updated, or new focus standards added to the document set. The IPC invites input on the effectiveness of the documentation and encourages user response through completion of ''Suggestions for Improvement'' forms located at the end of each document.

Acknowledgment

Any document involving a complex technology draws material from a vast number of sources. While the principal members of the IPC-2221 Task Group (D-31b) of the Rigid Printed Board Committee (D-30) are shown below, it is not possible to include all of those who assisted in the evolution of this Standard. To each of them, the members of the IPC extend their gratitude.

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Generic Standard on Printed Board Design

1 SCOPE

This standard establishes the generic requirements for the design of organic printed boards and other forms of component mounting or interconnecting structures, including PC card form factors. The organic materials may be homogeneous, reinforced, or used in combination with inorganic materials; the interconnections may be single, double, or multilayered.

1.1 Purpose The requirements contained herein are intended to establish design principles and recommendations that **shall** be used in conjunction with the detailed requirements of a specific interconnecting structure sectional standard (see 1.2) to produce detailed designs intended to mount and connect components. This standard is not intended for use as a performance specification for finished printed boards nor as an acceptance document for electronic assemblies.

1.2 Documentation Hierarchy This standard identifies generic physical design principles, and is supplemented by various sectional standards that provide sharper focus on specific aspects of printed board technology. These include:

IPC-2222 Rigid organic printed board design
IPC-2223 Flexible printed board design
IPC-2225 Organic, MCM-L, printed board design
IPC-2226 High Density Interconnect (HDI) printed board design

The documents are a part of the Family of Design Documents which is identified as IPC-2220. The number IPC-2220 is for ordering purposes only and includes this standard and the four listed above.

Note: IPC-2224, a sectional design standard for PC card form factors, was cancelled by the IPC. Relevant PC form factor design information has been transferred to this revision of IPC-2221 and to IPC-2222.

1.3 Presentation All dimensions and tolerances in this standard are expressed in hard SI (metric) units and parenthetical soft imperial (inch) units. Users of this standard are expected to use metric dimensions. All dimensions greater than or equal to 0.1 mm [0.0039 in] will be expressed in millimeters and inches. All dimensions less than 0.1 mm [0.0039 in] will be expressed in micrometers and microinches.

1.3.1 Dimensional Units The following is taken from National Institute of Standards and Technology - Metric Information and Conversions: ''Beginning January 1, 2010, the European Union Council Directive 80/181/EEC (Metric Directive) allowed the use of only metric units, and prohibited the use of any other measurements for most products sold in the European Union (EU). The Metric Directive made the sole use of metric units obligatory in all aspects of life in the European Union, extending to areas such as product literature and advertising.''

Most component datasheets are provided in metric units. Many printed board designers spend a lot of time converting between imperial (inch) and SI (metric). Round-off errors, when converting units, can result in inaccuracies that result in marginal or failed designs. However, the printed board fabrication vendors often default to imperial units. Electronic Computer Aided Design (ECAD) tools accommodate both metric and imperial library components being placed on the same printed board because dimensional precision is large enough to describe most standard components accurately.

Problems arise when importing information from third party software or trying to mix units during printed board layout. For example, if a portion of the printed board design is an imported Drawing Exchange Format (.DXF) file with metric units that needs to interface with a digital portion done in imperial units, a problem can occur where the data from the two grids are mixed. Unlike importing from libraries, a conversion to printed board units is not always done when importing DXF.

While a user can convert printed board units from metric to imperial in modern day tools without problems, this should not be done too often during the design phase as repeated conversions can introduce unexpected errors. A single set of units should be used in the layout of the printed board. If imported data is in metric units, the layout portion of the process should use metric units. Once the layout is complete and verified, the designer can convert the printed board to imperial units for documentation, if necessary.

1.4 Interpretation ''**Shall**,'' the imperative form of the verb, is used throughout this standard whenever a requirement is intended to express a provision that is mandatory. Deviation from a ''**shall**'' requirement may be considered if sufficient data is supplied to justify the exception.