The Institute for Interconnecting and Packaging Electronic Circuits

IPC-D-325A

Documentation Requirements for Printed Boards, Assemblies and Support Drawings

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1.0 SCOPE

This standard establishes requirements and other considerations for the documentation of printed boards and printed board assemblies.

1.1 Purpose The purpose of this standard is to establish the general requirements for the preparation of drawings necessary to fully describe end product printed boards, printed board assemblies and related support drawings. Special emphasis is given to the technical requirements necessary to fully describe the fabrication and assembly of various types of printed boards. Regardless of material, construction, layer count, special fabrication requirements, or end product usage, the documentation package may include, but not be limited to the following:

- Master Drawing Requirements
- Specifications
- Board Definition
- Artwork/Phototooling
- Soldermask Requirements
- Master Pattern Drawing
- Production Master
- Assembly Drawing and Parts List
- Electrical Test Requirements
- Final Schematic/Logic Diagram
- Related Support Drawings
- Artwork Plot Data
- Excellon Drill Data

Refer to IPC-D-275, ''Design Standard for Rigid Printed Boards and Rigid Printed Board Assemblies,'' regarding all subjects pertaining directly to design.

This standard may be used for both commercial and military applications. Printed boards and printed board assemblies intended for military usage **shall** be fabricated and/or assembled by a manufacturer that has been qualified to the appropriate military specification, unless otherwise agreed to contractually.

Documentation intended for military electronic equipment **shall** be so noted.

1.1.1 Organization of Information This standard is organized into various sections in order to provide information for the documentation of rigid printed boards and printed board assemblies.

The major sections and their specific emphasis are:

Section 1 – Scope, Purpose and Classification

Section 2 – Applicable Documents

Section 3 – Documentation Requirements

Section 4 – Documentation Package

Section 5 – Sample Figures and Examples

Section 6 – Master Drawing Notes and Check List

Section 7 – Design Outputs

Section 8 – Printed Board Assembly Drawings (Including Figures & Examples)

Section 9 – Printed Board Support Drawings

Section 10– Schematic / Logic Diagrams

1.2 Classification This standard recognizes that rigid printed boards and printed board assemblies are subject to classifications by intended end item use. Classification of producibility is related to complexity of the design and the precision required to produce the particular printed board or printed board assembly.

Any producibility level or producibility design characteristic may be applied to any end-product equipment category. Therefore, a high-reliability product designated as class ''3'' (see 1.2.2), could require level ''A'' design complexity (preferred producibility) for many of the attributes of the printed board or printed board assembly (see 1.2.3).

1.2.1 Board Types This standard provides design information for different board types. Board types are classified:

Type 1 – Single-Sided Printed Board

Type 2 – Double-Sided Printed Board

Type 3 – Multilayer Board without Blind or Buried Vias

Type 4 – Multilayer Board with Blind and/or Buried Vias

Type 5 – Multilayer Metal-Core Board without Blind or Buried Vias

Type 6 – Multilayer Metal-Core Board with Blind and/or Buried Vias

1.2.2 Performance Classes Three general end-product classes have been established to reflect progressive increases in sophistication, functional performance requirements and testing/inspection frequency. It should be recognized that there may be an overlap of equipment between classes.

The printed board user is responsible for determining the class in which his board product belongs.

Class 1 — General Electronic Products

Includes consumer products, some computer and computer peripherals, as well as general military hardware suitable for applications where cosmetic imperfections are not important and the major requirement is function of the completed printed board or printed board assembly.

Class 2 — Dedicated Service Electronic Products

Includes communications equipment, sophisticated business machines, instruments and military equipment where high performance and extended life is required, and for which uninterrupted service is desired but is not critical. Certain cosmetic imperfections are allowed.

Class 3 — High Reliability Electronic Products

Includes the equipment for commercial and military products where continued performance or performance on demand is critical. Equipment downtime cannot be tolerated, and must function when required such as for life support items, or critical weapons systems. Printed boards and printed board assemblies in this class are suitable for applications where high levels of assurance are required and service is essential.

1.2.3 Producibility Level When appropriate, this standard will provide three levels of design complexity: Levels A, B, and C. Included are special features, tolerances, measurements, assembly, testing of completion, and verification of the manufacturing process. Higher levels of design complexity often result in a reduction of the productibility level and, therefore, increased fabrication costs. These levels are:

Level A — General Design Complexity-Preferred

Level B — Moderate Design Complexity-Standard

Level C — High Design Complexity-Reduced Producibility

The producibility levels are not to be interpreted as a design requirement, but a method of communicating the degree of difficulty of a feature between design and fabrication/assembly facilities. The use of one level for a specific feature does not mean that other features must be of the same level. Selection should always be based on the minimum need, while recognizing that the precision, performance, conductive pattern density, assembly and testing requirements determine the design producibility level. The numbers listed within the numerous tables are to be used as a guide in determining what the level of producibility will be for any feature. The specific requirement for any feature that must be controlled on the end item **shall** be specified on the master drawing of the printed board or the printed board assembly drawing.

1.2.4 Documentation Classification This standard provides three classes for documentation requirements to reflect progressive increases in sophistication of the drawing package. The three classes of documentation are:

Class A — Minimal Documentation

Class B — Moderate Documentation

Class C — Full Documentation

Selection of class should be based on the minimum need, recognizing that less sophisticated classes require more coordination and communication between user and vendor. Requirements for documentation **shall** be specified in the contract order used to procure documentation, equipment or both.

Note: Classification of documentation requirements should not be confused with the classification of end item use, as referenced in other IPC standards and specifications which refer to: Class 1) consumer products; Class 2) general industrial; and Class 3) high reliability equipment. The need to apply documentation practices to a particular class of equipment should depend on the complexity of the interface required to produce the printed board; therefore, any documentation class may be applied to any of the end product equipment categories (classes) as required; examples: Class 2B would be industrial equipment supported by moderate documentation.

There are three classes of documentation requirements. These requirements reflect the differences in sophistication and completeness of the documentation packages. The three classes are defined as follows:

Class A — Minimal Documentation

This class of documentation is identified as minimal and consists of layout and artwork only. Class A documentation is usually used for internal use and requires a good deal of coordination between the user and manufacturer of the board. Information may be incomplete in some instances and relies heavily on in-house agreed to manufacturing processes, such as standard material, standard plating processes, standard tolerances, etc.

Documentation is suitable for the application, where the only requirement is that the manufacturer can produce a functional product from information supplied. It may include, as a minimum, the designer's layout or check plot containing manufacturing notes/instructions and single image artwork master.

Class B — Moderate Documentation

Class B documentation package consists of complete board definition, without any description of the manufacturing allowances that have been incorporated into the design. Contractual drawing requirements may apply. Quality conformance coupons may be defined by the design; their position in relationship to the board or the manufactured panel is optional.