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Qualification and Performance Specification for Printed Boards Containing Embedded Active and Passive Circuitry

Developed by the Embedded Devices Process Implementation Subcommittee (D-55) of the Embedded Components Committee (D-50) of IPC

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

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Qualification and Performance Specification for Printed Boards Containing Embedded Active and Passive Circuitry

1 SCOPE

This specification covers qualification and performance of embedded active and passive circuitry within the finished printed board.

1.1 Purpose The purpose of this standard is to define the electrical, mechanical and environmental requirements specific to embedded passive and active circuitry. These requirements are in addition to the applicable requirements of other performance specification(s) (e.g., IPC-6010 series, J-STD-001). Where specified, the requirements in this specification may supersede those requirements.

Substrates, as pertain to this standard, are materials (e.g., prepreg, laminate, films, cores, etc.) that serve as a platform for the embedded circuitry.

See IPC-7092 for additional guidance and information on embedded circuitry.

1.2 Classification IPC standards recognize that electrical and electronic assemblies are subject to classifications by intended end-item use. Three general end-product classes have been established to reflect differences in manufacturability, complexity, functional performance requirements, and verification (inspection/test) frequency. It should be recognized that there may be overlaps of equipment between classes.

CLASS 1 General Electronic Products

Includes products suitable for applications where the major requirement is function of the completed assembly.

CLASS 2 Dedicated Service Electronic Products

Includes products where continued performance and extended life is required, and for which uninterrupted service is desired but not critical. Typically, the end-use environment would not cause failures.

CLASS 3 High Performance/Harsh Environment Electronic Products

Includes products where continued high performance or performance-on-demand is critical, equipment downtime cannot be tolerated, end-use environment may be uncommonly harsh, and the equipment must function when required, such as life support or other critical systems.

1.3 Measurement Units All dimensions and tolerances in this specification are expressed in hard SI (metric) units. Users of this specification are expected to use metric dimensions. All dimensions $\geq$ 1.0 mm will be expressed in mm. All dimensions < 1.0 mm will be expressed in µm.

1.4 Definition of Requirements The words **shall** or **shall not** are used in the text of this document wherever there is a requirement for materials, preparation, process control or acceptance.

The word “should” reflects recommendations and is used to reflect general industry practices and procedures for guidance only.

Line drawings and illustrations are depicted herein to assist in the interpretation of the written requirements of this Standard. The text takes precedence over the figures.

Where the word **shall** is used in this Standard, the requirements for each class are in brackets next to the requirement.

N = No requirement has been established for this Class
A = Acceptable
P = Process Indicator
D = Defect

Examples:
[A1P2D3] is Acceptable Class 1, Process Indicator Class 2 and Defect Class 3
[N1D2D3] is No requirement has been established Class 1, Defect Classes 2 and 3
[A1A2D3] is Acceptable Classes 1 and 2, Defect Class 3
[D1D2D3] is Defect for all Classes

1.5 Process Control Requirements The primary goal of process control is to continually reduce variation in the processes, products, or services to provide products or processes meeting or exceeding user requirements. Process control tools such as IPC-9191 or other user-approved system may be used as guidelines for implementing process control.

A documented process control system, if established, **shall** define process control and corrective action limits.

This may or may not be a statistical process control system. The use of statistical process control (SPC) is optional and should be based on factors such as design stability, lot size, production quantities and the needs of the manufacturer.

When a decision or requirement is to use a documented process control system, failure to implement process corrective action and/or the use of continually ineffective corrective actions **shall** be grounds for disapproval of the process and associated documentation.

1.6 Order of Precedence The contract **shall** take precedence over this standard, referenced standards and drawings.

In the event of conflict, the following order of precedence applies:

1) Procurement as agreed and documented between user and supplier.
2) Master drawing, design brief or tech pack reflecting the user's detailed requirements.
3) When invoked by the customer or per contractual agreement, this standard.

When documents other than this standard are cited, the order of precedence **shall** be defined in the procurement documents. The user can specify alternative acceptance criteria.

1.6.1 Conflict In the event of conflict between the requirements of this standard and the applicable drawing(s) and documentation, the applicable user-approved drawing(s) and documentation govern.

Some examples of documentation include the contract, purchase order, technical data package, engineering specification or performance specification. In the event of a conflict between the text of this standard and the applicable documents cited herein, the text of this standard takes precedence. In the event of conflict between the requirements of this standard and drawing(s) and documentation that has not been user approved, this standard governs.

1.6.2 Clause References When a clause in this document is referenced, its subordinate clauses apply, unless the requirement references specific subordinate clauses.

1.6.3 Procurement Documentation The procurement documentation **shall** provide sufficient information to the supplier so the supplier can produce printed boards containing embedded active and passive circuitry and ensure the user receives the desired product. The procurement documentation should specify the requirements that can be selected from within this standard.

1.6.3.1 Selection for Procurement For procurement purposes, performance class **shall** be specified in the procurement documentation. The documentation **shall** provide sufficient information to the supplier so that one can fabricate the printed board and ensure that the user receives the desired product. Information that should be included in the procurement documentation is shown in IPC-D-325.

1.7 Quality Conformance This standard establishes a quality conformance system for suppliers to demonstrate the continual conformance of materials to the quality requirements of the standard. See Section 4 for quality conformance inspection requirements.

1.8 Abbreviations and Acronyms When used, periodic table elements are abbreviated in the standard. See Appendix A for full spellings of abbreviations (including elements) and acronyms used in this standard.