

PBA Design-for-eXcellence Guideline

EDM-D-013 Thermal Design of Electronics

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The Design-for-eXcellence Guidelines principles

The PBA Design-for-eXcellence (DfX) Guidelines are designed to provide all electronic supply chain actors involved in the design, qualification, industrialization and production of Printed Board Assemblies practical guidelines to master the multi-disciplinary hardware aspects of electronic module realization and operation in a cost-effective way. The PBA DfX Guidelines are not electrical design guidelines. The PBA DfX guidelines provide the electrical designer the boundary conditions of industrial electronic manufacturing technology and operational reliability. It is intended to support the development of cost-effective, reliable PBA with a short time-to-market requiring a minimum number of design iterations.

Some of the characteristics of the PBA DfX Guidelines are:

- The PBA DfX Guidelines are oriented towards the overall optimization of the physical design of the final PBA based product.
- The guidelines refer to the relevant industry standards that are predominantly used in the international electronics industry such as those published by organizations as IPC and JEDEC. The guidelines do not replace industrial standards but define or recommend what options in the standards to use and will fill-in gaps if necessary. They provide the basis on which a company/product/product-line or application specific approach for design, industrialization and/or realization can be defined.
- Scientific argumentation and physical models form the basis of a large part of the guidelines and of the associated tools. This allows the use of the guidelines beyond the boundary of the users' experience domain. Therefore, it provides a powerful product and process innovation aid.
- The PBA DfX Guidelines will not specify, recommend or exclude specific brands of materials, components, suppliers or products. They will put forward minimal requirements on quality, physical and chemical properties and testing. They define and provide the DfManufacturing window for PBA realization.
- The PBA DfX Guidelines are based on verifiable physical models, standards and empirical data.

PBA DfX Guideline Scope

- The PBA DfX Guideline goal is to support the integration of PBA in systems by providing guidelines how to specify, quantify and modify the thermal interaction between the PBA, the system and its environment.
- This DfX guideline provides a concise overview of well-proven and well-understood thermal PBA design techniques. These are translated into guidelines to make early design choices at PBA level that increase the probability of fulfilling the inter- and intra-system requirements when integrating the PBA inside the final product or system.
- This guideline applies to all types (rigid, flex, flex-rigid) and classes (IPC 1, 2 and 3) of PCB and PBA, both SnPb and leadfree soldered.

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1. Applicable Documents

This PBA DfX Guideline refers as part of the guideline to the most recent versions of the following documents and standards including their amendments.

IEC 60721	<i>Classification of Environmental Conditions</i>
ETSI EN 300 019	<i>Environmental Conditions and Environmental Tests for Telecommunications Equipment</i>
JESD15-1	<i>Compact Thermal Model Overview</i>
JESD15-3	<i>Two-Resistor Compact Thermal Model Guideline</i>
JESD15-4	<i>DELPHI Compact Thermal Model Guideline</i>
JESD51-12	<i>Guidelines for Reporting and Using Electronic Package Thermal Information</i>
JESD51-13	<i>Glossary of Thermal Measurement Terms and Definitions</i>

2. Applicability of the PBA DfX Guideline

- The recommendations given in this guideline are intended to help the user in making early design choices at PBA level that increase the probability of fulfilling the system level requirements when integrating the PBA inside the final product or system.
- These recommendations are of a generic nature. Therefore, in specific cases more optimal solutions may exist.
- Design specifications take precedence over this guideline.

3. EDM-D-013 objective

The reliability of electronic systems, containing PBA, is largely dependent on the temperature levels and variation of its components. Efficient thermal management of the PBA is needed to reduce the product failures that occur due to its thermal mission profile.

This guideline provides a first order estimation process to characterize the temperature of components on a PBA that can be applied already very early in the design phase i.e. prior to PCB layout.

It gives an insight in the different heat sources and cooling mechanisms that interact in an electronic system.

The guideline offers different optimization possibilities at PBA level. Correct positioning of heat sources (spacing), heat spreading in the PCB, guidance on thermal vias, efficient heat dissipation due to heat sinks, heat spreaders, etc. is the focus of the current guideline.