

PBA Design-for-eXcellence Guideline

EDM-D-012: Mechanical Integration

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The Electronics Design and Manufacturing 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 basic 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 hardware realization aspects 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 Mechanical Integration Guideline Scope

- This Mechanical Integration guideline provides a methodology to characterize the mechanical loading (vibration) on a PBA, how to estimate the PBA mechanical response and how to determine fixation points and the use of PBA stiffeners to reduce mechanical loading on the interconnections.

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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 standards and their amendments.

ETS 300 19	<i>Environmental Conditions and Environmental testing for Telecommunication Systems</i>
IEC 60721	<i>Classification of environmental conditions</i>
IEC 60068	<i>Environmental testing</i>
ISO 16750-3	<i>Road vehicles — Environmental conditions and testing for electrical and electronic equipment — Part 3: Mechanical loads</i>
J-STD-001DS	<i>Space Applications Electronic Hardware Addendum to J-STD-001D Requirements for Soldered Electrical and Electronic Assemblies</i>

2. Applicability of the PBA DfM Guideline

- Design recommendations given in the guideline are intended to help the user in making choices that improve the manufacturability, reliability, testability, etc., of the PBA. These recommendations are of a generic nature. Therefore, in specific cases more optimal solutions may exist.
- Design specification takes precedence over this guideline.
- IPC class 2 requirements and test procedures apply unless specified otherwise in this document.

3. EDM-D-012 Objective

PBA integrated in products and systems that are subjected to mechanical vibrations may suffer from high cycle solder joint fatigue as a consequence of this mechanical loading. Mechanical shock may lead to immediate failure or, when repeated, to low cycle fatigue of solder joints. Reducing mechanical load on the PBA by system approaches such as vibration damped suspension of electronics, proper fixation of the PBA to the system and PBA stiffening may be a solution when mechanical loading threatens PBA integrity. Unfortunately, far too often these mechanical loading issues are addressed (too) late in the design cycle – e.g. after failure in vibration testing of prototypes – leading too costly and time-consuming redesign of the PBA to allow extra fixation points and/or stiffeners to be added.

The objective of this guideline is to provide a methodology to estimate early in the design phase – prior to PCB layout – where fixation points or stiffeners are required.