

PBA Design-for-eXcellence Guideline

EDM-D-011 Electro-Magnetic Compatibility (EMC)

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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 Electro-Magnetic Compatibility Guideline Scope

- This Electro-Magnetic Compatibility (EMC) guideline provides a concise overview of well-proven and well-understood EMC design techniques at PBA level. These are translated into guidelines to make early design choices at PBA level that increase the probability of full-filling the inter- and intra-system EMC 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.

2014/30/EU	Directive 2014/30/EU of the European Parliament and of the Council of 26 February 2014 on the harmonisation of the laws of the Member States relating to Electro-Magnetic compatibility.
EDM-D-009	Signal Integrity Design Guideline
EDM-D-010	Power Integrity Design Guideline

2. Applicability and Objective of the Guideline EDM-D-011

- Requirements related to Electro-Magnetic Compatibility (EMC) are generally driven by the legal necessity for an electronic product or system to meet the essential requirements described in the EMC directive 2014/30/EU. Assessing that an electronic product or system indeed complies with these essential requirements is typically done by testing the product or system according to harmonized standards describing test methods and emission and susceptibility limits. This can be referred to as inter-system EMC.
- A second driving force is the need to avoid Electro-Magnetic Interference (EMI) between different PBAs inside the same product or system, which can be referred to as intra-system EMC.
- Although the emission and susceptibility limits are set at product or system level, design choices at PBA level have a crucial role for the EMC behavior of the total system. The active components on the PBA are the actual sources of outgoing Electro-Magnetic disturbances or are the components whose behavior is influenced by incoming Electro-Magnetic stresses. Whether or not these outgoing Electro-Magnetic disturbances will contribute to the emission of the final product/system or whether or not external Electro-Magnetic stresses will eventually reach the active components, is for a large part dependent on the early design choices at PBA level.
- 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 inter- and intra-system EMC requirements when integrating the PBA inside the final product or system.
- These recommendations are of a generic nature and give a concise survey of well-proven and well-understood EMC design techniques. In specific cases, more optimal solutions may exist.
- System level EMC design choices (external shielded enclosures, cable partitioning...) is beyond the scope of this document.
- The EMC behavior of a PBA is also largely determined by how well Signal Integrity (SI) and Power Integrity (PI) are implemented. The recommendations in this guideline complement those on SI (EDM-D-009) and PI (EDM-D-010) and should be considered together.