Memo

To:
From: Hans Manhaeve
CC:
Date:
Concerns: Test and Design for Test – Training class description

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Preamble

The "Test and Design for Test" training class is intended for Project Managers, Design engineers and Test engineers.

Increasing quality requirements, cost reduction pressures and short time to market demands require a close interaction between the Design & Test departments to reach the target product quality at the lowest cost. To achieve these targets a proper understanding of the different aspects that make up the product development flow, looked at from both the design and test perspective, is mandatory. An equally important factor is the establishment of a proper interaction between the design and test teams. This requires that the design teams have knowledge on the test capabilities and limitations, enabling the proper introduction of design-for-test methodologies and the fruitful execution of test preparation tasks. It is equally important that the test teams and project managers are aware of the impact of certain design-for-test strategies on the design work and that all are aware of the impact of certain design-for-test and test preparation actions on the ability to optimize the test and overall product flow.

The objective of this training course is to provide the proper knowledge to bridge the gap between Design and Test and provide a better understanding of the factors involved in reaching an optimized cost - quality level.

Training class content

The training class addresses the following topics.

The training class starts with a brief historical overview of the (micro-) electronics history and the related developments in electronic circuit and systems engineering, from designs made from discrete and base electronic building blocks to today's complex circuits emerging from system-on-chip and system-in-package solutions.
To build the bridges between design and test and to prepare for proper design-for-test, the remainder of the training class addresses the design and test topics from different angles. And is organized around three main themes, being Design, Test and Design-for-Test. At first the question is raised and answered "What means Designing?". In the next section the concept and meaning of "System design" is discussed. Then a jump is made to the other side of the spectrum and an introduction is given to the world of Test. Having acquired the base knowledge of both Design and Test allows to bridge the two domains and put the different Design-for-Test techniques and methods in their proper perspective. Before reaching conclusions attention will be paid to the impact of design complexity on test and the resulting move from simple pass/fail test to design related data driven test strategies.

The objective of the Design section is to give a proper view on the design world and the different design aspects. The System Design section follows the path from Idea to Product, defines the meaning of an "Electronic System", addresses the "cost of ownership" theme and different packaging options as well as the impact of packaging on the design trajectory and ends with a discussion of the design Complexity factor.

The objective of the “Test – an Introduction” section is to provide a deeper insight in the capabilities, limitations and requirements of test and the test flow. This will be done at first by situating simulation, verification and test in the product design, manufacturing and test flow. Next the role of Test and the different aspects that make up a test flow and a test program will be reviewed. Following that the different ways to test a circuit (test approaches) will be discussed from a methodological viewpoint as well as from a test parameter viewpoint. The methodological viewpoint will explore the path from Functional over Structural to Defect oriented test, thereby looking at the definition and application of fault models and how these can help to guide and improve the test process. The test parameter viewpoint will focus on the difference between voltage (logic) and current (I_{DDQ}) testing and zoom in to I_{DDQ} testing.

Having the background on “Design” as well as a proper insight in “What is Test all about and how can it be done”, enables to build the bridge between Design and Test.

In the “Design for Test” section that bridges the Design and Test world, the design task that are done in function of test preparation will be looked at, leading to the discussion of topics like test vector generation, fault simulation and fault grading. Once these aspects are mastered, a second theme that will be addressed is the difference between fault coverage and test coverage, putting meaning to the figures provided by the ATPG tools. Jumping back and forward between Design and Test the link will be made between “fault detection” and “defect detection”, answering the question “how efficient are tests driven by fault models in detecting real life defects?”. This will be elaborated further and underlined with practical data in the section “test quality and test coverage” that will address fault coverage and test coverage requirements for a quality and reliability perspective. Next the theme “Design for Test” will be addressed in more detail, answering the questions “what is Testability?”, how can we design a testable circuit and what should we take into account to assure testability?, before looking into different DFT strategies like “Ad-Hoc DFT”, “Scan and Boundary Scan”, “Build-In Self Test – BIST” and I_{DDQ} DFT.

Looking forward as well as compiling the gathered knowledge attention will be paid to the impact of design complexity on test and the resulting move from simple pass/fail test to design related data driven test strategies.

The training class is concluded by a set of global conclusion.

Upon completing this training class the participant will have acquired a proper understanding of what means “Design”, have a proper view on the capabilities and limitations of Test as well as a proper understanding of the DFT measures that can be taken to improve the test process and reduce product costs. With this knowledge the participant will have the proper knowledge to take the appropriate decisions that help to bridge the gap between Design and Test and have a better understanding of the factors involved in controlling the product development and realization costs.