PRACTICAL ISSUES OF FAILURE DIAGNOSIS AND ANALYSIS IN A FAST CYCLE TIME ENVIRONMENT

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In today’s world of fast product introductions and short product lifecycles, it has become necessary to have extremely fast diagnosis of development failures and reliability hazards before the product is introduced into the field. Thus the role of the failure analyst has changed from that of a reactive one to that of a proactive one.

It is no longer sufficient to wait for failures to come back from the field in order to assess the reliability of a product. By that time it is too late. It is also impractical if not impossible to devise enough tests to anticipate all failure modes and accelerate those failures within a reasonable length of time. There are too many variables and too many unknowns in the equation to use this “shot gun” approach. This results in too many reliability tests which have zero failures and failure rates calculated by inserting a failure into an obviously irrelevant test.

In order to adequately assess the reliability of a component in today’s world, it is necessary to first closely inspect the component both physically and electrically. Then, using this data and additional data garnered from the field of product from the same technology family, realistic tests can be run that will stress the parts to failure and a correct failure rate can be derived.

It is the role of the proactive failure analyst to conduct this electrical testing and construction analysis with an eye towards the physics of failure of the components in order to detect failures before they occur and assist the designer in eliminating the cause before the parts ship. This results in yield enhancement at the manufacturing line and a more robust, higher reliability component in the field.

In a fast cycle time environment the failure analysis group must provide easily accessible data to developers and participate in concurrent engineering of the parts which will be designed for reliability and diagnosibility when failure does occur.

When failure does occur it is no longer sufficient, in fact it is impossible, for the failure analyst to play the role solely of the materials analyst. In order to perform a modern failure analysis on a complex integrated circuit, the failure analyst must have a strong background in diagnostic testing and have state-of-the-art tools with which to work. These tools in conjunction with a well designed part where diagnosability was taken into consideration, not just test coverage alone, make a fast-turn analysis possible. In fact, it is now possible to turn an analysis and corrective action in a time in which the corrective action will still be relevant.

Of course, not all failures can be completely analyzed. Therefore a method of triage must be established. But, unless a part is fully analyzed it usually can’t be determined if the failure mechanism poses a substantial reliability hazard. This is where prior history of failure mechanisms combined with the construction analysis data and a knowledge of device physics applied to results of diagnostic functional testing will allow the analyst to make a judgment call. Failures analyzed must result in corrective actions which prevent recurrence of high impact yield or reliability problems. In today’s short product lifetimes, the analyst cannot afford to work on unique or irrelevant problems.

As the analyst becomes the caretaker of diagnostic testing, he/she plays a more crucial role in chip “bringup”. Since the designer cannot rely solely on models and simulations to prove device functionality, the analyst provides the chance for experimentation to validate assumptions and the expertise to diagnose the problems when the theory fails.

Finally, the failure analyst can work together with manufacturing to eliminate defects and streamline processes resulting in yield enhancement and greater productivity by participating in a design for manufacturability before full scale production has begun.