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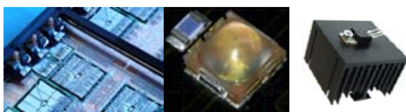
*System: MentorGraphics T3Ster®*

*Cumulative transient structure functions of thermal heat path through whole systems*


*IGBT, MOSFET, PowerLED, BJT, J-FET, Thyristor, Diodes, Multi-Die,…*

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# THERMAL TRANSIENT TESTING OF SEMICONDUCTOR POWER PACKAGES

Power semiconductors are an indispensable part of the application fields of energy generation and transportation. At this, the focus is on the future development of smaller, more reliable systems with changing requirements. The associated power density, the thermal management as well as the used materials become more and more important.

In the case of power modules, high currents have to be transported and the thermal management has to be handled in order to avoid damage to the components. The thermal transient analysis of semiconductors is a fast and effective method to detect first thermal bottlenecks. The capability of individual chips can be measured easily. But also the thermal performance of the entire system including the cooling device can be characterized. In the prototype phase, the fast assessment of the selected setup is particularly crucial to detect first failures to exploit the full potential for optimization in time. From a thermal point of view also the choice of the used materials is important to run reliable devices. The comparison between initial and used modules can indicate age-related defects.

There are many reasons concerning the emergence of defects in the devices. The increasing thermal strain of the device or the system is often in the foreground. In addition to the general breakdown of the silicon chip (chip breakage), the degradation of the chip connections from the selected substrate or Thermal Interface Material (TIM) are other failure reasons. The thermal transient measurement can help to determine these errors:

- Analysis of the total heat path of devices, parts and complete systems
- Characterization of chip inter-connections and their performance
- Optimization of heat sinks and their coupling (TIM-selection, material properties)
- Non-destructive and *in-situ* failure evaluation including act. power cycles
- Observation of the thermal behavior of the devices in case of application

The Fraunhofer IZM combines numerically secured approaches with a wide range of analyzing capabilities to develop the optimal adapted system for the required application. Also, different analysis techniques and ways of testing are performed in the house, so that numerical models can be calibrated and verified. These competencies and our knowledge in microelectronic technology, assembly and integration are the basis for valuable simulation models to achieve shorter development times and reliable products.

Web link: