

# **Multi-layer film Passivation Study for reliability performances enhancement of power semiconductor devices**

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Current automotive requirements are becoming more stringent in terms of devices operation under high-stress and harsh working conditions, such as high humidity and high temperature. In this context, passivation layers play a fundamental role in determining electrical and reliability performances.

This study focuses on primary and secondary passivation layers applied to state of the art power devices, and their influence on reliability. Power diodes assembled in standard module packages have been used as test vehicles and High Voltage, High Humidity, High Temperature Reverse Biased (THBHV-DC) tests were performed in order to stress the whole passivation structure.

A complete failure mode study was performed on a selection of several passivation materials, involving chemical-physical resistance analysis and reliability stress techniques, leading to the comprehension of phenomena behind layers degradation.

This analysis was followed by the optimization of the process, passivation material, and layers structure with the application of specific inorganic and organic layers combination. Our results reveal greatly improved lifetimes in THBHV-DC trials and show no more signs of physical and electrical degradation.

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