Overview:
0.35μm Test Chip Project

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Stress Migration

Stress migration remains of significant importance to semiconductor processing, and structures are designed for highly accelerated testing for this mechanism. However, there is questionable payback for the space and time allocated for such structures. This is primarily due to the related failure mechanism physics. Stress migration is heavily time dependent. Propagating tensile stresses due to thermal mismatch between oxides and conductors into voids can take weeks. However, if voids do occur and are present at the end-of-line testing where these WLR structures would be monitored, the test structure will highlight them.

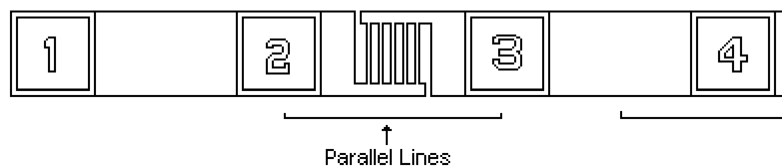

Figure 11 - Stress Migration Reference Structure

To detect the presence of voids, the test compares time-to-failure values from a reference and monitor structures for a given metal layer. The reference structure contains multiple identical segments in parallel to minimize the impact from a void that could be present within the reference area (Figure 12). This simple arrangement shunts current around a potential void laden reference segment. The monitor consists of identical size test segments arranged in series with alternating X and Y orientations (Figure 12). This prevents the structure from having wafer placement sensitivity due to any radial stresses.

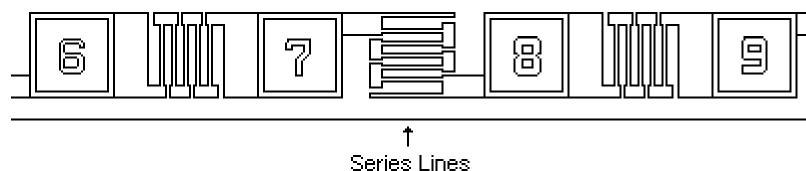

Figure 12 - Stress Migration Monitor Structure

Techniques utilizing a ramped breakdown method cause catastrophic failure and prevent effective analysis of the failure location. To address this undesirable result, a time-to-failure method can be more effective in detecting line voids. This approach also allows stress to be halted before full opening of the test line in order to preserve the void and allow failure analysis.

Chapter 6

Summary

The advantages of a well developed, mature WLR program have been touted through the years, but these benefits have not been easily replicated. The efforts of individual foundries to use these designed experiments to demonstrate structure effectiveness and statistical data will assist in verifying WLR's value as a process monitor. Thus, the FSA project proliferates the use of Reedholm WLR structures and test methods for semiconductor process that is significantly advancing WLR as a technology.

Chapter 7

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