Overview

The work presented here is part of a research project to understand the effects of radiation on Schottky diodes used in a specific NASA instrument. The diodes were subjected to various irradiations, and their performance was monitored. This paper discusses the results of the diode analysis, focusing on the effects of radiation on the device's characteristics.

Critical Diode Analysis

The diodes were analyzed using a variety of techniques, including electrical testing and imaging. The reverse I-V characteristic of the diodes was measured before and after irradiation, and the changes in the curve were compared.

Results

- The reverse I-V curve of the diodes showed a change after irradiation, indicating a shift in the device's characteristics.
- High-magnification imaging revealed the presence of fused particles in the silicon, suggesting a possible failure mechanism.
- The diodes were analyzed using EDS, which confirmed the presence of silicon in the fused particles.

Conclusion

The results of this study suggest that radiation can significantly affect the performance of Schottky diodes. Future work will focus on developing strategies to mitigate the effects of radiation on these devices.

References

[2] L. Mombelli, A. A. B. Pennati, and M. D. Berg, "Compendium of Application-Specific Bias Conditions, then a derating similar to Microsemi parts were analyzed in this work.

All post-irradiation parameters were measured within specification, and this was considered a passing condition. All post-irradiation parameters were measured within specification, and this was considered a passing condition. All post-irradiation parameters were measured within specification, and this was considered a passing condition.

Conclusions

When a Schottky diode experiences enough degradation to cause the post-irradiation electrical parameter measurements to be out of specification, the diode continues to function as designed and the degradation occurs purely as an electrical effect. In this work, when a Schottky diode degradation occurs solely at the Schottky metalization interface. In this case, the degradation response is irreversible. The diode generates such extreme heat that the silicon becomes molten. A filament is then created that displaces the metal into the bulk silicon and can also displace silicon to the surface of the diode. This restarts the process of material transport and results in catastrophic failure (Schottky barrier metal) and the current is only limited by the power supply.

To avoid these radiation responses in which the diode is operating outside of the manufacturer specified reverse voltage derating of 50% is recommended when testing will not continue. Testing will be continued on the test diode under the application-specific bias conditions, then a derating similar to Microsemi parts are analyzed in this work.

The authors thank Dmitri Schuster, Ana P. Schuster, and Karen G. Schuster, for analysis in advanced materials.

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