Case Study

Design in of a Selected MELF PIN Diode for a Castle Microwave Tier 1 Customer

Including detailing of assistance during the design phase of the project and support during production phase

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INTRODUCTION

This case study deals with the assistance given to a Tier 1 customer in selecting a suitable diode for their project. This includes the design phase, prototyping, qualification and details of the support given during the production phase of the project.

The customer had an existing product, a collision avoidance radar, in production and was embarking on a major review of the project with a view to reducing cost. Procurement had done all they could to reduce the material cost in the unit while Engineering were reviewing ways to reduce the time taken to build and test the unit. Procurement of the customer had approached their incumbent diode supplier but had not been offered any alternative diode suitable for the project which was a lower cost. Engineering approached the incumbent diode supplier with a draft procurement specification in order to select the diodes used to try to reduce alignment/test time on the unit. However the incumbent was not prepared to select diodes for the customer.

DESIGN PHASE

On a previous customer visit Castle Microwave had been made aware that there was a requirement for a selected diode. The draft procurement specification was appraised and the Metelics factory on the East Coast of the USA had available the closest standard part, the MMP7089-127-1 MELF PIN Diode and sample diodes were swiftly supplied to the customer for evaluation. A meeting was arranged between the Technical personnel from Metelics USA (East Coast) and the customer to discuss the results found by the customer. From the ensuing discussion of the results taken by the customer the value of for the diode was crucial to the yield of the unit seen by the customer. However the initial specification from the customer had been only for a C_T (max) and not a C_T (min) for the diodes. The Technical personnel from Metelics USA (East Coast) confirmed that C_T was measured for each device and these could be allocated specific capacitance Bins for this parameter at a minimal additional charge if the capacitance bins were not too small and would give unacceptably low yields from wafers. There ensued some significant discussion both at the meeting and during subsequent e-mails on the spread offered in the capacitance bins for C_T and various samples and quotes were supplied. It was explained to the customer that the factory could adjust the wafer properties to give the required C_T and the factory reviewed its results on the distribution of capacitance seen in production. Initially data was not stored (there was initially a “Go” / “No Go” test for the C_T required) but for the next wafer the factory amended their testing.

PROTOTYPE PHASE

Once the capacitance bins had been agreed enough didoes were purchased by the customer for the prototype build. At this stage the screening requirement was agreed with factory and where possible read across data was used. Extensive testing was done on the prototype units and at the completion of the tests a final adjustment was made to the CT required. This included setting the nominal CT to be 0.43pF with the following tolerances, +/- 0.02pF, +/- 0.025pF, +/- 0.03pF
The exact requirement was decided and the procurement spec was then re-issued and the part was assigned a specific part number, MX51959-127-1-R, to differentiate the diode from other Metelics parts.

PRODUCTION PHASE

After the success of the prototype phase the unit went into production. Due to the sophisticated design of the unit 35off diodes were used in each assemble and any deviation of any one of the 35 diodes could lead to the unit failing test. Yields were initially very good but after the unit had been in production for a few years and more and more different wafers were being used to supply the diodes the customer started to experience some poor yields. After extensive analysis of the causes of the failures various improvements were made to the build and testing of the units. However as the unit was improved eventually some failures over temperature were found to be caused by excessive variation of the diodes with temperature. To overcome this additional temperature screening was added to the diode specification. This did again add to the raw material cost of the unit but again test/alignment costs have been reduced.

CONCLUSION

The implementation of the selected MELF PIN diode has significantly reduced the test/alignment time required for the overall unit. Even though the price of the selected diode is an increase on the original incumbent diode this increased material cost is negligible when compared to the labour cost saved by the customer. Close support with the customer throughout the project has ensured that any technical issues are resolved in a timely manner.