WHITE PAPER

Customizing Processes for Hermetic Assembly Of Devices Designed for Plastic Packages (3 of 3)

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Abstract

Today's leading-edge semiconductor devices are designed and manufactured for high volume, low cost industrial and consumer based products. The design and layout of these new integrated circuits (ICs) favor plastic molded assembly with an eye toward reduced cost, not dependability. This leaves the high reliability, low volume military and aerospace applications with fewer hermetic package choices directly from the Original Component Manufacturer (OCM). The challenge exists to bridge the reliability requirements of military and aerospace communities with leading edge ICs designed for the mass market.

Package Seal Issues

Today's integrated circuit (IC) devices designed for plastic assembly may come with a die coat. The die coatings are added during the wafer fabrication process. This coating is typically used for additional protection of the circuitry from mechanical stresses caused by the plastic encapsulation process. Analog devices are particularly sensitive to these mechanical stresses which can alter the characteristics of the device.

The various die coat materials can be temperature sensitive and will peel off or blister at higher temperatures; typically greater than 300°C.

Hermetic packages have several methods of sealing which are all dependent on the package construction. Ceramic packages such as side brazed DIP (dual inline package) typically will use solder seal which has a eutectic liquidus state at about 280°C. CQFP (ceramic quad flat pack) may use a glass seal process with temperatures exceeding 400°C.

Since this die coat damage only occurs at the higher temperatures of the sealing process, it doesn't exist at the standard pre-cap inspection (MIL-STD-883 Test Method 2010 Internal Visual). This peeling or blistering of the die coat (as shown below in Figure 9) happens during sealing and will be rejectable per MIL-STD-883 Test Method 2013 Internal Visual For DPA (Destructive Physical Analysis).

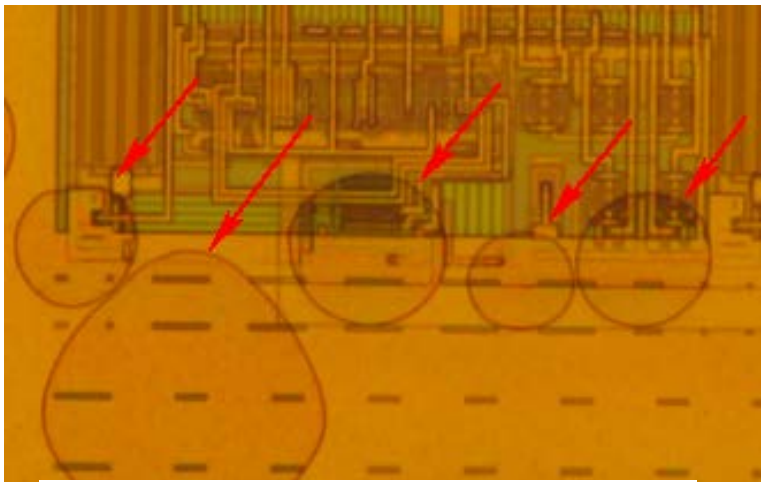
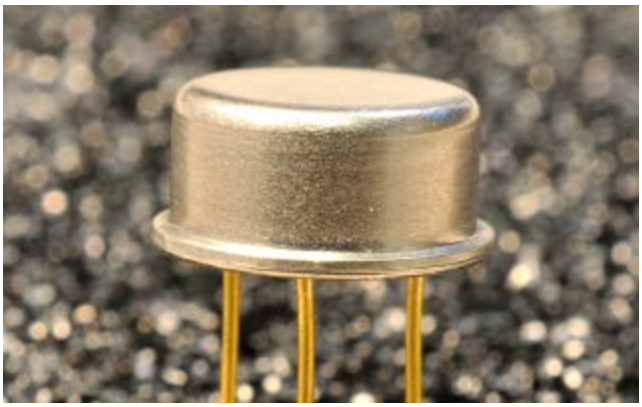


Figure 9: Die coat blistering cause by nominal sealing temperatures

One solution to the blister problem is the use of a weld seal process. This is the typical process used for sealing TO (transistor outline) header metal cans. During the process, the high welding temperatures are isolated to the seam area. For higher pin count devices, another seal process must be used. This process is called seam seal.



The seam seal process is normally used to create a seal between a metal lid and a metal package body. However, it can also be used to reflow a gold-tin preform between the metal lid and the ceramic package Kovar seal ring. This process also generates heat but it is localized and will not affect the die coat.

Figure 10: Standard Seam Sealing.

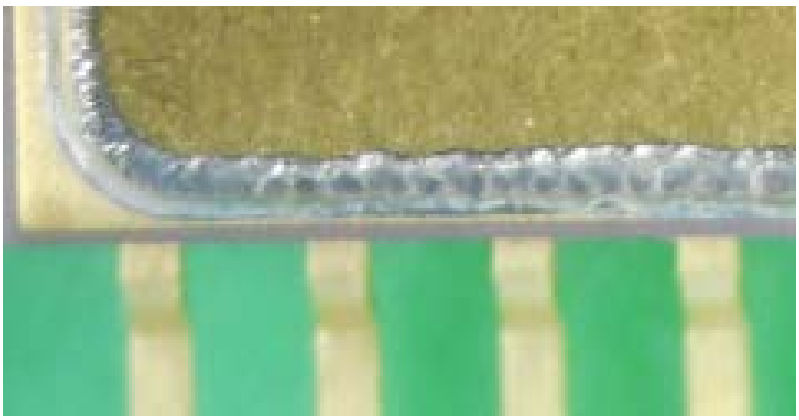


Figure 11: Seam Sealing using a solder preform.

Conclusion

The semiconductor market will continue to be driven by the commercial and industrial markets where die design considerations favor lower cost over long term reliability.

However, this doesn't mean the military and aerospace designs won't be able to benefit from the semiconductor processing breakthroughs happening today.

In this series, we covered ways Golden Altos uses to make this possible:

- Innovative wafer saw techniques for PCM removal
- Advanced packaging and wire bonding approaches
- Inventive sealing methods required when using coated die

Each device adaptation may have its own unique issues. Other assembly processes can be modified, as needed, to meet these challenges. Knowledgeable production operators working with experienced technical staff make these conversions a reality.

As a contract manufacturer, Golden Altos works with a wide range of wafers, dice, packaging configurations, and customer requirements. Each combination offers its own set of challenges. Our expertise in various wafer saw procedures, die attach techniques, wire bonding methods and package sealing approaches gives us the ability to deliver reliable, compliant product to our customers.