PARSA WIRELESS COMMUNICATIONS

EXPERTS & INNOVATORS IN COMMUNICATIONS TECHNOLOGIES

Reverse Engineering Project: Memory Chip

Challenge Posed by the Project & Expectations of the Customer

The challenges included identifying structures and materials through a series of primarily destructive processes, ensuring that data is gathered before sections are removed and that the processes do not change the structure of the memory chip. Additionally, we were tasked with understanding the manufacturing process, which often includes intermediate materials not present in the final product, as well as changes to shape or material compositions due to heat, pressure, or other manufacturing processes.

How Did the Consultant Approach the Challenge?

We devised a test plan to ensure that information is gathered and documented in a logical order, followed by prudent and organized destructive tests.

The first step was to conduct non-destructive tests, such as visual inspections, x-ray analysis, and electrical tests.

We then conducted destructive tests that would offer greater insight into the internal structures. These included:

- Cross sections to evaluate the interconnect structures (flip chip or wire bonds, vias), metal and insulation layers, die thickness, bonding materials, substrates, etc. Further analysis was done to identify elemental materials used.
- Removing plastic material in the package (de-cap) to reveal die surface and or wire bonds. Electrical tests or cross sections were done on selected features. Other tests were executed to identify materials used and to perform surface analysis.
- Layer by layer strip backs to reveal structures on a substrate, such as interconnected patterns or features, buried capacitors or other components.

We examined solder reflow shapes, epoxy distributions, layer overlaps, surface finishes, and material profiles to determine the manufacturing processes used to produce the memory chip.

What Equipment was used?

The equipment used included scanning electron and optical microscopes, energy-dispersive x-ray spectroscopy for element analysis, focus ion beam analysis for micro-cross sections, auger spectroscopy for surface analysis, x-ray, saws and polishing machines for cross-sectioning, chemical systems for de-encapsulating or layer-by-layer etch back.

Results and Deliverables

We provided the customer with high-resolution pictures of the important aspects of the chip, a list of materials used for interconnects and other structures, dimensions of critical features such as die thickness, interconnect size and type(s), and line-to-line spacing. We also identified, from our observations, that the device was most likely manufactured in:

- A thermo compression process because of the nature of the solder interconnect shape.
- A panel rather than a singulated form because of the edge profile that we observed.

Additionally, we provided a list of possible suppliers for key materials and assembly services.

1-203-504-2544 | www.parsawireless.com | Greenwich, CT U.S.A.