3D Glass Solutions System-on-a-Chip Case Study

How a leading electronics provider used 3D Glass Solutions' APEX® Glass to dramatically shrink a popular RF communications chip while improving overall device performance.

Client's Challenge

As a key component of their growth strategy to build devices to support the Internet of Things (IoT) market, a leading electronics Company was seeking a manufacturing technique that could lead to decreased form-factors and decreased power consumption for a popular RF communication chip. The Company had historically used printed circuit board (PCB) versions of this particular RF communications device; however, the smallest PCB was still too large and consumed too much power for the intended application (Figure 1).

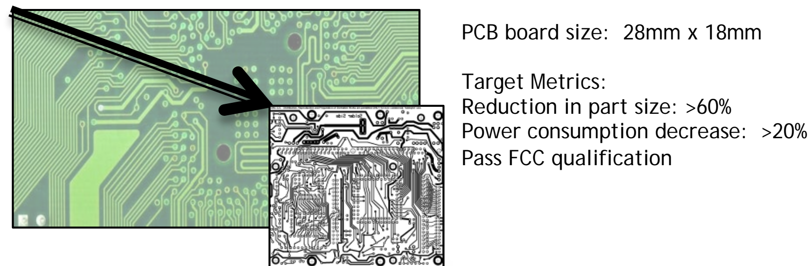

Figure 1. Client's objective was to reduce a popular RF module size by 60%

Given the strategic importance of this RF communication module for a number of IoT product lines, the Company asked 3D Glass Solutions, Inc. (3DGS) to help it address three objectives. Specifically, the Company wanted:

1. to translate a PCB layout into a glass System-on-Chip architecture,
2. substantially reduce part size, and
3. demonstrate a high volume manufacturing solution capable of scaling to millions of parts per year at affordable prices

3D Glass Solution

3DGS supported the Company by providing a well-coordinated teaming approach in support of the project. 3DGS provided technical, engineering, production, and CAD team members in support of the initial product translation.

3DGS assessed the project from many directions including a thorough Design for Manufacturing (DFM) assessment, a determination of unknowns, and manufacturing process flow layout.

Additionally, physical and electrical quality control metrics were defined and an initial quality plan was agreed to between 3DGS and the Company.

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Finally, areas of risk were identified and engineering splits were defined to mitigate these risks in prototyping.

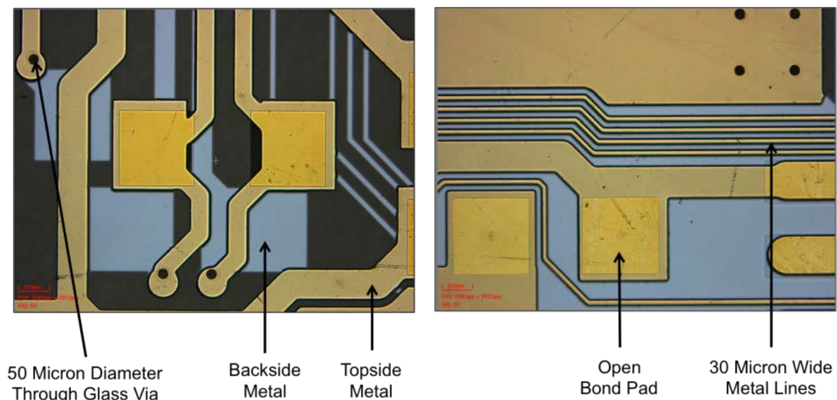

Figure 2.Select magnified images of the glass interposer RF module.

The Outcome

Over the course of this engagement, 3DGS worked closely with the Company and provided consistent communications related to prototyping progress, quality assessment, and schedule.

Prototype production commenced and several weeks later the double-sided glass interposer package was shipped to the customer. Each interposer die consisted of a 300 µm thick glass substrate with 96 copper filled through glass vias (TGV) for I/Os, 30 µm redistribution line width and spacing for tight electrical routing, and a solder mask for pick-and-place assembly.

In the end, 3DGS met all quality metrics associated with physical and electrical specifications for the designed product.

Final metrics included:

- 62% reduction in product size compared to the PCB analogue
- 28% reduction in total power consumption, and
- Product qualification through the Federal Communications Commission (FCC)

Next Steps

Next steps underway include a revised version with a targeted total reduction in size of >70%. This design revision will include several integrated passive devices built into the glass interposer, minimizing the device build of materials and reducing assembly costs.