Fan-Out Interposers Convert MicroBGAs to Standard Pitch

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Introduction

Handheld devices have a continuous hunger for smaller, more integrated semiconductor devices. To secure design wins, new ICs including memory chips, microcontrollers and DSPs are commonly launched in microBGA packages with ball-to-ball pitch as small as 0.4 mm. These fine pitch packages are well suited for assembly to the small, thin, fine line and space PCBs used in handheld devices.

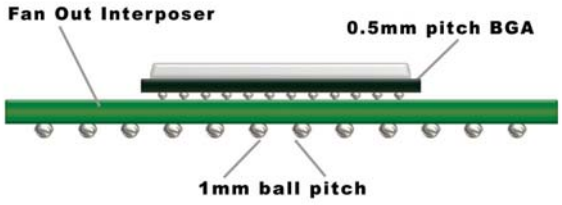
The same ICs that target the handheld market are often the best price/performance solution for larger systems and devices. However, adding microBGAs to larger boards can significantly increase the complexity and cost of PCBs, as microvias, blind/buried vias, and/or fine lines and spaces are often required to route the fine pitch packages. PCB prices are driven by technology and square inches, and on larger boards, higher density designs can increase PCB cost by tens or hundreds of dollars.

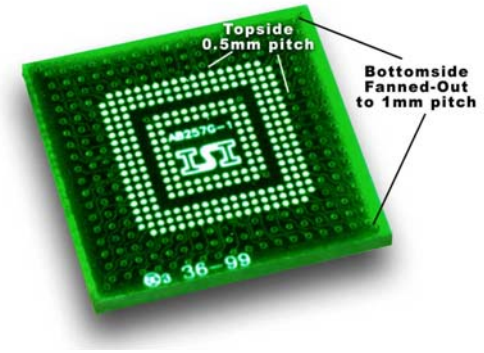
To avoid increased PCB density and cost, many OEMs try to avoid using BGAs under 1mm pitch.

A Different Approach

Interconnect Systems has worked with several OEMs to develop 'fan-out interposers' as a solution to this dilemma. A fan-out interposer converts a microBGA package to a larger pitch that is suitable for larger, thicker PCBs. For example, a 0.5mm pitch device can be converted to a 1mm pitch ball array. This allows the use of the latest, most cost effective ICs without increasing the cost of the system PCB.

A fan-out interposer utilizes a small PCB/substrate that is designed to route microBGA(s) land pattern to a larger pitch. Solder balls are added to the bottom side, and the microBGA is soldered to the topside. System designers then design their main board with the larger-pitch land pattern matching the bottom of the interposer.





Evaluating Interposer Cost Savings

During PCB layout, if there is a fine pitch BGA that is driving your design to additional layers, finer line & space, and/or microvias, a cost analysis should performed to determine if a 'standard' PCB with an interposer is more cost effective than a higher technology PCB without an interposer.

Additional cost savings occur if underfilling the microBGA is required. The underfill process is much more efficient at the interposer assembly level rather than on a manufacturing line configured for traditional PCB assembly.

By implementing the interposer approach, the high-density substrate is typically only 1 to 4 square inches, meaning dozens or hundreds of interposers can be fabricated on one panel.

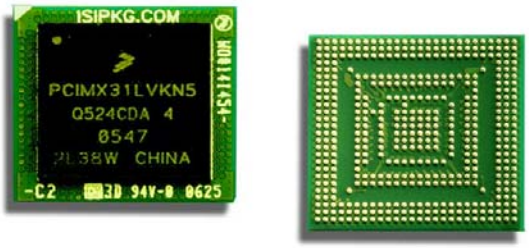
By keeping your board (with many square inches) as simple as possible, you maintain a broad supply base of PCB manufacturers and competitive pricing.

Design / Manufacturing / Reliability Considerations

Decoupling. To achieve the lowest inductance path, it may be necessary to add decoupling capacitors on the topside of the interposer around the perimeter of the fine pitch BGA. This can be done at very low incremental cost because the capacitors can be assembled in the same SMT process as the BGA.

SMT Compatibility. It is important to ensuring the interposer is compatible with standard, automated SMT processes. The interposers should be packed in JEDEC trays or tape and reel packaging. The solder balls on the interposer must meet the co-planarity and true position specifications of standard BGA packages, allowing the assembly line to treat it exactly like a standard large pitch

Underfill. MicroBGAs have much less solder volume at each ball than standard pitch BGAs, which can be a reliability concern in applications with mechanical shock, vibration and temperature cycling. Many IC manufactures recommend underfilling microBGAs to increase the solder joint reliability. Underfilling a microBGA on a large motherboard requires specialized equipment, and adds several manufacturing steps that can create process bottlenecks and increase manufacturing costs. Underfill can be efficiently applied during the interposer manufacturing process, another advantage of this design approach.



Conclusion

If fine-pitch BGAs are driving up your PCB complexity and cost, a fan-out interposer may provide a simple, cost effective solution.

Fan-out interposers have been successfully implemented in commercial, industrial and Mil/Aero applications.

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