VALTRONICLES
Insights into
Microelectronic Asssembly | Miniaturization | Mechatronics

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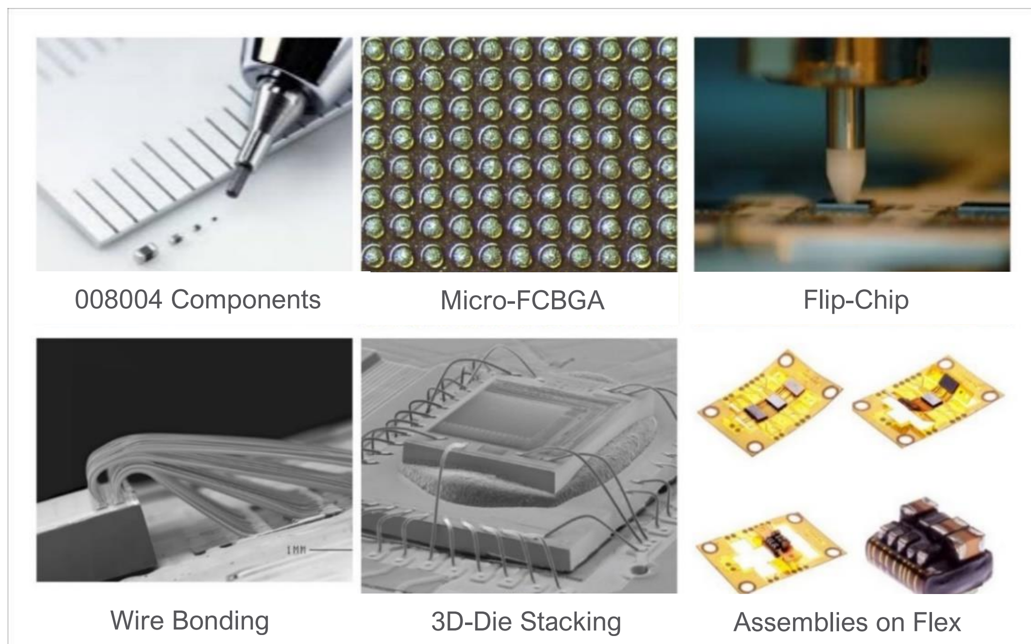
Miniaturization

The challenging trend for always smaller, lighter, faster and denser electronic devices

The race for always smaller, handheld, wearable or portable electronic devices has been driving various markets over the past few decades. Aerospace, media, consumer electronics and the stringent medical industry are looking for solutions allowing for innovative, faster, smarter and more efficient devices with shrinking form factors. Size reduction tending to miniaturization has many obvious advantages. Thinner, smaller, lighter, offering more functionalities and connecting us to a myriad of data and information clouds through IOT (Internet of Things) are the requirements influencing the consumer market. Mobile phones, tablets and PCs are the first devices that come to mind. Miniaturization has been particularly important in many of the technological advances that have occurred. In the medical industry too, miniaturization is paving the way for innovative devices, instruments and active implants.



008004 Components | Micro-FCBGA | Flip-Chip
Wire Bonding | 3D-Die Stacking | Assemblies on Flex

Advantages and Challenges of Miniaturization

Miniaturization has inherent advantages such as greater density and thus shorter signal paths. Smaller electronics therefore enable higher frequencies and clock rates. However, scaling-down devices is neither easy nor straightforward. Packing more functionality into smaller devices brings many challenges in terms of design, development and volume manufacturing. From the accurate

placement of the tiniest SMT components to the necessity of designing customized hybrid and high-density components, the challenge consists in innovating while keeping test and manufacturability in mind.

Placement of smallest passive components

Electronic components are getting smaller and smaller. The smallest being the 008004 (0.25 x 0.125 mm). The size in itself represents the major challenge for rework and handling. Not all SMT equipment allows for automatic placement. Innovative customized processes are needed to allow for high-speed placement with highest accuracy. Valtronic has developed a process for the placement of these 008004 components and will dedicate a future issue of the Valtronicles to this specific case study.

Ultra-fine pitches

Miniaturization goes along with audacious pitch reduction. Whatever the technologies used to achieve vertical interconnect in electronic packaging and integration, decreasing the pitch size is key. The risk of bridging is increasing accordingly. From wire bonding to micro-BGA, pitch reduction requires customized assembly processes and top-notch assembly lines allowing for high-accuracy placement of the connections. Experience and expertise with the different assembly techniques is also a huge differentiator, for instance when it comes to the solder paste stencil design, and the choice and adaptation of the right underfill, reflow and encapsulation process.

Customized 3D-Packaging

3D system integration relies on multiple die stacking solutions to enhance chip performance with high board footprint optimization. Dies can be connected to each other and then to the board through diverse bonding technologies. Micro BGA, Flip-Chip, wire bonding, and Chip on Flex are key for 3D packaging. Experience and expertise with each of these technologies allows to mix them for further highly reliable packaging customization.

Design for Manufacturing

Different technologies can be used to push the limits of miniaturization. During the design phase, the choice and mix of assembly techniques have to meet the required functionalities, address specific technical challenges and focus on manufacturability. Design for manufacturing must drive projects of audacious customized components and packages. Stable and volume capable assembly processes are key to manufacture such products with reasonable cost and highest quality and reliability.

Keep tuned for a closer look at miniaturization techniques

Miniaturization entails a wealth of possibilities for progress in many fields, especially in the medical device industry. Innovative assembly techniques, tools, processes and expertise are needed to tackle the challenges and push the limits of miniaturization. In future articles, we will tackle the different assembly technologies and provide recommendations and tips based on our 35+ years of experience as an electronic contract manufacturer.

Watch out for the next Valtronicles dedicated to BGA and Micro-BGA.
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The Valtronicles are Valtronic articles that provide insights into microelectronic assembly, miniaturization, mechatronics and box builds. Our articles are based on our 35+ years of experience as a full-service contract manufacturer. Through tangible case studies, we will focus on specific assembly challenges and provide some tips and recommendations on how to overcome them.