

Everything You Need to Know about BGA and CSP Sockets

BGA / CSP Socket Primer

Aries is proud to lead the industry with one of the most complete lines of sockets for BGA/CSP for Production, Test, and Burn-in applications to fit package size pitches from 0.5mm through 1.27mm. These sockets feature a variety of styles and sizes to meet your application's needs. The following is a thorough primer on the descriptions of the applications for these sockets.

GENERAL INFORMATION

Packaging IC's with BGA/CSP (Ball Grid Array/Chip Scale Package), solder ball terminations has become increasingly popular. In most applications, these devices are directly soldered down to pads on the target board. However, as with all the previous termination options (DIP, PGA, PLCC, etc.), there are always situations where it is desirable to put the package in a socket as opposed to permanently soldering it.

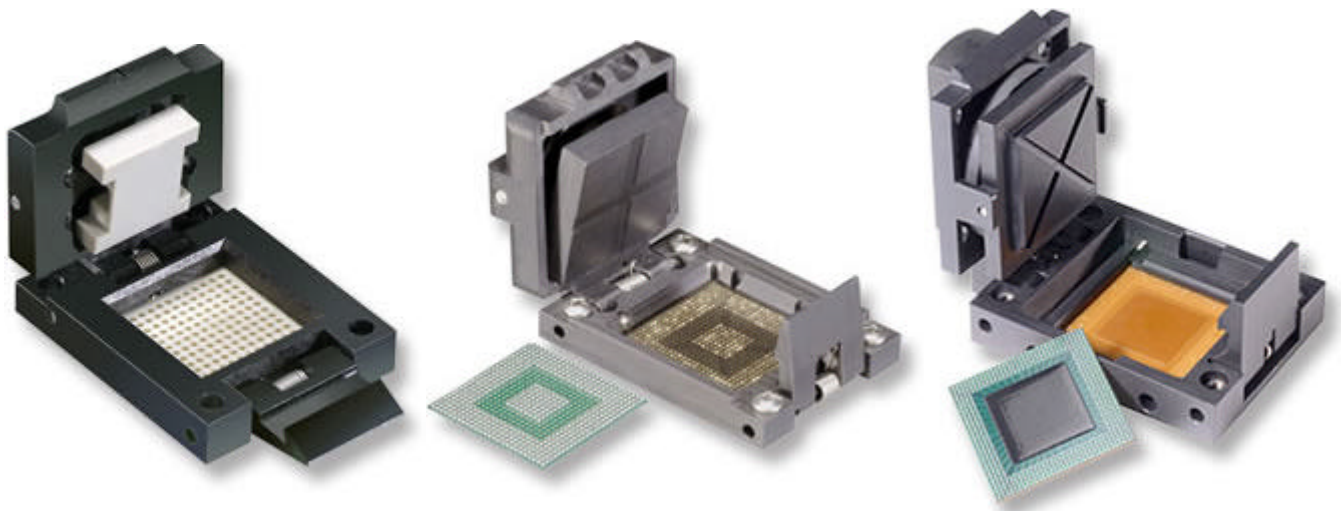
Developing a socket for these packages is no easy task, primarily because the solder balls (when used) of the devices are usually made out of "soft" material that can deform over time, especially if the application experiences any kind of temperature cycling. Most BGA solder balls are made out of 63/37 material (63% Sn, 37% Pb), which is very soft. Even when 90/10 (90% Pb, 10% Sn) material is used, the ball shape can deform enough to cause intermittencies with most socket designs.

With these considerations in mind, Aries Electronics manufactures a complete range of sockets to meet the ever-changing industry demands for interconnections of these types. Let's begin our discussion with our Test Sockets for BGA devices on 1.27mm and 1.00mm pitch—our BallNest™ sockets.

BGA/CSP SOCKETS

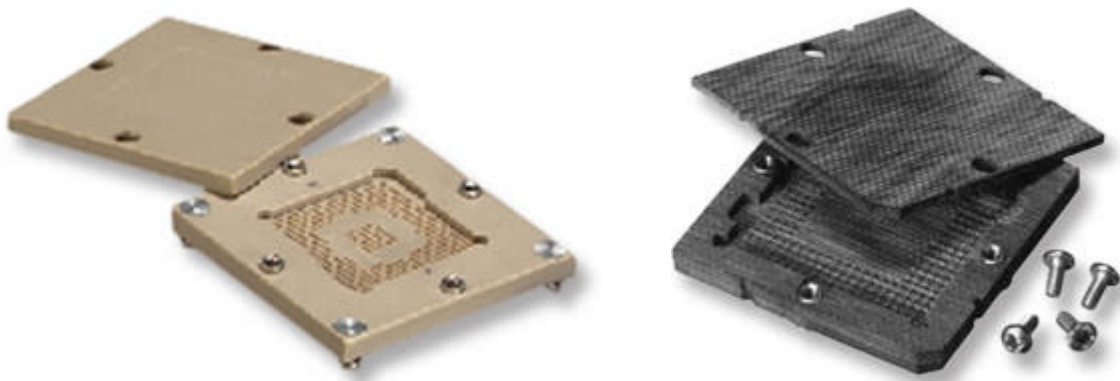
- **Aries patented CSP Sockets for Test and Burn-In applications up to 1GHz**

The CSP sockets for Burn-in applications are fitted with a special Aries Spring-Probe™ designed for over 200,000 cycles for Test and Burn-in.



These sockets are designed for use by virtually any CSP type packages from 1mm down to 0.5mm lead spacing (including, but not limited to, BGA, QFP, TSSOP, MLF, and QFN types of packages). The socket bodies are molded from high-temperature engineering plastics which allow for quick delivery and very competitive pricing and are available in 3 sizes: the first for ICs up to 13x13mm ([Data Sheet 23017](#)); for sizes up to 27x27mm ([Data Sheet 23018](#)); and for sizes up to 55x55mm ([Data Sheet 23020](#)) – all available now and an intermediate size for devices up to 40x40mm which is coming soon.

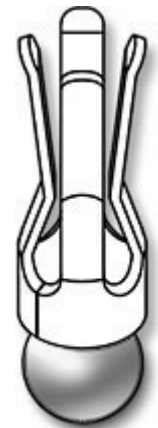
• Aries CSP/BallNest™ Hybrid Sockets



The CSP/BallNest™ Hybrid Socket (see [Data Sheet 23016](#)) is unique in our industry. This is a surface-mount socket designed to connect BGA or CSP devices on pitches of 1.00mm down to 0.5mm for Test, Burn-in, and prototype applications. The design utilizes a unique integral pressure pad which applies downward “Z-axis” force onto a spring-probe contact designed to “cup” the solder ball. This spring is secured within a custom interposer which allows for continuous contact force on the SMT PCB pads even when no chip is engaged!

These sockets are designed to maintain contact forces of 10-15g throughout the entire Test and Burn-in cycle. They incorporate machined high-temperature engineering plastic and Au-plated Spring Probe™ contacts.

The BallNest™ pin design provides a four-fingered “nest” for each ball termination of the device to be socketed. The device balls “nest” into these contacts like eggs in an egg carton (even if the eggs are slightly different shapes, they all nest into the receptacles of the carton). These sockets are currently available for BGA package pitches of 1.27mm. For pitches below 1.27mm, refer to CSP/BallNest Hybrid Sockets.



The BallNest™ contact design has been resistance tested through more than 1000 cycles with no significant reduction in performance. Each socket requires a cover, which must be designed specifically to accommodate the device being socketed, the cover screws into receptacles in the socket base. These receptacles for the cover screws are called “blind inserts.” This socket takes up a little more space on the target PCB, because there must be room in the perimeter of the base for the four blind inserts. Also, you must solder or bolt down the bottoms of the four blind inserts. This insures that the socket will not lift up off the board when you screw the cover into the base. The socket itself is terminated in 90/10 Sn/Pb BGA solder balls, which solders down onto the target PCB on the same footprint as the device being socketed.

This soldering process can also be used to mount a BallNest™ socket to an adapter board that is terminated with male thru-hole pins on the bottom, creating, in effect, a thru-hole solder tail socket for BGA devices.

Benefits of the BallNest™ pin include contact resistance of below 20 milliohms and extremely low readings for both inductance (less than 1nH) and capacitance (less than 1pF). The socket cover can be designed to incorporate heat sinks, yielding a socketing system with the utmost of flexibility.

• BGA Sockets and Adapters

Aries BGA Sockets and Adapters currently are available for any device on 1.00mm to 1.27mm pitch.

No socket company has yet been successful in designing a production socket for BGA devices where the devices are terminated in “standard” 63/37 BGA solder balls. Even if the BGA device is terminated in harder 90/10 material, it is proving impossible to design a female socket pin that works without problems. The best design currently on the market is the Aries Socket and Adapter system but even this design cannot overcome mating problems such as device ball deformity over temperature cycling.