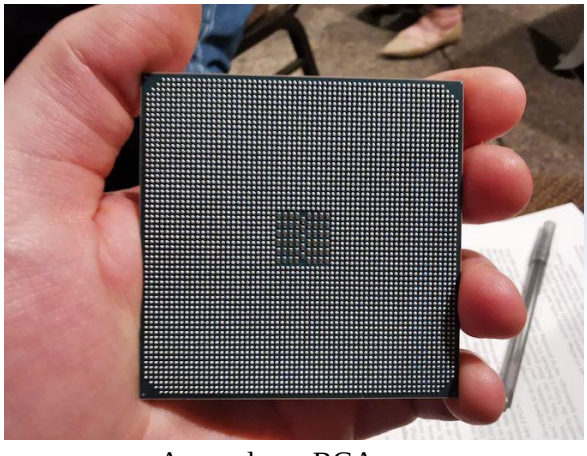
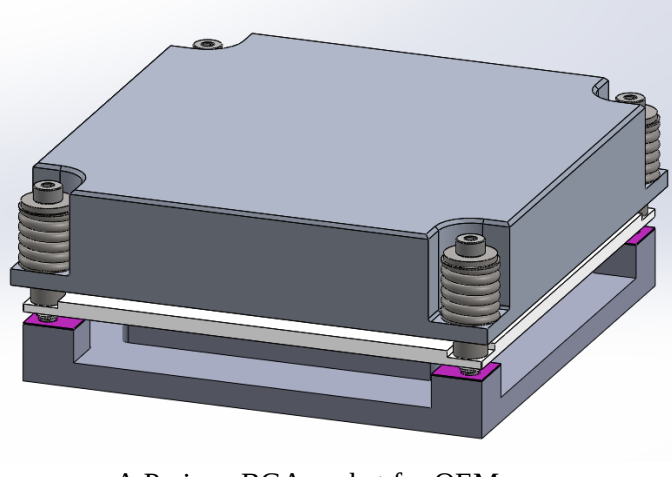
XILINX and other XAMPLES

Very large BGAs pose some real challenges for test and OEM sockets. Thousands of reliable contacts need to be made. Thermal management is always a concern. And the costs can be higher than desired.



A very large BGA

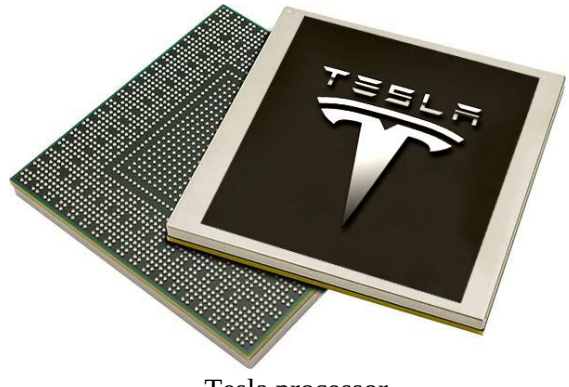


A Paricon BGA socket for OEMs

Xilinx and others

One of the best known IC suppliers using very large BGAs is Xilinx. Their packages can have 2,000+ solder balls on a 1mm pitch. Their devices, called FPGAs (field programmable gate arrays) and SoCs (systems on a chip), join other IC manufacturers who offer large MPUs or AI processors.

Xilinx FPGA



Tesla processor

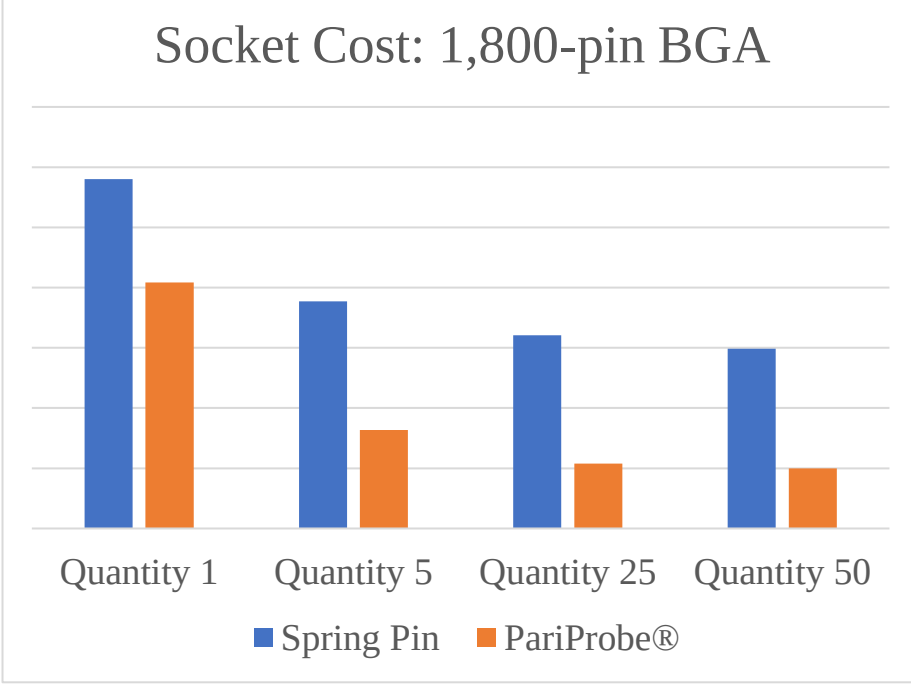
Why is a socket needed ?

IC packages like this are good candidates for a socket because:

The devices are expensive	A socket allows for the orderly assembly of functional products, without committing the expensive IC into the finished goods inventory until needed for shipments.
The devices are programmable	Devices can be programmed on separate and specialized equipment, and then mounted onto the functional PCBs when ready. Or, the devices can be removed from the PCB for programming updates as needed.

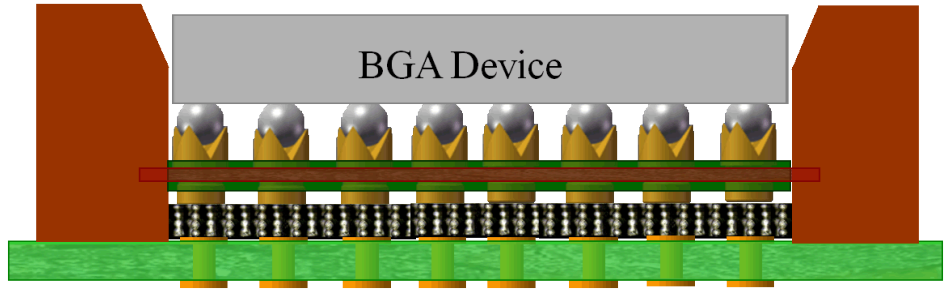
Why is a Paricon socket a good choice for a large BGA ?

Large-BGA elastomer membrane sockets are much less costly than large-BGA sockets made with conventional contact mechanisms.

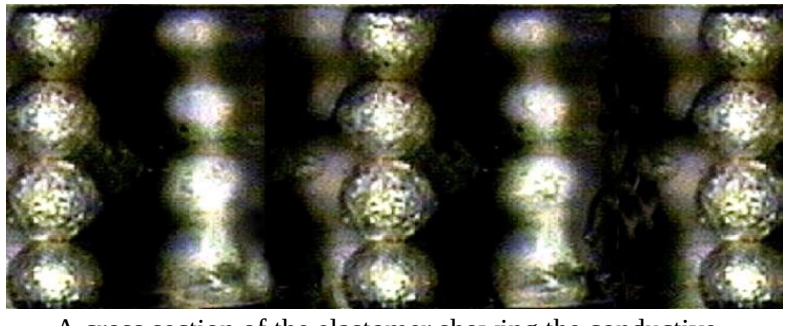


The PariProbe® 4-point metal contact engages each ball securely and is tolerant of variations in the solder ball positions. Each metal contact that engages a solder ball has a degree of independent motion that does not hinder the low CRES elastomer contact mechanism.

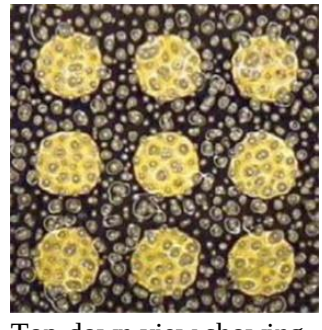
4-point crown metal contact



A cross section of a PariPoser socket showing the position of the elastomer, the PCB pads, the solder balls, and the floating metal contacts

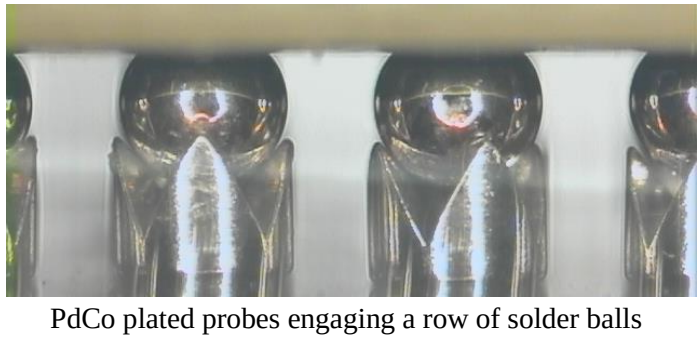


A cross section of the elastomer showing the conductive particle columns dispersed throughout the entire sheet

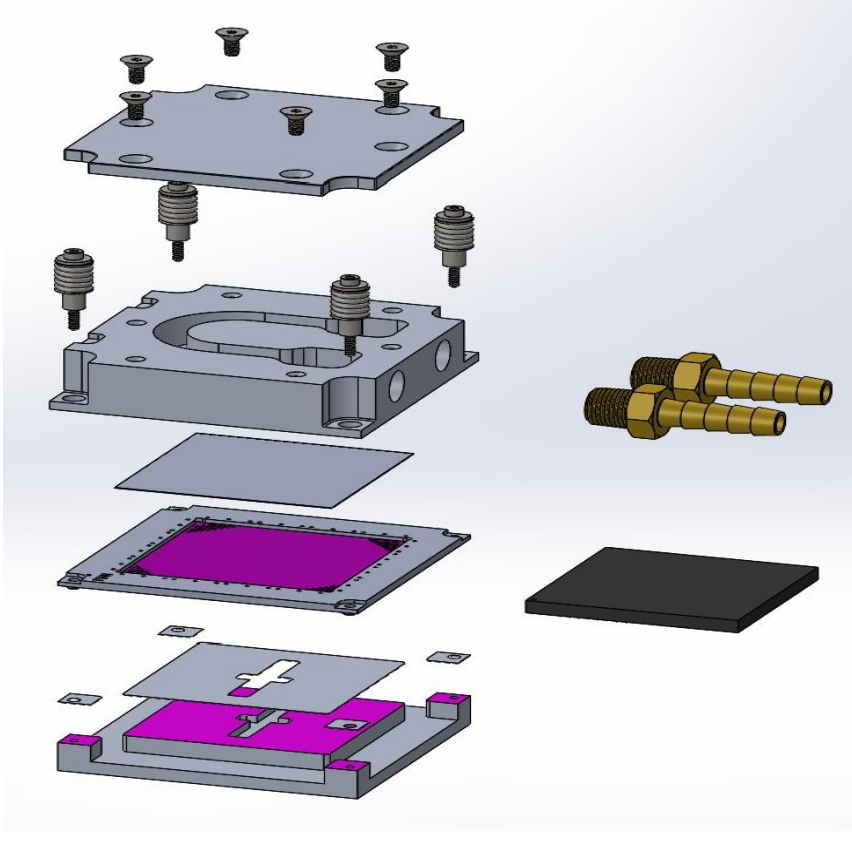


Top-down view showing redundant columns per pad

PariProbe® BeCu precision-machined contacts can be shaped to match the sizes and materials used in the solder balls. Typically, the PariProbe® contacts are then plated with PdCo to minimize solder contamination problems.



PdCo plated probes engaging a row of solder balls



Paricon BGA sockets can be customized. Shown below is a BGA socket with an integral water cooling head.

What kind of performance should I expect ?

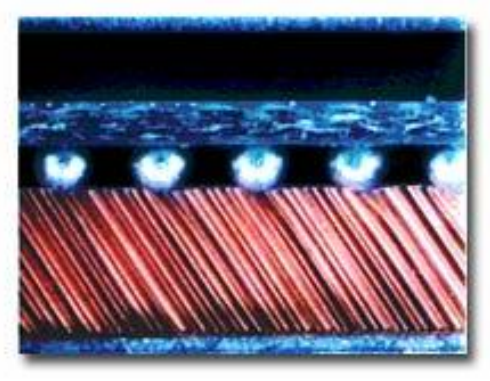
Contact pitch	1 mm
Length of PariProbe®	1mm
Diameter of PariProbe®	0.6mm
Thickness of elastomer	0.25mm
Travel/probe when engaged	0.08 mm - 0.1mm
Normal Force	30-40 grams per contact position
DC resistance	< 30 mΩ
Self inductance	0.3 nH
Current Rating	> 5 A per contact

Bandwidth @ -1dB	40 GHz
Temp. Rating	-50 °C to 150 °C
Durability	500K+ cycles

What's different about a Paricon elastomeric BGA socket ?

Paricon elastomeric BGA sockets use an elastomer with uniformly distributed conductive columns and floating metal contacts held in position with a Kapton carrier. The elastomer metal content is low (10%).

Some elastomer sockets have enameled wires encased in a silicone sheet. The bare-metal ends of the wires make the contact to the PCB pads and the solder balls.

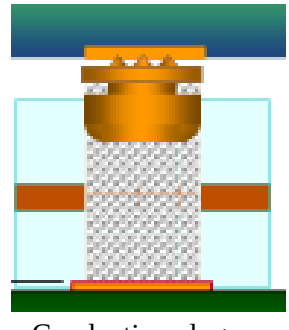


Wires encased in a silicone sheet

Some elastomer sockets use high-metal-content plugs that are positioned at the locations of the solder balls, and then held in that position by a carrier membrane or overmolded with silicone.

High metal content conductive plugs overmolded with silicone

Conductive plugs inserted in a carrier



Conductive plugs with a metal tip

What's the same about all elastomeric BGA sockets ?

All elastomer contacts compress about the same (< 30% of the contact length) at the contact locations.

All silicone sheets or plugs have to allow for a "squeeze relief" zone. The silicone doesn't really compress – it just changes shape.

Silicone has a high TCE, so lateral and vertical expansion needs to be taken into consideration.

Each contact needs a normal force of 30-40 grams. When there are a lot of contacts, the overall force per socket gets quite high. Usually, a stiffener plate under the PCB is needed.

What do I need to consider to get started ?

The IC manufacturer's data sheet ?

Are there any special considerations ?

What's the size and shape of the PCB contact pads ?

Is there solder mask on the DUT board ?