



## **PariPoser® Connector Products Application Guidelines**

(8/01/13)

### **Introduction**

When using copper based contacts, it is well understood that the design of the contact must follow design rules which match the application to the physical capability (and limitations) of the copper alloy. When these design rules are not followed, the resulting product will most likely not meet its intended use.

Elastomeric connectors, like copper contacts, must be constructed utilizing design rules based on an understanding of the mechanics of elastomers. Paricon has combined the efforts of more than 10 years of focused research at a cost of over \$30 million dollars to develop a high quality elastomeric interconnection capability as well as the design rules to create a broad range of high quality products. These products include test, burn-in and OEM applications.

To achieve optimum performance with PariPoser® materials, it is important to understand their structure and to provide the correct mechanical interface. Paricon's studies have shown that when the design rules are followed, very high performance electrical interconnection capability can be obtained for a wide range of applications including test, burn-in and production interconnection products.

### **PariPoser Structure**

The PariPoser® fabric is comprised of columns of silver-plated nickel particles uniformly distributed in a thin sheet of silicone. Typical sheet thickness ranges from 0.0025" to 0.015". When the PariPoser fabric is compressed between a pair of flat conductors the silicone elastically moves allowing the columns to electrically interconnect the conductors. The contact loading force is generated by the elastic displacement of the silicone. Paricon markets these products under the name "BallWire® contact". Unlike wire based elastomeric products, BallWire contacts are not easily damaged by excessive loading and are not subject to Euler Column failure. The nickel particles are very hard and are very effective at penetrating oxide layers.

The column density is such that multiple columns will contact each interconnection pad. The PariPoser column density is much greater than the contact spacing. Multiple BallWire™ columns will be present at each pad location. As a result, no orientation of the material, relative to the pads, is required. One just has to make sure that the components being interconnected are aligned to each other.

PariPoser fabric does not compress under load but moves elastically allowing the contact pads to make intimate contact with the BallWire columns. Space must be provided for the silicone to move into. This space is provided by the PariPoser surface roughness and the interstitial space between the contact pads. When a PariPoser connector is compressed between an LGA device and board, the PariPoser material conforms to the surface tending to fill all the voids providing a stable, gasket like interconnection. Little additional vertical motion will occur with load or time. The result is a very stable, environmentally protected interconnection.

PariPoser interconnection materials are formulated to optimize both insulation resistance and through resistance. Our standard design process is to require a gap between any adjacent conductors be at least 40% of the pitch. Hence when using our 1.0 mm pitch material, all spaces between any adjacent conductors must be at least 0.4 mm. When traces pass between pads can be contacted by the PariPoser fabric, the gap between the trace edge and the pad defines the required formulation. For this reason, Paricon recommends that no traces be placed on the surface layer in the pad field.

### Design Rules

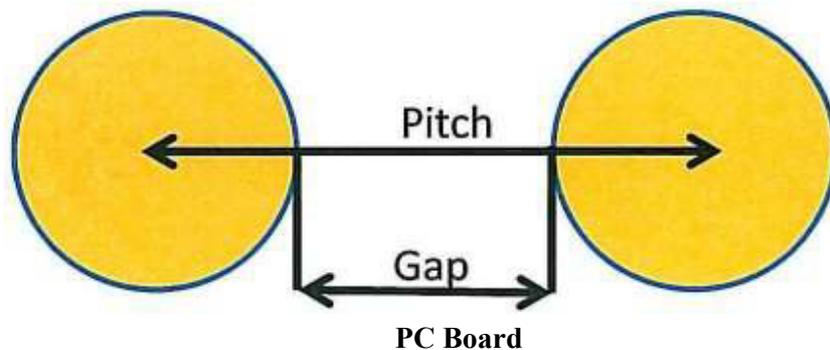
The following design rules will provide optimum performance when using PariPoser technology. Deviations from these rules should be reviewed with Paricon for input on the impact on performance. The following table summarizes the design rules.

## Contact Design Rules

Contact Pitch (mm)	Minimum Gap (mm)	Minimum Pad Area (mm) <sup>2</sup>	Minimum Combined Pad Height (Cu weight oz)	Minimum Combined Pad Height (inches)	Sheet Thickness (inches)	Sheet Thickness (mm)
1.27	0.51	0.46	2.00 oz	0.0028	0.0150	0.38
1.00	0.40	0.28	2.00 oz	0.0028	0.0100	0.25
0.80	0.32	0.18	1.50 oz	0.0021	0.0087	0.22
0.65	0.26	0.12	1.50 oz	0.0021	0.0068	0.17
0.50	0.20	0.071	1.00 oz	0.0014	0.0056	0.14
0.40	0.16	0.045	1.00 oz	0.0014	0.0044	0.11
0.30	0.12	0.025	0.75 oz	0.00105	0.0034	0.09
0.20	0.08	0.011	0.50 oz	0.0007	0.0025	0.06
0.10	0.04	0.0028	0.50 oz	0.0007	0.0021	0.05

Gap applies to pads on both surfaces

Area is projected interconnection area between opposing pads



- Pads can be of any shape but gaps between adjacent pads/ traces must be at least 40% of the defined pitch.
- Traces between pads are not recommended.
- Large ground pads should be segmented to allow flow of the silicone.
- No solder mask should be used in pad field or under contactor frame.
- Although solder plated pads have been demonstrated to be effective, Paricon recommends the use of gold plated pads for the best performance.
- The use of filled via technology has been demonstrated to provide increased pad area and, as would be expected, lower contact resistance.

### **LGA Device**

- Pads can be of any shape but gaps between adjacent pads / traces must be at least 40% of the defined pitch. Board pads and Device Pads must be considered together when defining the 40% gap.
- Traces between pads are not recommended.
- Solder mask is permitted as long as the pads on the board has no solder mask and the depth of the well created by the solder mask is no more than ~5% of the pad diameter. (A .025" diameter pad on 1mm pitch can be recessed 0.0012" from the plane of the solder mask.
- Solder plated pads can be used but the best performance for repeated insertions as seen in test and burn-in are obtained with gold plated systems.

### **BGA Device**

- In general, direct contact between a BGA device and the PariPoser material will tend to splay the columns and not provide as high a quality of performance as found with an LGA. Paricon has developed alternate contact solutions to provide optimum performance when interconnecting to a BGA device. The PariProbe® contact retains the high bandwidth capability of the PariPoser contact while allowing the well understood crown contact to make contact with the solder ball. A second solution comprises a unique flex circuit interposer which contacts the solder ball at the periphery, provides wipe, and protects its bottom from mechanical damage. It also provides a flat pad interface to the PariPoser for optimum performance. Contact Paricon for more details.

### **Kelvin Contactor**

- Kelvin contactor capability is provided by using the 0.1 mm PariPoser fabric in the contactor. The pad pairs on the board should follow the design rules of the 0.1 mm material. Hence the gap should be greater than 0.04 mm or 0.0016". A practical gap dimension is >0.0025".

### **Loading**

- A uniform load of 40–50 grams per contact (for 1 mm pitch applications) over the contact surface is recommended for optimum performance.
- A backing plate that prevents the PC board from moving more than 0.002" is recommended.
- An external spring member that maintains a constant load should be used.
- A uniform load spread over the entire device is preferred but not required except for devices that are very thin. Successful applications have been designed for ceramic packages using only a small portion of the edge of the package to apply the load.
- Load levelers such as silicone pads are very effective.

### **Durability**

- The PariPoser material is quite durable and can be used for several hundred thousand cycles in test applications. No cleaning is necessary under normal usage. Any loose debris that is on the PariPoser material can be blown off with compressed air (canned air). Alcohol can also be used to rinse debris from the PariPoser surface. Excess scrubbing of the surface is not recommended, as it can loosen the nickel particles causing a loss of conductivity. Removal of surface nickel particles is the key failure mechanism noted.
- The amount of set that the PariPoser material takes is slight and temperature dependent. Little permanent deformation is noted. The PariPoser material will conform to the pad geometry and an impression can be seen when the connector is disassembled. This is small and tends to fully recover in a short time. This phenomenon is not a "set" but is perhaps better described as being damped or viscous elasticity.

### **Performance Characteristics**

Paricon has developed many products and formulations to address a wide variety of applications. Specific data sheets and connector application support is available upon request.