

# Coax Probe Needle For Low Current Probe Cards

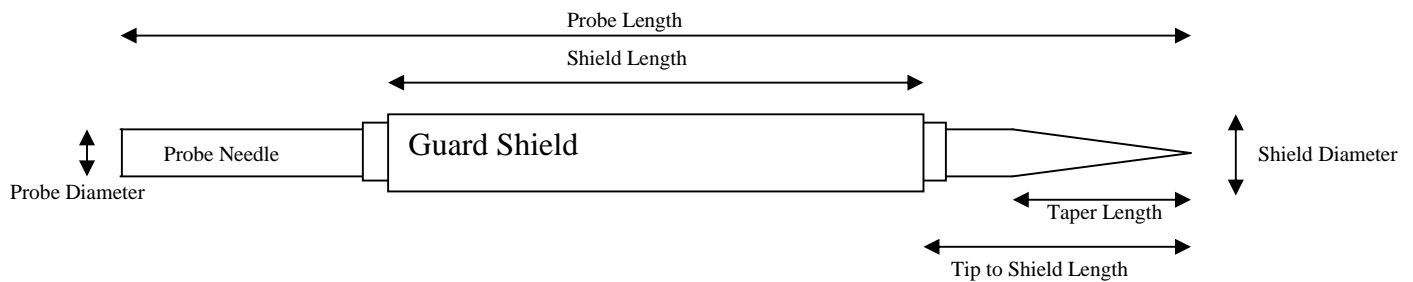
Probe cards used for parametric test are for many test applications required to make low current measurements in the Pico Amp (1e-12) and Femto Amp (1e-15) range. Even making measurements in the 10 to 100 Pico Amp range can be very time consuming because of the leakage and dielectric absorption properties of the epoxy ring and probe card.

The easiest way to remove the effects of leakage and dielectric absorption on epoxy ring low current probe cards is to use coax probe needles. This allows the shield of the probe needle that is driven to guard to completely eliminate the electrical effects of the epoxy ring holding them in place.

Up until now, most coax probe needles have been designed for AC high frequency performance and have been designed for 50 Ohm impedances. This has resulted in probe needles that are very large in diameter, or very fragile. These probe needles have typically not performed well in high volume production wafer test.

Available now are probes utilizing 0.010" or 0.008" diameter tungsten or tungsten / rhenium needles mounted inside a shield that is 0.020" or 0.018" in over all diameter. The shield is set back form the probe tip to allow for mounting in the epoxy ring and still maintain probe tip spacing to about 100um, depending on the probe card type and pad layout configuration.

Following are the mechanical dimensions and electrical parameters of the coax probe needles:



Coax Probe Needle Properties

Part	0.008 Probe		0.010 Probe	
	Inch	Metric	Inch	Metric
Probe Diameter	0.008	0.203	0.01	0.254
Shield Diameter	0.018	0.457	0.02	0.508
Taper Length	0.100	2.54	0.125	3.175
Tip to Shield Length	0.15	3.81	0.2	5.08
Shield Length	0.75	19.05	0.75	19.05
Probe Length	2.0	50.8	2.0	50.8
Electrical				
Impedance Ohms	11.7	Ohms	13.6	Ohms
Insulation Resistance				
Probe To Guard Shield	>1e13	Ohms	>1e13	Ohms

Metric dimensions shown in millimeters.

Contact factory for other dimensions.

Figure 1, Coax probe needle properties.

Coax probe needles are available in the following 4 standard configurations:

1. Diameter of 0.008” with the dimensions shown in the table. With tungsten probe wire.
2. Diameter of 0.008” with the dimensions shown in the table. With tungsten / rhenium probe wire.
3. Diameter of 0.010” with the dimensions shown in the table. With tungsten probe wire.
4. Diameter of 0.010” with the dimensions shown in the table. With tungsten / rhenium probe wire.

Changes in material or probe dimensions require special quoting. Contact the factory for custom configurations.

**Considerations for mounting of coax probe needles in epoxy.**

The construction techniques used to build a spider with coax probe needles is the same as building a spider with standard probe needles. There are however, some additional requirements that need to be applied to the assembly. Figure 2 shows a cross section of an epoxy ring with coax needles mounted in it. Figure 3 shows a top view of an epoxy ring with coax probe needles.

Requirements for building an epoxy ring with coax probe needles:

1. The guard shields must stick out both sides of the epoxy.
2. The guard shields can not touch each other. This would cause a guard to guard short.
3. There can not be any epoxy bridging from the shield to the needle.
4. There can not be any epoxy bridging from one needle to another needle.
5. The coax probe should be mounted in the epoxy such that it follows the guard trace on the printed circuit board where it will be mounted. The closer this can be controlled, the easier the wiring on the printed circuit board.
6. Typical coax probe angles for different parametric probe cards is as follows:
  - a. Agilent 7000 series 48 pin probe cards: 6.923 degrees
  - b. Keithley S600 and S400 series 64 pin probe cards: 5.625 degrees
7. The shield of the coax probe needs to be wired to the guard trace on the printed circuit board at the outside perimeter of the spider.
8. The probe needle is wired to the signal line connection for that pin. It should be directly wired without touching the PC board, or wired with coax wire that has the shield connected to guard and the center conductor connected to the signal connection. Twisted pair wiring may also be used to get the Kelvin connection at the probe needle.
9. Stack height of the spider is recommended to be 0.245” (6.2mm) from the bottom of the probe card to the probe tips.



Figure 2, Cross section of coax epoxy spider.

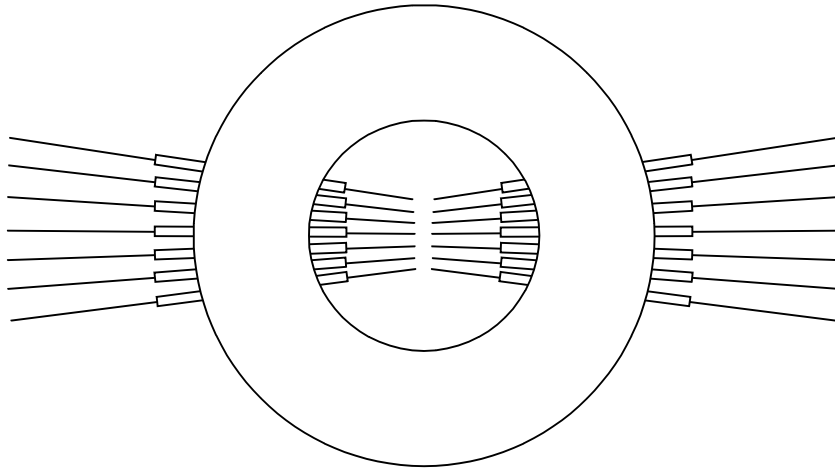


Figure 3, Top view of coax epoxy spider.

### **Additional Considerations**

1. The printed circuit board used for mounting the coax epoxy ring must be of a design that is consistent with low current measurements
2. The interconnect from the probe card to the coax epoxy spider must be made to be consistent with proper guarding and low current measurements.
3. .The ability for a probe card to make low current measurements is the combination of the probe card, coax epoxy spider, and interconnect.
4. Probe cards properly built with coax probe needles can achieve up to  $1e15$  Ohms insulation resistance from probe to probe and probe to ground with the guard driven.