international TEST SOLUTIONS	**Probe Form™**	**Technical Brief**

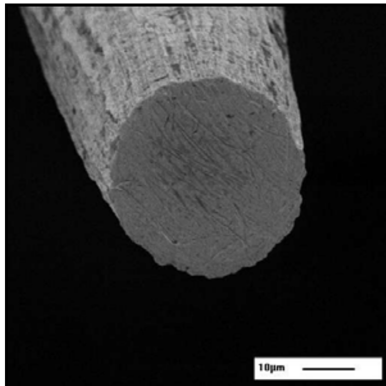
Increase Wafer Yield and Extend Probe Card Life

Low and stable contact resistance (C_{RES}) during wafer level testing is critical for maintaining high wafer yields. Probe tip shape and online cleaning are two important factors that can affect wafer yields and wafer sort probing consistency.

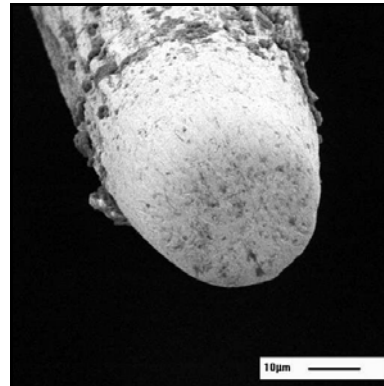
In cantilevered probe card applications, flat, semi-radiused, and radius probe tip geometries are commonly used. Flat tip probes are relatively easy to manufacture and maintain; however, over time these probes will start to make marginal electrical contact resulting in device yield fallout. The tip geometry as well as the grooved contact surface encourage adherent contaminants and oxides to accumulate. Online abrasive cleaning with lapping films, tungsten carbide disks, or ceramic plates is used to remove the contaminants and control the C_{RES}. As a consequence of online abrasive cleaning, frequent offline maintenance operations are needed to prolong probe card service life.

For radius tip probes, the smooth and rounded tip geometry allows bond pad metal to readily deform around the contact surface. With repeated touchdowns, adherent material collects away from the electrical contact region and consistent contact is made across a relatively clean surface. As such, radius tip probes improve C_{RES} stability while significantly reducing bond pad damage. Until recently, custom build procedures were necessary during card construction with radiused probes. Furthermore, online abrasive cleaning operations could easily damage the surface and affect the shape integrity.

Probe Form™ was developed for cantilevered probe technologies to provide a cost effective method of uniformly "reforming" a flat probe tip into a smooth, radius shape. A **Probe Form™** shaping operation can be easily incorporated into a probe card build process to "form" radius tips or into a probe card maintenance cycle to restore worn or deformed probe tips. To facilitate these operations, **Probe Form™** is available on a number of different substrates readily used by wafer prober and probe card analyzers.



Flat tip tungsten probe.



Reshaped and radiused probe.

Probe Form™ uses a highly cross-linked, non-corrosive polymer that has an operating temperature range of -50°C to +200°C. In order to reshape the flat tips of a new or well used probe card, the probes are repeatedly inserted into the **Probe Form™** polymer material. After multiple insertions, a radiused probe tip shape with a very smooth surface finish will be obtained. The rate of tip reshaping depends on the initial diameter, the probe needle material (i.e., tungsten, tungsten-rhenium, beryllium-copper, and Pd-alloy probes will be reshaped at different rates) and the grade of **Probe Form™**.

To maximize the tip size reduction and development of a highly polished radius shape, the probes are inserted into new locations of the polymer with an offset of approximately 2X the probe diameter. During the probe tip reshaping operation, no lateral loads are applied to the probes and thus the probe card planarity and alignment are unaffected.

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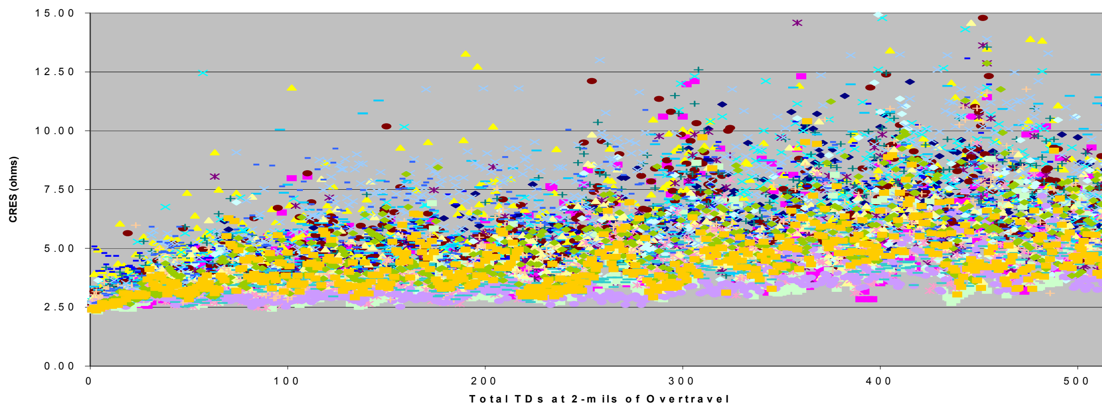
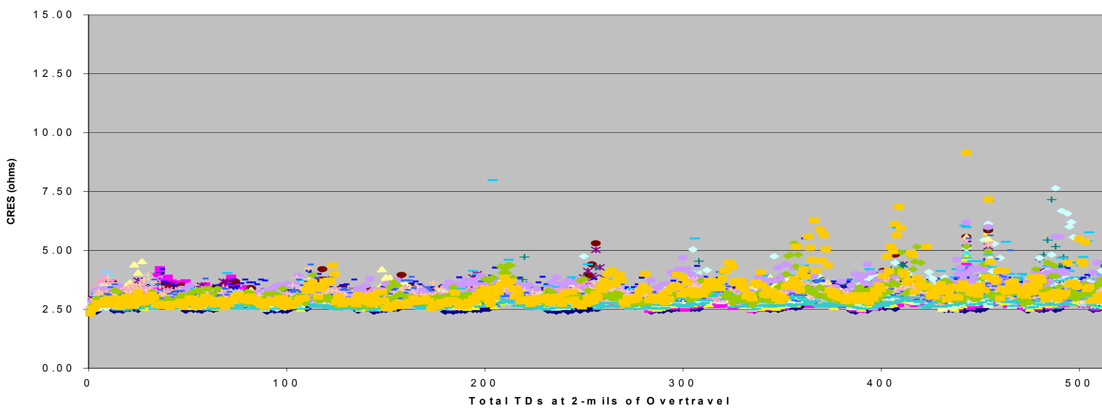
Probing with radius tip probes substantially reduces the C_{RES} variance when compared with flat tip probe performance (as shown below). Consistently low and controlled C_{RES} variance lends a certain confidence to first pass probe results (even if the C_{RES} has an upward trend) and diminishes the need to reprobe the same pads multiple times.

Particles, debris, and aluminum "worms" generated during probe can detrimentally affect C_{RES}, therefore, a non-destructive cleaning methodology, such as **Probe Polish™**, that collects the debris and maintains the tip shape is necessary to maintain high wafer yields. Radius probe tips with online cleaning and a routine maintenance program will extend probe card life and performance therefore increasing wafer yield and reducing cycle time.



C_{RES} vs. Touchdown using a Flat Tip on Test Die w/ No Online Cleaning



C_{RES} vs. Touchdown using a Reshaped Tip on Test Die w/ No Online Cleaning

Probe Form™ shapes the probe contact surface area of new and worn flat probe tips to attain smooth, radius tips that substantially improve C_{RES} stability and wafer yield. Application of online non-destructive cleaning, such as **Probe Polish™**, will effectively maintain the tip shape. **Probe Polish™** and **Probe Form™** are available on wafers, prober abrasion plates, and probe card analyzer abrasion plates.

Contact **International Test Solutions (ITS)** directly or a local **ITS** distributor with your specific probe card cleaning requirements.

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