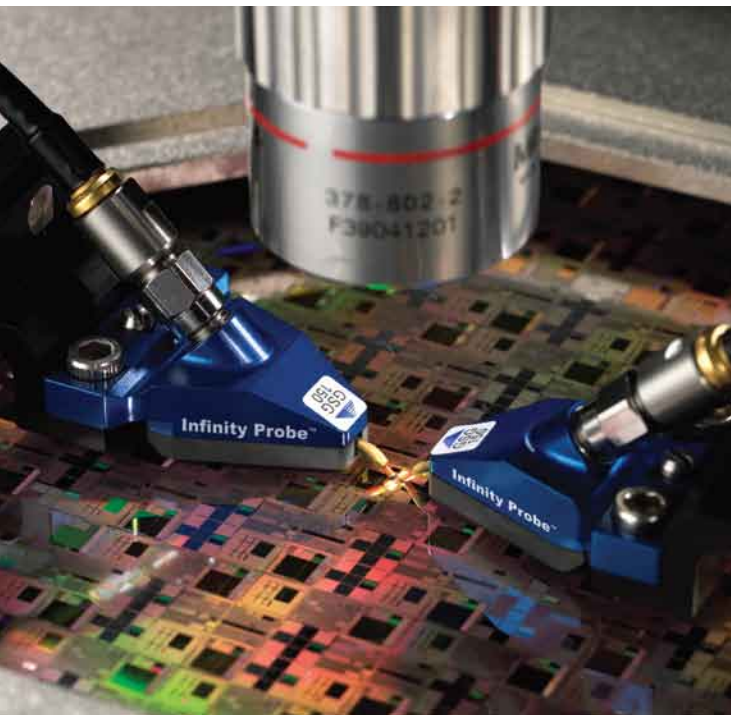


# *Infinity Probe<sup>®</sup>*

**High-frequency performance with  
low, stable contact resistance**



The Infinity Probe family sets a new benchmark for the device characterization and modeling community. This revolutionary probe combines extremely low and stable contact resistance on aluminum, copper or gold pads with unsurpassed RF measurement accuracy to give you highly reliable, repeatable measurements.



## Infinity Probes to 325GHz

The Infinity Probe is designed for both high-frequency performance and low and stable contact resistance on MOS aluminum pads. It sets the standard in mechanical and RF performance for device characterization and modeling. Whether you're probing on aluminum, copper or gold, the Infinity family has your probe.

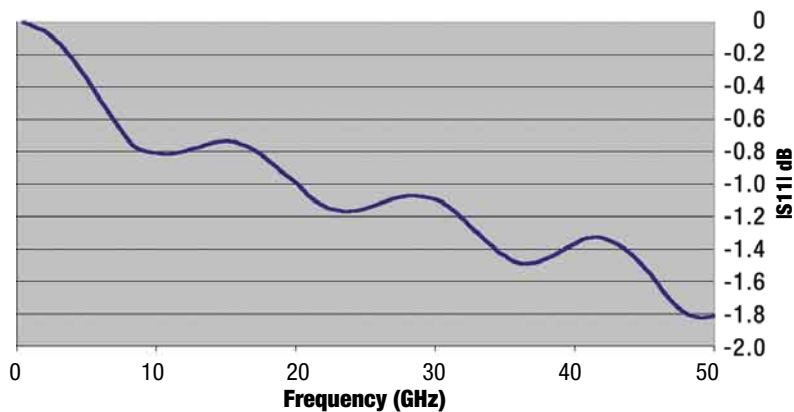
### Typical Contact Limitations

Aluminum and copper probe pads are much more difficult to accurately probe than gold pads due to limited contact quality. Measurements sensitive to series resistance are affected by contact resistance e.g. inductor Q. Aluminum pads require the probe to break through the naturally forming aluminum oxide for contact. Conventional RF probes use tungsten tips to penetrate this oxide layer. However, tungsten oxidizes and the aluminum easily accumulates on the probe tips. This significantly increases contact resistance and without frequent cleaning may result in poor measurement repeatability

### Implications

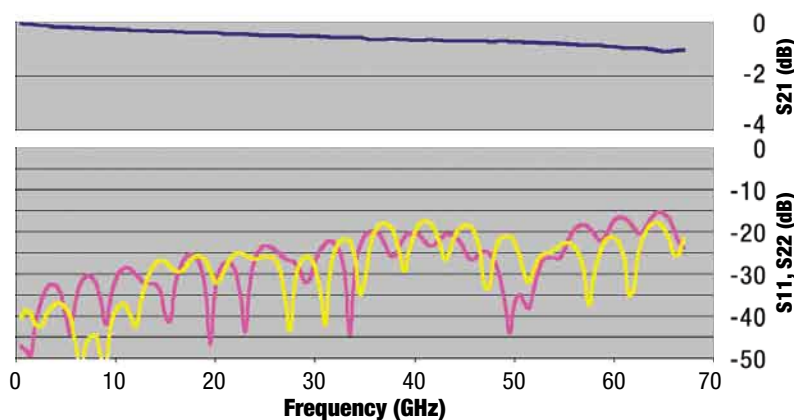
- Inconsistent measurements
- Manual intervention to sense contact resistance issues
- Reprobing often required
- Pad damage limits reprobing capability
- Increased test time, cost, reduction in productivity

## Calibration Verification Accuracy



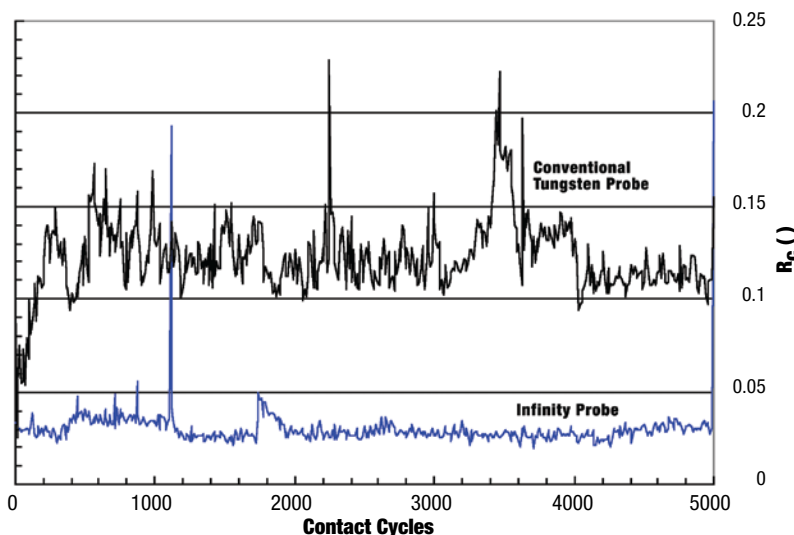
Verification Plot: Single port measurement of 40 ps transmission line

## Typical RF performance to 67 GHz



Typical S-parameters of i67-A-GSG-150 probe

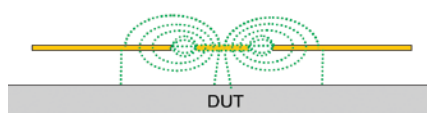
## Superior Low and Stable Contact Resistance



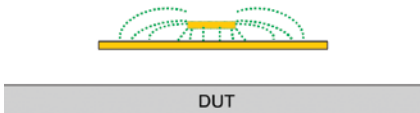
Typical Contact Resistance vs Number of Touchdowns on clean aluminum pads for a Conventional Tungsten Probe vs Infinity Probe

## Probe Tip Shielding

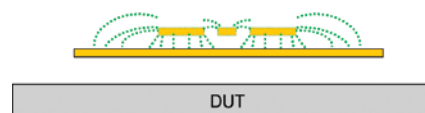
Coplanar – No shielding



Infinity Microstrip – DUT is shielded by ground plane



Dual Infinity Microstrip – DUT is shielded by ground plane



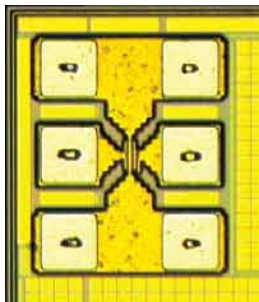
## The Infinity Probe:

The Infinity Probe reaches new performance levels through the combination of Cascade Microtech's proprietary thin-film technology and coaxial probe technology.

### Superior mechanical performance:

The Infinity Probe offers the lowest and most stable contact resistance available for probing aluminum pads. Its force delivery innovation ensures minimal horizontal tip motion (scrub) for breaking through aluminum oxide

- Contact area of probe tip: 12x12  $\mu\text{m}$
- Typical scrub is 25  $\mu\text{m}$
- Minimizes pad damage
- Probe reduced pad sizes



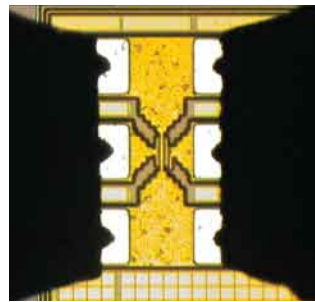
Small contact marks enable contact to small pads

### Superior RF performance:

The transmission lines on the Infinity thin-film confine fringing fields more tightly than conventional coplanar tips. Better field confinement reduces unwanted coupling to nearby devices or other probe tips, increasing RF measurement accuracy. RF characteristics are equal or superior to all other probe technologies in return loss, attenuation, and crosstalk.

### Infinity Probes – the new gold standard:

Gold pads also can have oxidizing layers or sprayings of polyimide contamination that a probe must penetrate for good repeatable contact. The superior contact and durability of the Infinity ensure better first time calibrations and longer life, increasing productivity and reducing cost of ownership.



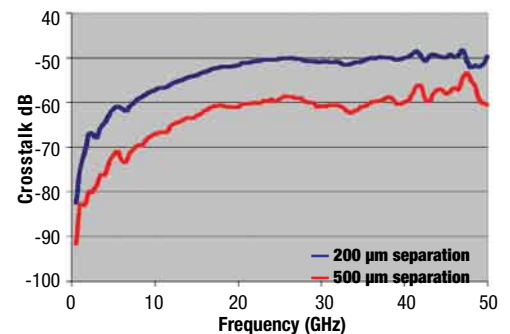
Excellent tip visibility Infinity Probe contacting Silicon RF device

### Features

- Precise lithographic thin-film construction
- Excellent crosstalk characteristics
- Non-oxidizing nickel alloy tips
- Innovative force delivery mechanism
- High current (2 amp) version available

### Benefits

- Superior field confinement reduces unwanted couplings and transmission modes
- Reference grade measurement accuracy and repeatability
- Small scrub minimizes damage to pads
- Typical contact resistance <0.05 ohm
- Save valuable wafer space by reducing pad geometries



Excellent X-talk characteristics

## Waveguide Infinity Series to 220 GHz

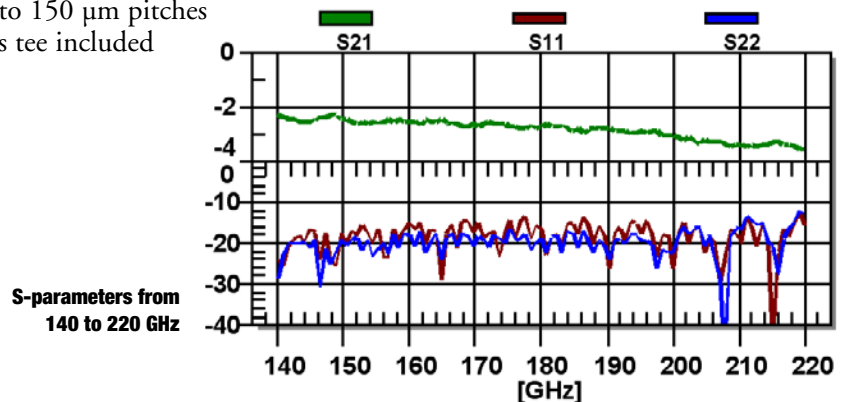
The Ft of devices continues to increase requiring test engineers to now validate the performance of their devices up to 220 GHz and beyond. The Infinity Probe is available in all the waveguide bands between 50 GHz and 220 GHz (WR15 to WR5). At ultra high frequency the challenge is to prevent the probe from behaving like an antenna. The Infinity Probe's revolutionary thin-film GSG-contact-tip design confines the electromagnetic (EM) fields near the probe tip. This control of the EM fields assures accurate and repeatable measurements to 220 GHz.

### Features:

- WR15, WR12, WR10, WR8, WR6, WR5 versions
- Typical Probe Loss: -1.50 to -5.0 dB @ 140-220 GHz (depending on frequency and pitch)
- Typical S11/S22: -13 dB
- 50 to 150  $\mu\text{m}$  pitches
- Bias tee included

### Benefits include:

- Able to contact ultra small pads
- Frequencies to 220 GHz and beyond



S-parameters from 140 to 220 GHz





## The Differential Challenge

Differential circuits are increasingly common in a wide range of high frequency applications. Multiport (4-port) network analyzers are often used to characterize these circuits. Characterization of differential passive elements like inductors and capacitors and RF test structures within narrow wafer scribe lines requires precision dual signal line high frequency probes. High accuracy, low crosstalk and low and stable contact resistance are achieved by Infinity dual probes.

### Current Limitations

- Accurate calibrations require high isolation between the signal ports
- GSGSG and GSSG are the most common probe configurations
- Conventional GSSG probe configurations have very high signal to signal coupling
- Isolation may be too low; i.e., 20 dB @ 20 GHz for GSSG or GSGSG 35 dB @ 40 GHz

### Implications

Using a conventional dual GSSG probe beyond 20 GHz or GSGSG probes beyond 35-40 GHz results in inherent errors built into the calibration and a lack in measurement precision. A probe with much better isolation between the two signal paths is needed for accuracy and consistency.



**The microstrip extends all the way to the probe tips**

### Dual Infinity Probe

The Dual Infinity probe provides unsurpassed isolation between the two signals.

- 15 dB better isolation than other mechanical probes
- Low and stable contact resistance for precision characterization of differential inductors or amplifiers

### Superior Crosstalk characteristics

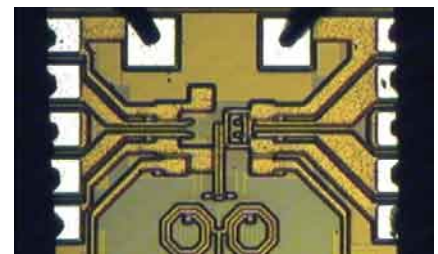
The low crosstalk characteristics of the dual Infinity ensures accurate calibrations. This is achieved by distancing the signal traces on the thin film and by placing a Ground Interposer between the two signals at the tips. This ensures that the fields from the signal lines effectively terminate on the interposer reducing the coupling between the two signals.

### Features

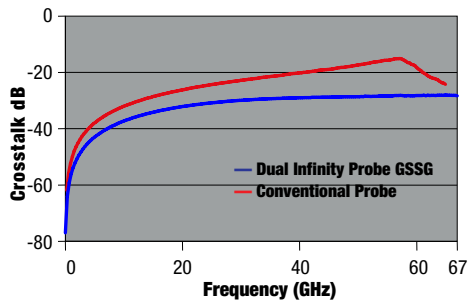
- Ground Interposer between the two signals
- GSGSG, GSSG, SGS versions

### Benefits

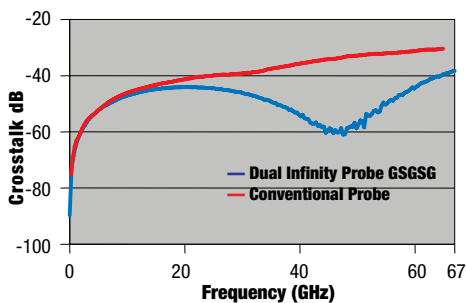
- Superior isolation between the adjacent signal lines
- Improved accuracy for multiport calibrations
- GSSG 150  $\mu\text{m}$ ; Typical crosstalk -25 dB @ 40 GHz
- Typical contact resistance < 0.05 ohm



**Dual Infinity Probe contacting distributed amplifier**



**GSSG configuration  
X-talk improvement > 10 dB @ 40 GHz**



**GSGSG configuration  
X-talk improvement > 15 dB @ 40 GHz**



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