Kepler Socket
Vertical Scrubbing Test Solution

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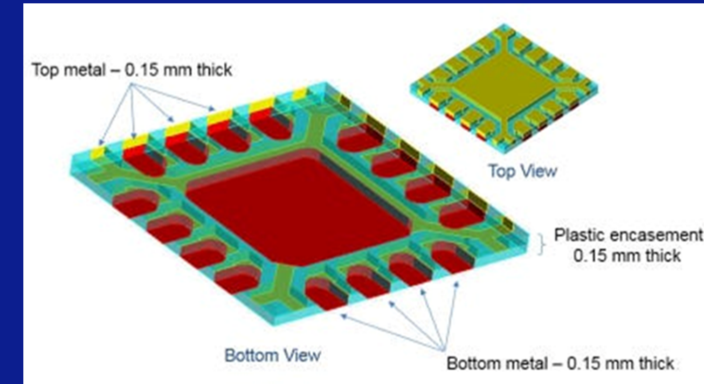
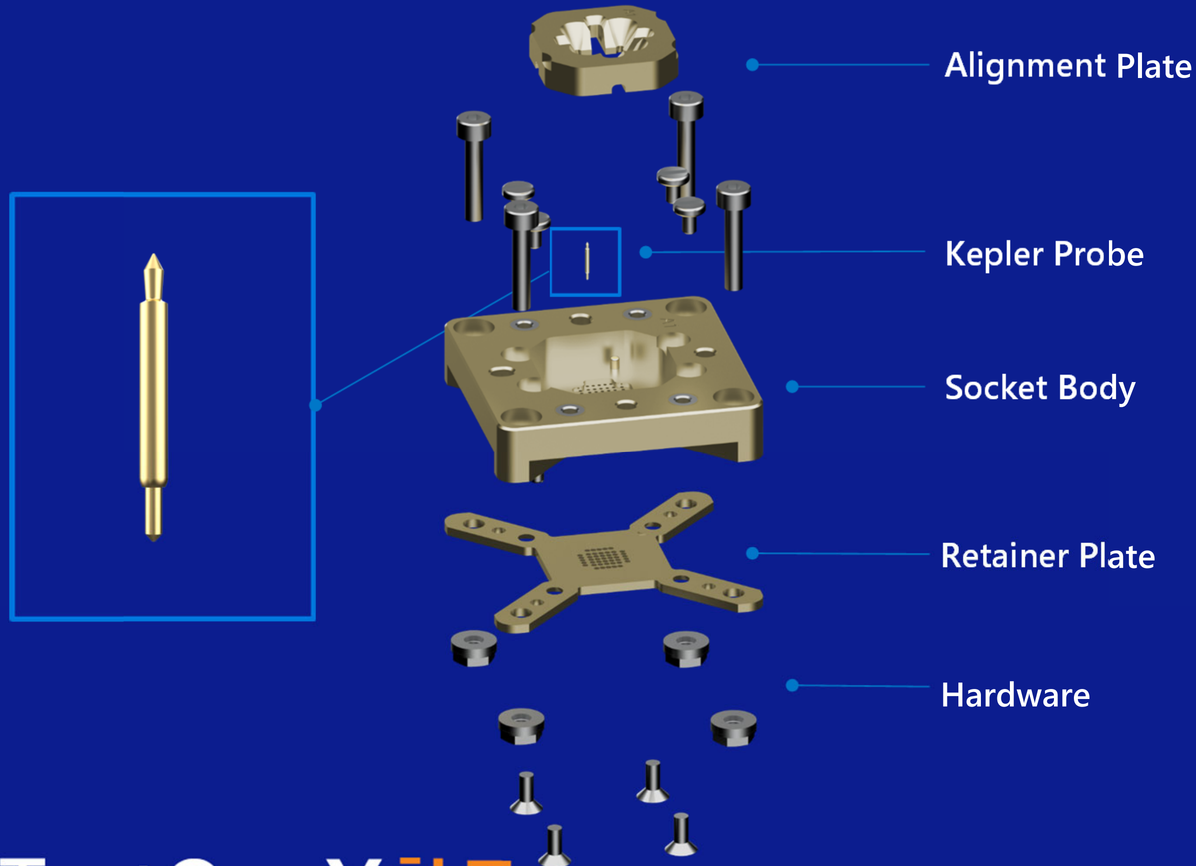
Test Challenges in Applications

- Test solutions in QFN, QFP, LGA
  - Spring probe technology
  - Cantilever scrubbing contacts

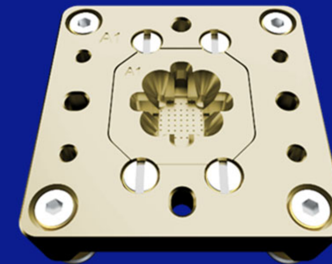


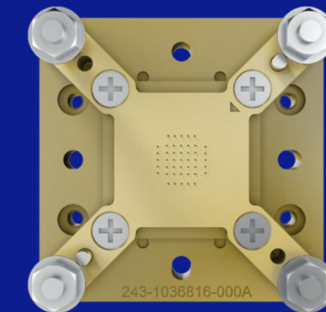
- Test challenges in QFN, QFP, LGA
  - Contact surface oxides and contamination
  - PCB damage and maintenance

Kepler Socket Structure



Patent in process





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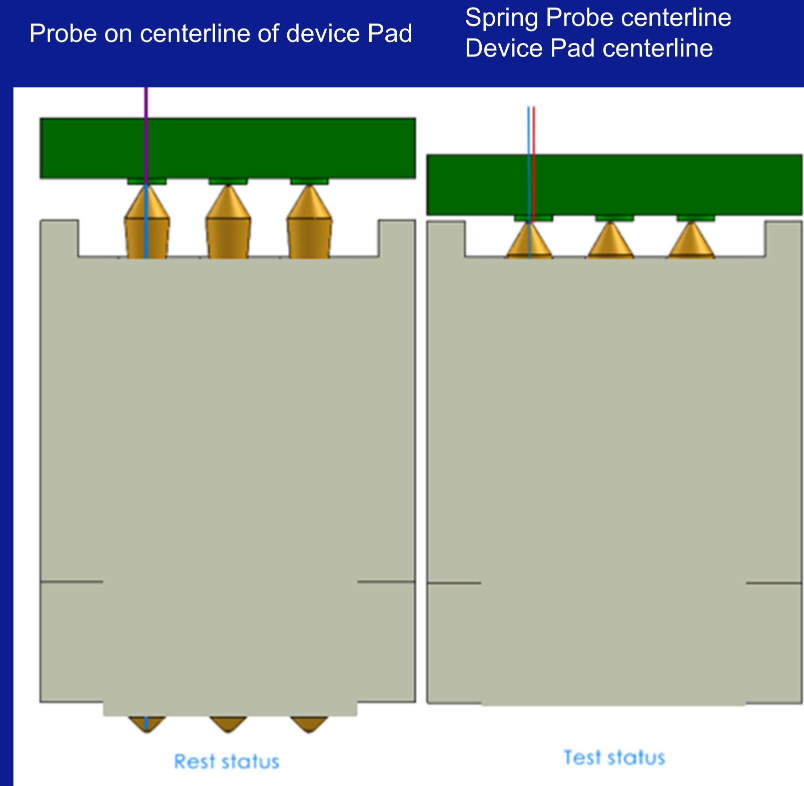
Product Features & Benefits

- Scrub action breaks through surface oxides on device pad with X-Y movement
- Match existing PCB socket footprint and test hardware lead to cost saving for customers
- Provides reliable and consistent contact for Matte Tin or NiPdAu pads, low contact resistance (CRES)
- Tri-Temp socket design to support -55 °C to +150 °C
- Configurable design flexibility for integrating into existing hardware setup
- Field repairable, easy cleaning and maintenance
- Allows for PCB topside components to be placed close to DUT for better signal performance and less signal loss
- Designed for manual test, bench test, and HVM production test

Probe on centerline of device Pad

Spring Probe centerline
Device Pad centerline



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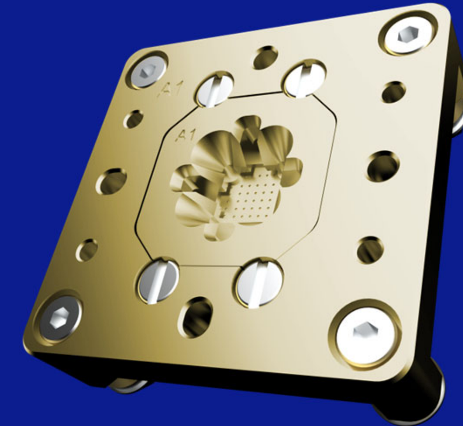
Product Specification

Mechanical Properties:

- Typical Application: QFN, LGA, QFP
- Minimum Pitch: 0.65 mm
- 851-1028630-HG00
- Probe Compliance: 0.55 mm
- Contact Force: 27 Grams @ 0.55 mm (recommended travel)
- Spring Type: Stainless Steel
- Contact Type: Conical Radius Tip
- Top Plunger: Pd Alloy gold plated
- Operating Temperature: -55 ℃ ~ 150 ℃
- Socket Material: PI-5
- Contact Life: Contacts tested to 500K



Electrical Properties

- Contact Resistance: <50 mΩ
- Current Carrying Capacity: Up to 3.1 Amps
- Insertion Loss 19.82 GHz @ -1dB
- Return Loss 16.8 GHz @ -10dB

*Other pitches and dimensions are available upon request

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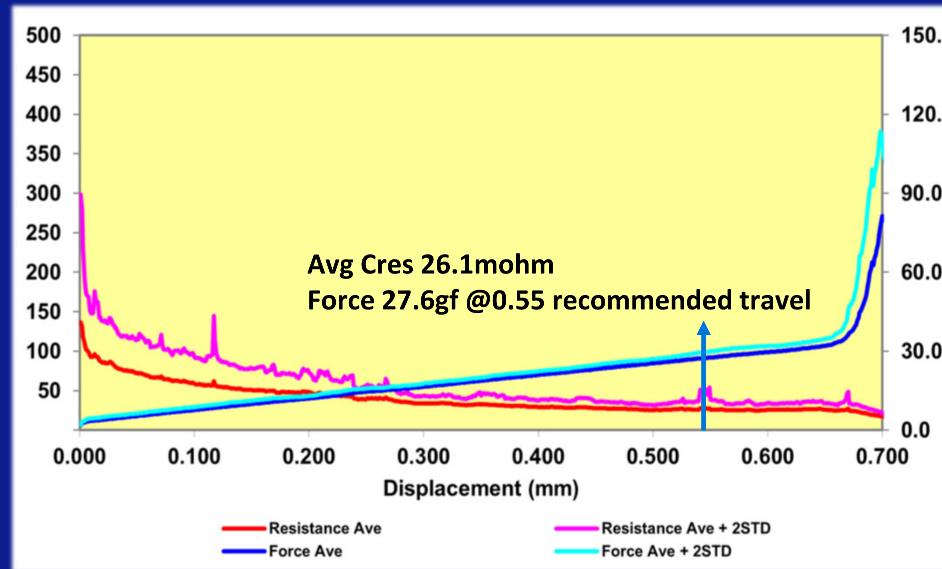
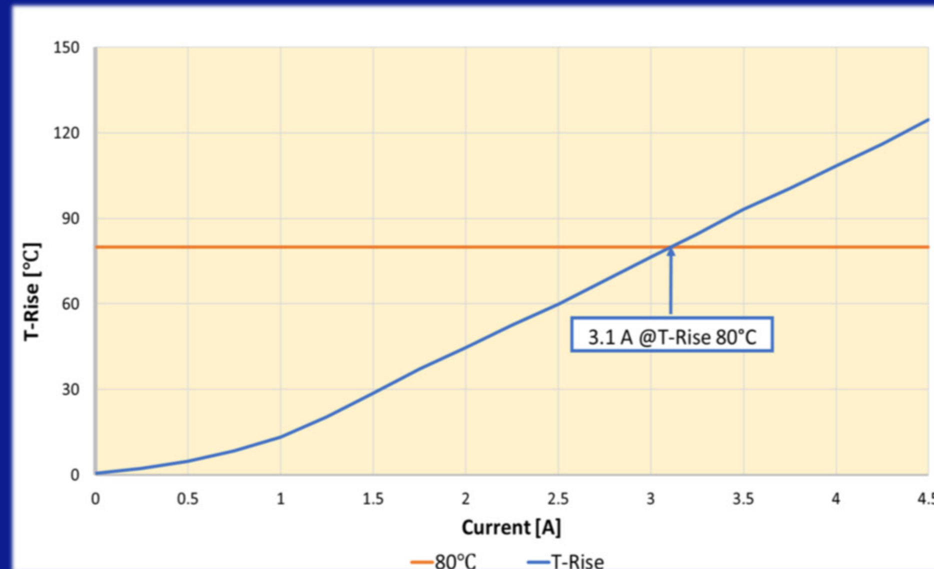
Product Testing Result - FDR & CCC

851-1028630-HG00



Force | Deflection | Resistance
Avg CRES: 26.1 mΩ
Force: 27.6 g @ 0.55 mm



Current Capacity Test - Single Pin in Free Air
Max T-Rise (C) Vs Current (A)

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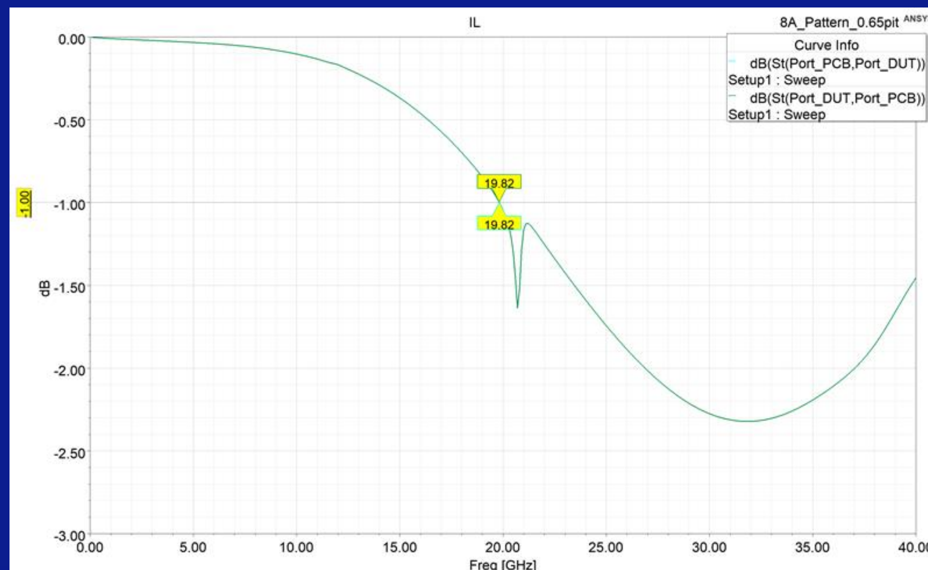
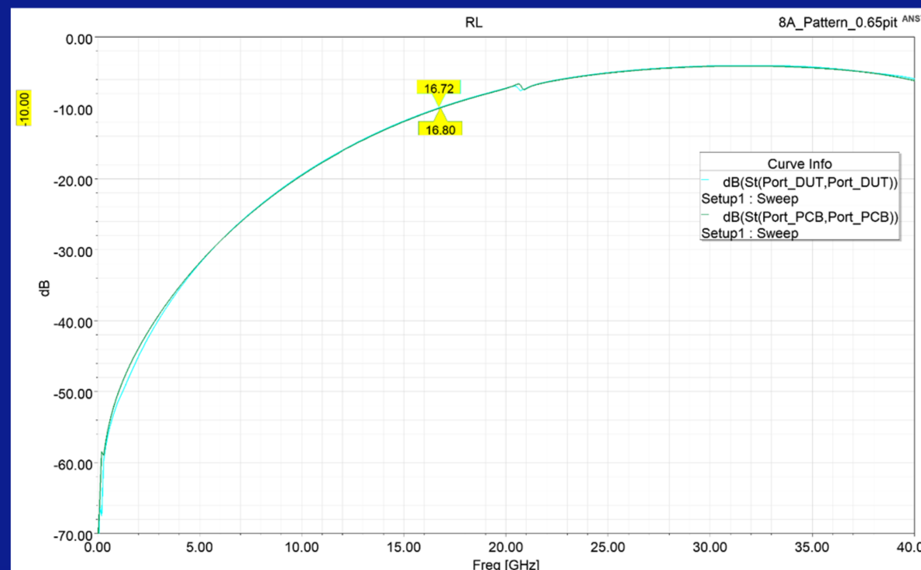
Product Testing Result - SI Performance





Insertion Loss:
- 19.82 GHz @ -1dB

Conditions:
- Socket housing: PI-5
- 8A Pattern
- 50 Ohm Impedance

Return Loss:
- 16.80 GHz @ -10dB

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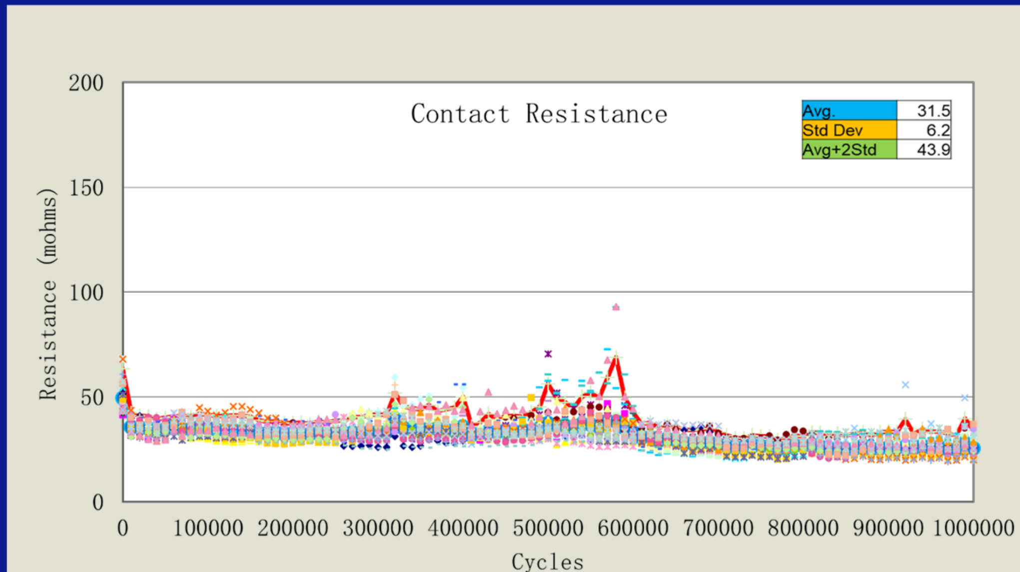
Product Testing Result - Test to Failure



Test items		0K	50K	150K	250K	400K	600K	1000K
LCT	Avg. Cres	28.7	37.3	35.8	33.8	35.7	35.3	26.1
	Std Dev.	4.2	6.7	5.2	5.9	10.8	6.8	4.1
	Avg.+2Std	37.1	50.7	46.1	45.6	57.2	48.9	34.3

Extended life testing: Testing to failure

In order to characterize Kepler and give our customers confidence in the launch of a new technology, we know that our standard design verification tests and life cycle tests need to achieve the results required for market adoption. For Kepler, we needed to demonstrate that the two-axis motion of the spring probe would not cause early life failure or hardware damage.

We conducted a "test to failure" process, cycling a device simulator to 1 million insertions to thoroughly characterize Kepler before it was used in the field. The results exceeded expectations, proving that Kepler is a robust and reliable system that provides out-of-the-box performance and will change the landscape of semiconductor testing.

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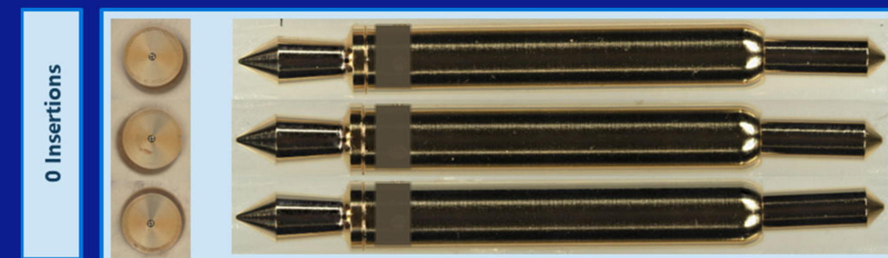
Scrub Effectiveness Verification

Measurements of the scrub length on device simulator and theoretical calculations, the induced mechanical scrub is:

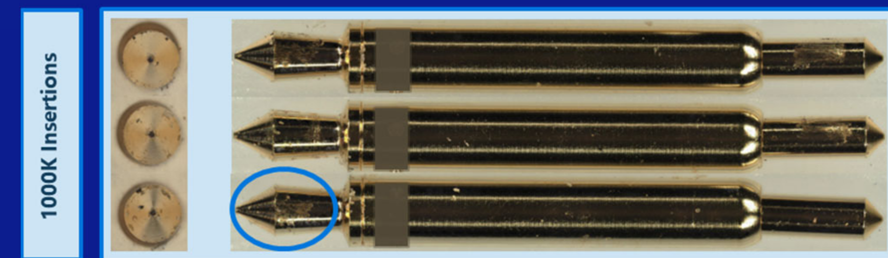
- Scrub effectiveness tested in lab environment using both our Lab Cycle Tester and the MPT to measure contact resistance at major intervals.
- During testing we validated that the top plunger maintained structural integrity until one million insertions testing on a NiPdAu device simulator.
- The minimum and maximum scrub length fell within our simulated distribution values of 0.015~0.037mm

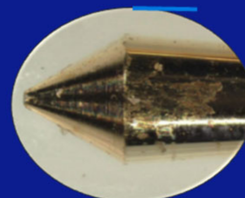
Material Type	Scrub length
Matte Tin	0.015 – 0.037 mm
NiPdAu / Ni Au	0.023 – 0.037 mm

0 Insertions



1000K Insertions





Little wear found after 1000K cycles

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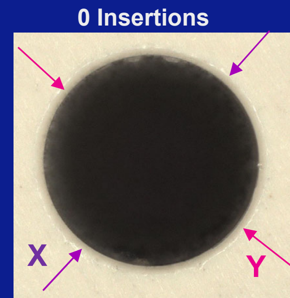
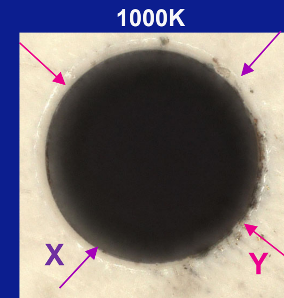
Kepler | Socket Cavity Hole Inspection

Cavity Hole Examples and Diameter Comparison: 0K MTC Cycled Probes vs Additional 1 Million LCT Cycled Probes

0 Insertions



1000K



Diameter (mm)	Direction	1	2	3	4	5	Avg.
0	X	0.387	0.386	0.386	0.385	0.387	/
1000K	X	0.387	0.386	0.387	0.385	0.388	/
Variation	/	0	0	0.001	0	0.001	0.0004
0	Y	0.387	0.387	0.387	0.386	0.388	/
1000K	Y	0.389	0.388	0.390	0.388	0.389	/
Variation	/	0.002	0.001	0.003	0.002	0.001	0.0018

Cavity holes have very low wear ~ actual hole 0.380 +/- 0.013mm

Providing consistent accuracy over the life of the probe

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Summary

- The special structure and contacts will generate X-Y movement in breaking though oxides and contamination, provide reliable contact to the device pad.
- Kepler socket compatible with existing footprint, easy maintenance, reduce cost of ownership.
- Widely used for manual, bench and HVM testing.

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