Spring Probe with Tip Scrubbing

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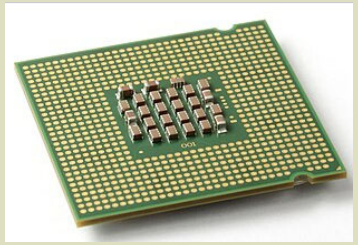
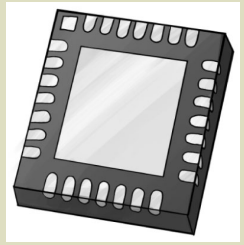
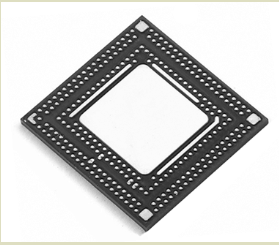
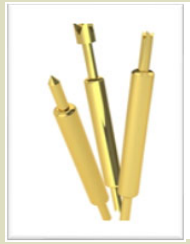
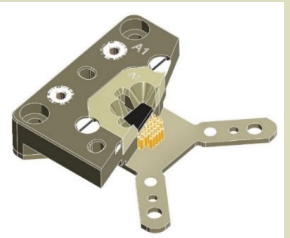
Mesa, Arizona • March 3–6, 2024

Contents

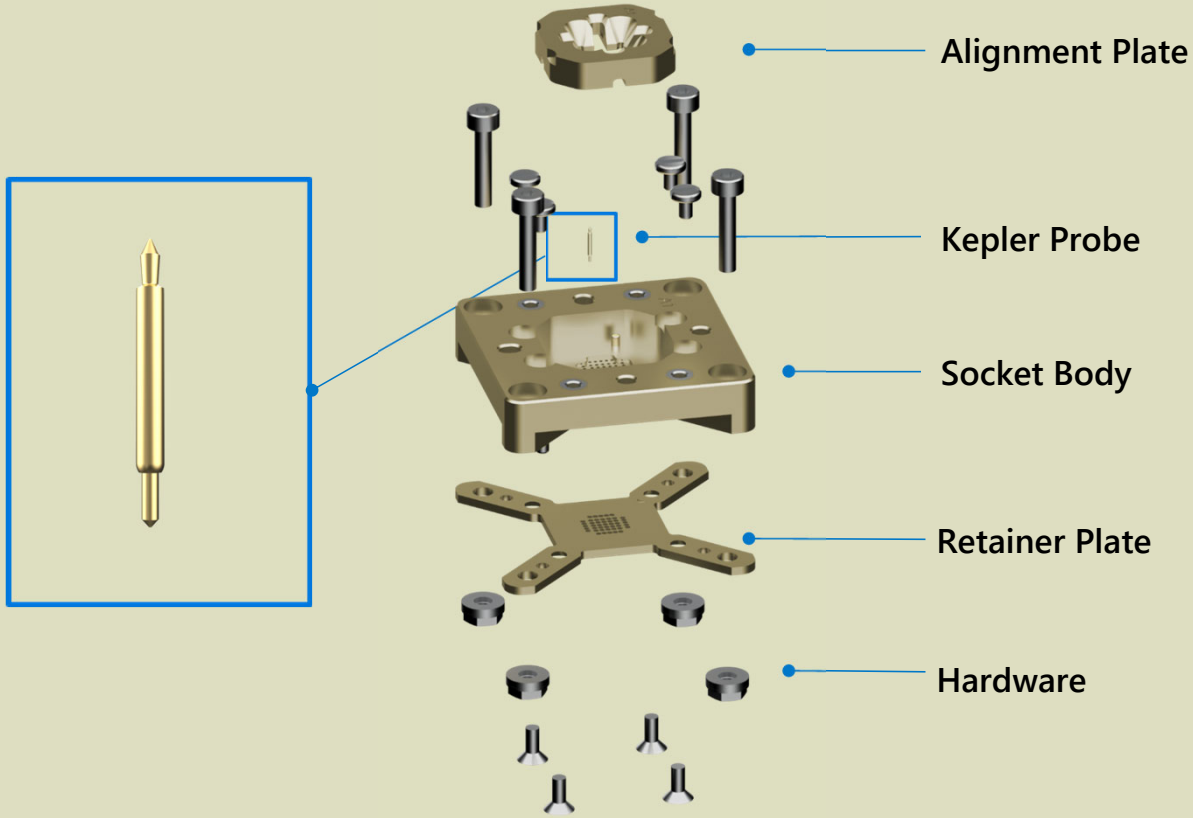
- Background
- Concept & Fundamentals
- Socket Performance
- Summary

Background - Compelling Story

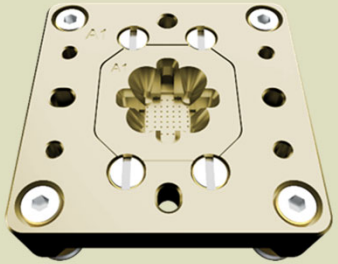
- Major Challenges in Testing LGA/QFN
  - Remove surface oxides
  - Remove contaminants
  - High Frequency
- Major Weakness of Existing Contacts
  - Traditional spring probe
    - No scrubbing on pad surface to remove contaminants
  - Scrubbing
    - Need off center on PCB, affecting PCB signal integrity
- Customer Request
  - Provide spring probe with scrubbing on pads

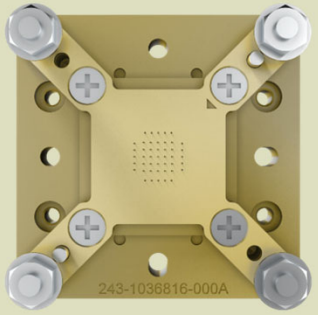






Concept & Structure



Patent in process





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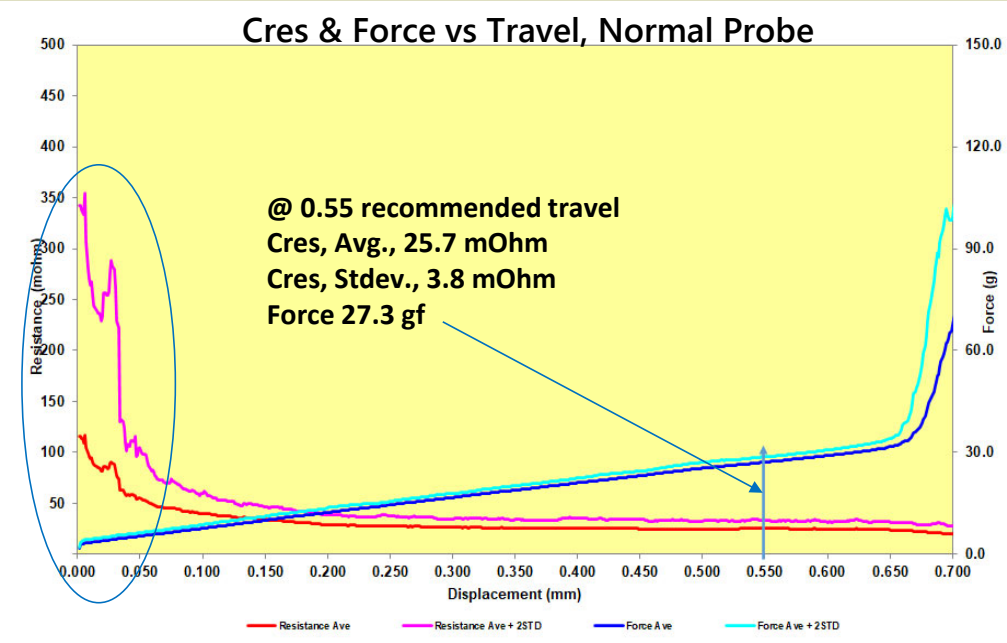
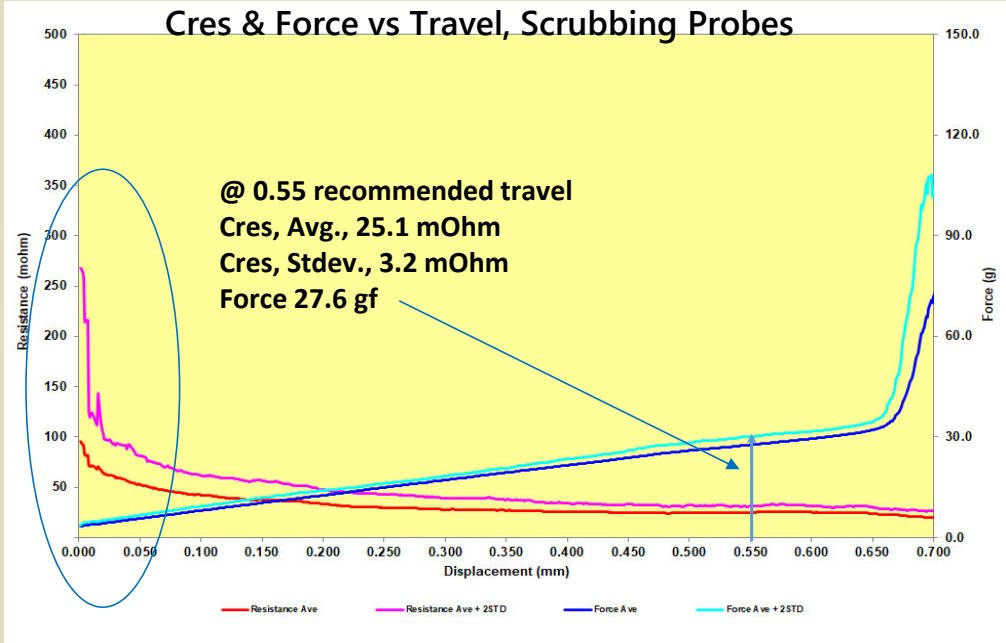
Comparisons – Force/Cres vs Travel

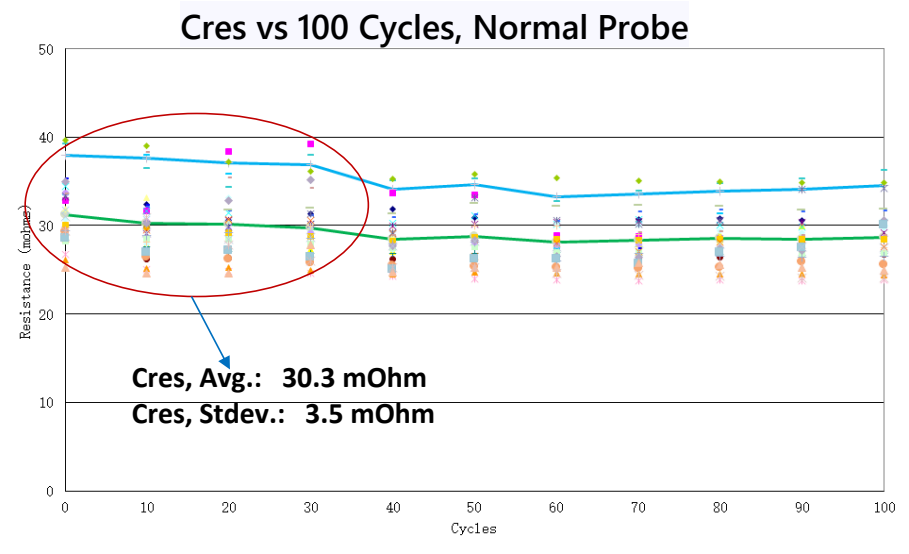
- Test Method & Discussions
  - Probe tested to measure electrical Contact Resistance (Cres) & force when compressing done.
  - Scrubbing probe has lower Cres at same force, especially at initial stage of compressions.

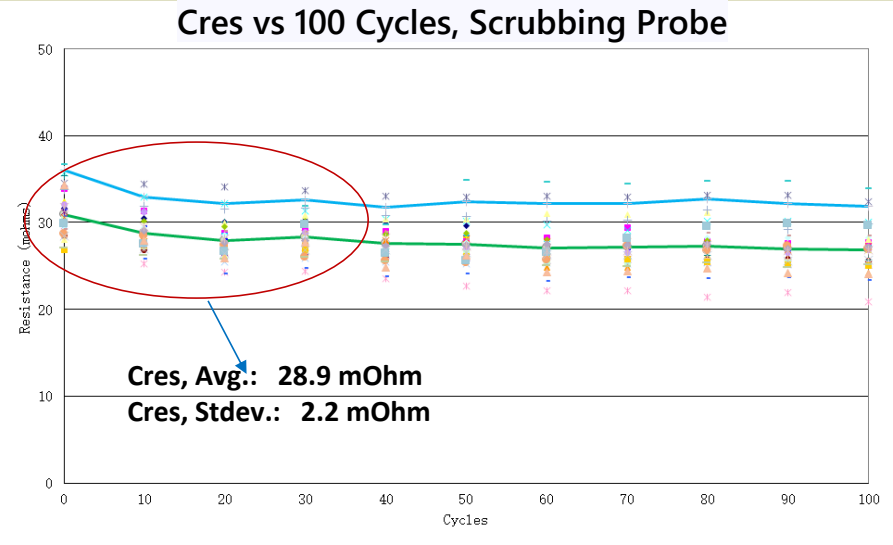




Comparison – Cres vs Cycles

- Test Method
  - Probe tested on cycling machine to measure Cres over number of cycles
  - Upper side contact pads, Ag plate

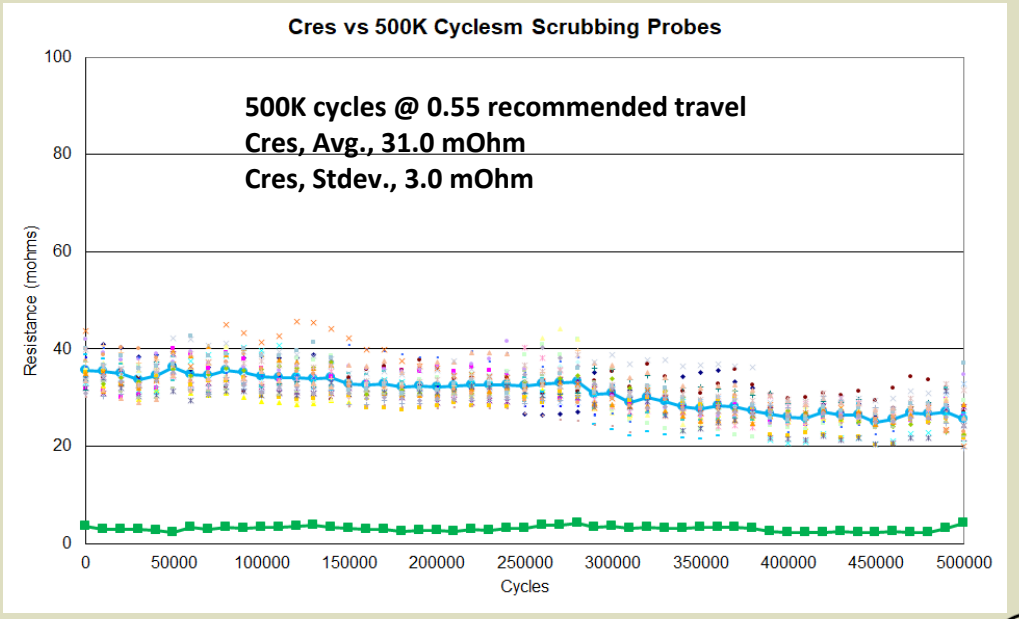




Performance – Cres vs 500K Cycles

- Test Method & Results Discussions
  - Probe tested on cycling machine to measure Cres over number of cycles
  - Upper side contact pads, Ag plate
  - Stable Cres over 500K

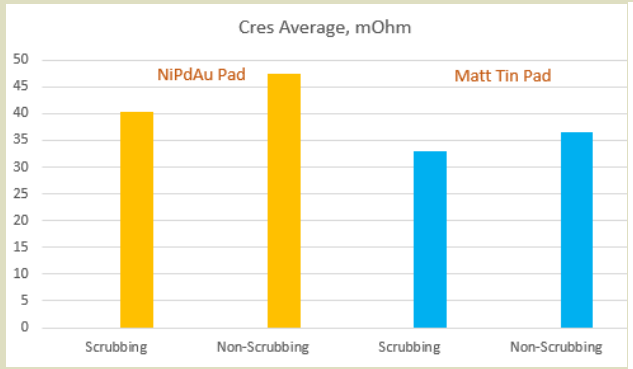
Cres	0	100K	200K	300K	400K	500K
Avg.	35.7	34.5	32.2	30.8	25.9	25.5
Stdev.	3.5	3.3	2.7	3.5	2.3	4.3

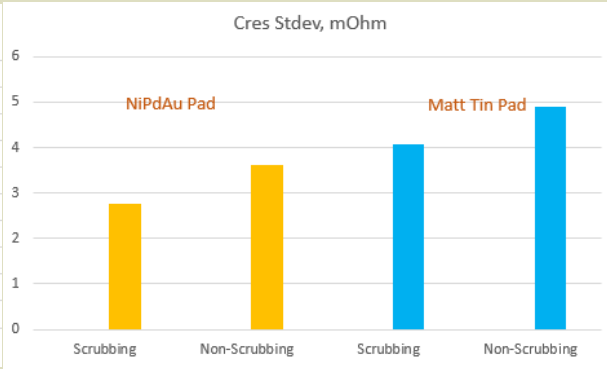


Cres Comparison – Scrubbing vs Normal Probes

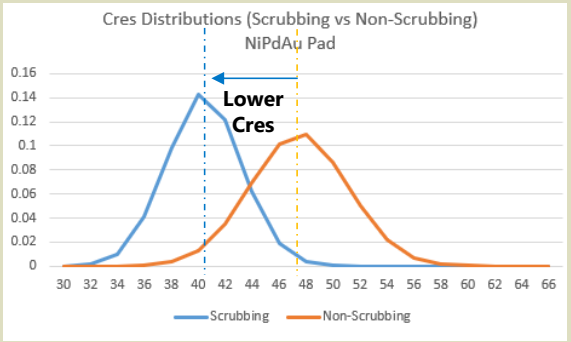
- Test Methods
  - Ni/Pd/Au contact pad
  - Matte Tin pad
- Test Results Summary
  - Scrubbing probes have better Cres, both lower Cres, Avg. and Cres, Stdev., than normal spring probes.
  - Cres distributions for both contact pads (NiPdAu, Matte Tin) show scrubbing probes have much less Cres diversity than normal probes

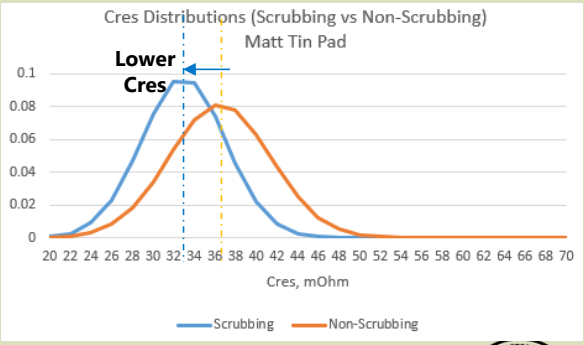
Cres, Avg. & Cres, Stdev.
Scrubbing Probe vs Normal Probe





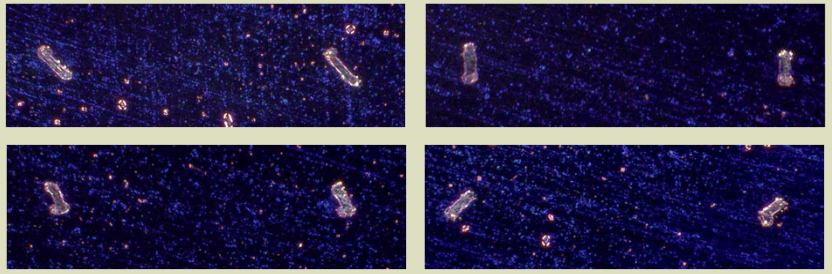
Cres Distributions
Scrubbing Probe vs Normal No-Scrubbing Probe



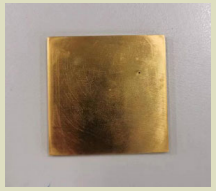


Performance – Scrubbing on Au Pads

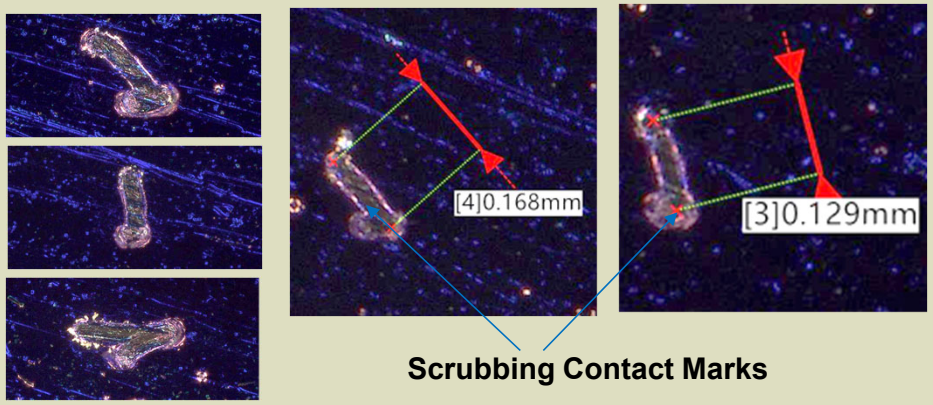
- Test Methods
  - Add blue ink layer on the Au plated contact unit surface
  - Compress contact unit once and measure scrubbing marks



- Test Results Summary
  - The scratch length 0.129~0.168mm (after 300K contacts in MTC cycling)



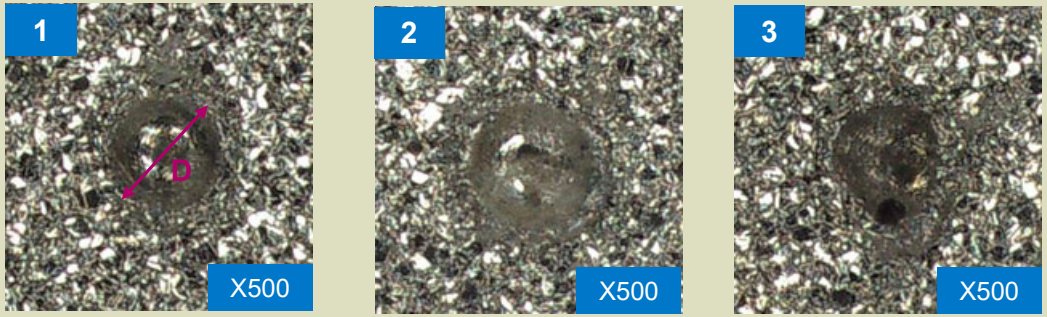
Gold Plated Plate for Tip Contact



Scrubbing Contact Marks

Performance – Scrubbing on Matte Tin Pads

- **Normal Spring Probe on Matte Tin**



- **Scrubbing Spring Probe on Matte Tin**

- Test Methods
  - Probe tested on Matte Pin pads
  - Compress 1k cycles
- Test Results Summary
  - Normal probes generate round contacts on pads
  - Scrubbing probe generate elliptic contacts on pads

Matte Tin Plate for Tip Contact

No.	Normal Probe (um)	Scrubbing Probe (um)	
	D	X	Y
1	52.7	60.6	73.5
2	59.6	62.6	85.6
3	49.0	70.7	93.4

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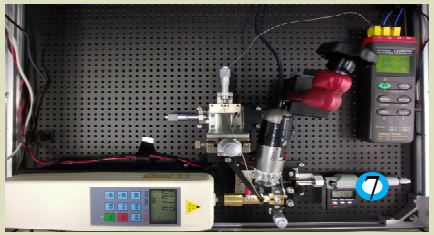
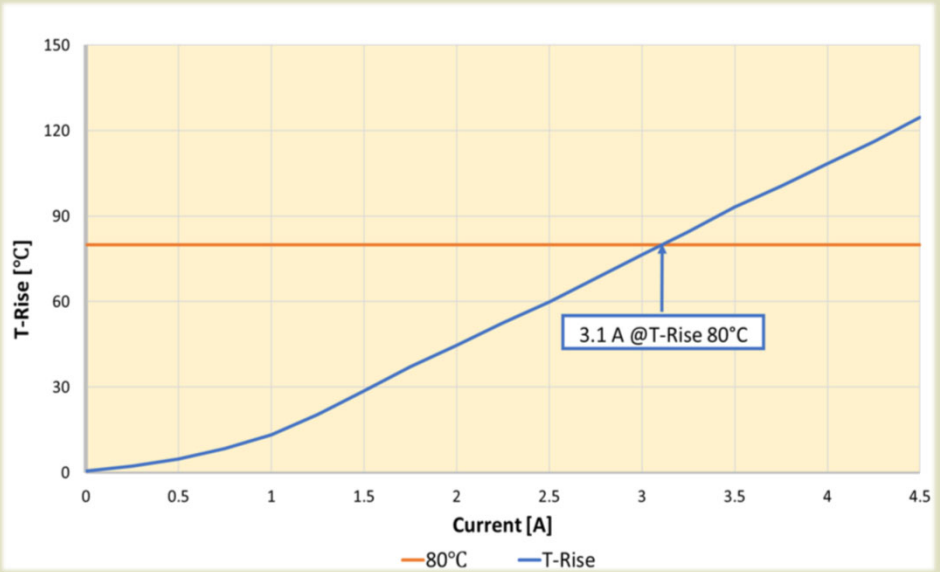
Performance – CCC

- Test Method & Results Discussions
  - Probe on Current Carrying Capacity (CCC) tester, current going through exposed single probe and measure probe temperature
  - Max current when probe temperature rise 80℃ as CCC spec.
  - Scrubbing probe has same CCC performance as normal probe in existing CCC measurement set up





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

Summary

- For more reliable contact and more consistent Cres, we have developed a new type of spring probe and socket (called Kepler technology, patent in process) with scrubbing functions on the package pads that can be used to test QFN, LGA, QFP or other types of similar packages.
- The special structure and contacts will generate X-Y movement in breaking though oxides and contamination, providing reliable contact to the device pad.
- Kepler socket is compatible with existing footprint for easy maintenance and reduced cost of ownership.
- Widely used for manual, bench and HVM (high volume manufacturing) testing.

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