Oren – Package Top Side Interposer for on Package Top Side Substrate Probing

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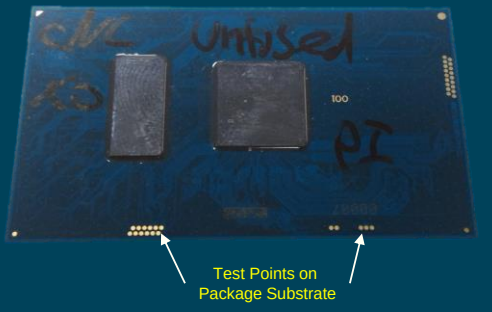
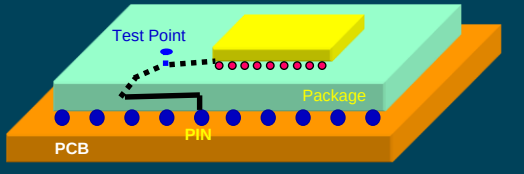
Problem Description

Typical on-package measurements require either expensive pogo-pin based top side probe solutions or complicated direct probing setups that include:

- Special probes (i.e. Keysight N5381A InfiniiMax II 12 GHz)
- Custom probe holder
- Cameras and special lighting
- Complicated socket retention
- Complicated and marginally effective thermal cooling solutions





Schematic representation of on package test points

Problem Description (cont'd)

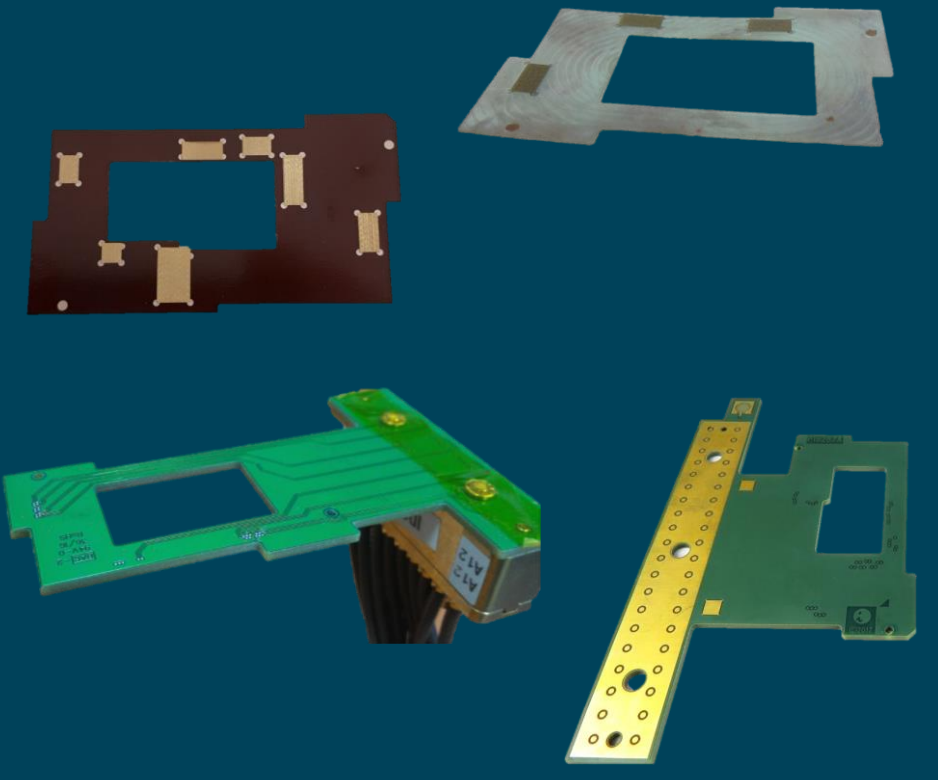
Other limitations of the direct probing:

- Up to 2 signals can be measured simultaneously
- Precise installation required
- Special employee training / skills
- Custom vibration-damping workstation (due to sensitivity to external physical disturbances)

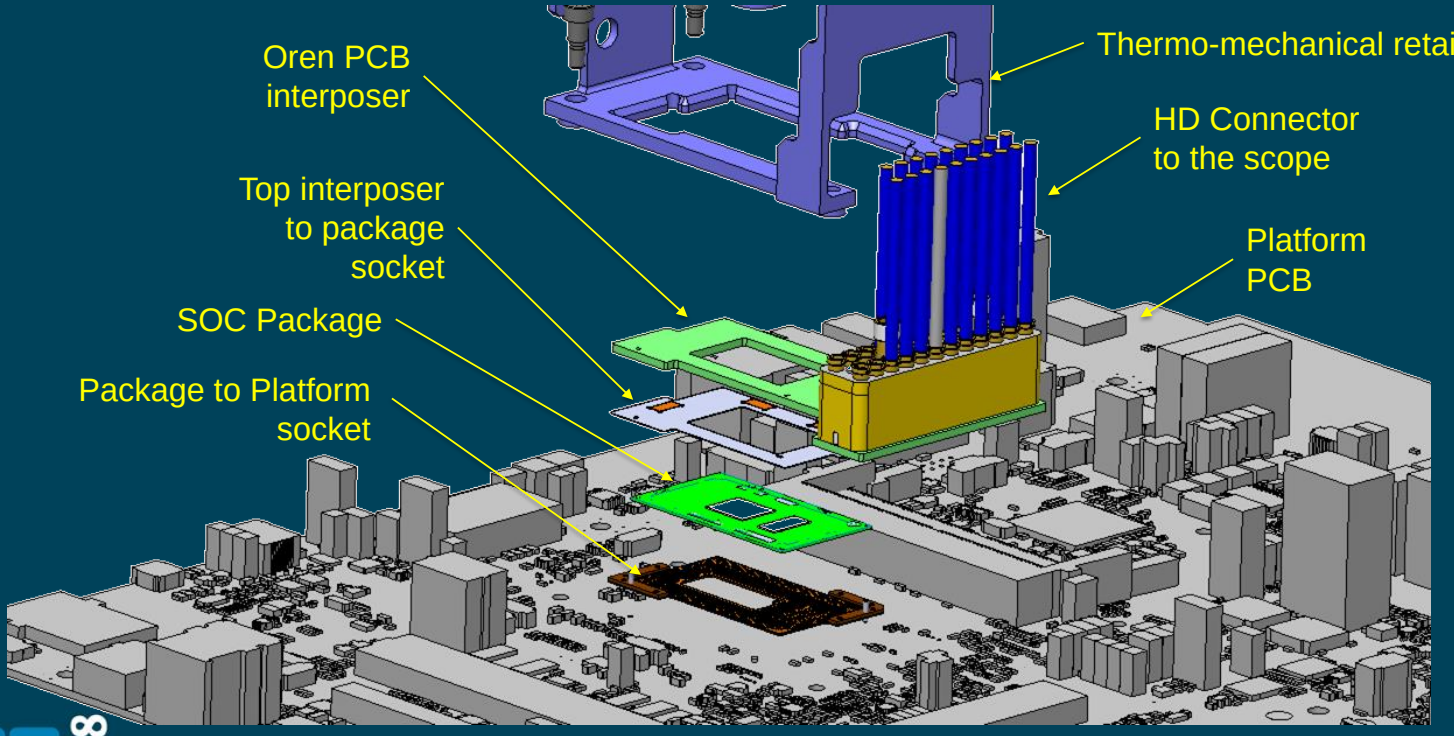
All of this makes a converged and consistent mode of work difficult to achieve.

Oren Benefits

- Low cost versatile solution for BGA package test probing of signals on socketed and soldered down packages
- Cost effective at low quantities, which follows with low numbers required at electrical validation phase
- No requirement to purchase a mold
- Not pad pattern dependent

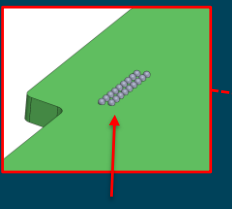


Oren System Introduction

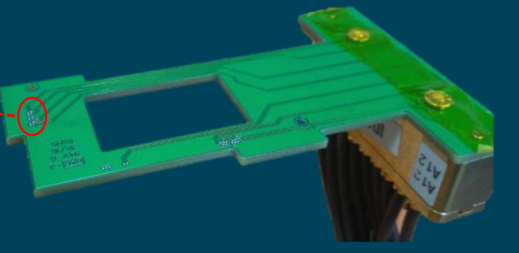


Oren Interconnects

- Ironwood socket uses Shin Etsu MT-T-4X-type material, 0.25mm thick
  - Numerous conductive micro needles embedded in elastomer substrate.
  - The minimal pitch of the wires is 0.05x0.050 mm. It is not the same in x and y direction.
  - The size of the PCB pad depends on the pitch.
  - The finish could be gold or solder.
  - Can be cut to size of the interconnect area
  - No requirement for custom match to footprint



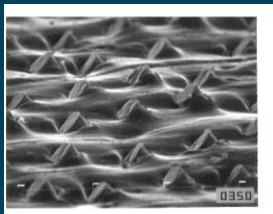
Solder bumps



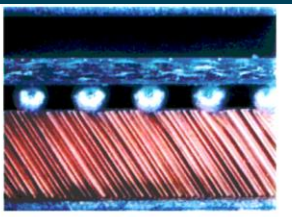
Oren Interposer (view from bottom)

Top interposer-to-package socket:
Elastomer guide (in white)
Shin Etsu Interconnect (in brown)

Shin Etsu Interconnect Sheet Highlights



Protruded wire from elastomer



BGA compressed on Elastomer

Wire marks on BGA

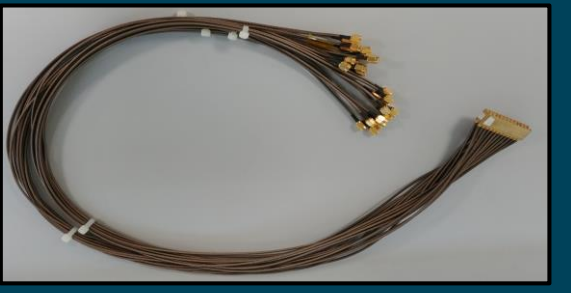
Features	Benefits
Short contact	High bandwidth applications
Gold plated Brass wire	Low contact resistance
Small socket footprint	Easy to place inductors, capacitors, resistors, etc for tuning and increasing bandwidth. Ideal for IC prototype and system testing and field upgradeable system designs
High resilient elastomer	Compression cycles in thousands
Optimized contact force	Reliable connection without damage to device or board

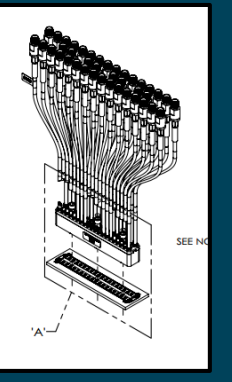
PCB design considerations

- Ground vias scattered around the board
  - Improve ground connection and referencing
- 50 Ohm impedance
  - Keep IL (Insertion Loss) low as possible at speeds above 1 Ghz
- 100 Ohm differential pair loosely coupled
- All GND reference planes connected to Samtec connector GND pads
- Provide two exposed GND pads on the top layer of the PCB to solder ground wires
- PCB alignment holes = 1.5mm diameter

Signal Measurements

- Analog signals up to 100 MHz
- PCB supports bandwidth at least 1 GHz
- HD Cable from Samtec is coaxial, each signal is covered in ground in order to preserve signal integrity and avoid signal interferences
- The signal (signal + ground) are connected through Keysight N5381A InfiniiMax II 12 GHz to the scope
- Getting ~17 signals
- SMP cables and connectors can be used instead of large 24 signal cable

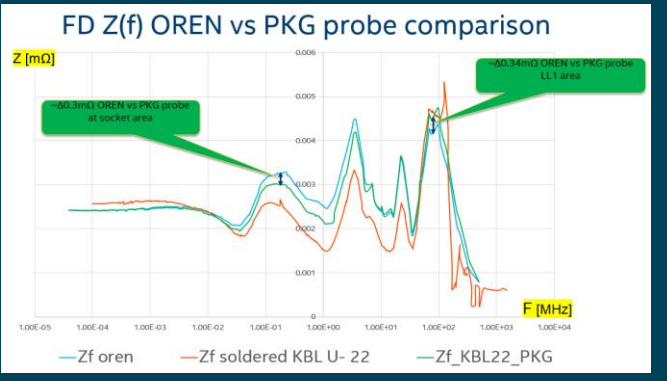




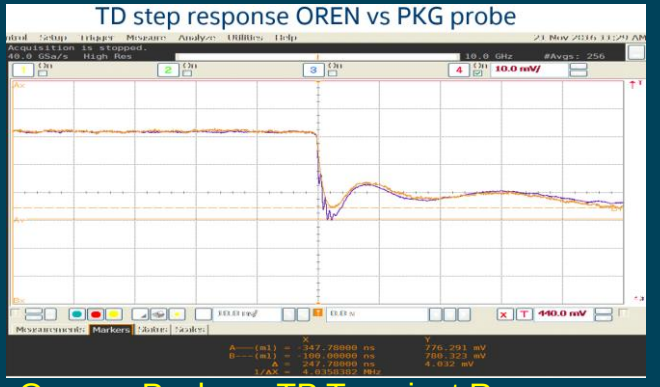
OREN →  → Scope

Results

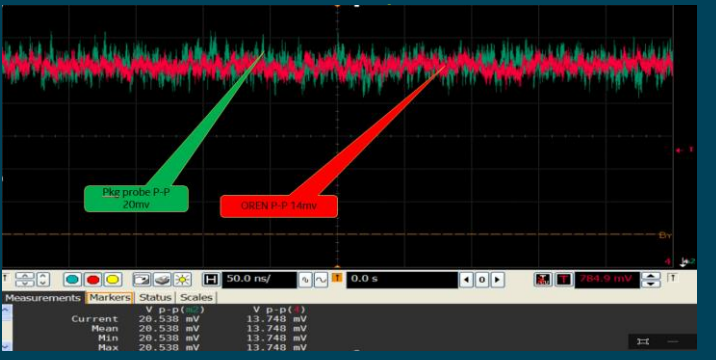
- Proof of Concept version has been successfully enabled in Electrical Validation Power Integrity lab.
- There is a good correlation of time and frequency domain between Oren Top side Interposer and package direct test point probing.



Oren vs Package TP Frequency



Oren vs Package TP Transient Response



Oren vs Package TP DC Offset Measurements

Images of Oren in Action!