

Upgrade Week COLUTA ADC

Update on Test Socket Progress

Michael Himmelsbach
On behalf of the COLUTA team

Upgrade Week
November 16th, 2022

Overview

- COLUTA ADC had successful FDR on Oct. 7th.
 - Proceeding with submission of pre-production/engineering run with no design changes.
 - Production testing of COLUTA will occur half at UT Austin and half at Université Paris-Saclay.
 - Lar Week (Oct. 2022) update regarding production testing preparations at Saclay: <https://indico.cern.ch/event/1204002/#5-test-setup-for-production-ad>
- Production testing preparations for UT Austin:
 - Production test socket;
 - Testboard layout;
 - BGA design review;
 - QR reader for robotic test stand.
- COLUTA Performance Testing Update.

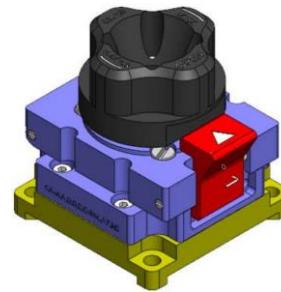
Production Testing Preparations

Production Test Socket – Requirements for Sockets

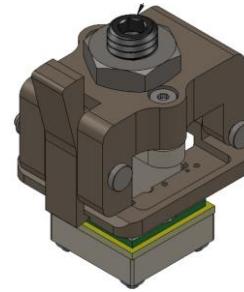
- Critical to have backside components *near as possible* to ASIC.
 - Depending on socket design and backplate:
 - capacitors may only be placed > 1 cm away from contact.
 - capacitors allowed directly beneath solder ball contact (strongly preferred).
- To route COLUTA BGA test board, we require PCB footprint size for pogo pin ≤ 0.425 mm.
- Simplicity to integrate with robotic test stand.
 - Zero insertion force/open top type sockets are most straightforward to integrate since we do not need separate pneumatic socketing system.
- Nice to have: socket footprint can also be used for soldered down chip.
 - Same PCB can be used with socket (for mass testing) or with soldered down chip (for precision tests).

Production Test Socket – Overview of Candidate Sockets

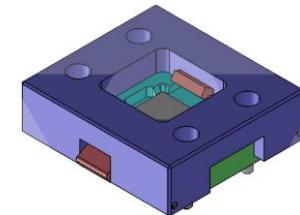
Knight Auto



Ironwood



VA Innovation



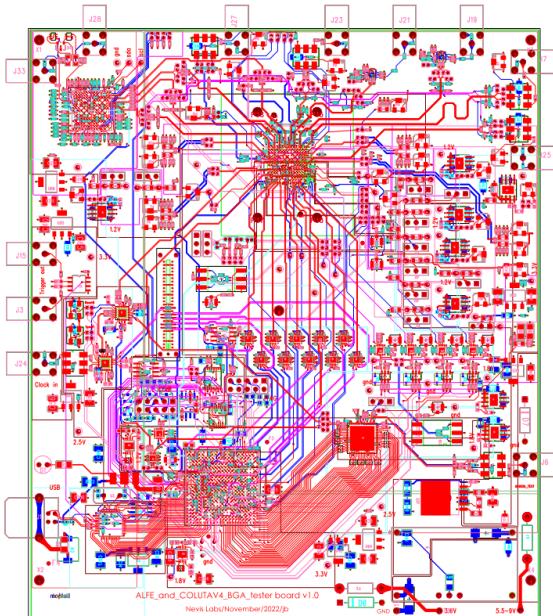
Backside components	✗ only outside keep out zones	✗ only outside of keep out zones	✓ directly beneath contact
Footprint size for pogo pin	✓ \varnothing 0.40 mm	✓ \varnothing 0.425 mm	✓ \varnothing 0.40 to 0.50 mm
Actuation/socketing mechanism	✗ compress chip in socket with pneumatic piston	✗ compress chip in socket with pneumatic piston	✓ depress top plate to open, zero insertion force required to socket

Production Test Socket

- 2 of 3 socket vendors were contacted.
 - No US distributors listed on Knight Auto's website.
 - Contacted manufacturer directly and awaiting response.
- Prices of all 3 sockets were roughly comparable (within 3x).
 - VAI was least expensive.
- Reasonable lead time on sockets investigated:
 - VAI 3 weeks;
 - Ironwood 4 weeks.
- Decision was made to proceed with VAI.

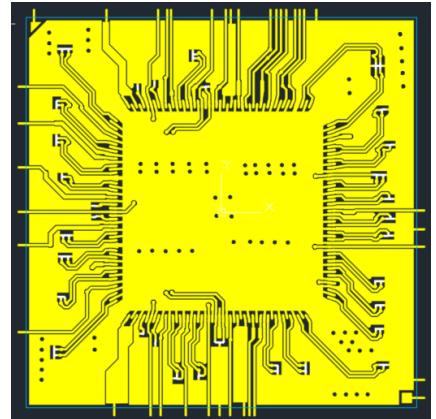
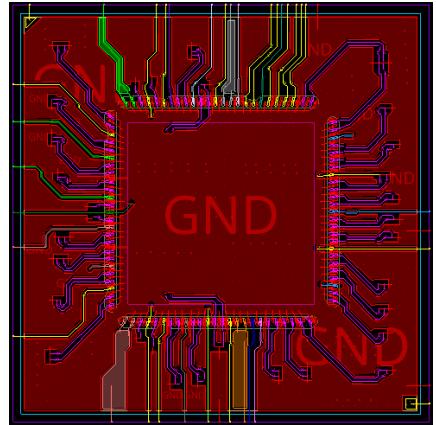
BGA Testboard Layout

- Production testboard designed for BGA packaged ASICs.
 - Builds on previous testboard designs.
 - Includes soldered down ALFE2 in BGA.
 - Integration tests possible before FEB2 prototype is fabricated.
 - Layout now includes VAI socket footprint.
- Ready to be fabricated when BGA packaging schedule is confirmed.
- Firmware & software will be based on previous versions (already have most of the needed functionality).



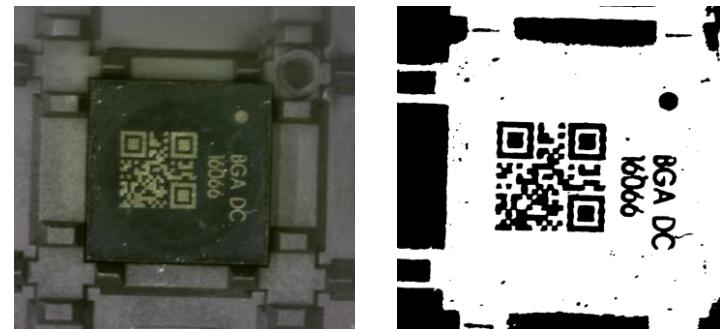
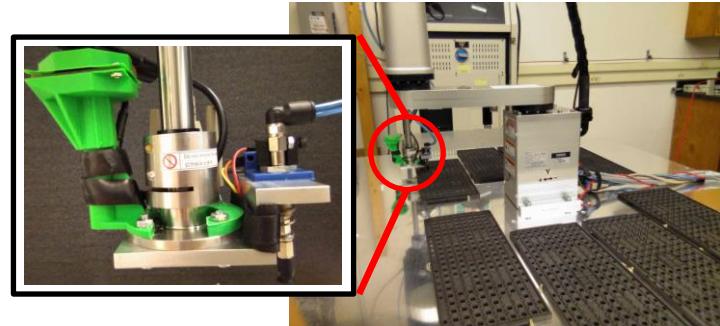
BGA Design Review

- JCET (packager) designed interposer for BGA and COLUTA team is reviewing the design.
- Design file (.mcm) did not indicate all production processes.
 - Etch back zones shown in separate design file (.dwg).
 - Review verified differential pairs will not be shorted after etch back production processes.
- Additional review of design in progress.
 - Netlist check, ballout and bondpad positions, etc.



QR Reader for Robotic Test Stand

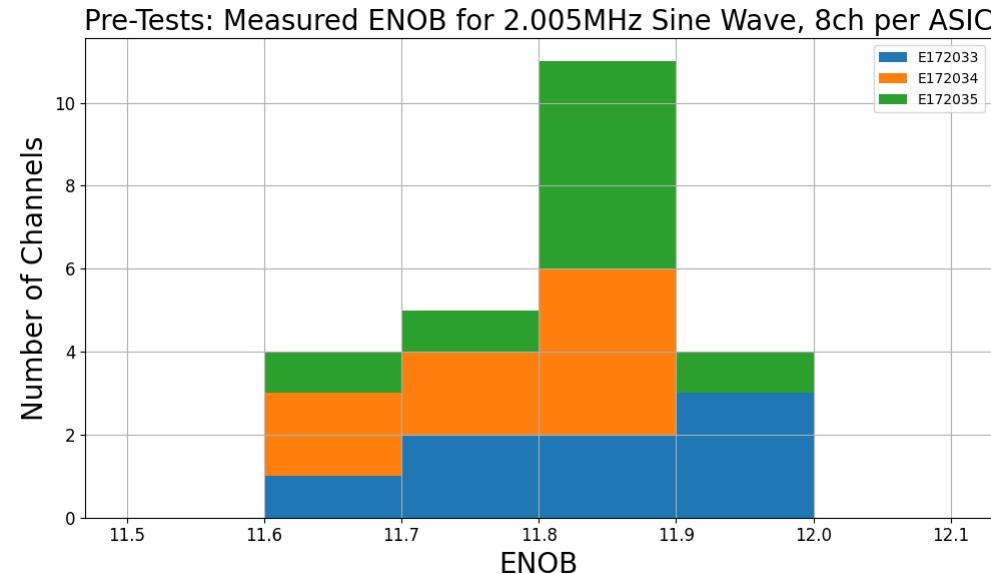
- Camera for reading QR code integrated into end of arm.
 - Custom holder designed and 3D printed.
 - Software written to position camera above chips, acquire pictures and decode QR codes.
- Verification tests are ongoing.
 - Pick and place followed by photographing and decoding of QR code.



COLUTA Performance Testing Update

CV4 Performance Uniformity

- We received comments from FDR that only a few ASIC channels and chips were evaluated in depth.
- Performance of CV4 tested with pure 2 MHz sine wave and ENOB extracted.
- 8 channels from 3 different ASICs show excellent uniform performance (ENOB).



Closing Remarks

- Successful FDR for COLUTA ADC on Oct 7th .
 - Proceeding with pre-production with no design changes from CV4.
- Preparation for mass QC testing in progress at Austin and in coordination with Saclay.
- Selection of a production test socket.
 - VA Innovation socket has been selected
- Testboard for BGA packaged ASICs has been laid out with test socket.
- BGA packaging is progressing.
 - COLUTA team in process of validating the design.
- Setup of robotic test stand at Austin in advanced stages of development.
 - QR reader integrated.
- COLUTAv4 ASICs show excellent uniform performance across all 8 channels.

BACKUP