COLUTA ADC Developments

Test Socket Progress

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On behalf of the COLUTA team

LAr Week
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Overview

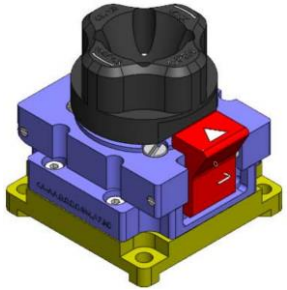
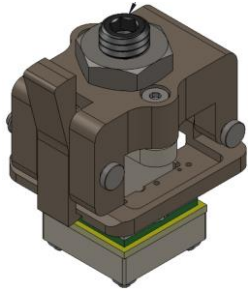
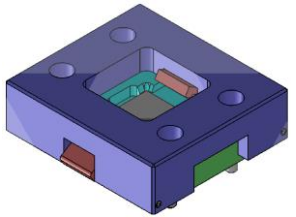
- COLUTA ADC had successful FDR on Oct. 7th.
  - Proceeding with submission of pre-production/engineering run with no design changes.
  - Production testing of COLUTA will occur half at UT Austin and half at Université Paris-Saclay.
    - COLUTA mass production testbench: https://indico.cern.ch/event/1225290/#7-coluta-mass-production-testb
- 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

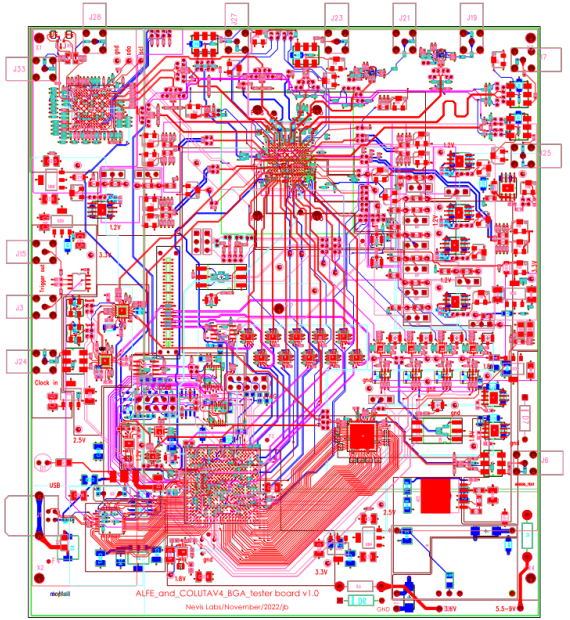
	Knight Auto	Ironwood	VA Innovation
			
Backside components	✗ only outside keep out zones	✗ only outside of keep out zones	✓ directly beneath contact
Footprint size for pogo pin	✓ ⌀ 0.40 mm	✓ ⌀ 0.425 mm	✓ ⌀ 0.40 to 0.50 mm
Actuation/socketing mechanism	✗ compress chip in socket with pneumatic piston	✗ 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
  - PO issued for 4 sockets in late Nov.

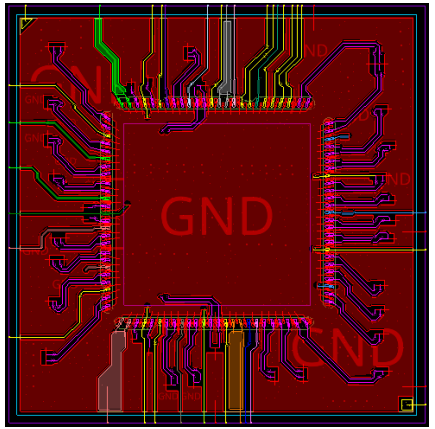
BGA Testboard Layout

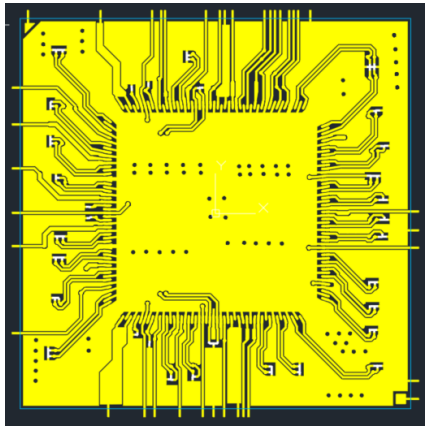
- Production testboard designed for BGA packaged ASICs.
  - Builds on previous testboard designs.
  - Includes soldered down ALFE2 in BGA.
    - Integration tests possible before FEB2 prototype is fabricated.
  - Layout now includes VAI socket footprint.
- Ready to be fabricated when BGA packaging schedule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



BGA Design Review

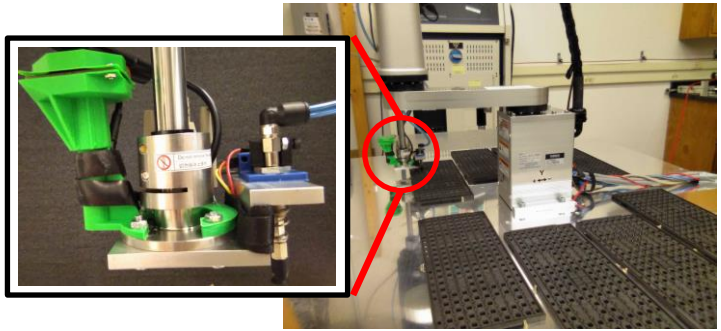
- JCET (packager) designed interposer for BGA and COLUTA team reviewed the design.
- Design file (.mcm) did not indicate all production processes.
  - Etch back zones shown in separate design file (.dwg).
    - Review verified differential pairs will not be shorted after etch back production processes.
- Additional design review to verify netlist, ballout, and bondpad positions, etc. was completed.

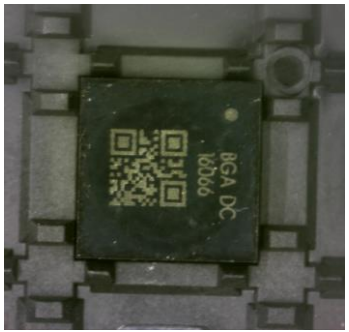




QR Reader for Robotic Test Stand

- Camera for reading QR code integrated into end of arm.
  - Custom camera holder was 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.
- To verify the contrast and quality of markings on packaged ASICs, we have requested sample QR codes from packager.

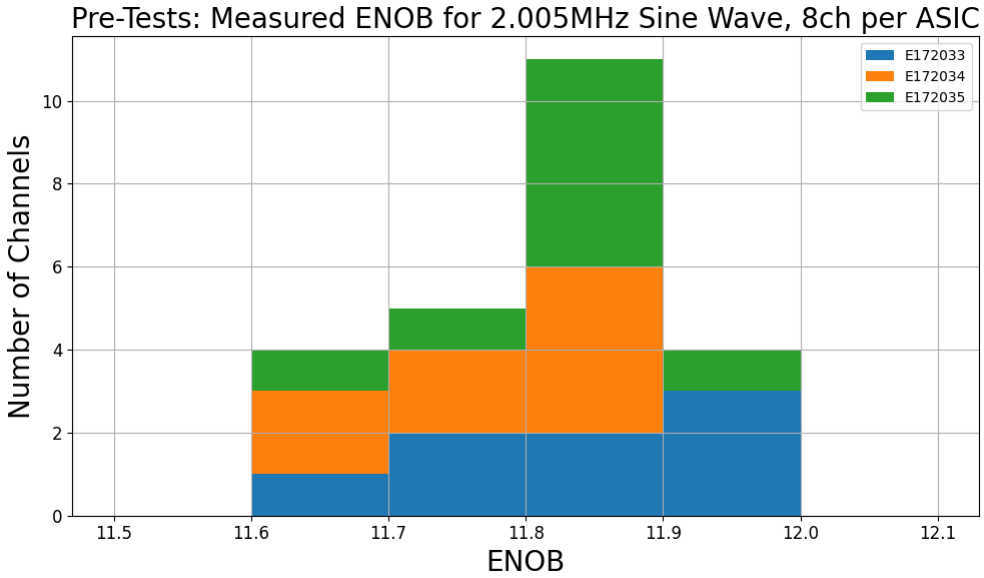




COLUTA Performance Testing Update

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 sockets have been ordered.
- Testboard for BGA packaged ASICs has been laid out with test socket.
- BGA packaging is progressing.
  - COLUTA team has validated 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