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Bump Bonding Status

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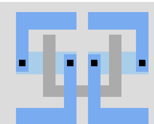
2nd International Workshop on DEPFET detectors and applications

Ringberg Castle

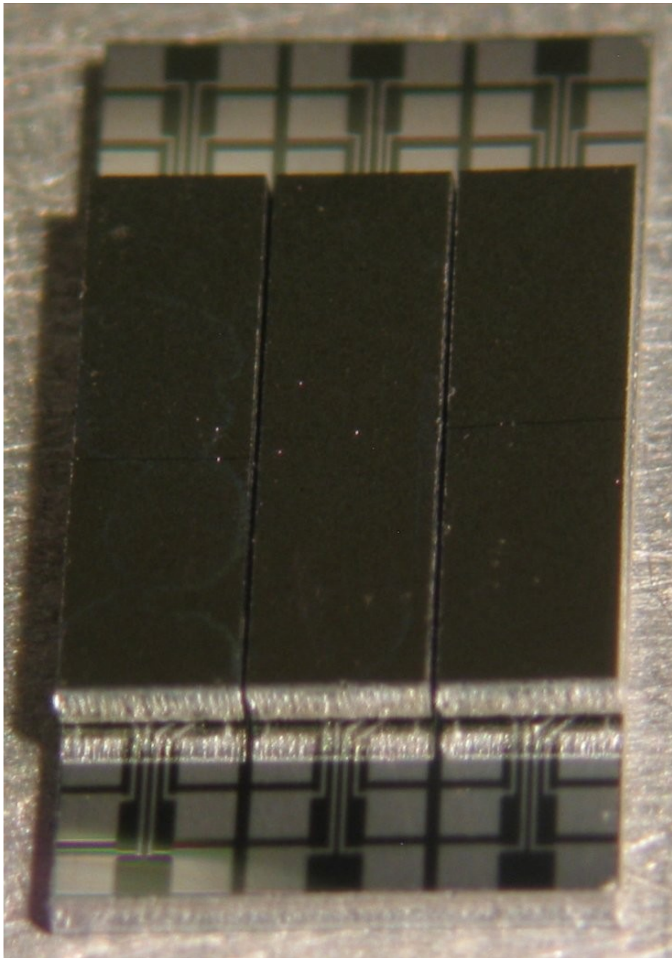
03. - 06.05.2009

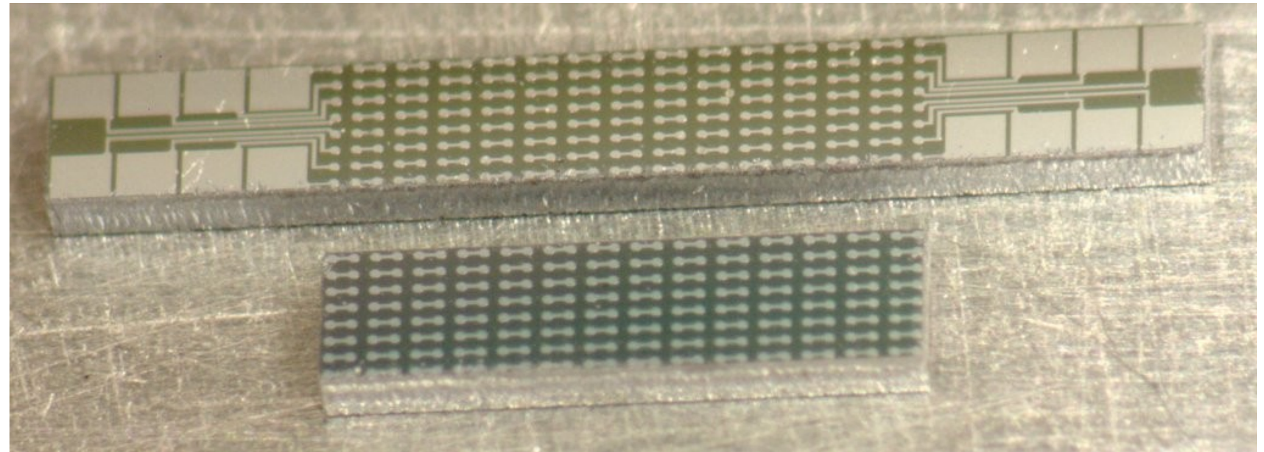
Content

- find minimum flip-chip force for gold in gold flipping
- destruction tests on PXD5 bumping teststructures
- destruction tests on UMC018 bumping teststructures
- preparations for evaluating solderball jetting



- Dummy chips made in DEPFET technology
  - only 1 metal layer





DCD dummy chip and substrate
224 pads

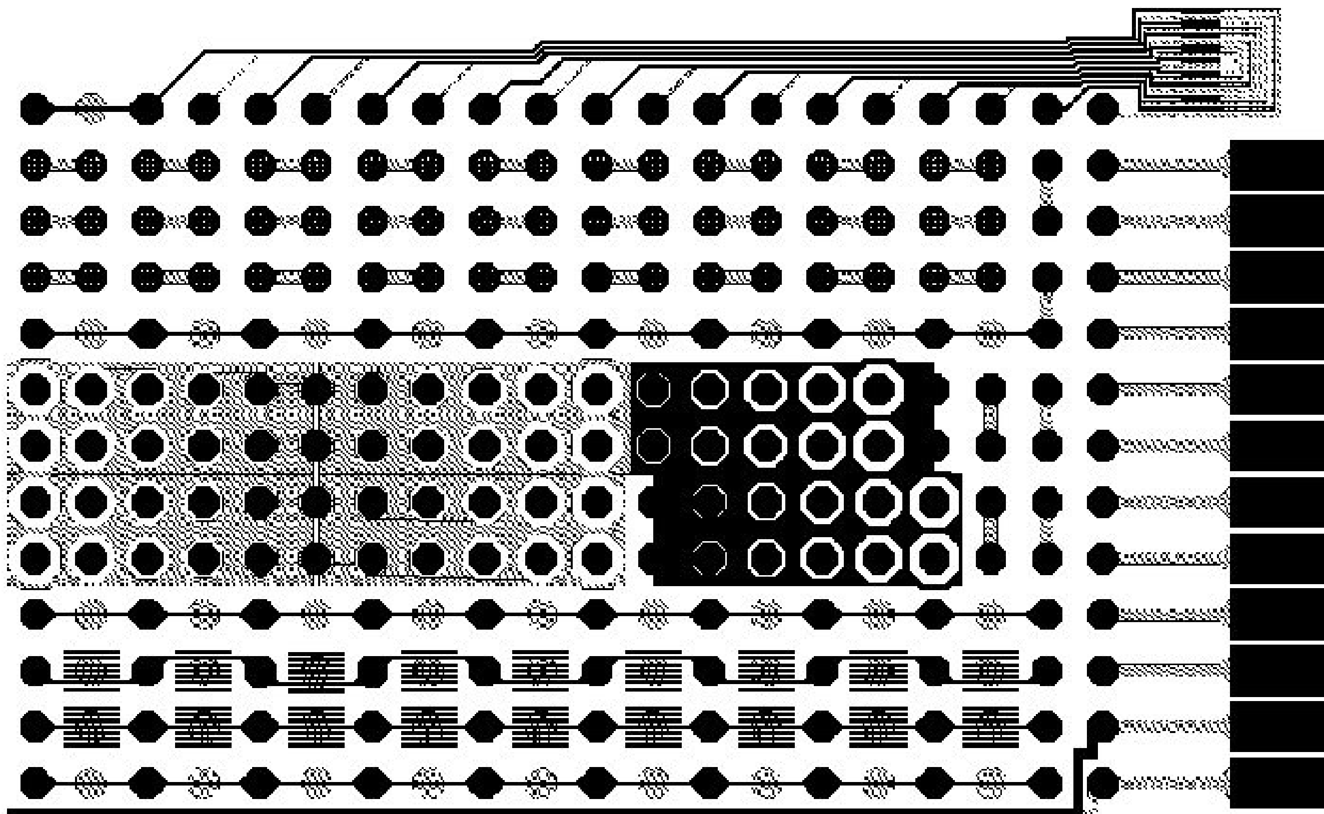
tripple dummy substrate and chips

Bump Bonding Force Tests

- check how low flipchip force can be
  - 20 singles and 10 tripples flipped
  - “double bump”: bumps on chip and substrate
- single dummies:
  - 20g/bump
    - chip moves slightly sidewards when bump-tails are touching
    - 1 of 180 snakes not connected
      - ok with 110gr/bump → bumpheight not uniform
  - 9g/bump coining + 20g/bump flipping
    - less chip movement
- tripple dummies:
  - flip-chip head larger then chip → all 3 chips pushed at once
    - need to increase force with every chip to ensure 20g/bumps (5kg, 10kg, 15kg)
    - Ineed chip-size head to get single dummy results
    - laser-cut chip edges not flat → some chips didn't fit

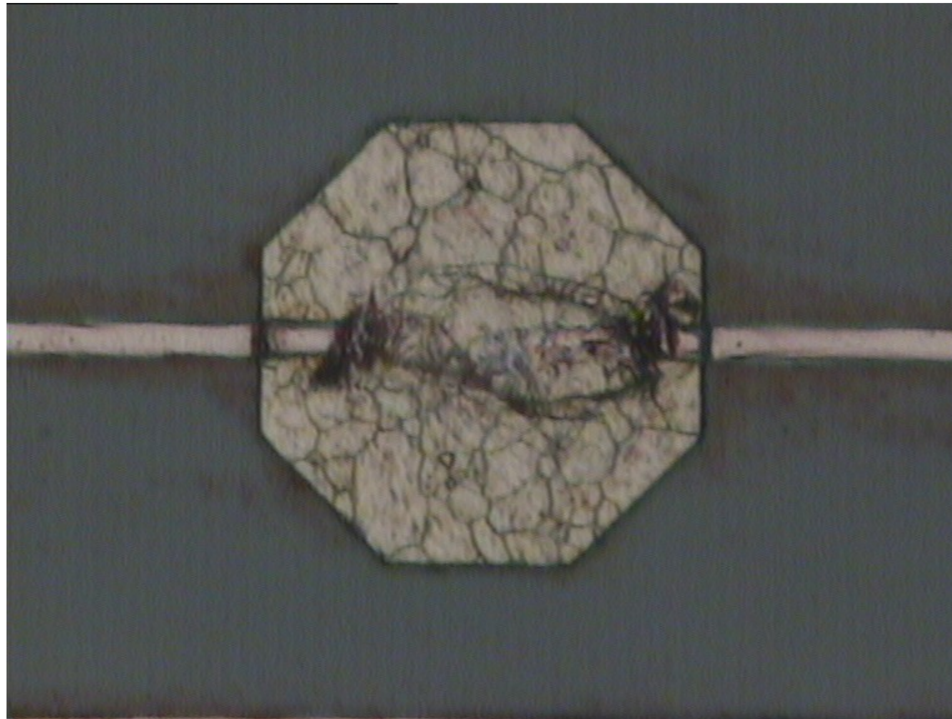
PXD5 Bumping Test Structures

- 6 test structures from PXD5 with 2 metal layer
  - test shorts between metal2 pad and metal1
  - 7µm trace, 60µm pad, 110µm pitch
- measured resistance before and after bumping



PXD5 Bumping Test Structures – Single Trace

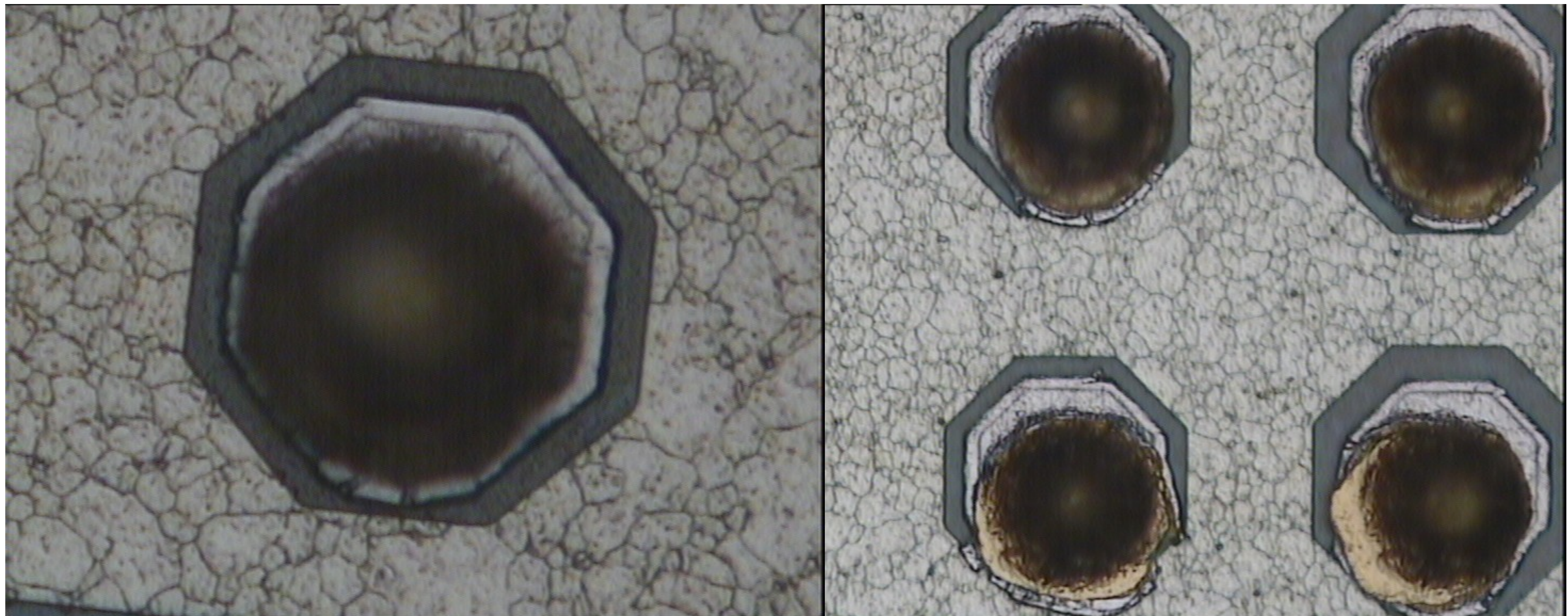
- Bumping on pads with a single trace was hardly possible
  - bonded bumps created shorts between trace and bump
  - removed bumps also removed trace
- Pads with multiple traces and 2 layered pads were bondable
- → metal layers in stream-out, stream-in procedure switched???
  - the trace should be below the pad according to Manuel's description



Pad after unsuccessful bumping

PXD5 Bumping Test Structures – Clearance

- bonding force while placing the bump squashes pad

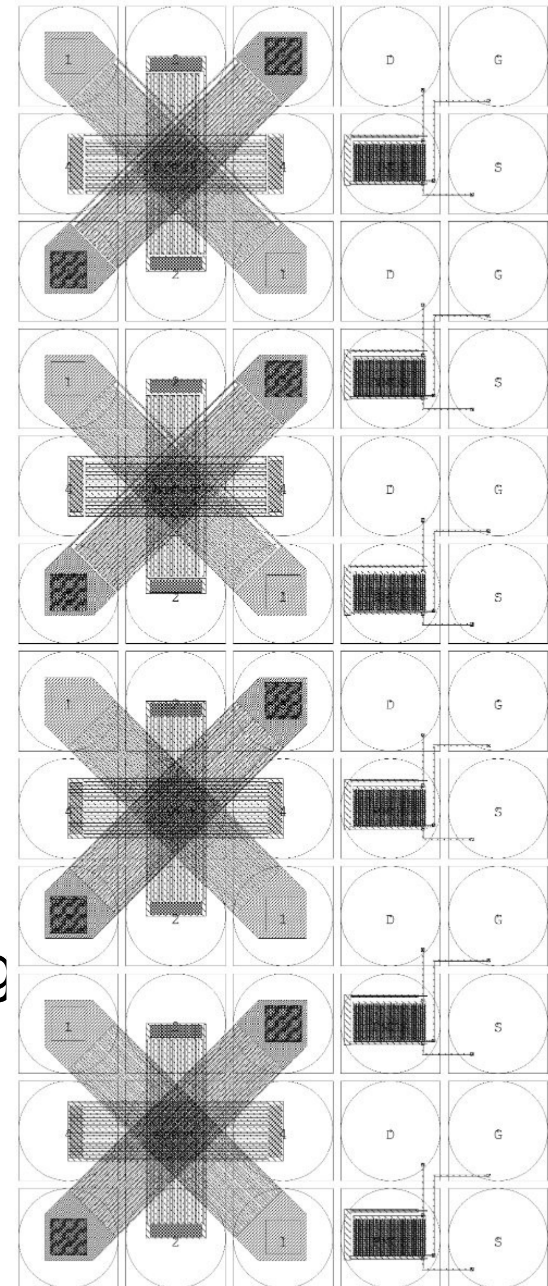


low power bonding; 4µm gap

high power bonding; 4µm + 8µm gap

UMC018 Bump Teststructures

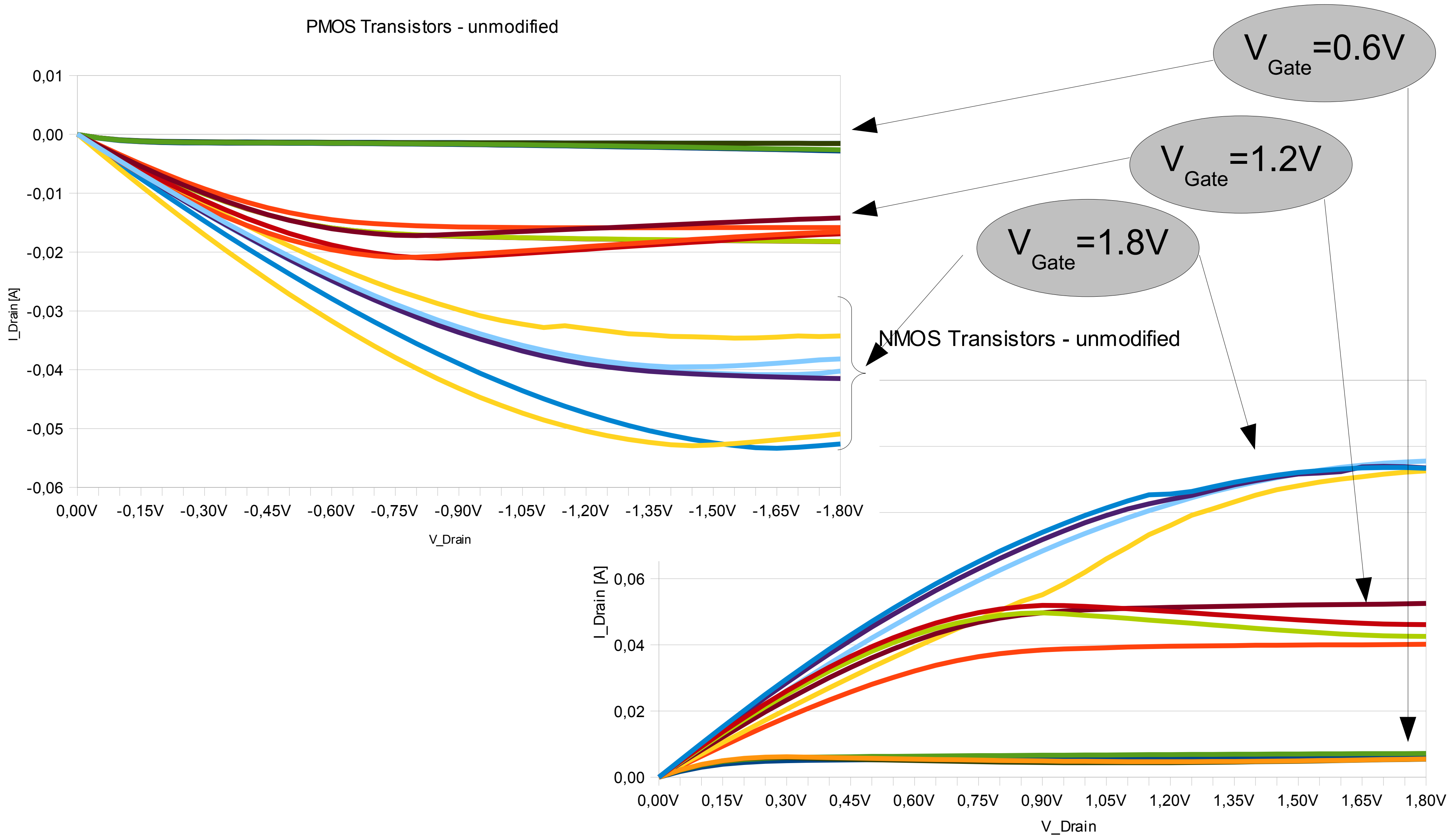
- 4 teststructures per chip
  - 2x poly - metal3 short test (parallel traces)
  - 2x poly - metal3 break test (snake struktures)
  - 1µm width
- 6 transistors
  - 3x NMOS and 3x PMOS transistors
  - l=400nm, w=800µm
- metal crossings and transistors under pad
  - metal4 - metal6 used for pad
  - 65µm pad diameter
- measured resistance and characterized transistors before and after bumping and flipping
  - flipping simulated with glas plate



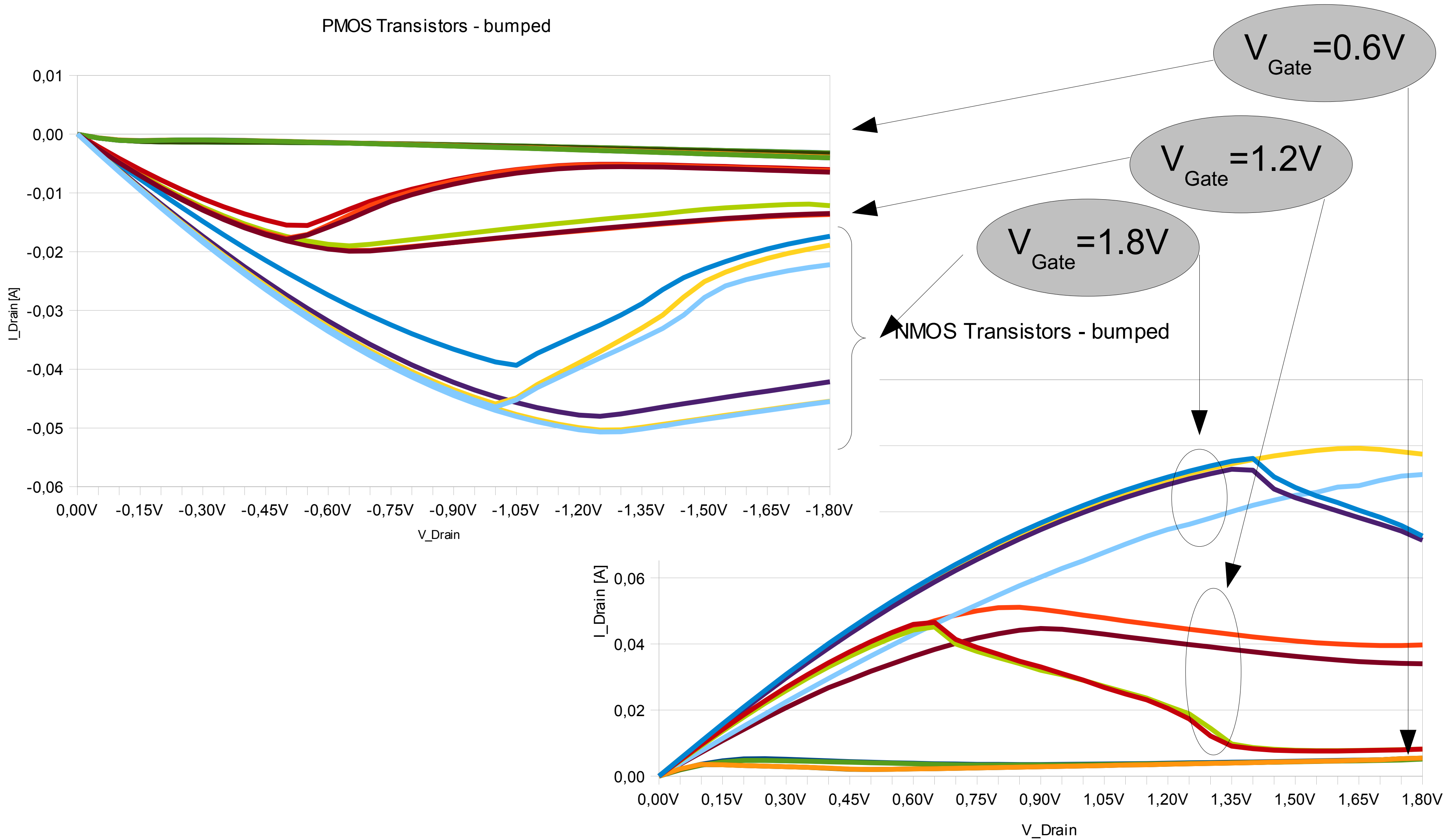
UMC018 Bump Teststructures

- no problems bumping on metal4 – metal6 pads
- no resistivity changes or shorts measured in layers poly – metal3

- 3x NMOS and 3x PMOS of 2 chips before bumping

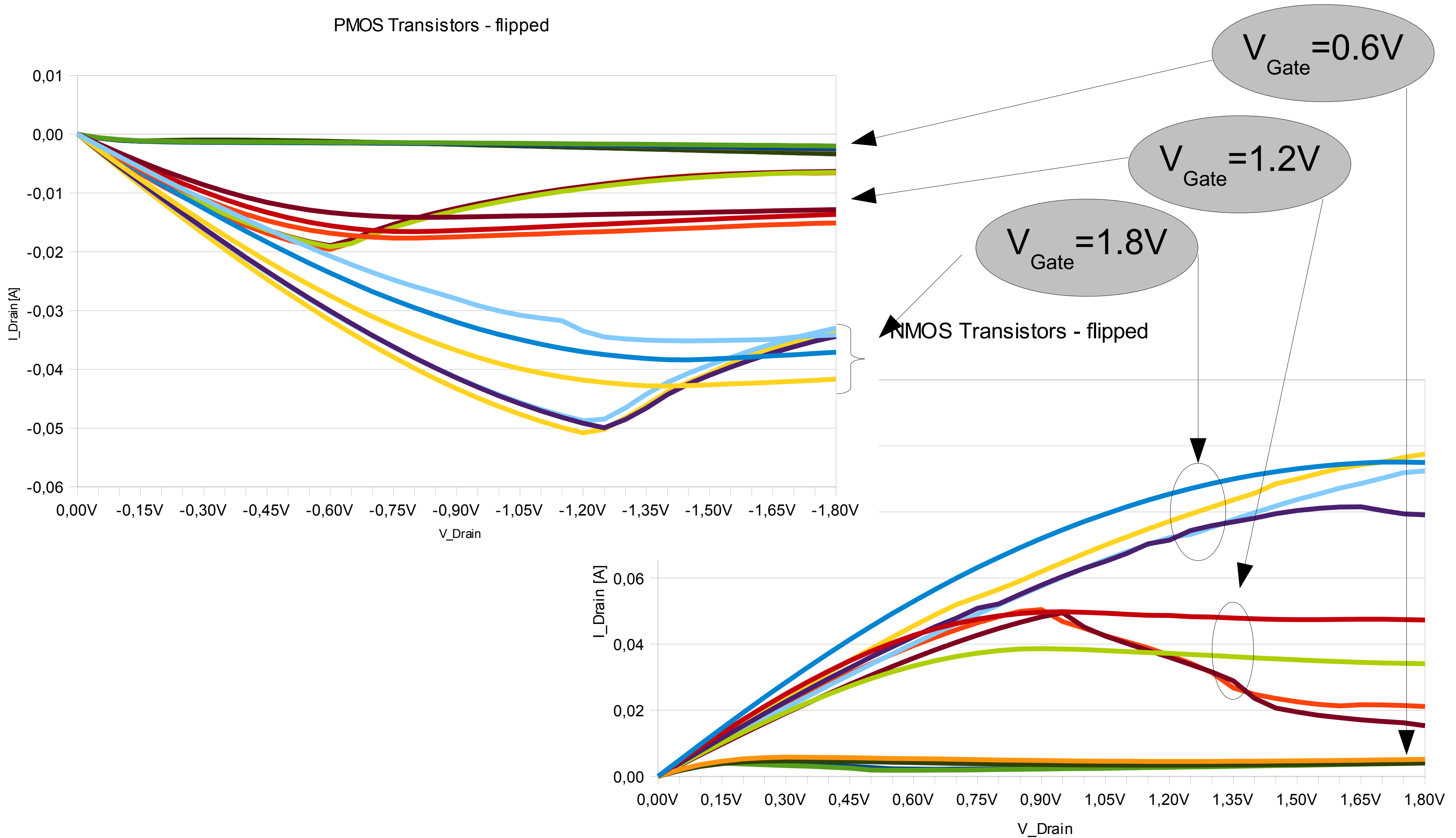


- Transistors after bumping



UMC018 Bump Teststructures

- Transistors after flipping

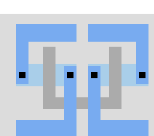


Force Tests for coining bumps

- coined bumps needed as UBM for jetting solderballs
  - 60µm flat
- 40g/bump coining
  - 40µm diameter of flat area
  - 70µm bump diameter
  - 20µm height
- 130g/bump coining
  - 60µm diameter of flat area
  - 70µm bump diameter
  - 10µm height

Solderball Jetting

- have sent some DCD dummies to PacTec for jetting solderballs
  - ~20 chips, singles and tripples
  - bumped and coined
- try soldering chips
- try rework of chips
  - Au bump with SnAg ball might be hard to rework
  - Pd bump with PbSn ball better → test Pd-bumping



Conclusion

- flipping Au-bumps with 20g/bump possible
- PXD5 bumping teststructures
  - trace below pad could not be tested
  - 6μm gap between 60μm pad and trace
- UMC018 teststuctures
  - no effects on poly up to metal3
  - transistors change
- solderball jetting
  - coining of bumps for UBM with 130g/bump
  - waiting for return of balled dummies

Thank you!