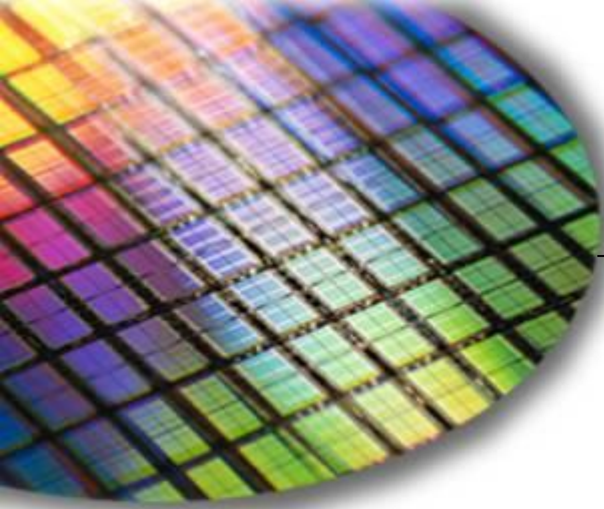


The World Leader in High Performance Signal Processing Solutions

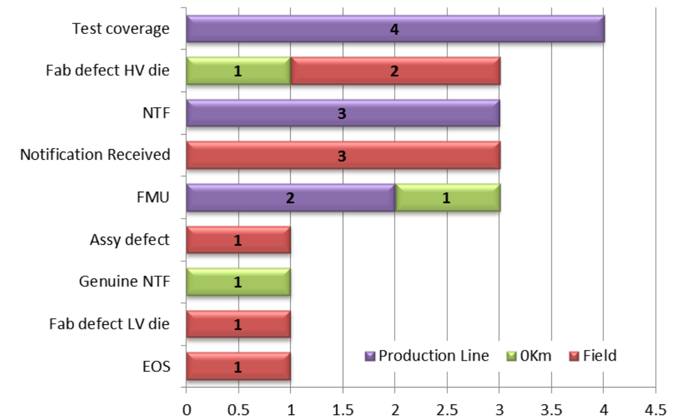
Corrective Action to address FOX defects / DELPHI

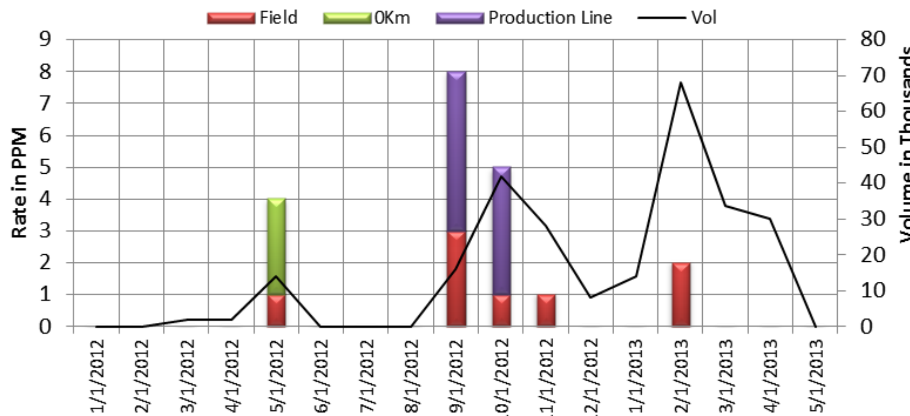
Minor Change: Layout Change to Mitigate Risk from Defects in Bond Pads.

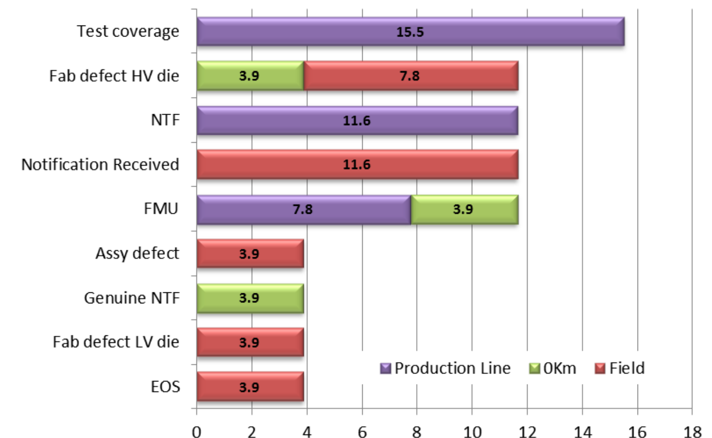
ANALOG DEVICES

Delphi AD7280A Returns by ADI Month of Assembly (Date Code)

- Delphi total Returns: 20
- All returns are prior to Containments and Corrective actions



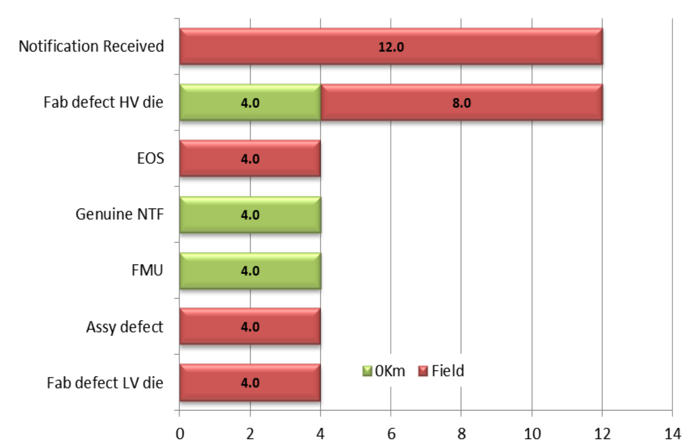


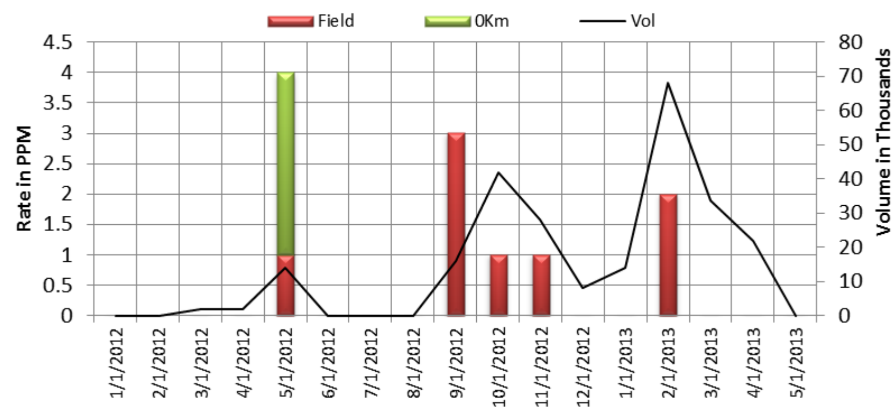


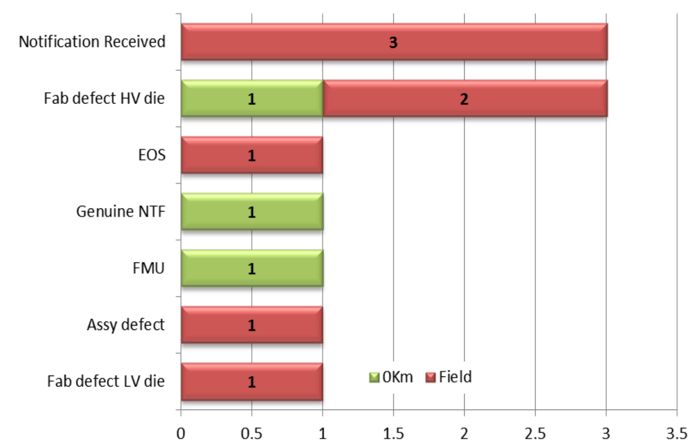
ANALOG DEVICES

Delphi / Ford AD7280A Returns by ADI Month of Assembly (Date Code)

- Delphi / Ford total Returns: 11
- All returns are prior to Containments and Corrective actions

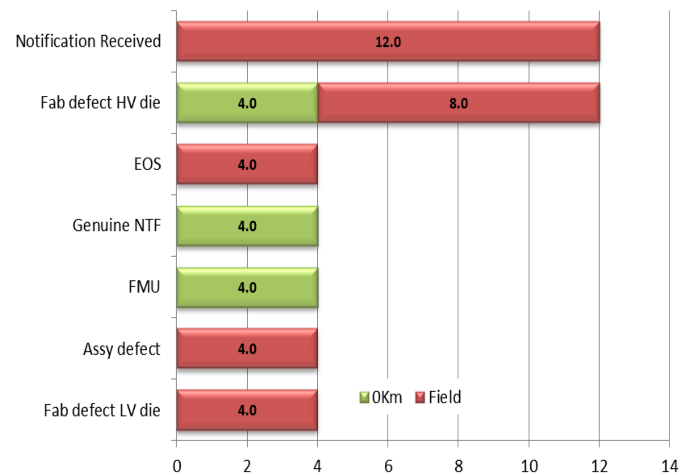


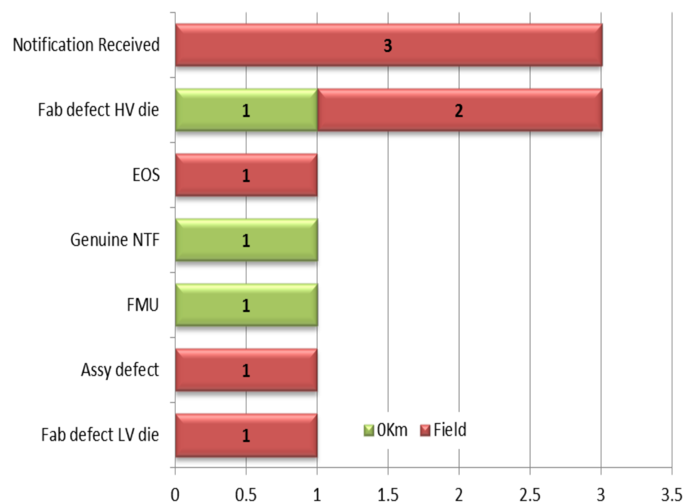




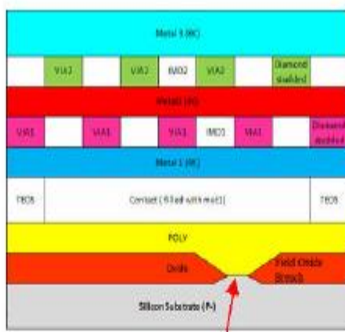
ANALOG DEVICES

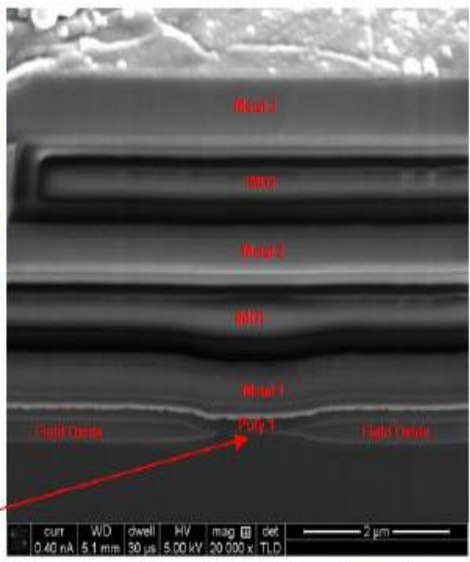
Focus: HV Die (FOX) defect (at 8th July)





Bond Pad Defect

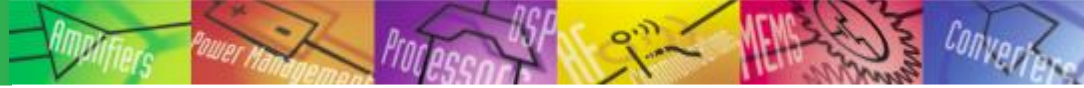




FIB X section & Sem of anomaly under pad

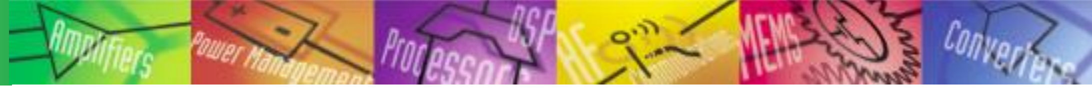
DELPHI/FA125020

ANALOG DEVICES



Modify Masks to increase TOX in Defect Location.

- This involves a single mask change.
- The change would apply to the area under the bond pad only .
- No changes to the circuit operation → a low risk change.
- The change would increase the normal oxide thickness under the bond pad from ~2800ang to ~3700ang.
- This change would increase the oxide thickness in the extra active defect site to ~820 ang.
- This oxide breakdown would be > 70 v and would not wear-out with 30v applied.



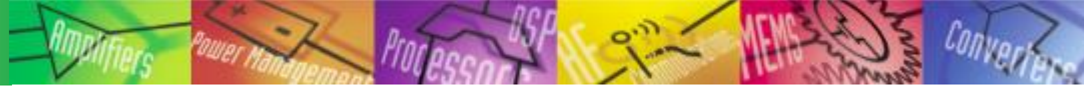
Why this addresses 100% of F-Ox failures

- We expect this change to fix 100% of the field oxide failures as the thicker oxide will not wear out with 30v stress.

- In order to prove this we have generated a test mask.

  - This creates a defect under the bond pad i.e. a mask with openings in field oxide.
  - Wafers will then be split between control and the new mask which thickens oxide in the defect site.

- This will allow us to prove/confirm that the issue is fixed with the new TGATE mask.



Earliest Implementation Timeline

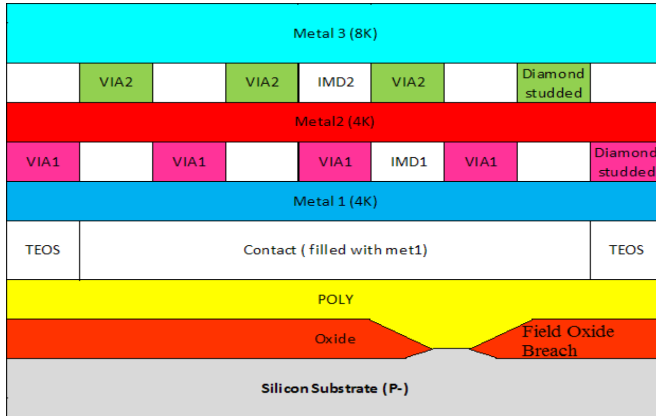
- Wafer Fabrication Change Review Board – 3rd July .
  - This will determine qualification requirements.
- First wafers to Probe - 17th July.
- CRB Final approval - 24th July.
- All wafers through TGATE mask stage after this would have new mask. This means wafers started into Fab from start of July '13 would have this change.
- Estimate of Earliest Cut Over Date: Changed material through to Finished Goods ~ 27th October 2013

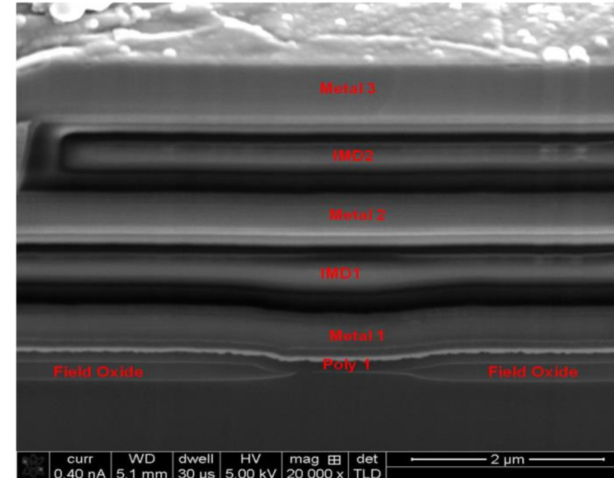
ANALOG DEVICES

Total Stack height for Bond Pad = ~61kA. Increase of <1k is within normal variation.

Layer									Thickness
Passivation									9KÅ
Metal 3 (8K)									9.5KÅ
	VIA2		VIA2	IMD2	VIA2		Diamond studded		11KÅ
Metal2 (4K)									7KÅ
VIA1		VIA1		VIA1	IMD1	VIA1		Diamond studded	11KÅ
Metal 1 (4K)									7KÅ
TEOS	Contact (filled with met1)							TEOS	1KÅ
POLY									3KÅ
Oxide									2.8KÅ
Silicon Substrate (P-)									

FOX Defect Formation





Defect Formation

If a particle lands on the nitride it can block the removal of the layer. This leaves a small piece of nitride in an area which should be clear

Bond pad defect in this area

- Defect at this stage would lead to the bond pad defect shown previously

- Field oxidation has a very specific sloped profile down to the gate region

Wafers then undergo multiple oxide growths and strip stages which remove both the nitride defect and the oxide under it and grow instead a thin oxide of 135ang in this region.

ANALOG DEVICES

Defect Formation

Thin oxide grows in defect region

Poly deposition creates a thin oxide capacitor.

TGATE Mask Change Proposal.

- ADI addressing root cause of occurrence via defect mitigation, error proofing .
- This involves an ability to ensure that tox. in the defect area is > 800 ang. vs. 135 ang. minimum currently .
- The change would apply to area under the bond pad only.

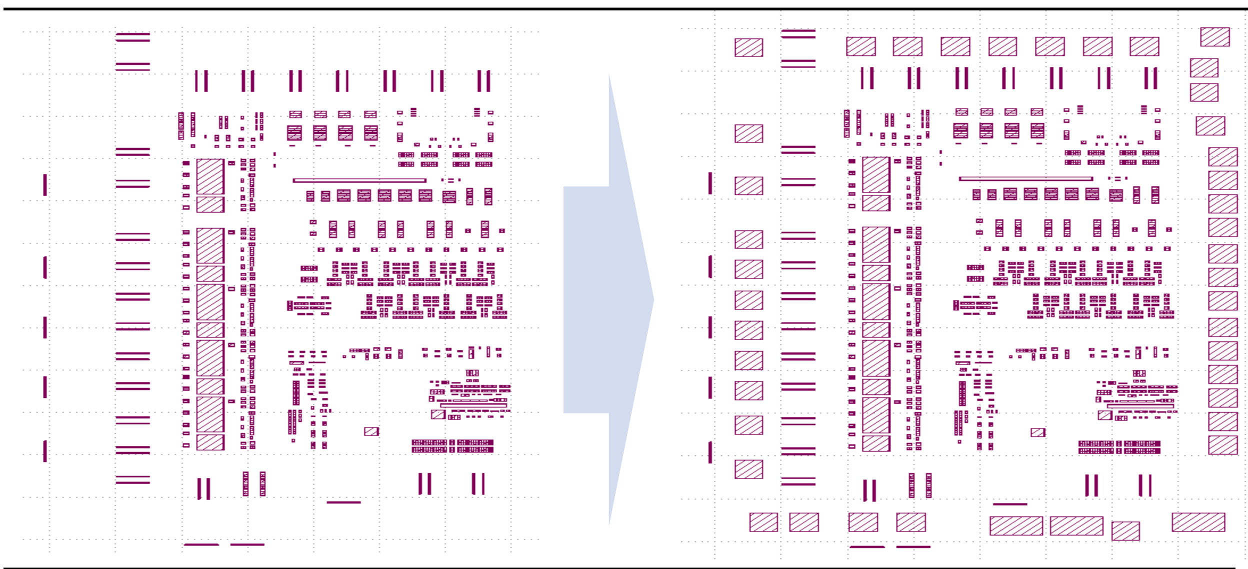
TGATE Mask Change

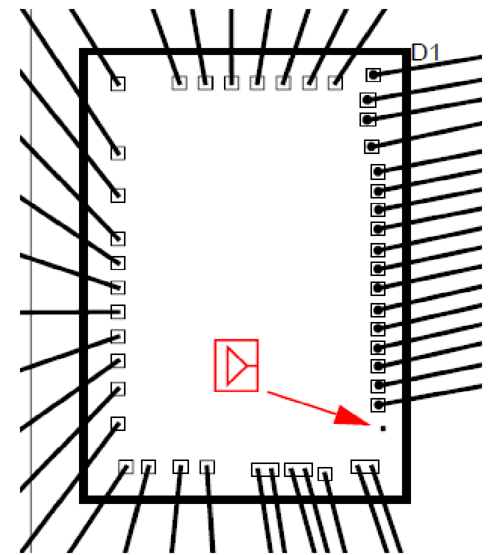
TGATE mask defines areas of thick gate oxide for high voltage devices on the process. The proposal involves changing this mask to include the bond pad areas without making any other in circuit changes.

'Before'

'After'

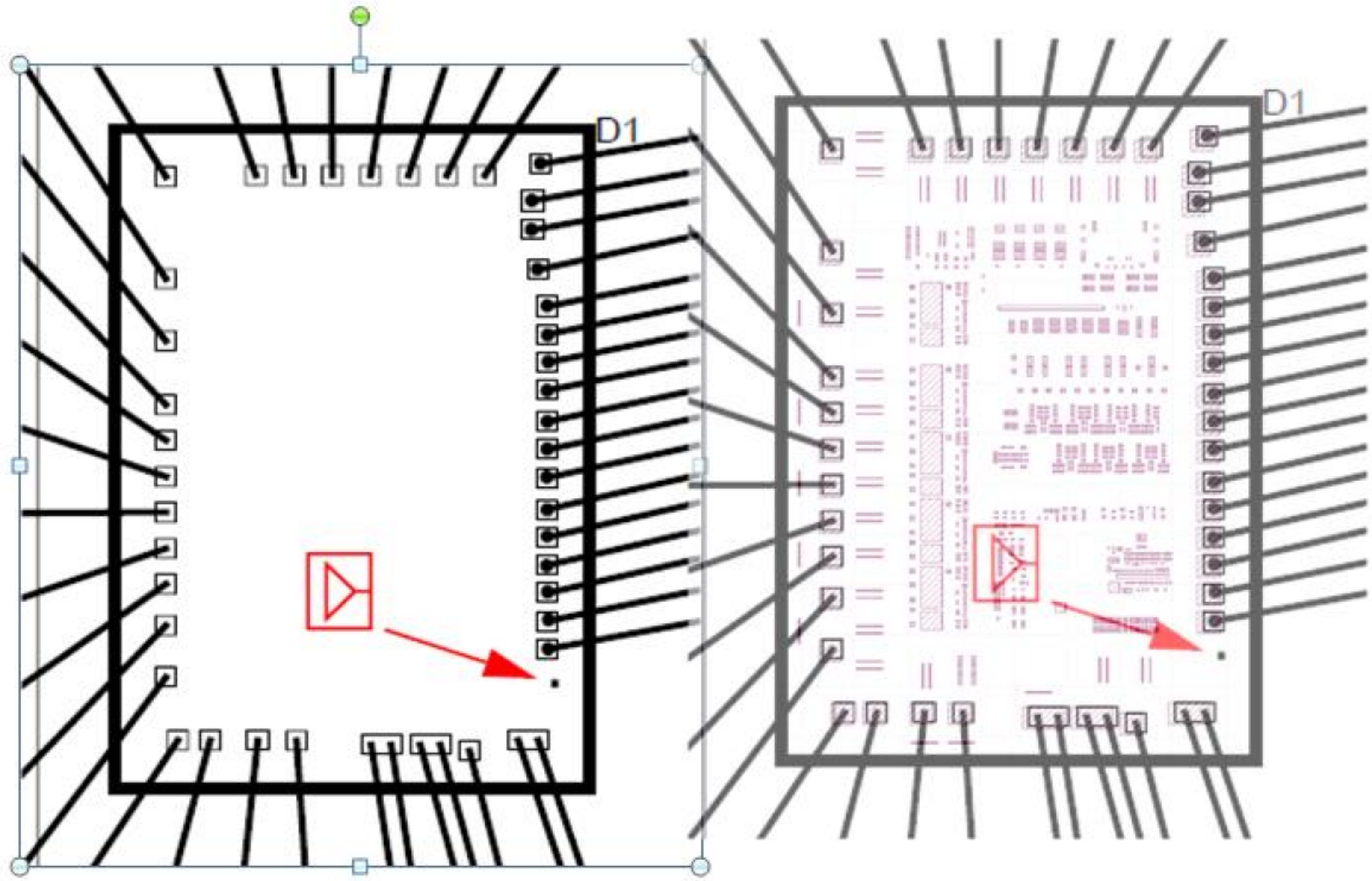
Reference
Bond Pad Layout





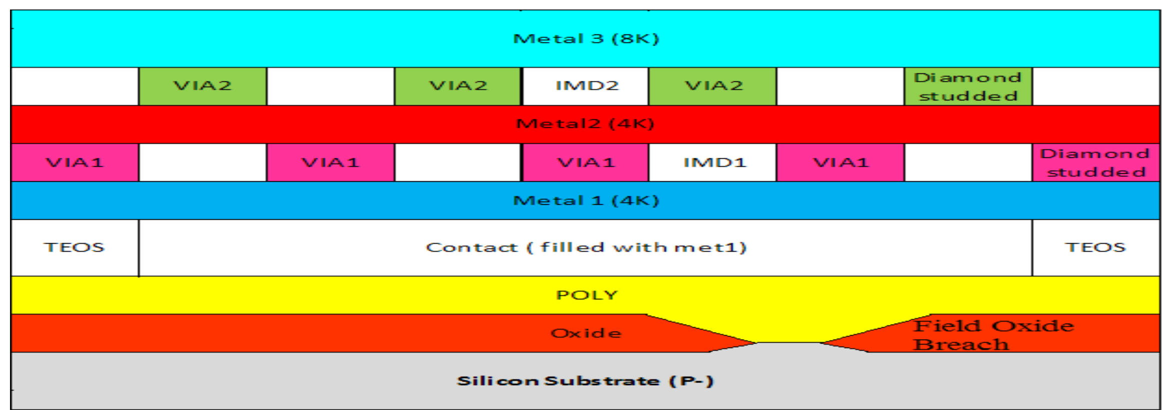
ANALOG DEVICES

Bond diagram overlay ……



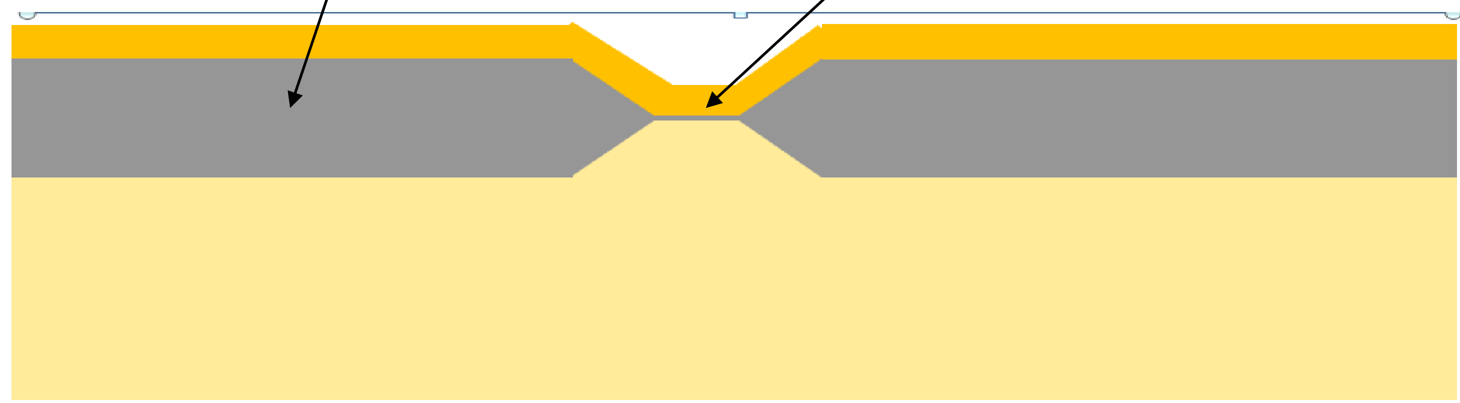
ANALOG DEVICES

Changes in Tox in Bond Pad Structure



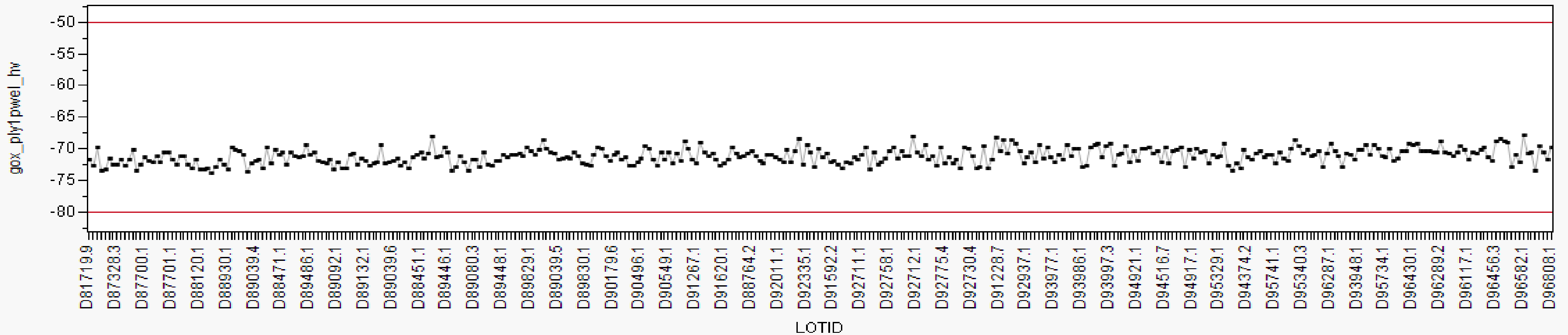
End of Line Field Oxide in bond pad region will thicken up to ~3700ang from ~2800

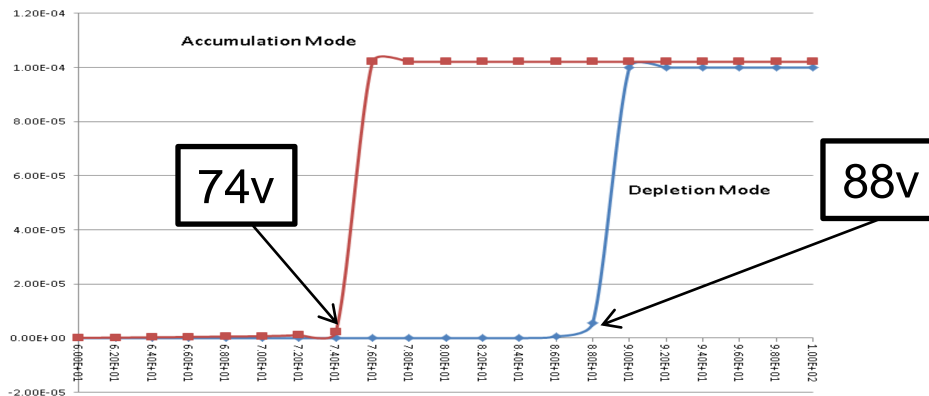
Defect Tox thickens up to ~820ang From ~135ang.



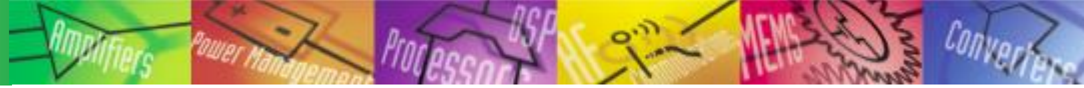
HV Gate Oxide End Of Line

- HV Gate Oxide is monitored at end of line using multiple structures
- HV Gox over PWEL trend shown below as measured in accumulation(-ve potential on the Poly) is > 70v will be higher again ~88v in depletion mode (+ve potential on the Poly).





ANALOG DEVICES



Summary

- A mask change affecting only the bond pad area of the AD7280 is proposed.
- This would thicken the oxide in the defect region to a level whereby it would be reliable with a 30V stress application.
- There is no process flow change involved in this proposal.
- This would not have any electrical effect on the product operation.
- Estimated earliest cut over date 27th October.