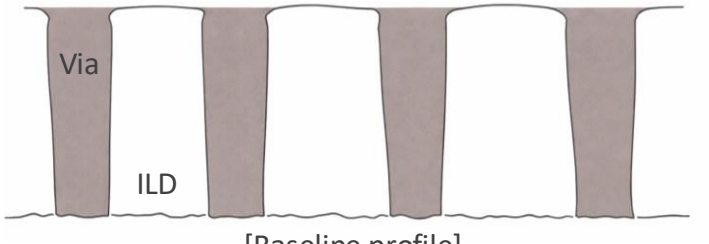
Increased Via Metal Volume While Maintaining Leakage Margin without Arcing

Objectives

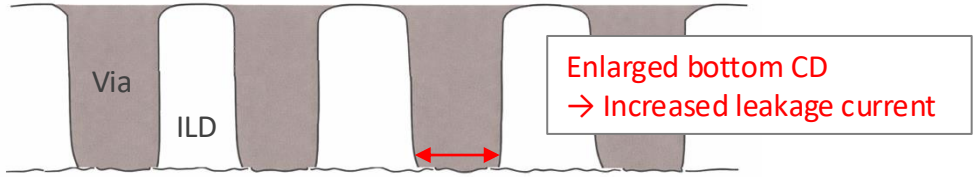
- Via etch process development
  - Increase via metal volume while maintaining leakage margin



[Baseline profile]

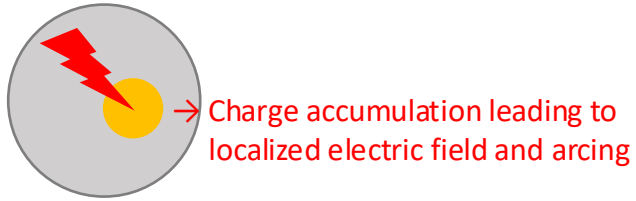
Challenges

- Bottom CD enlargement
  - Ion and radical bombardment at the via bottom causes **bottom CD enlargement**, resulting in **increased leakage current**



[Bottom CD enlarged profile]

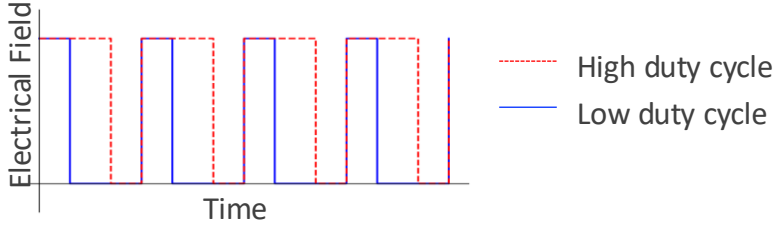
- Arcing during processing
  - Significant **plasma-induced arcing** causes **localized surface damage**



[Arcing on wafer]

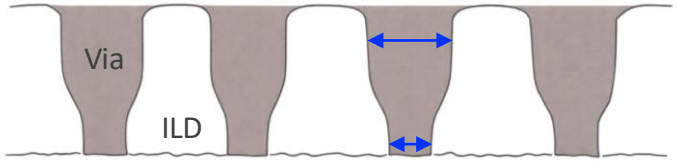
Approach

- Gas chemistry design
  - Optimize multi-step etch gas chemistries to improve via profile while **preserving bottom CD**
- Ion beam angle control
  - Control ion beam angle to **suppress bottom CD enlargement**
- Duty cycle adjustment
  - Adjust duty cycle to enable plasma relaxation during off periods, **mitigating charge buildup** with a controlled etch-rate trade-off



Outcome

- Target via profile achievement
  - Maintained bottom CD while increasing upper CD



[Target profile]

- Plasma process stability
  - Eliminated plasma arcing during processing

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