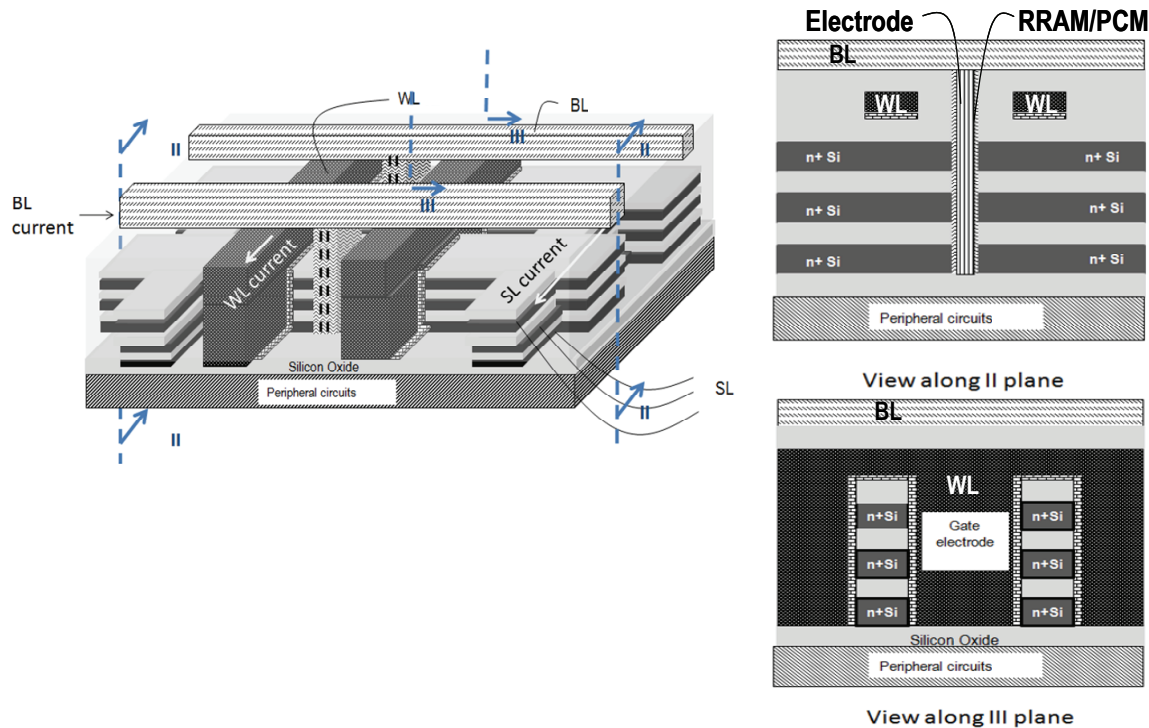


## Monolithic 3D Non-Volatile Memory: RRAM, PCM



### Technology:

The monolithic 3D IC technology is applied to producing a monolithically stacked single crystal silicon bidirectional transistor selector RRAM or PCM memory. 1T-1R memory cells enjoy a low number (shared) of litho steps, Cu or Al wiring, and is a scalable architecture. An efficient bipolar RRAM is now possible. Peripheral circuits below the monolithic memory stack deliver control functions.

Monolithic 3D IC provides a path to reduce NVM bit cost without investing in expensive scaling down.

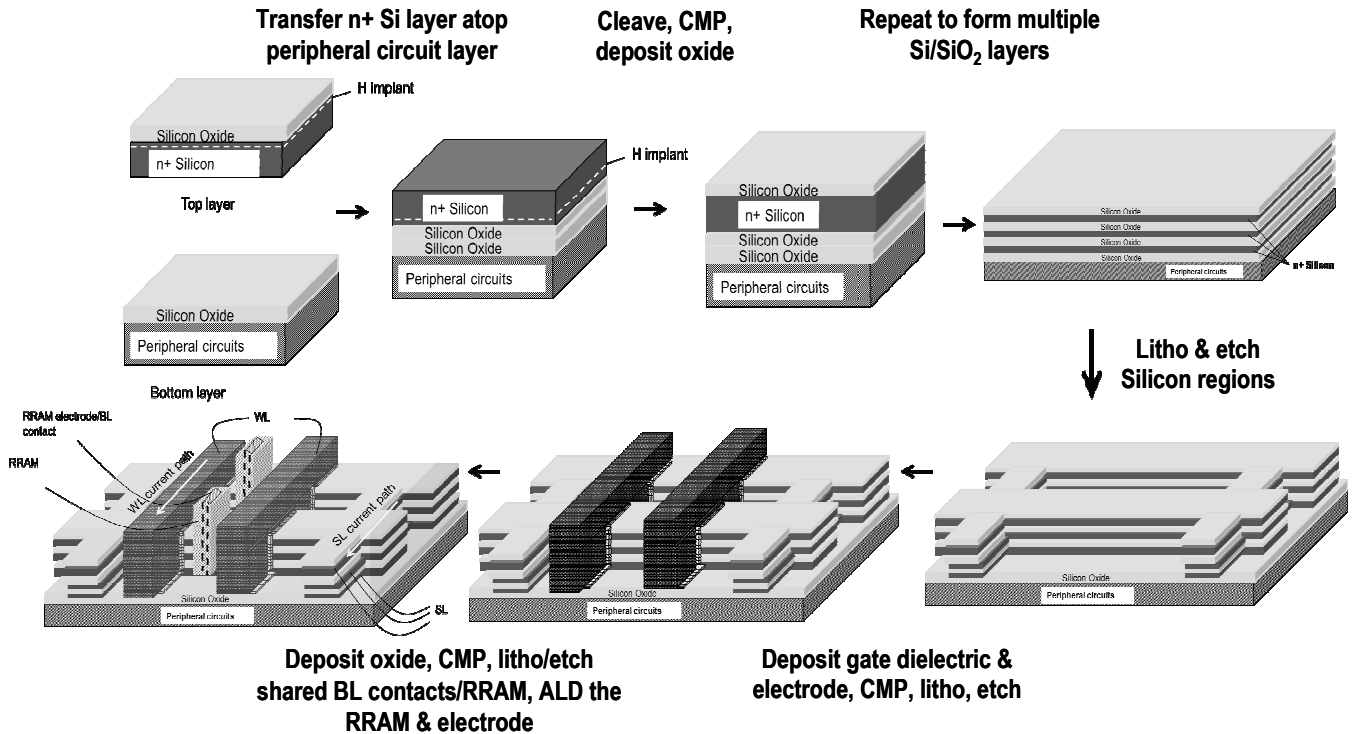
*See reverse side for more on details  
monolithic 3D IC technology & NVM flow*

### Benefits:

- 2-3X the density of NAND with similar number of litho steps
- Single crystal silicon bidirectional transistor selector
- Shared litho steps among many memory layers
- All layer single crystal silicon provides negligible leakage & dramatically better performance/power
- Scalable: Multiple generations of cost-per-bit improvement for same equipment cost and process node: use the same fab for 3 generations
- Forestalls next gen litho-tool risk
- Density & NV of Flash, but speeds and endurance approaching DRAM

Our low leakage 3D NVM technology provides:

- Shared litho steps to create stacked memory--low cost
- Compatible with whatever resistive material you choose
- Single crystal Si 3-terminal selectors allow bipolar operation



## Layer Transfer Technology (“Ion-Cut”) Defect-free single crystal obtained @ <400°C

Leveraging a mature technology (wafer bonding and ion-cleaving) that has been the dominant SOI wafer production method for over two decades.

**Innovate and create** multiple thin (10s – 100s nanometer scale) layers of virtually defect free Silicon by utilizing low temperature (<400°C) bond and cleave techniques, and place on top of active transistor circuitry. Benefit from a rich layer-to-layer interconnection density.

