

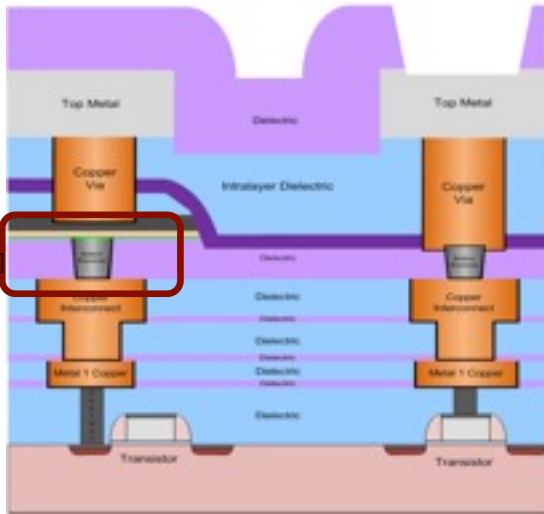


Life Beyond Flash: New Non-Volatile Memory Technologies

CBRAM®

Ishai Naveh, VP, Marketing
Adesto Technologies

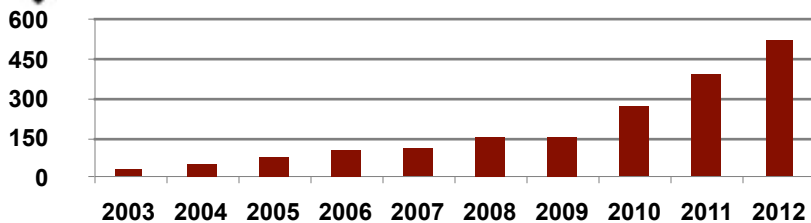
CBRAM[®]: Technology Advantages Drive Growth



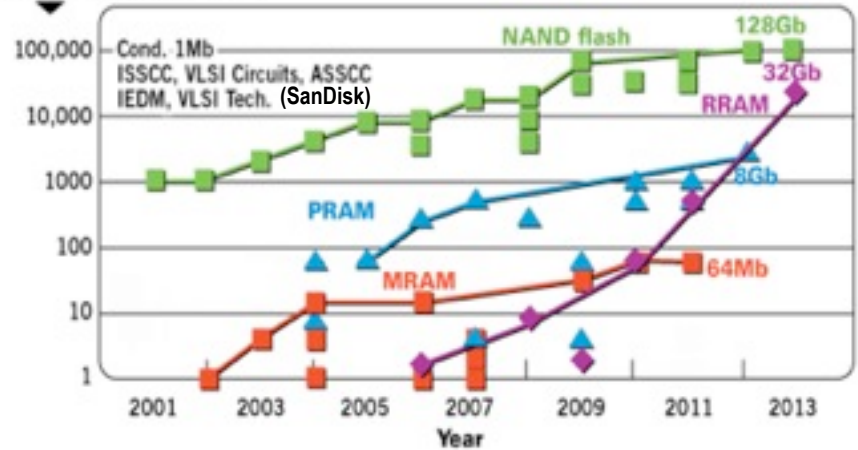
CBRAM Stack

Bottom electrode, memory stack and top electrode and contact integration

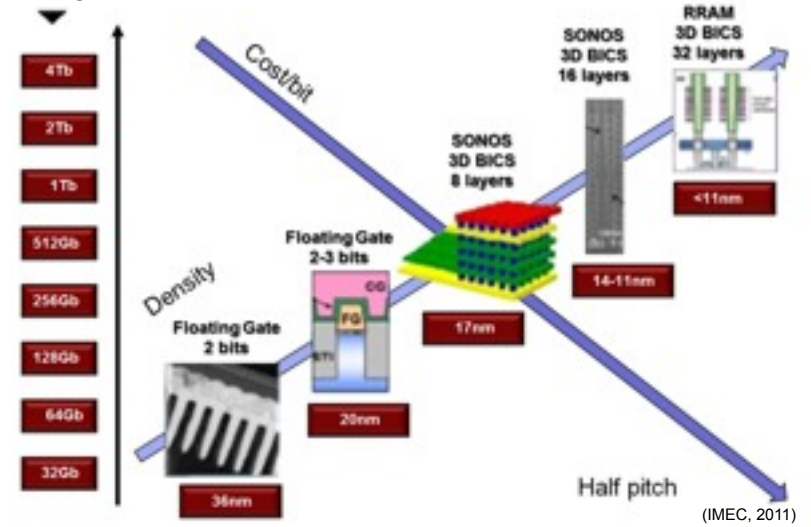
Resistive Memory Granted Patents



Storage Capacity (Mb)



Intercepting the NVM Roadmap



*T-Y. Liu (SanDisk) et al., "A 130.7mm² 2-Layer 32Gb ReRAM Memory Device in 24nm Technology", ISSCC 2013

**Laith Altimime, IMEC, IMEC Press Conference, 11/2011

CBRAM[®]: High Growth Applications

- ● **Battery-operated Wearable Electronics**
- Ultra-Low Power Embedded Devices**
- Low Power Smart Meters**
- Energy-Harvesting Body Monitors**



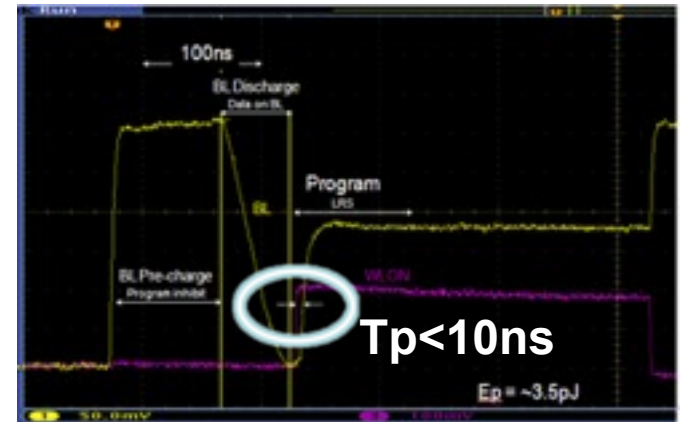
- Instant On Computers** ● ●
- Fast NVM Memory for Mobile Electronics**
- Fast, Energy-Saving Server Cache**



Comparison of Technology

Technology	CBRAM	ReRAM	FG Flash	MRAM	PCM
CMOS Compatibility	Yes	Yes	No	Yes	No
Read Core Voltage (V)	0.35	0.32	0.5	1.2	1.2
Write Core Voltage (V)	0.6	2.0	10	3.3	2.8
Program Energy/bit	1 pJ	2 nJ	100 pJ	10 pJ	250 pJ
Read Energy/bit	50 fJ	75 fJ	500 fJ	100 fJ	500 fJ
Charge pumps needed for <1 V SoC	No	Yes	Yes	Yes	Yes

~10ns to Write



- **DRAM Speed**
- **Low Power**
- **Non-volatile Memory**