



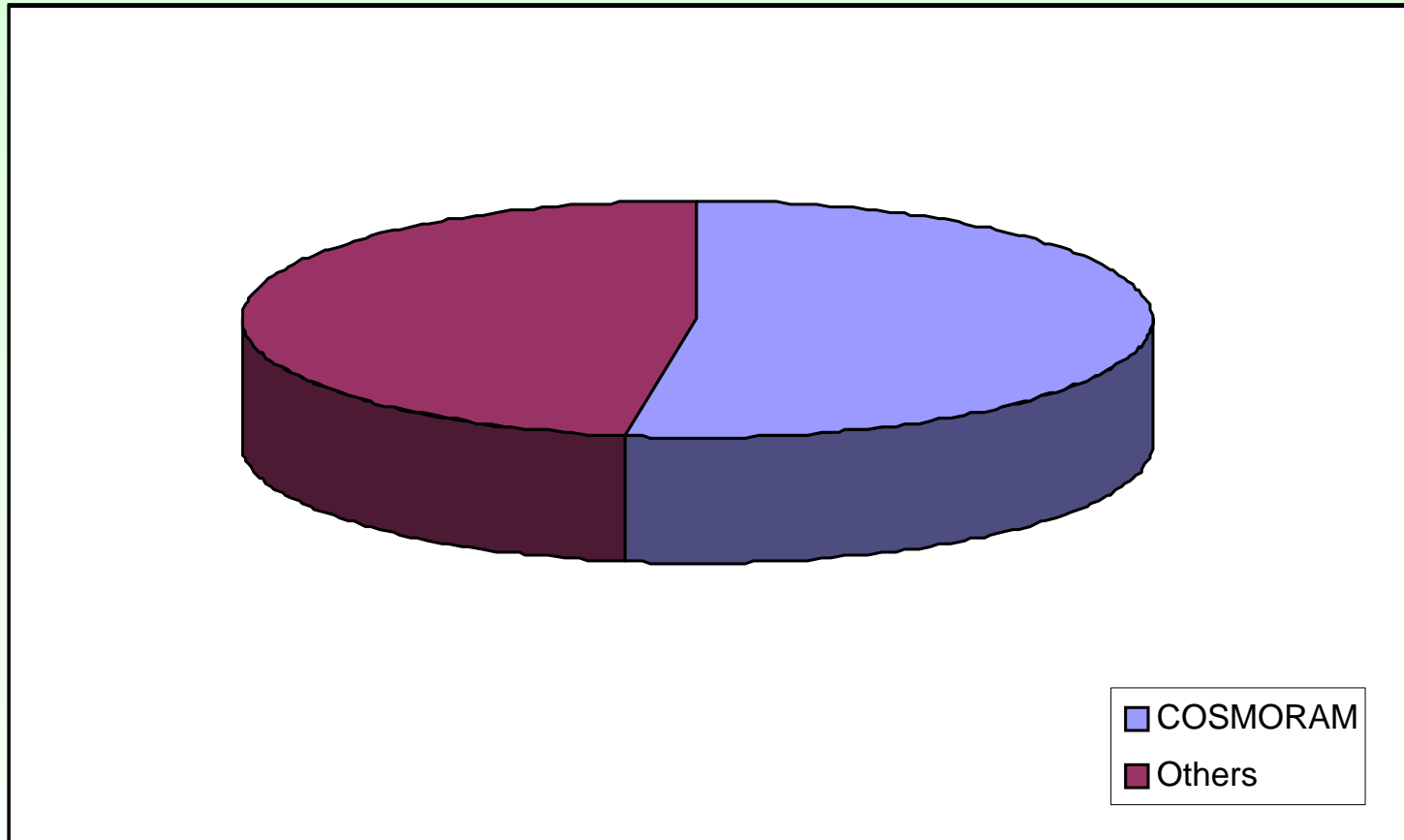
COSMORAM

About COSMORAM

- Common Specification for Mobile RAM
 - Agreed by Fujitsu, NEC Electronics and Toshiba
 - 1st Announcement in March 14, 2002
 - Standard Body
 - Function Truth Table
 - Configuration Register Definition
 - Basic Timing Diagram
 - Pin Assignment
 - Implementation method of supplier specific option
 - Detail AC timing is suppliers specific.

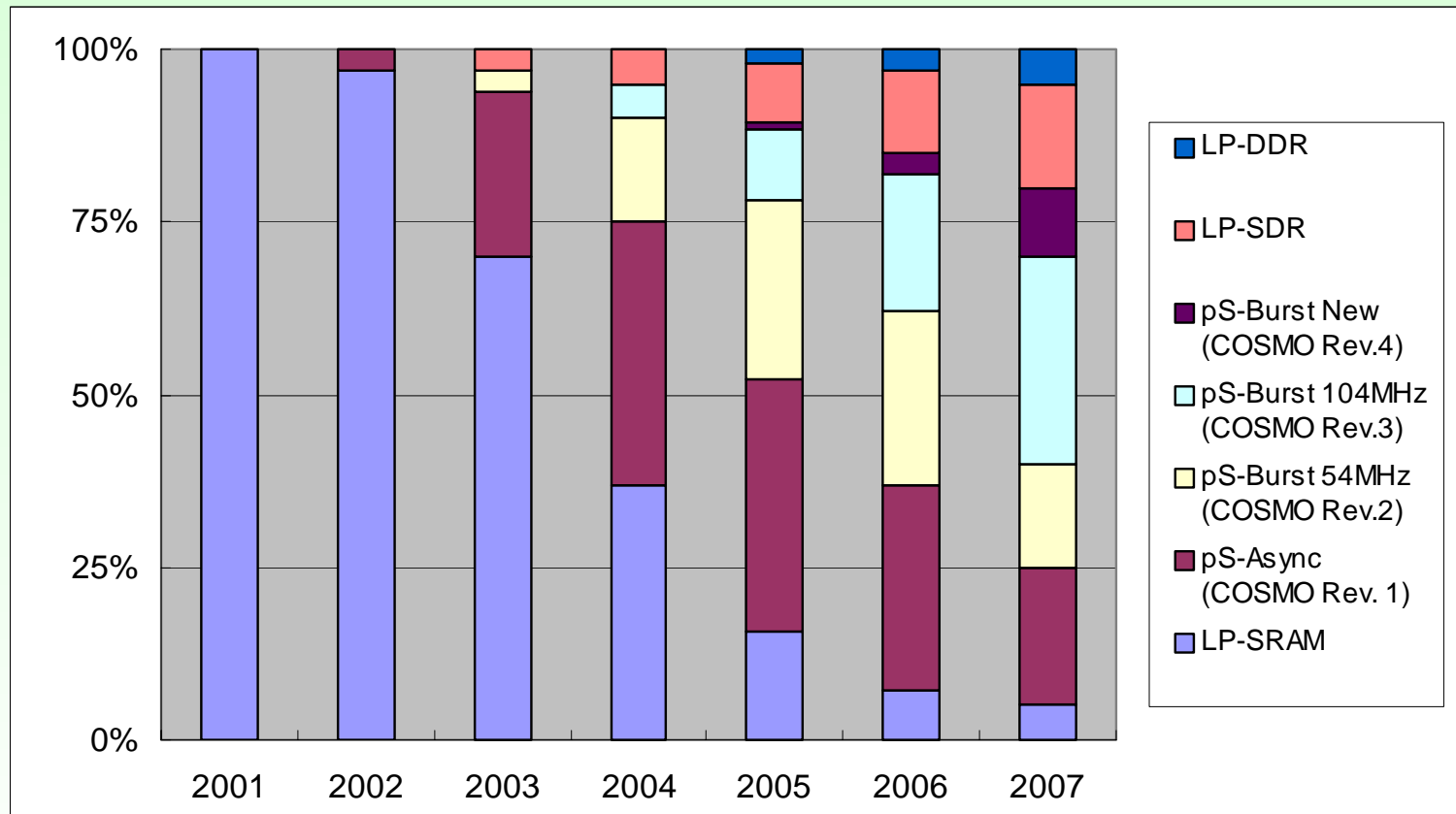
COSMORAM Market Share

■ No. 1 share in 2003



Market View

■ Pseudo-SRAM emerging in major dominant



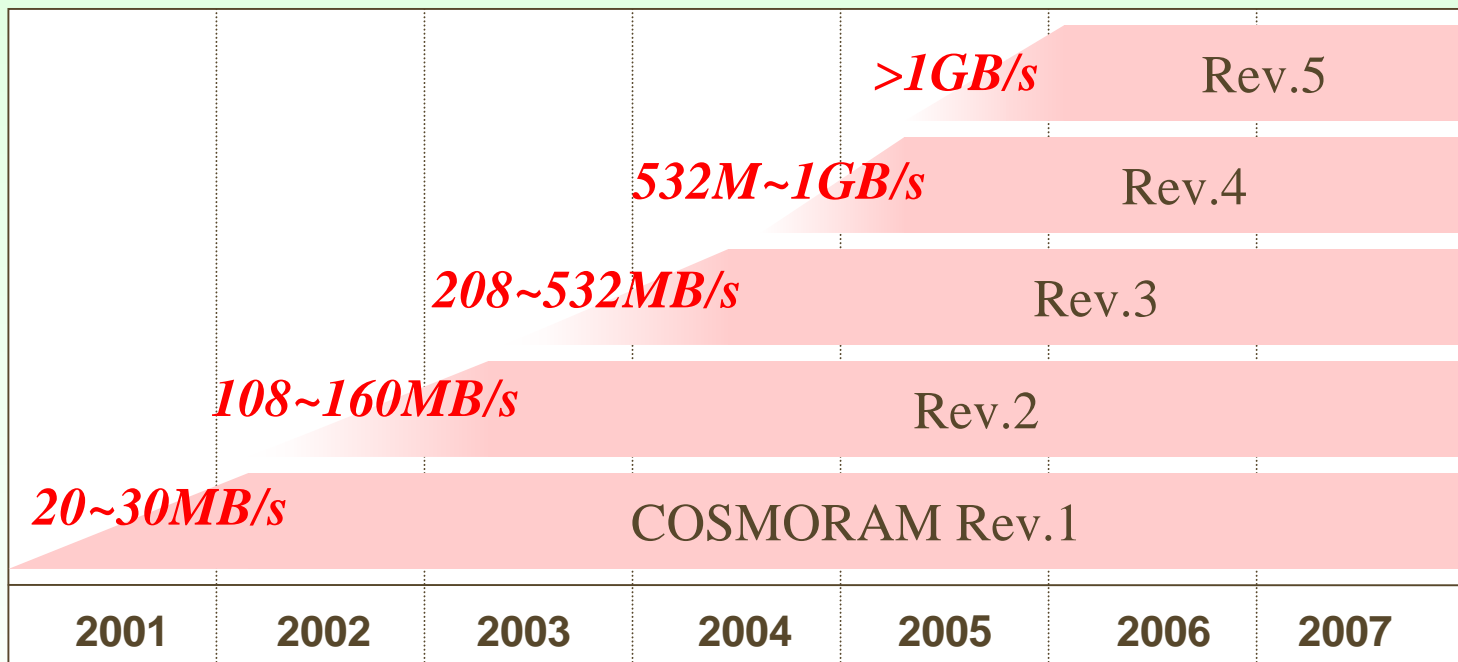
Standardization Strategy

- Define Multi-purpose Work Memory Solution for Mobile Platform
 - Keep NOR Flash Compatible Interface
 - Refresh Free Operation
 - Optimize spec. between performance and power

Roadmap

■ Standardization Milestone

- Mar./'02 : 1st Announcement for Page Mode & Partial Refresh
- Feb./'03 : 2nd Announcement for Burst Mode
- Sep./'04 : 3rd Announcement for Extended Burst & Multiplexed A/DQ



COSMORAM Rev.1

- Extension from LP-SRAM operation
 - Page Mode
 - Fast consecutive address access
 - 8 word page size (A0-A2)
 - Partial Refresh Function
 - Controlled by CE2
 - 1/4 size, 1/8 size, (1/16 size), and Deep Power Down
 - Full array data retention during normal standby

COSMORAM Rev.2

■ Synchronous Operation

- Burst Read & Write operation
- Compatible to Rev.1 at initial state (default)
 - Asynchronous page mode operation after power up
 - Set Configuration Register enables Burst mode
- Selection by Configuration Register :
 - PS, BL, Mode, RL, SW/BW, VE, WC
- Additional 3 pins from COSMORAM Rev.1
 - CLK :Clock input
 - /ADV : Address valid input (address latch signal)
 - /WAIT : Wait signal output (indicates data out status)

COSMORAM Rev.3

■ Enhancement on Burst Mode

- Inherit basic function from Rev.2
- Multiplexed A/DQ Bus as well as standard Demuxed Bus
 - Implementation method (metal option etc.) depends on each supplier
- Update on Configuration Register Option
 - CR Verify Access (& New CR Set/Verify Sequence)
 - User Configurable Output Driver Strength
- Byte Write Mask on each clock cycle

COSMORAM Rev.4

- Under Discussion

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