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2012 NAND Flash Outlook

-IN NAND WE TRUST-

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June 7th , 2012

Agenda

- ◆*Overview for 2012 NAND Flash Market*
- ◆*NAND Flash Supply Side Status*
- ◆*NAND Flash Demand Side Status*
- ◆*Smartphone, Tablet and Ultrabook*

Macro NAND Market→ Healthy and Balanced

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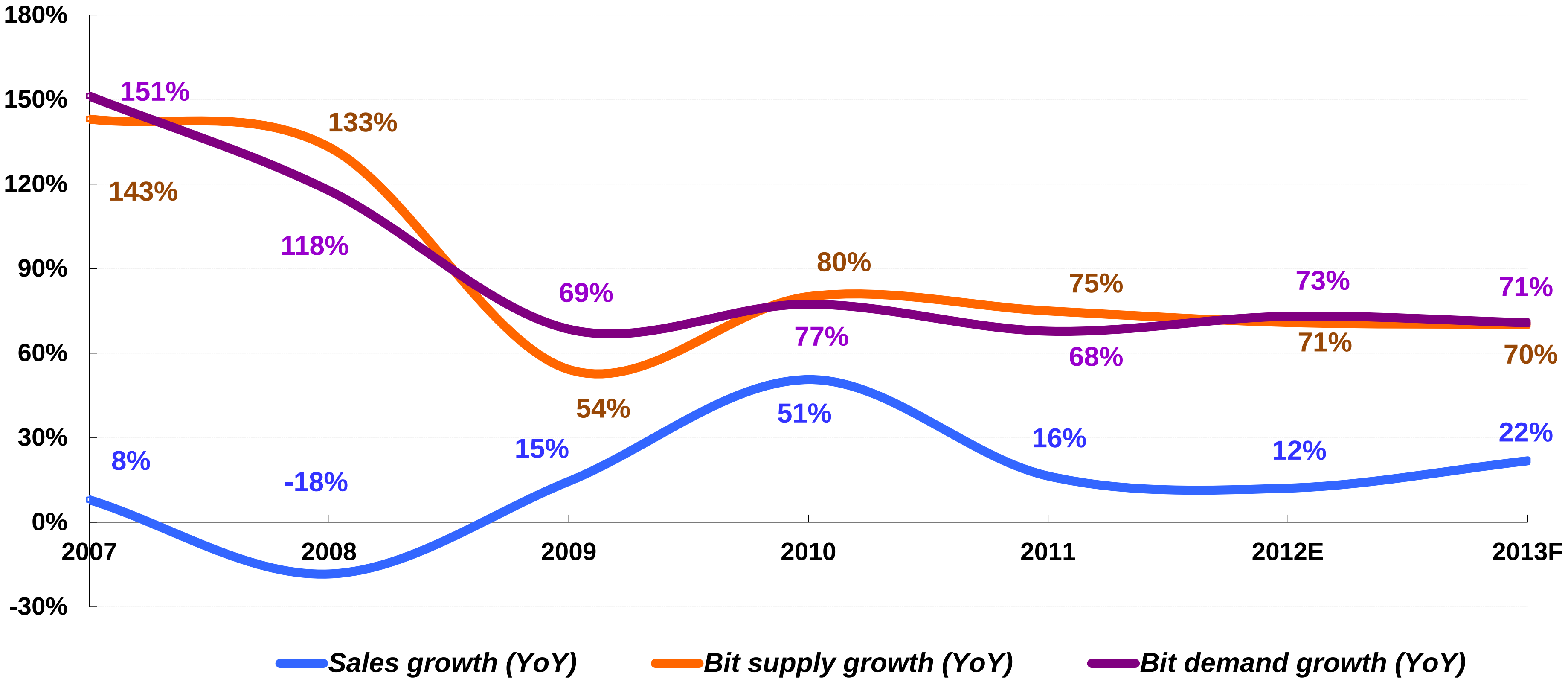

Source: DRAMeXchange, Jun., 2012

- *After 2008 financial crisis, NAND Flash makers learned from the undisciplined supply and implement output strategy based on real market demand for profitability and operational stability.*

- *NAND Flash market will be balanced and healthy in macro perspective.*

Warming Status from Mid-3Q, Helps to Drive the Market

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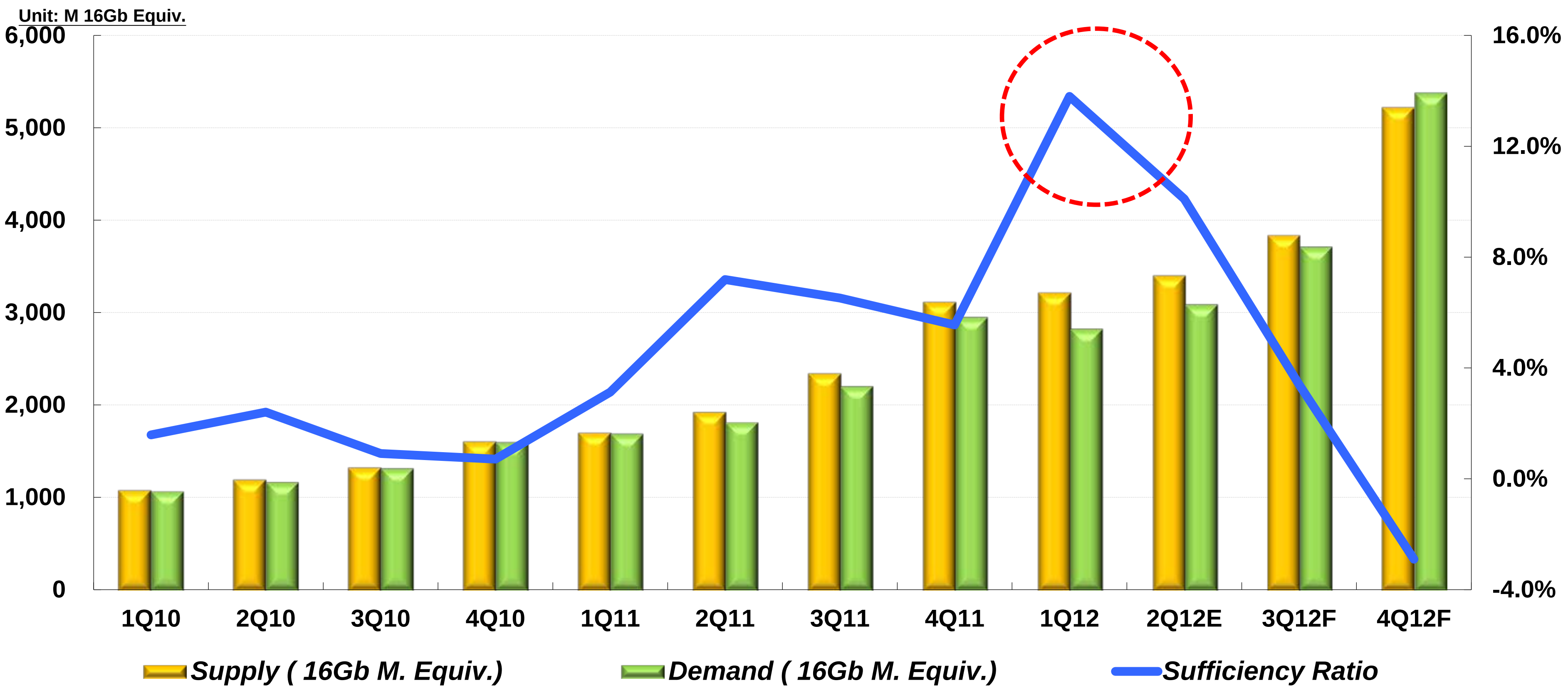

Source: DRAMeXchange, Jun., 2012

- ***NAND Flash market is highly correlated with the seasonality pattern of system products now, 2H'12 market will be triggered by new smartphone, tablet and ultrabook.***

- ***1H12 over-supply is a mix dynamics of softened demand from retail market as well as the impact from macro-economy slowdown.***

Memory Paradigm is Shifting to NAND Flash-1

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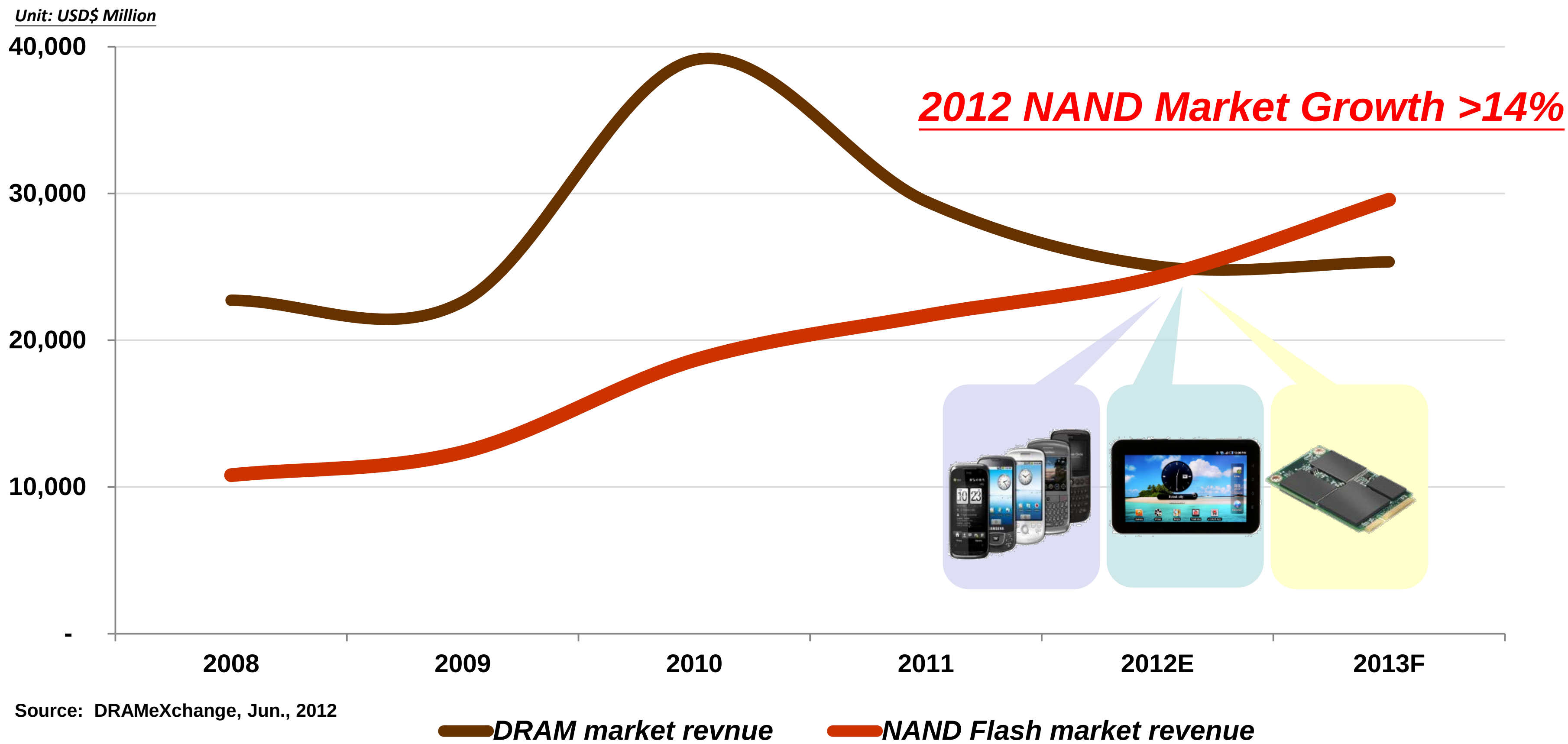

Source: DRAMeXchange, Jun., 2012

- *NAND Flash market revenue will likely surpass DRAM market revenue in 2012 given the strong demand from embedded storage of smartphone, tablet and Solid-State Drive.*
- *Aggressive content growth also helps to boost the revenue growth.*

Memory Paradigm is Shifting to NAND Flash-2

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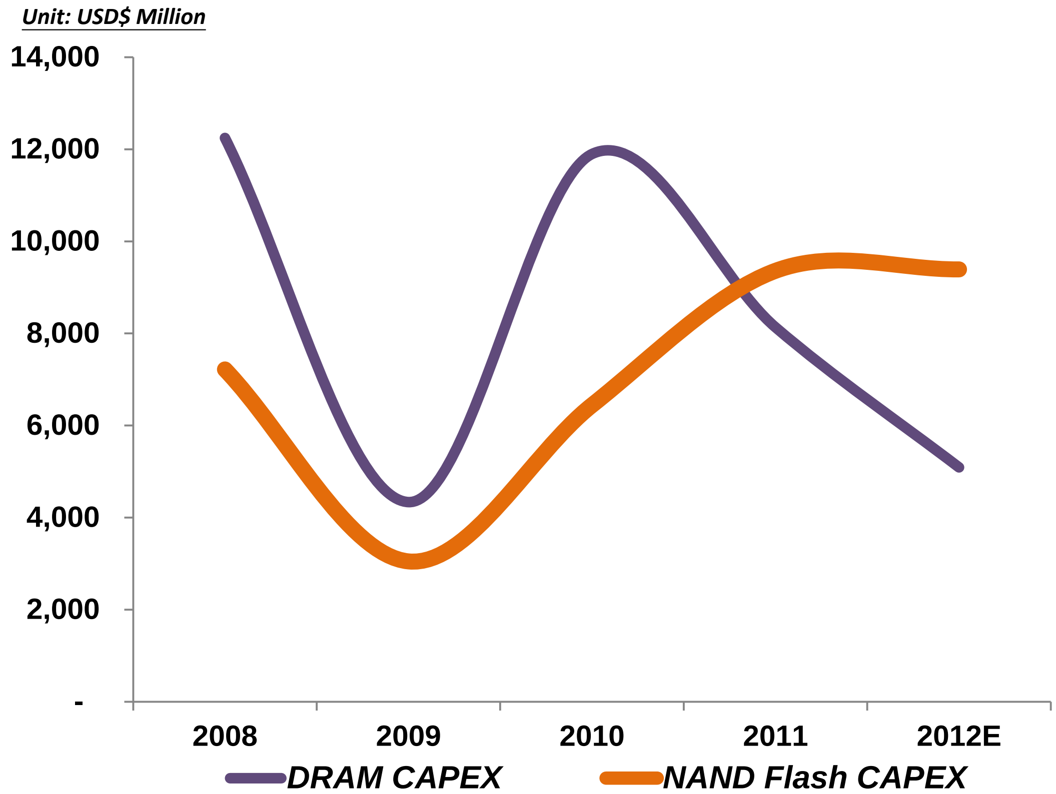
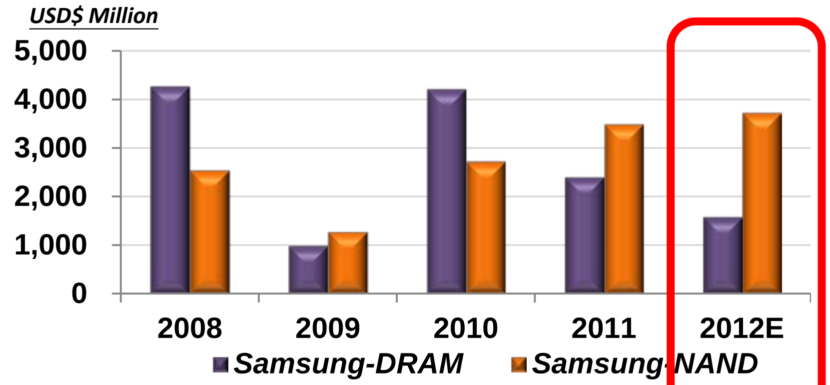
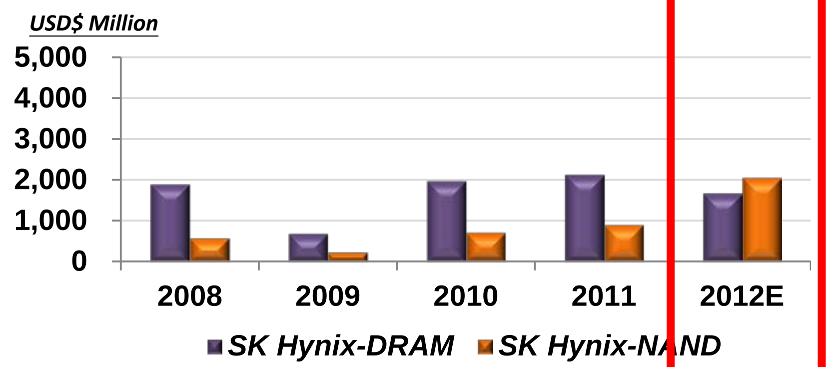
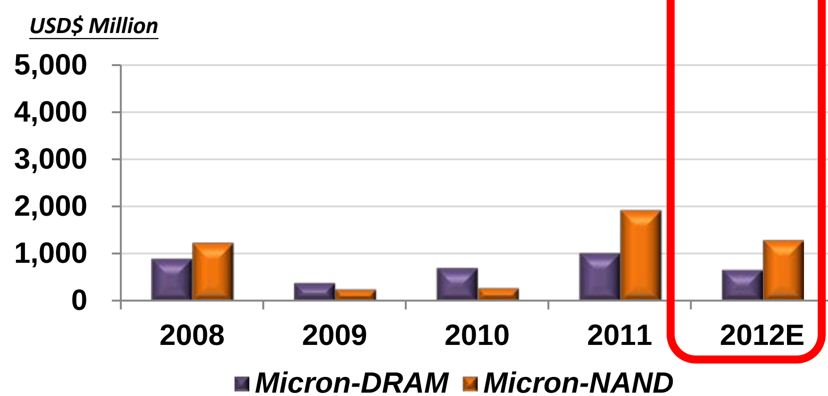


Source: Company, DRAMeXchange estimation, Jun., 2012

- ***Stable profitability and strong demand growth enables total memory solution providers dedicating more resource on NAND Flash.***







Stable Operating Margin on NAND Flash

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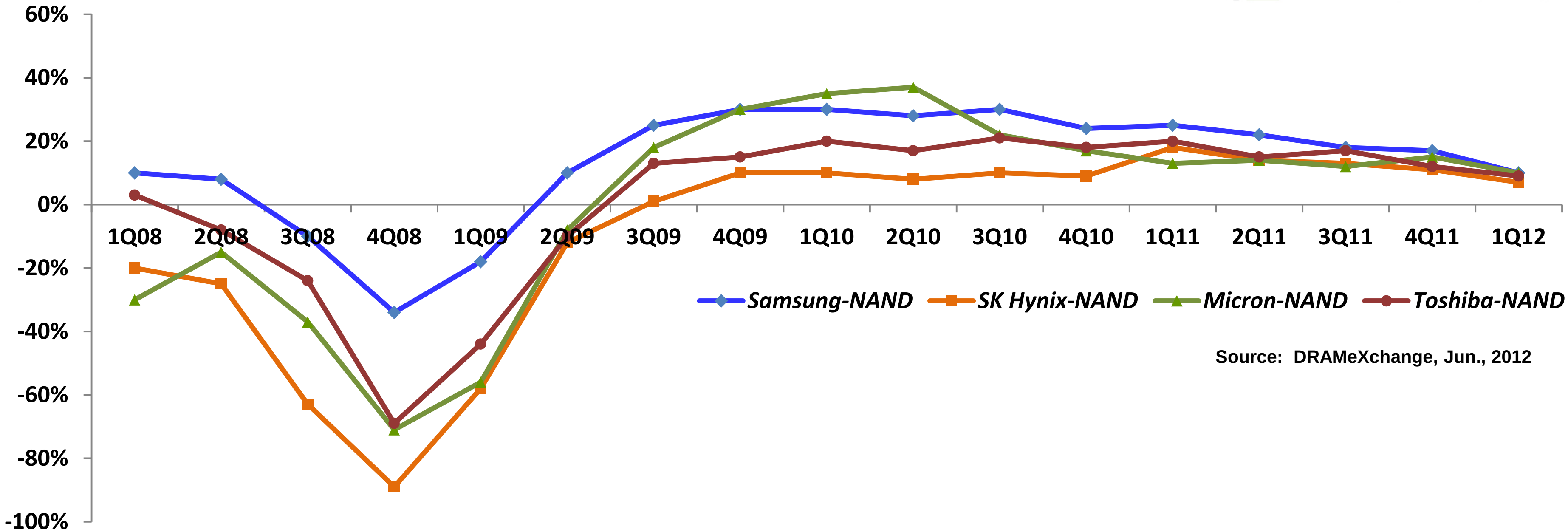

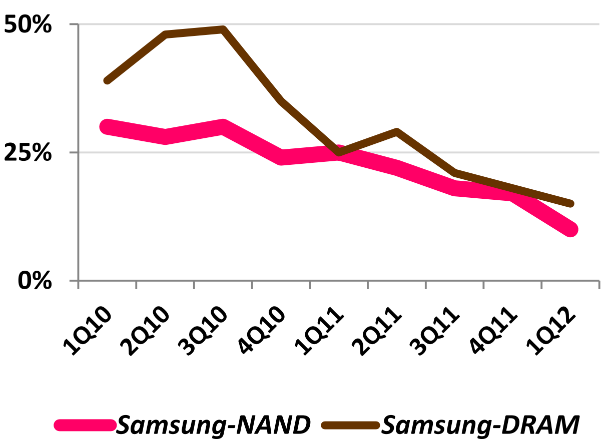

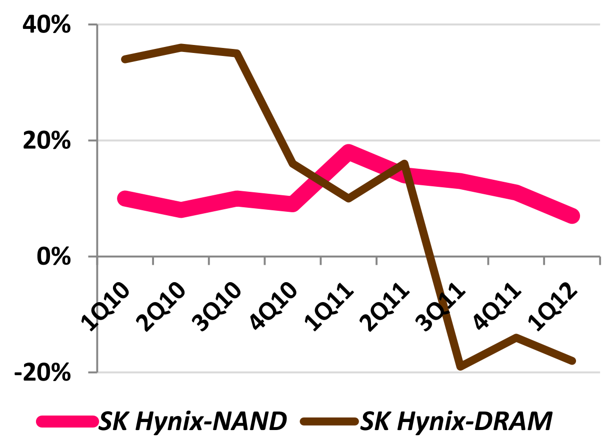

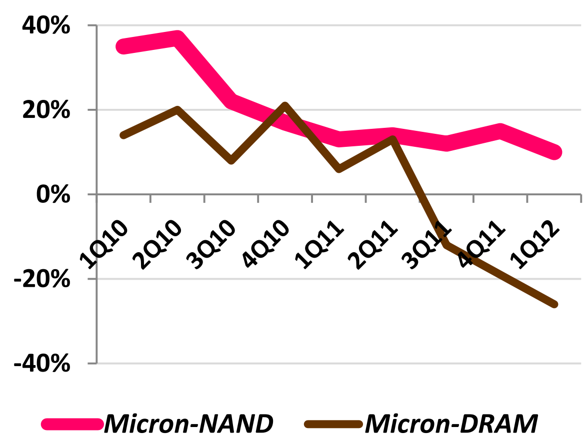

- ***Despite of continuous margin compression in recent quarters, NAND Flash makers still enjoy at least high single-digit operating margin through 3Q'09.***

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Strong Bit Growth& Stable Market Share Diagram

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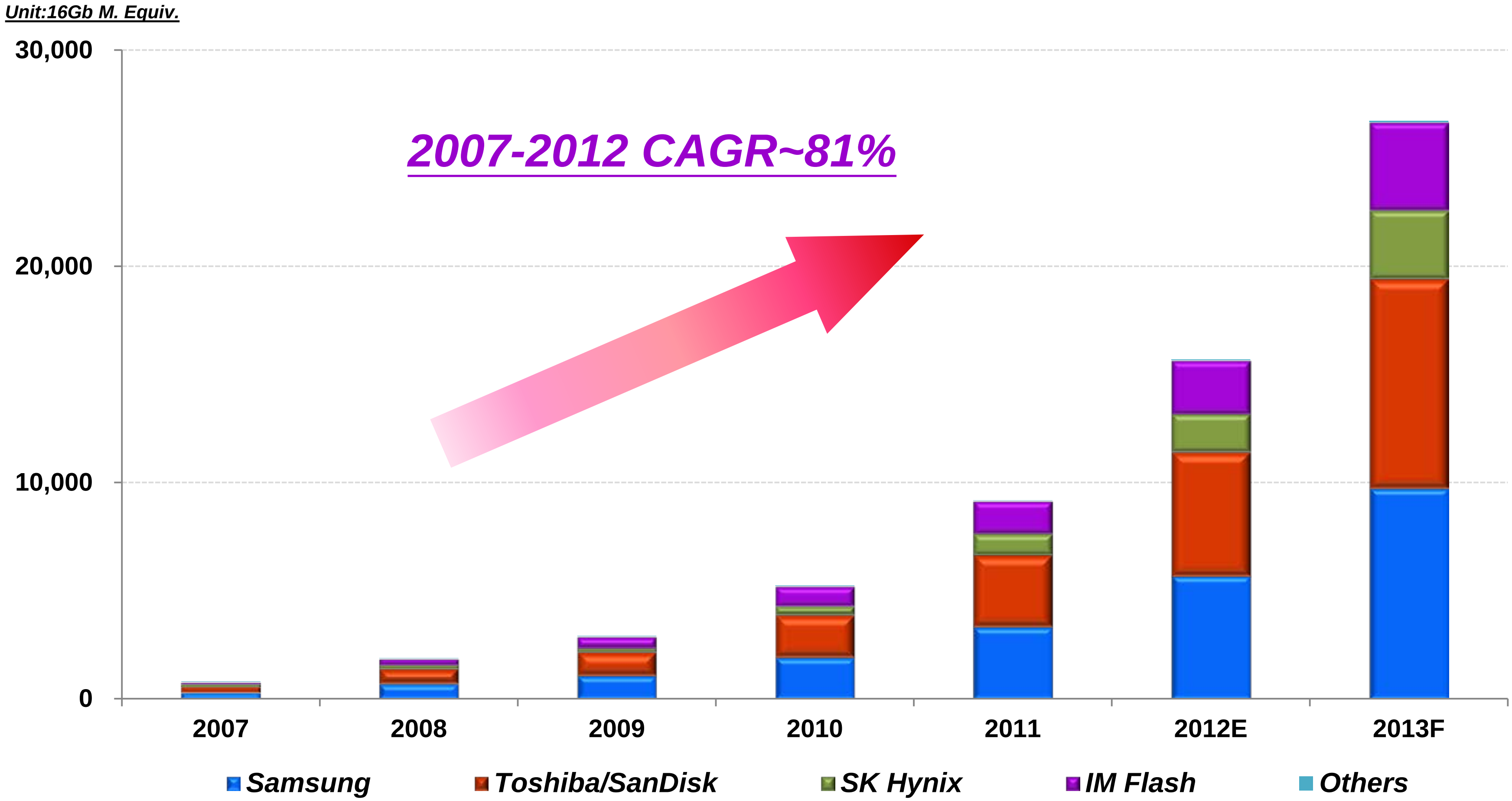

Source: DRAMeXchange, Jun., 2012

- *Samsung and Toshiba/SanDisk steadily account 36%-37% share respectively, followed by 15% from IM Flash and nearly 10% from SK-Hynix, NAND Flash supply shows disciplined dynamics.*

Cautious Wafer Expansion Plans for The Future

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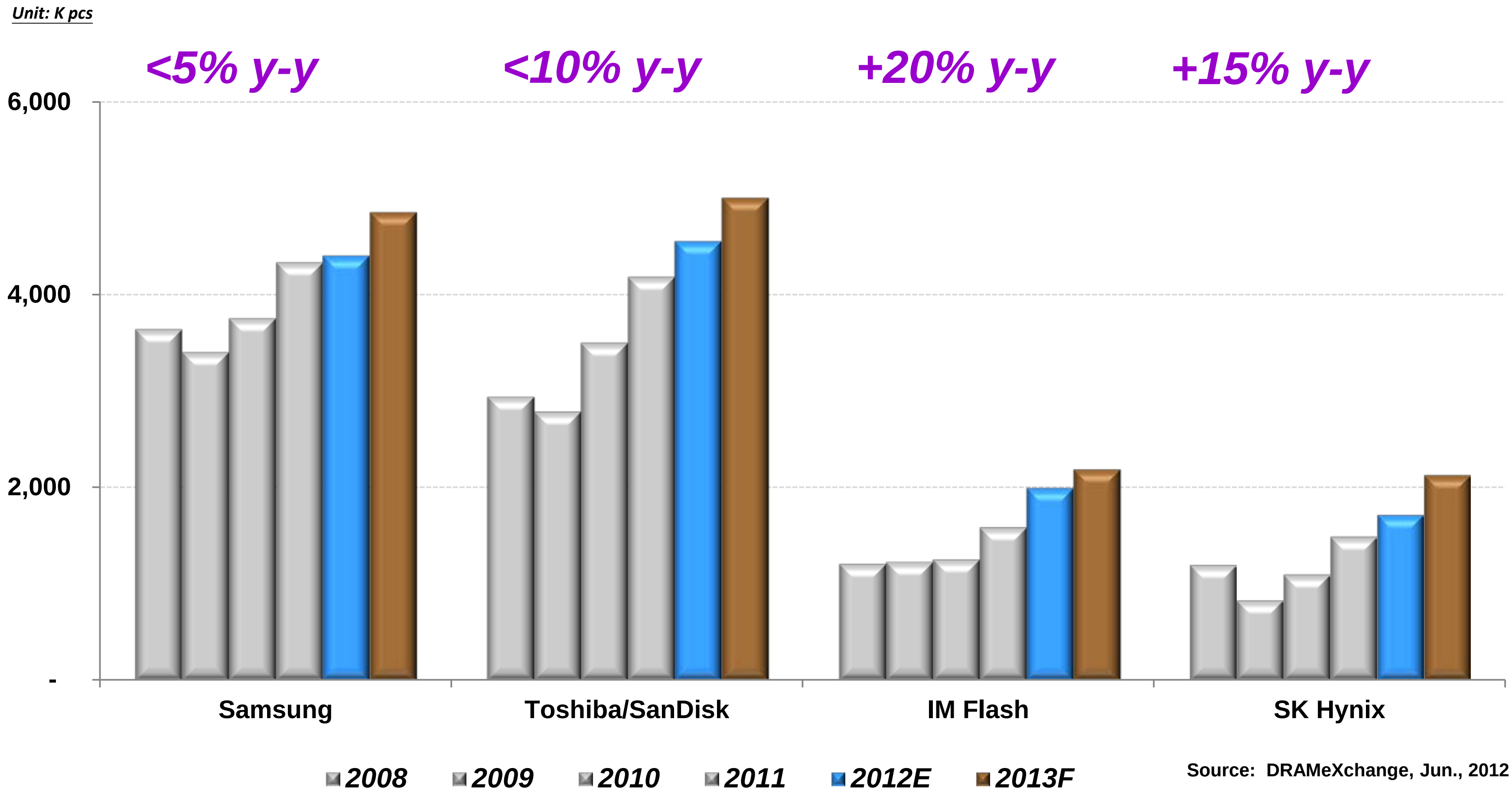

Source: DRAMeXchange, Jun., 2012

- *SK Hynix fab M12 will commence mass production from 4Q12*
- *IM Flash continues to cultivate the capacity from Singapore fab.*
- *Samsung new fab in China and Toshiba's phase 2 schedule of Fab 5 will commence mass production from 4Q13.*

Density is Driven by Large Capacity Applications

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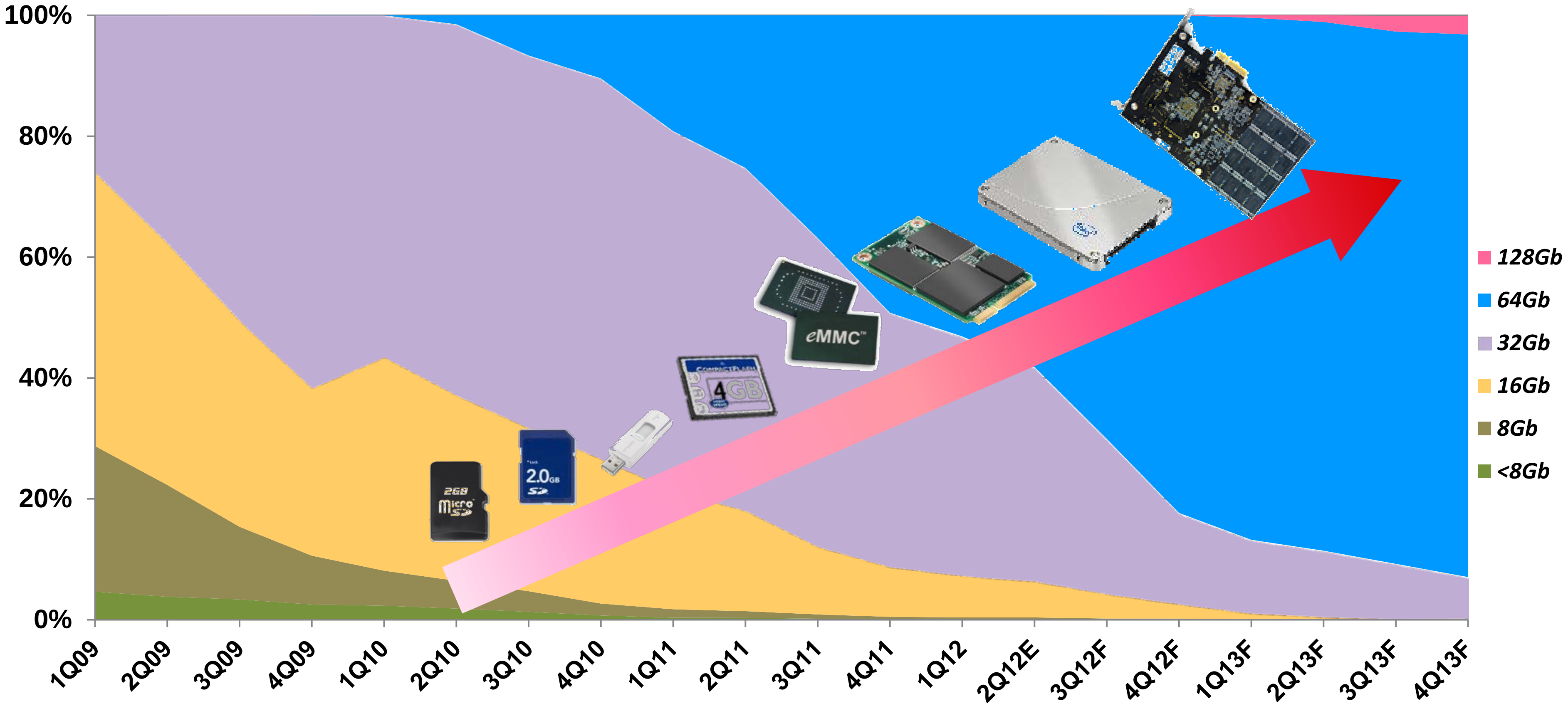
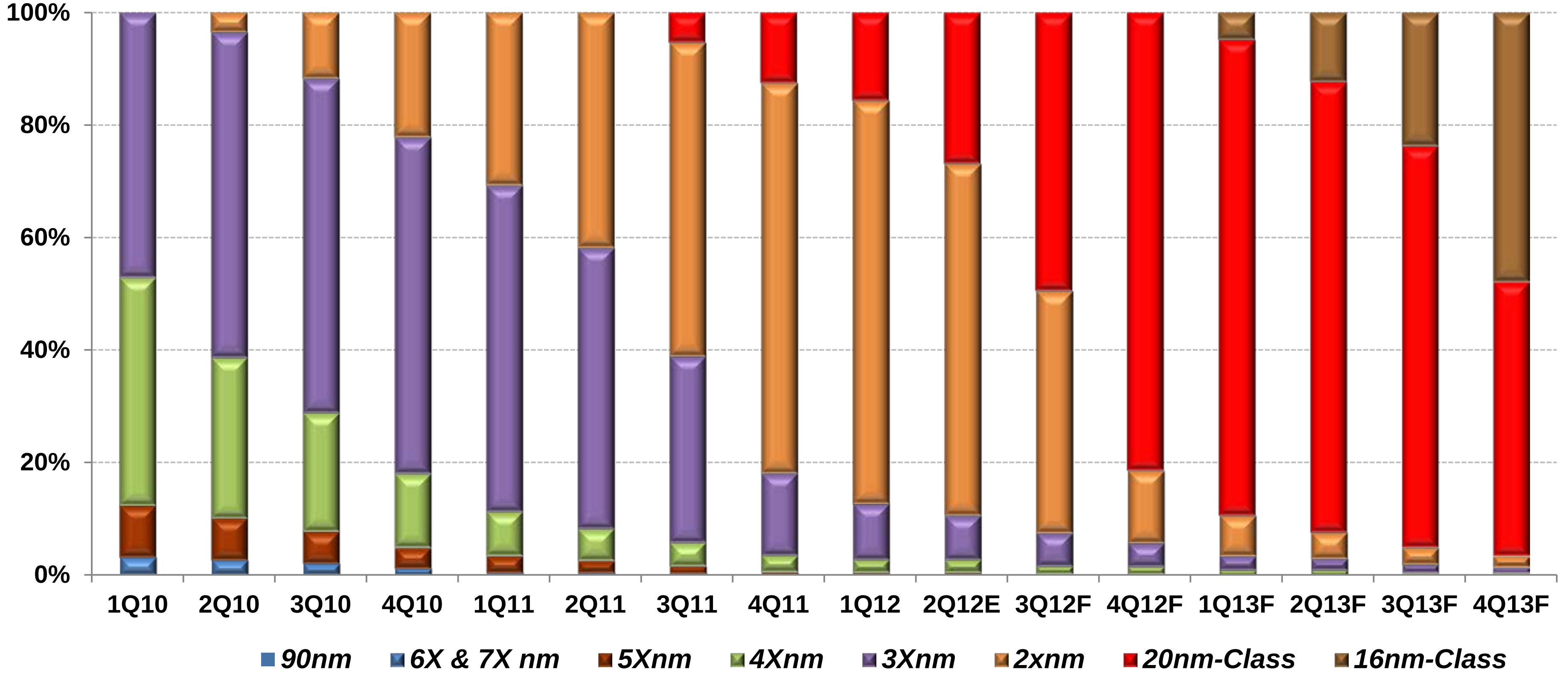


Source: DRAMeXchange, Jun., 2012

- ***Strong demand for large density storage helps to drive density evolution quicker than before after 2010.***
- ***20nm-class node product will be more cost-efficient for high density chip, results in migration enhancement to 64Gb and 128Gb after 2Q12.***

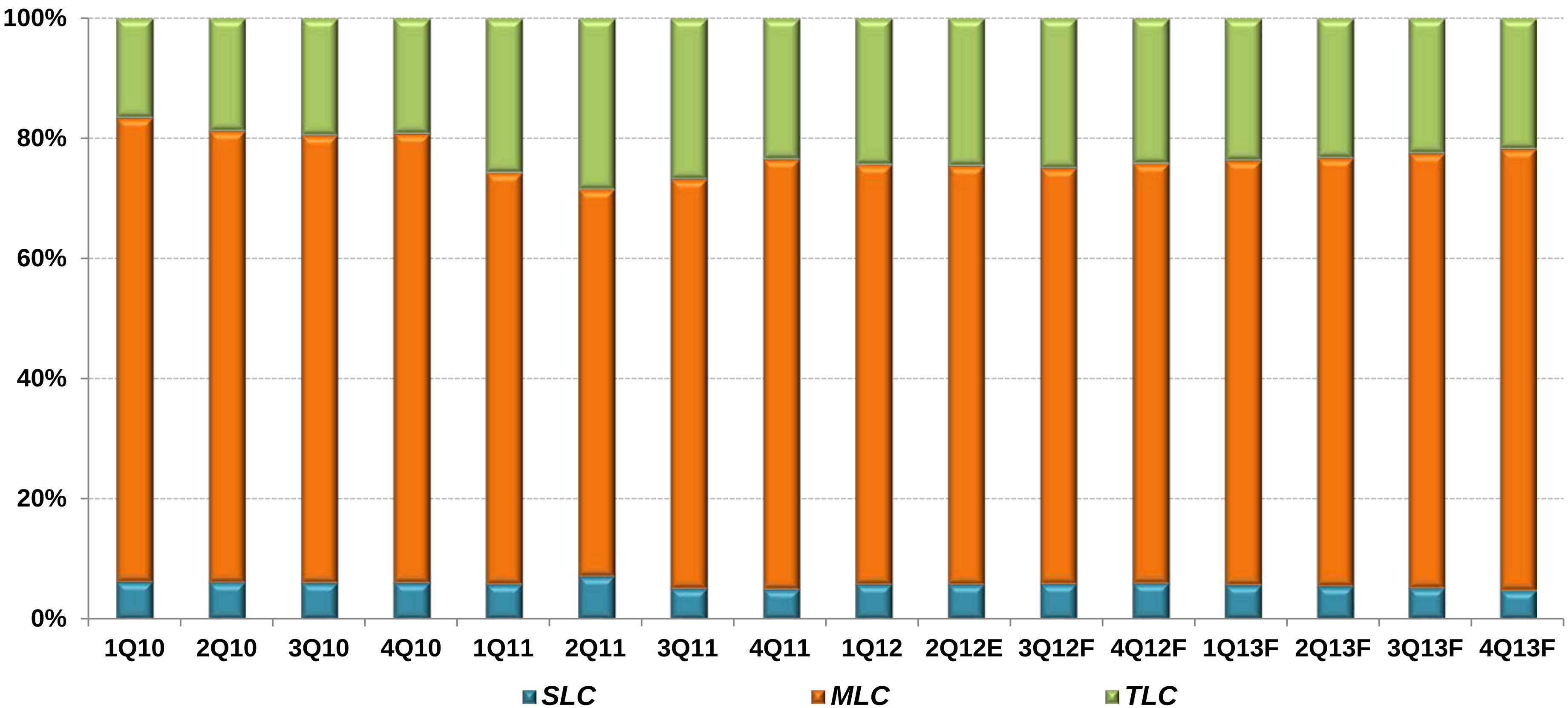
20nm-class Migration is Accelerated



Source: DRAMeXchange, Jun., 2012

- ***Yield rate for 20nm-class migration takes time to tune up, NAND Flash makers aim for further improvement in 3Q12.***
- ***20nm-class eMMC and SSD will boost the production portion from 2H12.***

Output Breakdown by Architecture



Source: DRAMeXchange, Jun., 2012

- ***TLC has more than 80% penetration rate in memory card and USB drive market for better cost structure concern.***
- ***MLC still remains dominating status in embedded products.***

NAND Flash Opportunity in System Products

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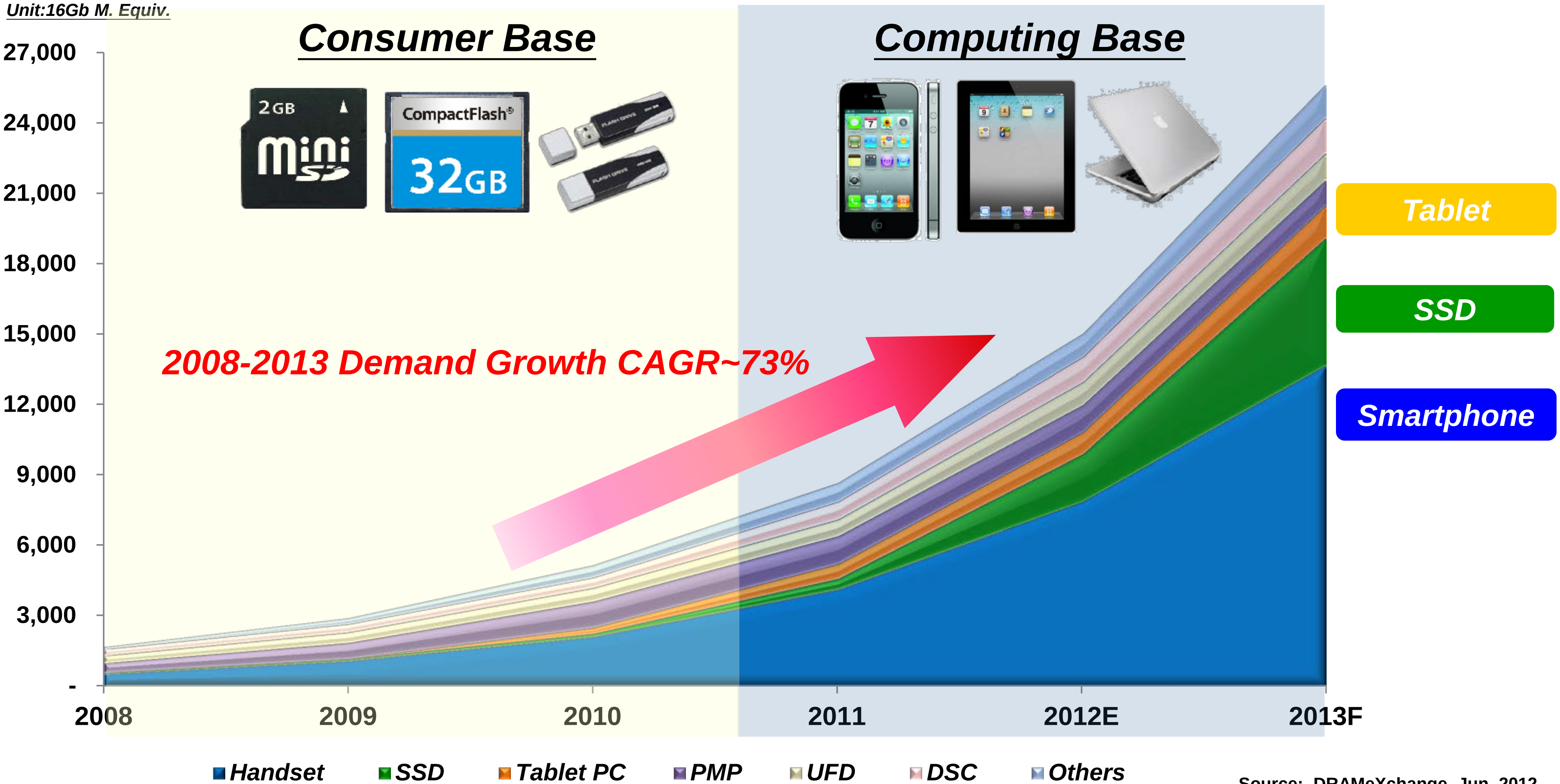

Source: DRAMeXchange, Jun, 2012

- *Catalysts come from rising popularity of smartphone, tablet and SSD.*
- *NAND Flash demand turns to computing device from consumer products after 4Q'10.*

Embedded Products are the Engine for Growth

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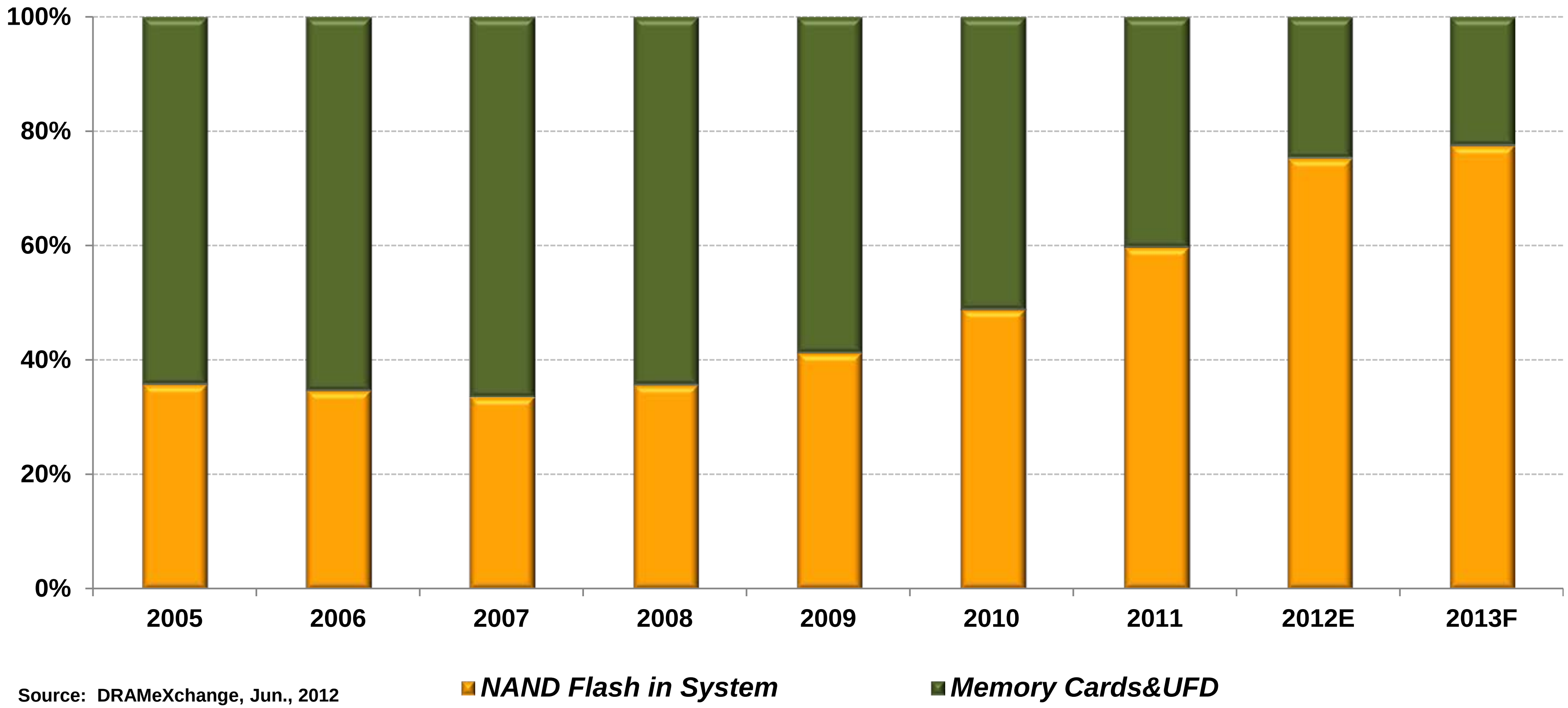

Source: DRAMeXchange, Jun., 2012

- ***SSD and eMMC unit consumption is 8-16 times more than UFD and memory card. Content and shipment growth from smartphone and ultrabook have re-shape the demand outlook.***

- ***Cloud storage service and embedded design is the structural impact on UFD and memory card.***

NAND Flash Storage Fits All Mobile Devices

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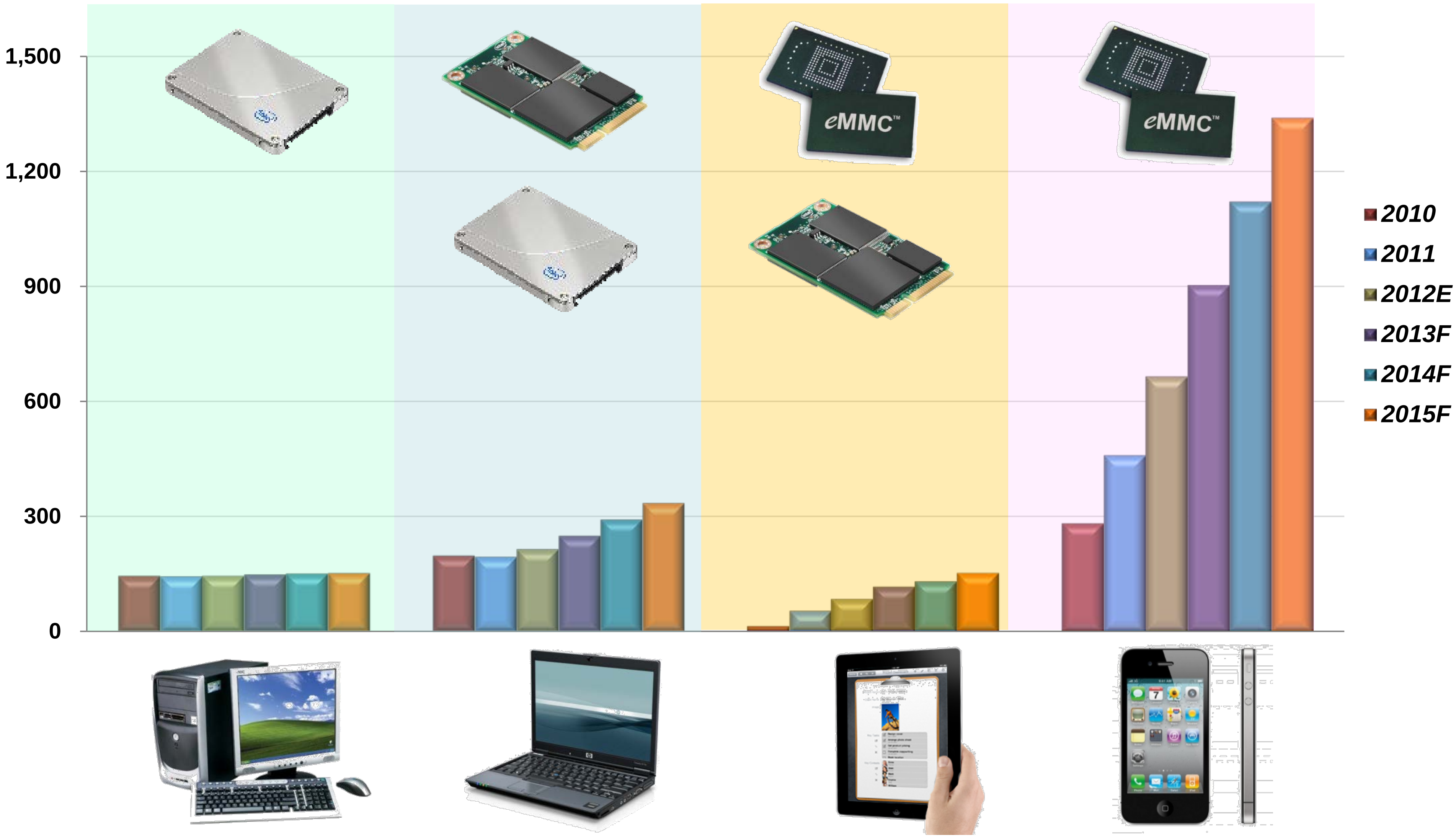
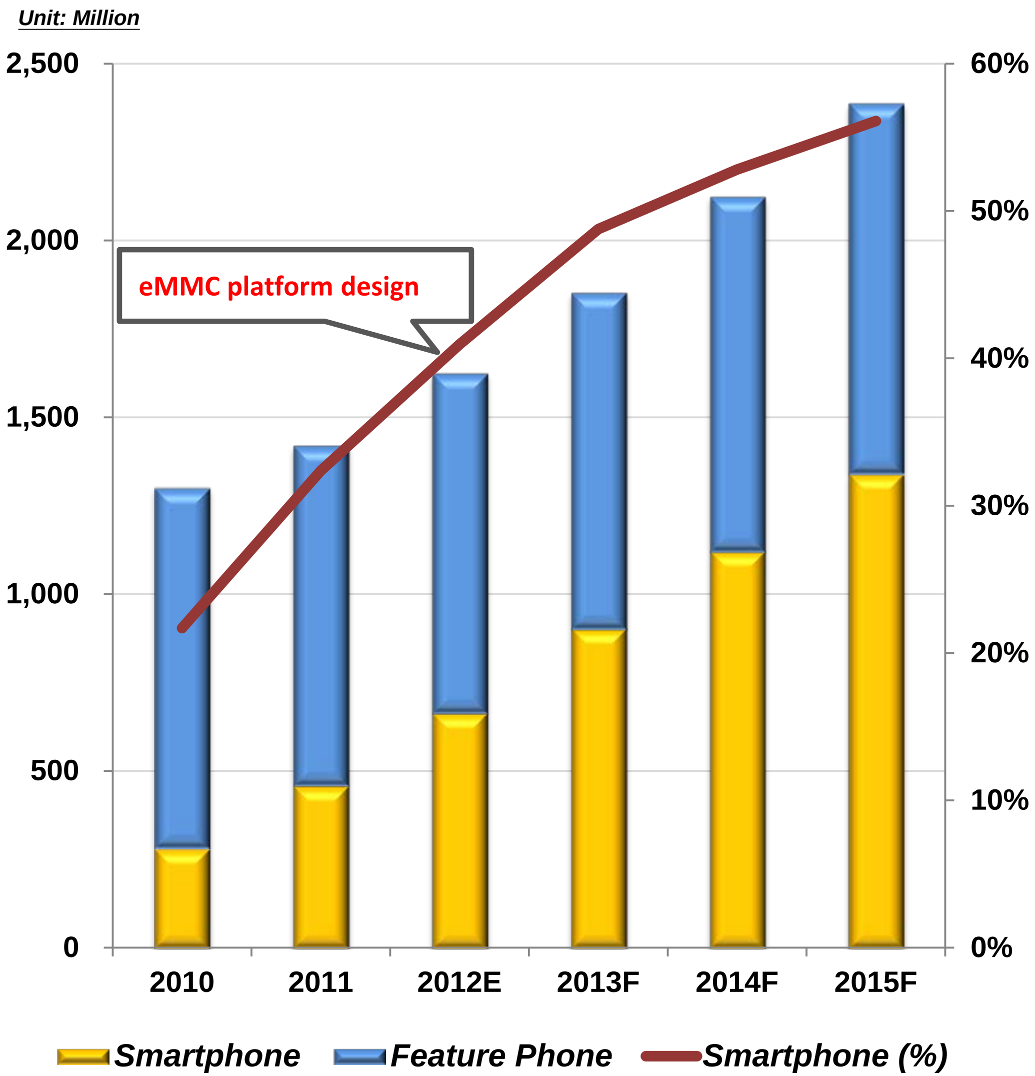
Unit: Million



Source: DRAMeXchange, Jun, 2012

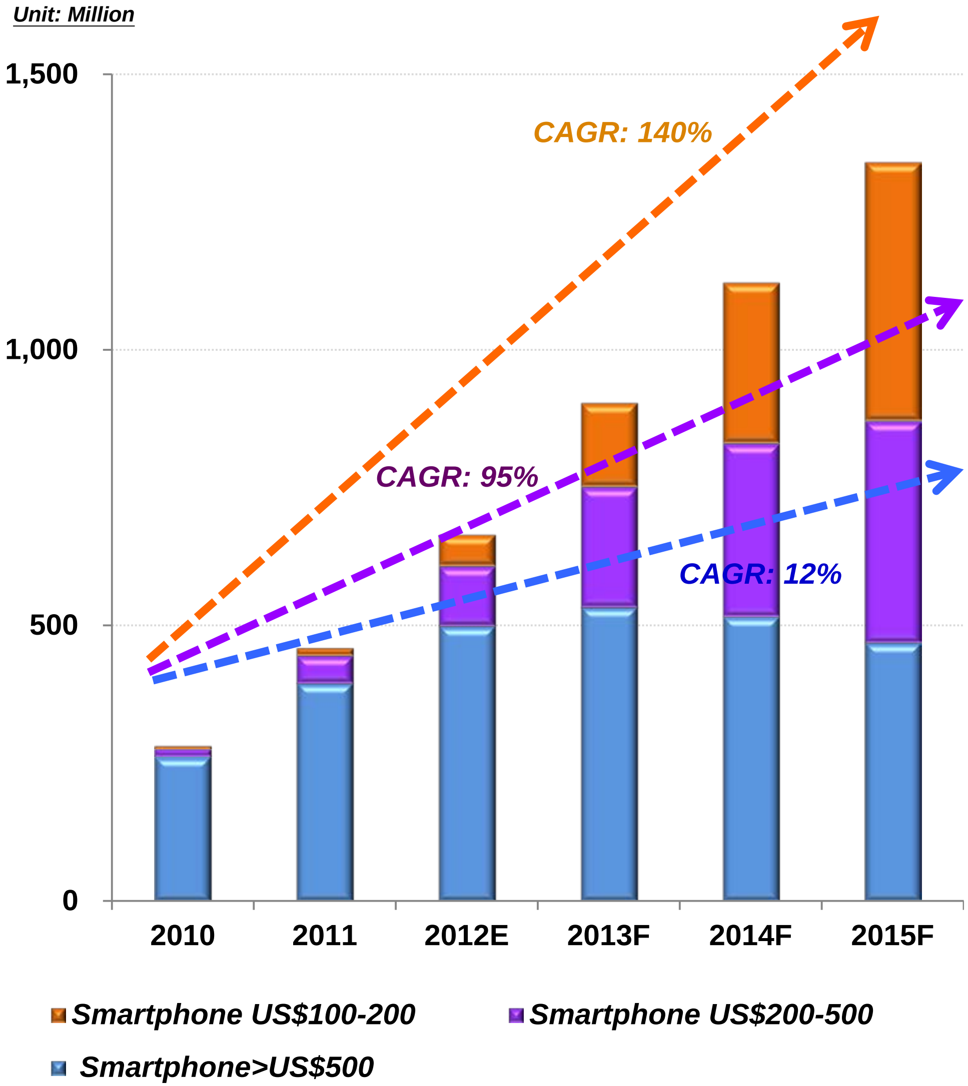
Robust Smartphone Unit Growth



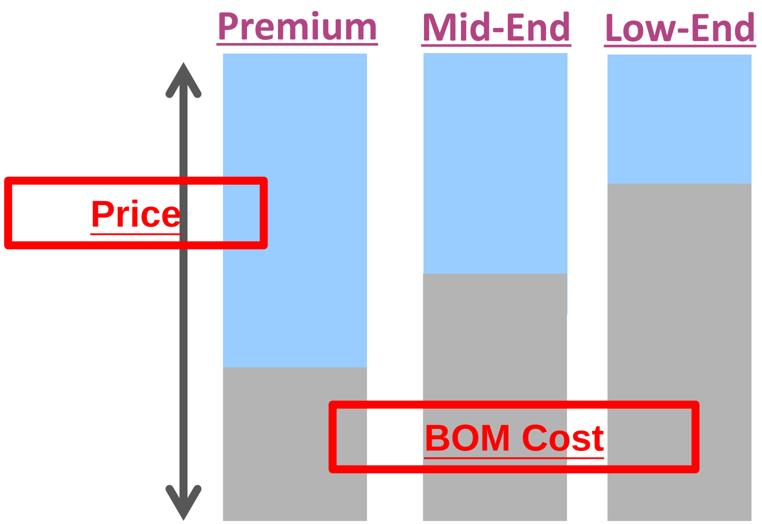
Source: DRAMeXchange, Jun., 2012

- ***2012 smartphone volume: 660 million.***
- ***eMMC is widely used in high-end smartphone in 2011 and penetrate into mid-end product lines from 2012.***
- ***eMMC design is raising from the high requirement of multi-media and high performance device.***

2012 Smartphone → Middle & Entry Models Surge



Source: DRAMeXchange, Jun., 2012



Gross Margin	35-40%	25-30%	15-20%

- ***"Premium" smartphone is reaching saturated in developed countries.***
- ***"Mid/Low-End" smartphone contains good momentum in China, Asia-Pacific and rest emerging areas.***
- ***"Mid/Low-End" segment margin is still attractive to new smartphone makers.***

eMMC is Penetrating into Wide Smartphone Portfolios

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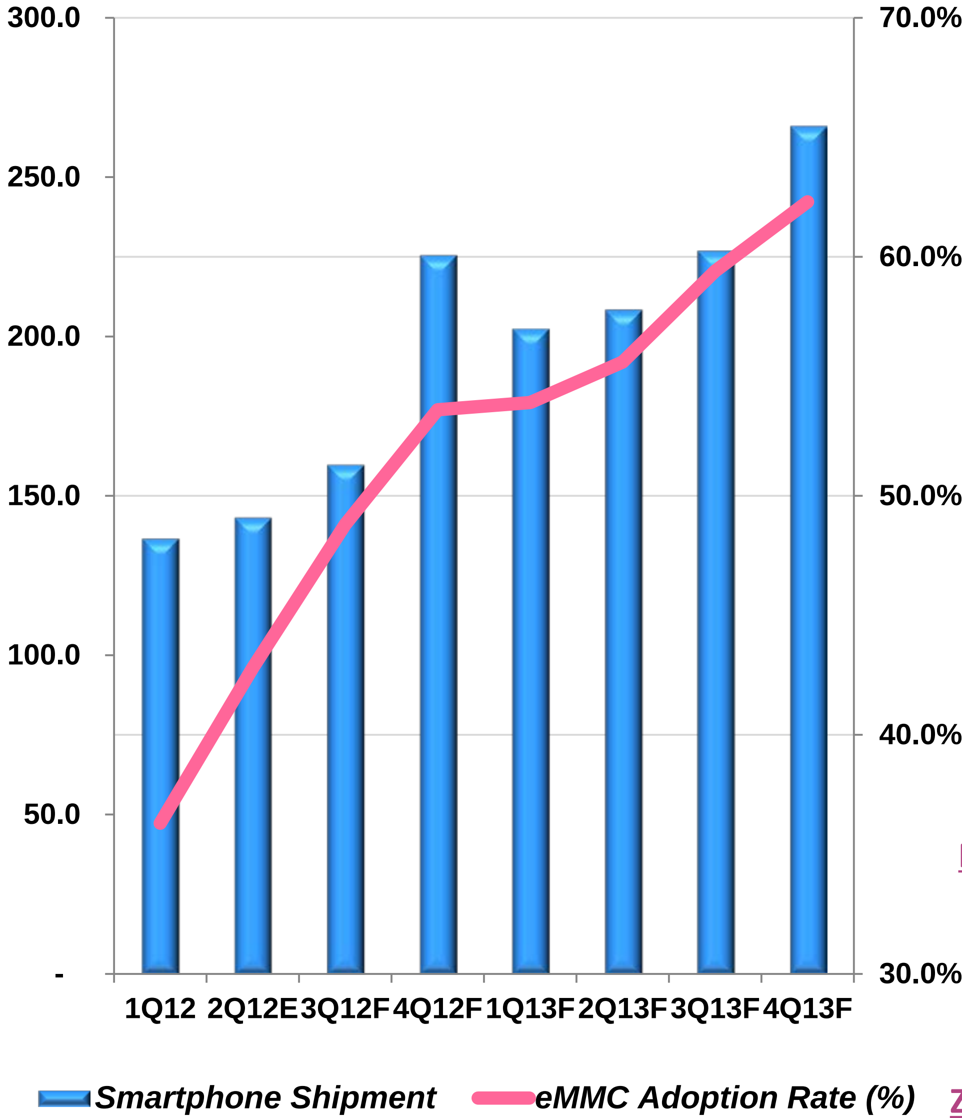
Unit: Million



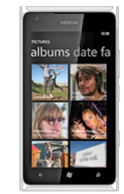
Source: DRAMeXchange, Jun., 2012

eMMC in High-Price models

SEC Galaxy S2

Sony Xperia S

HTC One X



Nokia Lumia 900

16GB/32GB

eMMC in Middle/Entry models

Nokia Lumia 610

SEC Galaxy Ace 2

ZTE Mimosa X

Blackberry Bold 9900

4GB/8GB

Media Tablet → Market Continues to Grow

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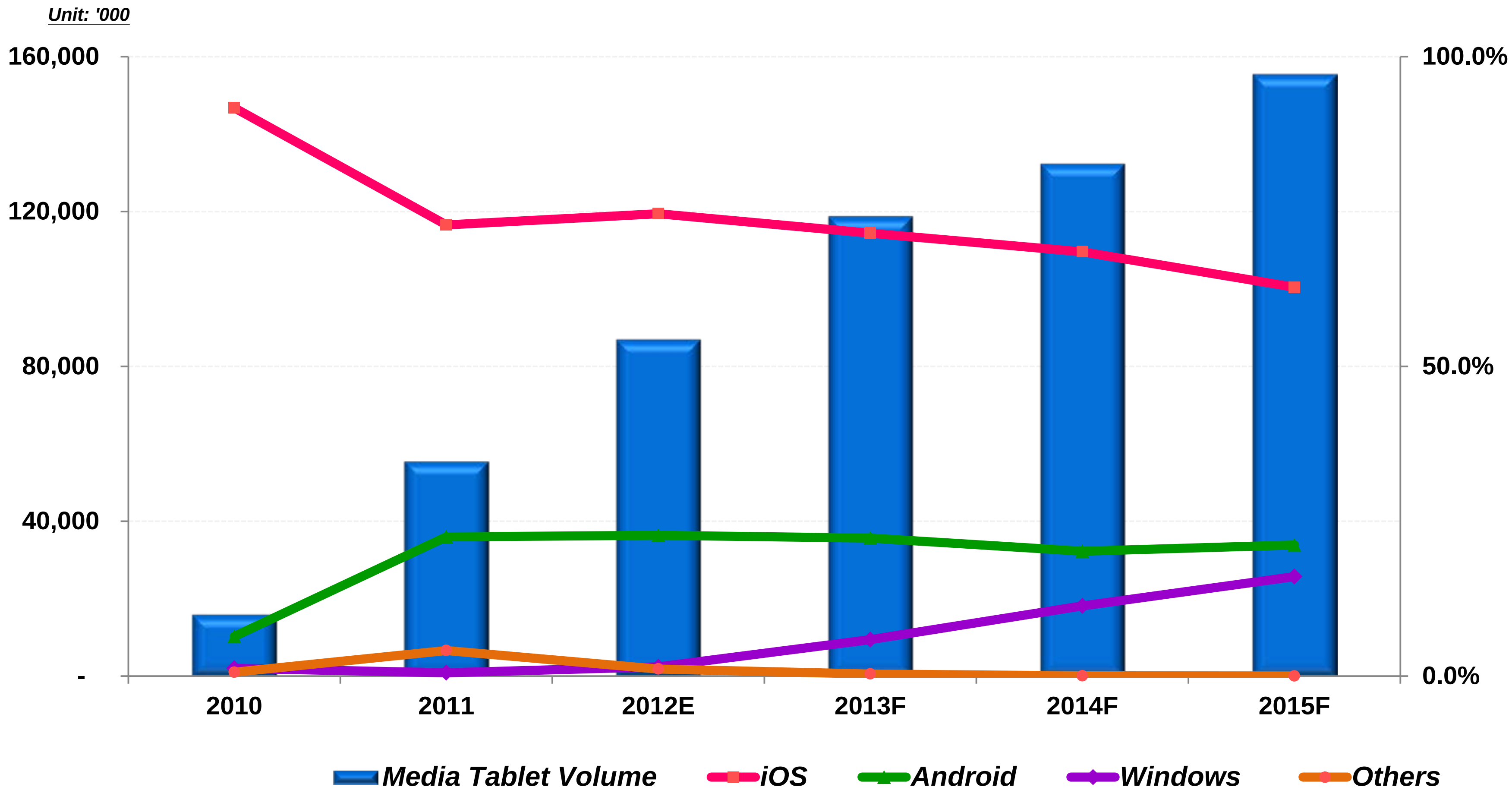

Source: DRAMeXchange, Jun., 2012

- *Windows8 is the key catalyst for media tablet growth from 2013.*
- *More than 97% media tablet models are designed in eMMC storage.*

eMMC Density is Categorized for Consumer Usage

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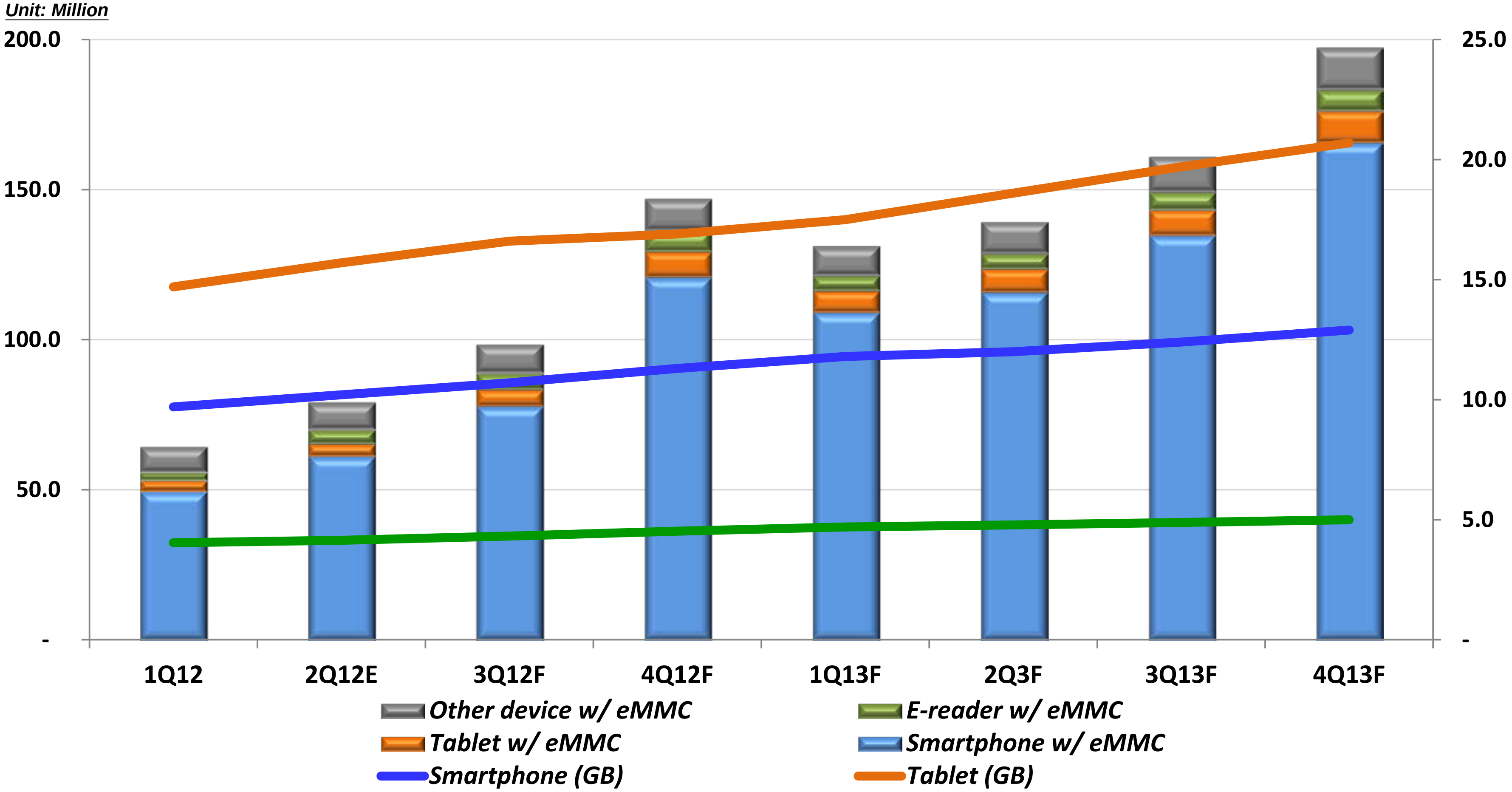

Source: DRAMeXchange, Jun., 2012

- Overall 2012 eMMC market size is closed to 400mn units, smartphone consumes most.
- Each device has identical content per box given different usage and cost structure.

Ultrabook is the Key to SSD

Ultrabook <13.3”

18mm

Ultrabook >13.3”

21mm

Brand/OEM

Quanta Computer · Inventec · Wistron · COMPAL · PEGATRON

Display	Memory	**Storage**	Battery	Enclosure

SSD Implementation in Ultrabook

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Premium Ultrabook

mSATA SSD

OR

Ultra-Slim SSD

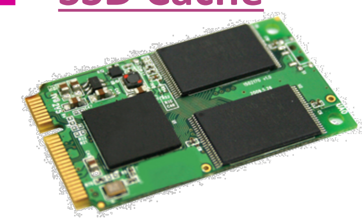
- Premium performance
- Extreme slim thickness

Value Ultrabook

Ultra-Slim HDD

+

SSD Cache



- Attractive storage capacity
- Better Price/Cost structure

Diversified Ultrabook is Foreseeable for PC-OEMs

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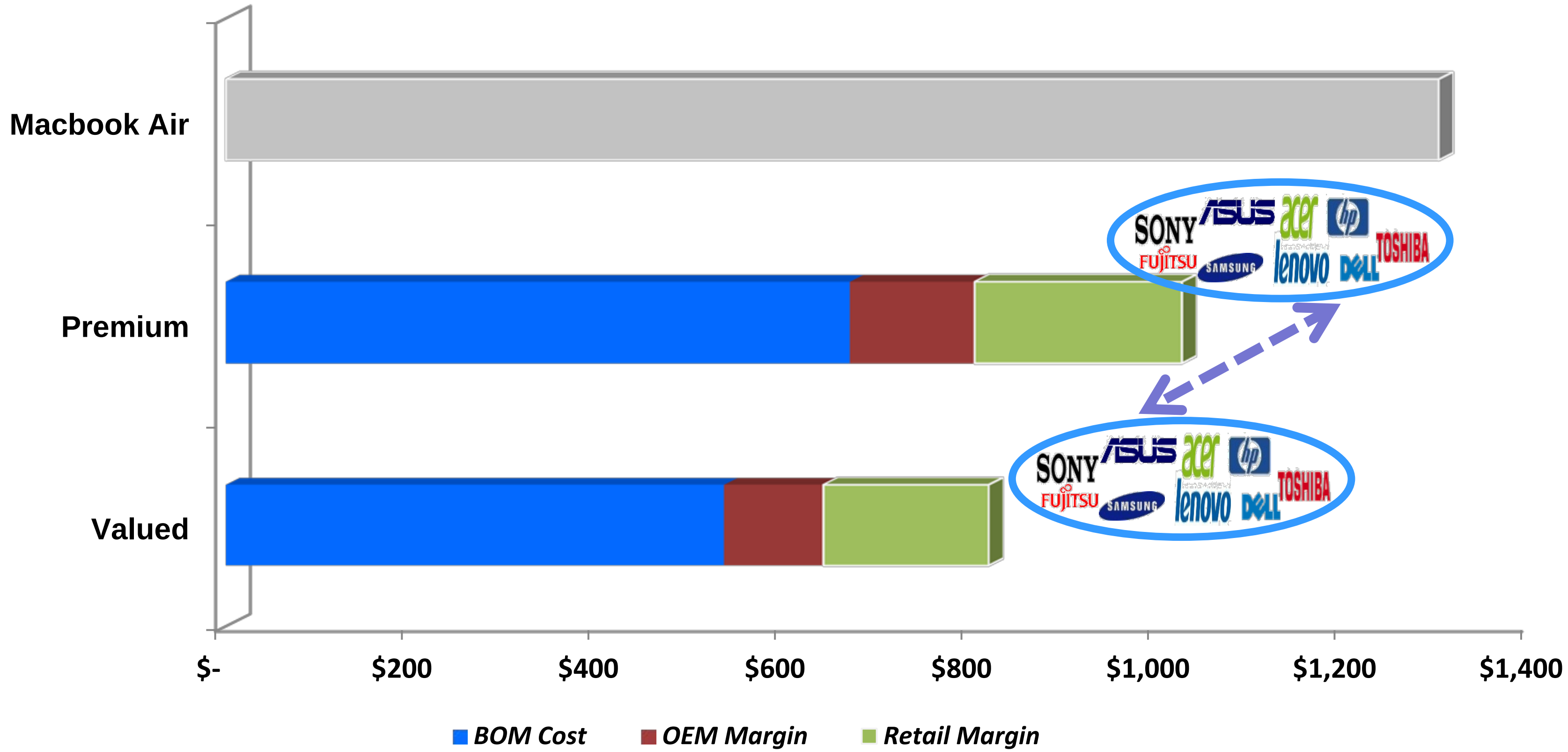

Source: DRAMeXchange, Jun., 2012

- ***Diversified ultrabook product mix will be dressed by major PC-OEMs given the incentive for distinguish from Apple "Macbook Air" .***

- ***More than 80% of ultrabook models in 2012 will be designed in valued lineups.***

Strong Momentum of ultrabook from 2H'12

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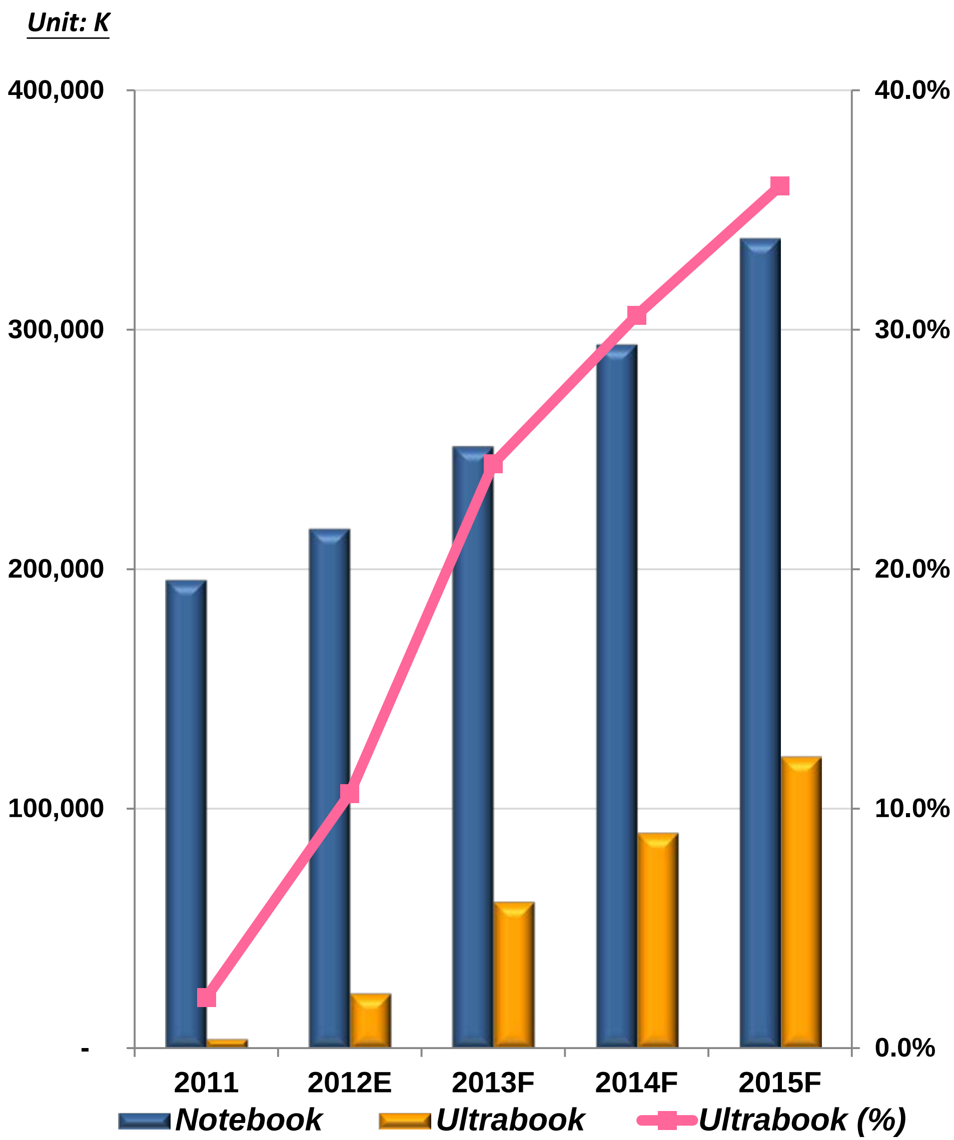

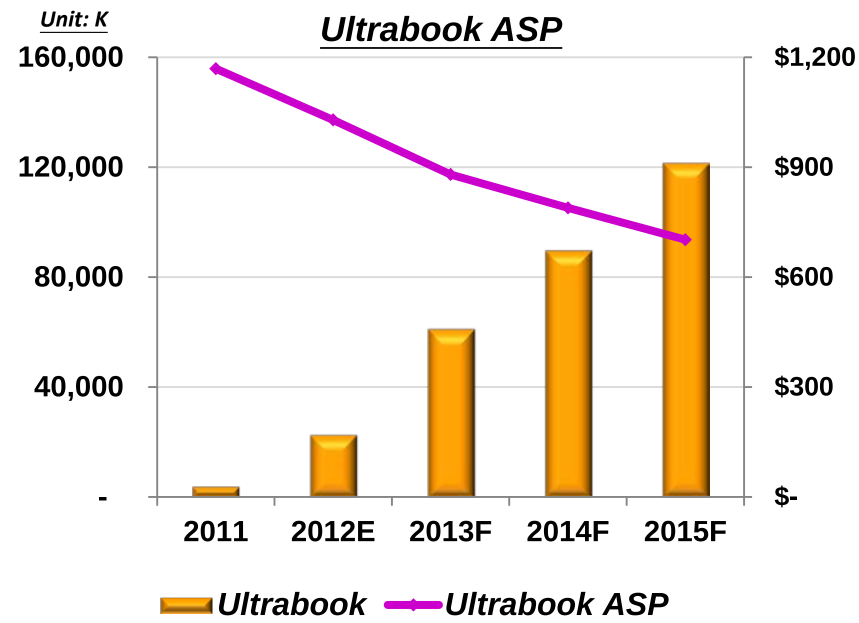

- *Ultrabook is around 10% of total notebook in 2012.*
- *Featured with affordable components and cost-down on key parts, ultrabook ASP continue to drop to boost penetration rate.*

Source: DRAMeXchange, Jun., 2012

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SSD- Slim Form Factor Drives Growth

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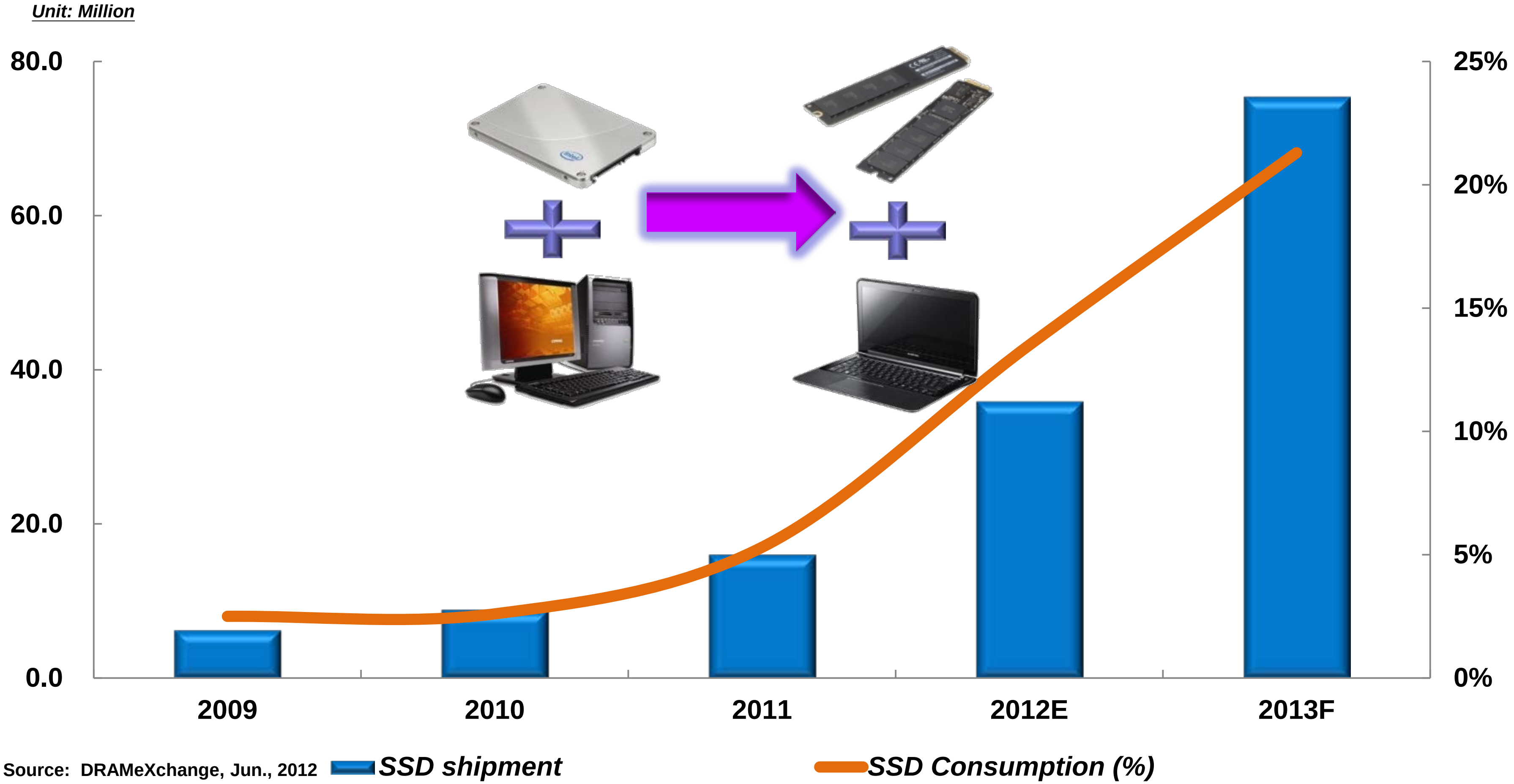

Source: DRAMeXchange, Jun., 2012

- *SSD is moving from retail market with regular form factor to mSATA with ultra-thin laptop.*
- *SSD accounts ~15% of NAND Flash consumption in 2012 and will be up to above 20% in 2013.*

Reiterate Positive on Long-Term NAND Flash Market

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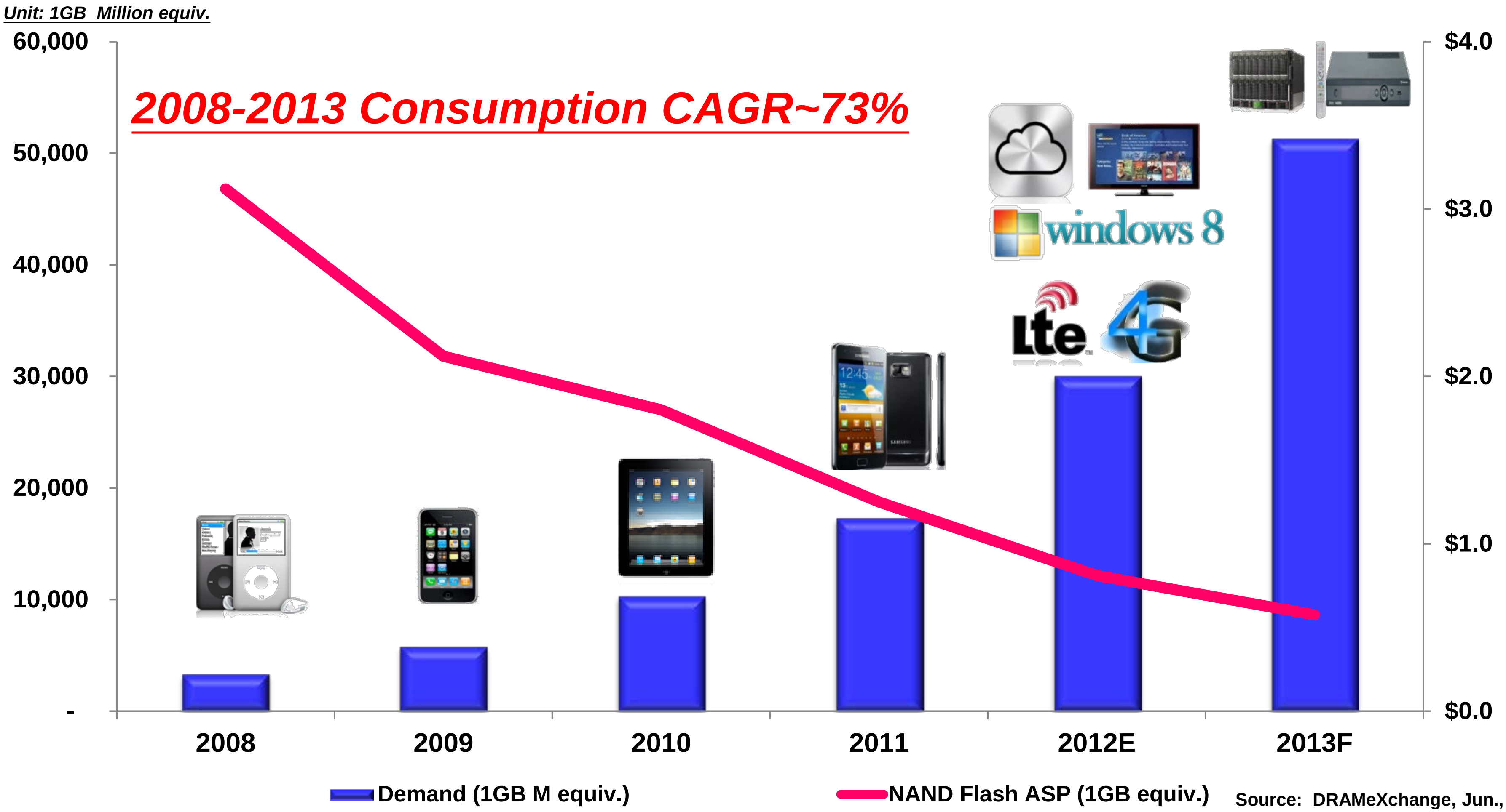

Source: DRAMeXchange, Jun., 2012

- *Catalysts for NAND Flash market growth include diversified and innovative applications as well as technology evolution. NAND Flash is viewed as the superior storage for devices.*

Thank You

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