Achieving Higher-Density Code Storage with Flash Memory
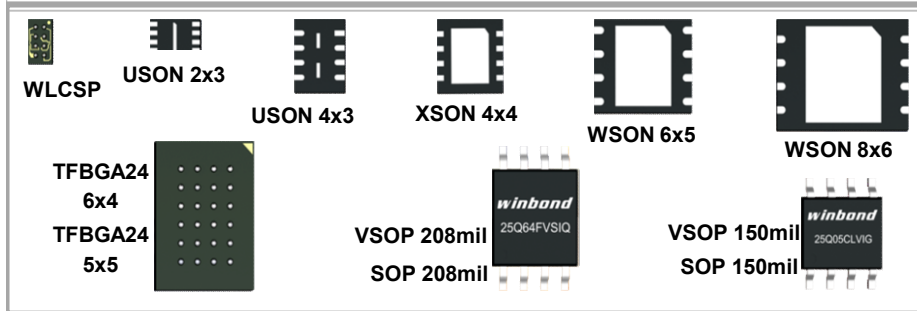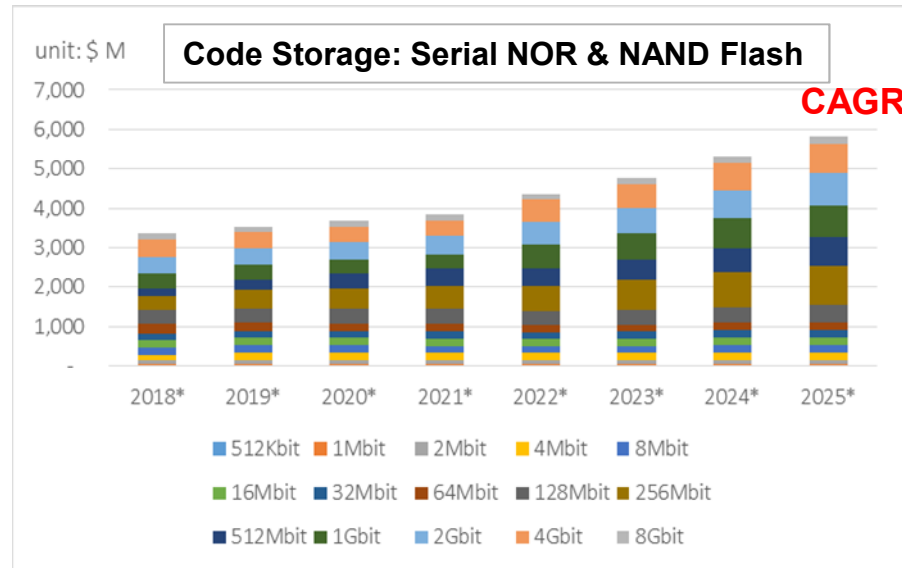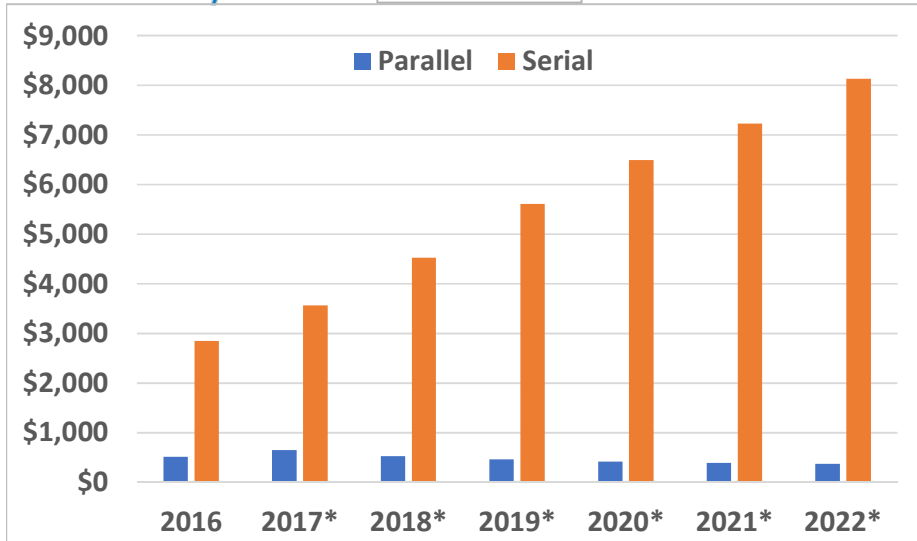
K.C.Shekar, Winbond Electronics

NEWM-301A-1: Life Beyond Flash - New Non-Volatile Memory Technologies
(New Memory Technologies Track)

Continuous Growth in Code Storage Flash

NOR Flash

Chart showing NOR Flash (Parallel vs Serial) revenue from 2016 to 2022*

Code Storage: Serial NOR & NAND Flash

CAGR 8%

unit: $ M

Stacked bar chart of Code Storage from 2018* to 2025* by density: 512Kbit, 1Mbit, 2Mbit, 4Mbit, 8Mbit, 16Mbit, 32Mbit, 64Mbit, 128Mbit, 256Mbit, 512Mbit, 1Gbit, 2Gbit, 4Gbit, 8Gbit

Serial Flash package types: WLCSP, USON 2x3, USON 4x3, XSON 4x4, WSON 6x5, WSON 8x6, TFBGA24 6x4, TFBGA24 5x5, VSOP 208mil, SOP 208mil, VSOP 150mil, SOP 150mil
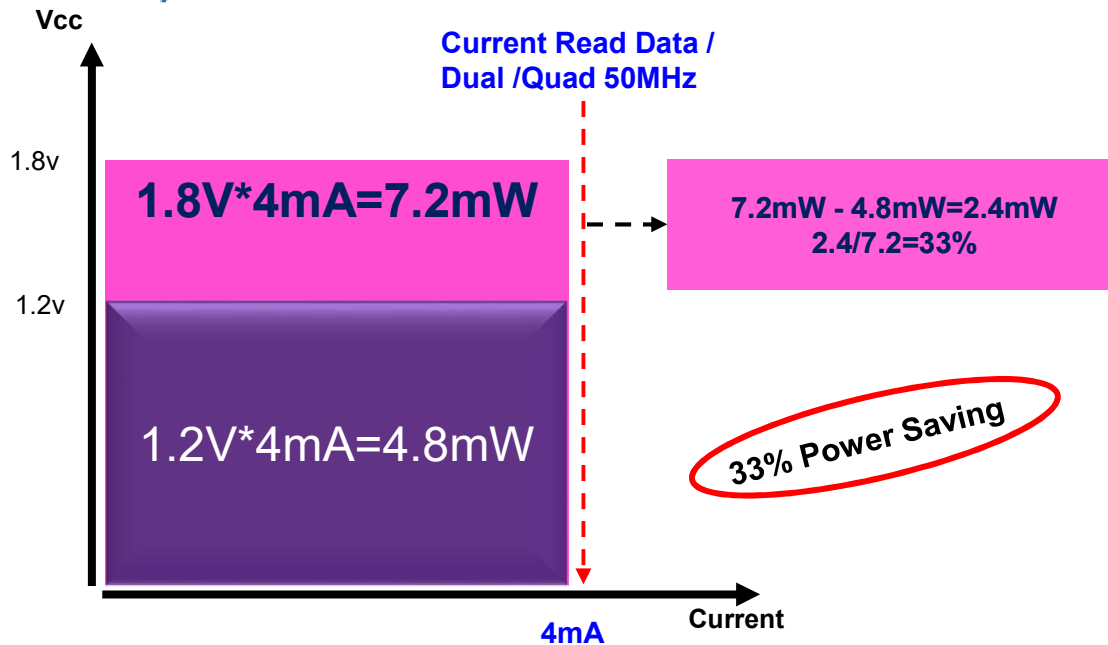
Serial Flash Packages

- Serial Flash is the code storage product of the future – 3V, 1.8V and 1.2V
- Code storage market grew continuously and has extended to higher densities
- 512Mb and lower densities are supported by NOR – mainly Serial
- 1Gb and higher densities are supported by SLC NAND

1.2V & 1.5V Serial Flash Save Power
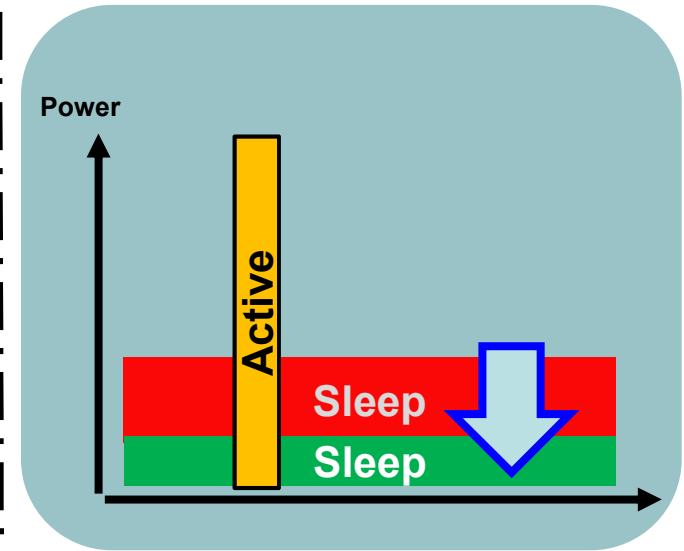
Vcc

**Current Read Data /
Dual /Quad 50MHz**

1.8v

1.8V*4mA=7.2mW

7.2mW - 4.8mW=2.4mW
2.4/7.2=33%

1.2v

1.2V*4mA=4.8mW

33% Power Saving

4mA

Current

Power

Active

Sleep

Sleep

**Saves Battery Power,
Increases usage time!**

157 bpm

2.31w   15:01

1.   Simplifies power domain design
      → **Reduces SoC cost and System level BOM cost**
2. High speed read operation and ultra low stand-by power
      → **Extends battery usage time**
3. Reduces noise coupling
      → **Flexible PCB design - Ideal for compact design**

Flash Memory Summit

W25N Serial NAND Flash Memory
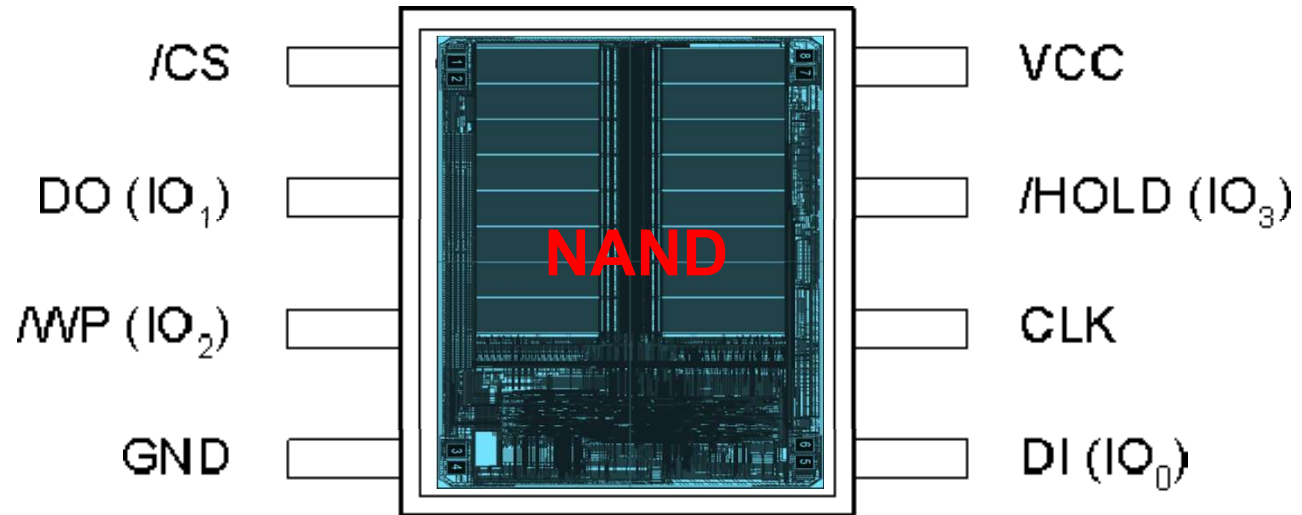
The technology becomes very expensive at process sizes below 5x nm. The new solution for applications requiring more than 512 Mb density with the SPI interface is Serial SLC NAND.

spiflash

/CS		VCC
DO (IO_1)	**NAND**	/HOLD (IO_3)
WP (IO_2)		CLK
GND		DI (IO_0)

- *Seamless transition* to SLC NAND with *standard SPI interface*
  - Same package and same pin-out, lower cost per bit
  - Built-in features: ECC, Bad Block Management - offload external controller
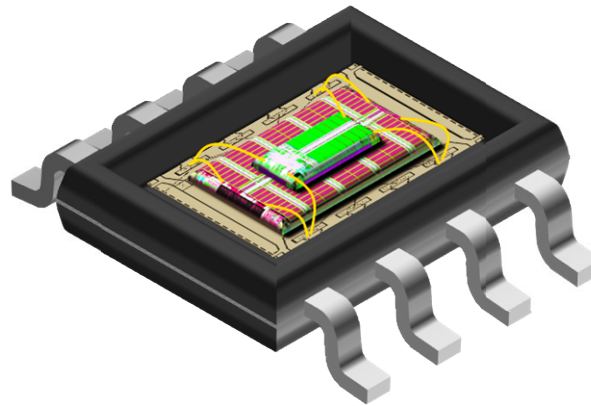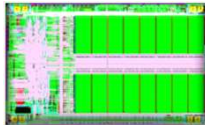 - Continuous Read - Improves system efficiency

spistack™

Code Storage
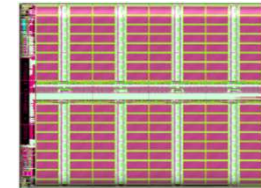- **- NOR Technology**
- **- Small Density**
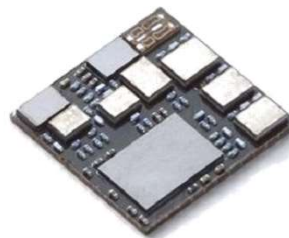- **- High Reliability**

Data Storage
- **- NAND Technology**
- **- Large Density**
- **- High P/E Speed**

"Small 8-pin Packages"

"Concurrent Operations"

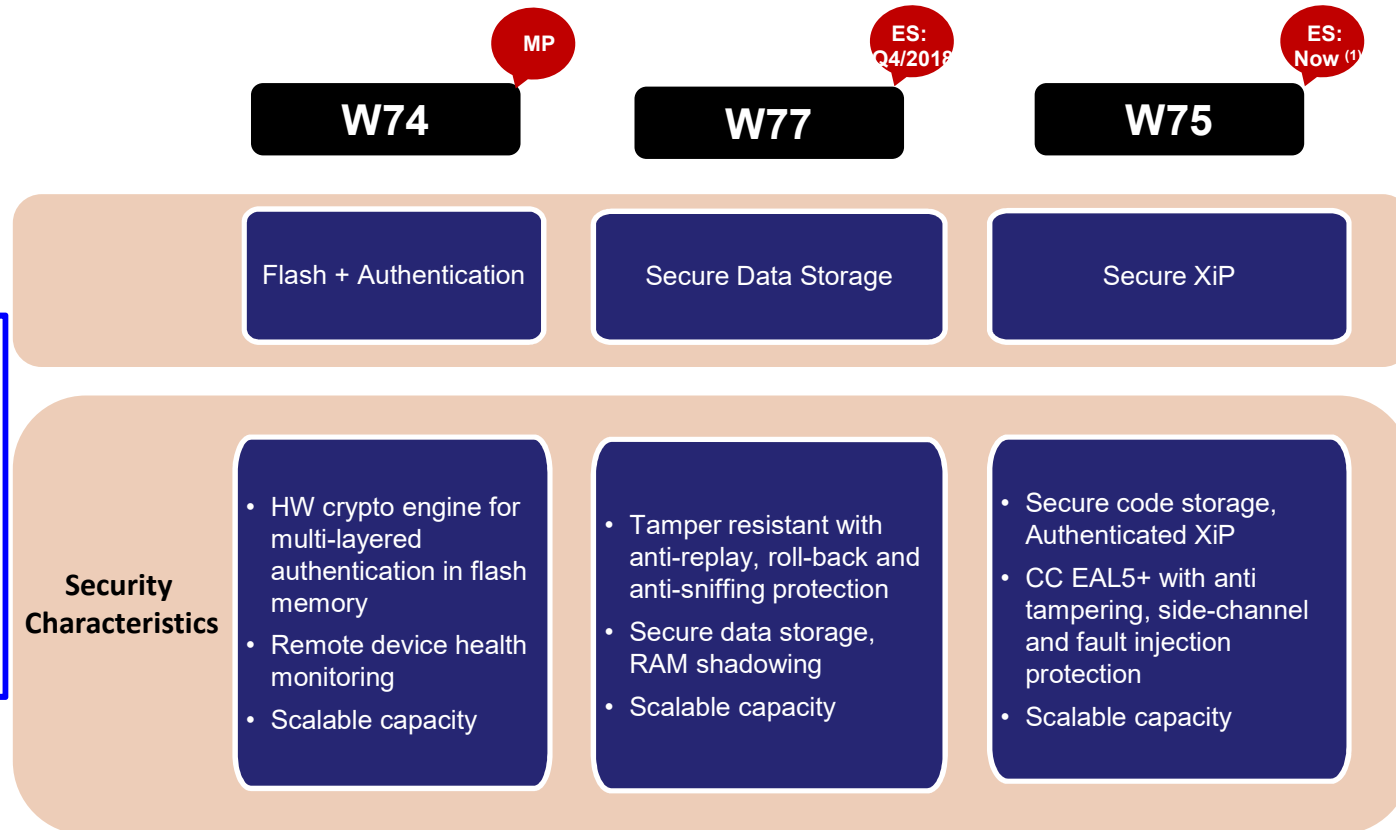*"Flexible Density Combinations"*

Ideal for compact design.

"Software Die Select"

"Continuous Read"

"Compatible SPI protocols"

Winbond Security Memory

Flash Memory Summit

	W74 (MP)	W77 (ES: Q4/2018)	W75 (ES: Now [1])
	Flash + Authentication	Secure Data Storage	Secure XiP

1) Authentication

2) Tamper Resistance

3) Smart Card Technology

Security Characteristics

W74 — Flash + Authentication
- HW crypto engine for multi-layered authentication in flash memory
- Remote device health monitoring
- Scalable capacity

W77 — Secure Data Storage
- Tamper resistant with anti-replay, roll-back and anti-sniffing protection
- Secure data storage, RAM shadowing
- Scalable capacity

W75 — Secure XiP
- Secure code storage, Authenticated XiP
- CC EAL5+ with anti tampering, side-channel and fault injection protection
- Scalable capacity

Future of Code Storage Memories

- Serial NOR Flash from 512Kb through 256Mb densities will continue to be used for IoT, Computer, Consumer and all common applications

- Serial SLC NAND Flash in the SPI interface is getting very popular and will continue to be used in high density code storage applications from 512Mb through 8Gb densities for the foreseeable future

- High density code storage applications include Automotive, Industrial, Storage, Networking, STB and Industrial-IoT applications. Some of these applications could also use SLC ONFi NAND Flash for legacy reasons.

- For density flexibility and space constrained applications, SpiStack products will be used with NAND for data storage and NOR for code storage combined - in a single package

- For enhanced security, Serial Secure Flash will be used in all types of applications for many years into the future

Please visit us at the Winbond Booth # 721

Thank You!!