



Flash Memory Summit

NOR Flash for wearables and hearables - Use Cases

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Trends in wireless earbuds and IoT wearables

- › For wireless earbuds such as TWS and IoT wearables, even the smallest devices are becoming smart and connected.
- › Greater intelligence are built in these devices and complex features, such as Active Noise Cancellation (ANC) and over-the-air updates, require more space for code and data logging.
- › Long battery life is essential to a great user experience.
- › Requires low-power and reliable flash memory in a tiny footprint.



Lower Power Trends



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- › Lower power devices will lead to a longer battery life which in turn means less frequent charging.
- › Smaller batteries also leads to smaller/lighter products.
- › New feature such as Active Noise Cancellation (ANC) requires a microphone to implement which further draws power.
- › Hence it is important that peripheral components are power efficient.



Light weight and Compact Form Factor Trends



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- › Wearables and earbuds need to be light weight and tiny.
- › A tiny component can enable System-in-Package (SiP) solution to meet tiny form factor design goals; enabling smaller PCB and smaller/lighter products
- › Light weight leads to enhance overall user comfort and experience.
- › For example: Typical TWS earbuds pair weighs in the order of 10g and typical TWS earbuds with charging case is of the order of 40-50g.



Growth drivers for small footprint NOR Flash memory

The market for NOR Flash memory in wireless earbuds and IoT wearables is expected to grow from \$90M in 2019 to \$265M in 2024 at a CAGR of 20%¹

Increasing density requirements from low-density (64Mb) to mid-density (256Mb) with growing code size, OTA² code updates, and additional storage for log files



Wireless Earbuds



Smart Watches

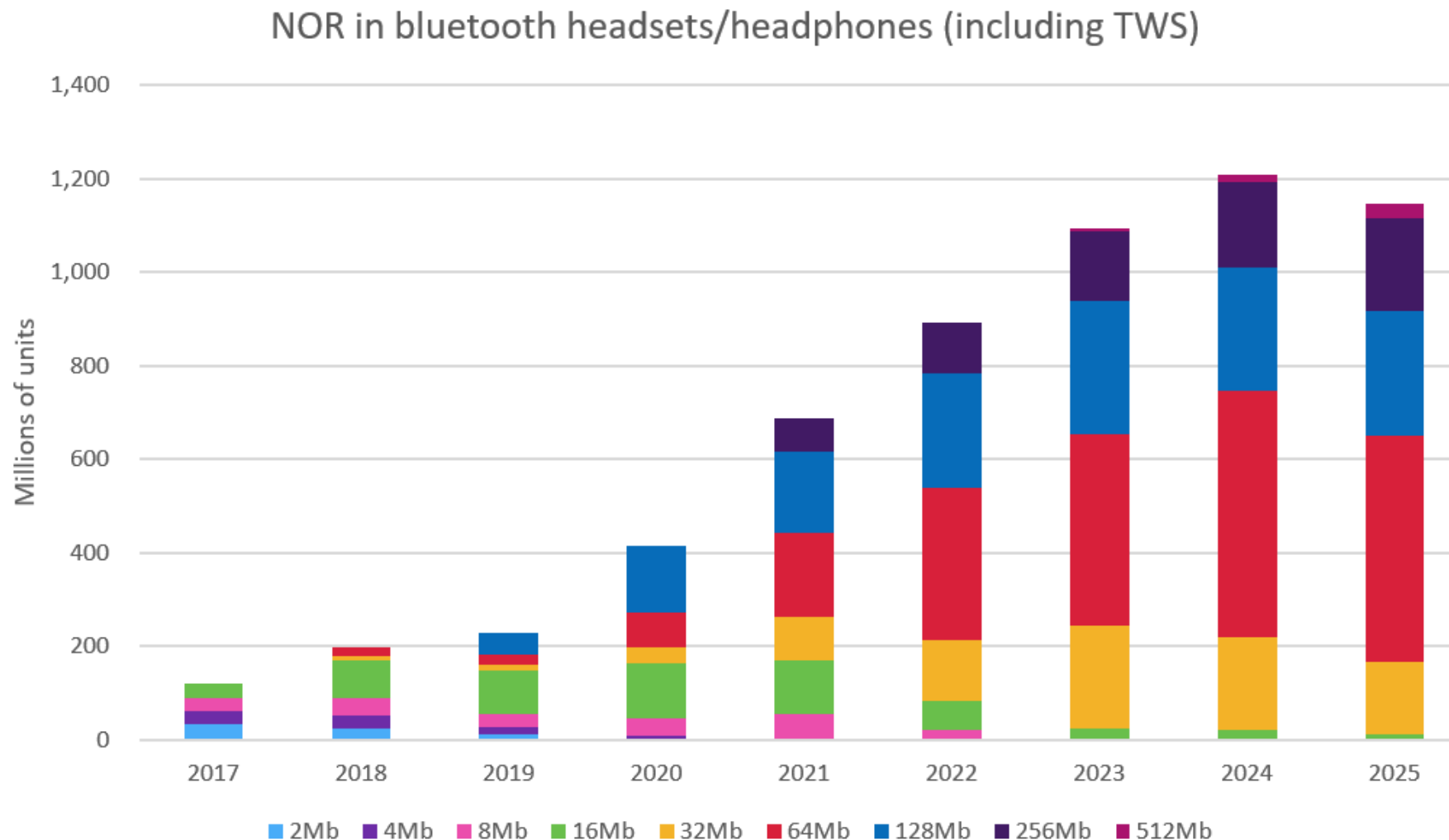


Wireless Headsets

Requires reliable and low-power code and data storage in a tiny footprint

¹ Sources: Gartner, ABI, Internal CY estimates ² Over-The-Air

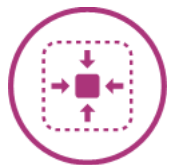
NOR in bluetooth headsets/headphones (including TWS), 2017-25



Source:2021 Omdia



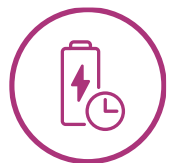
Introducing SEMPER™ Nano NOR Flash memory



Compact

Extremely small 256Mb NOR Flash

- › Compact footprint
- › Available in KGW, CSP, BGA*



Low Power

Best-in-class low power

- › Lowest standby and deep power down currents
- › Low active read current



Reliable

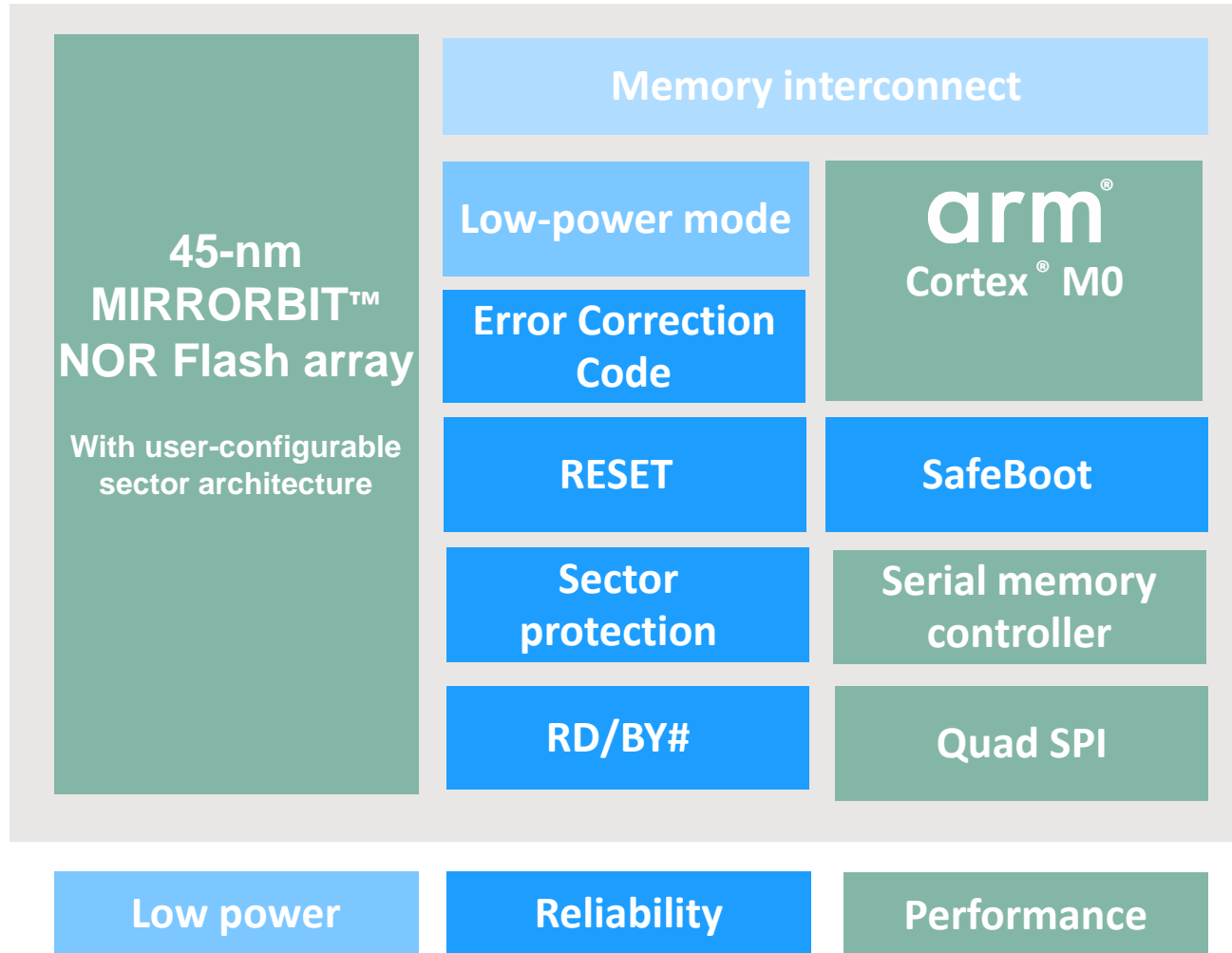
Enhanced reliability

- › Built-in Error Correction Code (SECDED)
- › Configurable sector architecture for code and data storage

* Upon request



SEMPER™ Nano: built on proven SEMPER™ Flash architecture



Density
256Mb

Voltage
1.8V

Performance
QSPI: 52 MB/s

Reliability
100K+ cycles endurance
25 years retention

Package & Temp
WLCSP, BGA*, KGW
-40 °C to 85 °C

* Upon request

SEMPER™ Nano Flash low power



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**54%
LOWER**

Standby current

5 μ A standby current*

**23%
LOWER**

Deep power down current

1 μ A deep-power-down current*

**42%
LOWER**

Program current

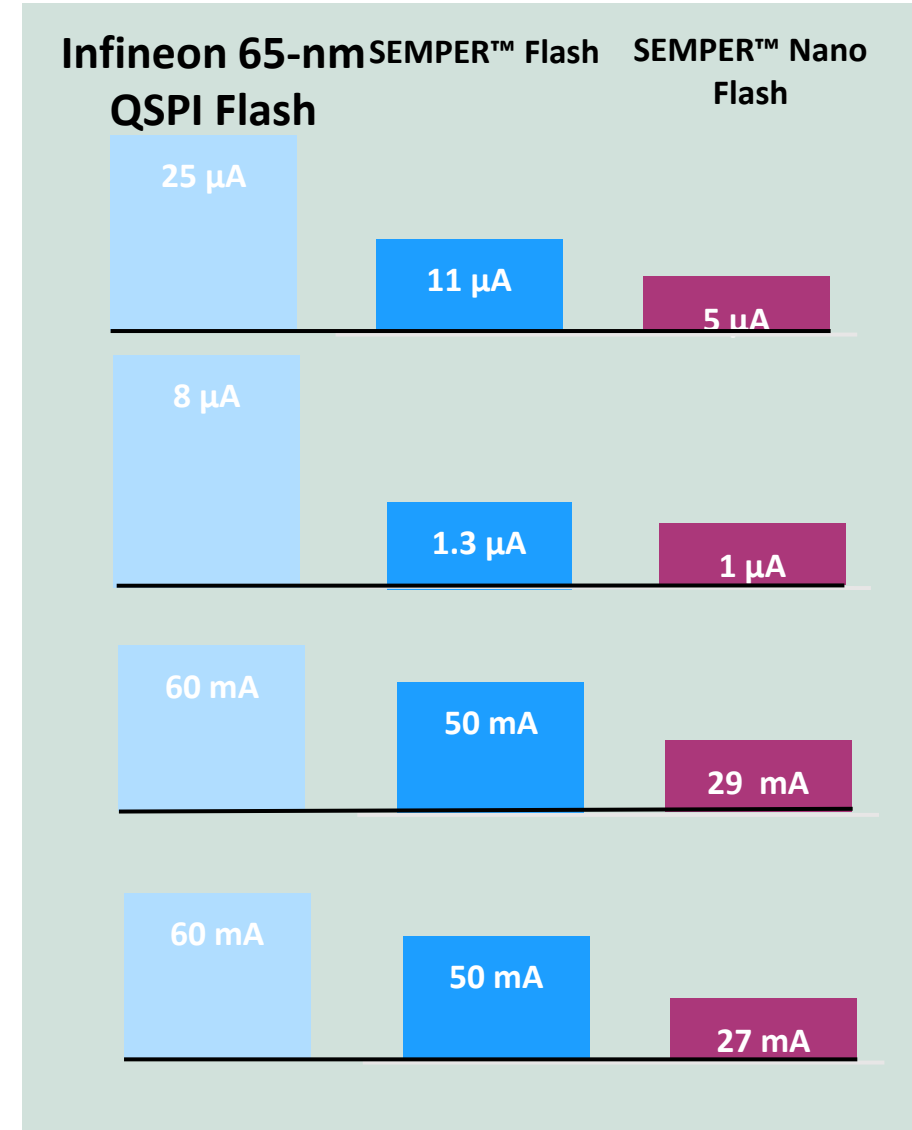
29 mA program current*

**46%
LOWER**

Erase current

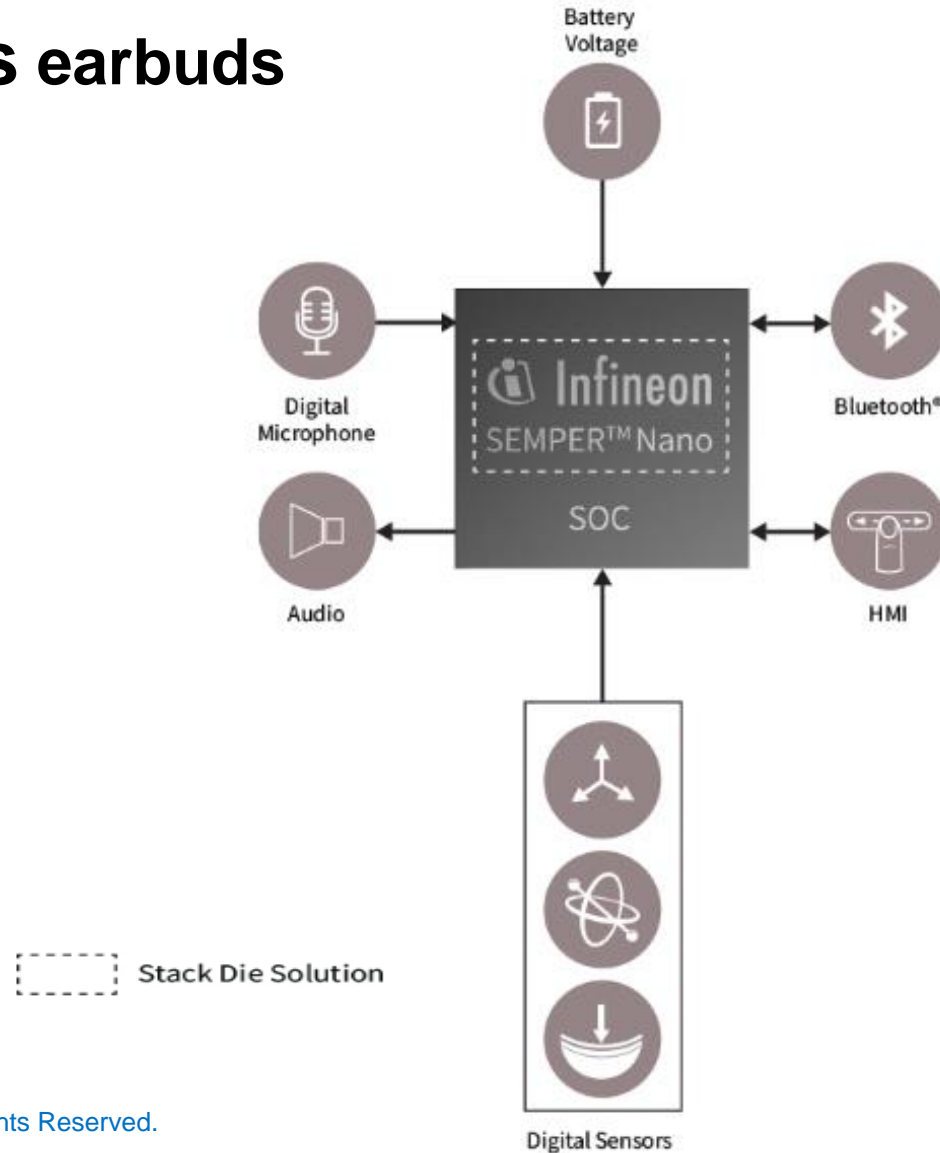
27 mA erase current*

***Extends battery life for battery-powered applications**



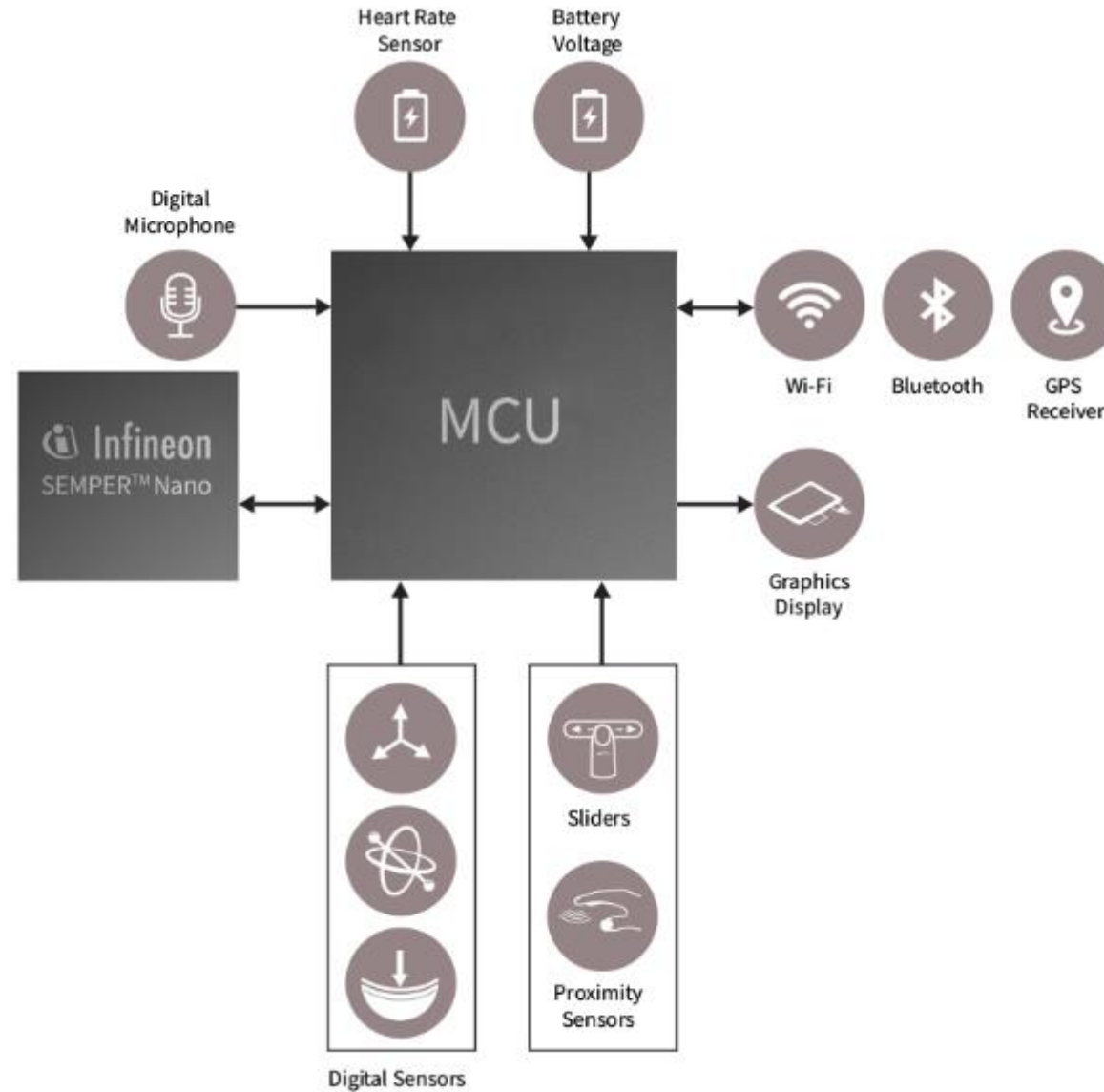
SEMPER™ Nano use cases 1

Wireless earbuds



SEMPER™ Nano use cases 2

Smart watch



SEMPER™ Nano collateral



Datasheet

- › SEMPER™ Nano Quad SPI Flash datasheet



Application notes

- › “Design and layout guide for SEMPER™ Nano Flash memory”
- › “Migration Guide from competitors QSPI Flash to SEMPER™ Nano Flash”
- › “SEMPER™ Nano configurable array architecture”
- › “Migration Guide from Infineon FS256S to SEMPER™ Nano Flash”



Models

- › Verilog models, IBIS models



Solutions Hub

- › Production-grade drivers, PMOD kits

Conclusion



IoT wearables market is expected to grow at a 20% CAGR driven by fitness and hearable applications

Smart functionality in IoT wearables requires mid-density, low-power and reliable NOR Flash in a tiny footprint

SEMPER™ Nano is the only compact footprint 256Mb NOR Flash, and delivers best-in-class low power and reliability



Part of your life. Part of tomorrow.