New Product Introduction:
2Mb-to-16Mb Excelon™ F-RAM Family
Energy-Efficient, High-Performance, High-Reliability NVM
Modern Systems Need Energy-Efficient, High-Performance, High-Reliability NVM Solutions

› The market for F-RAM, one type of NVM, is projected to grow from $251 million in 2015 to $461 million in 2020 at a CAGR of 13%¹

› 2Mb-to-16Mb F-RAM target market segments:

- Medical Devices
- Wearables
- Industrial Control and Automation
- Automotive

- Neuromodulator
- Smartwatch
- Motor Control
- Infotainment System

› Systems in these market segments require NVMs to frequently log sensor data and instantly capture critical system data on power loss

¹ Sources: Web-Feet Research, Semicast, Gartner, internal market research
F-RAM NVM – Essential for Mission-Critical Data-Logging in Fail-Safe Automotive and Industrial Systems

ADAS Vision System
- Capture real-time data instantly and store data on power-loss
- Ensure sufficient write-cycle endurance to log data for 20 years
- Retain data for > 5 years
- Should be designed with AEC-Q100 qualified memory components

Programmable Logic Controller
- Capture real-time data instantly and store data on power-loss
- Write data at throughputs equivalent to parallel battery-backed SRAMs
- Need sufficient NVM density and write cycle endurance to log data continuously over a 15-year product lifespan
- Eliminate back-up batteries to reduce cost and increase reliability

Excelon™ F-RAM
- Semper™ Secure NOR Flash
- Redundant SoC Boot Code and Calibration Data
- Sensor Data and Last Image Frame
- Other Infineon Portfolio Products

RDIMM
RS-232
RS-485
SD Card
Ethernet PHY
WIFI
USB
Buttons
Display
Input Module
Output Module
Output Actuators

Input Sensors
Application Processor (ASSP / SoC / FPGA)

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F-RAM NVM – Growing Need for High Density, Reliable Data-Logging in Portable and Implantable Medical Devices

- Require lowest energy components to maximize battery life
- Need sufficient NVM density and write cycle endurance to log data continuously over the product’s lifetime
- Should be immune to magnetic field effect and radiation
- Accommodate smallest footprint components to deliver small form-factors

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**Neuromodulator**

- Telemetry
- Sensors
- Microcontroller and Analog circuitry
- Battery

**Cardiac Implant**

- Electrode
- Heart Rate Sensor
- Microcontroller and Analog circuitry
- Battery
- Pulse Generator

Excelon™ F-RAM

Other Infineon Portfolio Products

2021-01-15

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Introducing Excelon™ F-RAM – The No-Data-Loss NVM

**Fast as Parallel Interface SRAMs**
- Low-pin-count Quad SPI interface
- 54MBps throughput at 108-MHz frequency
- NoDelay™ writes

**Best-in-Class Reliability**
- 100 trillion read/write cycles of endurance
- 160 years data retention at 50°C
- AEC-Q100 and Functional Safety (ISO 26262) compliant

**Ultra-Low-Energy**
- 200x less energy than EEPROMs
- Inrush current control during power-up
- Low-power modes: Standby, Deep-Power-Down, Hibernate
Simplify a conventional, complex, battery-operated, EEPROM-based design… By choosing F-RAM as your serial NVM solution… To produce better solutions for battery-operated applications at a lower cost.

2x EEPROM capacity for wear leveling

Wear leveling software algorithm to increase EEPROM write endurance

F-RAM pin-for-pin replacement for EEPROM SOIC8

<table>
<thead>
<tr>
<th>EEPROM</th>
<th>Excelon™ F-RAM</th>
</tr>
</thead>
<tbody>
<tr>
<td>192,000µJ</td>
<td>1,510µJ</td>
</tr>
</tbody>
</table>

High-write energy consumption\(^1\) compared with Excelon™ F-RAM

\(^1\) Conditions: 4-Mb density, maximum current (0.6 mA for F-RAM, 3 mA for EEPROM), burst write at 5-MHz SPI, 2.7 to 3.6 V
2Mb-to-16Mb Excelon™ F-RAM Family

Applications
Medical devices, wearables, industrial control and automation, and automotive

Features
- **Excelon™ Ultra**
  - 2Mb to 16Mb
  - 54-MHz Double Data Rate (DDR)/108-MHz Single Data Rate (SDR) Quad SPI
  - Industrial temperature range grade “I”: -40 °C to +85 °C
- **Excelon™ Auto**
  - 4Mb to 16Mb Auto “A”, 8Mb to 16Mb Auto “S”, 2Mb to 8Mb Auto “E”
  - 54-MHz Double Data Rate (DDR)/108-MHz Single Data Rate (SDR) Quad SPI
  - 40/50-MHz Serial Peripheral Interface (SPI)
  - Automotive temperature range grade “A”: -40 ºC to +85 ºC
  - Automotive temperature range grade “S”: -40 ºC to +105 ºC
  - Automotive temperature range grade “E”: -40 ºC to +125 ºC
- **Excelon™ LP**
  - 2Mb to 16Mb
  - 20-MHz SPI (Commercial/Industrial), 40/50-MHz SPI (Industrial)
  - Ultra low (0.75 µA) deep power down current
  - Ultra low (0.1 µA) hibernate current
  - Commercial temperature range grade “C”: 0 ºC to +70 ºC
  - Industrial temperature range grade “I”: -40 ºC to +85 ºC
  - Industrial temperature range grade “Q”: -40 ºC to +105 ºC
- Common features for Excelon™ Ultra/Auto/LP
  - Operating voltage ranges: 1.71 V to 1.89 V, 1.80 V to 3.60 V
  - 100-trillion read/write cycle endurance & 100-year data retention

Excelon™ F-RAM

Family Table

<table>
<thead>
<tr>
<th>Density</th>
<th>Standby Current (Typ.)</th>
<th>Active Current (Typ.)</th>
<th>Packages</th>
</tr>
</thead>
<tbody>
<tr>
<td>2Mb</td>
<td>2.3 µA</td>
<td>2.4 mA</td>
<td>SOIC (8), TDFN (8)</td>
</tr>
<tr>
<td>4Mb</td>
<td>2.3 µA</td>
<td>2.4 mA</td>
<td>SOIC (8), GQFN (8)</td>
</tr>
<tr>
<td>8Mb</td>
<td>3.5 µA</td>
<td>2.6 mA</td>
<td>SOIC (8), GQFN (8)</td>
</tr>
<tr>
<td>16Mb</td>
<td>8.0 µA</td>
<td>2.7 mA</td>
<td>FBGA (24)</td>
</tr>
</tbody>
</table>

1 Quad SPI has 4 I/Os
Excelon™ F-RAM Portfolio
Ultra Low Power | High Speed | High Endurance

<table>
<thead>
<tr>
<th>Excelon™ Auto</th>
<th>Excelon™ Ultra</th>
<th>Excelon™ LP</th>
</tr>
</thead>
<tbody>
<tr>
<td>CY15B116QSN</td>
<td>CY15V116QSN</td>
<td>CY15B116QI/N</td>
</tr>
<tr>
<td>16Mb; 1.8–3.6 V</td>
<td>16Mb; 1.71–1.89 V</td>
<td>16Mb; 1.71–1.89 V</td>
</tr>
<tr>
<td>24-ball FBGA</td>
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<td>24-ball FBGA</td>
</tr>
<tr>
<td>108-MHz QSPI; Auto S</td>
<td>108-MHz QSPI, Ind; Auto S</td>
<td>20/40-MHz SPI, Comm*, Ind</td>
</tr>
<tr>
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<td>24-ball FBGA</td>
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<td>24-ball FBGA</td>
</tr>
<tr>
<td>50-MHz SPI; Auto E</td>
<td>50-MHz SPI, Ind; Auto E</td>
<td>20/50-MHz SPI, Comm, Ind</td>
</tr>
<tr>
<td>CY15B116QN</td>
<td>CY15V116QN</td>
<td>CY15B116QN</td>
</tr>
<tr>
<td>8Mb; 1.8–3.6 V</td>
<td>8Mb; 1.71–1.89 V</td>
<td>8Mb; 1.71–1.89 V</td>
</tr>
<tr>
<td>24-ball FBGA</td>
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</tr>
<tr>
<td>8-pin SOIC</td>
<td>8-pin SOIC</td>
<td>8-pin SOIC</td>
</tr>
<tr>
<td>50-MHz SPI; Auto E</td>
<td>50-MHz SPI, Ind; Auto E</td>
<td>50-MHz SPI, Ind</td>
</tr>
</tbody>
</table>

1 Quad serial peripheral interface
2 Industrial grade -40°C to +85°C
3 Commercial grade 0°C to +70°C
4 AEC-Q100 -40°C to +105°C
5 AEC-Q100 -40°C to +85°C
6 AEC-Q100 -40°C to +125°C
7 Industrial Q grade -40°C to +105°C

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Getting Started With Excelon™ F-RAM

1. Download our application note: *SPI Guide for F-RAM (AN304)*
2. Register to access online support
3. Contact Sales to request a datasheet

Medical Devices

Wearables

Industrial Control and Automation

Automotive

Neuromodulator

Smartwatch

Motor Control

Infotainment System
Excelon™ F-RAM Resources

- Webpage
  - Excelon™ F-RAM Webpage
    - https://www.cypress.com/products/excelon-fram

- Product Overview (Webpage)
  - Brochure: Excelon™ Ultra F-RAM Memory
  - Brochure: Excelon™ Auto F-RAM Memory
  - Brochure: Excelon™ LP F-RAM Memory

- Application Notes
  - Designing with Cypress Quad SPI (QSPI) F-RAM
  - Designing with Excelon™ LP SPI F-RAM Low-Power Modes
  - SPI Guide for F-RAM

- Datasheets
  - 2Mb Excelon™ Auto F-RAM with Automotive-E Temperature Datasheet
  - 4Mb Excelon™ Ultra F-RAM with Quad SPI Interface Datasheet
  - 8Mb Excelon™ LP F-RAM with Inrush Current Control Datasheet

- Solution Videos
  - High-Speed Nonvolatile Data-Logging for Industry 4.0
  - No-Data-Loss Automotive EDR with Excelon™ F-RAM
  - Excelon™ LP for Portable & Implantable Medical Devices

- Kits & Development Boards
  - Excelon™ F-RAM Development Kit
  - PSoC® 6 WiFi-Bluetooth Pioneer Kit with Excelon™ Ultra F-RAM on-board
  - Access software and tools including example projects
Embedded systems require high-reliability NVMs to log data reliably in an energy-efficient manner.

Excelon™ F-RAM is the only NVM that offers high-reliability and high-performance with ultra-low-power consumption.

Excelon™ offers high-density, high-performance, low-pin-count interfaces to quickly access both program and log data.

More Information: www.cypress.com/excelon-fram
Part of your life. Part of tomorrow.