



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

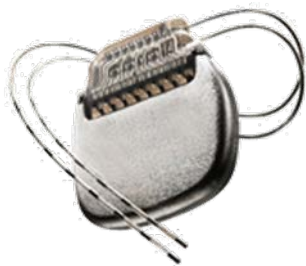
Infineon's virtual show 2020



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



Neuromodulator

[Wearables](#)



Smartwatch

Industrial Control and Automation



Motor Control

Automotive



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-Foot Research, Semicast, Gartner, internal market research

Design Problems Engineers Face

D+C



Systems require high-reliability NVMs to log data reliably

- › [EEPROM page](#) write requires additional capacitors or batteries to capture data on power loss, reducing reliability
- › EEPROM [write endurance](#) limitations reduce system reliability necessitating the use of wear leveling¹



Systems require energy-efficient NVMs to extend battery life

- › EEPROM consumes excess battery power for every 10-ms page write operation required to write only one byte
- › EEPROM consumes excess battery power due to its high active currents and wear leveling processes



System designers require high-performance, low-pin-count NVMs to quickly access programs, log data

- › Current low-pin-count NVMs lack the write bandwidth of high-speed parallel interfaces due to page write latencies
- › Parallel NVMs require larger packages and more microcontroller pins



Infineon's 2Mb-to-16Mb Excelon™ F-RAM product family solves all these problems

- › Consumes 127x² less energy than EEPROM for burst writes
- › Offers 54-MBps [Quad SPI](#) interface in small-footprint SOIC and GQFN package options
- › Eliminates the need for additional capacitors or batteries to complete a write on power loss
- › Provides 100 trillion cycles of write endurance vs. just 1 million for EEPROM

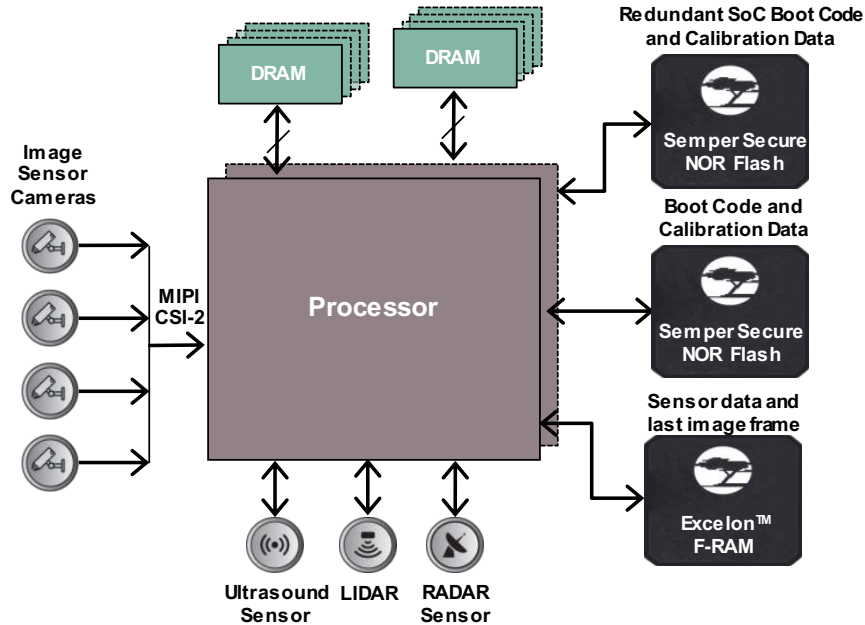
Infineon offers the industry's most energy-efficient, high-performance, high-reliability NVMs

¹ A method to prolong EEPROM write endurance that uses an EEPROM with up to 8x excess capacity and a software algorithm to move storage to unused memory addresses before the write endurance limit on an active address is reached

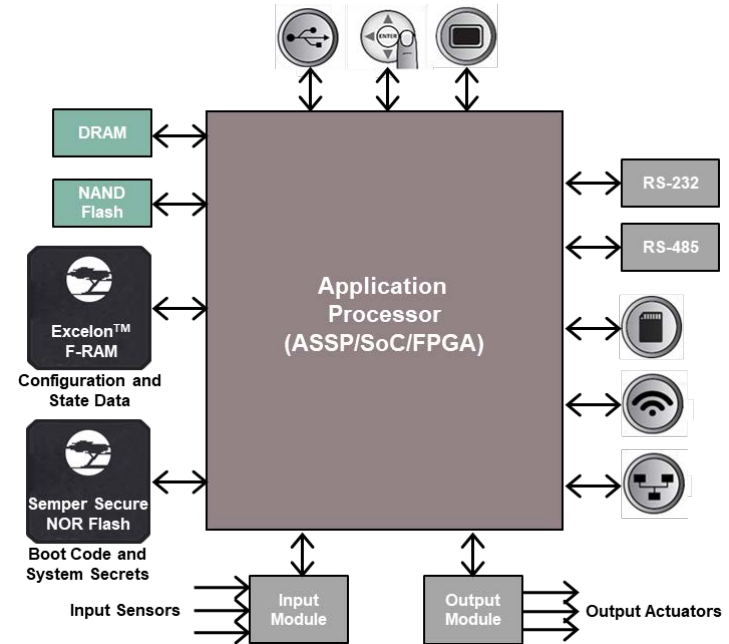
² Condition: 4Mb burst write at 5-MHz [SPI](#)

F-RAM NVM – Essential for data-logging in fail-safe Automotive and Industrial Systems

ADAS Vision System



PLC System Solution



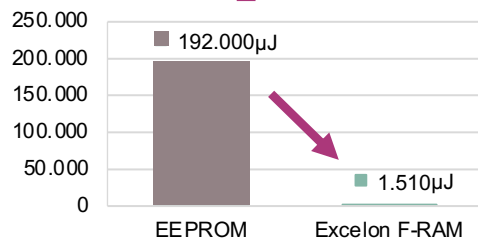
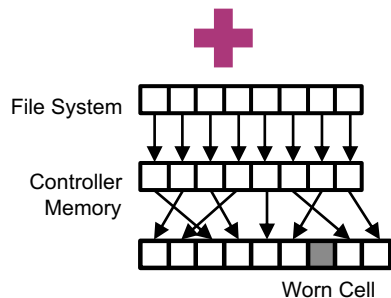
Growing need for High Density, Reliable & High Speed NVM for Mission-Critical Data-Logging

Excelon™ F-RAM is a better solution

Simplify a conventional, complex, battery-operated, EEPROM-based design...



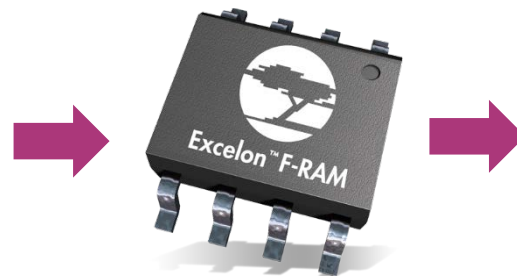
2x EEPROM capacity for wear leveling



High-write energy consumption¹ compared with Excelon F-RAM

¹ Conditions: 4Mb 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

By **choosing F-RAM** as your serial NVM solution...



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

To produce **better solutions** for **battery-operated applications** at a **lower cost**.

Medical Devices



Wearables



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 °C to +85 °C
- › Automotive temperature range grade "S": -40 °C to +105 °C
- › Automotive temperature range grade "E": -40 °C to +125 °C

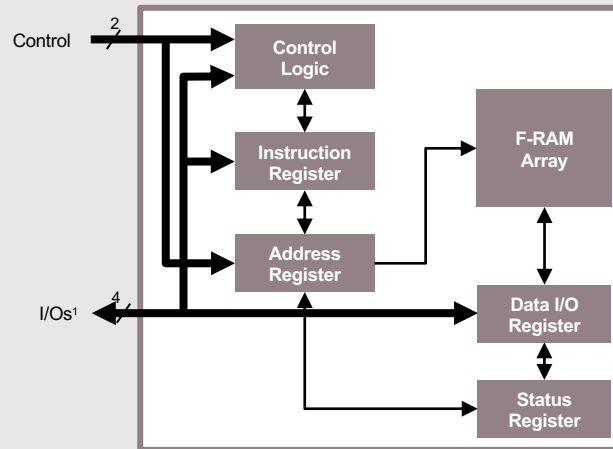
Excelon LP

- › 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 °C to +70 °C
- › Industrial temperature range grade "I": -40 °C to +85 °C
- › Industrial temperature range grade "Q": -40 °C to +105 °C

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

Density	Standby Current (Typ.)	Active Current (Typ.)	Packages
2Mb	2.3 µA	2.4 mA	SOIC (8), TDFN (8)
4Mb	2.3 µA	2.4 mA	SOIC (8), GQFN (8)
8Mb	3.5 µA	2.6 mA	SOIC (8), GQFN (8)
16Mb	8.0 µA	2.7 mA	FBGA (24)

¹ Quad SPI has 4 I/Os

F-RAM Portfolio

Low Power | High Endurance



LPC ¹ F-RAM			Processor Companion	Parallel F-RAM					
512Kb–16Mb	FM25V20A 2Mb; 2.0–3.6 V 40-MHz SPI; Ind ²	CY15B104Q 4Mb; 2.0–3.6 V 40-MHz SPI; Ind	<div>● Excelon³ F-RAM Up to 16Mb 1.8 V, 108-MHz QSPI⁴</div>	FM22L16/LD16 4Mb; 2.7–3.6 V 55 ns; x8; Ind					
	CY15B102Q 2Mb; 2.0–3.6 V 25-MHz SPI; Auto E ⁵	FM25V10/VN10 1Mb; 2.0–3.6 V 40-MHz SPI; Ind, Auto A ⁶		FM24V10/VN10 1Mb; 2.0–3.6 V 3.4-MHz I ² C; Ind, Auto A	FM28V102A 1Mb; 2.0–3.6 V 60 ns; x16; Ind	FM28V202A 2Mb; 2.0–3.6 V 60 ns; x16; Ind			
4–256Kb	FM25V05 512Kb; 2.0–3.6 V 40-MHz SPI; Ind, Auto A	FM24V05 512Kb; 2.0–3.6 V 3.4-MHz I ² C; Ind, Auto A		CY15B101N 1Mb; 2.0–3.6 V 60 ns; x16; Auto A	CY15B102N 2Mb; 2.0–3.6 V 60 ns; x16; Auto A				
	FM25V02A/W256 256Kb; V02A: 2.0–3.6 V W256: 2.7–5.5 V 40-MHz SPI; Ind, Auto A	FM24V02A/W256 256Kb; V02A: 2.0–3.6 V W256: 2.7–5.5 V 3.4-MHz I ² C; Ind, Auto A	FM33256 256Kb; 3.3 V; 16-MHz SPI Ind; RTC ⁷ ; Power Fail Watchdog; Counter	FM28V020 256Kb; 2.0–3.6 V 70 ns; x8; Ind	FM18W08 256Kb; 2.7–5.5 V 70 ns; x8; Ind				
	FM25V01A 128Kb; 2.0–3.6 V 40-MHz SPI; Ind, Auto A	FM24V01A 128Kb; 2.0–3.6 V 3.4-MHz I ² C; Ind, Auto A	FM31256/31(L)278 256Kb; 3.3, 5.0 V; 1-MHz I ² C; Ind; RTC; Power Fail; Watchdog; Counter	FM1808B 256Kb; 5.0 V 70 ns; x8; Ind	FM16W08 64Kb; 2.7–5.5 V 70 ns; x8; Ind				
	FM25640B/CL64B 64Kb; 3.3, 5.0 V 20-MHz SPI; Ind, Auto E	FM24C64/CL64 64Kb; 3.3, 5.0 V 1-MHz I ² C; Ind, Auto E	FM3164/31(L)276 64Kb; 3.3, 5.0 V; 1-MHz I ² C; Ind; RTC; Power Fail; Watchdog; Counter						
	FM25C160/L16 16Kb; 3.3, 5.0 V 20-MHz SPI; Ind, Auto E	FM24C16/CL16 16Kb; 3.3, 5.0 V 1-MHz I ² C; Ind, Auto A							
	FM25040/L04 4Kb; 3.3, 5.0 V 20-MHz SPI; Ind, Auto E	FM24C04/CL04 4Kb; 3.3, 5.0 V 1-MHz I ² C; Ind, Auto A							
<div><div>Low-pin-count</div><div>Industrial grade -40 °C to +85 °C</div></div>				Industrial	Development	Sampling	Production	Schedule	
<div><div>Ultra-low-energy</div><div>Quad serial peripheral interface</div></div>			<div>● This presentation</div>	Automotive				ES	MP
								QYYY	QYYY

¹ Low-pin-count

² Industrial grade -40 °C to +85 °C

³ Ultra-low-energy

⁴ Quad serial peripheral interface

⁵ AEC-Q100 -40 °C to +85 °C

⁶ AEC-Q100 -40 °C to +125 °C

● This presentation

Excelon™ F-RAM Portfolio

Ultra Low Power | High Speed | High Endurance



D+C

2Mb–16Mb

Excelon Auto				Excelon Ultra				Excelon LP															
Q221	CY15B116QSN	Q421	Q221	CY15V116QSN	Q421	Q221	CY15B116QSN	Q421	Q221	CY15B116QI/N	Q421	Q221	CY15V116QI/N	Q421									
16Mb; 1.8–3.6 V 24-ball FBGA 108-MHz QSPI ¹ Auto S ²				16Mb; 1.71–1.89 V 24-ball FBGA 108-MHz QSPI Auto S				16Mb; 1.8–3.6 V 24-ball FBGA 108-MHz QSPI, Ind ³				16Mb; 1.71–1.89 V 24-ball FBGA 108-MHz QSPI, Ind				16Mb; 1.8–3.6 V 24-ball FBGA 20/40-MHz SPI, Comm ⁴ , Ind				16Mb; 1.71–1.89 V 24-ball FBGA 20/40-MHz SPI, Comm, Ind			
Q221	CY15B116QN	Q421	Q221	CY15V116QN	Q421																		
16Mb; 1.8–3.6 V 24-ball FBGA 40-MHz SPI; Auto A ⁵				16Mb; 1.71–1.89 V 24-ball FBGA 40-MHz SPI; Auto A																			
Q221	CY15B108QSN	Q421	Q221	CY15V108QSN	Q421	Q221	CY15B108QSN	Q421	Q221	CY15V108QSN	Q421	Q221	CY15B108QN	Q421	Q221	CY15V108QN	Q421						
8Mb; 1.8–3.6 V 24-ball FBGA 108-MHz QSPI; Auto S				8Mb; 1.71–1.89 V 24-ball FBGA 108-MHz QSPI; Auto S				8Mb; 1.8–3.6 V 24-ball FBGA 108-MHz QSPI, Ind				8Mb; 1.71–1.89 V 24-ball FBGA 108-MHz QSPI, Ind				8Mb; 1.8–3.6 V 24-ball FBGA 50-MHz SPI, Ind, Ind Q ⁷				8Mb; 1.71–1.89 V 24-ball FBGA 50-MHz SPI, Ind, Ind Q			
CY15B108QN 8Mb; 1.8–3.6 V 8-pin SOIC 50-MHz SPI; Auto E ⁶				CY15V108QN 8Mb; 1.71–1.89 V 8-pin SOIC 50-MHz SPI; Auto E				CY15B108QSN 8Mb; 1.8–3.6 V 8-pin GQFN, SOIC 108-MHz QSPI, Ind				CY15V108QSN 8Mb; 1.71–1.89 V 8-pin GQFN, SOIC 108-MHz QSPI, Ind				CY15B108QI/N 8Mb; 1.8–3.6 V 8-pin GQFN 20/40-MHz SPI, Comm, Ind				CY15V108QI/N 8Mb; 1.71–1.89 V 8-pin GQFN 20/40-MHz SPI, Comm, Ind			
CY15B104QN 4Mb; 1.8–3.6 V 8-pin SOIC 50-MHz SPI; Auto E				CY15V104QN 4Mb; 1.71–1.89 V 8-pin SOIC 50-MHz SPI; Auto E																			
CY15B104QSN 4Mb; 1.8–3.6 V 8-pin SOIC 50-MHz SPI; Auto A				CY15V104QSN 4Mb; 1.71–1.89 V 8-pin SOIC 50-MHz SPI; Auto A				CY15B104QSN 4Mb; 1.8–3.6 V 8-pin GQFN, SOIC 108-MHz QSPI, Ind				CY15V104QSN 4Mb; 1.71–1.89 V 8-pin GQFN, SOIC 108-MHz QSPI, Ind				CY15B104QI/N 4Mb; 1.8–3.6 V 8-pin GQFN, SOIC 20/50-MHz SPI, Comm, Ind				CY15V104QI/N 4Mb; 1.71–1.89 V 8-pin GQFN, SOIC 20/50-MHz SPI, Comm, Ind			
CY15B102QSN 2Mb; 1.8–3.6 V 8-pin SOIC 50-MHz SPI; Auto E				CY15V102QSN 2Mb; 1.71–1.89 V 8-pin SOIC 50-MHz SPI; Auto E				Q120 CY15B102QSN Q121 2Mb; 1.8–3.6 V 8-pin SOIC 108-MHz QSPI, Ind				Q120 CY15V102QSN Q121 2Mb; 1.71–1.89 V 8-pin SOIC 108-MHz QSPI, Ind				Q120 CY15B102QN Q121 2Mb; 1.8–3.6 V 8-pin DFN, SOIC 50-MHz SPI, Ind				Q120 CY15V102QN Q121 2Mb; 1.71–1.89 V 8-pin DFN, SOIC 50-MHz SPI, Ind			

¹ Quad serial peripheral interface
² AEC-Q100 -40 °C to +105 °C

³ Industrial grade -40 °C to +85 °C
Commercial grade 0 °C to +70 °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

	Concept	Development	Sampling	Production	Schedule
Industrial					ES
Automotive					MP

Getting started with Excelon™ F-RAM

1. Download our App Note: [SPI Guide for F-RAM \(AN304\)](#)
2. [Register](#) to access online support
3. [Contact Sales](#) to request a datasheet

Medical Devices



Neuromodulator

[Wearables](#)



Smartwatch

Industrial Control and Automation



Motor Control

Automotive

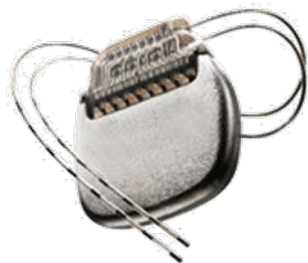


Infotainment System

Getting started with Excelon™ F-RAM

1. Identify accounts for joint visits
2. Show them the [Nonvolatile RAM Roadmap](#)
3. [Contact Sales](#) to request a datasheet

Medical Devices



Neuromodulator

[Wearables](#)



Smartwatch

Industrial Control and Automation






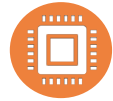


Motor Control

Automotive



Infotainment System

Excelon™ F-RAM Resources

	Webpage	<ul style="list-style-type: none"> › Excelon F-RAM Webpage
	Product Overview (Webpage)	<ul style="list-style-type: none"> › Brochure: Excelon Ultra F-RAM Memory › Brochure: Excelon Auto F-RAM Memory › Brochure: Excelon LP F-RAM Memory
	Application Notes	<ul style="list-style-type: none"> › Designing with Infineon Quad SPI (QSPI) F-RAM › Designing with Excelon LP SPI F-RAM Low-Power Modes › SPI Guide for F-RAM
	Datasheets	<ul style="list-style-type: none"> › 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	<ul style="list-style-type: none"> › 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	<ul style="list-style-type: none"> › 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

Summary



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

Learn more on [our webpage](#)



Part of your life. Part of tomorrow.