

What is FeRAM?

September 2024

RAMXFEED



Introduction Flow

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3 History | **Shipments, Awards**

4 Features | **Features of FeRAM**

5 Solutions | **Solutions by FeRAM to Customer Issues**

1. Overview of FeRAM

Overview

Usage

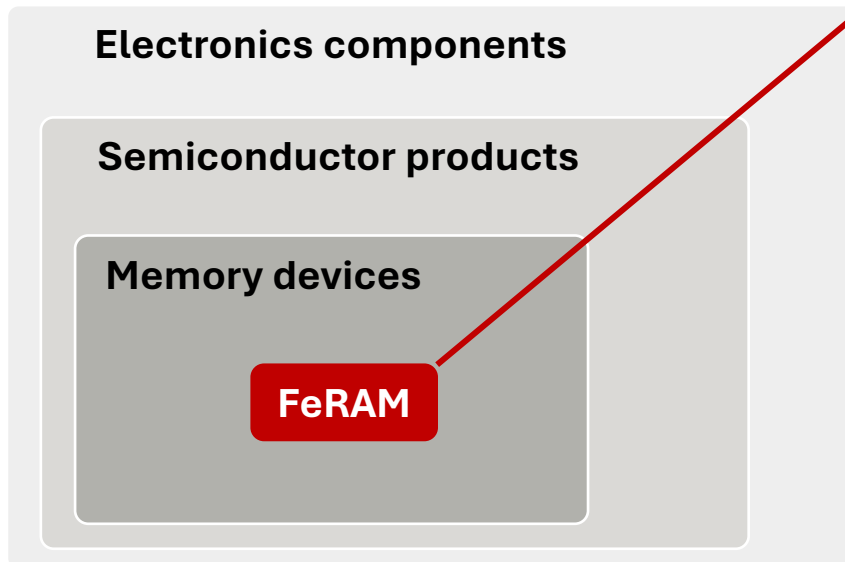
History

Features

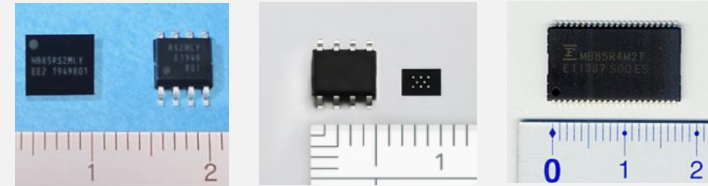
Solutions

■ What is FeRAM?

- FeRAM is a memory device in semiconductor products
- FeRAM stands for Ferroelectric Random Access Memory



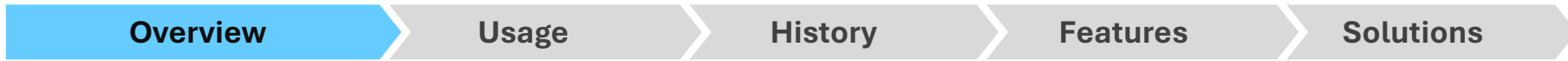
Photos of FeRAM devices



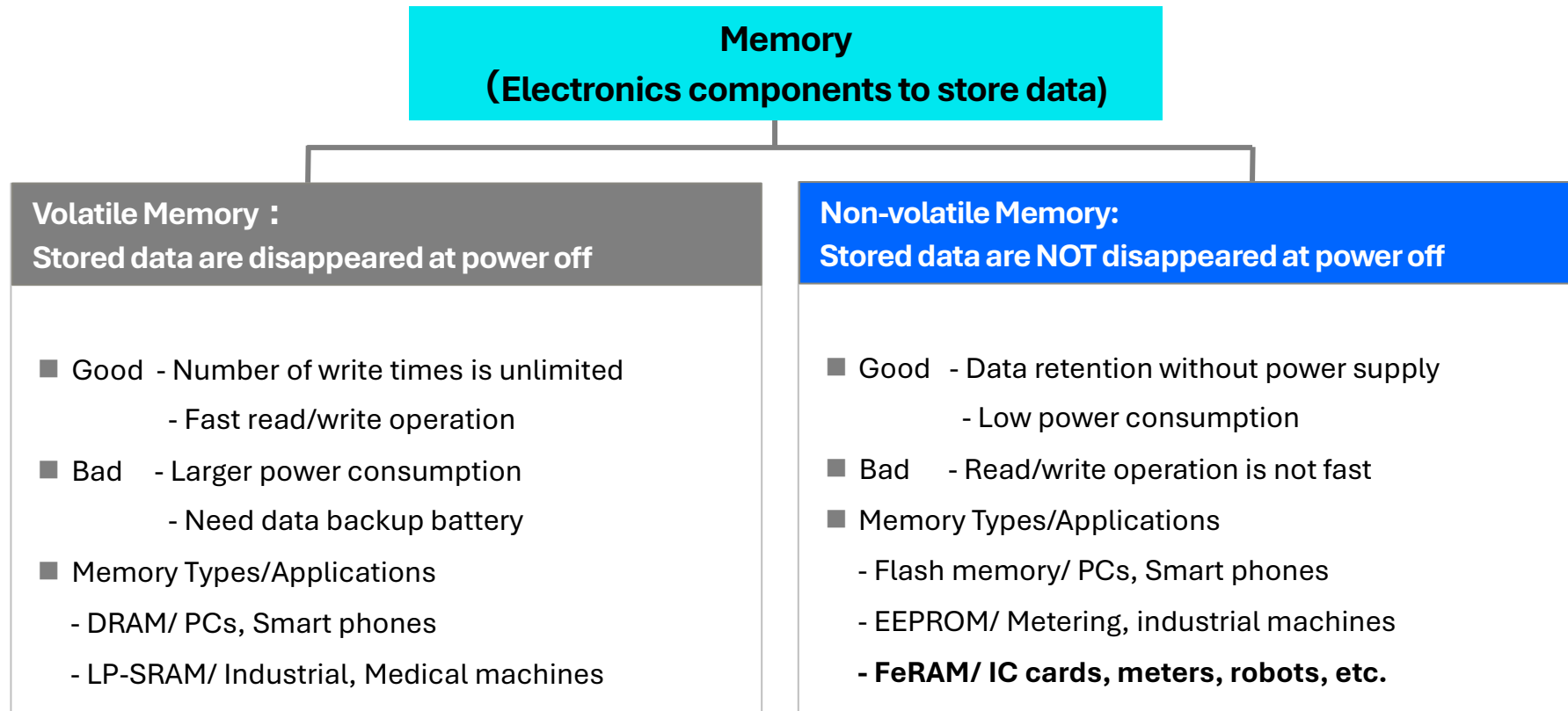
FeRAM packages



1. Overview of FeRAM



- **What kind of memory is FeRAM?**
 - FeRAM is type of **non-volatile memory**



1. Overview of FeRAM



■ FeRAM Lineup

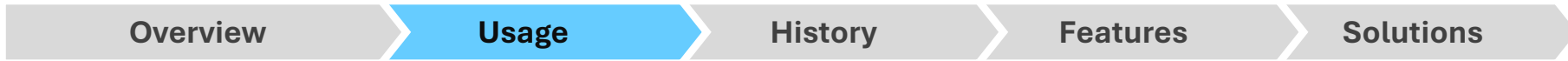
- Three interface: I2C, SPI, and Parallel
- Memory density: 4Kbit to 8Mbit
- Temperature range: Operating at maximum 125°C

Interface	I2C	SPI	Parallel
Density	4K to 1Mbit	16K to 8Mbit	256K to 8Mbit
Supply Voltage	1.7 to 1.95V / 1.8 to 3.6V 2.7 to 3.6V / 2.7 to 5.5V	1.65 to 1.95V / 1.7 to 1.95V 1.7 to 3.6V / 1.8 to 3.6V 2.7 to 3.6V / 2.7 to 5.5V	1.8 to 3.6V 2.7 to 3.3V
Operating Temperature	-40°C to +125°C -40°C to +105°C -40°C to +95°C -40°C to +85°C	-40°C to +125°C -40°C to +105°C -40°C to +95°C -40°C to +85°C	+40°C to +105°C -40°C to +85°C
Package	SOP, SON, DFN	SOP, SON, DFN, WL-CSP	SOP, TSOP, FBGA

* : Please confirm detailed specs by each product.

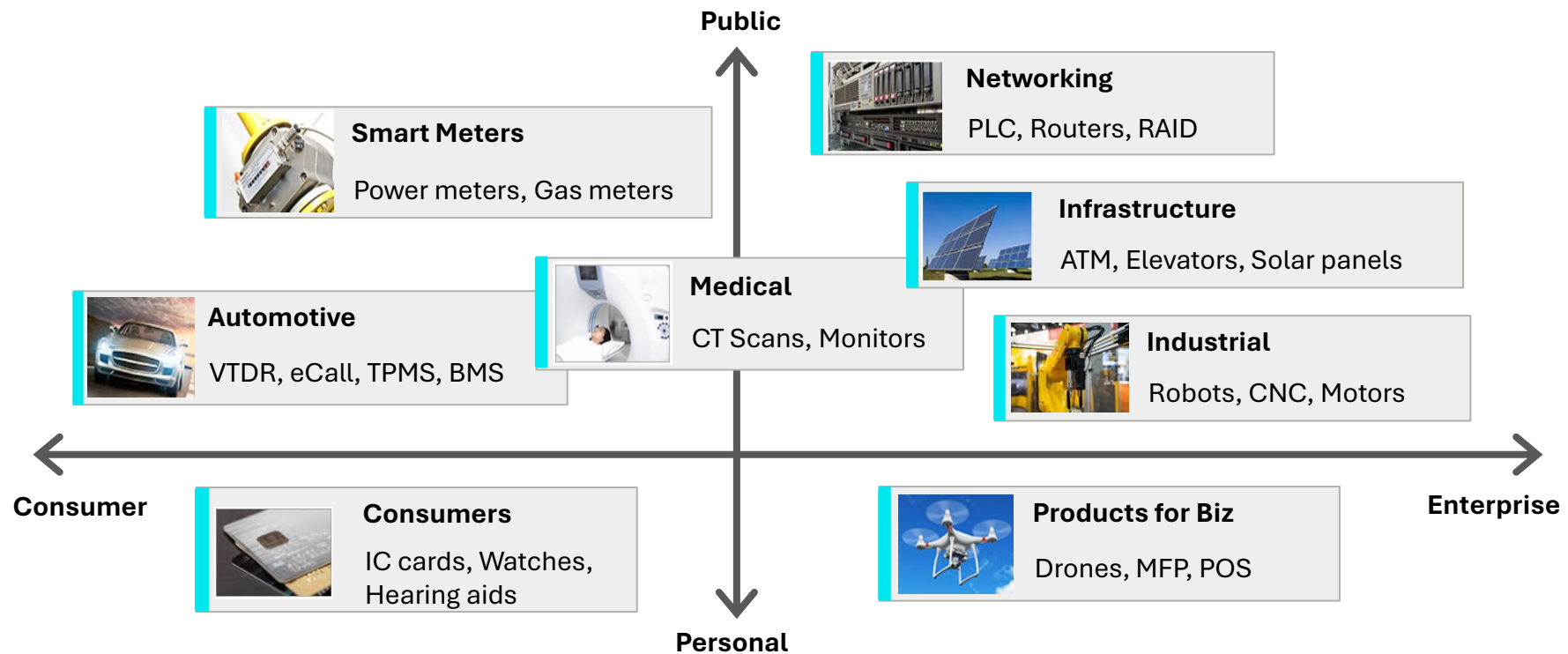
[As of September 2024]

2. Applications using FeRAM



■ Where is FeRAM used?

- Used in all kind of market segments, especially strong in the public services
- Suitable for frequent data logging requirement



3. History of shipment

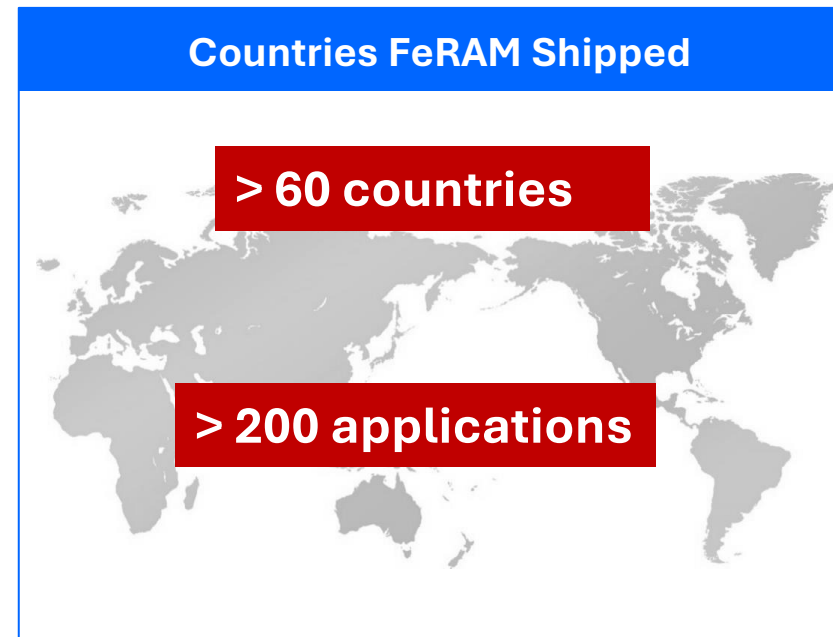
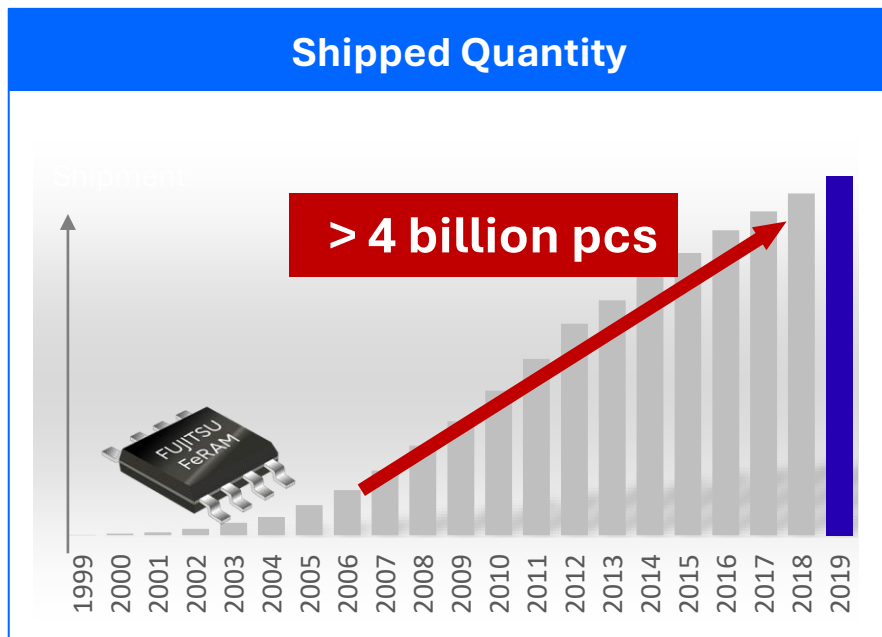


■ Quantity of FeRAM shipped

■ Production since 1999, total shipment is more than **4 billion pcs**

■ Countries FeRAM shipped

■ Used in over **60 countries**, more than **200 types** of applications



3. History of receiving awards

Overview

Usage

History

Features

Solutions

History of receiving awards for FeRAM

- Our company received **11 awards in 15 years** from domestic academic societies and government agencies

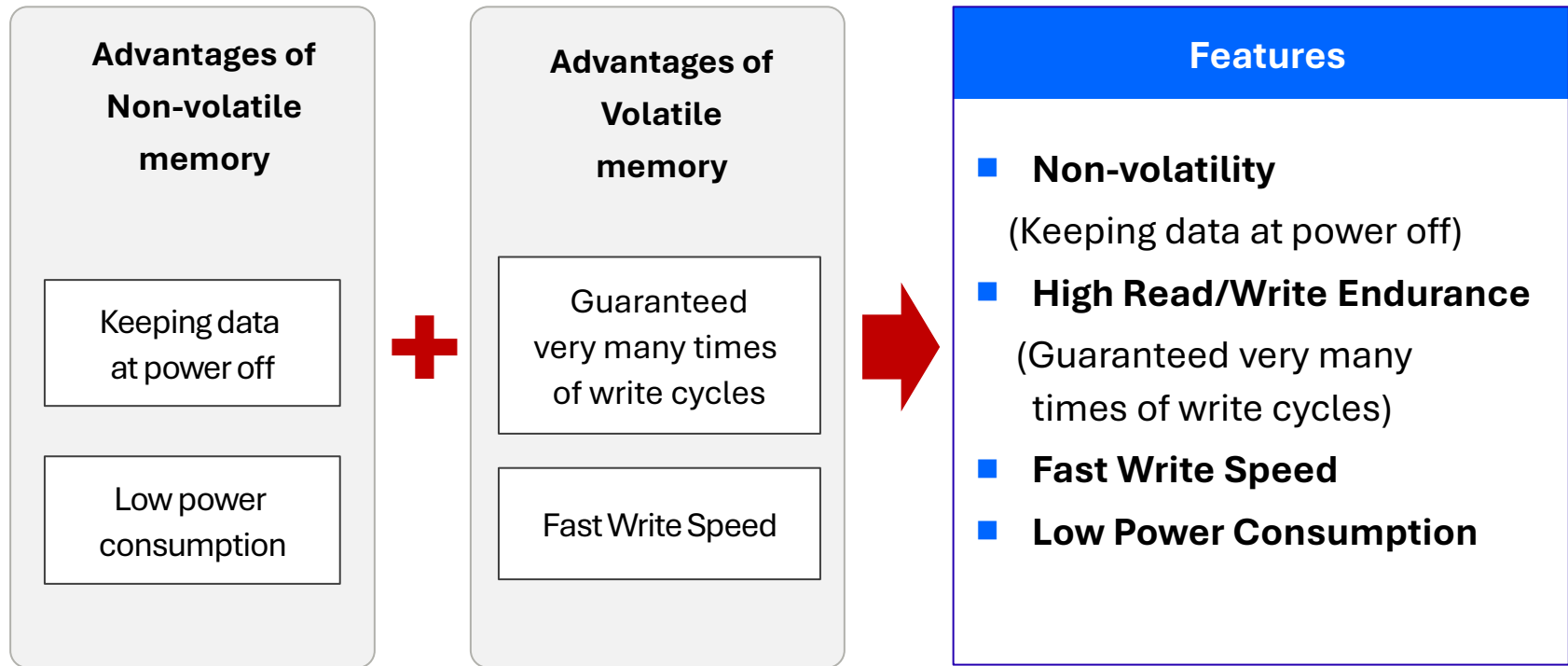
Year	Award Name	Organizer
2001	第8回LSIデザイン・オブ・ザ・イヤー優秀賞	半導体産業新聞社
2004	CORPORATE INOVATION AWARD	ISIF
2004	文部科学大臣表彰 研究功績者（研究功績者）	文部科学省
2007	第2回 ものづくり日本大賞 優秀賞	経済産業省等
2011	産学官連携功労者表彰 日本経済団体連合会会長賞	内閣府等
2013	応用物理学会フェロー表彰	応用物理学会
2013	文部科学大臣奨励賞、電気科学技術奨励賞	電気科学技術奨励会
2014	大河内記念技術賞	大河内記念会
2014	文部科学大臣表彰 科学技術賞（開発部門）	文部科学省
2014	第14回 山崎貞一賞	材料科学技術振興財団
2015	紫綬褒章	内閣府

4. Features of FeRAM



■ Features of FeRAM

■ Having advantages of both non-volatile and volatile memories



4. Features of FeRAM

Overview

Usage

History

Features

Solutions

■ Comparison to other memory devices

- Having advantages of both non-volatile and volatile memories

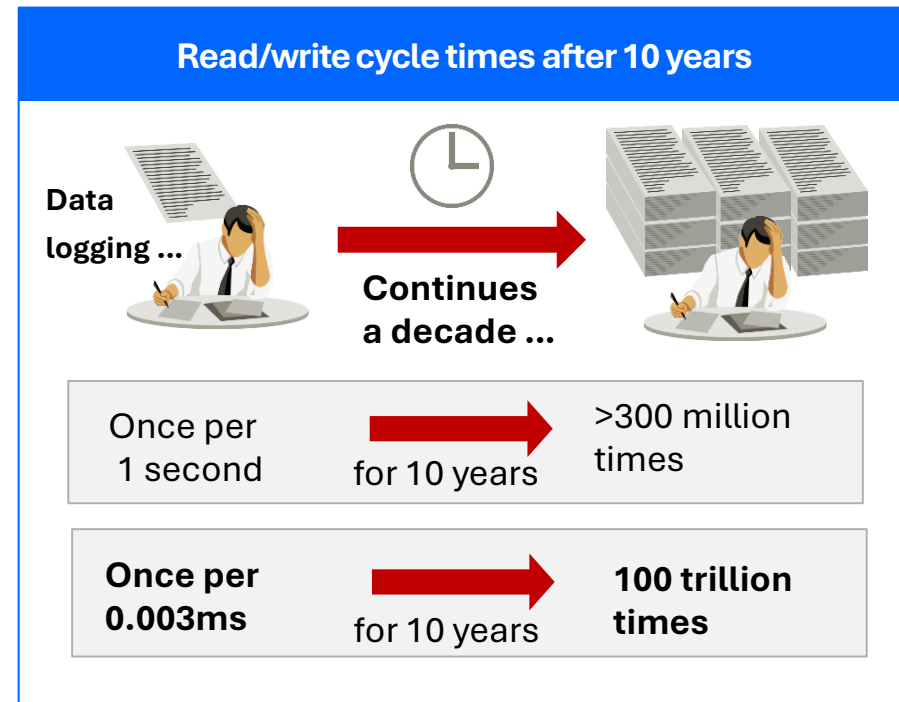
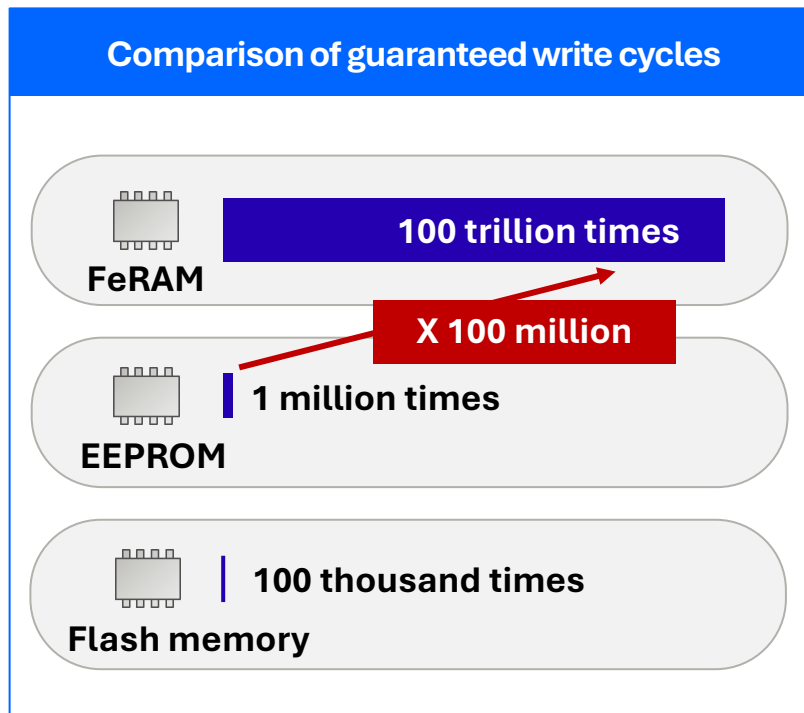
Item	FeRAM	EEPROM	Flash memory	SRAM
Memory Type	Non-volatile	Non-volatile	Non-volatile	Volatile
Data Backup Battery	No	No	No	Yes
Guaranteed Write Cycles	100 trillion	1 million	100 thousand	Unlimited
Write Method	Overwrite	Erase + Write	Erase + Write	Overwrite
Write Cycle Time	120ns	5ms	10 μ s	55ns
Booster Circuit	No	Yes	Yes	No

4. Features of FeRAM

■ FeRAM Feature – High Read/Write Endurance

■ Merit: Guarantees 100 trillion times of read/write cycles

- Reason: Enabled by FeRAM cell structure with ferroelectric property



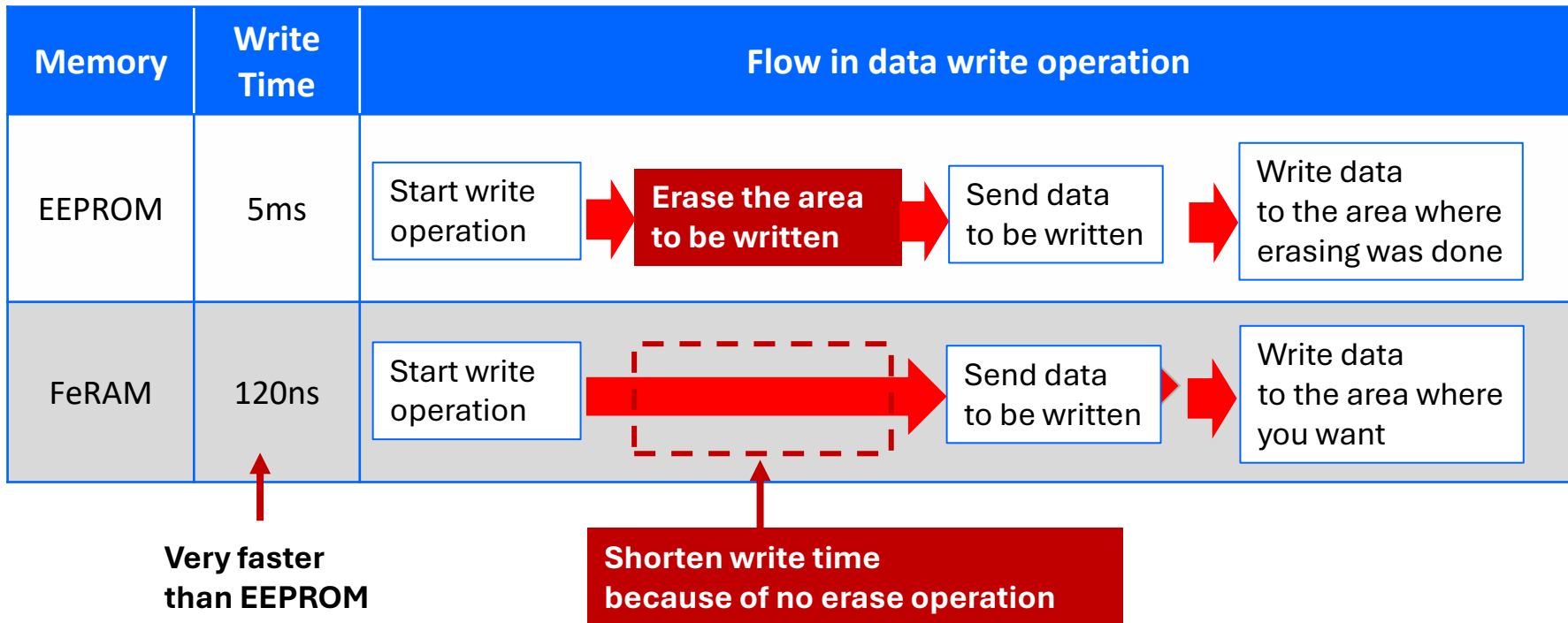
4. Features of FeRAM



■ FeRAM Feature – Fast Write Speed

■ Merit: Write cycle time of 120ns, faster than EEPROM

- Reason: Data erase operation is not needed during write operation



4. Features of FeRAM

Overview

Usage

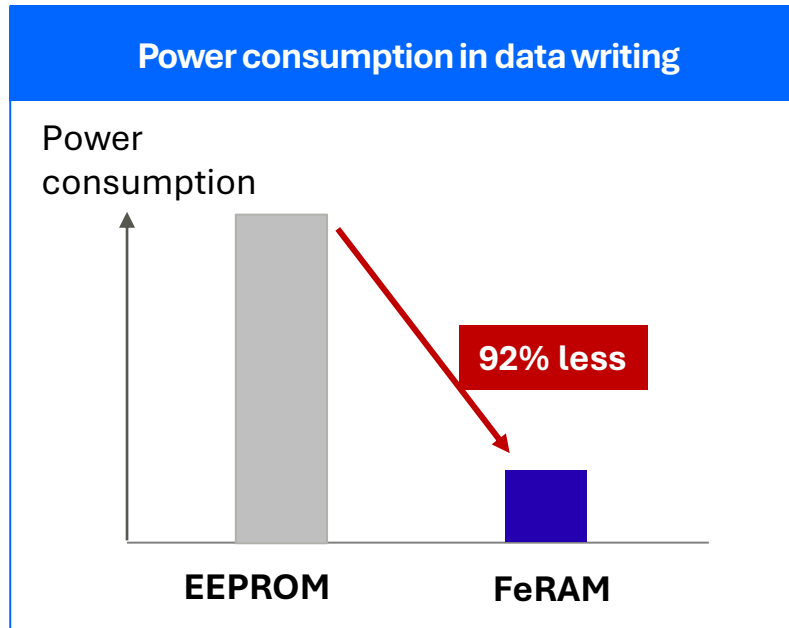
History

Features

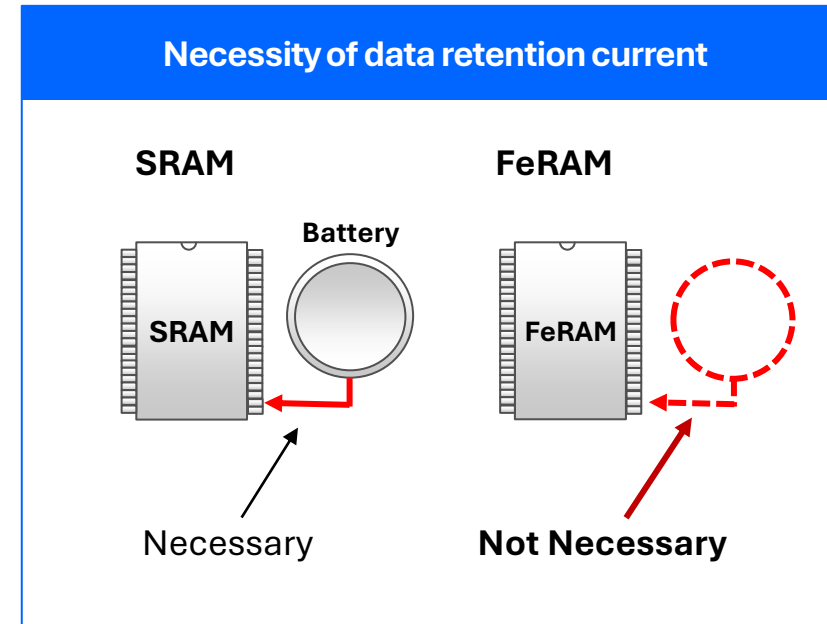
Solutions

■ FeRAM Feature – Low Power Consumption

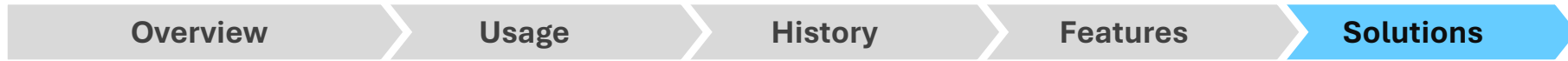
- Merit #1: Lower power in data writing, due to shorter write time
- Merit #2: No backup battery, due to data retention current is not necessary



Conditions: 2Mbit, 3V, SPI I/F, 2KB writing,
5MHz, 1s

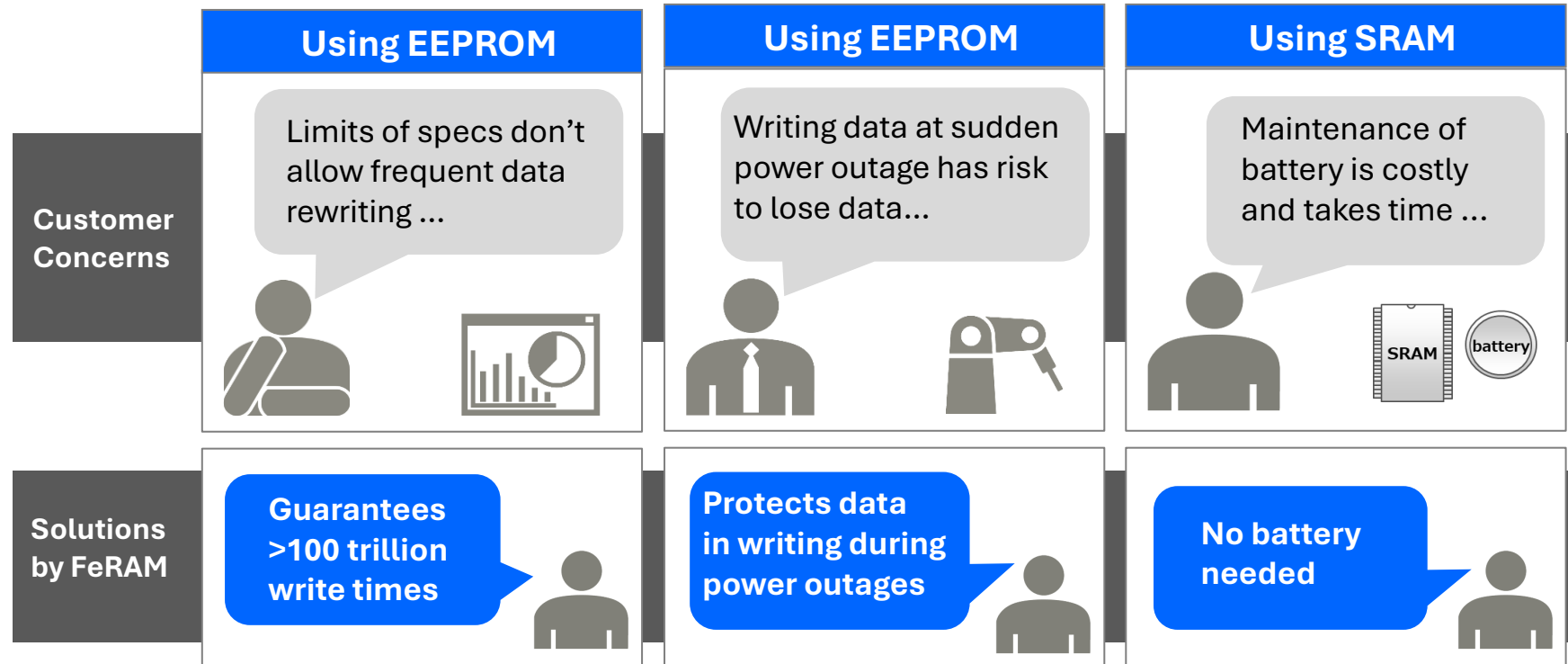


5. Solutions by FeRAM to Customer Issues



Customer Issues and Solutions

If you have the following concerns, consider solution by FeRAM



5. Solutions by FeRAM to Customer Issues

Overview

Usage

History

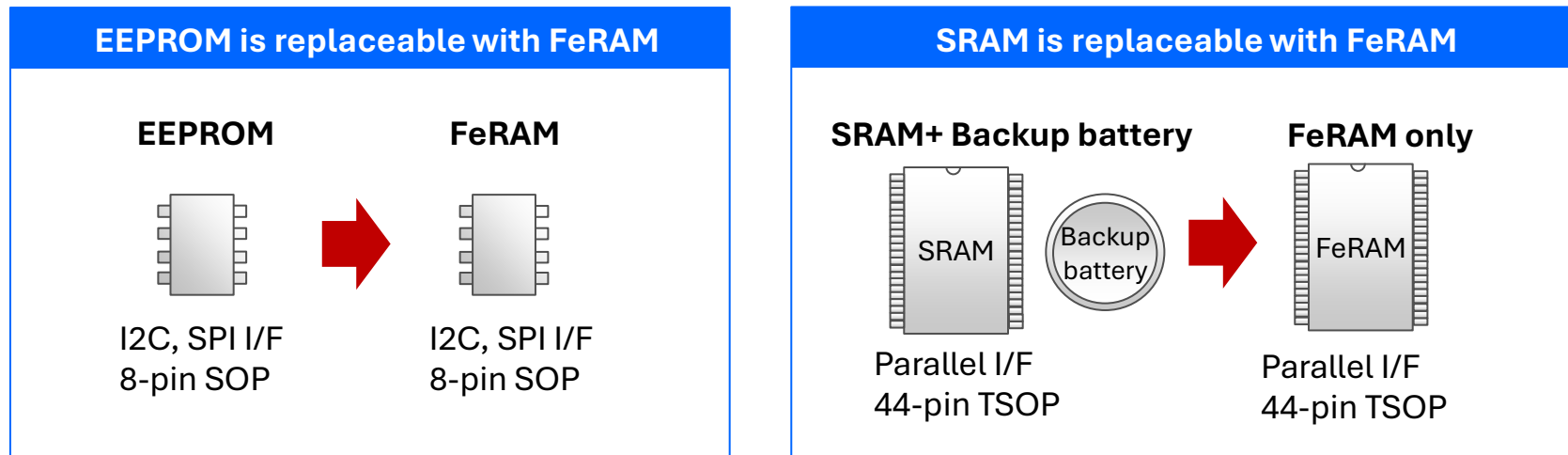
Features

Solutions

Fujitsu's support for customers

We support customers to replace with FeRAM easily

Development pin & interface compatible products



Supports to evaluate our FeRAM device

- Simulation models (Verilog, IBIS) for software evaluation
- Providing FeRAM via online to buy a few samples

RAMX**EED**

Our Memory, Your Future.