ONE-RENESAS MEMORY SOLUTIONS

Provides optimal memory portfolios to
industrial and communications applications

2024.09

INDUSTRY-LEADING MEMORY PRODUCTS

Renesas provides optimal memory portfolios for our customers. Renesas offers a broad line of low power, high-speed, industry-standard SRAMs that provide high reliability, stable supply and long lifetime support in the industrial and communications markets.

The Renesas FIFO portfolio includes more than 140 synchronous, asynchronous and bidirectional products to solve inter-chip communications protocol problems, such as rate matching, buffering and bus matching. Renesas' multi-port memory portfolio contains more than 100 types of asynchronous and synchronous dual-ports, four-ports and bank-switchable dual-ports.

Flash memory for code and data storage

Designed with industry NOR architecture, Renesas Flash meets the power and performance needs of industrial, power-conscious and battery-operated systems.

In addition to our Standard class of products that is designed for tasks such as system boot, our FusionHD, Ultra-Low Energy and DataFlash families are packed with options that can reduce MCU overhead and save more than 85% energy used by typical Flash.

Memory Types	Products
Low Power SRAM	■ (5V, 3V) 256Kb, 1Mb, 4Mb ■ (3V) 2Mb, 8Mb, 16Mb, 32Mb, 64Mb
Asynchronous Fast SRAM	■ (5V, 3.3V) 4Mb
	■ (5V) 16Kb, 64Kb, 256Kb, 1Mb ■ (3.3V) 1Mb, 4Mb
Synchronous SRAM	■ Pipeline Burst / Flow-through 4Mb, 9Mb ■ Zero Bus Turnaround (ZBT) 4Mb, 9Mb, 18Mb
Specialty Memory	■ Multi-Port (5V, 3.3V, 2.5V) 8Kb to 36Mb ■ FIFO (5V, 3.3V) 2Kb to 512Kb
EEPROM	■ Serial I/F: I^2C, SPI (1.8V to 5.5V) 2Kb to 512Kb
SPI NOR Flash	■ Standard Products: (1.8V) 8Mb to 256Mb, (1.8V to 3V, Wide Vcc) 256Kb to 32Mb, (3V) 256Kb to 256Mb
	■ System-Enhancing Products: Ultra-Low Energy (1Mb to 16Mb) FusionHD [4Mb to 32Mb] DataFlash [2Mb to 64Mb]

CONTENTS

Low Power SRAM _____ 03

Specialty Memory _____ 05

Multi-Port Memory / FIFO
Asynchronous / Synchronous SRAMs

EEPROM _____ 09

FLASH Memory _____ 10

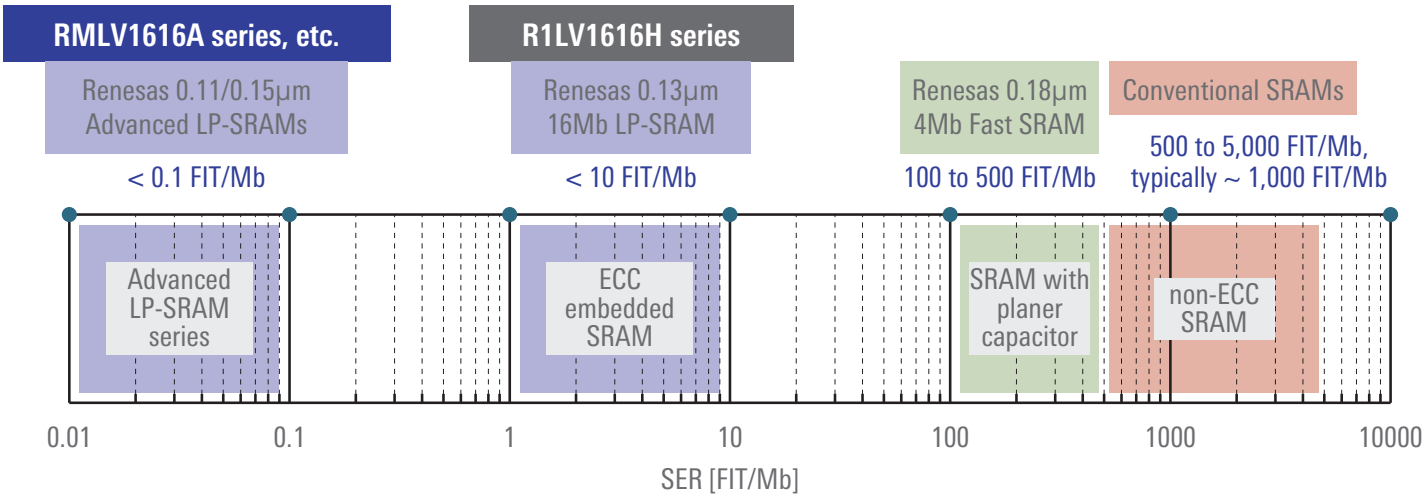
Low Power SRAM

The recent demands for highly secure and reliable user systems are driving increased demand for highly reliable SRAM, which is used to store important information such as system programs and financial transaction data. Renesas' Low Power SRAM (LPSRAM) products have a proven track record for application in middle- to small-scale memory systems and are designed to provide enhanced reliability and longer backup battery life for applications such as factory automation (FA), industrial equipment, and the smart grids.

Renesas' Advanced Low Power SRAMs, the core products series, have acquired a solid reputation for achieving both high-performance and high-reliability without any technical trade-off. These Advanced LPSRAM devices feature exclusive technology in the memory cells that achieves excellent soft error rate several orders magnitude lower than conventional Full CMOS memory cells.

Advanced LPSRAM has superior Soft Error Immunity to ECC-embedded SRAMs

Product Family	Countermeasure against soft error?	By what?	Soft error rate (Measured)
Advanced LPSRAM series (0.11µm / 0.15µm)	YES	Increasing Critical Charge (Qcrit) by the proprietary technology	< 0.04 FIT/Mb [0.11µm] < 0.06 FIT/Mb [0.15µm]
R1LV1616H series <EOL> (0.13µm CMOS 16Mb)	YES	Embedded ECC	< 5.5 FIT/Mb



Logarithmic (order of $\times 10^n$) Comparison of SRAM Soft Error Rate

Features

- High reliability
  - –Excellent soft error immunity without embedded ECC
  - –Latch-up free memory cell structure
- Stable supply and long-term support
  - –Covered by PLP: Product Longevity Program
- Wide line-up to support all applications
  - –Memory density: Lineup from 256Kb to 64Mb
  - –Supply voltage: 3V / 5V (continued support of 5V parts)
  - –Package: Varied package lineup

Applications

- Industrial
  - –Factory automation (PLC, CNC, etc.), servomotor, AC drives (inverter), industrial robot, plant control system, vending machine, ticket gate, automated teller machine, etc.
- Communication
  - –Router, switch, base station, etc.
- Social infrastructure
  - –Elevator system, transportation system, railway system, traffic signal system, smart grid devices, etc.
- Office automation
  - –Multi-function printer, etc.
- Consumer
  - –Gaming machine, musical instrument, calculator, etc.
- Car accessories (non-driveline devices)
  - –ETC, digital tachometer, etc.
- Medical / Healthcare
  - –Medical electronic devices

Product Differentiation

Renesas supports soft error free products for entire lineup of 256Kbit to 64Mbit

✓ Production Soft error countermeasure: Yes No

Vendor	Process	256Kb	1Mb	2Mb	4Mb	8Mb	16Mb	32Mb	64Mb
Renesas	0.15µm Advanced	✓	✓	✓	✓ (5V)	Change to 0.11µm Advanced			
	0.11µm Advanced				✓ (3V)	✓	✓	✓	✓
Competitor	90nm CMOS no ECC	✓	✓	✓	✓	✓	✓	✓	✓
	65nm CMOS ECC embedded				✓	✓	✓	✓	✓

Product Benchmark

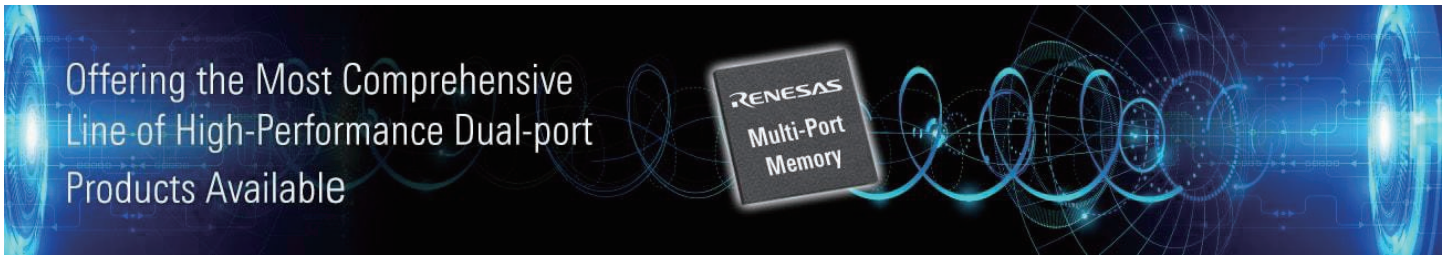
Only Renesas supports unique products that realize both lowest standby current and soft error free

Vender	Standby Current	Soft Error Rate
Renesas	0.3µA (4Mb, 3V Typ.)	< 0.04 FIT / Mb (0.11µm Advanced LPSRAM)
Competitor	3.5µA (4Mb, 3V Typ.)	500~5,000 FIT / Mb (90nm LPSRAM, w/o ECC)

Product Lineup

Product Series	Density	Org.	Supply Voltage (V)	Access Time (ns)	Standby Current (typ.)	Temp. Range	TSOP	SOP	FBGA	µTSOP
R1LP5256E	256 Kb	x8	4.5 - 5.5	55	0.6 µA	-40°C to 85°C	✓	✓		
R1LP0108E	1 Mb	x8	4.5 - 5.5	55	0.6 µA	-40°C to 85°C	✓	✓		
R1LP0408D	4 Mb	x8	4.5 - 5.5	55	0.8 µA	-40°C to 85°C	✓	✓		
R1LV5256E	256 Kb	x8	2.7 - 3.6	55	0.6 µA	-40°C to 85°C	✓	✓		
R1LV0108E	1 Mb	x8	2.7 - 3.6	55	0.6 µA	-40°C to 85°C	✓	✓		
R1LV0208BSA	2 Mb	x8	2.7 - 3.6	55	1 µA	-40°C to 85°C	✓			
R1LV0216BSB	2 Mb	x16	2.7 - 3.6	55	1 µA	-40°C to 85°C	✓			
RMLV0408E	4 Mb	x8	2.7 - 3.6	45	0.3 µA	-40°C to 85°C	✓	✓		
RMLV0414E	4 Mb	x16	2.7 - 3.6	45	0.3 µA	-40°C to 85°C	✓			
RMLV0416E	4 Mb	x16	2.7 - 3.6	45	0.3 µA	-40°C to 85°C	✓		✓	
RMLV0808BGSB	8 Mb	x8	2.4 - 3.6	45	0.45 µA	-40°C to 85°C	✓			
RMLV0816BGBG	8 Mb	x16	2.4 - 3.6	45	0.45 µA	-40°C to 85°C			✓	
RMLV0816BGSA	8 Mb	x16	2.4 - 3.6	45	0.45 µA	-40°C to 85°C	✓			
RMLV0816BGSB	8 Mb	x16	2.4 - 3.6	45	0.45 µA	-40°C to 85°C	✓			
RMLV0816BGSD	8 Mb	x16	2.4 - 3.6	45	0.45 µA	-40°C to 85°C				✓
RMLV1616A-S	16 Mb	x16	2.7 - 3.6	55	0.5 µA	-40°C to 85°C	✓		✓	✓
RMLV1616A-U	16 Mb	x16	2.7 - 3.6	45, 55	0.4 µA	-40°C to 85°C	✓		✓	
RMLV3216A	32 Mb	x16	2.7 - 3.6	55	0.6 µA	-40°C to 85°C	✓		✓	✓
RMWV6416A	64 Mb	x16	2.7 - 3.6	55	1.2 µA	-40°C to 85°C	✓		✓	✓

Multi-Port Memory



FIFO Logic Products

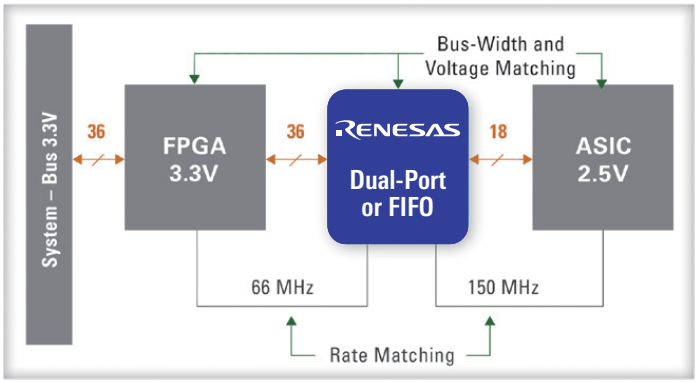
Renesas's multi-port memory portfolio includes more than 100 types of asynchronous and synchronous dual-ports, four-ports and bank-switchable dual-ports.

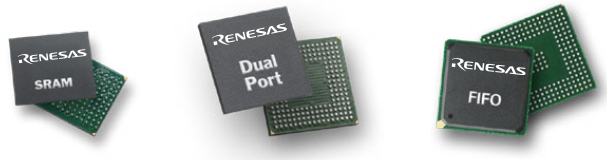
Multi-Port Memories

Renesas is the world leader in specialty memory with a dominant market position, a long history of innovation, and best-in-class support for FIFO and multi-port products. With hundreds of products and thousands of customers, Renesas continues to provide the highest quality, fastest, and most diverse line of specialty memory in the industry.

The Renesas multi-port memories portfolio includes more than 100 types of asynchronous and synchronous dual-ports, four-ports and and bank-switchable dual-ports. These multi-port memory devices are ideal for switches, routers, hubs, industrial equipment, fibre channel line cards and RAID controllers.

Our family of dual-port memories are the industry standard, with innovative features and speeds that provide superior value and performance to system level designs. Renesas strives to reduce the cost of high performance shared SRAM based dual-port memory solutions. We are and will continue to be the leading provider of Dual-Port synchronous and asynchronous memories in the semiconductor industry.





Multi-Port Memory Benefits

- Increases bandwidth (~2x SRAM)
- Reduces design complexity by solving inter-chip connection issues
- Solves bus matching issues from x8, x9, x16, x18, x36 up to x72 bit bus widths
- Allows mismatched voltage parts to be used together. 1.8, 2.5, 3.3 and 5V I/O's can be adapted
- Buffers bus speed mismatch from DC to 200 MHz
- Densities range from 8 Kb up to 36 Mb allowing a wide range of applications
- Improves time-to-market by using proven off-the-shelf devices

Multi-Port Product Family

Asynchronous Dual-Port RAMs
An asynchronous dual-port is a memory with non-clocked inputs and outputs for data, address, and control functions.

Bank-Switchable Dual-Port RAMs
Renesas synchronous bank-switchable dualported RAMS offer increased density, while retaining many of the features of true dual-ports including access to the shared array, separate clocks per port, 200 MHz operating speed, full-boundary counters, and pinouts compatible to the dual-port family.

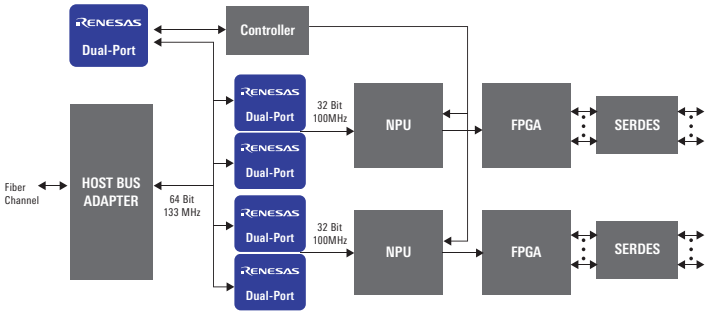
FourPort RAMs
Renesas four-port RAMs are cost-effective low-power multiports that provide maximum functionality while taking up minimum board space to address the needs of high-end multimedia handset applications.

Synchronous Dual-Port RAMs
Renesas synchronous dual-port RAM memory cells allow access to simultaneous access of address from both ports.

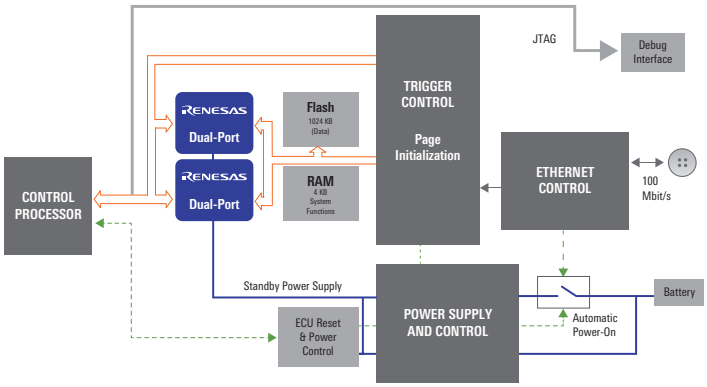
Asynchronous Low-Power Dual-Port RAMs
Renesas low-power dual-ports simplify the design process for hand held devices. Renesas LPDPs provide exceptionally low power consumption and the ability to buffer voltage, speed, and bus width mismatch between processors.

Typical Multi-Port Application Block Diagrams

Storage Area Network



Data Aquisition



Multi-Port End Applications Include

- Flight control
- Video conference system
- Sonar
- Gas sensor
- Semiconductor equipment
- Aircraft mission recorder
- PC for railway system
- Industrial robot
- Motor drive controller

FIFO Products

Renesas is the FIFO market leader with more than 140 synchronous, asynchronous and bi-directional products to help designers solve interchip communications problems, such as rate matching, buffering and bus matching.

FIFO Product Family

Asynchronous FIFOs

Renesas asynchronous FIFOs are a form of memory with separate strobes for reading and writing. When used to buffer data transmissions, they permit processing of data to proceed before the transmission has completed. They do this by preventing data overflow and underflow using logic to allow for unlimited expansion capability in both word size and depth.

Bi-Directional FIFOs

Renesas bi-directional FIFOs can transfer data in two directions, enabling optimized inter-processor and inter-DSP communication. To achieve the bidirectional transfer capability, especially useful in communication network equipment. The highly integrated devices provide two side-by-side FIFO memory arrays. They accelerate cycle times, reduce board space and allow more efficient bus utilization.

Queuing FIFOs

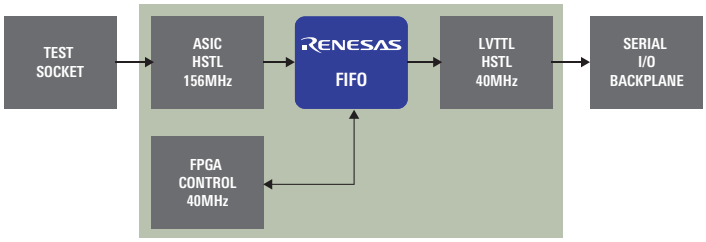
The Renesas FIFO Multi-Queue device is a fully programmable device, providing the user with flexibility in how queues are configured.

Synchronous FIFOs

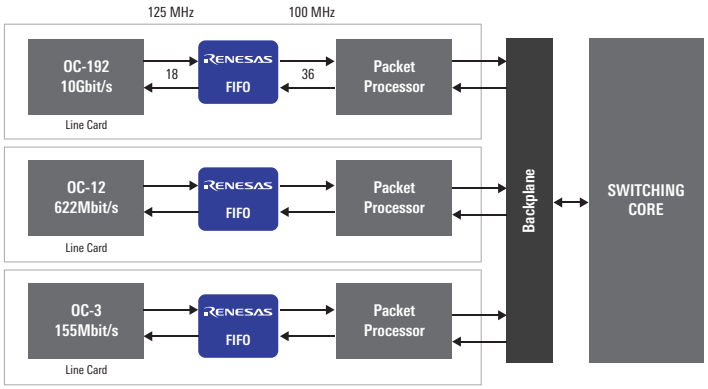
Renesas synchronous FIFOs are particularly appropriate for network, video, telecommunications, data communications and other applications that need to buffer large amounts of data.

Typical FIFO Application Block Diagrams

Test Equipment Application



Data Buffering: High Bandwidth LineCards



FIFO End Applications Include

- Medical recorder
- Repeater
- Ultrasound
- Densitometer
- Surgical instrument
- ATM
- Electroencephalograph
- Cell phone tester
- Commercial avionics
- Printer

SRAM

Asynchronous SRAMs, Synchronous Burst SRAMs, Zero Bus Turnaround (ZBT) SRAMs

In addition to our FIFOs and Multi-ports, Renesas offers a line of high-speed, industry-standard SRAMs that are used in communications, industrial and military markets. Renesas has been in the SRAM business for more than 40 years with a track record of consistant, innovative, high-quality products.

SRAM Benefits

- A wide range of products from 16-Kbit to 18-Mbit densities
- Synchronous and asynchronous architectures
- Renesas invented ZBT technology, the communications SRAM standard

Specialty Memory End Applications

- Industrial controls
- Medical applications
- Elevator controls
- Brewery controls
- Robotic welding

EEPROM

Renesas EEPROM realizes high-speed, low power consumption and a high level of reliability by employing advanced MONOS memory technology, CMOS process and low voltage circuitry technology.

Serial EEPROM Features

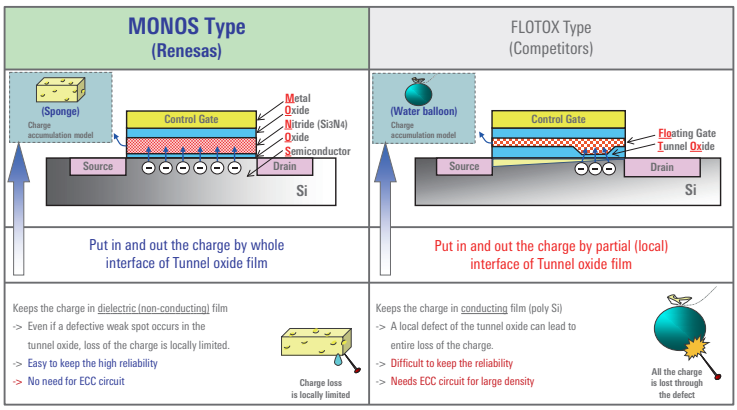
- Memory Density: 2Kb to 512Kb
- Standard serial interface: I²C (2-wire) and SPI bus enables a direct connection with MPU
- Data security function: write protection pin and software write protection
- Wide operating voltage range: 1.8V ~ 5.5V
- Wide temperature range of -40°C ~ +85°C
- Supports high-speed mode 400kHz~1MHz (I²C) and 3MHz~5MHz (SPI)
- Endurance: 1,000K cycles, Data retention: 100 years
- Compact packages: SOP-8 and TSSOP-8

Product Lineup

Product Series	Interface	Density	SOP-8 Package	TTSOP-8 Package
R1EX24002A / R1EX24004A / R1EX24008A	I²C	2Kb / 4Kb / 8Kb	✓	✓
R1EX24016A / R1EX24032A / R1EX24064A	I²C	16Kb / 32Kb / 64Kb	✓	✓
R1EX24128B / R1EX24256B / R1EX24512B	I²C	128Kb / 256Kb / 512Kb	✓	✓
R1EX25002A / R1EX25004A / R1EX25008A	SPI	2Kb / 4Kb / 8Kb	✓	✓
R1EX25016A / R1EX25032A / R1EX25064A	SPI	16Kb / 32Kb / 64Kb	✓	✓
HN58X25128 / HN58X25256	SPI	128Kb / 256Kb	✓	
R1EX25512A	SPI	512Kb	✓	✓

MONOS Structure

MONOS structure has an advantage that the stored charge in cell is less likely to be lost compared to another structure, FLOTOX. This leads to a longer data retention life.



EEPROM Applications

Used in a broad range of industrial to consumer fields for storing data that must be retained even after the power shutdown, such as parameters of manufacturing equipment or device setting information.

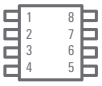
FLASH Memory

More Choices for the System Designer

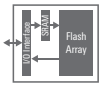
Renesas gives the system designer more choices in data and code storage to meet the power, processing and bandwidth challenges of power-conscious environments.
In addition to our Standard class of Flash that is designed for tasks such as system boot, our System-Enhancing class of memory can reduce MCU overhead and save up to 85% energy.

Standard Products
UNIVERSAL COMPATIBILITY

Ideal for Bootloader and Execute-in-Place tasks



STANDARD PIN OUT



STANDARD ARCHITECTURE

STANDARD COMMANDS

System-Enhancing Products
IMPROVED SYSTEM PERFORMANCE

Designed to save up to 85% energy and reduce MCU overhead

POWER and ENERGY SAVINGS

REDUCED CPU OVERHEAD

SIMPLIFIED SOFTWARE

HIGH EFFICIENCY ROBUST DATA LOGGING

Supports EXECUTE-IN-PLACE

Recommended Products by Task

Task	Recommended Product	Density	Family
Boot Code Code Shadow	AT25SL	32Mbit to 128Mbit 256Mbit available in Q1 2025	Standard 1.8V
	AT25SF	4Mbit to 256Mbit	Standard 3V
	AT25FF	4Mbit to 32Mbit	Standard Low Power
	AT25EU	1Mbit to 16Mbit	Ultra-Low Energy
Execute-in-Place	AT25XE	4Mbit to 32Mbit	FusionHD System-Enhancing Features
	AT25FF	4Mbit to 32Mbit	Standard Low Power
	AT25SL	32Mbit to 128Mbit 256Mbit available in Q1 2025	Standard 1.8V
	AT25SF	4Mbit to 256Mbit	Standard 3V
	AT25EU	1Mbit to 16Mbit	Ultra-Low Energy
System settings and configuration	AT25EU	1Mbit to 16Mbit	Ultra-Low Energy
	AT25XE	256Kbit to 32Mbit	FusionHD System-Enhancing Features
	AT25FF	4Mbit to 32Mbit	Standard Low Power
	AT45DB	2Mbit to 64Mbit	DataFlash High Efficiency Data Logging
Data Logging	AT45DB	2Mbit to 64Mbit	DataFlash High Efficiency Data Logging
	AT25XE	256Kbit to 32Mbit	FusionHD System-Enhancing Features

Download the Flash Product Selector Guide at

Features Available on Renesas Flash

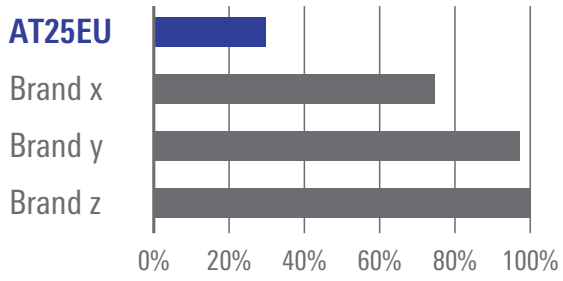
Product Features	System Benefit	AT25XE FusionHD	AT45 DataFlash	AT25EU Ultra low Energy	AT25FF Standard
Small Page Erase	Ideal for small updates Lower power Faster updates Reduce Flash wear	✓	✓	✓	
Read Modify Write	Single command update Reduces CPU overhead by 75% during memory updates	✓	✓		
Single and Dual R/W SRAM Buffers	SRAM buffers independently controlled by designer Save energy Concurrent R/W operation	✓ (Single)	✓ (Dual)		
Active Interrupt	Reduces MCU overhead / allows MCU to sleep	✓		✓	
Low power Sleep	Internal circuitry powered down Removes need for external FET / power switching	7nA	400nA	100nA	7nA

AT25EU The Newest Flash- Ultra-Low Energy Consumption

Total energy consumption is critical to battery-operated and power-conscious designs new AT25EU Flash combines low power plus fast performance to achieve the smallest energy footprint for power-conscious devices.

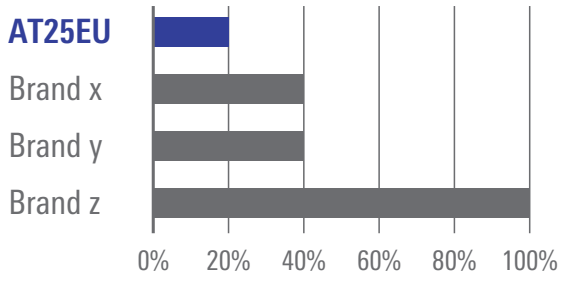
Read Power

Up to **70%**
LESS ENERGY



Deep Power Down

Up to **80%**
LESS ENERGY



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   "High Quality": Transportation equipment (automobiles, trains, ships, etc.); traffic control (traffic lights); large-scale communication equipment; key financial terminal systems; safety control equipment; etc.
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