

ONE-RENESAS MEMORY SOLUTIONS

Provides optimal memory portfolios to
industrial and communications applications



INDUSTRY-LEADING MEMORY PRODUCTS

The integration of IDT / Dialog to 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.



Memory Types	Products	Sources
Low Power SRAM	<ul style="list-style-type: none"> ▪ (5V, 3V) 256Kb, 1Mb, 4Mb ▪ (3V) 2Mb, 8Mb, 16Mb, 32Mb, 64Mb 	Renesas
Asynchronous Fast SRAM	<ul style="list-style-type: none"> ▪ (5V, 3.3V) 4Mb 	former IDT
	<ul style="list-style-type: none"> ▪ (5V) 16Kb, 64Kb ▪ (5V, 3.3V) 256Kb, 1Mb ▪ (3.3V) 4Mb 	
Synchronous SRAM	<ul style="list-style-type: none"> ▪ Pipeline Burst / Flow-through 1Mb, 2Mb, 4Mb, 9Mb ▪ Zero Bus Turnaround (ZBT) 4Mb, 9Mb, 18Mb 	former IDT
Specialty Memory	<ul style="list-style-type: none"> ▪ Multi-Port (5V, 3.3V, 2.5V, 1.8V) 8Kb to 36Mb ▪ FIFO (5V, 3.3V, 2.5V) 2Kb to 18Mb 	
EEPROM	<ul style="list-style-type: none"> ▪ Serial I/F: I²C, SPI (1.8V to 5.5V) 2Kb to 512Kb 	Renesas
SPI NOR Flash	<ul style="list-style-type: none"> ▪ Standard Products: (1.8V) 8Mb to 128Mb (1.8 to 3V, Wide Vcc) (3V) 256Kb to 128Mb 256Kb to 32Mb 	former Dialog
	<ul style="list-style-type: none"> ▪ System-Enhancing Products: Ultra-Low Energy (1Mb to 16Mb) Fusion / FusionHD [512Kb to 32Mb] DataFlash [2Mb to 64Mb] 	

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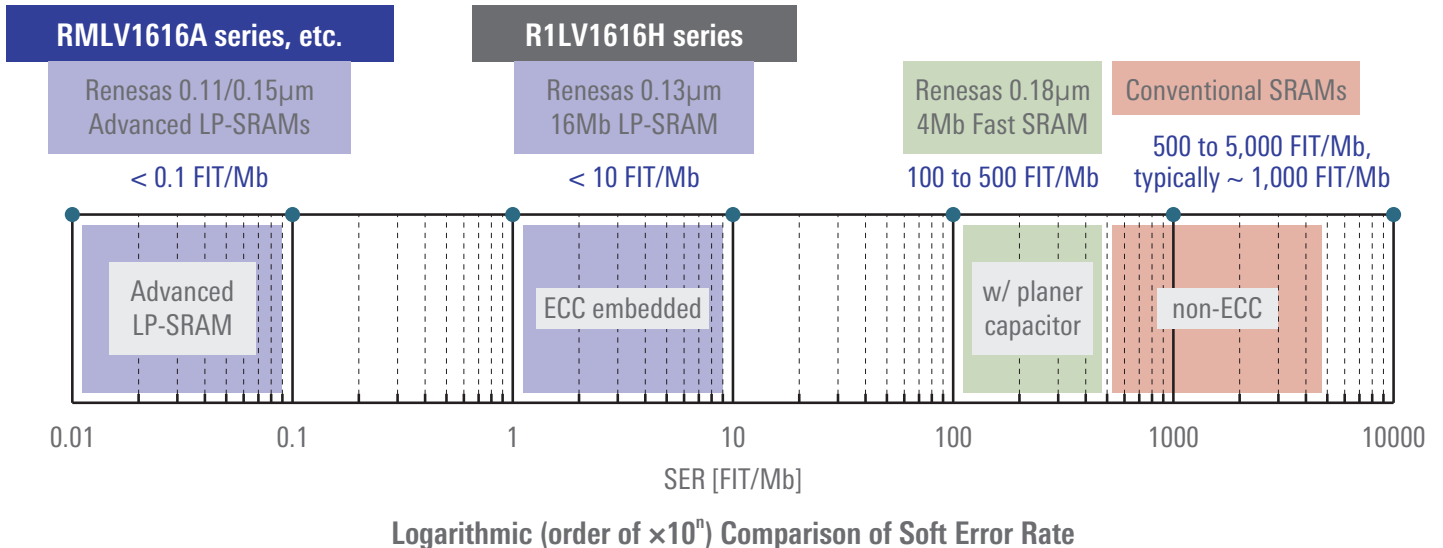
Low Power SRAM

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.

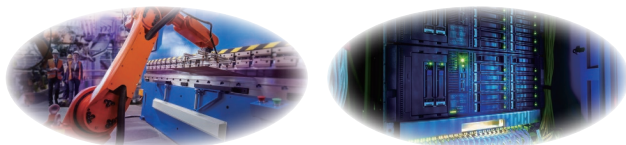
Advanced LPSRAM has superior Soft Error Immunity to ECC-embedded SRAMs

Product Family	Countermeasure against soft error?	By what?	Soft error rate (Measured)
Advanced LPSRAM series (0.11 μ m / 0.15 μ m)	YES	Soft Error immune process & device technology	< 0.04 FIT/Mb [0.11 μ m] < 0.06 FIT/Mb [0.15 μ m]
R1LV1616H series <EOL> (0.13 μ m CMOS 16Mb)	YES	Embedded ECC	< 5.5 FIT/Mb



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

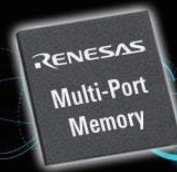
Vendor	Standby Current	Soft Error Rate
Renesas	0.3μA (4Mb, 3V Typ.)	< 0.04 FIT / Mb (0.11μm Advanced LPSRAM)
Competitor	3.5μA (4Mb, 3V Typ.)	500~5,000 FIT / Mb (90nm LPSRAM, w/o ECC)

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	✓		✓	✓
RMWV3216A	32 Mb	x16	2.7 - 3.6	55	1 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

Offering the Most Comprehensive Line of High-Performance Dual-port Products Available



FIFO Logic Products

Leading FIFO Solutions Helping Designers Solve Inter-chip Communications Protocol Problems



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

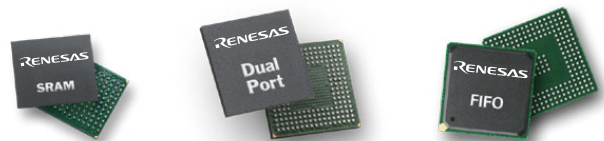
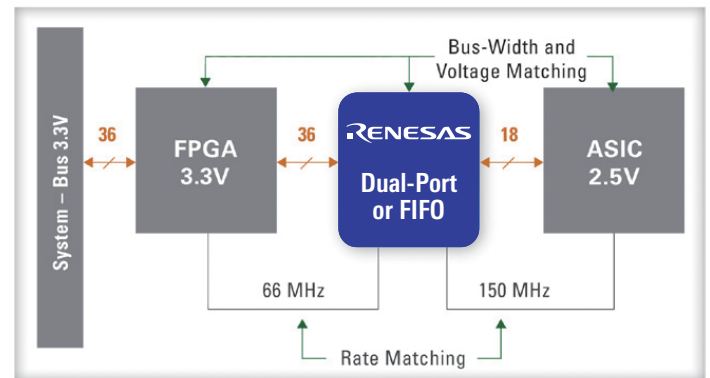
Renesas is the world leader in specialty memory with a dominant market position, a long history of innovation, and best-in-class support for FIFO and multi-port products. With hundreds of products and thousands of customers, Renesas continues to provide the highest quality, fastest, and most diverse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

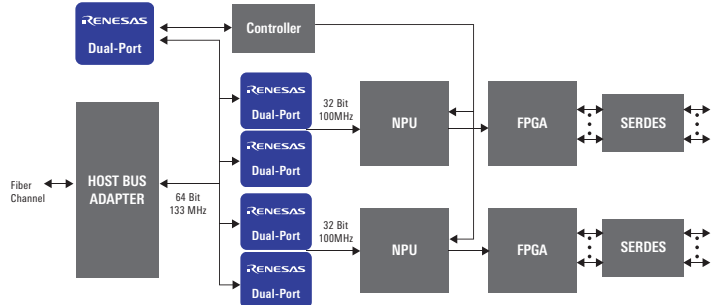
Renesas synchronous dual-port RAM memory cells allow access to simultaneous access of address from both ports.

Asynchronous Low-Power Dual-Port RAMs

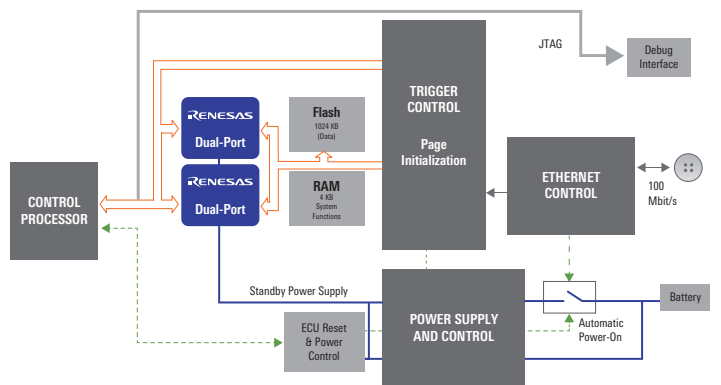
Renesas low-power dual-ports simplify the design process for hand held devices. Renesas LPDPs provide exceptionally low power consumption and the ability to buffer voltage, speed, and bus width mismatch between processors.

Typical Multi-Port Application Block Diagrams

Storage Area Network



Data Acquisition



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

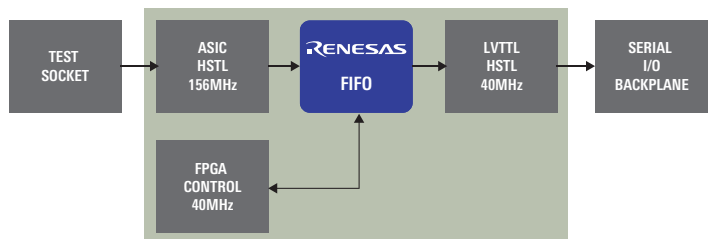
The Renesas FIFO Multi-Queue device is a fully programmable device, providing the user with flexibility in how queues are configured.

Synchronous FIFOs

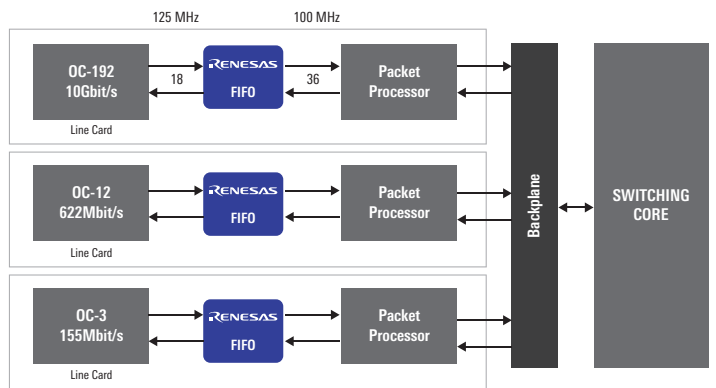
Renesas synchronous FIFOs are particularly appropriate for network, video, telecommunications, data communications and other applications that need to buffer large amounts of data.

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

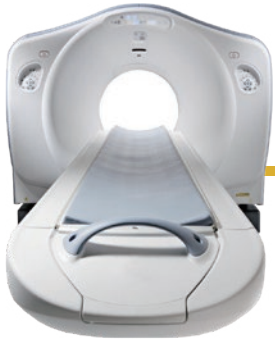
In addition to our FIFOs and Multi-ports, Renesas offers a line of high-speed, industry-standard SRAMs that are used in communications, industrial and military markets. Renesas has been in the SRAM business for more than 40 years with a track record of consistent, innovative, high-quality products.

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

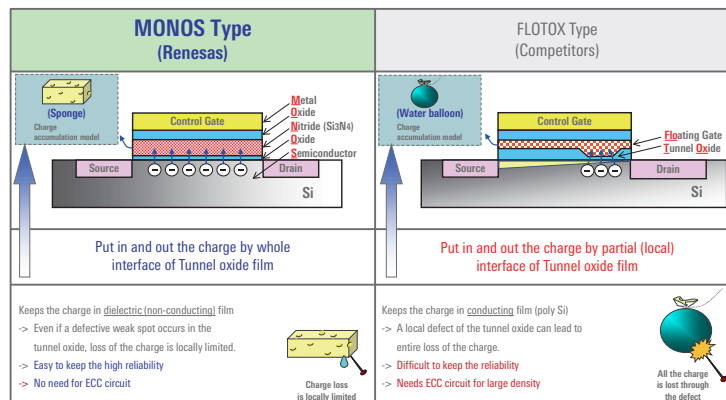
- Memory Density: 2Kb to 512Kb
- Standard serial interface: I²C (2-wire) and SPI bus enables a direct connection with MPU
- Data security function: write protection pin and software write protection
- Wide operating voltage range: 1.8V ~ 5.5V
- Wide temperature range of -40°C ~ +85°C
- Supports high-speed 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	TSSOP-8 Package
R1EX24002A / R1EX24004A / R1EX24008A	I ² C	2Kb / 4Kb / 8Kb	✓	✓
R1EX24016A / R1EX24032A / R1EX24064A	I ² C	16Kb / 32Kb / 64Kb	✓	✓
R1EX24128B / R1EX24256B / R1EX24512B	I ² C	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

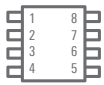
Renesas gives the system designer more choices in data and code storage to meet the power, processing and bandwidth challenges of power-conscious environments.

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.

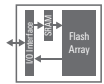
Standard Products

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	Standard 1.8V
	AT25SF	4Mbit to 128Mbit	Standard 3V
	AT25FF	4Mbit to 32Mbit	Standard Low Power
	AT25EU	1Mbit to 8Mbit available now 16Mbit available in Q1 2024	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	Standard 1.8V
	AT25SF	4Mbit to 128Mbit	Standard 3V
	AT25EU	1Mbit to 8Mbit available now 16Mbit available in Q1 2024	Ultra-Low Energy
System settings and configuration 	AT25EU	1Mbit to 8Mbit available now 16Mbit available in Q1 2024	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

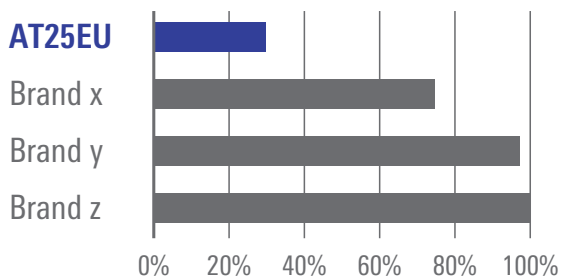
Product Features	System Benefit	AT25XE FusionHD	AT45 DataFlash	AT25EU Ultra low Energy	AT25FF Standard
Small Page Erase	Ideal for small updates Lower power Faster updates Reduce Flash wear	✓	✓	✓	
Read Modify Write	Single command update Reduces CPU overhead by 75% during memory updates	✓	✓		
Single and 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.

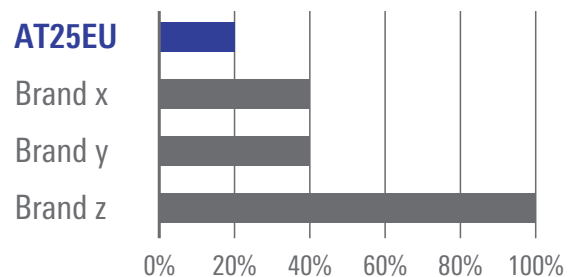
Read Power

Up to **70%**
LESS ENERGY



Deep Power Down

Up to **80%**
LESS ENERGY



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SALES OFFICES

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Renesas Electronics Corporation

TOYOSU FORESIA, 3-2-24 Toyosu, Koto-ku, Tokyo 135-0061, Japan

Renesas Electronics America Inc. Milpitas Campus

1001 Murphy Ranch Road, Milpitas, CA 95035, U.S.A.

Tel: +1-408-432-8888, Fax: +1-408-434-5351

Renesas Electronics America Inc. San Jose Campus

6024 Silver Creek Valley Road, San Jose, CA 95138, USA

Tel: +1-408-284-8200, Fax: +1-408-284-2775

Renesas Electronics Canada Limited

603 March Road, Ottawa, ON K2K 2M5, Canada

Tel: +1-613-595-6300, Fax: +1-613-595-6329

Renesas Electronics Europe GmbH

Arcadiastrasse 10, 40472 Düsseldorf, Germany

Tel: +49-211-6503-0, Fax: +49-211-6503-1327

Renesas Electronics (China) Co., Ltd.

Room 101-T01, Floor 1, Building 7, Yard No. 7, 8th Street, Shangdi, Haidian District, Beijing 100085, China

Tel: +86-10-8235-1155, Fax: +86-10-8235-7679

Renesas Electronics (Shanghai) Co., Ltd.

Unit 301, Tower A, Central Towers, 555 Langa Road, Putuo District, Shanghai 200333, China

Tel: +86-21-2226-0888, Fax: +86-21-2226-0999

Renesas Electronics Hong Kong Limited

Unit 3501-03, 35/F, One Kowloon, 1 Wang Yuen Street, Kowloon Bay, Hong Kong

Tel: +852-2265-6688, Fax: +852-2886-9022

Renesas Electronics Taiwan Co., Ltd.

13F, No. 363, Fu Shing North Road, Taipei 10543, Taiwan

Tel: +886-2-8175-9600, Fax: +886-2-8175-9670

Renesas Electronics Singapore Pte. Ltd.

80 Bendemeer Road, #06-02 Singapore 339949

Tel: +65-6213-0200, Fax: +65-6213-0300

Renesas Electronics Malaysia Sdn Bhd.

Unit No 3A-1 Level 3A Tower 8 UOA Business Park, No 1 Jalan Pengaturcara U1/51A, Seksyen U1, 40150 Shah Alam, Selangor, Malaysia

Tel: +60-3-5022-1288, Fax: +60-3-5022-1290

Renesas Electronics India Pvt. Ltd.

Bagmane Tech Park, Municipal No. 66/1-4, Lakeview Block, Block B, Ground Floor, Krishnappa Garden, C V Raman Nagar, Bengaluru, Karnataka 560 093, India

Tel: +91-90-67208700

Renesas Electronics Korea Co., Ltd.

7F, Hae-seong 2nd building, 508, Teheran-ro, Gangnam-gu, Seoul, Korea 06178

Tel: +82-2-558-3737, Fax: +82-2-558-5338