



# 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
	■ (5V, 3.3V) 4Mb
Asynchronous Fast SRAM	■ (5V) 16Kb, 1Mb ■ (3.3V) 1Mb, 4Mb
Synchronous SRAM	<ul> <li>Pipeline Burst / Flow-through 4Mb, 9Mb</li> <li>Zero Bus Turnaround (ZBT) 4Mb, 9Mb, 18Mb</li> </ul>
Specialty Memory	■ Multi-Port (5V, 3.3V, 2.5V) 8Kb to 36Mb ■ FIFO (5V, 3.3V) 2Kb to 512Kb
	<ul> <li>Standard Products: (1.8V) 8Mb to 256Mb, (1.8V to 3V, Wide Vcc) 256Kb to 32Mb, (3V) 256Kb to 256Mb</li> </ul>
SPI NOR Flash	System-Enhancing Products: Ultra-Low Energy (1Mb to 16Mb) FusionHD [4Mb 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.

#### **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**

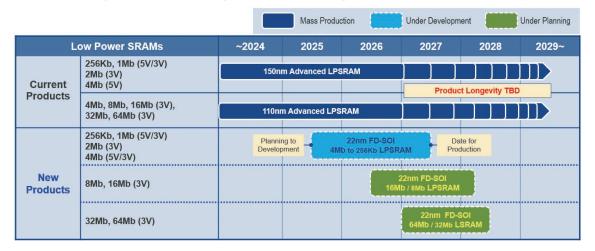
- Industrial
  - Factory automation (PLC, CNC, etc.), servomotor, AC drives
     (inverter), industrial robot, plant control system, vending machine, ticket gate, automated teller machine, etc.
- Communication
  - -Router, switch, base station, etc.
- Social infrastructure
  - Elevator system, transportation 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 Lineup**

Product Series	Density	Org.	Supply Voltage (V)	Access Time (ns)	Standby Current (typ.)	Temp. Range	TS0P	SOP	FBGA	μ <b>TSOP</b>
R1LP5256E	256 Kb	x8	4.5 - 5.5	55	0.6 μΑ	-40°C to 85°C	✓	✓		
R1LP0108E	1 Mb	x8	4.5 - 5.5	55	0.6 μΑ	-40°C to 85°C	✓	✓		
R1LP0408D	4 Mb	x8	4.5 - 5.5	55	0.8 μΑ	-40°C to 85°C	✓	✓		
R1LV5256E	256 Kb	x8	2.7 - 3.6	55	0.6 μΑ	-40°C to 85°C	✓	✓		
R1LV0108E	1 Mb	x8	2.7 - 3.6	55	0.6 μΑ	-40°C to 85°C	✓	✓		
R1LV0208BSA	2 Mb	x8	2.7 - 3.6	55	1 μΑ	-40°C to 85°C	✓			
R1LV0216BSB	2 Mb	x16	2.7 - 3.6	55	1 μΑ	-40°C to 85°C	✓			
RMLV0408E	4 Mb	x8	2.7 - 3.6	45	0.3 μΑ	-40°C to 85°C	✓	✓		
RMLV0414E	4 Mb	x16	2.7 - 3.6	45	0.3 μΑ	-40°C to 85°C	<b>√</b>			
RMLV0416E	4 Mb	x16	2.7 - 3.6	45	0.3 μΑ	-40°C to 85°C	✓		✓	
RMLV0808BGSB	8 Mb	x8	2.4 - 3.6	45	0.45 μΑ	-40°C to 85°C	<b>√</b>			
RMLV0816BGBG	8 Mb	x16	2.4 - 3.6	45	0.45 μΑ	-40°C to 85°C			✓	
RMLV0816BGSA	8 Mb	x16	2.4 - 3.6	45	0.45 μΑ	-40°C to 85°C	<b>✓</b>			
RMLV0816BGSB	8 Mb	x16	2.4 - 3.6	45	0.45 μΑ	-40°C to 85°C	<b>√</b>			
RMLV0816BGSD	8 Mb	x16	2.4 - 3.6	45	0.45 μΑ	-40°C to 85°C				✓
RMLV1616A-S	16 Mb	x16	2.7 - 3.6	55	0.5 μΑ	-40°C to 85°C	<b>√</b>		✓	✓
RMLV1616A-U	16 Mb	x16	2.7 - 3.6	45, 55	0.4 μΑ	-40°C to 85°C	<b>√</b>		✓	
RMLV3216A	32 Mb	x16	2.7 - 3.6	55	0.6 μΑ	-40°C to 85°C	✓		✓	✓
RMWV6416A	64 Mb	x16	2.7 - 3.6	55	1.2 μΑ	-40°C to 85°C	✓		✓	✓

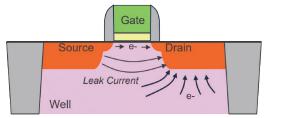
#### **Low Power SRAM Roadmap**

- Widest product lineup from 256Kbit to 64Mbit
- New products planned utilizing 22nm FD-SOI technology to ensure product longevity of Renesas Low Power SRAM product family

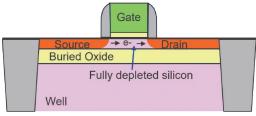


## **FD-SOI** – Advanced Technology Platform for New Products

■ An evolution of silicon on insulator (SOI) devices, with fully depleted channel structure formed on buried oxide (BOX) layer



**Bulk CMOS (conventional structure)** 



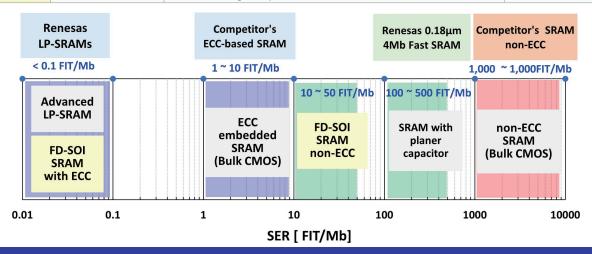
FD-SOI structure

#### In FD-SOI:

- BOX layer effectively mitigates excess leakage current, thereby enhancing low power operation.
- Minimal sensitive volume to high-energy particles (alpha-rays/neutrons) results in reduced charge collection, providing superior soft error immunity.
- Latch-up free: No parasitic PNPN structure formed within silicon substrate.

## **Soft Error Rate Comparison**

Product Family	Soft Error Mitigation?	By what?	Soft Error Rate
150nm / 110nm Advanced LP-SRAM (in stable production)	YES	Maximizing Critical Charge (Qcrit) by adding dedicated capacitor element     No need for embedded ECC	< 0.06 FIT/Mb [150nm] < 0.04 FIT/Mb [110nm] (Measured)
22nm FD-SOI SRAM (under development)	YES	Minimizing Collected Charge (Qcoll) by FD-SOI structure     Further SER mitigation by ECC	< 0.02 FIT/Mb [22nm] (Target value)



# **Multi-Port Memory**

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

# **FIFO Logic Products**



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

# RENESAS Pual Port FIFO

Bus-Width and

Voltage Matching

150 MHz

ASIC

2.5V

RENESAS

**Dual-Port** 

or FIFO

Rate Matching

36

66 MHz

**FPGA** 

3.3V

#### **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 dualports 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.

#### **Synchronous Dual-Port RAMs**

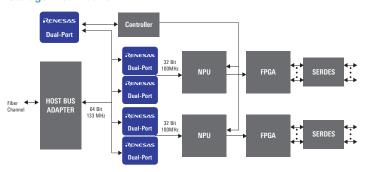
Renesas synchronous dual-port RAM memory cells allow access to simultaneous access of address from both ports.

#### **Asynchronous Low-Power Dual-Port RAMs**

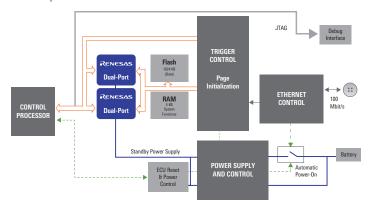
Renesas low-power dual-ports simplify the design process for hand held devices. Renesas LPDPs provide exceptionally low power consumption and the ability to buffer voltage, speed, and bus width mismatch between processors.

## **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**

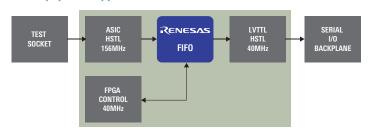
Renesas bi-directional FIFOs can transfer data in two directions, enabling optimized inter-processor and inter-DSP communication. To achieve the bidirectional transfer capability, especially useful in communication network equipment. The highly integrated devices provide two side-by-side FIFO memory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

#### **Synchronous FIFOs**

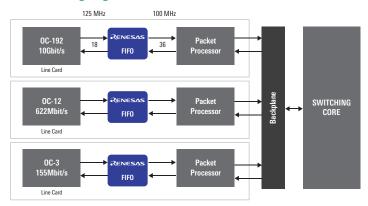
Renesas synchronous FIFOs are particularly appropriate for network, video, telecommunications, data communications and other applications that need to buffer large amounts of data.

## **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









MEMO	

# **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



HIGH EFFICIENCY ROBUST DATA LOGGING



REDUCED CPU OVERHEAD



Supports EXECUTE-IN-PLACE



SIMPLIFIED SOFTWARE

## **Recommended Products by Task**

Task	Task Recommended 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



## **Features Available on Renesas Flash**

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

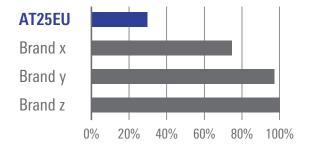
AT25EU

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.

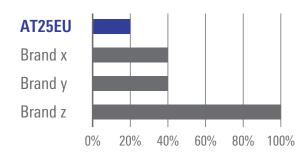
# **Read Power**

Up to 70% LESS ENERGY



# **Deep Power Down**

Up to **80%**LESS ENERGY





#### Renesas Electronics Corporation TOYOSU FORESIA, 3-2-24 Toyosu, Koto-ku, Tokyo 135-0061, Japan

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