

Renesas Standard SRAM Product Outline

April 17, 2024

Standard Memory Products Section,
Standard Products Department, Standard Products Division,
Analog & Connectivity Product Group,
Renesas Electronics Corporation

SRAM-2024-E-0417-1

Memory Products Portfolio

- “One-Renesas” provides optimum memory solutions to various application fields.

Memory Types	Products	Sources
Low Power SRAM	■ (5V, 3V) 256Kb, 1Mb, 4Mb ■ (3V) 2Mb, 8Mb, 16Mb, 32Mb, 64Mb	Renesas
Asynchronous Fast SRAM	■ (5V, 3.3V) 4Mb ■ (5V) 16Kb, 64Kb, 256Kb ■ (5V, 3.3V) 1Mb ■ (3.3V) 4Mb	
Synchronous SRAM	■ Pipeline Burst / Flow-through : 4Mb, 9Mb ■ Zero Bus Turnaround (ZBT) : 4Mb, 9Mb, 18Mb	former IDT
Specialty Memory	■ Multi-Port (5V, 3.3V, 2.5V) 8Kb ~ 36Mb ■ FIFO (5V, 3.3V, 2.5V) 2Kb ~ 9Mb	
EEPROM	■ Serial I/F: I2C, SPI (1.8V ~ 5.5V) 2Kb ~ 512Kb	Renesas
SPI NOR Flash	■ Standard Products: (1.8V) 8Mb ~ 128Mb (3V) 256Kb ~ 128Mb (1.8 ~ 3V, Wide Vcc) 256Kb ~ 32Mb ■ System-Enhancing Products: Fusion / FusionHD 512Kb~32Mb / DataFlash 2Mb~64Mb / Ultra-Low Energy 1Mb~4Mb	former Dialog

Covered by
this Material

Renesas Standard SRAM

Advantages

➤ Features

■ High Reliability

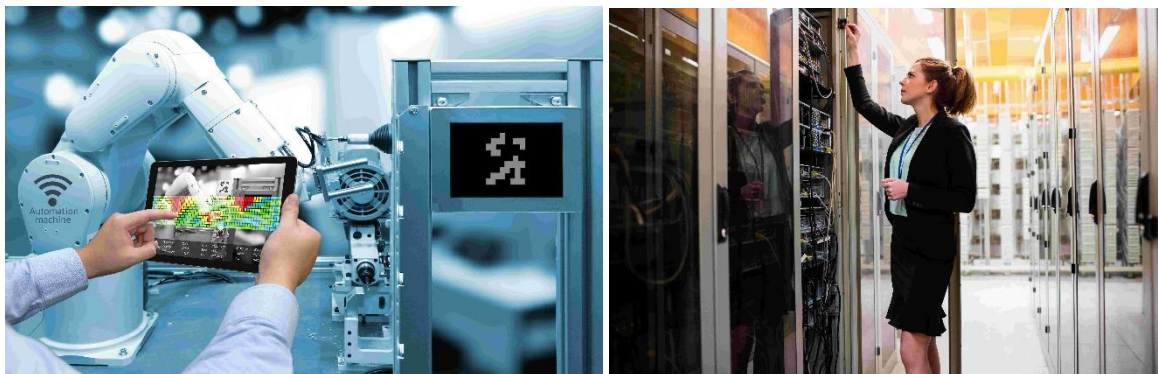
- ❑ Excellent soft error immunity without embedded ECC
- ❑ Latch-up free memory cell structure

■ Stable supply and long-term support

- ❑ Covered by PLP: Product Longevity Program

■ Wide lineup 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.

■ Medical / Healthcare

- ❑ Medical electronic devices

■ Office automation

- ❑ Multi-function printer, etc.

■ Consumer

- ❑ Gaming machine, musical instrument, calculator, etc.

■ Car accessories (non-driveline devices)

- ❑ ETC device, digital tachometer, etc.



Renesas Standard SRAM

Product Roadmap

■ Wide variety of SRAM product lineup 256Kb~64Mb

■ Roadmap

		Mass Production Under Development					
SRAM Type	Density (Voltage)	~2023	2024	2025	2026	2027	2028~
Low Power SRAM	256Kb, 1Mb (5V/3V) 2Mb (3V) 4Mb (5V)	0.15 μm Advanced LPSRAM					
	4Mb (3V) 8Mb, 16Mb (3V) 32Mb, 64Mb (3V)	0.11 μm Advanced LPSRAM					
	16Mb (3V) R1LV1616H series <EOL products>	0.13 μm (ECC-embedded)					
	16Mb (3V) RMLV1616A-U series Alternative to R1LV1616H series		0.11 μm Advanced LPSRAM				
Asynchronous Fast SRAM	4Mb (5V/3V)		MP: Now				
		0.18 μm CMOS					

As of Apr. 2024

Alternative to R1LV1616H series

RMLV1616A-U series

New Product, MP Now
Contact us for details

■ Drop-in Compatible Speed, Low Power and Packages plus Superior Soft Error Rate !

Items	R1LV1616H series <EOL products>	RMLV1616A-U series <Alternative products>	☑ Drop-in Compatibility & Remarks
Access time	45ns / 55ns	45ns / 55ns	☑ Supports 45ns
Standby current	0.5μA (typ.) / 8μA (max.)	0.5μA (typ.) / 8μA (max.)	☑ Supports 8μA, max.
Packages	48-ball FBGA (8.0x9.5mm2)	48-ball FBGA (7.5x8.5 mm2)	☑ Identical ball-pitch & pin configs.
	48-pin TSOP (I)	48-pin TSOP (I)	☑ Identical outline & pin configs.
Soft Error Mitigation (countermeasures)	YES (embedded ECC)	YES (Advanced LPSRAM)	☑ Refer to the page for Advanced LPSRAM technology
Soft Error Rate (measured)	< 5.5 FIT/Mb	< 0.04 FIT/Mb	☑ Superior to ECC-embedded SRAMs! Contact us for details

Product Lineup

16Mb Low Power SRAM

Wafer Process	Density	Catalog Part Name	Orderable Part Name	Package (pinout)	Packing Type	Access Time	Standby Current (typ. / max.)	Operating Voltage	Operating Temperature	PLP period	
		RMLV1616AGBG-4U2	RMLV1616AGBG-4U2#AC0	FBGA (48)	Tray	45ns	0.4μA / 8μA	2.7V ~ 3.6V	-40 ~ 85 °C		
			RMLV1616AGBG-4U2#KC0	FBGA (48)	Tape & Reel	45ns	0.4μA / 8μA	2.7V ~ 3.6V	-40 ~ 85 °C		
RMLV1616A-U series New Product		RMLV1616AGBG-5U2	RMLV1616AGBG-5U2#AC0	FBGA (48)	Tray	55ns	0.4μA / 8μA	2.7V ~ 3.6V	-40 ~ 85 °C		Dec. 2032 (Planned*)
			RMLV1616AGBG-5U2#KC0	FBGA (48)	Tape & Reel	55ns	0.4μA / 8μA	2.7V ~ 3.6V	-40 ~ 85 °C		
0.11μm Advanced	16Mbit	RMLV1616AGSA-4U2	RMLV1616AGSA-4U2#AA0	TSOP-I (48)	Tray	45ns	0.4μA / 8μA	2.7V ~ 3.6V	-40 ~ 85 °C		
			RMLV1616AGSA-4U2#KA0	TSOP-I (48)	Tape & Reel	45ns	0.4μA / 8μA	2.7V ~ 3.6V	-40 ~ 85 °C		
		RMLV1616AGSA-5U2	RMLV1616AGSA-5U2#AA0	TSOP-I (48)	Tray	55ns	0.4μA / 8μA	2.7V ~ 3.6V	-40 ~ 85 °C		
			RMLV1616AGSA-5U2#KA0	TSOP-I (48)	Tape & Reel	55ns	0.4μA / 8μA	2.7V ~ 3.6V	-40 ~ 85 °C		
RMLV1616A-S series Production Now		RMLV1616AGBG-5S2	RMLV1616AGBG-5S2#AC0	FBGA (48)	Tray	55ns	0.5μA / 16μA	2.7V ~ 3.6V	-40 ~ 85 °C	Dec. 2032	
			RMLV1616AGBG-5S2#KC0	FBGA (48)	Tape & Reel	55ns	0.5μA / 16μA	2.7V ~ 3.6V	-40 ~ 85 °C	Dec. 2032	
0.11μm Advanced	16Mbit	RMLV1616AGSA-5S2	RMLV1616AGSA-5S2#AA0	TSOP-I (48)	Tray	55ns	0.5μA / 16μA	2.7V ~ 3.6V	-40 ~ 85 °C	Dec. 2032	
			RMLV1616AGSA-5S2#KA0	TSOP-I (48)	Tape & Reel	55ns	0.5μA / 16μA	2.7V ~ 3.6V	-40 ~ 85 °C	Dec. 2032	
		RMLV1616AGSD-5S2	RMLV1616AGSD-5S2#AA1	μTSOP (52)	Tray	55ns	0.5μA / 16μA	2.7V ~ 3.6V	-40 ~ 85 °C	Dec. 2032	
			RMLV1616AGSD-5S2#HA1	μTSOP (52)	Tape & Reel	55ns	0.5μA / 16μA	2.7V ~ 3.6V	-40 ~ 85 °C	Dec. 2032	

* Note: To be given the same PLP period as other SRAMs.

Die-shrink with Achieving Low Power

0.11μm 32Mb/64Mb LPSRAM

Production Now

- Not only a generation change but also reduced operating / standby current

			0.15μm process	0.11μm process	
32Mb FBGA (48) TSOP-I (48) μTSOP (52)	Product family ->		R1LV3216R series	RMLV3216A series	
	Access time	tAA	55ns	55ns	
	Operating current	Icc1	55mA (Max.)	35mA (Max.)	Icc1 (Max.) reduction by 36%
	Standby current	ISB1	4μA (Typ.) @25°C 80μA (Max.) @85°C	0.6μA (Typ.) @25°C 24μA (Max.) @85°C	Isb1 (typ.) reduction by 85%
	Data retention voltage	VDR	2.0V	1.5V	
64Mb (MCP:32Mb x2) FBGA (48) TSOP-I (48) μTSOP (52)	Product family ->		R1WV6416R series	RMWV6416A series	
	Access time	tAA	55ns	55ns	
	Operating current	Icc1	60mA (Max.)	38mA (Max.)	Icc1 (Max.) reduction by 36%
	Standby current	ISB1	8μA (Typ.) @25°C 160μA (Max.) @85°C	1.2μA (Typ.) @25°C 46μA (Max.) @85°C	Isb1 (typ.) reduction by 85%
	Data retention voltage	VDR	2.0V	1.5V	

Basic Block Diagram

SRAM Battery Backup

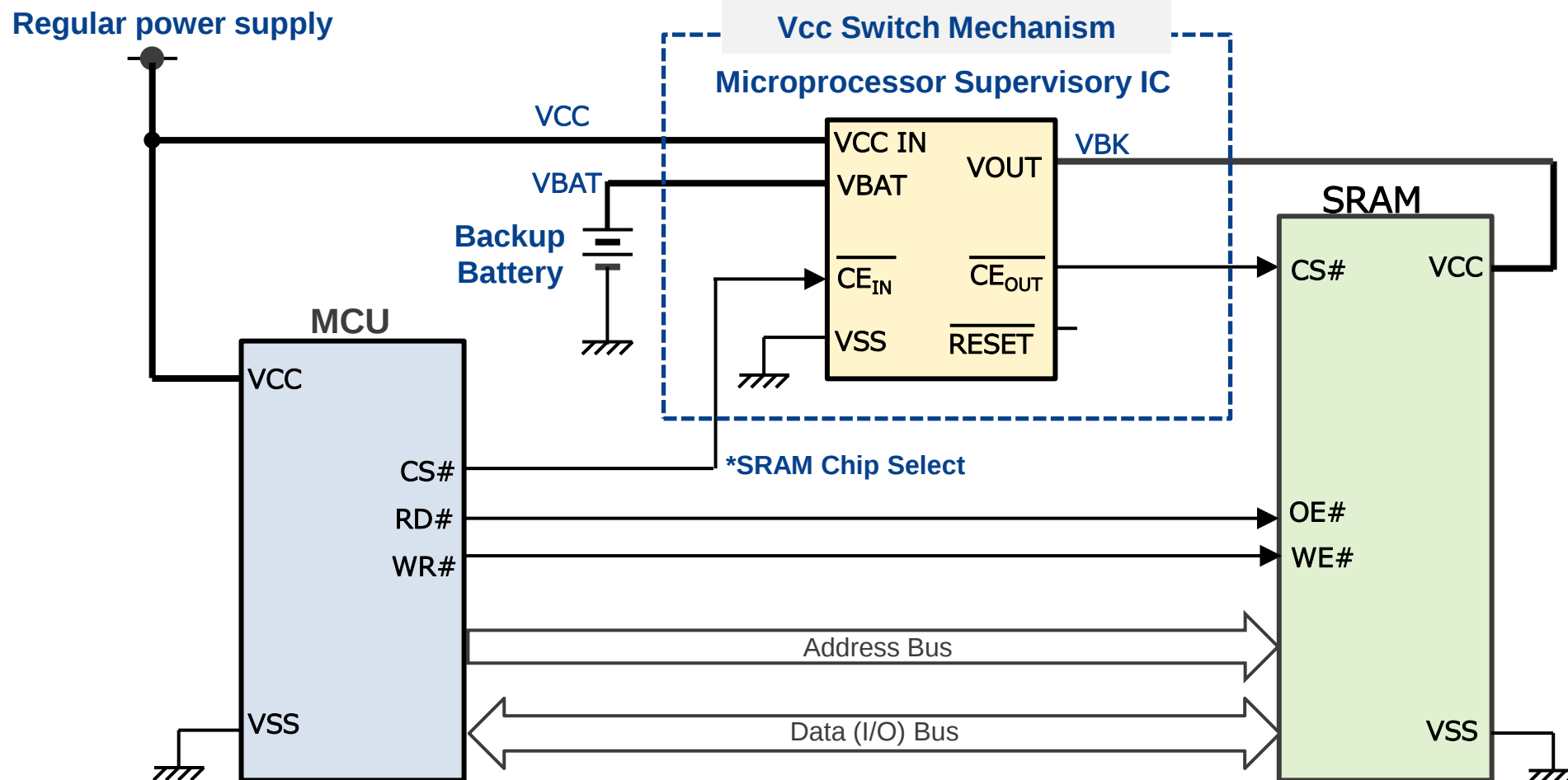
Non-volatile RAM by battery backup

- Low Standby Current = Longer battery life
- Low Soft Error Rate = High Reliability on data retention

Visit [SRAM FAQs](#) for detailed guidelines

[SRAM battery backup circuit \(recommended design technique\)](#)

[Cautions on SRAM battery backup circuits \(non-recommended\)](#)



Technology Challenges: Soft Errors

1. A phenomenon observed as a memory failure by occasional bit(s) upset.
Also referred as “Single Event Upset (SEU).”
2. Not a permanent hard failure and can be corrected by rewriting from the system (MCU) side.

Fig.2: Cosmic ray (neutron) induced soft error

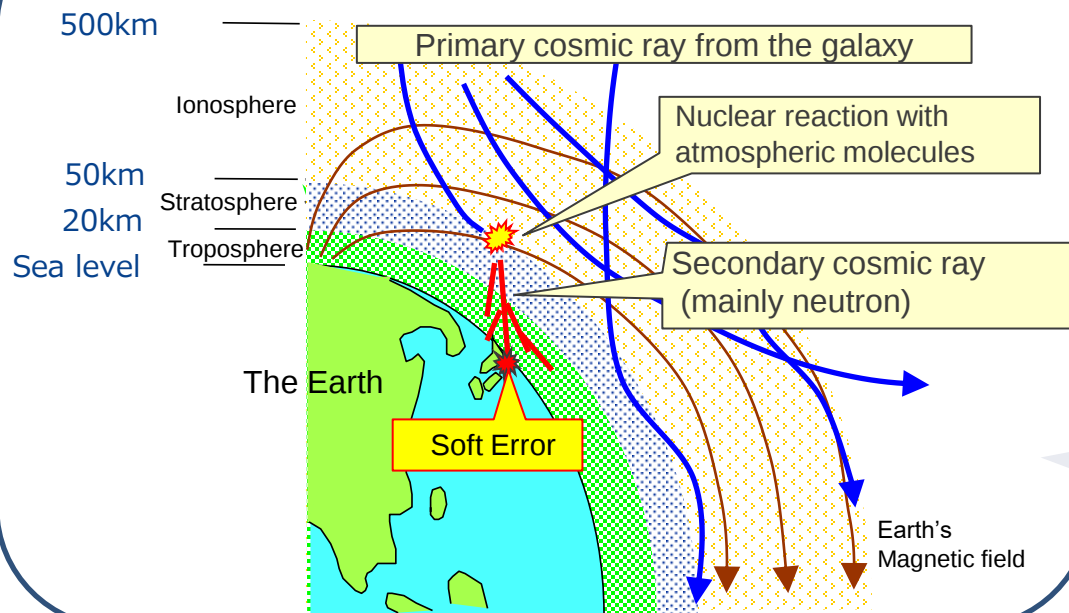
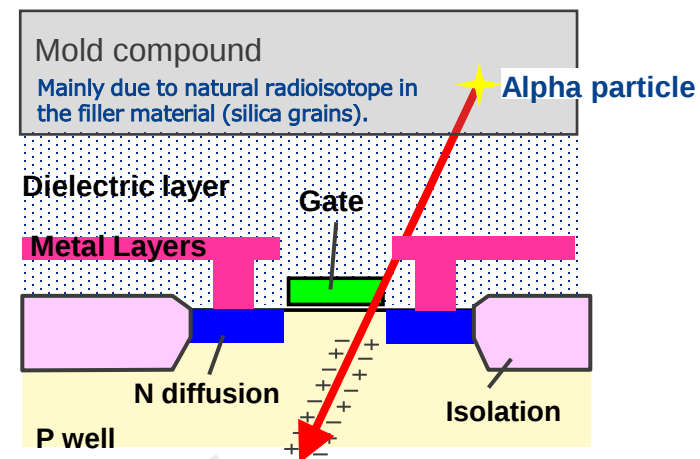


Fig.1: Alpha-particle induced soft error



3. Until the early '90s, the main cause was α (alpha) rays generated from radioisotopes contained in trace amounts in semiconductor packaging materials. (Fig.1)
4. Since the '90s, when the feature size of wafer process has been downsized to $0.1\mu\text{m}$ (100nm) or less, "Terrestrial Cosmic Rays" are being recognized as a dominant cause of soft errors. (Fig.2)

Product Differentiation

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

Soft Error Countermeasures ?

YES

NO

✓ In Production

Supplier	Process	256Kb	1Mb	2Mb	4Mb	8Mb	16Mb	32Mb	64Mb	Remarks
 LP-SRAM	0.15μm Advanced	✓	✓	✓	✓ (5V)	Changes to 0.11μm Advanced				Market Introduction in 2004 (first with 16Mb)
	0.11μm Advanced				✓ (3V)	✓	✓	✓	✓	Market Introduction in 2013 (first with 4Mb)
Competitor A LP-SRAM	90nm CMOS, Non-ECC	EOL	✓	✓	✓	✓	✓	✓	✓	90nm CMOS (Note)
	65nm CMOS, ECC embedded				✓	✓	✓	✓	✓	65nm CMOS (Note)
Competitor B LP-SRAM	CMOS, Non-ECC	✓	✓	✓	✓	✓	✓			No 32Mb+ product (Note)
	CMOS, ECC embedded				✓	✓				No 16Mb+ product (Note)

Note : Renesas recognition based on public information and sales information.
It is not the official announcement of each competitor company.

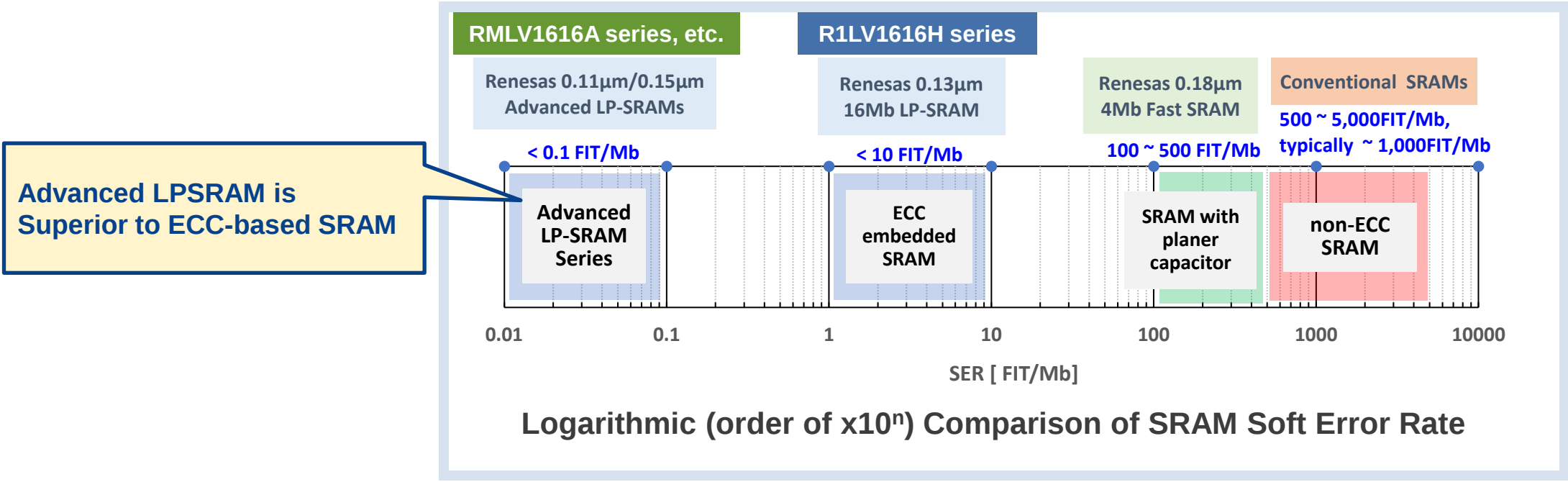
ECC: Error Correction Code, or Error Checking and Correction

Technology Comparison

Soft-error Countermeasures

Product Family	ECC installed?	Soft Error Mitigation?	By what?	Soft error rate (Measured)	Differentiator
Advanced LPSRAM series (0.11μm / 0.15μm)	NO	YES	Increasing Critical Charge (Qcrit) by the proprietary technology	< 0.04 FIT/Mb [0.11μm] < 0.06 FIT/Mb [0.15μm]	Outstanding soft error rate over ECC-based products
(EOL) R1LV1616H series (0.13μm CMOS 16Mb)	YES	YES	Embedded ECC	< 5.5 FIT/Mb	Single FIT/Mb: excellent soft error rate in practical use

Note: Critical charge (Qcrit) is the minimum electric charge to cause a bit flip.



Process & Device technology

Advanced Low Power SRAM

- Exclusive technology achieves both high-performance and high-reliability without any technical trade-off
- Excellent soft error immunity without embedded ECC
- Latch-up free memory cell structure

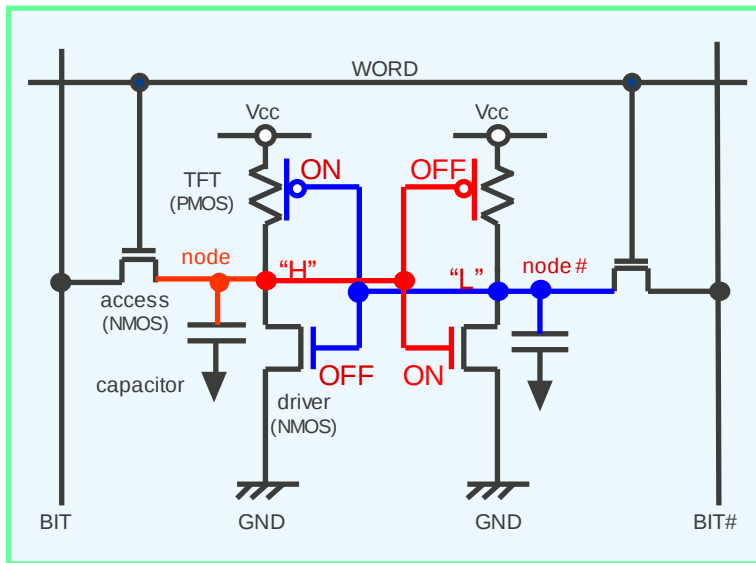


Fig.1: Memory cell circuit

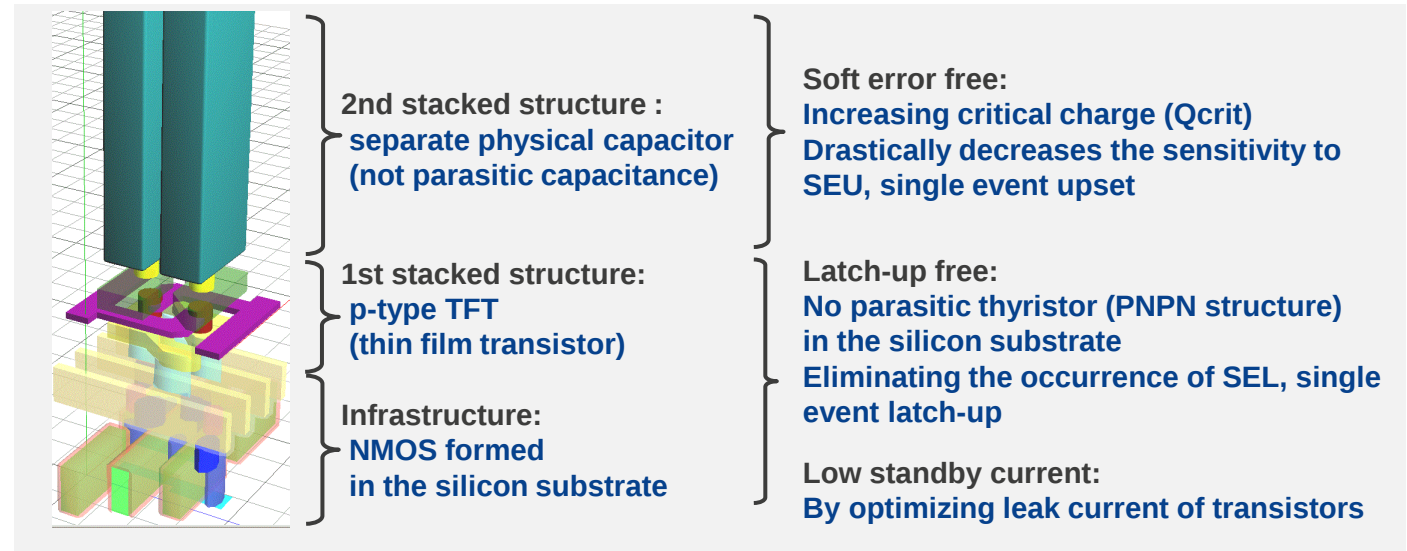
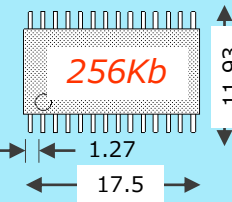
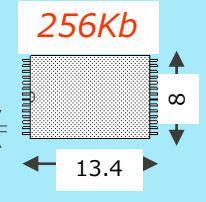
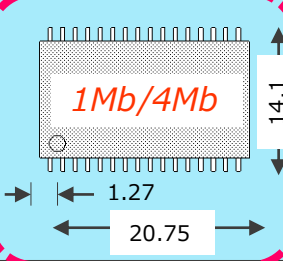
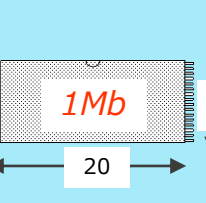
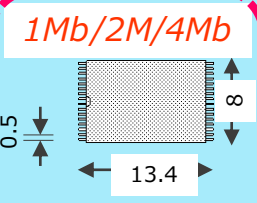
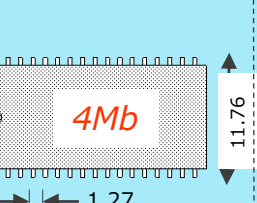
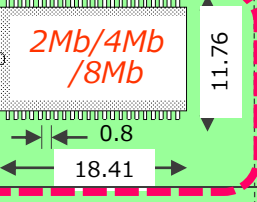
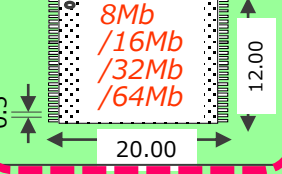
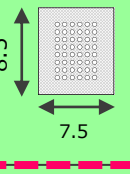
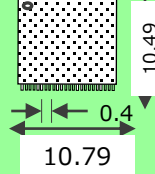


Fig.2: 3D image of the memory cell

Renesas LPSRAM Package Lineup

	SOP	TSOP-I	sTSOP	TSOP-II	μTSOP	FBGA
28pin	 256Kb 11.93 1.27 17.5	 256Kb 0.55 13.4 8				
32pin	 1Mb/4Mb 14.1 1.27 20.75	 1Mb 0.5 20 8	 1Mb/2M/4Mb 0.5 13.4 8	 4Mb 1.27 20.95 11.76	x8 Config.	
44pin				 2Mb/4Mb / 8Mb 0.8 18.41 11.76	x8 / x16 Config.	 4Mb / 8Mb / 16Mb / 32Mb / 64Mb
48pin (48ball)		 8Mb / 16Mb / 32Mb / 64Mb 0.5 20.00 12.00		 8Mb / 16Mb / 32Mb / 64Mb		 8.5 7.5
52pin	Renesas provides 6 kinds of common packages, which are upward compatible, making it easy to expand density without changing printed circuit board				 10.49 0.4 10.79	

Product Lineup

Low Power SRAMs (256Kb ~ 4Mb)

Product Series	Density	Org.	Operating Voltage	Access Time	Standby Current (typ.)	Operating Temperature	Chip Select Option	Package				Mass Production	PLP
								TSOP	SOP	FBGA	μTSOP		
R1LP5256E	256 Kb	x8	4.5 ~ 5.5V	55	0.6 μA	-40°C ~ 85°C	1: CS#	✓	✓			Now	Dec. 2032
R1LP0108E	1 Mb	x8	4.5 ~ 5.5V	55	0.6 μA	-40°C ~ 85°C	2: CS1#, CS2	✓	✓			Now	Dec. 2032 *Mar. 2031
R1LP0408D	4Mb	x8	4.5 ~ 5.5V	55	0.8 μA	-40°C ~ 85°C	1: CS#	✓	✓			Now	Dec. 2032 *Mar. 2031
R1LV5256E	256 Kb	x8	2.7 ~ 3.6V	55	0.6 μA	-40°C ~ 85°C	1: CS#	✓	✓			Now	Dec. 2032
R1LV0108E	1 Mb	x8	2.7 ~ 3.6V	55	0.6 μA	-40°C ~ 85°C	2: CS1#, CS2	✓	✓			Now	Dec. 2032 *Mar. 2031
R1LV0208BSA	2 Mb	x8	2.7 ~ 3.6V	55	1 μA	-40°C ~ 85°C	2: CS1#, CS2	✓				Now	Dec. 2032
R1LV0216BSB	2 Mb	x16	2.7 ~ 3.6V	55	1 μA	-40°C ~ 85°C	1: CS#	✓				Now	Dec. 2032
RMLV0408E	4 Mb	x8	2.7 ~ 3.6V	45	0.3 μA	-40°C ~ 85°C	1: CS#	✓	✓			Now	Dec. 2032 *Mar. 2031
RMLV0414E	4 Mb	x16	2.7 ~ 3.6V	45	0.3 μA	-40°C ~ 85°C	1: CS#	✓				Now	Dec. 2032
RMLV0416E	4 Mb	x16	2.7 ~ 3.6V	45	0.3 μA	-40°C ~ 85°C	2: CS1#, CS2	✓		✓		Now	Dec. 2032

* For TSOP-I (32) and TSOP-II (32) packages

(Note) Check the Renesas website for respective orderable part names.



[Low Power SRAMs | Renesas](#)

Product Lineup

Low Power SRAMs (8Mb ~ 64Mb)

Product Series	Density	Org.	Operating Voltage	Access Time	Standby Current (typ.)	Operating Temperature	Chip Select Option	Package				Mass Production	PLP
								TSOP	SOP	FBGA	μTSOP		
RMLV0808BGSB	8 Mb	x8	2.4 ~ 3.6V	45ns	0.45 μA	-40°C ~ 85°C	2: CS1#, CS2	✓				Now	Dec. 2032
RMLV0816BGBG	8 Mb	x16	2.4 ~ 3.6V	45ns	0.45 μA	-40°C ~ 85°C	2: CS1#, CS2			✓		Now	Dec. 2032
RMLV0816BGSA	8 Mb	x16	2.4 ~ 3.6V	45ns	0.45 μA	-40°C ~ 85°C	2: CS1#, CS2	✓				Now	Dec. 2032
RMLV0816BGSB	8 Mb	x16	2.4 ~ 3.6V	45ns	0.45 μA	-40°C ~ 85°C	1: CS#	✓				Now	Dec. 2032
RMLV0816BGSD	8 Mb	x16	2.4 ~ 3.6V	45ns	0.45 μA	-40°C ~ 85°C	2: CS1#, CS2				✓	Now	Dec. 2032
RMLV1616A-S	16 Mb	x16	2.7 ~ 3.6V	55ns	0.5 μA	-40°C ~ 85°C	2: CS1#, CS2	✓		✓	✓	Now	Dec. 2032
RMLV1616A-U	16 Mb	x16	2.7 ~ 3.6V	45ns, 55ns	0.4 μA	-40°C ~ 85°C	2: CS1#, CS2	✓		✓		Now	Dec. 2032 (Planned*)
RMLV3216A	32 Mb	x16	2.7 ~ 3.6V	55ns	0.6 μA	-40°C ~ 85°C	2: CS1#, CS2	✓		✓	✓	Now	Dec. 2032
RMWV3216A	32 Mb	x16	2.7 ~ 3.6V	55ns	1 μA	-40°C ~ 85°C	2: CS1#, CS2			✓		Now	Dec. 2032
RMWV6416A	64 Mb	x16	2.7 ~ 3.6V	55ns	1.2 μA	-40°C ~ 85°C	2: CS1#, CS2	✓		✓	✓	Now	Dec. 2032

* To be given the same PLP period as other SRAMs.

(Note) Check the Renesas website for respective orderable part names.



[Low Power SRAMs | Renesas](#)

Product Lineup

Asynchronous Fast SRAMs (4Mb)

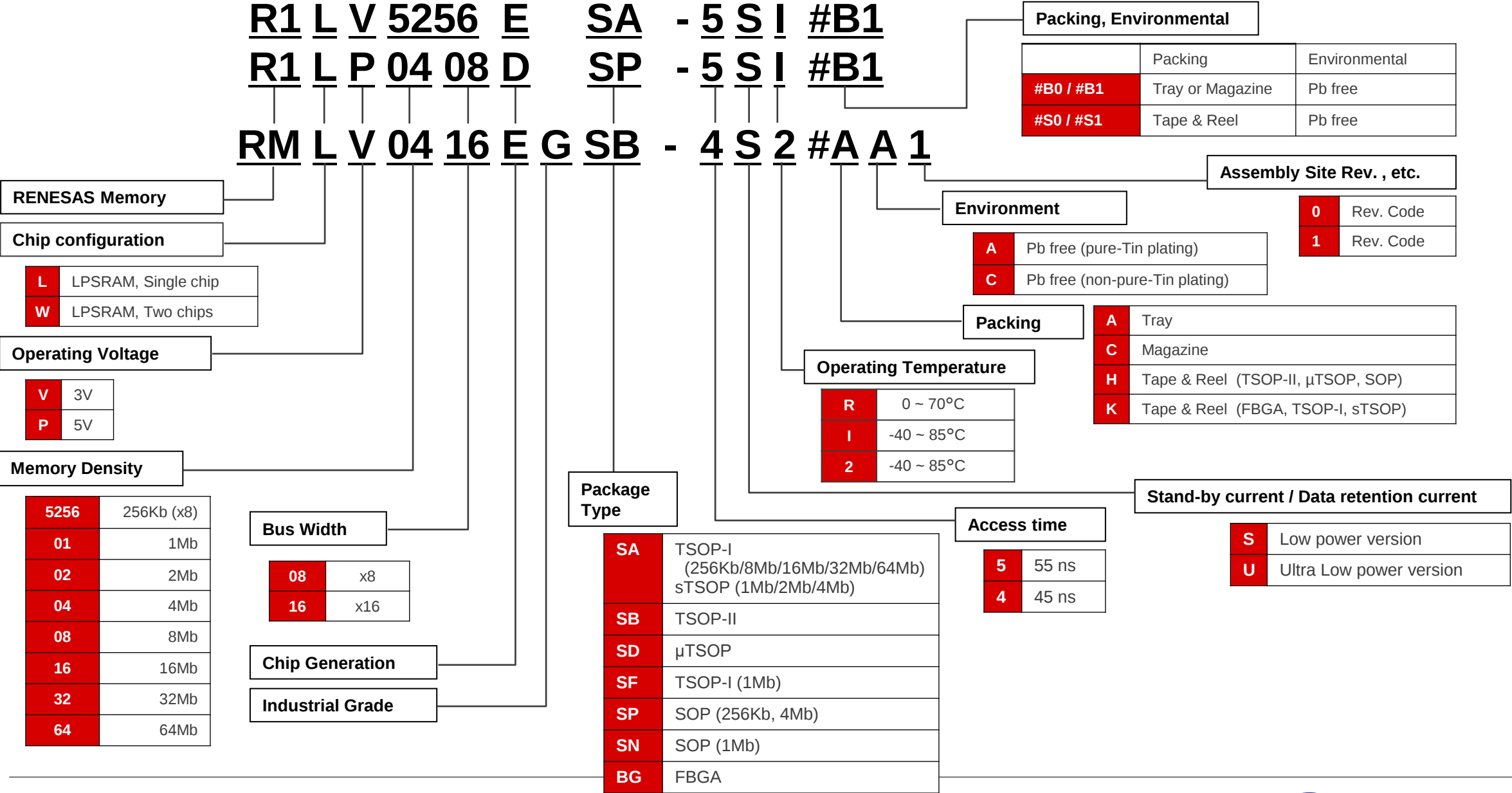
Product Series	Density	Org.	Operating Voltage	Access Time	Standby Current (max.) Std. / L-ver. / S-ver.	Operating Temperature	Chip Select Option	Package		Mass Production	PLP (for TSOP)
								TSOP	SOJ		
R1RP0408D-I	4Mb	x8	4.5 ~ 5.5V	12ns	5mA / - / -	-40°C ~ 85°C	1: CS#		✓	Now	-
R1RP0408D-R	4Mb	x8	4.5 ~ 5.5V	12ns	5mA / 1.0mA / -	0°C ~ 70°C	1: CS#		✓	Now	-
R1RP0416D-I	4Mb	x16	4.5 ~ 5.5V	10ns, 12ns	5mA / - / -	-40°C ~ 85°C	1: CS#	✓	✓	Now	Dec. 2032
R1RP0416D-R	4Mb	x16	4.5 ~ 5.5V	10ns, 12ns	5mA / 1.0mA / 0.5mA	0°C ~ 70°C	1: CS#	✓	✓	Now	Dec. 2032
R1RW0408D-I	4Mb	X8	3.0 ~ 3.6V	12ns	5mA / - / -	-40°C ~ 85°C	1: CS#		✓	Now	-
R1RW0408D-R	4Mb	x8	3.0 ~ 3.6V	12ns	5mA / 0.8mA / -	0°C ~ 70°C	1: CS#		✓	Now	-
R1RW0416D-I	4Mb	x16	3.0 ~ 3.6V	10ns, 12ns	5mA / - / -	-40°C ~ 85°C	1: CS#	✓	✓	Now	Dec. 2032
R1RW0416D-R	4Mb	x16	3.0 ~ 3.6V	10ns, 12ns	5mA / 0.8mA / 0.5mA	0°C ~ 70°C	1: CS#	✓	✓	Now	Dec. 2032

(Note) Check the Renesas website for respective orderable part names.

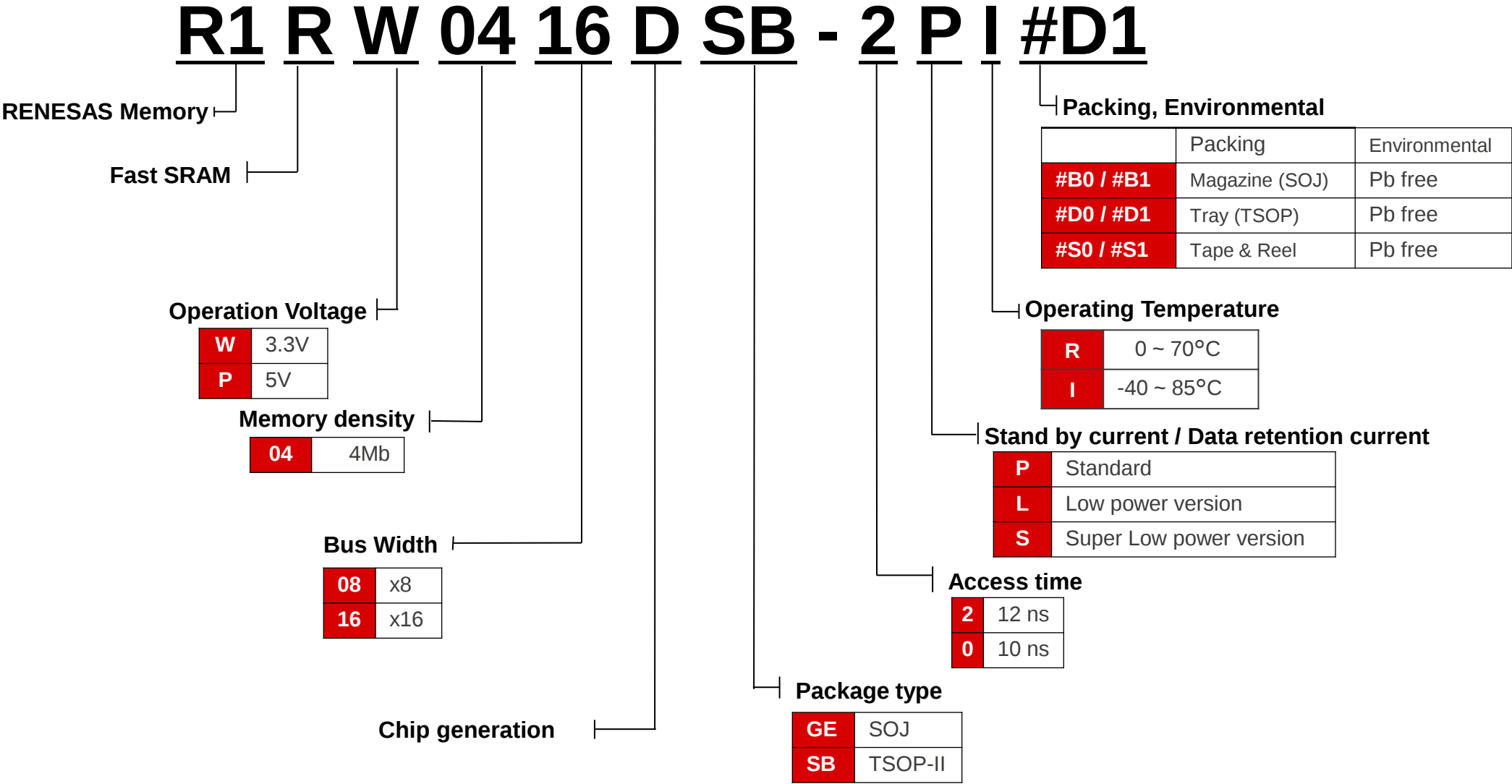


[Asynchronous SRAMs | Renesas](#)

Low Power SRAM : Part name decoder



Asynchronous Fast 4Mb SRAM : Part name decoder



[Renesas.com](https://www.renesas.com)