

Renesas Standard SRAM Product Outline

July 18, 2023

Standard Memory Products Section,
Standard Products Department, Advanced Analog Division,
Embedded Processing, Digital Power and Signal Chain Solutions Group,
Renesas Electronics Corporation

SRAM-2023-E-0718-1

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

Renesas Standard SRAM

Advantages

➤ Features

■ High Reliability

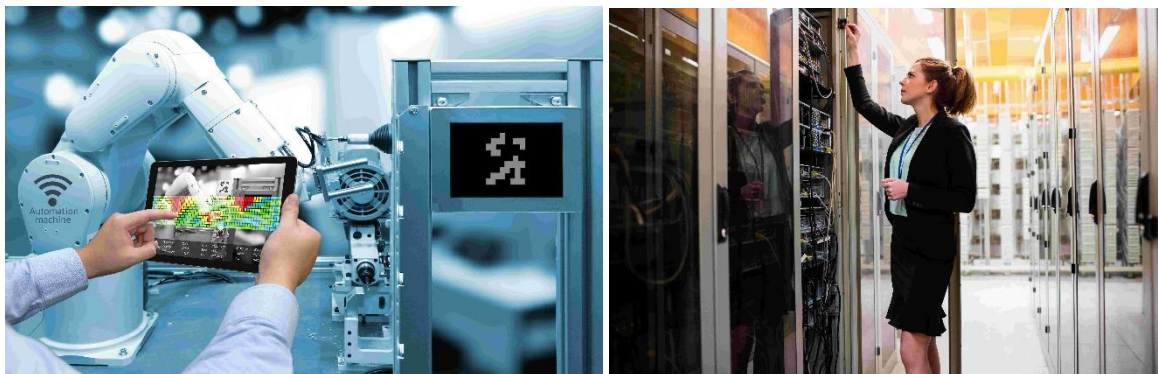
- ❑ Excellent soft error immunity without embedded ECC
- ❑ Latch-up free memory cell structure

■ 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)	~2022	2023	2024	2025	2026	2027~
Low Power SRAM	256Kb, 1Mb (5V/3V) 2Mb (3V) 4Mb (5V)	0.15 μ m Advanced LPSRAM					
	4Mb (3V) 8Mb, 16Mb (3V) 32Mb, 64Mb (3V)	0.11 μ m Advanced LPSRAM					
	16Mb (3V) R1LV1616H series <EOL products>	0.13 μ m (ECC embedded)					
	16Mb (3V) RMLV1616A-U series Alternative to R1LV1616H series	0.11 μm Advanced LPSRAM					
		CS: NOW MP Input (Order Start) : Oct.'23 ~					
Asynchronous Fast SRAM	4Mb (5V/3V)	0.18 μ m CMOS					

As of July 2023

Alternative to R1LV1616H series RMLV1616A-U series

Samples 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 (8.0x9.5mm ²)	48-ball FBGA (7.5x8.5 mm ²)	☑ 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 under Development		RMLV1616AGBG-5U2	RMLV1616AGBG-5U2#AC0	FBGA (48)	Tray	55ns	0.4μA / 8μA	2.7V ~ 3.6V	-40 ~ 85 °C		PLP 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 as soon as MP starts.

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

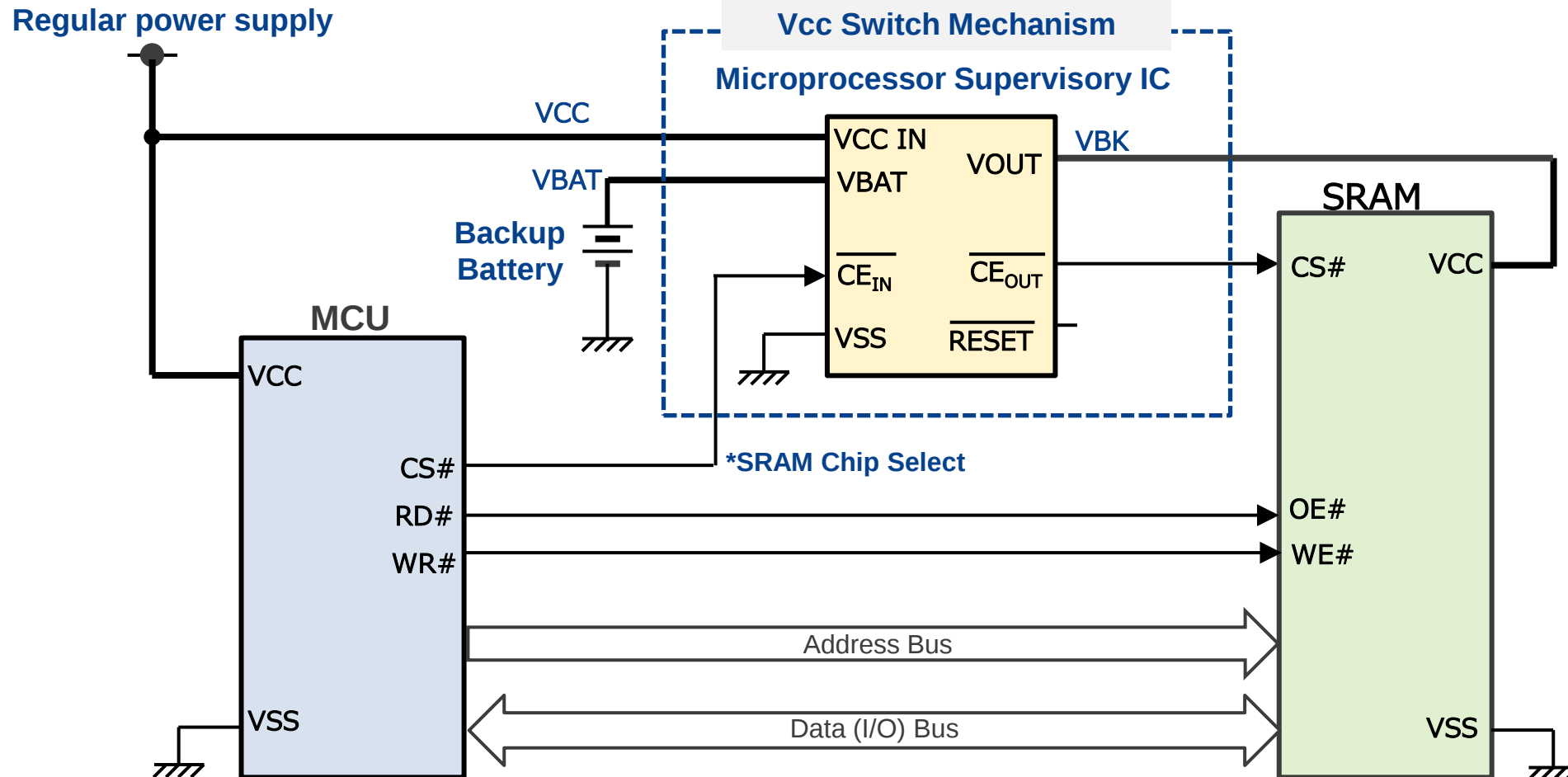
Non-volatile RAM by battery backup

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

Visit [SRAM FAQs](#) for detailed guidelines

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

[Cautions on SRAM 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

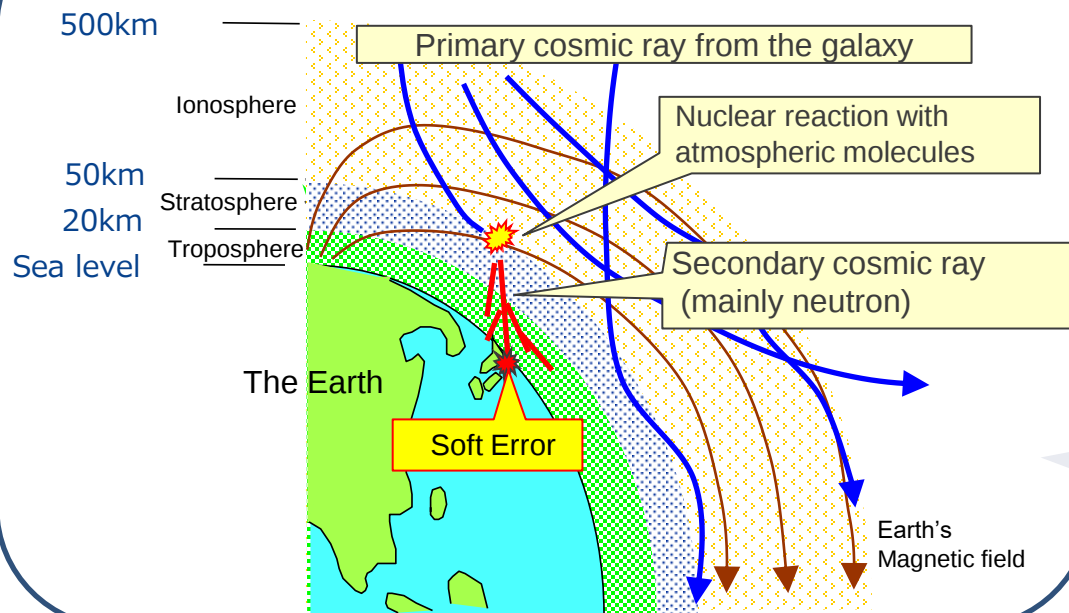
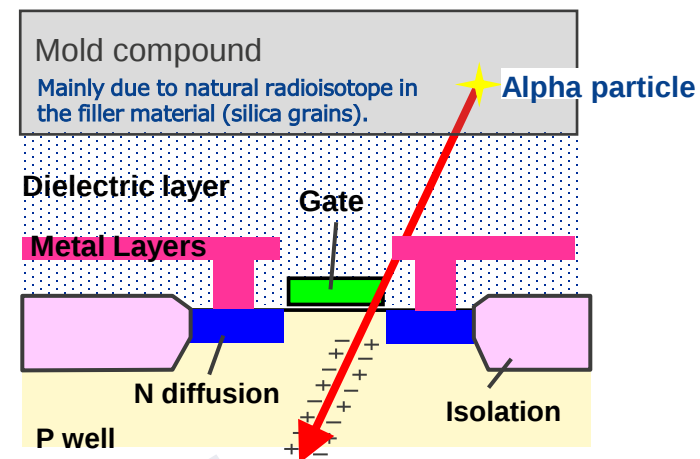


Fig.1: Alpha-particle induced soft error



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.

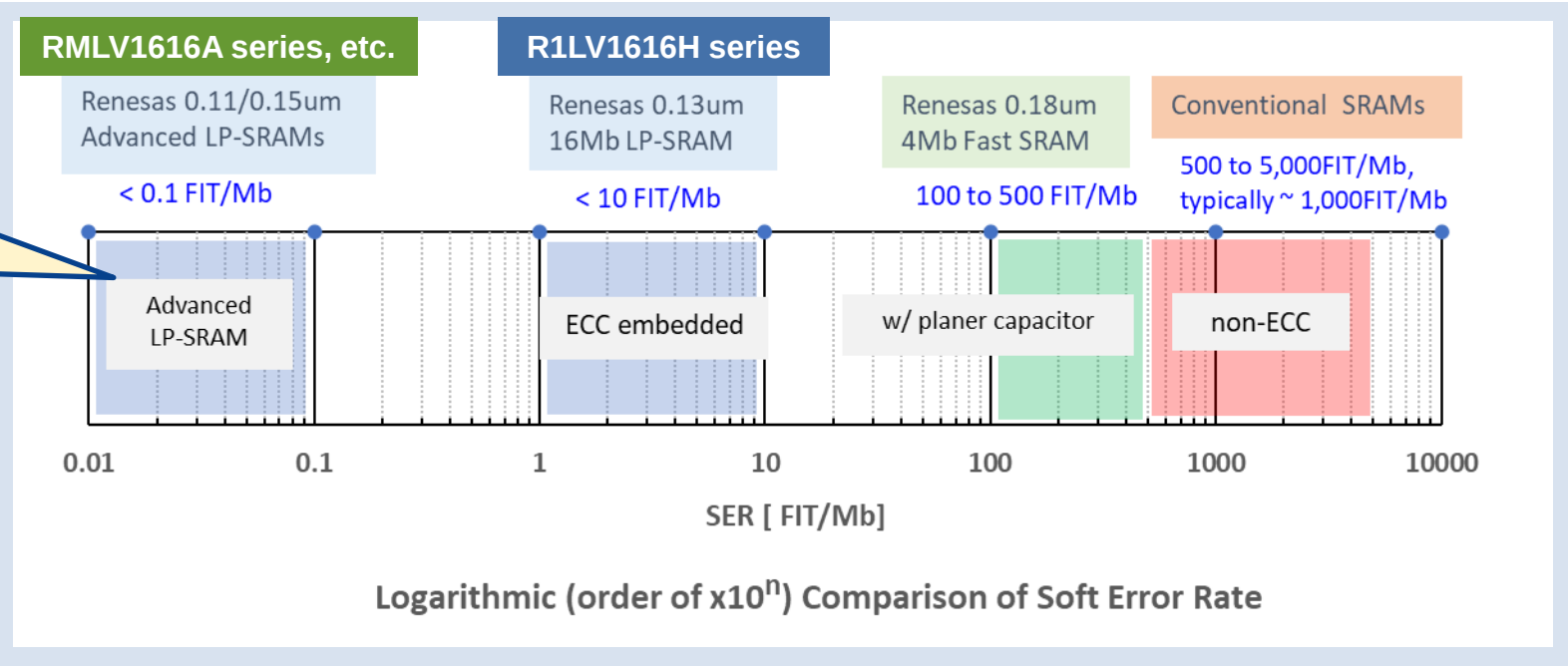
ECC: Error Correction Code, or Error Checking and Correction

Technology Comparison

Soft-error Countermeasures

Product Family	ECC embedded?	Soft Error Mitigation?	By what?	Soft error rate (Measured)	Differentiator
Advanced LPSRAM series (0.11μm / 0.15μm)	NO	YES	Soft-error immune process & device technology	< 0.04 FIT/Mb [0.11μm] < 0.06 FIT/Mb [0.15μm]	Outstanding soft error immunity over ECC-embedded products
R1LV1616H series (0.13μm CMOS 16Mb) <EOL>	YES	YES	Embedded ECC	< 5.5 FIT/Mb	Single FIT/Mb: excellent soft error immunity in practical use

Advanced LPSRAM is Superior to ECC-based SRAM



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

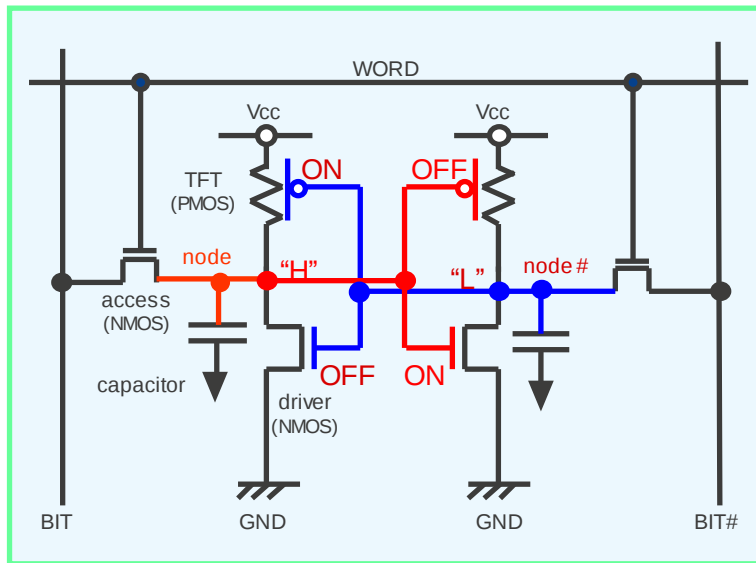


Fig.1: Memory cell circuit

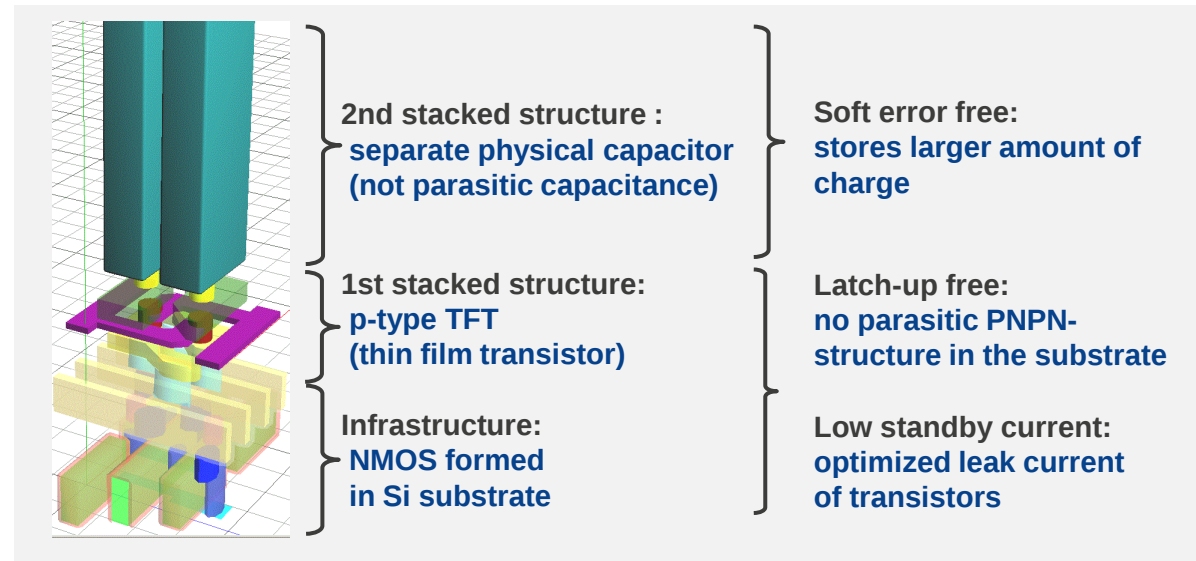
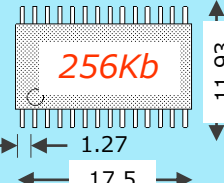
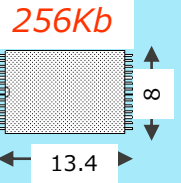
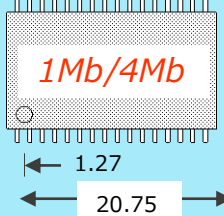
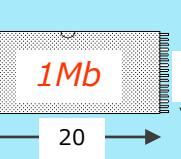
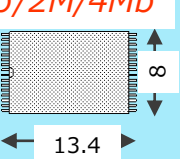
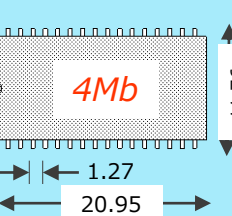
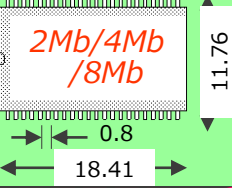
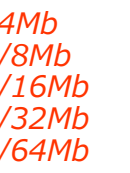
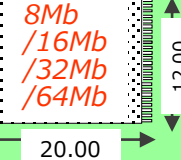
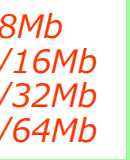
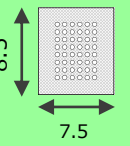
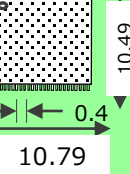


Fig.2: 3D image of the memory cell

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	✓		✓		Oct. '23	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 as soon as MP starts.

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



[Low Power SRAMs | Renesas](#)

Product Lineup

Asynchronous Fast SRAMs (4Mb)

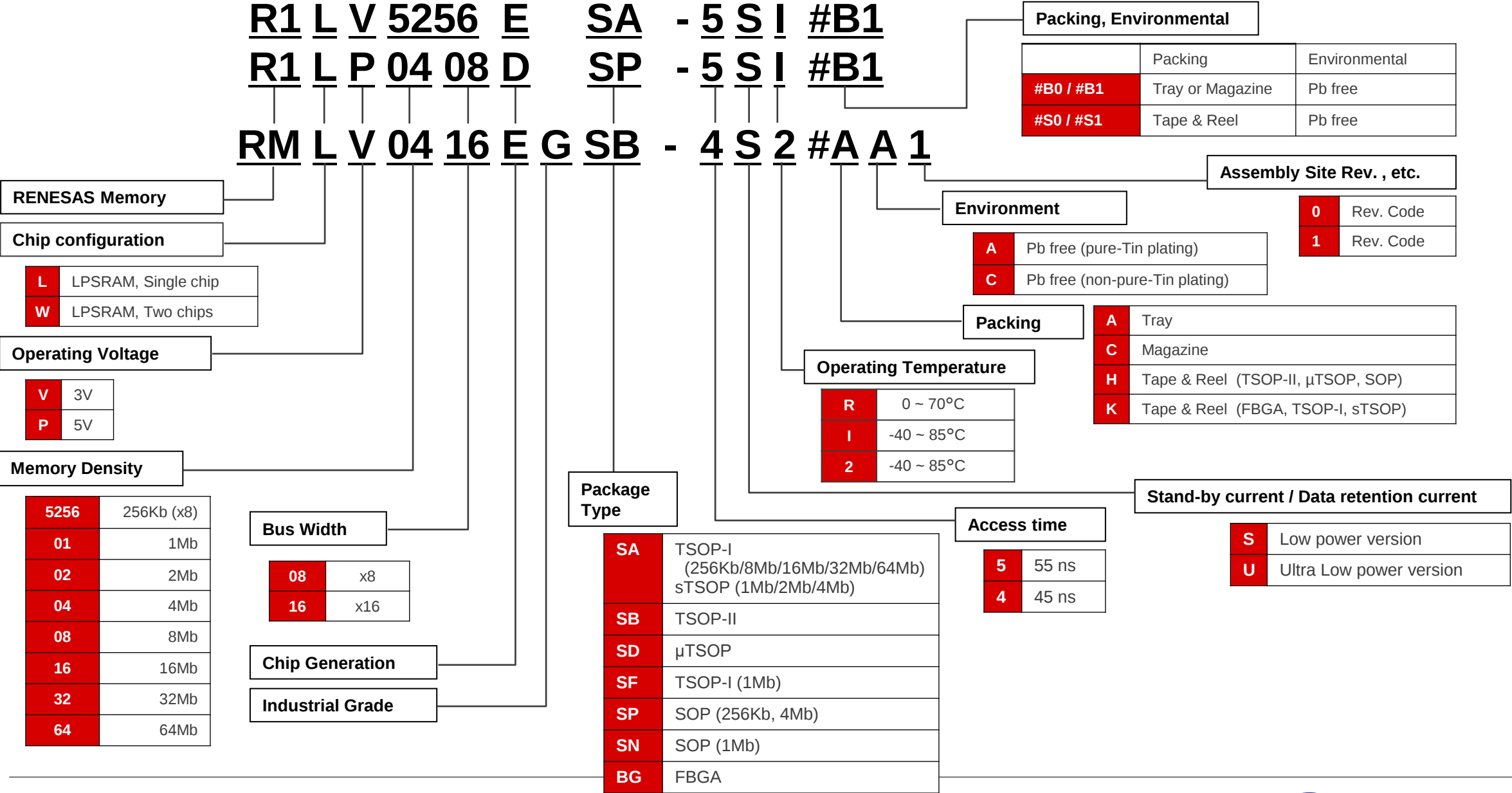
Product Series	Density	Org.	Operating Voltage	Access Time	Standby Current (max.) Std. / L-ver. / S-ver.	Operating Temperature	Chip Select Option	Package		Mass Production	PLP (for TSOP)
								TSOP	SOJ		
R1RP0408D-I	4Mb	x8	4.5 ~ 5.5V	12ns	5mA / - / -	-40°C ~ 85°C	1: CS#		✓	Now	-
R1RP0408D-R	4Mb	x8	4.5 ~ 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.

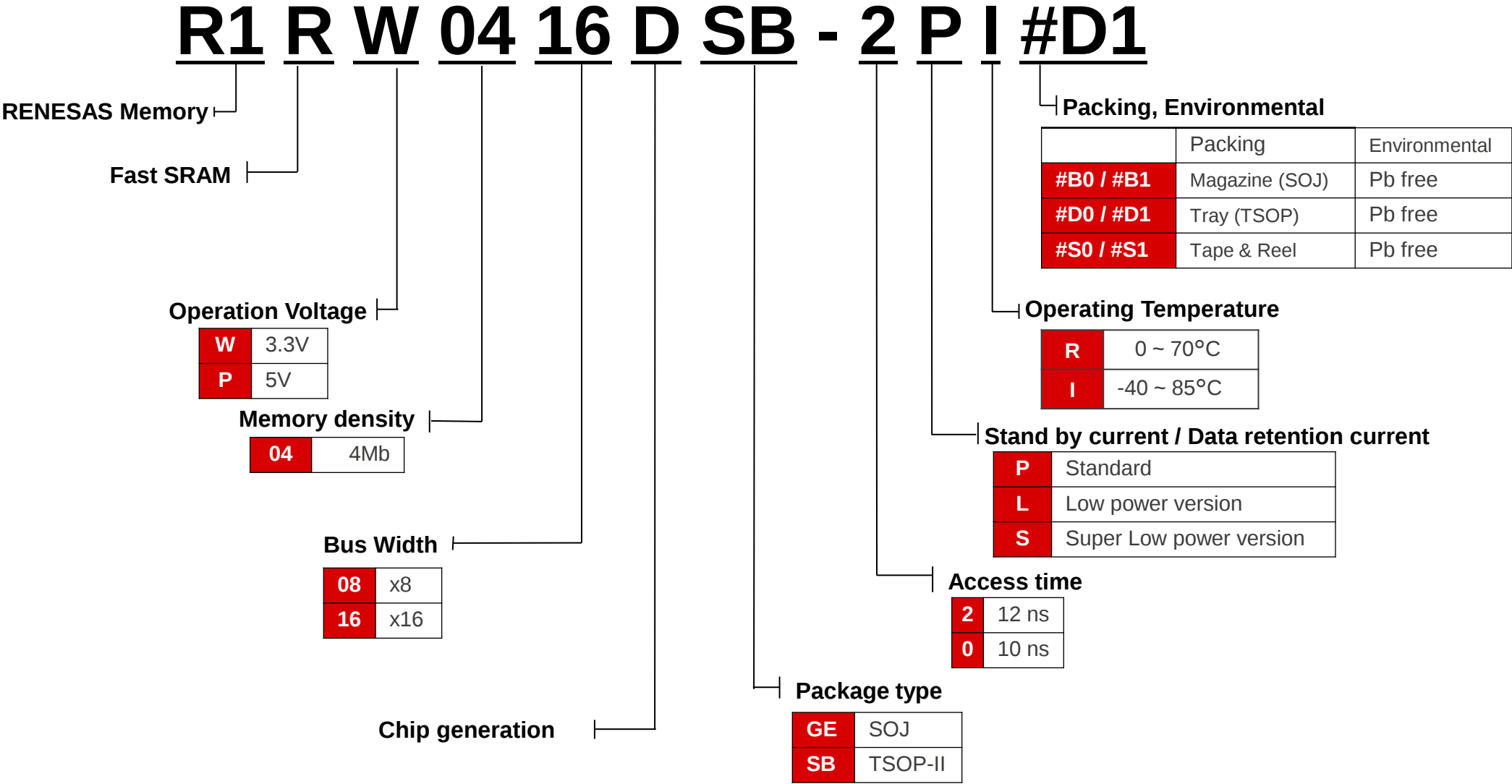


[Asynchronous SRAMs | Renesas](#)

Low Power SRAM : Part name decoder



Asynchronous Fast 4Mb SRAM : Part name decoder



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