To : Customer

Renesas Standard SRAM

Updated Information (June '08)

SRAM Group
SRAM/EEPROM Design Dept.
Standard Product Business Group
Renesas Technology Corp.

(1) Standard SRAM Overview

(2) LPSRAM series

- LPSRAM Products summary
- Advanced LPSRAM advantage

(3) Fast SRAM (for 4Mb & 18Mb Network SRAM)

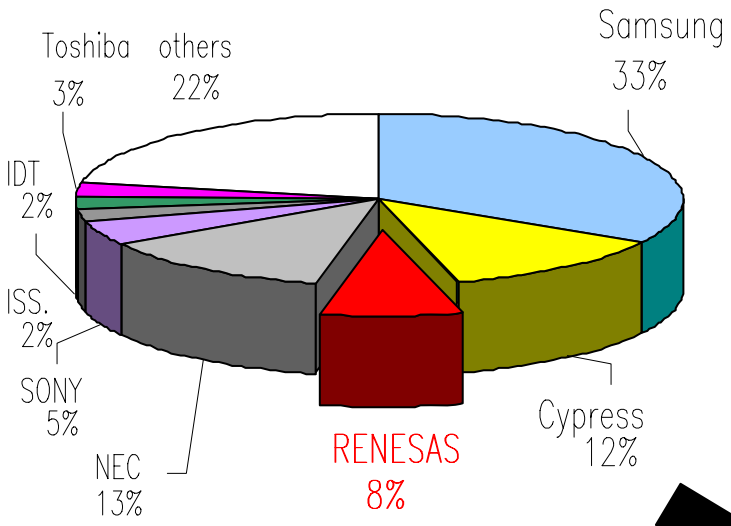
SRAM WW Share (LP SRAM / Fast SRAM)

2007 WW Share built up 15%
(Domestic Share : 50%)

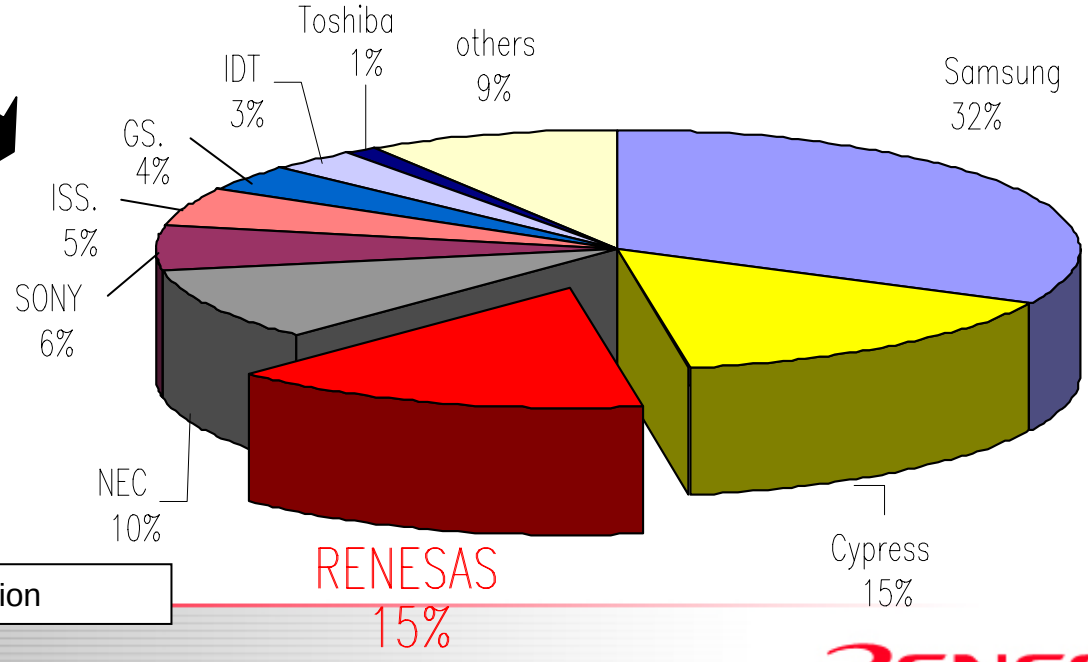
↓

2009 Target Share is 20% (WW)

SRAM WW Share ('05)



SRAM WW Share ('07)



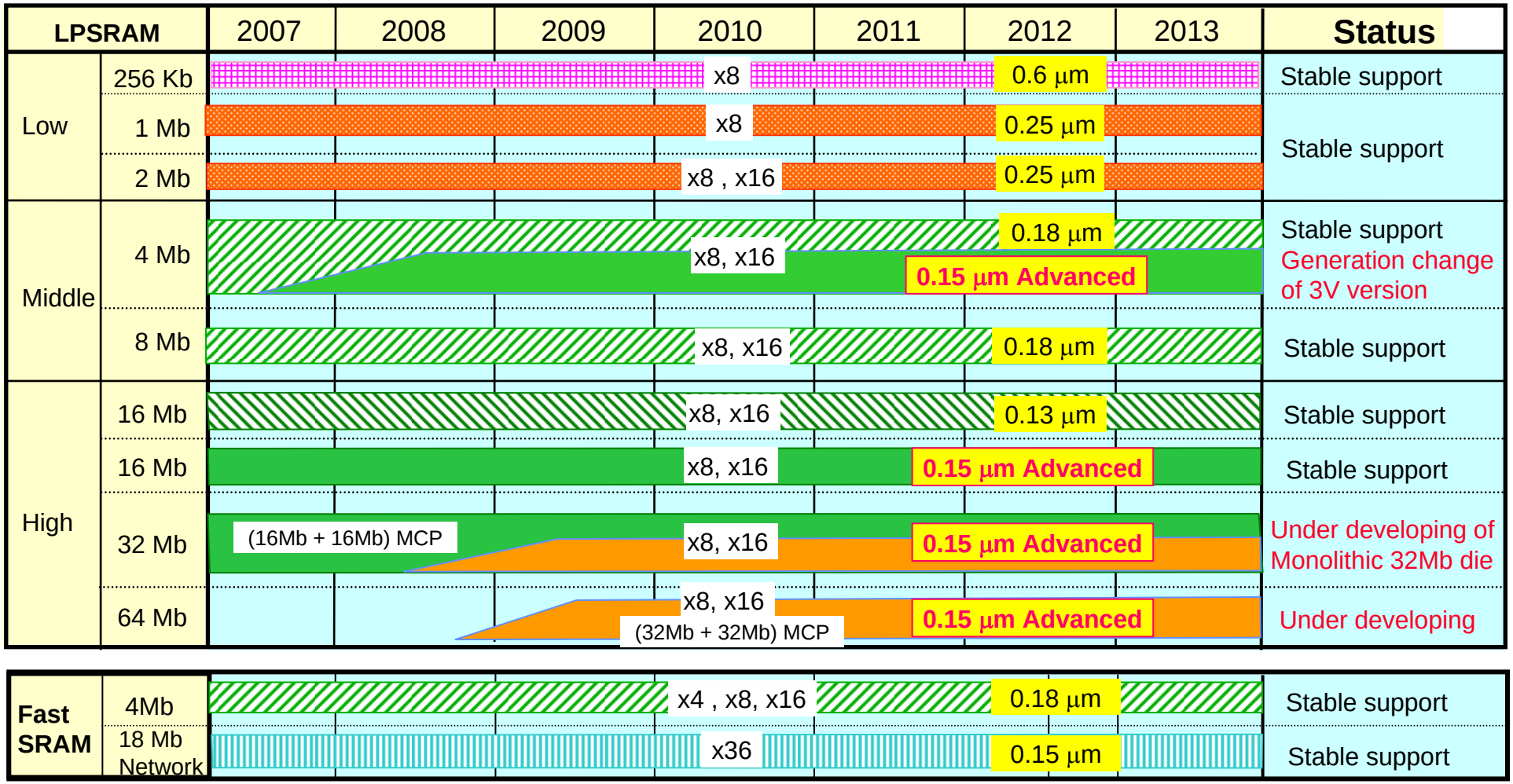
<Source> Share : Dataquest, Renesas' investigation

Renesas Standard SRAM Strategy ;

- Well balanced long term support with full line up
- Continue to produce low density series such as 256Kb , 1Mb , 2Mb LPSRAM
- Realize higher density & keep reliability by using advanced core technology
- Best offering with Renesas MCU as for external RAM

Standard SRAM Road Map

As of March 2008



(1) Standard SRAM Overview

(2) LPSRAM series

- **LPSRAM Products summary**
- Advanced LPSRAM advantage

(3) Fast SRAM (for 4Mb & 18Mb Network SRAM)

Low density (256 Kb, 1 Mb, 2 Mb) Series

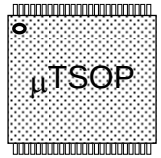
- Low typical standby current (under 0.3 μA)
- Long production and Market achievements
- Will continue keeping stable production

Stable Support !

Density	Type	Voltage	Package	Access time
256 Kb	M5M5256D Series	5 V 3.3 V	SOP, TSOP (sTSOP size)	55 ns/70 ns
1 Mb	M5M51008D, M5M5V108D Series	5 V 3.3 V	SOP, TSOP, sTSOP	55 ns/70 ns
2 Mb	M5M5V208A, M5M5V216A Series	3.3 V	TSOP, sTSOP	55 ns/70 ns

Middle Density (4 Mb, 8 Mb) Series

More Market Movement!

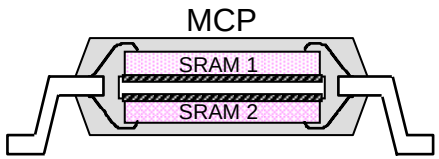


- 5 V Support
- Rich Package Lineup
- Will continue keeping stable production

Density	Type	Voltage	Package	Access time
4 Mb	• R1LP0408C,R1LV0408D, R1LV0416D, R1LV0414D Series	5 V, 3.3 V	SOP, TSOP, sTSOP , FBGA	55/70 ns
8 Mb	• M5M5W816, M5M5W817	3.3 V	µTSOP, TSOP, FBGA	55/70 ns
	• HM628100, HM6216514 HM62V8100 Series	5 V, 3.3 V	TSOP	55 ns

Large Density (16 Mb, 32 Mb, 64Mb) Series

Early Expand Enrichment!



- High performance : 45 ns, On chip ECC
- Advanced LPSRAM : 16 Mb 3.3V MP
- MCP (Multi Chip Package)

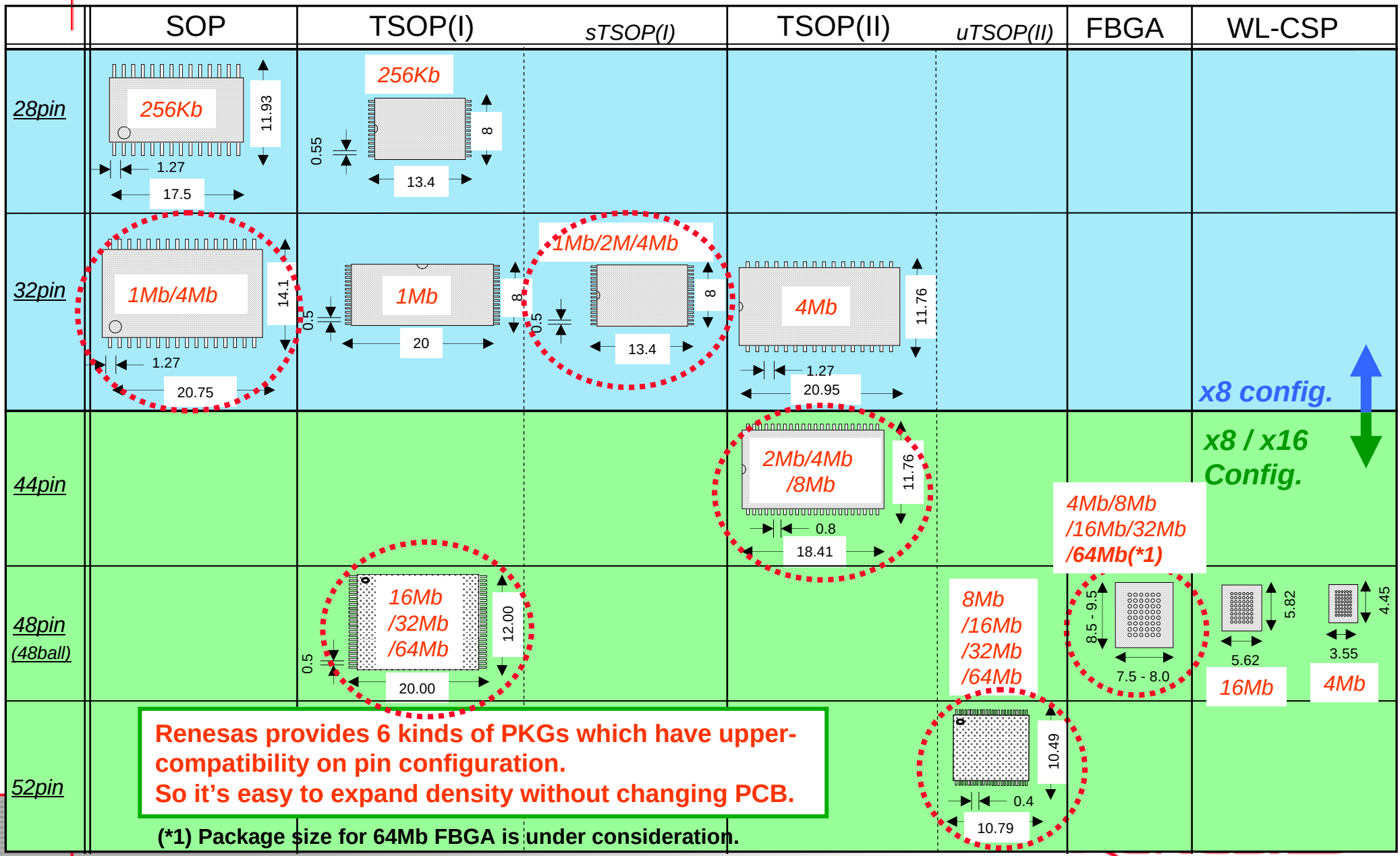
Density	Type	Voltage	Package	Access time /Feature
16 Mb	• R1LV1616H Series	3.3 V	TSOP, FBGA	45 ns/55 ns/On chip ECC

Advanced LPSRAM

16 Mb	• R1LV1616R Series	3.3 V	TSOP, μTSOP, FBGA	(55 ns)* / 70 ns/85 ns New type Memory Cell
32 Mb	• R1WV3216R Series (MCP)	3.3 V	μTSOP, FBGA	70 ns/85 ns New type Memory Cell
	• R1LV3216R Series (Monolithic)		TSOP, μTSOP	(55 ns)* / 70 ns New type Memory Cell
64 Mb	• R1WV6416R Series (MCP)	3.3 V	TSOP, μTSOP, FBGA	(55 ns)* / 70 ns New type Memory Cell

(*) Please contact each sales office in your region, in case of 55 ns parts inquiry.

Package line up for Renesas Low Power SRAM



(1) Standard SRAM Overview

(2) LPSRAM series

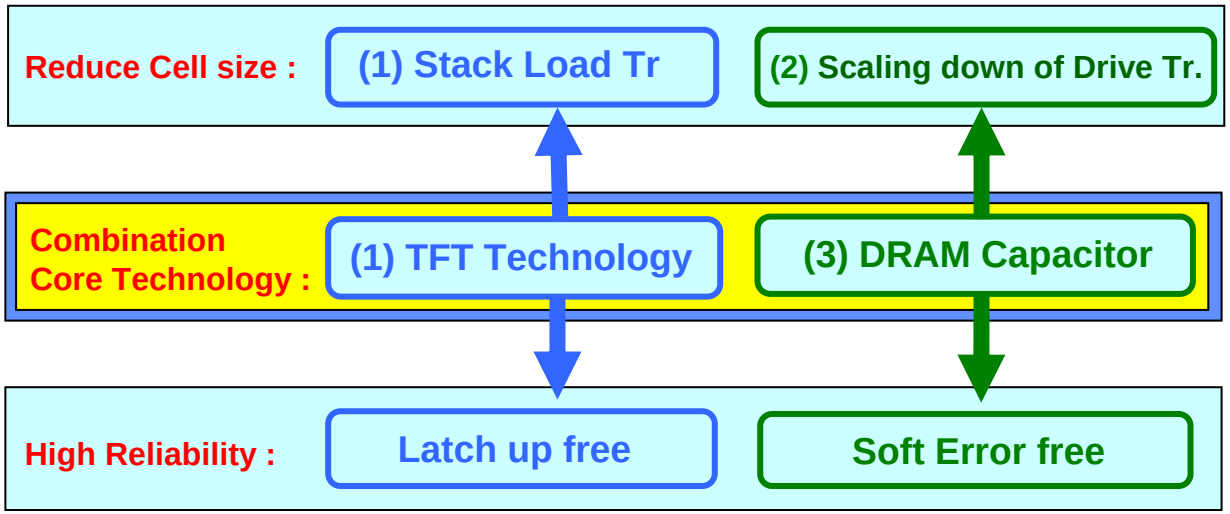
. LPSRAM Products summary

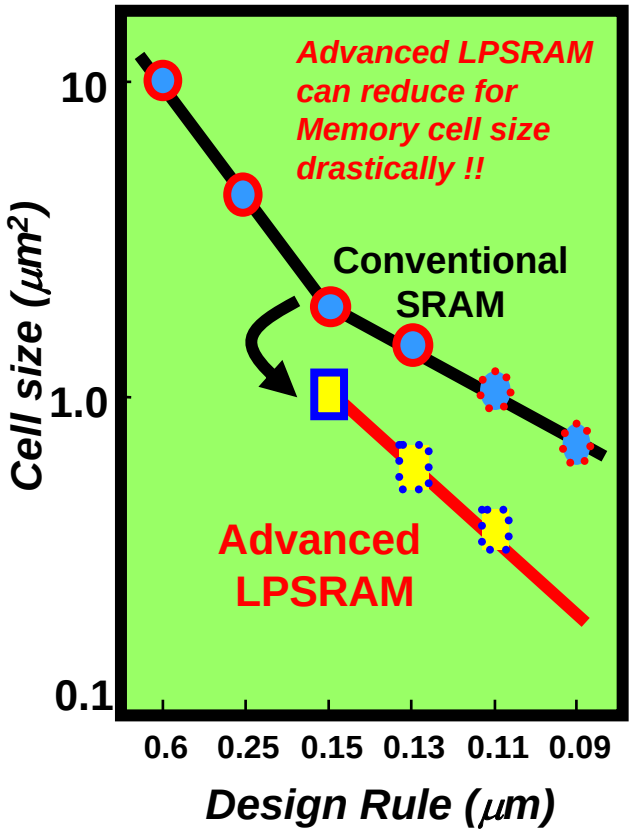
. **Advanced LPSRAM advantage**

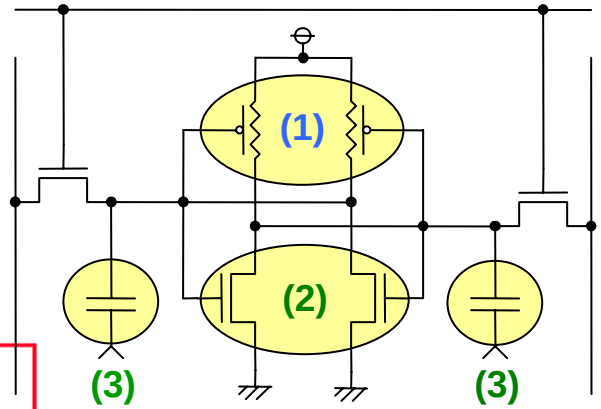
(3) Fast SRAM (for 4Mb & 18Mb Network SRAM)

Attractive core technology , Advanced LPSRAM

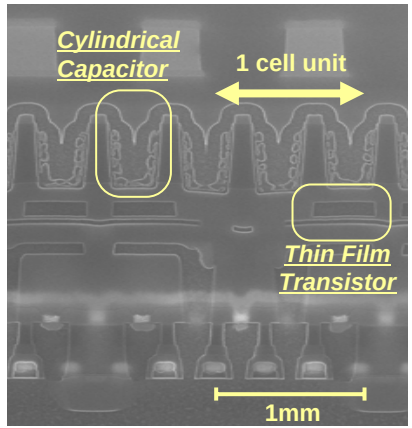
Getting higher reliability and smaller chip size , which are realized by core technology with TFT (Thin Film Transistor) & DRAM Capacitor







< Memory Cell circuit >



< Cross Section of Memory Cell >

0.15um Advanced LPSRAM can be achieved same cell size of 0.11 – 0.10um Conventional SRAM !!

RENESAS

Advanced LPSRAM Immunity against Soft Error

- A soft error occurs when .-particle or neutron hits Si substrate, and amount of electron absorbed to memory cell exceeds the critical charge.
- Soft error rate becomes smaller, as stored charge of memory cell is larger.
- Advanced LPSRAM cell has a capacitor used in DRAM on each storage node. As its stored charge is very large, soft error rate of Advanced LPSRAM is much smaller than conventional SRAM.

16Mbit Advanced SRAM Soft Error Evaluation Results

1. **System soft error test**

   We completed the system soft error evaluation and confirmed no error had occurred. As the result, the excellent result of “less than 100 FIT/device” could be confirmed, based on 60% C.L..

   => We could regard this part as “Soft error free”.

2. **Alpha-particle(241 Am) accelerated test**

   No error was observed in the test.

   We estimate that SER of Advanced SRAM is improved to 2 orders at least, compared with conventional SRAM.

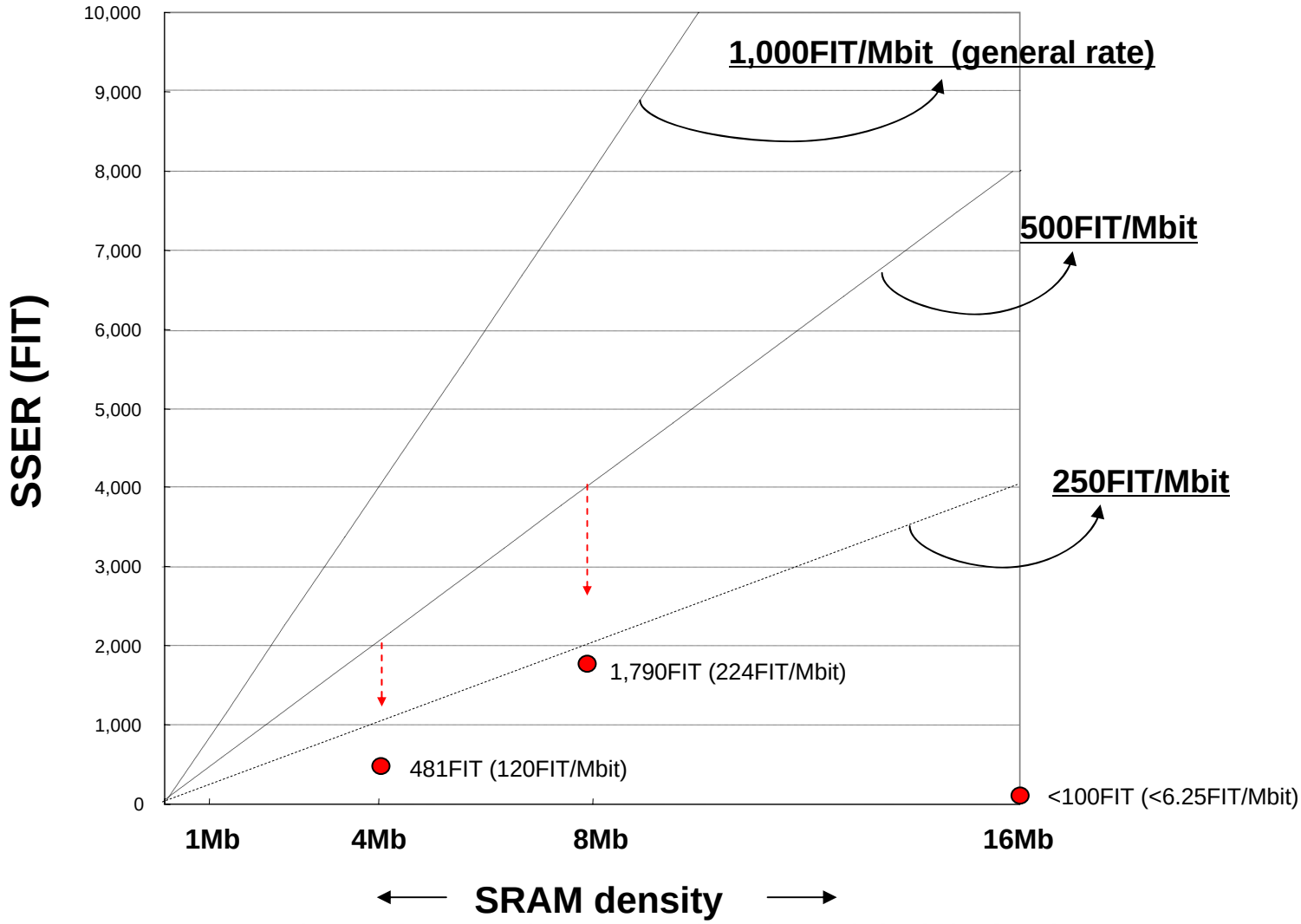
3. **High energy neutron beam accelerated test**

   Very good result was obtained.

   0.18um 8Mb SRAM (conventional) : SER=1

   0.15um 16Mb Advanced SRAM : SER=0.05

SER (soft error rate) on Renesas SRAMs



Production Running

16Mb & 32Mb (16Mb + 16Mb MCP) Advanced LPSRAM specification

Density	**16Mb** (2M x 8/1M x 16) *1	**32Mb** (4M x 8/2M x 16) *1 *16Mb + 16Mb MCP type*
Part number	R1LV1616R	R1WV3216R
Supply voltage [Vcc]	**2.7V to 3.6V**	
Access time	(55) *2 /70/85ns	70/85ns
Active current	25mA typ @ 3.0V,25C	30mA typ. @ 3.0V,25C
Data retention current	2μA typ @ 3.0V,25C	4μA typ. @ 3.0V,25C
Operating temperature	"R" : 0 to 70C , "I" : -40 to 85C	
Package	TSOP-48pin μTSOP-52pin FBGA(CSP)-48ball	μTSOP-52pin FBGA(CSP)-48ball

*1 : TSOP and μTSOP can be possible to switch over x8/x16.

*2 : Please contact each sales office in your region, in case of 55 ns parts inquiry.

Under development

32Mb & 64Mb (32Mb + 32Mb MCP) Advanced LPSRAM specification

Density	**32Mb** (4M x 8/2M x 16) *1 *32Mb monolithic chip type*	**64Mb** (8M x 8/4M x 16) *1 *32Mb + 32Mb MCP type*
Part number	R1LV3216R	R1WV6416R
Supply voltage [Vcc]	**2.7V to 3.6V**	
Access time	(55) *2 /70ns	(55) *2 / 70ns
Active current	40mA typ @ 3.0V,25C	45mA typ. @ 3.0V,25C
Data retention current	4μA typ @ 3.0V,25C	8μA typ. @ 3.0V,25C
Operating temperature	"R" : 0 to 70C , "I" : -40 to 85C	
Package	TSOP-48pin μTSOP-52pin	TSOP-48pin μTSOP-52pin FBGA(CSP)-48ball *3

*1 : TSOP and μTSOP can be possible to switch over x8/x16.
*2 : Please contact each sales office in your region, in case of 55 ns parts inquiry.
*3 : Package size of 64Mb FBGA is under consideration.

RENESAS

Production started from July '07

Generation change : 4Mb Advanced LPSRAM (3.3V series)

Spec. & Package are compatible with previous R1LV04xxC series !

Specification

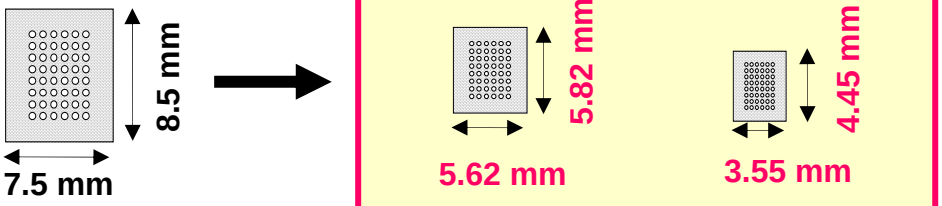
Configuration	512Kb x 8	256Kb x 16
Part number	R1LV0408DSP (SOP-32pin) R1LV0408DSA (sTSOP-32pin) R1LV0408DSB (TSOP-32pin)	R1LV0416DSB (TSOP-44pin two CS pins) R1LV0414DSB (TSOP-44pin one CS pin) R1LV0416DBG (FBGA-48ball)
Supply voltage [Vcc]	2.7V to 3.6V	
Access time	55ns / 70ns	
Active current	Typ. 8mA / Max. 25mA < @ 3.6V, 25C >	
Data retention current	Typ. 1μA / Max. 3μA < @ 3.0V, 25C >	

Set up for production

Applied for Smallest package : WL-CSP

Make the most of Advanced chip , for WL-CSP (Wafer Level Chip Scale Package)

(1) Package outline



Unit (mm)	fBGA	4Mb WL-CSP	16Mb WL-CSP
Size	7.5 x 8.5	3.55 x 4.45	5.62 x 5.82
Thickness	1.2	0.74	0.79
Ball numbers	48	47	48
Ball size	0.45	0.25	0.30
Ball pitch	0.75	0.45	0.55

(2) Target Application

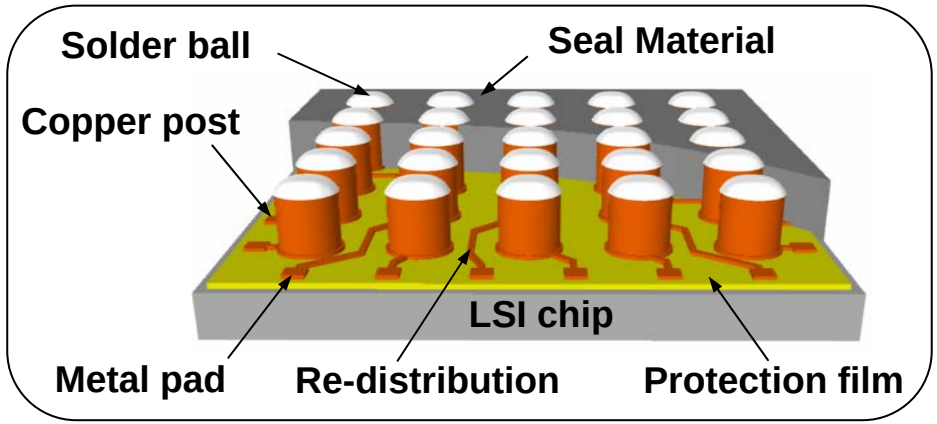
Consumer Market
(Handy small units)

(3) 16Mb Promotion Schedule

Sample : available
Mass Production : already

<4Mb ; Sample : available, M.P : 6/'08>

(4) WL-CSP Structure



Low Power SRAM line up

256 Kb

Supply voltage	Part number	Bit config	Package				Status
			DIP	SOP	TSOP	sTSOP	
4.5V - 5.5V	M5M5256D	32K×8	-	√	√	-	M.P
3.0V - 3.6V 4.5V - 5.5V	M5M5256D - xG	32K×8	-	√	√	-	M.P

1 Mb

Supply voltage	Part number	Bit config	Package				Status
			DIP	SOP	TSOP	sTSOP	
4.5V - 5.5V	M5M51008D	128K×8	-	√	√	√	M.P
2.7V - 3.6V	M5M5V108D	128K×8	-	√	√	√	M.P

2 Mb

Supply voltage	Part number	Bit config	Package				Status
			SOP	TSOP	sTSOP	TSOP-.	
2.7V - 3.6V	M5M5V208A	256K×8	-	-	√	-	M.P
2.7V - 3.6V	M5M5V216A	128K×16	-	-	-	√	M.P

4Mb

Supply voltage	Part number	Bit config.	Package				Remark	Status
			DIP	SOP	TSOP-.	sTSOP		
4.5V.5.5V	R1LP0408C	512K×8	-	√	√	-		M.P
2.7V.3.6V	R1LV0408D	512K×8	-	√	√	√		M.P

Supply voltage	Part number	Bit config.	Package		Remark	Status
			TSOP-.	FBGA (CSP)		
2.2V.3.6V	R1LV0416D	256K×16	√	√	With two CS input pins	M.P
2.2V.3.6V	R1LV0414D	256K×16	√	-	With one CS pin	M.P

8Mb

Supply voltage	Part number	Bit config.	Package			Remark	Status
			TSOP-.	FBGA(CSP)	uTSOP		
2.7V.3.6V	HM62V8100I	1M×8	√	-	-	Supporting “SL” version	M.P
4.5V.5.5V	HM628100I	1M×8	√	-	-	Supporting “SL” version	M.P
	HM6216514I	512K×16	√	-	-	Supporting “SL” version	M.P
2.7V.3.6V	M5M5W816	512K×16	√	√	-		M.P
	M5M5W817	512K×16 1M×8	-	-	√	Byte control for x8/x16 switch	M.P

16Mb

Supply voltage	Part number	Bit config.	Package			Remark	Status
			TSOP-.	FBGA(CSP)	uTSOP		
2.7V.3.6V	R1LV1616H	2M×8 1M×16	√	√	-	Byte control for x8/x16 switch	M.P

16 Mb Advanced

Supply voltage	Part number	Bit config.	Package			Remark	Status
			TSOP- I	uTSOP	FBGA (CSP)		
2.7V - 3.6V	R1LV1616R	2M×8 1M×16	√	√	√	TSOP & uTSOP : Byte control for x8/.16 switch FBGA : x16	M.P

32 Mb Advanced

Supply voltage	Part number	Bit config.	Package			Remark	Status
			TSOP- I	uTSOP	FBGA (CSP)		
2.7V - 3.6V	R1WV3216R (MCP type)	4M×8 2M×16	-	√	√	uTSOP : Byte control for x8/.16 switch FBGA : x16	M.P
	R1LV3216R (Monolithic type)	4M×8 2M×16	√	√	-	TSOP & uTSOP : Byte control for x8/.16 switch	Under development

64 Mb Advanced : (32Mb chip + 32Mb chip)

Supply voltage	Part number	Bit config.	Package			Remark	Status
			TSOP- I	uTSOP	FBGA (CSP)		
2.7V - 3.6V	R1WV6416R (MCP type)	8M×8 4M×16	√	√	√	TSOP & uTSOP : Byte control for x8/.16 switch FBGA : x16	Under development

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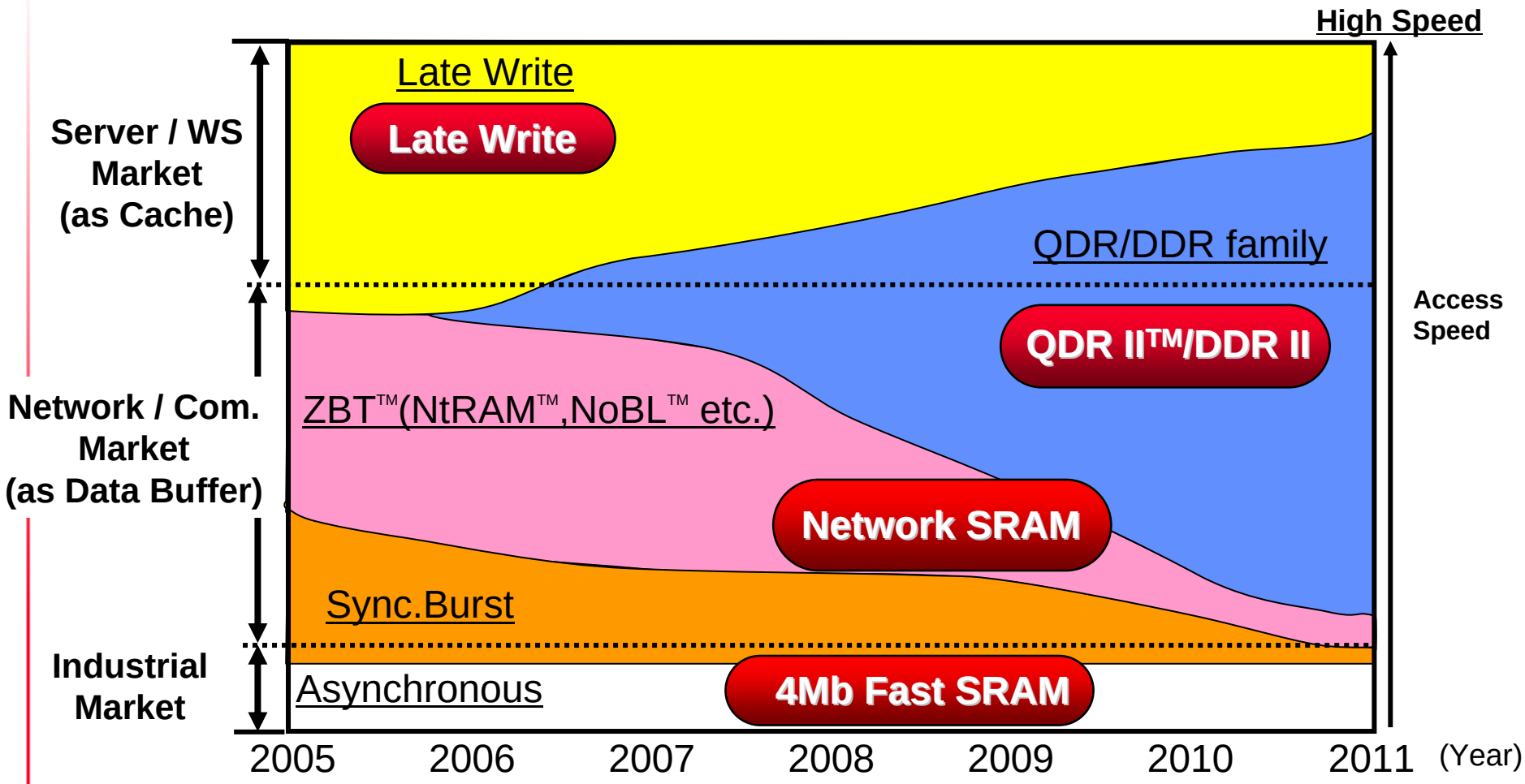
(2) LPSRAM series

. LPSRAM Products summary

. Advanced LPSRAM advantage

(3) Fast SRAM (for 4Mb & 18Mb Network SRAM)

High Speed SRAM Market Demand



Note 1 : ZBT™ and Zero Bus Turnaround are trademarks of IDT(Integrated Device Technology Inc.).
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3 : QDR and Quad Data Rate are trademarks of the QDR Consortium
4 : All Other registered trademarks or trademarks are the property of their respective owners.

18Mb Network SRAM specification

Part number		M5M5V5636GP	M5M5V5A36GP
Package		TQFP-100 pins	
Data transfer type		Pipeline	Flow through
Supply voltage	VDD	3.3 V/2.5V	3.3 V
	VDDQ	3.3V/2.5V	
Bit configuration		x36	
Frequency		167MHz	100MHz
Cycle time		6.0ns	10ns
Clock access time		3.8ns	8.5ns
Set up time		1.2ns	2.0ns
Hold time		0.8ns	0.8ns
Operating current		380mA max.	260mA max.
Stand-by current		30mA max.	30mA max.
Operating temperature*		C/I	C
Interface		LVCMOS	

Operating temp.* : C=0°C.+70°C, I=-40°C.+85°C

4MbFastSRAM specification

(Asynchronous)
- High speed/Low power consumption -

Supply voltage		5V+/-10%			3.3V+/-0.3V		
Bit configuration		x4	x8	x16	x4	x8	x16
Part number		**R1RP0404D**	**R1RP0408D**	**R1RP0416D**	**R1RW0404D**	**R1RW0408D**	**R1RW0416D**
Access time		(10ns)*1 / 12ns			(10ns)*1 / 12ns		
Operating current		130mA	130mA	160mA	100mA	100mA	130mA
Stand-by current		5mA max.			5mA max.		
	L	1.0mA max.			0.8mA max.		
	SL	-		0.5mA max.	-		0.5mA max.
Data retention current	L	500uA max.			400uA max.		
	SL	-		200uA max.	-		200uA max.
Extended temperature [-40 - +85°C]		-	√	√	-	√	√
Package	400mil SOJ	√	√	√	√	√	√
	400mil TSOP-.	-	-	√	-	-	√

*1 : 10ns speed item is under development.