MITSUBISHI
ELECTRONIC DEVICE GROUP

VLSI MOS MEMORY
RAM/ROM &
MEMORY CARDS

January 1991

MITSUBISHI ELECTRIC CORPORATION

MITSUBISHI

VLSI MOS Memory

RAM / ROM

New package

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January 1991

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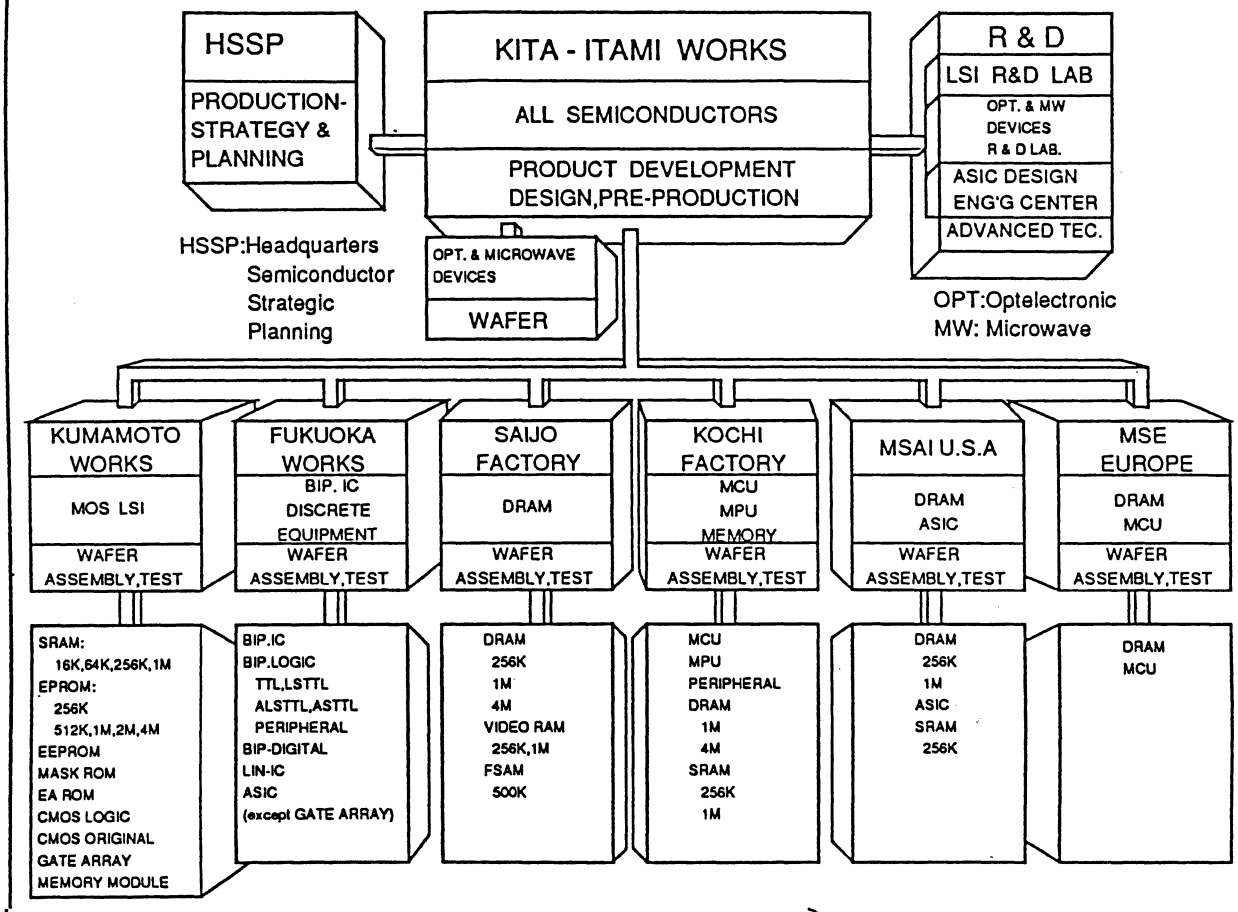
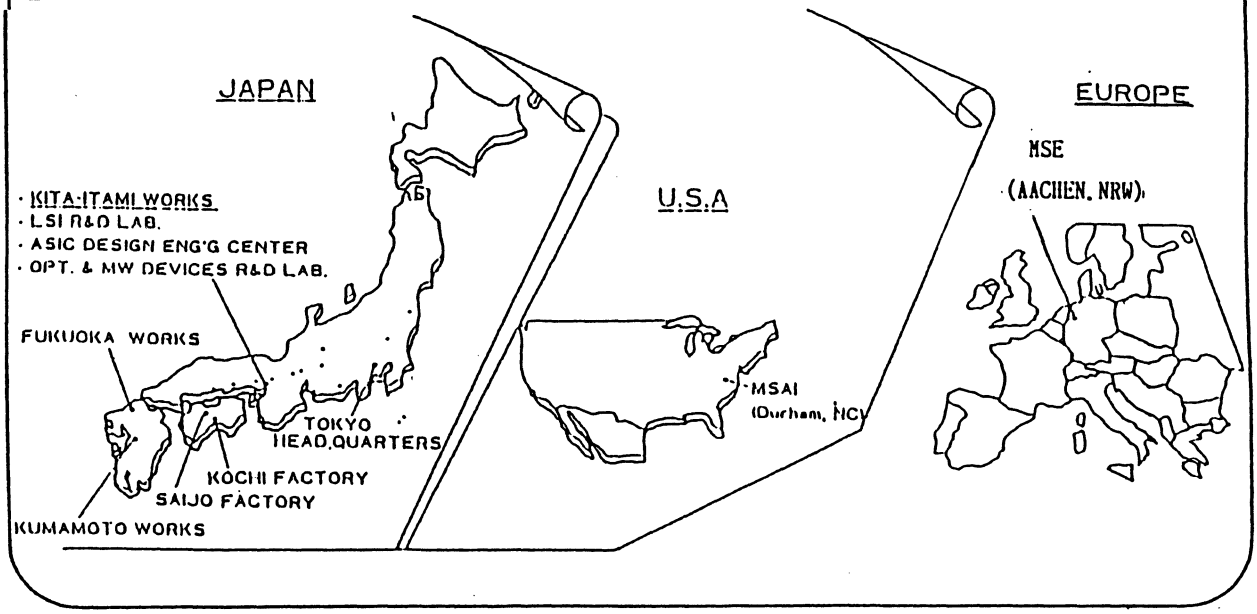
SEMICONDUCTOR TECHNOLOGY DEVELOPMENT and MANUFACTURING FACILITIES





MITSUBISHI ELECTRIC

MITSUBISHI MOS Memory LSI (1)

		Products	Type name	I Ref	Access(ns)	Sample	Production	Page
Dynamic		256KX1NMOS	M5M4256A,7A,P,L,J		85,100,120	-	Yes	
		64KX4NMOS	M5M4464AP,L,J		80,100,120	-	Yes	
		1MX1CMOS	M5M41000BP,J,L	L	70,80,100	-	Yes	38~44
		1MX1CMOS	M5M41000BP,J,L		60	-	91-2	〃
		1MX1CMOS	M5M41001BP,J,L	L	70,80,100	-	Yes	〃
		1MX1CMOS	M5M41002BP,J,L	L	70,80,100	-	Yes	〃
		1MX1CMOS	M5M41000BVP,RV	L	70,80,100	-	Yes	〃
		256KX4CMOS	M5M44256BP,J,L	L	70,80,100	-	Yes	〃
		256KX4CMOS	M5M44256BP,J,L		60	-	91-2	〃
		256KX4CMOS	M5M44258BP,J,L	L	70,80,100	-	Yes	〃
		256KX4CMOS	M5M44266BP,J,L	L	70,80,100	-	Yes	〃
		256KX4CMOS	M5M44268BP,J,L	L	70,80,100	-	Yes	〃
		256KX4CMOS	M5M44256BVP,RV	L	70,80,100	-	Yes	〃
		4MX1CMOS	M5M44100J,L	L	80,100	-	Yes	12~26
		4MX1CMOS	M5M44101J,L		80,100	-	Yes	〃
		4MX1CMOS	M5M44102J,L		80,100	-	Yes	〃
		1MX4CMOS	M5M44400J,L	L	80,100	-	Yes	〃
		1MX4CMOS	M5M44402J,L		80,100	-	Yes	〃
		4MX1CMOS	M5M44100AWJ,J,L,TP,RT	L	60,70,80,100	-	91-1	〃
		4MX1CMOS	M5M44101AWJ,J,L,TP,RT		60,70,80,100	-	91-1	〃
		4MX1CMOS	M5M44102AWJ,J,L,TP,RT		60,70,80,100	-	91-1	〃
		1MX4CMOS	M5M44400AWJ,J,L,TP,RT	L	60,70,80,100	-	91-1	〃
		1MX4CMOS	M5M44402AWJ,J,L,TP,RT		60,70,80,100	-	91-1	〃
		1MX4CMOS	M5M44410AWJ,J,L,TP,RT	L	60,70,80,100	-	91-1	〃
		1MX4CMOS	M5M44412AWJ,J,L,TR,RT		60,70,80,100	-	91-1	〃
		512KX8CMOS	M5M44800AJ,L,TP,RT	L	60,70,80,100	91-2	91-4	27~35
		512KX9CMOS	M5M44900AJ,L,TP,RT	L	60,70,80,100	91-7	91-10	〃
		256KX16CMOS	M5M44260AJ,(L),TP,RT	L	(60,70),80,100	91-2	91-4	〃
		256KX16CMOS	M5M44170AJ,(L),TP,RT	L	60,70,80,100	91-2	91-4	〃
		256KX18CMOS	M5M44280AJ,(L),TP,RT	L	(60,70),80,100	91-7	91-10	〃
		256KX18CMOS	M5M44190AJ,(L),TP,RT	L	60,70,80,100	91-7	91-10	〃
Video RAM		64KX4CMOS	M5M4C264L		100,120,150	-	Yes	53~54
		64KX4CMOS	M5M4C264AJ.L		80,100,120,	90-9	90-11	〃
		256KX4CMOS	M5M442256J.L		100,120	-	Yes	46~49
		256KX4CMOS	M5M442256AJ.L		70,80,100	90-12	91-2	〃
		128KX8CMOS	M5M482128J		100,120	-	Yes	50~52
		128KX8CMOS	M5M482128AJ		70,80,100	90-12	91-2	〃
Field SAM		80KX6CMOS	M5M4C500L		50,60,100	-	Yes	57~58
		80KX6CMOS	M5M4C500AL		30,50	90-6	90-12	〃
		261KX4CMOS	M5M4C900L		30(50)	-	TBD	55
Static	Std.			Isb				
		8kX8 CMOS	M5M5165P,FP	L	70,100,120	-	Yes	
		32KX8 CMOS	M5M5256BP,FP,KP	L/LL	70,85,100,120	-	Yes	75~76
		32KX8 CMOS	M5M5255BP,FP,KP	L/LL	70,85,100,120	-	Yes	〃
		32KX8 CMOS	M5M5256BVP,RV	L/LL	70,85,100,120	-	Yes	〃
		128KX8 CMOS	M5M51008P,FP,VP,RV	L/LL	70,85,100,120	-	Yes	69~74
	Fast	64KX1 CMOS	M5M5187AP,J		25,35,45,55	-	Yes	
		16KX4 CMOS	M5M5188AP,J —		25,35,45,55	-	Yes	64
		16KX4 CMOS	M5M5189AP,J (OE)		25,35,45,55	-	Yes	69
		64KX1 CMOS	M5M5187BP,J		15,20,25	-	Yes	68
		16KX4 CMOS	M5M5188BP,J —		15,20,25	-	Yes	69
		16KX4 CMOS	M5M5189BP,J (OE)		15,20,25	-	Yes	
		8KX8 CMOS	M5M5178P,KP,J		35,45,55	-	Yes	64~65
		8KX9 CMOS	M5M5179P,J		35,45,55	-	Yes	〃
		8KX8 CMOS	M5M5178AP,FP,J		15,20,25	-	Yes	〃
		8KX9 CMOS	M5M5179AP,FP,J		15,20,25	-	Yes	〃
		8KX8 CMOS	M5M5180AP,FP,J (Latch)		20,25	-	Yes	〃

MITSUBISHI MOS Memory LSI (2)

		Products	Type name	Access(ns)	Sample	Production	Page
Static	Fast	256K×1 CMOS	M5M5257P,J	35,45	-	Yes	67~68
		64K×4 CMOS	M5M5258P,J	35,45	-	Yes	〃
		256K×1 CMOS	M5M5257AP,J	25,30	-	Yes	〃
		64K×4 CMOS	M5M5258AP,J	25,30	-	Yes	〃
		256K×1 CMOS	M5M5257BP,J	15,20	90-12	91-3	67~68
		64K×4 CMOS	M5M5258BP,J	15,20	90-12	91-3	〃
		64K×4 CMOS	M5M5259BP,J,($\overline{OE}$)	15,20	91-2	91-3	〃
		32K×8 CMOS	M5M5278P,J	(15),20,25	91-1	91-3	66
		32K×9 CMOS	M5M5279P,J	(15),20,25	91-1	91-3	
		1M×1 CMOS	M5M51001P,J	25,35,45	-(25:91-1)	Yes(25:91-4)	63~65
		256K×4 CMOS	M5M51004P,J	25,35,45	-(25:91-1)	Yes(25:91-4)	〃
		256K×4 CMOS	M5M51014,J,(I/O Sepa)	25,35,45	-(25:91-1)	Yes(25:91-4)	〃
EPROM		32K×8 NMOS	M5L27256K	200,250	-	Yes	
		64K×8 NMOS	M5L27512K	170,200,250	-	〃	
		32K×8 CMOS	M5M27C256AK	85,100,120,150	-	〃	
		64K×8 CMOS	M5M27C512AK	100,120,150	-	〃	
		128K×8 CMOS	M5M27C100K	120,150,200,250	-	〃	84
		128K×8 CMOS	M5M27C101K,JK	120,150,200,250	-	〃	〃
		64K×16 CMOS	M5M27C102K,JK	120,150,200,250	-	〃	〃
		256K×8 CMOS	M5M27C201K,JK	100,120,150	-	〃	〃
		128K×16 CMOS	M5M27C202K,JK	100,120,150	-	〃	80
		512K×8 CMOS	M5M27C401K	120,150	-	〃	〃
		256K×16 CMOS	M5M27C402K	120,150	-	〃	〃
OTP		32K×8 NMOS	M5M27256P,FP	200,250	-	Yes	
		64K×8 NMOS	M5M27512P,FP	250	-	〃	
		32K×8 CMOS	M5M27C256AP,FP,VP,RV	(120),150	-	〃	
		64K×8 CMOS	M5M27C512AP,FP	150	-	〃	
		128K×8 CMOS	M5M27C100P	150	-	〃	86
		128K×8 CMOS	M5M27C101P,J,FP,VP,RV	150	-	〃	〃
		64K×16 CMOS	M5M27C102P,J,FP,VP,RV	150	-	〃	83
		256K×8 CMOS	M5M27C201P,J,FP,VP,RV	(120),150	-	〃	〃
		128K×16 CMOS	M5M27C202P,J,FP,VP,RV	(120),150	-	〃	〃
		512K×8 CMOS	M5M27C401P	150	-	91-2	
		256K×16 CMOS	M5M27C402P	150	-	91-2	
Mask ROM		512K×8 / 256K×16 CMOS	M5M23400AP,FP,VP,RV	150	-	Yes	92~95
		512K×8 CMOS	M5M23401AP,FP,VP,RV	150	-	Yes	〃
		1M×8 / 512K×16 CMOS	M5M23800P,FP,VP,RV	150	Yes	91-4	〃
		1M×8 CMOS	M5M23801P,FP,VP,RV	150	Yes	91-3	〃
		2M×8 / 1M×16 CMOS	M5M23160P,FP,VP,RV	150	Yes	91-3	〃
EEPROM		8K×8 CMOS	M5M28C64AP,FP,VP,RV	150,200	-	Yes	90~91
Flash EEPROM		128K×8 CMOS	M5M28F101P,J,FP,VP,RV	100,120,150	Yes	91-2	88
		64K×8 CMOS	M5M28F102P,J,FP,VP,RV	100,120,150	91-2	91-5	〃
Versatile Memory		256KOTP+16KSRAM	M6M72561J	ROM/SRAM	-	Yes	96
			M6M72561J-I	200 / 150	-	Yes	〃

MITSUBISHI Memory Module

	Products	Type name	Access(ns)	Sample	Production	Page
1MDRAM Module	1MX8 CMOS Fast Page mode	MH1M08B0J,JA	60,70,80,100	-	Yes	
	1MX9 CMOS Fast Page mode	MH1M09B0J,JA	60,70,80,100	-	Yes	
	1MX8 CMOS Nibble mode	MH1M08B1J,JA	70,80,100	-	Yes	
	1MX9 CMOS Nibble mode	MH1M09B1J,JA	70,80,100	-	Yes	
	1MX8 CMOS Static column mode	MH1M08B2J,JA	70,80,100	-	Yes	
	1MX9 CMOS Static column mode	MH1M09B2J,JA	70,80,100	-	Yes	
	1MX8 Double sided 25PIN	MH1M08BCJA	70,80,100	-	Yes	
	1MX9 Double sided Fast Page mode	MH1M9B0DJA	70,80,100	-	Yes	
	1MX9 Double sided Nibble mode	MH1M9B1DJA	70,80,100	-	Yes	
	1MX9 Double sided Static column mode	MH1M9B2DJA	70,80,100	-	Yes	
	2MX4 CMOS Fast Page mode	MH2M04B0J,JA	70,80,100	-	Yes	
	2MX4 CMOS Nibble mode	MH2M04B1J,JA	70,80,100	-	Yes	
	2MX4 CMOS Static column mode	MH2M04B2J,JA	70,80,100	-	Yes	
	256KX32 CMOS Fast Page mode	MH25632BJ	70,80,100	-	Yes	
	512KX32 CMOS Fast Page mode	MH51232BJ	70,80,100	-	Yes	
	256KX36 CMOS Page mode	MH25636BJ	85,100,120	-	Yes	
	512KX36 CMOS Page mode	MH51236BJ	85,100,120	-	Yes	
	1MX36 TSOP,CMOS Fast Page	MH1M36BBJ	70,80,100	-	Yes	
	256KX8 CMOS Fast Page mode	MH25608BAJ,JA	70,80,100	-	Yes	
	256KX9 CMOS Page mode	MH25609BAJ,JA	85,100,120	-	Yes	
	1MX36 Double sided 72PIN	MH1M36BJ	70,80,100	-	Yes	
	256KX16Pseudo-Pseudo SRAM Module	MH25616PNA	8MHz,10MHz	-	Yes	
	512KX8Pseudo-Pseudo SRAM Module	MH51208PNA	8MHz,10MHz	-	Yes	
4MDRAM Module	1MX9 CMOS Fast Page mode	MH1M09A0AJ,JA	60,70,80,100	-	Yes	
	4MX9 CMOS Fast Page mode	MH4M09A0J	80,100	-	Yes	102
	4MX9 Double Sided Fast Page mode	MH4M90DJA	80,100	-	Yes	
	1MX36 CMOS Fast Page mode	MH1M36CJ	80,100	-	Yes	
	1MX36 Double Sided Fast Page mode	MH1M36DJ	80,100	-	Yes	102
	1MX36 CMOS Low profile	MH1M36EJ	60,70,80,100	Yes	91/2	
	2MX36 Double Sided	MH2M36CJ	80,100	-	Yes	103
	2MX36 Double Sided Low profile	MH2M36EJ	60,70,80,100	Yes	91/2	103
	2MX8 Pseudo-Pseudo SRAM Module	MH2M08PNA	8MHz,10MHz	91/2	91/4	104
	2MX40 Double Sided Fast Page	MH2M40AJ	80,100	91/2	91/4	
	4MX36 Double Sided Fast Page	MH4M36AJ	80,100	91/2	91/4	
256KSRAM Module	128KX8 CMOS (30PIN N-C)	MH12808TNA	85,100,120	-	Yes	
	128KX8 CMOS (30PIN CS2)	MH12908TNA	85,100,120	-	Yes	
	256KX8 CMOS (30PIN,NC,TSOP)	MH25608TNA	85,100,120	-	Yes	
	256KX8 CMOS (30PIN CS2,TSOP)	MH25708TNA	85,100,120	-	Yes	
	256KX8 CMOS 35PIN SIM	MH25608SIN	70,85,100,120	-	Yes	
	512KX8 CMOS (TSOP)	MH51208TNA	85,100,120	-	Yes	
	512KX8 CMOS 64PIN SIM	MH51208SN	70,85,100,120	-	Yes	106
	256KX9 CMOS 35PIN SIM	MH25609ASN	100,120	-	Yes	
1MSRAM Module	512KX8 CMOS (TSOP,32PIN DIP)	MH51208ANA	85,100,120	-	Yes	
	512KX8 CMOS (SOP,32PIN DIP)	MH51208UNA	85,100,120	-	Yes	
	1MX8 CMOS (TSOP,36PIN DIP)	MH1M08TNA	85,100,120	91/1	91/4	
	2MX8 CMOS (TSOP,36PIN DIP)	MH2M08TNA	85,100,120	91/1	91/4	105
FSRAM Module	64KX32 CMOS (64PIN ZIP)	MH6432NZ	15,20	91/3	91/6	105
ROM Module	256KX16 CMOS	MH25616RNA	150,200,250	-	Yes	106
	512KX16 CMOS	MH51216RNA	150,200,250	-	Yes	
Video RAM Module	128KX16 CMOS	MH12816JZ	80,100,120	-	Yes	104
	128K X16CMOS	MH12816AJZ	70, 80, 100	91/2	91/3	

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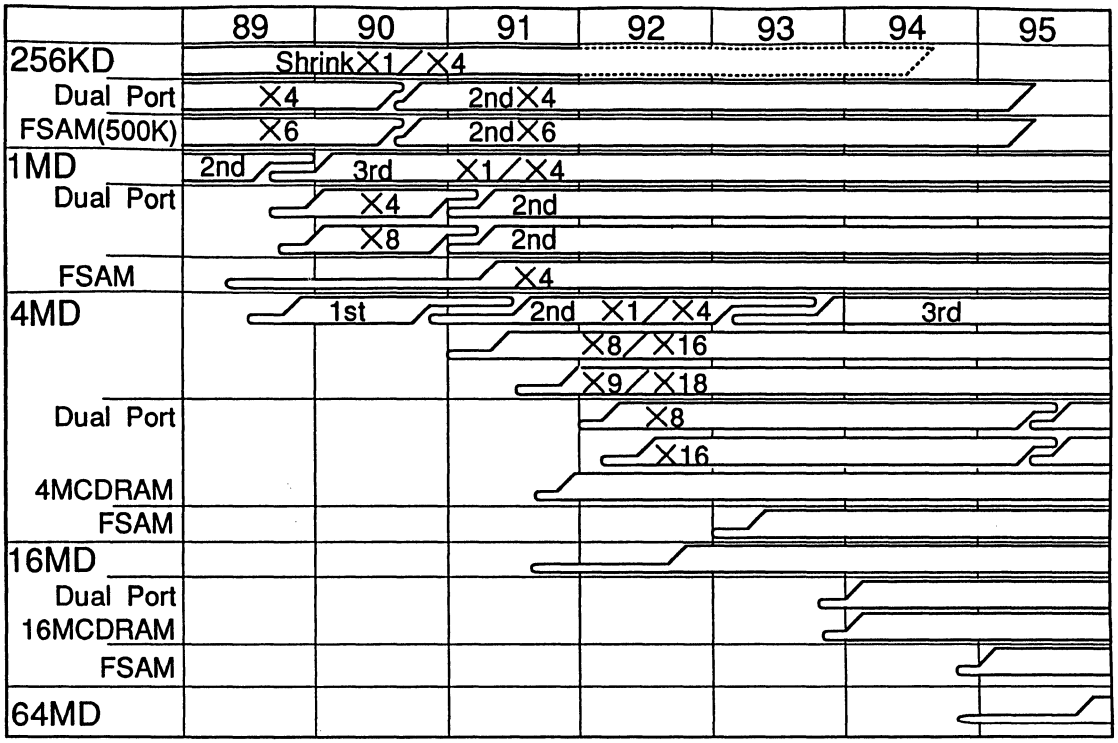
MITSUBISHI DRAM PLAN



MITSUBISHI ELECTRIC

New product / Under Development DRAM

Memory cap		1M					4M			
Organization		1M×1	256K×4	256K×4 (Dual port)	128K×8	261K×4 (FSAM)	4M×1	1M×4	512K×8	256K×16
Type name		M5M 41000B	M5M 44256B	M5M 442256	M5M 482128	M5M 4C900	M5M 44100A	M5M 44400A	M5M 44800A	M5M 44260A
Access time (ns)		70 80 100		100(30) 120(40)		30	60,80 70,100		60 70 80 100	(60) (70) 80 100
Pd. (mW) max.	Active	440 385 330		660 550		770	550 467.5 412.5 357.5		660 550 490 413	(1045) (908) 770 660
	St. by	2.75		27.5		33	5.5		5.5	5.5
Pins/Pkg*/W (mil)		18P(300) 26J 20L 24VP	20P(300) 26J 20L 24VP	28L(400) 28J(400)	40J(400)	28L	26WJ(350)26J(300) 20L(400)26TP(300) 26RT(300)		28J(400) 28L(400) 28TP,RT	40J(400) 44TP,RT
Chip size (mm^2)		3.88×11.39		5.08×13.54		4.94×13.85	5.36×14.45		5.81×14.80	5.81×14.80
Process technology		CMOS 0.9μ		CMOS 1.0μ			CMOS 0.7μ		CMOS 0.7μ	CMOS 0.7μ
Sample availability		Already		Already	Already	TBD	Already		91-2	91-2

*P = DIP, J = SMD, L = ZIP, VP = TSOP type I, TP = TSOP type II RT = reverse bend type TSOP

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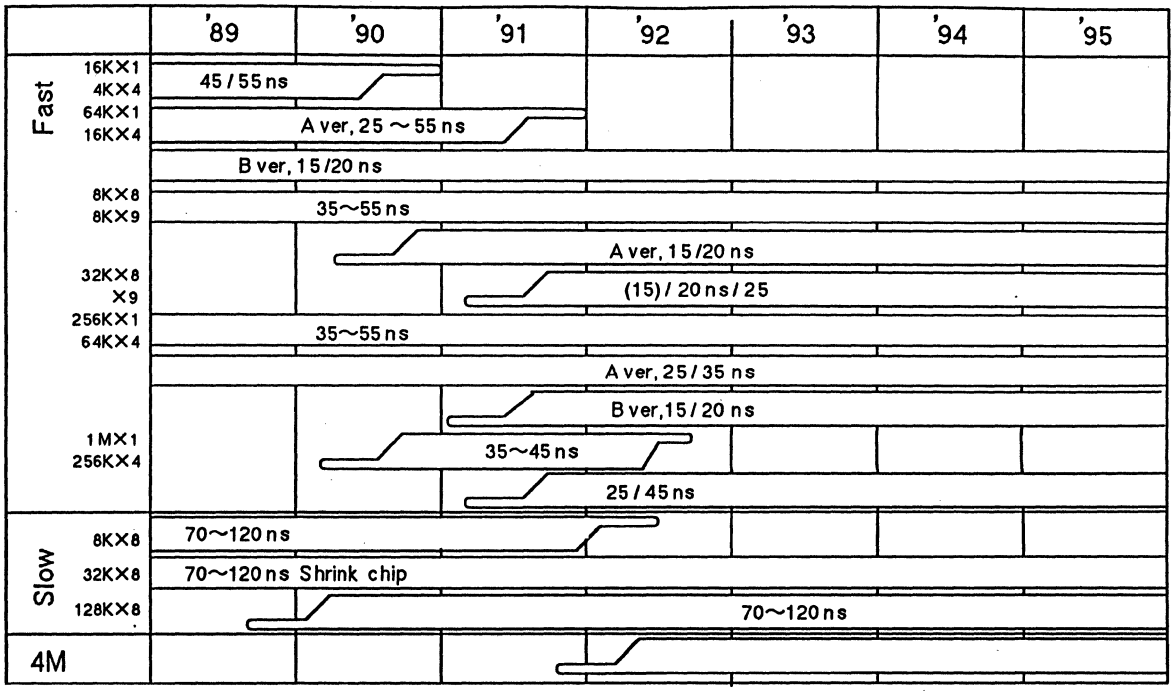
MITSUBISHI SRAM PLAN



MITSUBISHI ELECTRIC

NEW Product / Under Development SRAM

Process	B				C		D		E		
Memory cap	64K / 72K		256K		64K	256K	1M	64K / 72K	1M	256K / 288K	
Organization	64K×1 16K×4	8K×8 8K×9	32K×8	256K×1 64K×4	64K×4 16K×4	256K×1 64K×4	128K×8	8K×8 8K×9	1M×1 256K×4	256K×1 64K×4	32K×8 32K×9
Type name	M5M5187A M5M5188A M5M5189A	M5M5178 M5M5179	M5M5256B M5M5255B	M5M5257 M5M5258	M5M5187B M5M5188B M5M5189B	M5M5257A M5M5258A	M5M51008	M5M5178A M5M5179A M5M5180A	M5M51001 M5M51004	M5M5257B M5M5258B M5M5259B	M5M5278 M5M5279 M5M5269
Access time(ns)	25 35 45 55	35 45 55	70 85 100 120	35 45	15 20 25	25 30	70 85 100 120	15 20 25	25 35 45	15 20	(15) 20 25
Power(mw) Active Stand by (MOS) Stand by (3V)	550 11	660 11	385 0.55 0.15	660 11	550 55	660 55	385 0.55 0.15	660 55	660 55	660 55	660 55
Pins/Pkg/ Width(mil)	22P(300) 24P(300) 24J(300)	28P(300) 28J(300)	28P(300, 600) 28FP(450) 28TSOP	24P(300) 24J(300)	22P(300) 24P(300) 24J(300)	24P(300) 24J(300)	32P(600) 32FP(525) 32TSOP	28P(300) 28J(300) 28FP(450)	28P(400) 28J(400)	24P(300) 24J(300)	28P(300) 28J(300) 32P(300) 32J(300)
Chip Size(mm)	6.35×3.69	7.12×4.29	8.33×4.72	10.68×4.60	5.73×3.33	11.01×4.66	15.72×6.01	5.53×3.53	15.84×6.10	10.69×4.54	11.89×4.6
Channel length	1.1 μm	1.1 μm	1.1 μm	1.1 μm	1.1 μm	1.1 μm	0.9 μm	0.9 μm	0.8 μm	0.8 μm	0.8 μm
	1.6 μm	1.6 μm	1.6 μm	1.6 μm	1.2 μm	1.2 μm	1.1 μm	1.1 μm	1.0 μm	1.0 μm	1.0 μm
Design rule	1.3 μm	1.5 μm	1.0 μm	1.0 μm	1.1 μm	1.0 μm	0.8 μm	0.8 μm	0.8 μm	0.8 μm	0.8 μm
Process	CMOS,LDD,MoSi tox=220A				CMOS,LDD Mosi,tox=180A		CMOS,LDD Wsi 3-poly		CMOS,LDD Wsi 3-poly 2-Al		
Availability	Already	Already	Already	Already	Already	Already	Already	Already	Already (25:91-1)	90-12	91-1

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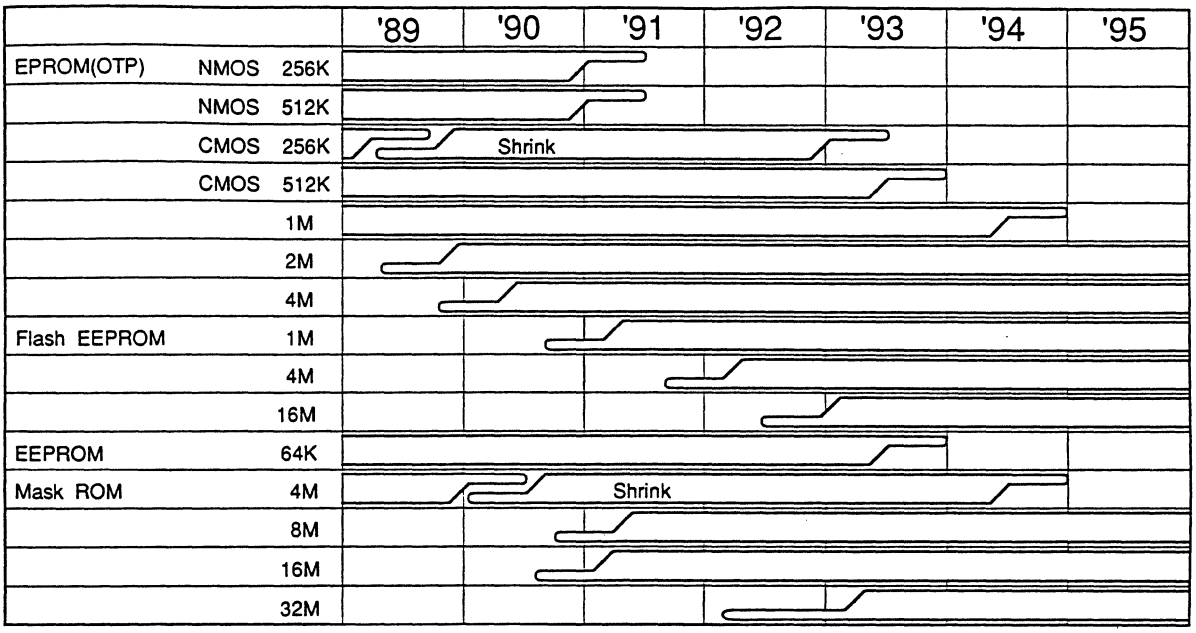
MITSUBISHI ROM PLAN



MITSUBISHI ELECTRIC

New Product / Under Development ROM

Device	EPROM / OTP**						EEPROM	MASK ROM					Flash EEPROM	
Memory cap.	1M		2M		4M		64K	4M		8M		16M	1M	
Organization	128K×8	64K×16	256K×8	128K×16	512K×8	256K×16	8K×8	512K×8 256K×16	512K×8	1M×8 512K×16	1M×8	2M×8 1M×16	128K×8	64K×16
Type name	M5M 27C100 / 101	M5M 27C102	M5M 27C201	M5M 27C202	M5M 27C401	M5M 27C402	M5M 28C64A	M5M 23400A	M5M 23401A	M5M 23800	M5M 23801	M5M 23160	M5M 28F101	M5M 28F102
Access time (ns)	120 150** 200 250	120 150** 200 250	100 120 150**	100 120 150**	120 150**	120 150**	150 200	150	150	150	150	150	100 120 150	100 120 150
Pd. (mW) max. Active	263	263	165	165	165	165	165	165	165	275	275	275	165	275
Pd. (mW) max. Standby	0.55	0.55	0.55	0.55	0.55	0.55	5.5	0.55	0.55	0.55	0.55	0.55	0.55	0.55
Chip size(mm^2)	45.0	48.6	50.9	53.5	87.5	91.5	34.2	58.5	58.5	73.2	73.9	128.7	38.1	TBD
Process technology	CMOS 1.2μm	CMOS 1.2μm	CMOS 0.9μm	CMOS 0.9μm	CMOS 0.9μm	CMOS 0.9μm	CMOS 1.2μm	CMOS 1.1μm	CMOS 1.1μm	CMOS 0.8μm	CMOS 0.8μm	CMOS 0.8μm	CMOS 0.9μm	CMOS 0.9μm
Pins Package* Width(mil)	32K(600) 32P(600) 32FP(525) 32J 32JK 40VP,RV	40K(600) 40P(600) 40FP(525) 44J 44JK 40VP,RV	32K(600) 32P(600) 32FP(525) 32J 32JK 40VP,RV	40K(600) 40P(600) 40FP(525) 44J 44JK 40VP,RV	32K(600) 32P(600)	40K(600) 40P(600)	28P(600) 28FP(450) 28VP,RV	40P(600) 40FP(525) 40VP,RV	32P(600) 32FP(525) 40VP,RV	42P(600) 44FP(600) 48VP,RV	32P(600) 32FP(525) 40VP,RV	42P(600) 44FP(600) 48VP,RV	32P(600) 32FP(525) 32J 32VP,RV	40P(600) 40FP(525) 44J 40VP,RV
Sample availability	Already	Already	Already	Already	Already	Already	Already	Already	Already	Already	Already	Already	Already	'91-2
Note														

Package* ··K:Ceramic DIP,P:DIP,FP:SOP,J:PLCC,VP / RV:TSOP,JK:Ceramic LCC(CLCC)

MITSUBISHI ELECTRIC

New package series for MOS Memory

		Organization	DIP		ZIP	PLCC	SOP	TSOP	SOJ	QFP	CLCC	Page
DRAM		256K×1	◎(16)		◎(16)	◎(18)	—	—	—	—	—	
		64K×4	◎(18)		◎(20)	◎(18)	—	—	—	—	—	
		1M×1	◎(18)		◎(20)	—	—	◎(24)	◎(26)	—	—	
		256K×4	◎(20)		◎(20)	—	—	◎(24)	◎(26)	—	—	
		4M×1	—		◎(20)	—	—	◎(26)	◎(26)	—	—	
		1M×4	—		◎(20)	—	—	◎(26)	◎(26)	—	—	
		512K×8	—		○(28)91-4	—	—	○(28)91-4	○(28)91-4	—	—	
		512K×9	—		○(28)91-10	—	—	○(28)91-10	○(28)91-10	—	—	
		256K×16	—		△(40)	—	—	○(44)91-4	○(40)91-4	—	—	
		256K×18	—		△(40)	—	—	○(44)91-10	○(40)91-10	—	—	
VRAM		64K×4	—		◎(24)	—	—	△	◎(24)	—	—	
		256K×4	—		◎(28)	—	—	△	◎(28)	—	—	
		128K×8	—		—	—	—	△	◎(40)	—	—	
FSAM		80K×6	—		◎(28)	—	—	△	△	—	—	
		261K×4	—		△(28)	—	—	—	—	—	—	
SRAM	SLOW	8K×8	300mil	600mil	—	—	◎(28)	—	—	—	—	
			—	◎(28)								
		32K×8	◎(28)	◎(28)	—	—	◎(28)	◎(28)	—	—	—	
		128K×8	—	◎(32)	—	—	◎(32)	◎(32)	—	—	—	
	FAST	64K×1	◎(22)	—	—	—	—	—	◎(24)	—	—	
		16K×4	◎(22)	—	—	—	—	—	◎(24)	—	—	
		16K×4($\overline{OE}$)	◎(24)	—	—	—	—	—	◎(24)	—	—	
		8K×8	◎(28)	◎(28)	—	—	◎(28)	—	◎(28)	—	—	
		8K×9	◎(28)	—	—	—	◎(28)	—	◎(28)	—	—	
		256K×1	◎(24)	—	—	—	—	△(24)	◎(24)	—	—	
		64K×4	◎(24)	—	—	—	—	—	◎(24)	—	—	
		32K×8	○(28)91-3	—	—	—	△(28)	—	○(28)91-3	—	—	
		32K×9	○(32)91-3	—	—	—	△(32)	—	○(32)91-3	—	—	
		1M×1	400mill ◎(28)	—	—	—	—	△(32)	◎(28)	—	—	
		256K×4	400mill ◎(28)	—	—	—	—	△(32)	◎(28)	—	—	
		256K×4 I/O separate	400mill ○(32)	—	—	—	—	—	◎(32)	—	—	
EPROM	1M	128K×8	◎(32)		—	—	—	—	—	—	◎(32)	
		64K×16	◎(40)		—	—	—	—	—	—	◎(44)	
	2M	256K×8	◎(32)		—	—	—	—	—	—	◎(32)	
		128K×16	◎(40)		—	—	—	—	—	—	◎(44)	
	4M	512K×8	◎(32)		—	—	—	—	—	—	△	
		256K×16	◎(40)		—	—	—	—	—	—	△	
OTP	1M	128K×8	◎(32)		—	◎(32)	◎(32)	◎(40)	—	—	—	
		64K×16	◎(40)		—	◎(44)	◎(40)	◎(40)	—	—	—	
	2M	256K×8	◎(32)		—	◎(32)	◎(32)	◎(40)	—	—	—	
		128K×16	◎(40)		—	◎(44)	◎(40)	◎(40)	—	—	—	
	4M	512K×8	◎(32)		—	—	—	—	—	—	—	
		256K×16	◎(40)		—	—	—	—	—	—	—	
MASK ROM	4M	512K×8	◎(32)		—	—	◎(32)	◎(40)	—	—	—	
		512K×8/256K×16	◎(40)		—	—	◎(40)	◎(40)	—	—	—	
	8M	1M×8	○(32)91-3		—	—	○(32)91-5	○(40)91-6	—	—	—	
		1M×8/512K×16	○(42)91-4		—	—	○(44)91-7	○(48)91-8	—	—	—	
	16M	2M×8/1M×16	○(42)91-3		—	—	○(44)91-6	○(48)91-8	—	—	—	
Flash EEPROM	1M	128K×8	○(32)91-1		—	○(32)91-4	○(32)91-4	○(32)91-4	—	—	—	
		64K×16	○(40)91-5		—	○(44)91-6	○(40)91-6	○(40)91-6	—	—	—	

◎:Production, ○:Development, Production start time
△:Market Survey, —:No plan

MITSUBISHI ELECTRIC

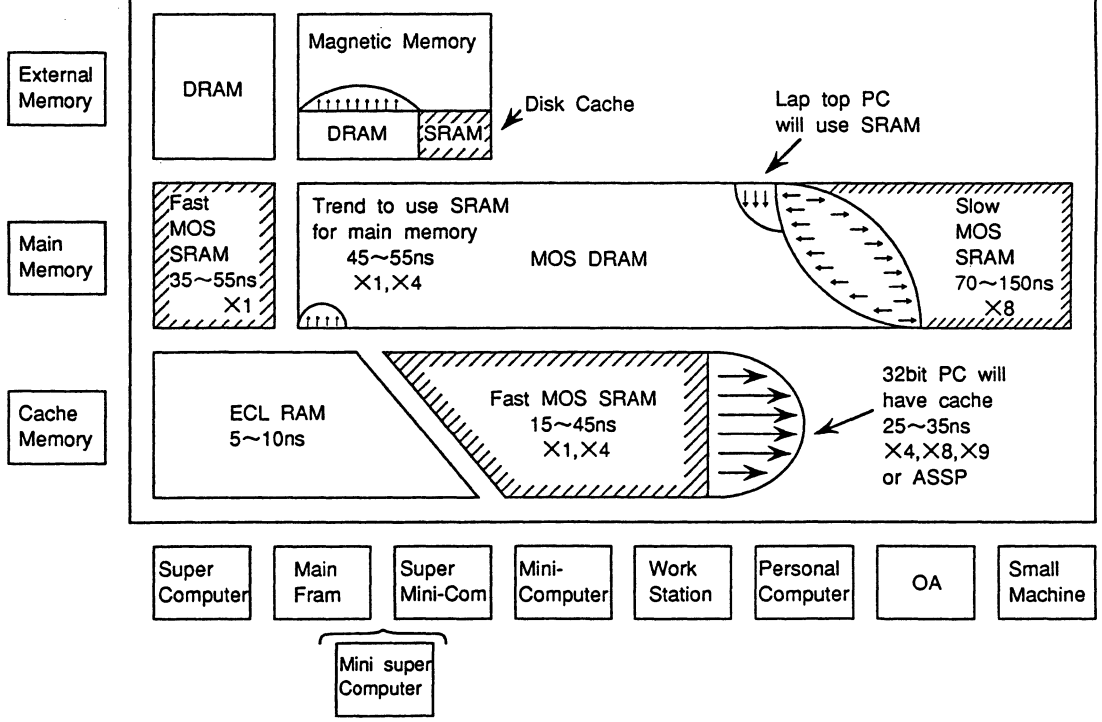
Semiconductor Devices in Computer

Functional Block	Personal Computer		EWS	Small & Medium Computer	Large Computer	Super Computer
	Book Type Lap top	Desk Top				
CPU	Standard MPU			Custom and semicustom LSI MPU Permeation	Semicustom LSI	
Other Control Unit	Custom & Semicustom LSI ASSP			Semicustom LSI		
Main Memory	DRAM Mainly	DRAM			DRAM Mainly	SRAM
	SRAM Partially				SRAM Partially	
Cache Memory	—	SRAM				—
Display Memory	DRAM Mainly VRAM Partially		VRAM		—	

Semicustom LSI : Gate Array and Standard Cell

MITSUBISHI ELECTRIC

Application of DRAM/SRAM



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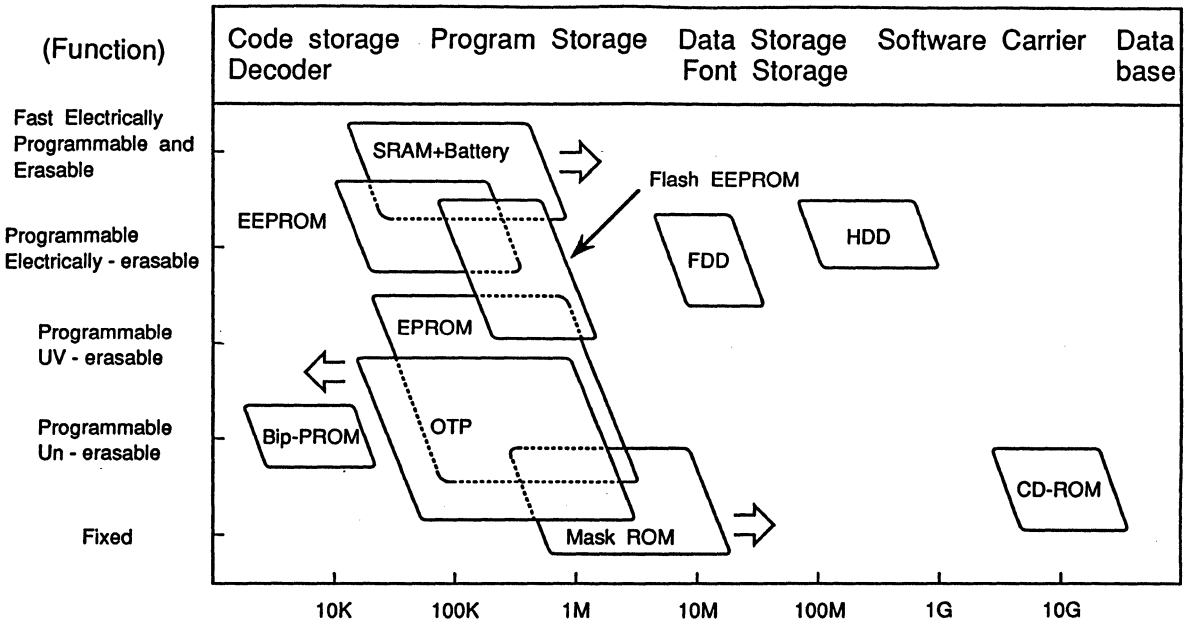
Application of ROM



MITSUBISHI ELECTRIC

Quality & Reliability of MITSUBISHI MOS Memory

Type of device		Incoming Inspection ppm		Field Data FIT	
		Target 1991	Results 1990	Target 1991	Results 1990
DRAM	M5M44100J, M5M44400J	100	—	100	—
	M5M41000BP	100	30~150	50	50~100
	M5M44256BP	100	30~150	50	50~100
SRAM	M5M51008P	100	—	100	—
	M5M5256BP	100	50~100	100	50~100
	M5M51001P	100	50~100	100	50~100
	M5M5257P/AP, M5M5258P/AP	100	50~100	100	50~100
EPROM	M5M27C401K	100	100~200	100	50~100
	M5M27C201K	100	100~150	100	50~100
	M5M27C101K	100	100~150	50	50~80

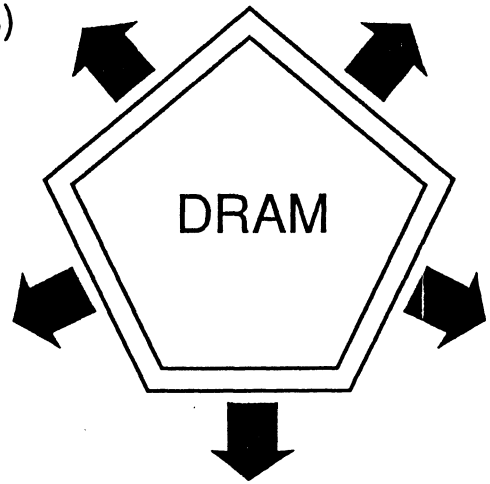
Technical Strategy of DRAM

High Performance

Fast Access Time (60ns)
Low Power Version
Wide Range Temp.

High Density

1MD・3rd
4MD・2nd
16MD



Various Word Organization

×8,×9,×16,×18

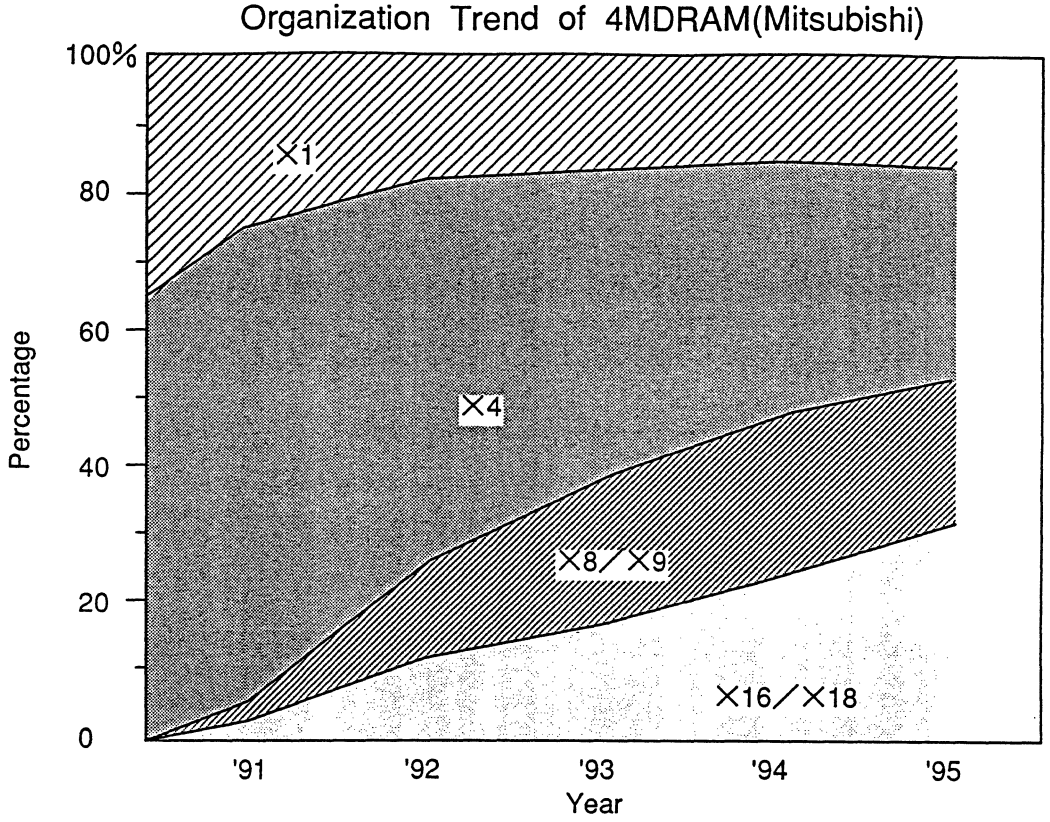
Various Package

TSOP SOJ ZIP DIP
Module／Board

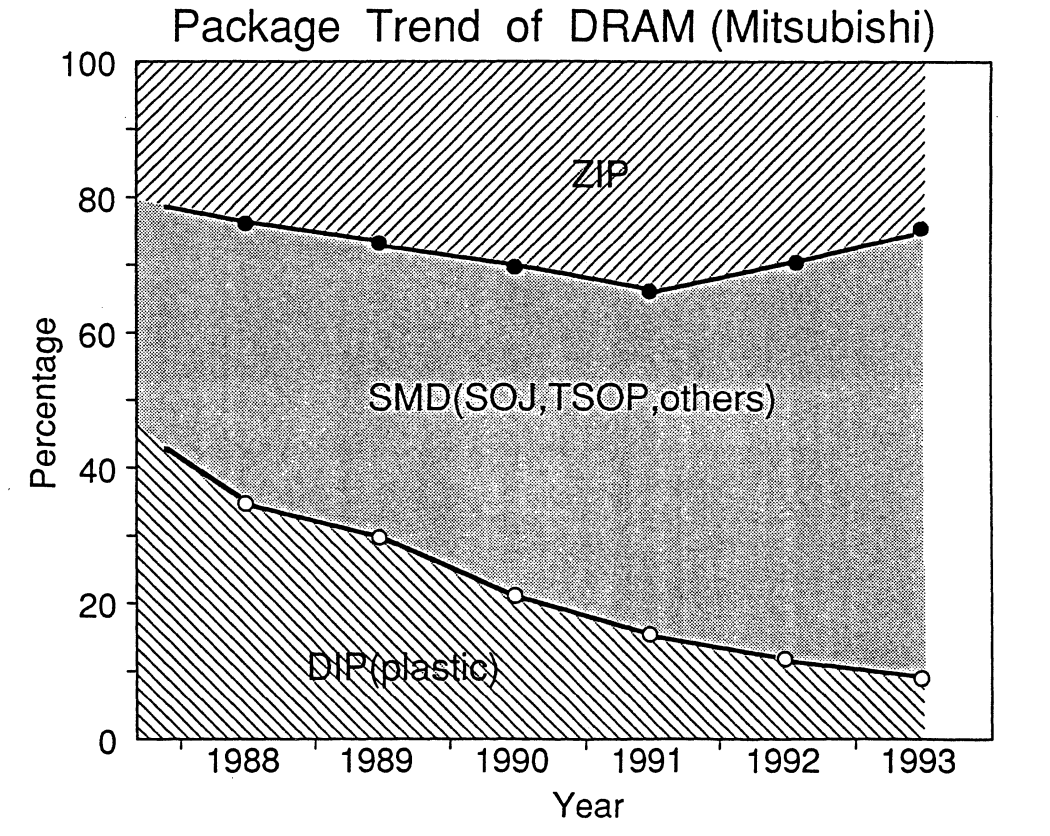
AS Memory → Display

1M VRAM
1M FSAM
256K VRAM
500K FSAM
CDRAM

MITSUBISHI ELECTRIC



MITSUBISHI ELECTRIC



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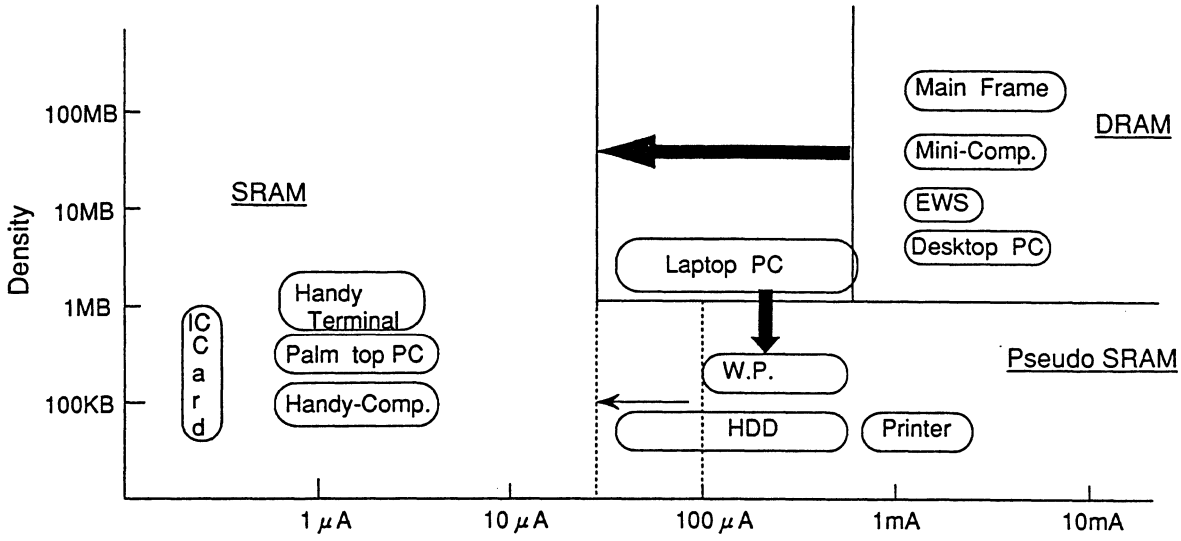
Application of DRAM, PSRAM and SRAM



MITSUBISHI ELECTRIC

Mitsubishi 1st Generation 4M DRAM Series

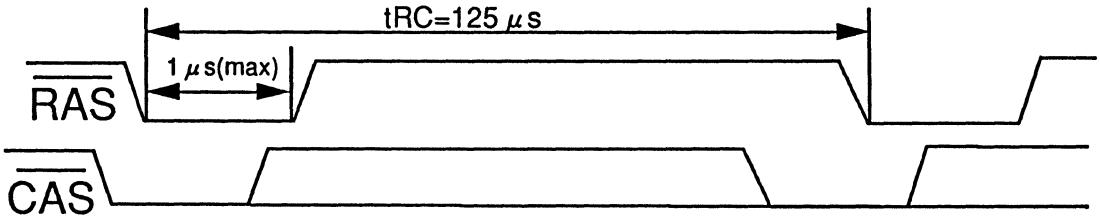
Type Name	Description	Package	Speed item	Low Power Version*	Production
M5M44100J,L	4M×1,Fast page mode	SOJ,ZIP	-8,-10	Yes	Yes
M5M44101J,L	4M×1,Nibble mode	SOJ,ZIP	-8,-10	—	Yes
M5M44102J,L	4M×1,Static column mode	SOJ,ZIP	-8,-10	—	Yes
M5M44400J,L	1M×4,Fast page mode	SOJ,ZIP	-8,-10	Yes	Yes
M5M44402J,L	1M×4,Static column mode	SOJ,ZIP	-8,-10	—	Yes

・Organization (×1／×4)…Al mask masterslice
・Function mode (Fast page／Nibble／Static Column)…Wire bonding option
＊Icc2 (MOS) = Icc8 = 500 μA (Max) at tREF = 128msec

LOW POWER DRAM SERIES

Device		tREF	tRC	Icc2(MOS)	Icc8
1M X 1 (B) 256K X 4 (B)	F.P.	64ms /512cycle	125 μs	200 μA	200 μA
4M X1 1M X4	F.P.	128/1024	125	LL 300 L 500	LL 300 L 500
4M X 1 (A) 1M X 4 (A)	F.P.	128/1024	125	200 (300)	200 (300)
512K X 8 (A) X 9 (A)	F.P.	128/1024	125	100	250 (Future Target 200)
256K X 16/ 18 (A) 2 $\overline{CAS}$ / 1 $\overline{WE}$	F.P.	64/512	125	100	350 (F.T.300)
256K X 16/ 18 (A) 1 $\overline{CAS}$ / 2 $\overline{WE}$	F.P.	128/1024	125	100	250 (F.T.200)
64K X 4 VRAM (A)		32/256	125	200	300

Icc8 : CBR Extended (Slow) Refresh Current



$\overline{CAS}$ = 0.2V or CBR Cycling
$\overline{OE}$ = Vcc -0.2V
$\overline{WE}$ = Vcc-0.2V or 0.2V
Add = Vcc-0.2V or 0.2V
DQi = Vcc-0.2V or 0.2V or O pen

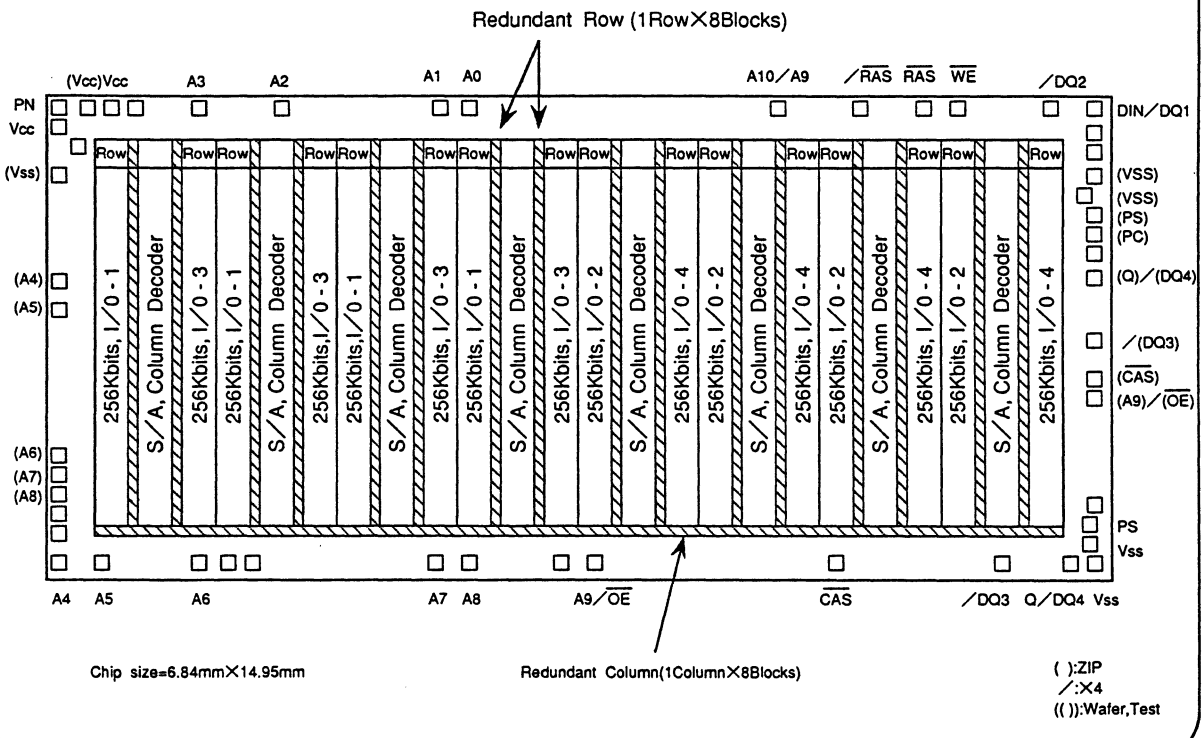
MITSUBISHI ELECTRIC

Features of 1st Generation 4MDRAM

- 4M×1／1M×4 organization
- Package ····· 26pin 350mil SOJ
  20pin 400mil height ZIP
- Additional Function ····· Fast Page, Nibble, Static Column.
- Single 5volt power supply
- Test mode ····· JEDEC Standard (External Timing Induced)
- High speed／Low power, 80nsec access time at 523 mW
  100nsec access time at 468 mW
- Twin - well CMOS
- 0.8 μm minimum feature size : chip size 102mm^2
  cell size 12.3 μm^2
- Stacked cell structure

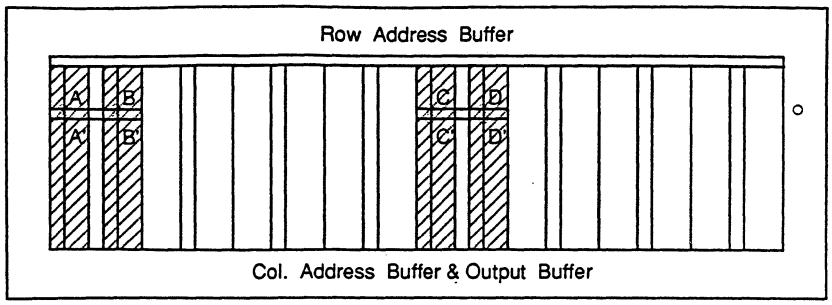
MITSUBISHI ELECTRIC

Chip Architecture of 1st Generation 4MDRAM

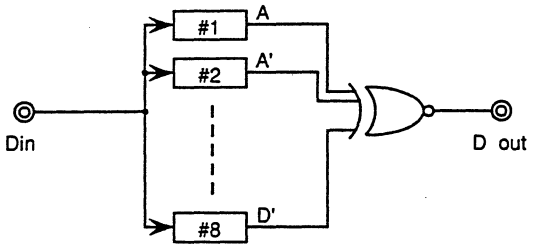


MITSUBISHI ELECTRIC

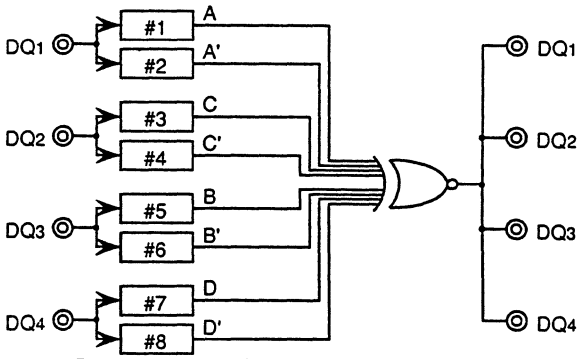
Configuration of Test Mode



×1



×4



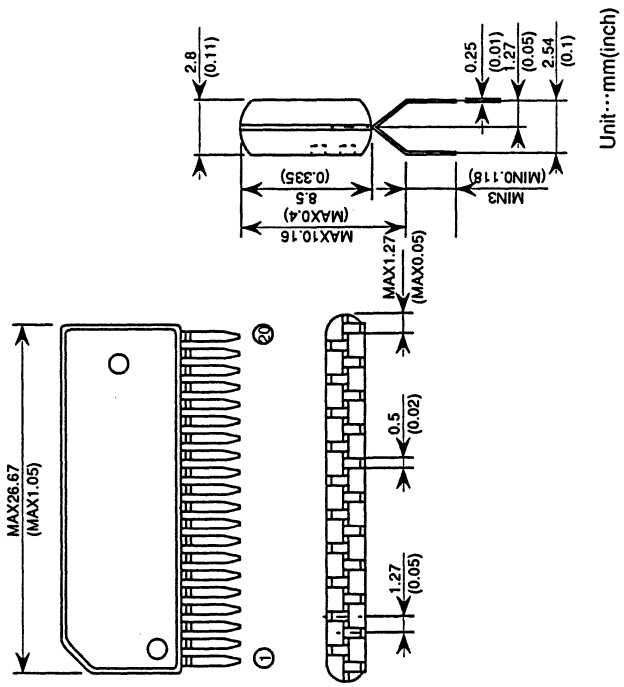
Don't care address : RA10,CA10,CA0(×1)

Don't care address : CA0(×4)

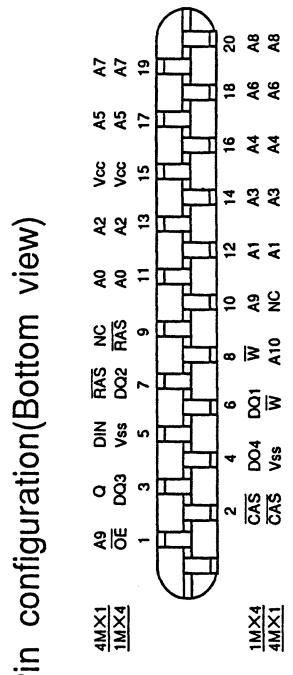
MITSUBISHI ELECTRIC

20Pin ZIP for 4M×1 and 1M×4 DRAM

Outline Drawing



Pin configuration(Bottom view)



MITSUBISHI ELECTRIC

Long Term Life Test Data for 4MDRAM SOJ and ZIP

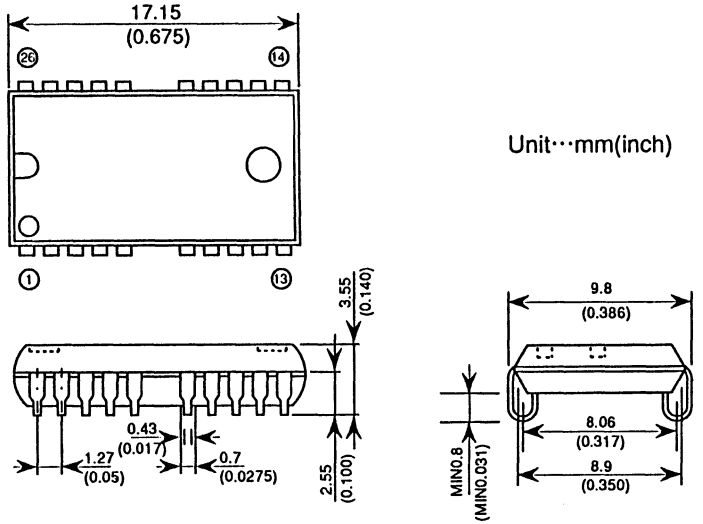
Test	Condition	Item tested	Failures/Sample size	
			SOJ	ZIP
High temperature operating life test	Ta=125℃ Vcc=7.5V t=1000hrs	· DC and function · Stability of electrical margins	0/120	1*/120
	Ta=150℃ Vcc=7.0V t=1000hrs	· DC and function · Stability of electrical margins	1*/120	——
Low temperature operating life test	Ta=-20℃ Vcc=8.0V t=1000hrs	· DC and function · Stability of electrical margins	0/50	0/30
High temperature storage test	Ta=175℃ t=1000hrs	· DC and function · Stability of electrical margins	0/80	0/80
Soldering heat test	260℃ 10sec	· DC and function	0/10	0/10
Thermal shock test	-55/125℃ 15cycles			
Temperature cycling test	-65/150℃ 1000cycles	· DC and function	0/120	0/120
Pressure cooker test	121℃ 100%RH t=240hrs	· DC and function · Stability of electrical margins	0/140	0/180
Pressure cooker test with DC bias	140℃ 85%RH Vcc=5.5V t=1000hrs	· DC and function · Stability of electrical margins	2**/82	0/160
Humidity test with DC bias	85℃ 85%RH Vcc=5.5V t=2000hrs	· DC and function · Stability of electrical margins	0/230	0/230

* : Single bit failure, ** : DC failure

MITSUBISHI ELECTRIC

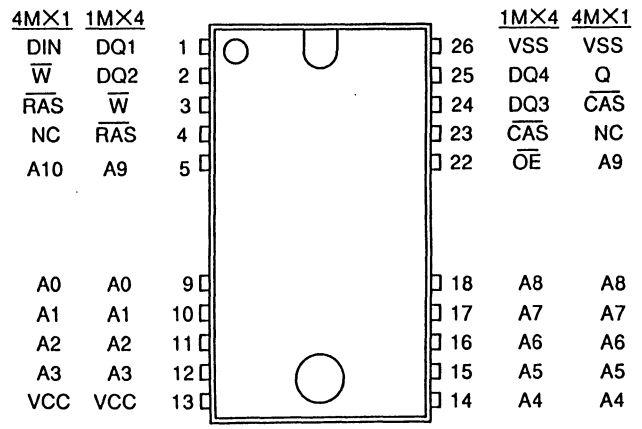
26Pin SOJ for 4M×1 and 1M×4 DRAM

Outline Drawing (Tentative)



Unit···mm(inch)

Pin configuration(Top view)



MITSUBISHI ELECTRIC

Package Reliability Data for 4MDRAM

Test	Condition	Failures/Sample size	
		SOJ	ZIP
Solderability	230℃, 5sec	0/50	0/50
Resistance to solvent	Solvent Aceton Isopropyl alcohol Trichloroethane	0/30	0/30
Lead pull	230g, 30sec	0/30	0/30
Lead bend	230g, 90℃, 3times	0/30	0/30
Radiography	Check of Lead frame Die attach Au wire Resin void	0/100	0/100
Salt atmosphere	35℃, 5wt%salt, 48hrs	0/30	0/30
Package crack	85℃, 85%RH, 72hrs→ Soldering(260℃, 30sec)	0/30	0/30

MITSUBISHI ELECTRIC

Results of Infant Mortality Study for 4MDRAM

Sample	Condition	Sample size	Failures
M5M44100J	Dynamic burn-in Ta=125℃ Vcc=7V t=100hours	5,102	9 (Single bit : 7 Bit line : 1 Word line : 1)
M5M44100L		3,645	6 (Single bit : 5 Bit line :1)
Total		8,747	15

* In case the field condition of Ta=55℃ and Vcc=5V
  =15/(8,747×100×100×9.4)
  =18FIT
* In case the field condition of Ta=70℃ and Vcc=5V
  =15/(8,747×100×100×5.3)
  =32FIT

MITSUBISHI ELECTRIC

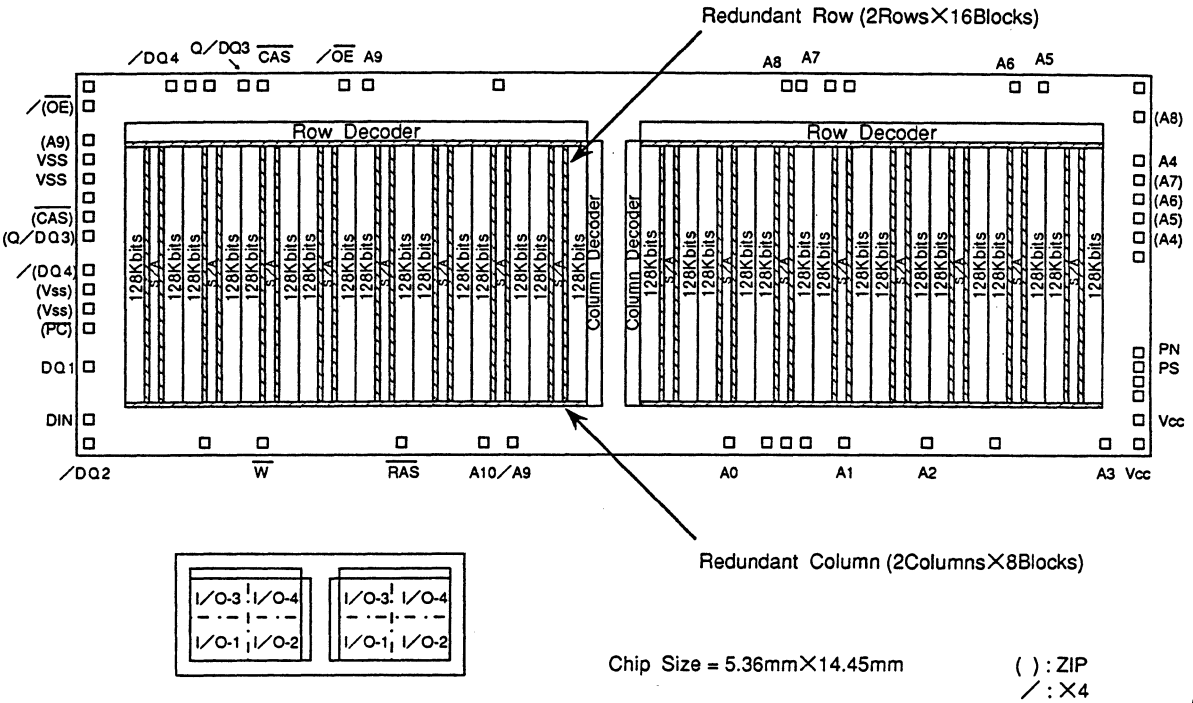
Mitsubishi 2nd Generation 4M DRAM Series

Type Name	Description	Package	Speed Item	Low Power Version	Sample	Production
M5M44100AWJ,J,L,TP,RT	4M×1,Fast Page mode	SOJ(300),ZIP SOJ(350),TSOP	-6,-7,-8,-10	YES	—	'91/1
M5M44101AWJ,J,L,TP,RT	4M×1,Nibble mode	SOJ(300),ZIP SOJ(350),TSOP	-6,-7,-8,-10	—	—	'91/1
M5M44102AWJ,J,L,TP,RT	4M×1, Static Column mode	SOJ(300),ZIP SOJ(350),TSOP	-6,-7,-8,-10	—	—	'91/1
M5M44400AWJ,J,L,TP,RT	1M×4,Fast Page mode	SOJ(300),ZIP SOJ(350),TSOP	-6,-7,-8,-10	YES	—	'91/1
M5M44402AWJ,J,L,TP,RT	1M×4, Static Column mode	SOJ(300),ZIP SOJ(350),TSOP	-6,-7,-8,-10	—	—	'91/1
M5M44410AWJ,J,L,TP,RT	1M×4,Fast Page mode Write Per Bit	SOJ(300),ZIP SOJ(350),TSOP	-6,-7,-8,-10	YES	—	'91/1
M5M44412AWJ,J,L,TP,RT	1M×4,Static Column mode Write Per Bit	SOJ(300),ZIP SOJ(350),TSOP	-6,-7,-8,-10	—	—	'91/1
M5M44800AJ,L,TP,RT	512K×8,Fast Page	SOJ(400),ZIP(400) TSOP(400)	-6,-7,-8,-10	YES	'91/2	'91/4
M5M44900AJ,L,TP,RT	512K×9,Fast Page	ditto	ditto	YES	'91/7	'91/10
M5M44260AJ,(L),TP,RT	256K×16,Fast Page (2$\overline{CAS}$,1$\overline{W}$)	SOJ(400),TSOP(400) (ZIP(475))	-8,-10 (-6,-7)	YES	'91/2	'91/4
M5M44170AJ,(L),TP,RT	256K×16,Fast Page (1$\overline{CAS}$,2$\overline{W}$)	ditto	-6,-7,-8,-10	YES	'91/2	'91/4
M5M44280AJ,(L),TP,RT	256K×18,Fast Page (2$\overline{CAS}$,1$\overline{W}$)	ditto	-8,-10 (-6,-7)	YES	'91/7	'91/10
M5M44190AJ,(L),TP,RT	256K×18,Fast Page (1$\overline{CAS}$,2$\overline{W}$)	ditto	-6,-7,-8,-10	YES	'91/7	'91/10

- Organization (×1/×4) ---------- Wire Bonding option
- Fast Access Mode (Fast Page/Nibble/Static Column) ------ Wire Bonding option
- Write Per Bit Function (With/Without) ---------- Wire Bonding option
- TSOP Package (Type II) --------- Normal bend type (TP) & Reverse bend type (RT)
- ×8/×16 . . . Metal mask option
- ×9/×18 . . . Metal mask option

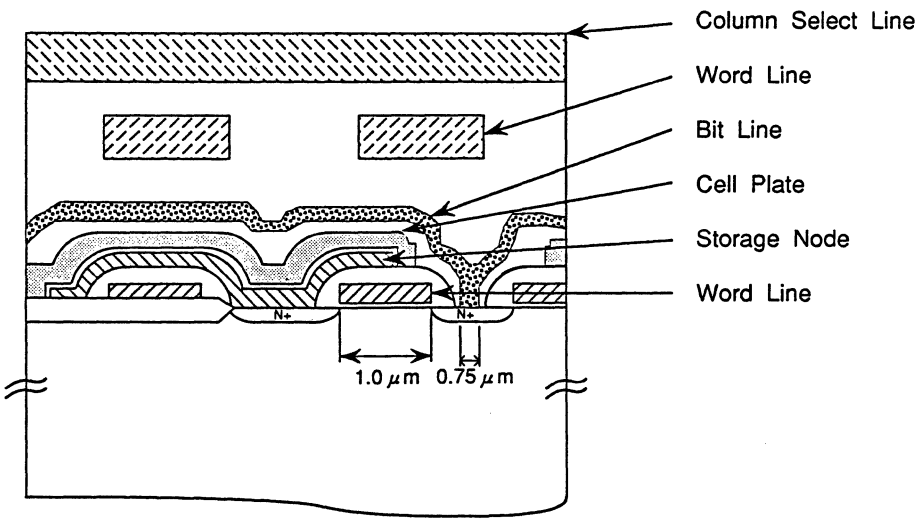
MITSUBISHI ELECTRIC

Chip Architecture of 2nd Generation 4M DRAM



MITSUBISHI ELECTRIC

Memory Cell Structure and Minimum Design Features of 2nd Generation 4M DRAM



Stacked Cell

MITSUBISHI ELECTRIC

Spec. Comparison between 1st and 2nd Generation 4MDRAM

Spec. \ Gen.		1st Generation	2nd Generation
Organization		×1,×4 (Al Masterslice)	×1,×4 (Bonding option)
Package		350mil SOJ 400mil ZIP	350mil SOJ 300mil SOJ 400mil ZIP 300mil TSOP (II)
Access Time		80/100ns	60/70/80/100ns
Power Supply Current	Operating	95/85mA	100/85/75/65mA
	Stand - by	2mA (TTL) 1mA (MOS)	2mA (TTL) 1mA (MOS)
Fast Access Mode		Fast Page Nibble (×1 Only) Static Column (Bonding Option)	Fast Page Nibble (×1 Only) Static Column (Bonding Option)
Write Per Bit Function (×4 Only)		No	Yes (Bonding Option)
Test Mode		8-bit Parallel	16-bit Parallel
Low Power Version Refresh Current (tref=128ms)		Yes 500 μA	Yes 200 μA*

*: Target Spec.

MITSUBISHI ELECTRIC

Comparison of 4M DRAM Design Technology

	1st Generation	2nd Generation
Chip Size	102mm²	77.5mm²
Memory Cell Size	12.3 μm²	9.0 μm²
Minimum Feature Size	0.8 μm	0.7 μm
Inter-Connection Layer	Metal:1(Word Line) Poly-silicon:3(Tr.Cell Capacitor) Poly-cide:1(Bit Line)	Metal : 2(Word Line,Column Select Line) Poly-silicon : 3(Tr.,Cell Capacitor) Poly-cide : 1(Bit Line)
Partial Activation	1/4	1/8
Memory Cell/Bit Line	128	64
Redundancy	8 Rows,8 Columns	32 Rows,16 Columns
Metal Masterslice	×1/×4	———
Wire Bonding Option	Fast Access Mode SOJ/ZIP	×1/×4 Fast Access Mode Write Per Bit SOJ&TSOP/ZIP

MITSUBISHI ELECTRIC

Comparison Process Design between 1st and 2nd Generation 4MDRAM

	1st Generation	2nd Generation
Isolation	Single Locos	Single Locos
Well	Twin-well	Twin-well
Cell structure	Stacked Tox (eff) = 100 Å	Stacked Tox (eff) = 80 Å
Transistor	Nch : 0.9 μm(LDD) Pch : 1.1 μm(S.W)	Nch : 0.8 μm(LDD) Pch : 1.0 μm(LDD)
1st Poly-Si	Transistor(Poly-Si) Tox = 200 Å	Transistor(Poly-Si) Tox = 180 Å
2nd Poly-Si	Storage Node	Storage Node
3rd Poly-Si	Capacitor(Poly-Si) Tox (eff) = 100 Å	Capacitor(Poly-Si) Tox (eff) = 80 Å
4th Poly-Si	Bit line WSi_2/Poly-Si	Bit line WSi_2/Poly-Si
1st Metal layer	Word line Pile Al-Si-Cu/TiN	Word line Pile Al-Si-Cu/TiN
2nd Metal layer	None	Column Select line Al-Si-Cu/TiN
Passivation	P-SiN	P-SiN
Coating	Polyimide (10 μm)	Polyimide (10 μm)

MITSUBISHI ELECTRIC

Comparison between 1st and 2nd Genration 4M DRAM

-SOJ/ZIP Package-

	1st	2nd
Plastic material	Epoxy-resin	same
Lead frame material	Fe-Ni 42 Alloy	same
Die attach	Soft solder	same
Wire bonding material	Au 30 μm ϕ	same
Wire bonding method	Thermosonic	same
Lead frame finish	Sn/Pb plating	same
α Flux of Plastic material	<0.001 CpH	same
Marking	Ink	Laser

2nd Generation 4M DRAM Thermal Resistance

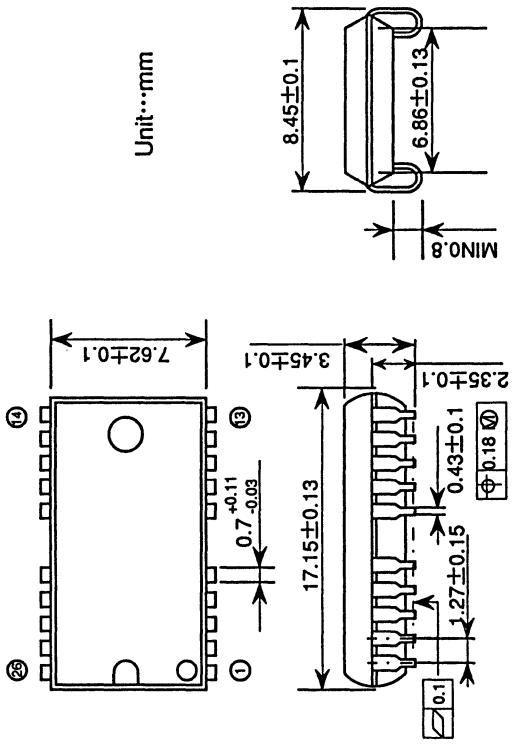
Package Type	θJA (℃/W)			θJC (℃/W)
	Hanging	Mounted on standard PCB		In Fluorinert Liquid
	0 (f/m)	0 (f/m)	200 (f/m)	
SOJ (300mil)	95	75	55	16
SOJ (350mil)	90	75	55	16
ZIP (400mil)	85	70	50	16
TSOP (Type II)	120	85	70	16

Note
(1) Standard PCB
Material ……glass epoxy(one side face Cu Pattern)
Size……70mm×70mm,1.6mm(thickness)
Cu thickness…18 μm
(2) f/m…feet/minute
(200f/m=1m/s)

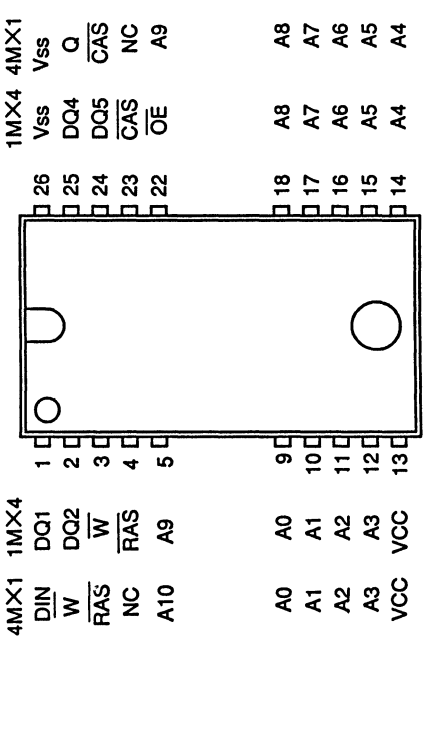
MITSUBISHI ELECTRIC

26Pin 300mil SOJ for 4M×1 and 1M×4DRAM

Outline Drawing



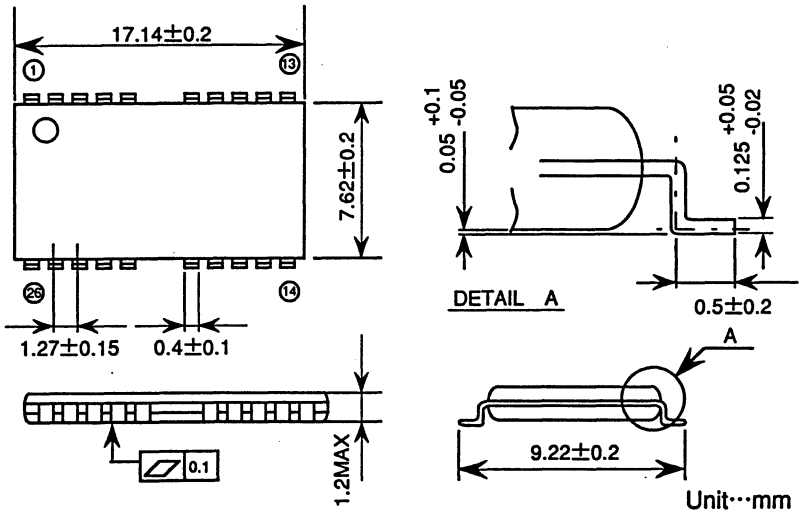
Pin Configuration (Top View)



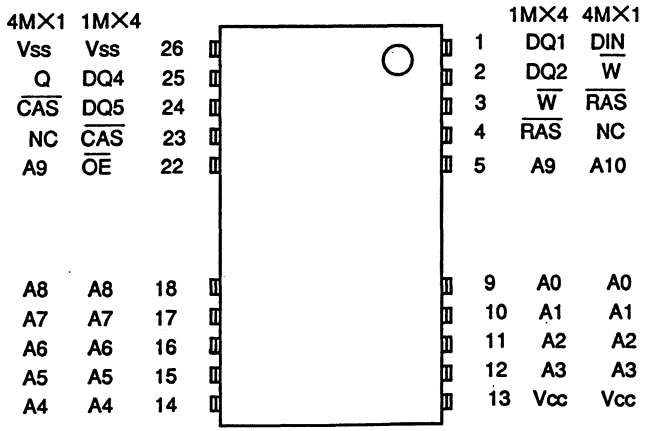
MITSUBISHI ELECTRIC

26Pin TSOP for 4M×1 and 1M×4 DRAM
(Reverse Bend Type)

Outline Drawing



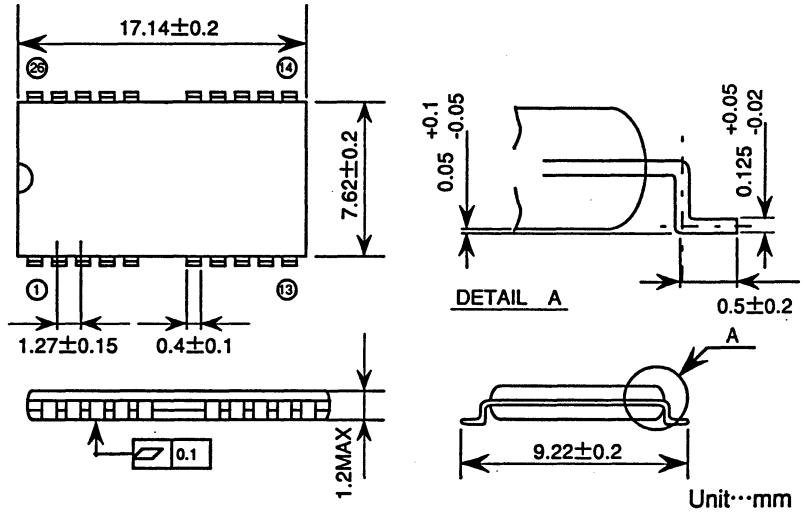
Pin Configuration (Top View)



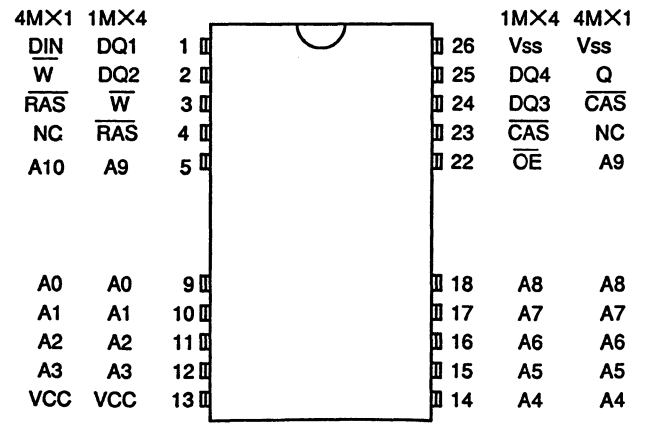
MITSUBISHI ELECTRIC

26Pin TSOP for 4M×1 and 1M×4 DRAM
(Normal Bend Type)

Outline Drawing



Pin Configuration (Top View)



MITSUBISHI ELECTRIC

Electrical Characteristics of 2nd Generation 4MDRAM

SUMMARY (for 80ns device)

Electric Characteristics	Data Mean	Sigma	Limit	Test Condition
Icc1	62.5mA	0.65	75mA	Vcc=5.5V,Tc=160ns,Ta=25° C
Icc2(MOS)	55.5 μA	3.10	1.0mA	Vcc=5.5V,Ta=25° C
Icc2(TTL)	1.12mA	0.02	2.0mA	ditto
Icc3	62.9mA	0.61	75mA	Vcc=5.5V,Tc=160ns,Ta=25° C
Icc4	62.6mA	1.26	75mA	Vcc=5.5V,Tc=50ns,Ta=25° C
TRAC	61.9ns	1.22	80ns	Vcc=4.5V,Ta=80° C
TCAC	11.8ns	0.23	20ns	ditto
TAA	34.0ns	0.90	40ns	ditto
TRAH	3.8ns	0.12	10ns	ditto
TASR	-4.8ns	0.12	0ns	Vcc=5.5V,Ta=25° C
TCAH	8.9ns	0.21	15ns	Vcc=4.5V,Ta=80° C
TASC	-7.8ns	0.16	0ns	Vcc=5.5V,Ta=25° C
TRP	26.1ns	0.51	70ns	Vcc=4.5V,Ta=80° C
TREF(Pause)	507.5ms	136.4	16.4ms	Vcc=5.5V,Ta=80° C
TREF(Disturb)	372.6ms	104.7	16.4ms	ditto

Sample Size=20pcs

MITSUBISHI ELECTRIC

Power Supply Current Waveforms of 2nd Generation 4MDARM

Operating Current
Average:85mA
Vcc=5.5V,25℃,Tc=120ns

Stand-by Current
Average:0.5mA
Vcc=5.5V,25℃
MOS Input Level

MITSUBISHI ELECTRIC

RELIABILITY TEST RESULT of 2nd Generation 4MDRAM

300mil SOJ

TESTING ITEM	CONDITION	CHECKING ITEM	FAILURES / SAMPLE SIZE ×1	FAILURES / SAMPLE SIZE ×4
High temperature operating life test	Ta=125℃ Vcc=7.5V t=1000hrs	Function and DC Stability of electrical margins	0/72	1*1/284
	Ta=150℃ Vcc=7.5V t=1000hrs	Function and DC Stability of electrical margins	0/36	0/72
Low temperature operating life test	Ta=-20℃ Vcc=8.0V t=1000hrs	Function and DC Stability of electrical margins	0/30	0/30
High temperature storage test	Ta=175℃ t=1000hrs	Function and DC Stability of electrical margins	0/52	0/160
Temperature cycling test	-65/150℃ 1000cycles	Function and DC	0/68	0/125
Thermal shock test	-55/125℃ 1000cycles	Function and DC	0/25	0/50
Soldering heat test	260℃ 10sec	Function and DC	0/50	0/50
Humidity test with DC bias	85℃ 85%RH Vcc=5.5V t=2000hrs	Function and DC Stability of electrical margins	0/36	0/65
Pressure coocker test with DC bias	140℃ 85%RH Vcc=5.5V t=1000hrs	Function and DC Stability of electrical margins	1*2/36	1*3/135
Pressure coocker test	121℃ 100%RH t=240hrs	Function and DC Stability of electrical margins	0/64	0/96

*1:Single bit failure *2,3:DC failre

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RESULTS OF INFANT MORTALITY STUDY for 2nd Generation 4MDARM

Sample	Condition	Sample size	Failures
M5M44400AJ	Dynamic burn-in Ta=125℃ Vcc=7.5V t=100 hours	2.653	7 (Single bit : 5, Bit line : 2)

* In case the field condition of Ta=55℃ and Vcc=5.0V

$=7/(2.653\times10^{3}\times10^{2}\times2.970\times10^{3})$

=8.9FIT

* In case the field condition of Ta=70℃ and Vcc=5.0V

$=7/(2.653\times10^{3}\times10^{2}\times1.702\times10^{3})$

=15FIT

MITSUBISHI ELECTRIC

Advanced Information

MITSUBISHI BYTE WIDE DRAMs

Specifications for BYTE WIDE 4M DRAM are not final. Some specifications are subject to change.

1. 512K×8/×9

2. 256K×16/×18

(Note)

2 $\overline{CAS}$,1$\overline{W}$ ····· FOR COMPUTERS

1 $\overline{CAS}$,2$\overline{W}$ ····· FOR GRAPHICS

(Note)

Part number of 2 $\overline{CAS}$ type has been changed from M5M44160A to M5M44260A.

MITSUBISHI ELECTRIC

Advanced Information

512K ×8/9 4Mbit DRAM Proposed Spec.

- Same Package : 512K×8 and 512K×9
- Fast Page Mode Support
- Refresh Period : 1024cycles/16ms
  (Refresh Address : A9～A0)
- Package : 28pin 400mil SOJ
  28pin 400mil ZIP
  28pin 400mil TSOP TypeII

MITSUBISHI ELECTRIC

Advanced Information

512K ×8 4M DRAM Target Spec.

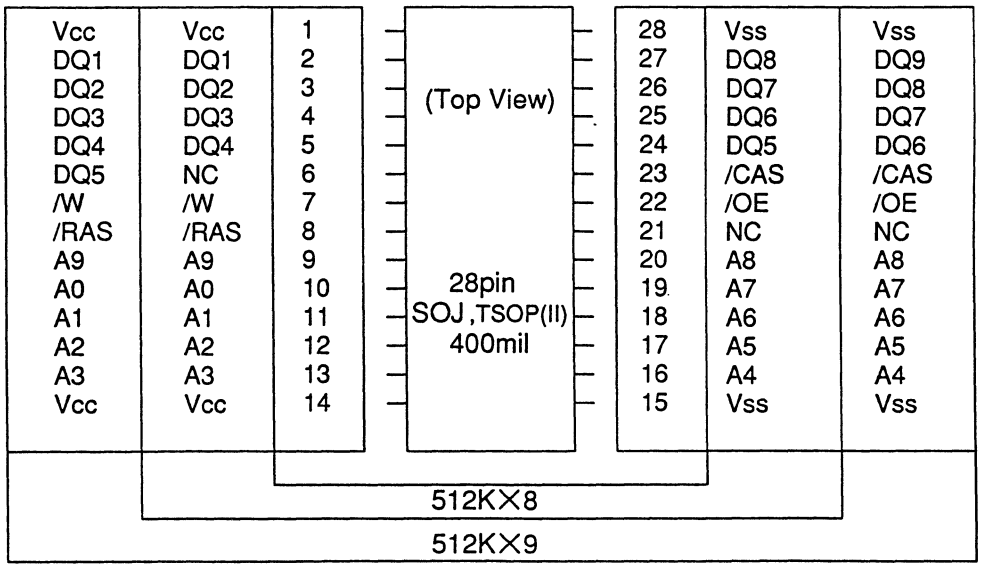
Access Time/Cycle Time		: 60ns/120ns,	70ns/140ns,	80ns/160ns,	100ns/190ns
Power Dissipation* (max)	Operating	: 660mW, (120mA)	550mW, (110mA)	490mW, (90mA)	413mW (75mA)
	Stand by	: 5.5mW(1mA)			
Fast Access Mode		: Fast Page Mode			
Refresh Cycle		: 1024cycles /16ms (Refresh Address A9～A0)			
Package		: 28pin 400mil SOJ 28pin 400mil ZIP 28pin 400mil TSOP(II)			
Technology		: Based on 2nd Generation 4M DRAM chip Twin-well CMOS 0.7 μm minimum feature size Stacked cell structure Double Aluminum layers			

* Low power version with extended CBR refresh being considered.
Icc8=250 μA,Icc2=100 μA,tREF=125 μs

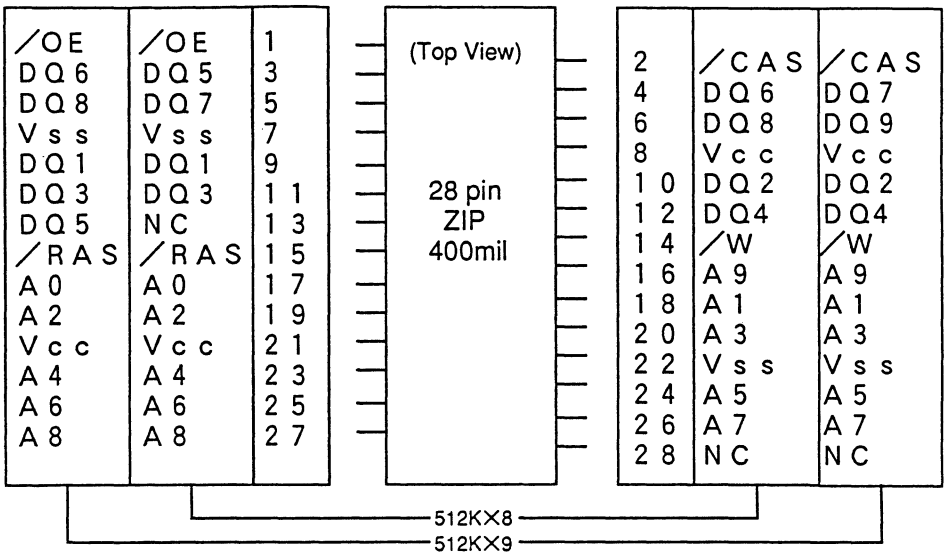
MITSUBISHI ELECTRIC

Advanced Information

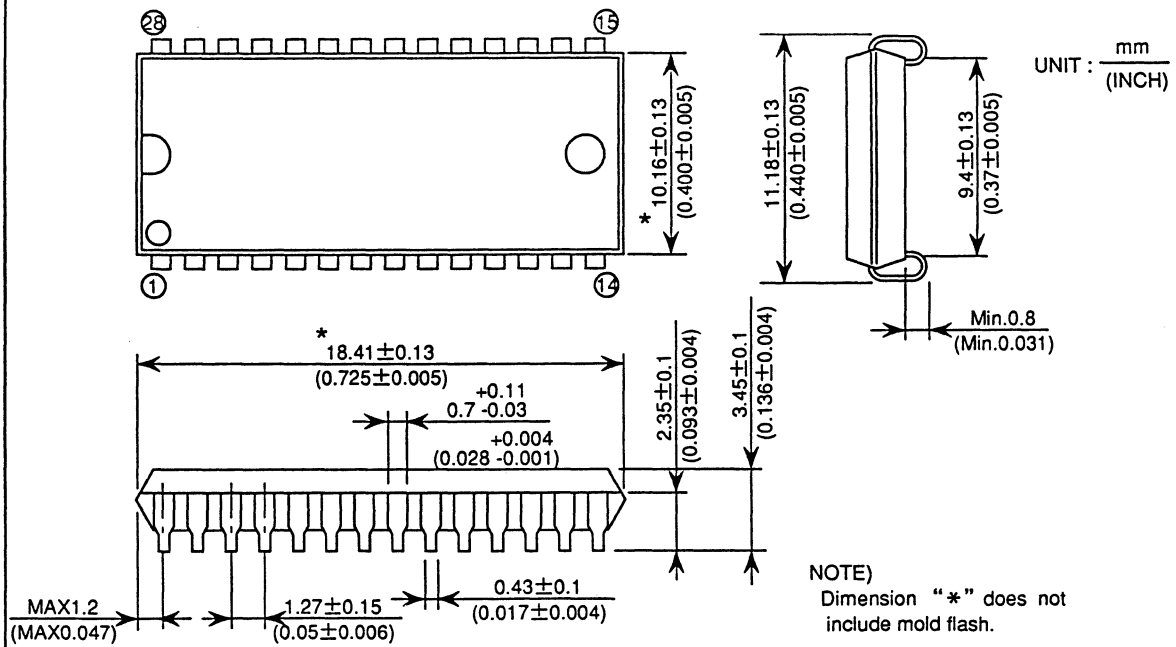
512K×8/9 4Mbit DRAM Pin Configuration



512KX8/9 4Mbit DRAM Pin Configuration



28Pin SOJ For 512KX8 DRAM

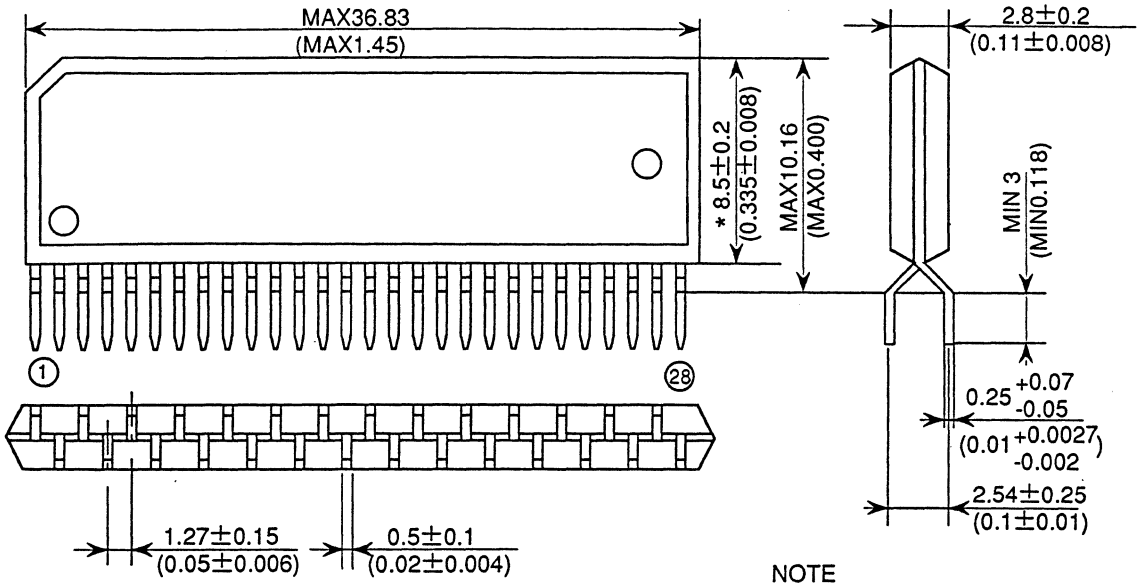


NOTE)
Dimension "*" does not include mold flash.

MITSUBISHI ELECTRIC

Advanced Information

28pin ZIP For 512K×8 DRAM



NOTE
(1) UNIT-mm(INCH).
(2) DIMENSION WITH * DOES NOT INCLUDE MOLD FLASH

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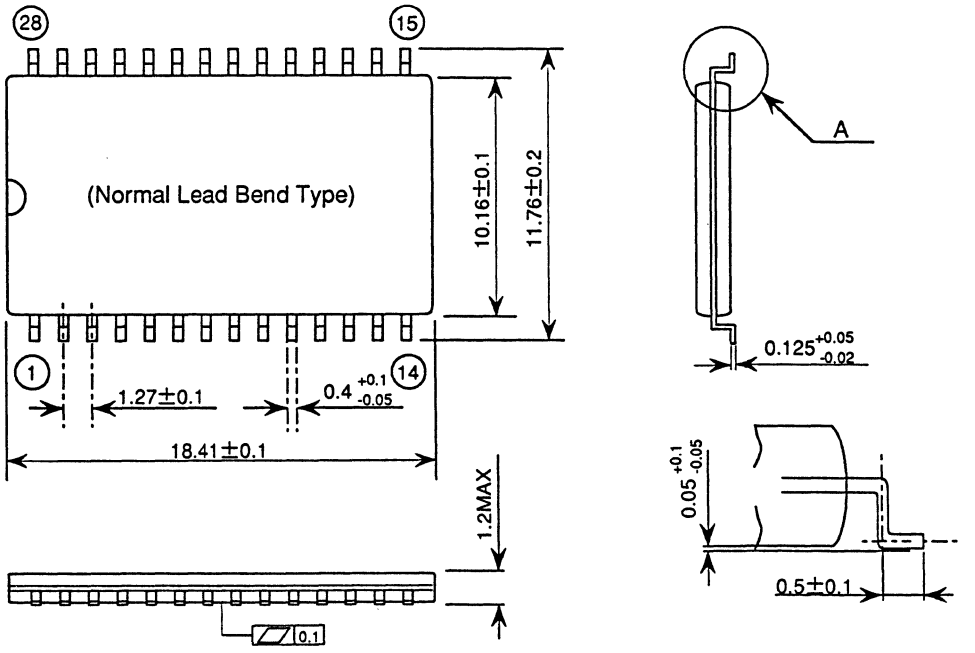
Advanced Information

28pin TSOP(TypeII) For 512K×8 DRAM

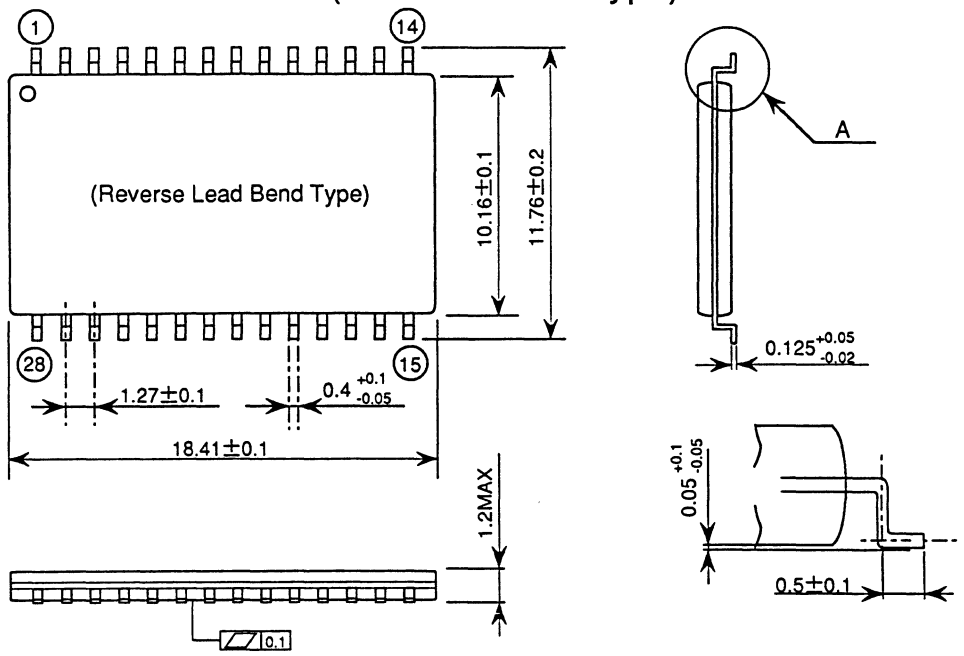


UNIT—mm

MITSUBISHI ELECTRIC

Advanced Information

28pin TSOP(TypeII) For 512K×8 DRAM
(Reverse Bend Type)



MITSUBISHI ELECTRIC

Advanced Information

256K ×16/18 4MbitDRAM Proposed Spec

- Same Package : 256K×16 and 256K×18

- Byte and Word Operation
  - 2$\overline{CAS}$,1$\overline{W}$: Byte/Word Read,Byte/Word Write
  - 1$\overline{CAS}$,2$\overline{W}$: Word Read,Byte/Word Write

- Fast Page Mode Support

- Refresh Period
  - 2$\overline{CAS}$,1$\overline{W}$: 512cycles/8ms
    (Refresh Address : A8～A0)
  - 1$\overline{CAS}$,2$\overline{W}$: 1024cycles/16ms
    (Refresh Address : A9～A0)

- Package : 40pin 400mil SOJ
  44pin 400mil TSOP TypeII

MITSUBISHI ELECTRIC

Advanced Information

256K×16 4M DRAM Target Spec.

		M5M44260A **) (2CAS,1W)	M5M44170A (1CAS,2W)
Access Time /Cycle Time (ns)		(60/120,70/140*),80/160,100/190	60/120,70/140,80/160,100/190
Power Dissipation (ma x)	Operating mW (mA)	[1045, 908]*) 770, 660 [190, 165] 140, 120)	770, 660, 578, 495 (140, 120, 105, 90)
	Stand by mW(mA)	5.5(1.0)	5.5(1.0)
Refresh Cycle (Refresh Address)		512cycles/8ms (A8～A0)	1024cycles/16ms (A9～A0)
Package		40pin 400mil SOJ 44pin400mil TSOP(II)	
Technology		Same as 512K×8 4M DRAM	
Low Power Version Refresh Current(μA) (tc=125 μs)		Yes 350	Yes 250

*) Depend on maximum allowable power dissipation

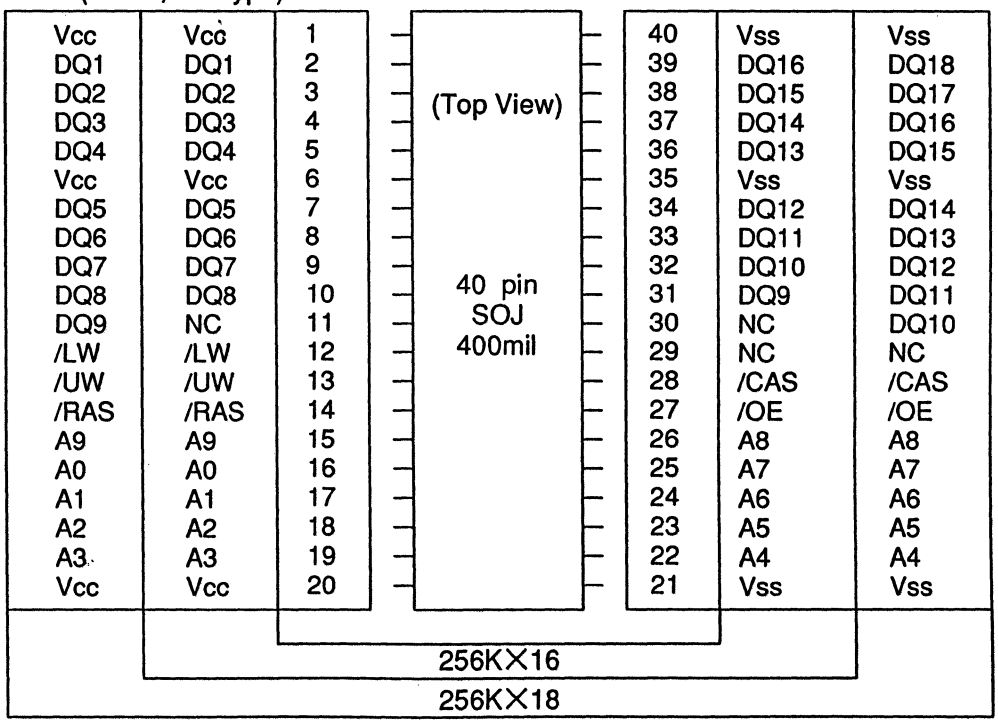
**) Part number of 2 $\overline{CAS}$ type has been changed from M5M44160A to M5M44260A

MITSUBISHI ELECTRIC

Advanced Information

256K×16/18 4Mbit DRAM Pin Configuration

(1$\overline{CAS}$,2$\overline{W}$ Type)



MITSUBISHI ELECTRIC

Advanced Information

256K×16/18 4Mbit DRAM Pin Configuration

(2$\overline{CAS}$,1$\overline{W}$ Type)

Vcc	Vcc	1	40	Vss	Vss
DQ1	DQ1	2	39	DQ16	DQ18
DQ2	DQ2	3	38	DQ15	DQ17
DQ3	DQ3	4	37	DQ14	DQ16
DQ4	DQ4	5	36	DQ13	DQ15
Vcc	Vcc	6	35	Vss	Vss
DQ5	DQ5	7	34	DQ12	DQ14
DQ6	DQ6	8	33	DQ11	DQ13
DQ7	DQ7	9	32	DQ10	DQ12
DQ8	DQ8	10	31	DQ9	DQ11
DQ9	NC	11	30	NC	DQ10
NC	NC	12	29	/LCAS	/LCAS
/W	/W	13	28	/UCAS	/UCAS
/RAS	/RAS	14	27	/OE	/OE
NC	NC	15	26	A8	A8
A0	A0	16	25	A7	A7
A1	A1	17	24	A6	A6
A2	A2	18	23	A5	A5
A3	A3	19	22	A4	A4
Vcc	Vcc	20	21	Vss	Vss

(Top View)

40 pin
SOJ
400mil

256K×16

256K×18

MITSUBISHI ELECTRIC

256K×16/18 4Mbit DRAM Pin Configuration

(1$\overline{CAS}$,2$\overline{W}$ Type)

Vcc	Vcc	1	44	Vss	Vss
DQ1	DQ1	2	43	DQ16	DQ18
DQ2	DQ2	3	42	DQ15	DQ17
DQ3	DQ3	4	41	DQ14	DQ16
DQ4	DQ4	5	40	DQ13	DQ15
Vcc	Vcc	6	39	Vss	Vss
DQ5	DQ5	7	38	DQ12	DQ14
DQ6	DQ6	8	37	DQ11	DQ13
DQ7	DQ7	9	36	SQ10	DQ12
DQ8	DQ8	10	35	DQ9	DQ11
NL	NL	11	34	NL	NL
NL	NL	12	33	NL	NL
DQ9	NC	13	32	NC	DQ10
/LW	/LW	14	31	NC	NC
/UW	/UW	15	30	/CAS	/CAS
/RAS	/RAS	16	29	/OE	/OE
A9	A9	17	28	A8	A8
A0	A0	18	27	A7	A7
A1	A1	19	26	A6	A6
A2	A2	20	25	A5	A5
A3	A3	21	24	A4	A4
Vcc	Vcc	22	23	Vss	Vss

(Top View)

44 pin
TSOP(II)
400mil

256K×16

256K×18

NL=NO LEAD

MITSUBISHI ELECTRIC

256K×16/18 4Mbit DRAM Pin Configuration

(2$\overline{CAS}$,1$\overline{W}$ Type)

Vcc	Vcc	1	44	Vss	Vss
DQ1	DQ1	2	43	DQ16	DQ18
DQ2	DQ2	3	42	DQ15	DQ17
DQ3	DQ3	4	41	DQ14	DQ16
DQ4	DQ4	5	40	DQ13	DQ15
Vcc	Vcc	6	39	Vss	Vss
DQ5	DQ5	7	38	DQ12	DQ14
DQ6	DQ6	8	37	DQ11	DQ13
DQ7	DQ7	9	36	DQ10	DQ12
DQ8	DQ8	10	35	DQ9	DQ11
NL	NL	11	34	NL	NL
NL	NL	12	33	NL	NL
DQ9	NC	13	32	NC	DQ10
NC	NC	14	31	/LCAS	/LCAS
/WE	/WE	15	30	/UCAS	/UCAS
/RAS	/RAS	16	29	/OE	/OE
NC	NC	17	28	A8	A8
A0	A0	18	27	A7	A7
A1	A1	19	26	A6	A6
A2	A2	20	25	A5	A5
A3	A3	21	24	A4	A4
Vcc	Vcc	22	23	Vss	Vss
		256K×16			
	256K×18				

(Top View)

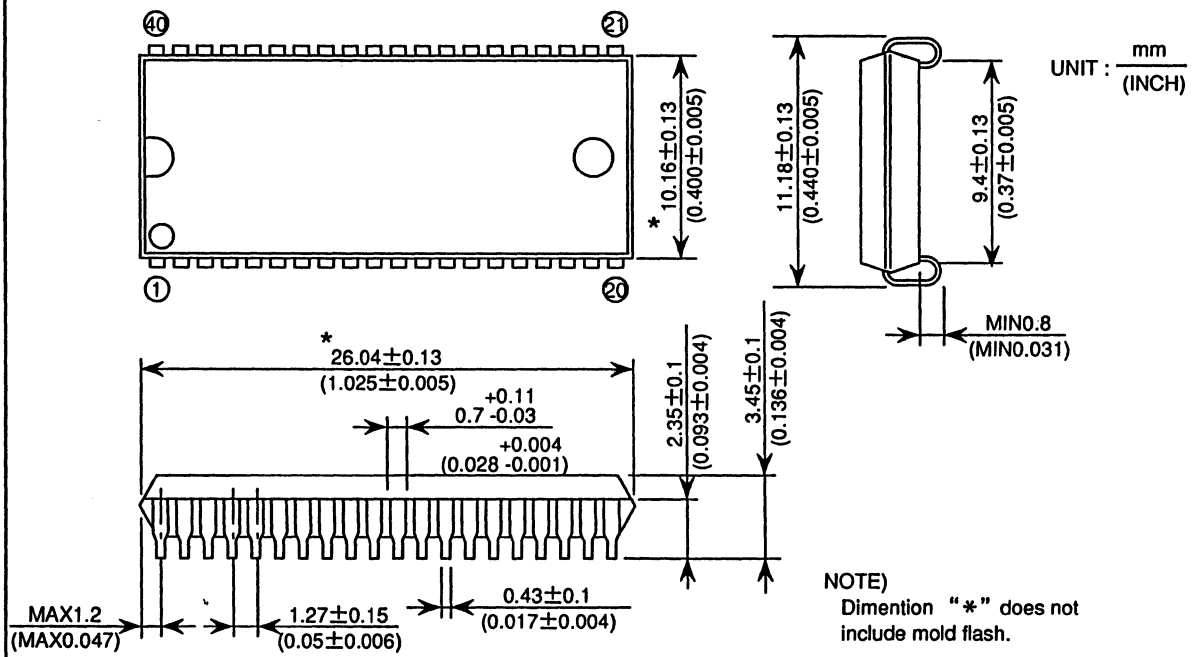
44 pin
TSOP(II)
400mil

NL=NO LEAD

MITSUBISHI ELECTRIC

Advanced Information

40Pin SOJ For 256K×16 DRAM

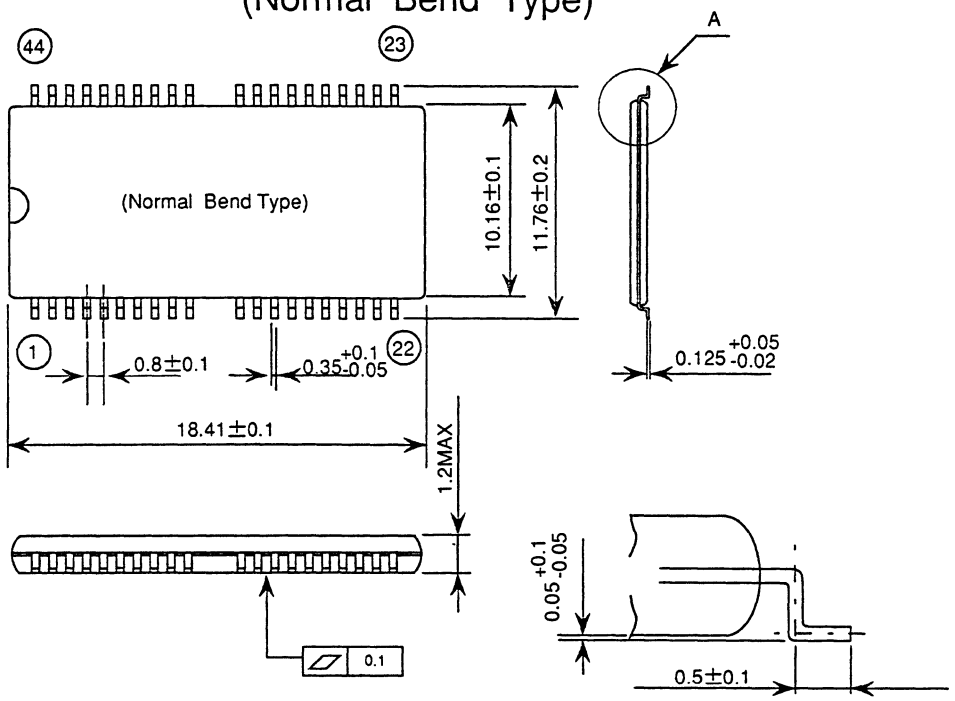


NOTE)
Dimention "*" does not include mold flash.

MITSUBISHI ELECTRIC

44pin TSOP (TypeII) For 256K×16DRAM

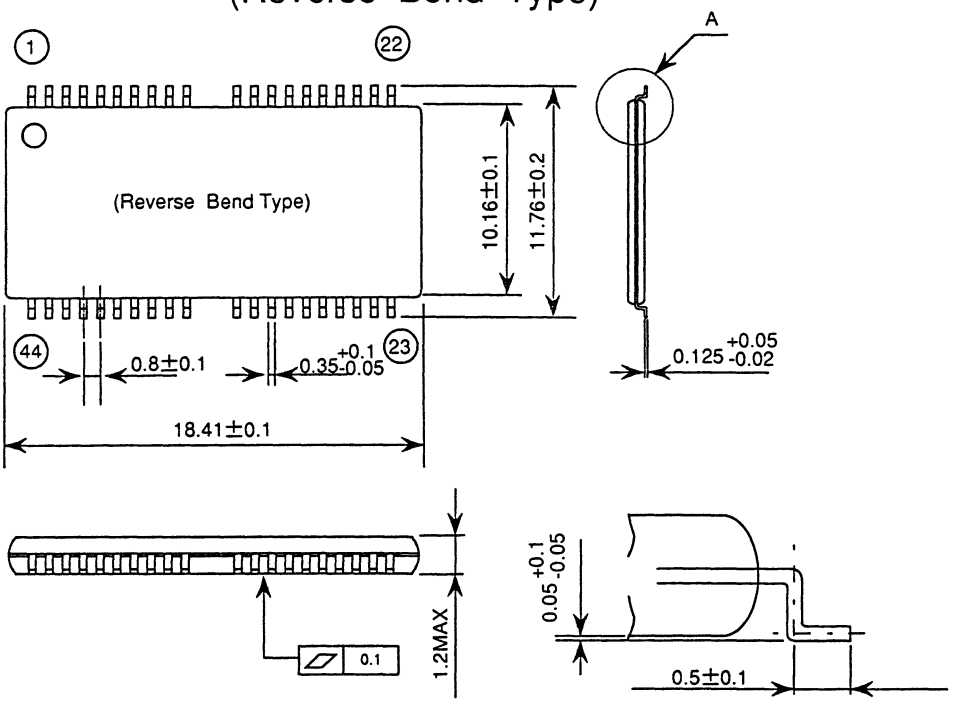
(Normal Bend Type)



MITSUBISHI ELECTRIC

44pin TSOP (TypeII) For 256K×16 DRAM

(Reverse Bend Type)



MITSUBISHI ELECTRIC

Advanced Information

4M SILICON FILE

1.Ultra Low Power ; Battery Drive / Back Up
2.4Mx1 / 1Mx4
3.Pin Compatible with Existing Standard 4M
4.Fast Access Time
5.Fast Page Mode Support
6.Entering into Self Refresh Mode by
RAS Clock Toggling at Slow Freguency

MITSUBISHI ELECTRIC

Advanced Information

4M SILICON FILE TARGET SPEC

4Mx1 /1Mx4	26pin 300mil SOJ
Power Dissipation	Icc 1 =90mA (tc=160ns) Icc 2 =0.5mA
Ultra Low Self Refresh Current	Icc 8 = 30 μA(Ta=50℃) 60 μA(Ta=60℃) 120 μA(Ta=70℃)
Fast Access	tRAC /tC =80ns / 160ns tCAA =40ns tCAC /tPC =20ns / 50ns (Fast Page)
Refresh	$\overline{CAS}$ before $\overline{RAS}$ Refresh,$\overline{RAS}$ only Refresh Hidden Refresh
Normal Refresh	1024 cycles / 32ms
Sample	1992 / M

MITSUBISHI ELECTRIC

Advanced Information

4M SILICON FILE Self Refresh

- $\overline{RAS}$ clock Toggleing by Maintaining $\overline{CAS}$ Low to Stabilize Substrate Voltage
- Different from Existing $\overline{RAS}$ = $\overline{CAS}$ = Low Self Refresh
- Power Dissipation / pcs Consumed by $\overline{RAS}$ Clock Generator is Small
- Ideal to the Systems where Low Power is Essential at Data Hold Period

  Battery Drive, Battery Back UP
- Development of the DRAM controller being Considered.

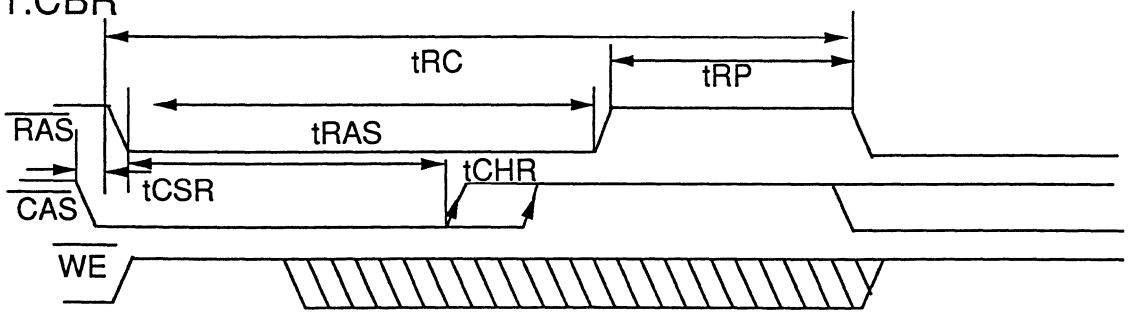
  MPU : 80286, 80386SX

MITSUBISHI ELECTRIC

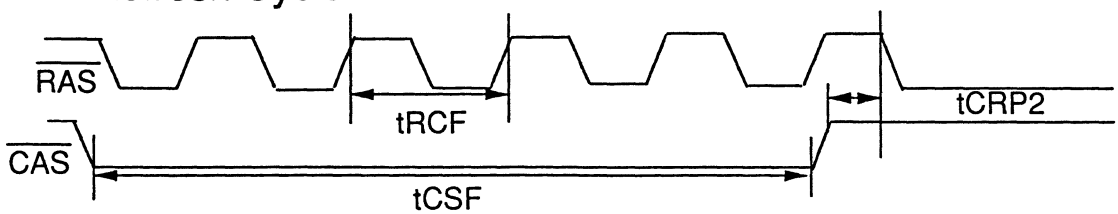
Advanced Information

4M SILICON FILE Refreshing

1.CBR



2.Self Refresh Cycle



tRCF = 32 μs, 16 μs, 8 μs

Ta = 50 ℃, 60 ℃, 70 ℃

MITSUBISHI ELECTRIC

SPEC of 3rd Generation 1M DRAM

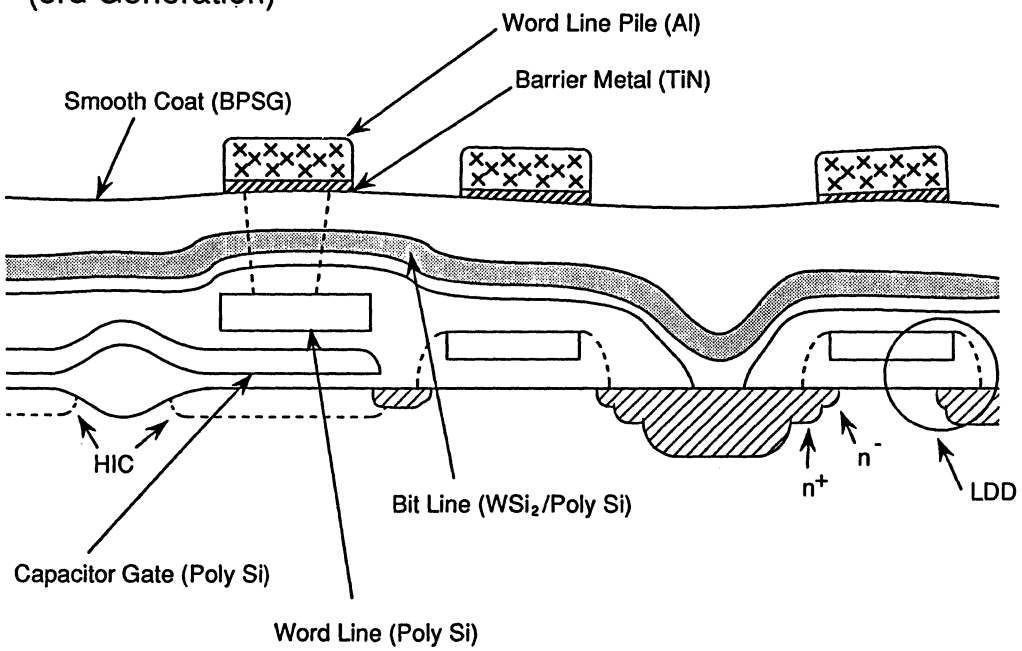
(M5M41000B
M5M44256B)

- ☐ Organization ×1, ×4 (Al-mask masterslice)
- ☐ Optional Function Fast Page
  Nibble (only ×1)
  Static Column
  Write per bit (only ×4)
  } bonding Option
- ☐ Characteristics Access time 70ns/80ns (/100ns)
  80mA/70mA (/60mA)
- ☐ Chip Size 44.2mm²

MITSUBISHI ELECTRIC

Memory Cell Structure of 1M DRAM

(3rd Generation)



MITSUBISHI ELECTRIC

Mitsubishi 3rd Generation 1MDRAM Series

Parts Number	Description	Package	Stand-by Power Speed Item
M5M41000BP,J,L	1M×1,Fast Page Mode	DIP,SOJ,ZIP	-7,-8,-10
			-7L,-8L,-10L
			-6
M5M41000BVP,RV		TSOP Type I	-7,-8,-10
			-7L,-8L,-10L
M5M41001BP,J,L	1M×1,Nibble Mode	DIP,SOJ,ZIP	-7,-8,-10
M5M41002BP,J,L	1M×1,Static Column Mode	DIP,SOJ,ZIP	-7,-8,-10
M5M44256BP,J,L	256K×4,Fast Page Mode	DIP,SOJ,ZIP	-7,-8,-10
			-7L,-8L,-10L
			-6
M5M44256BVP,RV		TSOP Type I	-7,-8,-10
			-7L,-8L,-10L
M5M44258BP,J,L	256K×4,Static Column Mode	DIP,SOJ,ZIP	-7,-8,-10
M5M44266BP,J,L	256K×4,Fast Page,Write per bit	DIP,SOJ,ZIP	-7,-8,-10
M5M44268BP,J,L	256K×4,Static Column,Write per bit	DIP,SOJ,ZIP	-7,-8,-10

- Organization (×1／×4)…Al master slice
- Function (Fast Page／Nibble／Static Column／Write per Bit)…Wire Bonding Option
- "L" version…Selection (Stand-by power max : 200 μA)
- Package (DIP-SOJ／ZIP-TSOP…Wire Bonding Option

MITSUBISHI ELECTRIC

1M DRAM "LOW POWER VERSION"

(M5M41000BP, J, L VP,RV-7L,-8L,-10L)
(M5M44256BP, J, L VP,RV-7L,-8L,-10L)

Feature:

Stand by Current I_{CC2} = 200uA max
($\overline{RAS}$,$\overline{CAS}$,$\overline{OE}$ = Vcc-0.2V)

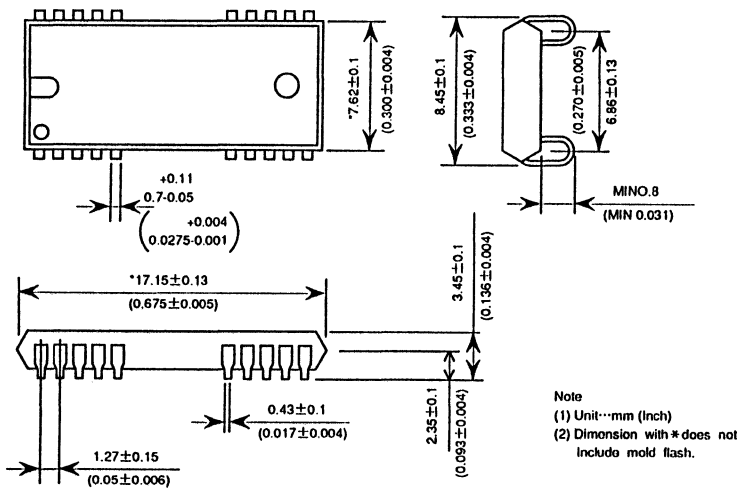
Refresh Current I_{CC8} = 200uA max

(Battery Back Up Mode) { $\overline{CAS}$ Before $\overline{RAS}$ Refresh, $\overline{OE}$ = VCC-0.2V, tc = 125 μs }

Refresh Cycle Time t_{REF} = 64msmax

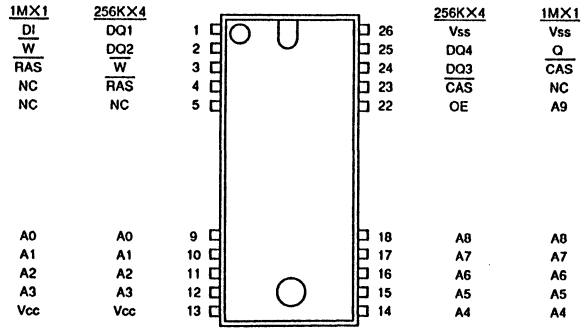
26Pin SOJ for 1M×1 & 256K×4

Outline Drawing (Final)



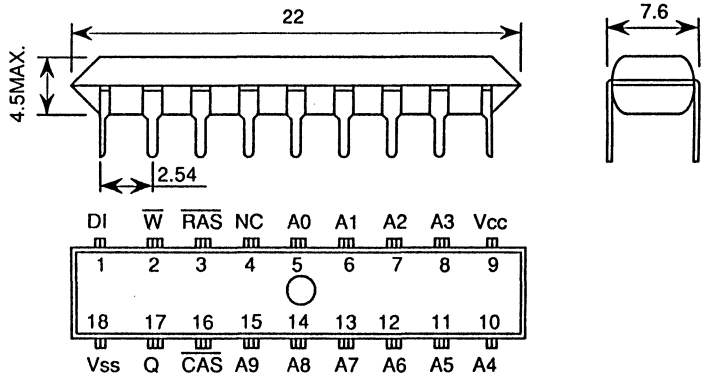
Note
(1) Unit…mm (Inch)
(2) Dimension with * does not include mold flash.

Pin Configuration



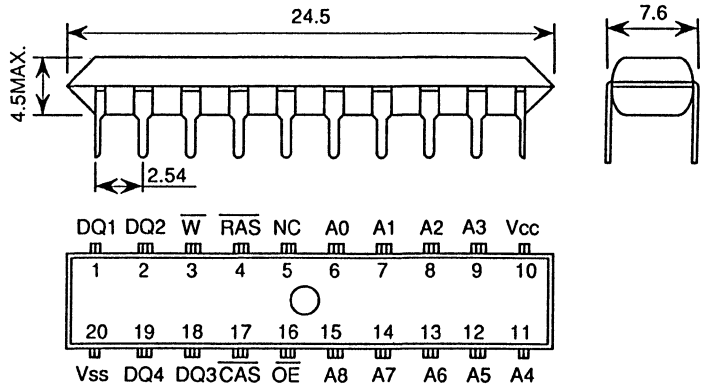
MITSUBISHI ELECTRIC

PACKAGE DIMENSION and PIN CONFIGURATION OF 1M×1 DRAM



(BOTTOM) DIMENSION IN MM

PACKAGE DIMENSION and PIN CONFIGURATION OF 256K×4 DRAM



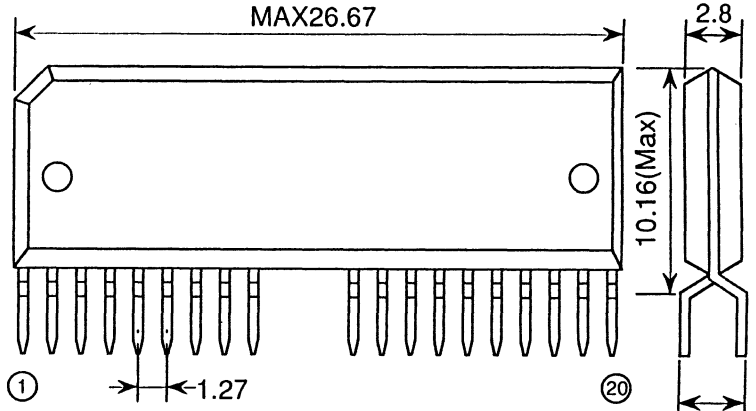
(BOTTOM) DIMENSION IN MM

Comparison between P-DIP, SOJ and ZIP for M5M41000A and M5M41000B

Package	P-DIP	SOJ	ZIP
Pin number	18 (20*)	20	20
Plastic material	Epoxy - resin	Same	Same
Lead frame material	Fe - Ni 42alloy	Same	Same
Die attach	Soft solder	Same	Same
Wire bonding material	Au 30 μm ϕ	Same	Same
Wire bonding method	Thermosonic	Same	Same
Lead frame finish	Sn/Pb plating	Same	Same
α Flux of plastic material	$\langle$0.001 CpH	Same	Same

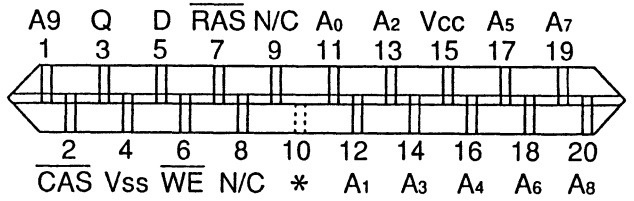
* : M5M44256A and M5M44256B

Package dimension and pin configuration (Bottom view) of 20 pin ZIP

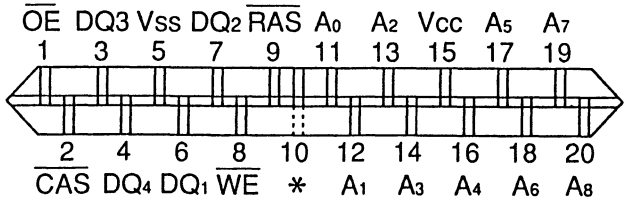


Dimension in mm

M5M41000BL (1M×1 DRAM)



M5M44256BL (256K×4 DRAM)



Note : * means no lead

MITSUBISHI ELECTRIC

1M DRAM DIP,SOJ,ZIP,TSOP
Thermal Resistance (3rd generation)

1. 1M×1 (CMOS)

Package Type	Package Name	θJA (℃/W)			θJC (℃/W)
		Hanging	Mounted on standard PCB		In fluorinert liquid
		0 (f/m)	0 (f/m)	200 (f/m)	
DIP	18P4 Y	100	76	60	19
SOJ	26P0 J	113	81	64	18
ZIP	20P5 L	98	75	60	19
TSOP	24P3 B	150	94	74	17

2. 256K×4

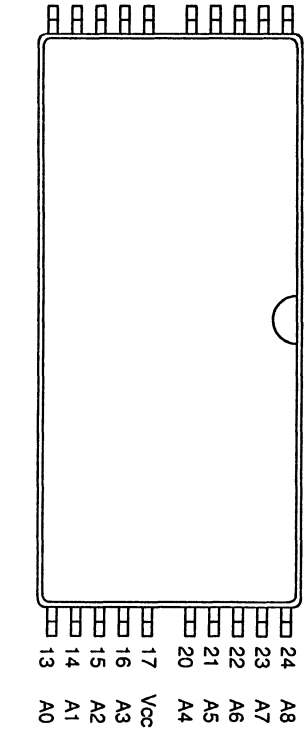
Package Type	Package Name	θJA (℃/W)			θJC (℃/W)
		Hanging	Mounted on standard PCB		In fluorinert liquid
		0 (f/m)	0 (f/m)	200 (f/m)	
DIP	20P4 Y	96	74	59	19
SOJ	26P0 J	113	81	64	18
ZIP	20P5 L	98	75	60	19
TSOP	24P3 B	150	94	74	17

Note
(1) Standard PCB
Material···glass epoxy (one side face Cu pattern)
size···70mm×70mm,1.6mm (thickness)
Cu thickness···18 μm
(2) f/m···feet/minute
(200f/m=1m/s)

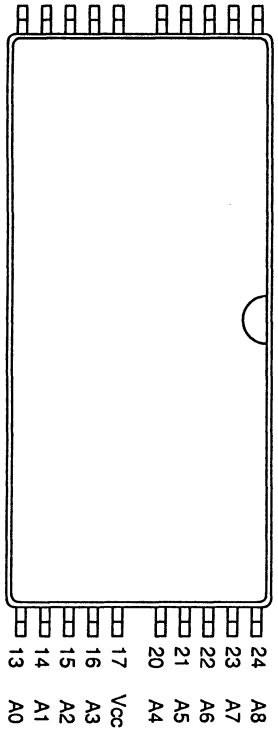
MITSUBISHI ELECTRIC

Pin configuration (Top view) of 256K×4 & 1M×1DRAM TSOP

1. 256K×4 (M5M44256BVP,M5M44266BVP)



2. 1M×1 (M5M41000BVP)



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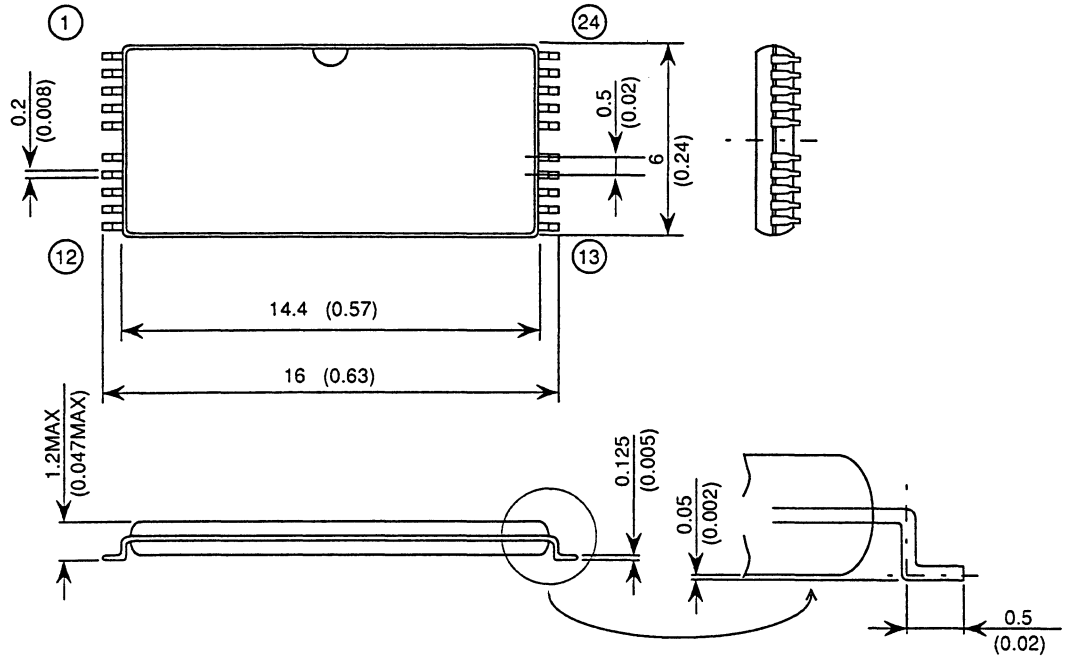
Dimension of 24pin TSOP



Unit ··· mm (inch)

MITSUBISHI ELECTRIC

Comparison of TSOP and SOJ package for 1M DRAM

Items		TSOP	SOJ
Package size	Plane(mm^2)	16.0×6.0* (96.0)	17.15×8.45 (144.9)
	Height(mm)	1.2	3.45
Lead pitch (mm)		0.5	1.27
Standard memory Module 1M×9 (mm^3)		88.9×25.4×2.54 (5735)	88.9×20.3×5.08 (9167)
Reliability		Care (Thermal Stress)	Very Good
Weight (g)		0.22	0.75
Production cost (Ratio)		1.1	1.0
Sample Schedule		Yes	Production

*Need the chip - capacitor area

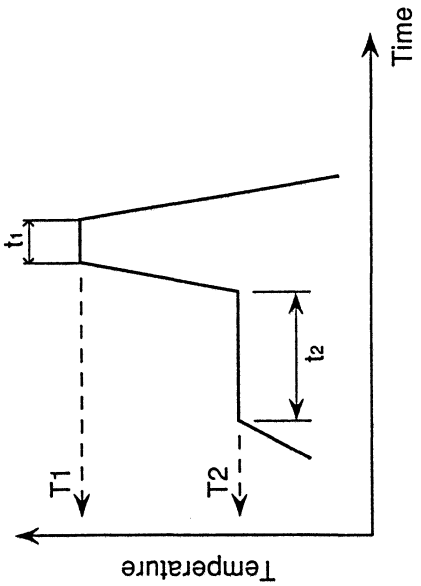
Package Reliability in 1M DRAM

Test	Condition	Failures/Sample Size		
		DIP	ZIP	SOJ
Solderability	230℃ , 5sec	0/10×5	0/10×5	0/10×5
Resistance To Solvent	Solvent (Acetone, Isopropyl Alcohol, Trichloroethane)	0/10×3	0/10×3	0/10×3
Lead Pull	230g , 30sec	0/10×3	0/10×3	0/10×3
Lead Bend	230g ,90℃, 3Times	0/10×3	0/10×3	0/10×3
Radiography	Check of Lead Frame Die Attach Au - Wire Resin Void	0/20×5	0/20×5	0/20×5
Salt Atmosphere	35℃ , 5% , Solt 48 hours	0/10×3	0/10×3	0/10×3

Recommendation For Solder Reflow

1. Baking before Solder Reflow
   Baking condition ; Ta = 125℃
   Duration = 20 ~ 24hrs

2. Temperature Profile of VPS



T1 : 215℃ max.
T2 : 150℃±10℃
t1 : 20sec max.
t2 : approx. 2min.
Slope = 1℃ ~ 4℃/sec.

AS Memory

High Speed
Low Power
New Function
Multi Bit

MITSUBISHI ELECTRIC

1M BIT DUAL - PORT DYNAMIC RAM

2nd Generation (A.ver)

Design Concepts

- ○ Based on the 256K VRAM Architecture
- ○ High Speed — tRAC = 70nsMAX, tSCC = 30nsMAX
- ○ Low Power — CMOS
- ○ Relaxed Real Time Transfer Timing (Split SAM Architecture)
- ○ High Performance
  - Flash Write (X4/X8)
  - Block Write (X4/X8)
- ○ High Density Package
  - 28pin ZIP/SOJ (X4)
  - 40pin SOJ (X8)
- ○ Productivity
  - Aluminum Master Sliced X4/X8
- ○ High Quality
  - Based on the 1M DRAM (III) Process/Memory Cell

MITSUBISHI ELECTRIC

1M bit Dual Port DRAM Feature

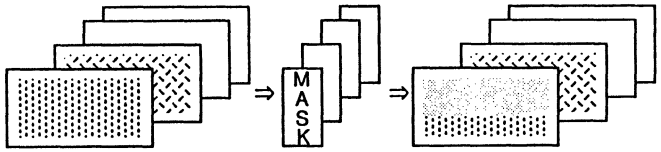
2nd Generation (Aver.)

	M5M442256A	M5M482128A
RAM Size	256K×4	128K×8
SAM Size	512×4	256×8
Serial IN/OUT	YES	YES
Write per Bit	YES	YES
Split SAM	YES	YES
Flash Write	YES	YES
Block Write	YES	YES
Fast Page Mode	YES	YES
ZIP Package (400Mil)	YES (28 Pin)	-------
SOJ Package (400Mil)	YES (28 Pin)	YES(40 Pin)
DIP Package	-------	-------

MITSUBISHI ELECTRIC

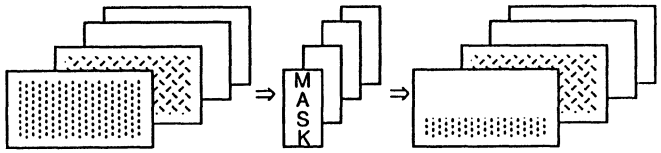
Dual Port DRAM Feature

Write per bit



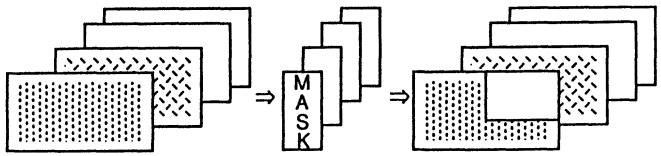
Masked Write

Flash Write



Fast Clear

Block Write



Window Clear

MITSUBISHI ELECTRIC

NEW

M5M442256A
256K×4bit Dual Port DRAM

Feature

Dual Port RAM
- RAM Port 256K×4bit
  - tRAC 70/80/100ns Max
- SAM Port 512×4bit
  - tSCC 30/30/30ns Max

- ○Bi - directional Date Transfer between RAM and SAM
- ○Bi - directional SAM Port
- ○Addressable Start Pointer of SAM
- ○Fully Asynchronous Dual Port Accessability
- ○Write per Bit Function
- ○Relaxed Real Time Data Transfer (Split SAM architecture)
- ○Flash Write Function
- ○Block Write Function
- ○Fast Page Mode,Hidden Refresh and CAS befor RAS Refresh
- ○512 cycle/8ms Refresh
- ○Low Power (CMOS)

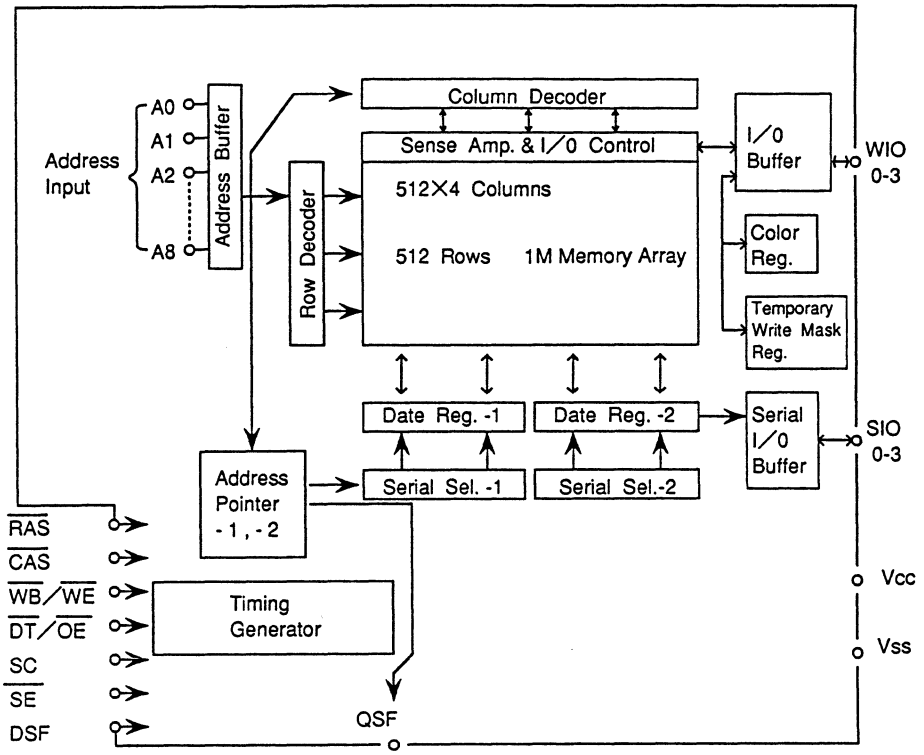
RAM Port/SAM Port	100ns Ver.
Standby/Standby	5mA Max.
Active/Standby	60mA Max.
Standby/Active	35mA Max.
Active/Active	90mA Max.

- ○28pin 400mil ZIP/SOJ

MITSUBISHI ELECTRIC

M5M442256A

256K×4bit Dual Port DRAM BLOCK DIAGRAM

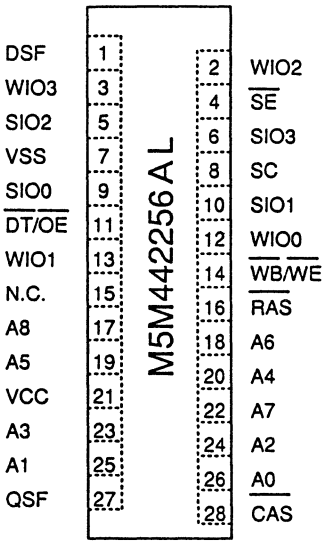


MITSUBISHI ELECTRIC

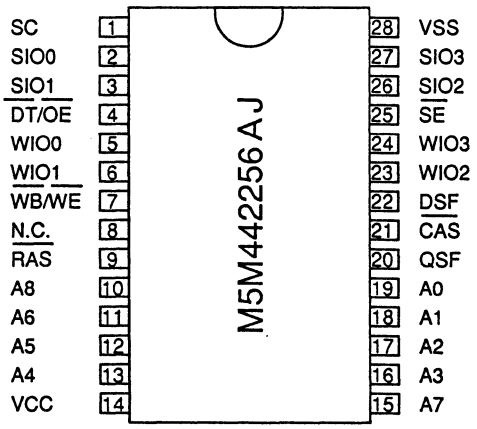
M5M442256A

256K×4 BIT DUAL-PORT DRAM

PIN CONFIGURATION



400mil 28pin ZIP
28P5L



400mil 28pin SOJ
28P0K

MITSUBISHI ELECTRIC

M5M442256 A
256K×4bit Dual Port DRAM

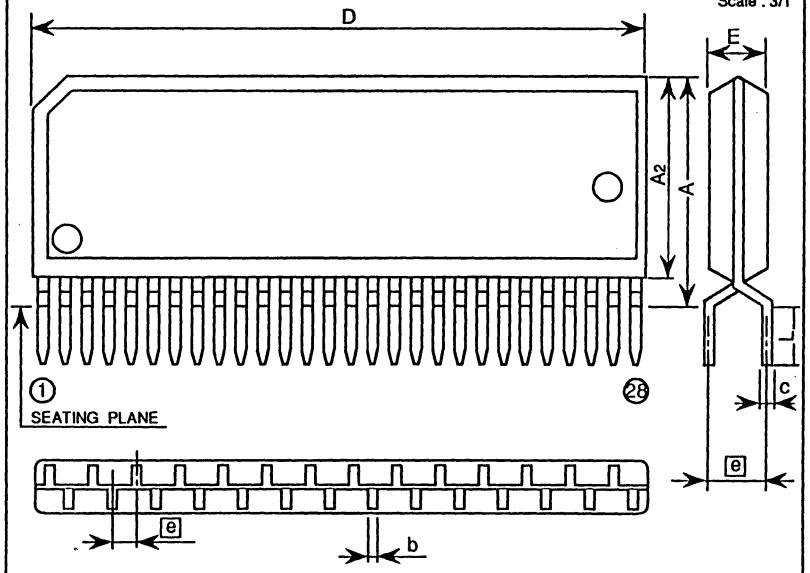
MITSUBISHI SEMICONDUCTOR PACKAGES

28P5L

Plastic 28Pin ZIP

Package Name	Lead Treatment	Weight(g)	EIAJ Code No.	JEDECCode No.
28P5L	Solder plating		—	—

Scale : 3/1



Symbol	Dimension in Millimeters			Dimension in Inches		
	Min	Nom	Max	Min	Nom	Max
A	-	-	10.16	-	-	0.400
A_2	8.3	8.5	8.7	0.327	0.335	0.343
b	0.4	0.5	0.6	0.016	0.020	0.024
c	0.2	0.25	0.32	0.008	0.010	0.013
D	35.35	35.55	35.75	1.392	1.400	1.407
E	2.6	2.8	3.0	0.102	0.110	0.118
e	-	1.27	-	-	0.050	-
e	-	2.54	-	-	0.100	-
L	3.0	-	-	0.118	-	-

MITSUBISHI ELECTRIC

M5M442256 A
256K×4bit Dual Port DRAM

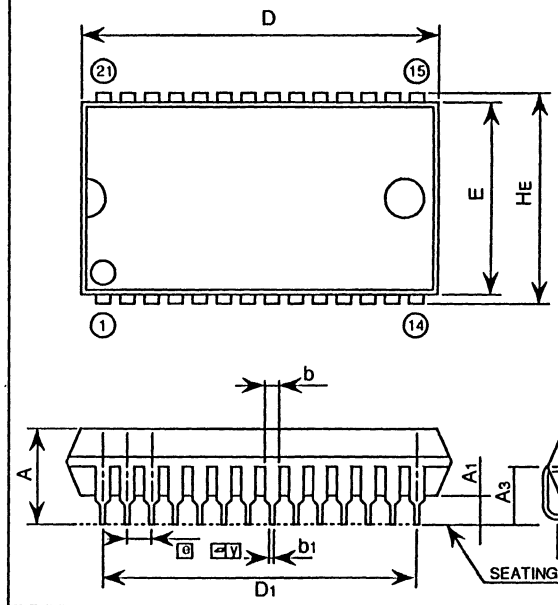
MITSUBISHI SEMICONDUCTOR PACKAGES

28POK

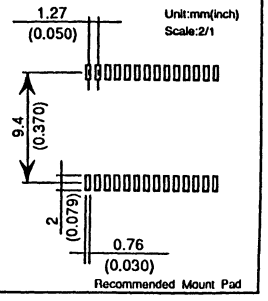
Plastic 28pin 400mil SOI

Package Name	Lead Treatment	Weight(g)	EIAJ Code No.	JEDECCode No.
28POK	Solder plating		—	—

Scale:4/1



Symbol	Dimension in Millimeters			Dimension in Inches		
	Min	Nom	Max	Min	Nom	Max
A	-	-	3.55	-	-	0.140
A_1	0.8	-	-	0.031	-	-
A_2	2.25	2.35	2.45	0.089	0.093	0.096
b	0.67	0.7	0.81	0.026	0.028	0.032
b_1	0.33	0.43	0.53	0.013	0.017	0.021
D	18.28	18.41	18.54	0.720	0.725	0.730
D_1	-	16.51	-	-	0.65	-
E	10.03	10.16	10.29	0.395	0.400	0.405
E_1	9.27	9.4	9.53	0.365	0.370	0.375
e	-	1.27	-	-	0.050	-
HE	11.05	11.18	11.31	0.435	0.440	0.445
y	-	-	0.1	-	-	0.004



M5M442256A 256K×4bit Dual port DRAM
M5M482128A 128K× 8bit Dual port DRAM

Table

	/RAS falling edge							CAS falling edge				Write Mask Op.	Raster Op.	Register			
code mnemonic	CAS	DT/ OE	WB/ WE	DSF	SE	Addr.	WIOn	WB/ WE	DSF	Addr.	WIOn			Write Mask WM1 temporary	Write Mask WM2 persistant	color	
option	0	0	0	0	-	-	-	-	-	-	-	-	-	-	-	-	None Use
	0	0	0	1	-	-	-	-	-	-	-	-	-	-	-	-	C.B.R
CBR	0	0	1	0	-	-	-	-	-	-	-	-	-	-	-	-	C.B.R
	0	0	1	1	-	-	-	-	-	-	-						
CBR	0	1	1	0	-	-	-	-	-	-	-	-	-	-	-	-	C.B.R
	0	1	1	1	-	-	-	-	-	-	-						
MWT/ PWT	1	0	0	0	0/1	Row	WM1	-	0	TAP	-	Yes per Row	-	Lord Use	-	-	Wr. Transfer(/SE=0) Pseudo Wr. Transfer(/SE=1)
	1	0	0	0	0/1	Row	WM1	-	1	TAP	-						
SWT	1	0	0	1	-	Row	WM1	-	0	TAP	-	Yes per Row	-	Lord Use	-	-	Split Write Transfer with New Mask
	1	0	0	1	-	Row	WM1	-	1	TAP	-						
RT	1	0	1	0	-	Row	-	-	0	TAP	-	-	-	-	-	-	Read Transfer
	1	0	1	0	-	Row	-	-	1	TAP	-						
SRT	1	0	1	1	-	Row	-	-	0	TAP	-	-	-	-	-	-	Split Read Transfer
	1	0	1	1	-	Row	-	-	1	TAP	-						
RWNM	1	1	0	0	-	Row	WM1	*E/L	0	Col	DQin	Yes	-	Lord Use	-	-	Read Write with New Mask
BWNM	1	1	0	0	-	Row	WM1	-	1	Col	Sel.	Yes	-	Lord Use	-	Use	Block Write with New Mask
FWT	1	1	0	1	-	Row	WM1	-	0	-	-	Yes per Row	-	Lord Use	-	-	Flash Write with New Mask
	1	1	0	1	-	Row	WM1	-	1	-	-						
RW	1	1	1	0	-	Row	-	*E/L	0	Col	DQin	-	-	-	-	-	Read/ Write with No Mask
BW	1	1	1	0	-	Row	-	-	1	Col	Sel.	-	-	-	-	Use	Block Write with No Mask
LCR	1	1	1	1	-	Ref	-	*E/L	0	-	CLR.	-	-	-	-	Lord	Load Color Reg.
	1	1	1	1	-	Ref	-	*E/L	1	-	CLR.						

※E/L:Early write/Late write

MITSUBISHI ELECTRIC

M5M482128A
128K×8bit Dual - Port DRAM

Feature

- ○Dual Port RAM
  - RAM Port 128K×8bit
    - tRAC 70／80／100ns Max.
  - SAM Port
    - tSCC 30／30／30ns Max
- ○Bi - directional Date Transfer between RAM and SAM
- ○Bi - directional SAM Port
- ○Addressable Start Pointer of SAM
- ○Fully Asynchronous Dual Port Accessability
- ○Write per Bit Function
- ○Relaxed Real Time Data Transfer (Split SAM architecture)
- ○Flash Write Function
- ○Block Write Function
- ○Fast Page Mode,Hidden Refresh and／CAS befor／RAS Refresh
- ○512 cycle／8ms Refresh
- ○Low Power (CMOS)

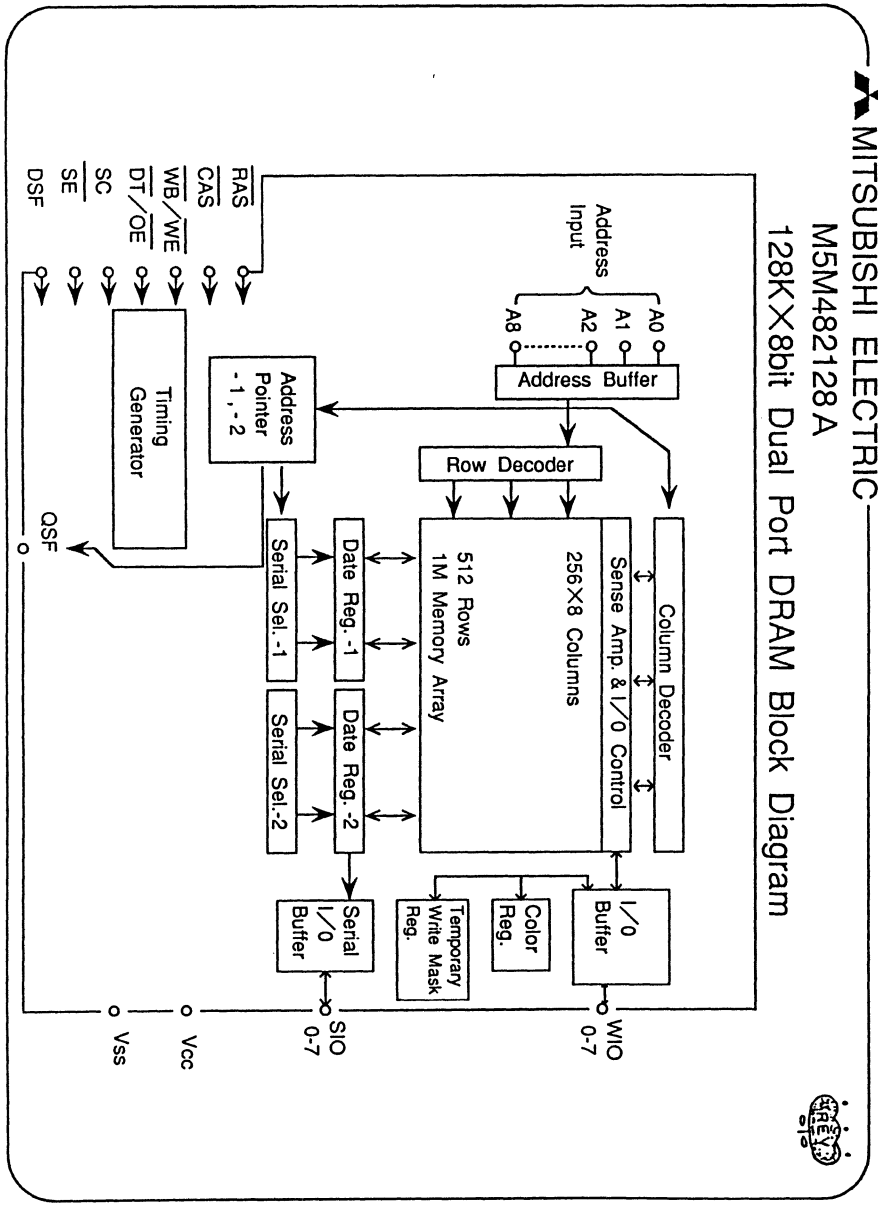
RAM Port／SAM Port	100ns Ver.
Stand-by／Stand-by	5mA Max.
Active／Stand-by	60mA Max.
Stand-by／Active	35mA Max.
Active／Active	90mA Max.

- ○40pin 400mil SOJ

MITSUBISHI ELECTRIC

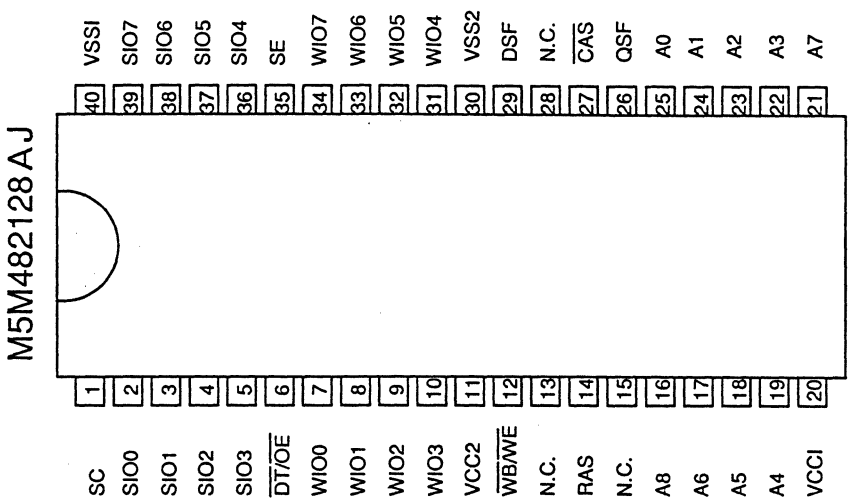
M5M482128A

128K×8bit Dual Port DRAM Block Diagram



MITSUBISHI ELECTRIC

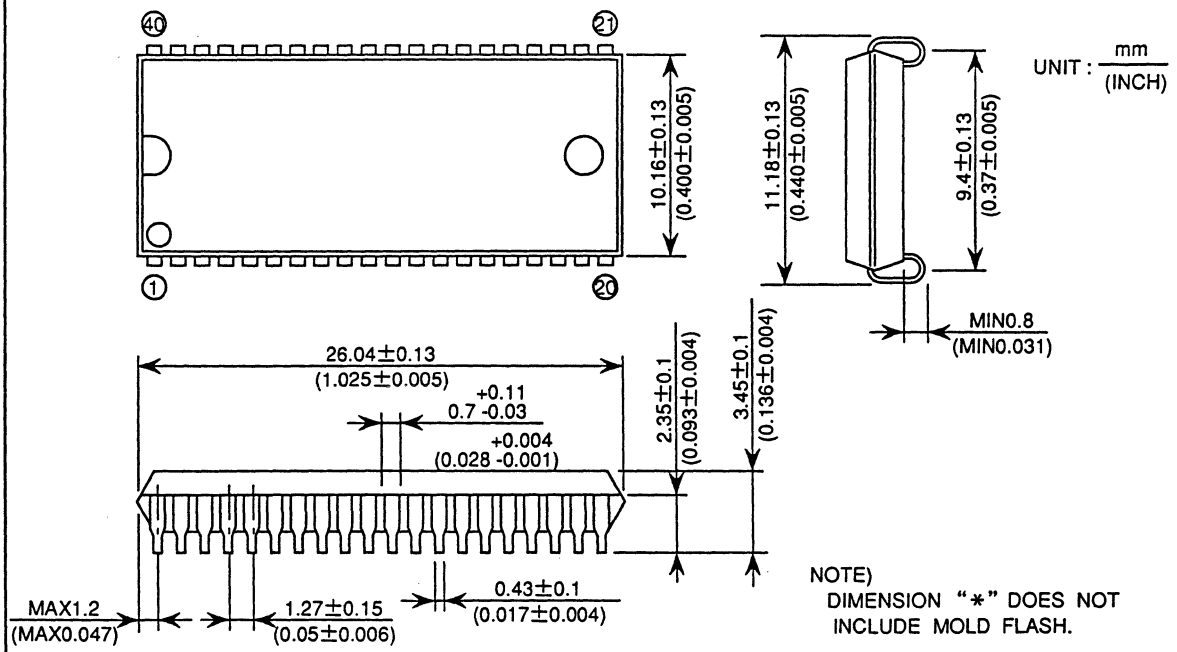
PIN CONFIGURATION
128KX8 Dual Port DRAM
400mil 40PIN SOJ



MITSUBISHI ELECTRIC

M5M482128A

128KX8bit Dual Port DRAM



NOTE)
DIMENSION "*" DOES NOT
INCLUDE MOLD FLASH.

MITSUBISHI ELECTRIC

1M VRAM (Dual Port RAM)

2nd Generation (A ver)

M5M442256A / M5M482128A

What New are : "High Performance"

COMPARISON between 1st and 2nd Generation

Generation	1st	2nd (Target)
Feature	Fast Page Split SAM Flash Write Block Write	Same Same Same Same
Access Time RAM Port tRAC tCAC SAM Port tSCA tSCC	 120/100 35/ 30 40/ 30 40/ 30	 100/ 80 /70 30/ 25/ 20 25/ 25/25 30/ 30/30
Power Dissipation Icc1 (RAM) Icc8 (SAM) Icc12 (X fer)	 60/ 70 40/ 50 100/120	 60/ 75/ 85 35/ 35/ 35 90/110/120
Package 256K×4 128K×8	 400mil ZIP/SOJ 400mil SOJ	 Same Same {T S O P (planning)}
Design Rule	1.0 μm	0.9 μm
Gate Oxide(Call)	SiO_2 80 Å	SiO_2 75 Å
Gate Length(NMOS)	1.1 μm	0.9 μm
Gate Length(PMOS)	1.5 μm	1.2 μm

MITSUBISHI ELECTRIC

256K VRAM (Dual Port RAM)

2nd Generation (A ver.)

M5M4C264AL/J (64KX4)

What New are ;

- Function
  - Upper Compatible with M5M4C264L
  - Write per Bit
- Characteristics
  - High Speed
    - Fast (Enhanced) Page Mode

tRAC	80ns	Max.	←	100ns
tCAC	25ns	Max.	←	50ns
tSCA	25ns	Max.	←	35ns
tSCC	30ns	Max.	←	35ns

  - Low Power Dissipation
    - 35% Decreased from M5M4C264

	RAM/SAM			
Icc1	Act/Stb	60mA Max.	←	70mA Max.
Icc8	Stb/Act	at tRC = 160ns	←	at tRC = 200ns
		30mA Max.		45mA Max.
		at tRC = 30ns		at tRC = 40ns

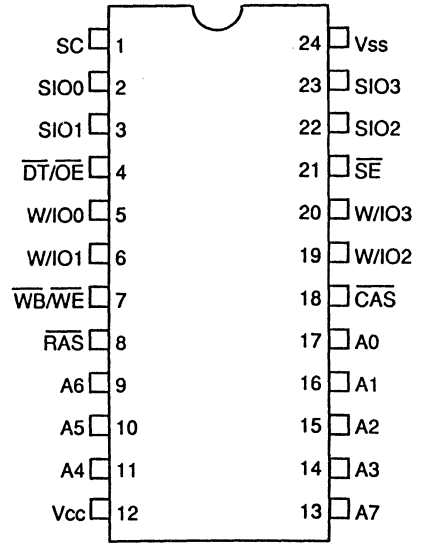
- Package
  - 400mil 24pin ZIP
  - 300mil 24pin SOJ
- Production Plan (SOJ)
  - ES 90/9
  - CS 90/11

256K VRAM (Dual Port RAM)

2nd Generation (A ver.)

M5M4C264AL/J (64KX4)

300mil 24Pin SOJ Pinout



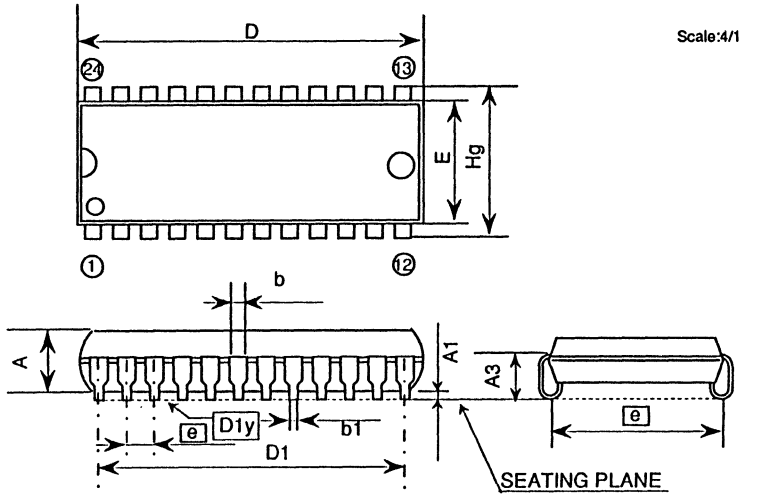
MITSUBISHI ELECTRIC

256KVRAM (Dual Port RAM)

2nd Generation(AVer.)

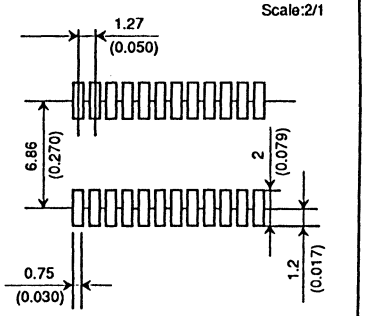
M5M4C264AJ(64K×4)

Package Name	Lead Treatment	Weight (g)	EIAJ Code No.	JEDEC Code No.
24POJ	Solder Plating		———	———



Symbol	Dimension in Millimeters			Dimension in Inches		
	Min	Non	Max	Min	Non	Max
A	-	-	3.55	-	-	0.140
A1	0.8	-	-	0.031	-	-
A3	2.25	2.35	2.45	0.089	0.093	0.096
b	0.67	0.7	0.81	0.026	0.028	0.032
b1	0.33	0.43	0.53	0.013	0.017	0.021
D	15.74	15.87	16.0	0.620	0.625	0.630
D1	-	13.97	-	-	0.550	-
E	7.52	7.62	7.72	0.296	0.300	0.304
e	6.73	6.86	6.99	0.265	0.270	0.275
e	-	1.27	-	-	0.050	-
Hg	8.35	8.45	8.55	0.330	0.333	0.337
Y	-	-	0.1	-	-	0.004

Unit:mm(inch)
Scale:2/1



Recommended Mount Pad

261Kx4bit Field SAM
(M5M4C900L)

Feature

Memory Size

Field Memory	(FMEM)	288ROWx928COLx4bit
Serial Input Memory	(SIM)	928x4bit
Serial Output Memory	(SOM)	928x4bit

Cycle Time

Serial Input Memory (SIM)	tc=50nsMin
Serial Output Memory (SOM)	tc=30nsMin

Asynchronous Operatable SIM and SOM
Split SAM Architecture

Bidirectional Data Transfer between SIM and FMEM

Addressable SIM/SOM Tap

Simple Timing Controlability with Triple Multi BUS
ROW Add./COL.Add./Command

Package 28pin ZIP (400mil)

Application

Field Memory for TV/VCR/Video Printer
NTSC/PAL/SECAM/ID/ED/HD TV System

Band Memory for Page Printer
LBP,PPC,FAX

High Speed Buffer Memory

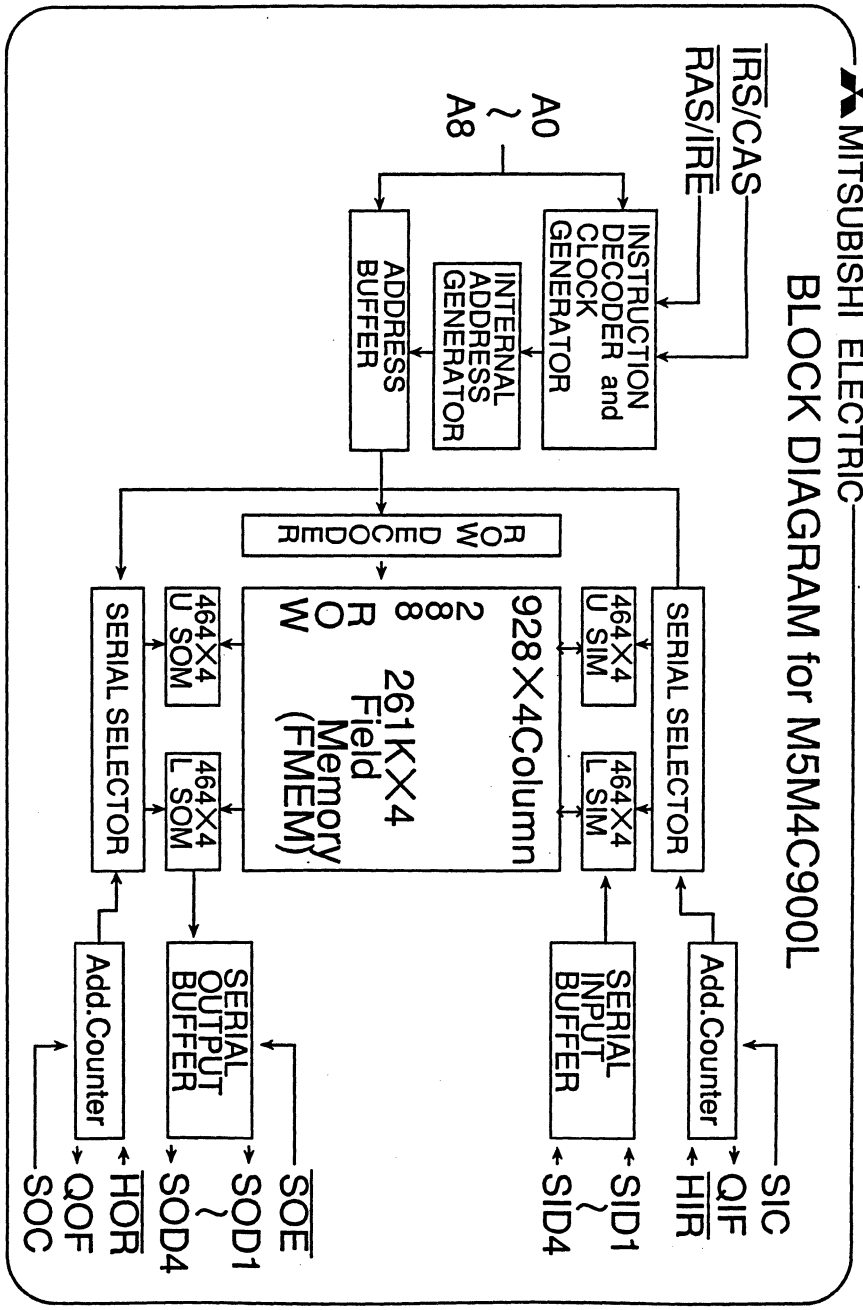
MITSUBISHI ELECTRIC

Field SAM (M5M4C500AL) for TV/VCR

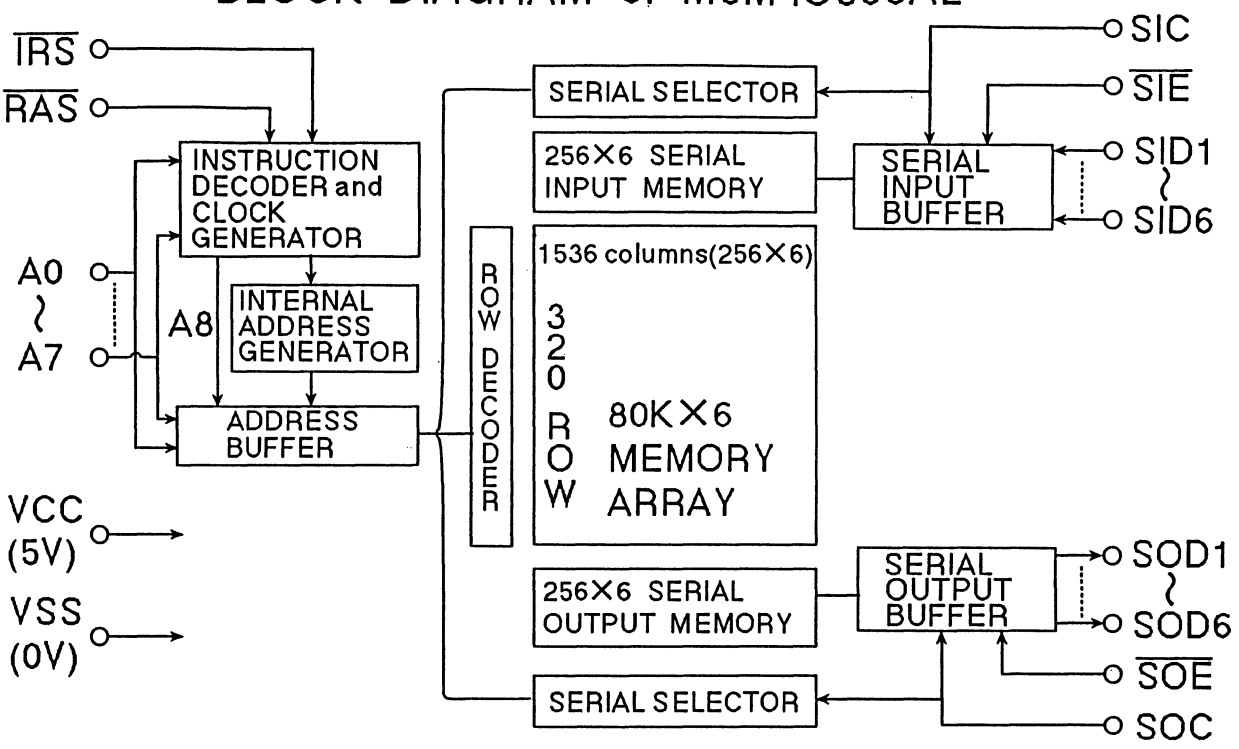
Features

Type name	Serial Read/Write cycle Time	Serial Access Time	Data Transfer cycle Time	Typical Power Dissipation
M5M4C500AL-3	30ns	25ns	390ns	170mW
M5M4C500AL-5	50ns	40ns	810ns	130mW

- Optimum Architecture for TV and VCR
  - Field Memory (MEM) : 80K × 6
  - Serial Input Memory (SIM) : 256 × 6
  - Serial Output Memory (SOM) : 256 × 6
- Bidirectional Data Transfer functions between MEM and SIM, between MEM and SOM.
- Asynchronously Operatable Serial Input / Output Buffer.
- Package : 28pin 400mil ZIP (Zigzag Inline Package)
- Twin-well CMOS process for Low Power dissipation anb high reliability.



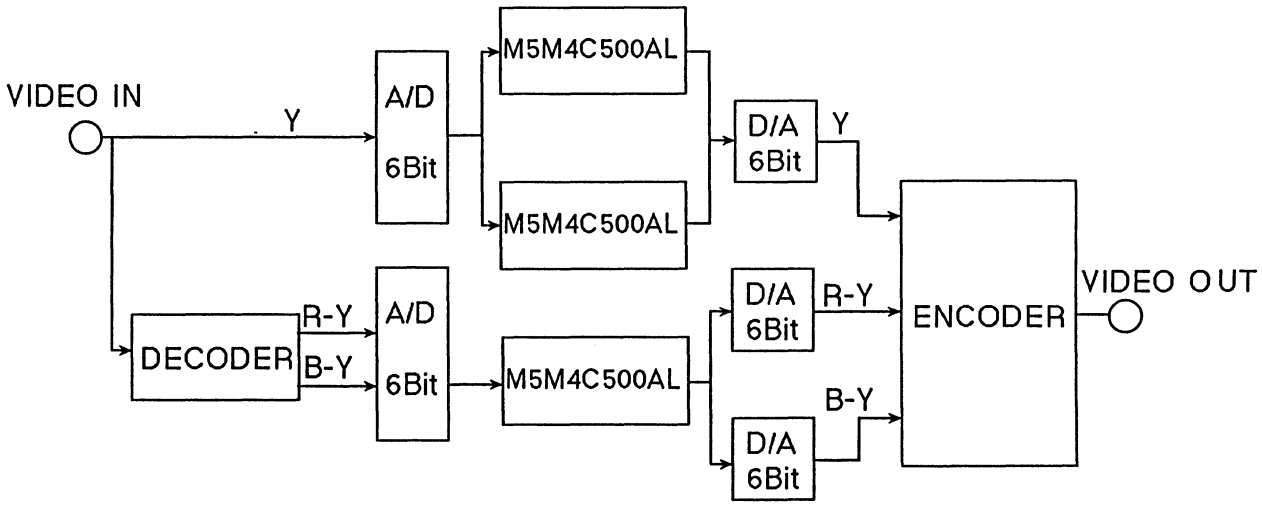
BLOCK DIAGRAM of M5M4C500AL



Field SAM (M5M4C500AL) for TV/VCR

Application 1

TV/VCR Full digital play system.

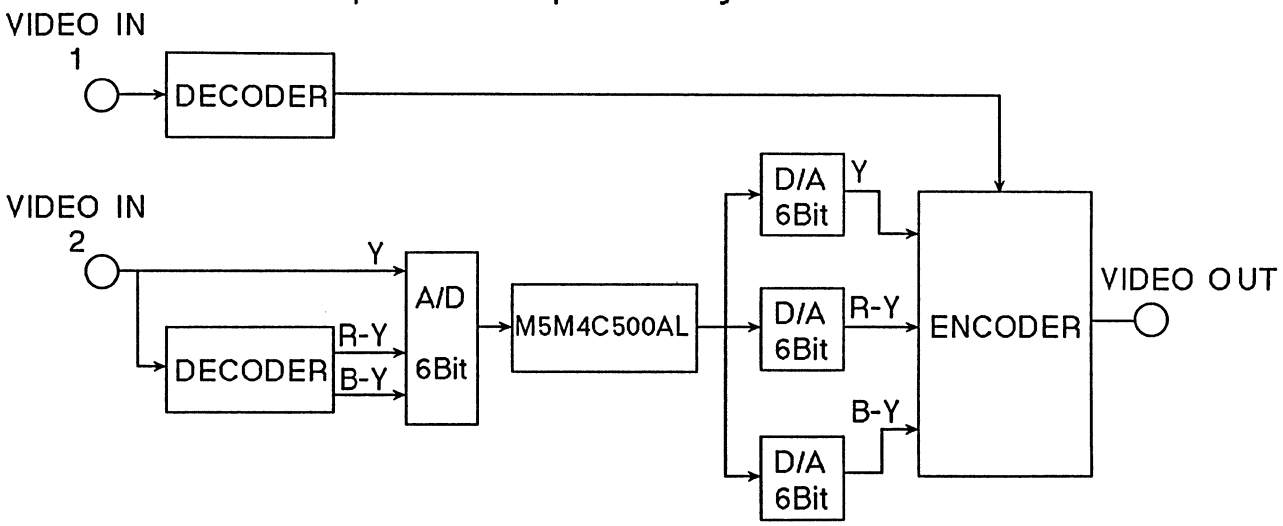


MITSUBISHI ELECTRIC

Field SAM (M5M4C500AL) for TV/VCR

Application 2

TV/VCR picture in picture system.



MITSUBISHI ELECTRIC

FSAM — FEATURES of PRODUCTS —

	M5M4C500	M5M4C500A	M5M4C900
SAMPLE SCHEDULE	MP NOW 500K/M	ES N O W CS 90-12	ES TBD CS TBD
MEMORY SIZE	480K bits		1.02M bits
ORGANI-ZATION	320×256×6		288×928×4
SAM CYCLE TSCC	50ns	30ns	30ns
PACKAGE OPTIONS	28PIN ZIP	28PIN ZIP	28PIN ZIP
APPLI-CATIONS	Picture In Picture Multi Screen Video Printer		IDTV,EDTV HDTV Video Printer

MITSUBISHI ELECTRIC

Advanced Information

4M bit Cached DRAM (M5M44409TP)

What's New!

High Band width Memory 100M Words/sec.

High Speed Cache SRAM on DRAM.

Target Applications

- High Speed Cache & Main Memory for PC,WS.
- 2nd/3rd Cache for Main Frame.

MITSUBISHI ELECTRIC

Advanced Information

4M bit Cached DRAM

Feature

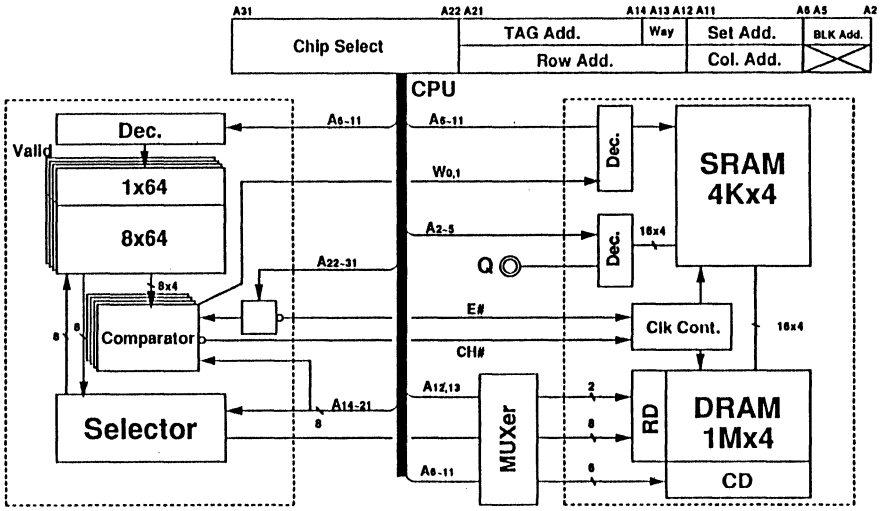
- 1M× 4 bit DRAM and 4K×4bit High Speed Cache SRAM are integrated
- High Speed Cache Access : 10ns max
- Block(16×4bit) Transfer Capable between DRAM and SRAM
- Support to the Direct Map/Associatiative System

MITSUBISHI ELECTRIC

Advanced Information

4M bit Cached DRAM

Block Diagram in a 4Way Set Associative System



MITSUBISHI ELECTRIC

Advanced Information

4M bit Cached DRAM

TARGET PERFORMANCE

Type name	Cache Hit Access/cycle	Array Access/cycle	Cache Fill Time with Copy Back	Power Dissipation
M5M44409TP-10	10ns/10ns	70ns/140ns	210ns	Cache:550mW Array:413mW
M5M44409TP-15	15ns/15ns	70ns/140ns	210ns	Cache:440mW Array:413mW
M5M44409TP-20	20ns/20ns	80ns/160ns	240ns	Cache:385mW Array:358mW

Technical Strategy of SRAM

1M (×8, ×4, ×1)
4M (×16, ×8, ×4, ×1)

High Density

High Speed

64K (×1, ×4,) 15,20ns
64K (×8, ×9,) 15,20ns
256K (×1, ×4) 25,30ns
256K (×1, ×4) 15,20ns
1M (×1, ×4) 25,30ns

SRAM

New Function
New Package

TEMP.RANGE(-20℃～)
OE FUNCTION
CS/CS FUNCTION
LOW VTG OPERATION (128K×8)
ADDRESS LATCH FUNCTION (8K×8)
ECL I/O BI-CMOS
DIP/SKINNY/SOP/SOJ/TSOP

Low Power

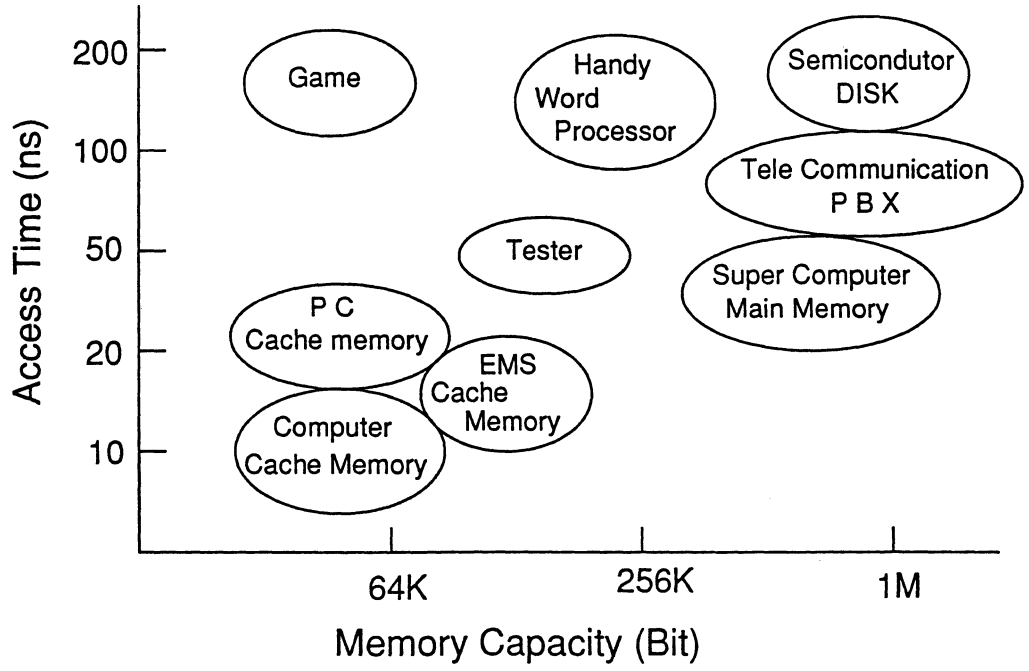
64K (8K×8) L(=LL) Version
256K (32K×8) L/LL Version
1M (128K×8) L/LL Version

256K (×1, ×4, 35, 45ns) L Version
64K (×1, 45ns) L Version

.....Under developement
or
Under consideration

MITSUBISHI ELECTRIC

Application of Static RAM



MITSUBISHI ELECTRIC

Mitsubishi Fast SRAM Selection

Super Computer Main Frame	1M×1	M5M51001-25/35/45	DIP,SOJ
	256K×4	M5M51004-25/35/45,M5M51014-25/35/45(I/O Sepa.)	DIP,SOJ
	256K×1	M5M5257B-15/20,M5M5257A-25/30,M5M5257-35/45	DIP,SOJ
	64K×4	M5M5258B-15/20,M5M5258A-25/30,M5M5258-35/45	DIP,SOJ
	64K×4(OE)	M5M5259B-15/20	DIP,SOJ
Mini Computer EWS	32K×8	M5M5278-15/20/25	DIP,SOJ
	32K×9	M5M5279-15/20/25,M5M5269-15/20/25	DIP,SOJ
Personal Computer	64K×1	M5M5187B-15/20,M5M5187A-25/35	DIP,SOJ
	16K×4	M5M5188B-15/20,M5M5188A-25/35	DIP,SOJ
	16K×4(OE)	M5M5189B-15/20,M5M5189A-25/35	DIP,SOJ
	8K×8	M5M5178A-15/20/25,M5M5178-35/45	SOJ, DIP,SOP
	8K×8(Latch)	M5M5180A-20/25	SOJ, DIP,SOP
	8K×8	M5M5179A-15/20/25,M5M5179-35/45	SOJ, DIP,SOP

MITSUBISHI ELECTRIC

MITSUBISHI SRAM Selection

Memory Capacity	Access time (ns)	15	20	25	30	35	45	55	70	85	100	120	150
16K	16K×1						M5M21C67P						
	4K×4						M5M21C68P						
64K	8K×8	M5M5178AP			28P4Y	M5M5178P			M5M5165P,FP				
	8K×9	M5M5179AP				M5M5179P							
	64K×1	M5M5187BP,J			M5M5187AP,J								
	16K×4	M5M5188BP,J			M5M5188AP,J								
		M5M5189BP,J			M5M5189AP,J								
256K	32K×8	M5M5278P,J							M5M5256BP,FP,KP				
									M5M5255BP,FP,KP S2付				
									M5M5256BVP,RV				
	256K×1	M5M5257BP,J		M5M5257AP,J		M5M5257P,J							
	64K×4	M5M5258BP,J		M5M5258AP,J		M5M5258P,J							
1M	128K×8								M5M51008P,FP,VP,RV				
	1M×1			M5M51001P,J									
	256K×4			M5M51004P,J									
	256K×4 I/F sepa			M5M51014J									

20P4 28P4 28P2W 28P4Y 22P4H 24P0J OE付 28P4 28P2W 28P2C-A 28P2C-B 32P4

MITSUBISHI ELECTRIC

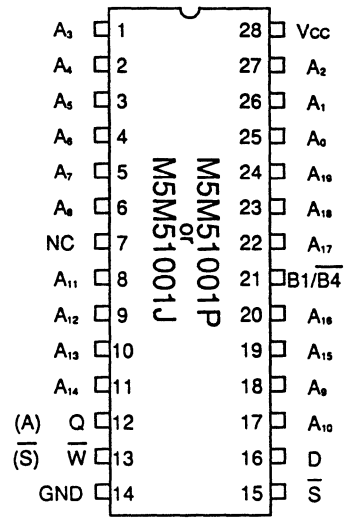
MITSUBISHI 256KX4 / 1MX1 Static RAM

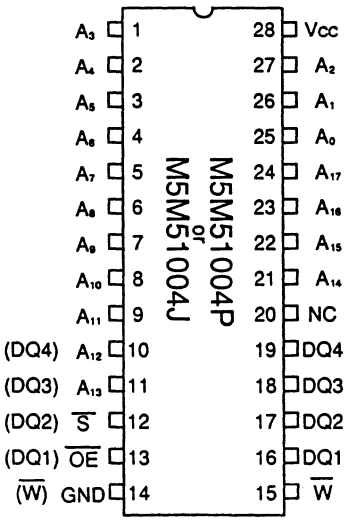
TARGET FEATURES

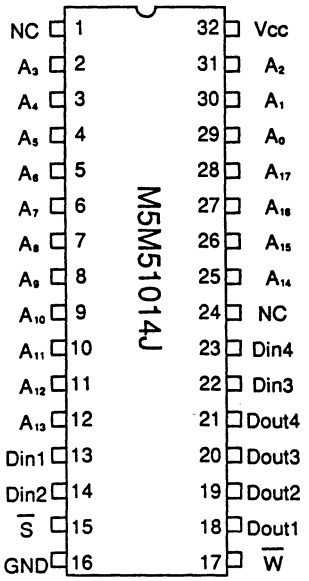
Organization	256KX4 / 1M×1
Design Rule	0.8 μm
Process technology	CMOS, Triple poly-Si Double Al
Access time	25ns / 35ns / 45ns
Active current	120mA(max.)
Standby current	40mA(max.)
Chip size	6.10X15.84(96.6)mm^2
Cell size	5.875X8.5(49.9) μm^2
Package	28-pin / 400mil DIP, SOJ
Sample Availability	NOW 25ns Jan.'91
Production	NOW 25ns Apr.'91

MITSUBISHI ELECTRIC

1M Fast SRAM PIN CONFIGURATION





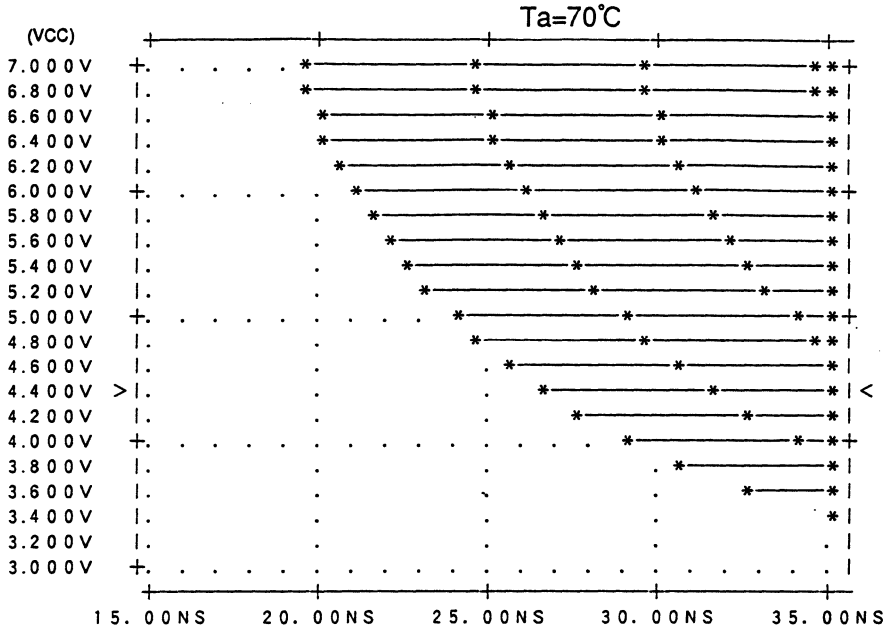


MITSUBISHI ELECTRIC

1MX1 / 256KX4 FAST SRAM

(M5M51001 / M5M51004 / M5M51014)

Access Time Shmoo Plot



Address Access Time

MITSUBISHI ELECTRIC

8KX8／8KX9 SRAM

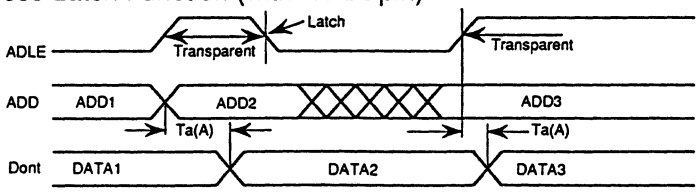
(M5M5178A／79A／80A)

TARGET FEATURES

・Organization	8KX8(78A／80A) 8KX9(79A)
・Design Rule	0.8 μm
・Process	CMOS,Triple poly-Si,
・technology	Single Al
・Access time	78A／79A 15ns／20ns／25ns 80A 20ns／25ns Ta(OE)=8ns／10ns
・Active current	120mA(max)
・Standby current(AC)	30mA(max)
・Chip size	5.53X3.53mm²
・Cell size	10.5X8.0 μm²

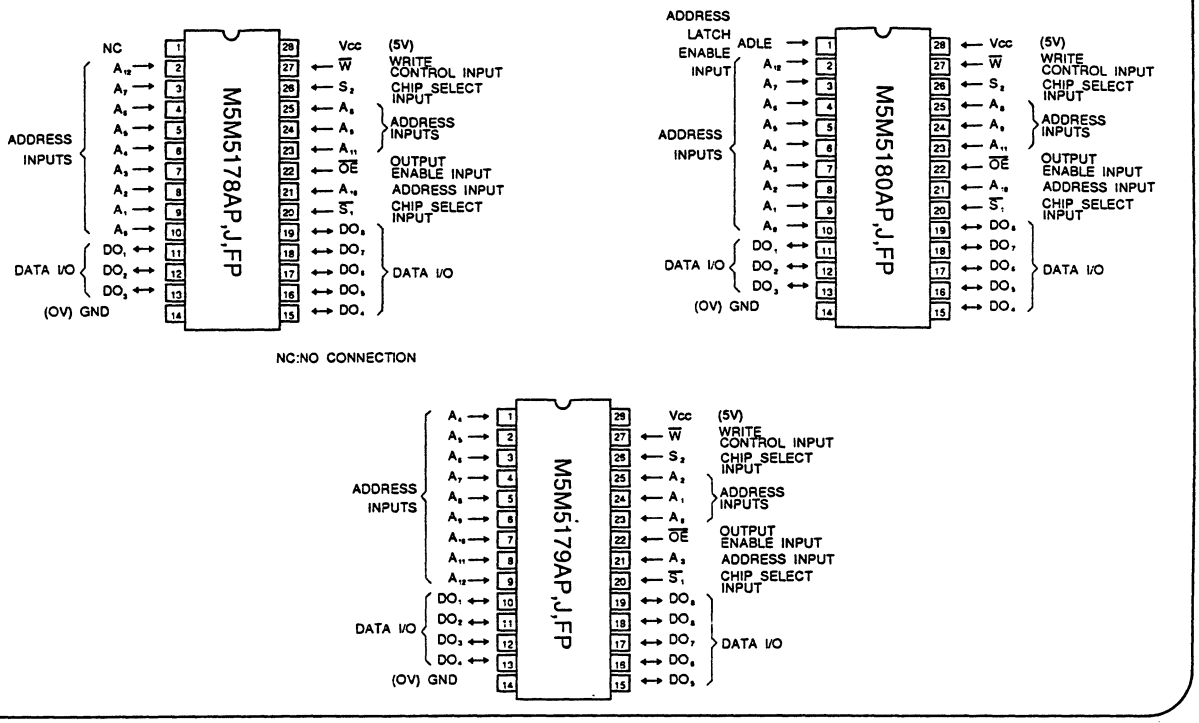
M5M5180A FEATURES

・Address Latch Function (with ADLE pin)



MITSUBISHI ELECTRIC

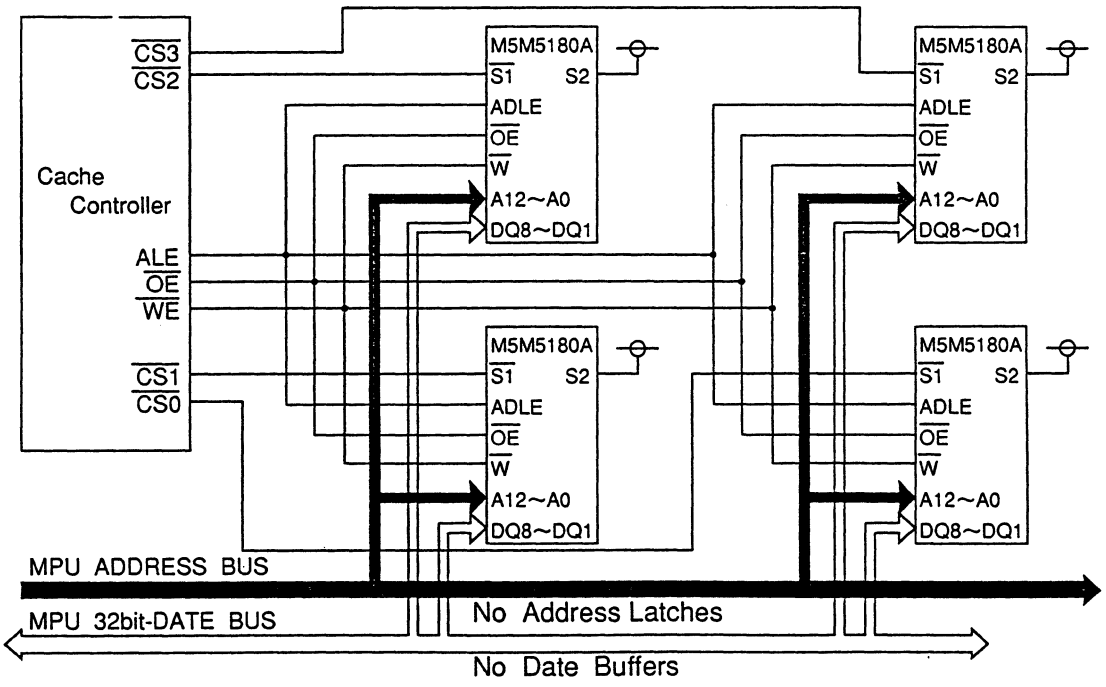
8KX8,8KX9 FAST SRAM PIN CONFIGURATION (TOP VIEW)



NC:NO CONNECTION

MITSUBISHI ELECTRIC

Example of Cache with M5M5180A
— 32KB Direct Mapping —



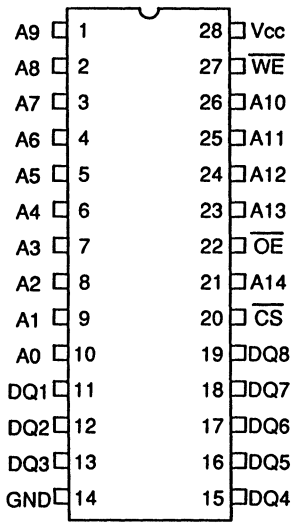
MITSUBISHI ELECTRIC

32KX8 / 32KX9 FAST SRAM
(M5M5278/M5M5279/M5M5269)

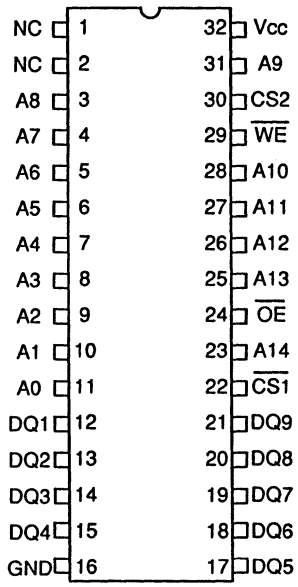
Organization	32KX8 / 32KX9
Design Rule	0.8 μm
Process Technology	CMOS Double Al Triple Poly-Si
Access Time	(15ns) / 20ns/25ns
Active Current	140mA(max)
Standby Current	30mA(max)
Chip Size	4.6X11.89mm^2
Cell Size	6.3X10.0 μm^2
ESD(@1.5Kohm, 100pf	>3000V
Soft Error Rate	<300fit
Latch-up(@Vcc=5V)	Free
Package	300mil DIP, SOJ 32KX8 28pin 32KX9 32pin
Sample Availability	Jan '91
Production	Mar'91

MITSUBISHI ELECTRIC

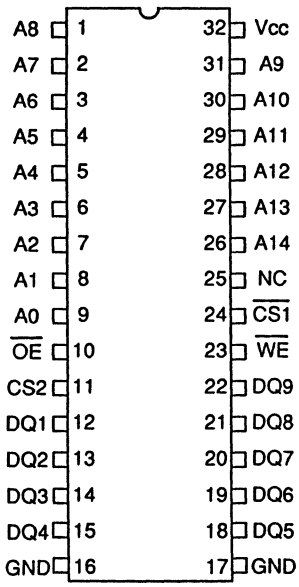
32KX8/32KX9 Fast SRAM Pin Out



M5M5278P,J
32KX8



M5M5279P,J
32KX9



M5M5269FP
32KX9

MITSUBISHI ELECTRIC

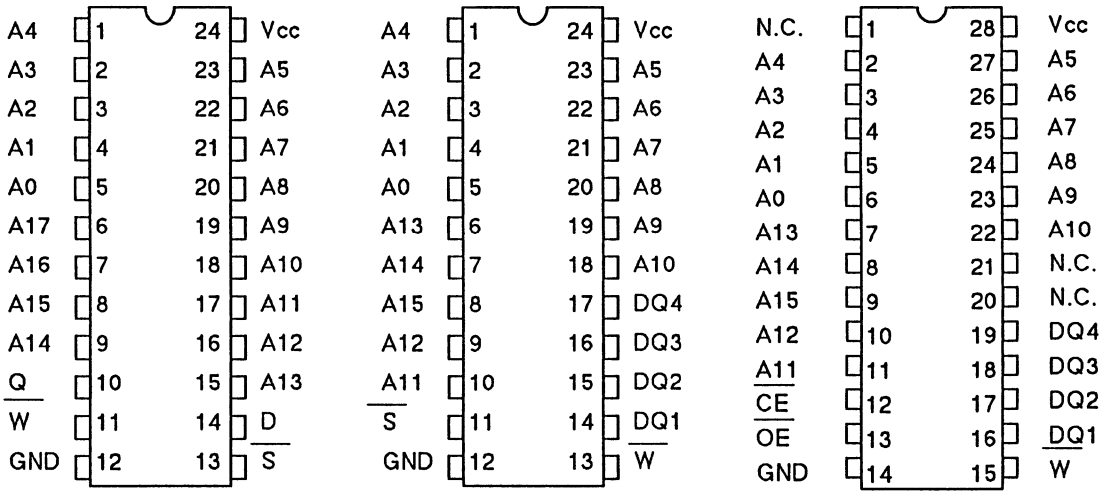
256KX1 / 64X4 FAST SRAM (M5M5257B / 58B / 59B)

TARGET FEATURES

Organization	64KX4/256KX1
Design Rule	0.8μm
Process technology	CMOS,Triple poly-Si Double Al
Access time	15ns/20ns
Active current	120mA(max)
Standby current(AC)	30mA(max)
Chip size	4.54X10.69mm²
Cell size	6.3X10.0μm²
ESD(@1.5KΩ,100pf)	>3000V
Soft error rate	<300fit
Latch-up(@Vcc=5V)	Free
Package	24pin/300mil DIP,SOJ (5259B 28pin)
Sample Availability	'90-12 (5259B '91-2)
Production	'91-3 (5259B '91-3)

MITSUBISHI ELECTRIC

256KX1/64KX4 Fast SRAM Pin Out



M5M5257BP,J
256KX1

M5M5258BP,J
64KX4

M5M5259BP,J
64KX4 With $\overline{OE}$

MITSUBISHI ELECTRIC

Deisign Objective of 256K Fast SRAM

	M5M5257AP	256K word × 1 bit
	M5M5258AP	64K word × 4 bit
Package	300 mil 24pin plastic DIP	
Power supply	single 5V	
Access time	25,30	
Power Dissipation	active	660mW max.
	stand by (TTL level)	165mW max.
	stand by (MOS level)	55mw max.
Process technology	scaled CMOS 1.0 μm design rule	

MITSUBISHI ELECTRIC

Design Objective of 64K Fast SRAM

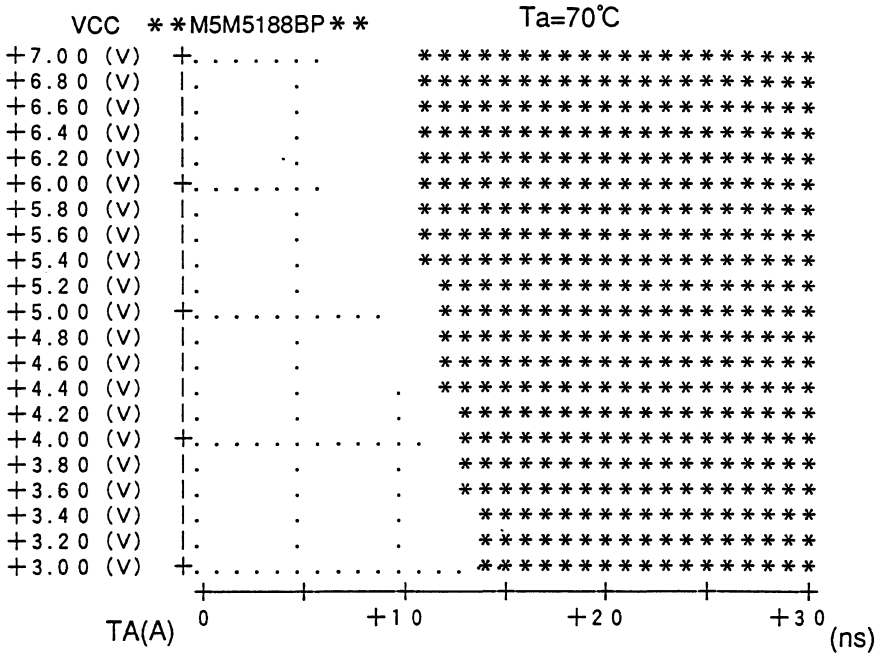
Organization	M5M5187BP	65536 word×1 bit
	M5M5188BP	16384 word×4 bit
	M5M5189BP	16384 word×4 bit with $\overline{OE}$ pin
Package	M5M5187BP/5188BP	300 mil 22 pin plastic DIP
	M5M5189BP	300 mil 24 pin plastic DIP
Power supply	single 5V	
Access time	15ns,20ns,25ns	
Power dissipation	active	660mW max
	stand by (TTL level)	165mW max
	stand by (MOS level)	55mW max
Process technology	scaled CMOS 1.1 μm design rule	
Chip size	19.1mm^2	

SOJ package is available (24P 300mil)

MITSUBISHI ELECTRIC

64K FAST SRAM (M5M5188BP, 16K×4)

Access Time Shmoo Plot



ADDRESS ACCESS TIME

MITSUBISHI ELECTRIC

1M bit SRAM (128K×8)

M5M51008P/FP/VP/RV

131072 word×8bit CMOS RAM

Features

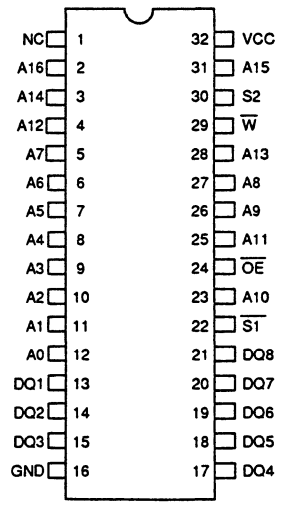
- High speed 70/85/100/120ns
- Low power
  - Low power* Standby 10 μW (typ)
    Operation 200mW (typ) 10MHz
- Single 5V Supply
- Completely static...No clock is required.

Process

- 0.8 μm Mixed CMOS
- Tripple poly Si

Package

- 600 mil DIP
- 525 mil SOP
- 8×20mm² TSOP



32 PIN Package
P/FP Outline

MITSUBISHI ELECTRIC

M5M51008P/FP/VP/RV
Address Access Time

MITSUBISHI ELECTRIC

M5M51008P/FP/VP/RV Power Supply Current

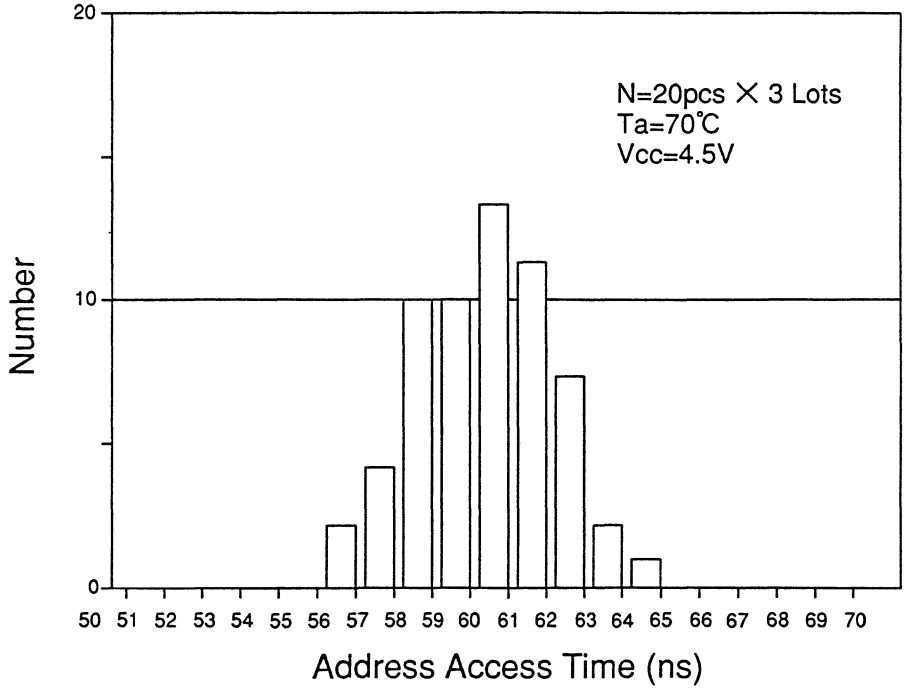
MITSUBISHI 1M SRAMSeries

Part NO.	Item	Access Time	Stand by Current	Package
M5M51008P	70,85,10,12	70ns,85ns,100ns,120ns	2mA	600mil DIP
	70L,85L,10L,12L	70ns,85ns,100ns,120ns	50 μA(3V,70℃)	
	70LL,85LL, 10LL,12LL	70ns,85ns,100ns,120ns	10 μA(3V,70℃)	
M5M51008FP	70,85,10,12	70ns,85ns,100ns,120ns	2mA	525mil SOP
	70L,85L,10L,12L	70ns,85ns,100ns,120ns	50 μA(3V,70℃)	
	70LL,85LL, 10LL,12LL	70ns,85ns,100ns,120ns	10 μA(3V,70℃)	
M5M51008VP RV	70,85,10,12	70ns,85ns,100ns,120ns	2mA	8×20mm TSOP
	70L,85L,10L,12L	70ns,85ns,100ns,120ns	50 μA(3V,70℃)	
	70LL,85LL 10LL,12LL	70ns,85ns,100ns,120ns	10 μA(3V,70℃)	

MITSUBISHI ELECTRIC

1MSRAM Distribution of Access Time

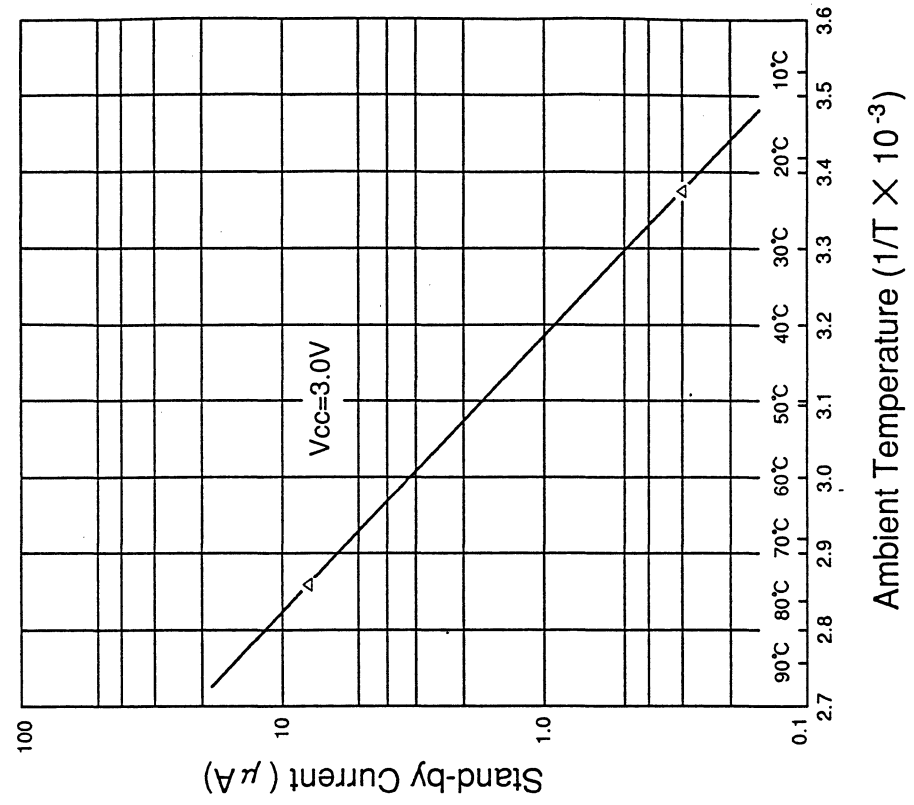
M5M51008P/FP/VP/RV



MITSUBISHI ELECTRIC

M5M51008P/FP/VP/RV

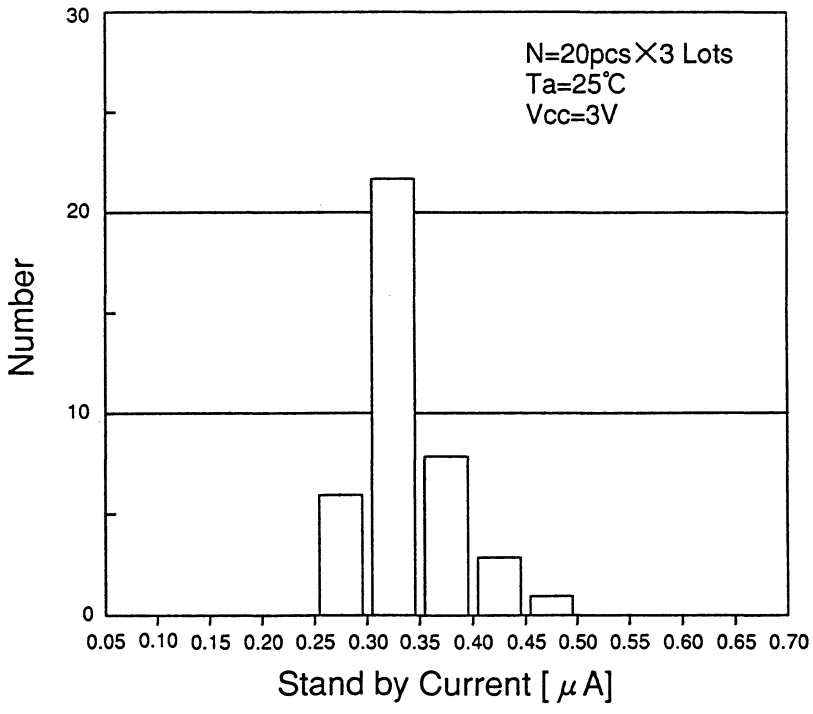
Stand by Current



MITSUBISHI ELECTRIC

1MSRAM Distribution of Stand by Current

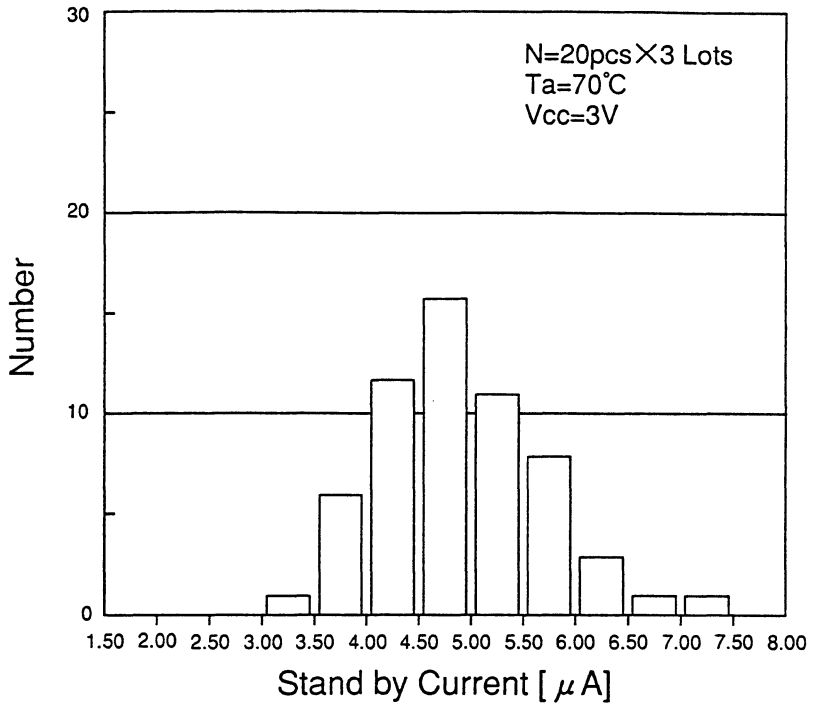
M5M51008P/FP/VP/RV



MITSUBISHI ELECTRIC

1MSRAM Distribution of Stand by Current

M5M51008P/FP/VP/RV

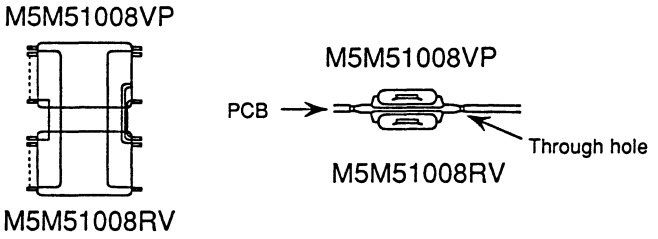


MITSUBISHI ELECTRIC

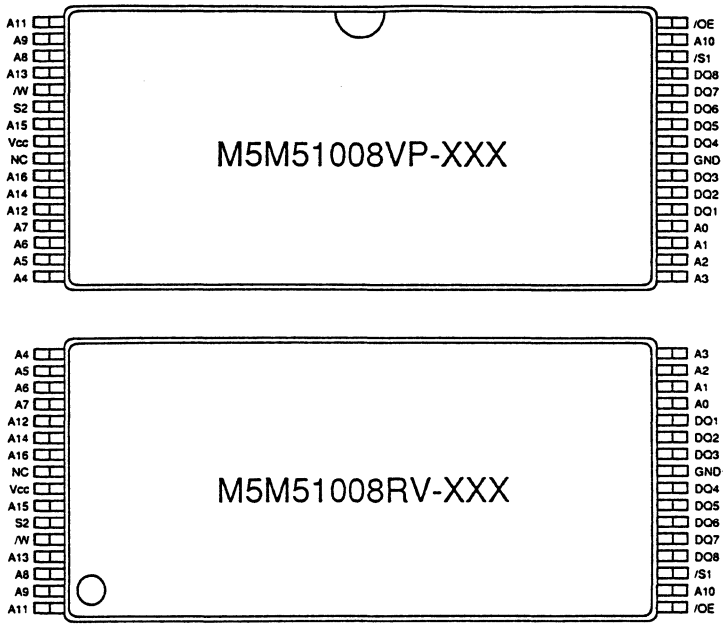
M5M51008VP/RV TSOP
(Thin Small Outline Package)

Advantage of TSOP

Very Small · · · · · · · ·	1/2 area of SOP,comparable size as TAB 1/4 volume of SOP
High reliability · · · · ·	100% burn in & full test can be done
Short lead length · · · ·	Low inductance, Low capacitance (DIP 10nH → 2nH) (DIP 1.5pF → 0.5pF)
Uniform lead length · · ·	Uniform electric characteristics
Easy PCB layout · · · ·	Normal lead type and reverse bend type are availabe

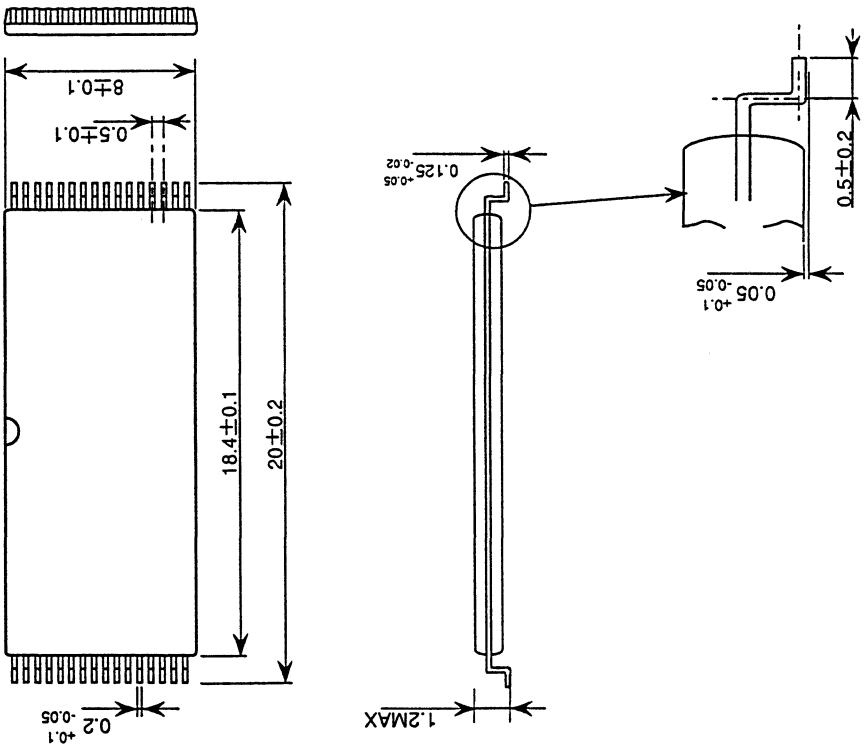


M5M51008VP/RV TSOP Outline



MITSUBISHI ELECTRIC

1M SRAM TSOP Dimensions



MITSUBISHI ELECTRIC

256K SRAM Shrink Chip Series

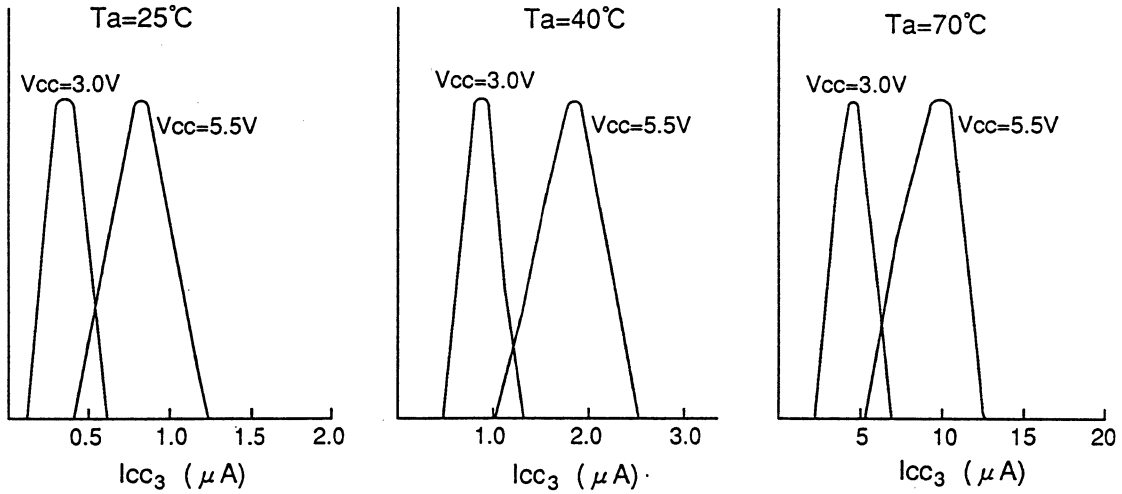
Part No.	Item	Access Time	Stand-by Curnent	Package	Remark
M5M5256BP	70,85,10,12	70ns,85ns,100ns,120ns	2mA	600mil DIP	
	70L,85L,10L,12L	70ns,85ns,100ns,120ns	100 μA		
	70LL,85LL,10LL,12LL	70ns,85ns,100ns,120ns	20 μA		
M5M5256BKP	70,85,10,12	70ns,85ns,100ns,120ns	2mA	300mil DIP (Skinny package)	
	70L,85L,10L,12L	70ns,85ns,100ns,120ns	100 μA		
	70LL,85LL,10LL,12LL	70ns,85ns,100ns,120ns	20 μA		
M5M5256BFP	70,85,10,12	70ns,85ns,100ns,120ns	2mA	SOP	
	70L,85L,10L,12L	70ns,85ns,100ns,120ns	100 μA		
	70LL,85LL,10LL,12LL	70ns,85ns,100ns,120ns	20 μA		
M5M5256BVP BRV	70L,85L,10L,12L	70ns,85ns,100ns,120ns	100 μA	TSOP	
	70LL,85LL,10LL,12LL	70ns,85ns,100ns,120ns	20 μA		
M5M5255BP	70,85,10,12	70ns,85ns,100ns,120ns	2mA	600mil DIP	S1,S2
	70L,85L,10L,12L	70ns,85ns,100ns,120ns	100 μA		
	70LL,85LL,10LL,12LL	70ns,85ns,100ns,120ns	20 μA		
M5M5255BKP	70,85,10,12	70ns,85ns,100ns,120ns	2mA	300mil DIP	S1,S2
	70L,85L,10L,12L	70ns,85ns,100ns,120ns	100 μA		
	70LL,85LL,10LL,12LL	70ns,85ns,100ns,120ns	20 μA		
M5M5255BFP	70,85,10,12	70ns,85ns,100ns,120ns	2mA	SOP	S1,S2
	70L,85L,10L,12L	70ns,85ns,100ns,120ns	100 μA		
	70LL,85LL,10LL,12LL	70ns,85ns,100ns,120ns	20 μA		

MITSUBISHI ELECTRIC

256KSRAM(M5M5256B)

Stand-by Current V.S.Ambient Temperature

256K SRAM (M5M5256B)
Distribution of stand-by current

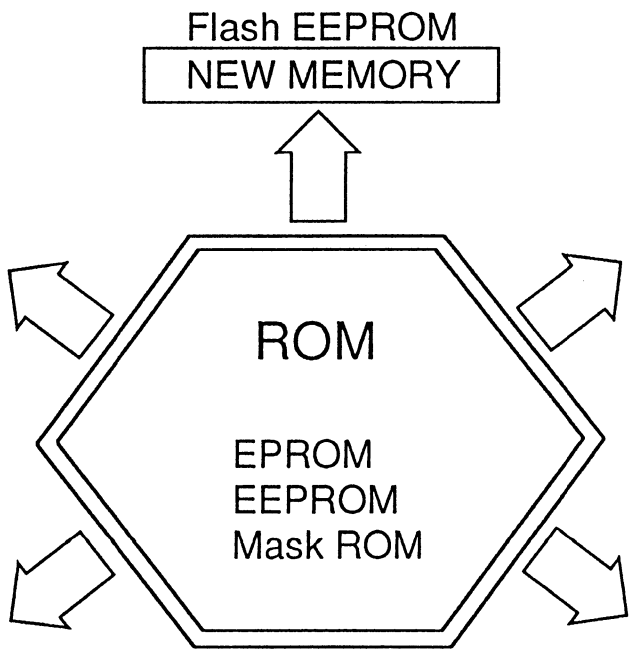


General Reliability Evaluations for M5M5256BKP

Test Item	Test Condition	Failure Identification	Sample Size	Failures
Dynamic Life Test (1)	Ta = 125℃ Vcc = 6.0V t = 2000 Hrs	DC and Function Stability of electrical margins	200	0
Dynamic Life Test (2)	Ta = -40℃ Vcc = 7.0V t = 1000 Hrs	DC and Function Stability of electrical margins	50	0
Thermal Stress: Soldering Heat	260℃,10 sec	DC and Function Stability of electrical margins	100	0
Thermal Stress: Thermal Shock	-55℃/125℃ 15 cycles	DC and Function Stability of electrical margins	100	0
Thermal Stress: Temperature cycling	-65℃/150℃ 100 cycles	DC and Function Stability of electrical margins	100	0
Moisture Resistance	Ta = 85℃ Relative Humidity =85% Vcc = 5.5V t = 2000 Hrs	DC and Function Stability of electrical margins	200	*1
Pressure Cooker Test (1)	Ta = 121℃ Relative Humidity =100% t= 200 Hrs	DC and Function Stability of electrical margins	150	0
Pressure Cooker Test (2)	Ta = 140℃ Relative Humidity =85% Vcc = 5.5V t = 500h	DC and Function Stability of electrical margins	100	0
High Temperature Storage	Ta = 150℃ t = 1000 hrs	DC and Function Stability of electrical margins	100	0

* ; AL Corrosion

ROM Technology Trend



HIGH DENSITY

2M/4M EPROM
8M/16M MASK ROM

AS MEMORY

Versatile Memory
256K,OTP
16K,SRAM
Ports

HIGH SPEED

EPROM:85～120ns
EEPROM:150ns
Mask ROM:150ns
Flash EEPROM:100ns

Various Package

DIP→SMD
SOP
PLCC
TSOP
QFP
CLCC

NEW FUNCTION

Byte—wide→Word—wide
EPROM:Page Programming

MITSUBISHI ELECTRIC

MITSUBISHI ROM Selection

Device			Access Time (ns) 50	100	150	200	250
EPROM	32K×8	NMOS		M5M27C256AK			M5L27256K
	32K×8	CMOS					
	64K×8	NMOS				M5L27512K	
	64K×8	CMOS		M5M27C512AK			
	128K×8	CMOS			M5M27C100K		
	128K×8	CMOS			M5M27C101K,JK		
	64K×16	CMOS			M5M27C102K,JK		
	256K×8	CMOS		M5M27C201K,JK			
	128K×16	CMOS		M5M27C202K,JK			
	512K×8	CMOS			M5M27C401K		
	256K×16	CMOS			M5M27C402K		
Mask ROM	512K×8/256K×16	CMOS			M5M23400AP,FP		
	512K×8	CMOS			M5M23401AP,FP		
	1M×8/512K×16	CMOS			M5M23800P *		
	1M×8	CMOS			M5M23801P *		
	2M×8/1M×16	CMOS			M5M23160P *		
EEPROM	8K×8	CMOS			M5M28C64AP,FP,VP,RV		
Flash EEPROM	128K×8	CMOS		M5M28F101P *			
	64K×16	CMOS		M5M28F102P *			

* :under development

MITSUBISHI ELECTRIC

Mitsubishi EPROM

General Features

1) High Performance
- High Speed·····85ns(27C256A), 100ns(27C512A,2M EPROM)
  120ns(1M EPROM, 4M EPROM)
- Low Power·····30mA(Active)/100 μA(Standby) (27C256A, 2M,4M EPROM)
  50mA(Active)/100 μA(Standby) (1M EPROM,27C512A)

2) High Quality
- High reliability ····· <100fit
- Low incoming failure rate····· <100ppm
  ESD Endurance ····· >1000V(100PF, 1.5KΩ), >300V(200PF, 0Ω)

3) Complete screening and test procedure
- Data retention test for all bits of all devices
- AC/DC characteristics test for all devices

4) Many varieties and Large volume production capacity
- Pioneer of EPROM in JAPAN (from 2K bit)
- Main EPROM supplier from 256K bit to the current devices

MITSUBISHI ELECTRIC

Comparison Table of Mitsubishi EPROM

Memory capacity		256K	512K	1M		2M		4M	
Organization		32K×8	64K×8	128K ×8	64K ×16	256K ×8	128K ×16	512K ×8	256K ×16
Type name		M5M 27C256AK	M5M 27C512AK	M5M 27C100/ 101K	M5M 27C102K	M5M 27C201K	M5M 27C202K	M5M 27C401K	M5M 27C402K
Process technology		CMOS 1.2 μm	CMOS 1.2 μm	CMOS 1.2 μm	CMOS 1.2 μm	CMOS 0.9 μm	CMOS 0.9 μm	CMOS 0.9 μm	CMOS 0.9 μm
Access time (ns)		85 100 120 150	100 120 150	120 150 200 250	120 150 200 250	100 120 150	100 120 150	120 150	120 150
Active current(mA)		30	50	50	50	30	30	30	30
Standby current (mA)		0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Read	Vcc(V) Vpp(V)	5	5	5	5	5	5	5	5
Program	Vcc(V) Vpp(V)	6 12.5	6 12.5	6 12.5	6 12.5	6 12.5	6 12.5	6.25 12.75	6.25 12.75
Pins/Package*/ Width (mil)		28K (600)	28K (600)	32K (600) 32JK	40K (600) 44JK	32K (600) 32JK	40K (600) 44JK	32K (600)	40K (600)
Note									

Package＊…K:CERDIP,JK:CLCC

MITSUBISHI ELECTRIC

Comparison Table of Mitsubishi OTPROM

Memory capacity		256K	512K	1M		2M		4M	
Organization		32K×8	64K×8	128K ×8	64K ×16	256K ×8	128K ×16	512K ×8	256K ×16
Type name		M5M 27C256AP	M5M 27C512AP	M5M 27C100/ 101P	M5M 27C102P	M5M 27C201P	M5M 27C202P	M5M 27C401P	M5M 27C402P
Process technology		CMOS 1.2 μm	CMOS 1.2 μm	CMOS 1.2 μm	CMOS 1.2 μm	CMOS 0.9 μm	CMOS 0.9 μm	CMOS 0.9 μm	CMOS 0.9 μm
Access time ( ) Special Spec (ns)		(120) 150	(120) 150	150	150	(120) 150	(120) 150	150	150
Active current(mA)		30	50	50	50	30	30	30	30
Standby current (mA)		0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Read	Vcc(V) Vpp(V)	5	5	5	5	5	5	5	5
Program	Vcc(V) Vpp(V)	6 12.5	6 12.5	6 12.5	6 12.5	6 12.5	6 12.5	6.25 12.75	6.25 12.75
Pins/Package*/ Width (mil)		28P(600) 28FP(450) 28VP,RV	28P(600) 28FP(450)	32P(600) 32FP(525) 32J 40VP,RV	40P(600) 40FP(525) 44J 40VP,RV	32P(600) 32FP(525) 32J 40VP,RV	40P(600) 40FP(525) 44J 40VP,RV	32P(600)	40P(600)
Note									

Package＊…P:DIP,FP:SOP,J:PLCC,VP/RV:TSOP

MITSUBISHI ELECTRIC

4M CMOS EPROM (M5M27C401K, M5M27C402K)

Feature

1) Organization and pinout	M5M27C401K 512Kx8bit, 32pin DIP, JEDEC
	M5M27C402K 256Kx16bit, 40pin DIP,JEDEC
2) High speed access time	120ns/150ns (max.)
3) Low power supply current	30mA (Active)/0.1mA (Standby)
4) Vcc tolerance	5V±10%
5)Programming voltage	12.75V

Technology

1) High performance Si-gate twin well CMOS 0.9 μm design rule
2) Low resistance material
3) Redundancy circuit for high yield

MITSUBISHI ELECTRIC

2M CMOS EPROM (M5M27C201K, M5M27C202K)

Feature

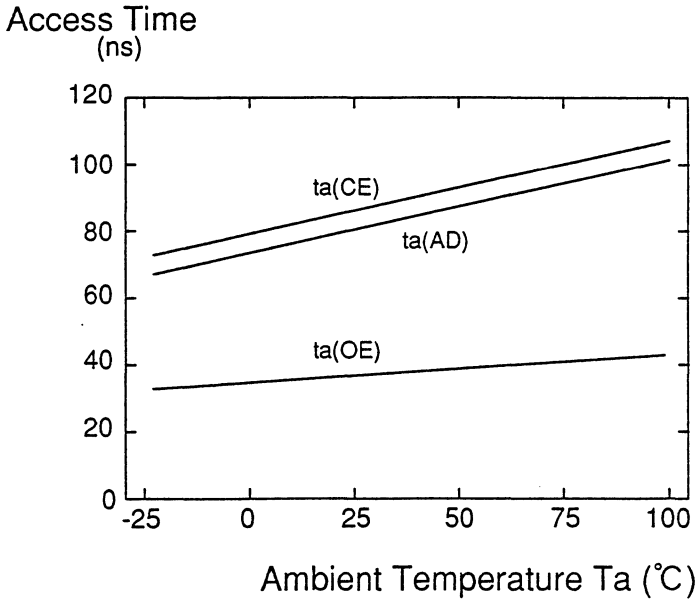
1) Organization and pinout	M5M27C201K 256Kx8bit, 32pin DIP, JEDEC
	M5M27C202K 128Kx16bit, 40pin DIP,JEDEC
2) High speed access time	100ns/120ns/150ns (max.)
3) Low power supply current	30mA (Active)/0.1mA (Standby)
4) Vcc tolerance	5V±10%
5) Programming voltage	12.5V
6) Page programming algorithm	4-byte or 2-word programming

Technology

1) High performance Si-gate twin well CMOS 0.9 μ design rule
2) Low resistance material
3) Redundancy circuit for high yield

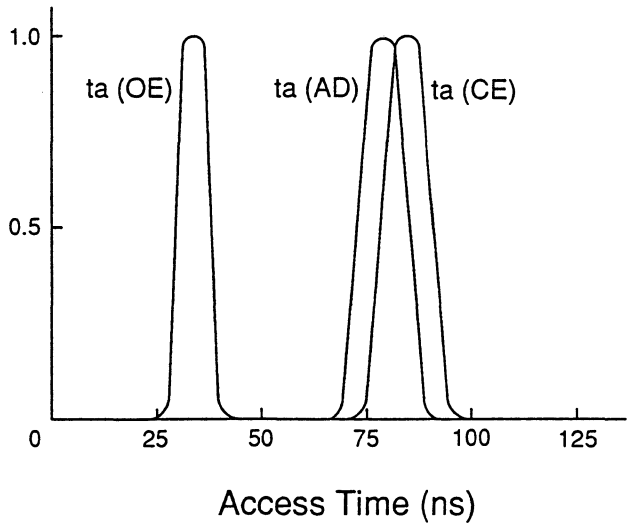
CMOS EPROM M5M27C202K

Access Time vs Ambient Temperature (Vcc=5V)



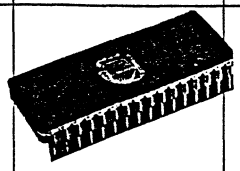
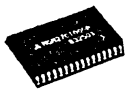
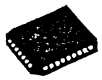
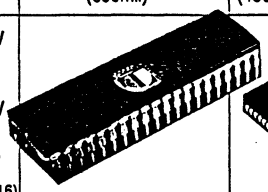
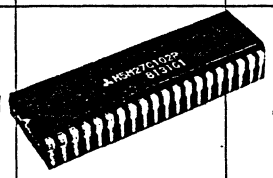
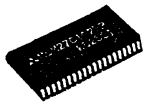
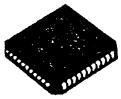
CMOS EPROM M5M27C202K

Normalized Distribution of Access Time (Vcc=5.OV,Ta=25℃)



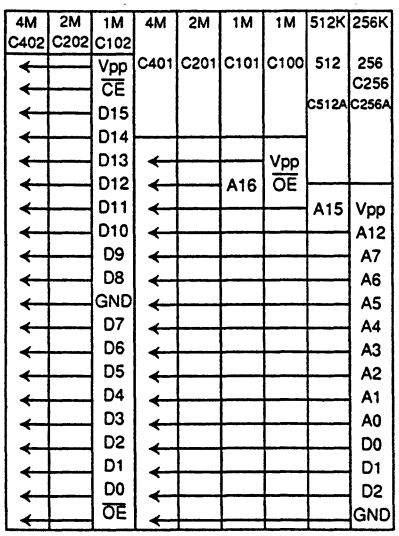
MITSUBISHI ELECTRIC

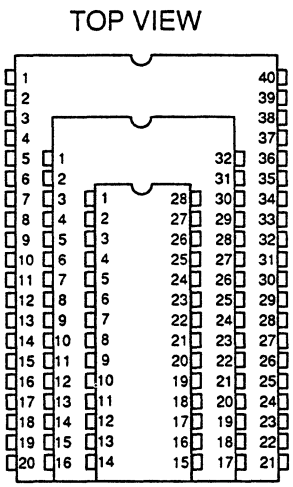
1M/2M EPROM/OTP Packages

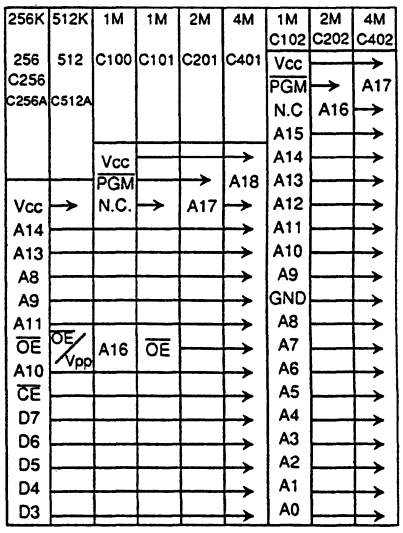
	EPROM		OTP ROM			
	CERDIP (K)	CLCC(JK)	DIP (P)	SOP (FP)	PLCC (J)	TSOP(VP,RV)
Byte Wide (×8)	 32pin Dlp (600mil)	 32pin CLCC (450mil×550mil)	 32pin DIP (600mil)	 32pin SOP (525mil)	 32pin PLCC (450mil×550mil)	 (VP)
Word Wide (×16)	 40pin DIP (600mil)	 44pin CLCC (650mil×650mil)	 40pin DIP (600mil)	 40pin SOP (525mil)	 44pin PLCC (650mil×650mil)	 (RV) 40pin TSOP (14mm×10mm)

MITSUBISHI ELECTRIC

EPROM / OTP Pin Configurations (DIP.SOP)





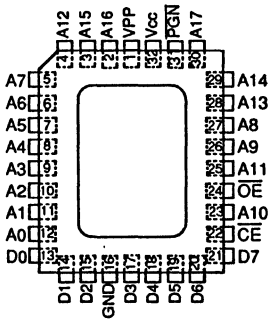


28, 32, 40pin DIP :600mil
28pin SOP :450mil
32, 40pin SOP :525mil

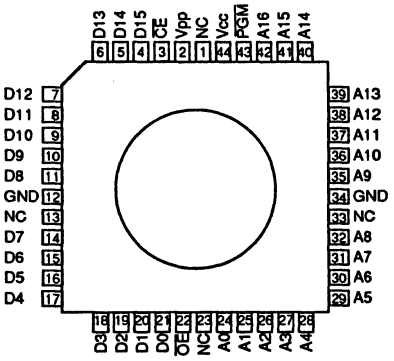
2M CMOS EPROM (CLCC)

Features

1) Varieties of organization and pinout
   M5M27C201JK ------- 256KX8bit, 32pin, JEDEC pin out
   M5M27C202JK ------- 128KX16bit, 44pin, JEDEC pin out
2) High speed access time 100/120/150ns(max)
3) Pin compatible with PLCC(OTPROM)



32pin



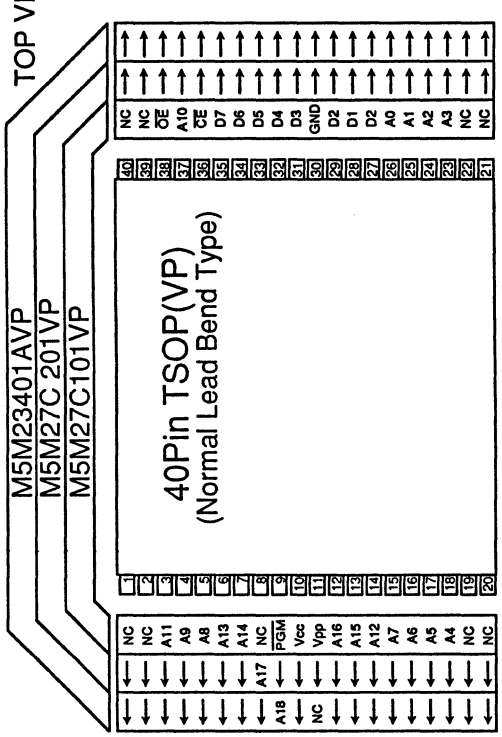
44pin

MITSUBISHI ELECTRIC

1M,2M OTP ROM / 4M Mask ROM Pin configuration (TSOP)

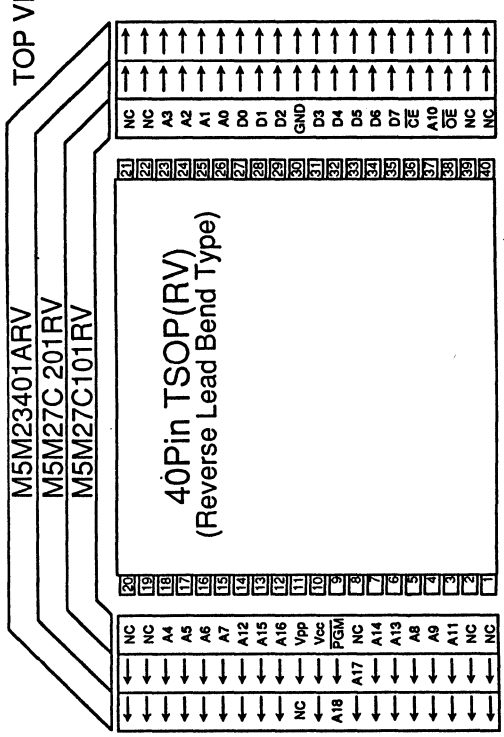
TOP VIEW

M5M23401AVP
M5M27C 201VP
M5M27C101VP



TOP VIEW

M5M23401ARV
M5M27C 201RV
M5M27C101RV



MITSUBISHI ELECTRIC

CMOS 1.2 μm EPROM/OTP Series

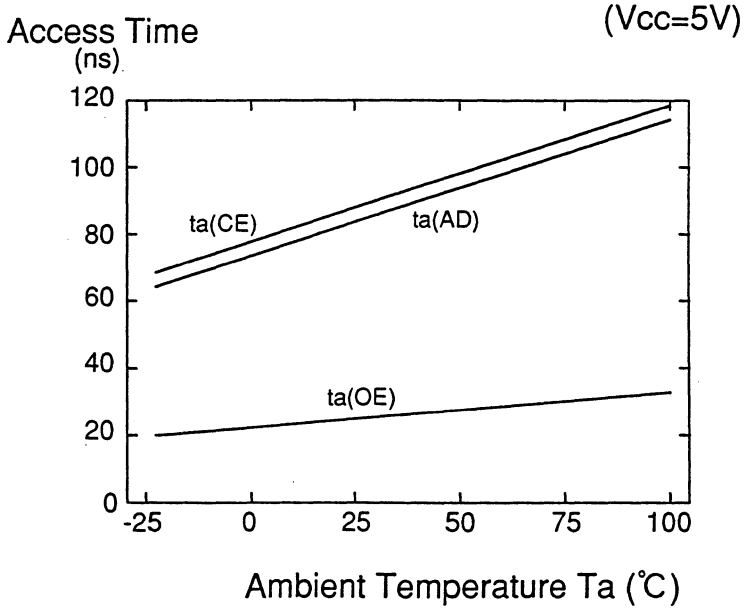
Technology

1) High performance Si-gate N-well CMOS
   1.2 μm design rule
   Memory Cell size:4.5x4.5 μm
   Channel length:1.5 μm(N),2.0 μm(P)
2) Low resistance material
   MoSi
3) Redundancy circuit for high yield
   1M EPROMs/OTPs
4) High speed circuit
   High speed differential sense amplifier
5) CMOS 1.2 μm EPROM/OTP Series:
   M5M27C256A, M5M27C512A,M5M27C100,
   M5M27C101, M5M27C102

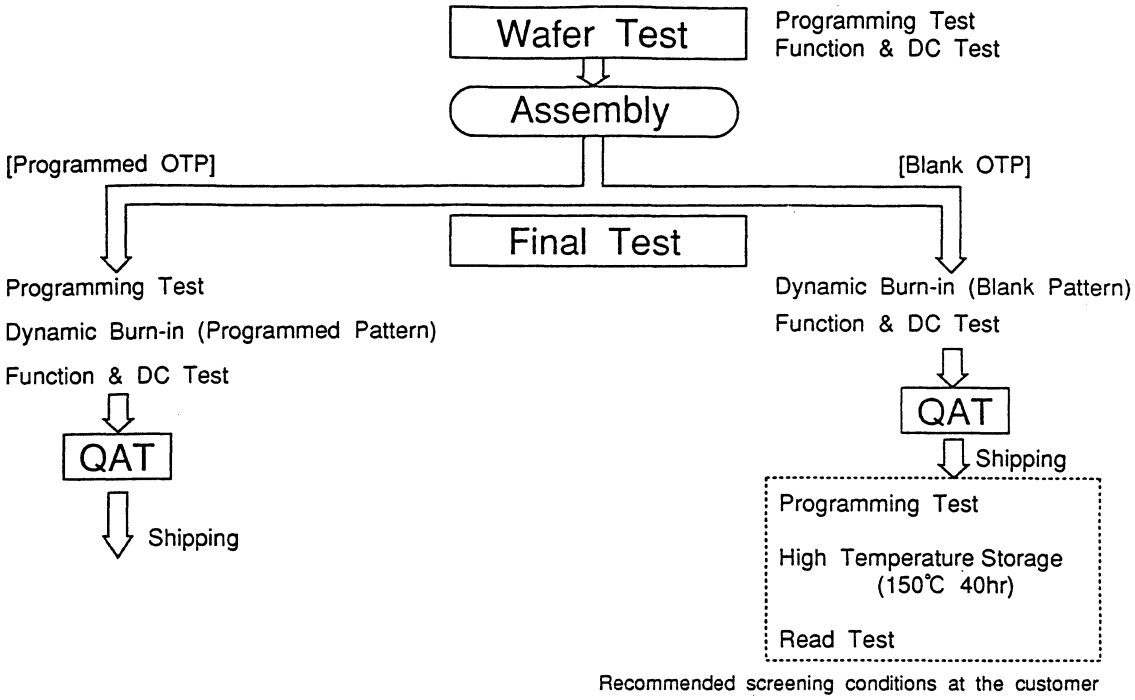
MITSUBISHI ELECTRIC

— CMOS EPROM M5M27C100K — M5M27C101K

Access Time vs Ambient Temperature



OTP Test Flow



Recommended screening conditions at the customer

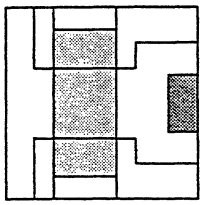
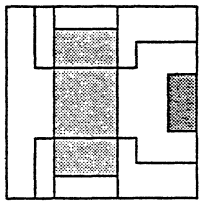
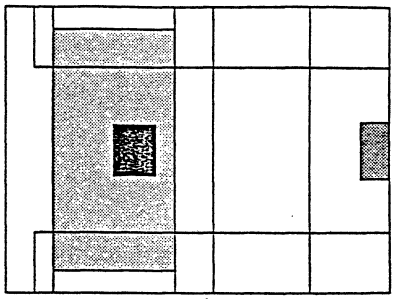
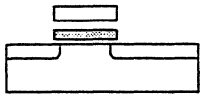
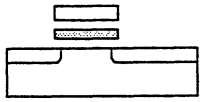
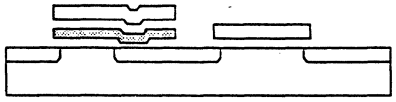
APPROVED EPROM PROGRAMMER

EPROM PROGRAMMER MAKER	PROGRAMMER TYPE	
	GANG	SINGLE
ADVANTEST CORPORATION	R4951 R4952 R4949	R4945 R4944/A
ANDO ELECTRIC CO.,LTD	AF9720 AF9721 AF9722*	AF9703 AF9704
AVAL DATA CORPORATION	PKW-1600	PKW-1100/A PKW-3100
DATA I/O CORPORATION	S1000 280 288	UNIPAK2B UNISITE40 201
MINATO ELECTRONICS INC	MODEL-1870A MODEL-1910	MODEL-1900 MODEL-1890/A

* Plan to approve

MITSUBISHI ELECTRIC

MITSUBISHI FLASH EEPROM,EPROM & EEPROM CELL

	Flash EEPROM	EPROM	EEPROM
Top View			
Cross Section			
Program	Hot Electron Injection	Hot Electron Injection	Tunneling
Erase	Tunneling	UV light	Tunneling

MITSUBISHI ELECTRIC

Advanced Information

1M FLASH EEPROM (M5M28F101P)

Target Features

1) Organization	128k x 8bit
2) High Speed Access Time	100ns/120ns/150ns(max.)
3) Power Supply	Vcc=5v±10% Vpp=12.0v±0.6v
4) Low Power	50mA(Active)/0.1mA(Standby)
5)Program/Erase Operation	Software Command Control
6) Program Time	10 μs Typical Byte-Program 2sec Typical Chip-Program
7) Erase Time	1sec Typical Chip-Erase
8) Endurance	10000 Cycles
9)Package	32 Pin DIP 32 Pin SOP 32 Pin PLCC 32 Pin TSOP

Technology

1) High Performance Si-Gate Twin-Well CMOS 0.9 μm Design Rule
2) Self-Aligned Stacked Gate (EPROM Base)

1M FLASH EEPROM
MODE SELECTION TABLE

Mode \ Pins		$\overline{CE}$	$\overline{OE}$	$\overline{WE}$	VPP	Data I/O
Read-Only	Read	VIL	VIL	VIH	VPPL	Data Out
	Output Disable	VIL	VIH	VIH	VPPL	Floating
	Standby	VIH	X	X	VPPL	Floating
Read/Write	Read	VIL	VIL	VIH	VPPH	Data Out
	Output Disable	VIL	VIH	VIH	VPPH	Floating
	Standby	VIH	X	X	VPPH	Floating
	Write	VIL	VIH	VIL	VPPH	Data In

VPPL=0～VCC+2.0V
VPPH=12.0±0.6V
X can be VIL or VIH

MITSUBISHI ELECTRIC

1M FLASH EEPROM
SOFTWARE COMMAND DEFINITION

Command	Bus Cycles Req'd	First Bus Cycle			Second Bus Cycle		
		Mode	Address	Data I/o	Mode	Address	Data I/o
Read memory	1	write	X	00H	—	—	—
Set-up program/program	2	write	X	40H	write	PA	PD
Program verify	2	write	X	C0H	Read	X	PVD
Set-up erase/erase	2	write	X	20H	write	X	20H
Erase verify	2	write	EVA	A0H	Read	X	EVD
Reset	2	write	X	FFH	write	X	FFH
Read device identifier code	2	write	X	90H	Read	DIA	DID

PA = Programmed Address
EVA = Erase-Verified Address
DIA = Device Identifier Address : 0000H for manufacturer code,0001H for device code.
PA and EVA are latched on the falling edge of the $\overline{WE}$ pulse.
PD = Programmed Data : Data is latched on the rising edge of the $\overline{WE}$ pulse.
PVD = Program-Verified Data
EVD = Erase-Verified Data
DID = Device Identifier Data : 1CH for manufacturer code,D0H for device code.

MITSUBISHI ELECTRIC

Advanced Information

1M Flash EEPROM
(M5M28F102P,FP,J,VP,RV)

Target Features

1) Organization	64Kx16bit
2) High Speed Access Time	100ns/120ns/150ns(max.)
3) Power Supply	Vcc=5V±10% Vpp=12.0V±5%
4) Low Power	50mA(Active)/0.1mA(Standby)
5) Program/Erase Operation	Software Command Control Erase / Program Pulse Controlled by Timer
6) Program Time	10 μs Typical Byte-Program 1 sec Typical Chip-Program
7) Erase Time	1 sec Typical Chip-Erase
8) Program/Erase Cycles	10000 Cycles
9) Package	40 pin DIP, SOP, TSOP, 44pin PLCC

Technology

1) High performance Si-Gate Twin-well CMOS (0.9 μm Rule)

2) Self-Aligned Stacked Gate(EPROM Base)

3) Redundancy Circuit for High Yield

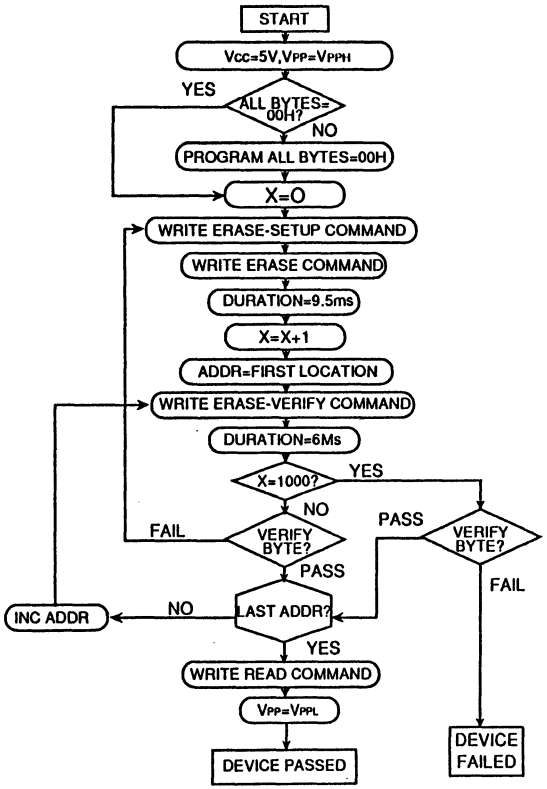
MITSUBISHI ELECTRIC

1M(64K x 16) Flash EEPROM
Software Command Definition

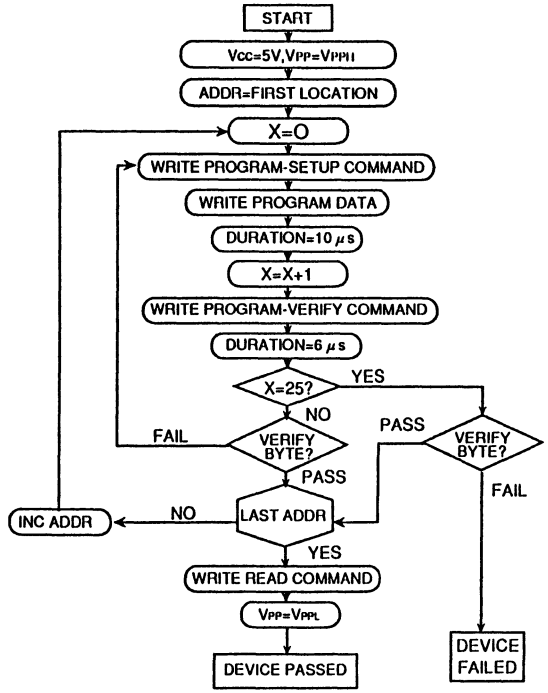
Command	Bus Cycles Req'd	First Bus Cycle			Second Bus Cycle		
		Mode	Address	Data	Mode	Address	Data
Read Memory	1	Write	X	0000H	—	—	—
Set-up Program/Program	2	Write	X	0040H	Write	PA	PD
Program Verify	2	Write	X	00C0H	Read	X	PVD
Set-up Erase/Erase	2	Write	X	0020H	Write	X	0020H
Erase Verify	2	Write	EVA	00A0H	Read	X	EVD
Reset	2	Write	X	FFFFH	Write	X	FFFFH
Read Device Identifier Code	2	Write	X	0090H	Read	DIA	DID

PA = Programmed Address : Address is latched on the falling edge of $\overline{WE}$.
EVA=Erase-Verified Address : Address is latched on the falling edge of $\overline{WE}$.
DIA= Device Identifier Address
PD= Programmed Data : Data is latched on the rising edge of $\overline{WE}$.
PVD= Program-Verified Data
EVD= Erase-Verified Data
DID= Device Identifier Data

Flash EEPROM
Erase Algorithm Flowchart



Flash EEPROM
Programming Algorithm Flowchart



MITSUBISHI ELECTRIC

64K CMOS EEPROM (M5M28C64AP)

Features

1) Organization	8Kx8bit, 28pin DIP (JEDEC pinout)
2) High Speed access time	150ns/200ns (max.)
3) Low Power	165mW (Active)/5.5mW (Standby)
4) Write Operation	32 Byte Page Mode Write Data Polling
5) High Endurance	10000 Erase/Write 10Years Data Retention
6) Package	M5M28C64AP ·····28pin DIP M5M28C64AFP ·····28pin SOP M5M28C64AVP,RV·····28pin TSOP

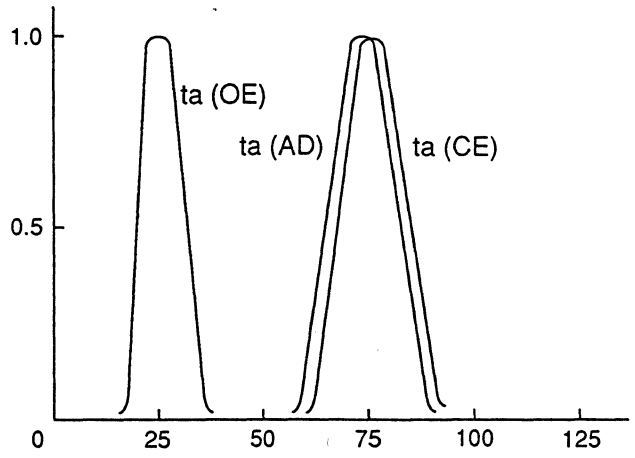
Technology

1) High performance Si-gate N-well CMOS 1.2 μm design rule
2) Low resistance material MoSi
3) Built-in ECC circuit for high reliability

MITSUBISHI ELECTRIC

—CMOS EEPROM M5M28C64AP—

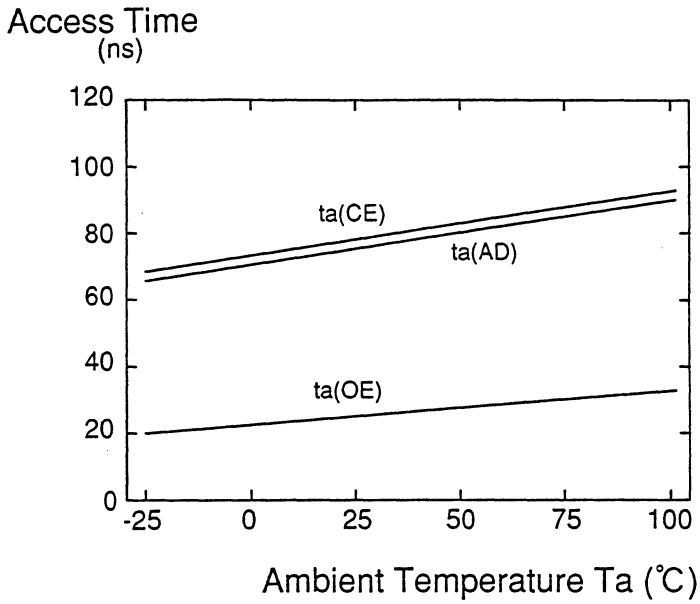
Normalized Distribution of Access Time
(Vcc=5.OV,Ta=25℃)



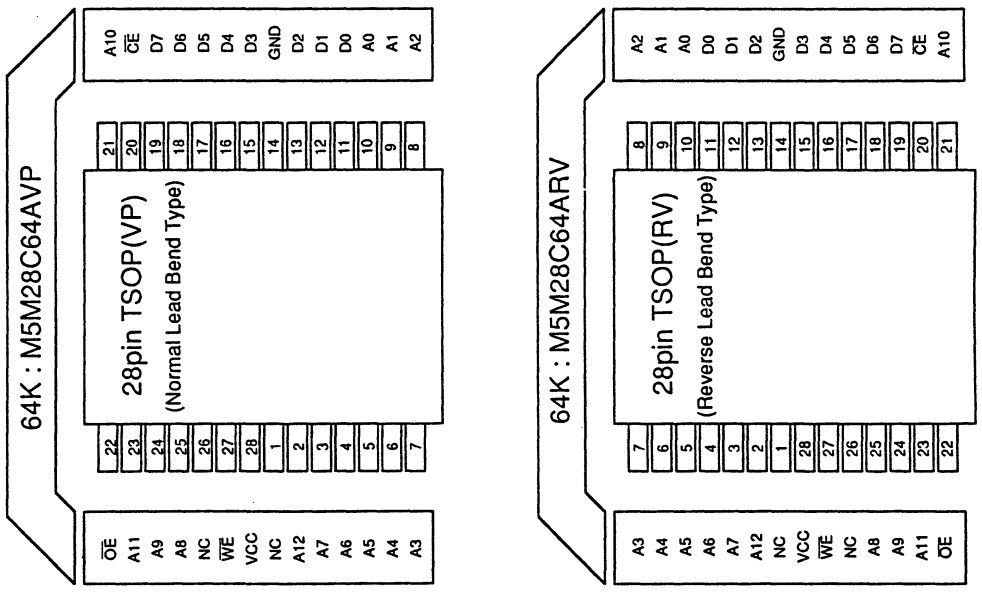
— CMOS EEPROM M5M28C64AP —

Access Time vs Ambient Temperature

(Vcc=5V)



EEPROM Pin Configurations (TSOP)



MITSUBISHI ELECTRIC

Comparison Table of Mitsubishi Mask ROM

Memory capacity	4M		8M		16M
Organization	512k×8/ 256k×16	512k×8	1M×8／ 512k×16	1M×8	2M×8／ 1M×16
Type name	M5M23400A	M5M23401A	M5M23800	M5M23801	M5M23160
Process technology	CMOS 1.1 μm	CMOS 1.1 μm	CMOS 0.8 μm	CMOS 0.8 μm	CMOS 0.8 μm
Access time (ns)	150	150	150	150	150
Supply voltage (V)	5	5	5	5	5
Active current (mA)	30	30	50	50	50
Stand by current (mA)	0.1	0.1	0.1	0.1	0.1
Pins／ Package */ Width(mil)	40P(600) 40FP(525) 40VP,RV	32P(600) 32FP(525) 40VP,RV	42P(600) 44FP(600) 48VP,RV	32P(600) 32FP(525) 40VP,RV	42P(600) 44FP(600) 48VP,RV
Note					

Package* ---- P:DIP , FP:SOP , VP／RV:TSOP

MITSUBISHI ELECTRIC

16M Mask ROM

Target Features

1) Organization M5M23160 ・・・2M×8／1M×16
2)High Speed Access Time 150ns(max.)
3)Low Power 50mA(Active)
0.1mA(Standby)
4)Package M5M23160P ・・・42pin DIP(600mil)
M5M23160FP ・・・44pin SOP(600mil)
M5M23160VP/RV ・・・48pin TSOP(12×18mm)

Technology

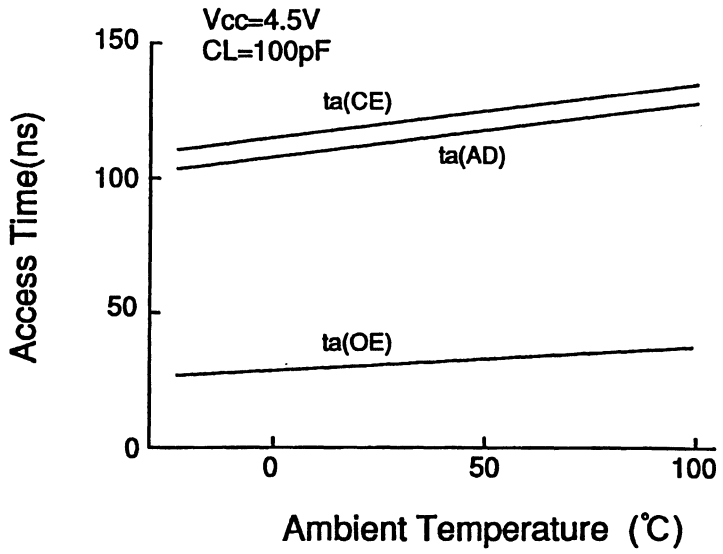
1)High performance Si-gate twin well CMOS
2)Design rule 0.8 μm
3)Built-in ECC circuit for high yield

MITSUBISHI ELECTRIC

NEW

16M bit Mask ROM M5M23160P,FP,VP,RV

Access Time vs Ambient Temperature



MITSUBISHI ELECTRIC

8M Mask ROM

Target Features

1) Organization M5M23800 ・・・1M×8／512K×16
M5M23801 ・・・1M×8

2)High Speed Access Time 150ns(max.)

3)Low Power 50mA(Active)
0.1mA(Standby)

4)Package
M5M23800P ・・・42pin DIP(600mil)
M5M23800FP ・・・44pin SOP(600mil)
M5M23800VP/RV ・・・48pin TSOP(12×18mm)
M5M23801P ・・・32pin DIP(600mil)
M5M23801FP ・・・32pin SOP(525mil)
M5M23801VP/RV ・・・40pin TSOP(10×14mm)

Techonology

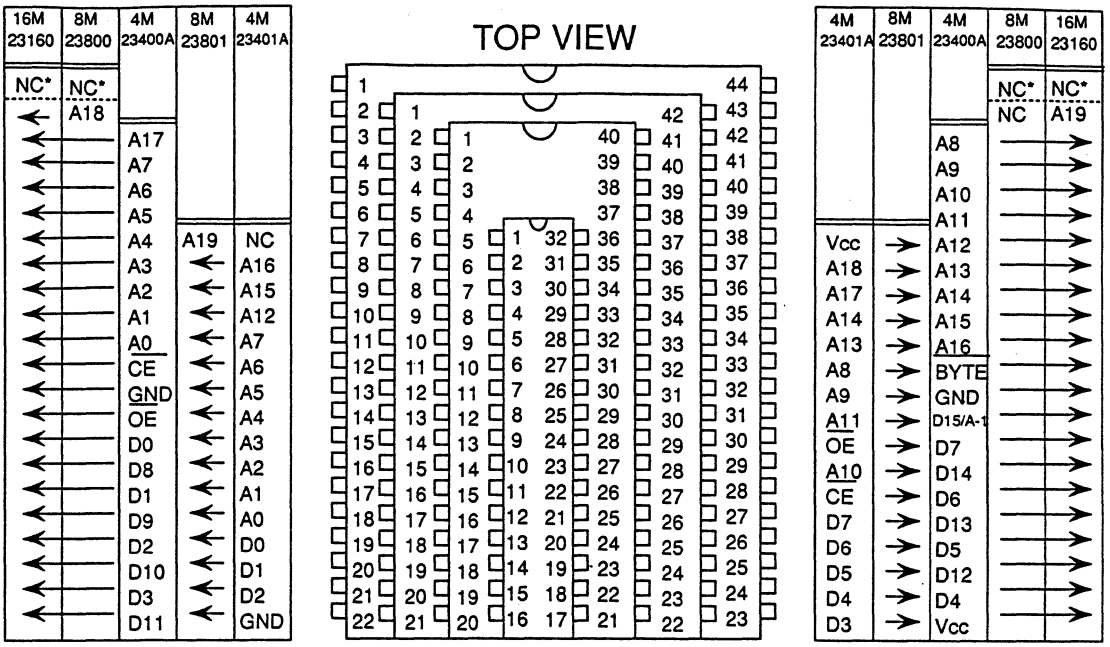
1)High performance Si-gate twin well CMOS

2)Design rule 0.8 μm

3)Built-in ECC circuit for high yield

MITSUBISHI ELECTRIC

Mask ROM Pin Configuration (DIP,SOP)

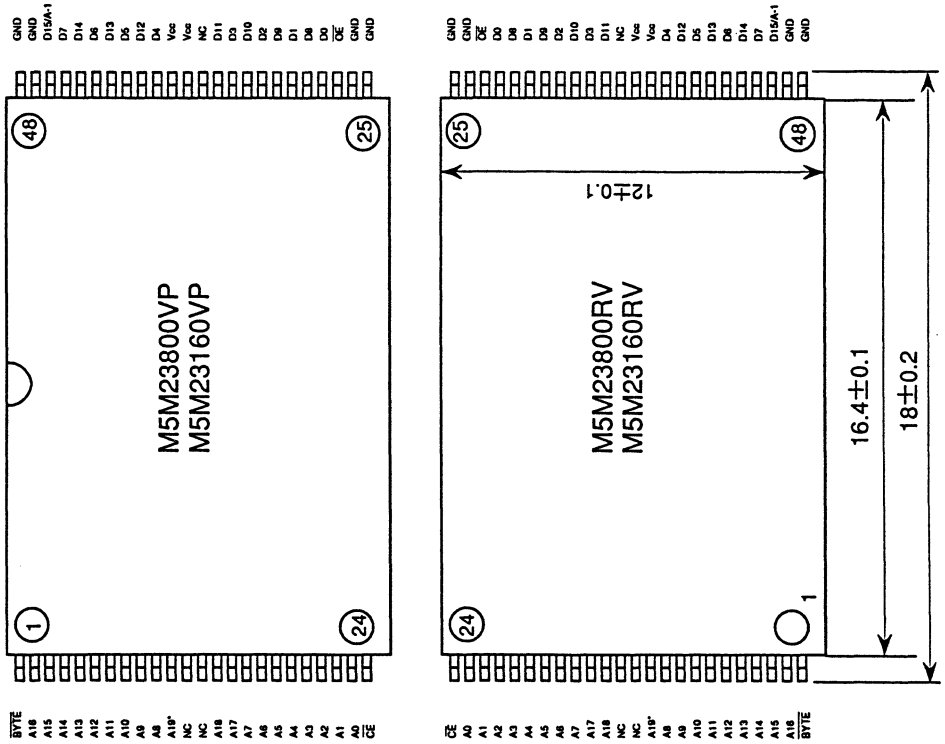


NC*:NC(44pinSOP)

32,40,42pin DIP:600mil
32,40pin SOP:525mil
44pin SOP:600mil

MITSUBISHI ELECTRIC

8M,16M Mask ROM Pin Configuration(TSOP)



MITSUBISHI ELECTRIC

4M Mask ROM

Features

1) Organization
   - M5M23400A ··· 512Kx8/256Kx16
   - M5M23401A ··· 512Kx8

2) High Speed Access Time — 150ns(max.)

3) Low Power — 30mA(Active)/0.1mA(Standby)

4) Package
   - M5M23400AP ··· 40pin DIP(600mil)
   - M5M23400AFP ··· 40pin SOP(525mil)
   - M5M23400AVP/RV ··· 40pin TSOP(10x14mm)
   - M5M23401AP ··· 32pin DIP(600mil)
   - M5M23401AFP ··· 32pin SOP(525mil)
   - M5M23401AVP/RV ··· 40pin TSOP(10x14mm)

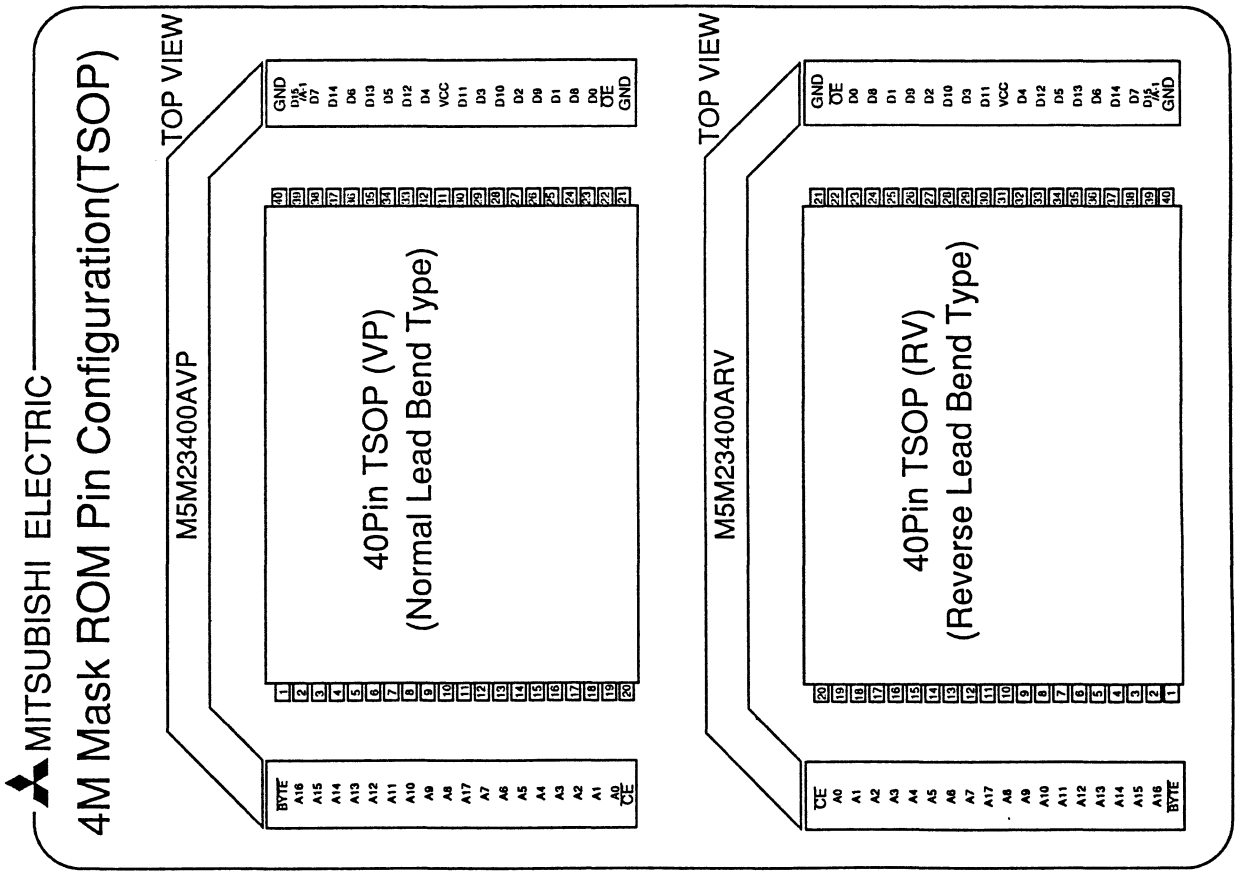
Technology

1) High performance Si-Gate CMOS

2) Design rule 1.1 μm

MITSUBISHI ELECTRIC

4M Mask ROM Pin Configuration(TSOP)



Versatile Memory M6M72561J, J-I

1. Temperature range

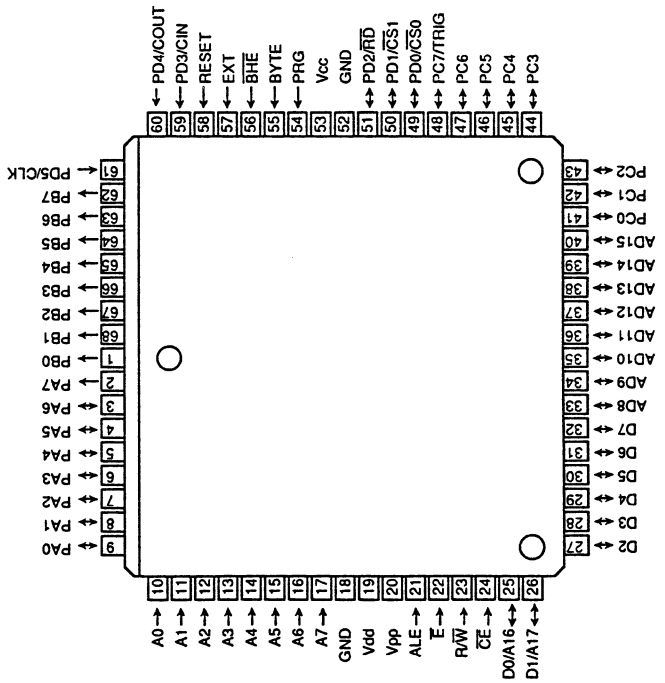
M6M72561J	0 ～ 70℃
M6M72561J-I	- 40 ～ 85℃

2. Package — 68PLCC

3. Function

- OTPROM : Organization ..... 32Kx8 / 16Kx16 bit
  - Access time 200ns
  - Programming ... 27C256 Compatible(Socket Adapter)
- SRAM : Organization ..... 2Kx8 / 1Kx16 bit
  - Access time 150ns
- Counter : Presettable 8 bit up - counter
- I / O Port : Input Port ..... 8 + 6 bit
  - Output Port ..... 8 bit
  - I / O Port ..... 8 bit

M6M72561J / J-I
Pin Configuration



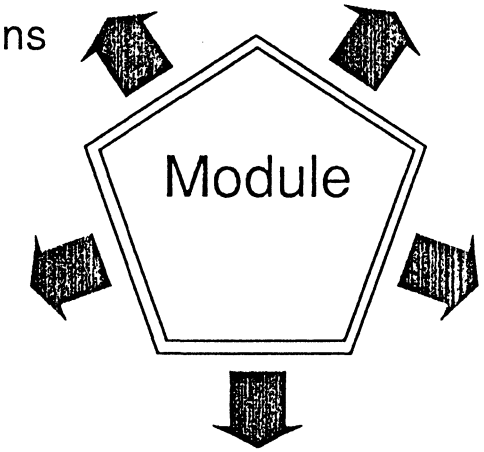
Technical Strategy of Module

High Performance

DRAM Module:60ns
Fast SRAM Module:45ns

High Density

1M×36bit DRAM
4M×9bit DRAM
512K×8bit SRAM
(Compatible
4MSRAM DIP)



New Concept

Stacked Memory
(Fast SRAM)
Module for SMT

Various Package

SIM,SIP,ZIMP
DIP

As Memory

Pseudo-Pseudo SRAM Module
Custom Module

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M E L C O

Memory Module

Development and Production Route

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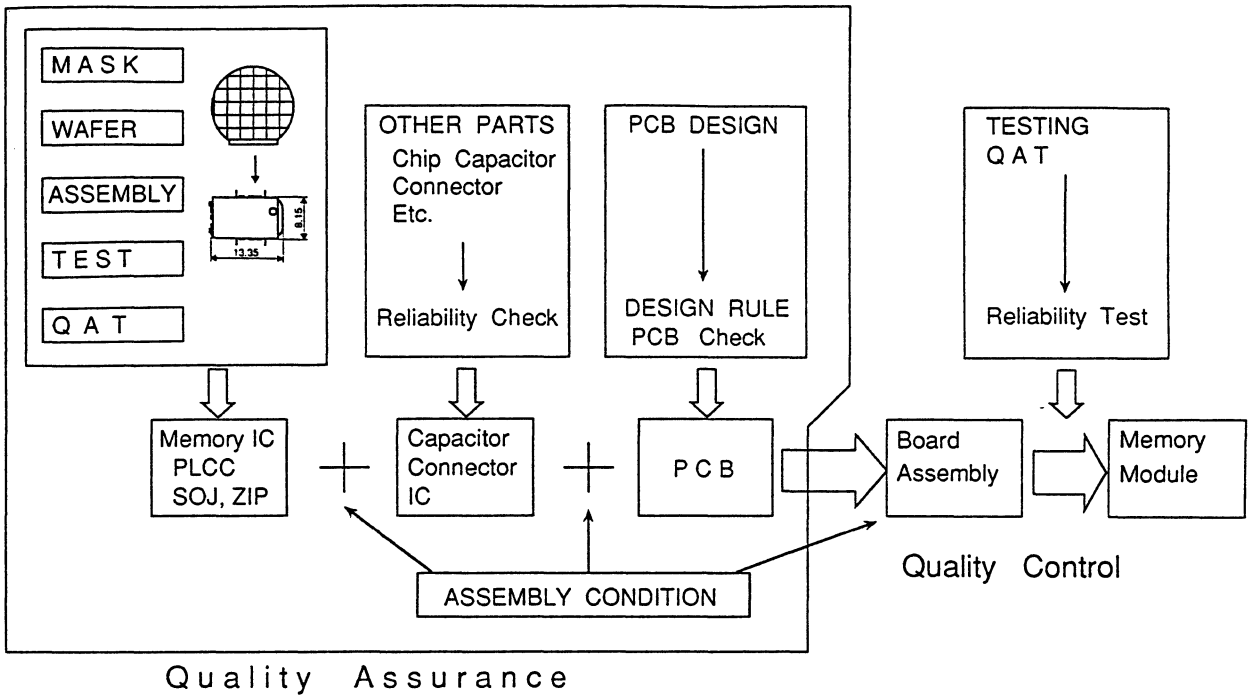
Concept of Mitsubishi Surface Mount Technology

* High reliable SMD memory IC is mounted
* Full automatic chip placement system
* Accurate SMD placement with pattern recognition system
* AIR Reflow soldering
* Ultrasonic and vapor phase cleaning
* Total quality control from wafer process to memory Module

MITSUBISHI ELECTRIC

Total Quality Assurance of Memory Module



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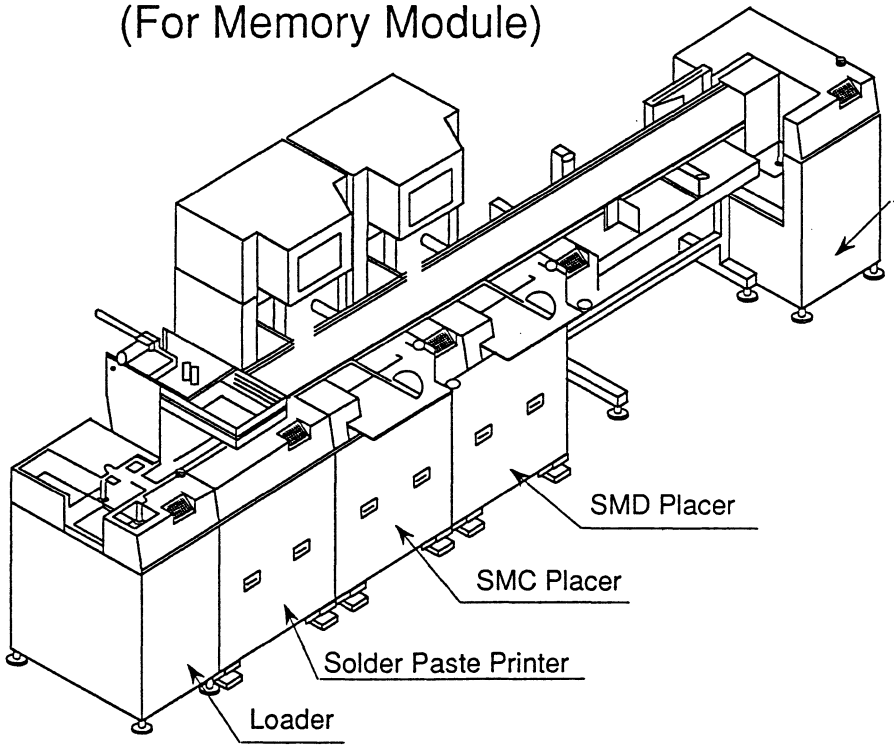
Automatic Chip Placement Syatem (For Memory Module)



-Specification-

1.Mountable Chip.
PLCC,SOJ,SOP,TSOP
Chip-Capacitor
Chip Resister.
2.Mounting Accuracy.
±0.08mm
3.Placement Area.
X=150mm
Y=150mm

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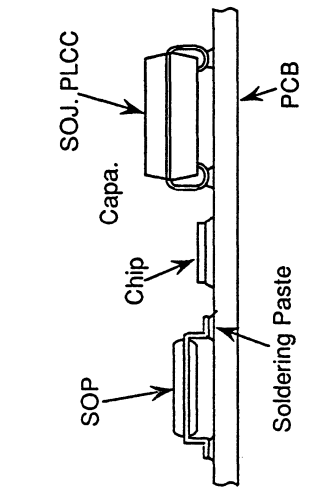
Assmbly Flow Chart Of Memory Module



Screen Printing → SMC Mounting → SMD Mounting → Reflow Soldering (AIR Reflow) → Cleaning → Connector Mounting → Soldering → Cleaning

NOTE
SMC : Chip Capa.
Chip Tantalum.
SMD : SOJ, PLCC, SOP, TSOP.

MITSUBISHI ELECTRIC

Mitsubishi Memory Module Series

Type		Pin	Density	DRAM	SRAM	ROM	VRAM
SIMM	2.54 mm	30	256K × 9	MH25609BAJ			
			1M × 9	MH1M09B0J MH1M09A0AJ			
			4M × 9	MH4M09A0J			
		35	256K × 8		MH25608S1N		
	1.27 mm	64	512K × 8		MH51208SN		
		72	256K × 36	MH25636BJ			
			512K × 36	MH51236BJ			
			1M × 36	MH1M36BJ			
			2M × 36	MH2M36CJ			
			2M × 40	MH2M40AJ			
			4M × 36	MH4M36AJ			
SIP	2.54 mm	30	256K × 9	MH25609BAJA			
			1M × 9	MH1M09B0JA MH1M09A0AJA			
			4M × 9	MH4M09A0JA			
DIP (600mil)	2.54 mm	32	128K × 8		MH12808TNA		
			256K × 8		MH25608TNA		
			512K × 8		MH51208TNA MH51208ANA MH51208UNA		
		34	512K × 8			MH51208RNA *	
		36	1M × 8		MH1M08TNA*		
			2M × 8		MH2M08TNA*		
		40	512K × 8	MH51208PNA			
		42	256K × 16			MH25616RNA	
			2M × 8	MH2M08PNA*			
		44	512K × 16			MH51216RNA	
		46	256K × 16	MH25616PNA			
ZIMP	1.27 mm	46	128K × 16				MH12816JZ
		64	64K × 32		MH6432NZ		

* :under development

MITSUBISHI ELECTRIC

×36bit Memory Module,Organization LIST

Hight	Words	TYPE NAME	Thickness	Loaded Memory IC				Access time	Comment
				Main		Parity			
25.4mm (1 inch)	256K	MH25632BJ	5.08	M5M44256BJ	8pcs	——		70, 80,100	
		MH25636BJ	5.08	M5M44256BJ	8pcs	M5M4256AJ	4pcs	85,100,120	
		MH26636BJ	5.08	M5M44256BJ	8pcs	M5M44266BJ	1pcs	80,100	W/B Module
	512K	MH51232BJ	8.5	M5M44256BJ	16pcs	——		70, 80,100	
		MH51236BJ	8.5	M5M44256BJ	16pcs	M5M4256AJ	8pcs	85,100,120	
		MH52236BJ	8.5	M5M44256BJ	16pcs	M5M44266BJ	2pcs	80,100	W/B Module
	1M	MH1M36DJ	8.5	M5M44400J	8pcs	M5M41000BJ	4pcs	80,100	
		MH1M36EJ	5.08	M5M44400AJ	8pcs	M5M41000BVP	4pcs	80,100	TSOP Module
		MH1M36FJ	5.08	M5M44400AJ	8pcs	M5M44410AJ	1pcs	80,100	W/B Module
	2M	MH2M36EJ	8.5	M5M44400AJ	16pcs	M5M41000BVP	8pcs	80,100	TSOP Module
		MH2M36FJ	8.5	M5M44400AJ	16pcs	M5M44410AJ	2pcs	80,100	W/B Module
31.75 (1.25)	1M	MH1M36BBJ	4.3	M5M41000BVP	32pcs	M5M41000BVP	4pcs	70, 80,100	TSOP Module
		MH1M36CJ	5.08	M5M44400J	8pcs	M5M41000BJ	4pcs	80,100	
	2M	MH2M36CJ	8.5	M5M44400J	16pcs	M5M41000BJ	8pcs	80,100	
32.77 (1.29)	4M	MH4M36AJ	8.5	M5M44400AJ	32pcs	M5M44400AJ	4pcs	80,100	
40.64 (1.6)	1M	MH1M36BJ(SC)	8.5	M5M41000BJ	32pcs	M5M41000BJ	4pcs	70, 80,100	Solder Coat
		MH1M36BJ(g)	8.5	M5M41000BJ	32pcs	M5M41000BJ	4pcs	70, 80,100	gold plated

M5M4256AJ :18PIN PLCC ,256KD (×1) page
M5M44256BJ :26PIN 300mil SOJ,1MD (×4) Fast page
M5M44266BJ :26PIN 300mil SOJ,1MD (×4) Fast page, W/B
M5M41000BJ :26PIN 300mil SOJ,1MD (×1) Fast page
M5M41000BVP:24PIN TSOP ,1MD (×1) Fast page
M5M44400J :26PIN 350mil SOJ,4MD (×4) Fast page
M5M44400AJ :26PIN 300mil SOJ,4MD(×4) Fast page
M5M44410AJ :26PIN 300mil SOJ,4MD(×4) Fast page, W/B

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SRAM Module Organization LIST

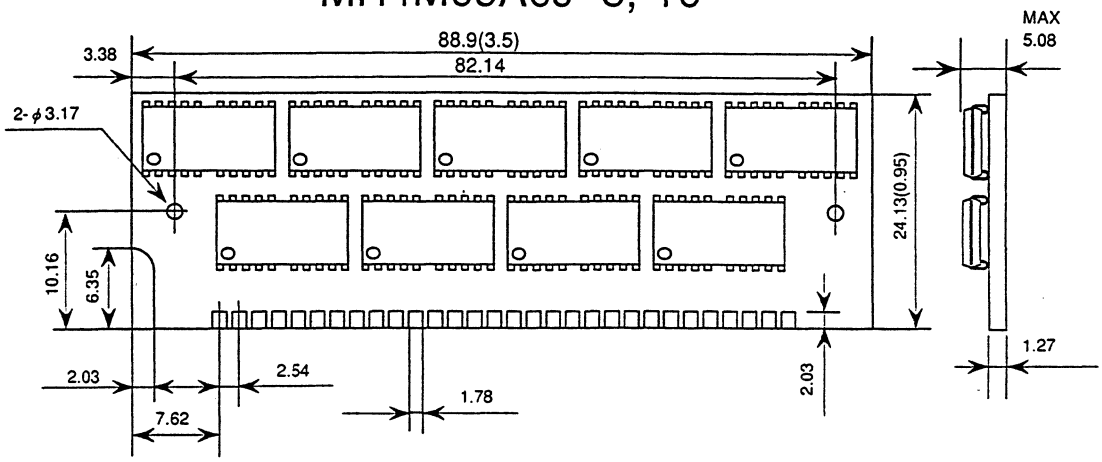
	Words	Bits	DEVICE NAME	Pin Number	Access time (ns)	Stand-by *2 current (μA)	Loaded IC	
							Memory IC	Other
SIMM	256K	8	MH25608SIN	35	70,85,100	200	M5M5256BFP 8pcs	
	512K	8	MH51208SN	64 *1	70,85,100	400	M5M5256BFP 16pcs	
DIP (600mil)	128K	8	MH12808TNA	32	85,100,120	100	M5M5256BFP 4pcs	M74HCT138-1FP 1pcs
	256K	8	MH25608TNA	32	85,100,120	200	M5M5256BRV/VP 8pcs	M74HC138VP 1pcs
	512K	8	MH51208TNA	32	85,100,120	400	M5M5256BRV/VP 16pcs	M74HC138VP 2pcs
			MH51208ANA	32	85,100,120	undecided	M5M51008VP/RV 4pcs	M74HC138VP 1pcs
			MH51208UNA	32	85,100,120	undecided	M5M51008FP 4pcs	M74HC138VP 1pcs
			MH51208PNA	40	8MHZ,10MHZ	3.5mA *3	M5M44256BJ 4pcs	M66200FP 1pcs M66213FP 2pcs
	1M	8	MH1M08TNA *4	36	85,100,120	undecided	M5M51008VP/RV 8pcs	M74HC138VP 1pcs
	2M	8	MH2M08TNA *4	36	85,100,120	undecided	M5M51008VP/RV 16pcs	M74HC138VP 2pcs
			MH2M08PNA *4	42	8MHZ,10MHZ	undecided	M5M44400J 4pcs	M66200FP 1pcs M66213FP 2pcs
	256K	16	MH25616PNA	46	8MHZ,10MHZ	3.5mA *3	M5M44256BJ 4pcs	M66200FP 1pcs M66213FP 2pcs
ZIMP	64K	32	MH6432NZ	64	15,20	undecided	M5M5258BJ 4pcs	

*1:1.27mm lead pitch, *2:Vcc=3V, *3:Vcc=5.5V, *4:under development

M5M5256BFP :256KSRAMfSOP
M5M5256BRV/VP :256KSRAM TSOP
M5M51008VP/RV :1M SRAM TSOP
M5M44256BJ :1M DRAM (×4) SOJ
M5M44400J : 4M DRAM (×4) SOJ
M74HCT138-1FP :Decoder SOP
M74HC138VP : Decoder VSOP
M66200FP :D RAM Controller SOP
M66213FP :AD DRESS Buffer SOP

MITSUBISHI ELECTRIC

4M×9 DRAM Memory Module PIN configuration
MH4M09A0J -8,-10

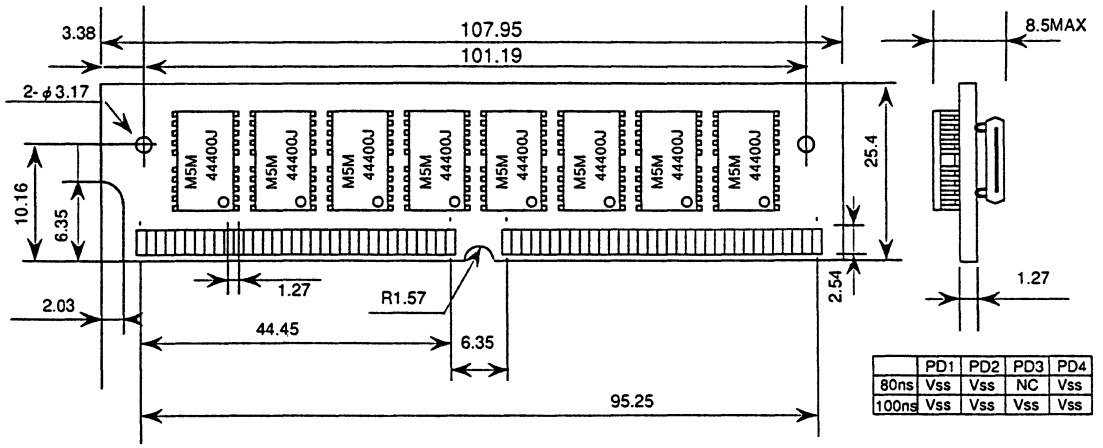


1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Vcc	$\overline{CAS}$	DQ0	A0	A1	DQ1	A2	A3	Vss	DQ2	A4	A5	DQ3	A6	A7	DQ4	A8	A9	A10	DQ5	$\overline{W}$	Vss	DQ6	NC	DQ7	QP,	$\overline{RAS}$	$\overline{CASP}$	DP	Vcc

- chip carrier M5M44100J -8,-10
- socket Molex Type 78810
  AMP Type 643930

MITSUBISHI ELECTRIC

1M×36 DRAM Memory Module PIN configuration
MH1M36DJ -8,-10



	PD1	PD2	PD3	PD4
80ns	Vss	Vss	NC	Vss
100ns	Vss	Vss	Vss	Vss

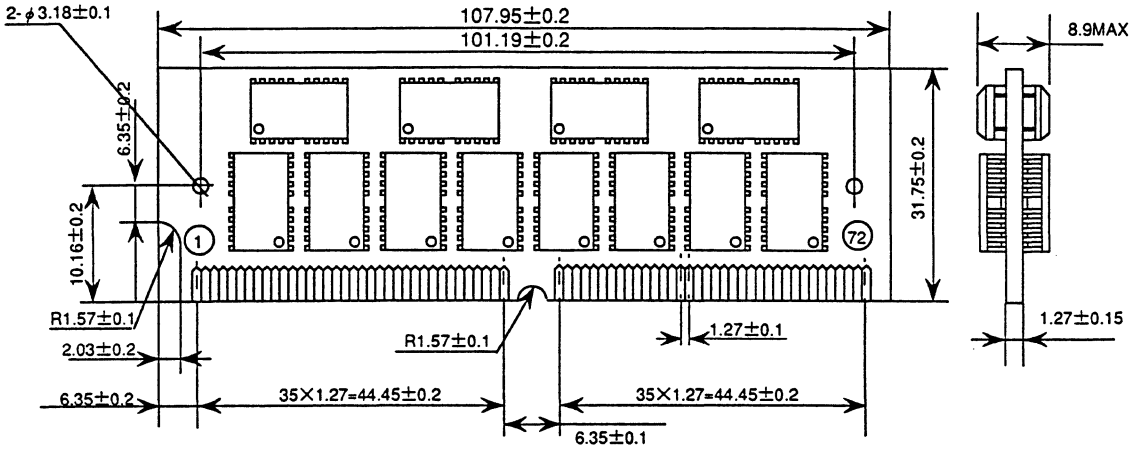
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
Vss	DQ0	DQ16	DQ1	DQ17	DQ2	DQ18	DQ3	DQ19	VDD	N.C	A9	A1	A2	A3	A4	A5	NC	DQ4	DQ20	DQ5	DQ21	DQ6	DQ22	DQ7	DQ23	A7	N.C.	VDD	A8	A9	N.C.	$\overline{RAS2}$	MP2	MP0

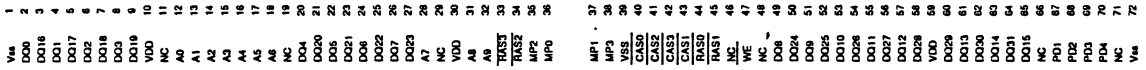
37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72
MP1	MP3	Vss	$\overline{CAS0}$	$\overline{CAS2}$	$\overline{CAS3}$	$\overline{CAS1}$	$\overline{RAS0}$	N.C	N.C	$\overline{WE}$	N.C	DQ8	DQ24	DQ9	DQ25	DQ10	DQ26	DQ11	DQ27	DQ12	DQ28	VDD	DQ29	DQ13	DQ30	DQ14	DQ31	DQ15	N.C	PD1	PD2	PD3	PD4	N.C	Vss

- chip carrier M5M44400J -8,-10
  M5M41000BJ -8,-10
- socket Molex Typ 78841-7202
  TI TS820102B-72-00

MITSUBISHI ELECTRIC

2M×36 DRAM Memory Module PIN configuration
MH2M36CJ -8,-10

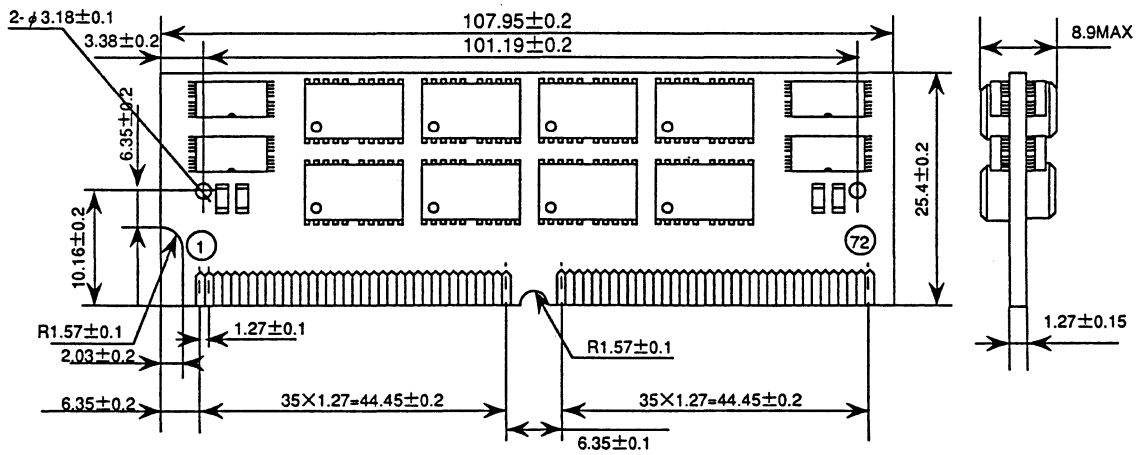


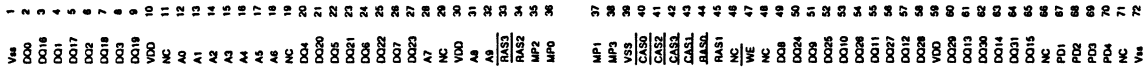


- chip carrier M5M44400J -8,-10
  M5M41000BJ -8,-10
- socket Molex Type 78841-7202
  TI TS820102B-72-00

MITSUBISHI ELECTRIC

2M×36 DRAM Memory Module PIN configuration
MH2M36EJ-6,-7,-8,-10

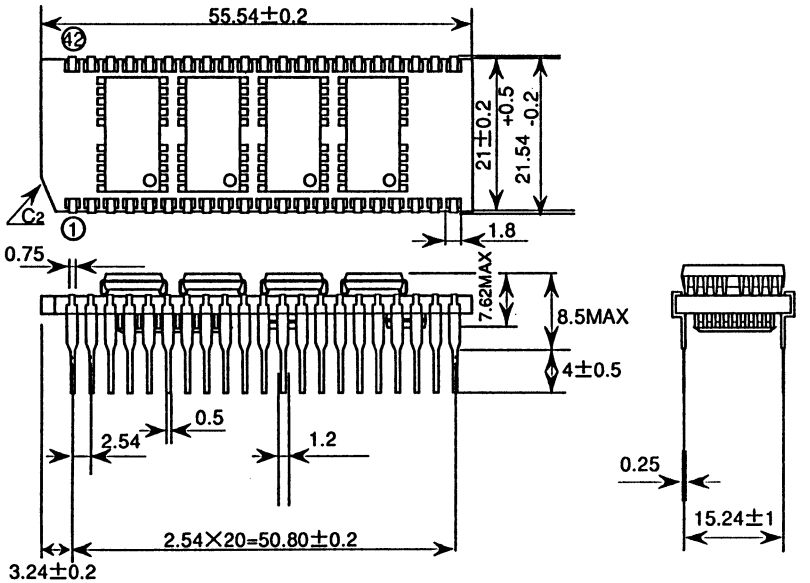


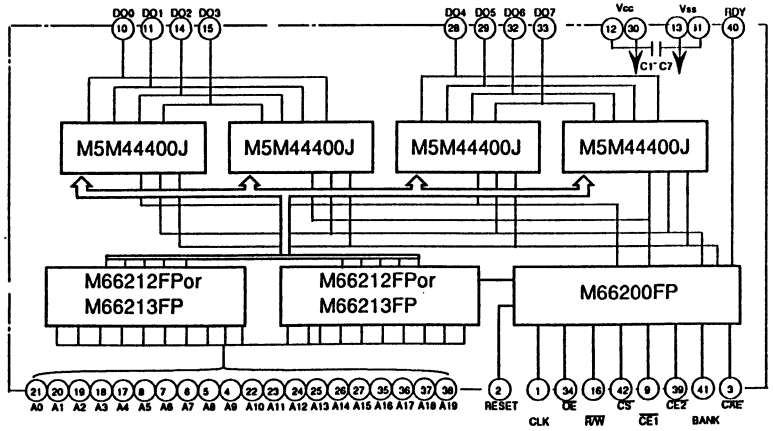


- chip carrier M5M44400AJ -6,-7,-8,-10
  M5M41000BJ -6,-7,-8,-10
- socket Molex Type 78841-7202
  TI TS820102B-72-00

MITSUBISHI ELECTRIC

2M×8 Pseudo-Pseudo SRAM Module
MH2M08PNA PIN configuration





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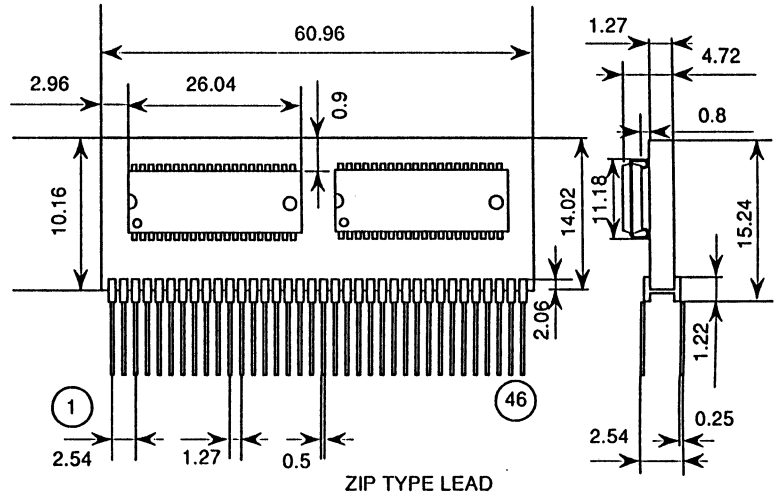
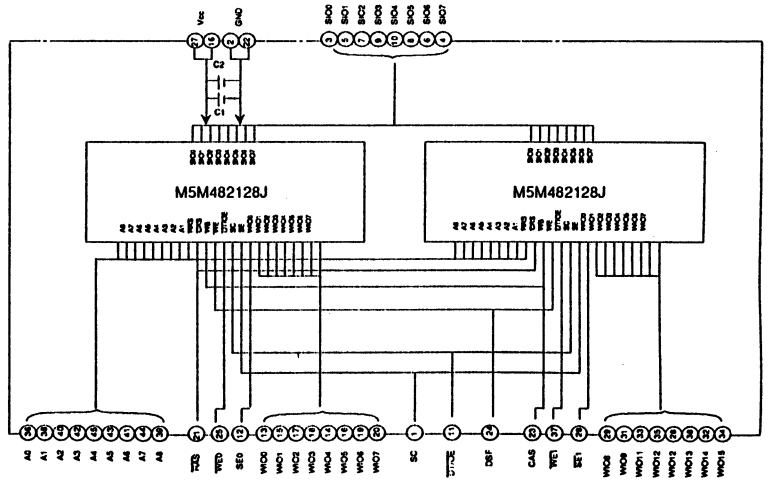
128K×16 Video RAM Module
MH12816JZ PIN configuration,Dimension



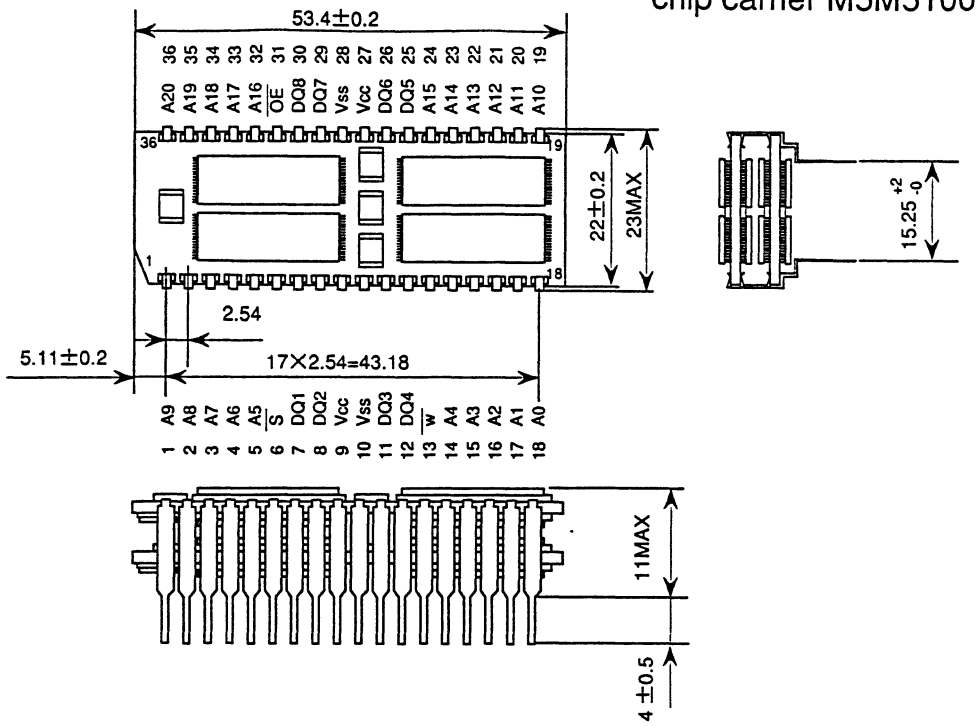
ZIP TYPE LEAD



MITSUBISHI ELECTRIC

2M×8 SRAM Memory ModulePIN configuration MH2M08TNA -85,10,12

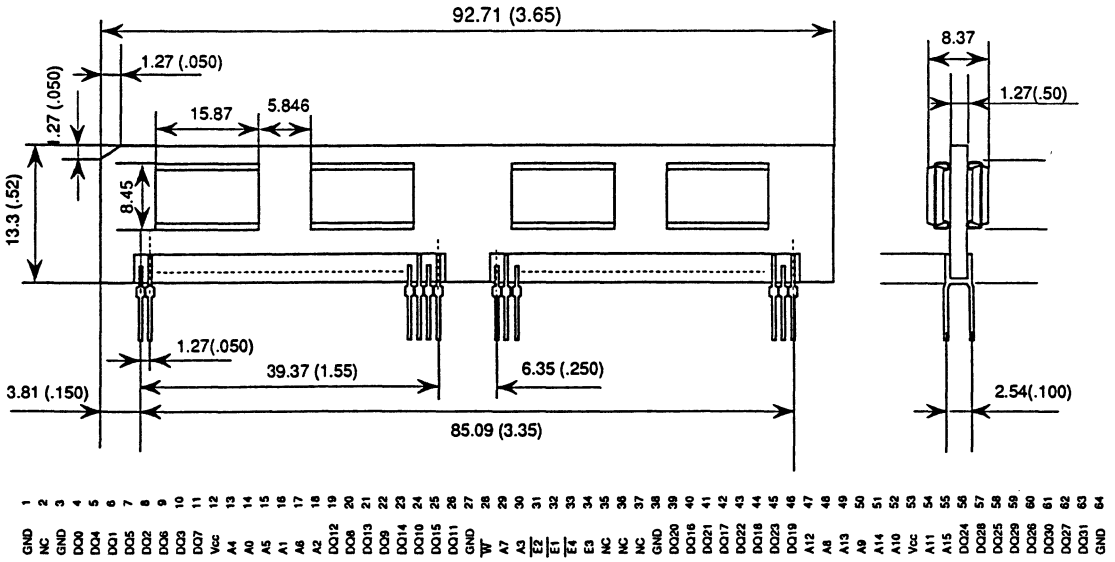
chip carrier M5M51008VP,RV



MITSUBISHI ELECTRIC

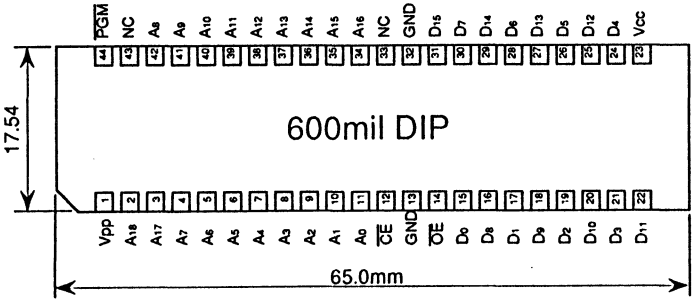
MH6432NZ Fast SRAM Module PIN configuration,Dimension

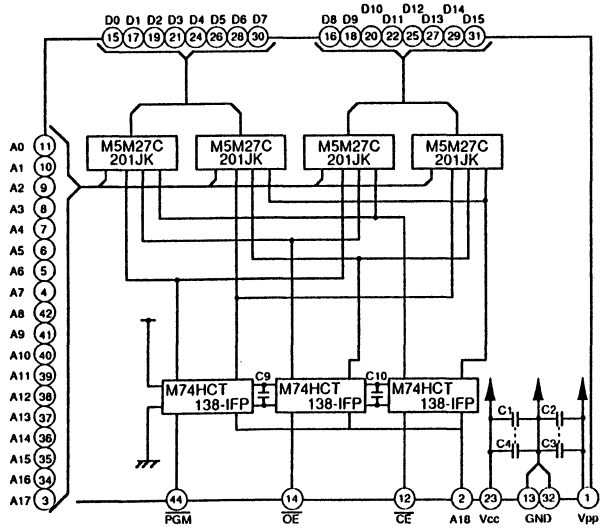
chip carrier M5M5258BJ 8pcs



MITSUBISHI ELECTRIC

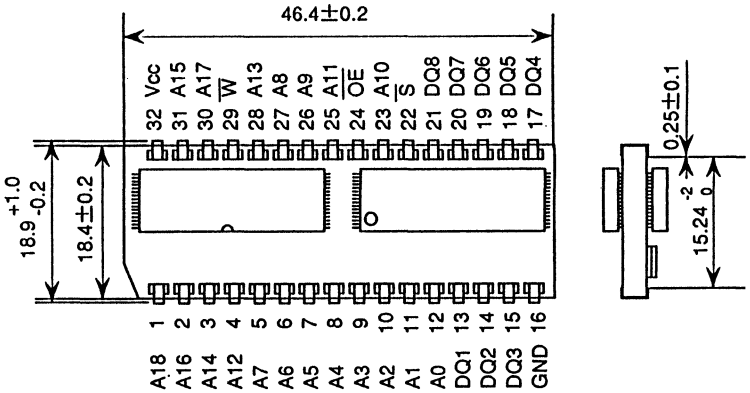
512K×16 EPROM Module
MH51216RNA PIN Configuration, Dimension

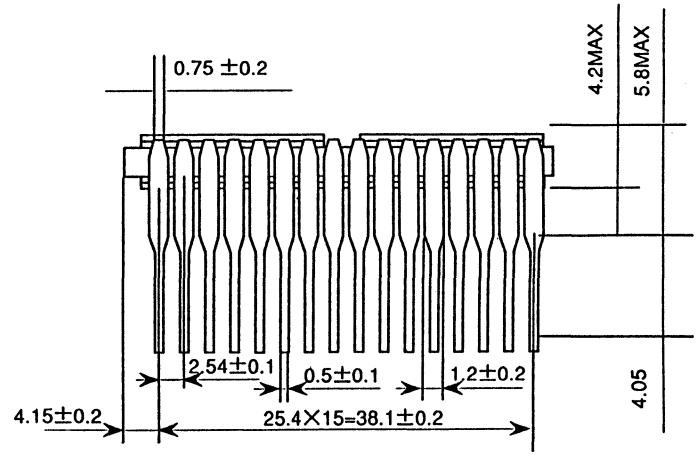




MITSUBISHI ELECTRIC

512K×8 SRAM Memory Module
PIN configuration,Dimension
MH51208ANA -85L,-10L,-12L,-15L
-85H,-10H,-12H,-15H





chip carrier M5M51008VP,RV

SOCKET FOR TSOP

Type of Device	Package Dimension	Test/Burn-In Socket	Burn-In Socket
M5M5178VP,RV(64K SRAM) M5M5256BVP,RV(256K SRAM) M5M27C256AVP,RV(256K OTPROM) M5M28C64AVP,RV(64K E^2PROM)	28pin(Mitsubishi Original)	IC51-0282-673-1 *1	
M5M41000BVP,RV M5M44256BVP,RV (1M DRAM)	24pin(Type I, 6×16,0.5mmpitch)	IC51-0242-1006-1(20) *1	CTP2024001A *2
M5M51008VP,RV(1M SRAM)	32pin(Type I, 8×20,0.5mmpitch)	IC51-0322-1207-1 *1	CTP032-002A *2
M5M27C101VP,RV(1M OTPROM) M5M27C102VP,RV(〃) M5M27C201VP,RV(2M OTPROM) M5M27C202VP,RV(〃) M5M23400AVP,RV(4M MaskROM) M5M23401AVP,RV(〃)	40pin(Type I, 10×14,0.5mmpitch)	IC51-0402-965-1 *1	IC162-0402-041 *1
M5M44100ATP,RT M5M44400ATP,RT (4M DRAM)	26pin(Type II, 300mil,1.27mmpitch)	——	CTP2026003B *2

*1 YAMAICHI ELECTRIC MFG.CO.,LTD. TEL OSAKA (06) 396 - 6191, CA U.S.A 408 - 452 - 0797
*2 TEXAS INSTRUMENTS JAPAN LTD. TEL OSAKA (06) 204 - 1882, MASS U.S.A 508 - 699 - 5247

Burn-In Socket means a open top type (No Force Insertion)
Test/Burn-In socket means a socket with lid.

Notes:

Notes:

Notes:

MITSUBISHI IC CARD

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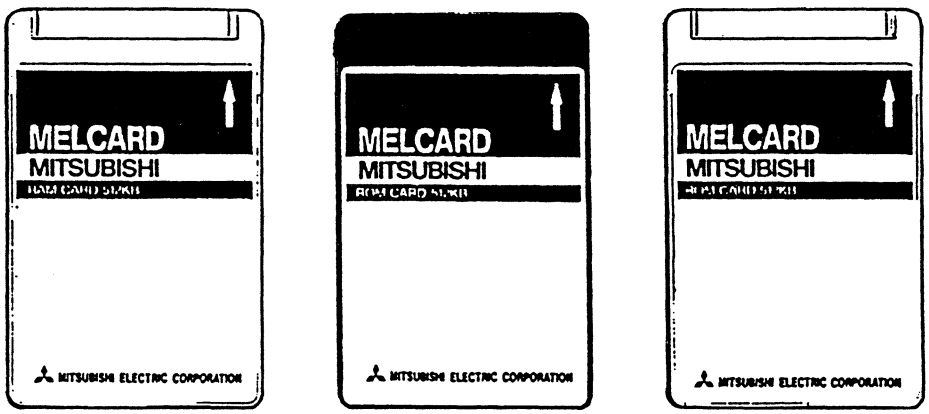
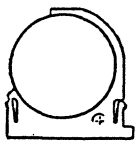
MELCARD

MITSUBISHI

MEMORY CARD

SRAM OTPROM MASK ROM





January 1991

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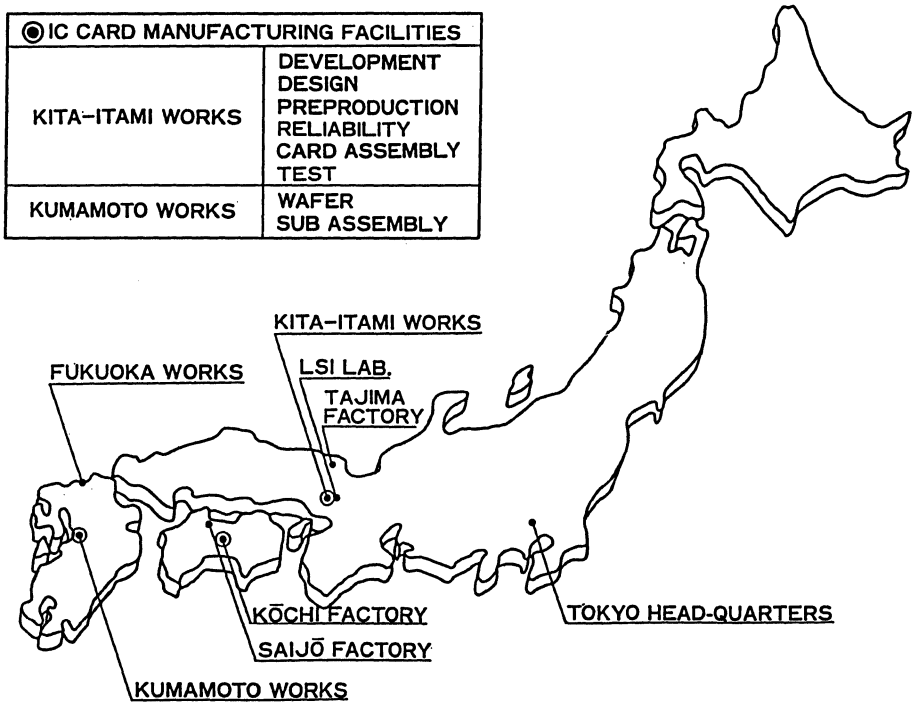
MITSUBISHI ELECTRIC

MELCARD

LOCATION OF MANUFACTURING FACILITIES

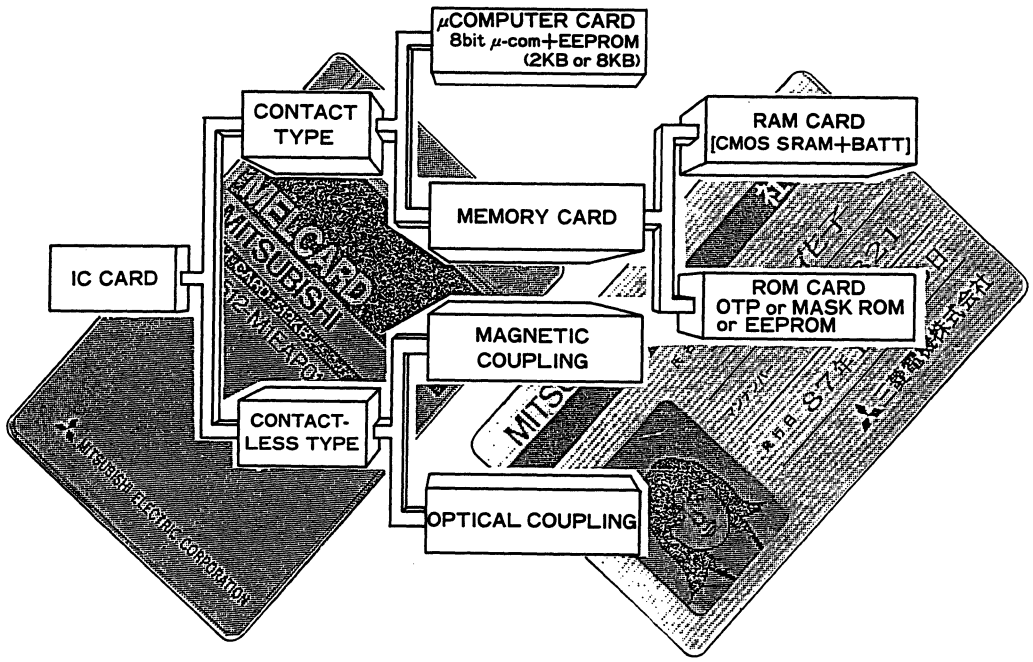
◉IC CARD MANUFACTURING FACILITIES	
KITA-ITAMI WORKS	DEVELOPMENT DESIGN PREPRODUCTION RELIABILITY CARD ASSEMBLY TEST
KUMAMOTO WORKS	WAFER SUB ASSEMBLY



MITSUBISHI ELECTRIC

MELCARD

CLASSIFICATION



MITSUBISHI MEMORY CARD (I)

Rev

	Products				Type name	Access(ns)	Other	Sample	Production	Note
Static RAM	2 P 60 pin	8 bit	W/O	32KB	MF332A-M4DAPXX	200	W/O buffer	–	Yes	
				32KB	MF332A-MDDAPXX	200		–	Yes	
				64KB	MF364A-M2DAPXX	200	W/O buffer	–	Yes	
				64KB	MF364A-M9DAPXX	200		–	Yes	
				128KB	MF3128-M1DAPXX	200		–	Yes	
				128KB	MF3128-M1EAPXX	250		–	Yes	
			W P	256KB	MF3256-M1DAPXX	200		–	Yes	
			·	256KB	MF3256-M1EAPXX	250		–	Yes	
			B M	512KB	MF3512-M1DAPXX	200		–	Yes	
				512KB	MF3512-M1EAPXX	250		–	Yes	
				256KB	MF3256-M3EARXX	250	4.2t, Built in rechargeable battery	–	Yes	
				512KB	MF3512-M3EARXX	250		–	Yes	
			W/	32KB	MF332A-MADAPXX	200		–	Yes	
				64KB	MF364A-M6DAPXX	200		–	Yes	
				128KB	MF3128-M6DAPXX	200		–	Yes	
				128KB	MF3128-M6EAPXX	250		–	Yes	
				256KB	MF3256-M6DAPXX	200		–	Yes	
				256KB	MF3256-M6EAPXX	250		–	Yes	
				256KB	MF3256-MGDAPXX	200	Low Stand-by	Yes	'91/1Q	
			W P	256KB	MF3256-MHDAPXX	200	Low Voltage	Yes	'91/1Q	Low Stand-by
			·	512KB	MF3512-M6DAPXX	200		–	Yes	
			B M	512KB	MF3512-M6EAPXX	250		–	Yes	
				512KB	MF3512-MGDAPXX	200	Low Stand-by	Yes	'91/1Q	
				512KB	MF3512-MHDAPXX	200	Low Voltage	Yes	'91/1Q	Low Stand-by
				1MB	MF31M0-M6DAPXX	200	1Mbit SRAM×8	Yes	'91/1Q	
				2MB	MF32M0-M6DAPXX	200	1Mbit SRAM×16	Yes	'91/1Q	

Note : [Card thickness : 3.4mm unless otherwise noted, Panel material : Metal]

2 P : two-piece connector type, C/E : Card edge type

8 bit: data width = 8bit type, 16 bit: data width = 16bit type

W/ : with , W/O : without

B M : battery monitor option, W P : write protect option

MITSUBISHI MEMORY CARD (II)

Rev

Products					Type name	Access(ns)	Other	Sample	Production	Note
Static RAM	2 P 60 pin	16 bit		128KB	MF3129-M1DAP××	200		–	Yes	
			W/O	128KB	MF3129-M1EAP××	250		–	Yes	
				256KB	MF3257-M1DAP××	200		–	Yes	
			W P	256KB	MF3257-M1EAP××	250		–	Yes	
			·	512KB	MF3513-M1DAP××	200		–	Yes	
			B M	512KB	MF3513-M1EAP××	250		–	Yes	
				64KB	MF365A-M6DAP××	200		–	Yes	
				128KB	MF3129-M6DAP××	200		–	Yes	
			W/	128KB	MF3129-M6EAP××	250		–	Yes	
				256KB	MF3257-M6DAP××	200		–	Yes	
			W P	256KB	MF3257-M6EAP××	250		–	Yes	
			·	512KB	MF3513-M6DAP××	200		–	Yes	
			B M	512KB	MF3513-M6EAP××	250		–	Yes	
				1MB	MF31M1-M6DAP××	200	1Mbit SRAM×8	Yes	'91/1Q	
				2MB	MF32M1-M6DAP××	200	1Mbit SRAM×16	Yes	'91/1Q	
	C/E	8 bit		32KB	MF332A-MCDAC××	200		–	Yes	
			W/O	64KB	MF364A-M8DAC××	200		–	Yes	
				128KB	MF3128-M2DAC××	200		–	Yes	
			W P	128KB	MF3128-M2EAC××	250		–	Yes	
			·	256KB	MF3256-M2DAC××	200		–	Yes	
			B M	256KB	MF3256-M2EAC××	250		–	Yes	
				512KB	MF3512-M2DAC××	200		–	Yes	
				512KB	MF3512-M2EAC××	250		–	Yes	

MITSUBISHI MEMORY CARD (Ⅲ)

Rev

Products					Type name	Access(ns)	Other	Sample	Production	Note
Static RAM	C/E	8 bit		32KB	MF332A-MBDAC××	200		–	Yes	
				64KB	MF364A-M7DAC××	200		–	Yes	
				128KB	MF3128-M7DAC××	200		–	Yes	
			W/	128KB	MF3128-M7EAC××	250		–	Yes	
				256KB	MF3256-M7DAC××	200		–	Yes	
			W P	256KB	MF3256-M7EAC××	250		–	Yes	
			·	512KB	MF3512-M7DAC××	200		–	Yes	
			B M	512KB	MF3512-M7EAC××	250		–	Yes	
				1MB	MF31M0-M7DAC××	200	1Mbit SRAM×8	Yes	'91/1Q	
				2MB	MF32M0-M7DAC××	200	1Mbit SRAM×16	Yes	'91/1Q	
		16 bit		128KB	MF3129-M1DAC××	200		–	Yes	
			W/O	128KB	MF3129-M1EAC××	250		–	Yes	
				256KB	MF3257-M1DAC××	200		–	Yes	
			W P	256KB	MF3257-M1EAC××	250		–	Yes	
			·	512KB	MF3513-M1DAC××	200		–	Yes	
			B M	512KB	MF3513-M1EAC××	250		–	Yes	
				64KB	MF365A-M7DAC××	200		–	Yes	
				128KB	MF3129-M7DAC××	200		–	Yes	
			W/	128KB	MF3129-M7EAC××	250		–	Yes	
				256KB	MF3257-M7DAC××	200		–	Yes	
			W P	256KB	MF3257-M7EAC××	250		–	Yes	
			·	512KB	MF3513-M7DAC××	200		–	Yes	
			B M	512KB	MF3513-M7EAC××	250		–	Yes	
				1MB	MF31M1-M7DAC××	200	1Mbit SRAM×8	Yes	'91/1Q	
				2MB	MF32M1-M7DAC××	200	1Mbit SRAM×16	Yes	'91/1Q	
OTP	2 P 60 pin	8 bit		32KB	MF432A-F2EAP××	250	256K × 1pc	–	Yes	
				64KB	MF464A-F1EAP××	250	256K × 2pcs	–	Yes	
				128KB	MF4128-F1EAP××	250	256K × 4pcs	–	Yes	
				128KB	MF4128-F3EAP××	250	1M × 1pc	–	Yes	
				256KB	MF4256-F1EAP××	250	256K × 8pcs	–	Yes	
				256KB	MF4256-F3EAP××	250	1M × 2pcs	–	Yes	
				512KB	MF4512-F1EAP××	250	512K ×16pcs	–	Yes	
				512KB	MF4512-F3EAP××	250	1M × 4pcs	–	Yes	
				1MB	MF41M0-F1EAP××	250	1M × 8pcs	–	Yes	
				2MB	MF42M0-F1EAP××	250	1M ×16pcs	–	Yes	

MITSUBISHI MEMORY CARD (IV)

Rev

	Products			Type name	Access(ns)	Other	Sample	Production	Note
OTP	2 P 60 pin	16 bit	64KB	MF465A-F1EAP××	250	256K × 2pcs	–	Yes	CE/OE W/O buffer
			128KB	MF4129-F1EAP××	250	256K × 4pcs	–	Yes	
			128KB	MF4129-F3EAP××	250	1M × 1pc	–	Yes	
			256KB	MF4257-F1EAP××	250	256K × 8pcs	–	Yes	
			256KB	MF4257-F3EAP××	250	1M × 2pcs	–	Yes	
			512KB	MF4513-F1EAP××	250	256K ×16pcs	–	Yes	
			512KB	MF4513-F3EAP××	250	1M × 4pcs	–	Yes	
			1MB	MF41M1-F1EAP××	250	1M × 8pcs	–	Yes	
			2MB	MF42M1-F1EAP××	250	1M ×16pcs	–	Yes	
			4MB	MF44M1-F1DAP××	200	2M ×16pcs	Yes	'91/1Q	
	C/E	8 bit	32KB	MF432A-F3EAC××	250	256K × 1pc	Yes	'91/1Q	
			64KB	MF464A-F2EAC××	250	256K × 2pcs	Yes	'91/1Q	
			128KB	MF4128-F2EAC××	250	256K × 4pcs	Yes	'91/1Q	
			128KB	MF4128-F4EAC××	250	1M × 1pc	Yes	'91/1Q	
			256KB	MF4256-F2EAC××	250	256K × 8pcs	Yes	'91/1Q	
			256KB	MF4256-F4EAC××	250	1M × 2pcs	Yes	'91/1Q	
			512KB	MF4512-F2EAC××	250	256K ×16pcs	Yes	'91/1Q	
			512KB	MF4512-F4EAC××	250	1M × 4pcs	Yes	'91/1Q	
			1MB	MF41M0-F2EAC××	250	1M × 8pcs	Yes	'91/1Q	
			2MB	MF42M0-F2EAC××	250	1M ×16pcs	Yes	'91/1Q	
		16 bit	64KB	MF465A-F2EAC××	250	256K × 2pcs	Yes	'91/1Q	CE/OE W/O buffer
			128KB	MF4129-F2EAC××	250	256K × 4pcs	Yes	'91/1Q	
			128KB	MF4129-F4EAC××	250	1M × 1pc	TBD	TBD	
			256KB	MF4257-F2EAC××	250	256K × 8pcs	Yes	'91/1Q	
			256KB	MF4257-F4EAC××	250	1M × 2pcs	Yes	'91/1Q	
			512KB	MF4513-F2EAC××	250	256K ×16pcs	Yes	'91/1Q	
			512KB	MF4513-F4EAC××	250	1M × 4pcs	Yes	'91/1Q	
			1MB	MF41M1-F2EAC××	250	1M × 8pcs	Yes	'91/1Q	
			2MB	MF42M1-F2EAC××	250	1M ×16pcs	Yes	'91/1Q	

MITSUBISHI MEMORY CARD (V)

Rev

	Products			Type name	Access(ns)	Other	Sample	Production	Note
MASK	2 P 60 pin	16 bit	512KB	MF7513-F3EAP××	250	4M × 1pc	—	'91/1Q	
			1MB	MF71M1-F3EAP××	250	4M × 2pcs	—	Yes	
			2MB	MF72M1-F3EAP××	250	4M × 4pcs	—	'91/1Q	
DRAM	2 P 60 pin	8 bit	512KB	MF1512-M1CAP××	150		—	Yes	
		16 bit	512KB	MF1513-M1CAP××	150		—	Yes	
			1MB	MF11M1-M1CAP××	150		—	Yes	
			2MB	MF12M1-M1CAP××	150		—	Yes	
			3MB	MF13M1-M1CAP××	150		—	Yes	
EEPROM	2 P 60 pin	8 bit	W/WP 8KB	MF808A-F1EAP××	250		Yes	'91/1Q	
			16KB	MF816A-F1EAP××	250		Yes	'91/1Q	
			32KB	MF832A-F1EAP××	250		Yes	'91/1Q	
			64KB	MF864A-F1EAP××	250		Yes	'91/1Q	
			128KB	MF8128-F1EAP××	250		Yes	'91/1Q	
			192KB	MF8192-F1EAP××	250		Yes	'91/1Q	

MITSUBISHI MEMORY CARD (VI)

Rev

Products					Type name	Access(ns)	Other	Sample	Production	Note
S t a t R i A c M	2 P 68Pin	8/16 Bit	W P ・ B M 付	64KB	MF365A-L2DAT××	200		Yes	'91/2Q	JEIDA PC9 Ver 4
				128KB	MF3129-L2DAT××	200		Yes	'91/2Q	PCMCIA Ver 1.0
				256KB	MF3257-L2DAT××	200		Yes	'91/1Q	
				512KB	MF3513-L2DAT××	200		Yes	'91/1Q	
				1MB	MF31M1-L2DAT××	200		Yes	'91/1Q	
				2MB	MF32M1-L2DAT××	200		Yes	'91/1Q	
O T P	2 P 68Pin	8/16 Bit		256KB	MF4257-G1EAT××	250		'91/3	'91/2Q	
				512KB	MF4513-G1EAT××	250		'91/3	'91/2Q	
				1MB	MF41M1-G1EAT××	250		'91/3	'91/2Q	
				2MB	MF42M1-G1EAT××	250		'91/3	'91/2Q	
				4MB	MF44M1-G1EAT××	250		'91/3	'91/2Q	
M A S K R O M	2 P 68Pin	8/16 Bit		512KB	MF7513-G1DAT××	200		TBD	TBD	JEIDA PC9 Ver 4
				1MB	MF71M1-G1DAT××	200		TBD	TBD	PCMCIA Ver 1.0
				2MB	MF72M1-G1DAT××	200		'91/1Q	'91/2Q	
				4MB	MF74M1-G1DAT××	200		'91/1Q	'91/2Q	
				8MB	MF78M1-G1DAT××	200		'91/1Q	'91/2Q	
				16MB	MF716M-G1DAT××	200		'91/3Q	'91/4Q	
F l a s h	2 P 68Pin	8/16 Bit		256KB	MF8257-G1EAT××	250		TBD	TBD	JEIDA PC9 Ver 4
				512KB	MF8513-G1EAT××	250		TBD	TBD	PCMCIA Ver 1.0
				1MB	MF81M1-G1EAT××	250		'91/2	'91/2Q	
				2MB	MF82M1-G1EAT××	250		'91/2	'91/2Q	

Note : [Card thickness : 3.3㎜ unless otherwise noted, Panel material : Metal]
2 P : two-piece connector type
8/16bit: data width = 8bit or 16bit (controllable)
W/ : with , W/O : without
B M : battery monitor option, W P : write protect option

MITSUBISHI MEMORY CARD (Ⅶ)

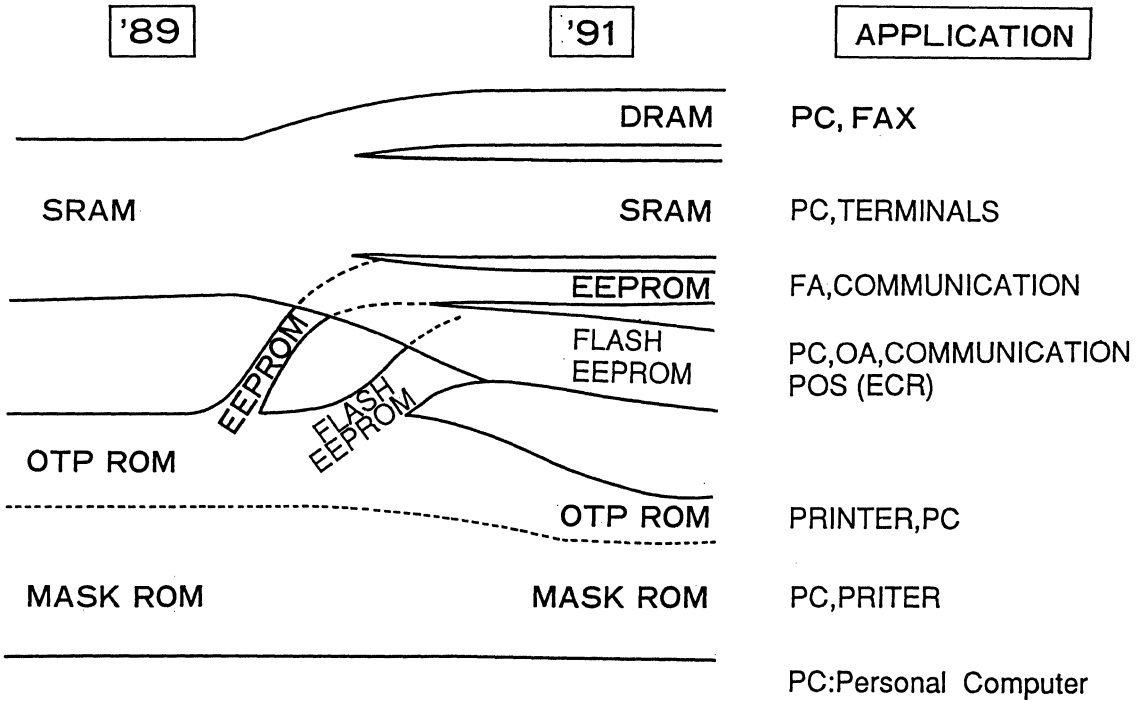
OTP Programming Adapter

Products	Type name	Applicable OTP IC	Sample	Production	Note
2 P	MFT2A01-001	256Kbit	–	Yes	
	MFT2A02-001	1Mbit	–	Yes	
	MFT2A03-001	1Mbit (data width=16 bit)	–	Yes	
C/E	MFT2A01-002	256Kbit	–	Yes	
	MFT2A02-002	1Mbit	–	Yes	

Connector

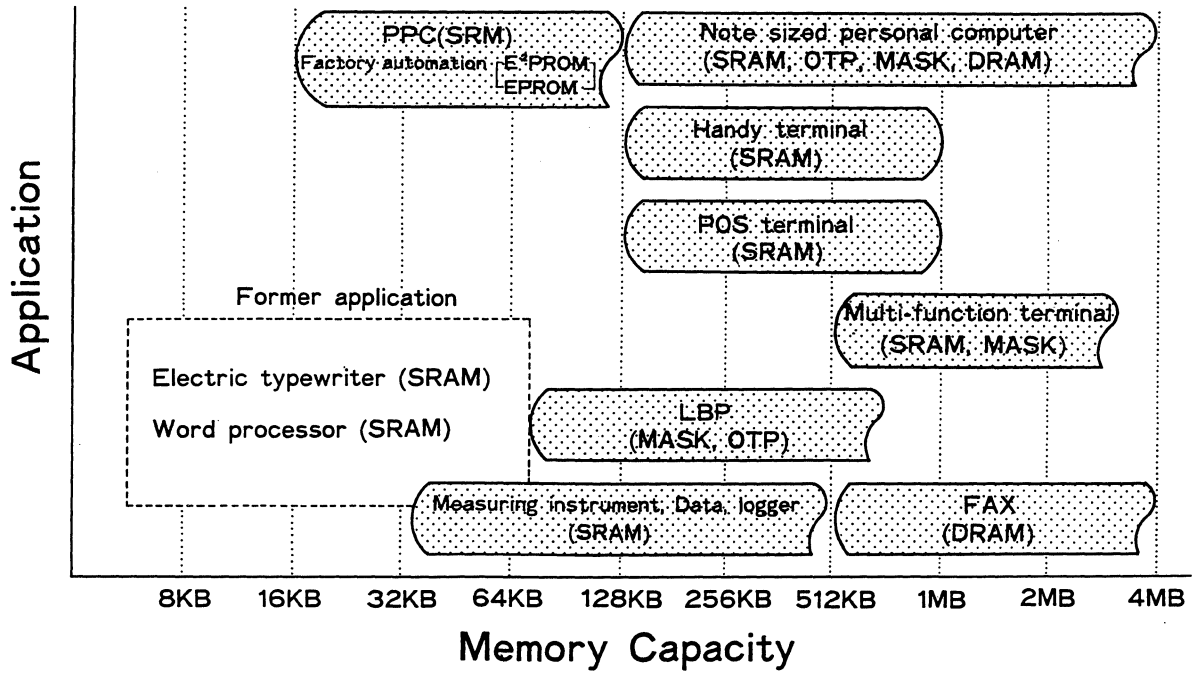
Products			MELCO Type name	Mfr. & Type name	Sample	Production	Note
2 P	Right Angle	same length	MFC60P1-01-R2	Du pont 69740-001	–	Yes	
		longer GND pin	MFC60P1-05-R2	Du pont 86291-001	–	Yes	
	Straight	same length	MFC60P1-01-S2	Du pont 69739-001	–	Yes	
		longer GND pin	MFC60P1-05-S2	Du pont 86465-001	–	Yes	
	Ejector		——	Du pont 86933-001	Yes	–	
			——	JAE JC20EA-D60PR-LT1-A1	Yes	–	
C/E	Right Angle		MFC50C1-01-R1	———	–	Yes	
	Push-in Push-out		MFC50E1-C01	Hoshiden Electronics HGC342-01-200	Yes	–	

TREND OF MEMORY ICS FOR MEMORY CARDS



MITSUBISHI IC CARD
MITSUBISHI ELECTRIC
MELCARD

Application of High Capacity Memory Card



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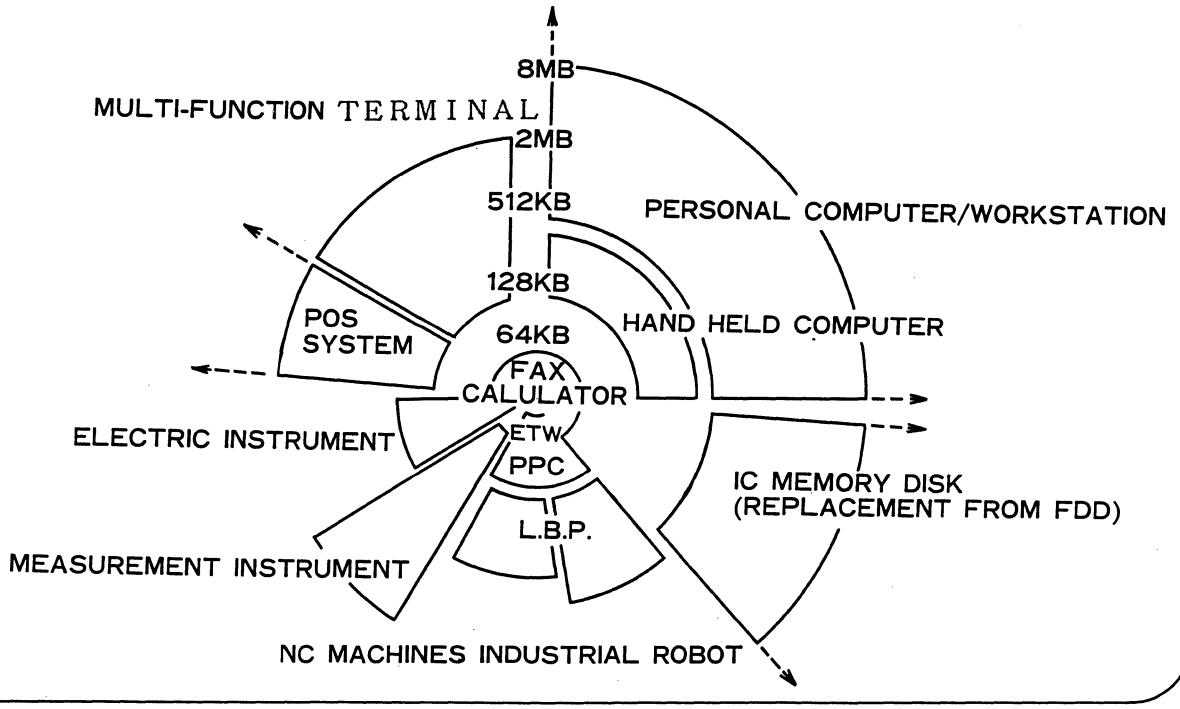
Application Systems and Memory Capacity of Memory Card

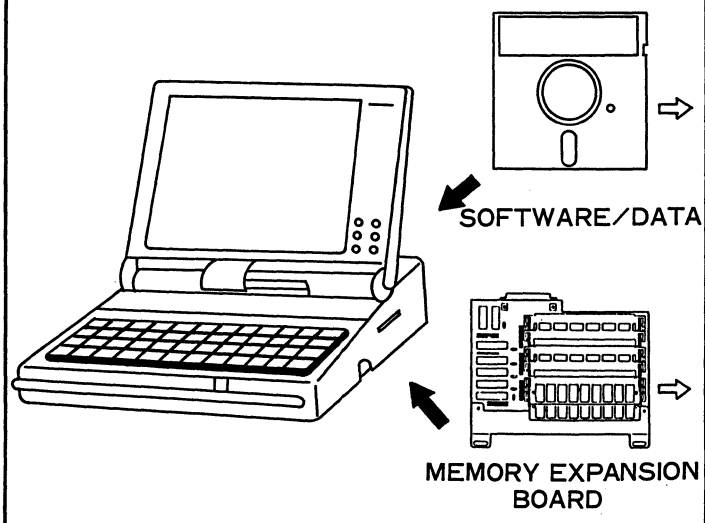
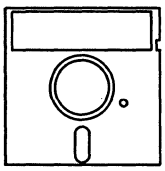


MITSUBISHI IC CARD

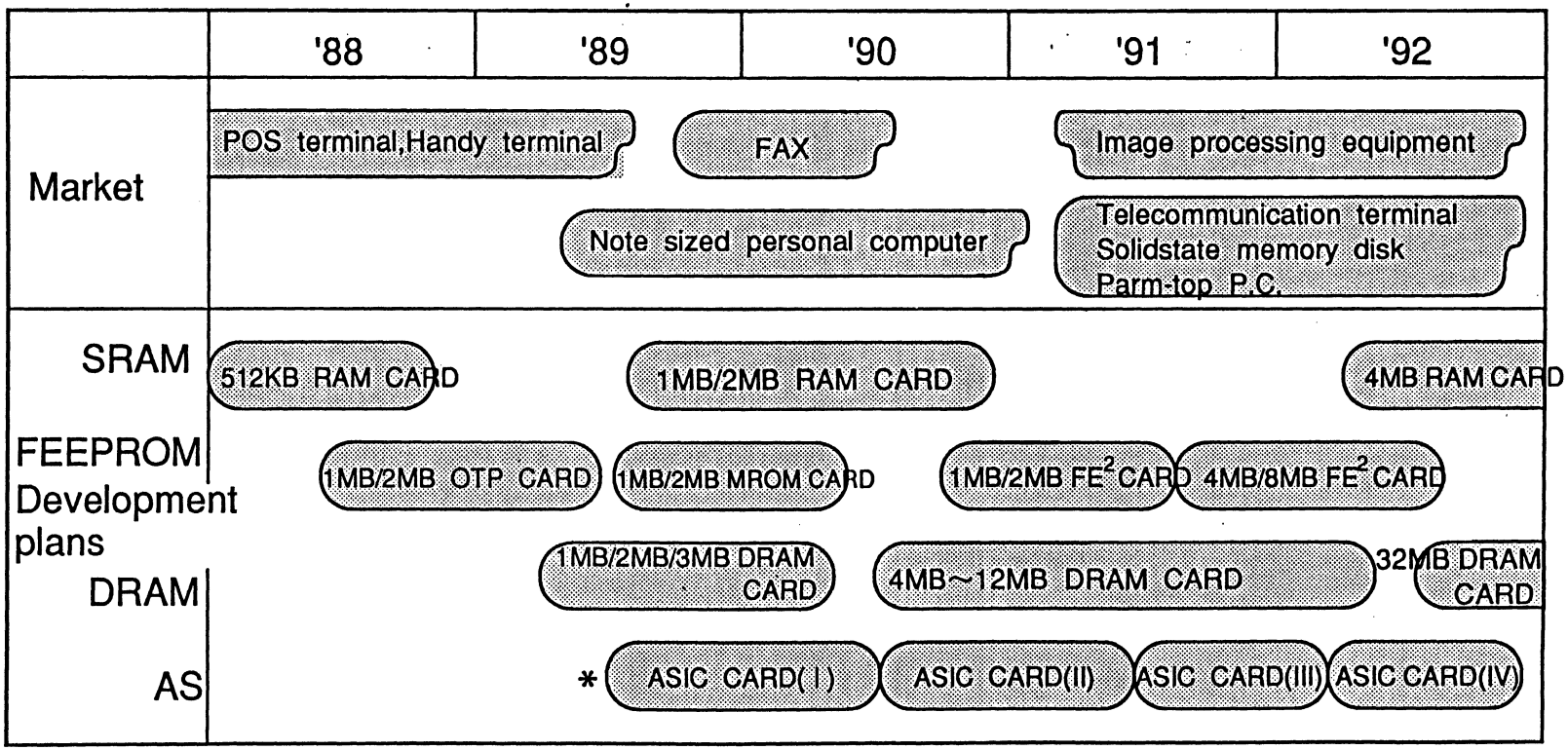
MITSUBISHI ELECTRIC

MELCARD

APPLICATION EXAMPLES FOR PERSONAL COMPUTER

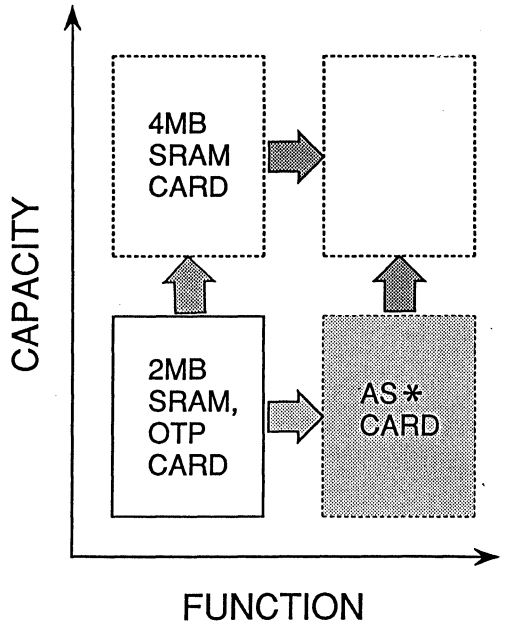
WITHOUT MEMORY CARD	WITH MEMORY CARD	
	CASE I USING FLOPPY DISK	CASE II USING MEMORY CARD
		 [SRAM CARD OTPROM CARD MROM CARD]
	PLUS MEMORY EXPANSION  [DRAM CARD]	PLUS MEMORY EXPANSION  [DRAM CARD SRAM CARD]

MARKET TRENDS and MITSUBISHI DEVELOPMENT PLAN



* ASIC CARD (I):Mix memory card
  ASIC CARD (II):Multi-function card having custom ICs.

DEVELOPMENT STRATEGY for MEMORY CARD



:now,available

:2nd step under development

:3rd step under planning

*Application Specific (including mix-memory card)

MITSUBISHI ELECTRIC
MITSUBISHI IC CARD
MELCARD

DEVELOPMENT STRATEGY of NEW(HR) MEMORY CARD

1. APPLICATION of MOST ADVANCED IC to CARD

A) SRAM 256kb → 1Mb
B) DRAM 1Mb → 4Mb
C) OTP 2Mb → (4Mb)
D) MASKROM 4Mb → (8～16Mb)
E) FEEPROM (1Mb)
F) HCMOS LOGIC and ASIC for INTERFACE

2. IMPROVEMENT of CARD RELIABILITY with TSOP IC

A) SEVERE BURN-IN TEST to TSOP IC

B) COMPLETE TESTING to TSOP IC

C) ZERO FAILURE in PROCESS of CARD ASSEMBLY

3 · HIGH RELIABLE PCB ASSEMBLY PROCESS

A)WIRE BONDING

→NO-OXIDIZATION SOLDERING

(with non-active gas)

B)REFLOW SOLDERING

→VAPOR PHASE SOLDERING

AIR FLOW SOLDERING

(in low temperature and uniform heating)

Rev

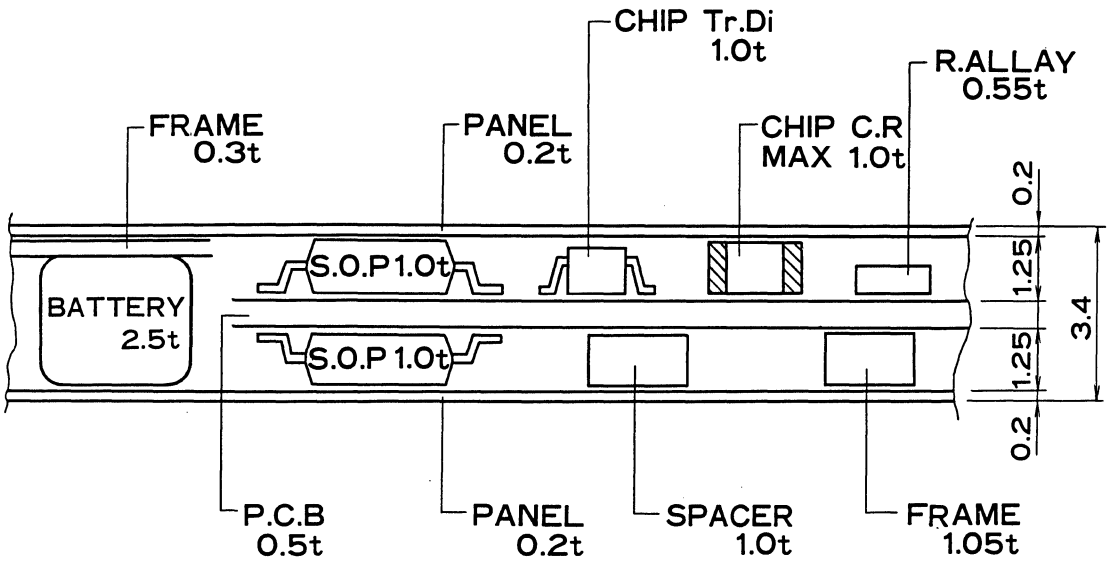
Memory Cards New Product Plan

	Sample	Production
· 1MB/2MB SARM Cards	:Yes	91/1Q
· 512KB to 3MB DRAM Cards	:Yes	Yes
· 4MB to 12MB DRAM Cards	:91/1Q	91/ 2Q
· 128KB to 2MB Flash E^2PROM Cards	:91/1Q	91/ 2Q
· JEIDA Ver.4(PCMCIA) Cards	:Yes	91/ 1Q

MITSUBISHI ELECTRIC
MITSUBISHI IC CARD
MELCARD

FEATURES of MELCARDS

- Uses TSOP(1.0mmt) for most advanced memory and high reliability.
- One to 16(~24) memory ICs can be mounted in a card
- AS ICs can be mounted in a card.
- Apply special screening tests to memory ICs.
- Buffered interface.
- Ability to change memory type(SRAM, OTP, MROM···), capacity(32KB to 8MB), or data bit width(8bit, 16bit) without changing connector type.



MITSUBISHI ELECTRIC
MITSUBISHI IC CARD
MELCARD

MELCO TSOP SERIES PLAN

Pin Count	Pkg Width	Package Length			
		13.4mm	14mm	16mm	20mm
24 Pin	6mm	—	256K V-RAM	1M D-RAM	—
28 Pin	8mm	256K S-RAM	—	—	—
32 Pin	8mm	—	—	—	1M S-RAM
40 Pin	10mm	—	1M OTP	—	—

MITSUBISHI ELECTRIC

MELCARD

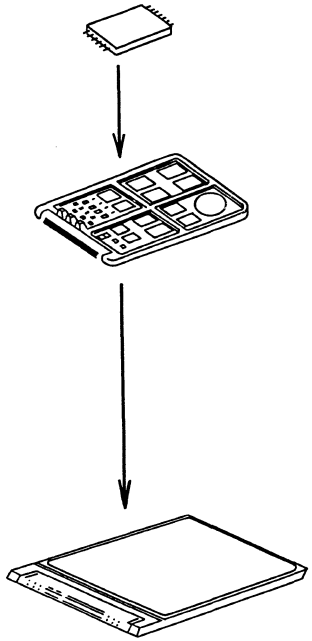
Reliability Evaluation Flow for New Products

Reliability evaluation of the new component parts

Reliability evaluation of the module fabricated with the new component parts

Electrical characteristic evaluation: temperature dependence and parameter distribution

Reliability evaluation of memory cards

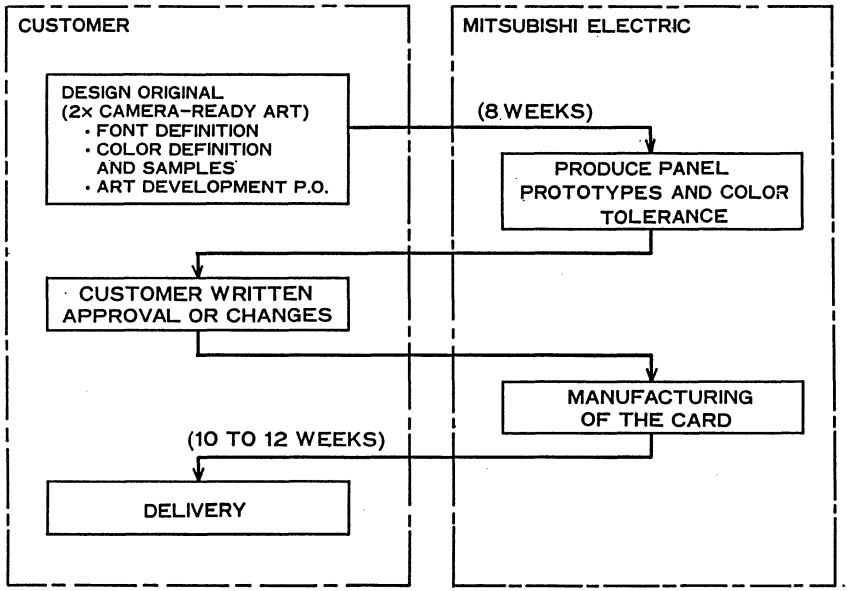


MITSUBISHI ELECTRIC

MELCARD

CUSTOMER-DEFINED ARTWORK DEVELOPMENT FLOW

The following exhibits the typical development flow for customer-defined artwork development.



Note that artwork is NOT released for volume Memory-Card production unless Mitsubishi Electric Corp. has received the customer's written approval of artwork prototypes.

Typical turn-around time from customer inputs to delivery of artwork prototypes is 8 weeks. Non-standard artwork turn-around tims will vary. Pricing for customer-defined artwork development is quoted upon customer request.

MITSUBISHI ELECTRIC

MELCARD

Reliability Test Results of TSOP

Test Items	Test Conditions	Sample	Sample Size	Failures
Solderability	230℃, 5sec Measuring items : visual	M5M5256VP M5M27256VP M74HC138VP 4066VP,245VP M51959VP	22 22 22 22	0 0 0 0
Temperature Cycling	−65℃~150℃ 100cyc	M5M5256VP M5M27256VP M74HC138VP 4066VP,245VP M51959VP	160 50 50 50	0 0 0 0
High Temperature Storage	150℃, 1000h	M5M5256VP M5M27256VP M74HC138VP 4066VP,245VP M51959VP	160 196 110 88	0 0 0 0
Humidity Bias	85℃/85% RH 5.0V, 1000h	M5M5256VP M5M27256VP M74HC138VP 4066VP,245VP M51959VP	176 110 110 88	0 0 0 0
Pressure Cooker Test	121℃, 2atm 240h	M5M5256VP M74HC138VP 4066VP,245VP	242 110	0 0
Operation Life Test	125℃, 6.0V 1000h	M5M5256VP	352	0
	150℃, 8.5V 1000h	M74HC138VP 4066VP,245VP	110	0

Note 1. Pre-conditionings for PCT and moisture resistance:
Bake(125℃, 24h)→VPS(215℃, 10sec)

Note 2. Measuring items: electrical characteristics

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MELCARD

Memory Cards
Reliability Test Results of Module (HR Series)

Test Items	Test Conditions	Sample Size	Failures
High Temperature Bias	125℃, 7V, 1000h	56	0
High Temperature Storage	125℃, 1000h	56	0
Temperature Cycling	−40℃~125℃, 100cyc	98	0
Moisture Resistance	85℃/85% RH, 1000h	56	0
Low Temperature Storage	−40℃, 1000h	27	0

Note 1. Measuring item: electrical characteristics

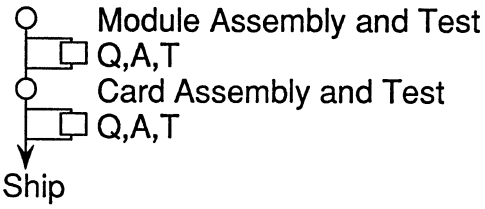
Memory Cards
Reliability Test Results of Memory Card (HR Series)

Test Items	Test Conditions	Sample Size	Failures
High Temperature Bias	85℃, 5V, 1000h	67	0
Low Temperature Storage	−40℃, 1000h	27	0
Moisture Resistance	85℃/85% RH, 1000h	56	0
Temperature Cycling	−40℃~85℃, 10~	67	0
Vibration	1.5mm(P•P), 10~55Hz, 2h/X,Y,Z	16	0
Bending	5kg stress, 100times	37	0
Torsion	5kg stress, 100times	37	0
Fall	0.75m,plastic tile,3times	27	0

Note 1. Measuring items: electrical characteristics.

2-Stage Quality Assurance Test

Rev



Q,A,T		Module	Card
Grupe A	Electrical	○	○
	Visual Mechanical	○	○
Grupe B	Temperature Cycling	○	
Grupe C	Temperature Cycling	○	○
	Storage	○	○
	Operating Life	○	○
	Moisture Resistance	○	○
	Vibration		○
	Bending		○
	Torsion		○
	Fall,etc.		○

Pin Description of Connector(HR Series) 60Pins 2P Type

Odd numbered pins

Pin No.	Symbol	SRAM 8 bit 8MB	SRAM 16 bit 8MB	OTP 8 bit 8MB	OTP 16 bit 8MB	MASK 8 bit 8MB	MASK 16 bit 8MB	E²PROM 8 bit 192 KB	DRAM 16 bit 3MB
1	C 1	N. C	N. C	N. C	N. C	N. C	N. C	N. C	N. C
3	N.C/Vpp1	N. C	N. C	Vpp1	Vpp1	N. C	N. C	N. C	N. C
5	A12	A12	A12	A12	A12	A12	A12	A12	$\overline{CAS4}$
7	A 7	A 7	A 7	A 7	A 7	A 7	A 7	A 7	A 7
9	A 6	A 6	A 6	A 6	A 6	A 6	A 6	A 6	A 6
11	A 5	A 5	A 5	A 5	A 5	A 5	A 5	A 5	A 5
13	A 4	A 4	A 4	A 4	A 4	A 4	A 4	A 4	A 4
15	A 3	A 3	A 3	A 3	A 3	A 3	A 3	A 3	A 3
17	A 2	A 2	A 2	A 2	A 2	A 2	A 2	A 2	A 2
19	A 1	A 1	A 1	A 1	A 1	A 1	A 1	A 1	A 1
21	A 0	A 0	A 0	A 0	A 0	A 0	A 0	A 0	A 0
23	D 0	D 0	D 0	D 0	D 0	D 0	D 0	D 0	D 0
25	D 1	D 1	D 1	D 1	D 1	D 1	D 1	D 1	D 1
27	D 2	D 2	D 2	D 2	D 2	D 2	D 2	D 2	D 2
29	GND	GND	GND	GND	GND	GND	GND	GND	GND
31	D 3	D 3	D 3	D 3	D 3	D 3	D 3	D 3	D 3
33	D 4	D 4	D 4	D 4	D 4	D 4	D 4	D 4	D 4
35	D 5	D 5	D 5	D 5	D 5	D 5	D 5	D 5	D 5
37	D 6	D 6	D 6	D 6	D 6	D 6	D 6	D 6	D 6
39	D 7	D 7	D 7	D 7	D 7	D 7	D 7	D 7	D 7
41	$\overline{C E}$	$\overline{C E}$	$\overline{C E}$	$\overline{C E}$	$\overline{C E}$	$\overline{C E}$	$\overline{C E}$	$\overline{C E}$	N. C
43	A10	A10	A10	A10	A10	A10	A10	A10	N. C
45	$\overline{O E}$	$\overline{O E}$	$\overline{O E}$	$\overline{O E}$	$\overline{O E}$	$\overline{O E}$	$\overline{O E}$	$\overline{O E}$	N. C
47	A11	A11	A11	A11	A11	A11	A11	A11	$\overline{CAS5}$
49	A 9	A 9	A 9	A 9	A 9	A 9	A 9	A 9	N. C
51	A 8	A 8	A 8	A 8	A 8	A 8	A 8	A 8	A 8
53	A13	A13	A13	A13	A13	A13	A13	A13	$\overline{RAS4}$
55	A14	A14	A14	A14	A14	A14	A14	A14	$\overline{RAS5}$
57	$\overline{WE/PGM1}$	$\overline{W E}$	N. C	$\overline{PGM1}$	$\overline{PGM1}$	N. C	N. C	$\overline{W E}$	$\overline{W E}$
59	Vcc	Vcc	Vcc	Vcc	Vcc	Vcc	Vcc	Vcc	Vcc

Even numbered pins

Pin No.	Symbol	SRAM 8 bit 8MB	SRAM 16 bit 8MB	OTP 8 bit 8MB	OTP 16 bit 8MB	MASK 8 bit 8MB	MASK 16 bit 8MB	E²PROM 8 bit 192 KB	DRAM 16 bit 3MB
2	BM/N.C	B M	B M	N. C	N. C	N. C	N. C	N. C	N. C
4	Vpp2/N.C	N. C	N. C	N. C	Vpp2	N. C	N. C	N. C	N. C
6	CD1	CD1	CD1	CD1	CD1	CD1	CD1	CD1	CD1
8	A15	A15	A15	A15	A15	A15	A15	A15	$\overline{RAS0}$
10	A16	A16	A16	A16	A16	A16	A16	A16	$\overline{RAS1}$
12	A17	A17	A17	A17	A17	A17	A17	A17	$\overline{RAS2}$
14	A18	A18	A18	A18	A18	A18	A18	N. C	$\overline{RAS3}$
16	A19	A19	A19	A19	A19	A19	A19	N. C	$\overline{CAS0}$
18	A20	A20	A20	A20	A20	A20	A20	N. C	$\overline{CAS1}$
20	A21	A21	A21	A21	A21	A21	A21	N. C	$\overline{CAS2}$
22	A22	A22	N. C	A22	N. C	A22	N. C	N. C	$\overline{CAS3}$
24	D 8	N. C	D 8	N. C	D 8	N. C	D 8	N. C	D 8
26	D 9	N. C	D 9	N. C	D 9	N. C	D 9	N. C	D 9
28	D10	N. C	D10	N. C	D10	N. C	D10	N. C	D10
30	GND	GND	GND	GND	GND	GND	GND	GND	GND
32	GND	GND	GND	GND	GND	GND	GND	GND	GND
34	D11	N. C	D11	N. C	D11	N. C	D11	N. C	D11
36	D12	N. C	D12	N. C	D12	N. C	D12	N. C	D12
38	D13	N. C	D13	N. C	D13	N. C	D13	N. C	D13
40	D14	N. C	D14	N. C	D14	N. C	D14	N. C	D14
42	D15	N. C	D15	N. C	D15	N. C	D15	N. C	D15
44	$\overline{S 1}$	N. C	$\overline{S 1}$	N. C	N. C	N. C	N. C	N. C	N. C
46	S2/PGM2	N. C	S 2	N. C	$\overline{PGM2}$	N. C	N. C	N. C	N. C
48	WP/N.C	W P	W P	N. C	N. C	N. C	N. C	W P	N. C
50	C 2	N. C	N. C	N. C	N. C	N. C	N. C	N. C	N. C
52	B 0	B0 (GND)	B0 (GND)	B0 (GND)	B0 (GND)	B0 (N. C)	B0 (N. C)	B0 (N. C)	B0 (GND)
54	B 1	B1 (GND)	B1 (GND)	B1 (N. C)	B1 (N. C)	B1 (GND)	B1 (GND)	B1 (N. C)	B1 (GND)
56	B 2	B2 (GND)	B2 (GND)	B2 (GND)	B2 (GND)	B2 (GND)	B2 (GND)	B2 (GND)	B2 (N. C)
58	CD2	CD2	CD2	CD2	CD2	CD2	CD2	CD2	CD2
60	Vcc	Vcc	Vcc	Vcc	Vcc	Vcc	Vcc	Vcc	Vcc

PIN ASSIGNMENT OF CARD

50-pin of Card-Edge Type

Pin No.	Symbol	Input or Output	SRAM 8bit 8MB	SRAM 16bit 8MB	OTP 8bit 8MB	OTP 16bit 8MB	MASK 8bit 8MB	MASK 16bit 8MB
1	GND	Input	GND	GND	GND	GND	GND	GND
2	C D	Output	C D	C D	C D	C D	C D	C D
3	Vpp1/BM	I/O	B M	B M	Vpp1	Vpp1	N. C	N. C
4	A22/Vpp2	Input	A22	N. C	A22	Vpp2	A22	N. C
5	A21	〃	A21	A21	A21	A21	A21	A21
6	A20	〃	A20	A20	A20	A20	A20	A20
7	A19	〃	A19	A19	A19	A19	A19	A19
8	A18	〃	A18	A18	A18	A18	A18	A18
9	A17	〃	A17	A17	A17	A17	A17	A17
10	A16	〃	A16	A16	A16	A16	A16	A16
11	A15	〃	A15	A15	A15	A15	A15	A15
12	A12	〃	A12	A12	A12	A12	A12	A12
13	A 7	〃	A 7	A 7	A 7	A 7	A 7	A 7
14	A 6	〃	A 6	A 6	A 6	A 6	A 6	A 6
15	A 5	〃	A 5	A 5	A 5	A 5	A 5	A 5
16	A 4	〃	A 4	A 4	A 4	A 4	A 4	A 4
17	A 3	〃	A 3	A 3	A 3	A 3	A 3	A 3
18	A 2	〃	A 2	A 2	A 2	A 2	A 2	A 2
19	A 1	〃	A 1	A 1	A 1	A 1	A 1	A 1
20	A 0	〃	A 0	A 0	A 0	A 0	A 0	A 0
21	D 0	I/O	D 0	D 0	D 0	D 0	D 0	D 0
22	D 1	〃	D 1	D 1	D 1	D 1	D 1	D 1
23	D 2	〃	D 2	D 2	D 2	D 2	D 2	D 2
24	D 3	〃	D 3	D 3	D 3	D 3	D 3	D 3
25	D 4	〃	D 4	D 4	D 4	D 4	D 4	D 4
26	D 5	〃	D 5	D 5	D 5	D 5	D 5	D 5
27	D 6	〃	D 6	D 6	D 6	D 6	D 6	D 6
28	D 7	〃	D 7	D 7	D 7	D 7	D 7	D 7
29	D 8	〃	N. C	D 8	N. C	D 8	N. C	D 8
30	D 9	〃	N. C	D 9	N. C	D 9	N. C	D 9
31	D10	〃	N. C	D10	N. C	D10	N. C	D10
32	D11	〃	N. C	D11	N. C	D11	N. C	D11
33	D12	〃	N. C	D12	N. C	D12	N. C	D12
34	D13	〃	N. C	D13	N. C	D13	N. C	D13
35	D14	〃	N. C	D14	N. C	D14	N. C	D14
36	D15	〃	N. C	D15	N. C	D15	N. C	D15
37	$\overline{\text{C E}}$	Input	$\overline{\text{C E}}$	$\overline{\text{C E}}$	$\overline{\text{C E}}$	$\overline{\text{C E}}$	$\overline{\text{C E}}$	$\overline{\text{C E}}$
38	A10	〃	A10	A10	A10	A10	A10	A10
39	$\overline{\text{O E}}$	〃	$\overline{\text{O E}}$	$\overline{\text{O E}}$	$\overline{\text{O E}}$	$\overline{\text{O E}}$	$\overline{\text{O E}}$	$\overline{\text{O E}}$
40	A11	〃	A11	A11	A11	A11	A11	A11
41	A 9	〃	A 9	A 9	A 9	A 9	A 9	A 9
42	A 8	〃	A 8	A 8	A 8	A 8	A 8	A 8
43	A13	〃	A13	A13	A13	A13	A13	A13
44	A14	〃	A14	A14	A14	A14	A14	A14
45	$\overline{\text{LOWE/WE/PGM1}}$	〃	$\overline{\text{W E}}$	$\overline{\text{LOWE}}$	$\overline{\text{PGM1}}$	$\overline{\text{PGM1}}$	N. C	N. C
46	$\overline{\text{HIWE/PGM2}}$	〃	N. C	$\overline{\text{HIWE}}$	N. C	$\overline{\text{PGM2}}$	N. C	N. C
47	WP/N.C	Output	W P	W P	N. C	N. C	N. C	N. C
48	C 1	——	N. C	N. C	N. C	N. C	N. C	N. C
49	Vcc	Input	Vcc	Vcc	Vcc	Vcc	Vcc	Vcc
50	GND	〃	GND	GND	GND	GND	GND	GND

List of Symbols

Rev

Symbol	Name	Function
NC	No Connection	No signal shuld be applied to NC.
BM/NC	Battery Monitor / No Connection	Monitor pin of built-in battery voltage. / No signal should be applied to NC.
CD, CD1, CD2	Card Detector	Detector for card insertion or removal. CD is connected to GND for CE type, CD1 and CD2 are shorted together and not being connected to GND for 2P (60-pin) type.
A0～A22	Address Bus	Address bus line. Max.No is depend on memory capacity and unnecessary pins are NC.
D0～D7	Data Bus	Data bus line. Lower 8bits Data for 16bits bus type .
D8～D15	Upper 8bits Data Bus	Data bus line for 16bits bus type use only. Upper 8bits Data for 16bits bus type .
$\overline{CE}$	Card Enable	When $\overline{CE}$ is "L", the card is active for read/write.
$\overline{WE}$	Write Enable	For 8bits bus card use only. When $\overline{WE}$ is "L", the card allows to write data.
$\overline{OE}$	Output Enable	When $\overline{OE}$ is "L", the card allows to read data.
$\overline{S1}$, $\overline{LOWE}$	Write Enable of Lower 8bits Data	For 16bits bus card use only. When "L", the card allows to write lower 8bits data.
$\overline{S2}$, $\overline{HIWE}$	Write Enable of Upper 8bits Data	For 16bits bus card use only. When "L", the card allows to write upper 8bits data.
Vpp1, Vpp2	Power supply for Programming use of OTP card	Apply a rated voltage in programming mode. (programming, verify, and pragram-inhibit) Connected to Vcc in condition of read, output disable and standby modes. Vpp1 : Lower 8bits use for 16bits bus type. Vpp2 : Upper 8bits use for 16bits bus type.
$\overline{PGM1}$, $\overline{PGM2}$	Program	OTP card use only. When PGM is specified in pin assignment. PGM1or2 : "L" for program, "H" for verify.
WP/NC	Write Protect Monitor / No Connection	Monitor pin of write protect switch condition. "H" level (Vcc level) at write protect condition, "L" level (GND level) at normal condition. / No signal should be applied to NC.
C1, C2		C1 and C2 are reserved for future use, normally NC.
B0, B1, B2		2P type (60pin) use only. These pins are used to distinguish a kind of card.
Vcc GND	Power Supply	Power supply for card.

Pin Configuration of JEIDA/PCMCIA Card

Pin No.	Symbol	I/O	Function	Pin No.	Symbol	I/O	Function
1	GND		0V	35	GND		0V
2	D3	I/O	Data I/O	36	$\overline{CD1}$	I/O	Card Detect 1
3	D4	I/O	〃	37	D11	I/O	Data I/O
4	D5	I/O	〃	38	D12	I/O	〃
5	D6	I/O	〃	39	D13	I/O	〃
6	D7	I/O	〃	40	D14	I/O	〃
7	$\overline{CE1}$	I	Card Enable 1	41	D15	I/O	〃
8	A10	I	Address input	42	$\overline{CE2}$	I	Card Enable 2
9	$\overline{OE}$	I	Output Enable	43	$\overline{RFSH}$	I	Refresh for PSRAM
10	A11	I	Address input	44	RFU		Reserved for Future Use
11	A9	I	〃	45	RFU		〃
12	A8	I	〃	46	A17	I	Address input
13	A13	I	〃	47	A18	I	〃
14	A14	I	〃	48	A19	I	〃
15	$\overline{WE}$ ($\overline{PGM}$)	I	Write Enable (Program input)	49	A20	I	〃
16	RDY/$\overline{BSY}$	O	Ready/Busy for EEPROM	50	A21	I	〃
17	VCC		Power Supply	51	VCC		Power Supply
18	VPP1		Power Supply for Program (Even Byte)	52	VPP2		Power Supply for Program (Odd Byte)
19	A16	I	Address input	53	A22	I	Address input
20	A15	I	〃	54	A23	I	〃
21	A12	I	〃	55	A24	I	〃
22	A7	I	〃	56	A25	I	〃
23	A6	I	〃	57	RFU		Reserved for Future Use
24	A5	I	〃	58	RFU		〃
25	A4	I	〃	59	RFU		〃
26	A3	I	〃	60	RFU		〃
27	A2	I	〃	61	$\overline{REG}$	I	Attribute Memory select
28	A1	I	〃	62	BVD2	O	Battery Voltage Detect 2
29	A0	I	〃	63	BVD1	O	Battery Voltage Detect 1
30	D0	I/O	Data I/O	64	D8	I/O	Data I/O
31	D1	I/O	〃	65	D9	I/O	〃
32	D2	I/O	〃	66	D10	I/O	〃
33	WP	O	Write Protect	67	$\overline{CD2}$	O	Card Detect 2
34	GND		0V	68	GND		0V

Note 1 : Pins 36 and 67 are grounded.

2 : No signal should be applied to any "RFU" pin.

SRAM CARD

[32KB / 64KB / 128KB / 256KB / 512KB / 1MB / 2MB]

Mitsubishi SRAM card is consisted of 256kb or 1Mb SRAM ICs with VSOP (TSOP),many kinds of buffer ICs, decoder ICs and voltage detectors.

- Write protect switch : with or without
- Battery monitor terminal : with or without
- Access time : 200ns (150ns type is also available by screening)
- Card dimension : 54.0×85.6×3.4t (mm)
- Buffer on address bus,data bus and control lines

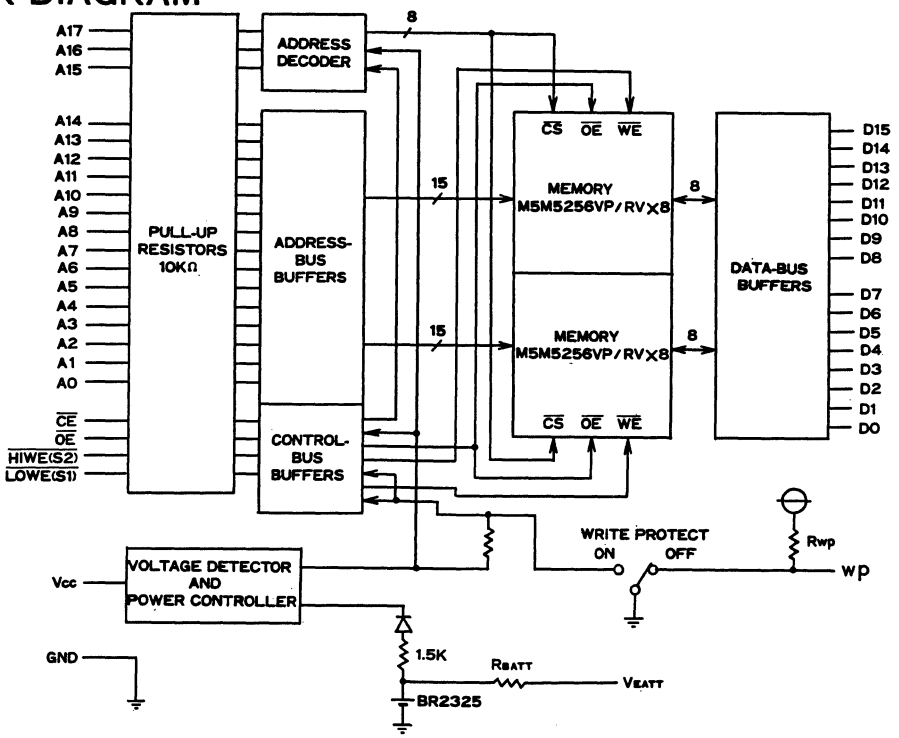
Application

Book type personal computer,Handy-terminal, Multifunction terminal,POS-terminal etc.

MITSUBISHI ELECTRIC
MITSUBISHI IC CARD
MELCARD

MF3513-M6DAPXX
[512KB SRAM CARD]

BLOCK DIAGRAM

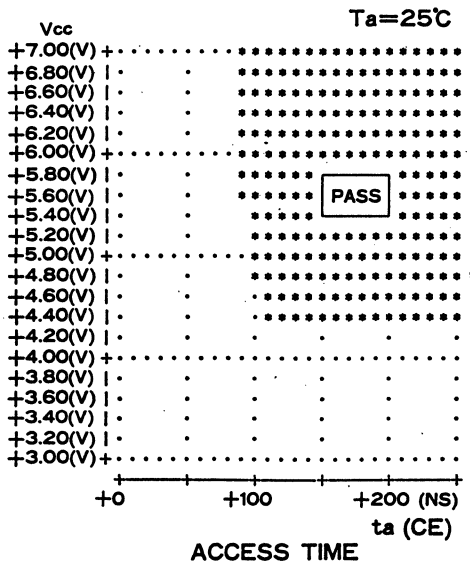


MITSUBISHI ELECTRIC

MELCARD

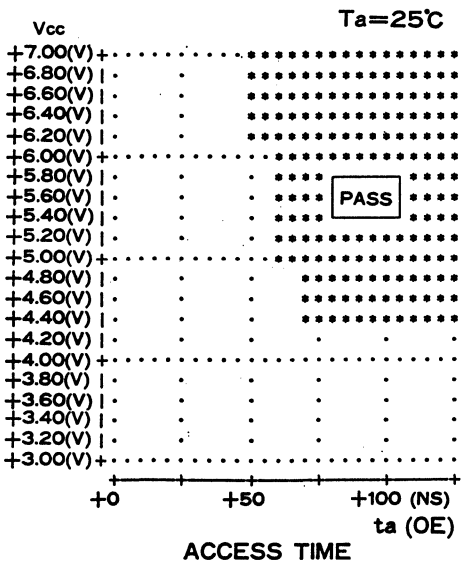
MF3513-M6DAPXX

Card enable access time



ACCESS TIME

Output enable access time



ACCESS TIME

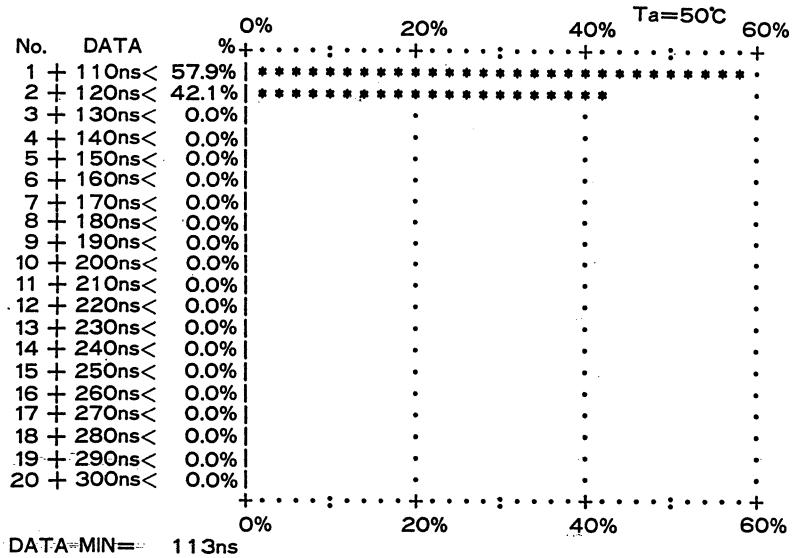
MITSUBISHI IC CARD

MITSUBISHI ELECTRIC

MELCARD

MF3513-M6DAPXX

Distribution of ta (CE)
512K BYTES RAM CARD



DATA MIN= 113ns
DATA MAX= 126ns
MAX−MIN= 13ns
DATA MEAN= 119ns
SIGMA= 4ns
3SIGMA= 11ns

MITSUBISHI ELECTRIC

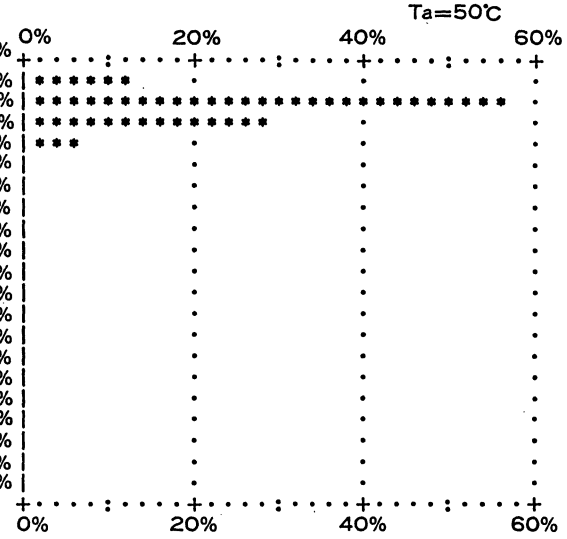
MELCARD

MF3513-M6DAPXX

Distribution of ta (OE)
512K BYTES RAM CARD

Ta=50℃

No.	DATA	%
1	66ns<	11.0%
2	68ns<	55.6%
3	70ns<	27.8%
4	72ns<	5.6%
5	74ns<	0.0%
6	76ns<	0.0%
7	78ns<	0.0%
8	80ns<	0.0%
9	82ns<	0.0%
10	84ns<	0.0%
11	86ns<	0.0%
12	88ns<	0.0%
13	90ns<	0.0%
14	92ns<	0.0%
15	94ns<	0.0%
16	96ns<	0.0%
17	98ns<	0.0%
18	100ns<	0.0%
19	102ns<	0.0%
20	104ns<	0.0%



DATA MIN= 66ns
DATA MAX= 72ns
MAX—MIN= 6ns
DATA MEAN=69ns
SIGMA= 1ns
3SIGMA= 4ns

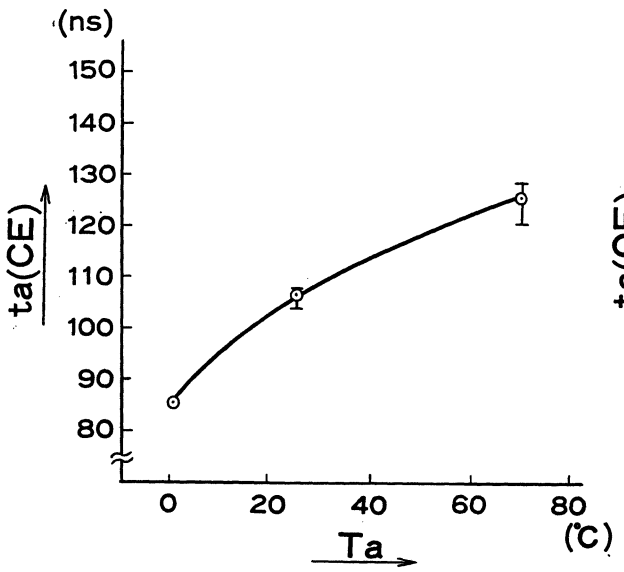
MITSUBISHI IC CARD

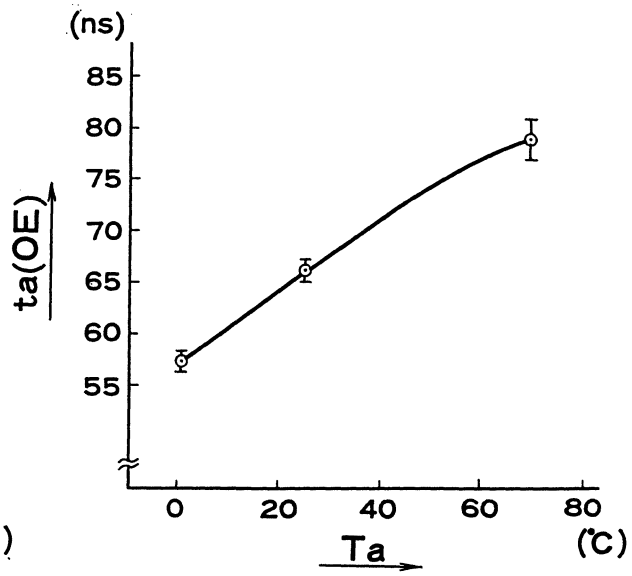
MITSUBISHI ELECTRIC

MELCARD

MF3513-M6DAPXX

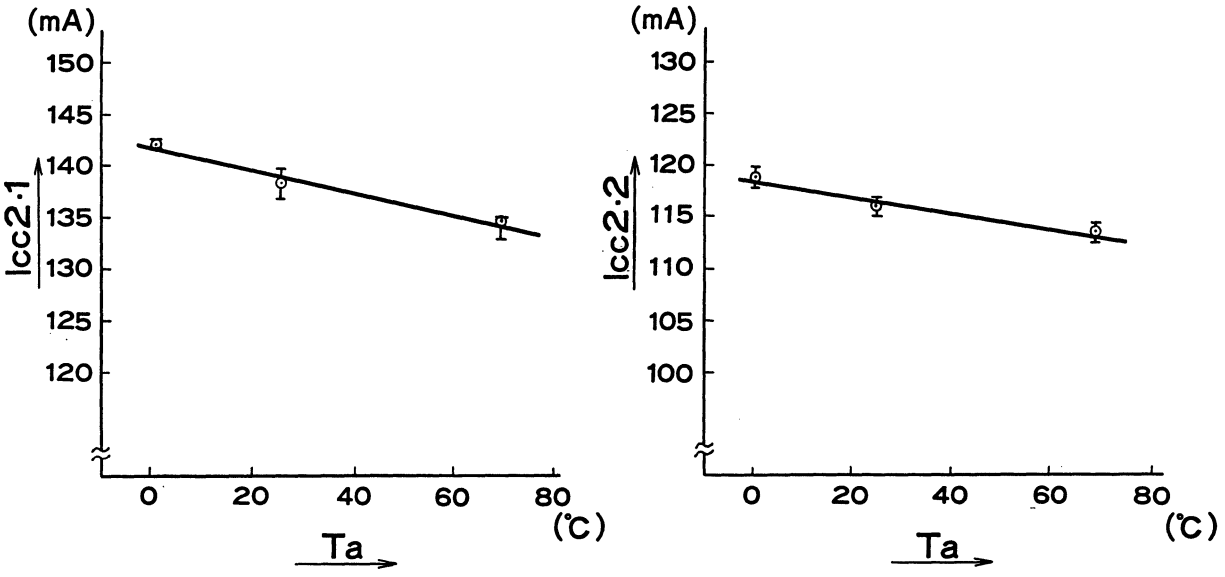
Access Time vs Ambient Temperature





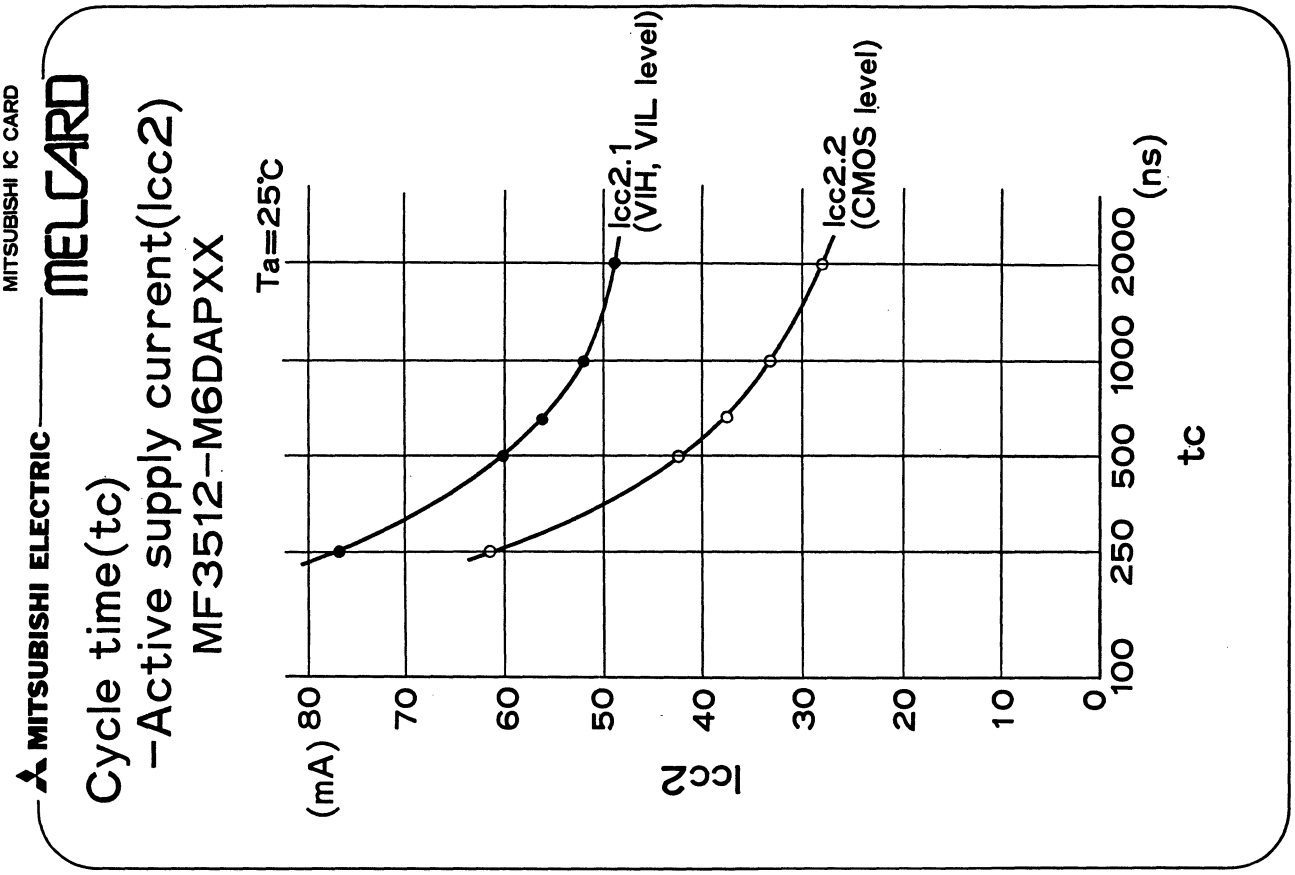
MF3513-M6DAPXX

Active Supply Current(Icc2) vs Ambient Temperature

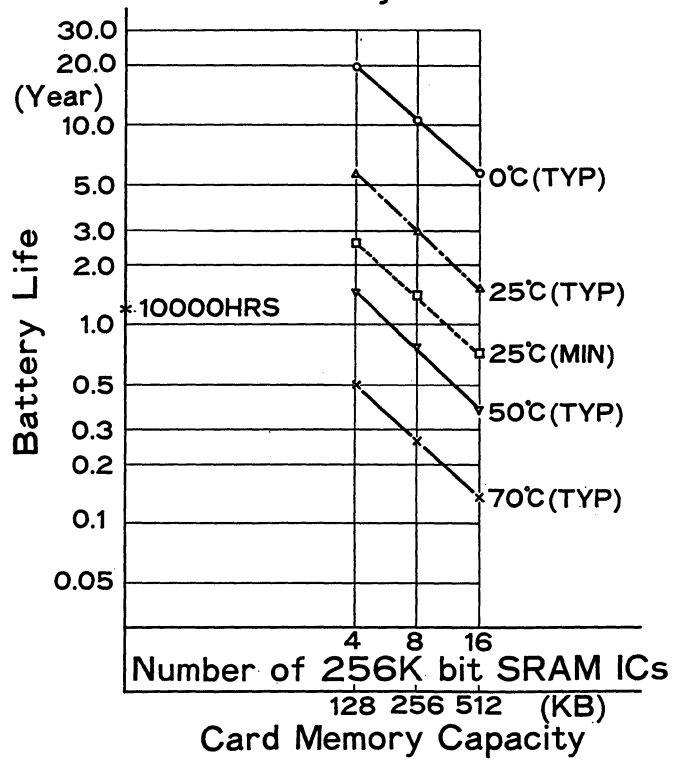


(VIH, VIL level) (CMOS Level)

Cycle time(tc) -Active supply current(Icc2) MF3512-M6DAPXX



SRAM Card Battery Life vs Memory Capacity (calculation)



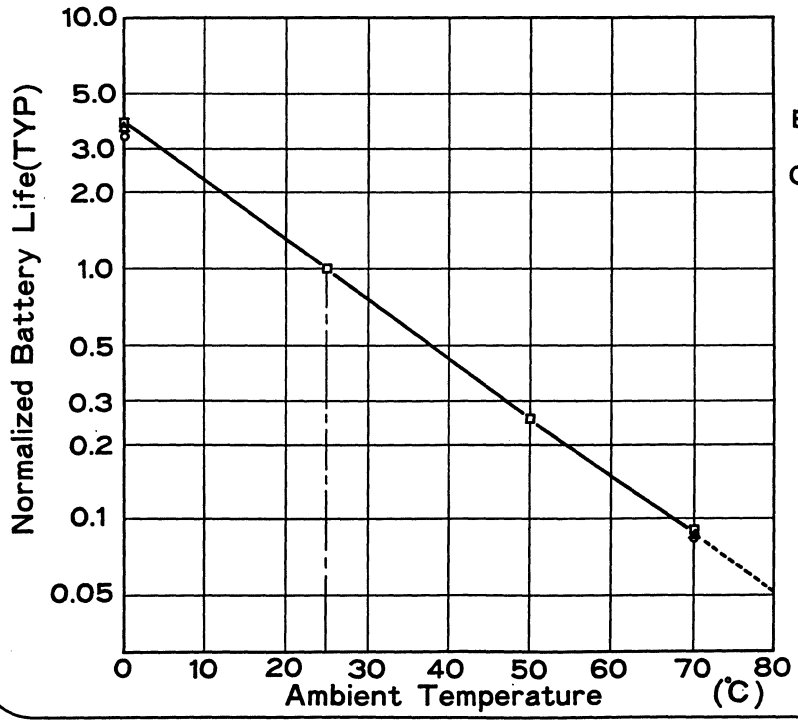
BATTERY TYPE BR2325

CARD TYPE
128K : MF3128-M6DAPXX
256K : MF3256-M6DAPXX
512K : MF3512-M6DAPXX

STANDBY CURRENT of a RAM
0.8uA(typ) Ta=25℃

MITSUBISHI IC CARD
MITSUBISHI ELECTRIC
MELCARD

Battery Life vs Ambient Temperature (calculation)



BATTERY TYPE : BR2325

CARD TYPE
128K : MF3128-M6DAPXX ○
256K : MF3256-M6DAPXX △
512K : MF3512-M6DAPXX □

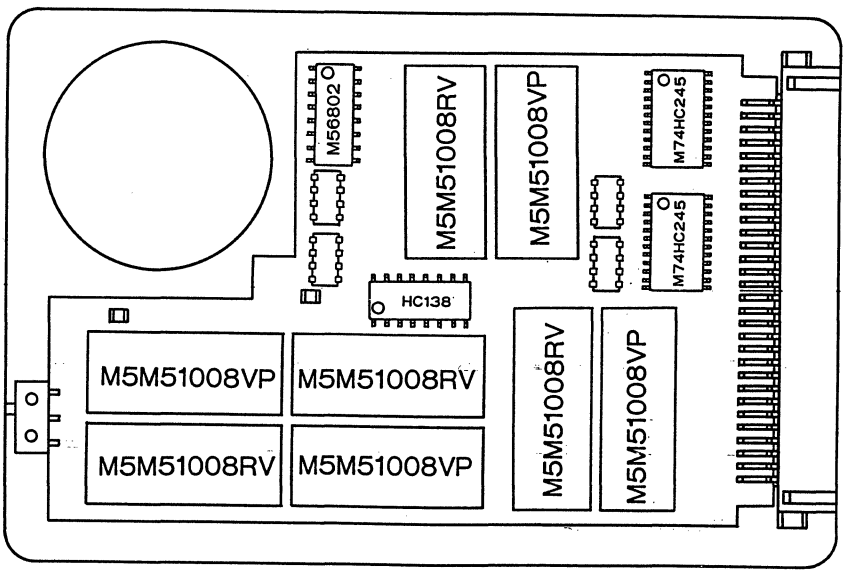
Rev

Features of Low Standby SRAM card

Item	Low Standby SRAM card	Standard SRAM card
Standby current	0.1mA typ.	13mA typ.
Access time	200ns	200ns
Battery monitor	Yes	Yes
Write Protect	Yes	Yes
Write Protect monitor pin	CMOS output	51KΩ pull-up resistor or GND
Resistors on address bus	A15~A18:100KΩ pull-down resistors Other address pin: No resistor	10KΩ pull-up resistors

MITSUBISHI ELECTRIC
MITSUBISHI IC CARD
MELCARD

2MB SRAM CARD

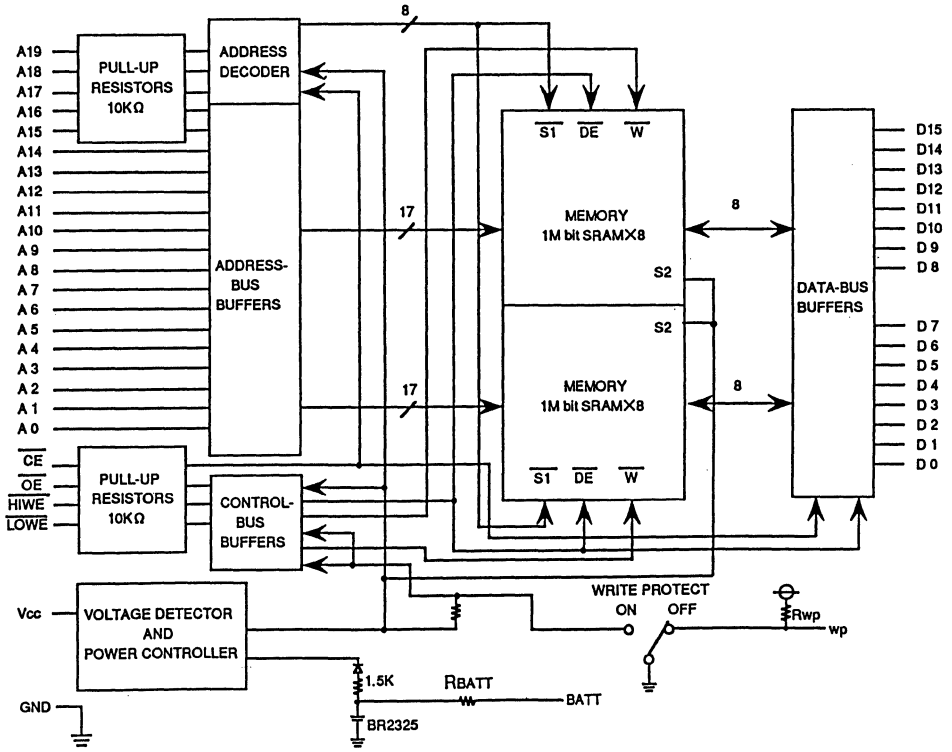


Unit : mm

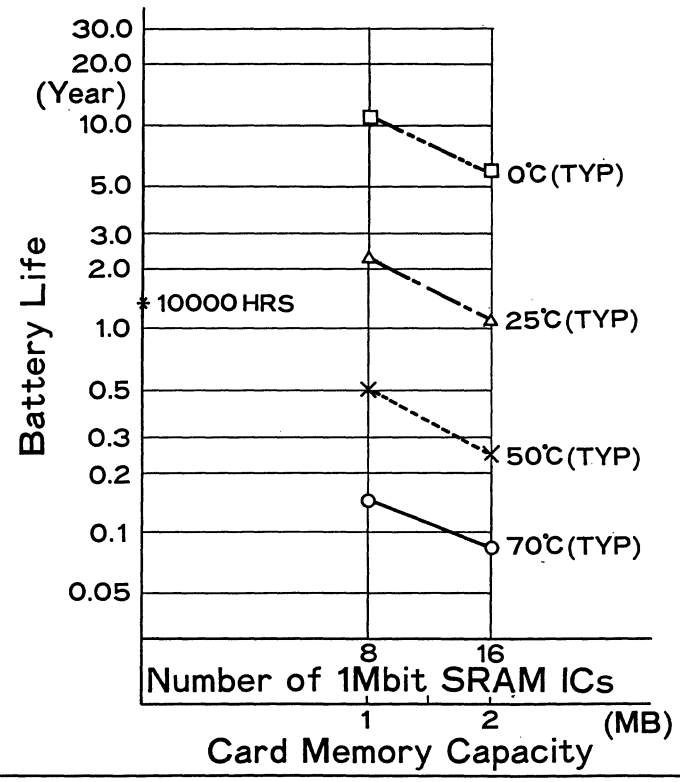
MF32M1-M6DAP××

Rev

BLOCK DIAGRAM [2MB SRAM CARD]



SRAM Card Battery Life vs Memory Capacity (Preliminary)



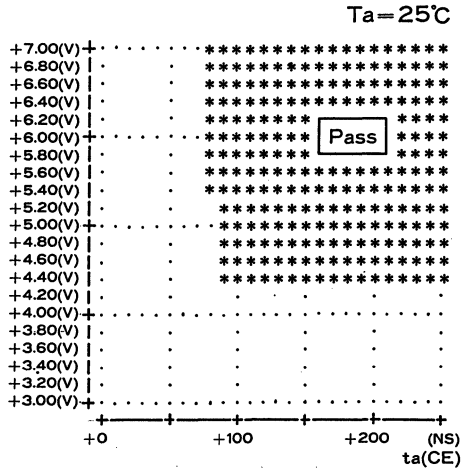
BATTERY TYPE CR2325

CARD TYPE
1MB : MF31MO-M6DAP××
2MB : MF32MO-M6DAP××

STANDBY CURRENT of a RAM
1.0uA(typ) Ta=25℃
Vcc=3V

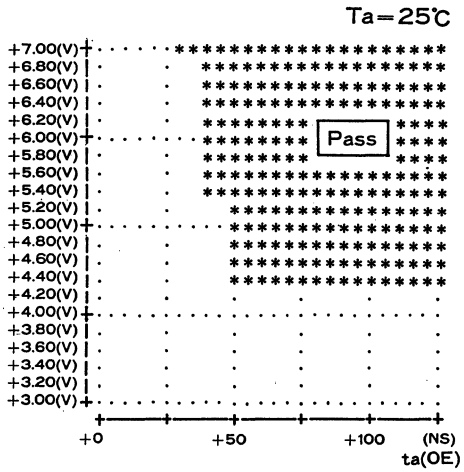
2MB SRAM CARD (MF32M1-M6DAPXX)

Card Enable access time



ACCESS TIME

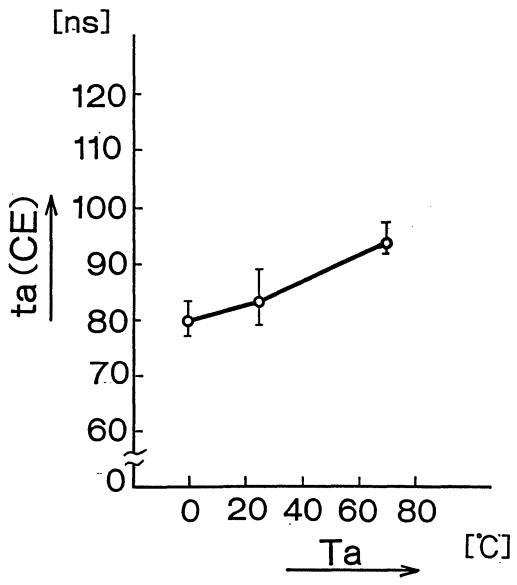
Output Enable access time

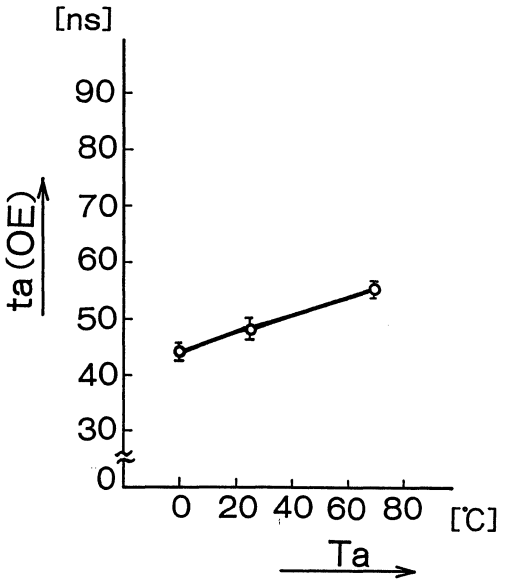


ACCESS TIME

MF32M1-M6DAPXX

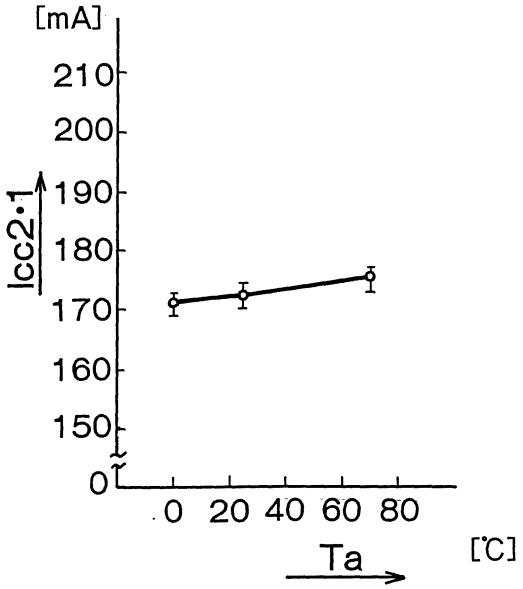
Access Time vs Ambient Temperature



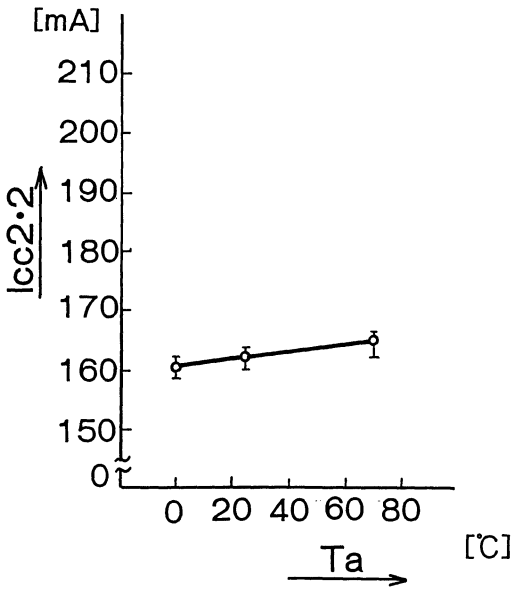


MF32M1-M6DAPXX

Active Supply Current (Icc2) vs Ambient Temperature

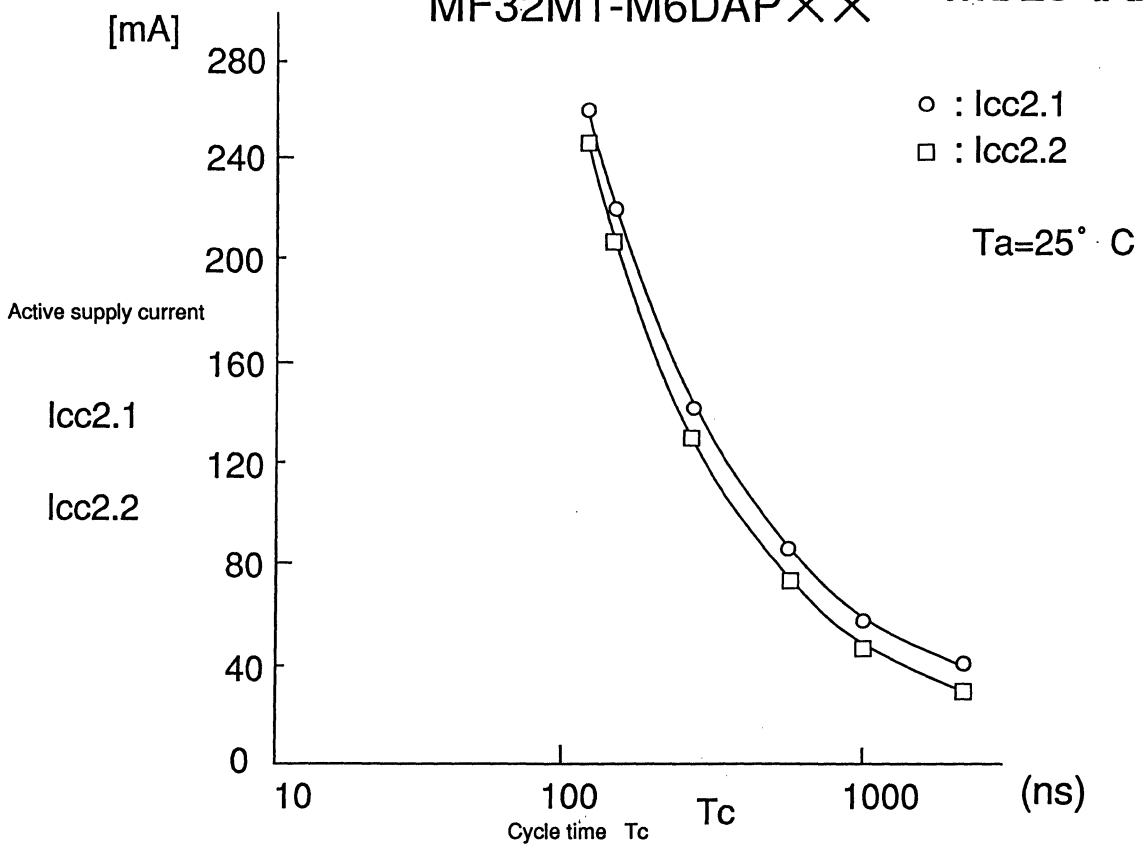


(V_{IH}, V_{IL} Level)



(CMOS Level)

MF32M1-M6DAP××



JEIDA SRAM CARD
[128KB/256KB/512KB/1MB/2MB]

DESCRIPTION

Mitsubisi JEIDA SRAM cards are developped based on JEIDA IC Memory card guideline Ver.4 which is the same specification issued by PCMCIA in U.S.A.

FEATURES

- Access time 200ns max.
- Buffered interface
- Thickness 3.3±0.1mm
- Interface level TTL level
- Battery life 2 years typ.(2MB)
- 2 level battery voltage detection

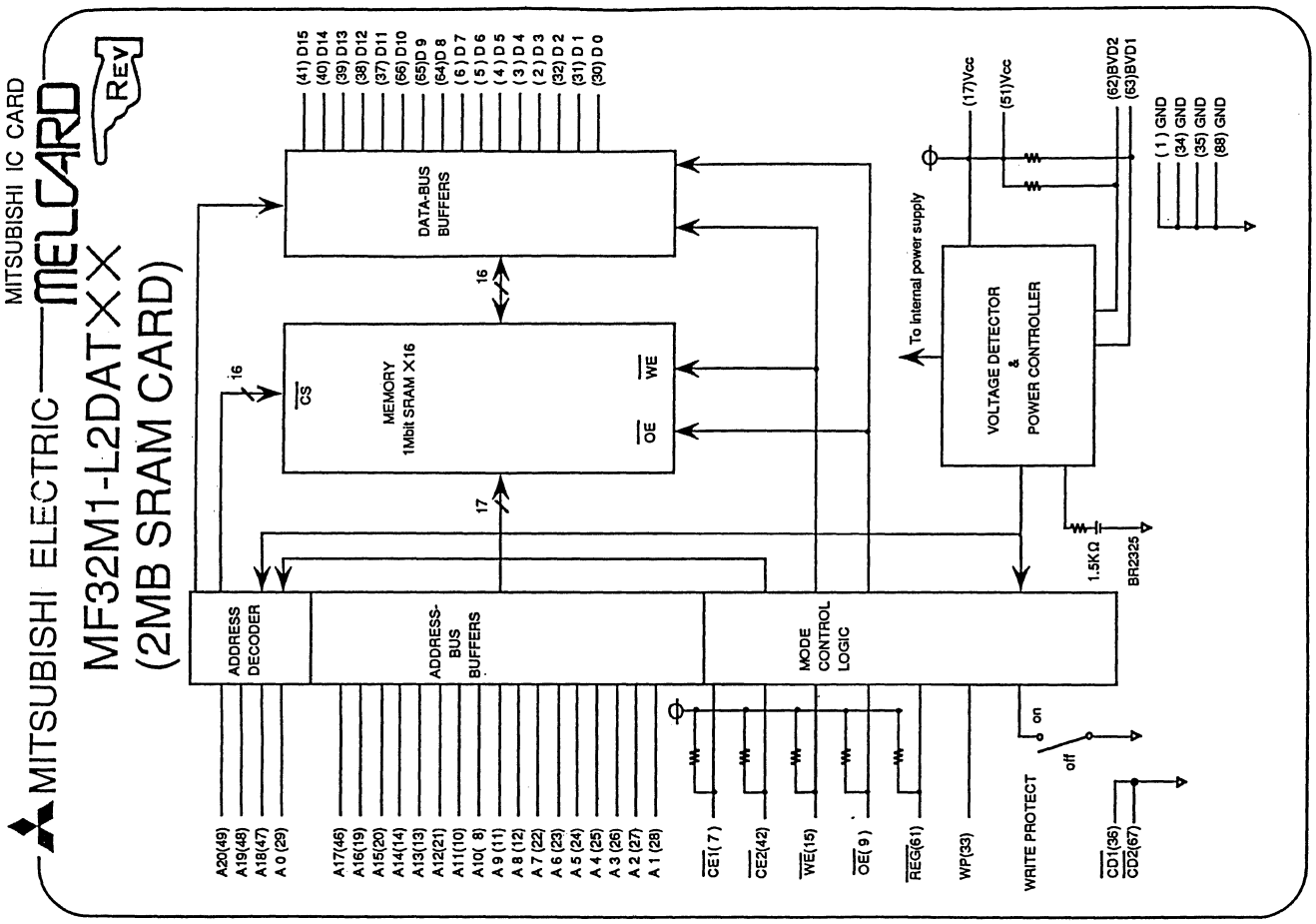
APPLICATION

Book type personal computer ,Handy-terminal

MITSUBISHI ELECTRIC
MITSUBISHI IC CARD
MELCARD
Rev

Comparison between MELCARD and JEIDA Guideline

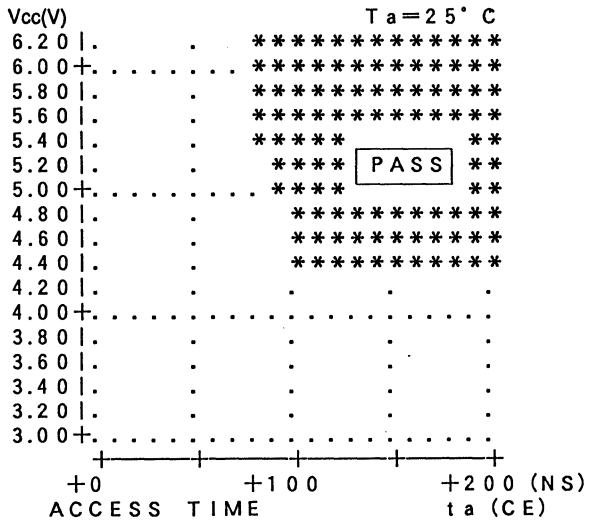
Item \ Type		MITSUBISHI		JEIDA Guideline Ver.4
		2P-60 Type	JEIDA Type	
Dimensions (mm)	Length	85.6±0.2	85.6±0.2	85.6±0.2
	Width	54.0±0.1	54.0±0.1	54.0±0.1
	Thickness	3.4±0.1	3.3±0.1	3.3～5.0
Pin Counts		60	68	68
Data-bus Width		8 or 16	8/16	8/16
Maximum Capacity		8MB(16MB)	64MB	64MB
Battery Voltage Detection		Analog	Digital (2 levels)	Digital (1or2 levels)
Card Information		Yes: [Memory Type]	No:[FFh]	No:[FFh]
			Yes:[Under planning]	Yes:[Defined]

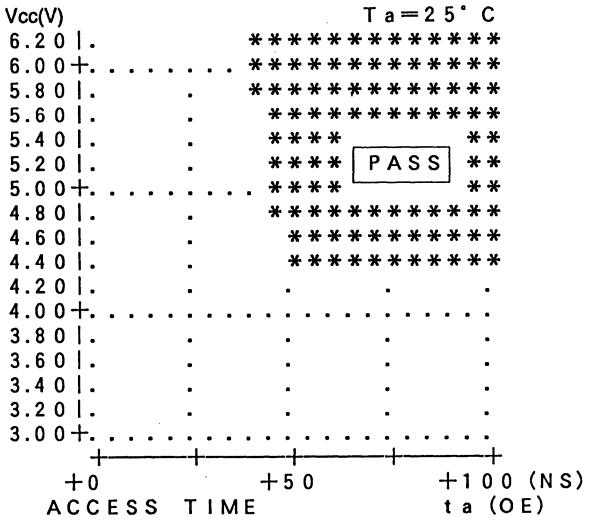


MITSUBISHI ELECTRIC

MITSUBISHI IC CARD
MELCARD

MF32M1-L2DATXX





Note:16bit access

OTP ROM CARD

[32KB / 64KB / 128KB / 256KB / 512KB / 1MB / 2MB / 4MB]

DESCRIPTION

Mitsubishi OTP ROM card is consisted of 256Kbit, 1Mbit or 2Mbit OTP ICs with VSOP (TSOP), address bus buffer ICs, decoder ICs and control bus buffer IC.

Features

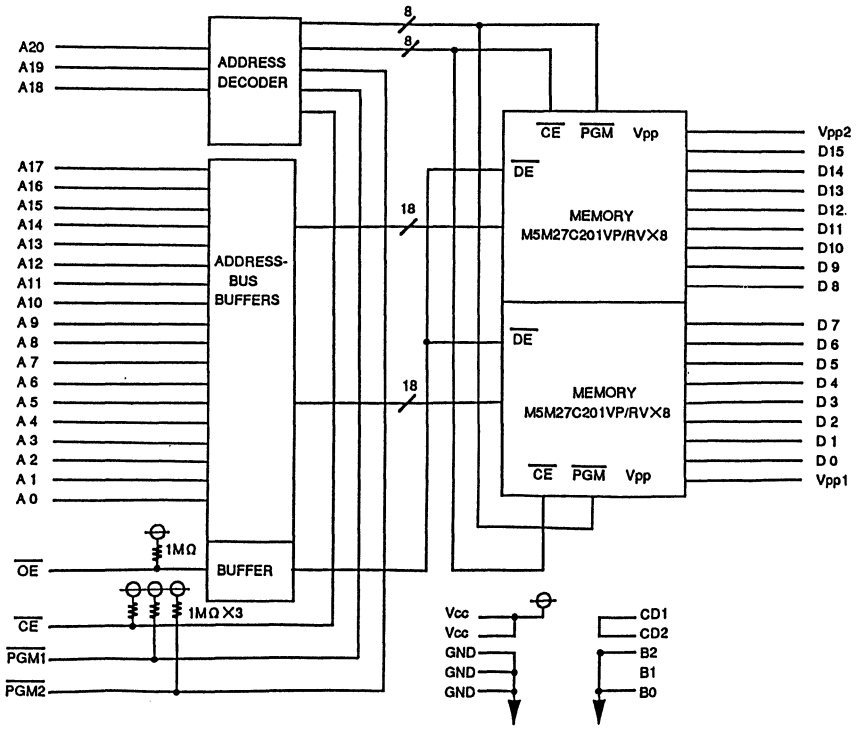
- Data bit length:8bit type or 16bit type
- access time:250ns (200ns type is also available by screening)
- Card dimension:54.0×85.6 ×3.4t (mm)
- Buffer on address bus and control line

Application

Book type personal computer,Printer, Multifunction terminal,PBX,etc.

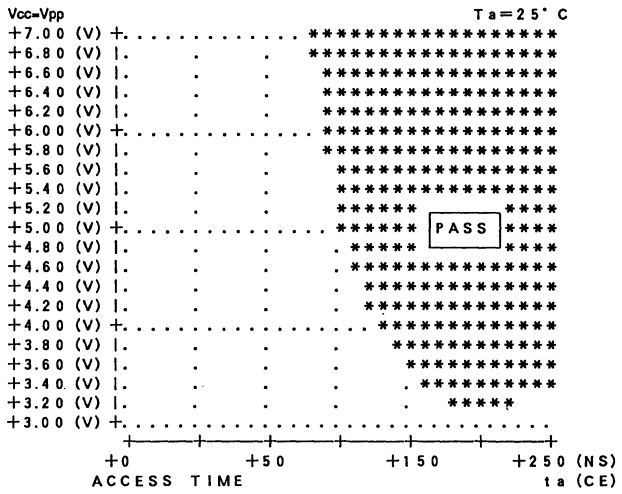
MF44M1-F1DAP××

BLOCK DIAGRAM

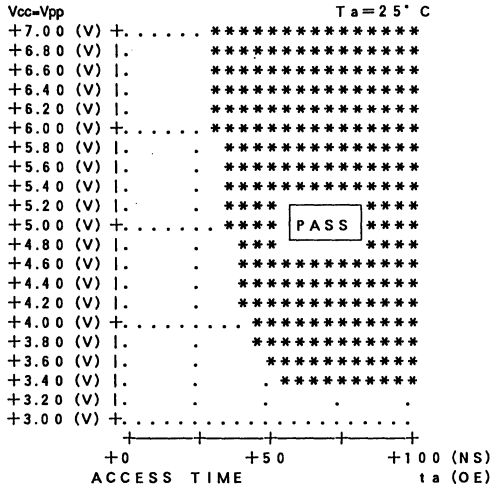


MF44M1-F1DAPXX

Card sellect access time

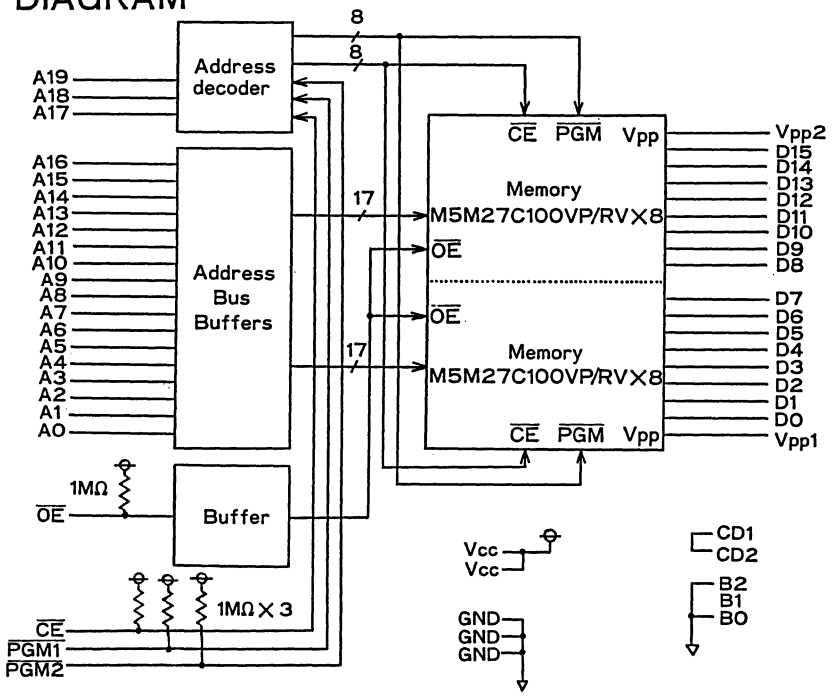


Output enable access time



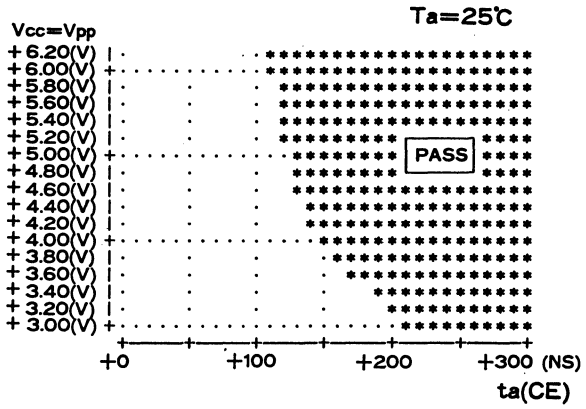
MF42M1-F1XAPXX
(2MB OTP CARD)

BLOCK DIAGRAM



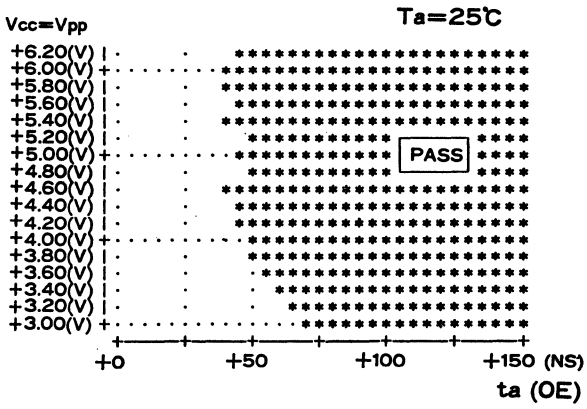
MF42M1-F1EAPXX

Card enable access time



ACCESS TIME

Output enable access time



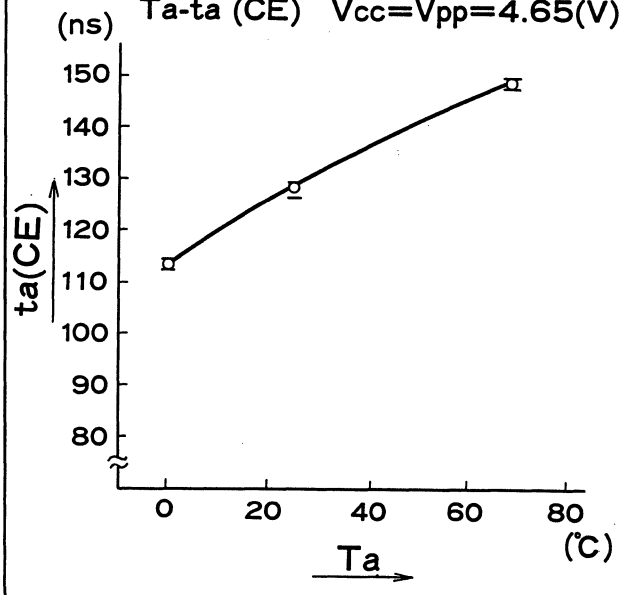
ACCESS TIME

MITSUBISHI IC CARD
MITSUBISHI ELECTRIC
MELCARD

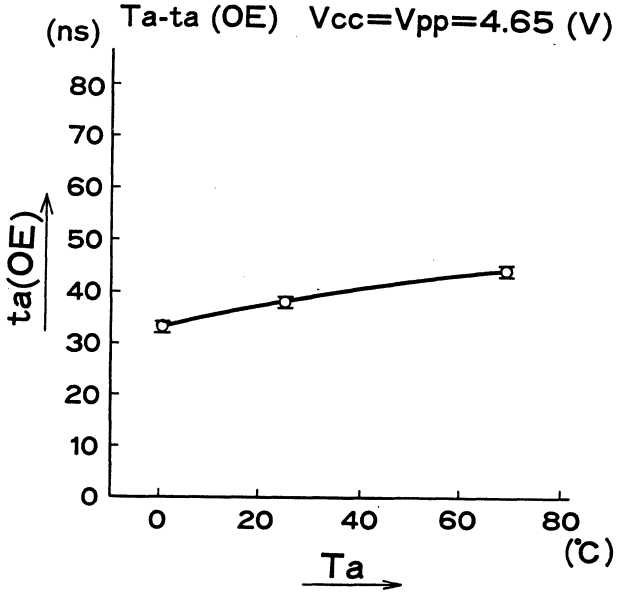
MF42M1-F1EAPXX

Access Time vs Ambient Temperature

Ta-ta (CE) Vcc=Vpp=4.65(V)

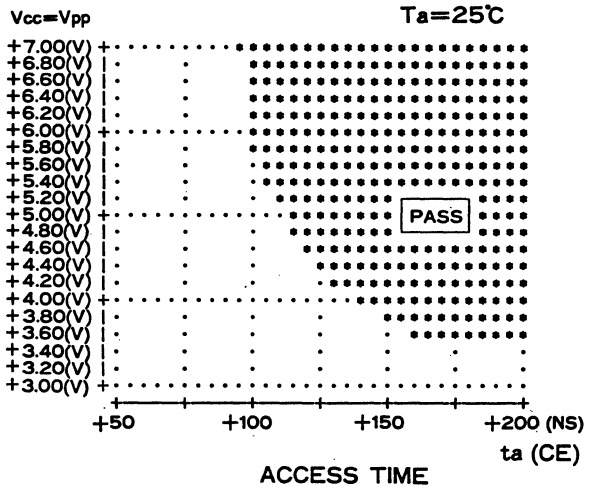


Ta-ta (OE) Vcc=Vpp=4.65 (V)



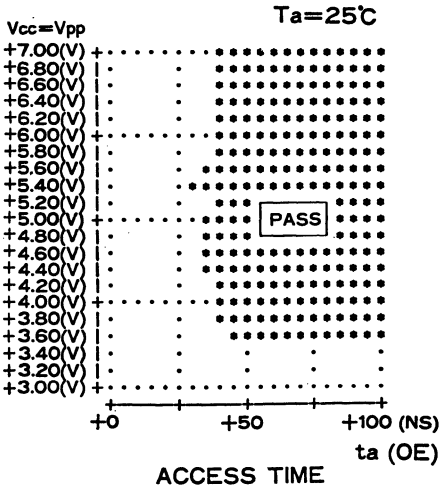
MF4512-F3EAPXX

Card enable access time



ACCESS TIME

Output enable access time



ACCESS TIME

MITSUBISHI IC CARD
MITSUBISHI ELECTRIC
MELCARD

PROGRAMMING FLOW CHART

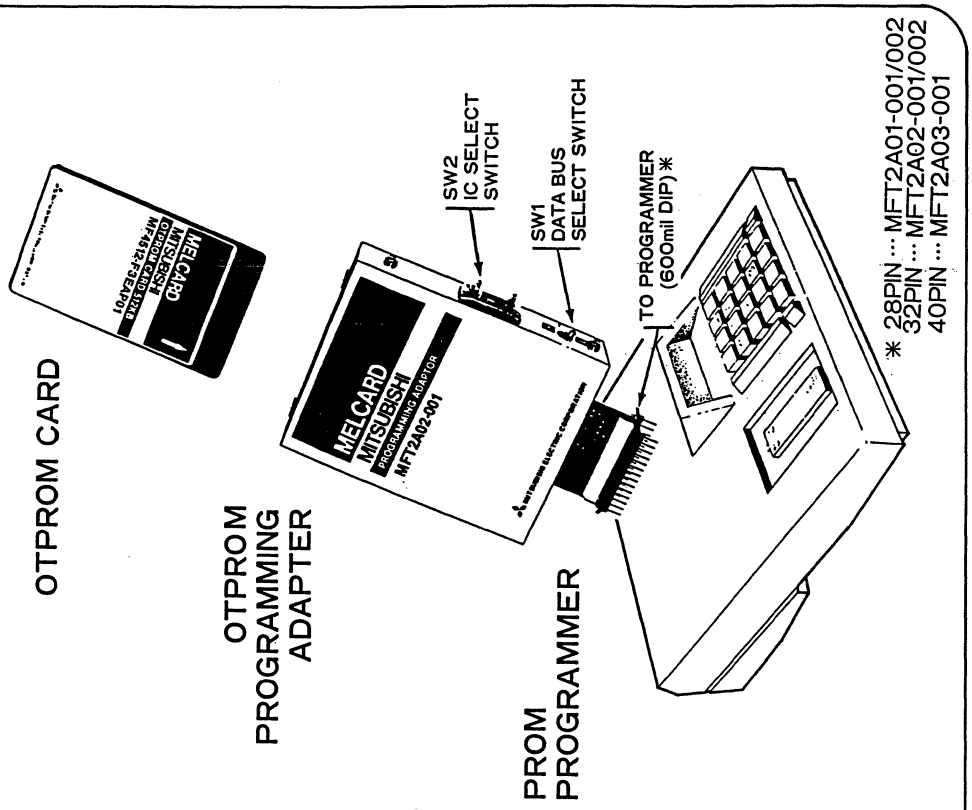
[Card-Level Programming]

FLOW CHART	FAILURE RATE	NOTE
PROGRAMMING & DATA CHECK	[Programming error] 0.1~1%/IC (average 0.3%)	Programming error
BAKING (125℃ 40hr)		Baking method is the other method of burning in. But please understand that the panel color may change slightly. In that case please paste labels on the card panel.
DATA CHECK	[Baking error] 0.1~1%/IC (average 0.3%)	

MITSUBISHI ELECTRIC

MELCARD

OTPROM MEMORY CARD PROGRAMMING ADAPTER



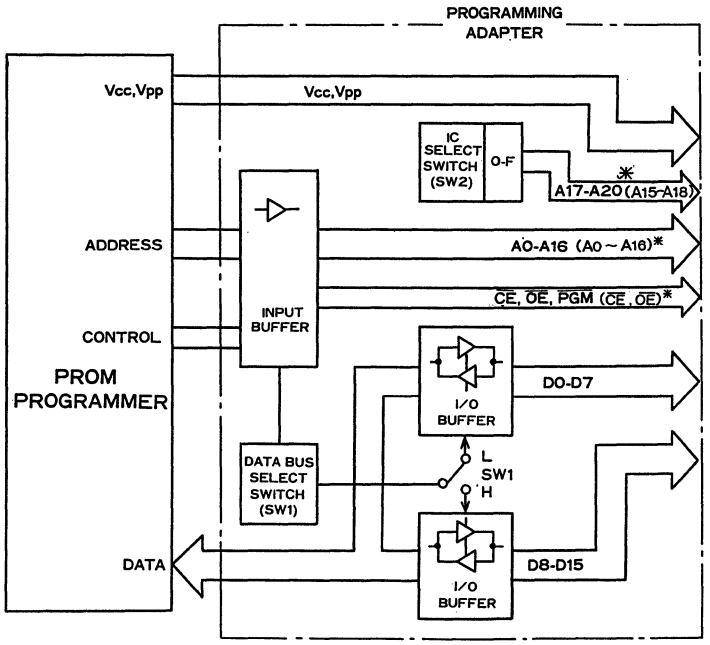
MITSUBISHI IC CARD

MITSUBISHI ELECTRIC

MELCARD

MFT2A02-001/002

BLOCK DIAGRAM



OTPROM CARD

*( ) Signal ··MFT2A01-001/002

MITSUBISHI ELECTRIC

MELCARD

Programming Adapter Selection Table of Card and Programmer

〔256Kbit PROM Type〕

Adapter Part Number	Card Type
MFT2A01-001	(8bit) MF432A-F2XXPXX MF464A-F1XXPXX MF4128-F1XXPXX MF4256-F1XXPXX MF4512-F1XXPXX
	(16bit) MF465A-F1XXPXX MF4129-F1XXPXX MF4257-F1XXPXX MF4513-F1XXPXX
MFT2A01-002	(8bit) MF4128-F2XXCXX MF4256-F2XXCXX MF4512-F2XXCXX
	(16bit) MF4129-F2XXCXX MF4257-F2XXCXX MF4513-F2XXCXX

Recommended PROM Programmers

MAKER	TYPE	SOCKET	ROM TYPE
DATA I/O	280		F/P CODE =93/32
Minato Electronics	Model 1890		E510
Advantest Corp.	R4949	R49492B	256I
Ando Electric Co., Ltd.	AF9720		256
	AF9704		
Promac Data Systems Corp.	Model 2A		256

MITSUBISHI IC CARD

MITSUBISHI ELECTRIC

MELCARD

Programming Adapter Selection Table of Card and Programmer

〔1M bit PROM Type〕

Adapter Part Number	Card Type
MFT2A02-001	(8bit) MF4128-F3XXPXX MF4256-F3XXPXX MF4512-F3XXPXX MF41M0-F1XXPXX MF42M0-F1XXPXX
	(16bit) MF4257-F3XXPXX MF4513-F3XXPXX MF41M1-F1XXPXX MF42M1-F1XXPXX
MFT2A02-002	(8bit) MF4128-F4XXCXX MF4256-F4XXCXX MF4512-F4XXCXX MF41M0-F2XXCXX MF42M0-F2XXCXX
	(16bit) MF4257-F4XXCXX MF4513-F4XXCXX MF41M1-F2XXCXX MF42M1-F2XXCXX
MFT2A03-001	(16bit) MF4129-F3XXPXX

Recommended PROM Programmers

MAKER	TYPE	SOCKET	ROM TYPE
Minato Electronics	Model 1890		E72A
Advantest Corp.	R4949	R49492B	1MH2
Ando Electric Co., Ltd.	AF9704		2201
Promac Data Systems Corp.	Model 2A		2201

MAKER	TYPE	SOCKET	ROM TYPE
Minato Electronics	Model 1890		E716
Advantest Corp.	R4949	R49493B	1MH1
Ando Electric Co., Ltd.	AF9704		2202
Promac Data Systems Corp.	Model 2A		2202

MITSUBISHI ELECTRIC

MELCARD

EEPROM CARD

[8KB/16KB/32KB/64KB/128KB/192KB]

DESCRIPTION:

EEPROM card which is placed twenty-four 64Kbit EEPROM devices maximumly.

FEATURES:

- Fast read access time : 250ns
- Data polling
- Page mode write : 32bytes
- Automatic erase before write : 10ms max.
- Erase/write cycle : 10,000 cycles min.
- data retention : 10 years min.
- Buffers on address and data bus

APPLICATION:

Factory automation, NC machine, Telephone

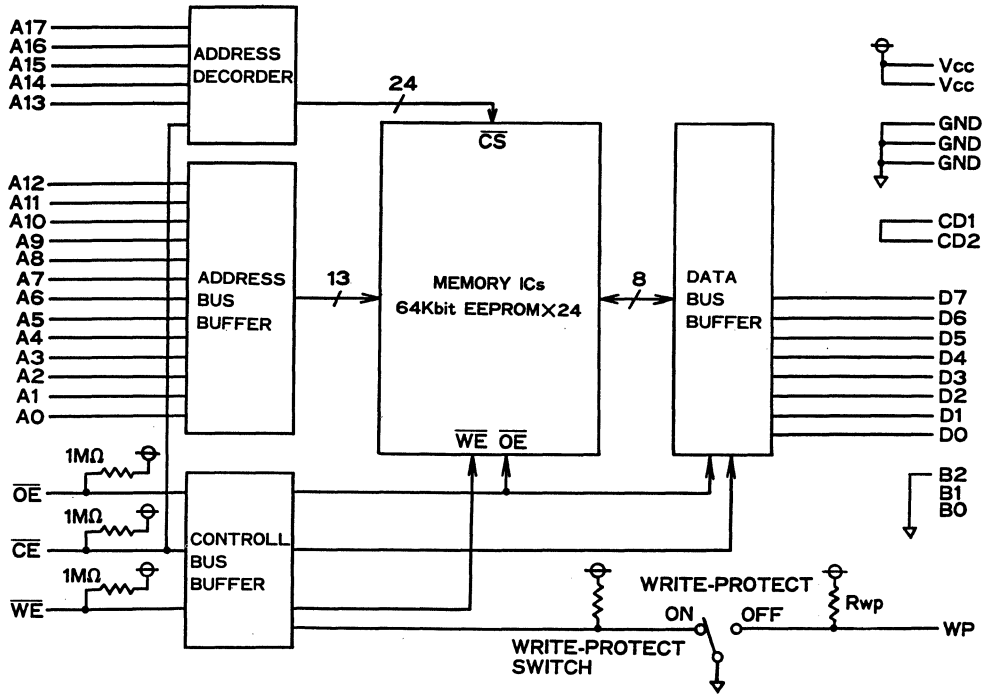
MITSUBISHI IC CARD

MITSUBISHI ELECTRIC

MELCARD

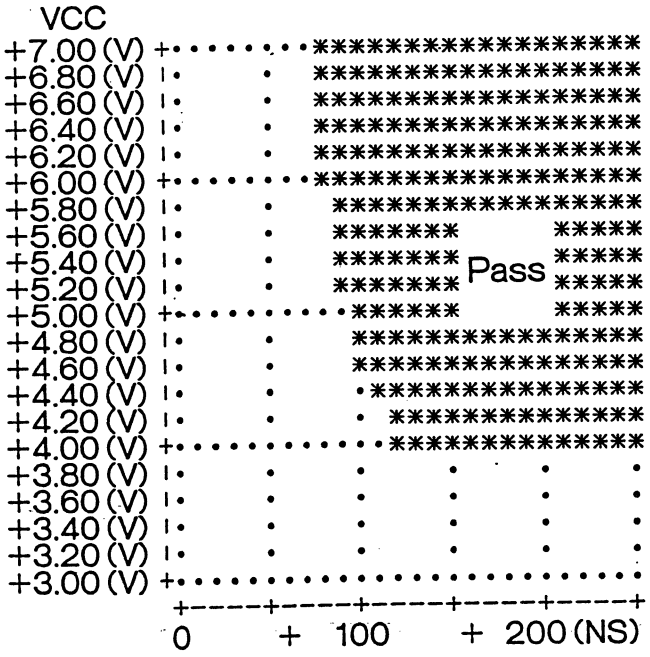
MF8192-F1EAPXX (192KB EEPROM CARD)

BLOCK DIAGRAM



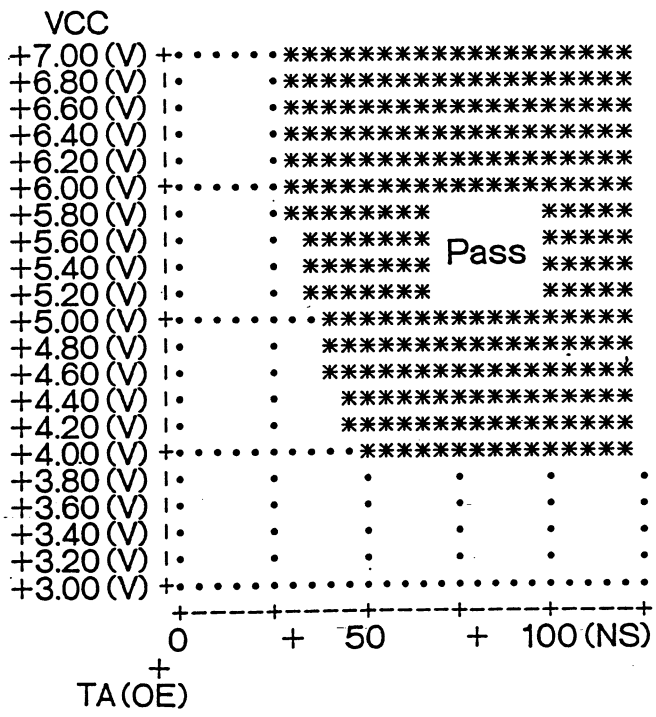
MF816A-FIEAPXX

Card Enable access time
Ta = 25℃



ACCESS TIME ta(CE)

Output Enable access time
Ta = 25℃



ACCESS TIME ta(OE)

MITSUBISHI ELECTRIC

MELCARD

DRAM CARD

[512KB/1MB/2MB/3MB]

DESCRIPTION

These are consisted of industry standard 256K×4 dynamic RAMs in Very Small Outline Package (TSOP).
The mounting of TSOP make possible the thin outline and large memory capacity card.

FEATURES

- High Speed : Access Time 150ns.
- Standard Card Size : 54mm(W)×85.6mm(L)×3.4mm(T).
- 60pins 2piece connector type.
- Low stand-by current.
- 512 refresh cycles Per 64mS
- $\overline{RAS}$ only refresh, $\overline{CAS}$ before $\overline{RAS}$ refresh, and Hidden refresh, modes are availble and Page-mode Capabilities.

APPLICATION

Main/Extension memory unit for FAX,
Personal computer.

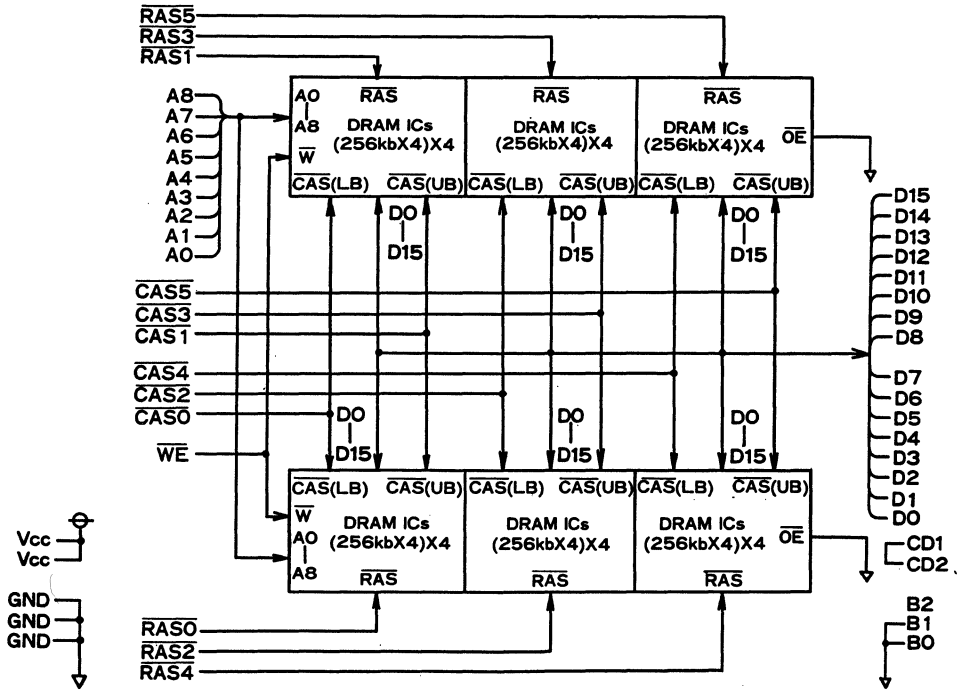
MITSUBISHI IC CARD

MITSUBISHI ELECTRIC

MELCARD

MF13MI-M1CAPXX (3MB DRAM CARD)

BLOCK DIAGRAM



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MELCARD

Features of DRAM CARD

(512KB/1MB/2MB/3MB, 16bit DATA width)

Memory Capacity	Access Time (Max, ns)	Operation Current (Max, mA)	Stand-by Current (Max, mA)		Control Pin	
			$\overline{RAS}=\overline{CAS}=V_{IH}$	$\overline{RAS}=\overline{CAS}=V_{CC}-0.5V$	$\overline{RAS}$	$\overline{CAS}$
512KB	150	200	8	2	$\overline{RAS0}$	$\overline{CAS0},\overline{CAS1}$
1MB	150	208	16	4	$\overline{RAS0},\overline{RAS1}$	$\overline{CAS0},\overline{CAS1}$
2MB	150	224	32	8	$\overline{RAS0},\overline{RAS1}$ $\overline{RAS2},\overline{RAS3}$	$\overline{CAS0},\overline{CAS1}$ $\overline{CAS2},\overline{CAS3}$
3MB	150	240	48	12	$\overline{RAS0},\overline{RAS1}$ $\overline{RAS2},\overline{RAS3}$ $\overline{RAS4},\overline{RAS5}$	$\overline{CAS0},\overline{CAS1}$ $\overline{CAS2},\overline{CAS3}$ $\overline{CAS4},\overline{CAS5}$

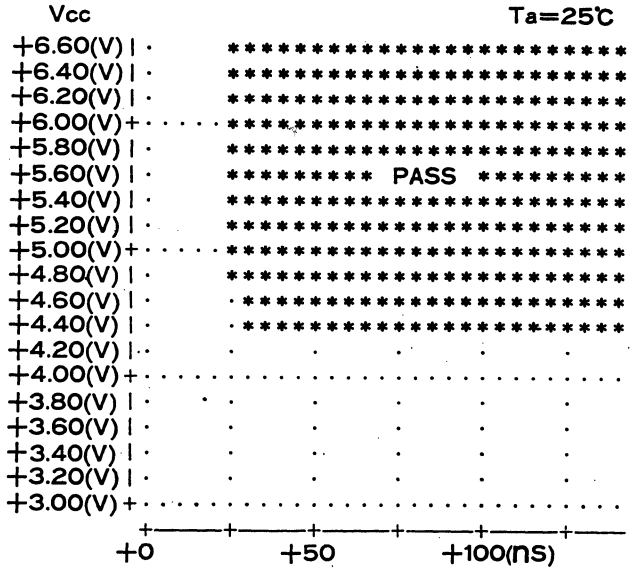
MITSUBISHI IC CARD

MITSUBISHI ELECTRIC

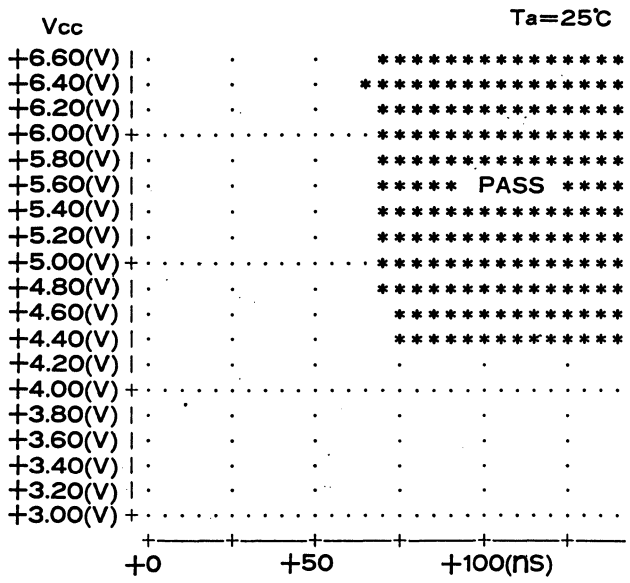
MELCARD

MF12M1-M1CAPXX

ACCESS TIME FROM $\overline{CAS}$



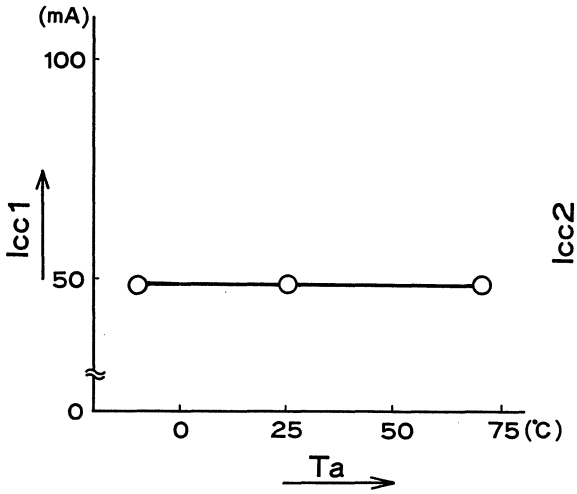
MF12M1-M1CAPXX
ACCESS TIME FROM $\overline{RAS}$

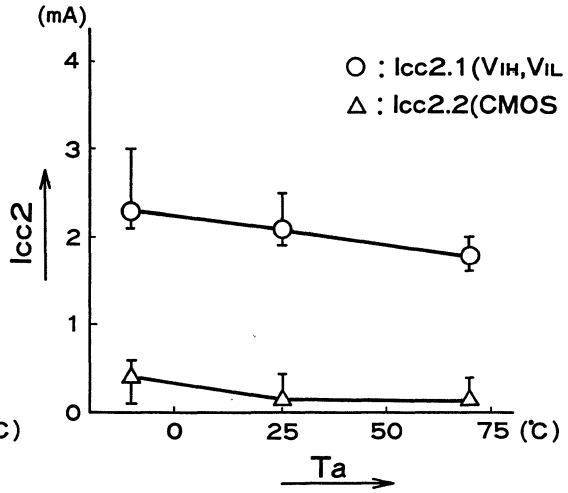


ACCESS TIME FROM $\overline{RAS}$

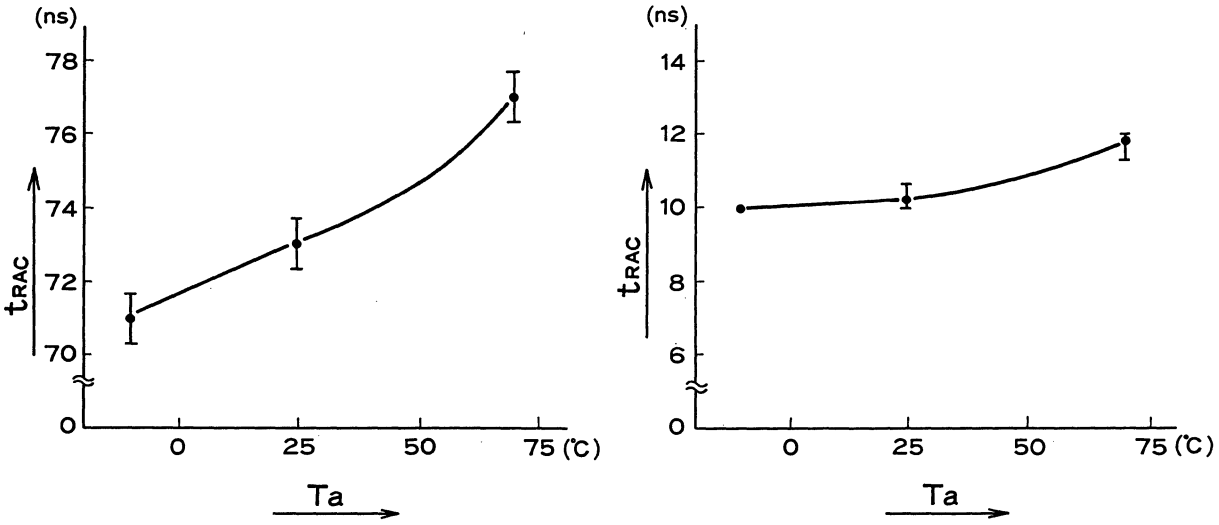
MITSUBISHI IC CARD
MITSUBISHI ELECTRIC
MELCARD

512KB DRAM CARD(MF1512-MICAPXX)
Supply Current(I_{CC1}, I_{CC2}) vs Ambient Temperature

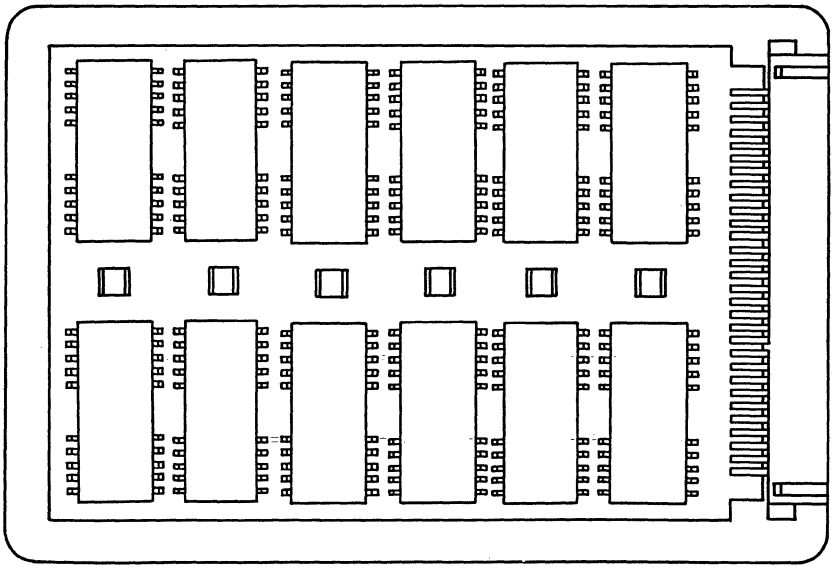




512KB DRAM CARD (MF1512-MICAPXX)
Access Time vs Ambient Temperature



12MB* DRAM CARD LAYOUT
(Preliminary)



*12 pieces 4Mbit DRAM IC each side of PCB=Total 24×4Mb DRAM IC's

MITSUBISHI ELECTRIC

MELCARD

DRAM CARD
(2MB/4MB/8MB/12MB)

DESCRIPITION

These memory cards contain 4,8,16 or 24 industry standard 1Mb×4 Dynamic RAMs in Thin and Small Outline Package(TSOP). The use of TSOP makes possible 3.4mm card thickness and highest density memory capacity credit card size.

FEATURES

- High Speed : Access Time from $\overline{RAS}$ 150ns.
- Standard Card Size : 54mm(W)×85.6mm(L)×3.4mm(T).
- 60pins pin-and-socket(2p)connector type.
- Low stand-by current
- $\overline{RAS}$ only refresh, $\overline{CAS}$ before $\overline{RAS}$ refresh Hidden refresh, and Page-mode functions are available.

APPLICATION

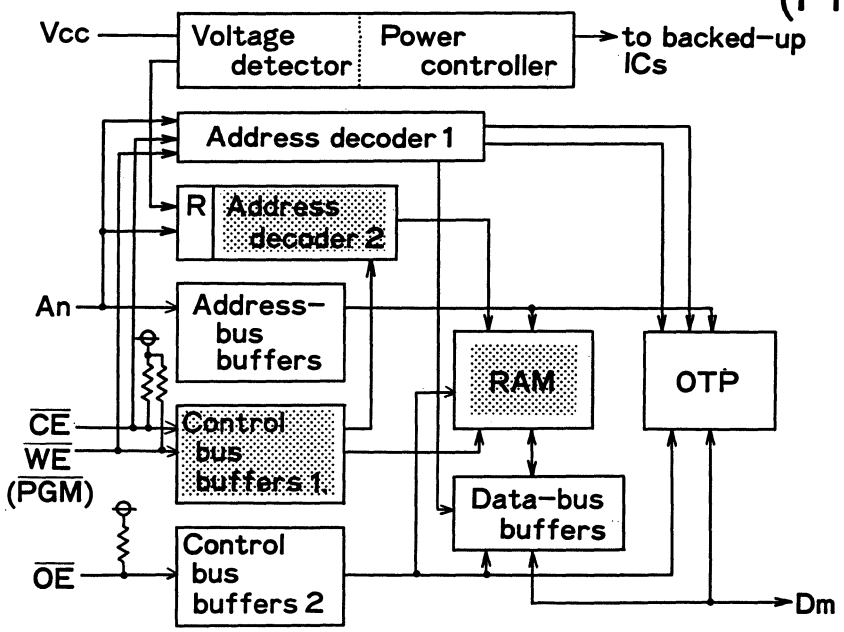
Main/Extension memory unit for Personal Computer, Laser-Printer, FAX etc.

MITSUBISHI IC CARD

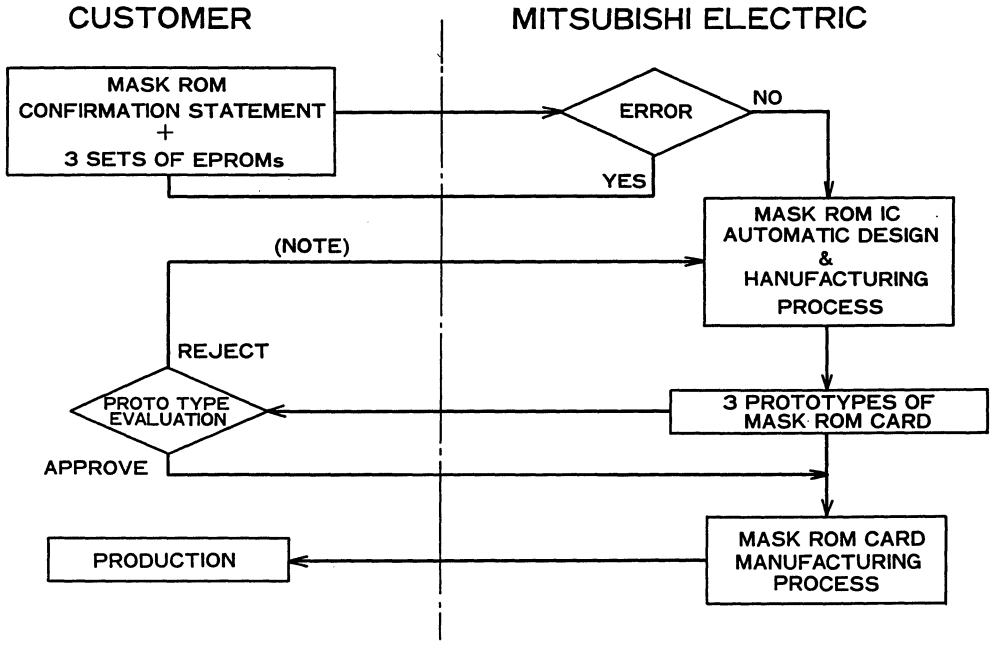
MITSUBISHI ELECTRIC

MELCARD

Block diagram of Mixed card (RAM/OTP)
(Preliminary)



MASK ROM CARD DEVELOPMENT SYSTEM



(NOTE) If the customer change the MASK ROM code, another MASK ROM charge is required.

MITSUBISHI IC CARD
MITSUBISHI ELECTRIC
MELCARD

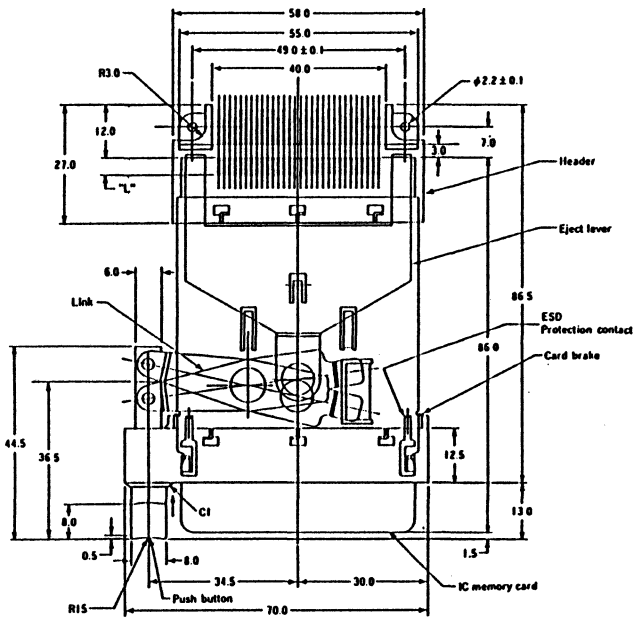
EJECTION TYPE CONNECTORS

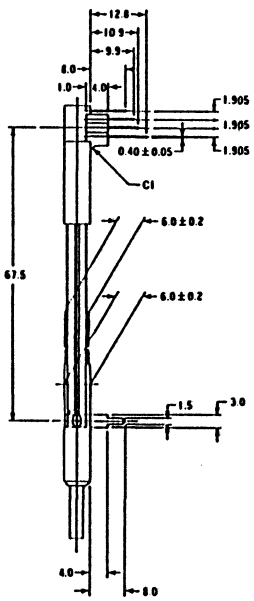
Applicable Card Type	Mfr, Part Number and Mfr	Mechanism for ejection	Dimensions
2P (60pin)	86933-001 Mfr : Du pont	Push-Button Ejection	70mm(W)×86.5mm(L) ×10mm*(H) (4mm stand-off)
	JC20EA-D60PR-LT1-A1 Mfr : JAE	Push-Button Ejection	78mm(W)×88.5mm(L) ×6.5mm*(H)
CE (50pin)	HGC032-01-010 Mfr : HOSHIDEN ELECTRONICS	Spring-Activated Push In-Push Out	70.5mm(W)×90mm(L) ×14mm*(H)

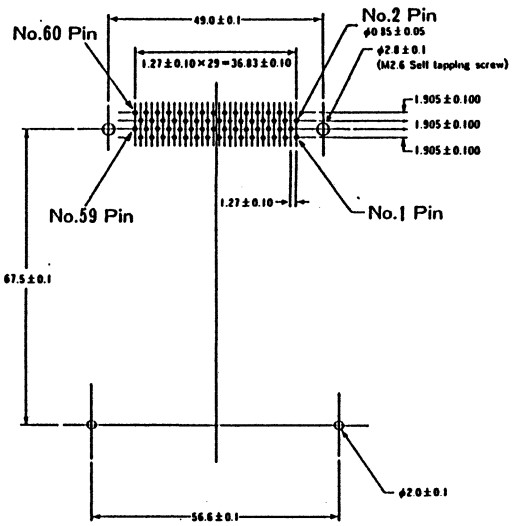
※Hight is from PCB

MITSUBISHI ELECTRIC

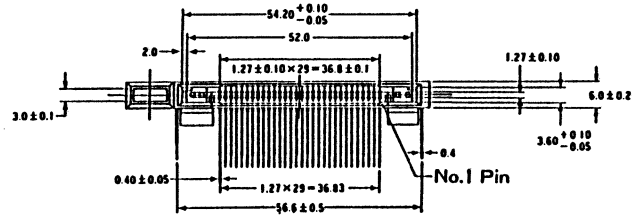
MELCARD

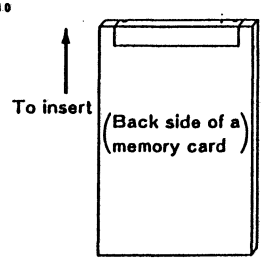


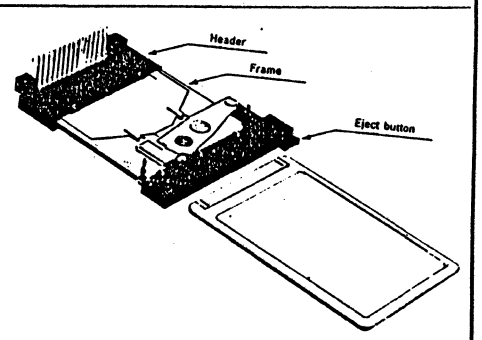




PWB Layout (Top view)







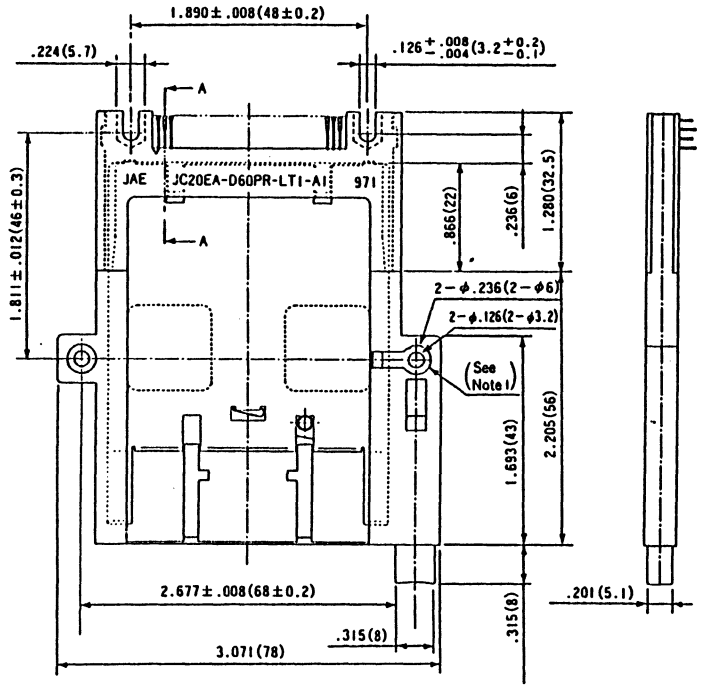
Du Pont Micro-Tri-Beam™ Eject Header
P/N 86933-001

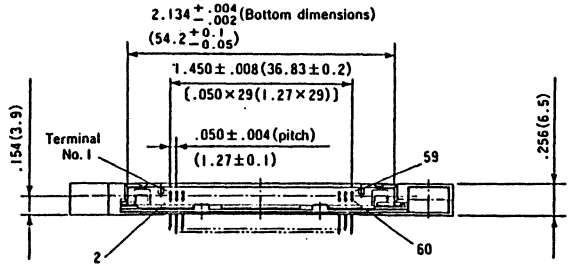
● Note: Header must be mounted on a back of PCB, when the memory card is to be inserted as shown in a picture.

Code: _____ Date: _____ Page____ of____

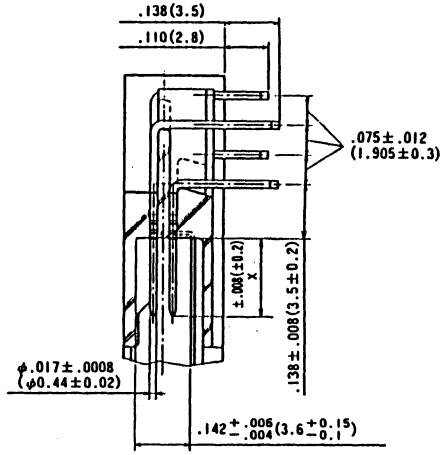
MITSUBISHI ELECTRIC

MELCARD





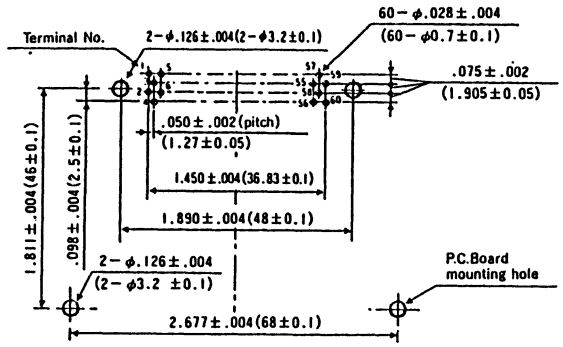
Section A-A



DIMENSION X

Terminal Nos. 29, 30, 32, 59, 60	.197"(5mm)
Other terminals	.157"(4mm)

● P.C.B. MOUNTING HOLE DIMENSIONS (Ref.)



JAE

CONNECTOR WITH ONE-PUSH EJECTOR BUTTON

● PART NUMBER : JC20EA-D60PR-LT1-A1

(Note 1) Shown here is the lug mounting position for using an optional version with a grounding lug. The P.C. Board mounting hole requires a ground area to connect this lug.

Code: _____ Date: _____ Page____ of____

MITSUBISHI ELECTRIC

MELCARD

MITSUBISHI ELECTRIC MEMORY CARD PRODUCT DESIGNATION

Rev

MF 3 128 - M1 E A P XX

MITSUBISHI MELCARD

INDICATES MEMORY TYPE

1 : DRAM CARD
3 : SRAM CARD
4 : OTP CARD
7 : MASK ROM CARD
8 : EEPROM CARD
9 : COMPLEX MEMORY CARD

INDICATES MEMORY CAPACITY AND DATA WIDTH

MEMORY CAPACITY	DATA BUS 8bit	16 bit
8KB	08A	09A
16KB	16A	17A
32KB	32A	33A
64KB	64A	65A
128KB	128	129
256KB	256	257
512KB	512	513
1MB	1MO	1M1
2MB	2MO	2M1
4MB	4MO	4M1
8MB	8MO	8M1

INDICATES FAMILY OF FUNCTION

INDICATES ACCESS TIME

A : 100NS D : 200NS
B : 120NS E : 250NS
C : 150NS F : 300NS

INDICATES DESIGN REVISION

A→ B→ C→

VARIOUS CARD CONNECTOR STRUCTURE

P : 2P-60 PINS(PIN & SOCKET)
T : 2P-68 PINS(PIN & SOCKET)
C : CARD EDGE-50 PINS

INDICATES CARD PANEL ARTWORK TYPE AND/OR PROGRAM CODE

00-BLANK CARD, NO ARTWORK
01-MITSUBISHI ARTWORK
XX-INDICATES CUSTOMER(S) ARTWORK AND/OR PROGRAM CODE(S)

Notes:

Notes:

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