KMM5394000AKM Fast Page Mode

4Mx39 DRAM SIMM , 4K Refresh , 5V
Using 16M DRAM with 300 mil Package

GENERAL DESCRIPTION

The Samsung KMM5394000AKM is a 4M bit x 39 Dynamic RAM high density memory module. The Samsung KMM5394000AKM consists of ten CMOS 4Mx4bit DRAMs in 24-pin SOJ packages mounted on a 72-pin glass-epoxy substrate. A 0.22uF decoupling capacitor is mounted on the printed circuit board for each DRAM. The KMM5394000AKM is a Single In-line Memory Module with edge connections and is intended for mounting into 72 pin edge connector sockets.

FEATURES

• Performance Range:

	tRAC	tCAC	tRC
KMM5394000AKM - 5	50ns	13ns	90ns
KMM5394000AKM - 6	60ns	15ns	110ns
KMM5394000AKM - 7	70ns	20ns	130ns
KMM5394000AKM - 8	80ns	20ns	150ns

- Fast Page Mode Operation
- $\overline{CAS}$-before-$\overline{RAS}$ refresh capability
- $\overline{RAS}$-only and Hidden refresh capability
- TTL compatible inputs and outputs
- Single +5V±10% power supply
- 4096 cycles/64 ms refresh
- JEDEC standard PDPin & pinout
- **PCB : Height (1000 mil), single sided component**

PIN CONFIGURATIONS

Pin	Symbol	Pin	Symbol
1	Vss	37	DQ33
2	DQ0	38	DQ35
3	DQ16	39	Vss
4	DQ1	40	$\overline{CAS0}$
5	DQ17	41	$\overline{CAS2}$
6	DQ2	42	$\overline{CAS3}$
7	DQ18	43	$\overline{CAS1}$
8	DQ3	44	$\overline{RAS0}$
9	DQ19	45	NC
10	Vcc	46	DQ37
11	A10	47	$\overline{W}$
12	A0	48	Vss
13	A1	49	DQ8
14	A2	50	DQ24
15	A3	51	DQ9
16	A4	52	DQ25
17	A5	53	DQ10
18	A6	54	DQ26
19	$\overline{OE}$	55	DQ11
20	DQ4	56	DQ27
21	DQ20	57	DQ12
22	DQ5	58	DQ28
23	DQ21	59	Vcc
24	DQ6	60	DQ29
25	DQ22	61	DQ13
26	DQ7	62	DQ30
27	DQ23	63	DQ14
28	A7	64	DQ31
29	DQ36	65	DQ15
30	Vcc	66	DQ38
31	A8	67	PD1
32	A9	68	PD2
33	NC	69	PD3
34	$\overline{RAS2}$	70	PD4
35	DQ34	71	A11
36	DQ32	72	Vss

PIN NAMES

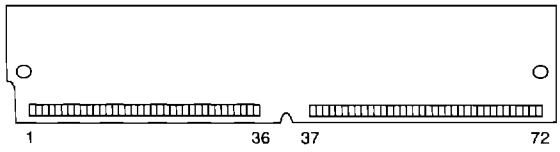
A0 - A11	Address Inputs
DQ0 - DQ38	Data In/Out
$\overline{W}$	Read/Write Input
$\overline{RAS0}$, $\overline{RAS2}$	Row Address Strobe
$\overline{CAS0}$ - $\overline{CAS3}$	Column Address Strobe
PD1 - PD4	Presence Detect
Vcc	Power(+5V)
Vss	Ground
NC	No Connection
$\overline{OE}$	Output Enable

PRESENCE DETECT PINS (Optional)

Pin	50NS	60NS	70NS	80NS
PD1	TBD	TBD	NC	TBD
PD2			NC	
PD3			Vss	
PD4			Vss	

*Pin Connection Changing Available

PIN CONNECTIONS (Front View)



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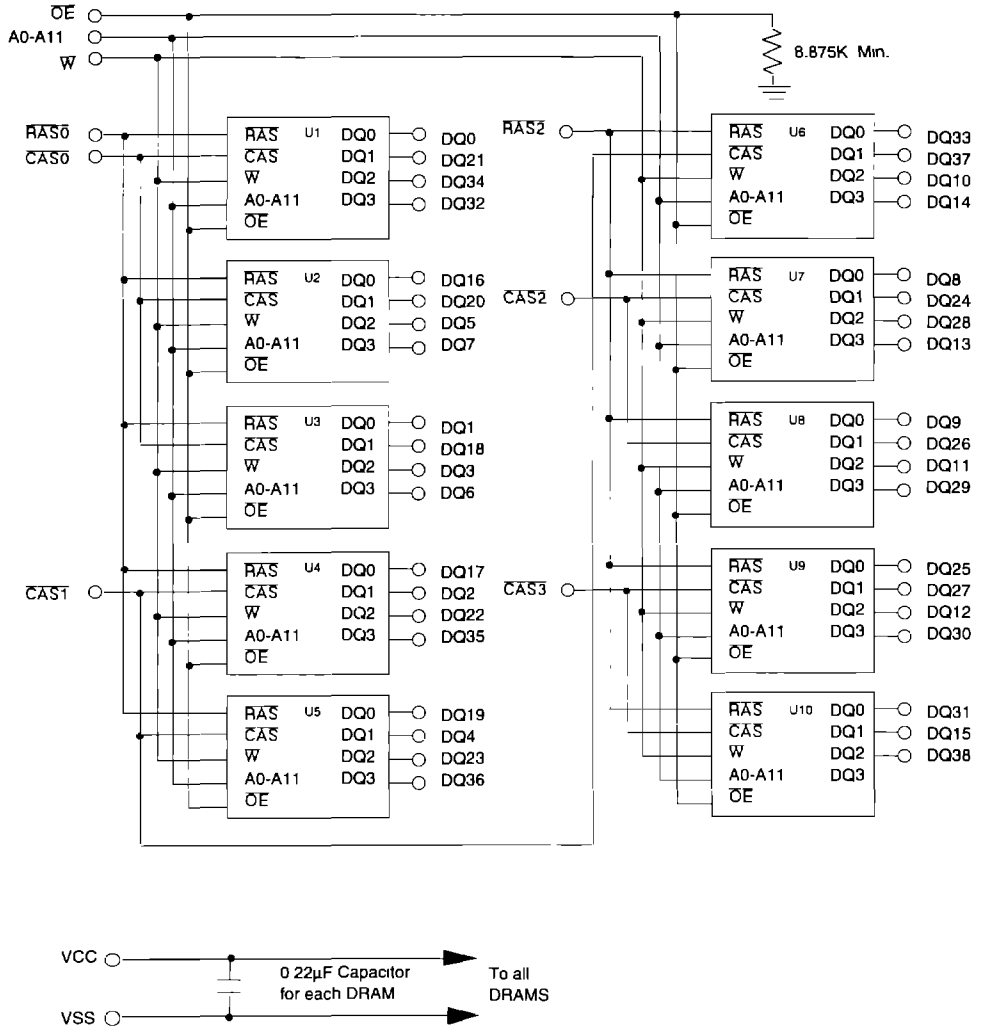
FUNCTIONAL BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS *

Item	Symbol	Rating	Unit
Voltage on any pin relative to Vss	VIN,VOUT	-1 to +7.0	V
Voltage on Vcc supply relative to Vss	Vcc	-1 to +7 0	V
Storage Temperature	Tstg	-55 to +150	°C
Power Dissipation	Pd	10	W
Short Circuit Output Current	IOS	50	mA

* Permanent device damage may occur if ABSOLUTE MAXIMUM RATINGS are exceeded Functional operation should be restricted to the conditions as detailed in the operational sections of this data sheet Exposure to absolute maximum rating conditions for intended periods may affect device reliability

RECOMMENDED OPERATING CONDITIONS (Voltage referenced to Vss, Ta = 0 to 70 °C)

Item	Symbol	Min	Typ	Max	Unit
Supply Voltage	Vcc	4.5	5 0	5.5	V
Ground	Vss	0	0	0	V
Input High Voltage	VIH	2 4	-	Vcc+1	V
Input Low Voltage	VIL	-1 0	-	0 8	V

DC AND OPERATING CHARACTERISTICS (Recommended operating conditions unless otherwise noted.)

Parameter	Part No	Symbol	Min	Max	Unit
Operating Current * ($\overline{RAS}$, $\overline{CAS}$, Address cycling @tRC=min)	KMM5394000AKM - 5	ICC1	-	900	mA
	KMM5394000AKM - 6		-	800	mA
	KMM5394000AKM - 7		-	700	mA
	KMM5394000AKM - 8		-	600	mA
Standby Current ($\overline{RAS}$=$\overline{CAS}$=$\overline{W}$=VIH)		ICC2	-	20	mA
$\overline{RAS}$ Only Refresh Current * ($\overline{CAS}$= VIH, $\overline{RAS}$ cycling @tRC =min.)	KMM5394000AKM - 5	ICC3	-	900	mA
	KMM5394000AKM - 6		-	800	mA
	KMM5394000AKM - 7		-	700	mA
	KMM5394000AKM - 8		-	600	mA
Fast Page Mode Current * ($\overline{RAS}$=VIL, $\overline{CAS}$ cycling : tPC=min.)	KMM5394000AKM - 5	ICC4	-	800	mA
	KMM5394000AKM- 6		-	700	mA
	KMM5394000AKM - 7		-	600	mA
	KMM5394000AKM - 8		-	500	mA
Standby Current ($\overline{RAS}$=$\overline{CAS}$=$\overline{W}$=Vcc-0.2V)		ICC5	-	10	mA
$\overline{CAS}$-Before-$\overline{RAS}$ Refresh Current * ($\overline{RAS}$ and $\overline{CAS}$ cycling @tRC =min)	KMM5394000AKM - 5	ICC6	-	900	mA
	KMM5394000AKM - 6		-	800	mA
	KMM5394000AKM - 7		-	700	mA
	KMM5394000AKM - 8		-	600	mA
Input Leakage Current (Any input 0 ≤ VIN ≤ Vcc+0 5V, all other pins not under test = 0 V.)		II(L)	-100	100	µA
Output Leakage Current (Data out is disabled, 0V ≤ Vout ≤ Vcc)		IO(L)	-10	10	µA
Output High Voltage Level (IOH = - 5mA)		VOH	2.4	-	V
Output Low Voltage Level (IOL = 4.2mA)		VOL	-	0.4	V

* NOTE . ICC1,ICC3,ICC4 and ICC6 are dependent on output loading and cycle rates. Specified values are obtained with the output open. ICC is specified as an average current. In ICC1 and ICC3, address can be changed maximum two times while $\overline{RAS}$=VIL In ICC4, address can be changed maximum once within one page mode cycle .

CAPACITANCE (Ta = 25°C , Vcc=5V , f = 1 MHz)

Item	Symbol	Min	Max	Unit
Input capacitance [A0-A11]	CIN1	-	80	pF
Input capacitance [$\overline{W}$, $\overline{OE}$]	CIN2	-	90	pF
Input capacitance [$\overline{RAS0}$ $\overline{RAS2}$]	CIN3	-	55	pF
Input capacitance [$\overline{CAS0}$ - $\overline{CAS3}$]	CIN4	-	40	pF
Input/Output capacitance [DQ0-38]	CDQ1	-	17	pF

AC CHARACTERISTICS (0°C≤Ta≤70°C, Vcc=5.0V±10%. See notes 1,2.)

STANDARD OPERATION	Symbol	-5		-6		-7		-8		Unit	Notes
		Min	Max	Min	Max	Min	Max	Min	Max		
Random read or write cycle time	tRC	90		110		130		150		ns	
Access time from $\overline{RAS}$	tRAC		50		60		70		80	ns	3,4
Access time from $\overline{CAS}$	tCAC		13		15		20		20	ns	3,4,5
Access time from column address	tAA		25		30		35		40	ns	3,11
$\overline{CAS}$ to output in Low-Z	tCLZ	0		0		0		0		ns	3
Output buffer turn-off delay	tOFF	0	13	0	15	0	20	0	20	ns	7
Transition time (rise and fall)	tT	3	50	3	50	3	50	3	50	ns	2
$\overline{RAS}$ precharge time	tRP	30		40		50		60		ns	
$\overline{RAS}$ pulse width	tRAS	50	10K	60	10K	70	10K	80	10K	ns	
$\overline{RAS}$ hold time	tRSH	13		15		20		20		ns	
$\overline{CAS}$ hold time	tCSH	50		60		70		80		ns	
$\overline{CAS}$ pulse width	tCAS	13	10K	15	10K	20	10K	20	10K	ns	
$\overline{RAS}$ to $\overline{CAS}$ delay time	tRCD	20	37	20	45	20	50	20	60	ns	4
$\overline{RAS}$ to column address delay time	tRAD	15	25	15	30	15	35	15	40	ns	11
$\overline{CAS}$ to $\overline{RAS}$ precharge time	tCRP	5		5		5		5		ns	
Row address set-up time	tASR	0		0		0		0		ns	
Row address hold time	tRAH	10		10		10		10		ns	
Column address set-up time	tASC	0		0		0		0		ns	
Column address hold time	tCAH	10		10		15		15		ns	
Column address hold referenced to $\overline{RAS}$	tAR	40		45		55		60		ns	6
Column Address to $\overline{RAS}$ lead time	tRAL	25		30		35		40		ns	
Read command set-up time	tRCS	0		0		0		0		ns	
Read command hold referenced to $\overline{CAS}$	tRCH	0		0		0		0		ns	9
Read command hold referenced to $\overline{RAS}$	tRRH	0		0		0		0		ns	9
Write command hold time	tWCH	10		10		15		15		ns	
Write command hold referenced to $\overline{RAS}$	tWCR	40		45		55		60		ns	6
Write command pulse width	tWP	10		10		15		15		ns	
Write command to $\overline{RAS}$ lead time	tRWL	15		15		20		20		ns	
Write command to $\overline{CAS}$ lead time	tCWL	13		15		20		20		ns	
Data-in set-up time	tDS	0		0		0		0		ns	10
Data-in hold time	tDH	10		10		15		15		ns	10
Data-in hold referenced to $\overline{RAS}$	tDHR	40		45		55		60		ns	6
Refresh period	tREF		64		64		64		64	ms	
Write command set-up time	tWCS	0		0		0		0		ns	8
$\overline{CAS}$ setup time (C-B-R refresh)	tCSR	10		10		10		10		ns	
$\overline{CAS}$ hold time (C-B-R refresh)	tCHR	10		10		15		15		ns	
$\overline{RAS}$ precharge to $\overline{CAS}$ hold time	tRPC	5		5		5		5		ns	
Access time from $\overline{CAS}$ precharge	tCPA		30		35		40		45	ns	3
Fast Page mode cycle time	tPC	35		40		45		50		ns	
$\overline{CAS}$ precharge time (Fast page)	tCP	10		10		10		10		ns	
$\overline{RAS}$ pulse width (Fast page)	tRASP	50	200K	60	200K	70	200K	80	200K	ns	
$\overline{W}$ to $\overline{RAS}$ precharge time(C-B-R refresh)	tWRP	10		10		10		10		ns	
$\overline{W}$ to $\overline{RAS}$ hold time(C-B-R refresh)	tWRH	10		10		10		10		ns	
$\overline{CAS}$ precharge(C-B-R counter test)	tCPT	20		20		30		30		ns	

STANDARD OPERATION	Symbol	-5		-6		-7		-8		Unit	Notes
		Min	Max	Min	Max	Min	Max	Min	Max		
$\overline{OE}$ Access time	tOEA		13		15		20		20	ns	
$\overline{OE}$ to data delay	tOED	15		15		20		20		ns	
Output buffer turn off delay time from $\overline{OE}$	tOEZ	0	15	0	15	0	20	0	20	ns	
$\overline{OE}$ command hold time	tOEH	13		15		20		20		ns	
$\overline{RAS}$ hold time referenced to $\overline{OE}$	tROH	13		15		20		20		ns	

NOTES

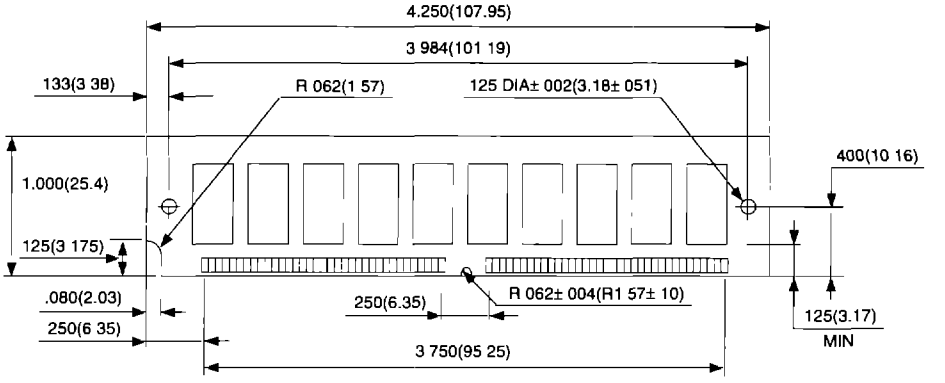
1. An initial pause of 200μs is required after power-up followed by any 8 $\overline{RAS}$-only or $\overline{CAS}$-before-$\overline{RAS}$ refresh cycles before proper device operation is achieved.
2. VIH (min) and VIL (max) are reference levels for measuring timing of input signals. Transition times are measured between VIH(min) and VIL(max) and are assumed to be 5ns for all inputs
3. Measured with a load equivalent to 2 TTL loads and 100pF.
4. Operation within the tRCD(max) limit insures that tRAC(max) can be met. tRCD(max) is specified as a reference point only. If tRCD is greater than the specified tRCD(max) limit, then access time is controlled exclusively by tCAC
5. Assumes that tRCD ≥ tRCD(max).
6. tAR, tWCR, tDHR are referenced to tRAD(MAX)
7. This parameter defines the time at which the output achieves the open circuit condition and is not referenc -ed to VOH or VOL.
8. tWCS is non restrictive operating parameter It included in the data sheet as electrical characteristic only If tWCS≥tWCS(min) the cycle is an early write cycle and the data out pin will remain high impedance for the duration of the cycle.
9. Either tRCH or tRRH must be satisfied for a read cycle
10. These parameters are referenced to the $\overline{CAS}$ leading edge in early write cycles
11. Operation within the tRAD(max) limit insures that tRAC (max) can be met. tRAD(max) is specified as reference point only. If tRAD is greater than the specified tRAD (max) limit, then access time is controlled by tAA.

TIMING DIAGRAM

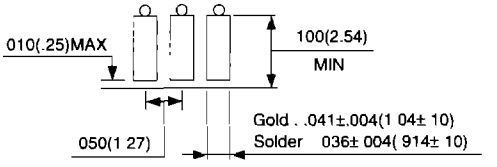
Please refer to attached timing chart (II) !

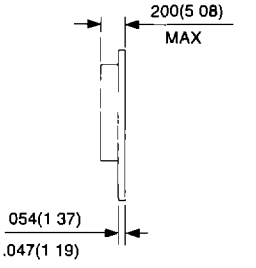
PACKAGE DIMENSIONS

Units : Inches (millimeters)



Gold & Solder Plating Lead





Tolerances . ±.005(.13) unless otherwise specified

NOTE The used device is 4Mx4 DRAM , SOJ
DRAM Part No : KM44C4000AK (300 mil)

Revision History
Rev 0 0 22 Dec '93