

- Organization . . . 4 194 304 × 36
- Single 5-V Power Supply ($\pm 10\%$ Tolerance)
- 72-Pin Single-In-Line Memory Module (SIMM) for Use With Sockets
- Uses Eight 16M-bit Dynamic RAMs (DRAMs) in Plastic Small-Outline J-Lead (SOJ) Packages and Four 4M-bit DRAMs in Plastic SOJ Packages
- Long Refresh Period . . . 32 ms (2 048 Cycles)[†]
- All Inputs, Outputs, and Clocks are Fully TTL Compatible
- Common $\overline{\text{CAS}}$ Control for Nine Common Data-In and Data-Out Lines in Four Blocks
- Separate $\overline{\text{RAS}}$ Control for Eighteen Data-In and Data-Out Lines in Two Blocks

- 3-State Output
- Performance Ranges:

	ACCESS TIME t_{RAC} (MAX)	ACCESS TIME t_{CAC} (MAX)	ACCESS TIME t_{AA} (MAX)	READ OR WRITE CYCLE (MIN)
'497MBK36H/I-60	60 ns	15 ns	30 ns	110 ns
'497MBK36H/I-70	70 ns	18 ns	35 ns	130 ns
'497MBK36H/I-80	80 ns	20 ns	40 ns	150 ns

- Low Power Dissipation
- Operating Free-Air Temperature Range . . . 0°C to 70°C
- Presence Detect
- Gold-Tabbed Version Available TM497MBK36H
- Tin-Lead (Solder) Tabbed Version Available: TM497MBK36I

description

The TM497MBK36H/I is a 144M-bit dynamic random-access memory (DRAM) device organized as four times 4 194 304 × 9 (bit 9 generally is used for parity) in a 72-pin leadless single-in-line memory module (SIMM). The SIMM is composed of eight TMS417400ADJ, 4 194 304 × 4-bit DRAMs in 24/26-lead plastic SOJ packages, and four TMS44100DJ, 4 194 304 × 1-bit DRAMs in 20/26-lead plastic SOJ packages mounted on a substrate with decoupling capacitors. TMS417400ADJ and TMS44100DJ are described in the TMS417400A and TMS44100 data sheets (literature numbers SMKS889 and SMHS561, respectively).

The TM497MBK36H/I is available in a double-sided, BK, leadless module for use with sockets. The TM497MBK36H/I features $\overline{\text{RAS}}$ access times of 60, 70, and 80 ns. This device is characterized for operation from 0°C to 70°C.

operation

The TM497MBK36H/I operates as eight TMS417400ADJs and four TMS44100DJs connected as shown in the functional block diagram and Table 1. See the TMS417400A and TMS44100 data sheets for details of operation. The common I/O feature dictates the use of early write cycles to prevent contention on D and Q.

Table 1. Connection Table

DATA BLOCK	$\overline{\text{RASx}}$	$\overline{\text{CASx}}$
DQ0–DQ8	$\overline{\text{RAS0}}$	$\overline{\text{CAS0}}$
DQ9–DQ17	$\overline{\text{RAS0}}$	$\overline{\text{CAS1}}$
DQ18–DQ26	$\overline{\text{RAS2}}$	$\overline{\text{CAS2}}$
DQ27–DQ35	$\overline{\text{RAS2}}$	$\overline{\text{CAS3}}$



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[†] A0–A9 address lines must be refreshed every 16 ms.

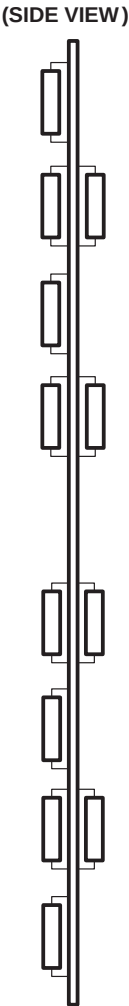
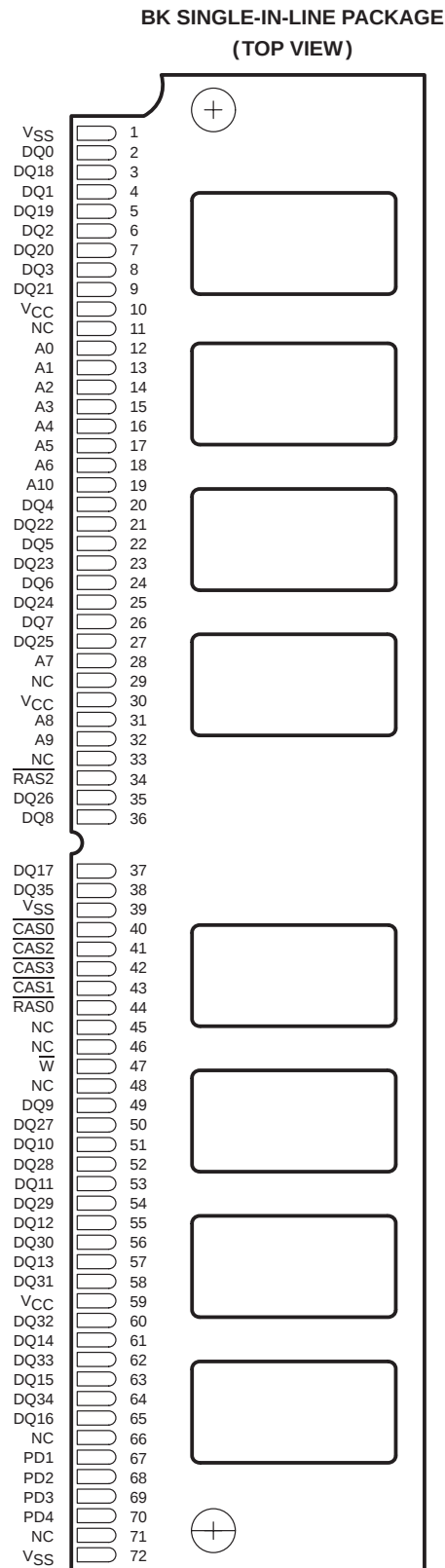
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TM497MBK36H, TM497MBK36I
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DYNAMIC RAM MODULES
SMMS676 – MARCH 1997



PIN NOMENCLATURE	
A0 – A10	Address Inputs
CAS0 – CAS3	Column-Address Strobe
DQ0 – DQ7, DQ9 – DQ16, DQ18 – DQ25, DQ27 – DQ34	Data Input/Output
DQ8, DQ17, DQ26, DQ35	Parity
NC	No Connection
PD1 – PD4	Presence Detect
RAS0, RAS2	Row-Address Strobe
VCC	5-V Supply
VSS	Ground
W	Write Enable

PRESENCE DETECT					
SIGNAL (PIN)		PD1 (67)	PD2 (68)	PD3 (69)	PD4 (70)
TM497MBK36H/I	80 ns	VSS	NC	NC	VSS
	70 ns	VSS	NC	VSS	NC
	60 ns	VSS	NC	NC	NC

refresh

The refresh period is extended to 32 ms and, during this period, each of the 2 048 rows must be strobed with $\overline{\text{RAS}}$ to retain data. Address line A10 must be used as the most significant refresh-address line (lowest frequency) to ensure correct refresh for both TMS417400A and TMS44100. A0–A9 address lines must be refreshed every 16 ms as required by the TMS44100 DRAM. $\overline{\text{CAS}}$ can remain high during the refresh sequence to conserve power.

power up

To achieve proper operation, an initial pause of 200 μs followed by a minimum of eight initialization cycles is required after full V_{CC} level is achieved. These eight initialization cycles need to include at least one refresh (RAS-only or CAS-before-RAS [CBR]) cycle.

single-in-line memory module and components

PC substrate: $1,27 \pm 0,1$ mm (0.05 inch) nominal thickness; 0.005 inch/inch maximum warpage

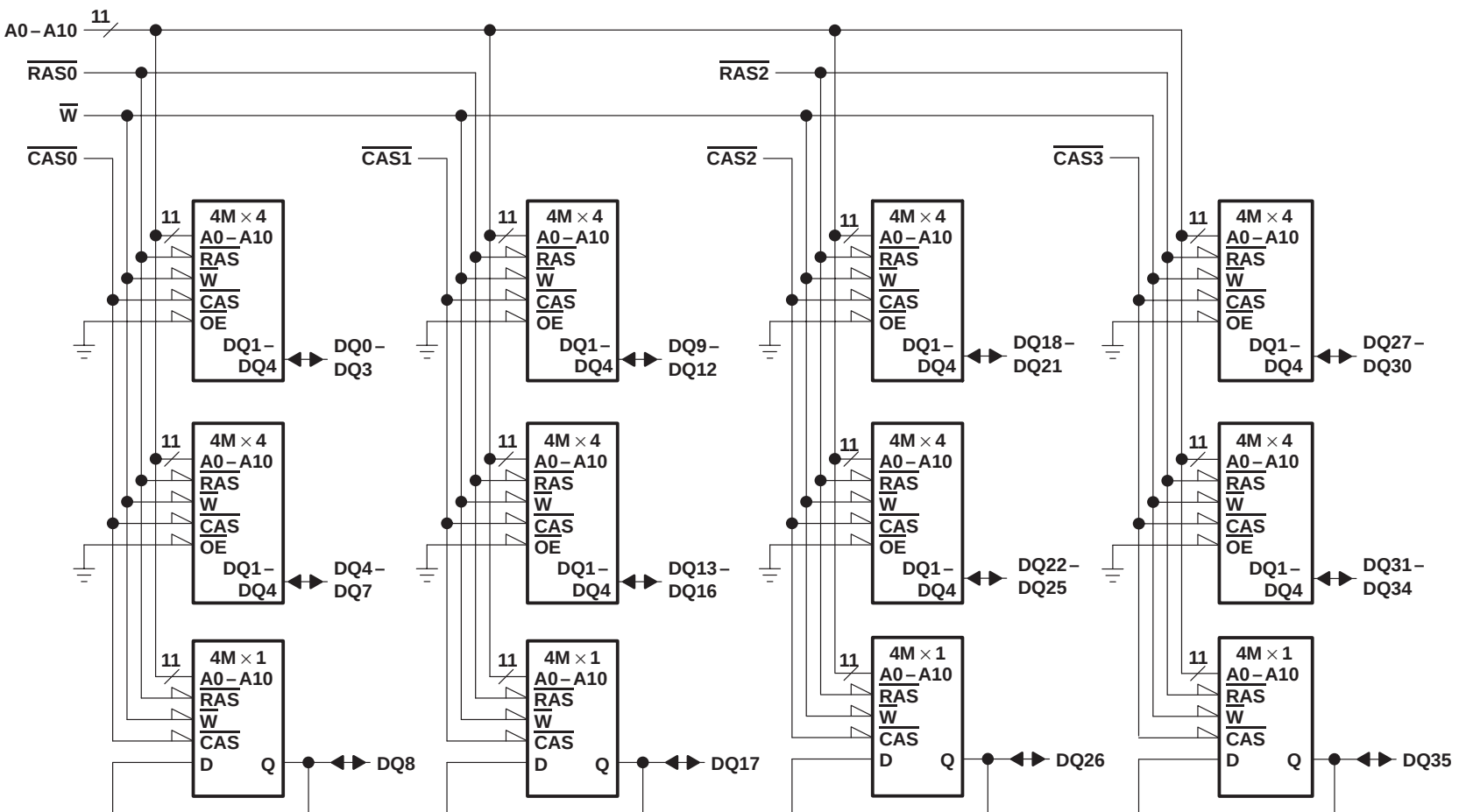
Bypass capacitors: Multilayer ceramic

Contact area for TM497MBK36H: Nickel plate and gold plate over copper

Contact area for TM497MBK36I: Nickel plate and tin-lead over copper

TM497MBK36H, TM497MBK36I
4194304 BY 36-BIT
DYNAMIC RAM MODULES
 SMMS676 - MARCH 1997

functional block diagram



absolute maximum ratings over operating free-air temperature range (unless otherwise noted)[†]

Supply voltage range, V_{CC} (see Note 1)	– 1 V to 7 V
Input voltage range (see Note 1)	– 1 V to 7 V
Short-circuit output current	50 mA
Power dissipation	12 W
Operating free-air temperature range, T_A	0°C to 70°C
Storage temperature range	– 55°C to 125°C

[†] Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

NOTE 1: All voltage values are with respect to V_{SS} .

recommended operating conditions

	MIN	NOM	MAX	UNIT
V_{CC} Supply voltage	4.5	5	5.5	V
V_{IH} High-level input voltage	2.4		6.5	V
V_{IL} Low-level input voltage (see Note 2)	– 1		0.8	V
T_A Operating free-air temperature	0		70	°C

NOTE 2: The algebraic convention, where the more negative (less positive) limit is designated as minimum, is used in this data sheet for logic voltage levels only.

electrical characteristics over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted)

PARAMETER	TEST CONDITIONS	'497MBK36H/I-60		'497MBK36H/I-70		'497MBK36H/I-80		UNIT
		MIN	MAX	MIN	MAX	MIN	MAX	
V_{OH} High-level output voltage	$I_{OH} = -5$ mA	2.4		2.4		2.4		V
V_{OL} Low-level output voltage	$I_{OL} = 4.2$ mA		0.4		0.4		0.4	V
I_I Input current (leakage)	$V_{CC} = 5.5$ V, $V_I = 0$ V to 6.5 V, All other pins = 0 V to V_{CC}		± 120		± 120		± 120	µA
I_O Output current (leakage)	$V_{CC} = 5.5$ V, $V_O = 0$ V to V_{CC} , CAS high		± 10		± 10		± 10	µA
I_{CC1} Read- or write-cycle current (see Note 3)	$V_{CC} = 5.5$ V, Minimum cycle		1300		1160		1040	mA
I_{CC2} Standby current	$V_{IH} = 2.4$ V (TTL), After one memory cycle, RAS and CAS high		24		24		24	mA
	$V_{IH} = V_{CC} - 0.2$ V (CMOS), After one memory cycle, RAS and CAS high		12		12		12	mA
I_{CC3} Average refresh current (RAS-only or CBR) (see Note 3)	$V_{CC} = 5.5$ V, Minimum cycle, RAS cycling, CAS high (RAS-only); CAS before RAS (CBR)		1300		1160		1040	mA
I_{CC4} Average page current (see Note 4)	$V_{CC} = 5.5$ V, $t_{PC} = \text{MIN}$ RAS low, CAS cycling		920		800		680	mA

NOTES: 3. I_{CC3} is measured with a maximum of one address change while $\overline{\text{RAS}} = V_{IL}$.

4. I_{CC4} is measured with a maximum of one address change while $\text{CAS} = V_{IH}$.

TM497MBK36H, TM497MBK36I
4194304 BY 36-BIT
DYNAMIC RAM MODULES

SMMS676 – MARCH 1997

capacitance over recommended ranges of supply voltage and operating free-air temperature, $f = 1$ MHz (see Note 5)

PARAMETER		MIN	MAX	UNIT
$C_{i(A)}$	Input capacitance, address inputs		60	pF
$C_{i(C)}$	Input capacitance, $\overline{CAS}$ inputs		21	pF
$C_{i(R)}$	Input capacitance, $\overline{RAS}$ inputs		42	pF
$C_{i(W)}$	Input capacitance, write-enable input		84	pF
C_o	Output capacitance	DQ pins	7	pF
		Parity pins	12	

NOTE 5: $V_{CC} = 5\text{ V} \pm 0.5\text{ V}$, and the bias on pins under test is 0 V.

switching characteristics over recommended ranges of supply voltage and operating free-air temperature

PARAMETER	'497MBK36H/I-60		'497MBK36H/I-70		'497MBK36H/I-80		UNIT
	MIN	MAX	MIN	MAX	MIN	MAX	
t_{AA}	Access time from column address		30	35	40		ns
t_{CAC}	Access time from $\overline{CAS}$ low		15	18	20		ns
t_{CPA}	Access time from column precharge		35	40	45		ns
t_{RAC}	Access time from $\overline{RAS}$ low		60	70	80		ns
t_{CLZ}	$\overline{CAS}$ to output in low-impedance state		0	0	0		ns
t_{OH}	Output disable time, start of $\overline{CAS}$ high		3	3	3		ns
t_{OFF}	Output disable time after $\overline{CAS}$ high (see Note 6)		0	15	0	20	ns

NOTE 6: t_{OFF} is specified when the output is no longer driven.

timing requirements over recommended ranges of supply voltage and operating free-air temperature

	'497MBK36H/I-60		'497MBK36H/I-70		'497MBK36H/I-80		UNIT
	MIN	MAX	MIN	MAX	MIN	MAX	
t_{RC}	Cycle time, random read or write (see Note 7)		110	130	150		ns
t_{PC}	Cycle time, page-mode read or write (see Notes 7 and 8)		40	45	50		ns
t_{RASP}	Pulse duration, page-mode, $\overline{RAS}$ low		60	100 000	80	100 000	ns
t_{RAS}	Pulse duration, nonpage-mode, $\overline{RAS}$ low		60	10 000	80	10 000	ns
t_{CAS}	Pulse duration, $\overline{CAS}$ low		15	10 000	20	10 000	ns
t_{CP}	Pulse duration, $\overline{CAS}$ high		10	10	10		ns
t_{RP}	Pulse duration, $\overline{RAS}$ high (precharge)		40	50	60		ns
t_{WP}	Pulse duration, $\overline{W}$ low		10	10	10		ns
t_{ASC}	Setup time, column address before $\overline{CAS}$ low		0	0	0		ns
t_{ASR}	Setup time, row address before $\overline{RAS}$ low		0	0	0		ns
t_{DS}	Setup time, data before $\overline{CAS}$ low		0	0	0		ns
t_{RCS}	Setup time, $\overline{W}$ high before $\overline{CAS}$ low		0	0	0		ns
t_{CWL}	Setup time, $\overline{W}$ low before $\overline{CAS}$ high		15	18	20		ns
t_{RWL}	Setup time, $\overline{W}$ low before $\overline{RAS}$ high		15	18	20		ns
t_{WCS}	Setup time, $\overline{W}$ low before $\overline{CAS}$ low		0	0	0		ns
t_{WRP}	Setup time, $\overline{W}$ high before $\overline{RAS}$ low (CBR refresh only)		10	10	10		ns

NOTES: 7. All cycles assume $t_T = 5$ ns.

8. To assure t_{PC} min, t_{ASC} should be $\geq t_{CP}$.



timing requirements over recommended ranges of supply voltage and operating free-air temperature (continued)

		'497MBK36H/I-60		'497MBK36H/I-70		'497MBK36H/I-80		UNIT
		MIN	MAX	MIN	MAX	MIN	MAX	
t _{CAH}	Hold time, column address after $\overline{\text{CAS}}$ low	10		15		15		ns
t _{RHCP}	Hold time, $\overline{\text{RAS}}$ high from $\overline{\text{CAS}}$ precharge	35		40		45		ns
t _{DH}	Hold time, data after $\overline{\text{CAS}}$ low	10		15		15		ns
t _{RAH}	Hold time, row address after $\overline{\text{RAS}}$ low	10		10		10		ns
t _{RCH}	Hold time, $\overline{\text{W}}$ high after $\overline{\text{CAS}}$ high (see Note 9)	0		0		0		ns
t _{RRH}	Hold time, $\overline{\text{W}}$ high after $\overline{\text{RAS}}$ high (see Note 9)	0		0		0		ns
t _{WCH}	Hold time, $\overline{\text{W}}$ low after $\overline{\text{CAS}}$ low	10		15		15		ns
t _{WRH}	Hold time, $\overline{\text{W}}$ high after $\overline{\text{RAS}}$ low (CBR refresh only)	10		10		10		ns
t _{CHR}	Delay time, $\overline{\text{RAS}}$ low to $\overline{\text{CAS}}$ high (CBR refresh only)	10		10		10		ns
t _{CRP}	Delay time, $\overline{\text{CAS}}$ high to $\overline{\text{RAS}}$ low	5		5		5		ns
t _{CSH}	Delay time, $\overline{\text{RAS}}$ low to $\overline{\text{CAS}}$ high	60		70		80		ns
t _{CSR}	Delay time, $\overline{\text{CAS}}$ low to $\overline{\text{RAS}}$ low (CBR refresh only)	5		5		5		ns
t _{RAD}	Delay time, $\overline{\text{RAS}}$ low to column address (see Note 10)	15	30	15	35	15	40	ns
t _{RAL}	Delay time, column address to $\overline{\text{RAS}}$ high	30		35		40		ns
t _{CAL}	Delay time, column address to $\overline{\text{CAS}}$ high	30		35		40		ns
t _{RCD}	Delay time, $\overline{\text{RAS}}$ low to $\overline{\text{CAS}}$ low (see Note 10)	20	45	20	52	20	60	ns
t _{RPC}	Delay time, $\overline{\text{RAS}}$ high to $\overline{\text{CAS}}$ low	5		5		5		ns
t _{RSH}	Delay time, $\overline{\text{CAS}}$ low to $\overline{\text{RAS}}$ high	15		18		20		ns
t _{REF}	Refresh time interval		32		32		32	ms
t _T	Transition time	2	30	2	30	2	30	ns

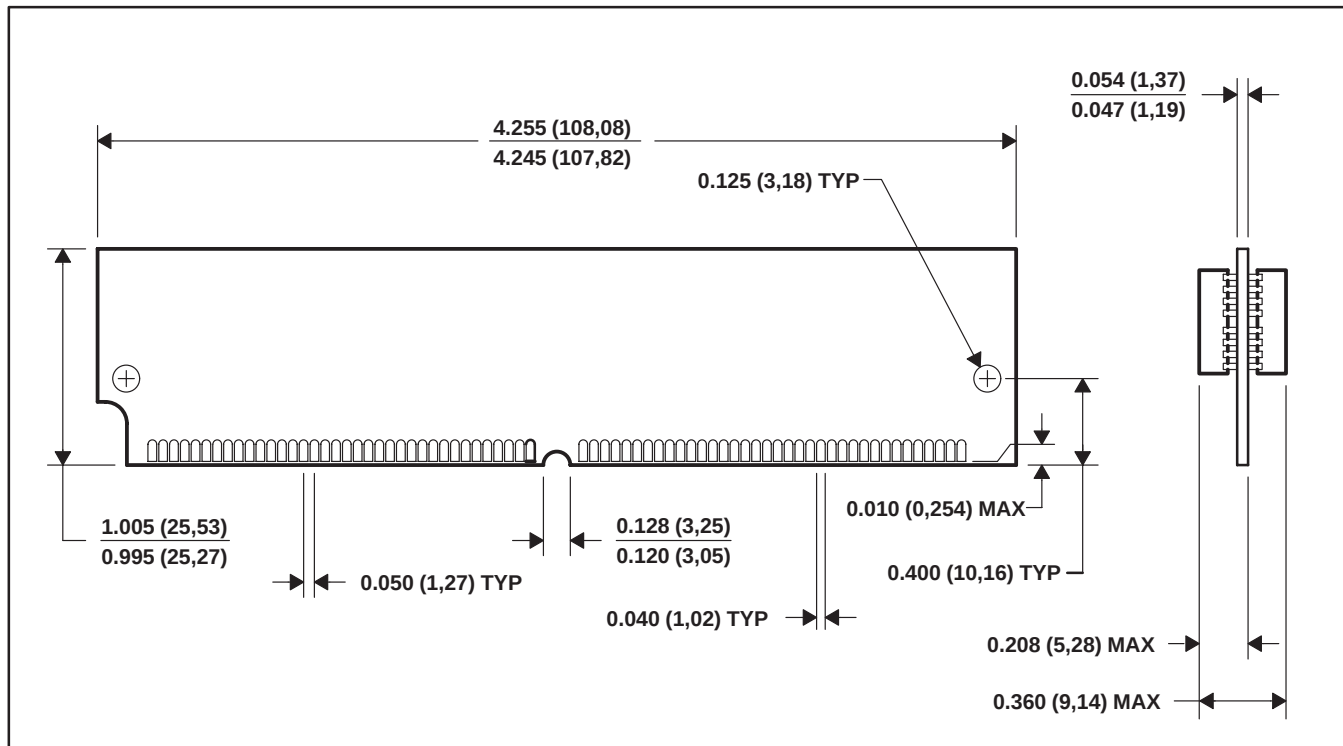
NOTES: 9. Either t_{RRH} or t_{RCH} must be satisfied for a read cycle.
10. The maximum value is specified only to ensure access time.

SMMS676 – MARCH 1997

MECHANICAL DATA

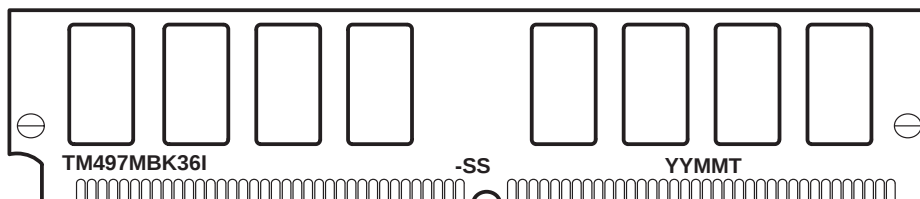
BK-72 PIN SINGLE-IN-LINE MEMORY MODULE

R-PSIP-N72



NOTE A: All linear dimensions are in inches (millimeters).

device symbolization



YY = Year Code
MM = Month Code
T = Assembly Site Code
-SS = Speed Code

NOTE A: Location of symbolization may vary.

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