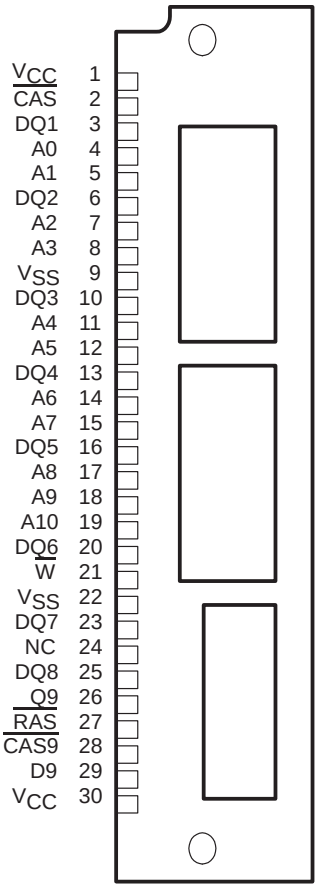
- **Organization . . . 4194304 × 9**
- **Single 5-V Power Supply (±10% Tolerance)**
- **30-Pin Single-In-Line Memory Module (SIMM) for Use With Sockets**
- **Utilizes One 4-Megabit and Two 16-Megabit Dynamic RAMs in Plastic Small-Outline J-Lead (SOJ) Packages**
- **Long Refresh Period 32 ms† (2048 Cycles)**
- **All Inputs, Outputs, and Clocks Fully TTL Compatible**
- **3-State Outputs**
- **Performance Ranges:**

	ACCESS TIME (t_{RAC}) (MAX)	ACCESS TIME $t_{(AA)}$ (MAX)	ACCESS TIME (t_{CAC}) (MAX)	READ OR WRITE CYCLE (MIN)
'497EU9-60	60 ns	30 ns	15 ns	110 ns
'497EU9-70	70 ns	35 ns	18 ns	130 ns
'497EU9-80	80 ns	40 ns	20 ns	150 ns

- **Common $\overline{CAS}$ Control for Eight Common Data-In and Data-Out Lines**
- **Separate $\overline{CAS}$ Control for One Separate Pair of Data-In and Data-Out Lines**
- **Low Power Dissipation**
- **Operating Free-Air Temperature Range 0°C to 70°C**
- **Enhanced Page Mode Operation With $\overline{CAS}$-Before-$\overline{RAS}$ (CBR), $\overline{RAS}$-Only, and Hidden Refresh**

U SINGLE-IN-LINE PACKAGE
(TOP VIEW)



description

The TM497EU9 is a 4M-byte dynamic random-access memory (RAM) organized as 4194304 × 9 bits [bit nine (D9, Q9) is generally used for parity and is controlled by $\overline{CAS9}$] in a 30-pin leadless single-in-line memory module (SIMM). The SIMM is composed of two TMS417400DJ, 4194304 × 4-bit dynamic RAMs, each in a 24/26-lead plastic small-outline J-lead (SOJ) package, and one TMS44100DJ, 4194304 × 1-bit dynamic RAM in a 20/26-lead plastic SOJ package, mounted on a substrate with decoupling capacitors.

PIN NOMENCLATURE

A0–A10	Address Inputs
$\overline{CAS}$, $\overline{CAS9}$	Column-Address Strobe
DQ1–DQ8	Data In/Data Out
D9	Data In
NC	No Connection
Q9	Data Out
$\overline{RAS}$	Row-Address Strobe
V_{CC}	5-V Supply
V_{SS}	Ground
$\overline{W}$	Write Enable

The TM497EU9 is available in the U single-sided, leadless module for use with sockets and is characterized for operation from 0°C to 70°C.

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

operation

The TM497EU9 operates as two TMS417400DJs and one TMS44100DJ connected as shown in the functional block diagram (refer to the TMS417400 and TMS44100 data sheets for details of their operation). The common I/O feature of the TM497EU9 dictates the use of early write cycles to prevent contention on D and Q.

refresh

The refresh period is extended to 32 ms and, during this period, each of the 2048 rows must be strobed with $\overline{RAS}$ in order to retain data. $\overline{CAS}$ can remain high during the refresh sequence to conserve power. In addition, the ten least significant row addresses (A0–A9) must be refreshed every 16 ms as required by the TMS44100.

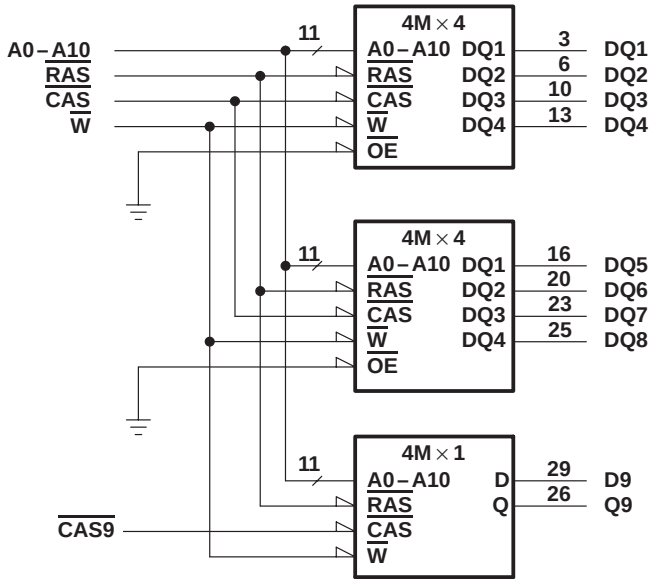
power up

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 ($\overline{RAS}$-only or CBR) cycle.

single-in-line memory module and components

PC substrate: 1,27 mm (0.05 inch) nominal thickness; 0.005 inch/inch maximum warpage
Bypass capacitors: Multilayer ceramic
Contact area for socketable devices: Nickel plate and solder plate over copper

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
Voltage range on any pin (see Note 1) . . . . . – 1 V to 7 V
Short-circuit output current . . . . . 50 mA
Power dissipation . . . . . 3 W
Operating free-air temperature range, T_A . . . . . 0°C to 70°C
Storage temperature range, T_{stg} . . . . . – 55°C to 150°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 for logic-voltage levels only.

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

PARAMETER		TEST CONDITIONS	'497EU9-60		'497EU9-70		'497EU9-80		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 V, V_I = 0 V to 6.5 V, All other pins = 0 V to V_{CC}		±10		±10		±10	µA
I_O	Output current (leakage)	V_{CC} = 5.5 V, V_O = 0 V to V_{CC}, $\overline{CAS}$ high		±10		±10		±10	µA
I_{CC1}	Read- or write-cycle current (see Note 3)	V_{CC} = 5.5 V, Minimum cycle		325		290		260	mA
I_{CC2}	Standby current	V_{IH} = 2.4 V (TTL), After 1 memory cycle, $\overline{RAS}$ and $\overline{CAS}$ high		6		6		6	mA
		V_{IH} = V_{CC} – 0.2 V (CMOS), After 1 memory cycle, $\overline{RAS}$ and $\overline{CAS}$ high		3		3		3	
I_{CC3}	Average refresh current ($\overline{RAS}$-only or CBR) (see Note 3)	V_{CC} = 5.5 V, Minimum cycle, $\overline{RAS}$ cycling, $\overline{CAS}$ high ($\overline{RAS}$-only); $\overline{RAS}$ low after $\overline{CAS}$ low (CBR)		325		290		260	mA
I_{CC4}	Average page current (see Note 4)	V_{CC} = 5.5 V, t_{PC} = MIN, $\overline{RAS}$ low, $\overline{CAS}$ cycling		210		180		150	mA

NOTES: 3. Measured with a maximum of one address change while $\overline{RAS}$ = V_{IL}
4. Measured with a maximum of one address change while $\overline{CAS}$ = V_{IH}

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, A0 – A10			15	pF
$C_{i(D)}$	Input capacitance, data input (D9)			5	pF
$C_{i(R)}$	Input capacitance, strobe input ($\overline{RAS}$)			21	pF
$C_{i(C)}$	Input capacitance, strobe inputs	$\overline{CAS}$		14	pF
		$\overline{CAS9}$		7	
$C_{i(W)}$	Input capacitance, $\overline{W}$			21	pF
$C_{o(DQ)}$	Output capacitance (DQ1 – DQ8)			7	pF
$C_{o(Q)}$	Output capacitance (Q9)			7	pF

NOTE 5: V_{CC} = 5 V ± 0.5 V, and the bias on pin under test is 0 V.

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

PARAMETER		’497EU9-60		’497EU9-70		’497EU9-80		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	18	0	20	ns

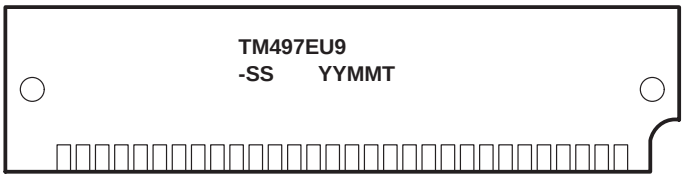
NOTE 6: t_{OFF} is specified when the output is no longer driven.

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

PARAMETER		’497EU9-60		’497EU9-70		’497EU9-80		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	70	100 000	80	100 000	ns
t_{RAS}	Pulse duration, nonpage mode, $\overline{RAS}$ low	60	10 000	70	10 000	80	10 000	ns
t_{CAS}	Pulse duration, $\overline{CAS}$ low	15	10 000	18	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
t_{CAH}	Hold time, column address after $\overline{CAS}$ low	10		15		15		ns
t_{DH}	Hold time, data after $\overline{CAS}$ low	10		15		15		ns
t_{RAH}	Hold time, row address after $\overline{RAS}$ low	10		10		10		ns
t_{RCH}	Hold time, $\overline{W}$ high after $\overline{CAS}$ high (see Note 9)	0		0		0		ns
t_{RRH}	Hold time, $\overline{W}$ high after $\overline{RAS}$ high (see Note 9)	0		0		0		ns
t_{WCH}	Hold time, $\overline{W}$ low after $\overline{CAS}$ low	10		15		15		ns
t_{WRH}	Hold time, $\overline{W}$ high after $\overline{RAS}$ low (CBR refresh only)	10		10		10		ns
t_{RHCP}	Hold time, $\overline{RAS}$ high from $\overline{CAS}$ precharge	35		40		45		ns
t_{CHR}	Delay time, $\overline{RAS}$ low to $\overline{CAS}$ high (CBR refresh only)	10		10		10		ns
t_{CRP}	Delay time, $\overline{CAS}$ high to $\overline{RAS}$ low	5		5		5		ns
t_{CSH}	Delay time, $\overline{RAS}$ low to $\overline{CAS}$ high	60		70		80		ns
t_{CSR}	Delay time, $\overline{CAS}$ low to $\overline{RAS}$ low (CBR refresh only)	5		5		5		ns
t_{RAD}	Delay time, $\overline{RAS}$ low to column address (see Note 10)	15	30	15	35	15	40	ns
t_{RAL}	Delay time, column address to $\overline{RAS}$ high	30		35		40		ns
t_{CAL}	Delay time, column address to $\overline{CAS}$ high	30		35		40		ns
t_{RCD}	Delay time, $\overline{RAS}$ low to $\overline{CAS}$ low (see Note 10)	20	45	20	52	20	60	ns
t_{RPC}	Delay time, $\overline{RAS}$ high to $\overline{CAS}$ low	0		0		0		ns
t_{RSH}	Delay time, $\overline{CAS}$ low to $\overline{RAS}$ high	15		18		20		ns
t_{REF}	Refresh time interval		32		32		32	ms
t_T	Transition time	3	30	3	30	3	30	ns

NOTES: 7. All cycle times assume t_T = 5 ns.
8. To assure t_{PC} min, t_{ASC} should be ≥ t_{CP}.
9. Either t_{RRH} or t_{RCH} must be satisfied for a read cycle.
10. The maximum value is specified only to assure access time.

device symbolization



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

NOTE: The location of the part number may vary.

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