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The Netherlands

B.E.M.-1 [2 x 1024 x 8 bit]

LOW COST STATIC RAM CARD

GENERAL DESCRIPTION

The B.E.M.-1 2x1024x8 bit static RAM card is a general purpose memory-expansion card with access/cycle time of 500 nsec. in standard version. For 250 nsec. access/cycle time, order B.E.M.-1A.

Because of its bi-directional data bus-structure the B.E.M.-1 card will be extremely useful in microprocessor applications.

As the block-diagram shows the memory-structure consists of two arrays of 1024x8 bit each. Both arrays have a common address-bus (A0-A9) as well as a common bi-directional data bus (D0-D7).

Selection of one of the arrays is done by pulling the corresponding select line (S1-S2) down.

The user has to take care that only one S-line can be activated the same time, which implies that some kind of decoding is required.

We recommend decoders with open collector outputs (e.g. 74145).

The pull-up resistors required are mounted on the B.E.M.-1 card.

In some microprocessor systems decoding is already available for small expansion.

For instance in case of the KIM-1 micro-computer the memory capacity can be expanded with 4096x8 bit (two B.E.M.-1 cards) without the need for additional active components.

For READ/WRITE control two inputs are available. 1) The WE input connected directly to the WE inputs of all RAM IC's of both arrays and 2) the R/W input.

Pulling the WE input down initiates the WRITE operation. During a WRITE operation it is necessary to disconnect the internal D-out bus from the data bus. This is accomplished by the R/W signal going to a low level.

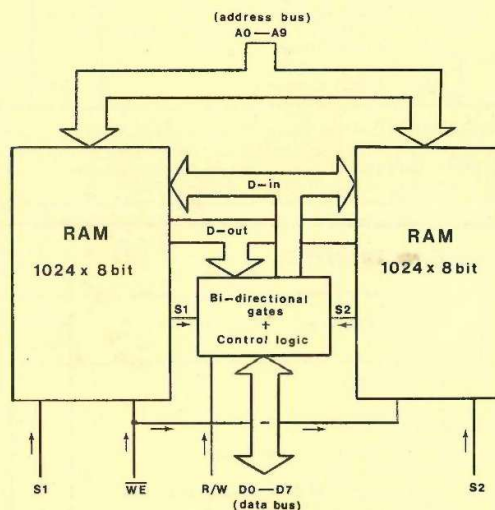
In some applications control of both inputs by the same signal is possible.

However, to get a more flexible design both functions are separated.

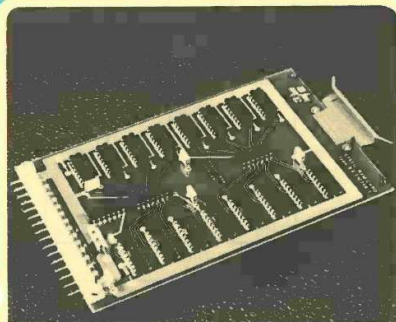
FOR MICROPROCESSOR APPLICATIONS

FEATURES

- * LOW-COST RAM EXPANSION CARD
- * FULLY STATIC
- * ALL INPUTS/OUTPUTS TTL COMPATIBLE
- * EURO CARD FORMAT (100 x 160 mm.)
- * 31-PIN INDIRECT CONNECTOR (DIN 41617)
- * BI-DIRECTIONAL 8 BIT DATA BUS
- * 500 NSEC. ACCESS/CYCLE TIME STANDARD
- * SIMPLE DECODING
- * GENEROUS OEM DISCOUNTS AVAILABLE



BLOCK DIAGRAM



INPUT-OUTPUT CONNECTIONS

Pin	Function	Pin	Function	Pin	Function
1	VSS	11	N.C.	21	A 0
2	VSS	12	N.C.	22	A 4
3	A 7	13	N.C.	23	A 3
4	A 8	14	N.C.	24	A 2
5	A 9	15	R/W	25	A 1
6	S 2	16	N.C.	26	S 1
7	D 6	17	D 1	27	WE
8	D 4	18	D 3	28	A 5
9	D 2	19	D 5	29	A 6
10	D 0	20	D 7	30	VCC
				31	VCC + 5V

ABSOLUTE MAXIMUM RATINGS

Ambient Temperature under Bias..... 0°C to 70°C
 Storage Temperature..... -55°C to $+120^{\circ}\text{C}$
 Voltage on Any Pin with Respect
 to Ground..... -0.3V to $+7\text{V}$

Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage to the BEM-1 card. This is a stress rating only and functional operation of the device at these or at any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

DC CHARACTERISTICS

($T_A = 0^{\circ}\text{C}$ to $+70^{\circ}\text{C}$, $V_{CC} = 5\text{V} \pm 5\%$ unless otherwise specified)

Symbol	Parameter	Limits			Unit	Test Conditions
		Min.	Typ.*	Max.		
I_{LIA}	Input Load Current Address Pins + WE input			160	μA	$V_{IN} = 0$ to V_{CC}
I_{LID}	Input Load Current Data bus Pins (Output not selected)			60	μA	S_1 or $S_2 = 2.4\text{V}$ $V_{DB} = 0.4\text{V}$ to V_{CC}
I_{PS}	Power Supply Current		550	1050	mA	All inputs = 5.25V Data Out not selected, $T_A = 25^{\circ}\text{C}$
I_{PS}	Power Supply Current			1250	mA	At $T_A = 0^{\circ}\text{C}$ (worst case conditions)
V_{IL}	Input "Low" Voltage	-0.5		0.8	V	
V_{IH}	Input "High" Voltage	2.0		V_{CC}	V	
V_{OL}	Output "Low" Voltage			0.4	V	$I_{OL} = 16\text{mA}$
V_{OH}	Output "High" Voltage	2.4			V	$I_{OH} = -5.2\text{mA}$

* Typical values are for $T_A = 25^{\circ}\text{C}$ and nominal supply voltage.
 The S_1 and S_2 inputs are loaded by one TTL load + one pull-up resistor of 680 Ohm each.
 Besides a maximum current of $160\text{ }\mu\text{A}$ has to be added to the load conditions.
 The R/W input is loaded by one TTL load only.

AC CHARACTERISTICS

($T_A = 0^{\circ}\text{C}$ to $+70^{\circ}\text{C}$, $V_{CC} = 5\text{V} \pm 5\%$ unless otherwise specified)

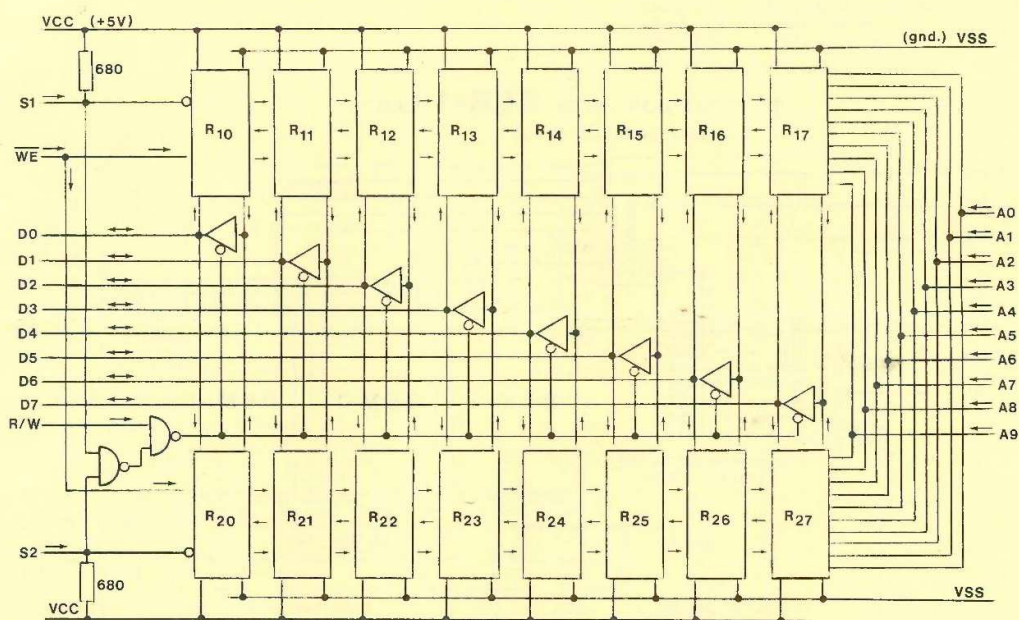
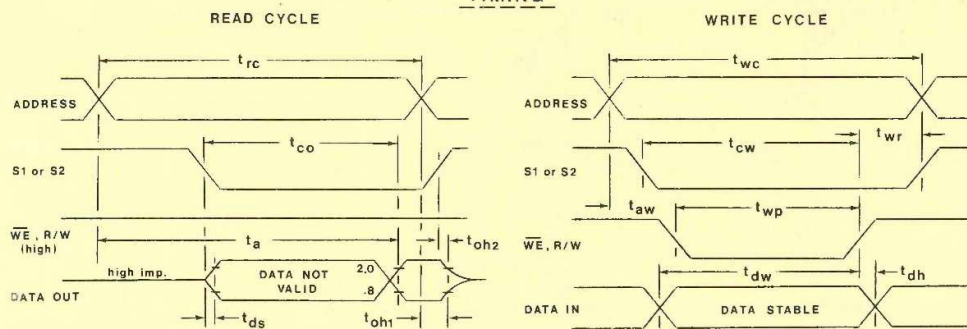
Symbol		Parameter	BEM-1			BEM-1A				Unit
			Limits			Limits				
			Min.	Typ.	Max.	Min.	Typ.*	Max.		
READ CYCLE	t _{rc}	Read Cycle	500			250			ns	
	t _a	Access Time			500			250	ns	
	t _{co}	Chip Enable to Output Time			350			130	ns	
	t _{oh1}	Previous Read Data Valid with Respect to Address	50			40			ns	
	t _{oh2}	Previous Read Data Valid with Respect to Chip Enable	0			0			ns	
	t _{ds}	Delay Time Select to Data Out			25			25	ns	
WRITE CYCLE	t _{wc}	Write Cycle	500			250			ns	
	t _{aw}	Address to Write Setup Time	150			20			ns	
	t _{wp}	Write Pulse Width	300			180			ns	
	t _{wr}	Write Recovery Time	50			0			ns	
	t _{dw}	Data Setup Time	330			180			ns	
	t _{dh}	Data Hold Time	0			0			ns	
	t _{cw}	Chip Enable to Write Setup Time	400			180			ns	

* Typical values are for $T_A = 25^{\circ}\text{C}$ and nominal supply voltage.

A.C. Conditions of test:

Input Pulse Levels: 0.8V to 2.0V Input Rise and Fall Times: 10 ns

TIMING



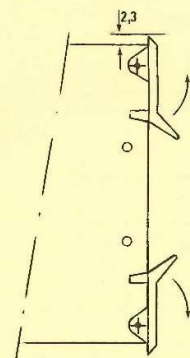
B.E.M-1 CIRCUIT DIAGRAM

COMPONENT LIST (standard version)

Name	Type	Pcs.
Tri-state Buffer	74125	2
Nand-gate	7400	1
RAM 1024 X 1 (R ₁₀ - R ₂₇)	2102-1 (or equivalent)	16
Resistor	680 Ohm.	2
Capacitor*	0.1 μ F	5
Electrolitic-capacitor*	10 μ F	1

MECHANICAL SPECIFICATIONS

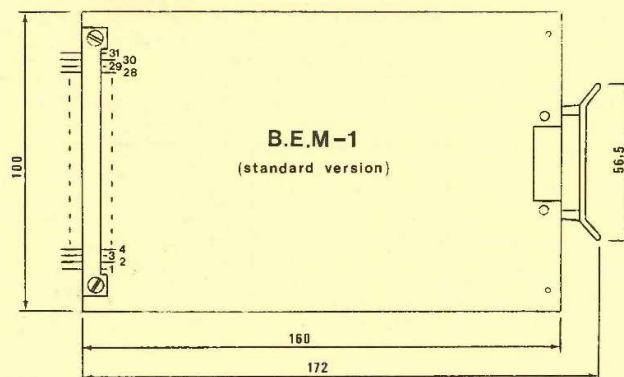
- 1) PRINTED CIRCUIT: 1.6 mm. epoxy glass fiber reinforced in EURO CARD format (100 X 160 mm.) Double sided metallized with plated through holes finally covered with an epoxy mask on both sides.
- 2) CONNECTOR: 31-pin (gold plated) indirect connector (DIN 41617)
- 3) STANDARD version with card handle. (Card ejectors are optional without additional costs, Order BEM-1E).
- 4) STANDARD version without IC sockets. (IC socket version is optional, Order BEM-1S or BEM-1ES).



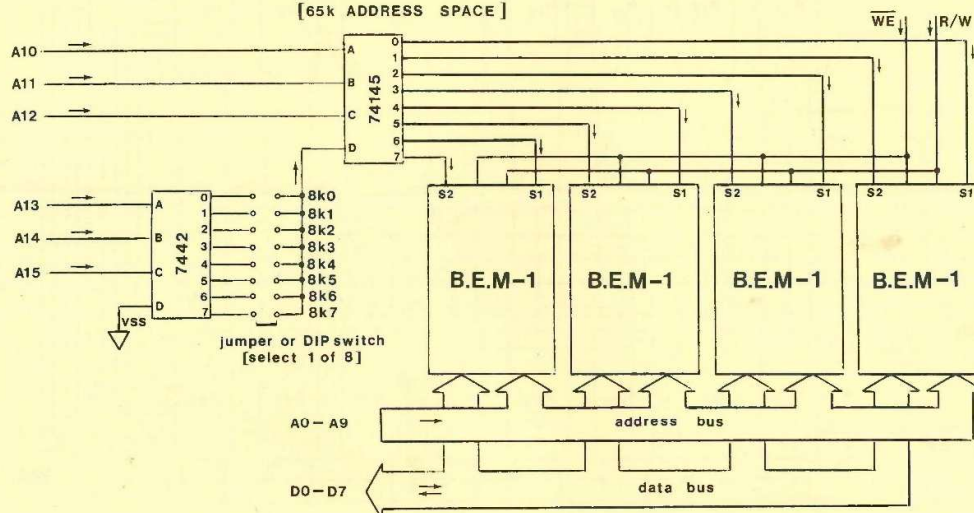
B.E.M-1E
(with card ejectors)

Maximum thickness all versions: 12.5 mm.
Solder side : - 2.0 mm.
Component side : + 8.8 mm.

MECHANICAL LAY-OUT (dimensions in mm.)



8k EXPANSION WITH B.E.M-1 CARDS [65k ADDRESS SPACE]



Expansion of more than 8K can simply be achieved by adding more 74145 decoders (with a maximum of 8) to the circuit. The A, B and C inputs have to be connected in parallel to the address lines A_{10} , A_{11} and A_{12} .

The D input can be connected to one of the unused outputs of the 7442.

The user has to take care the address lines A_{10} , A_{11} and A_{12} are not loaded to much in respect to the drive capability of these lines.

Buffers may be necessary depending on the system used.