



4 KBYTE EPROM CARD

Memory expansion for 6502 systems

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As part of further memory expansion for 6502-based systems such as the KIM, Junior, SYM, etc., a 4 Kbyte EPROM card is described here. It is suitable for two types of EPROM, the TMS2516 and the 2716, the latter being the most common. The board plugs into the motherboard published in a previous issue of Radio Bulletin. Combined with the EPROM programmer (RB December 1980 and January 1981), this gives you the tools needed to put programs such as an assembler, a high-level programming language, a bootstrap loader or your own developments into ROM and run them from there.

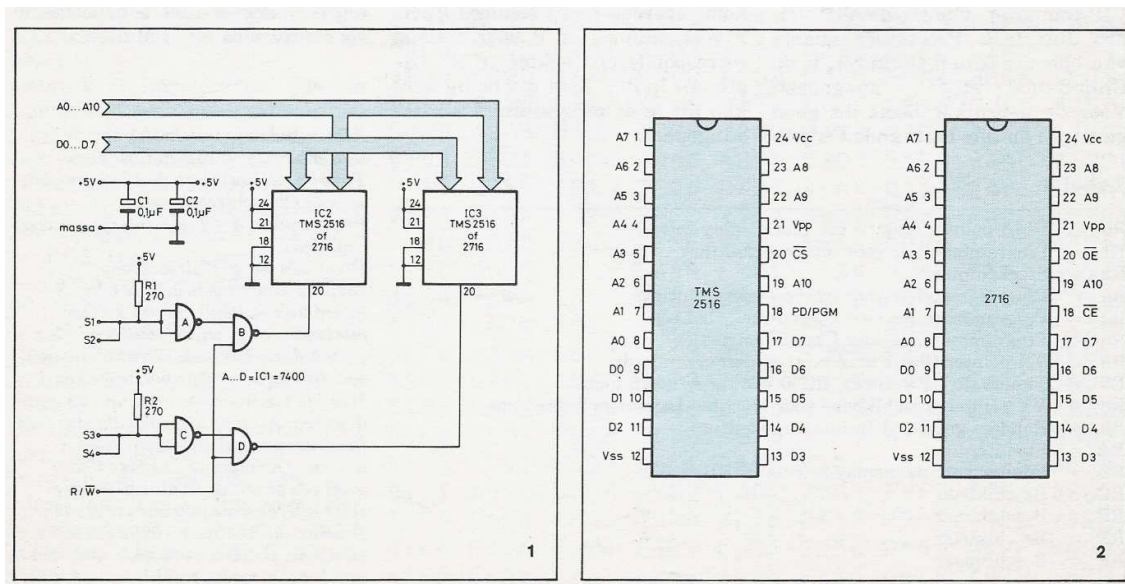


Fig. 1. Schematic of the EPROM card for 4 Kbytes of memory.

Fig. 2. Pin connections of the TMS2516 and the 2716.

Selection

One card holds two EPROMs of 2 Kbytes each, so together they cover a memory area of 1000 hex. Selection is done by means of lines S1 to S4, each of which addresses a 1 Kbyte area. Combining two lines in a "wired OR" produces 2 Kbyte select signals, suitable for one EPROM (see fig. 1). There are small differences between the 2516 and the 2716 in the way the EPROM is selected. The 2516 has a "power down" (pin 18) and a "chip select" (pin 20), see fig. 2. The 2716 has a "chip enable" (pin 18) and an "output enable" (pin 20). Their operation, however, is almost the same. When pin 18 is made low, the EPROM enters the normal, active state and can be read. When this pin is high, the EPROM is in the so-called "power down" state and its total dissipation drops by about 75 %. In this state it is not possible to read data. When pin 20 is made low, data from the EPROM is put on the data bus. On the board described here, pin 18 is tied to ground, so the EPROMs are always active. This is necessary because the standard versions of these EPROMs respond too slowly to selection via this pin. The actual selection is therefore done via pin 20. This input responds fast enough that the data bus does not run into trouble. The dissipation, however, is permanently 100 %.

Read/write

The card includes a 7400. Its purpose is to prevent an accidental write to the EPROM from having disastrous consequences. In a previous design, the 2 Kbyte EPROM card, it was possible to write to the EPROM. In doing so, the processor puts data on the bus that is to be written to the memory location concerned. However, that same address also selects the memory location in the EPROM, and the EPROM will try to put the data stored there on the bus as well. Because two drivers are then trying to use the bus at the same time, a current large enough to damage something can flow. By combining the select signal with the "read/write" line via a gate circuit, write actions no longer result in the EPROM concerned being selected.

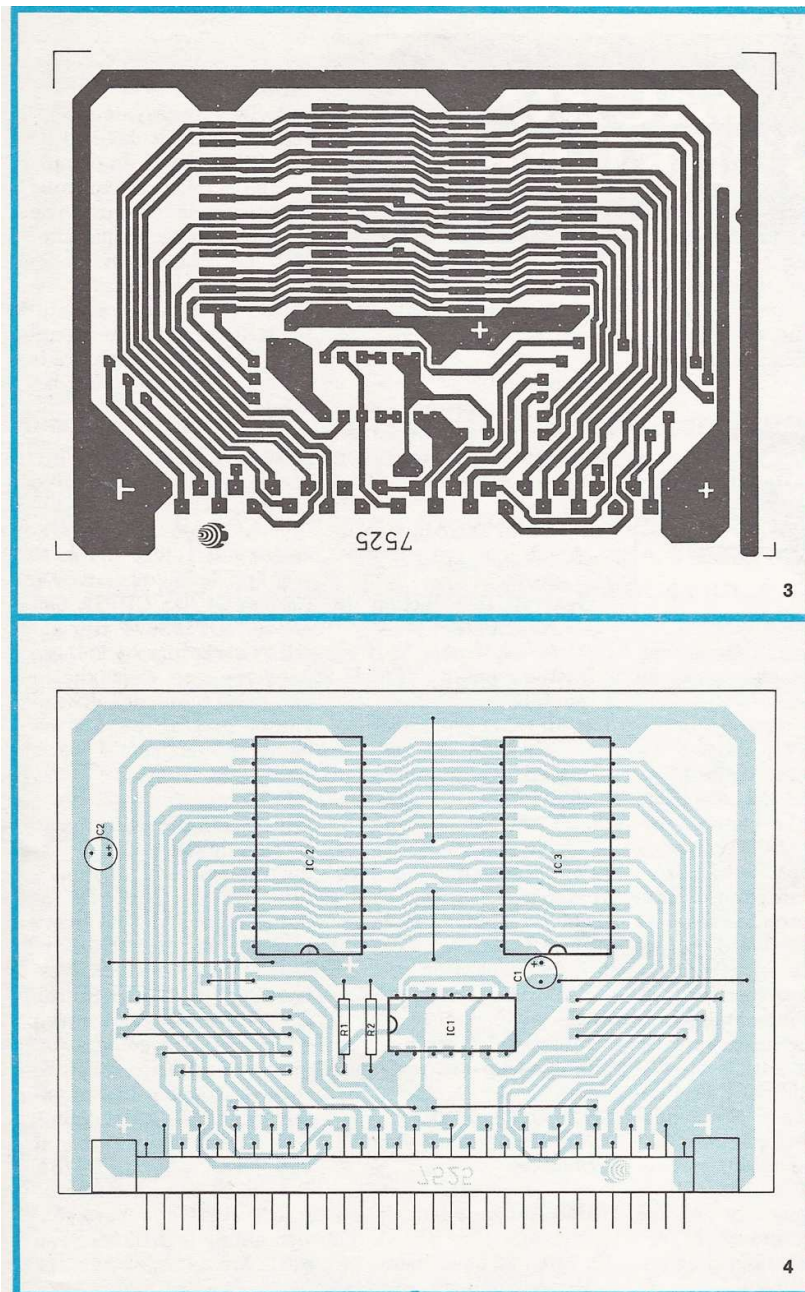


Fig. 3. PCB layout for the EPROM card.

Fig. 4. Component layout of the EPROM card.

Hardware

Memory ICs of 2 Kbytes need an extra address line, A10. On the memory motherboard this is already present on pin 11, which had not been used until now. A10 actually serves here as a 1 Kbyte select signal. Select lines S1 and S2, and likewise S3 and S4, are tied together and provided with a pull-up resistor to +5 V. This is possible because the select IC, the 74LS145, has open-collector outputs. Pin 21 (V_{pp}) of the EPROMs is connected to the positive supply voltage, which is required for read mode.

Construction

This is relatively simple. First fit the wire links, then the resistors and the tantalum capacitors. Next the IC sockets and the 31-pin DIN connector. Then insert the 7400 IC, followed by the EPROMs. The board can optionally be made taller to leave room for a handle, which makes it easier to pull the card out of the motherboard. The PCB layout and component layout are shown in figs. 3 and 4.