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An 82S23 PROM Programmer!

-- now build those projects using one!

The 82S23 is merely the Schottky version of the 8223 programmable read only memory which has become popular in home-built amateur radio equipment. A year ago the 8223 was plentiful on the surplus market. Now, however, the supply is drying up because it is no longer manufactured (at least not by Signetics Corporation). Being an experimenter, I bought the Schottky type PROMs when they were offered at the same price as the 8223. I was in trouble immediately. My programmer was the usual simple type the circuit of which has been published in several hobby magazines. Even by using a fusing potential of 15 volts and no current limiting, I could not blow the links.

A Solution

A chance acquisition of the publication, *Signetics Bipolar Memories* (current issue, no date), led to a solution to my problem. Among other things, the manual shows a circuit for programming the 82S23 and the 82S123 (3-state output). Evidently a short rise time and a controlled amount of fusing current are required to completely and permanently fuse the links in a Schottky PROM. Five 1-shots are used to automatically pulse three parameters of the PROM. A hurry-up version of the circuit was put together and it works just fine. No construction details are included in the manual, so a potential builder might benefit from my labors.

The Schottky programmer is complicated and costly when compared with the simpler programmer usually used for home programming of the 8223 (e.g., *RTTY Journal*, February, 1976, page 9). Also, the programmer will not be used often, so the average ham will look to avoid buying parts. Be sure to check all switches to be used in the address and bit positions. Old toggle switches sometimes hang up and toggle later. This could ruin a PROM. I lost one that way even though I had checked and doubled-checked the switch.

Remember that there are two configurations for double-throw toggle switches (something that even the catalogs don't always mention). Some switches have the "ON" position coincident with the toggle handle, and in others the handle is opposite the "ON" position. Wiring will be made more difficult, but be sure to install the switches so the positions of the toggle handles mean the same thing. A quad NAND gate and two 2N697 transistors may be used instead of the dual peripheral driver. A resistor of about 470 Ohms should be placed between the outputs of the gates and the transistor bases. Be careful in using a lower value of dropping resistor to get more brilliance if you substitute LEDs; the DUT (device under test) may have to sink too much current. An SE 9300 family transistor may be substituted for the MJE 1103 (it must be a Darlington type). Be sure to provide heat sinking for all three voltage regulators. The zener diode clamp at VR3 will overheat and fail if pin 3 of the regulator is left ungrounded for an extended period. An additional 1-shot and LED may be used to see if the 1-shots in the circuit are functioning. See page 84 of *Radio Electronics Magazine* for June, 1976.

Referring to page 26 of the Signetics manual, the timing diagram below the circuit diagram indicates the action initiated by the five 1-shots. However, more information is needed to fully explain the operation. See Table 1. CR1-CR3 are the diodes in the base circuit of Q2 (2N2222). Q1 controls the 15 volt input power to VR2. Q3 and Q4 are the substituted 2N697 transistors. Q3 controls output of

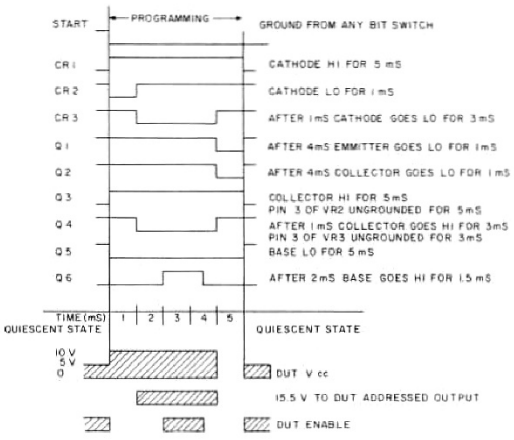
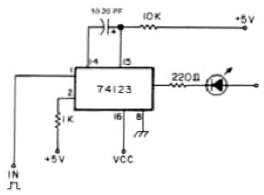


Table 1. Programmer timing diagram.

Fig. 1. Pulse catcher, Radio Electronics Magazine, *June, 1976.*



VR2, 5 volts for DUT verification and 10 volts during most of the programming cycle. VR2 output is forced to zero, however, near the end of the cycle, by action of Q1. Q4 switches output of VR3 from zero to 15.5 volts for fusing the links. Q5 and Q6 are in the NOR gate which enables the DUT. U4 is the substituted quad NAND gate.

With the simpler programmer, an address is selected and about 12.5 volts is applied for (hopefully) ½ second. In the Schottky version of the programmer, fusing operation is as follows:

1. DUT disabled;
2. Vcc raised to 10 volts for 4 ms;
3. After 1 ms (after start of programming), addressed output is raised to 15.5 volts for 3 ms;
4. After 2 ms DUT is enabled for 1.5 ms;
5. Both Vcc and fusing voltages go to zero for 1 ms.

At the end of the 5 ms programming period, conditions revert to their quiescent state (5 volts at Vcc and DUT enabled).

Inasmuch as these memories are irreversibly programmed, the unit should be checked each time it is used (DUT not installed).

U4 (7400) Not In Socket

1. All LEDs lighted.
2. Check 10 volts at DUT socket pin 16.
3. Check logic LO at DUT socket pin 15.
4. Check 15.5 volts at DUT socket pins 1-9 when BIT switches are in the N.O. position and 2 volts when in the N.C. position.

U4 In Socket

1. All LEDs lighted.
2. Check 5 volts at DUT socket pin 16.
3. Check 0 volts at DUT socket pins 1-9 when BIT switches are in the N.O. position and 5 volts in the N.C. position.
4. Logic LO at DUT socket pin 15.
5. Check 5 volts at DUT pins 10-13 when ADDRESS switches are in the "1" position and 0 volts when they are in the "0" position.

It is well to check that the DUT has not already been programmed or has missing bits for some other reason. After checkout of the unit as above, use the following procedure to verify the status of the DUT.

1. Set ADDRESS switches to the "0" position.

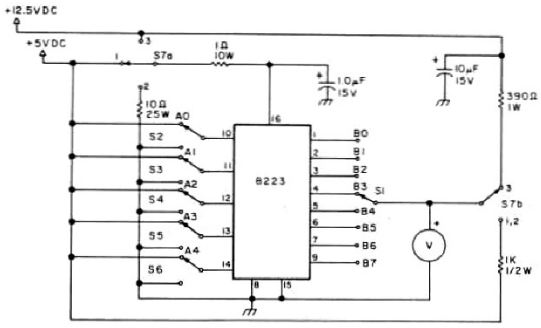


Fig. 2. "Simpler" programmer circuit.

2. Set BIT switches to the N.C. position.
3. Insert DUT.
4. Any LEDs that are lighted indicate blown links at address 00000.
5. Check other addresses as appropriate by setting the ADDRESS switches. (Do Not Touch The Bit Switches.)

Operation

Programming the DUT is pure simplicity, but attention to detail is enforced just as in any programming.

1. Set ADDRESS switches.
2. Actuate required BIT switch to blow the link.
3. The LED will light.
4. Actuate any remaining switch for logic "1" at that address.
5. Set next address and continue.

Conclusion

This programmer for Schottky PROMs works fine for the non-Schottky 8223. Industrial users of PROMs are not always so lucky with their exotic, automatic programmers. One $8,000 machine will program the 82S23 but not the 8223. There are substitutes for the 8223 and 82S23 but caution is advised; there are subtle differences. For instance, in some units, the outputs are programmed from "1" to "0" instead of from "0" to "1" as in the 8223 and 82S23.

A review of other programmer circuits in the Signetics manual makes it apparent that a "universal" programmer could be built to program at least all of the Signetics PROMs of this type. A universal programmer would make an excellent club project. In addition to automatic identifiers for repeaters and RTTY, the impact of microprocessors is beginning to be felt by almost everyone. As more "software" becomes available, operators will want some of their short routines stored in "firmware." ■