

Still Using a "Model T" TV/Game Antenna Switch?

Electronic circuit automatically switches
a TV antenna input to video game or computer and back.

By Gary Kloesz, *Motorola, Inc.*

TV receivers are commonly used as a means of displaying the outputs of video games and personal computers. To prevent interference with neighbors' TV reception, it is imperative that an FCC-approved isolation switch be used, of course. This requires the user to manually move a switch lever to the desired source.

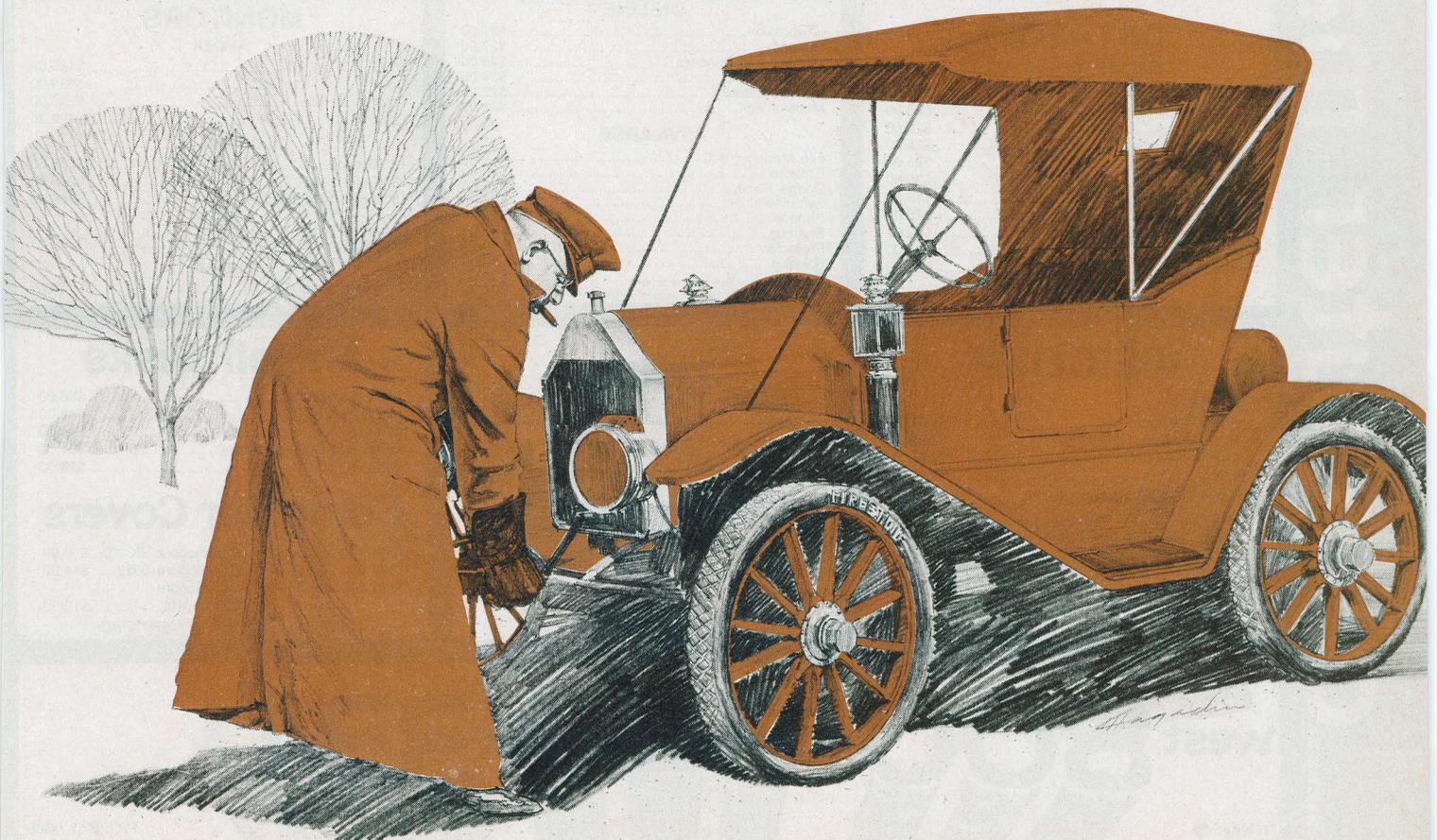
Invariably, the user forgets to switch back to the TV position after

using another device. Therefore, when another person switches on the set, he or she sees only picture "snow" until the switch is moved to its TV position. This bothersome situation can be eliminated with the use of the automatic electronic switch presented here.

Circuit Operation. The key to this electronic circuit is the MPN3401 PIN diode. This type of diode can

switch from a low-value resistor to a low-value capacitor depending on whether it is turned on or off. The circuit in Fig. 1 uses this property either to conduct (low resistance) or block (small capacitance) the incoming signal.

To pass a signal from the antenna input to the output, diodes *D1* and *D2* are turned on. At the same time *D3* and *D4* are off, resulting in a high impedance to the unwanted



signal from the game/computer input. To attenuate the unwanted signal further, *D6* is also turned on. This creates a low resistance to ground between *D3* and *D4*. Figure 2 illustrates the ac path when the antenna, or A, input is selected.

An advantage of this type of switch is that it can be activated through remote control. For example, turning on the game or computer can automatically "throw" the switch. The switching signal is supplied by the game or computer. It is simply a dc voltage of 5 to 10 V, which is found on the switched side of the game/computer power supply. The signal is transmitted via the cable that connects the game/computer to the TV set. Another advantage is that an electronic device is immune to problems caused by dust, dirt, and wear. There is one disadvantage, however. This switch requires a minimum of 5 mA continuous power to operate because one set of diodes is always on.

With regard to FCC requirements, the electronic switch meets them easily. It provides low (0-dB) insertion loss and high isolation (60 dB) between inputs as shown in the oscilloscope photos of Fig. 3.

Construction. The antenna switch can be constructed on a pc board. The foil pattern is shown in Fig. 4, with the corresponding parts-placement diagram given in Fig. 5. Since this is an r-f circuit, take care to leave as much ground plane as possible and to trim component leads short. If desired, enclose the circuit in a box.

For remote control switching, a dc blocking capacitor must be added to the cable that connects the game or computer to the antenna switch. It should be added at the game/computer end to isolate the switching voltage from the modulator output. Also a 1-kilohm resistor should be connected as shown in Fig. 6. These two components should be housed in a separate adapter box. If the automatic switching feature is not required, the transistor network can be replaced by an ordinary dpdt switch (Fig. 7).

The power supply for the switch can be any 5-to-10-V, calculator-

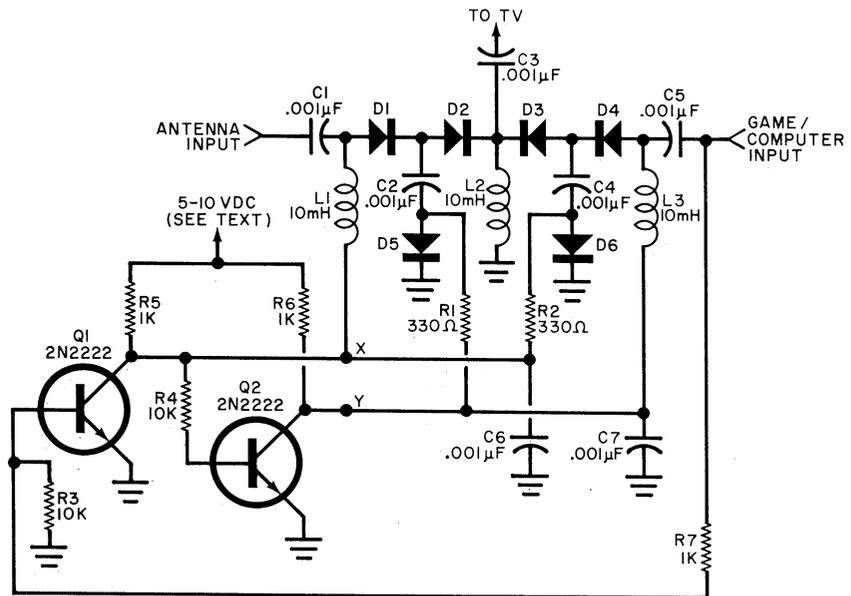


Fig. 1. Circuit operation depends on the switching diodes, *D1* through *D6*.

PARTS LIST

- C1 through C8—0.001- μ F ceramic disc capacitor
- D1 through D6—Silicon PIN switching diode (MPN3401 or similar)
- L1 through L3—10- μ H molded choke (J.W. Miller #9320-30 or similar)
- Q1, Q2—General-purpose npn transistor (2N2222 or similar)
- R1, R2—330-ohm, 1/4-W carbon resistor
- R3, R4—10-kilohm, 1/4-W carbon resistor
- R5 through R8—1-kilohm, 1/4-W carbon resistor
- Misc.—Power supply (see text), F connectors (1 male, 1 chassis-mount fe-

male), RCA phono connector (1 male, 1 female), short piece of 75-ohm coax cable (RG-59U), two 75/300-ohm matching transformers (if required), dpdt switch (if automatic switching feature is not used).

Note: The following is available from **Circuit Specialists, Inc., 738 S. Perry Lane, Tempe, AZ 85281: complete kit of parts including pc board at \$28.95 postpaid. Also available separately: pc board at \$4.95 postpaid and Motorola MPN3401 PIN diode at \$1.00 each postpaid. Arizona residents, add 4% sales tax.**

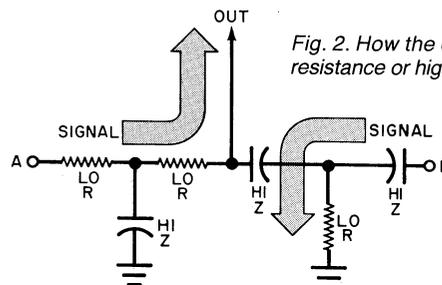


Fig. 2. How the diodes present either low resistance or high capacitance to the input.

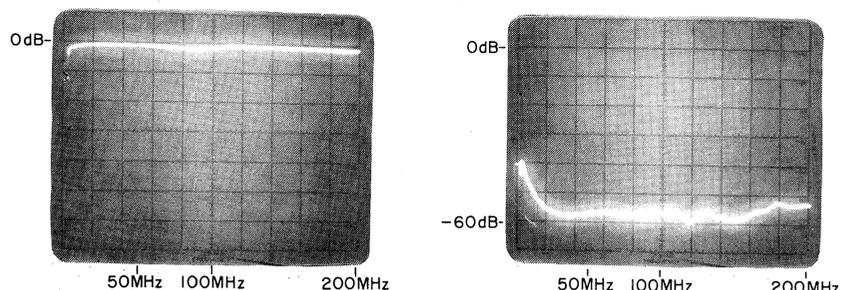


Fig. 3. Scope photos show low (0 dB) insertion loss (left) and high (60 dB) isolation between inputs using the switch.

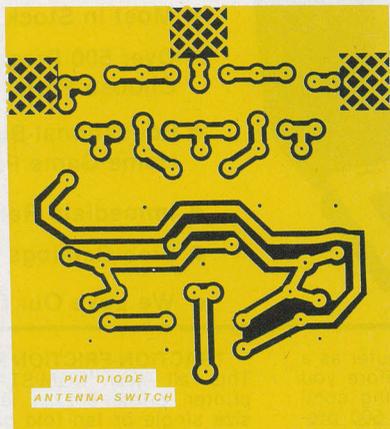


Fig. 4. Foil pattern for the printed circuit board.

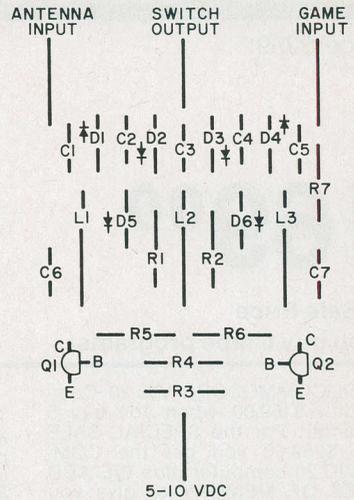


Fig. 5. Component layout for pc board.

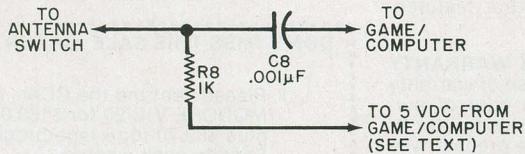


Fig. 6. Circuit for adapter box connected to game or TV.

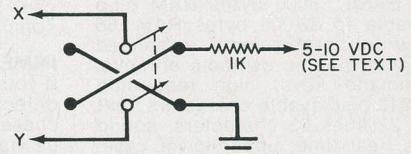


Fig. 7. Use a switch to cut out the automatic circuit.

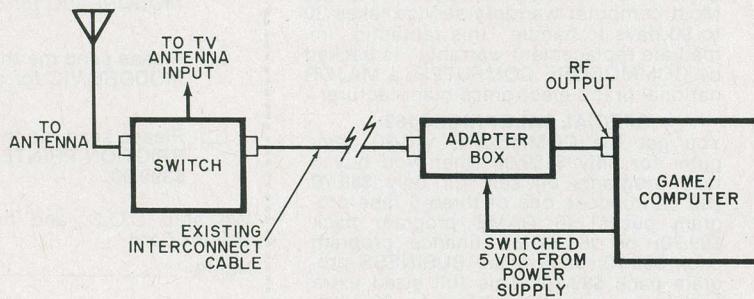


Fig. 8. Use this diagram to connect the automatic switch to the TV and the adapter box and game/computer.

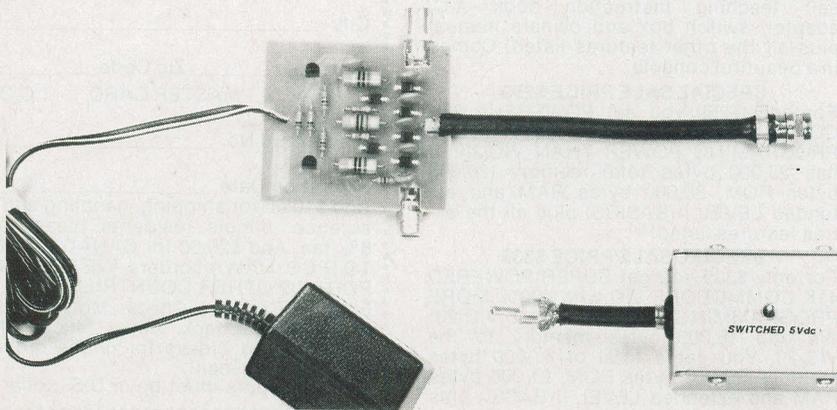


Photo showing the automatic switch, adapter box, and power converter.

type, plug-in, dc power supply such as a 9-V battery eliminator.

The switch is designed for a 75-ohm antenna system. If you have a 300-ohm system, matching transformers are required at both the an-

tenna input and TV output. The game/computer input does not require a matching transformer because it is already a 75-ohm source.

Connect the switch to your system as shown in Fig. 8. You're now

ready to watch TV or run your microcomputer or video game. Whichever you choose, your TV will give you the proper display automatically and you won't have to switch the antenna. ◇