

**Table 7-18**  
Speaker connector signals

Pin	Signal	Description
1	SPKR	Speaker signal. This line will deliver about 0.5 watt into an 8-ohm speaker.
2	+5	+5V power supply. Note that the speaker is not connected to system ground.

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## The speaker

The Apple IIe's built-in loudspeaker is controlled by a single bit of output from the IOU (Input Output Unit). The signal from the IOU is AC coupled to Q5, an MPSA13 Darlington transistor amplifier. The speaker connector is a Molex KK100 connector, J18 in Figure 7-15b, with two square pins 0.25 inches tall and on 0.10-inch centers.

A light-emitting diode is connected in parallel across the speaker pins such that, when the speaker is not connected, the diode glows whenever the speaker signal is on. This diode is used as a diagnostic indicator during assembly and testing of the Apple IIe.

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## Game I/O signals

Several I/O signals that are individually controlled via soft switches are collectively referred to as the game signals. Even though they are normally used for hand controls, these signals can be used for other simple I/O applications. There are five output signals: the four annunciators, numbered A0 through A3, and one strobe output. There are three one-bit inputs, called *switches* and numbered SW0 through SW2, and four analog inputs, called *paddles* and numbered PDL0 through PDL3.

The annunciator outputs are driven directly by the IOU (Input Output Unit). These outputs can drive one **TTL (transistor-transistor logic)** load each; for heavier loads, you must use a transistor or a TTL buffer on these outputs. These signals are only available on the 16-pin internal connector. (See Table 7-19.)

The strobe output is a pulse transmitted any time a program reads or writes to location \$C040. The strobe pin is connected to one output of the 74LS154 address decoder. This TTL signal is normally high; it goes low during  $\phi 0$  of the instruction cycle that addresses location \$C040. This signal is only available on the 16-pin internal connector. (See Table 7-19.)

The game inputs are multiplexed along with the cassette input signal by a 74LS251 eight-input multiplexer enabled by the C06X' signal from the 74LS154 I/O address decoder. Depending on the low-order address, the appropriate game input is connected to bit 7 of the data bus.