

Audio Powered Tape Recorder Controller

Add convenience to your hamshack.

by Gregory R. McIntire KE0UV

Have you ever needed a device that would turn a tape recorder on and off through the presence or absence of the audio being recorded? I wanted to record the transmissions from the Russian cosmonauts on 2 meters, but I could never be at home when they were active. I needed just such a device, with a few more requirements. In addition to stopping and starting on its own, I wanted it to operate without external power. I already have too many plugs in the wall. Nor did I want to use batteries, since the device would be in service for long periods of time.

Audio Activated Circuit

After much trial and error experimenting with various types of transistors, I devised a simple yet effective circuit. The finished device is basically a switch that will open or close any circuit (such as a tape recorder motor supply line or pause control), of up to 3 amps or up to 60 volts (it must not exceed 20 watts), by the presence or absence of an audio signal. It requires no batteries or power supply. The audio signal itself supplies the power to operate this switch.

The actual switch is a power MOSFET. Although it requires an extremely low amount of gate current for operation, it does require at least 4 volts at the gate. Voltage at an 8 ohm audio source is much less than 4 volts at normal audio listening levels. In fact, I consider the audio quite loud with a peak voltage of only 1.5 volts across an 8 ohm speaker. So, unless the audio source is a ghetto blaster cranked up to full volume, the voltage level of the audio must be increased in order for it to turn the MOSFET on.

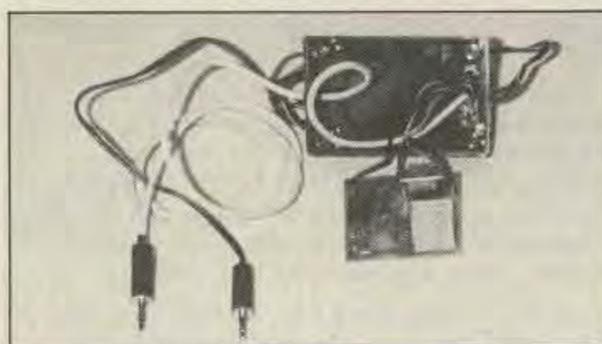


Photo A. The recorder controller circuit, housed in a small plastic box, is ready to be hooked up.

Increasing the Voltage

An 8 to 1000 ohm audio transformer is used for two purposes: First, it presents an 8 ohm load to the audio source (such as the external speaker jack of a radio), and secondly, it multiplies the voltage several times. It still does not step up the audio voltage enough at low or moderate volume levels, though. Therefore, I used a network of four diodes and four capacitors to *quadruple* the voltage output of the transformer. This reduces the available current, but there is still much more current than the MOSFET requires.

Since using an external speaker jack will usually disconnect the receiver's speaker, I included an external speaker jack in this circuit. A second jack supplies the actual audio source for recording. Except for a slight attenuation of the audio, caused by the resistors in series with the jacks, this device has no effect on the quality of the audio source.

Circuit Operation

Audio from an 8 ohm source is fed to the

8 ohm windings of a small audio transformer. The audio is also connected to two other jacks through appropriate resistors, to provide audio sources for external speaker and/or tape recorder input. The output (high impedance) windings of the transformer is fed to a "diode, capacitor voltage quadrupler circuit." This provides enough voltage to switch on the power MOSFET. A zener diode is used at the MOSFET gate to *clamp* the voltage to a safe level, since a *high* audio level from the source can be multiplied above the maximum gate voltage.

The output of the MOSFET (drain to source) does not supply any voltage or current, but rather acts as a single-pole, single-throw switch. This switch opens and closes the circuit of the tape recorder's motor via a relay in the tape recorder or via a remote control jack on the recorder. That is, the

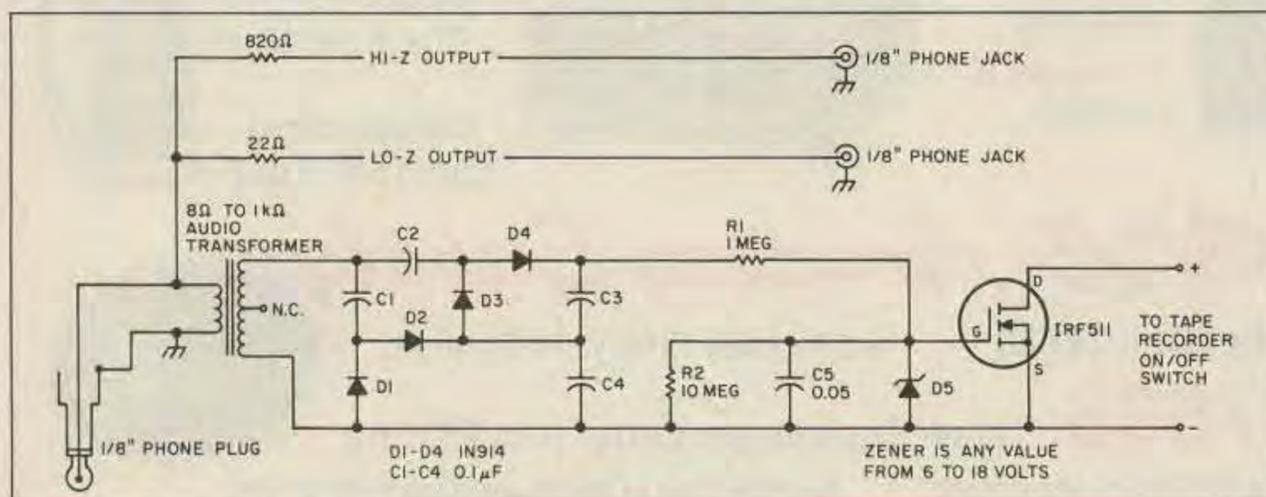


Figure 1. Schematic of the audio-powered tape recorder controller.

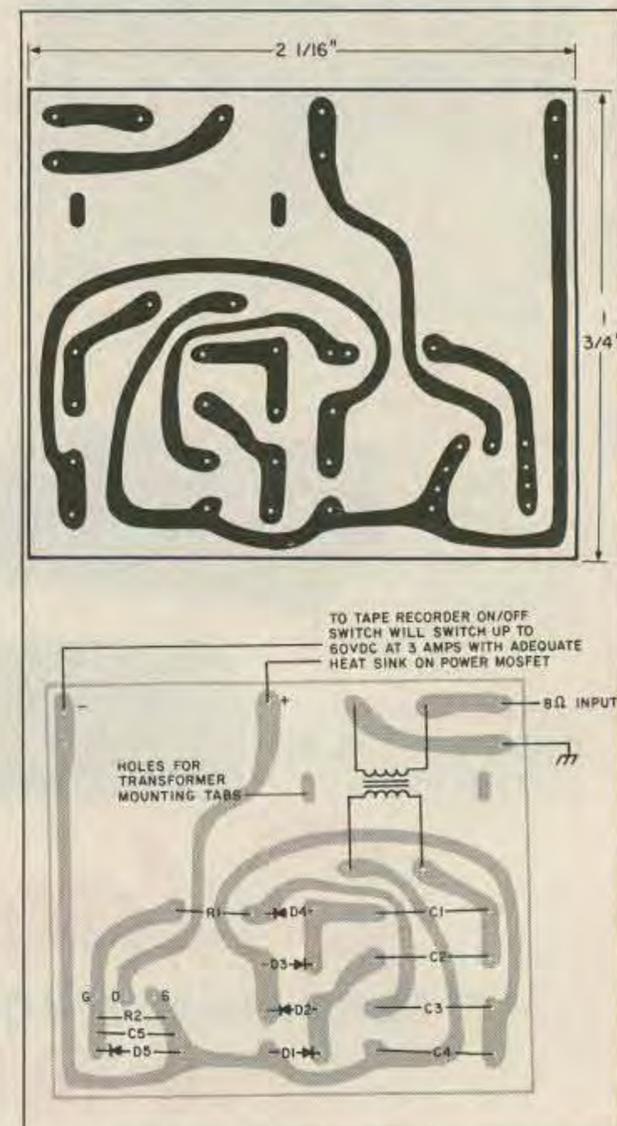


Figure 2. (a) PC board foil pattern. (b) Parts placement.

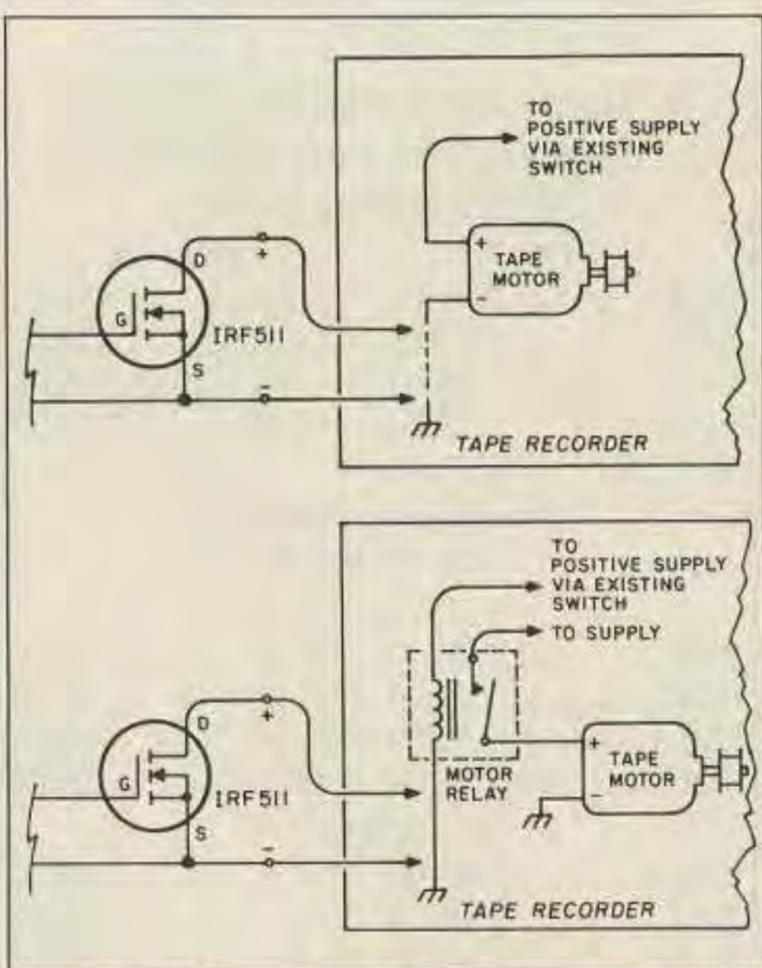


Figure 3. (a) Two methods of connecting the tape recorder controller to the motor of the recorder.

(b) Controlling the recorder via the built-in remote control/pause jack. [Ed Note: Some recorder pause controls have a grounded center pin; just switch polarities on the controller output in this case.]

Parts List

All components are available at Radio Shack stores.

1	IRF511 power MOSFET	RS 276-2072
T1	audio transformer	RS 273-1380
C1,C2,C3,C4	0.1 μ F caps	RS 272-135
C5	0.047 μ F cap	RS 272-143
D1,D2,D3,D4	1N914 diodes	RS 276-1122
D5	zener diode	RS 276-562*
R1	resistor	1 megohm
R2	resistor	10 megohm
R3	resistor	22 ohm
R4	resistor	820 ohm**
	plugs and jacks as required (see text)	

* Or any zener value between 6 and 15 volts.

** For tape recorder LINE input use an 820 ohm resistor; for MIC input use a 100k resistor or pot.

A blank PC board is available from FAR Circuits, 18N640 Field Court, Dundee IL 60118 for \$3 + \$1.50 postage.

MOSFET can be inserted into the tape recorder motor supply line if the recorder does not have built-in remote control ON/OFF operation.

Construction Notes

Any construction technique can be employed here, as nothing is critical about this circuit. I made a printed circuit board, as I find this method of construction simpler and more goof-proof than perfboard or point-to-point wiring.

I used a small plastic box (Radio Shack 270-230) to house the unit. I also wired one $\frac{1}{8}$ " mini phone plug to the input of the device and another such plug to the switched output, as my radio speaker jack and tape recorder ON/OFF jack are both the same. Use whatever type of plugs and/or jacks you need for interfacing your own equipment.

Although it wouldn't cause any damage to put the wrong plug into the wrong jack, I advise labeling the plugs. The IRF511 power

MOSFET is internally protected against static shock, but it's still a good idea to take care when installing MOS devices.

Two jacks mounted in the plastic box are connected to the audio source via limiting resistors. They are used for a source of audio for the tape recorder and a source for an external speaker. The 22 ohm resistor is put in series with an external speaker because the transformer already provides an 8 ohm load to the audio source (scanner, transceiver, etc.). This also ensures that an external speaker will not drop the voltage below the threshold of the MOSFET.

Ready to Record

Plug the audio input side of the device into the external speaker jack of any audio source. Plug or connect the high impedance jack into the tape recorder audio input. (If your audio source already has a TAPE jack for recording, this will not be necessary, of course.) If your recorder has a LINE input, R4 should be 820 ohms. If you use the MIC input then R4 should be a 100k resistor or pot. The switched output of the controller should be hooked up to the recorder's PAUSE/REMOTE control jack (Figure 3b). If your recorder has no PAUSE/REMOTE control jack then you can connect the

output of the device into the motor circuit of the recorder. If you use the direct connect method, the IRF511 MOSFET must be inserted into the negative or grounded side of the motor or motor relay (Figure 3a). Cut the wire on the motor and connect the drain pin of the MOSFET to the motor or the motor relay. Connect the source pin to ground.

Now turn on the tape recorder and set it to RECORD. Slowly turn up the volume of the audio source until the recorder motor starts turning. This should occur at a low to moderate volume level. If it doesn't, check your wiring and connections. Also

be sure you have the polarity correct on all five of the diodes.

I tried several minor variations of this circuit (with different transformers, capacitors, and resistors) and it worked just as well. The main requirement is to send 4 volts minimum to the gate of the MOSFET to switch it on.

The MOSFET switches on fast, but when the audio source stops, it waits a second or two before it switches off. This way it doesn't switch off during pauses between words. At the start of a transmission, you rarely miss a single syllable, and the end doesn't drop off in mid-sentence.

For a couple of months now, I have been using this device, sometimes connected to the 2 meter rig and sometimes to a scanner. It works very well; and perhaps best of all, it doesn't require batteries, wall transformers, or any other source of power! **73**

Gregory R. McIntire KE0UV, Hillview Tr. Ct. Lot 92, Belle Fourche SD 57717.