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$5 Infrared Remote Tester

Build this and look like a hero.

This article describes a simple device to test all kinds of infrared transmitting devices. All parts are available at Radio Shack at a total cost of around $5. It has no adjustments and the physical layout is not critical.

Okay, you're a ham. By default, you're also the electronics expert of the family. On call "24/7" (hours a day/days a week) for all kinds of questions. For example, some family member tells you: "My TV remote doesn't work." What do you do? First, you check that the batteries are installed properly, then you check the batteries with your DMM/VOM to make sure they're good. You point it at the TV, CD player, DVD player, etc., and hopefully it works. If it does, you're a hero for discovering that the batteries were put in backward after the old dead ones were replaced.

But what do you do if it still doesn't work? How can you tell if the problem is in the remote or the TV? I suppose you could go to a store and buy one of those universal remotes. But what if you're checking an IR keyboard or mouse or other device with an IR transmitter that doesn't have a generic replacement available at the corner store?

This article describes an IR receiver that tells if the IR is transmitting by blinking an LED at the same rate as the transmitted signal. You can build this very simple project for about $5 and have a portable checker that you can loan to friends, relatives, and neighbors. All parts are available at Radio Shack; if you have the proverbial "well stocked junk box," you may already have most parts on hand.

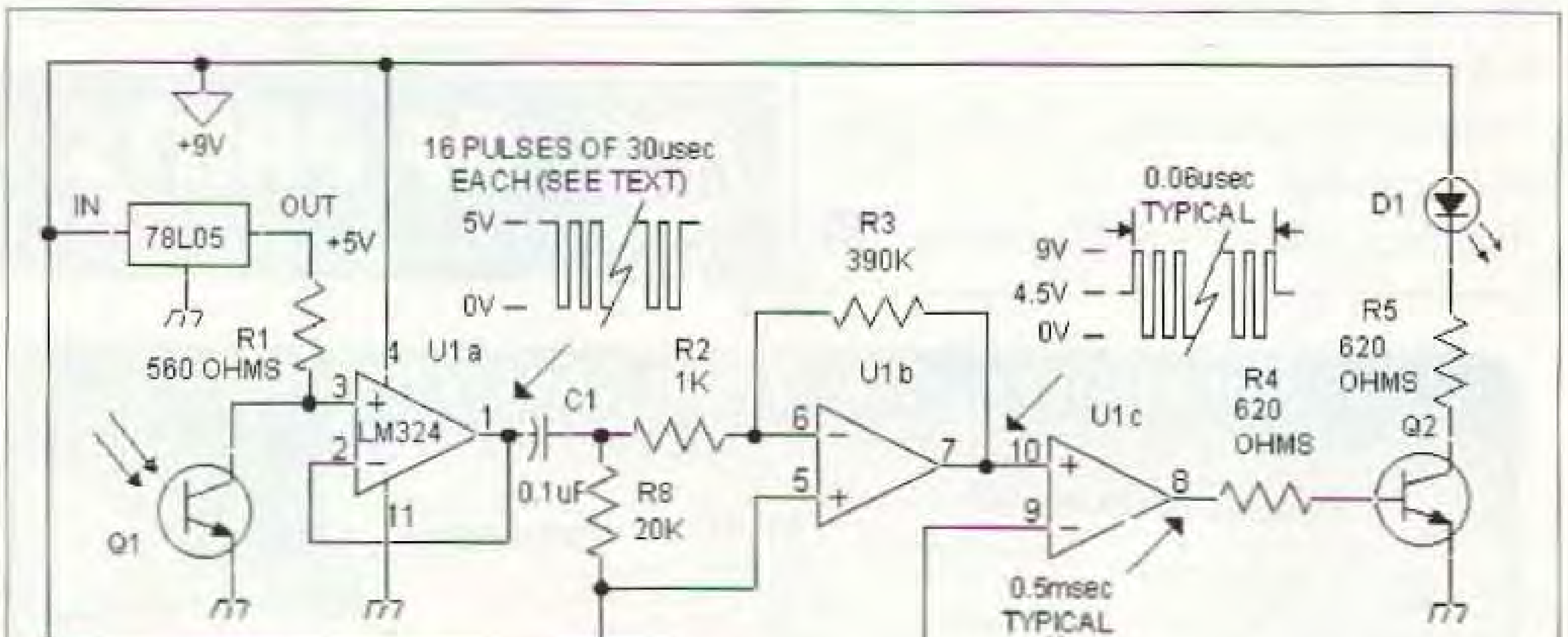

Fig. 1. Schematic with typical waveforms.

Circuit operation

The schematic with typical waveforms is shown in **Fig. 1**. The incoming IR signal shines on the domed top of transistor Q1, causing it to conduct current, resulting in a voltage drop across R1. Op amp U1a is wired as a buffer to isolate the detector from the rest of the circuit. C1 couples the signal from this buffer to amplifier U1b. U1d with R6 and R7 provide a "stiff" virtual ground halfway between ground and the supply voltage. This virtual

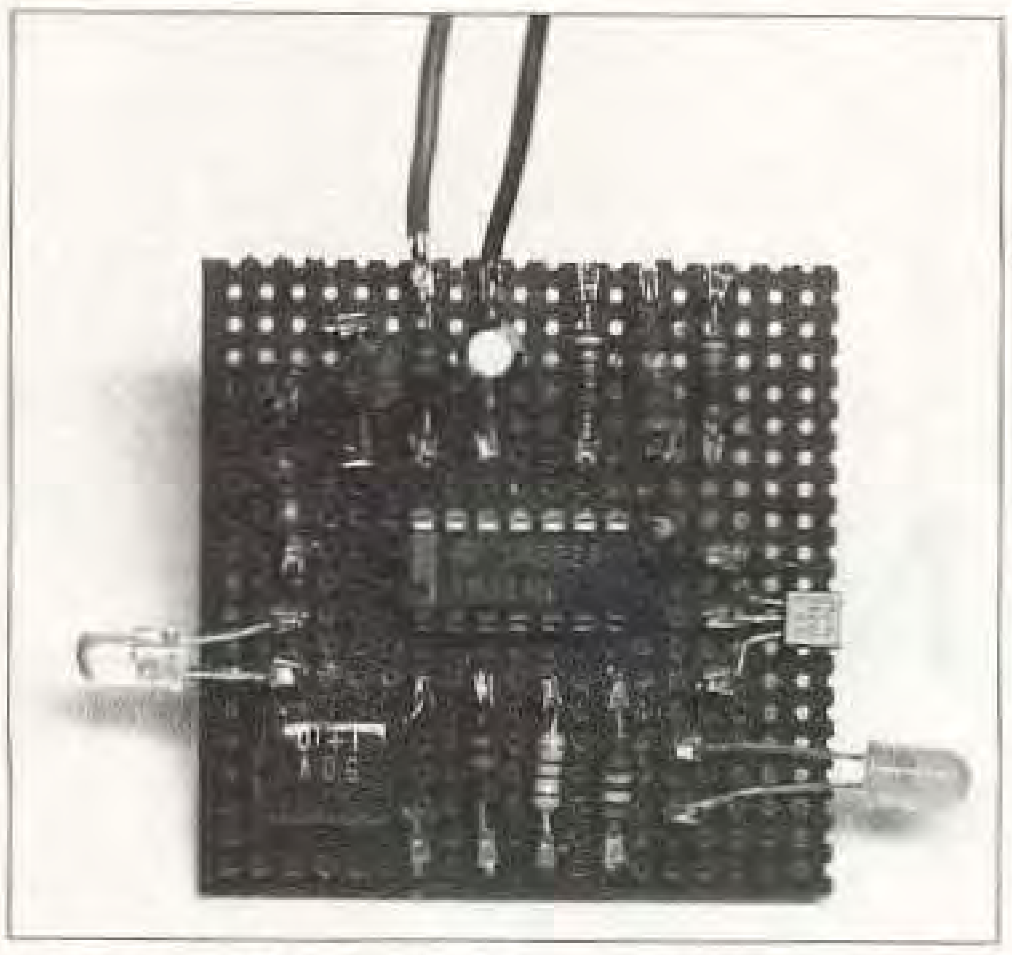

Photo A. Here's the board, right out in the open so you can get a good look.

ground is used to make the power supply act like it is a ± 4.5 volt power supply. The bottom of R8 is tied to virtual ground to keep the input to U1b from floating to V+ or V–. If the input did float either high or low, operation of the circuit would cease.

U1b with R2 & R3 amplify the signal by a factor of 390 (R3/R2). The voltage at U1b pin 7 is halfway between V supply and ground, with the IR signal superimposed on top of it. By amplifying the signal by a factor of 390, it saturates the output of U1b. The squarewave output of U1b goes from 1.5 volts less than the supply voltage to true ground. U1d is used as a comparator. Pin 9 is held at 5% above virtual ground by resistors R9 and R10. Pin 8 goes to +7.5 volts when pin 10 is more positive than pin 9. Q2 is turned on through R4 only on the positive part of the squarewave signal from U1d. Q2 lights the LED.

I used an LM324 since it is capable of accepting and outputting a low voltage right down to 5 millivolts above – V supply (pin 11). This is needed since Q2's base must be less than 0.65 volts above true ground to shut off with no incoming signal.

The waveforms shown on the schematic represent just part of a complex waveform. Vary the timebase of an oscilloscope from 0.5 milliseconds to 20 microseconds to see all parts of the actual waveform. The amplitude at U1a pin 1 will vary with distance. I obtained 3 volts peak-to-peak at 3 inches. The maximum working range was 23 feet. The signal at the IR sensor at this distance is of course very low.

Construction

I constructed my unit using perfboard and push-in clips. I didn't choose to lay out or fabricate a PC board since I built only one unit. Before mounting the board in a small box the project looked like **Photo A**. The completed unit can be put in a small box (**Photo B**). I suggest locating the input transistor at the end of the box and the LED on top of the box.

You will have to perform testing in a dimly lit room (not total darkness) or shield the IR detector with an opaque tube to let light in only from "head-on." If sunlight or bright lights are shining on the detector, the LED will be on full-time and prevent you from testing a remote unit. You could also reduce the gain of U1b so the tester is not as sensitive, but I did not try this.

An interesting point is that you can see the 60 Hz sine wave from an incandescent light bulb by monitoring pin 1 of U1 with an oscilloscope. You will have to adjust the sensitivity of the oscilloscope to accommodate the signal level since it will vary with the distance to the light bulb.

Summary

You can build this project in just a few hours. With it you can help neighbors, relatives, and fellow workers troubleshoot their IR transmitter devices. If you make it look homemade, people will likely ask how you knew to build a tester like this. Use that opportunity to talk up electronics and ham radio as a hobby.

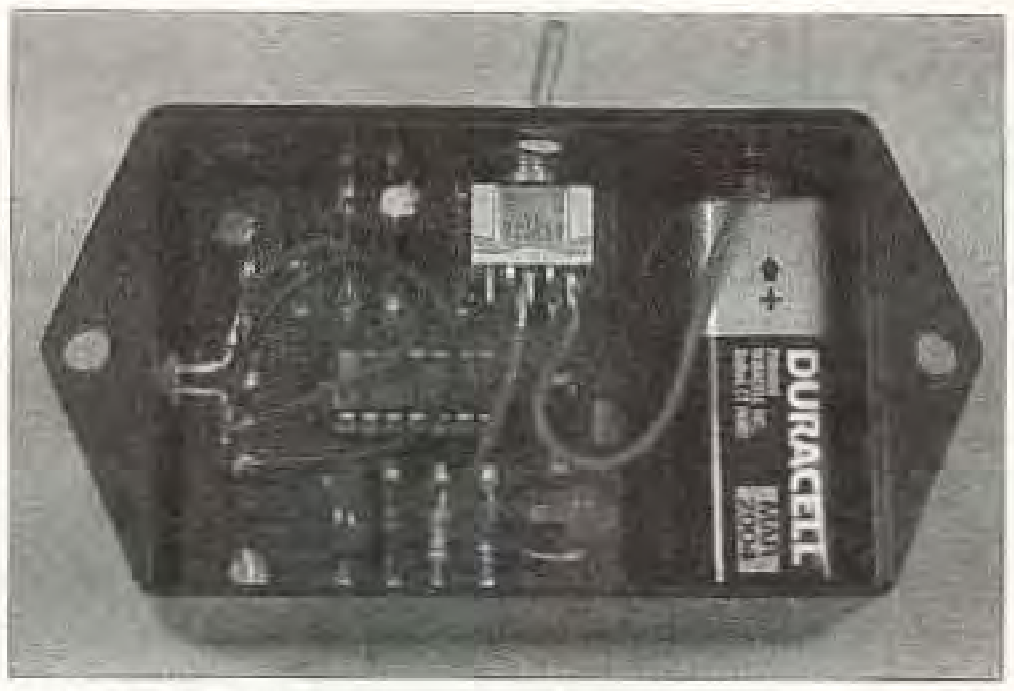

Photo B. The completed unit.

There are probably some changes you can make to produce a waveform at IC1b pin 7 that is a little more squared off (it is quite rounded off) and more accurately represents what is actually being sent from the IR transmitter. I didn't bother to research this any further since I just wanted to know if the IR remote was actually transmitting. If you have an oscilloscope, monitor pin 1 to see the differences between codes sent when pushing different buttons.

I had fun building and debugging this project. If you build it, please let me know how you like it and if you made any changes. I would like to hear from you. Don't be surprised if you get that "Gee, what an electronics genius you are!" look from someone you help. Happy soldering!