

# 38

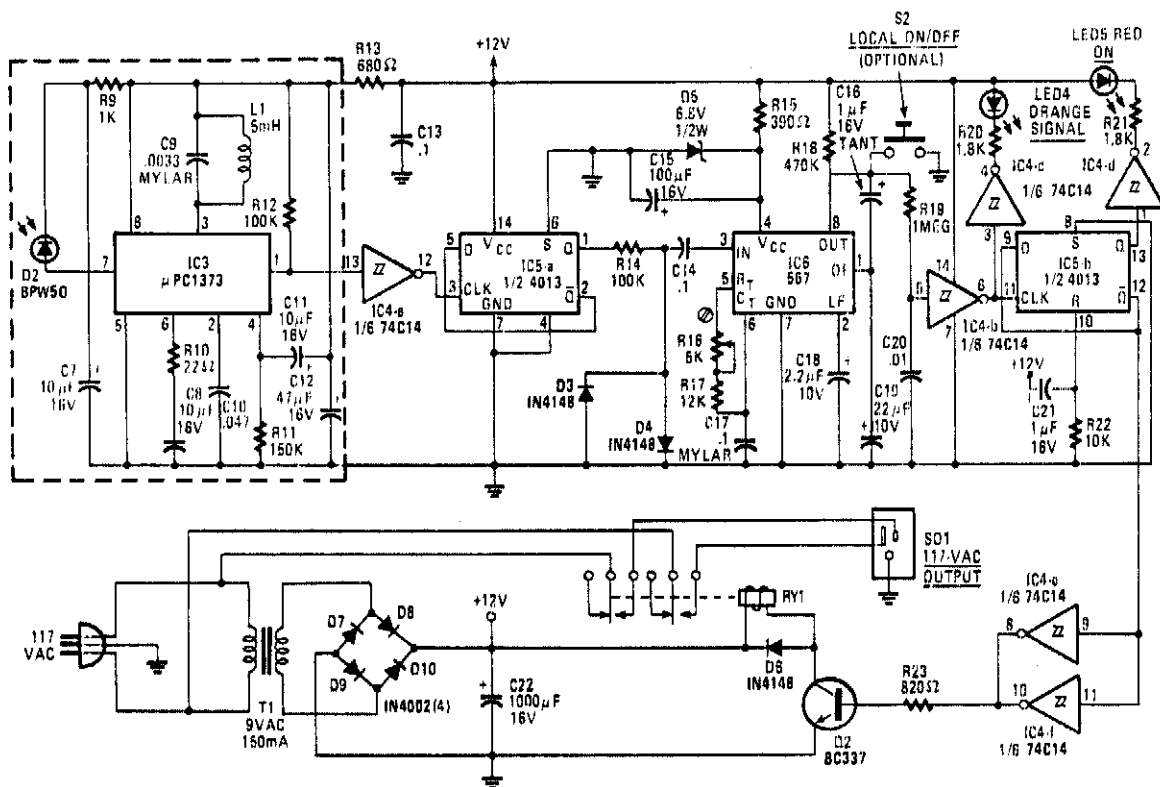
## Infrared Circuits

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The sources of the following circuits are contained in the Sources section, which begins on page 667. The figure number in the box of each circuit correlates to the entry in the Sources section.

- IR Receiver I
- IR Receiver II
- Wireless IR Security System
- IR Detector
- Infrared Remote Controller
- IR-Controlled Soldering Station
- Infrared "People" Detector
- IR Heat-Controlled Kitchen Fan
- Simple IR Transmitter
- IR Transmitter
- IR Remote Extender
- Infrared Remote-Control Tester
- Voice-Modulated Pulse FM IR Transmitter

## IR RECEIVER I



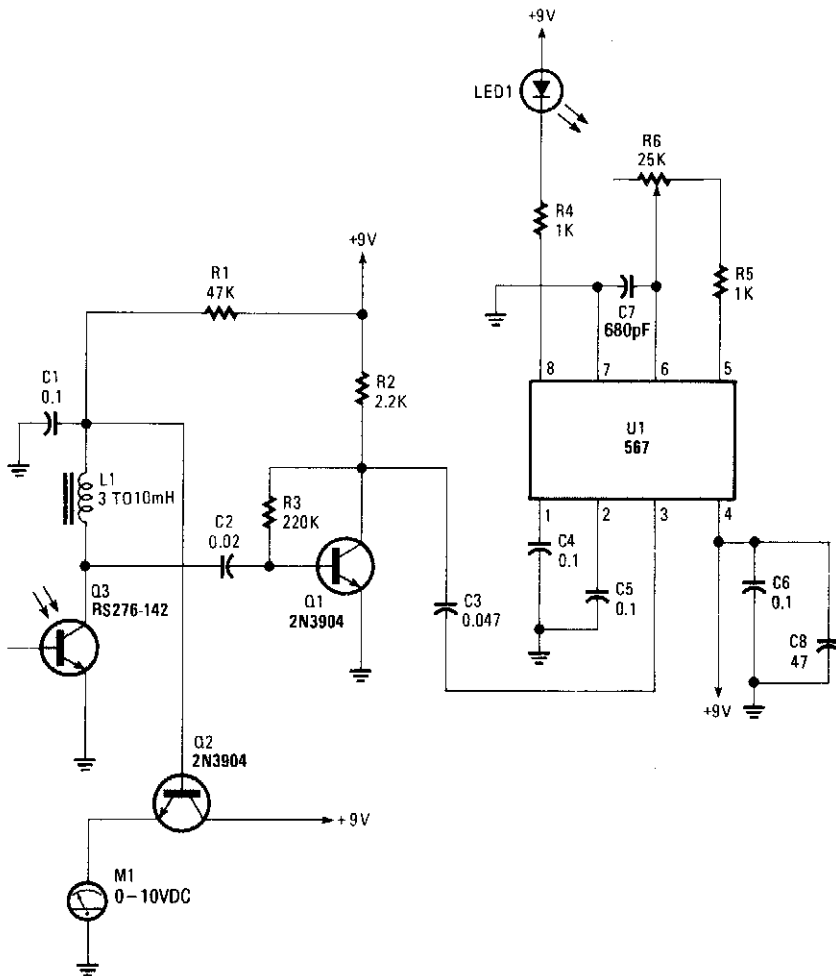
RADIO-ELECTRONICS

Fig. 38-1

This receiver is built around a uPC1373 IR remote-control preamplifier, a sensitive 30-to-40 kHz tuned detector, an automatic gain control, a peak detector, and an output waveshaping buffer. The demodulated signal from the preamp stage is sent to IC4A, a 74C14 Schmitt trigger. The squared-up 1500-Hz signal is then sent to the clock input of IC5A, half of a 4013 dual "D" flip-flop. That 750-Hz signal is clipped to approximately 0.7-V p-p by diodes D3 and D4. The clipped signal is then fed to IC6, a 567 tone decoder. The output of that IC goes low whenever the frequency of the signal fed to it is within the lock range of its internal VCO.

When IC6 detects a signal of the proper frequency, pin 8 goes low. The output signal is fed through another Schmitt trigger (IC4B), which drives another "D" flip-flop, IC5B. Schmitt trigger IC4B also drives IC4C, which in turn drives LED4, SIGNAL, which lights up whenever a signal is received. The Q output of IC5B drives two parallel-connected inverters. IC4C and IC4F turn transistor Q2 on when Q goes low. That transistor energizes the relay; its contacts switch the controlled device on and off.

## IR RECEIVER II

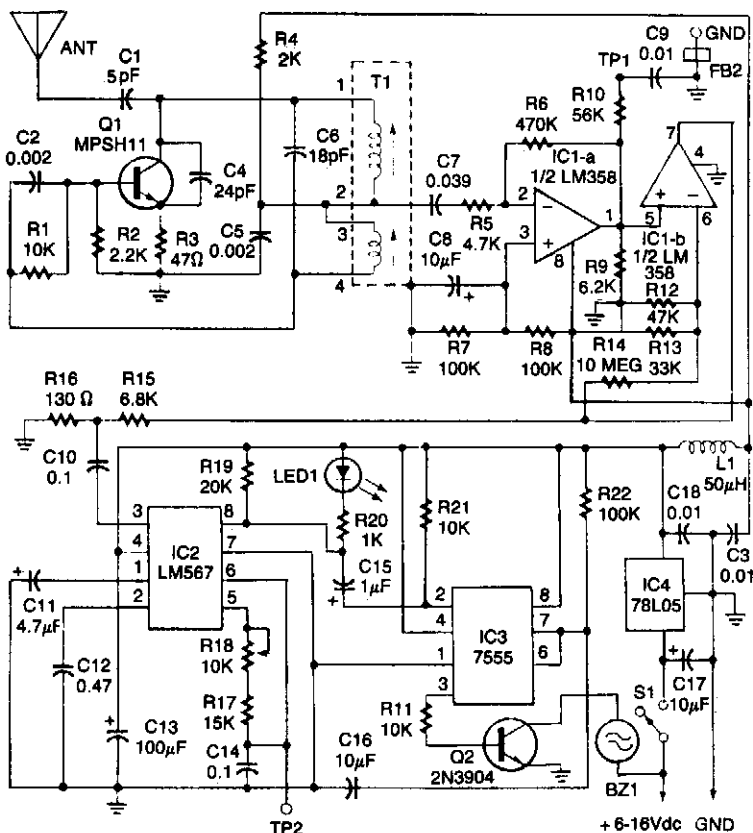


POPULAR ELECTRONICS

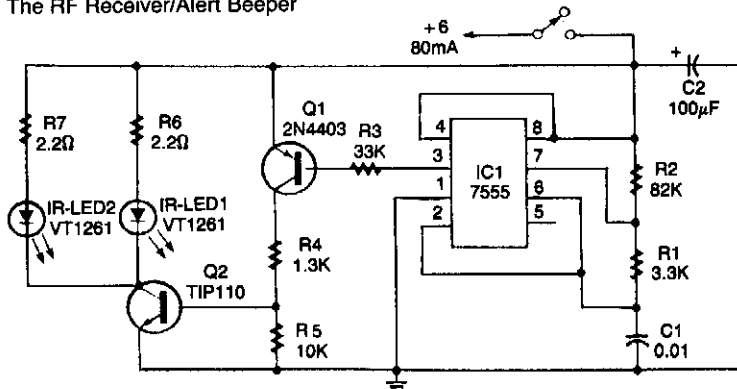
**Fig. 38-2**

Q3 is an IR phototransistor that responds to a modulated IR beam. Q1 amplifies the ac component of the IR beam. Q2 drives a meter as a relative indication of the strength of the light beam. A strong beam gives a lower meter reading. U1 is a tone decoder that produces a low output on pin 1 during reception for an IR beam that is modulated with the correct tone frequency, determined by R6.

## WIRELESS IR SECURITY SYSTEM



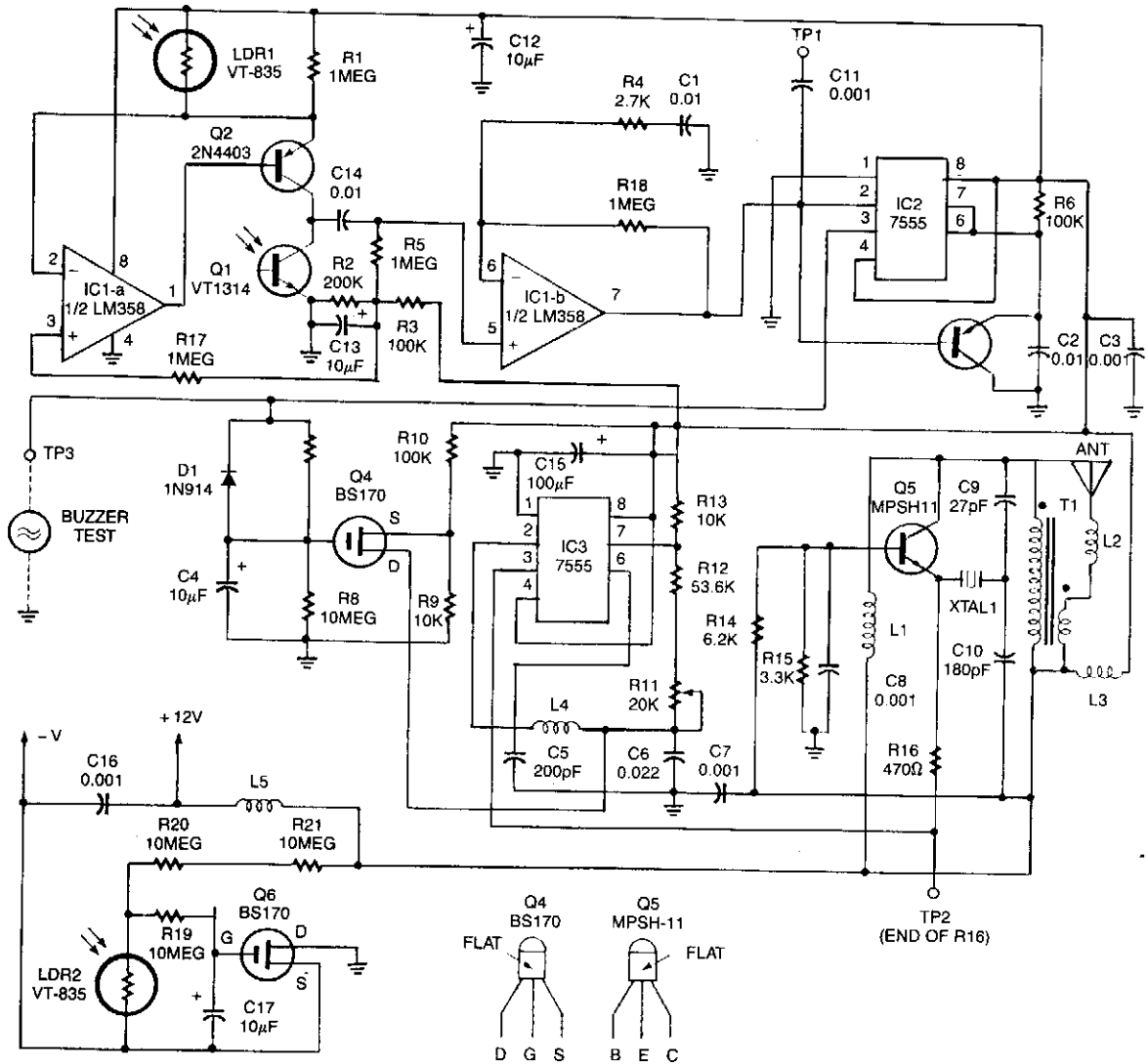
The RF Receiver/Alert Beeper



The IR Transmitter

This system contains an IR transmitter, an IR receiver/RF transmitter, and an RF receiver/alert beeper. Two IR LEDs in the transmitter transmit a pulsed beam of invisible infrared light to the receiver, which contains an IR phototransistor. The phototransistor detects and amplifies the pulse-modulated IR beam. If the receiver section senses that the IR beam is momentarily interrupted by an object blocking the

## WIRELESS IR SECURITY SYSTEM (Cont.)

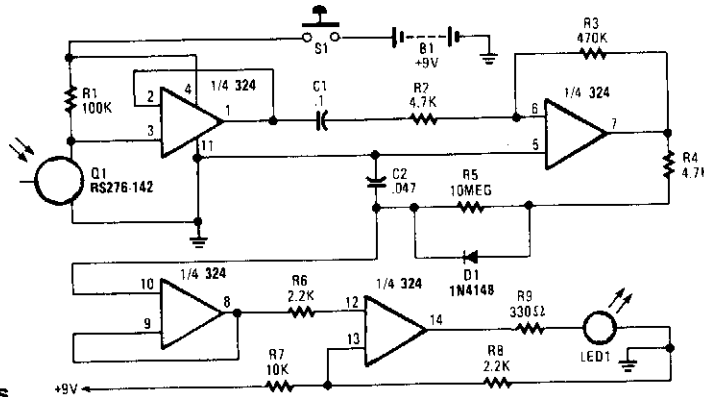


The IR Receiver/RF Transmitter

beam's path, it triggers the transmitter, which outputs a 49.890-MHz carrier that is amplitude-modulated by a 490-Hz tone.

Upon receiving the 490-Hz amplitude-modulated carrier, the RF receiver/beeper unit sounds an alarm that alerts the user to the intrusion. The system is not limited to just one RF transmitter. A single RF receiver/beeper can be used to monitor any number of RF transmitters (or locations). However, the receiver/beeper unit cannot discriminate between different transmitter sites in multiple-transmitter systems.

## IR DETECTOR

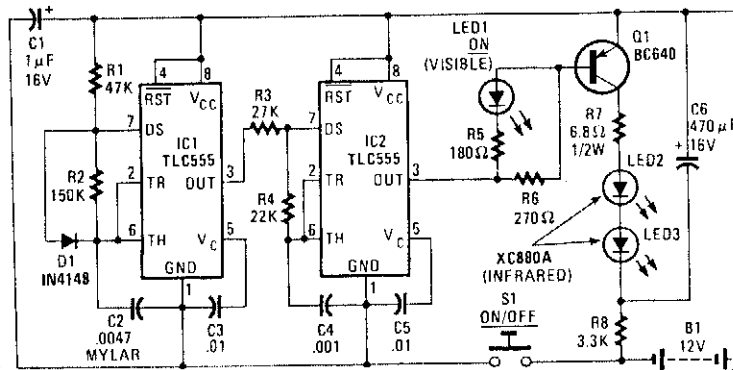


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Fig. 38-4

Useful for checking TV remote controls, IR-based alarm systems, and IR sources, this circuit causes LED1 to turn on for two seconds in the presence of IR light pulses. U1A acts as a voltage follower for detector Q1. C1 and R2 form a differentiating network and U1B acts as an amplifier for the pulses, which charges C2. Voltage follower U1C samples the voltage on C2 and drives comparator U1D, which switches LED1 on or off.

## INFRARED REMOTE CONTROLLER



RADIO-ELECTRONICS

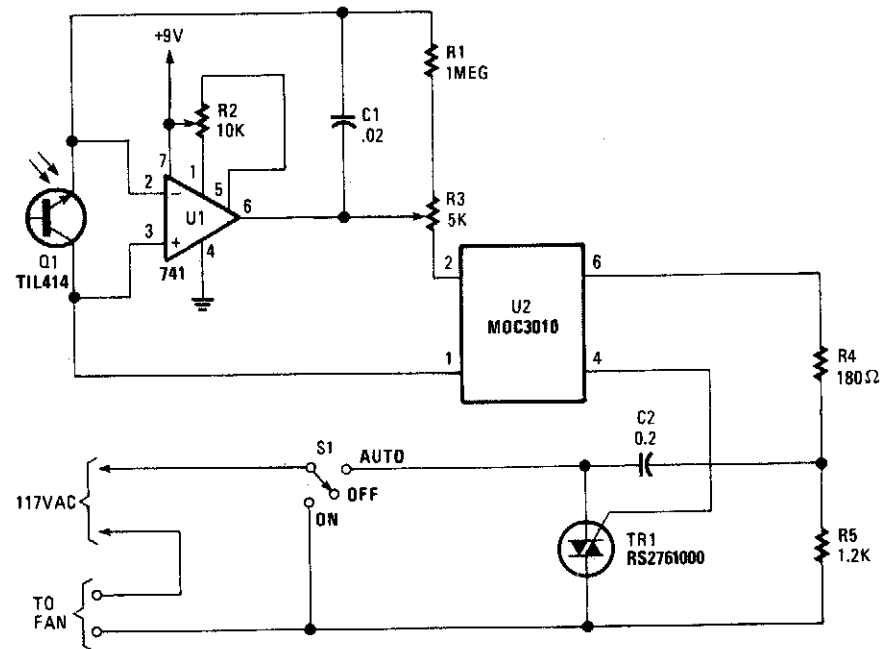
Fig. 38-5

The transmitter is built around two CMOS 555 timer ICs (TLC 555s). The transmitter generates a modulated 35-kHz IR signal. The 35-kHz carrier frequency is generated by IC2, and the 1 500-Hz modulating signal is generated by IC1. The output of IC2 drives LED1 through resistor R5; that LED provides visual indication that the transmitter is working. In addition, IC2 drives transistor Q1, which drives the two infrared LEDs (LED 2 and LED3).

To provide the high current needed to drive the two IR LEDs, capacitor C6 is precharged, the charge it contains is dumped when S1 is pressed. When S1 is not pressed, the power to the ICs is cut off. However, C6 is kept charged via R8. Then, when S1 is pressed, the current stored in C6 can be used to drive the LEDs for as much as 1/2 second. That's plenty of time for the receiver to pick up a signal.



## IR HEAT-CONTROLLED KITCHEN FAN

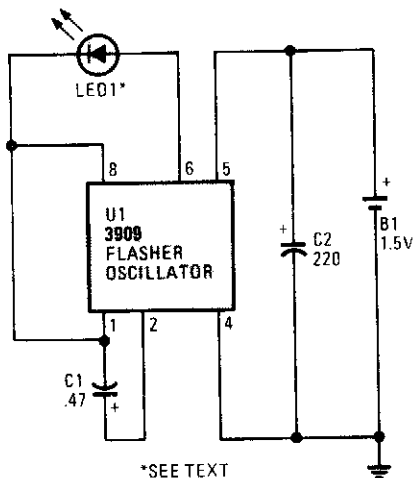


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Fig. 38-8

Q1 senses IR from heat sources, causes U1 to switch, activates optocoupler U1, and triggers TR1. This controls a fan. The Triac is from Radio Shack, or else a 200-V, 6-A unit (C106B) can be used.

## SIMPLE IR TRANSMITTER



\*SEE TEXT

The IR diode's flash rate is determined by the value of C1, a 220- $\mu$ F capacitor that sets the rate of oscillation at 1 Hz per second. Reducing C1 will increase the frequency of the circuit, while larger values will decrease the frequency.

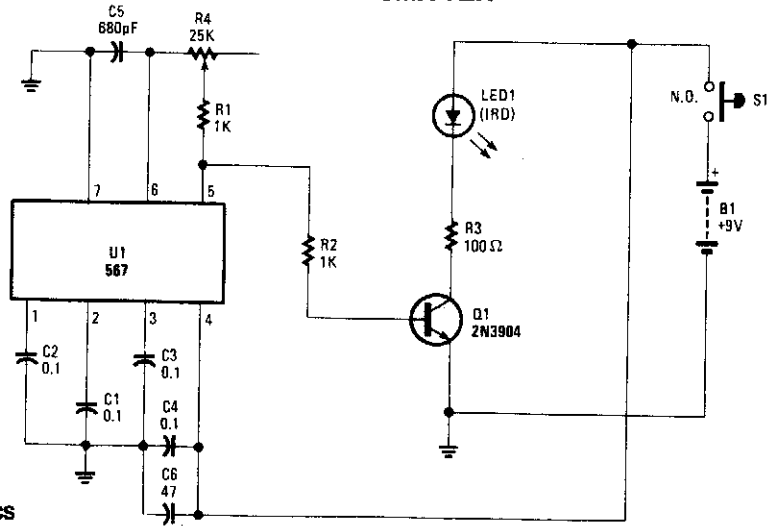
Because the circuit only sends out single, narrow pulses of invisible light, the IR receiver only responds with a click for every output pulse.

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Fig. 38-9



## IR TRANSMITTER

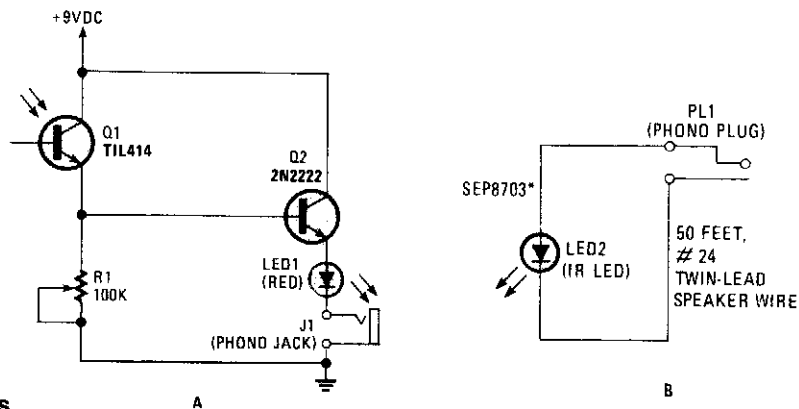


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Fig. 38-10

Using an NE567 as a tone oscillator, this circuit produces an IR signal from the LED, which is modulated with a square wave. LED1 is an IR-emitting LED. The modulation helps improve performance under high ambient light conditions.

## IR REMOTE EXTENDER



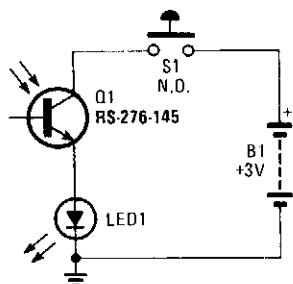
POPULAR ELECTRONICS

Fig. 38-11

This circuit can be used to operate a VCR or CD player from another room. It's really an infrared signal repeater. The signal from the remote is received and then retransmitted over wires to an infrared LED. The beam from the LED is then picked up by the receiving window on the VCR or CD player.

The visible light LED (LED1) in series with the IR unit (LED2) is used to indicate that the transmitted signal has been detected. The 100-kΩ trimmer potentiometer (R1) adjusts the repeater's sensitivity. The resistor that is usually found in series with the LEDs is omitted, because the voltage reading is about 1.0 Vdc as a result of the voltage drop across the lines.

## INFRARED REMOTE CONTROL TESTER

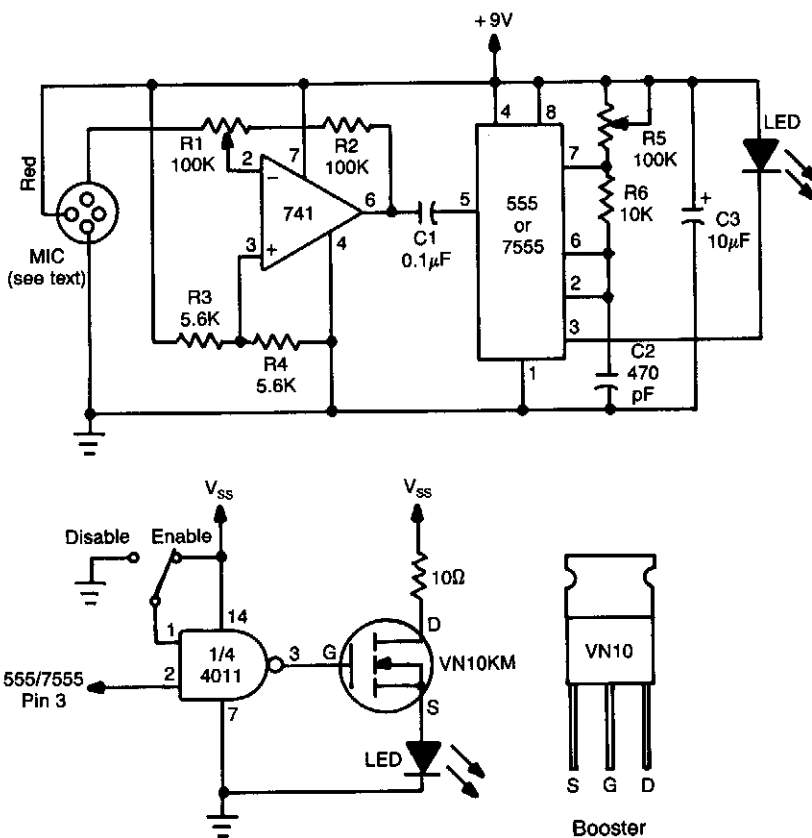


Using a battery, a phototransistor and a visible-light LED, this simple circuit is a "go/no go" tester for IR remote control devices. The illumination of the LED indicates that Q1 is being modulated by IR energy.

POPULAR ELECTRONICS

Fig. 38-12

## VOICE-MODULATED PULSE FM IR TRANSMITTER



POPULAR ELECTRONICS

Fig. 38-13

This circuit has a 741 audio amplifier, which is fed by a microphone (use an amplified type), an FM modulator, and a CMOS timer that acts as a VCO. The LED is pulsed with the timer output (the booster circuit can be used for increased range). This yields an FM-modulated, pulsed IR beam.