ULTRASONIC SWITCH

EM
N. SHARMA
TESTED

Ashok Mehra

Here is a low cost, wireless switch controller. It uses ultrasonic sound waves for remote control of switch.

As with any other remote control, the system basically comprises a mini transmitter and a receiver circuit. Sound of frequency up to 20KHz is audible to human beings. Frequencies above 20 KHz are inaudible. The transmitter circuit generates ultrasonic sound of frequency between 40-50 KHz. The receiver senses the ultrasonic sound generated from the transmitter and switches on a relay.

Fig. 1 shows the block diagram of the ultrasonic switch. The transmitter uses a 555 based astable multivibrator. It oscillates at a frequency of 40-50 KHz. An ultrasonic transmitter transducer is used here to transmit ultrasonic sound effectively. The transmitter runs on a 9V battery. The ultrasonic receiver circuit uses an ultrasonic receiver transducer to sense ultrasonic signals. It uses a two-stage amplifier, a rectifier stage, and an operational amplifier in inverting mode. Output of operational amplifier is connected to a relay through a complimentary relay driver stage. A 9V adapter can be used to power receiver circuit. When switch S1 of transmitter is pressed, it generates ultrasonic sound. Ultrasonic receiver transducer receives the sound and converts it to electrical variations of the same frequency. Transistors Q3 and Q4 amplify these signals. The amplified signals are then rectified and filtered. The filtered DC voltage is given to inverting pin of operational amplifier IC2. The non-inverting pin of IC2 is connected to a variable DC voltage through VR2 which determines the threshold value of ultrasonic signal received by the receiver for operation of relay RL1. The inverted output of IC2 is used to bias transistor Q5. When transistor Q5 conducts, it supplies base bias to transistor Q6. When transistor Q6 conducts, it energises the relay RL1. The relay can be used to control any electrical or electronic equipment.

Frequency of ultrasonic sound generated can be varied by adjusting VR1. Adjust it for maximum performance. Ultrasonic sounds are highly directional. So when you are operating the switch the ultrasonic transmitter transducer of transmitter should be placed towards ultrasonic receiver transducer of receiver circuit for proper functioning. The receiver is always kept in switched on position.

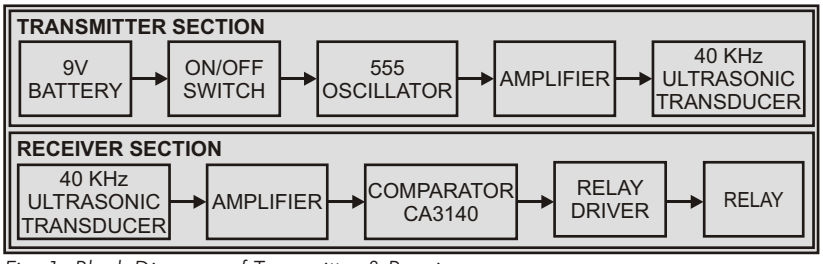

Fig. 1: Block Diagram of Transmitter & Receiver

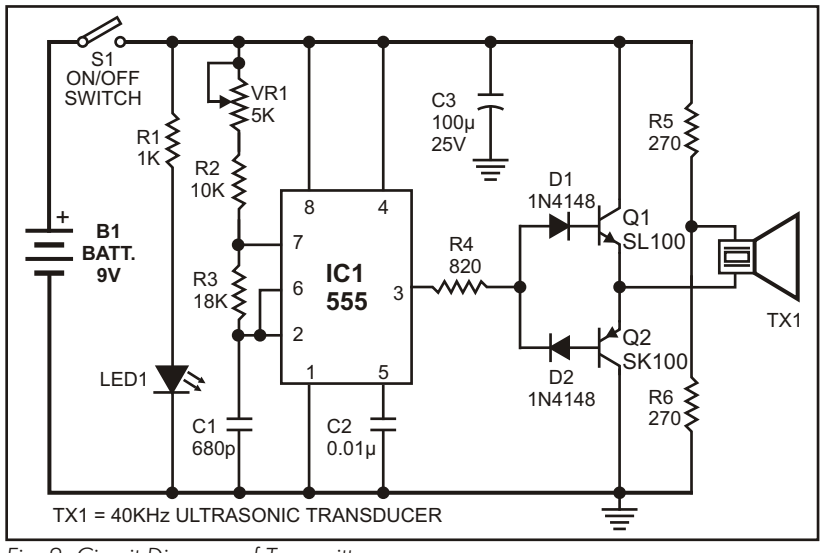

Fig. 2: Circuit Diagram of Transmitter.

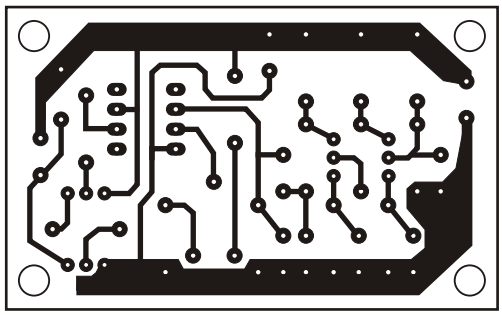

Fig. 4: Actual - size, solder-side PCB layout of Receiver.

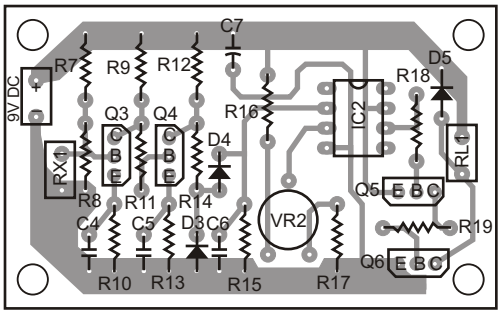

Fig. 5: Component layout for the PCB of Receiver.

SEMICONDUCTORS

IC1	NE555 Timer
IC2	CA3140
Q1,Q6	SL100
Q2	SK100
Q3,Q4	BC548
Q5	BC558
D1-D4	1N4148
D5	1N4007
LED1	Red LED

RESISTORS

R1, R19	1K
R2,R11,R14,R16,R17	10K
R3	18K
R4	820
R5,R6	270
R7	390K
R8	470K
R9,R13	15K
R10	12K
R12	4.7K
R15	100K
R18	27
VR1,VR2	5K

CAPACITORS

C1	680p
C2	0.01u
C3,C7	100u, 25V
C4	0.22u
C5	0.1u
C6	0.56u

MISCELLANEOUS

B1	9V Battery
S1	On/Off Switch
TX1	40KHz Ultrasonic Transmitter transducer
RX1	40KHz Ultrasonic Receiver transducer
RL1	9V, 150 Relay

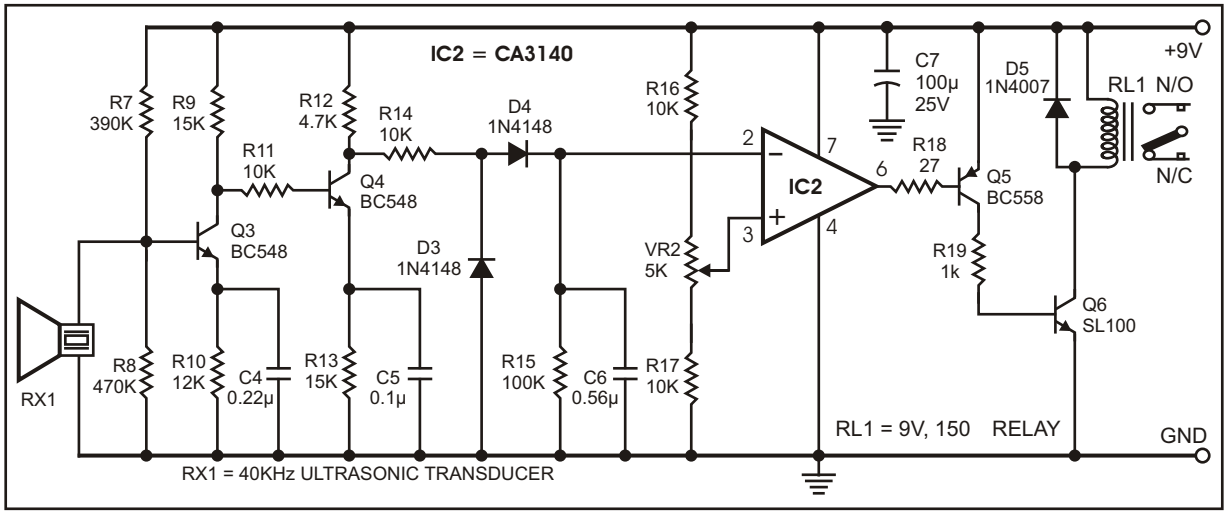

Fig. 3: Circuit Diagram of Receiver.

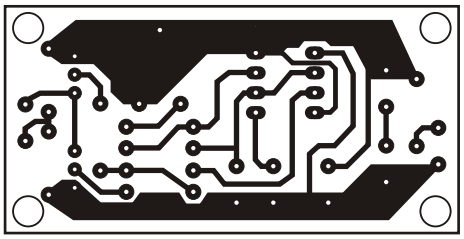

Fig. 6: Actual - size, solder-side PCB layout of Transmitter.

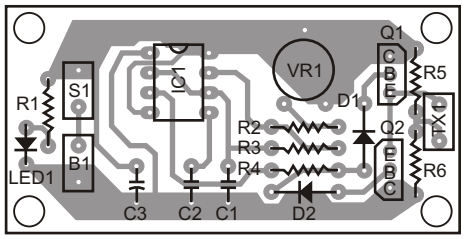

Fig. 7: Component layout for the PCB of Transmitter.