

Versatile Tester with Audio Indication

Each component of this simple oscillator circuit can be replaced to check faulty components, and provide several other applications too!

D. Venkatasubbiah

Here is a simple but versatile continuity tester for checking resistors, capacitors, wiring connections, transformer windings and electric bulbs etc. It not only tests their condition but also indicates the approximate range of component value.

Moreover, it helps in testing semiconductor devices such as diodes and general-purpose transistors. Interestingly, it can identify their leads if their marking of actual pin code on the casing or on the package has been erased. It can even indicate whether it is a pnp or a npn transistor. Thus, an unknown transistor can be easily identified, both for its type and leads configuration, in many cases successfully.

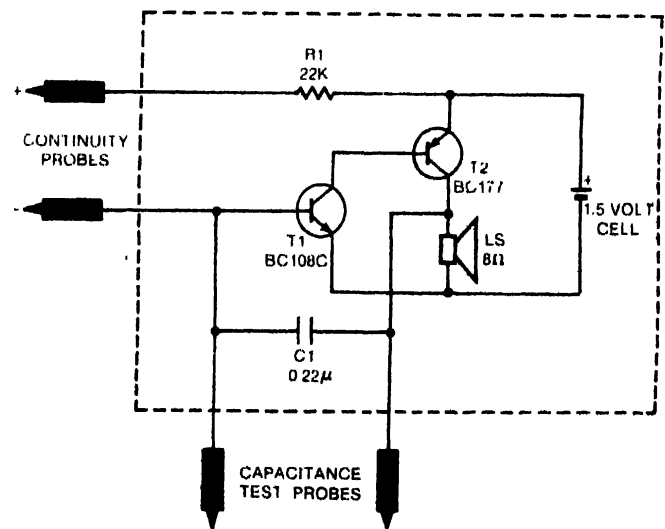
In addition, the tester can probe the condition and quality of loudspeakers and dry cells too. It may be noted that batteries are actually checked here under load and thus give a realistic picture. The loudspeaker is similarly tested under true dynamic conditions, and so even its audio frequency characteristics can be monitored. Testing a loudspeaker with a multimeter or with any simple meter is not possible. But this tester does it!

The tester can also be used as a musical toy, water level indicator, rain alarm, soil moisture tester, body resistance tester and so on. For all this, it requires just five standard components.

Simplicity of the circuit, single 1.5V dry cell operation, and an audible indication are the novel and useful features of this arrangement. Anyone can afford this fail-proof tester which can be fitted in a plastic box of the size of a pocket transistor radio. The speaker alone limits the size of tester assembly.

In the circuit, T1 and T2 form an audio oscillator with C1 in the feedback loop. The two transistor stages provide the

oscillator requirement of proper phasing of 360° between the output and input automatically. The feedback is controlled by the time constant of R1 and C1 which controls the pitch of the tone. The output of the transistors has low impedance and works best into a low impedance speaker of 4 to 16 ohms directly.



The versatile continuity tester circuit which has numerous applications.

PARTS LIST

T1	BC108C npn silicon transistor
T2	BC177 pnp silicon transistor
C1	0.22 μ F polyester
R1	22-kilohm, 1/4 watt, $\pm 5\%$ carbon
BATT.	1.5-volt, penlight cell
LS	8-ohm loudspeaker
	Testing probes, general-purpose board, battery holders, connecting wires etc.

A single 1.5V cell gives enough volume for continuity tests. If one needs more volume, two or even three cells may be connected in series.

The circuit's operation is virtually fool-proof and almost any audio transistor will function in the circuit. The values of R1 and C1 need not be precise. Even T1 and T2 can be interchanged by reversing the battery polarity.

It is not necessary to use any extra switch for switching the tester on and off. When the tester is not in use, the battery faces only the collector to emitter resistances of transistors in non-conduction state of no bias drive. These resistances are high enough to limit the leakage of battery in idle condition. However, if the tester is idle for too long a period, the battery may be removed from the tester circuit to avoid leakage.

As continuity and resistance tester

When the continuity probes are open, the circuit is ineffective and no current flows. On connecting the unit under test across the continuity probes, if there is proper continuity through the unit under test, the sound is heard.

It is possible to test the continuity of electric bulbs, transformer windings, chokes, inductors, electric heaters, stove elements, wires, cables, power cords, hot plates, ovens, switches, TV antennae and printed patterns in circuit boards. However, while testing continuity, the capacitance test probes should be left open.

This continuity tester uses only 1.5V supply and hence is quite safe for testing many sensitive components too. With many multimeters, we are unable to check the continuity of 1M or higher resistors as the needle refuses to move. But this tester emits sound even in that range.

Resistors of near-zero to over 1 megohm can be tested by connecting them across the continuity probes, while keeping the capacitance test probes open. For higher resistances, the tone frequency becomes lower. For very high resistances, instead of a continuous sound only ticking sound is heard. Thus it gives a fairly good indication of the value of resistance under test, by comparison.

As capacitance tester

For testing capacitors, the continuity probes should touch each other and the capacitor under test connected across the capacitance test probes. Capacitors in the range of 0.22 μ F to 250 μ F can be tested easily and directly.

Here also, with high value capacitors, ticking will be heard and the ticking rate becomes slower with higher value capacitors. For testing lower value capacitors, say down to 0.01 μ F, C1 should be disconnected and R1 should be increased to about 150 k. The electrolytic capacitors should be connected with proper polarity, as indicated in the capacitance test probes.

The circuit is safe even while testing a short-circuited capacitor, in which condition it gives no sound. Thus it

indicates the short without damaging itself.

As diode tester

The diode under test should be connected across the continuity probes, keeping the capacitor test probes open. This tester monitors the diode's action and gives an indication of reverse resistance too.

If anode of the diode is connected to positive marked continuity probe and cathode of the diode is connected to negative marked continuity probe, a good diode allows the oscillator to work and so a continuous sound is heard. If the diode's connections are reversed, the reverse resistance comes into the circuit. For an ideal diode no sound should be heard. However, most diodes have limited (very high) reverse resistance which is indicated by a ticking sound. The ticking rate gives the quality of reverse characteristics.

If the diode is open, it gives no sound in both directions. If the diode is shorted inside, it gives the same continuous tone in both directions.

Even if the correct diode leads are not known, this tester can be used to identify the anode and cathode leads correctly. Normally, a dot on the diode's body indicates the cathode terminal. If this dot is not visible, this tester helps to identify the leads.

Because of 1.5V operation, this tester is safe for testing sensitive signal diodes as well. Some multimeters use 3 V, or even 9 V, and are therefore unsafe for testing voltage sensitive components.

As transistor tester

If it is a general-purpose transistor, you can test its leads as well as performance. Short-circuit the continuity probes and make sure of sound from the loudspeaker.

For testing a pnp transistor, replace T2 with it and try it in T2's socket randomly in all of the six possible ways. Change the positions of leads until the circuit oscillates and produces sound. Leads of the transistor in this position obviously correspond to that of the good transistor T2 it replaced. If oscillator refuses to work in any of the positions, the transistor is faulty.

Similarly, an npn transistor can be tested in the socket of T1. If even the type of transistor is not known, it may be tested one by one in sockets of T1 and T2.

Some transistors like AC126 and AC128 give feeble sound when emitter and collector leads are interchanged. This also helps in identifying transistor terminals.

Base-to-emitter and base-to-collector junctions can be tested for diode action by connecting them across the continuity probes. For a npn transistor connect the base to the positive marked continuity probe and connect the emitter and collector one by one to the negative marked probe. Good junctions permit the oscillator to work and sound is heard. If the connections are reversed it should give no sound or only ticking should be heard. Similarly, pnp transistor's base-to-emitter and base-to-collector junctions can be checked. □

As loudspeaker tester

Testing a loudspeaker is tricky. By merely testing continuity of speaker's coil full information is not obtained about the working condition of the loudspeaker. Doubt persists about the paper cone condition and the state of fixture of the coil and the cone. The best course is to test loudspeaker in its actual dynamic state of working for true evaluation. For testing any low impedance loudspeaker, all that is required is to replace the actual loudspeaker in the circuit with the loudspeaker under test and observe its performance. Remember, the continuity probes must be shorted for testing. Put a variable potentiometer either across continuity terminals or in place of R1 and observe the change in sound by varying the potentiometer. Thus, the audio characteristics of a loudspeaker or transistor used can be studied.

Except for the loudspeaker, rest of the circuit can be fitted into even a matchbox. So this simple gadget can help in on-the-spot evaluation of loudspeakers while buying them in the market. This tester is ideal to check the low-cost loudspeakers, no two pieces of which behave identically. For checking quality products this tester may not serve well, except for giving information whether the unit is functional or defective.

As musical toy

Replacing resistor R1 by a potentiometer or by a bank of resistors and switching them into circuit sequentially, changes the tester into a musical toy organ. Choose resistors in the range of 10k to 100k in steps of about 10k for good results. Remember, it needs only single penlight cell, though two cells may be used for more sound.

As water level indicator/rain alarm/soil moisture tester

The continuity probes can be used for water level indication too. When both probes are immersed in water, the tester emits sound. Arrange the probes such that one of them is near bottom of water tank and the other near its top, where the level is to be indicated. Thus it can be used to switch off the water booster pump when water tank is full, on hearing the sound.

For rain alarm, the probes may be left outside in the open, fitted in a container for collecting rain water, with some spacing in between them. When it rains, the rain water or rain drops bridge the circuit to produce an audio alarm.

For soil moisture tester, the probes may be made of two suitable lengths of brass rods. The circuit can be used to test the water content of pot plants. An advantage of this tester is that the probes enable the soil beneath the surface to be checked instead of just relying on its surface condition.

By holding the two probes in both hands, one can also compare the body resistance! The tester produces a ticking sound. If the probes are held more firmly, the ticking rate becomes faster, indicating a fall in contact resistance. Thus, it shows that the contact resistance at the skin constitutes a major portion of body resistance. If the hands are mois-

tened, the ticking rate increases further.

As battery checker

A multimeter tests the battery voltage but not the quality of the battery. The mere testing of open-circuit voltage is not at all an adequate test. The test should be done on load, i.e., while testing a battery voltage with multimeter. Shunt the battery with a load and then test its voltage.

Instead, this simple tester may be used for the same purpose. For testing the battery (or dry cell), connect it in place of the circuit's battery terminals with proper polarity. Of course, while testing single cells if the battery terminals are reversed, it causes no harm, except that the tester refuses to work. The circuit components are quite safe even with reversal of a single cell's voltage.

Quality of battery can be judged from the sound produced. A fresh or good battery gives more sound. An old and used battery produces faint sound. The 'dead' battery produces no sound at all.

You can test batteries or dry cells from 1.5 V to 9 V. Even the button cell used in your watch can be faithfully tested. This also implies that this tester can be powered by even a button cell to make it compact. Short the continuity probes and leave the capacitance test probes open while testing batteries. □

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