SQUEEKIE.

Most forms of test equipment are expensive. For the newcomer to electronics a method of testing a wide variety of components is required. The device described costs about £4 and yet will test the following components:-

Resistors up to 10MΩ,
LEDs,
Transformers,
Diodes,
Cables,
Switches,
Fuses,
Transistors and
Capacitors.

It can also be used for testing Continuity and Insulation of circuits.

It was originally designed as a simple constructional project for students, to enable them to test the components that they salvaged from redundant and broken pieces of equipment. It has also served as a toy for young children, who find that by placing their fingers across the terminals, they can make the device

squeek.

No on/off switch is needed since the quiescent current consumption is much less than 1μA.. In practice a PP3 battery will provide several years of reasonable use.

The circuit diagram is shown below in figure 1.

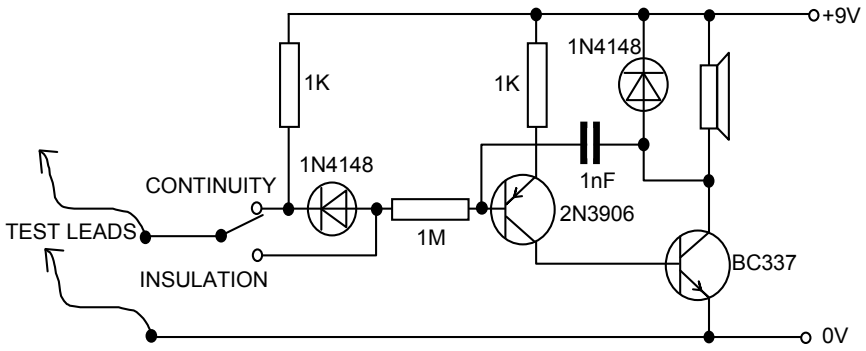


Figure 1

A switch is used to select between the **Continuity** and the **Insulation** setting.

Squeekie is constructed on a piece of fibre glass printed circuit board, and the component layout is shown in figure 2

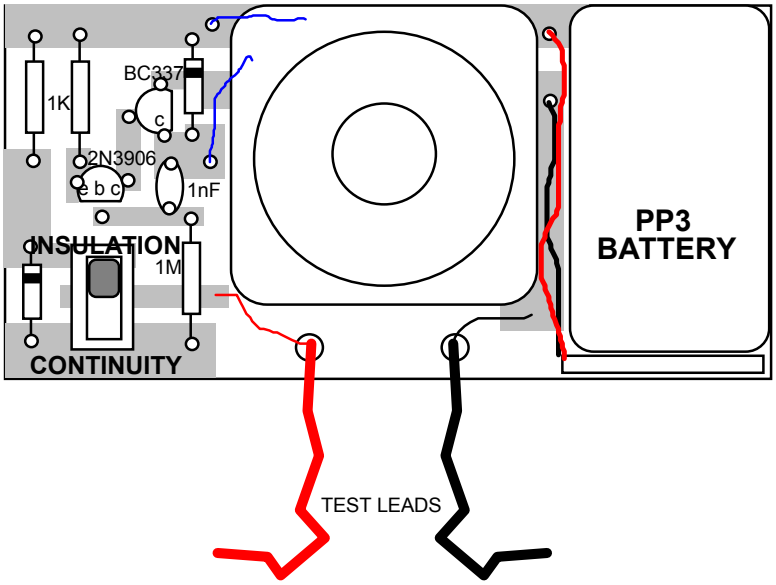


Figure 2

MAKING SQUEEKIE.

1). The copper side of a piece of printed circuit board, 5cm by 10cm, is thoroughly cleaned using an abrasive rubber.

2). The copper side is then wiped with a paper tissue and Propanone (which is a strong degreasing agent). Once the copper has been cleaned it should not be touched since it will contaminate the surface.

3). The copper track layout, shown in figure 3, is cut out (use the spare one at the back of this booklet) and placed onto the copper side of the board. It will need to be held in place with sticky tape.

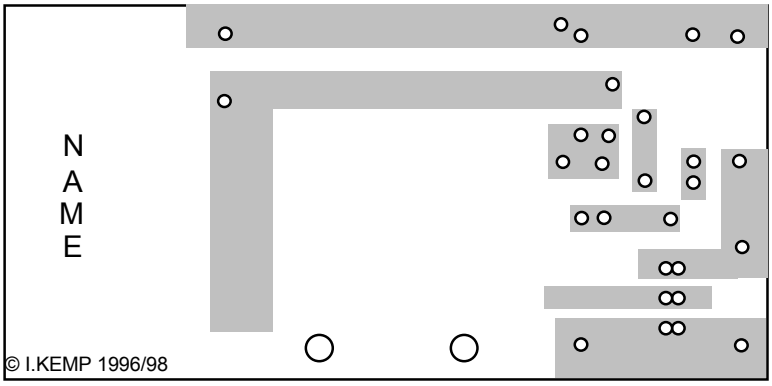


Figure 3

4). A centre punch is used to make a small mark onto the copper, through the paper copper track layout. The mark only needs to be deep enough to see.

5). When all of the holes have been centre punched, the paper layout is carefully removed and a pen containing acid resistant ink is used to join up the marks on the copper board to form the same pattern as shown on the copper track layout. Your name can be written onto the copper, using one of the pens, where there is a blank space.

6). The ink must be left until it is thoroughly dry and then the circuit board is placed upside down into a bath of etching acid. All of the copper that is not covered with ink will be dissolved into the acid.

CAUTION. THE ACID WILL CAUSE DAMAGE IF IT COMES IN CONTACT WITH SKIN OR CLOTHES. USE EXTREME CAUTION WHEN HANDLING THE ACID BATH.

7). When the circuit board has been etched, it must be thoroughly washed under cold running water to remove any acid.
It is then dried and 1mm holes are drilled through the board where they were centre punched. The holes for the switch and leads will then need to be enlarged to 3.5mm using a larger drill.
When drilling circuit boards always drill from the copper side through the board onto a scrap piece of wood.

8). Once all of the holes are drilled, the copper side of the board should be gently rubbed with a fine file to remove burr from the holes. The ink is then removed using Propanone and paper towels. The copper should then be polished with the abrasive rubber again, wiped over with Propanone and then sprayed with a protective plastic layer.(Do this near an open window).

9). When the plastic layer has dried the components can be inserted into the board and soldered. Two pieces of tinned copper wire should be attached to the speaker, and then the speaker should be attached to the circuit board using double sided tape.

10). The circuit is tested by connecting a battery and touching the test leads together. If a high pitched noise is heard from the speaker then all is well and your Squeekie works.

USING SQUEEKIE.

The following components can all be tested for Continuity, with the switch set in the **Continuity** position:-

Fuses,
Leads,
Lamps,
Inductors,
Transformers,
Speakers,
Switches, etc.

The component is connected between the test leads. If the component is not open circuit then there will be a high pitched note emitted from Squeekie. It is also worth testing the leakage on leads, transformers, switches, etc. This is achieved by setting the switch to the **Insulation** setting and connecting the test leads between the different windings on transformers, different leads on multi lead cables or across the terminals of a switch when it is switched off. Any note emitted during these tests indicates poor insulation and the component or cable should be considered suspect.

NOTE. You should not hold the Squeekie leads when making insulation tests since the resistance of your body is much less than the insulation you are testing and so will produce inaccurate results.

CAPACITORS.

To test capacitors use the **Insulation** setting. When first connected there may be a short squeek emitted but this should quickly stop. Any remaining note indicates a "leaky" capacitor. Electrolytic capacitors are naturally leaky and so these should be tested using the **Continuity** setting. Any remaining squeek on this range indicates a very leaky component.
NOTE. Electrolytic capacitors are polarised, i.e. they should be connected the correct way round in the circuit. On "Squeekie" the black lead is negative and the red lead is positive.

An approximate value for the capacitor under test ca be obtained by noting how long the initial note, emitted by "Squeekie", lasts. The longer the note, the larger the value, assuming very little leakage. By comparing the duration of the note with that produced by capacitors of known value, an approximate measurement of the capacitance can be obtained. Remember to short circuit the leads of the capacitor to discharge it before repeating the tests.

RESISTORS.

For resistors up to approximately 10KΩ use the **Continuity** setting. The larger the value of the resistor the lower the pitch of the note emitted by "Squeekie". As with capacitors, it is possible to obtain the approximate value of the resistor by matching the pitch of the note produced by a resistor of known value with that of the unknown value. For resistors larger than 10KΩ the **Insulation** setting should be used.

DIODES.

Use the **Continuity** setting and connect the diode to the test leads. When the band on the diode is connected to the Black wire, there should be a "Squeek". When the connections are reversed there should be no sound at all. To check the leakage of the diode the **Insulation** setting should be used. The diode should be connected with the band towards the red lead. With a silicon diode there should be no sound produced, but with a germanium diode there may be a low pitched note.

LIGHT EMITTING DIODES AND DISPLAYS.

Use the **Continuity** setting. When connected one way round the LED should light and there should be a squeek. When the connections are reversed there should be no sound or light. If a sound is produced without the LED lighting, the LED is faulty.

TRANSISTORS.

The **Continuity** setting is used to check the various "diode junctions" around the transistor. These are shown in figure 4.

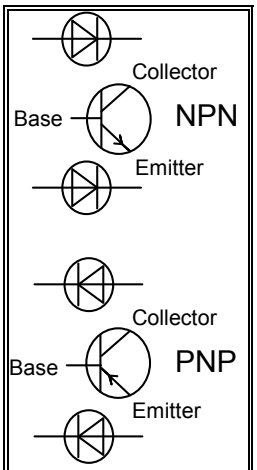
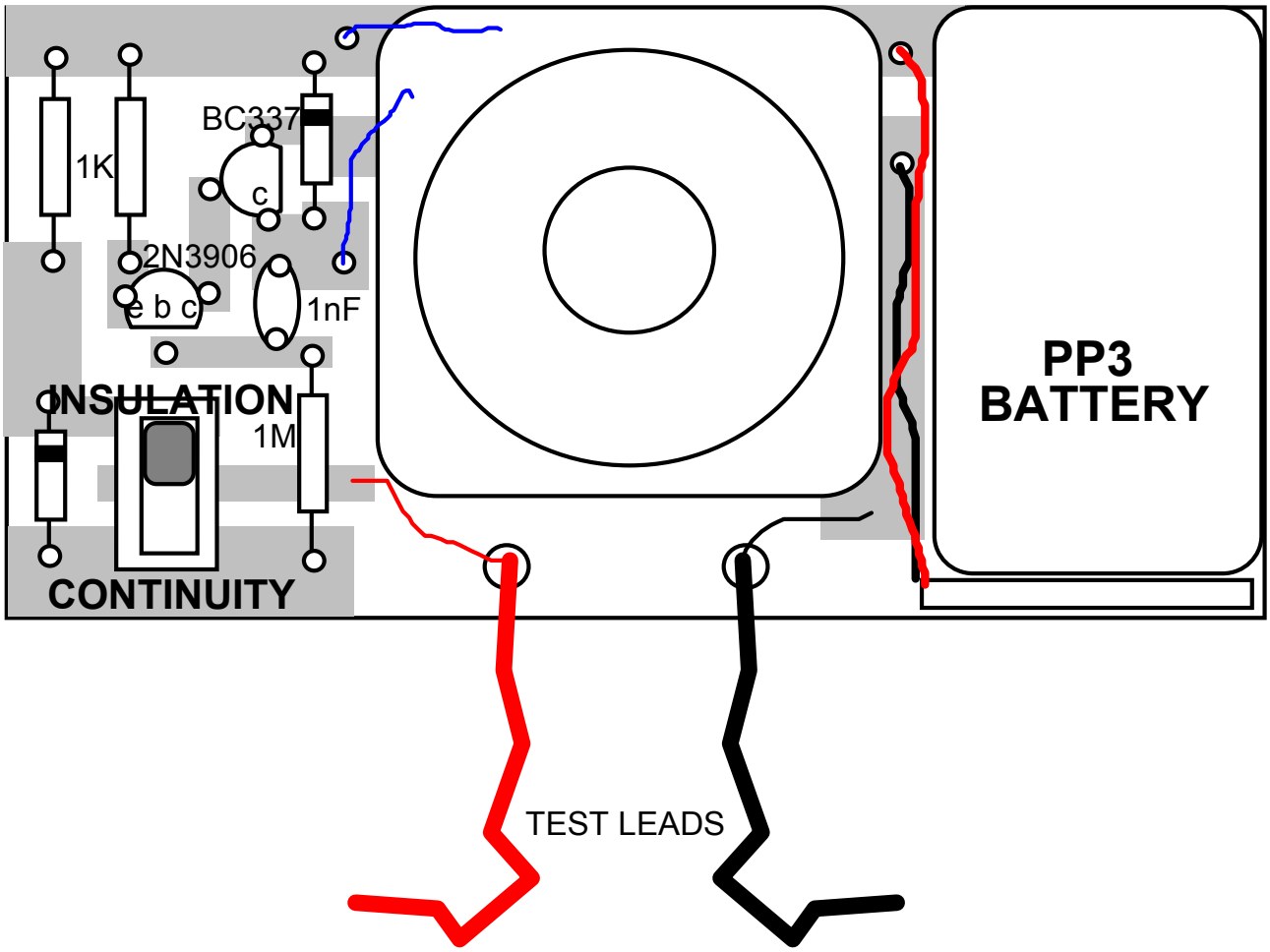
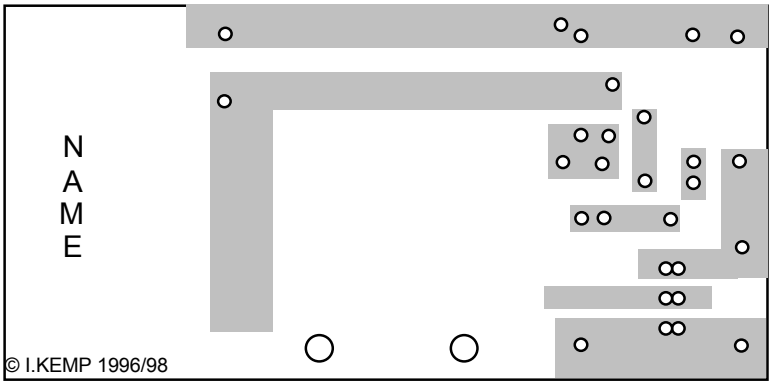


Figure 4


BC337
1K
c
2N3906
e b c
1nF
INSULATION
1M
CONTINUITY
PP3
BATTERY
TEST LEADS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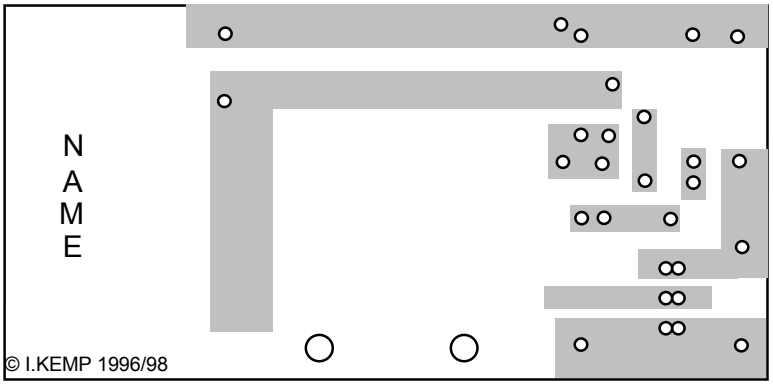
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