

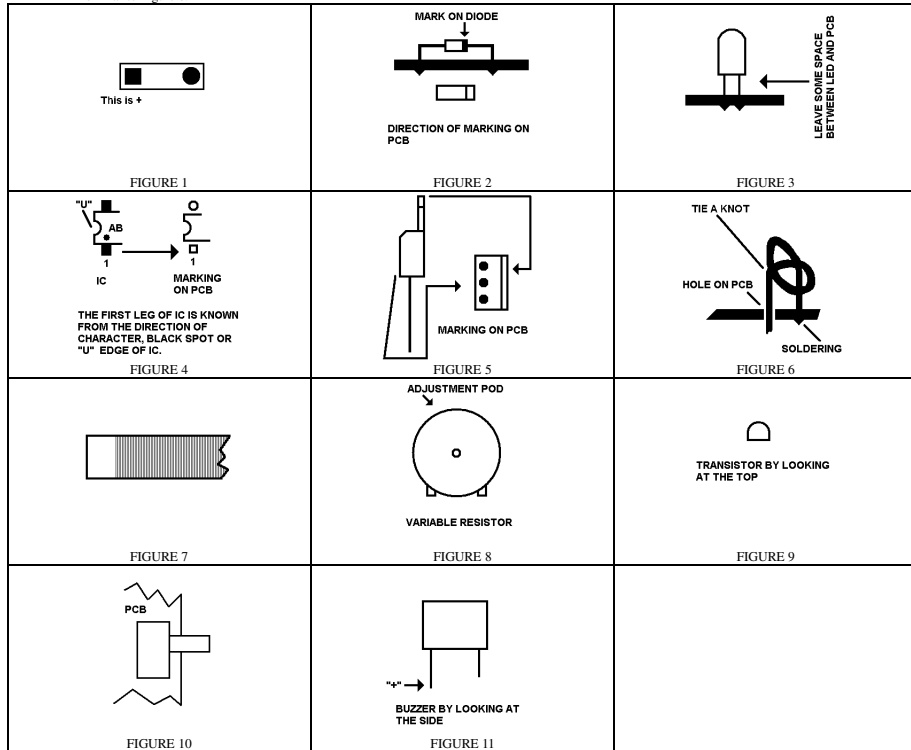
METAL DETECTOR

PRODUCT CODE: M00270036

DESCRIPTION: Using single inductor for both source and sensor for detecting the metal.

READ BEFORE INSTALLATION:

- Put the component on the side of screen printing and solder on the back of PCB without printing.
- Placing direction of component.
- 1. On component, longer leg is "+".
- 2. On PCB marking, square pad as Figure 1 is always "+".
- 3. For diode, please install as Figure 2.
- Do not put the LED to very bottom, just install as Figure 3.
- For any IC, finding out which leg is first leg (FIGURE 4) is important. Also, solder the socket (chair) to the PCB and the IC sit on the top.
- For 9V Battery Adaptor, Red is B+ and Black is B-. Also, please tie a knot after the red and black wire has passed the neighbors hole before soldering. This is similar to Figure 6.



CIRCUIT EXPLANATION:

Please read the below together with the circuit diagram in Figure 12.

I have divided the circuit into seven parts for better understanding.

Part 1 is the oscillator circuit formed by capacitor C6, C7 and inductor. The oscillator circuit is formed because transistor Q1 and Q2 form a phase inverter. The inductor can be seen as source of magnetic field and the sensor of metal detector. When the inductor is close to the metal, the inductor would be seen having a resistor parallel with the inductor (Point A and Point B) with this. You can understand as the inductor transfer the energy to the metal. This energy is, in fact, exist as eddy current on the metal. This mean the resistance of R4 would finally become lower (A resistor is connected with R4 parallel in virtual way). More the metal sensed by inductor, the resistance of R4 would be lower. R4 is a feedback resistor. When the resistance of R4 is lower, more the feedback, then the voltage between point B and ground is lower. The capacitor C3, R2 and R7 is to make sure the sine wave coming from Part 1 would swing at the middle potential between the top and ground so as to prevent clipping of wave. The Operation Amplifier of U1A is just work as buffer. This can isolate the circuit before and after this. Part 3 is to change the AC sine wave to DC voltage signal for detecting at later circuit. The function of C4, D2 and D3 is to make sure that the bottom of sine wave would touch the ground of the circuit. As a result, the peak to peak amplitude of sine wave coming from leg 1 of U1A would become DC signal before entering U1B. U1B is also work as buffer.

Part 4 is an amplifier circuit. This is to amplify the signal before detecting.

Part 5 is a comparator circuit. This is done by U1D. When the metal is close to the inductor, the peak to peak amplitude of original sine wave would become lower, then this compare the voltage coming from voltage divider of V1. When leg 12 is higher than leg 13, the output of leg 14 would be high. So you can see V1 is for sensitivity adjustment of this metal detector.

Part 6 is to tell the user if metal is detected. This is done by the Buzzer BZ and LED L2. When leg 14 of U1D is high, this would turn on the transistor Q3. Then the BZ and L2 would be on.

Part 7 is just for input of power. D1 is to prevent voltage from connecting in wrong direction. VRE is a voltage regulator circuit so that the whole circuit is stable at 5V. This is important in this circuit. For example, the oscillator circuit may not work if the voltage enter and leave Q1 and Q2 is not at wanted voltage.

INSTALLATION:

Just install the component to the PCB M00260061 according to below table.

ITEM	SYMBOL ON PCB	DESCRIPTION	OUTLOOK	DIRECTION IS IMPORTANT?
1	R1	RESISTOR, 330 ohms	ORANGE, ORANGE BROWN	NO
2	R2	RESISTOR, 1M ohms	BROWN, BLACK, GREEN	NO
3	R3	RESISTOR, 220K ohms	RED, RED, YELLOW	NO
4	R4	RESISTOR, 15K ohms	BROWN, GREEN, ORANGE	NO
5	R5	RESISTOR, 220K ohms	RED, RED, YELLOW	NO
6	R6	RESISTOR, 1M ohms	BROWN, BLACK, GREEN	NO
7	R7	RESISTOR, 1M ohms	BROWN, BLACK, GREEN	NO
8	R8	RESISTOR, 330 ohms	ORANGE, ORANGE BROWN	NO
9	R9	RESISTOR, 10K ohms	BROWN, BLACK, ORANGE	NO
10	R10	RESISTOR, 20K ohms	RED, BLACK, ORANGE	NO
11	R11	RESISTOR, 100K ohms	BROWN, BLACK, YELLOW	NO
12	Q1	TRANSISTOR, PNP	FIGURE 9, MARK WITH 9015	YES
13	Q2	TRANSISTOR, NPN	FIGURE 9, MARK WITH 9014	YES
14	Q3	TRANSISTOR, NPN	FIGURE 9, MARK WITH 9014	YES
15	D1	DIODE, IN4001	FIGURE 2 (MOSTLY BLACK)	FIGURE 2
16	D2	DIODE, IN60P	FIGURE 2 (MOSTLY TRANSPARENT RED)	FIGURE 2
17	D3	DIODE, IN60P	FIGURE 2 (MOSTLY TRANSPARENT RED)	FIGURE 2
18	D4	DIODE, IN60P	FIGURE 2 (MOSTLY TRANSPARENT RED)	FIGURE 2
19	C1	CAPACITOR, 0.1uF	MARK WITH 0.1uF OR SAME MEANING OF VALUE	YES
20	C2	CAPACITOR, 0.33uF	MARK WITH 0.33uF OR SAME MEANING OF VALUE	YES
21	C3	CAPACITOR, 22*10E4 pF	MARK WITH 224 OR SAME MEANING OF VALUE	NO
22	C4	CAPACITOR, 22*10E4 pF	MARK WITH 224 OR SAME MEANING OF VALUE	NO
23	C5	CAPACITOR, 10*10E3pF	MARK WITH 103 OR SAME MEANING OF VALUE	NO
24	C6	CAPACITOR, 10*10E4pF	MARK WITH 104 OR SAME MEANING OF VALUE	NO
25	C7	CAPACITOR, 22*10E4 pF	MARK WITH 224 OR SAME MEANING OF VALUE	NO
26	C8	CAPACITOR, 22*10E4 pF	MARK WITH 224 OR SAME MEANING OF VALUE	NO
27	V1	VARIABLE RESISTOR, 10K ohms	FIGURE 8	NO
28	L1	LED	LED	YES
29	L2	LED	YELLOW	YES
30	U1	DIP 14 SOCKET	14 LEGS	NO
31	VRE	VOLTAGE REGULATOR, LM7805	FIGURE 5	FIGURE 5
32	SWITCH	SLIDE SWITCH	SIX LEGS	FIGURE 10
33	B+, B-	9V BATTERY ADAPTOR	RED WIRE, BLACK WIRE	YES
34	A, B	INDUCTOR	FIGURE 7.	NO
35	BZ	BUZZER	FIGURE 11	FIGURE 11
36	ON THE TOP OF ITEM 30	IC, LM324	14 LEGS	FIGURE 4

- After you have connected the inductor to the PCB. Please use some glue or other method for mounting the inductor to the PCB. For example, solder the legs you cut from resistor after installation and forming two pieces of long metal wire. Then use those two long metal wires (Using metal wire for mounting would not have big bad effect to the function of the detector) to mount the inductor firmly on the PCB.
- The 9V battery can be mounted on the PCB with some metal wire with the hole on the PCB.

CIRCUIT DIAGRAM:

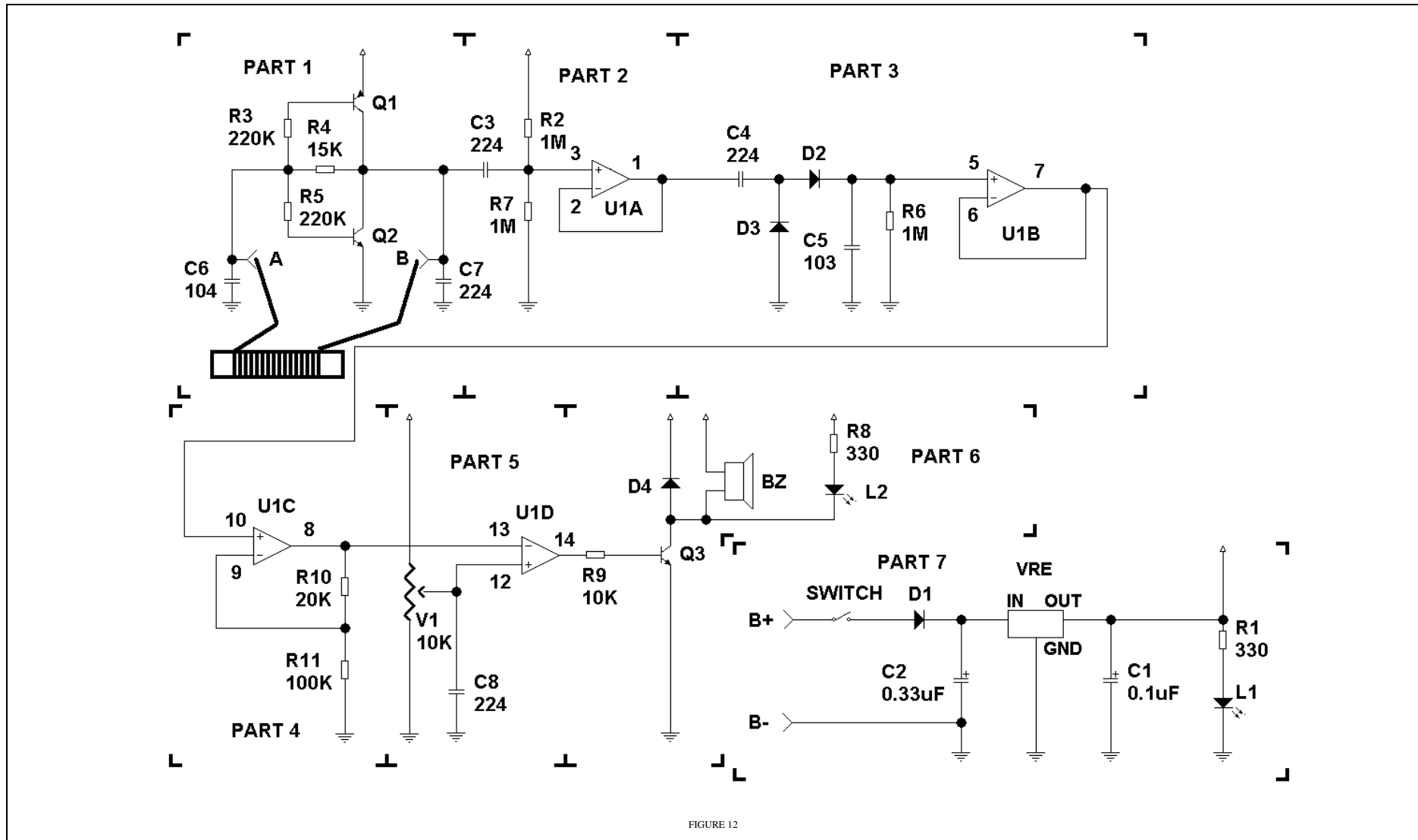


FIGURE 12