

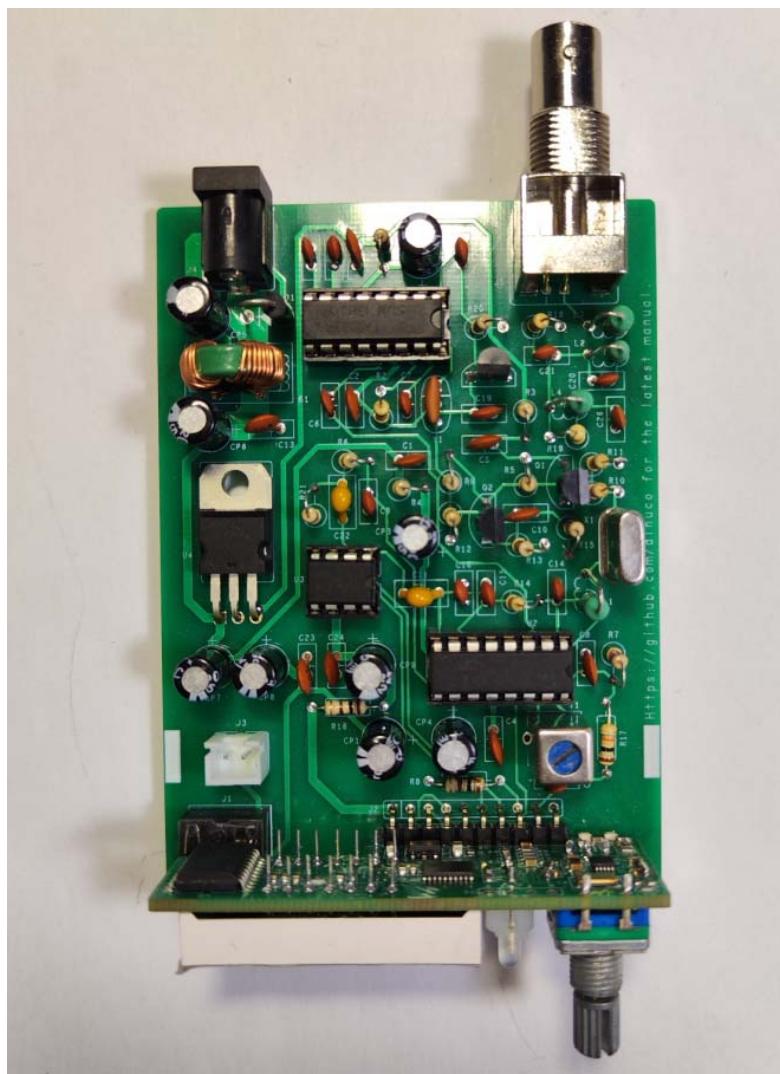
# R10 Shortwave PLL Receiver Kit

## Assemble Manual V9.0

### Overview

This kit is specially for receiving ordinary short-wave broadcast signals, combined with the actual use of the domestic situation, after many optimizations to form the current version.

The hardware described in this article is V9.0 and the main PCB labelled “HM00ABRA\_9”.



### Specifications

Supply Voltage : 12V (It is recommended to use linear regulated power supply or battery)

Current: 110mA

Tuning Range : 3-23MHz

Mode : AM

Step: 1KHz/10KHz/100KHz

### Circuit Description

Refer to the circuit diagram shown on the last page of this document.

The signal received by the antenna first enters the filter network, and the function of the bandpass filter is to ensure that the 3-23MHz signal can enter the source pole following circuit composed of J310, and other signals are attenuated to the greatest extent. The signal is then fed into the TA2003 , and there is a mixer inside the TA2003 that mixes the received signal with the PLL local oscillator signal.

The IF frequency is 10.7MHz, and the signal out of TA2003 is sent to 10.7MHz ceramic filter, whose function is to filter out the irrelevant signal generated by mixing, and then it is amplified by 2N2222, after filtering, the signal is sent to TA7613 for further IF amplification, detection, and audio amplify.

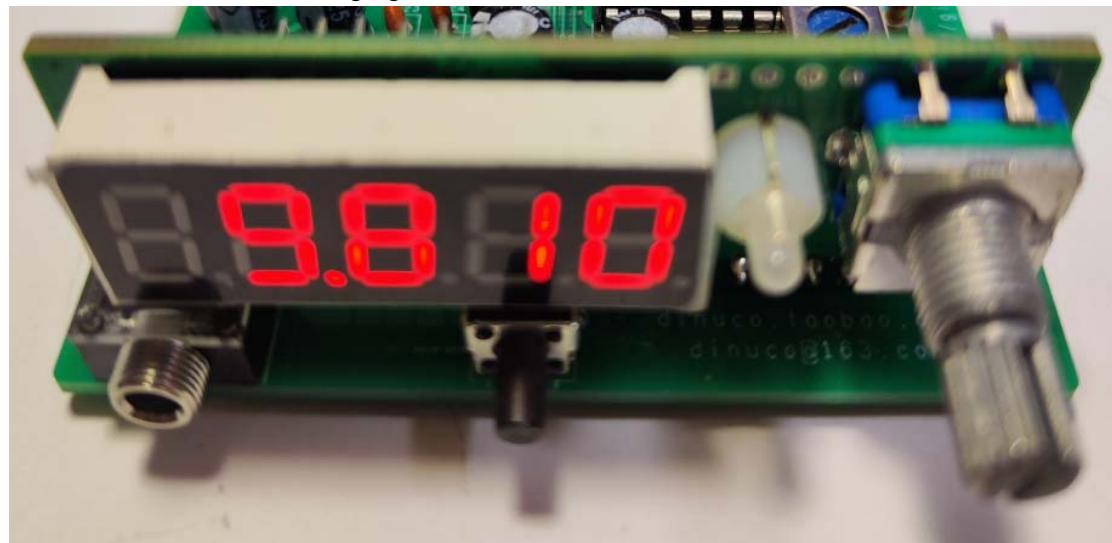
The TA7613 completes the detection of AM signals and has an internal audio power amplifier that can directly drive speakers.

### Component Selection

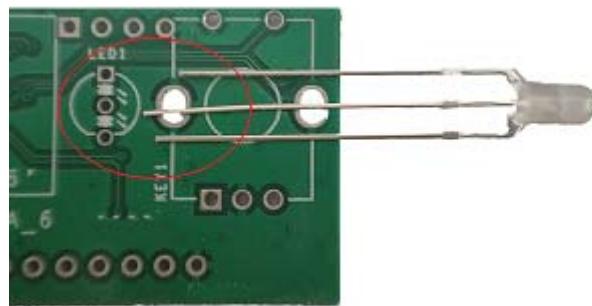
All capacitors less than 1000pF are high-frequency ceramics, capacitors greater than 1uF are aluminum electrolytic capacitors, and all resistors are 1/4W 5% fixed resistors.

### Soldering Reminder

The display board needs to be welded with digital LED and connector plug-in by itself. After installation, the following figure is shown:



Pay more attention to the LED pin direction.



### Assembly and Adjustment

Test all transistors, resistors and capacitors with a multimeter before installing all components. Then install all components against the circuit diagram and the markings on the PCB board.

Generally follow the low to high order of installation. At the same time, install a socket for the integrated circuit, which can effectively avoid welding the core integrated circuit. Everything is in order, check and connect the power supply, the positive and negative polarity of the power supply must not be connected wrong.

Plug the walkman headset into the headphone socket, and you can hear white noise when you power it on. Attach a section of flexible wire about 3 meters to the antenna, and the noise will be heard significantly larger, which means that the RF channel is basically OK.

Debugging steps without instrument:

- 1 Connect a 3-meter cable to the antenna socket and power it on.
- 2 The electric display frequency of the machine is 9.810, and the encoder can be gently adjusted to a certain AM broadcasting station.
- 3 At this time, the ear will appear broadcast sound, adjust T1 so that the noise is the highest and the noise is the lowest.

Do not screw the core in T1. It is recommended to use a non-inductive driver or a plastic driver for adjustment.

The requirements of the power plug (5.5/2.1) are as follows:

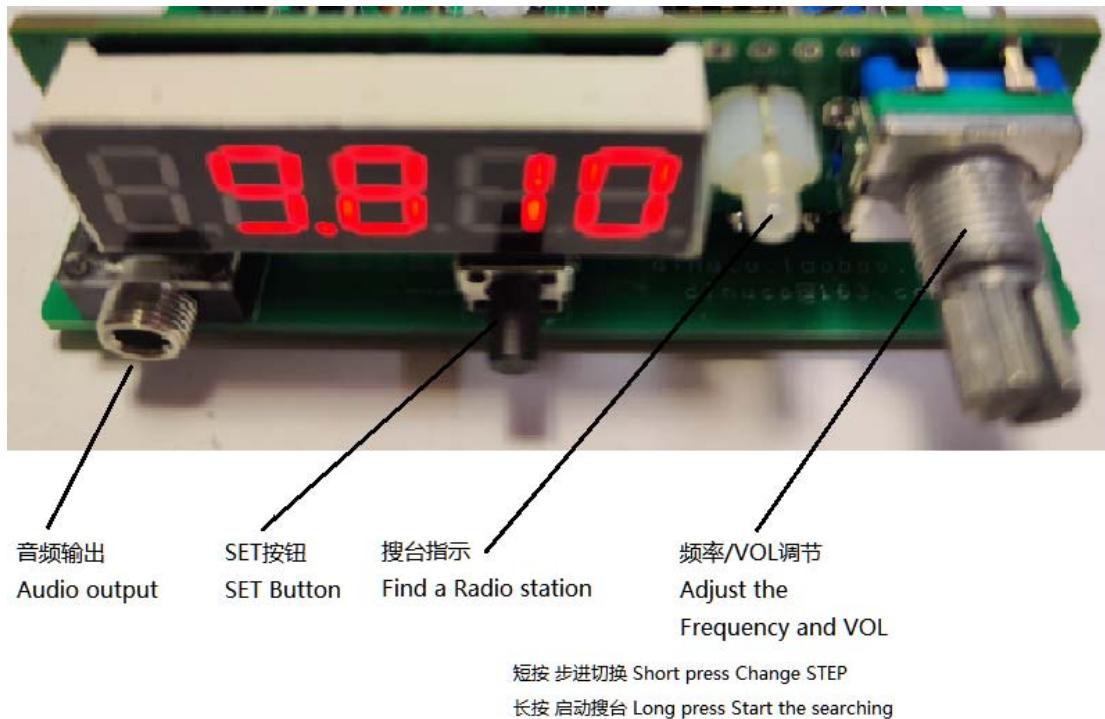


### Chassis mounting

This circuit board can be conveniently placed in a standard aluminum profile case with a size of 76mm\*35mm\*100mm (this case is not included in this kit, please purchase it yourself if necessary).

### Instructions for use

1 After the machine is powered on for the first time, the machine is in frequency adjustment mode by default, and the digital LED displays numbers, representing the frequency value. Turn the encoder and the frequency should follow. Short press the encoder, the step value should change (not in use of the digitizer turns black). The panel displays the following:



2 Do not press the SET button first, rotate the encoder to see whether the display frequency of the digital LED display changes.

3 Connect the antenna, press the SET button, then C1\_15 is displayed, keep pressing the button, exit the configuration mode when C4\_68 is displayed, and enter the working mode again. All modes are described as follows:

C1 15 Sound setting, default 15, can be adjusted between 0 and 25, the louder with the value.

C2 15 Search threshold setting, default 15, can be adjusted between 0-25, the larger mean the stronger signal.

C3 50 IF frequency setting, default 50 (unit: 200Hz), can be adjusted between 0 and 99, indicating that the IF frequency is  $10690000 \text{ Hz} + 50 * 200 \text{ Hz}$ .

C4 68 25MHz Clock offset. The default value is 68 (unit: 100Hz). The default frequency is  $25,000,000 \text{ Hz} + 68 * 100 \text{ Hz}$ . If there are some wander in the receiving frequency, the 25MHz clock frequency on the PLL small board can be measured by the frequency meter, and the clock frequency offset can be adjusted according to the test value.

Note: C3 C4 can only be set with instruments and experience, and the modified value will not take effect immediately. You need to exit the configuration mode and adjust the working frequency to take effect.

Because it takes time to configure the EEPROM in the MCU, do not power off at will during configuration to avoid misoperation.

If the configuration is wrong, do not panic, hold down the SET key, re-power on, the machine will be restored to the default setting according to the SET key state.

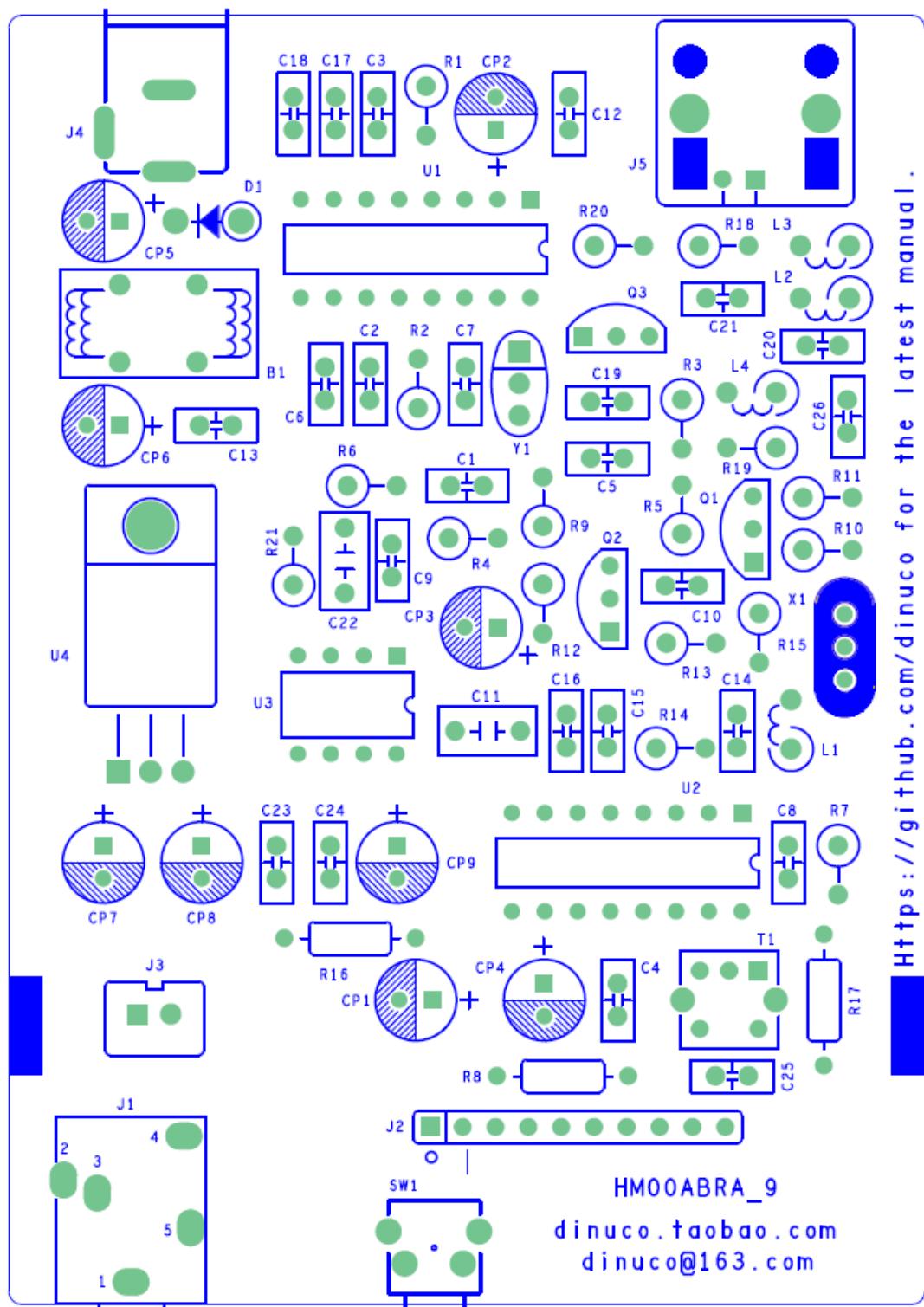
**Parts List**

<b>1/4W 5% Resistors</b>		
R1,R8,R13,R16	100	
R2,R10,R11,R14	1K	
R3,R4,R15	10	
R5	220	
R6,R12,R17	10K	
R7,R9,R21	22K	
R18	100K	
R19	4.7K	
R20	470	
<b>Beads, inductors, transformers</b>		
L1,L4	100uH	
L2	820nH	
L3	4.7uH	
T1	7X7-10.7MHz	
B1	T120604 Common-mode coil	
<b>Chip capacitance</b>		
C1,C2,C3,C4,C5,C8,C10,C 13,C19,C23,C24	0.1uF(104)	
C6	100pF(101)	
C7,C12,C14,C15,C17,C18,	0.01uF(103)	

C21,C25		
C9,C16	4700pF(472)	
C20	1pF	
C26	1500pF	
C11,C22	3.3uF/50V	
<b>Electrolytic capacitance</b>		
CP1,CP5,CP6,CP9	220uF /25V	
CP2,CP3,CP4,CP7,CP8	100uF /25V	
<b>Transistor</b>		
D1	P6KE16A	
Q1,Q2	2N2222	
Q3	J310	
<b>IC</b>		
U1	TA2003 (DIP16)	Have IC socket
U2	TA7613 (DIP16)	Have IC socket
U3	FM62429 (DIP8)	Have IC socket
U4	7805 /TO220	
<b>Crystals and filters</b>		
Y1	10.7MHz	
X1	10M08A	
<b>Other components</b>		
J1	3.5mm stereo socket	PHN (audio output)
J2	CON10 socket	Connected to the LED display board

J3	Speaker socket	SPK
J4	Power socket	5.5/2.1
J5	BNC	
SW1	Button	
Blank PCB board ×1pcs		
The display board includes a circuit board, a 3mm LED, a digital LED display, and an encoder		

### PCB Assembly Drawing



### Resistor Color Codes and Ceramic Capacitor Identification

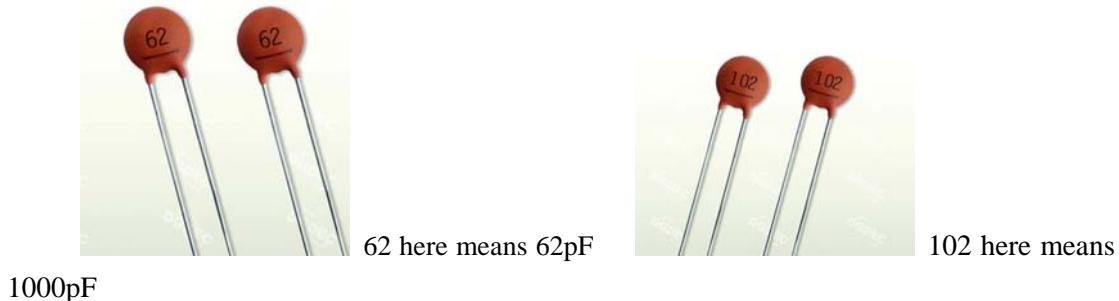
Resistors are marked using colored bands. Most resistors are 5% accuracy parts and marked with four bands. Less common 1% accuracy resistors are marked with 5 color rings. The following table can be used to read the value of these resistors:

**电阻色环对照表**

四环	五环	六环	温度系数 PPM/ $^{\circ}\text{C}$	误差 %	乘数 (W)	代表数值					
			100 50 15 25	$\pm 1\%$ $\pm 2\%$	$10^1$ $10^2$ $10^3$ $10^4$ $10^5$ $10^6$ $10^7$ $10^8$ $10^9$ $10^{-1}$ $10^{-2}$	1 2 3 4 5 6 7 8 9					
			10 5	$\pm 0.5\%$ $\pm 0.25\%$ $\pm 0.1\%$ $\pm 0.05\%$							
			1	$\pm 5\%$ $\pm 10\%$							
10K, 0.5%	470K, 1%	2.2K, 0.1%	15PPM								
黑色	棕色	红色	橙色	黄色	绿色	蓝色	紫色	灰色	白色	金色	银白色

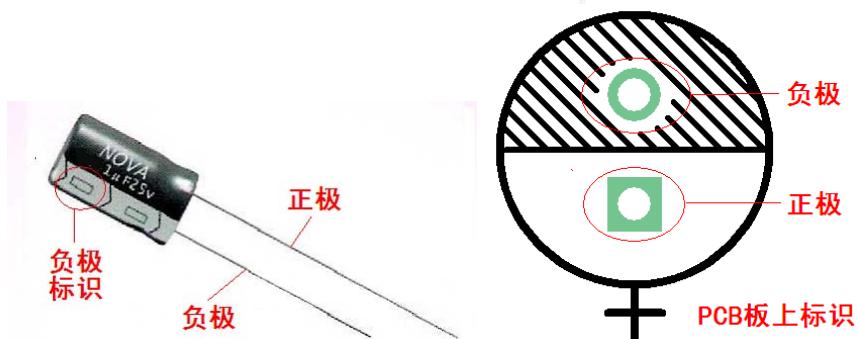
The capacitance of ceramic capacitors is generally denoted in units of pF (p meaning pico or  $10^{-12}$ ). However, some parts are directly labeled, such as 1000p, 220p, etc.

Most are labelled in exponential terms, such as 102,221. The first two digits are two most significant digits of the capacitor's value, the last digit being the number of zeros added after these digits. For example, "102" means that the leading digits are 10, while 2 means that 2 more zeros are added, i.e. 1000pF. Similarly, "221" means that the leading digits are 22, and 1 means that one further zero is added, i.e. 220pF.

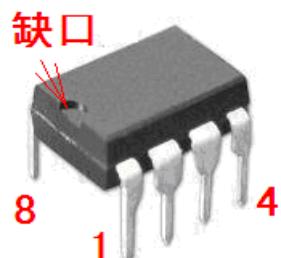


### Polarity of Electrolytic Capacitors

Electrolytic capacitors are polarised. Please make sure that the positive and negative pins of these capacitors correspond correctly to the PCB markings when inserting these parts.



### IC Identification

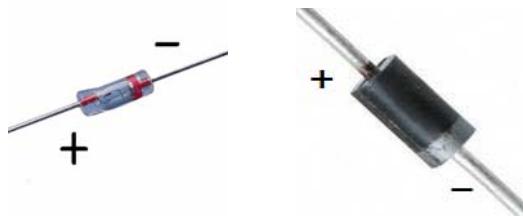


8 脚直插管脚排列

### Identification of Transistors and Diodes



TO-92 package pin arrangement



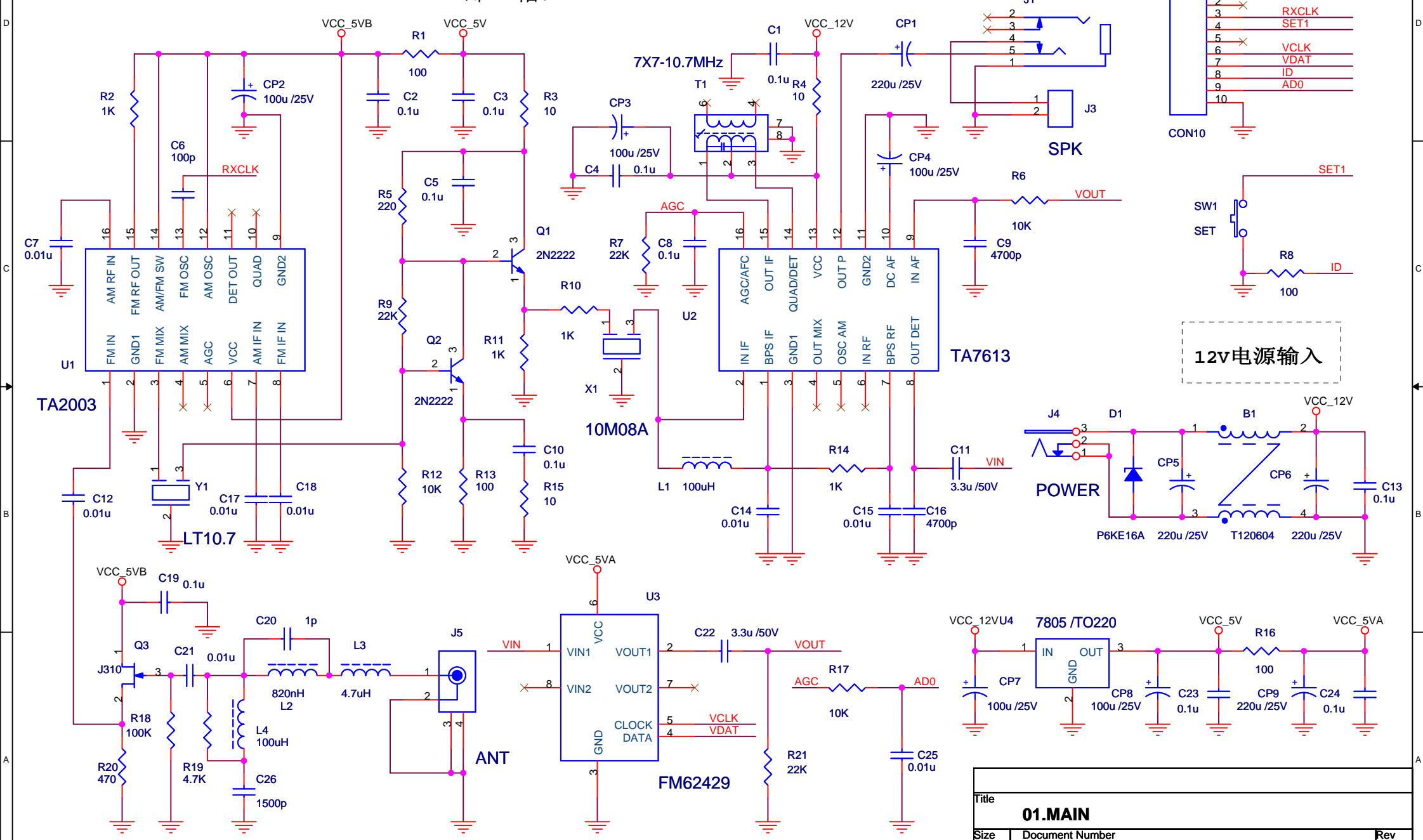
1N4148 diode polarity

P6KE16A diode polarity

# R10 短波PLL接收机电路图 (V9.0)

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