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UNTERSUCHUNG EINES GEMEINSAMEN EMITTER-VERSTÄRKERS IN EINEM BIPOLAREN TRANSISTOR.

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Zusammenfassung: Ein Bipolartransistor ist ein Halbleiterbauelement, das üblicherweise zur Verstärkung verwendet wird. Das Gerät kann analoge oder digitale Signale verstärken. Es kann auch Gleichstrom schalten oder als Oszillator fungieren. Physikalisch verstärkt ein Bipolartransistor den Strom, er kann jedoch in Schaltungen geschaltet werden, die zur Verstärkung von Spannung oder Leistung ausgelegt sind.
In den Dioden-Tutorials haben wir gesehen, dass einfache Dioden aus zwei Teilen Halbleitermaterial bestehen, um einen einfachen PN-Übergang zu bilden, und wir haben auch etwas über ihre Eigenschaften und Eigenschaften gelernt.
Schlüsselwörter: Bipolartransistor, Emitter, Ozyllograph, Generator, Bode-Plotter, Voltmeter, Quelle, Knoten, Widerstände, Elektronik-Werkbank.

INVESTIGATION OF A COMMON EMITTER AMPLIFIER MADE IN A BIPOLAR TRANSISTOR.

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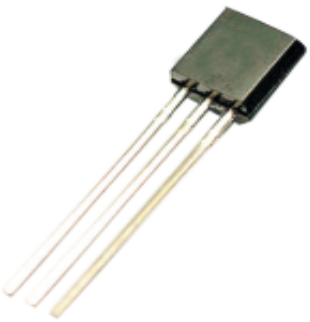
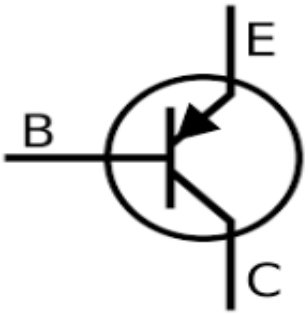
Abstract: A bipolar transistor is a semiconductor device commonly used for amplification. The device can amplify analog or digital signals. It can also switch DC or function as an oscillator. Physically, a bipolar transistor amplifies current, but it can be connected in circuits designed to amplify voltage or power.
In the diode tutorials, we saw that simple diodes are made up of two pieces of semiconductor material to form a simple PN-junction, and we also learned about their properties and characteristics.
Keywords: Bipolar Transistor, Emitter, Ocyllograph, generator, bode plotter, voltmeters, source, knots, resistances, Electronic Workbench.

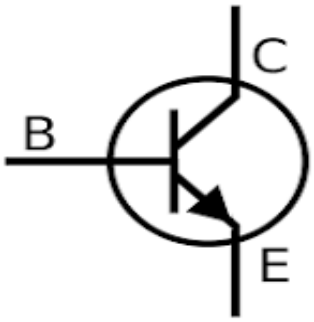
If we now join together two individual signal diodes back-to-back, this will give us Two PN-junctions connected together in series that share a common P or N terminal. The fusion of these two diodes produces a three layer, two junctions, and three terminal devices forming the basis of a Bipolar Junction Transistor, or BJT for short.



Typical Bipolar Junction Transistor



PNP BJT



NPN BJT

Introduction to BJT

Transistors are three terminal active devices made from different semiconductor materials that can act as either an insulator or a conductor by the application of a small signal voltage. The transistor's ability to change between these two states enables it to have two basic functions: "switching" (digital electronics) or "amplification" (analogue electronics). Then bipolar transistors have the ability to operate within three different regions:

Active Region – the transistor operates as an amplifier
Saturation – the transistor is "Fully-ON" operating as a switch
Cut-off – the transistor is "Fully-OFF" operating as a switch

Introduction

A bipolar junction transistor is a three-terminal semiconductor device that consists of two p-n junctions which are able to amplify or magnify a signal. It is a current controlled device. The three terminals of the BJT are the base, the collector, and the emitter. A signal of a small amplitude applied to the base is available in the amplified form at the collector of the transistor. This is the amplification provided by the BJT. Note that it does require an external source of DC power supply to carry out the amplification process.

Construction of Bipolar Junction Transistor BJT is a semiconductor device that is constructed with 3 doped semiconductor Regions i.e. Base, Collector & Emitter separated by 2 p-n Junctions.

Bipolar transistors are manufactured in two types, **PNP** and **NPN**, and are available as separate components, usually in large quantities. The prime use or function of this type of transistor is to amplify current. This makes them useful as switches or amplifiers. They have a wide application in electronic devices like mobile phones, televisions, radio transmitters, and industrial control.

Operation of Bipolar Junction Transistor There is three operating regions of a bipolar junction transistor:

Active region: The region in which the transistors operate as an amplifier.
Saturation region: The region in which the transistor is fully on and operates as a switch such that collector current is equal to the saturation current.
Cut-off region: The region in which the transistor is fully off and collector current is equal to zero.

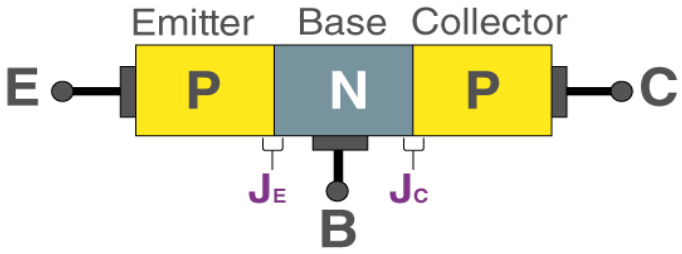
Types of Bipolar Junction Transistor

There are two types of bipolar junction transistors:
PNP bipolar junction transistor
NPN bipolar junction transistor

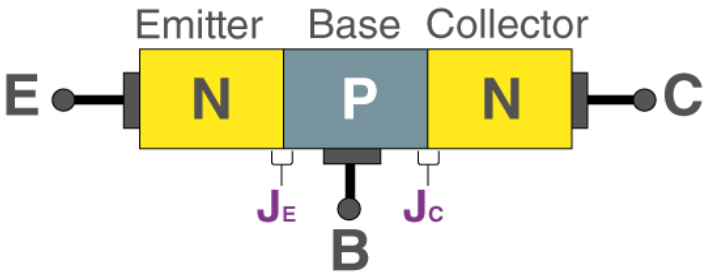
Theory

The Bipolar Transistor basic construction consists of two PN-junctions producing three connecting terminals with each terminal being given a name to identify it from the other two. These three terminals are known and labelled as the Emitter (E), the Base (B) and the Collector (C) respectively.

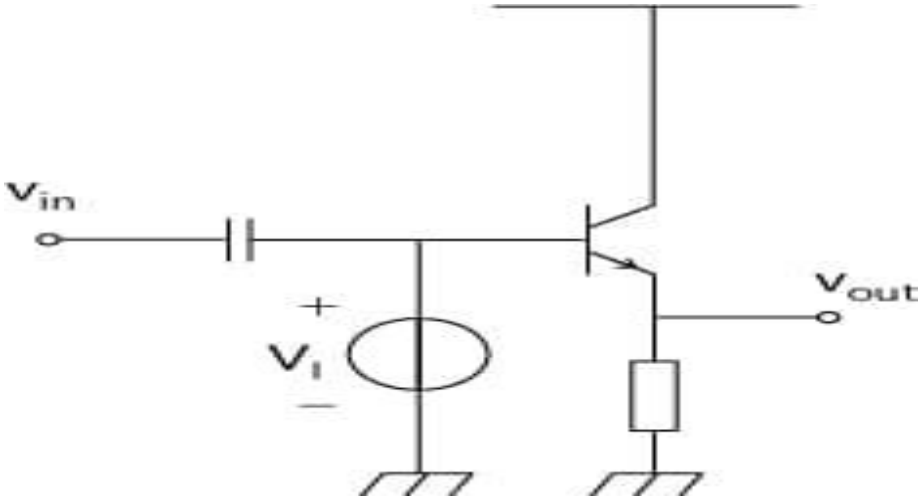
In PNP BJT, the n-type semiconductor is sandwiched between the two p-type semiconductors. The two p-type semiconductors act as emitter and collector respectively while the n-type semiconductor acts as a base.



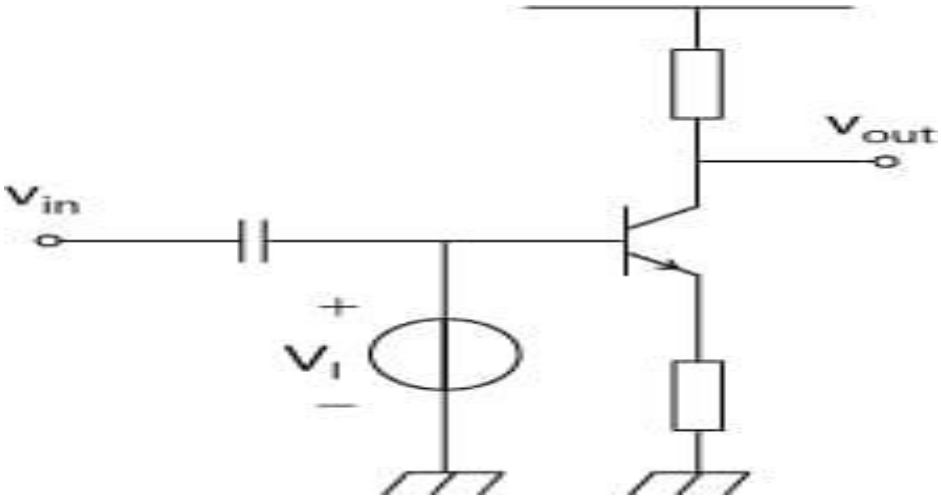
In NPN BJT, p-type semiconductor is sandwiched between the two n-type semiconductors. The two n-type semiconductors act as emitter and collector respectively while the p-type semiconductor acts as a base. This is shown in the figure below.



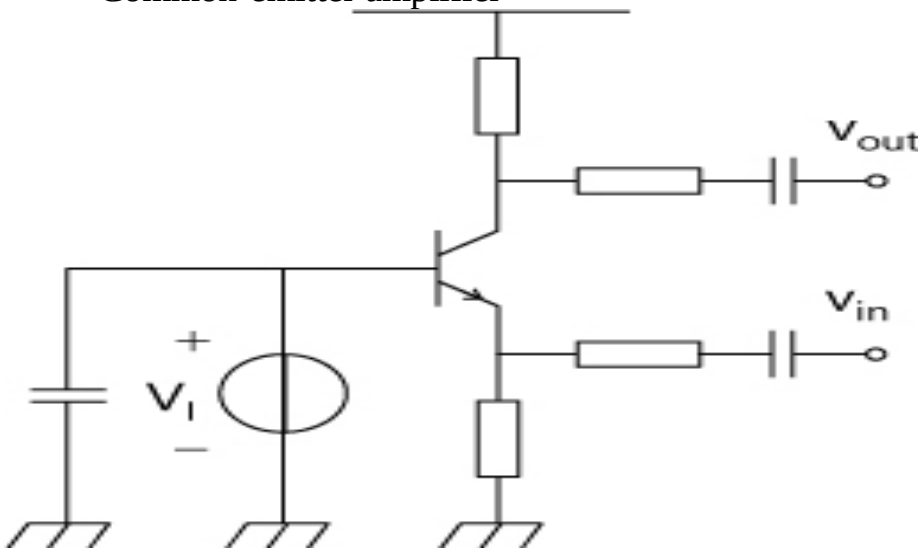
Schematic representation of bipolar transistors



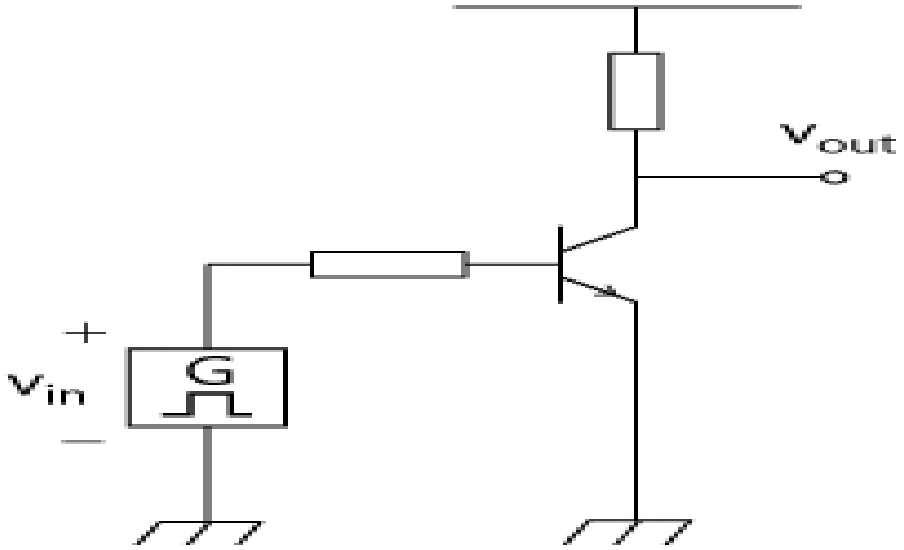
Common-collector amplifier (emitter follower)



Common-emitter amplifier



Common-base amplifier



Switching circuit

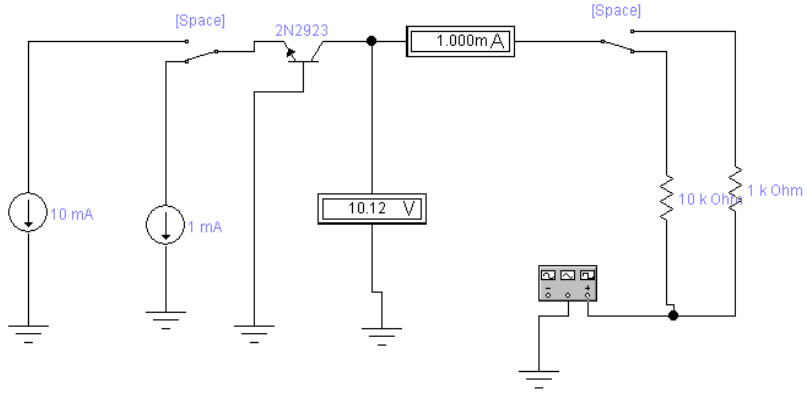
In today's advanced world of electronics, bepolar transistors are used in almost all electronic devices.Training and research of bipolar transistors in the process of training our future engineers is one of the most pressing areas. The study of electronic devices and the observation of their operation is not a complex topic for us today because we have thousands of programs that study electronic devices today.

One such program is the Electronic Workbench, one of the most convenient programs for student work and device research. In this article, we will look at the process of studying a bipolar transistor developed in an electronic workbench program. we study the general emitter amplifier of a bipolar transistor and observe the input and output signals of this amplifier through the oscilloscope.

Results:

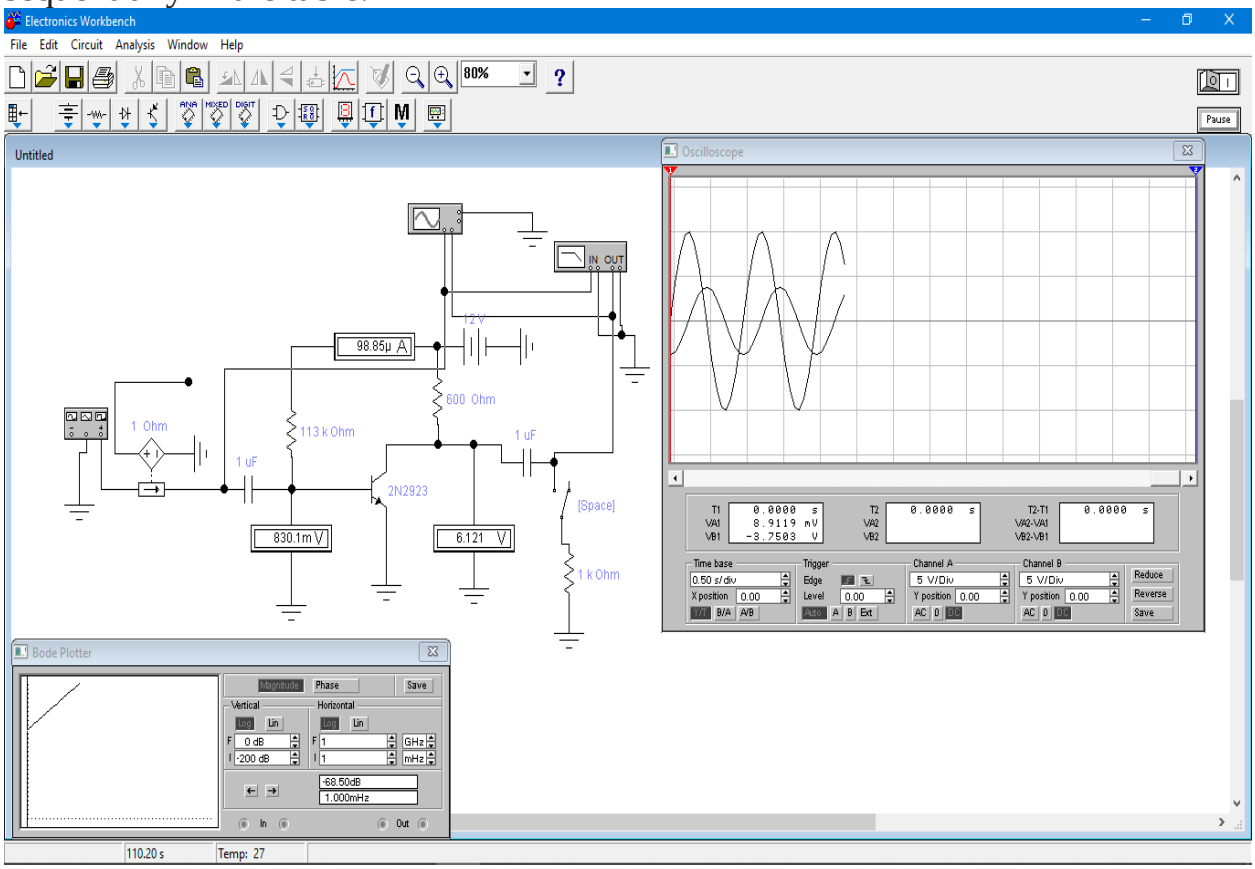
In the electronic workbench, we can create an electronic circuit using a bipolar transistor, and its operation is monitored by computing devices and the results are tabulated.

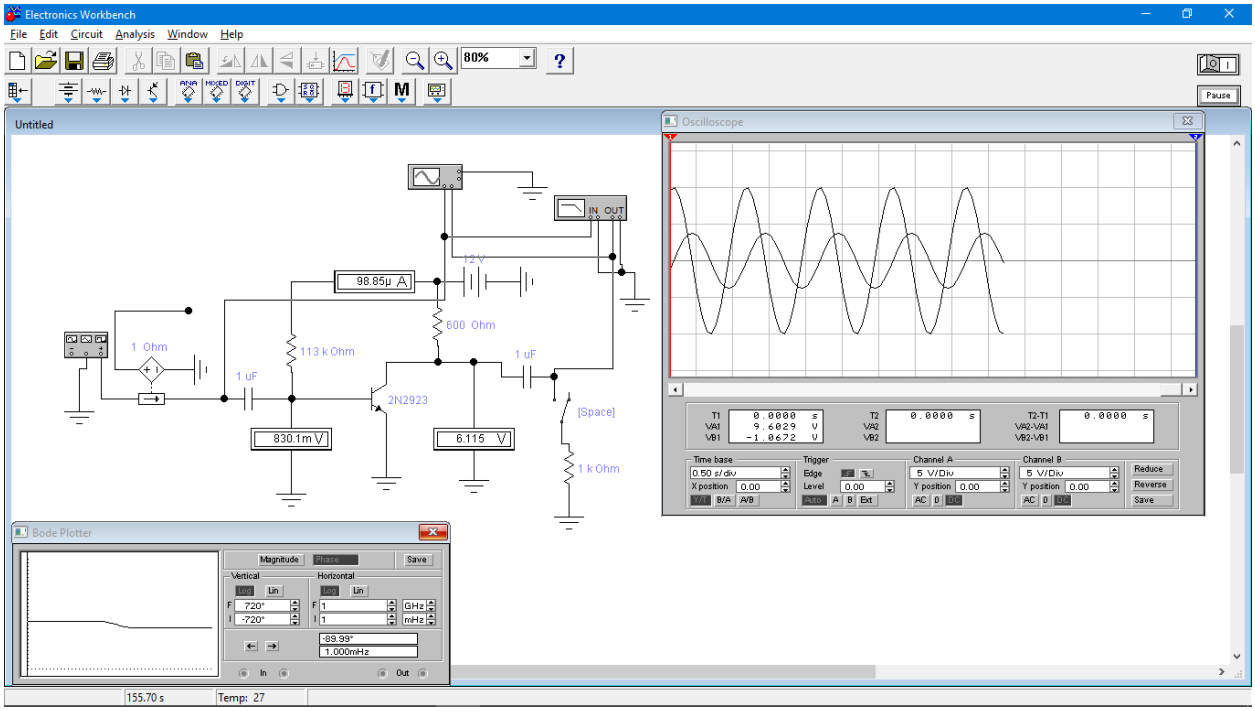
Scheme 1

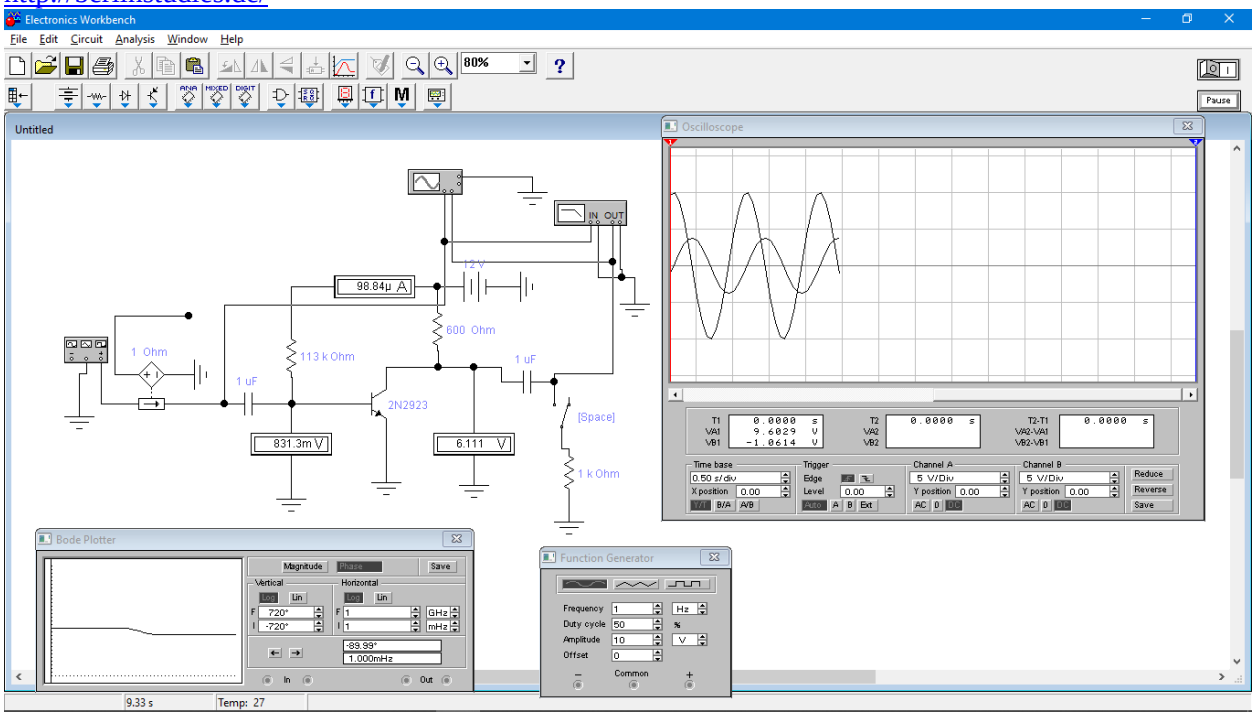


Using our Scheme 1, we explore the process of operating a circuit using an electronic workbench program.

The results of the diagram collected in the workbench program were completed sequentially in the table.







the following was used in assembling the circuit
1.Ocyllograph
2.generator
3. bode plotter,
4.2 voltmeters,
5.9 zazemliniyies,
6.source
7.10 knots
8.3 resistances
9.n-p-n junction transistor 2N2923
10.2 capacitors and several wires were used.

The process of doing work:

1.EWB program was launched and the schematic shown in Figure 1 was assembled.
2.The parameters of the scheme elements are set as shown in Figure 1.
3.The scheme is started by pressing Ctrl + G.
4. The SS connector is connected to a current source of 1 mA, in which case the emitter current is IE = 1 mA
5. The offset parameter of the GEN generator was set to 0 V and the readings of the ammeter and voltmeter were recorded.
6. The readings of the ammeter and voltmeter for each of its values were recorded by varying the GEN from 0 V to 20 V with the step shown in Table 1.
7. The results obtained are given in the table.

1 table

I_E, mA		*Offset*, V										
		0	2	4	6	8	9	10	11	12	15	20

1	U, V	-7.59	-7.00	-6.08	-5.05	-3.36	-2.04	0.52	1.44	2.39	5.25	10.12
	I, mA	0.88	0.28	0.47	0.66	0.84	0.93	0.96	0.96	0.97	0.98	1
10	U, V	-8.17	-7.57	-6.64	-5.36	-3.84	-3.08	0.48	1.44	2.41	5.30	9.91
	I, mA	0.94	2.87	4.78	6.66	8.51	9.42	9.62	9.67	9.70	9.82	10.21

1. Connect the SS to the 10mA power supply of the switch and reconnect points 5,6,7
2. Based on the results obtained, the output characteristics of the connected transistor according to the general basic scheme were performed for the values of the emitter current 1mA and 10 mA.

Conclusion

This article examines the input and output signals of a bipolar transistor. The necessary results for students of electronic specialties of higher education students were analyzed. The methods of assembling the circuit through an electronic workbench were taught and the desired results were obtained.

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