# ROMANIAN ELECTRONIC COMPONENTS IN THE MUSEUM OF THE FACULTY OF ENGINEERING IN REȘITA

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**ABSTRACT:** The work presents a part of the electronic components, passive, active, integrated, linear and digital circuits, produced in Romania, exhibited in the Museum of the Faculty of Engineering in Reșita, with which the students of the Faculty of Engineering worked in applied didactic activities, in the over 50 years of university activity at Reșita. A few of these are still present in some teaching activities in the laboratories, which highlights their quality. In the paper, several types of electronic components are listed, then presented in figures so that, as far as possible, they can be identified by type. Thus, their positioning was done so that identification elements could be distinguished (abbreviations IPRS, IPEE, ME, letter β, component code), and in some cases original labels/packaging containing identification elements were also placed. Alongside, bibliographical sources are indicated, usually company catalogs, in which there is a detailed presentation of the technical parameters of the components. These components, initially made on the basis of licenses from prestigious companies from France, Italy, the USA, but also others, and then as a result of own research, allowed the Romanian electronics industry to be one among the first in the world in the 1970s and 1980s. We believe that the issue addressed is important, in the context where almost all Romanian factories producing electronic components no longer work, but at the same time, the Romanian management factors the problem of Romania's reindustrialization, in which the IT field occupies an important place.

**KEY WORDS :** electronic components, romanian, museum, engineering faculty

## 1. INTRODUCTION

In the period up to 1989, it is known that Romania was geopolitically part of the group of European countries called communist, led by the former USSR. Under these conditions, economic and trade ties with other countries, except for those in the group, were limited. Thus, the development of the countries in this group was largely based on internal resources. However, in the period 1965 – 1989, Romania experienced a remarkable industrial development being supported, by granting licenses, primarily from developed Western countries, due to Romania's relative ideological distance from the USSR, perceived as the main enemy of the USA and Western Europe. The economic development also materialized through the construction of factories producing Romanian electronic components and equipment, a basis for other important sectors of the economy, but also for professional teaching activity, especially in the technical and engineering faculties. In the Museum of the Faculty of Engineering in Reșița [1] (Figure 1), Romanian electronic components and equipment are exhibited that were used in the didactic process of higher education in Reșiţa starting from 1971, the year of the establishment of the Institute of Subengineering in Reșiţa (ISR), as a result of a long industrial tradition of 200 years, then. We believe that knowledge of these aspects is all the more important, as almost all Romanian factories producing electronic components no longer exist, the Romanian industry being destroyed, first of all, due to faulty management, and in these conditions that are

being talked about more and more of a reindustrialization of Romania.


Figure 1 Images from the Museum of the Faculty of Engineering in Reșita

## 2. THE PRODUCTION OF ELECTRONIC COMPONENTS IN ROMANIA

Starting with the 1960s and until the 2000s, Romania produced electronic components, many of them top-notch, mostly based on licenses from France, Italy, USA, Japan, etc. , but along the way, also on a series of own research, considering that in all the companies involved there were research and development teams. The main industrial structures for the production of electronic components were: the Băneasa Radio Parts and Semiconductors Company (IPRS), Bucharest Microelectronics (ME), the Center for Scientific Research and Technological Engineering for Semiconductors Bucharest (CCSIT-S), Tehnoton Iași, the Components Company Passive Electronics Curtea de Argeș (IPEE Curtea de Argeș), Electronics Bucharest, Ferite Urziceni Factory (FFU).

The electronic components produced were those known and still used today: resistors, capacitors, coils, diodes of all types, bipolar and field-effect transistors, thyristors, LED optoelectronic devices and photodetectors, logic integrated circuits from the TTL and CMOS families, current then , programmable and system integrated circuits from the then-current processor families, Intel 8080 and Z80, high-utility integrated linear integrated circuits such as operational amplifiers and of audio frequency, circuits for radio-tv, specialized circuits for some categories of industrial applications. These achievements were also possible due to the fact that Romania had at that time and still has now, a prestigious body of physicist scientists (the transistor, one of the most important inventions in the history of mankind is an achievement, first of all, of physicists, for which he received the Nobel Prize in 1956). The electronic components produced were the basis of the development of the profile industry, which produced high-end equipment such as electronic computers in the Bucharest Electronic Computer Factory (IC Felix), programmable automata and industrial robots at Automatica Bucharest, professional industrial equipment at the Electronic Equipment Enterprise of Industrial Measurement (IEMI Bucharest) radio receivers and televisions at Electronics Bucharest, etc.

## 3. ELECTRONIC COMPONENTS IN THE FACULTY OF ENGINEERING MUSEUM

In the Faculty of Engineering from Reșița (former ISR until 1991), as in all specialized educational institutions in the country, in the theoretical and applied didactic activity, during the period 1971 - 1990, but also later, until the first years after the year 2000, it worked to a great extent with the whole range of Romanian electronic components and electronic equipment equipped with these components.

### 3.1 Passive electronic components

The first passive components used in the didactic application activity in the university laboratories in Reșita were resistors and capacitors from IPRS, some of these types being indicated in figure 2 [2], followed shortly by components from IPEE Curtea de Arges ( Figure 3 )[3].


Figure 2 Capacitors and thermistors produced at IPRS Baneasa


Figure 3 Capacitors and resistors produced at IPEE Curtea de Argeș

### 3.2 Diodes, thyristors and transistors

The bipolar semiconductor components that formed the basis of electronic circuits in the 1960s - 1980s were produced at IPRS, initially under prestigious licenses such as Thomson and ITT, but also others. IPRS produced a wide range of diodes (rectifier, switching, high frequency, varicap, Zenner, etc.) and thyristors, as appropriate, of low, medium, high and very high powers, currents up to 1000 amperes (Figure 4), [4]. [5]. [6]. [7]. [8] Bipolar type transistors, used in the laboratories of Reșita in the didactic activity, are indicated in figure 5 [2]. [8], [9] Also in figure 5 [2] [8] [9] some TEC-J transistors (BF245) are also present, the IPRS also producing such components along the way.

The names of the diodes and transistors produced at IPRS were similar to those already established internationally, and the components were compatible with them in terms of technical performance and encapsulation equivalence and pin layout.

To a lesser extent, activities were carried out with TEC-MOS transistors, created and produced at the ICCE enterprise, which had as its main objective and achieved the obtaining of original products. [10] [11] [12] Their name had as the first two letters RO (obviously from Romania), followed by another letter with the type of component and a group of numbers. Some components are shown in figures 6. [13].

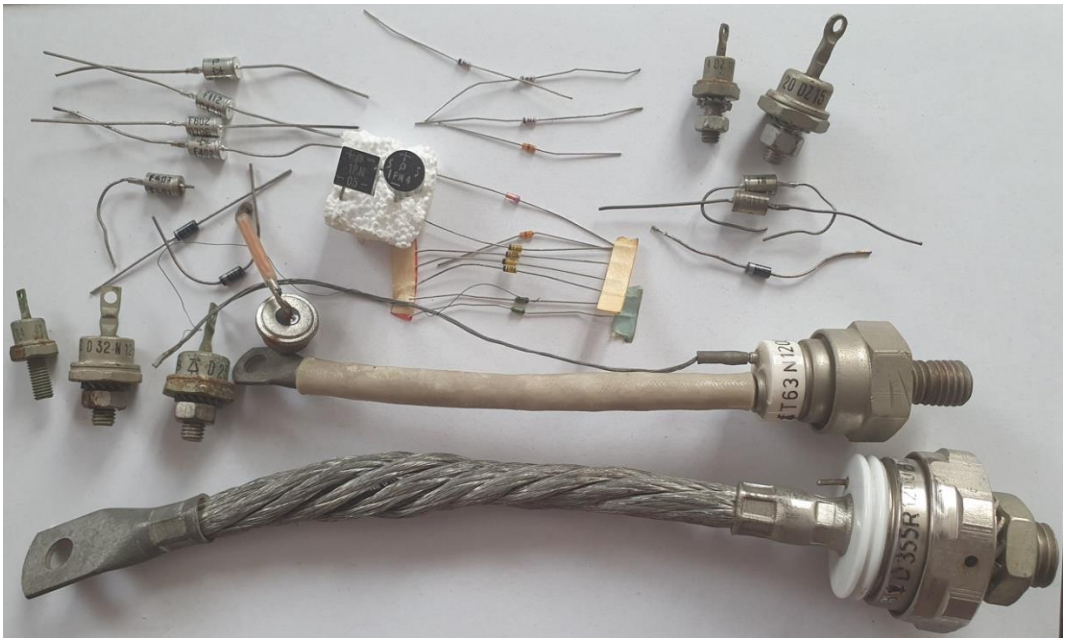

Figure 4 Diodes and thyristors produced at IPRS Baneasa

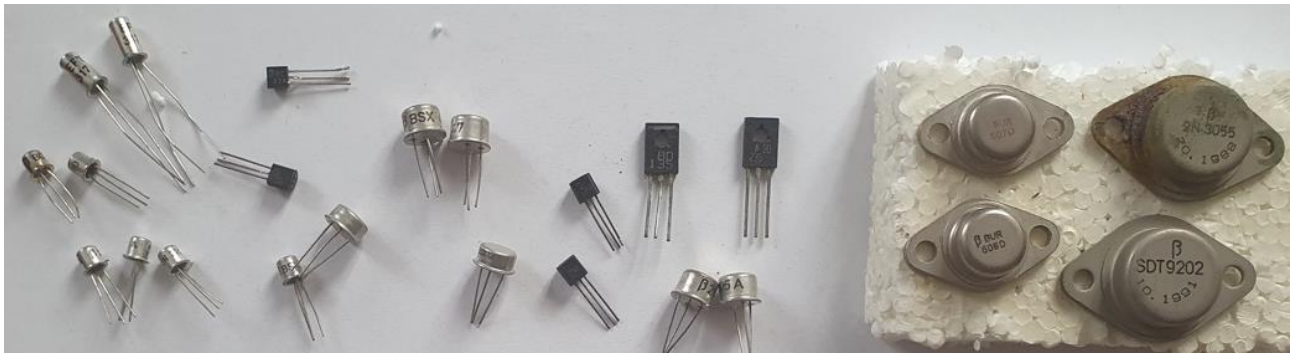


Figure 5 Bipolar and field-effect transistors produced at IPRS Baneasa

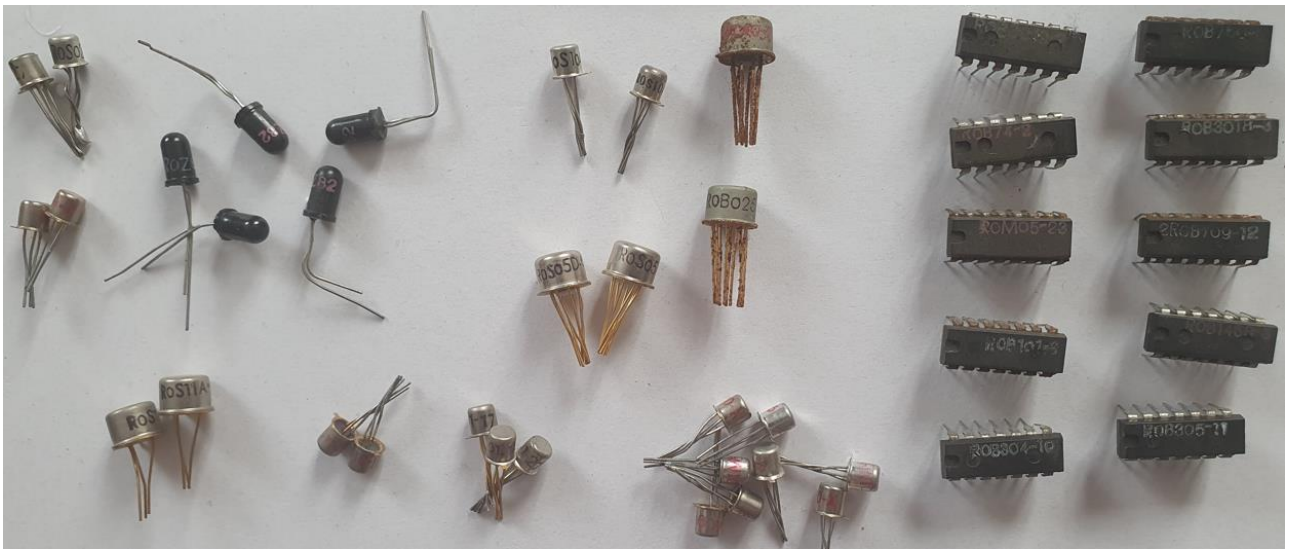

Figure 6 TEC-MOS transistors and linear integrated circuits produced at ICCE Bucharest

### 3.3 Integrated circuits

Digital integrated circuits (another great invention for which the Nobel Prize was

awarded, also in physics, in 2000) began to be used worldwide, on a large scale since the 1960s, in Romania their presence was notable in the 1970s. Initially, bipolar integrated circuits from the TTL to IPRS family were produced, which had the prefix CDB in the name, meaning bipolar digital circuits, followed by a group of 3 or 4 digits. These (Figure 7) [2] [8] were also present in the laboratory works of the students in ISR. They were fully compatible with similar circuits produced by then-largest manufacturer Texas Instruments Inc., which had the SN prefix and the same group of digits, [14] but also with similar components produced by other companies. Working with CDB circuits facilitated students' knowledge of high-end equipment made with similar components, from international manufacturers.

Since the 1980s ISR students have been able to work with CMOS logic integrated circuits, 4000 series, produced at Microelectronica, the most technologically advanced factory of that time, which originally produced under Italian license SGS-ATES. Then the students also worked with other special integrated circuits also made at Microelectronics in NMOS and PMOS technology. The prefixes in the names of the circuits were MMC (Figure 8) [15] [16] for CMOS circuits, MMN for NMOS ones and MMP for the circuits made in PMOS technology.

Towards the end of the 1980s, students could practically get to know the first compatible digital programmable circuits from current families at that time, Intel 8080 and Z80, also produced at Microelectronica, with notation prefixes MMN, MBD (Figure 8) [15]. [16].

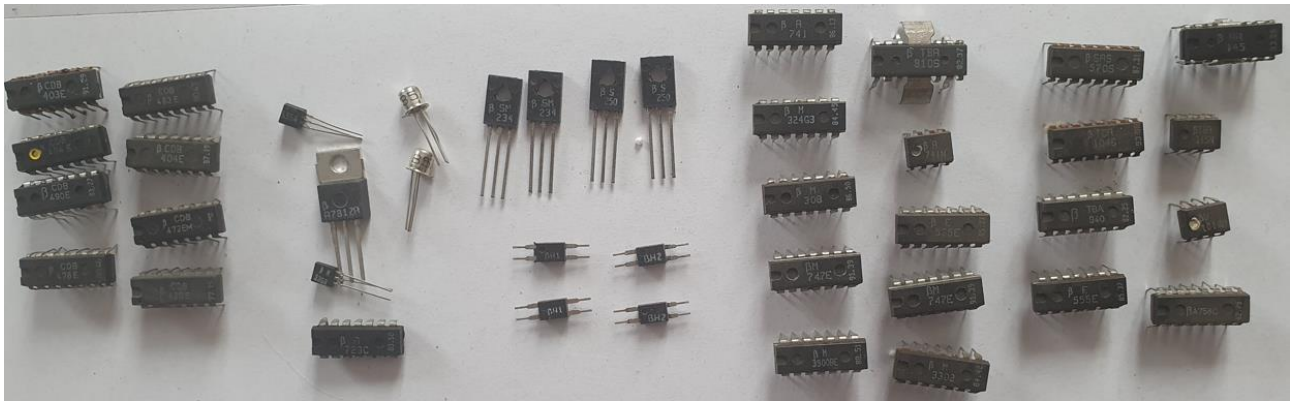

Figure 7 Logic integrated circuits from the TTL family, sensors and linear bipolar integrated circuits produced at IPRS Baneasa

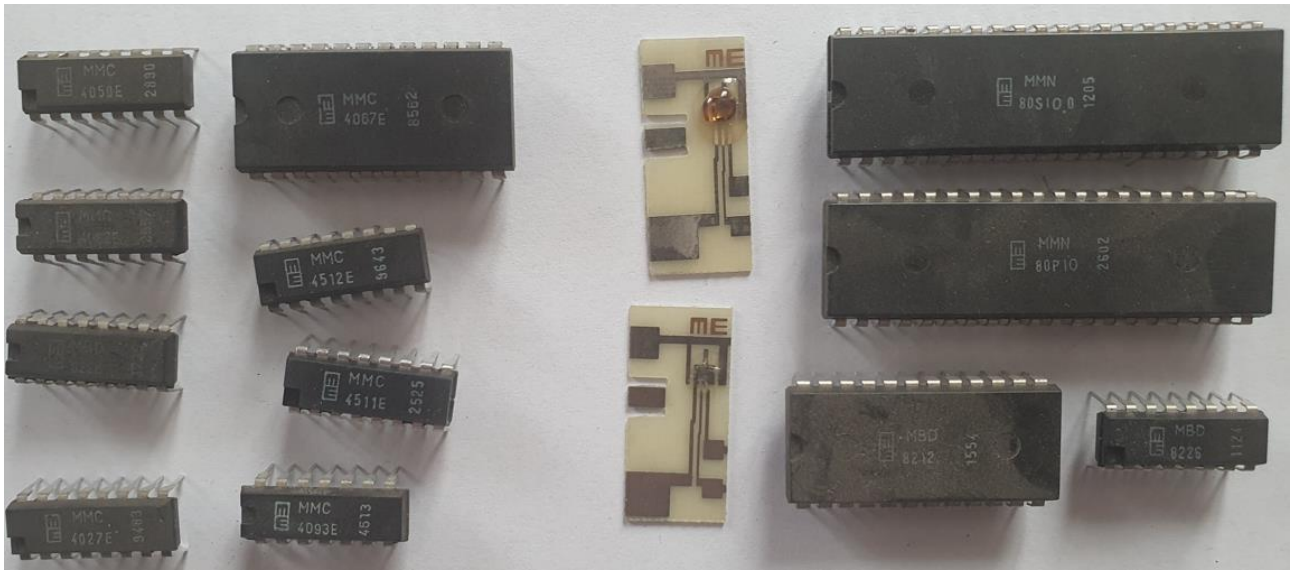


Figure 8 Logic integrated circuits in MOS technology and sensors produced at Microelectronica Bucharest

The main manufacturer of linear integrated circuits, initially based on Western licenses, was IPRS. It produced amplifiers for small signals (including the most successful integrated circuit of all time –β- A 741, in production for almost 60 years, marketed and used today) and large for low and medium frequency, radio and TV circuits, voltage stabilizers, integrated sensors, etc. [2]. [8] [17]. Some components are shown in figures 7 [8] [17]. [18]. [19] [20]. [21].

Although with a much smaller weight, the third Romanian manufacturer of integrated circuits, ICCE, in this chapter, came with its own products not covered by the other two manufacturers, such as circuits for high frequency and microwaves, circuits for data acquisition analog, circuits with a high degree of component coupling for certain special applications such as nuclear and military power. Some of the components that were worked with are present in (Figure 6) [13].

## 4. KITS WITH ELECTRONIC COMPONENTS

In the last years of operation, some companies have produced, at affordable prices, electronic kits with various types of circuits with manufactured components, as is the case with IPRS. They constituted a good practical support for the training of those interested in electronics. In the engineering faculty of Reșita there was a period (unfortunately quite short) when the project activity in the electronics discipline included the elaboration of a theoretical and practical work, with such an electronic putty. In the Museum of the Faculty of Engineering in Reșita, several such electronic kits are exhibited. (Figure 9).


Figure 9 Kits of electronic circuits with components produced at IPRS Baneasa

## CONCLUSION

Starting from the thoughts of the illustrious Nicolae Iorga: "A people who do not know their history is like a child who does not know their parents" and "Knowing history, heroes, tradition, we become more sociable, more altruistic, more loving to people and life", I considered that the realization of a museum of the Faculty of Engineering in Reșita is a necessary, useful and responsible act, and the exhibition of Romanian electronic components in the museum, as part of the history of higher engineering education in Reșita, is a natural act.

The work presents a part of the electronic components, passive, active, integrated, linear and digital circuits, produced in Romania, exhibited in the Museum of the Faculty of

Engineering in Reșita, with which the students of the Faculty of Engineering worked in applied didactic activities, in the over 50 years of university activity at Reșita.

The figures in the work were made in such a way that, as far as possible, the marking of the exposed components could be identified, and in the text of the work, next to the figures, bibliographic notes were indicated, usually product catalogs containing technical parameters. Thus, it is possible that, following the correlation of the photos and the bibliography, the technical parameters of the exposed components, which were worked on in the Faculty of Engineering, will be known, completing the historical picture.

In perspective, it is desired to increase the number of exhibits with pieces from the mentioned period, which are still found in the laboratories and with pieces that have already been brought to the museum space, but which have not been exhibited for various reasons: inadequate condition, lack of space for display.

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