# THE TRANSDUCER OF PRESSURE WITH THE FREQUENCY OUTPUT

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*Abstract* – In the given article the possibility of making the transducer of pressure with a frequency output signal is shown on the basis of the autogenerating arrangement which will consist of bipolar transistor and MOSFET transistor. Analytical dependencies of function transformation and sensitivity are received. Sensitivity of the arrangement 2,0-4,25 kHz / Pa·$10^5$.

## 1. Introduction

The microelectronic transducers of mechanical quantities define precision and reliability of monitoring systems of processes, environmental propertys, safety of operation of nuclear, thermal, chemical installations, aircrafts, sea objects, etc.

One of perspective scientific directional, allowing to solve a complex of the tasks in view suggested in the given operation, use of dependence of jet properties and a negative resistance of semiconductor devices of effect of pressure and making on this basis of a new class of the microelectronic transducers is [1]. In devices of such type there is a transformation of pressure to the frequency signal that allows to establish transducers on integrated technology and enables to boost fast operation, precision and sensitivity, to improve reliability, noise performance in terms of error probability and long-term parameter stability [2].

## 2.Theoretical and experimental researches

The circuit of the frequency transducer of pressure presented on fig. 1. The transistor structure of the frequency transducer of pressure contains bipolar and MOSFET - transistors, and the emitter bipolar to the transistor is connected to sink MOSFET - transistor. Tensiosensitive a element is the bipolar transistor.

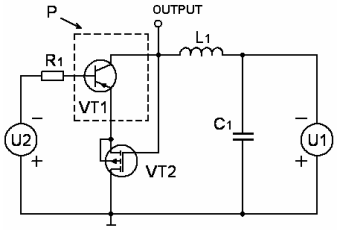


Fig. 1. A circuitry of the transducer of pressure on the basis of transistor structure

The generator of electrical oscillations is created on the basis of transistors structure with a negative resistance. Presence of a differential negative resistance speaks necessity to cancel to them of an energy loss in an oscillation circuit created reactive component impedance on electrodes a collector - sink and an exterior inductive resistance. One of basic characteristics of the transducer is dependence of its function of transformation. Function of transformation is featured by the equation

$$F = \frac{1}{2\pi\left|R_g^{-}(P)\right|C_{EKV}(P)}\left[\frac{R_g^2(P)C_{EKV}(P)}{L}-1\right]^{1/2}, \qquad (1)$$

Where $R_g^{(-)}(P)$ - a dynamic negative resistance of an oscillation circuit, $C_{EKV}(P)$ - the equivalent capacity of a oscillation circuit of the transducer, $L$ - a tuned-circuit inductance. Sensitivity of the transducer is defined on the basis of expression (1) behind the formula

$$S_F^P = \frac{\frac{R_g(P)C_{EKV}(P)\frac{dR_g(P)}{dP}}{L}+\frac{R_g^2(P)\frac{dC_{EKV}(P)}{dP}}{L}}{4\pi R_g(P)C_{EKV}(P)\sqrt{\frac{R_g^2(P)C_{EKV}(P)}{L}-1}} - \frac{\sqrt{\frac{R_g^2(P)C_{EKV}(P)}{L}-1}\frac{dR_g(P)}{dP}}{2\pi R_g^2(P)C_{EKV}(P)} - \frac{\sqrt{\frac{R_g^2(P)C_{EKV}(P)}{L}-1}\frac{dC_{EKV}(P)}{dP}}{2\pi R_g(P)C_{EKV}^2(P)}. \qquad (2)$$

The diagram of function of transformation presented on fig. 2, and the diagram of sensitivity on fig. 3. Apparently from this diagram, sensitivity of the transducer changes from 4,25 kHz / Pa·$10^5$ up to 2,0 kHz / Pa·$10^5$ over the range from 0 up to 12·$10^5$ Pa.

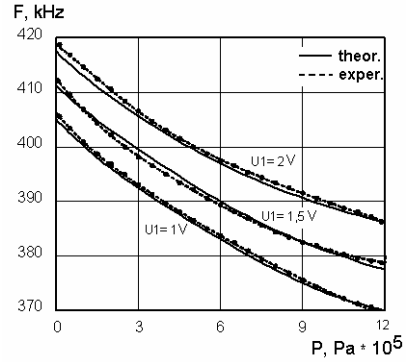


Fig.2. Theoretical and experimental dependences frequency generation of the transducer from pressure

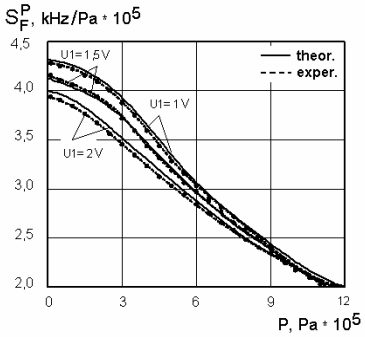


Fig. 3. Dependences of sensitivity of the frequency transducer of pressure

## 3. Conclusions

The integrated circuit of the transducer of pressure with the frequency output is offered on the basis of bipolar and field transistors in which tensiosensitive as a element acts bipolar tensiotransistor on a membrane. Sensitivity of the transducer of pressure makes 2,0-4,25 kHz/Pa·$10^5$ over the range pressures from 0 up to 12·$10^5$ Pa.

## 4. References

[1] Осадчук В.С., Осадчук О.В. Реактивные свойства транзисторов и транзисторных схем. -Винница: «Универсум-Винница», 1999. - 275с.

[2] Новицкий П.В., Кноринг В.Г., Гутников В.С. Цифровые приборы с частотными датчиками. –Л.: Энергия, 1970. – 424с.