UDC: 621.382: 681.586.776

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TEMPERATURE CONVERTER BASED ON IGBT-BJT STRUCTURE WITH NEGATIVE RESISTANCE

Анотація. У роботі аналізується сучасний стан розвитку перетворювачів температури на основі піроелектриків, представлений та описаний новий перетворювач температури на основі транзисторної структури з від'ємним опором, змодельовано вольт-амперну і частотну характеристики даного пристрою в програмному середовищі Pspice.

Ключові слова: біполярний транзистор з польовим керуванням (БТПК), біполярний перехідний транзистор (БПТ), піроелектричний перетворювач температури, активний генератор, структура з від'ємним опором, датчик потужності випромінювання, піроелектричний детектор.

Abstract. The paper analyses modern development status of temperature converter on the basis of piroelectrics, represents and describes a new temperature converter on the basis of transistor structure with negative resistance, simulates current-voltage and frequency characteristic of this device in the software environment Pspice.

Keywords: insulated gate bipolar transistor (IGBT), bipolar junction transistor (BJT), piroelectric, temperature converter, active oscillator, structure with negative resistance, emanation power transducer sensor, piroelectric detector.

Piroelectric substances find wide application as touch sensitive devices of different function, detectors and receivers of emanations, thermal sensor instruments [1]. Their key property – any kind of radiation which hits the piroelectric sample, causes modification of its temperature and corresponding alteration of polarisation [1]. The main input influence on piroelectric transducers is a thermal one, with several operations – thermal and mechanical, thermal and electrical and so on. Listed operations irrespective of their physical nature on character of creation of an electrical signal are divided into generating and parametric, in this connection a dual circuit of a piroelectric sensor control is possible to present in the form of parallel (during current measuring) or consecutive (during power measuring) capacitor and oscillator joint (current source or voltage) [1].

We suggest to include this IGBT into the schema with the bipolar device

for creating structure with a negative resistance for the purpose to create self-oscillator. The schema of such metering device is given on fig. 1.

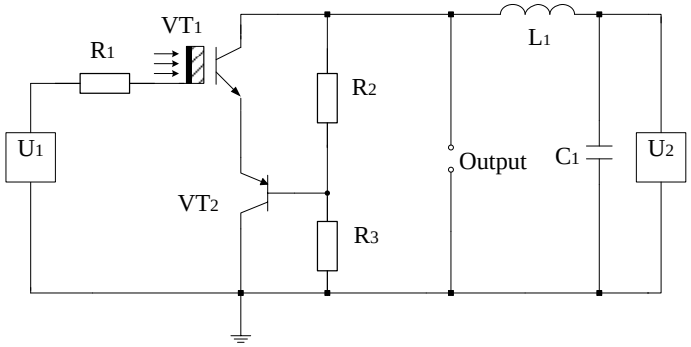

Fig. 1. The converter of temperature on the basis of the IGBT-BJT structure with a negative resistance

As is seen from fig. 10 the device contains first voltage source U_1 that is connected by one pole to the gate IGBT VT_1 with raised dust on baseline a film of piroelectric and an absorber of emanations, and the other pole to the collecting channel BJT VT_2 which is connected to ground connection, emitter IGBT VT_1 is connected to emitter BJT VT_2, and collecting channel IGBT VT_1 is connected to passive inductance L_1, baseline BJT VT_2 is connected between the sequentially connected resistors R_2 and R_3 which are in bridge connected by other poles to IGBT-BJT structure, and also in bridge to transistors VT_1 and VT_2 passive inductance L_1 and capacitor S_1 and the second voltage source U_2 is connected.

Having analyzed physical basis of piroelectric sensors operation, the existing methods of temperature measuring on the basis of piroelectrics, the authors suggest the new device for measuring temperature on the basis of IGBT-BJT structures with negative resistance.

The dependence of reactive properties of IGBT-BJT structure with negative resistance on the temperature is proved and conversion temperature in frequency signal happens in the the metal-pyroelectric-semiconductor structure with negative resistance, which allows create temperature converter, which is working on a "temperature - frequency" principle.

There had been simulated the operation of device for measuring temperature on the basis of IGBT-BJT structures with negative resistance in software environment Pspice, in the result of which there had been received the voltage-current characteristics and frequency characteristic.

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Microwave and Telecommunication Technology (CriMiCo), 2013 23rd International Crimean Conference. 8-14 Sept. 2013. –P. 1069 - 1070.