Leibniz Ferdinand Braun Institut

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GaN based THz camera - broadband, high sensitivity & fast response at room temperature

FBH develops highly sensitive, fast-response and broadband terahertz (THz) power detectors for CW and pulsed operation based on its in-house GaN HEMT MMIC process. The THz power detectors are scalable in frequency as well as in manufacturing costs and are also very compact. To achieve this, different types of epitaxial structures, detector layouts and antenna structures have been investigated.

The detectors are based on miniature transistor structures, which can be realized as integrated or packaged arrays. A patent-protected design for FET-based THz detectors is available for use at ambient temperatures. Due to the inherent high breakdown voltage and high current capabilities of FBH's GaN HEMT MMIC process, the detectors are particularly robust. This offers the unique opportunity to tailor both transistors and antenna structures for use up to several THz. FBH's THz detectors can be easily integrated into two-dimensional plane arrays, the core component for THz cameras. The readout of the 12 x 12 pixel focal plane detector array integrated with bow-tie antenna structures in Fig. 1 is very fast, thus achieving high data rates. Fast THz cameras with high sensitivity are mandatory for many industrial applications. Fig. 2 depicts the constructed THz camera with card edge sockets to connect with the read-out electronics and processing.

Applications

- industrial quality control
- biomedical applications
- security applications

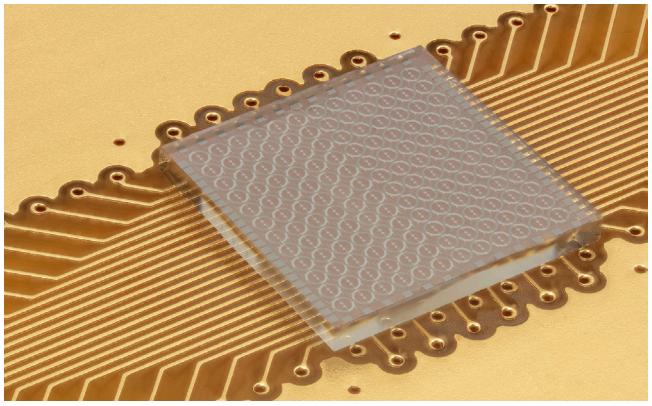

Fig.1: Chip with 12 x 12 pixel focal plane array of bow-tie detectors

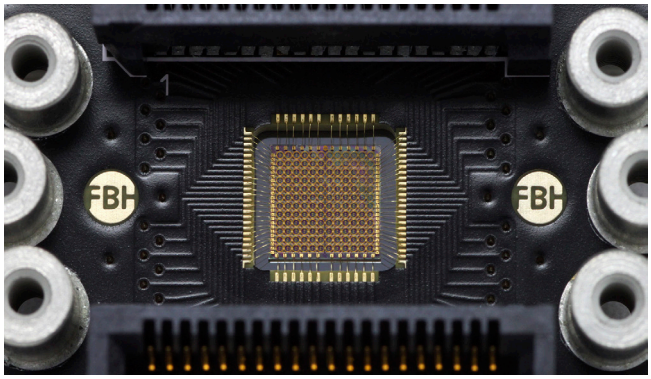

Fig.2: Constructed THz camera with card edge sockets to connect

Specifications

- frequency range 100 – 2500 GHz
- single detector sensitivity NEP ≤ 50 pW/Hz$^{0.5}$
- chip size 5 mm x 5 mm
- pixel distance 380 µm
- linear polarized
- room temperature operation

Profile

The Ferdinand-Braun-Institut, Leibniz-Institut für Höchstfrequenztechnik (FBH) researches electronic and optical components, modules and systems based on compound semiconductors. In the field of III-V electronics, it manufactures high-frequency devices and circuits for communications, power electronics, and sensor technology. Moreover, FBH develops light sources from the visible to the UV spectral range: high-power diode lasers, UV light sources, and hybrid laser systems. Applications range from medical technology, materials processing and sensors to optical communications in space and integrated quantum technology. In close cooperation with industry, its research results lead to cutting-edge products.

The institute is a member of the Leibniz Association and part of Research Fab Microelectronics Germany (FMD).