

Component



Micromachined Ultrasonic Transducers

Fast Facts

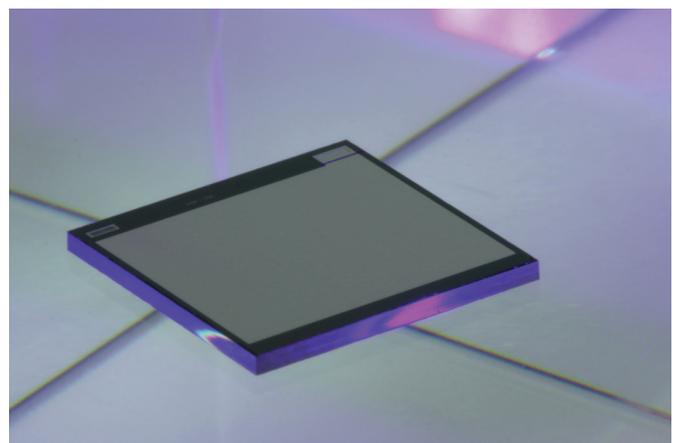
- Miniaturization
- High sensitivity
- Array functionality
- CMOS compatibility
- RoHS compliance
- High bandwidth
- Low power consumption
- Scalable manufacturing
- High reproducibility
- Design freedom
- Good acoustic matching
- No self-heating
- High-temperature stable

The three Fraunhofer institutes ENAS, IPMS and ISIT develop ultrasonic transducers for a wide range of applications that can generate high-frequency sound waves with a high sound pressure. The core of this ultrasonic sensor technology are MEMS transducers, which are manufactured using semiconductor fabrication processes. The devices are driven either capacitively or piezoelectrically, so that when an alternating electrical voltage is applied, it causes the transducers' membranes to vibrate. The components thus generate high-frequency oscillations that locally and alternately compress the surrounding medium to produce sound waves.

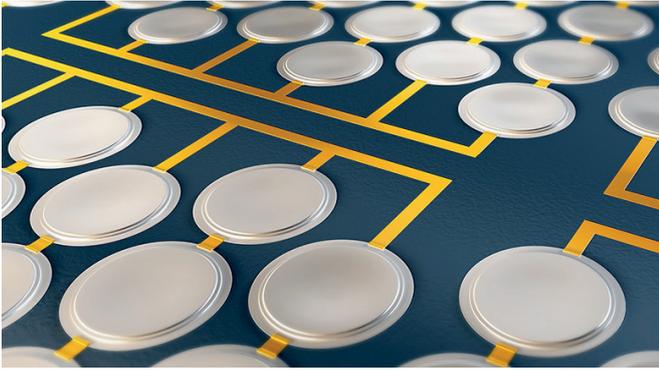
A typical feature of MUTs is the use of resonance to generate even stronger vibration amplitudes. With the MEMS-based sound transducers, the operation frequency can be easily adjusted to the customer's requirement, and thus an optimal design of the devices can be found for the customers. Due to the compact geometries and low weight of the MEMS sound exciters, the Fraunhofer-manufactured transducers are easy to mount in various setups. Moreover, thanks to established semiconductor manufacturing processes, they can be easily integrated with the necessary drive electronics.

The institutes focus on

- Capacitive micromachined ultrasonic transducers (CMUT)
- Piezoelectric micromachined ultrasonic transducers (PMUT)
- In-plane capacitive micromachined ultrasonic transducers (L-CMUT)



*Capacitive micromachined ultrasonic transducer.
(Fraunhofer ENAS)*



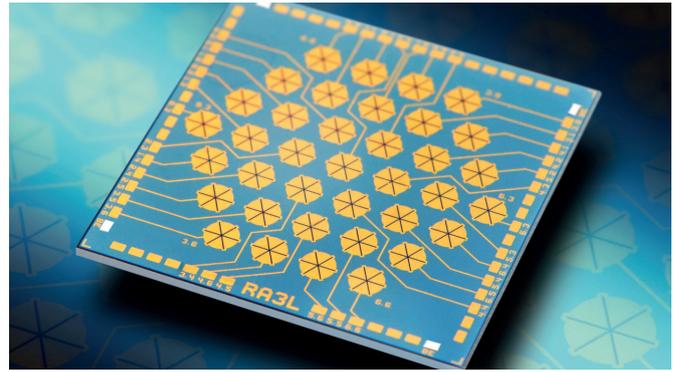
Capacitive micromachined ultrasonic transducer.
(Fraunhofer IPMS)

Development Potentials

The Fraunhofer ultrasonic transducers offer advantages especially for manufacturers of measuring equipment. If different components are arranged close together to form an array, a whole range of new applications opens up. In this way, for example, the positions of objects can be reliably mapped in three-dimensional space by correlating the signals received with different propagation times with the position of each individual transducer (beam forming). On the other hand, it is also possible to align the transmission of an ultrasonic wave so that it hits exactly one targeted point in space (beam steering).

One-Stop-Shop for MUTs

Within the framework of the Research Fab Microelectronics Germany (FMD), the ultrasound competencies of the three Fraunhofer Institutes IPMS, ISIT and ENAS are bundled in the form of a one-stop store especially for SMEs. A comprehensive technology portfolio for a wide range of applications is offered, as well as the infrastructure for pilot production in the institutes' own clean rooms. The modular approach allows ultrasound systems with customized sensor solutions to be quickly and efficiently implemented in targeted applications.



Piezoelectric micromachined ultrasonic transducer.
(Fraunhofer ISIT)

Suggested Applications

Production

- Micropositioning
- Height measurement
- Pick-and-place
- Level and flow measurement
- Process and condition monitoring
- Material analysis in harsh environments
- Non-destructive testing

Human-machine interaction

- Collision sensing
- Gesture control

Medical technology

- Flow measurement
- Sonography
- Endoscopy
- IVUS
- ICEfluid metering (level, flow rate)
- Acoustic actuation and manipulation

In cooperation with



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All information contained
in this fact sheet is preliminary
and subject to change. Furthermore,
the described system is not a commercial
product.