TeraSense

Terahertz imaging systems

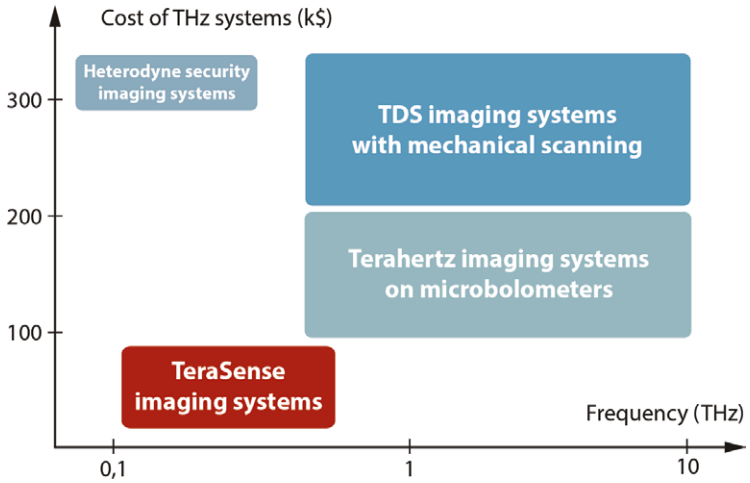
The World's First

HIGH-SPEED TERAHERTZ IMAGING SYSTEMS

TeraSense has developed and patented technology for making semiconductor detector arrays for terahertz imaging. The novel TeraSense detectors feature excellent sensitivity compared to other available instruments operating in the frequency range of 0.05 – 0.7 THz. In addition, 2D sensor arrays are scalable in the number of pixels to match the required shape and dimensions, from a square to a linear matrix. The available pixel sizes are 0.5x0.5, 1.5x1.5, and 3.0x3.0 millimeters. Owing to the compatibility of the technology with mass-production lines in the semiconductor industry, TeraSense detectors are low-cost and ease of large-scale fabrication.

Based on the cutting-edge TeraSense imaging technology, highly sensitive and exceptionally compact THz cameras can be produced. With such a camera, a remarkable sub-mm spatial resolution and ultra-fast registration rate of up to 5,000 fps have been achieved. As this novel technology presently outranks any competition, it has excellent potential to become an expedient element in a broad scope of hi-tech applications, such as THz non-destructive testing, security screening, medical imaging, and terahertz communication, to name a few. What is more, due to their compact size and functional flexibility, TeraSense cameras can be incorporated into more elaborate industrial solutions.

Existing terahertz imaging systems



For the terahertz signal generation purposes, TeraSense makes use of proprietary IMPATT and Schottky-diode technologies. Designed to operate in the terahertz frequency range of 0.1 – 0.3 THz, these state-of-the-art devices are currently some of the most powerful solid-state THz sources on the market. They generate a continuous wave (CW) signal with an output power level of up to 0.5 W. All TeraSense generators feature a phenomenally long lifetime of fully stable and reliable operation. Moreover, it is their extremely compact size and low cost that put these devices in the vanguard of the competition. All these advantages imply numerous possibilities in terms of both small and large-scale applications as they enable straightforward integration of TeraSense sources as stand-alone units into complex industrial systems.

Terasense products

Terahertz imaging cameras

- Wide spectral range 50 GHz – 0.7 THz
- Noise Equivalent Power 1 nW/√Hz
- High-speed image acquisition rate up to 50 frames per second
- 1.5 mm pixel pitch
- Customized solutions and compact size
- Low cost

Ultrafast line camera for conveyor applications

TeraSense has developed terahertz camera optimized for high-speed conveyor industrial applications.
The camera features 5 kHz (5000 frames per second) speed, custom pixel number and special software to stitch shots.

Number of pixels (scalable): 256 x 1
Min detectable power/pixel:

- 100 nW (at 5000 fps)
- 45 nW (at 1000 fps)
- 14 nW (at 100 fps)

Terahertz sources

IMPATT diodes (IMPact ionization Avalanche Transit-Time)

- High power output
- Protective isolator for enhanced stability
- TTL modulation option with 1µs rise/fall time
- High-gain horn antenna or WR- type flange

Frequencies	100 GHz	140 GHz	200 GHz	300 GHz	600 GHz
Output power	80 / 180 / 400 mW 0.8 W / **1.6 W**	30 / 80 / 180 **400 mW**	10 / 40 / 70 **200 mW**	10 / 30 / 50 **80 mW**	**2 mW**

Tunable terahertz sources

Frequency range	**70 – 77 GHz**	**140 – 155 GHz**	**280 – 310 GHz**
Maximum power	300 mW	100 mW	30 mW

- Linewidth < 300 Hz
- TTL modulation
- Power stability: 0.1% per hour, 1% per day

Ultrafast terahertz detectors

	Ultrafast	**Fast**
Response time	150 ps	1 µs
Spectral range	50 GHz - 0.7 THz	50 GHz - 0.7 THz
Impedance	50 Ω	10 k Ω
Responsivity	0.5 V/W	10 V/W
Noise equivalent power	2 nW/ √Hz	1 nW/√Hz
No power supply	✓	✓

Optics for terahertz

TeraSense offers custom manufacturing of quasi-optical components for THz range: PTFE and TPX lenses, windows, prisms, attenuators, polarizers, beam splitters. Terahertz lenses are done with diameters 1 - 30 cm and focal lengths 50 - 300 mm.

CE *TeraSense Imaging Cameras and IMPATT diodes have EC Certificare of Compliance (EC Certificate of Conformity) and are 100% environmentally friendly products that can be safely used with no detriment to human health/safety.*

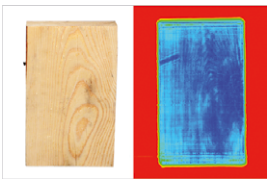
Featured clients

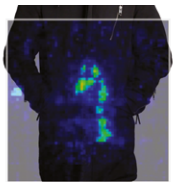
INO ENEA NEC Pioneer SMART KERI SISTEMA MICHELIN TOPTICA PHOTONICS Nikon Panasonic NUCTECH

Applications

Terahertz quality control

Non-destructive analysis (NDT) of the internal structure of objects (quality control of products). THz cameras enable visualization of the contents of sealed packages or food products under various enclosures.





Terahertz wireless communication

Building high-frequency wireless telecommunication systems of a new generation (up to 100 Gbit/sec). This application holds high promise for high-speed information transmission between electronic devices, building wireless local area networks (WLAN) and wireless personal area networks (WPAN) of new generation, and creating entirely secured dedicated channels of wireless communication.

Terahertz imaging security

Security systems for various applications: people screening, luggage scanning, as well as scanning postal parcels and envelopes in terms of prohibited items inside. Here, the emphasis is primarily made on one feature: unlike X-ray, THz radiation is not detrimental to the human body. THz scanners allow remote detection of metallic, plastic, ceramic, and other object concealed underclothes — at a distance of a few meters.

Terahertz imaging in medicine

THz tomography in medicine allows to conduct analysis of the upper layers of a human body — skin, vessels, joints, and muscles. There are known successful applications of THz tomography for detecting skin and breast cancers at early stages. In addition, the capability of visualizing current conditions of wounds under gypsum/bandage layers also represents high interest.

Scientific research

Scientific applications of THz radiation include spectroscopy of long-wavelength lattice vibrations of crystals, bending vibrations of molecules. Frequencies of soft modes in ferroelectric materials and frequencies matching the energy of apertures in superconductors are also ‘residing’ within the THz range. Terahertz frequency range is convenient for the creation and study of metamaterials and plasmonic effects.

About TeraSense

Since 2008
bringing innovations in THz imaging

Over 500 happy clients
in science and industry

50+ distributors
around the world

2 headquarters and
40 people team
with half holding Ph.D. degree

Products used at
5 continents in over
50 countries of the world

100+ publications
and **5 patents**

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