The World’s First
HIGH SPEED TERAHERTZ IMAGING SYSTEMS
TeraSense has developed and patented a ground-breaking technology for making new-generation semiconductor detector arrays for terahertz imaging. The novel TeraSense detectors boast excellent sensitivity compared to other available instrumentation operating in frequency range of 0.05 – 0.7 THz. 2D sensor arrays are scalable in the number of pixels to match required shape and dimensions, from a square to a linear matrix, with available pixel sizes of 0.5x0.5, 1.5x1.5 and 3.0x3.0 millimeters. Owing to compatibility of the TeraSense technology with mass-production lines in semiconductor industry, additional advantages of TeraSense detectors are their low cost and ease of large-scale fabrication.

Based on the cutting-edge TeraSense imaging technology, a highly sensitive and exceptionally compact THz camera has been produced. With such a camera there has been achieved a remarkable sub-mm spatial resolution and ultra-fast registration rate of up to 50,000 fps. As this novel technology presently outranks any competition, it has great 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.

For the terahertz signal generation purposes TeraSense makes use of proprietary IMPATT and Schottky-diode technologies. Designed to operate in sub-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 that have capacity to generate a Continuous Wave (CW) signal with output power level of up to 0.5 W. All TeraSense generators feature phenomenally long life-time 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 5000 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)
**Sub-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

<table>
<thead>
<tr>
<th>Frequencies</th>
<th>100 GHz</th>
<th>140 GHz</th>
<th>200 GHz</th>
<th>300 GHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output power</td>
<td>80 / 180 / 400 mW / 0.8 W</td>
<td>30 / 90 / 180 mW</td>
<td>50 / 100 / 200 mW</td>
<td>10 / &gt;20 / 40 mW</td>
</tr>
</tbody>
</table>

**Ultrafast terahertz detectors**

<table>
<thead>
<tr>
<th>Feature</th>
<th>Ultrafast</th>
<th>Fast</th>
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</thead>
<tbody>
<tr>
<td>Response time</td>
<td>150 ps</td>
<td>1 μs</td>
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<tr>
<td>Spectral range</td>
<td>50 GHz - 0.7 THz</td>
<td>50 GHz - 0.7 THz</td>
</tr>
<tr>
<td>Impedance</td>
<td>50 Ω</td>
<td>10 k Ω</td>
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<tr>
<td>Responsivity</td>
<td>0.5 V/W</td>
<td>10 V/W</td>
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<tr>
<td>Noise equivalent power</td>
<td>2 nW/√Hz</td>
<td>1 nW/√Hz</td>
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<tr>
<td>No power supply</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

**Terahertz security body scanner**

Working distance: 3 - 6 m

Imaging area (at 3 m):
- 70 x 70 cm (at 3 m)
- 120 x 120 cm (at 6 m)

Resolution:
- 3 cm (at 3 m)
- 6 cm (at 6 m)

Operating frequency: 100 GHz

THz sensor array: 3 x 3 mm, 32 x 32 px

Number of sources: 6

Frame rate: Live Stream

**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.

**Featured clients**

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

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

Terahertz wireless communication
Building high-frequency wireless telecommunication systems of 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, as well as 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: that unlike X-ray, THz radiation is not detrimental to human body. THz scanners allow remote detection of metallic, plastic, ceramic and other object concealed under clothes — 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. Capability of visualizing current conditions of wounds under gypsum/bandage layers also represents high interest.

Terahertz science
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 THz range. Terahertz frequency range is convenient for creation and study of meta-materials 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