Terahertz components

THz emitters and detectors

Accessories

FEATURES

- Based on LT-GaAs or GaBiAs photoconductive material
- Optimized for wavelengths around 800 nm or 1060 nm
- Wide spectral range and low noise
- Sub-picosecond temporal resolution
- Technical passport and test report included

APPLICATIONS

- Time-resolved broadband THz spectroscopy
- Optical pump – THz probe spectroscopy
- THz imaging

THz emitter and **THz detector** consists of a microstrip photoconductive antenna (PCA) fabricated on GaAs substrate. Depending on pump laser wavelength either low temperature grown GaAs (LT-GaAs) or GaBiAs is used as photoconductor. On its surface a coplanar Hertzian type dipole antenna structure is formed using AuGeNi metallization. Photoconductive antenna geometry, as well as the properties of photoconductor epitaxial layers are optimized for highest THz radiation output efficiency, while preserving optimal bandwidth. As a result, typical emitted THz radiation power exceeds 10 μW, when pumped by laser with 30 mW output power and 150 fs pulse duration. FWHM bandwidth of detection system exceeds 700 GHz with usable spectral range of 0.1–4 THz.

THz emitter or detector is illuminated by laser beam from panel side. Laser beams must be focused between two electrodes (*Fig. 1*). The gap between metallic contacts is similar to laser spot diameter in detector case and larger – in emitter case. THz radiation is collected by integrated lens, manufactured from high-density silicon, mounted on X-Y stage. EKSPLA offers two standard types of these lenses: for collimated or diverging THz beam output. In second case PCA is placed in aplanatic point of silicon lens, which reduces THz beam aberrations. Adjustment screws are used for Si lens positioning onto PCA center. SMA sockets on back side of the housing are used for connecting DC or AC bias to THz emitter and lock-in amplifier input to THz detector. Any of three M6 holes can be used for THz emitter mounting on optical table.

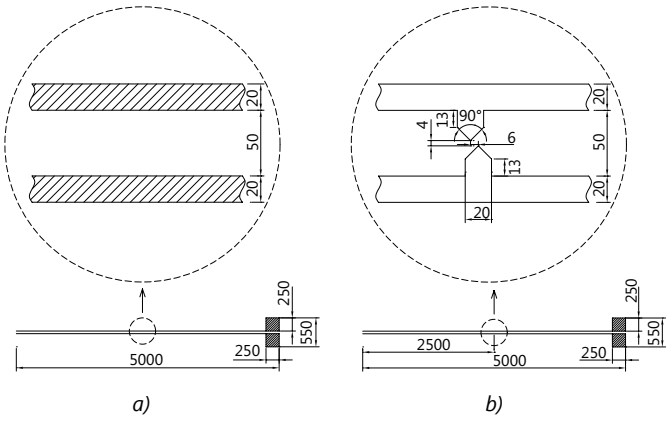


Fig. 1. Microstip antena drawings: (a) emitter, (b) detector

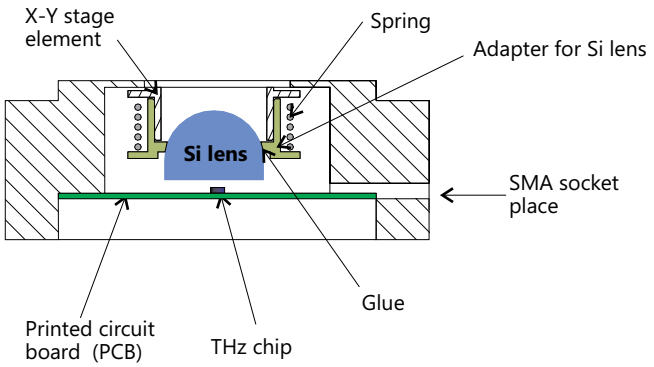


Fig. 2. THz emitter and detector crossection

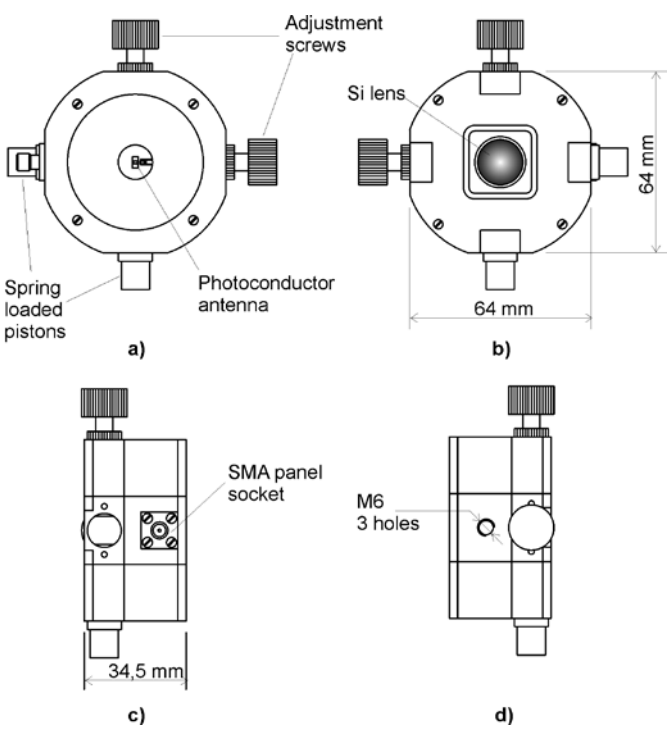


Fig. 3a. THz emitter/detector housing (model with collimated THz output)

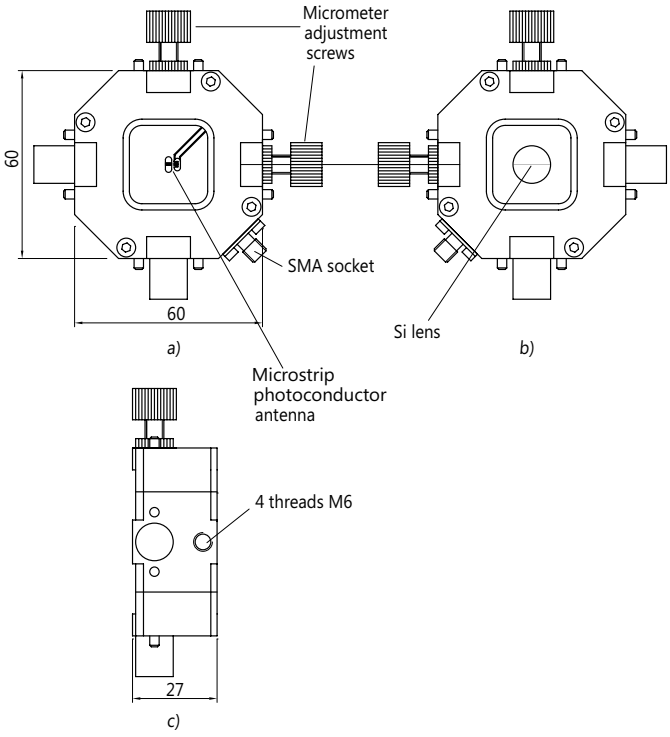


Fig. 3b. THz emitter/detector housing (model with diverging THz output)

THZ EMITTER/DETECTOR MOUNTING STAGE

Separately from THz emitter and detector EKSPLA provides convenient mounting stage compatible with both devices. It contains lens, mounted on adjustable XY holder, compact stage for shifting lens along optical axis and rail, on which both: lens and emitter/detector are mounted. This helps with pump beam guiding to the gap between electrodes located on photoconductive antenna, as well as adjusting beam diameter on active surface. Convenient fixing screws allow fast mounting and removing each part of this simple setup.

SPECIFICATIONS

Beam height	105 mm
X, Y axis travel range	3 mm
Z axis travel range	13 mm
Lens diameter	25.4 mm
Lens focal diameter	50 mm
Lens anti-reflection coating	AR/AR at selected wavelength (standard: 800 / 1030 / 1064 nm)

Fig. 4. Emitter (or detector) mounted on its stage.

BIAS POWER SUPPLY TMS-100 FOR THZ EMITTER

FEATURES:

- Low noise
- DC or square-wave output (needs external TTL input)
- Cable for connection to THz emitter included

Fig. 5. Front view of TMS-100 power supply

SPECIFICATIONS

Square-wave modulation frequency	10 Hz - 100 kHz
Output voltage	30-70 V (adjustable)
Max current	1 mA
Output socket	BNC
Mains	100/220 VAC, 50/60 Hz
Dimensions (W×L×H)	130 × 190 × 39 mm

OPERATIONAL PREAMPLIFIER FOR THZ DETECTOR

Fig. 6. External view of preamplifier

SPECIFICATIONS

PREAMPLIFIER	
Preamplifier type	current-voltage converter
Conversion coefficient	> 10^6
Preamplifier head dimensions	60 × 12 × 15 mm
POWER SUPPLY	
Preamplifier power supply dimensions	155 × 65 × 80 mm
Preamplifier power supply output voltage	+ 15 V, - 15 V
Preamplifier power supply line voltage	220 V or 110 V

* Preamplifier head is equipped with SMA connector matched with EKSPLA THz detector.

THZ SPECTROSCOPY KIT

EKSPLA "THz spectroscopy kit" contains all the components necessary to build THz-TDS system. The standard kit consists of photoconductive antenna THz emitter and detector, pump laser beam guiding optics, motorized delay line with controller, bias power supply TMS-100, THz beam guiding optics, sample holder and lock-in amplifier. All components are assembled on the baseplate of 60×80 cm dimensions. Four standard configurations are available, optimized for transmission, reflection, imaging or pump-probe measurement. All can be easily interchanged and modified. Any other optional configuration can be ordered initially or as a future upgrade. THz spectroscopy kit is controlled by dedicated software LabView™ based.

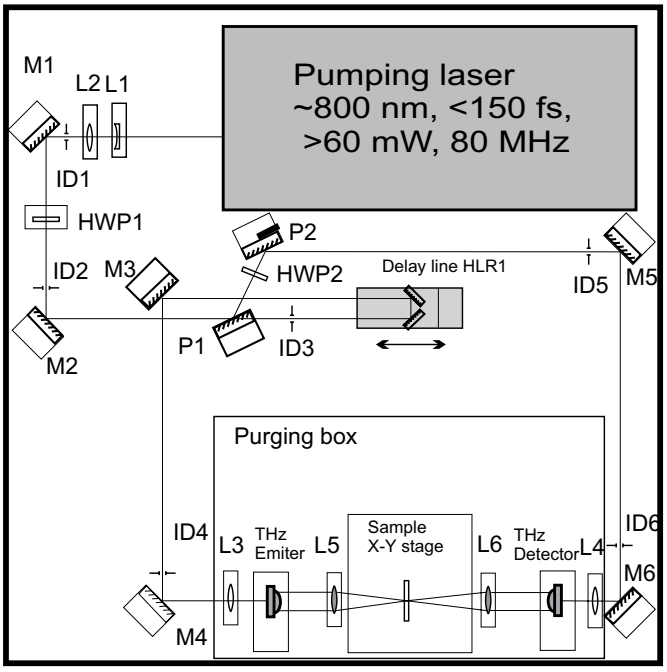


Fig. 7. Optical layout of THz spectroscopy kit in transmission configuration

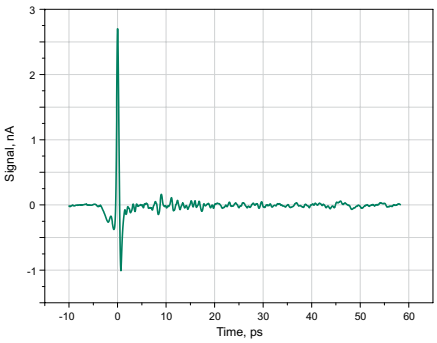
SPECIFICATIONS [1)]

MODEL	Emitters		Detectors	
	EMT-08	EMT-10	DET-08	DET-10
PHOTOCONDUCTIVE ANTENNA				
Photoconductive material	LT-GaAs	GaBiAs	LT-GaAs	GaBiAs
Dimensions of the wafer	5 × 1.5 mm			
Thickness	600 µm			
Antenna type	strip line		dipole	
Bias voltage	50 V max, 40 V typical		–	
Central THz frequency	~0.5 THz		–	
Detected THz bandwidth	–		>4 THz	
INTEGRATED FOCUSING LENS				
Material	HRFZ-silicon			
Geometrical form	hyper-hemi-sphere			
THz beam output	collimated or diverging		–	
X-Y adjustable stage range	±3 mm			
PUMP BEAM PARAMETERS				
Excitation wavelength	800±40 nm	1060±40 nm	800±40 nm	1060±40 nm
Average power [1)]	<50 mW	<30 mW	<50 mW	<30 mW
Pulse duration	<150 fs			
Pulse repetition rate	20-100 MHz			
Beam profile	near to Gaussian			
Beam diameter [2)]	~2 mm			

[1)] Subject to laser pulse duration, repetition rate and beam size at the surface of wafer
[2)] Recommended value, if used with EKSPLA THz emitter/detector mount of THz spectroscopy kit

ORDERING INFORMATION

DESCRIPTION	MODEL	NOTES
THz emitter for 800 nm wavelength	EMT-8	Includes Si lens and coaxial cable with BNC connector
THz detector for 800 nm wavelength	DET-8	Includes Si lens and coaxial cable with BNC connector
THz emitter for 1060 nm wavelength	EMT-10	Includes Si lens and coaxial cable with BNC connector
THz detector for 1060 nm wavelength	EMT-10	Includes Si lens and coaxial cable with BNC connector
THz emitter/detector mouting stage	MNT	Includes pump beam focusing lens on XYZ stage
TMS-100M bias power supply	TMS-100	30-70 V DC or square-wave output
Operational preamplifier	PAM	Current-voltage converter, 106 V/A gain, includes 15 V power supply



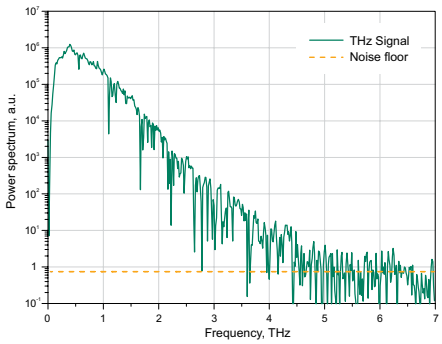


Fig. 8. The measured THz signal and its spectrum. Average optical power incident to the emitter was 20 mW and to the detector – 26 mW.

Laser: Yb:KGW, wavelength – 1030 nm, duration – 70 fs, pulse repetition rate – 75 MHz.

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