

# THz Emitter and Detector for Free Space Coupling



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 0.1–5 THz.

### 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 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. Teravil 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 spherical 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.

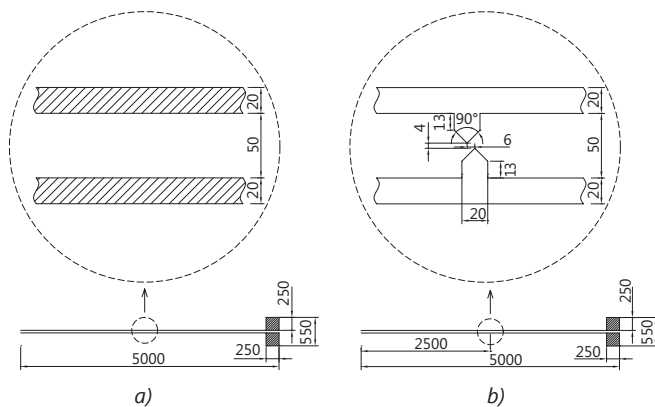


Fig. 1. Microstrip antenna drawings: (a) emitter, (b) detector

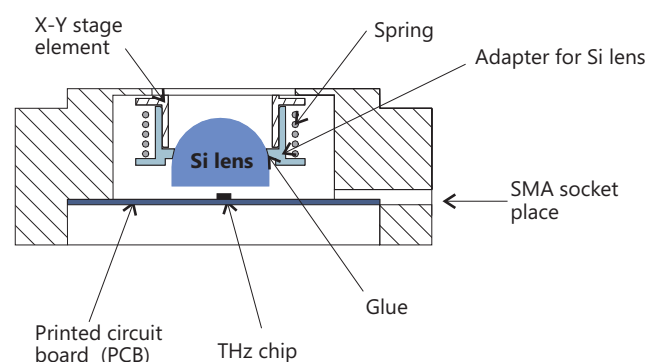


Fig. 2. THz emitter and detector crosssection

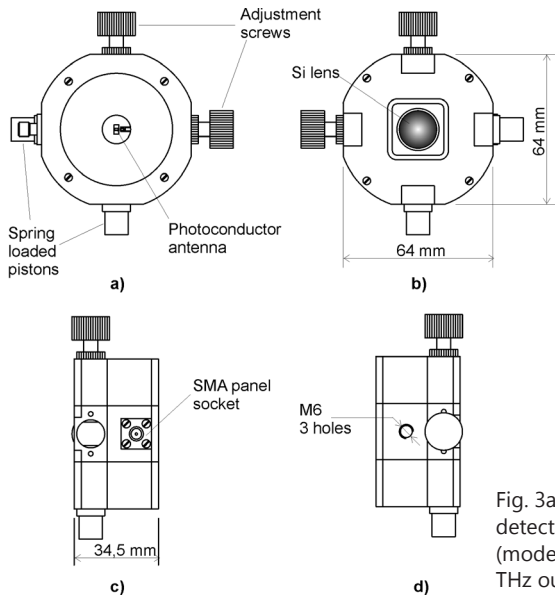


Fig. 3a. THz emitter/detector housing (model with collimated THz output)

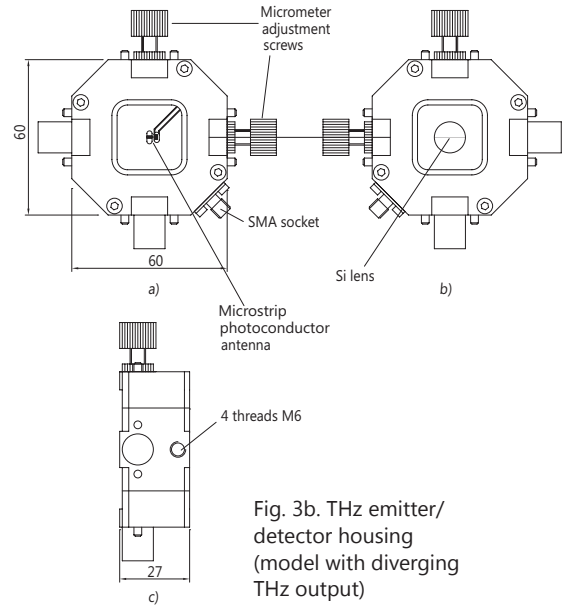


Fig. 3b. THz emitter/detector housing (model with diverging THz output)

SPECIFICATIONS <sup>1)</sup>

Model	Emitters		Detectors <sup>3)</sup>	
	EMT-08	EMT-10	DET-08	DET-10
<b>PHOTOCONDUCTIVE ANTENNA</b>				
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		±12 V	
Central THz frequency	~0.5 THz		0.5 THz	
Detected THz bandwidth	-		up to 5 THz	
<b>INTEGRATED FOCUSING LENS</b>				
Material	HRFZ-silicon			
Geometrical form	hyper-hemi-sphere			
THz beam output	collimated or diverging		-	
X-Y adjustable stage range	±3 mm			
<b>PUMP BEAM PARAMETERS</b>				
Excitation wavelength	800±40 nm	1060±40 nm	800±40 nm	1060±40 nm
Average power <sup>1)</sup>	<50 mW	<20 mW	<50 mW	<20 mW
Pulse duration	<150 fs			
Pulse repetition rate	20-100 MHz			
Beam profile	near to Gaussian			
Beam diameter <sup>2)</sup>	~2 mm			

<sup>1)</sup> Subject to laser pulse duration, repetition rate and beam size at the surface of wafer.

<sup>2)</sup> Recommended value, if used with TERAVIL THz emitter/detector mount of THz spectroscopy kit.

<sup>3)</sup> Integrated preamplifier could be provided.

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 mounting 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