

Data Sheet bPCA-100-05-10-1060

Photoconductive THz antenna for laser excitation wavelength ~ 1060 nm
and Bow-tie structure



PCA – Photo Conductive Antenna

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1 Mounting Options

| | |
|-------------------------|---|
| bPCA-100-05-10-1060-0 | Unmounted PCA chip |
| bPCA-100-05-10-1060-h | Mounted on hyperhemispherical Si lens |
| bPCA-100-05-10-1060-h-l | Mounted on hyperhemispherical Si lens plus Adjusted focusing optical lens for free space laser excitation |
| bPCA-100-05-10-1060-h-f | Mounted on hyperhemispherical Si lens plus Adjusted optical fiber |
| bPCA-100-05-10-1060-c | Mounted on collimating aspheric Si lens |
| bPCA-100-05-10-1060-c-l | Mounted on collimating aspheric Si lens plus Adjusted focusing optical lens for free space laser excitation |
| bPCA-100-05-10-1060-c-f | Mounted on collimating aspheric Si lens plus Adjusted optical fiber |
| bPCA-100-05-10-1060-a | Mounted on aspheric focusing Si lens |
| bPCA-100-05-10-1060-a-l | Mounted on aspheric focusing Si lens plus Adjusted focusing optical lens for free space laser excitation |
| bPCA-100-05-10-1060-a-f | Mounted on aspheric focusing Si lens plus Adjusted optical fiber |

Nomenclature

bPCA-100-05-10-1060-X-Y

| | | |
|-------------------------|-----------------------|-------------------|
| bPCA-100-05-10-1060-X-Y | Antenna design | Bow-tie |
| bPCA-100-05-10-1060-X-Y | Antenna length | 100 μm |
| bPCA-100-05-10-1060-X-Y | Gap distance | 05 μm |
| bPCA-100-05-10-1060-X-Y | Gap width | 10 μm |
| bPCA-100-05-10-1060-X-Y | Excitation wavelength | 1060 nm |
| bPCA-100-05-10-1060-X-Y | Mounted Si lens | 0 / h / c / a |
| bPCA-100-05-10-1060-X-Y | Adjusted | l / f |

2 PCA Specification

2.1 bPCA-100-05-10-1060-0

- Unmounted PCA chip

Table 1: Specification bPCA-100-05-10-1060-0

| Parameter | | Min | Recommended | Max |
|--|---------------------------|----------------|-------------|--------------------------|
| Laser source | Wavelength | 650 nm | 1060 nm | 1060 nm |
| | Avg. optical power | - | 10 mW | 20 mW |
| | Avg. power density | - | - | 70 000 W/cm ² |
| | Fluence | - | - | 1 000 μJ/cm ² |
| | Pulse duration | - | 100 fs | 200 fs |
| | Repetition rate | 70 MHz | 80 MHz | - |
| | Spot diameter | 5 μm | 6 μm | - |
| Bias source | Voltage [V _e] | - | - | 20 V |
| | Modulation frequency | 0 Hz (Dc) | 10 kHz | 10 MHz |
| Dark resistance [R _d] ¹ | | > 15 MΩ | - | - |
| Parameter | | Typical | | |
| PCA chip | Width | 4 mm ± 0.2 mm | | |
| | Depth | 4 mm ± 0.2 mm | | |
| | Height | 625 μm ± 25 μm | | |
| THz Beam | Focal length | Dot source | | |

¹ Measurement conditions: room temperature & measuring voltage of 3.3 V

2.2 bPCA-100-05-10-1060-h

- Mounted on hyperhemispherical Si lens (LSH-D12-T7.13)

Table 2: Specification bPCA-100-05-10-1060-h

| Parameter | | Min | Recommended | Max |
|--|-----------------------------------|---|-------------|--------------------------|
| Laser source | Wavelength | 650 nm | 1060 nm | 1060 nm |
| | Avg. optical power | - | 10 mW | 20 mW |
| | Avg. power density | - | - | 70 000 W/cm ² |
| | Fluence | - | - | 1 000 μJ/cm ² |
| | Pulse duration | - | 100 fs | 200 fs |
| | Repetition rate | 70 MHz | 80 MHz | - |
| | Spot diameter | 5 μm | 6 μm | - |
| Bias source | Voltage [V _e] | - | - | 20 V |
| | Modulation frequency | 0 Hz (Dc) | 10 kHz | 10 MHz |
| Dark resistance [R _d] ² | | > 15 MΩ | - | - |
| Parameter | | Typical | | |
| Package | | Max. diameter 25.4 mm Min. length 9.5 mm | | |
| THz Beam | Virtual focal length ³ | 26.5 mm | | |
| | Divergence angle | 17° | | |

² Measurement conditions: room temperature & measuring voltage of 3.3 V

³ Measured from the apex

2.3 bPCA-100-05-10-1060h-I

- Mounted on hyperhemispherical Si lens (LSH-D12-T7.13)
- Adjusted focusing optical lens for free space laser excitation

Table 3: Specification bPCA-100-05-10-1060-h-I

| Parameter | | Min | Recommended | Max |
|--|-----------------------------------|--|-------------|--------------------------|
| Laser source | Wavelength | 650 nm | 1060 nm | 1060 nm |
| | Avg. optical power | - | 10 mW | 20 mW |
| | Avg. power density | - | - | 70 000 W/cm ² |
| | Fluence | - | - | 1 000 μJ/cm ² |
| | Pulse duration | - | 100 fs | 200 fs |
| | Repetition rate | 70 MHz | 80 MHz | - |
| | Beam diameter ⁴ | - | 1.8 mm | 2.2 mm |
| Bias source | Voltage [V _e] | - | - | 20 V |
| | Modulation frequency | 0 Hz (Dc) | 10 kHz | 10 MHz |
| Dark resistance [R _d] ⁵ | | > 15 MΩ | - | - |
| Parameter | | Typical | | |
| Package | | Max. diameter 25.4 mm Min. length 20.9 mm | | |
| THz Beam | Virtual focal length ⁶ | 26.5 mm | | |
| | Divergence angle | 17° | | |

⁴ Collimated laser beam

⁵ Measurement conditions: room temperature & measuring voltage of 3.3 V

⁶ Measured from the apex

2.4 bPCA-100-05-10-1060-h-f

- Mounted on hyperhemispherical Si lens (LSH-D12-T7.13)
- Adjusted optical fiber

Table 4: Specification bPCA-100-05-10-1060-h-f

| Parameter | | Min | Recommended | Max |
|--|-----------------------------------|--|-------------|--------------------------|
| Laser source | Wavelength | 650 nm | 1060 nm | 1060 nm |
| | Avg. optical power | - | 10 mW | 20 mW |
| | Avg. power density | - | - | 70 000 W/cm ² |
| | Fluence | - | - | 1 000 μJ/cm ² |
| | Pulse duration | - | 100 fs | 200 fs |
| | Repetition rate | 70 MHz | 80 MHz | - |
| | Beam diameter ⁷ | - | 1.8 mm | 2.2 mm |
| Bias source | Voltage [V _e] | - | - | 20 V |
| | Modulation frequency | 0 Hz (Dc) | 10 kHz | 10 MHz |
| Dark resistance [R _d] ⁸ | | > 15 MΩ | - | - |
| Parameter | | Typical | | |
| Package | | Max. diameter 30.5 mm Min. length 54.6 mm (without fiber) | | |
| THz Beam | Virtual focal length ⁹ | 26.5 mm | | |
| | Divergence angle | 17° | | |

⁷ Collimated laser beam

⁸ Measurement conditions: room temperature & measuring voltage of 3.3 V

⁹ Measured from the apex

2.5 bPCA-100-05-10-1060-c

- Mounted on collimating Si lens (LSA-D20-T13.77)

Table 5: Specification bPCA-100-05-10-1060-c

| Parameter | | Min | Recommended | Max |
|---|----------------------------|--|-------------|--------------------------|
| Laser source | Wavelength | 650 nm | 1060 nm | 1060 nm |
| | Avg. optical power | - | 10 mW | 20 mW |
| | Avg. power density | - | - | 70 000 W/cm ² |
| | Fluence | - | - | 1 000 μJ/cm ² |
| | Pulse duration | - | 100 fs | 200 fs |
| | Repetition rate | 70 MHz | 80 MHz | - |
| | Spot diameter | 5 μm | 6 μm | - |
| Bias source | Voltage [V _e] | - | - | 20 V |
| | Modulation frequency | 0 Hz (Dc) | 10 kHz | 10 MHz |
| Dark resistance [R _d] ¹⁰ | | > 15 MΩ | - | - |
| Parameter | | Typical | | |
| Package | | Max. diameter 25.4 mm Min. length 16.0 mm | | |
| THz Beam | Focal length ¹¹ | ∞ | | |
| | FWHM ¹² | 11.0 mm | | |

¹⁰ Measurement conditions: room temperature & measuring voltage of 3.3 V

¹¹ Measured from the apex

¹² Full Width at Half Maximum

2.6 bPCA-100-05-10-1060-c-I

- Mounted on collimating Si lens (LSA-D20-T13.77)
- Adjusted focusing optical lens for free space laser excitation

Table 6: Specification bPCA-100-05-10-1060-c-I

| Parameter | | Min | Recommended | Max |
|---|-----------------------------|--|-------------|--------------------------|
| Laser source | Wavelength | 650 nm | 1060 nm | 1060 nm |
| | Avg. optical power | - | 10 mW | 20 mW |
| | Avg. power density | - | - | 70 000 W/cm ² |
| | Fluence | - | - | 1 000 μJ/cm ² |
| | Pulse duration | - | 100 fs | 200 fs |
| | Repetition rate | 70 MHz | 80 MHz | - |
| | Beam diameter ¹³ | - | 1.8 mm | 2.2 mm |
| Bias source | Voltage [V _e] | - | - | 20 V |
| | Modulation frequency | 0 Hz (Dc) | 10 kHz | 10 MHz |
| Dark resistance [R _d] ¹⁴ | | > 15 MΩ | - | - |
| Parameter | | Typical | | |
| Package | | Max. diameter 25.4 mm Min. length 25.0 mm | | |
| THz Beam | Focal length ¹⁵ | ∞ | | |
| | FWHM ¹⁶ | 11.0 mm | | |

¹³ Collimated laser beam

¹⁴ Measurement conditions: room temperature & measuring voltage of 3.3 V

¹⁵ Measured from the apex

¹⁶ Full Width at Half Maximum

2.7 bPCA-100-05-10-1060-c-f

- Mounted on collimating Si lens (LSA-D20-T13.77)
- Adjusted optical fiber

Table 7: Specification bPCA-100-05-10-1060-c-f

| Parameter | | Min | Recommended | Max |
|---|-----------------------------|--|-------------|--------------------------|
| Laser source | Wavelength | 650 nm | 1060 nm | 1060 nm |
| | Avg. optical power | - | 10 mW | 20 mW |
| | Avg. power density | - | - | 70 000 W/cm ² |
| | Fluence | - | - | 1 000 μJ/cm ² |
| | Pulse duration | - | 100 fs | 200 fs |
| | Repetition rate | 70 MHz | 80 MHz | - |
| | Beam diameter ¹⁷ | - | 1.8 mm | 2.2 mm |
| Bias source | Voltage [V _e] | - | - | 20 V |
| | Modulation frequency | 0 Hz (Dc) | 10 kHz | 10 MHz |
| Dark resistance [R _d] ¹⁸ | | > 15 MΩ | - | - |
| Parameter | | Typical | | |
| Package | | Max. diameter 30.5 mm Min. length 54.6 mm (without fiber) | | |
| THz Beam | Focal length ¹⁹ | ∞ | | |
| | FWHM ²⁰ | 11.0 mm | | |

¹⁷ Collimated laser beam

¹⁸ Measurement conditions: room temperature & measuring voltage of 3.3 V

¹⁹ Measured from the apex

²⁰ Full Width at Half Maximum

2.8 bPCA-100-05-10-1060-a

- Mounted on focusing Si lens (LSA-D20-T14-F50)

Table 8: Specification bPCA-100-05-10-1060-a

| Parameter | | Min | Recommended | Max |
|---|----------------------------|--|-------------|--------------------------|
| Laser source | Wavelength | 650 nm | 1060 nm | 1060 nm |
| | Avg. optical power | - | 10 mW | 20 mW |
| | Avg. power density | - | - | 70 000 W/cm ² |
| | Fluence | - | - | 1 000 μJ/cm ² |
| | Pulse duration | - | 100 fs | 200 fs |
| | Repetition rate | 70 MHz | 80 MHz | - |
| | Spot diameter | 5 μm | 6 μm | - |
| Bias source | Voltage [V _e] | - | - | 20 V |
| | Modulation frequency | 0 Hz (Dc) | 10 kHz | 10 MHz |
| Dark resistance [R _d] ²¹ | | > 15 MΩ | - | - |
| Parameter | | Typical | | |
| Package | | Max. diameter 25.4 mm Min. length 16.0 mm | | |
| THz Beam | Focal length ²² | 50.0 mm | | |
| | Convergence angle | 10° | | |

²¹ Measurement conditions: room temperature & measuring voltage of 3.3 V

²² Measured from the apex

2.9 bPCA-100-05-10-1060-a-I

- Mounted on focusing Si lens (LSA-D20-T14-F50)
- Adjusted focusing optical lens for free space laser excitation

Table 9: Specification bPCA-100-05-10-1060-a-I

| Parameter | | Min | Recommended | Max |
|---|-----------------------------|--|-------------|--------------------------|
| Laser source | Wavelength | 650 nm | 1060 nm | 1060 nm |
| | Avg. optical power | - | 10 mW | 20 mW |
| | Avg. power density | - | - | 70 000 W/cm ² |
| | Fluence | - | - | 1 000 μJ/cm ² |
| | Pulse duration | - | 100 fs | 200 fs |
| | Repetition rate | 70 MHz | 80 MHz | - |
| | Beam diameter ²³ | - | 1.8 mm | 2.2 mm |
| Bias source | Voltage [V _e] | - | - | 20 V |
| | Modulation frequency | 0 Hz (Dc) | 10 kHz | 10 MHz |
| Dark resistance [R _d] ²⁴ | | > 15 MΩ | - | - |
| Parameter | | Typical | | |
| Package | | Max. diameter 25.4 mm Min. length 25.0 mm | | |
| THz Beam | Focal length ²⁵ | 50.0 mm | | |
| | Convergence angle | 10° | | |

²³ Collimated laser beam

²⁴ Measurement conditions: room temperature & measuring voltage of 3.3 V

²⁵ Measured from the apex

2.10 bPCA-100-05-10-1060-a-f

- Mounted on focusing Si lens (LSA-D20-T14-F50)
- Adjusted optical fiber

Table 10: Specification bPCA-100-05-10-1060-a-f

| Parameter | | Min | Recommended | Max |
|---|-----------------------------|--|-------------|--------------------------|
| Laser source | Wavelength | 650 nm | 1060 nm | 1060 nm |
| | Avg. optical power | - | 10 mW | 20 mW |
| | Avg. power density | - | - | 70 000 W/cm ² |
| | Fluence | - | - | 1 000 μJ/cm ² |
| | Pulse duration | - | 100 fs | 200 fs |
| | Repetition rate | 70 MHz | 80 MHz | - |
| | Beam diameter ²⁶ | - | 1.8 mm | 2.2 mm |
| Bias source | Voltage [V _e] | - | - | 20 V |
| | Modulation frequency | 0 Hz (Dc) | 10 kHz | 10 MHz |
| Dark resistance [R _d] ²⁷ | | > 15 MΩ | - | - |
| Parameter | | Typical | | |
| Package | | Max. diameter 30.5 mm Min. length 54.6 mm (without fiber) | | |
| THz Beam | Focal length ²⁸ | 50.0 mm | | |
| | Convergence angle | 10° | | |

²⁶ Collimated laser beam

²⁷ Measurement conditions: room temperature & measuring voltage of 3.3 V

²⁸ Measured from the apex

3 Application Note

3.1 Measurement Setup

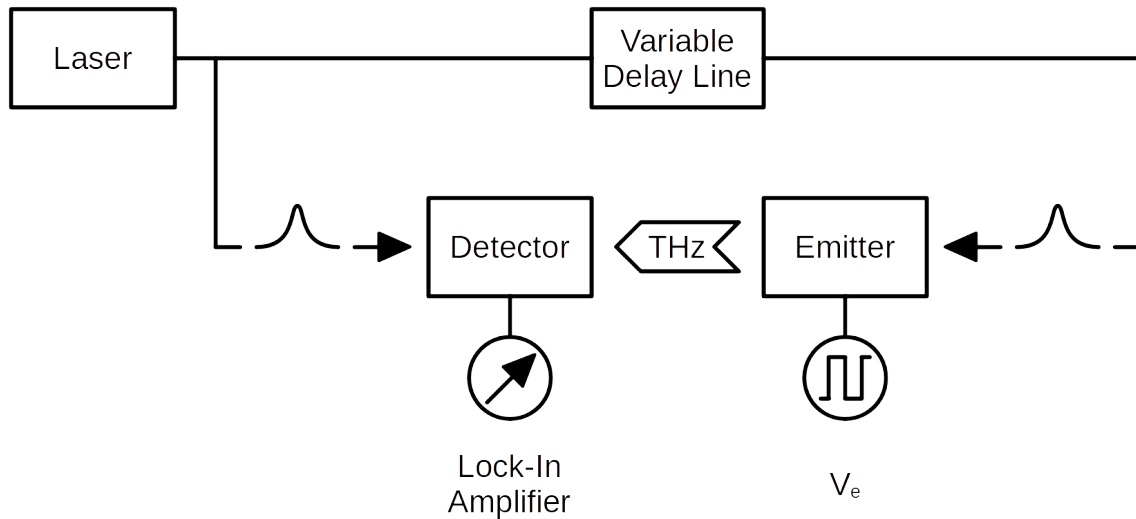


Figure 1: Setup for THz measurements

3.2 PCA Design

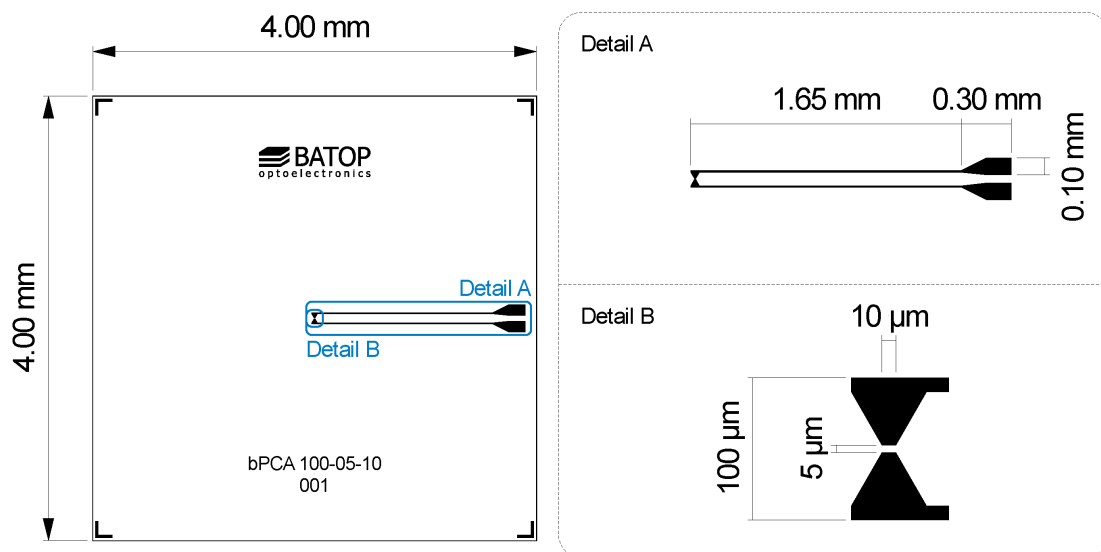


Figure 2: PCA dimensions

Antenna length = 100 μm / Gap distance = 5 μm / Gap width = 10 μm

3.3 PCA Performance

Performance of the recommended PCA combination:

PCA-40-05-10-1060 (Emitter) & bPCA-100-05-10-1060 (Detector)

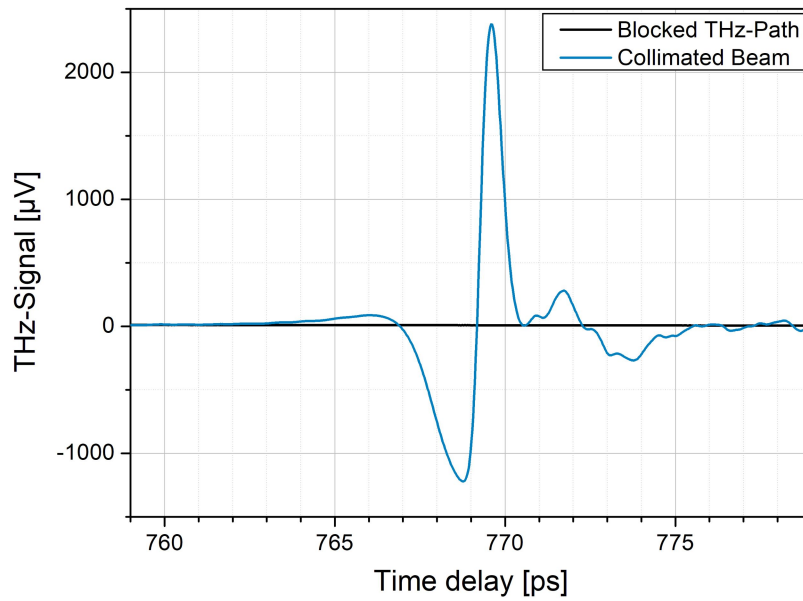


Figure 3: THz signal

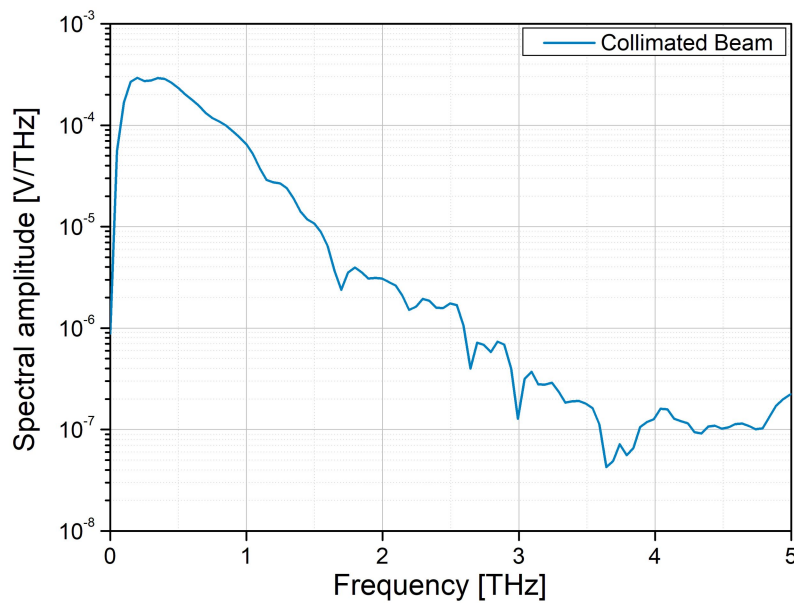


Figure 4: THz spectrum

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