

## Data Sheet PCA-40-05-10-800

Photoconductive THz antenna for laser excitation wavelength  $\sim 800$  nm  
and **Parallel-line** structure



PCA – **Photo Conductive Antenna**

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## 1 Mounting Options

PCA-40-05-10-800-0	Unmounted PCA chip
PCA-40-05-10-800-h	Mounted on hyperhemispherical Si lens
PCA-40-05-10-800-h-l	Mounted on hyperhemispherical Si lens <b>plus</b> Adjusted focusing optical lens for free space laser excitation
PCA-40-05-10-800-h-f	Mounted on hyperhemispherical Si lens <b>plus</b> Adjusted optical fiber
PCA-40-05-10-800-c	Mounted on collimating aspheric Si lens
PCA-40-05-10-800-c-l	Mounted on collimating aspheric Si lens <b>plus</b> Adjusted focusing optical lens for free space laser excitation
PCA-40-05-10-800-c-f	Mounted on collimating aspheric Si lens <b>plus</b> Adjusted optical fiber
PCA-40-05-10-800-a	Mounted on aspheric focusing Si lens
PCA-40-05-10-800-a-l	Mounted on aspheric focusing Si lens <b>plus</b> Adjusted focusing optical lens for free space laser excitation
PCA-40-05-10-800-a-f	Mounted on aspheric focusing Si lens <b>plus</b> Adjusted optical fiber

## Nomenclature

PCA-40-05-10-800-X-Y

PCA-40-05-10-800-X-Y	Antenna design	Parallel-line
PCA-40-05-10-800-X-Y	Antenna length	40 $\mu\text{m}$
PCA-40-05-10-800-X-Y	Gap distance	05 $\mu\text{m}$
PCA-40-05-10-800-X-Y	Gap width	10 $\mu\text{m}$
PCA-40-05-10-800-X-Y	Excitation wavelength	800 nm
PCA-40-05-10-800-X-Y	Mounted Si lens	0 / h / c / a
PCA-40-05-10-800-X-Y	Adjusted	l / f

## 2 PCA Specification

### 2.1 PCA-40-05-10-800-0

- Unmounted PCA chip

Table 1: Specification PCA-40-05-10-800-0

Parameter		Min	Recommended	Max
Laser source	Wavelength	650 nm	780 nm	850 nm
	Avg. optical power	-	10 mW	15 mW
	Avg. power density	-	-	50 000 W/cm <sup>2</sup>
	Fluence	-	-	750 μJ/cm <sup>2</sup>
	Pulse duration	-	100 fs	200 fs
	Repetition rate	70 MHz	80 MHz	-
	Spot diameter	5 μm	6 μm	-
Bias source	Voltage [V <sub>e</sub> ]	-	-	20 V
	Modulation frequency	0 Hz (Dc)	10 kHz	10 MHz
Dark resistance [R <sub>d</sub> ] <sup>1</sup>		> 2 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		

<sup>1</sup> Measurement conditions: room temperature & measuring voltage of 3.3 V

## 2.2 PCA-40-05-10-800-h

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

Table 2: Specification PCA-40-05-10-800-h

Parameter		Min	Recommended	Max
Laser source	Wavelength	650 nm	780 nm	850 nm
	Avg. optical power	-	10 mW	15 mW
	Avg. power density	-	-	50 000 W/cm <sup>2</sup>
	Fluence	-	-	750 μJ/cm <sup>2</sup>
	Pulse duration	-	100 fs	200 fs
	Repetition rate	70 MHz	80 MHz	-
	Spot diameter	5 μm	6 μm	-
Bias source	Voltage [V <sub>e</sub> ]	-	-	20 V
	Modulation frequency	0 Hz (Dc)	10 kHz	10 MHz
Dark resistance [R <sub>d</sub> ] <sup>2</sup>		> 2 MΩ	-	-
Parameter		Typical		
Package		Max. diameter 25.4 mm Min. length 9.5 mm		
THz Beam	Virtual focal length <sup>3</sup>	26.5 mm		
	Divergence angle	17°		

<sup>2</sup> Measurement conditions: room temperature & measuring voltage of 3.3 V

<sup>3</sup> Measured from the apex

## 2.3 PCA-40-05-10-800h-I

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

Table 3: Specification PCA-40-05-10-800-h-I

Parameter		Min	Recommended	Max
Laser source	Wavelength	650 nm	780 nm	850 nm
	Avg. optical power	-	10 mW	15 mW
	Avg. power density	-	-	50 000 W/cm <sup>2</sup>
	Fluence	-	-	750 μJ/cm <sup>2</sup>
	Pulse duration	-	100 fs	200 fs
	Repetition rate	70 MHz	80 MHz	-
	Beam diameter <sup>4</sup>	-	1.4 mm	1.6 mm
Bias source	Voltage [V <sub>e</sub> ]	-	-	20 V
	Modulation frequency	0 Hz (Dc)	10 kHz	10 MHz
Dark resistance [R <sub>d</sub> ] <sup>5</sup>		> 2 MΩ	-	-
Parameter		Typical		
Package		Max. diameter 25.4 mm Min. length 20.9 mm		
THz Beam	Virtual focal length <sup>6</sup>	26.5 mm		
	Divergence angle	17°		

<sup>4</sup> Collimated laser beam

<sup>5</sup> Measurement conditions: room temperature & measuring voltage of 3.3 V

<sup>6</sup> Measured from the apex

## 2.4 PCA-40-05-10-800-h-f

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

Table 4: Specification PCA-40-05-10-800-h-f

Parameter		Min	Recommended	Max
Laser source	Wavelength	650 nm	780 nm	850 nm
	Avg. optical power	-	10 mW	15 mW
	Avg. power density	-	-	50 000 W/cm <sup>2</sup>
	Fluence	-	-	750 μJ/cm <sup>2</sup>
	Pulse duration	-	100 fs	200 fs
	Repetition rate	70 MHz	80 MHz	-
	Beam diameter <sup>7</sup>	-	1.4 mm	1.6 mm
Bias source	Voltage [V <sub>e</sub> ]	-	-	20 V
	Modulation frequency	0 Hz (Dc)	10 kHz	10 MHz
Dark resistance [R <sub>d</sub> ] <sup>8</sup>		> 2 MΩ	-	-
Parameter		Typical		
Package		Max. diameter 30.5 mm Min. length 54.6 mm (without fiber)		
THz Beam	Virtual focal length <sup>9</sup>	26.5 mm		
	Divergence angle	17°		

<sup>7</sup> Collimated laser beam

<sup>8</sup> Measurement conditions: room temperature & measuring voltage of 3.3 V

<sup>9</sup> Measured from the apex

## 2.5 PCA-40-05-10-800-c

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

Table 5: Specification PCA-40-05-10-800-c

Parameter		Min	Recommended	Max
Laser source	Wavelength	650 nm	780 nm	850 nm
	Avg. optical power	-	10 mW	15 mW
	Avg. power density	-	-	50 000 W/cm <sup>2</sup>
	Fluence	-	-	750 μJ/cm <sup>2</sup>
	Pulse duration	-	100 fs	200 fs
	Repetition rate	70 MHz	80 MHz	-
	Spot diameter	5 μm	6 μm	-
Bias source	Voltage [V <sub>e</sub> ]	-	-	20 V
	Modulation frequency	0 Hz (Dc)	10 kHz	10 MHz
Dark resistance [R <sub>d</sub> ] <sup>10</sup>		> 2 MΩ	-	-
Parameter		Typical		
Package		Max. diameter 25.4 mm Min. length 16.0 mm		
THz Beam	Focal length <sup>11</sup>	∞		
	FWHM <sup>12</sup>	11.0 mm		

<sup>10</sup> Measurement conditions: room temperature & measuring voltage of 3.3 V

<sup>11</sup> Measured from the apex

<sup>12</sup> Full Width at Half Maximum

## 2.6 PCA-40-05-10-800-c-I

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

Table 6: Specification PCA-40-05-10-800-c-I

Parameter		Min	Recommended	Max
Laser source	Wavelength	650 nm	780 nm	850 nm
	Avg. optical power	-	10 mW	15 mW
	Avg. power density	-	-	50 000 W/cm <sup>2</sup>
	Fluence	-	-	750 μJ/cm <sup>2</sup>
	Pulse duration	-	100 fs	200 fs
	Repetition rate	70 MHz	80 MHz	-
	Beam diameter <sup>13</sup>	-	1.4 mm	1.6 mm
Bias source	Voltage [V <sub>e</sub> ]	-	-	20 V
	Modulation frequency	0 Hz (Dc)	10 kHz	10 MHz
Dark resistance [R <sub>d</sub> ] <sup>14</sup>		> 2 MΩ	-	-
Parameter		Typical		
Package		Max. diameter 25.4 mm Min. length 25.0 mm		
THz Beam	Focal length <sup>15</sup>	∞		
	FWHM <sup>16</sup>	11.0 mm		

<sup>13</sup> Collimated laser beam

<sup>14</sup> Measurement conditions: room temperature & measuring voltage of 3.3 V

<sup>15</sup> Measured from the apex

<sup>16</sup> Full Width at Half Maximum



## 2.7 PCA-40-05-10-800-c-f

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

Table 7: Specification PCA-40-05-10-800-c-f

Parameter		Min	Recommended	Max
Laser source	Wavelength	650 nm	780 nm	850 nm
	Avg. optical power	-	10 mW	15 mW
	Avg. power density	-	-	50 000 W/cm <sup>2</sup>
	Fluence	-	-	750 μJ/cm <sup>2</sup>
	Pulse duration	-	100 fs	200 fs
	Repetition rate	70 MHz	80 MHz	-
	Beam diameter <sup>17</sup>	-	1.4 mm	1.6 mm
Bias source	Voltage [V <sub>e</sub> ]	-	-	20 V
	Modulation frequency	0 Hz (Dc)	10 kHz	10 MHz
Dark resistance [R <sub>d</sub> ] <sup>18</sup>		> 2 MΩ	-	-
Parameter		Typical		
Package		Max. diameter 30.5 mm Min. length 54.6 mm (without fiber)		
THz Beam	Focal length <sup>19</sup>	∞		
	FWHM <sup>20</sup>	11.0 mm		

<sup>17</sup> Collimated laser beam

<sup>18</sup> Measurement conditions: room temperature & measuring voltage of 3.3 V

<sup>19</sup> Measured from the apex

<sup>20</sup> Full Width at Half Maximum

## 2.8 PCA-40-05-10-800-a

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

Table 8: Specification PCA-40-05-10-800-a

Parameter		Min	Recommended	Max
Laser source	Wavelength	650 nm	780 nm	850 nm
	Avg. optical power	-	10 mW	15 mW
	Avg. power density	-	-	50 000 W/cm <sup>2</sup>
	Fluence	-	-	750 μJ/cm <sup>2</sup>
	Pulse duration	-	100 fs	200 fs
	Repetition rate	70 MHz	80 MHz	-
	Spot diameter	5 μm	6 μm	-
Bias source	Voltage [V <sub>e</sub> ]	-	-	20 V
	Modulation frequency	0 Hz (Dc)	10 kHz	10 MHz
Dark resistance [R <sub>d</sub> ] <sup>21</sup>		> 2 MΩ	-	-
Parameter		Typical		
Package		Max. diameter 25.4 mm Min. length 16.0 mm		
THz Beam	Focal length <sup>22</sup>	50.0 mm		
	Convergence angle	10°		

<sup>21</sup> Measurement conditions: room temperature & measuring voltage of 3.3 V

<sup>22</sup> Measured from the apex

## 2.9 PCA-40-05-10-800-a-l

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

Table 9: Specification PCA-40-05-10-800-a-l

Parameter		Min	Recommended	Max
Laser source	Wavelength	650 nm	780 nm	850 nm
	Avg. optical power	-	10 mW	15 mW
	Avg. power density	-	-	50 000 W/cm <sup>2</sup>
	Fluence	-	-	750 μJ/cm <sup>2</sup>
	Pulse duration	-	100 fs	200 fs
	Repetition rate	70 MHz	80 MHz	-
	Beam diameter <sup>23</sup>	-	1.4 mm	1.6 mm
Bias source	Voltage [V <sub>e</sub> ]	-	-	20 V
	Modulation frequency	0 Hz (Dc)	10 kHz	10 MHz
Dark resistance [R <sub>d</sub> ] <sup>24</sup>		> 2 MΩ	-	-
Parameter		Typical		
Package		Max. diameter 25.4 mm Min. length 25.0 mm		
THz Beam	Focal length <sup>25</sup>	50.0 mm		
	Convergence angle	10°		

<sup>23</sup> Collimated laser beam

<sup>24</sup> Measurement conditions: room temperature & measuring voltage of 3.3 V

<sup>25</sup> Measured from the apex

## 2.10 PCA-40-05-10-800-a-f

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

Table 10: Specification PCA-40-05-10-800-a-f

Parameter		Min	Recommended	Max
Laser source	Wavelength	650 nm	780 nm	850 nm
	Avg. optical power	-	10 mW	15 mW
	Avg. power density	-	-	50 000 W/cm <sup>2</sup>
	Fluence	-	-	750 μJ/cm <sup>2</sup>
	Pulse duration	-	100 fs	200 fs
	Repetition rate	70 MHz	80 MHz	-
	Beam diameter <sup>26</sup>	-	1.4 mm	1.6 mm
Bias source	Voltage [V <sub>e</sub> ]	-	-	20 V
	Modulation frequency	0 Hz (Dc)	10 kHz	10 MHz
Dark resistance [R <sub>d</sub> ] <sup>27</sup>		> 2 MΩ	-	-
Parameter		Typical		
Package		Max. diameter 30.5 mm Min. length 54.6 mm (without fiber)		
THz Beam	Focal length <sup>28</sup>	50.0 mm		
	Convergence angle	10°		

<sup>26</sup> Collimated laser beam

<sup>27</sup> Measurement conditions: room temperature & measuring voltage of 3.3 V

<sup>28</sup> Measured from the apex

### 3 Application Note

#### 3.1 Measurement Setup

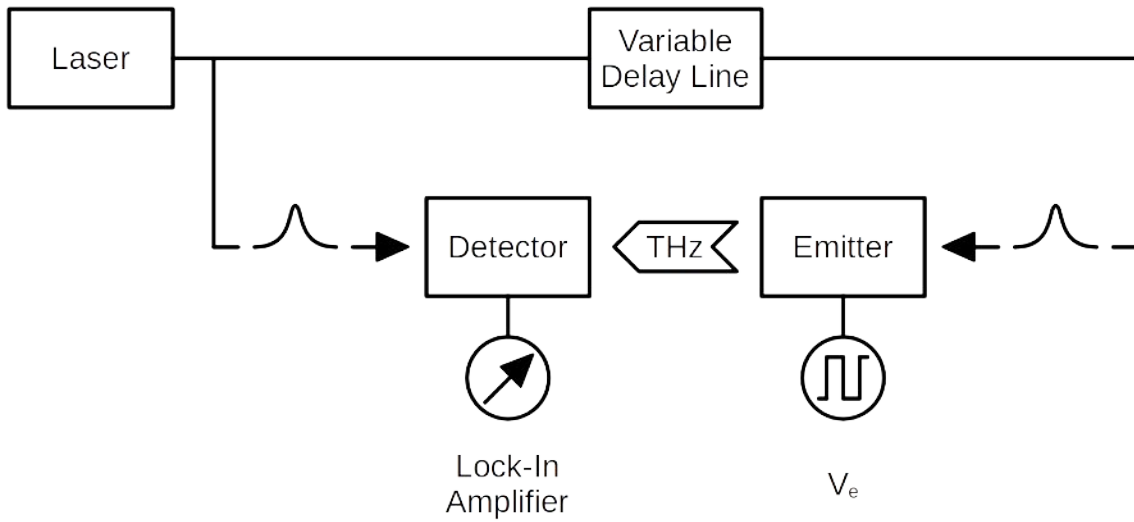


Figure 1: Setup for THz measurements

#### 3.2 PCA Design

Figure 2: PCA dimensions

Antenna length = 40  $\mu\text{m}$  / Gap distance = 5  $\mu\text{m}$  / Gap width = 10  $\mu\text{m}$

## 3.3 PCA Performance

Performance of the recommended PCA combination:

PCA-40-05-10-800 (Emitter) & bPCA-100-05-10-800 (Detector)

Figure 3: THz signal

Figure 4: THz spectrum

## 4 Contact Details

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