Chiral Photonics
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PROFA™ Pitch Reducing Optical Fiber Array – Two-Dimensional (2D)

Pitch Reducing Optical Fiber Arrays (PROFAs) provide low loss coupling between standard optical fibers and photonic integrated circuits.

Unlike typical fiber arrays, they also provide high density coupling that minimizes the valuable chip real estate needed for optical input/output (I/O). They can provide spot size conversion between small cross-section, chip-based waveguides and standard optical fibers.

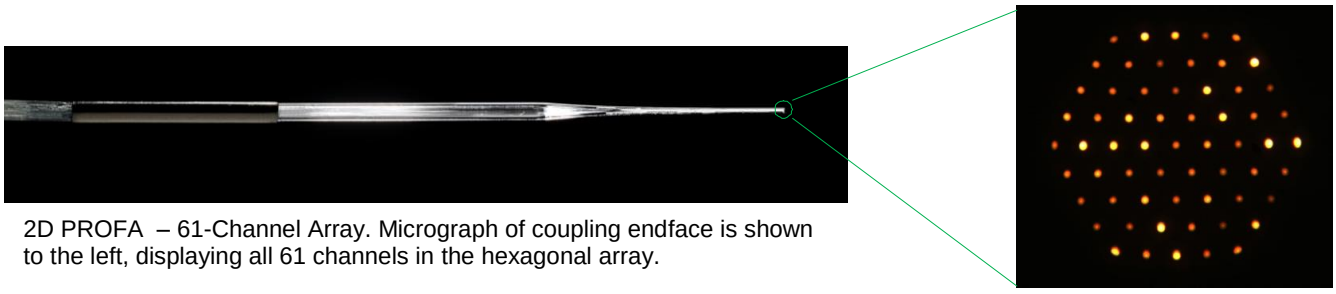
Two-dimensional (2D) PROFAs are used for chip face coupling to vertical grating couplers with mode field diameters of 9-11 µm or to chip-based devices such as VCSELs or photodiodes. Standard 2D PROFAs are available as hexagonal lattice arrays with up to 61 channels.

One-dimensional (1D) PROFAs are available in standard linear arrays of one to six channels and are typically used for chip edge coupling to waveguides with approximately 2 µm diameter mode field sizes.

Please speak to us about other mode field sizes and lattice configurations which have been addressed with custom PROFAs.

PROFAs are also used within coupled and packaged solutions that Chiral Photonics can provide.

For your photonic integrated circuit packaging needs, please be sure to contact us for our Optical Coupling & Packaging Design Guide which contains packaging recommendations to assist in your design work. Please send an e-mail to OptDesignGuide@chiralphotonics.com and we will get that right out to you.



2D PROFA – 61-Channel Array. Micrograph of coupling endface is shown to the left, displaying all 61 channels in the hexagonal array.

2D PROFA Specifications

Please speak to us about your custom or OEM needs. Custom PROFAs have been supplied to address different channel counts, wavelengths and configurations:

PARAMETER	UNIT	2D PROFA
Central Wavelength [1]	nm	1550
Mode Field Size [2]	µm	9-11
Bandwidth	nm	> 50
Insertion Loss [3]	dB	< 1 dB
Optical Return Loss [4]	dB	< -40
Crosstalk	dB	< -35
Number of Channels [5]		1-61
Channel Spacing [6]	µm	35 - 50
Maximum Channel Position Deviation [7]	µm	See chart below
Pigtails [8]		SM, 1 meter long, coated fiber
Operating Temperature	C	-40 to +85
Storage Temperature	C	-70 to +85
Package Type [9]		See **Dimensional Drawings** below

[1] Other wavelengths available upon request.

[2] Measured as $1/e^2$ intensity. Other mode field sizes available upon request.

[3] Measured from fiber pigtail to device tip, per channel.

[4] Intrinsic to device.

[5] Typical array is hexagonal. Other lattice arrays have been accommodated. Larger channel counts can also be accommodated.

[6] Other channel spacing sizes can also be accommodated.

[7] Measured typical error for 61-channel PROFA relative to “perfect array” channel position. Dependent on array size and pitch.

[8] Other pigtails, connectorization and other pigtail lengths available upon request.

[9] Please speak to us about your custom package and splicing needs.

Channel Position Deviation from Ideal Hexagonal Grid vs. Array Size:

2D PROFA - Number of Channels:	7	19	37	61
Positional Deviation – Average	0.3	0.4	0.7	1.0
Positional Deviation – Standard Deviation	0.1	0.2	0.2	0.3
Positional Deviation – Maximum Deviation	0.3	0.7	1.0	1.6

PROFA Benefits

Form Factor/High Density: Typical lenses cannot be packed closer than 125 microns, compromising the inherent density achievable on-chip. This advantage becomes even more compelling when an arrayed interconnect is of interest.

Polarization: Many waveguides are polarization sensitive and maintaining polarization through a lens to small waveguides is challenging if not impossible.

Currently only 1D PROFAs are available in PM versions. Stay tuned for 2D PROFAs.

Robust connection: PROFAs are intended to be butt coupled. No air gap eliminates the effects of thermal excursions in the package and dust that can make its way into the optical path. The monolithic all-glass construction enables sealing via adhesives or glass or solder (with metallization) for hermiticity, as needed.

Cost: In addition to performance advantages, the PROFA is competitively priced in volume quantities.

Technology Comparison

	APPLICATION REQUIREMENT				
TECHNOLOGY	**Mode Field Size ≤1 µm**	**Adaptable mode field profile**	**Polarization Maintenance**	**Wide Bandwidth**	**Cost Effective**
Lensed fiber	X	X	X	✓	✓
On-chip spot size converter	✓	✓	✓	✓	X
Second order grating	✓	-	-	X	✓
Tapered standard fiber	X	X	X	✓	✓
Lensed fiber + On-chip spot size converter		✓	X	✓	X
PROFA	✓	✓	✓	✓	✓

Ordering Information

PROFA2D - [λ] – [CC/SS]-[PT] – [CON] – [C]

Options

[λ]	Central Wavelength	Standard: Custom:	1550 nm wwww = customer specified: 800-2000 nm
[CC/SS]	Array Specifications	Standard: Custom:	Number of Channels (CC) = 01-61 Channel Spacing (SS) = 35 - 55 µm ccss = customer specified: cc = no. of channels, ss: channel spacing *Standard lattice is hexagonal, please specify if otherwise*
[PT]	Pigtails	Standard: Custom:	SMXX = singlemode, XX meter long ttll = customer specified: tt = fiber type, ll = pigtail length
[CON]	Connectors	Standard: Custom:	FC/UPC, FC/APC, LC/UPC or LC/APC (specify) CC/CCC = customer specified
[C]	Custom		C = denotes any custom feature, including all connectors

Examples

PROFA2D-1550-07/35-SM01:
2D PROFA, 1550 nm central wavelength, 7-channel, 35 µm channel spacing , SM pigtail – 1 meter long

PROFA2D-1550-07/50-SM01-FC/APC-C:
2D PROFA, 1550 nm central wavelength, 7-channel, 50 µm channel spacing , SM pigtail – 1 meter long, FC/APC connectors on pigtails

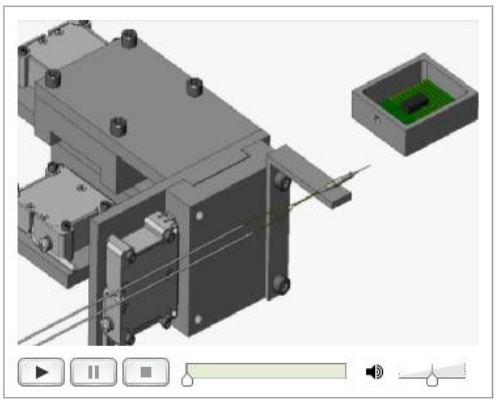
PROFA2D-1550-61/40-SM02-LC/UPC-C:
2D PROFA, 1550 nm central wavelength, 61-channel, 40 µm channel spacing , SM pigtail – 2 meters long, LC/UPC connectors on pigtails

Technical Notes

Cleaning and Care: PROFAs are all-glass and, therefore, can be cleaned with alcohol much like a bare fiber tip. Care must be taken to avoid breaking or chipping the tip as any damage to the tip will likely cause the device to be unusable.

Alignment and Coupling: The device is aligned similarly to other micro-optic devices, e.g. similar to working with lensed fibers. Using the PROFA, the most efficient and stable coupling is achieved by butt coupling the device to the waveguide. Often customers will use index matching liquids or adhesives but this is not required.

Rough Alignment: 2D PROFAs are typically provided with a fiducial marking relative to the numbered channels of the array. This can be used to achieve rough alignment of the PROFA.



Alignment of PROFA animation

Fine Alignment: A five axis stage with at least 1 micron resolution is typically used for XYZ motion as well as angular alignment. The needed stage resolution will depend on the mode field sizes one is working with and the application. A general rule of thumb is 10% of the mode field diameter, or 1 µm for a standard 2D PROFA.

Dimensional Drawing