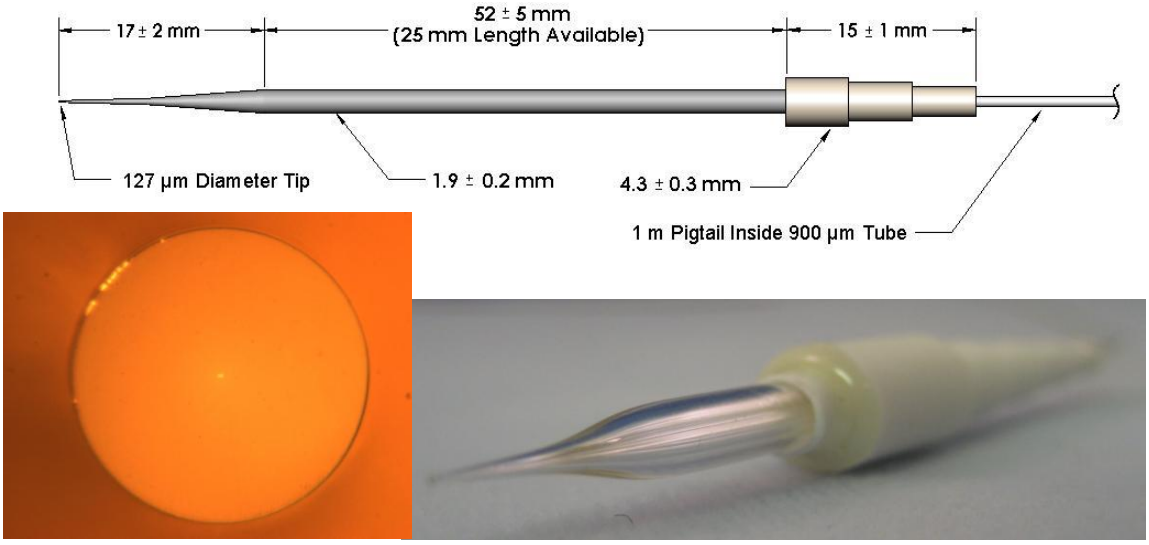
Spot-Size Converting Interconnect

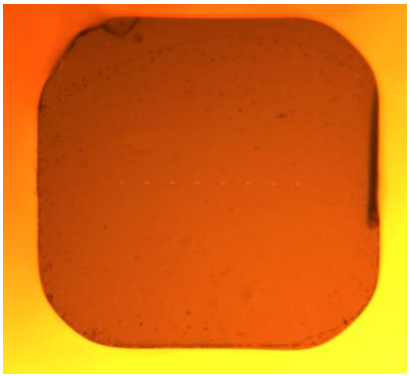
The Helica™ Spot-Size Converting Interconnect (SSCI) is an efficient and highly robust connector for directly coupling singlemode optical fiber to planar waveguide devices or other high numerical aperture (NA) waveguides with mode field dimensions down to sub-micron sizes.

This interconnect can be directly abutted without the need for an air gap as required for lensed fibers. The connection can also be enhanced with index matching adhesives for robust connections immune to thermal excursions, dust and vibrations. The interconnect maintains polarization and can even be supplied with an integrated polarizer – linear or circular – for delivery of light to polarization sensitive waveguides.



Spot-Size Converting Interconnect (SSCI) – polarization maintaining version. The all-fiber optical path is housed within a rugged all-glass housing shown above, right, and schematically, top. The tapered face is shown above, left, with the polarization-maintaining core visible in the center.

These interconnects offer the lowest loss connections possible without the need for on-chip spot size conversion or lensed fibers. SSCIs offer lower insertion loss than on-chip conversion without lowering wafer yield due to more complex processing and increased chip size. On-chip conversion will often also require the use of lensed fibers. Lensed fibers are challenged to couple to micron-level waveguides and maintain polarization with their requisite air gap between the lens and the waveguide. This air gap also adds to instabilities that can arise with even slight thermal excursions in the package when working with micron-level mode field dimensions.



Arrayed SSCIs are also available to address the need for high density interconnects with multiple channels that can be spaced less than 25 microns apart. These custom SSCIs, like the tapered face of an eight-channel design shown to the right, are typically fabricated to match the chip design's spacing and mode field diameter requirements. Other requirements that have been customized include the SSCI outer profile shape (e.g. chamfered square, shown to the right), dimensions and length and coatings (such as metallization) to enable easy integration into specific package designs. Similarly the boot and fiber packaging can be customized to meet customer needs.

PROPERTIES			
Central Wavelength [1]	980/1064 nm	1310 nm	1550 nm
Mode Field size [2]	0.5 x 0.8 µm	0.7 x 1.0 µm	0.8 x 1.2 µm
Bandwidth	> 50 nm		
Polarization Extinction Ratio (PER) – for PM version [3,4]	> 20 dB		
Typical Insertion Loss	< 1 dB		
Optical Return Loss	-22 to -24 dB, -40 dB available (LRL)		
Package Style [5]	All-glass		
Pigtails [6]	PM, 1 m, inside 900 µm furcation tube		
Operating Temperature	-40 to +85°C		
Storage Temperature	-70 to +85°C		

[1] Other wavelengths available upon request.
[2] Mode field dimensions can be tailored upon request
[3] Typically, passing polarization aligned to fiber's slow axis. Can be customized.
[4] Polarizing – linear or circular – also available to deliver light with PER > 30 dB
[5] Typical package, shown in schematic above, for PM version. For polarizing versions and other custom needs, please inquire.
[6] Connectorization, other pigtails (e.g. SM), pigtail lengths and jacketing available upon request.

Ordering information:

SSCI – [**λ**] — [**PT**] — [**CON**] — [**LRL**] — [**C**]

Options			
λ	Central Wavelength	Standard	**980**, **1064**, **1310**, **1550** nm
		Custom	***wwww*** = Customer specified: 800 to 2000 nm
PT	Pigtails	Standard	**PMXX** = Polarization Maintaining (PANDA), 1 meter long typical (PM01)
			SMXX = Singlemode, 1 meter long typical (SM01)
		Custom	***ttll*** = Customer specified: **tt** = fiber type, **ll** = pigtail length
CON	Connectors	Standard	**FC/UPC**, **FC/APC**, **LC/UPC** or **LC/APC** (specify)
		Custom	***CC/CC*** = Customer specified
LRL	Low Return Loss		**LRL** = <-40 dB Back-reflection
C	Custom		**C** = Custom – enter for every custom option above (including **LRL**) OR for polarizing – linear or circular OR custom package requirements OR other custom requirements to be specified

For example:

SCCI-1550-PM01:	Spot-size converting interconnect, 1550 nm central wavelength, PM fiber pigtail – 1 meter long, No connector
SCCI-1310-PM02-FC/APC-C	Spot-size converting interconnect, 1310 nm central wavelength, PM fiber pigtail – 2 meter long, FC/APC connector, Custom
SCCI-1480-SM01-C	Spot-size converting interconnect, 1480 nm central wavelength, SM fiber pigtail – 1 meter long, No connectors, Custom

Benefits

There are a variety of selling points depending on the customer's vantage point, including:

- **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, especially in high speed applications (e.g. InP) are polarization sensitive and maintaining polarization through a lens to small waveguides is challenging if not impossible.
  Polarizing the light for delivery of linear or circularly polarized light is also valuable for many applications
- **Robust connection:** 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 SSCI is competitively priced and even arrayed interconnects can approach $100 per channel in volume quantities.

	Application Requirements				
	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
Spot-size converting interconnect	✓	✓	✓	✓	✓