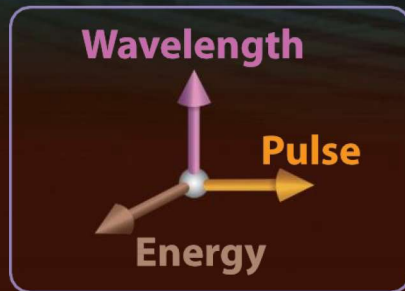


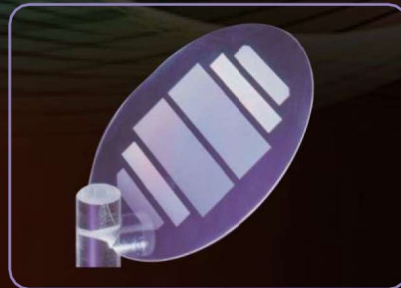
$$E = hc/\lambda = \text{HC Photonics} / \text{full spectrum } \lambda$$

Enable Generation & Sensing of Full Spectrum Laser Sources as well as their applications



Laser Sources

+
with



PPXX Technology

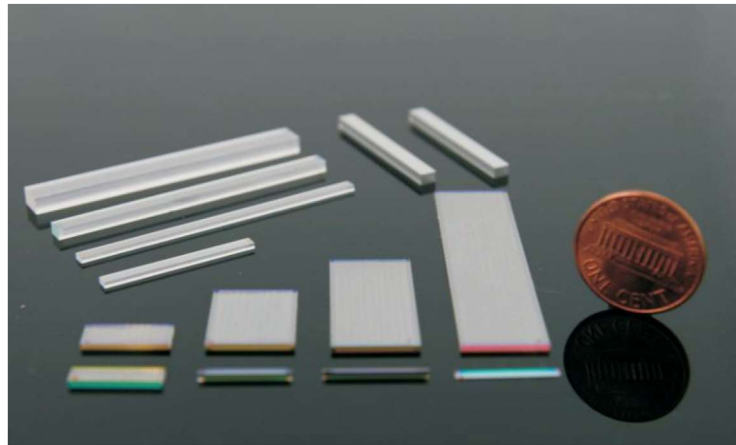
=
enable



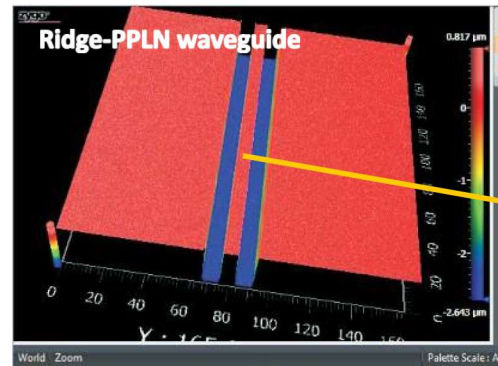
Full Spectrum Opportunities



Periodically Poled Lithium Niobate/Lithium Tantalate (PPXX chips)

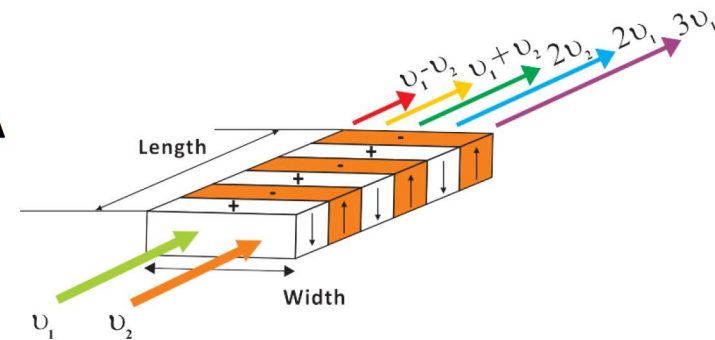


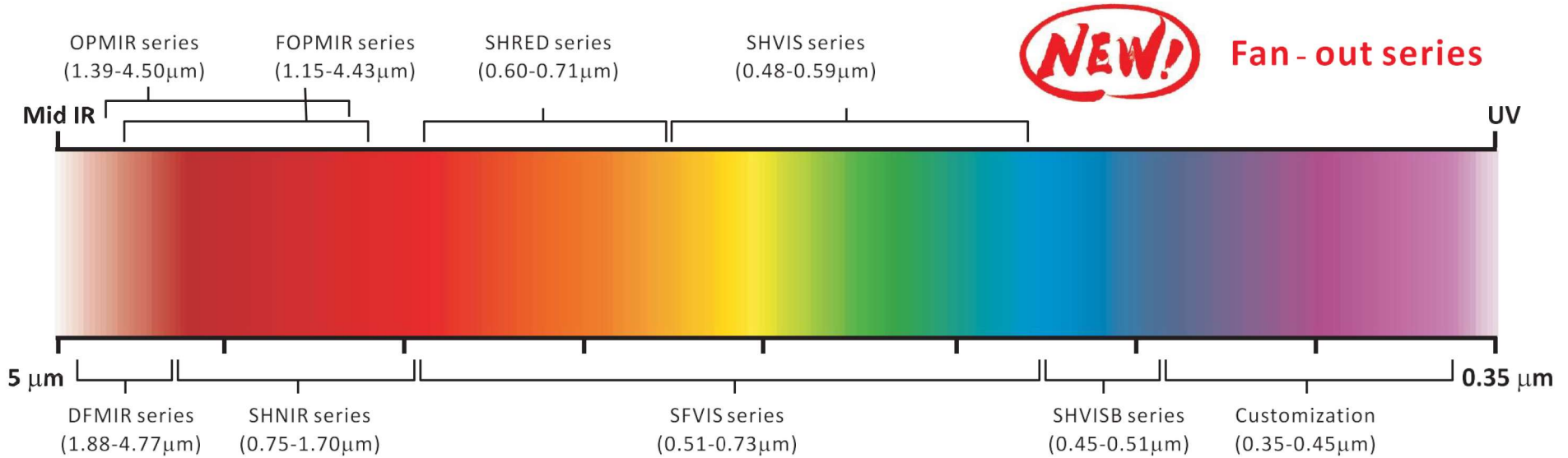
PPXX (Periodically Poled Lithium Niobate/Tantalate) is an efficient laser wavelength conversion technology, which enables the generation of new laser wavelengths via $\chi(2)$ nonlinearity of the materials. With the engineered microstructure on ferroelectric nonlinear materials and the special waveguide solution, HCP's PPXX chips provide you efficient frequency conversion processes for full-spectrum applications.



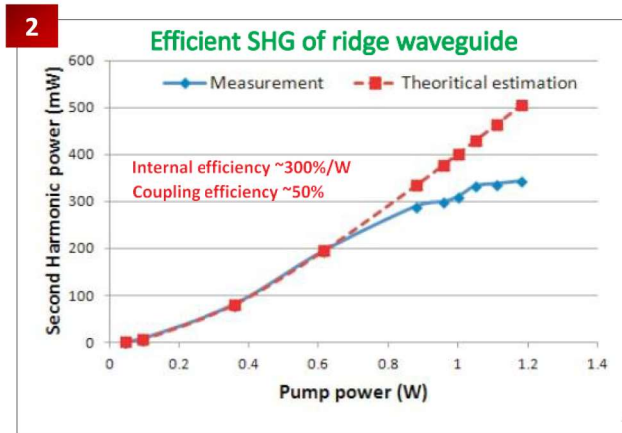
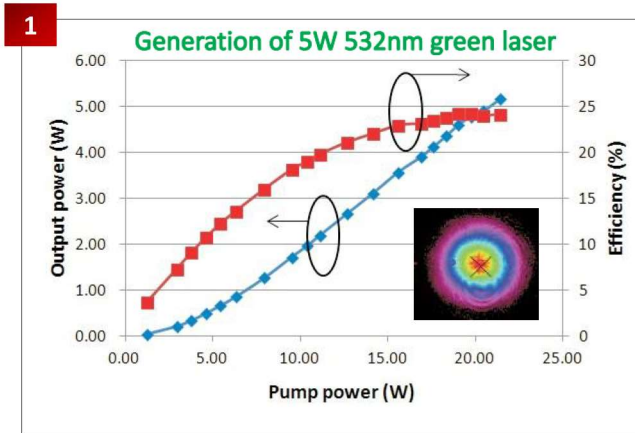
Configuration of nonlinear frequency conversion:

- SHG
- SFG
- DFG/OPA
- SPDC
- OPO
- OPG
- ...



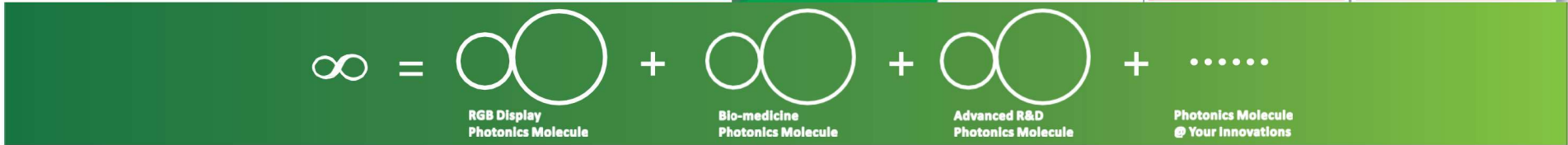


SHIPPING TODAY >365 stock PPLNs with single/multiple/fan-out design in different lengths with optional chip holders & oven sets



(1) Generation of high power visible light by single pass frequency doubling in PPLT. The beam quality remains nearly Gaussian beam.

(2) The efficient SHG for 1μm pump in 1cm-long ridge waveguide. The propagation loss and fiber-waveguide mode mismatching have been taken into account in the coupling efficiency.

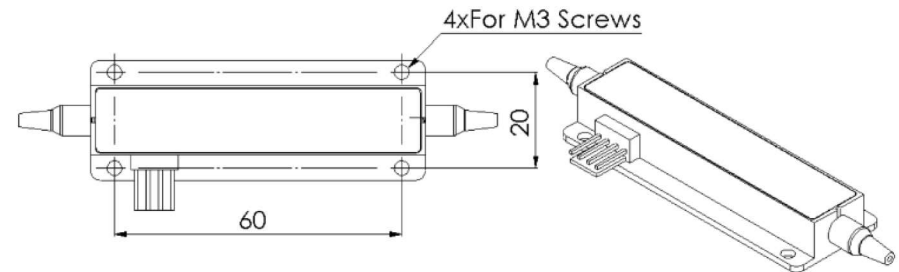


PPXX Mixers **NEW** Telecom band SHG & Quantum

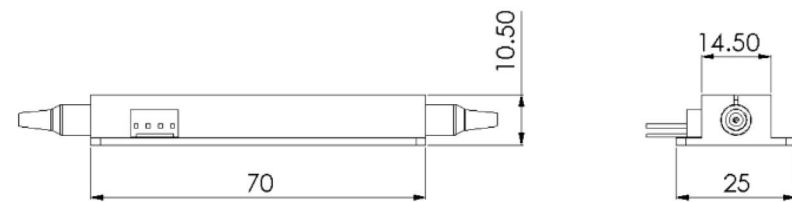
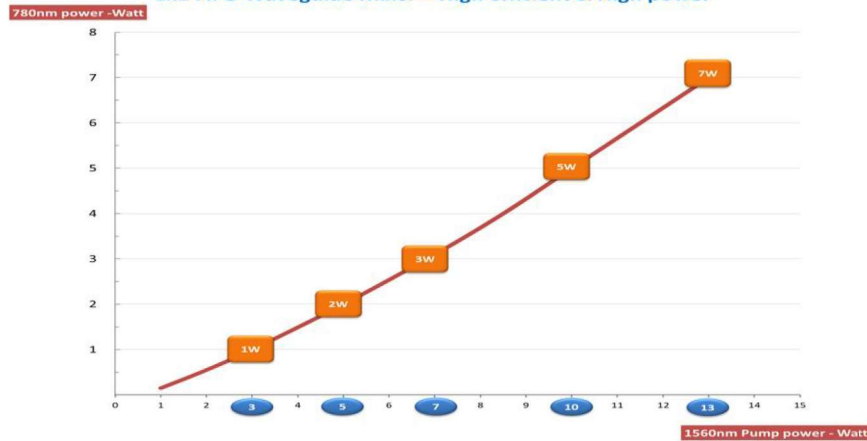


- High efficiency (up to 65%)
- High power (output up to **7W/8.5W-1x1/1x0**)
- Compact/Robust package (~18 cc only)
- Custom Wavelengths upon request
- All-fibered (FIFO, Fiber-In & Fiber-Out)
- **Commercial volume available**

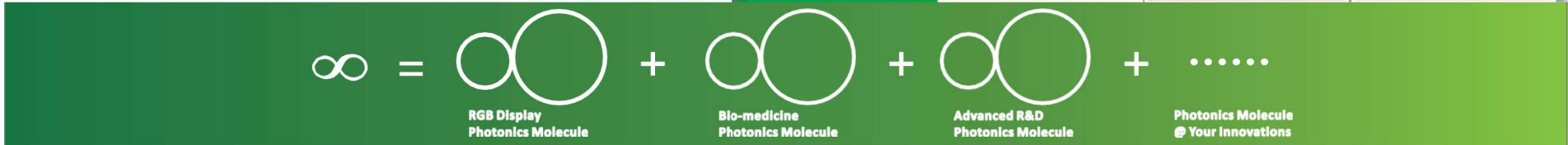
Package dimension:



1x1 FIFO Waveguide Mixer – High efficient & High power

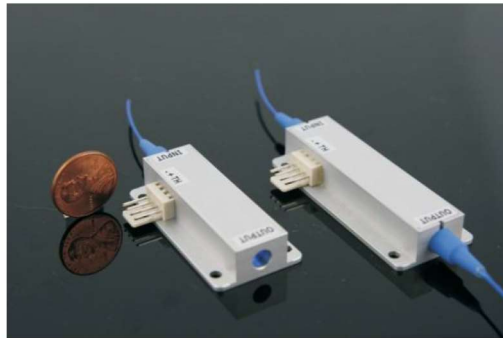


Unit: mm



PPXX Mixers

- Waveguide mixer



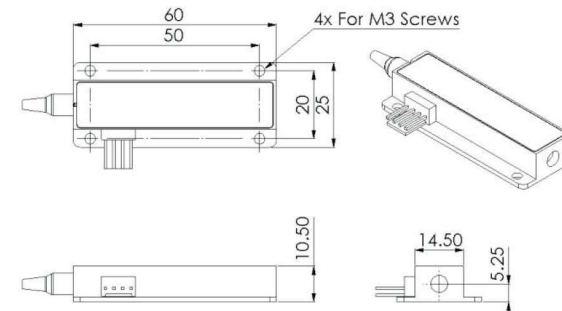
Features:

- High efficiency (up to 65%)
- High power (up to **8.5W** free-space out)
- Compact/Robust package
- Custom Wavelengths upon request
- All-fibered(FIFO, Fiber-In & Fiber-Out)
- **Commercial volume available**

Applications:

- Industrial Quality Control
- Quantum
- Bio & Medicine
- Spectroscopy & Environment
- Space & Defense
- Science & Research

Package dimension:

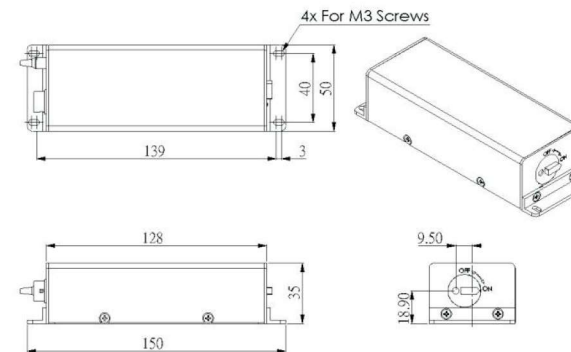


unit: mm

- Bulk mixer



HCP's precision alignment and photonics packaging facilities provide fast customization and commercialization services. Our "Mixer" is a compact, plug & play module designed for wavelength conversion applications, featuring integrated optics and electronics. The mixer frees your hands from the delicate optical alignment, and offers an effortless, maintenance-free solution. Our service range covers simulation, integration and qualification test. We aim to realize your innovation and special application with "Photonics Packaging & Application Integration Service".



unit: mm

General specifications of standard PPXX mixers

Parameters	Bulk type	Waveguide type
Series	B(450-495nm) Y(560-580nm)	G(495-560nm) O(580-620nm) R(620-800nm)
Options	Power monitoring, Controller, Special filters	Power monitoring, Controller, Special filters, Fiber adaptor package
Functionality	SHG/SFG/DFG/OPA/OPG/SPDC ...	
Output power	Up to 10W	Up to 8.5W
Required pump power	Up to 40W	Up to 13W
Beam Characteristics	TEM00, Collimated	TEM00, oval shape, circular
Beam quality, M^2	<1.2	
Polarization	Linear, >20dB	
Return loss	-45dB	-40dB
Environmental condition	15~30deg.C (Operation), -20~70deg.C (storage & Transportation)	

Custom options:

1. Wavelength range: UV (355nm)~MIR (4200nm)
2. Integrated photodetector for output power monitoring
3. Configurations of nonlinear frequency conversion: SHG, SFG, DFG/OPA, SPDC, etc.
4. Specified fiber coupled output e.g. PM480, SMF1550 and fiber length with or without connectors
5. 1x0 (fiber in/free space out), 1x1 (fiber in/out), 2x0 (2 fibers in/free space out), 2x1(2 fibers in/1 fiber out)

Please refer to "PPLN Optical Mixers" catalog for further information

NEW

PPXX chips

PPXX mixers

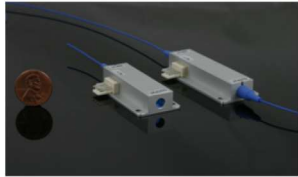
OPO mixers

Accessories

Photonics services

HCP
HC PHOTONICS CORP.

1x0 8.5W 780nm Waveguide Mixer



- Plug & play
- High power & high efficiency
- Compact & robust

Preliminary

Reference Specification sheet

Optics (General)	unit	Specification			Note
Mixer Type		Second Harmonic Generation (SHG)			
Mixer Pigtailling Type		1x0			
Input Wavelength	nm	1560			[1]
Output Wavelength	nm	780			
Input Fiber, Connector		PM1550 + mode adaptor, None			
Output Fiber, Connector		Free space, divergence (ellipse shape)			
Specified pump power	W	13			
Pump condition		CW, single longitudinal mode			
Optics (output)	unit	Minimum	Typical	Maximum	Note
Output power @ specified pump	W	8.5	8.8		[2]
Output polarization state		linear @ vertical axis			
Output PER	dB	18	20		
Back reflection of IR wavelength	dB		-45	-40	
Mechanics	unit	Specification			Note
Housing dimension (LxWxH)	mm	60 x 25 x 10.5			
Electrics	unit	Minimum	Typical	Maximum	Note
Electrical connector		Molex 0022112042 (4P)			
Thermoelectric cooler		-3.9V, -1.7A maximum			
NTC Thermistor resistance@25°C	kΩ	10			
Thermistor B vale (B25/85)	K	3478			
Environment	unit	Minimum	Typical	Maximum	Note
Storage temperature (no humidity)	°C	-20	-	70	
Operating ambient temperature range	°C	15	25	30	
Operating relative humidity (non condensing)	%RH	0	-	85	
Vibration / Shock		Refer to ISTA-2A			
Restriction of hazardous substances directive (RoHs)		Declaration of Conformity to 2011/65/EU			

[1] Any wavelength at C band is available with the same spec upon request.

[2] Input wavelength is not filtered. (Filter can be added optionally in different housing.)

HCP
HC PHOTONICS CORP.

1x1 7W 780nm Waveguide Mixer



- Plug & play
- High power & high efficiency
- Compact & robust
- All-fibered (FIFO, fiber input & fiber output)

Preliminary

Reference Specification sheet

Optics (General)	unit	Specification			Note
Mixer Type		Second Harmonic Generation (SHG)			
Mixer Pigtailling Type		1x1			
Input Wavelength	nm	1560			
Output Wavelength	nm	780			
Input Fiber, Connector		PM1550+mode adaptor			[1]
Output Fiber, Connector		PM780/850, None			
Specified pump power	W	13			
Pump condition		CW, Single longitudinal mode			
Optics (output)	unit	Minimum	Typical	Maximum	Note
Output power @ specified pump	W	7	7.2		[2]
Output polarization state		linear @ slow axis			
Output PER	dB	18	20		
Back reflection of IR wavelength	dB		-45	-40	
Mechanics	unit	Specification			Note
Housing dimension (LxWxH)	mm	70 x 25 x 10.5			
Electrics	unit	Minimum	Typical	Maximum	Note
Electrical connector		Molex 0022112042 (4P)			
Thermoelectric cooler		-3.9V, -1.7A maximum			
NTC Thermistor resistance@25°C	kΩ	10			
Thermistor B vale (B25/85)	K	3478			
Environment	unit	Minimum	Typical	Maximum	Note
Storage temperature (no humidity)	°C	-20	-	70	
Operating ambient temperature range	°C	15	25	30	
Operating relative humidity (non condensing)	%RH	0	-	85	
Vibration / Shock		Refer to ISTA-2A			
Restriction of hazardous substances directive (RoHs)		Declaration of Conformity to 2011/65/EU			

[1] Additional fiber mode adaptor is included.

[2] Input wavelength is not filtered. (Filter can be added optionally in different housing.)



PPXX Cavity Mixers



Cavity configuration is an alternative way to enhance nonlinear frequency conversion. To fit all kinds of applications, HCP develops a versatile cavity mixer platform with a users-friendly interface. This structure seamlessly adapts to various form, including external pump OPO (EP-OPO), Intra-cavity OPO (IC-OPO), Intra-cavity SFG (IC-SFG), Intra-cavity DFG (IC-DFG) etc. They are widely applied for generating NIR signal wavelengths between 1.4-2 um and MIR idler wavelengths between 2.3-4.5 um.

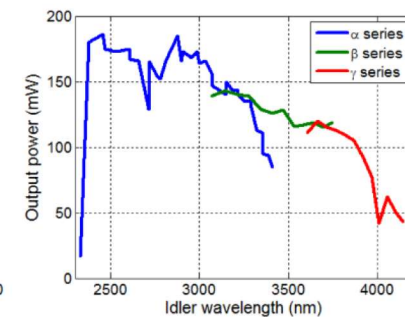
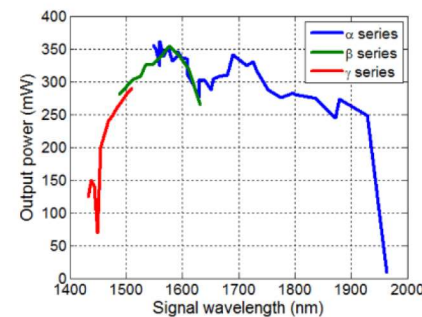
Features:

- Cavity enhanced for higher efficiency
- Wavelength from UV/Visible to NIR/MIR
- Fiber delivery optional
- Wavelength tunable up to few-hundreds nm
- Convenient, compact and robust

Parameter	unit	ICOPO-B ¹ & ICOPO-TB ²
Signal/Idler Wavelength	nm	α series: 1560-1880/2500-3300 β series: 1495-1640/3000-3700 γ series: 1440-1510/3600-4080
Signal/Idler Output Power	mW	α series: 250/100 β series: 250/90 γ series: 200/70
Linewidth	GHz	300
Beam Quality		TEM00, Signal M2<1.2, Idler M2<1.5
Polarization		Linear, >20dB

1. ICOPO-B: broad bandwidth (few nm), specific wavelength within α,β,γ range could be designed

2. ICOPO-TB: tunable (few hundred nm)



NEW

PPXX chips

PPXX mixers

OPO mixers

Accessories

Photonics services

HCP
HC PHOTONICS CORP.

EPOPO-TB Mixer



- CW mid-infrared output at Watt level
 - Tunable wavelength from 1.44-1.88 micron and 2.5-4.08 micron
 - NIR /MIR dual outputs
 - Fiber output for the NIR port optional
- Preliminary**

Reference Specification sheet

Optics (General)	unit	Specification	Note		
Module type		EPOPO-TB			
Mixer Pigtailling Type		1 x (0 + 0)			
Input Wavelength	nm	1064	[1]		
Input Fiber, Connector		FUD3460, None			
Pump condition		CW, single frequency, or multimode with <0.1nm linewidth			
Specified pump power	W	10			
Output Wavelength - Signal	nm	α series - 1560 - 1880 β series - 1495 - 1640 γ series - 1440 - 1510			
Output Wavelength - Idler	nm	α series - 2500 - 3300 β series - 3000 - 3700 γ series - 3600 - 4080			
Output power - Signal	W	α series - 3, β series - 2.5, γ series - 2	[2]		
Output power - Idler	W	α series - 1.5, β series - 1.5, γ series - 1	[2]		
Output type		CW, free space, collimated	[3]		
Optics (output)	unit	Minimum	Typical	Maximum	Note
Beam quality, M ² - Signal			1.1	1.2	
Beam quality, M ² - Idler			1.2	1.5	
Linewidth	GHz		150	300	
Diameter of collimated output beam (Signal / Idler)	mm	0.8 / 3	1 / 3.5	2 / 4	[4]
Output beam (TEM ₀₀) ellipticity	%		10	20	
Residual power rejection ratio at different wavelength	dB	40	45		
Output polarization state			linear @ vertical axis		
Output PER	dB	20	25		
Output beam height	mm	43.5	44	44.5	
Output beam angle	mrad	-7.5	0	7.5	
Mechanics	unit	Specification	Note		
Housing dimension (L*W*H)	mm	~ 272 x 140 x 65			
Electrics	unit	Minimum	Typical	Maximum	Note
Electrical connector			DTSC-20-s		[5]
Environment	unit	Minimum	Typical	Maximum	Note
Storage temperature (no humidity)	°C	5	-	65	
Operating ambient temperature range	°C	10	25	35	
Operating relative humidity (non condensing)	%RH	0	-	85	

HCP
HC PHOTONICS CORP.

Ultrafast OPG series Bulk Mixer



- Ultrafast OPG module with NIR and MIR outputs
- Up to 10% conversion efficiency
- Linear polarized

Reference Specification sheet

Optics (General)	unit	Specification	Note		
Mixer type		Ultrafast OPG Mixer			
Mixer pigtailling type		0 + (0 x 0)			
Input wavelength	nm	1060			
Output signal central wavelength	nm	1570 to 1700	[1]		
Output idler central wavelength	nm	2800 to 3400	[1]		
Pump condition		>50nJ, >35fs			
Output type		Free space, collimated			
Optics (Output)	unit	Minimum	Typical	Maximum	Note
Output conversion efficiency (Signal / Idler)	%	10 / 7		24 / 10	[2]
Output pulse width (Signal / Idler)	fs		150 / 65	200 / 100	
Diameter of collimated output beam (Signal / Idler)	mm	2.5 / 3.5		3.5 / 4.5	[3]
Beam quality, M ²			2	2.5	[3]
Output beam (TEM ₀₀) ellipticity	%			15	
Output polarization state			Linear @ vertical axis		
Output PER	dB	20			
Output beam height	mm	25	25.5	26	
Output beam angle	mrad	-7.5	0	7.5	
Mechanics	unit	Specification	Note		
Housing dimension (LxWxH)	mm	150 x 100 x 42	[4]		
Electrics	unit	Minimum	Typical	Maximum	Note
Electrical connector				Hirose HR 10G-10R-10P(73)	
Thermoelectric cooler				-3.2V, ~4A maximum	
NTC Thermistor resistance@25°C	kΩ		10		
Thermistor B vale (B25/85)	K		3478		
Environment	unit	Minimum	Typical	Maximum	Note
Storage temperature (no humidity)	°C	-20	-	70	
Operating temperature range	°C	10	25	35	
Operating relative humidity (non condensing)	%RH	0	-	85	
Vibration / Shock				Refer to ISTA-2A	
Restriction of hazardous substances directive (RoHs)				Declaration of Conformity to 2011/65/EU	



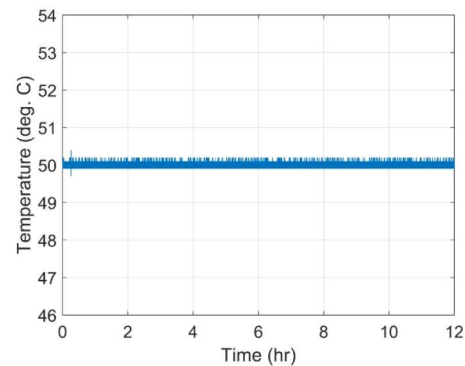
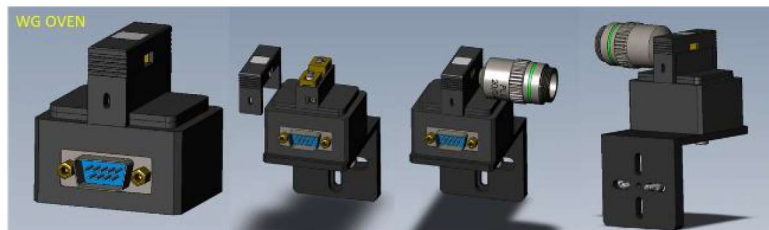
Accessories

- Temperature controller & Ovens

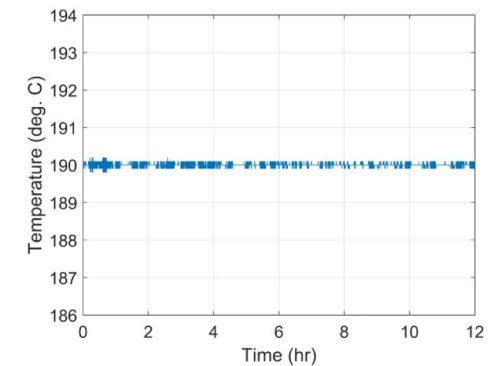
TC-038D



- PID control
- Auto-tuning & programmable
- Tuning step: 0.1°C
- Temperature tuning range: ambient temp. to 200°C
- Storage temperature: -20°C to 70°C
- Maximum power consumption: 24V/60W
- Communication Interface: USB & GUI program included
- Dimension: 150(L) x 90(W) x 65(H) mm³
- CE, RoHS/REACH compliance
- Excellent temperature stability

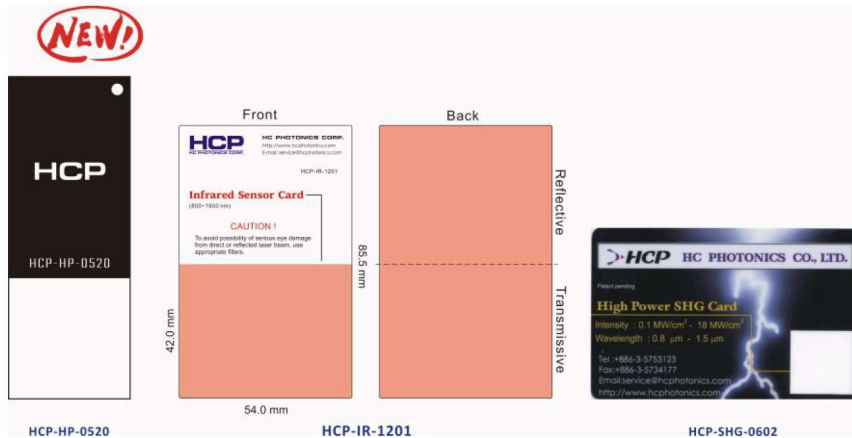


Temperature stability at 50 degrees Celsius

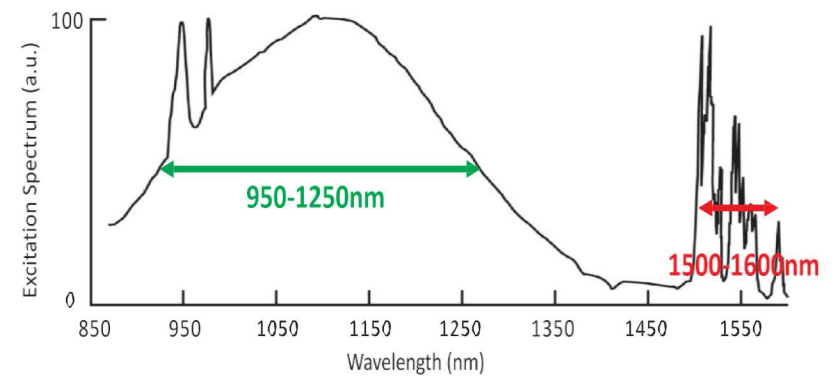


Temperature stability at 190 degrees Celsius

- IR sensing card



Technical information:



Welcome OEM orders with your logo and designs

Features:

- Ideally designed for CW or pulsed lasers (800~1600nm)
- Edge-to-edge design for easy alignment
- No optical recharging is required (HCP-HP-0520 & HCP-SHG-0602)
- ISO standard PVC card or Metal Aluminum base
- 2-in-1 card - Reflective & Transmissive (see laser spot from back side)
- Could be cut into small pieces for use (HCP-IR-1201)

Applications:

- View, locate and analyze CW Lasers, Pulsed Lasers, and IR Laser Diodes)

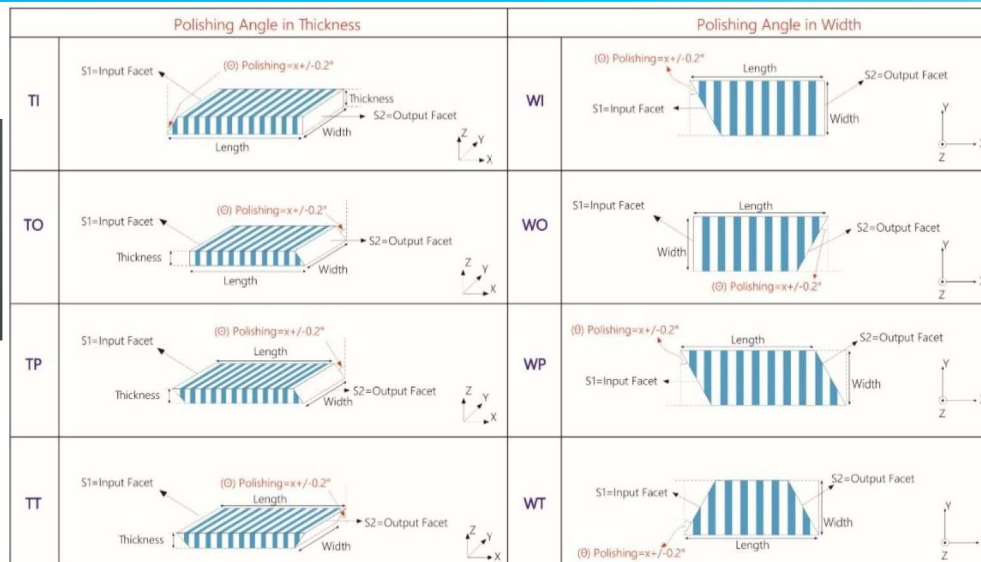
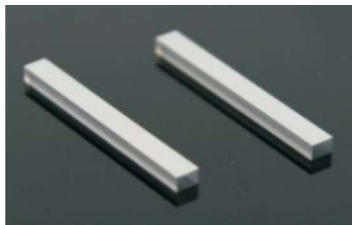
Specification	HCP-IR-1201	HCP-HP-0520	HCP-SHG-0602
Sensing Wavelength Range	800~1600 nm	800~1600 nm	800~1600 nm
Emission Wavelength Range	520~670 nm	400~800 nm	400~800 nm
Physical Dimension	86 mm x 54 mm	101 mm x 38 mm	86 mm x 54 mm
Active Region	86 mm x 54 mm (overall) 42 mm x 54 mm (transmissive) 43.5 mm x 54 mm (reflective)	38 mm x 38 mm (reflective)	20 mm x 20 mm (reflective)
Substrate Material	ISO standard PVC card	Aluminum	ISO standard PVC card



Full spectrum atoms are ready for your special photonics molecules

Photonics services

- Precision polishing



HC Photonics has excellent polishing capacities in house to meet specified requirements, such as wedge polishing, flatness, scratch/dig parallelism,...etc.



Technical information

Dimension Specification	P	G	Q
Parallelism S1//S2(0°±)	3'	5'	5'
Perpendicularity(90°±)	15'	21'	35'
ΔX (mm)	± 0.2 , X ≥ 5 mm ± 0.1 , X < 5 mm		
ΔY (mm)	± 0.1		
ΔZ (mm)	± 0.05		

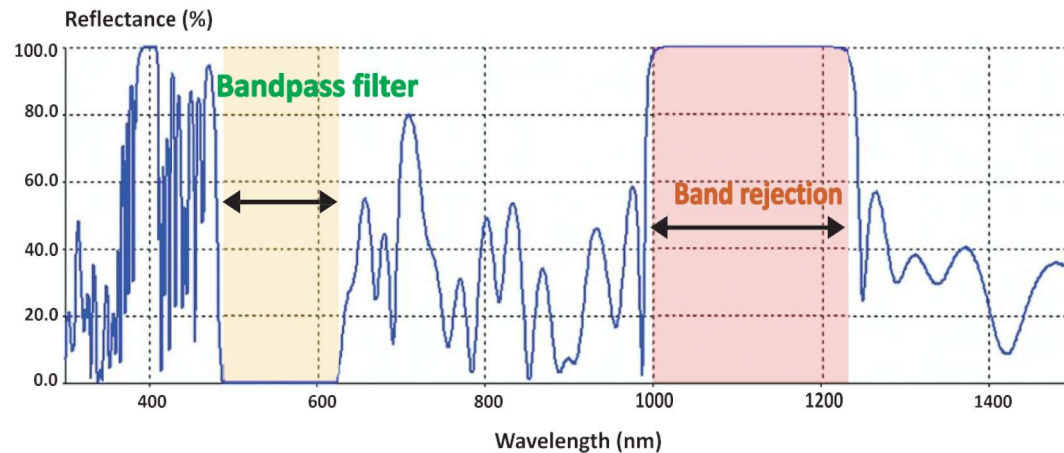
Surface Specification	A1	A2	A3
Scratch/Dig (S/D) based on MIL-O-13830	10/5	20/10	20/20
Clear Aperture (C.A.) in Z	80%		
Clear Aperture (C.A.) in Y	90%		
Chipping on S1 & S2	No chipping within C.A.		
Flatness (λ@633nm)	λ/10	λ/6	λ/6

- Optical coating



With extensive experiences at optical coating, HCP specializes on coating various substrates, such as Lithium Niobate or BK series glassed. We offer not only anti-reflection coating but beam splitter (50/50) and dichroic mirrors as well. By specifying your substrate, polarization and incident angle on inquiry, HCP is ready to offer comprehensive solutions tailored just for you.

- ▶ Sputter thin film deposition coater with radical assisted sputtering (RAS) technology
- ▼ Spectrometer for reflectance measurement



Technical information

Specifications	
Substrate	MgO:LN/LT/Quartz/Fused Silica/Optical Glass/Others
Incident Angle (Polarization)	0°/45° (P/S)
Coating Specification	Anti-Reflection (AR), Beam Splitter, High-Reflection (HR), custom spec
Damage threshold	>3GW/cm ² @1064nm, 30ns pulse, 25um radius, 1-3kHz Repetition rate
Surface Specification	A1/A2/A3 (see polishing spec on Page 9)



Your trusted value co-creation partner

