



NanoSpeed™ Premium 1x1, 1x2, 2X2 Fiber Optical Switch (1MHz, -30°C to 85°C Capability)

(Protected by U.S. patents 7,403,677B1; 6,757,101B2; and pending patents)

Product Description

The NS Premium Series fiber optic switch is developed for high repeat rate and moderate driving voltage based on the standard NS series of switching technology. This is achieved using patented electro-optical configuration featuring clean fast response without ripples and temperature compensation for outdoor operation. The NSP fiber optic switch is designed to meet the most demanding switching requirements of continuous operations over 25 years and non-mechanical ultra-high reliability.

The NSP Series switch is controlled by 5V TTL signals with a specially designed electronic driver having performance optimized for various repetition rate.

Performance Specifications

NanoSpeed P Series Switches	Min	Typical	Max	Unit	
Insertion Loss ^[1]	1900-2200nm ^[2]	0.8	1.5	dB	
	1260-1650nm	0.6	1.0		
	850-1100nm	1.2	1.5		
	780-850nm ^[2]	1.2 ^[1b]	1.5		1.8
	680 - 780nm ^[2]	1.5 ^[1b]	1.8		2.0
Cross Talk ^[3]	Single stage	18	25	35	dB
	Dual stage	30	36	45	
Durability	10 ¹⁴			cycles	
PDL (SMF Switch only)	0.15		0.3	dB	
PMD (SMF Switch only)	0.1		0.3	ps	
ER (PMF Switch only)	18	25	dB		
IL Temperature Dependency	0.25		0.5	dB	
Return Loss	45	50	60	dB	
Optical transition time ^[4]	40	90	ns		
Driver Repeat Rate	200kHz driver	DC	200	kHz	
	1000kHz driver	DC	1000		
Optic power Handling ^[5]	Normal power version		300	mW	
	High power version		5	W	
Operating Temperature	Standard	-5	75	°C	
	Large range version	-30	85		
Dimension	Please check the package option very carefully				
Storage Temperature	-40	100	°C		

[1] Measured without connectors. For other wavelengths, please contact us.
 [2] Wavelength <850nm or > 1900nm will be implemented in the special version.
 [3] Cross talk is measured at 100kHz, which may be degraded at the higher repeat rate.
 [4] It is defined as the rising or fall time between 10% and 90% of optical intensities.
 [5] Defined at 1310nm/1550nm. For the shorter wavelength, the handling power may be reduced, please contact us for more information.
 [1b] NPLC version available for high power and low loss that incorporating fiber core enlargement (expensive).

Features

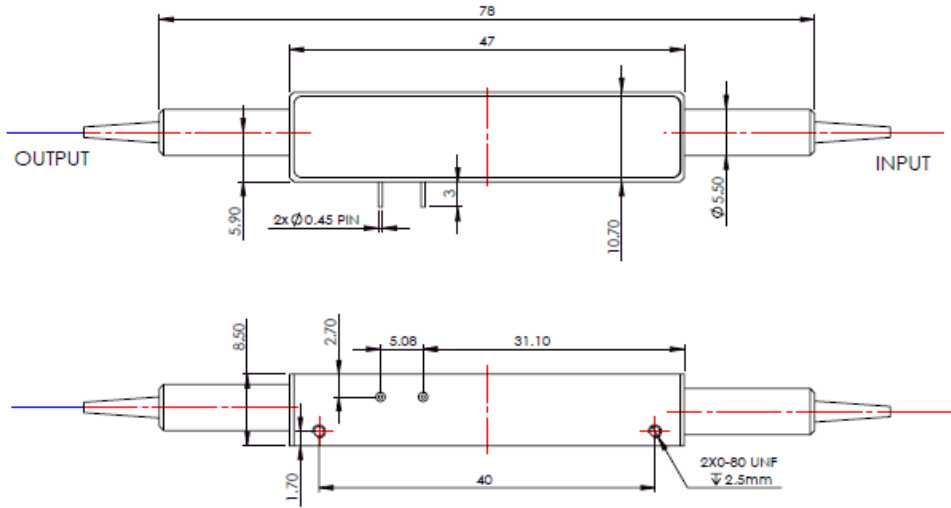
- Solid-State
- High speed
- Ultra-high reliability
- Low insertion loss
- Compact

Applications

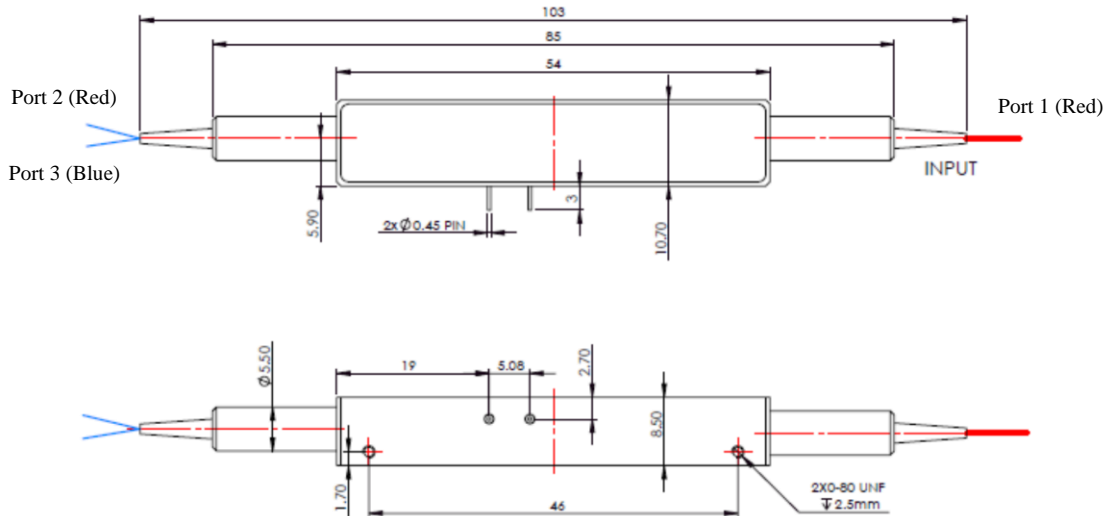
- Optical blocking
- Configurable operation
- Instrumentation

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Mechanical Dimensions (Unit: mm)



Package Type –I: NPSW-1x1

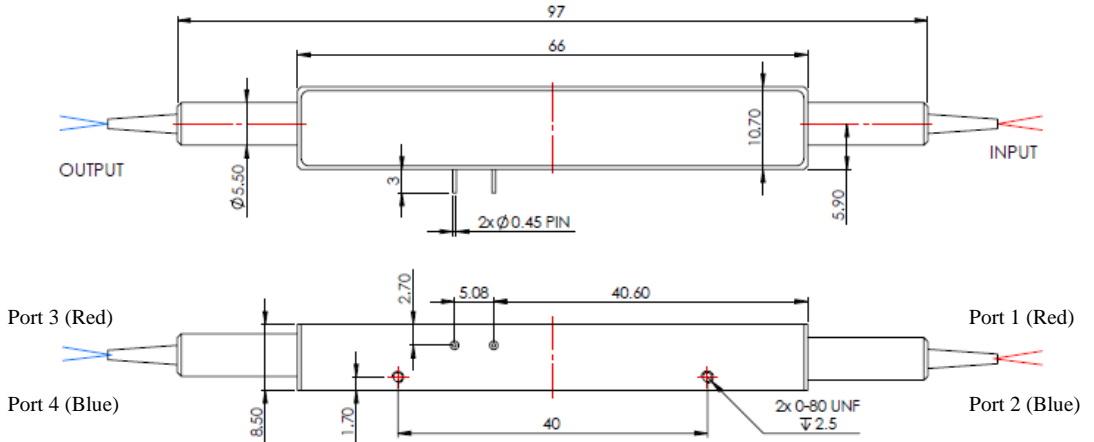


Package Type –II: NPSW-1x2 for wavelength $\geq 1030\text{nm}$ only

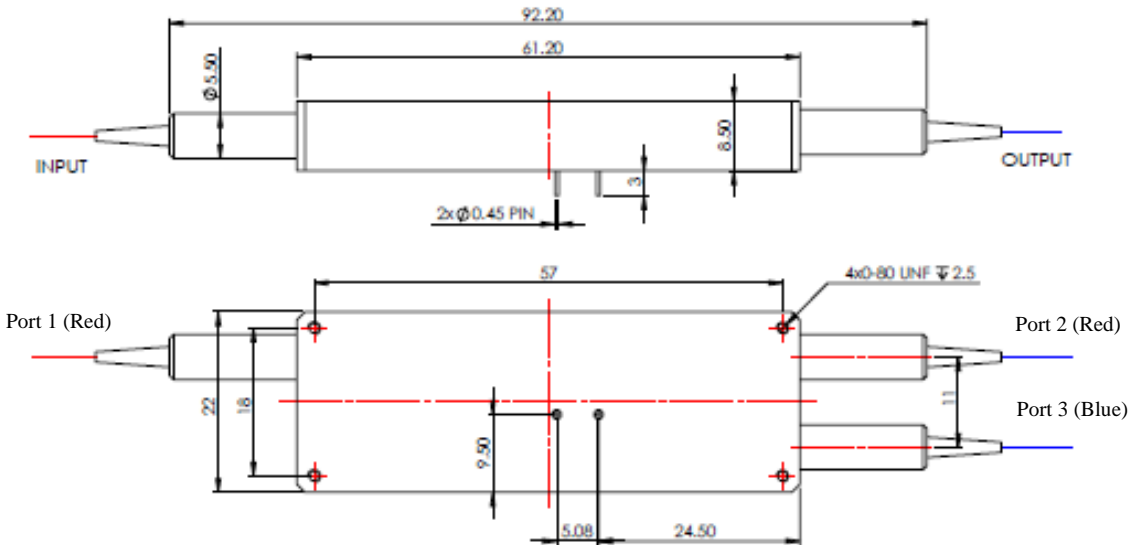
*Product dimensions may change without notice. This is sometimes required for non-standard specifications.

NanoSpeed™ Premium 1x1, 1x2, 2X2 Fiber Optical Switch

Mechanical Dimensions (Unit: mm)



Package Type –III: NPSW-2x2 for wavelength $\geq 1030\text{nm}$ only



Package Type –IV: 1-stage NPSW-1x2 ($\lambda \leq 1\mu\text{m}$), 2-stage NPSW-1x2, NPHW-1x1 & 1x2, NPTW-1x2

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Mechanical Dimensions (Unit: mm)

TBD (65mmx22mmx8.5mm)

Package Type –V: NPHW-2x2 under development

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Optical Path Driving Table

1x1 Optical Path	TTL Signal
ON for normally-open, OFF for normally-close	L (= 0V)
OFF for normally-open, ON for normally-close	H (> 3.5V)

1x2 Optical Path	TTL Signal
Port 1→ Port 2	L (=0V)
Port 1→ Port 3	H (> 3.5V)

2x2 Optical Path	TTL Signal
Port 1→Port 3, Port 2→Port 4	L (= 0V)
Port 1→Port 4, Port 2→Port 3	H (> 3.5V)

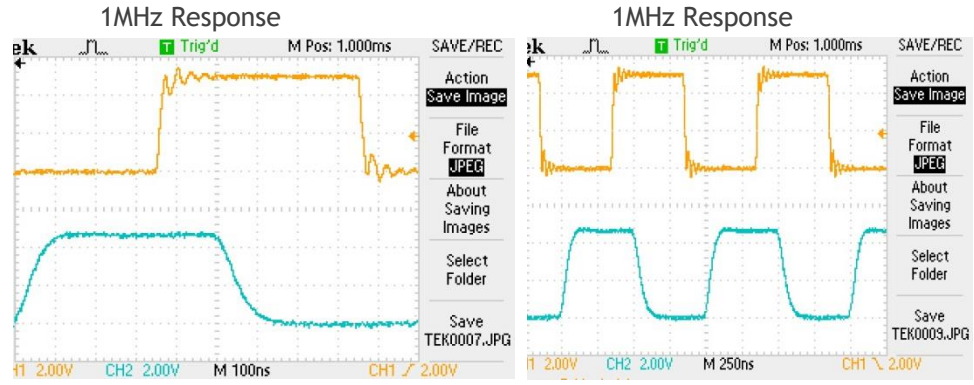
Driving Board Selection

Maximum Repetition Rate	Part Number (P/N)
200kHz	NSDR-1P1aM1111
1MHz	NSDR-1P1aH1111

* Note: For customers that prefer to design their own driving circuit, they are responsible for the optical performance. For more technical information, please contact us.

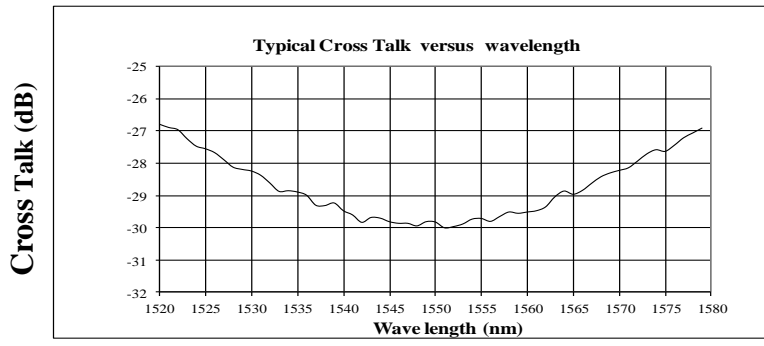
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Typical Speed and Repetition Measurement



Note: Top Traces are electrical; Bottom traces are optical

Typical Bandwidth Measurement



Ordering Information

Please carefully read Q & A in the next page before ordering.

	Type	Wavelength ^[3]	Grade ^[4]	Repetition Rate	Fiber Type	Fiber Length	Connector ^[1]
NPSW = Normal power version	1x1=11 1x2=12 2x2=22	1060=1 2000=2 1310=3 1550=5 1625=6 850=8 780=7 650=E 550=F 400=G Special=0	Single stage =1 Dual stage = 2	200kHz=1 1MHz=2	SMF-28=1 HI1060=2 HI780=3 PM1550/250=5 PM980=9 Special=0	Bare fiber=1 900um loose tube=3 Special=0	None=1 FC/PC=2 FC/APC= 3 SC/PC=4 SC/APC=5 ST/PC=6 LC/PC=7 LC/APC=8 Special=0

[1]: Please contact the sale about the high power connector.
 [2]: NPLC version is available only for wavelength shorter than 780nm and single stage version.
 [3]: The wavelength with red color can be implemented in the special version with a long lead-time.
 [4]: 2 stage version is not available for 2x2 currently.

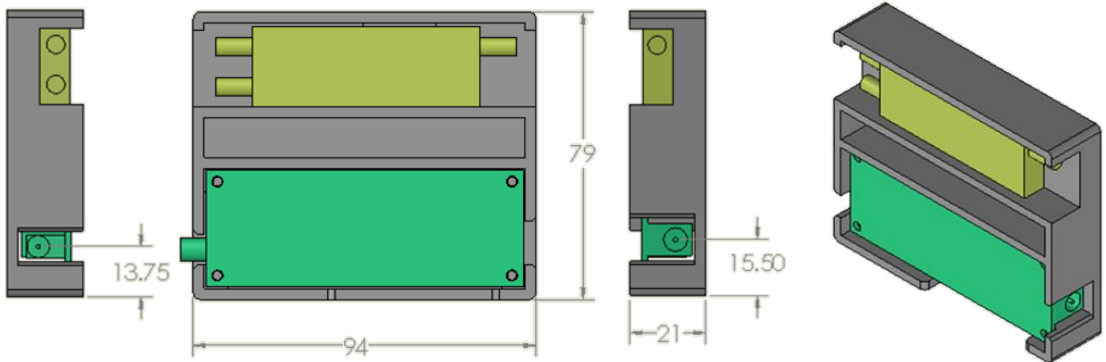
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Q & A

Q: Can NP device be directly mounted on PCB driver, such as NSDR?

A: NO. NP devices can be operated at high frequency up to 1MHz, but the IL and CT are sensitive to the non-uniformity of temperature across device. So, it is highly recommended to separate the NP device with the driver in a platform such as shown in the following example. The delivery of NPSW with driver will be packaged in the 3D printed platform.

The following is one module of NPSW-1x2 & 100kHz of NSDR in a 3D printed platform.



Q: Does NP device drift over time and temperature?

A: NP devices are based on electro-optical crystal materials that can be influenced to a certain range by the environmental variations. The insertion loss of the device is only affected by the thermal expansion induced miss-alignment. For extended temperature operation, we offer special packaging to -40 -100 °C. The extinction or cross-talk value is affected by many EO material characters, including temperature-dependent birefringence, V_p , temperature gradient, optical power, at resonance points (electronic). However, the devices are designed to meet the minimum extinction/cross-talk stated on the spec sheets. It is important to avoid a temperature gradient along the device length.

Q: What is the actual applying voltage on the device?

A: 100 to 300V depending on the version.

Q: How does the device work?

A: NP devices are not based on Mach-Zander Interference, rather birefringence crystal's nature beam displacement, in which the crystal creates two different paths for beams with different polarization orientations.

Q: What is the limitation for faster operation?

A: NP devices have been tested to have an optical response of about 300 ps. However, practical implementation limits the response speeds. It is possible to achieve a much faster response when operated at partial extinction value. We also offer resonance devices over 20MHz with low electrical power consumption.