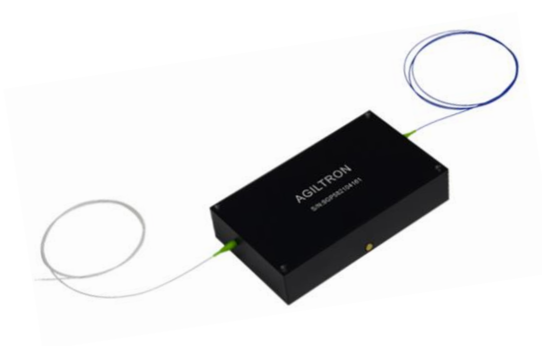
NanoSpeed™ Premium
50dB Extinction, Low Drift 1x1, 1x2, 2x2 Fiber Optical Switch
(50ns rise/fall, 1dB loss, bidirectional, SMF, PMF, up to 10W optical power)

DATASHEET

BUY NOW



The NS Premium Series fiber optic switch uniquely features low optical loss, fast response, high on-off extinction of 30dB, little drift, and high optical power handling. This is achieved using patented electro-optical configuration of clean fast response without ripples and temperature compensation in combination with compensating electro-optical control technology that significantly reduces drift to achieve a high on/off ratio at high speed. The switch is intrinsically bidirectional and selectable for polarization-independent or polarization-maintain by the fiber type. The NSP fiber optic switch is designed to meet the most demanding switching requirements of continuous operations over 25 years. The non-mechanical design provides ultra-high reliability and vibration insensitivity. The NSP Series switch is mounted on a specially designed PCB driver with 0-5V TTL trigger signals. The rise/fall time is intrinsically related to the crystal properties, and the repetition rate is associated with the driver. There are poor frequency response sections in the operation bandwidth due to the device resonances. No optical signal loss occurs during the switching in which optical power is transferred continuously from one port to another (see graph at the end).

The NS series switches respond to a control signal with any arbitrary timing with frequency from DC up to MHz. The switch is usually mounted on a tuned driver prior to shipping. The electrical power consumption is related to the repetition rate the switch is operated.

The device may have some drift over time when operated at a zero switching rate.

The dual-stage configuration increases the extinction ratio or cross-talk value.

Features

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

Applications

- Optical blocking
- Configurable operation
- Instrumentation

Specifications

Parameter		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	2.2	
Cross Talk [3]	1x1, 1x2	50	50	60	dB
	2x2	49	49	50	
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 Rise/Fall Time [4]			50	60	ns
Repetition Rate		0.0001		50	kHz
Optic power Handling [5]	Normal power version		0.3	0.5	W
	High power version		5	10	W
Operating Temperature range		-20		70	°C
Storage Temperature		-40		100	°C

Notes:

[1]. Measured without connectors. Each connector adds 0.3dB.
[2]. Wavelengths < 850nm or > 1900nm will be implemented in the special version.
[3]. ± 25nm, 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 is reduced, see graph
[1b]. NPLC version available for high power and low loss that incorporates fiber core enlargement (expensive).

Warning: **This is an OEM module designed for system integration. Do not touch the PCB by hand. The electrical static can kill the chips even without a power plug-in. Unpleasant electrical shock may also be felt. For laboratory use, please buy a Turnkey system.**

Rev 04/27/24

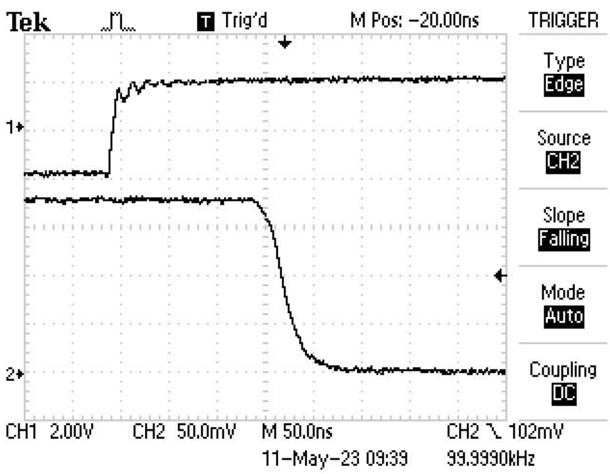
Mechanical Dimensions (mm)

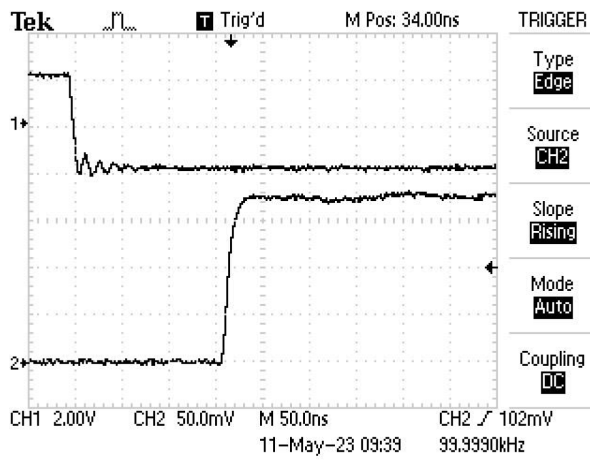
Device

Mounted On Driver

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

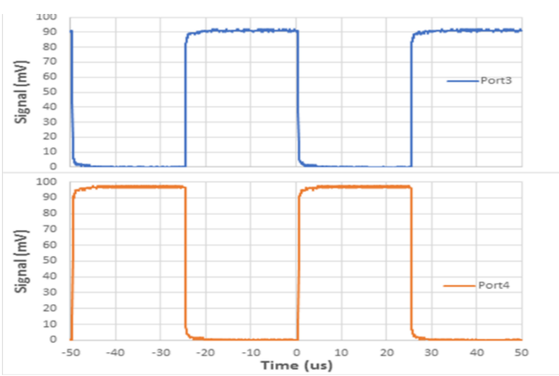
Typical Rise/Fall Response



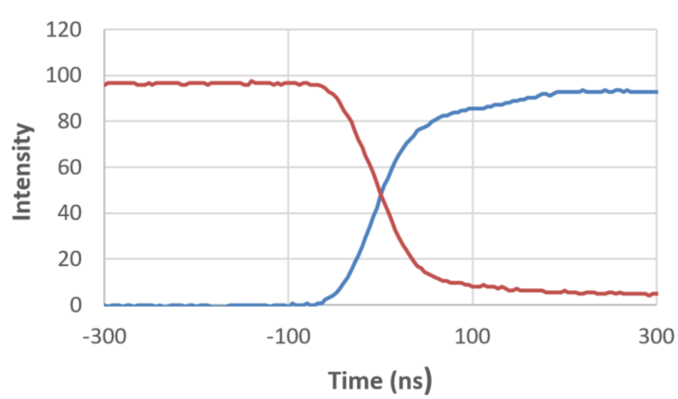


Note: Top Traces are electrical; Bottom traces are optical

Typical 20KH Switching Between Two Ports



Output Ports Intensity Exchange During Switching



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)

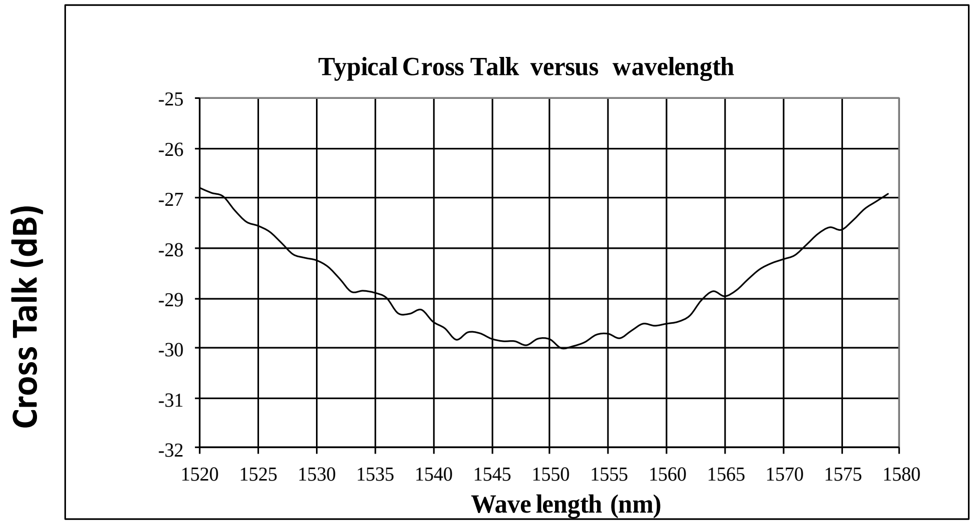
2x2 Optical Path	TTL Signal
Port 1 → Port 3, Port 2 → Port 4	L (= 0V)
Port 1 → Port 4, Port 2 → Port 3	H (> 3.5V)

Driving Board

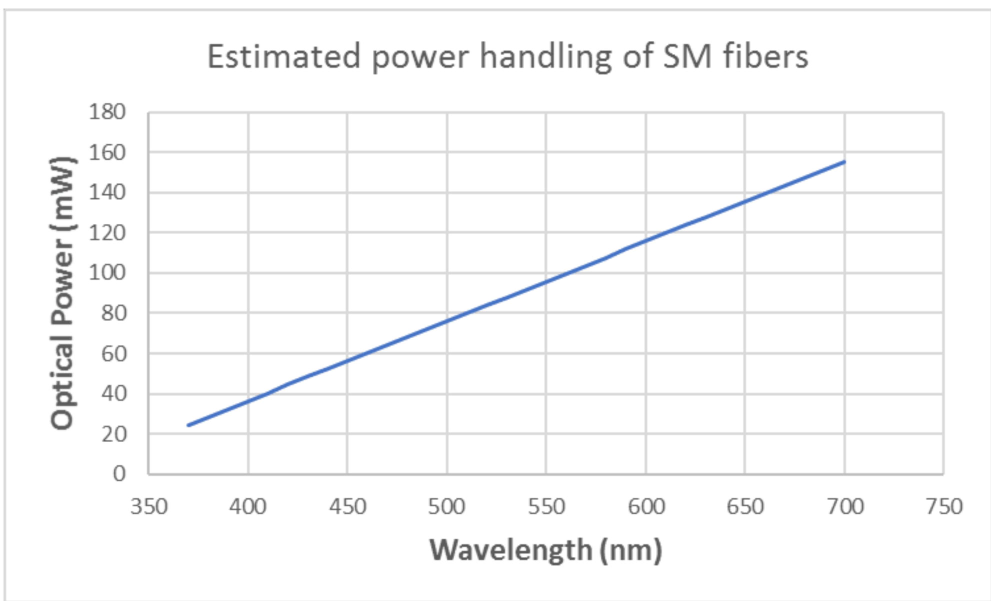
It has an SMA connector for TTL input.

It comes with a 12V wall-pluggable power supply.

Typical Bandwidth Measurement



Optical Power Handling vs Wavelength For Single-Mode Fibers (core size related)



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Ordering Information

	□□	□	□	□	□	□	□	□
Prefix	**Type**	**Wavelength [1]**	**Power**	**Repetition Rate**	**Fiber Type [2]**	**Fiber Cover**	**Fiber Length**	**Connector [3]**
NPS5-	1x1 Transparent = 1T 1x1 Opaque = 1O 1x2 = 12 2x2 = 22	1060 = 1 2000 = 2 1310 = 3 1550 = 5 1625 = 6 850 = 8 780 = 7 650 =E 550 = F 450 = G Special = 0	0.3W = 1 5W = 2 10W = A 15W = C 20W = D	50kHz = 1	SMF-28=1 HI1060=2 HI780=3 PM1550=5 PM980=9 Special=0	Bare fiber=1 900um tube=3 Special=0	0.25m=1 0.5m=2 1.0 m=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 = A E2000 APC = 9 LC/UPC = U Special = 0

[1]. Red Color marked is special order. For operating wavelength beyond stated range, special order can be made with specific coatings. Short Wavelength Bands have lower optical power handling. They use special crystals.

[2]. **PM1550** fiber works well for **1310nm**

[3]. High power connector can be ordered separately

NOTE:

- **Opaque** – light is blocked without applying a voltage
- **Transparent** – light goes through without applying a voltage

Fiber Core Alignment

Note that the minimum attenuation for these devices depends on excellent core-to-core alignment when the connectors are mated. This is crucial for shorter wavelengths with smaller fiber core diameters that can increase the loss of many decibels above the specification if they are not perfectly aligned. Different vendors' connectors may not mate well with each other, especially for angled APC.

Fiber Cleanliness

Fibers with smaller core diameters (<5 µm) must be kept extremely clean, contamination at fiber-fiber interfaces, combined with the high optical power density, can lead to significant optical damage. This type of damage usually requires re-polishing or replacement of the connector.

Maximum Optical Input Power

Due to their small fiber core diameters for short wavelength and high photon energies, the damage thresholds for device is substantially reduced than the common 1550nm fiber. To avoid damage to the exposed fiber end faces and internal components, the optical input power should never exceed 20 mW for wavelengths shorter 650nm. We produce a special version to increase the how handling by expanding the core side at the fiber ends.

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 ^{0}C. The extinction or cross-talk value is affected by many EO material characters, including temperature-dependent birefringence, Vp, 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.

Operation Manual

1. Connect a control signal to the SMA connector on the PCB.
2. Attach the accompanied power supply (typically a wall-pluggable unit).
3. The device should then function properly.

Note: Do not alter device factory settings.