# NanoSpeed ${ }^{\text {TM }} 2 \mathrm{X} 2$ Series Fiber Optical Switch 



## Features

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

The NS Series $2 \times 2$ solid-state fiber optic switch connects optical channels by redirecting an incoming optical signal into a selected output optical fiber. This is achieved using patented non-mechanical configurations with unique electro-optical design, eliminating the need for mechanical movement and organic materials. The NS fiber optic switch is designed to meet the most demanding switching requirements of ultra-high reliability, fast response time, and continuous switching operation. The switch is intrinsically bidirectional and selectable for polarizationindependent or polarization-maintain by the fiber type.
5V TTL signals control the NS Series switch with a specially designed electronic driver having performance optimized for various repetition rates.
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 due to the device resonances. The NS devices are shipped mounted on a tuned driver.
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 before shipping. The electrical power consumption is related to the repetition rate at which the switch is operated.
The dual-stage configuration increases the extinction ratio or cross-talk value.

## Specifications

| Parameter |  | Min | Typical | Max | Unit |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Insertion Loss ${ }^{[1]}$ | 1260~1650nm |  | 0.8 | 1.2 | dB |
|  | 960~1260nm |  | 1.0 | 1.3 | dB |
| Cross Talk ${ }^{[2]}$ |  | 18 | 25 | 35 | dB |
| Durability |  | $10^{14}$ |  |  | cycles |
| PDL (SMF Switch only) |  |  | 0.15 | 0.3 | dB |
| ER (PMF Switch only) |  | 18 | 25 |  | dB |
| IL Temperature Dependency |  |  | 0.25 | 0.5 | dB |
| Return Loss |  | 45 | 50 | 60 | dB |
| Response Time (Rise, Fall) |  |  |  | 300 | ns |
| Fiber Type |  | SMF-28, Panda PM, or equivalent |  |  |  |
| Driver Repeat Rate | 100 kHz driver | DC | 100 |  | kHz |
|  | 300 kHz driver | DC | 300 |  | kHz |
| Optic power Handling ${ }^{[3]}$ |  |  | 0.3 | 20 | W |
| Operating Temperature |  | -5 |  | 70 | ${ }^{\circ} \mathrm{C}$ |
| Storage Temperature |  | -40 |  | 85 | ${ }^{\circ} \mathrm{C}$ |

Note:
[1] Measured without connectors. For other wavelength, please contact us.
[2] $\pm 25 \mathrm{~nm}$, Cross talk is measured at 100 kHz , which may be degraded at the high repeat rate.
[3] Defined at $1310 \mathrm{~nm} / 1550 \mathrm{~nm}$.

> 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.

[^0]
# NanoSpeed ${ }^{\text {TM }} 2 \mathrm{X} 2$ Series Fiber Optical Switch 

(SM, PM, Bidirectional)

## DATASHEET

## Mechanical Dimensions (mm) of NSSW-2x2 w/o driver


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

## Optical Path Driving Table

| Optical Path | TTL Signal |
| :---: | :---: |
| Port $1 \rightarrow$ Port 3, Port 2 $\rightarrow$ Port 4 | $\mathrm{L}(<0.8 \mathrm{~V})$ |
| Port $1 \rightarrow$ Port 4, Port $2 \rightarrow$ Port 3 | $\mathrm{H}(>3.5 \mathrm{~V})$ |

## Driving Board Selection

| Maximum Repetition Rate | Part Number (P/N) |
| :---: | :---: |
| 100 kHz | NSSW100ns100kHzD |
| 300 kHz | NSSW100ns300kHzD |

[^1]
# NanoSpeed ${ }^{\text {TM }} 2 \mathrm{X} 2$ Series Fiber Optical Switch 

(SM, PM, Bidirectional)
100 kHz Driver Mechanical Drawing (mm)


## 300kHz Driver Mechanical Drawing (mm)

NOTE: When ordered with 300 kHz driver, NSSW$2 \times 2$ is installed on the driver and packed in the enclosure to minimize the drift of CT due to the environment variation.

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## DATASHEET

Typical Speed Response Measurement


Optical: -
Electrical: -

Typical Bandwidth Measurement


## (SM, PM, Bidirectional)

## DATASHEET

## Ordering Information

|  | 22 | $\square$ | 1 | 1 | $\square$ | $\square$ | $\square$ | $\square$ | $\square$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Prefix | Type | Wavelength ${ }^{[1]}$ | Configuration | Package | Fiber Type | Fiber Cover | Fiber Length | Connector | Optical Power |
| NSSW- | $2 \times 2=22$ | $\begin{aligned} & 1060 \mathrm{~nm}=1 \\ & 1310 \mathrm{~nm}=3 \\ & 1410 \mathrm{~nm}=4 \\ & 1550 \mathrm{~nm}=5 \\ & \text { Special }=0 \end{aligned}$ | Single stage $=1$ | Standard = 1 | $\begin{aligned} & \text { SMF-28 }=1 \\ & \text { HI1060 }=2 \\ & \text { PM1550 }=5 \\ & \text { PM980 }=9 \\ & \text { Special }=0 \end{aligned}$ | $\begin{array}{\|l} \hline \text { Bare Fiber }=1 \\ \text { 900um Tube = } 3 \\ \text { Special = } \end{array}$ | $\begin{aligned} & 0.25 m=1 \\ & 0.5 m=2 \\ & 1.0 m=3 \\ & \text { Special }=0 \end{aligned}$ | $\begin{aligned} & \text { None = } 1 \\ & \text { FC/PC }=2 \\ & \text { FC/APC }=3 \\ & \text { SC/PC }=4 \\ & \text { SC/APC }=5 \\ & \text { ST/PC }=6 \\ & \text { LC/PC }=7 \\ & \text { Duplex LC/PC }=8 \\ & \text { LC/APC }=9 \\ & \text { E2000 APC }=\text { A } \\ & \text { LC/UPC }=\text { U } \\ & \text { Special }=0 \end{aligned}$ | $\begin{aligned} & \text { Regular }=1 \\ & 1 \mathrm{~W}=\mathrm{A} \\ & 2 \mathrm{~W}=\mathrm{B} \\ & 5 \mathrm{~W}=\mathrm{C} \\ & 10 \mathrm{~W}=\mathrm{D} \\ & 20 \mathrm{~W}=\mathrm{E} \end{aligned}$ |

[1]. For shorter wavelength, please refer to Premium NS switches
NOTE:
PM1550 fiber works well for 1310nm

## 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 $(<5 \mu \mathrm{~m})$ 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 1550 nm 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 650 nm . We produce a special version to increase the how handling by expanding the core side at the fiber ends.

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(SM, PM, Bidirectional)

Optical Power Handling vs Wavelength For Single-Mode Fibers


# NanoSpeed ${ }^{\text {TM }} 2 \mathrm{X} 2$ Series Fiber Optical Switch 

## (SM, PM, Bidirectional)

## DATASHEET

Q \& A

Q: Does NS device drift over time and temperature?
A: NS 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 $-40-100^{\circ} \mathrm{C}$. 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 400 V depending on the version.
Q: How does the device work?
A: NS 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: NS 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 20 MHz 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.


[^0]:    Legal notices: All product information is believed to be accurate and is subject to change without notice. Information contained herein shall legally bind Agiltron only if it is specifically incorporated into the terms and conditions of a sales agreement. Some specific combinations of options may not be available. The user assumes all risks and liability whatsoever in connection with the use of a product or its application.
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[^1]:    * 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.

