

NanoSpeed™ 1x2 Series Multi-Mode Fiber Optical Switch

(Bidirectional)



DATASHEET

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Features

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

Applications

- Optical protection
- Configurable operation
- Instrumentation



The NanoSpeed™ series multi-mode 1x2 solid-state fiber (MMF) optic switch connects optical channels by redirecting an incoming optical signal into a selected output optical fiber. This is achieved using patent non-mechanical configurations with solid-state all-crystal designs, which eliminates 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 polarization-independent or polarization-maintain by the fiber type.

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

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 prior to shipping. The electrical power consumption is related to the repetition rate the switch is operated.

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

Specifications

Parameter		Min	Typical	Max	Unit
Central wavelength ^[1]		630		2000	nm
Wavelength Range			± 25		nm
Durability		10 ¹⁴			cycles
Insertion Loss ^[2]			1.5	1.8	dB
Cross Talk On/Off Ratio ^[3]		15	18		dB
MDL			0.3		dB
IL Temperature Dependency			0.25	0.5	dB
Return Loss		20	25		dB
Response Time (Rise, Fall)				300	ns
Fiber Type		50/125, 62.5/125, or equivalent			
Driver Repeat Rate	100kHz driver	DC	100		kHz
	500kHz driver	DC	500		kHz
Optic Power Handling ^[4]			0.5	20	W
Operating Temperature ^[5]		-5		45	°C
Storage Temperature		-40		85	°C

Notes:

- [1]. Operation bandwidth is ±25nm approximately at 1550nm.
Wavelength shorter than 850nm may be with a long lead time.
- [2]. Measured without connector under source with CPR =13dB
- [3]. ±25nm, Cross talk is measured at 100kHz under source with CPR =13dB, which may be degraded at the high repeat rate.
- [4]. Defined at wavelength >1300nm. For the shorter wavelength, the handling power may be reduced, please contact us for more information.
- [5]. The switches can be operated in a wider temperature range from as -10 to 70°C, but some performances such as on/off ratio will be degraded.

Note: The specifications provided are for general applications with a cost-effective approach. If you need to narrow or expand the tolerance, coverage, limit, or qualifications, please [click this link](#):

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.

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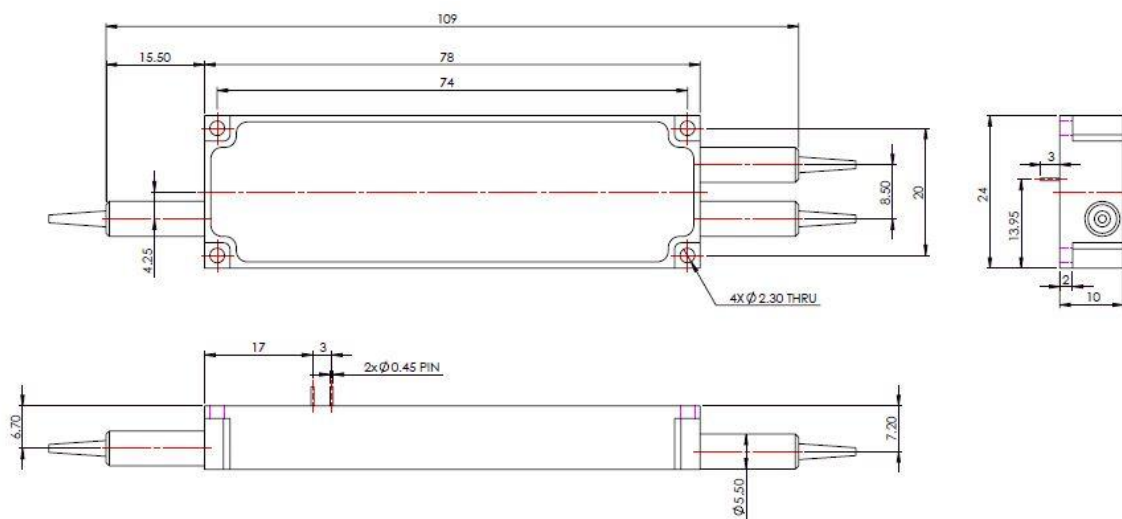
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Mechanical Dimensions (Unit: mm)



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Optical Path Driving Table

Optical Path	TTL Signal
Port 1 → Port 2	L (< 0.8V)
Port 1 → Port 3	H (> 3.5V)

Driving Board Selection

Maximum Repetition Rate	Part Number (P/N)
100 kHz	SWDR-11a261111
500 kHz	SWDR-11a291111

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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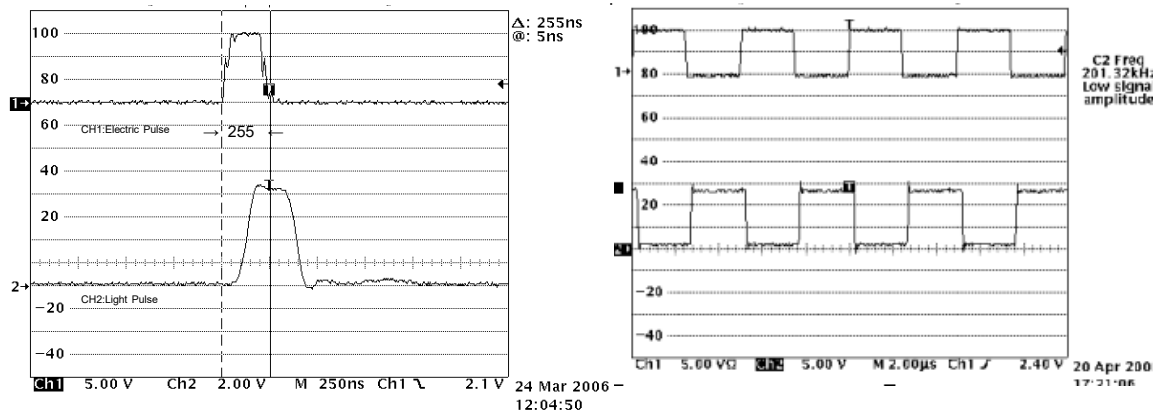
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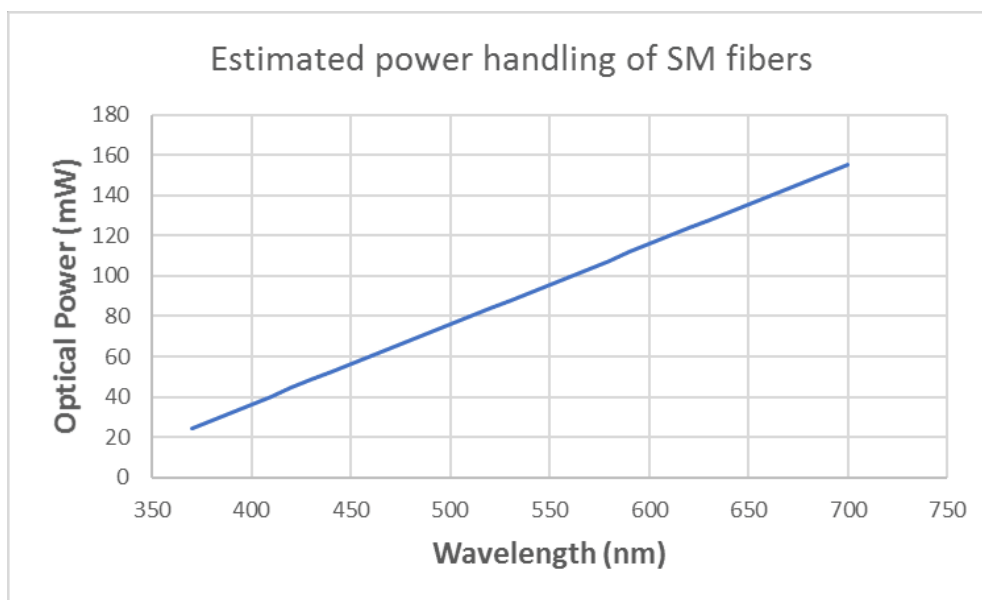
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Speed and Repetition Measurement



Optical Power Handling vs Wavelength For Single-Mode Fibers



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Ordering Information (Part Number)

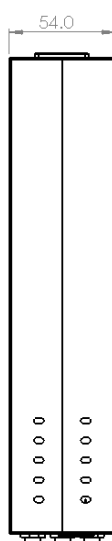
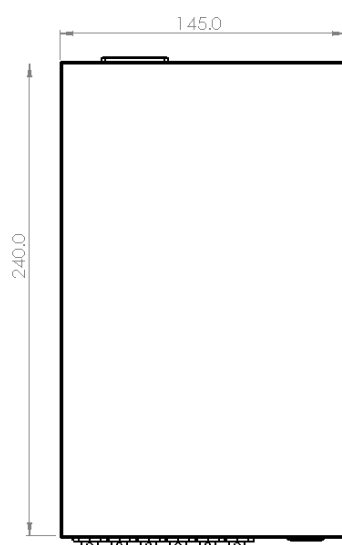
Prefix	Type	Wavelength ^[1]	Configuration	Package	Fiber Type	Fiber Cover	Fiber Length	Connector ^[2]	Optical Power	Benchtop
NSMS-	1x2 = 12	1060 = 1 1310 = 3 1550 = 5 850 = 8 650 = E 1750 = A 2000 = B Special = 0	Standard = 1	Standard = 1	50/125 MMF ^[3] = 5 62.5/125 MMF = 6 Special = 0	Bare fiber = 1 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=8 E2000 APC = A LC/UPC = U Special=0	Regular = 1 1W = A 2W = B 5W = C 10W = D 20W = E	None = 1 Benchtop = B

[1]. The wavelength shorter than 850nm can be produced in the special version with a long lead time

[2]. The default connector configuration uses fiber with 0.9 mm buffer protection. The connector cannot be installed directly onto bare fiber because the bare fiber is prone to damage during shipping. However, the connector can be assembled on bare fiber if a 3 cm protective loose tube is added for reinforcement. The customer may remove this protective tube after testing. The optical power handling of a standard connector is less than 0.5 W for SMF-28 fiber and decreases further for smaller-core fibers.

[3]. For laser with mode fill ratio CPR <14

Benchtop Box Mechanical Dimension



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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 mis-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 400V 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 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.

Application Notes

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 ($<5 \mu\text{m}$) 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 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 handling by expanding the core side at the fiber ends.

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