

NanoSpeed™ Cascaded 1x4 Fiberoptic Switch

(SMF, PMF, MM, 780-2000 nm, Bidirectional)



DATASHEET

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Features

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

Applications

- Optical blocking
- Configurable operation
- Instrumentation



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](#):

The NS Series 1×4 Solid-State Fiber Optic Switch is constructed by cascading three 1×2 solid-state optical switches to route an input optical signal to one of four output fibers. The switch employs Agiltron's patented non-mechanical all-crystal electro-optic architecture, eliminating moving parts, organic materials, and mechanical wear. This solid-state design provides exceptional reliability, ultrafast switching, and virtually unlimited operational lifetime. The switch is intrinsically bidirectional and is available in both polarization-independent (PI) and polarization-maintaining (PM) fiber configurations. Agiltron recommends operating the switch with its dedicated PCB driver, available on our website. The driver provides high efficiency, low power consumption, a single 12 VDC supply, and standard TTL-compatible control inputs for plug-and-play integration. The switching speed is determined primarily by the electro-optic crystal properties, while the maximum repetition rate depends on the driver electronics. As with all electro-optic devices, narrow frequency regions of reduced switching efficiency may occur due to structural resonances. To maximize performance, each switch is factory tuned and shipped with a matched driver. The NS Series accepts arbitrary electrical control waveforms from DC to the MHz range, enabling both single-shot and continuous high-speed switching applications. Power consumption is proportional to the switching repetition rate. The cascaded dual-stage switching architecture provides enhanced extinction ratio and reduced crosstalk compared with a single-stage design, making the NS Series well suited for demanding optical communication, sensing, quantum technology, aerospace, and defense applications.

Specifications

Parameter		Min	Typical	Max	Unit
Central Wavelength		780		2000	nm
Insertion Loss ^[1]	1700~2300nm		1.6	2.8	dB
	1260~1650nm		1.1	2.0	
	960~1260nm		2.0	2.9	
	760~960nm		3.0	4.8	
Cross Talk On/Off Ratio ^[2]	Single stage	18	25	30	dB
	Dual stage	30	35	40	
Durability		10 ¹⁴			cycles
PDL for SMF version			0.2	0.4	dB
PER for PMF version		18	22		
IL Temperature Dependency			0.3	0.5	dB
Polarization Mode Dispersion (SMF version)			0.1	0.3	ps
Return Loss		45	50		dB
Electrical-Optical Delay				250	ns
Response Time (Rise, Fall)		30		300	ns
Repetition Rate ^[3]		DC	100		kHz
Optical Power Handling ^[4]			0.3	20	W
Operating Temperature ^[5]		-5		45	°C
Storage Temperature		-40		85	°C

Notes:

- [1] Defined for single stage version (NSSW) w/o connector. Add 0.6dB more for dual-stage (NSDW) version.
- [2]. ±25nm
- [3] Standard driver. High repetition rate (up to 300 kHz) is available with special circuit, please call us.
- [4] Defined at 1550nm. For the shorter wavelength, the handling power will be reduced. High power version (up to 5W) for 1310nm/1550nm is available; please call 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.

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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[+1 781-935-1200](tel:+17819351200)

sales@agiltron.com

www.agiltron.com

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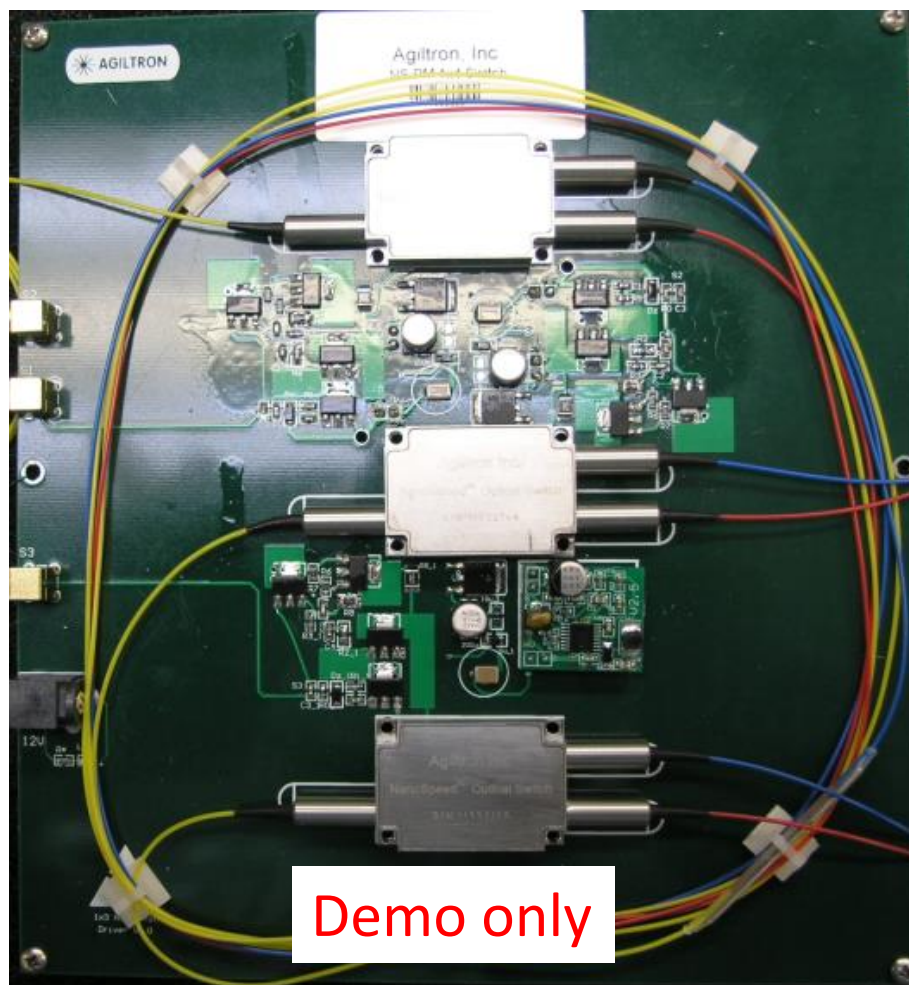
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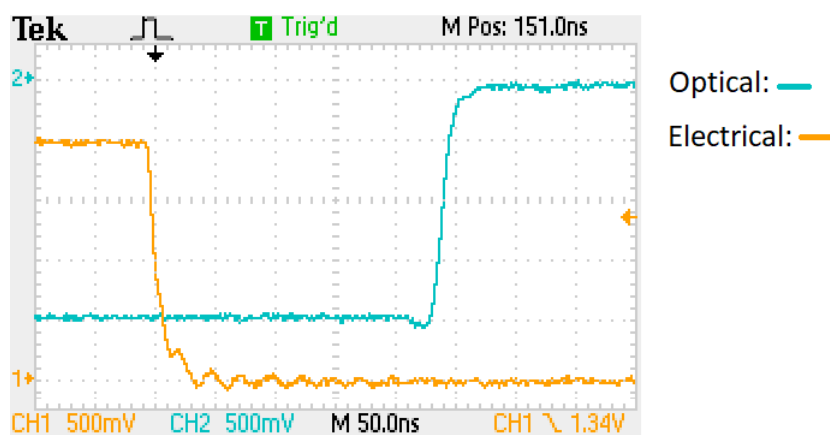


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Schematic Assembly on PCB driver



Typical Speed Response Measurement



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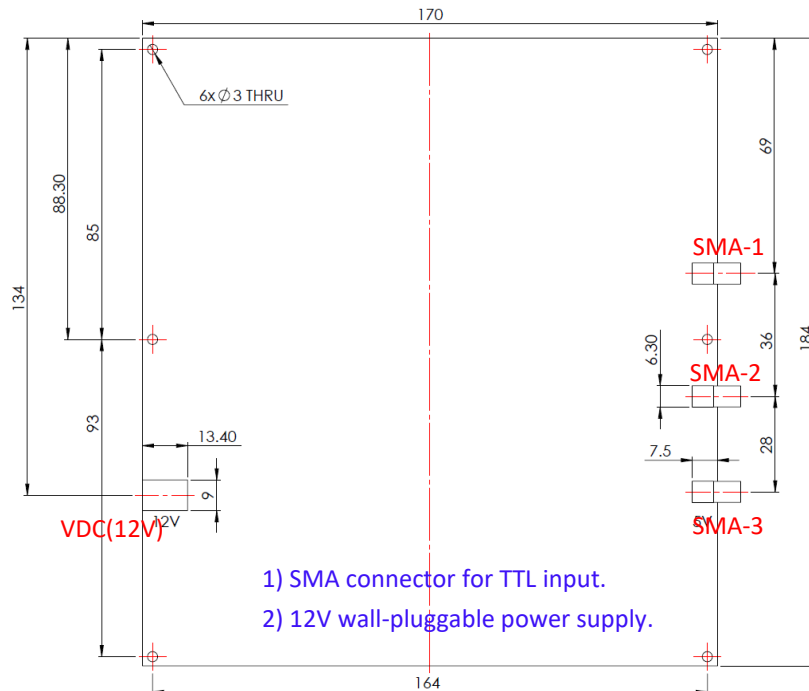
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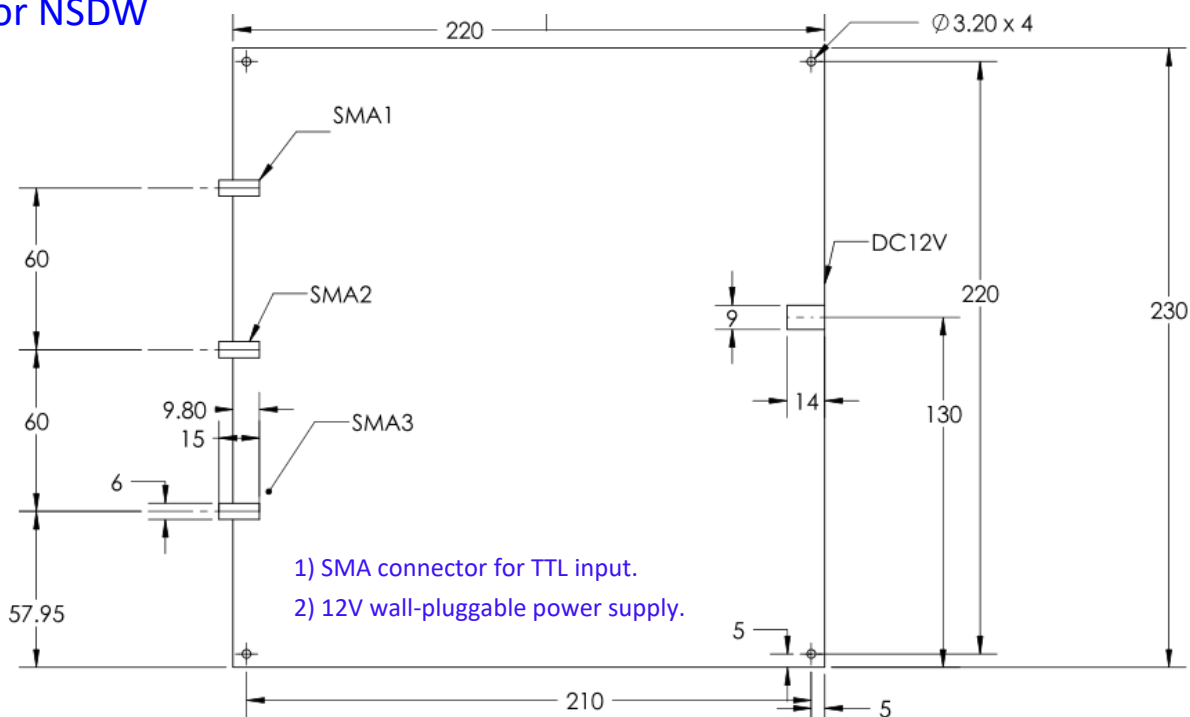
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Mechanical Drawing of 100kHz Driver (mm)

Driver for NSSW



Driver for NSDW



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Electric Driving Table

Driving Table (TTL control)

Optical Path	SMA-1	SMA-2	SMA-3
Input Port -> Port 1	0V	0V	0V
Input Port -> Port 2	0V	H	0V
Input Port -> Port 3	H	0V	0V
Input Port -> Port 4	H	0V	H

Note: $3.0V \leq H \leq 5.0V$

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Ordering Information (Part Number)

Prefix	Type ^[3]	Wavelength	Optical Power ^[6]	Max Repetition	Fiber Type	Fiber Cover	Fiber Length	Connector ^{[7][8]}	Package	Benchtop
NSSW ^[1]	SMF-1x4 = 14	1060 = 1	300mW = 1	100kHz driver = 1	SMF-28 = 1	Bare fiber = 1	0.25m = 1	None = 1	PCB = 1	None = 1
NSDW ^[2]	SMF-1x3 = 13	L Band = 2	2W = 2	300kHz driver = 3	PM1310 = 4	900um loose tube = 3	0.5m = 2	FC/PC = 2	1U Rack = 2	Benchtop = B
	PMF-1x4 ^[4] = 4A	1310 = 3	5W = 5	Special = 0	PM1550 = 5	Special = 0	1.0 m = 3	FC/APC = 3		
	PMF-1x4 ^[5] = 4B	1550 = 5	10W = A		HI1060 = 2		Special = 0	LC/PC = 7		
	PMF-1x3 ^[4] = 3A	1750nm = A	15W = C		HI780 = 3			LC/APC = 9		
	PMF-1x3 ^[5] = 3B	2000nm = B	20W = D		MM50/125 ^[9] = M			E2000 APC = A		
		780 = 7	Special = 0		Special = 0			Special = 0		
		850 = 8								
		980 = 9								
		Special = 0								

[1]. **NSSW** – **NS** type of **S**ingle stage **sW**itch

[2]. **NSDW** – **NS** type of **D**ual stage **sW**itch

[3]. **SMF**: single mode fiber; **PMF**: polarization maintain fiber.

[4]. Blocking fast axis for PM fiber version in 1x3 or 1x4.

[5]. Blocking slow axis for PM fiber version in 1x3 or 1x4

[6]. Defined at 1550nm. Optical power handling will be reduced significantly @ wavelength <1100nm

[7]. Regular fiber connector has PER ~22dB. Connector with PER >27 dB is available using special process

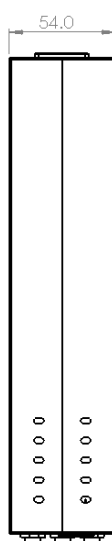
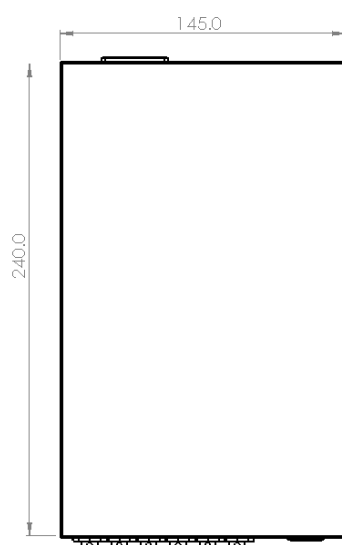
[8]. The default connector configuration uses fiber with 0.9 mm buffer protection. The connector cannot be installed directly onto bare fiber because the bare fiber is prone to damage during shipping. However, the connector can be assembled on bare fiber if a 3 cm protective loose tube is added for reinforcement. 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.

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

Note:

- ☐ **PM1550** fiber works well for **1310nm**

Benchtop Box Mechanical Dimension



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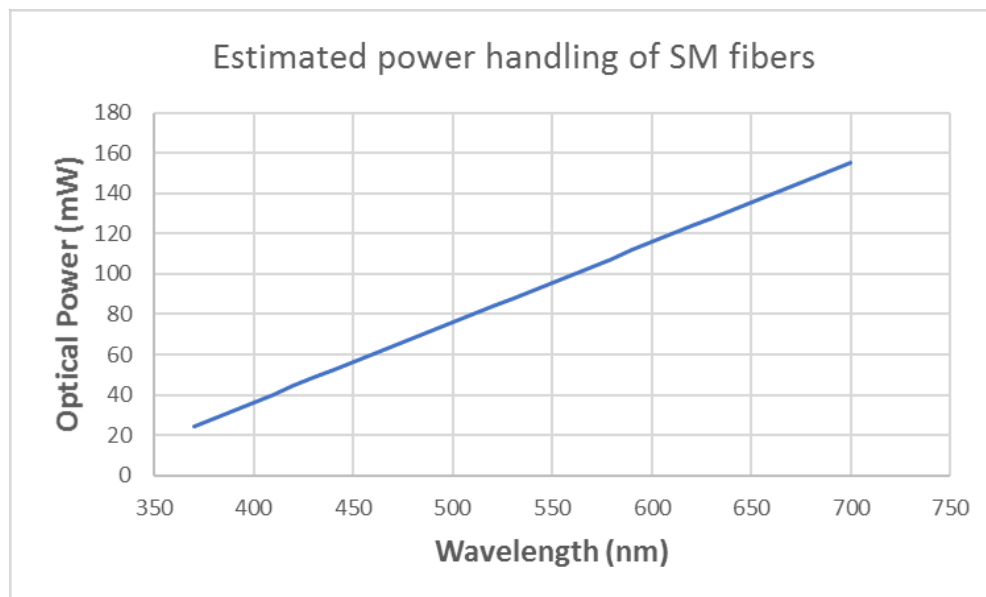
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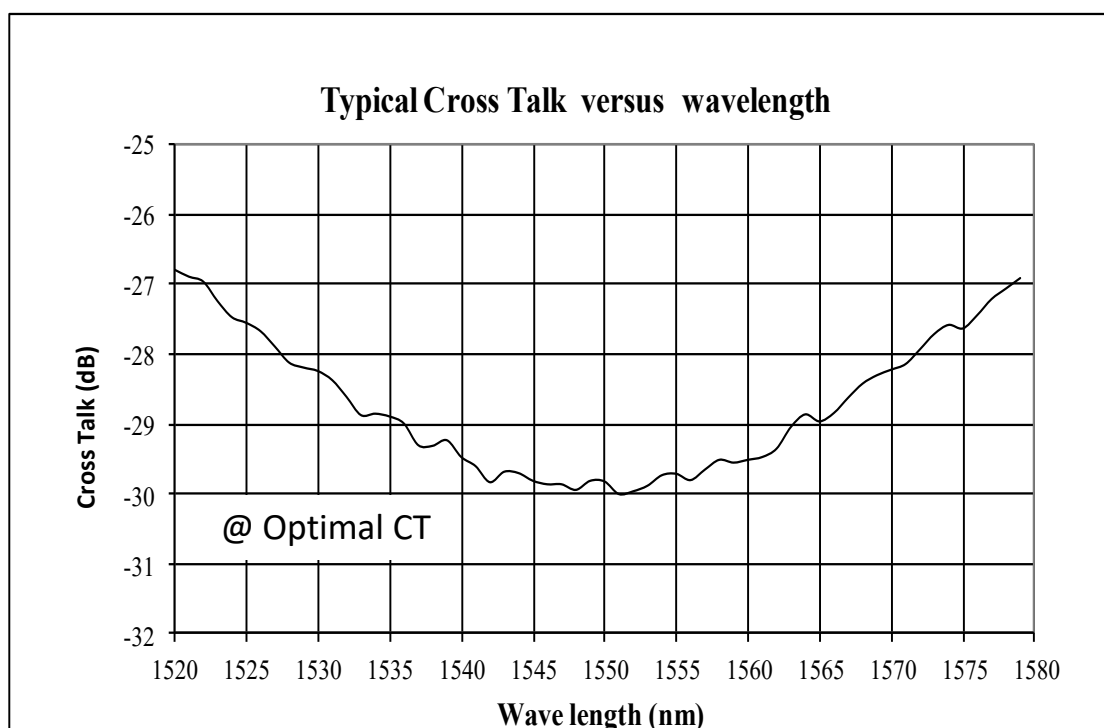


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Optical Power Handling vs Wavelength For Single-Mode Fibers



Typical Wavelength Dependence



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Q & A

Q: Does NS series of 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 °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 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 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.

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