

NanoSpeed™ 1x6 High Speed 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



The NS Series 1x6 high-speed fiber optic switch is constructed by cascading five 1x2 switches. It connects optical channels by redirecting an incoming optical signal into a selected output optical fiber. This is achieved using patented non-mechanical configurations with solid-state all-crystal designs, which eliminate 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-maintaining by the fiber type. The device comes with a PCB driver that operates with a 12V DC power supply and 5 independent TTL control signal inputs. The rise and fall times are intrinsically related to the crystal properties, and the repetition rate is associated with the driver. Some frequency response sections exhibit poor frequency response due to device resonances. The NS devices are shipped mounted on a tuned driver. The NS series switches respond to control signals with any arbitrary timing at frequencies from DC up to MHz. The electrical power consumption is related to the repetition rate at which the switch is operated.

Specifications

Parameter		Min	Typical	Max	Unit
Central Wavelength		780		2000	nm
Insertion Loss ^[1]	1700~2300nm		3.5	4.8	dB
	1260~1650nm		2.5	3.0	
	960~1260nm		2.8	3.5	
	760~960nm		3.0	4	
Cross Talk On/Off Ratio ^[2]		20	25		dB
Durability		10 ¹⁴			cycles
Polarization Dependent Loss			0.20	0.35	dB
IL Temperature Dependency			0.25	0.5	dB
Polarization Mode Dispersion			0.1	0.3	ps
Return Loss		45	50		dB
Electrical-Optical Delay				250	ns
Response Time (Rise, Fall)		50		300	ns
Repetition Rate ^[3]		DC	100		kHz
Optical Power Handling ^[4]			0.3	5	W
DC Power Voltage		11.5	12	12.5	V
Power consumption ^[5]		0.5	2	10	W
Operating Temperature ^[6]		-5		55	°C
Storage Temperature		-40		85	°C

Notes:

[1] Excluding connectors.

[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 may be reduced. High power version (up to 5W) for 1310nm/1550nm is available; please call us for more information.

[5]. Repetition rate dependent.

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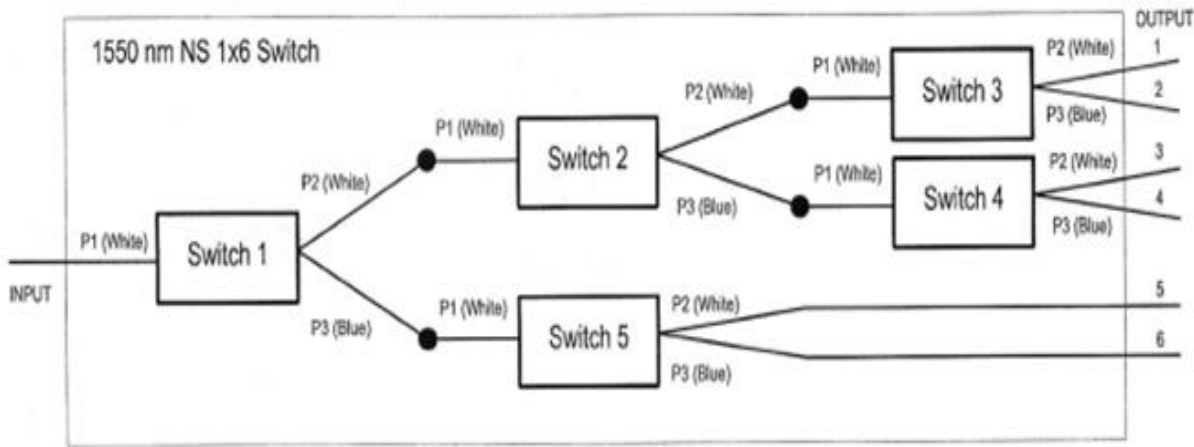
(SMF, PMF, MM, 780-2000 nm, Bidirectional)



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Optical Path

Optical Path:



Driving Table:

Optical Path	SMA Connector Number				
	1	2	3	4	5
Input → Output 1					
Input → Output 2			+		
Input → Output 3		+			
Input → Output 4		+		+	
Input → Output 5	+				
Input → Output 6	+				+

Note: "+" 5 VDC

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

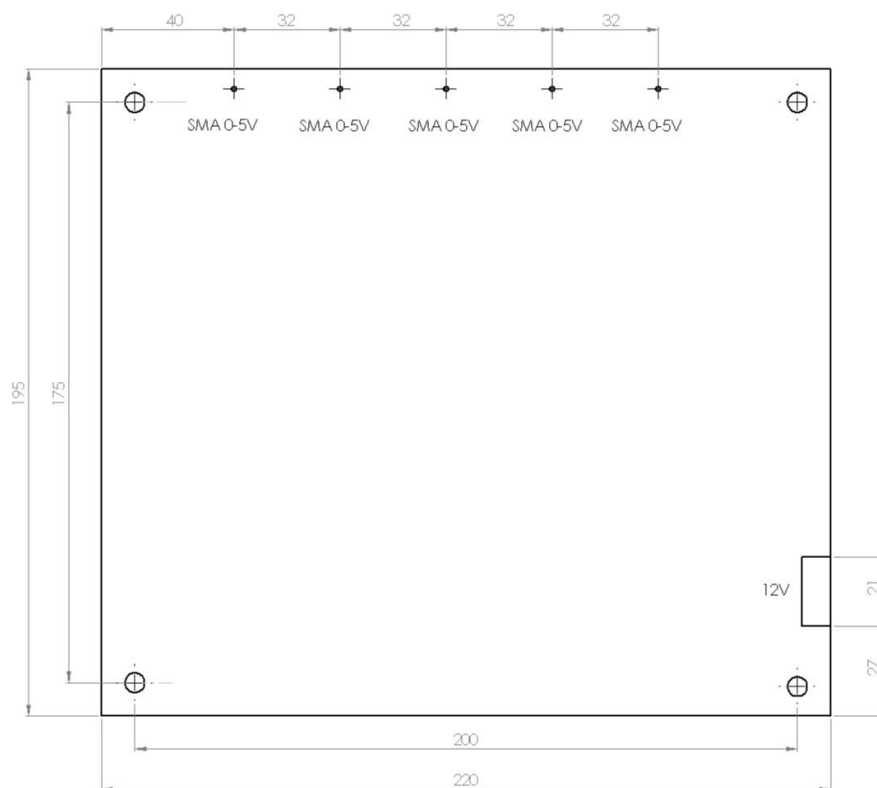
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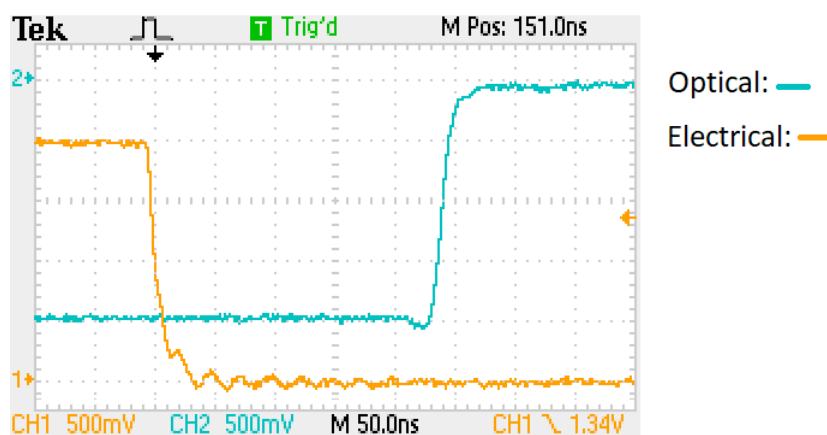
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Mechanical Drawing (mm)- Mounted on a PCB



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Typical Speed Response Measurement



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Ordering Information (Part Number)

Prefix	Type	Wavelength	Optical Power	Repetition	Fiber Type	Fiber Cover	Fiber Length	Connector ^{[1][2]}	Package	Benchtop
NSSW-	1x6 = 16	1060 = 1 L Band = 2 1310 = 3 1550 = 5 1750nm = A 2000nm = B 780 = 7 850 = 8 980 = 9	300mW = 1 5W = 2 10W = A 15W = C Special = 0	100kHz = 1 200kHz = 2 300kHz = 3 1MHz = 9 Special = 0	SMF-28 = 1 PM1550 = 5 HI1060 = 2 HI780 = 3 MM50/125 ^[3] = M Special = 0	Bare fiber = 1 900umtube = 3 Special = 0	0.25m = 1 0.5m = 2 1.0 m = 3 Special = 0	None = 1 FC/PC = 2 FC/APC = 3 LC/PC = 7 LC/APC = 9 E2000 APC = A LC/UPC = U Special = 0	PCB = 1 1U Rack = 2 With Cover = 3	None = 1 Benchtop = B

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

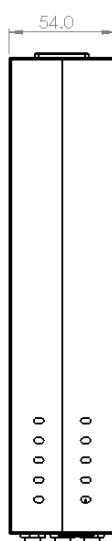
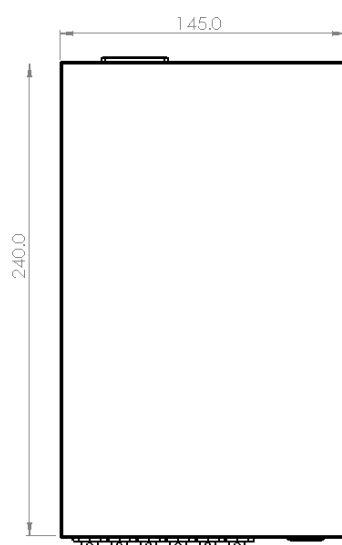
[2]. The default connector configuration uses fiber with 0.9 mm buffer protection. The connector cannot be installed directly onto bare fiber because the bare fiber is prone to damage during shipping. However, the connector can be assembled on bare fiber if a 3 cm protective loose tube is added for reinforcement.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

Note:

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

Benchtop Box Mechanical Dimension



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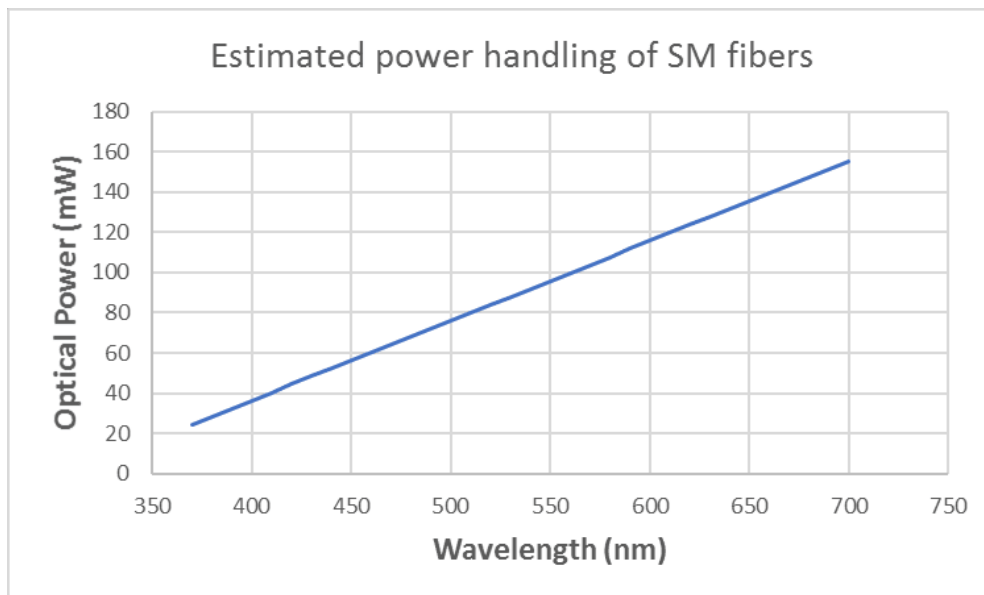
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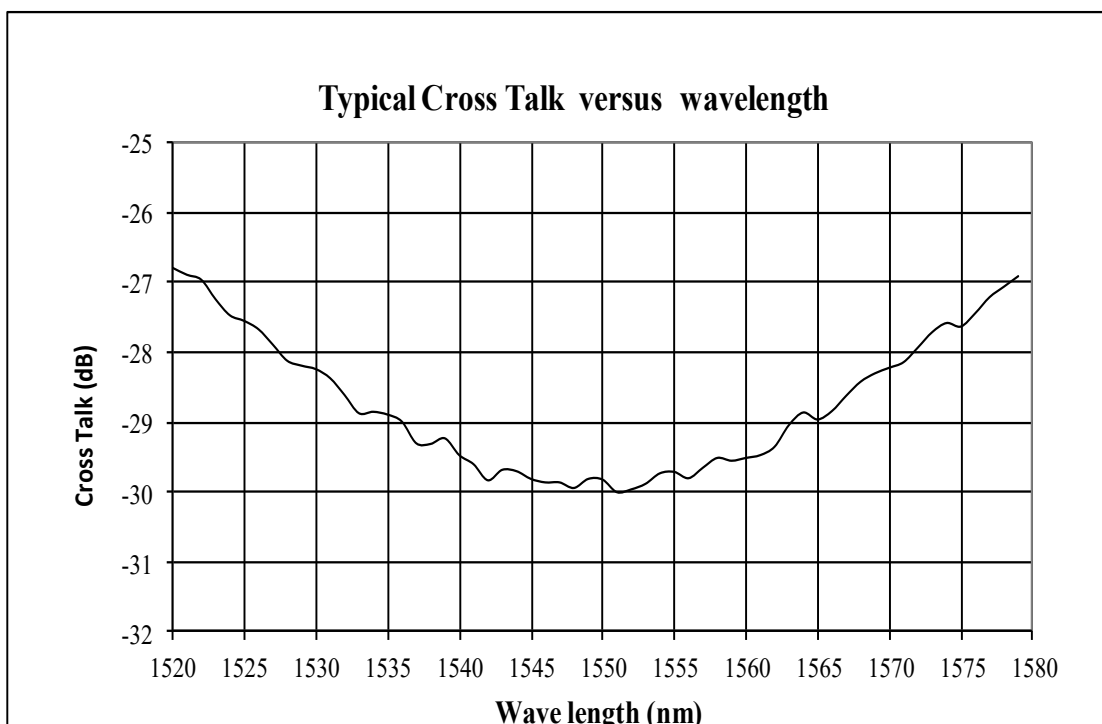


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Optical Power Handling vs Wavelength For Single-Mode Fibers



Typical Wavelength Dependence



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Q & A

Q: Does NS 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 misalignment. 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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