

# NanoSpeed™ Ultra-Fast 1x1, 1x2, 2X2 Fiber Optical Switch (5ns Rise/Fall Time, Bidirectional)

(Protected by U.S. patents 7,403,677B1; 6,757,101B2; and pending patents)

## Product Description

The NS Ultra-Fast (NF) Series fiber optical switch is based on a patented electro-optical configuration, featuring low optical loss, high optical power handling, and wide temperature operation with built-in compensation. The NS fiber optical switch meets the most demanding switching requirements of continuous operations over 25 years and non-mechanical ultra-high reliability (passed Telcordia and space qualifications). It has an ultra-fast rise and fall time about 5ns, repetition rate up to 1MHz, and can generate short optical pulse about 60 ns.

The NF Series switch is mounted on a specially designed electronic driver using a 5V TTL control signal through a SMA input and a 110V power plug-in.

## Performance Specifications

NanoSpeed U Series Switches		Min	Typical	Max	Unit
Insertion Loss <sup>[1]</sup>	1900-2200nm		0.8	1.5	dB
	1260-1650nm		0.6	1.0	
	960-1100nm		1.2	1.5	
	780-960nm		1.5	1.8	
	680 - 780nm		1.8	2.0	
Cross Talk <sup>[2]</sup>	Single Stage	18	25	30	dB
Durability		10 <sup>14</sup>			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		dB
Optical Rise Time <sup>[3]</sup>			5	10	ns
Optical Fall Time <sup>[3]</sup>			5	10	ns
Repetition Rate		DC		200	kHz
		DC		1000	
Optic power Handling <sup>[4]</sup>	Normal power version		300		mW
	High power version			5	W
Operating Temperature	Standard	-5		75	°C
	Special version	-30		85	
Storage Temperature		-40		100	°C

[1] Measured without connectors.

[2] Cross talk is measured at 100kHz, which may be degraded at the higher repeat rate.

[3] It is defined as the rising or fall time between 10% and 90% of optical intensities.

[4] Defined at 1310nm/1550nm. For the shorter wavelength, the handling power may be reduced, please contact us for more information.

### Features

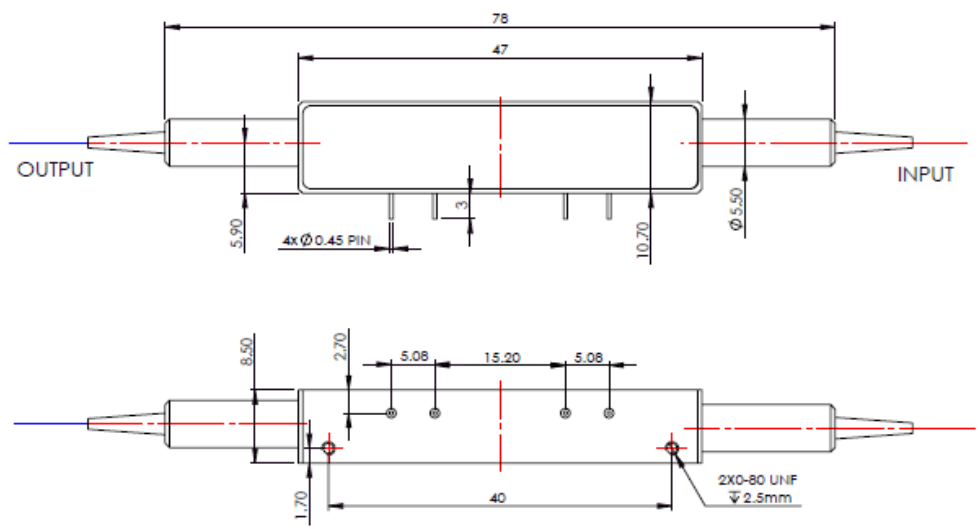
- High Reliability
- High Speed
- Low loss
- Compact

### Applications

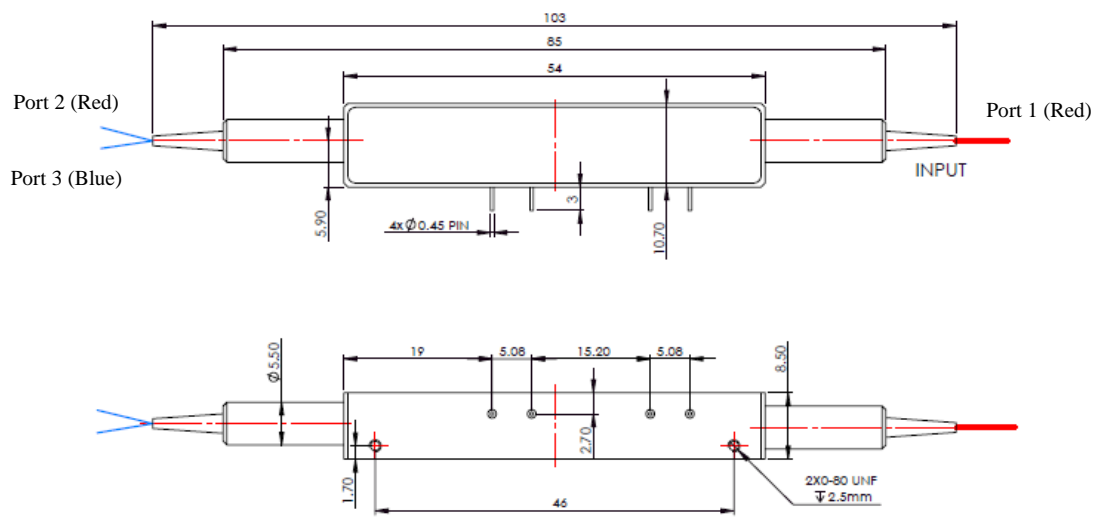
- Optical blocking
- Q-switch
- Data process
- Instrumentation

# NanoSpeed™ Ultra-Fast 1x1, 1x2, 2X2 Fiber Optical Switch (5ns Rise/Fall Time, Bidirectional)

## Mechanical Dimensions (Unit: mm)



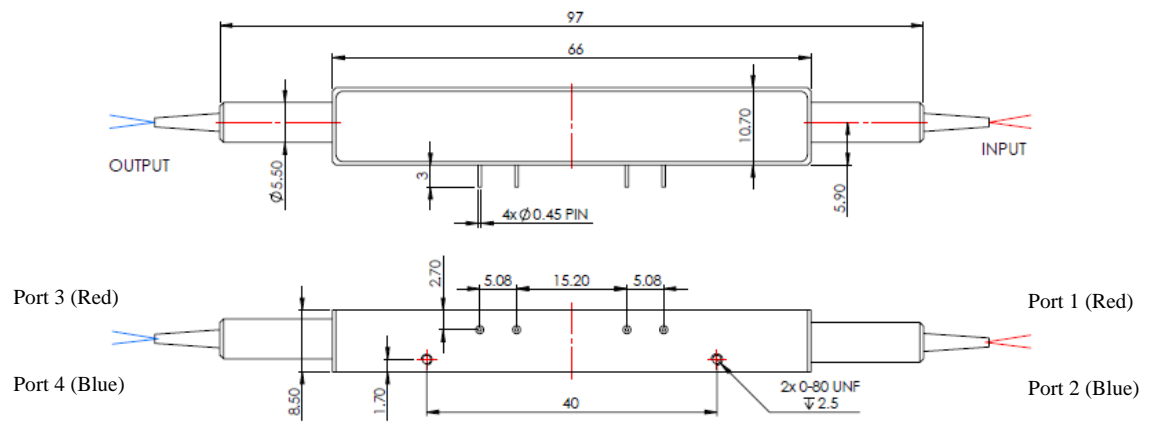
**Package Type -I: NFSW-1x1**



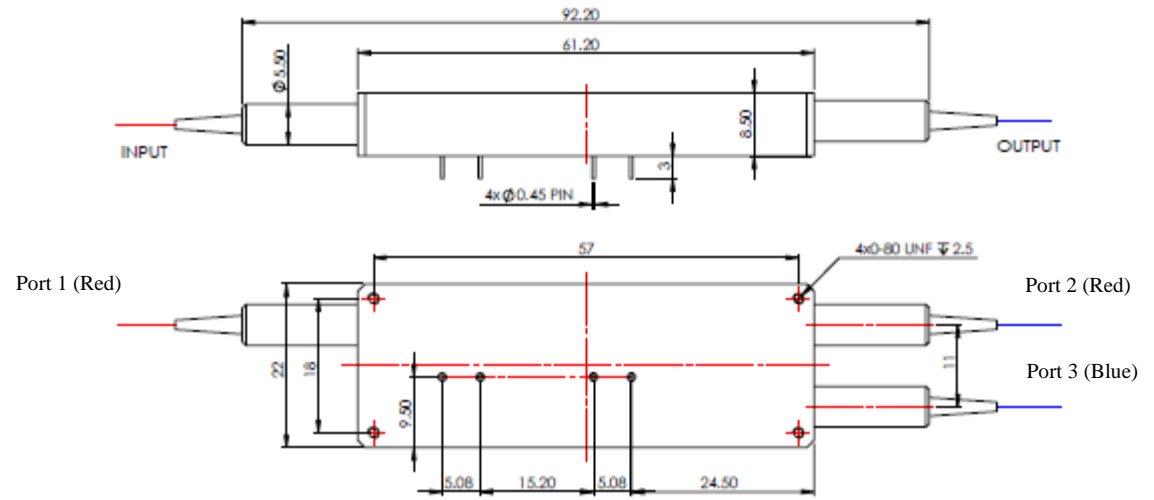
**Package Type -II: NFSW-1x2**

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## Mechanical Dimensions (Unit: mm)



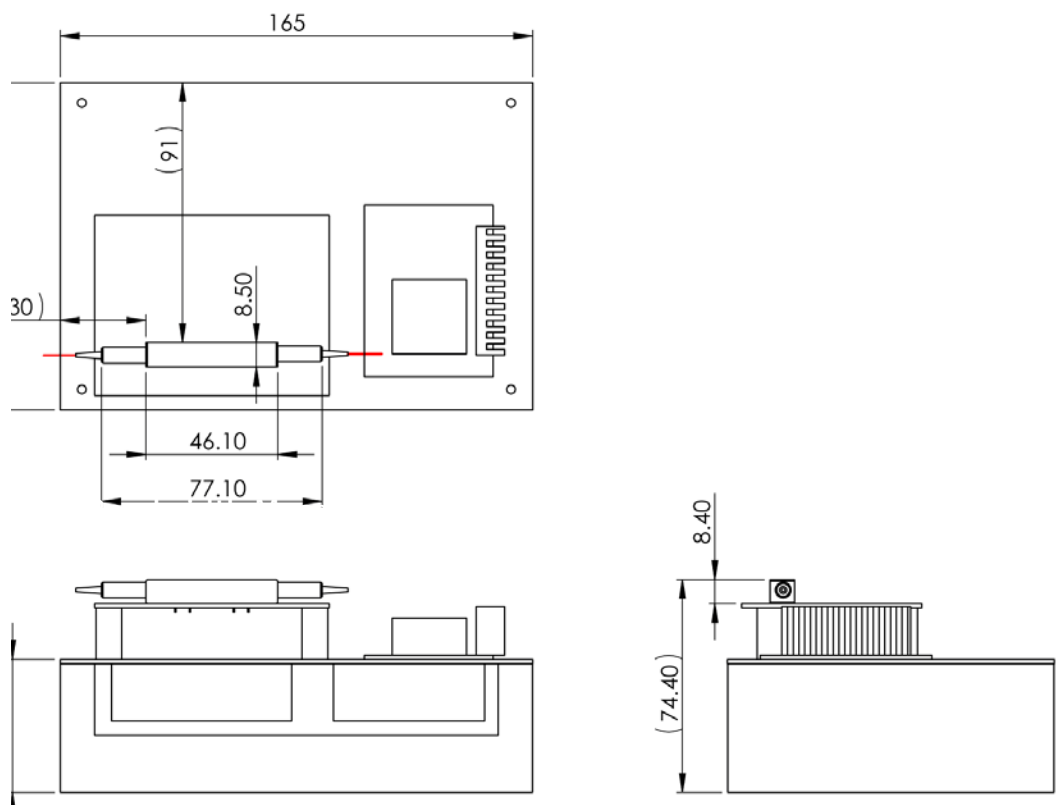
### Package Type -III: NFSW-2x2



### Package Type -IV: NFHW-1x1 & 1x2

# NanoSpeed™ Ultra-Fast 1x1, 1x2, 2X2 Fiber Optical Switch (5ns Rise/Fall Time, Bidirectional)

## NFSW and Driver Mounting Dimension (mm)



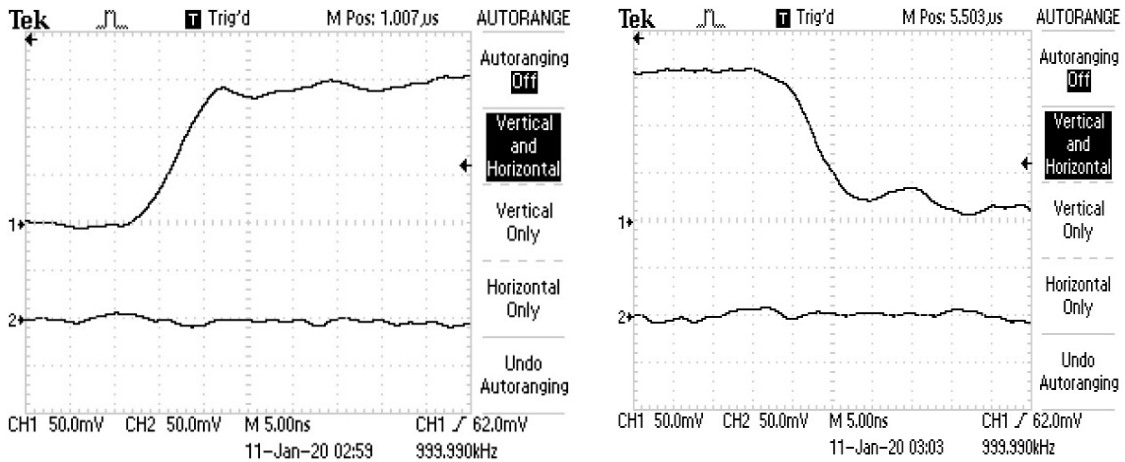
## Electronic Driving Information

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)

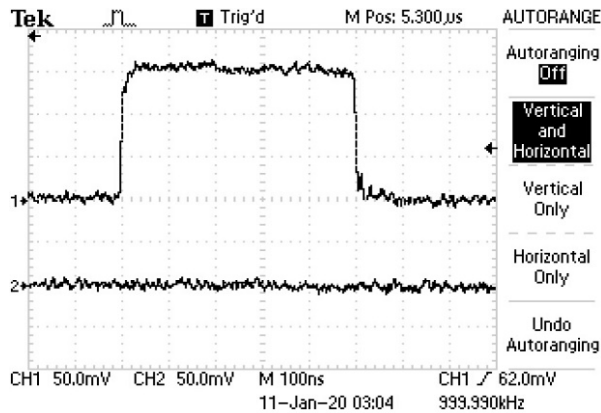
1. Power Input: 110-220 AC
2. Power Consumption: <10W

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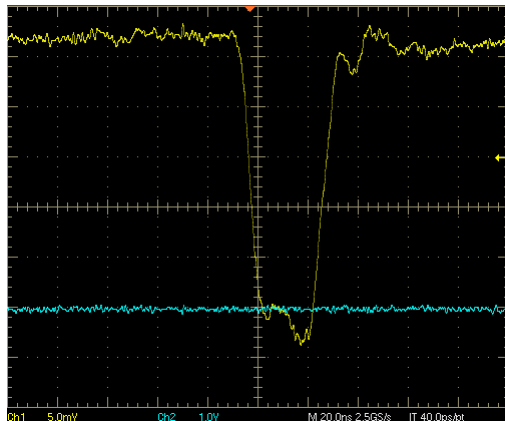
## Typical Rise and Fall Optical Switching Measurement



## Typical Optical Switch Repetition Measurement (1MHz)

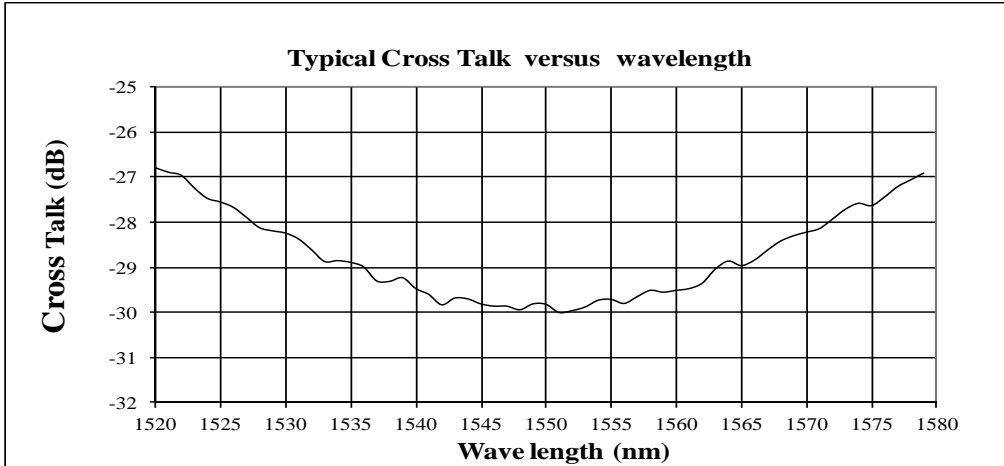


## Typical Optical Pulse Generation (60ns)



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## Typical Wavelength Dependence Extinction Measurement



## Ordering Information

	Type	Wavelength	Grade	Repetition Rate	Fiber Type	Fiber Length	Connector <sup>[1]</sup>
<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> - <input type="checkbox"/> <input type="checkbox"/>	1x1=11 <sup>[2]</sup> 1x2=12 2x2=22	1060=1 2000=2 1310=3 1480=4 1550=5 1625=6 780=7 850=8 650=E 550=F 400=G 1565-1620=L Special=0	Single stage =1	200kHz=2 1MHz=6	SMF-28=1 HI1060=2 HI780=3 PM1550/400=4 PM1550/250=5 PM850=8 PM980=9 Special=0	Bare fiber=1 900um loose tube=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 Special=0

[1] Contact us for high power connector

[2] For wavelength shorter than 950nm, customer needs to order 1x2, leaving the extra port unused. This make the device stable by guiding the unwanted light out.

# NanoSpeed™ Ultra-Fast

## 1x1, 1x2, 2X2 Fiber Optical Switch

(5ns Rise/Fall Time, Bidirectional)

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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 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,  $V_p$ , 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.