

NanoSpeed™ Ultra-Fast NxM Fiber Optical Switch 10ns



(10ns rise/fall time, polarization insensitive, all wavelengths, bidirectional, up to 20W)

DATASHEET

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Features

- Low Loss
- High Reliability
- High Power
- Bidirectional

Applications

- Laser System
- Quantum System
- Instruments

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 Ultra-Fast Series (NF) fiber optical switch is based on a patented electro-optical configuration featuring low optical loss, wide temperature operation, and polarization insensitivity. The NS fiber optical switch has ultra-high reliability and can continuously operate for over 25 years in a vibration environment (passed Telcordia and space qualifications). The switch is bidirectional and available with configurations of polarization-independent or polarization-maintain. The rise/fall time is intrinsically related to the crystal properties, and the repetition rate is associated with the driver. The NF Series switch is mounted on an electronic driver having a 5V TTL control signal SMA input and a DC power supplier. There are poor frequency response sections in which the on/off ratio does not meet the spec due to the device's mechanical resonances. The on/off ratio can be optimized for certain frequencies with requests.

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
Insertion Loss ^[1]	1900~2200nm		1.6	2.8	dB
	1700~2300nm		0.8	1.8	
	1260~1650nm		3	3.6	
	960~1100nm		3	3.9	
	780~960nm		4	4.5	
	520~680nm		6	6.9	
Cross Talk On/Off Ratio ^[2]		18	20 ^[2]	30	dB
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		5	8	10	ns
Optical Fall Time		5	8	10	ns
Minimum Pulse Width			90		ns
Repetition Rate ^[3]		DC		2	MHz
Optic Power Handling ^[4]	Normal power version		0.3	0.5	W
	High power version		5	20	W
Operating Temperature ^[5]		-5		45	°C
Storage Temperature		-40		85	°C

Notes:

[1] For 1x4, for 1x8 adds 1dB, for 1x12 adds 2dB, for 1x24 adds 3dB

Measured without connectors. Each connector adds 0.2 to 0.3dB

[2] ± 25 nm, The typical cross talk is measured at DC-20kHz and may be degraded at a higher repeat rate.

[3] The driver is optimized at a repeat rate >500kHz. The specs exclude a few resonant frequency points. The performance can be optimized at other frequencies.

[4] The standard version is defined at 1310nm/1550nm. For the shorter wavelength, the handling is reduced see the graph. High power version has a fiber end beam expander, thus cost more

[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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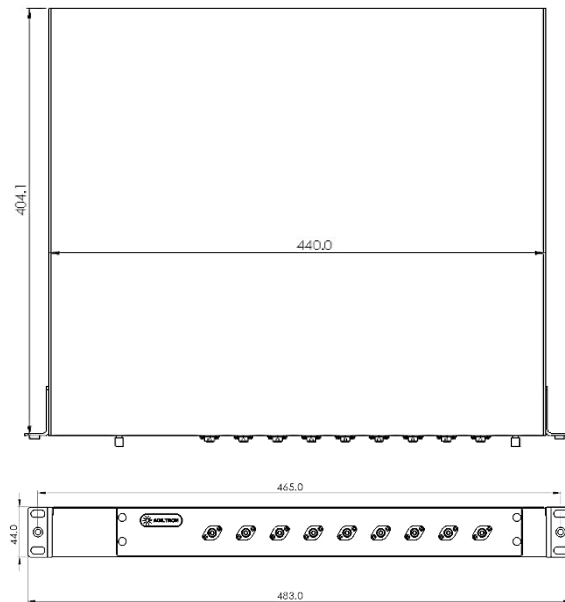


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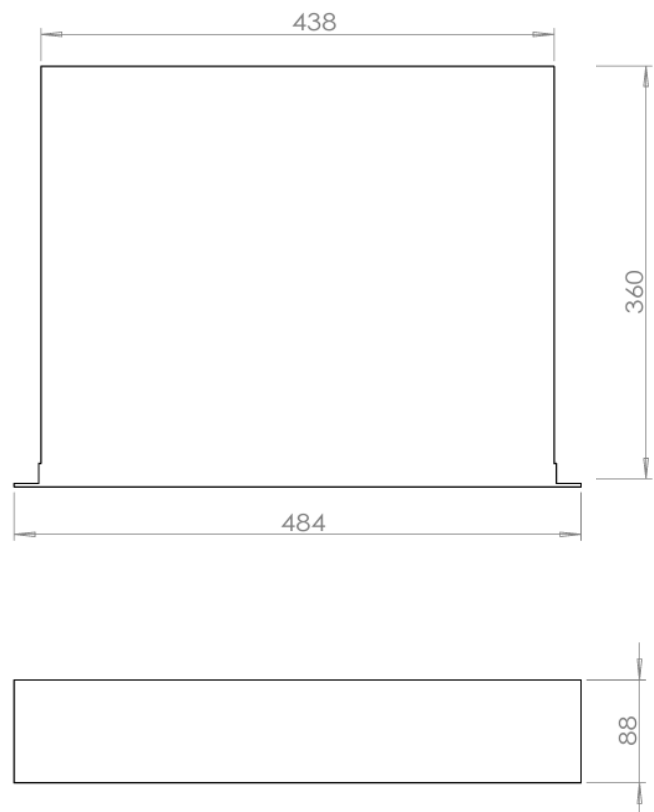
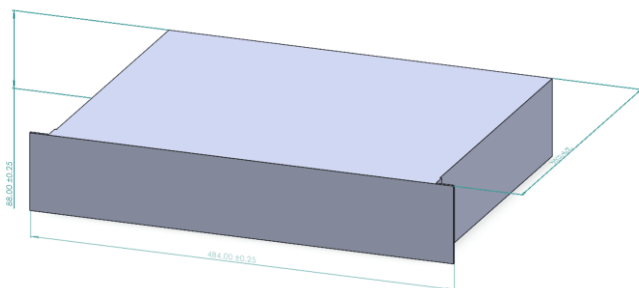
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Mechanical Dimensions (Unit: mm): The Rack Size is related to the switch and connector selection

■ 1 U



■ 2 U



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

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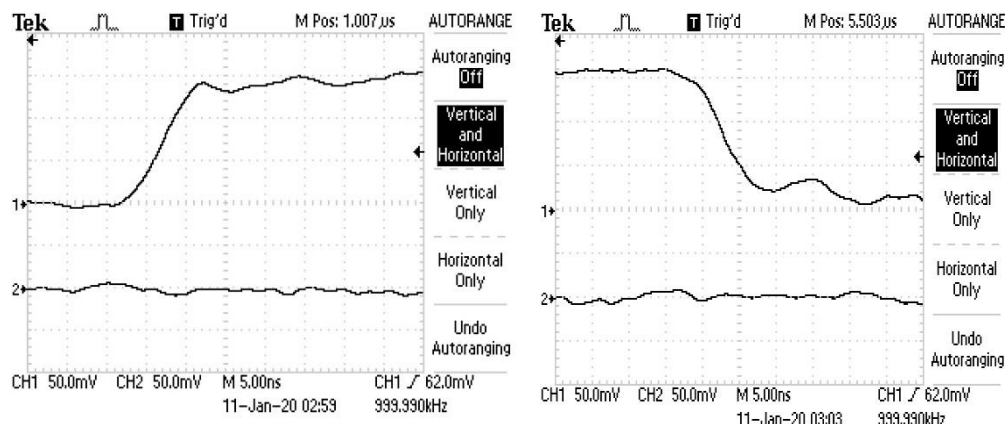
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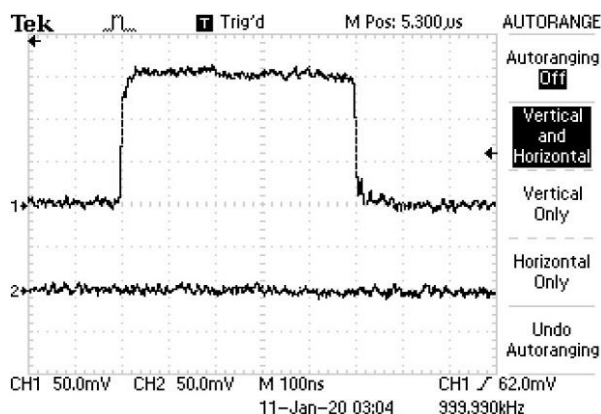
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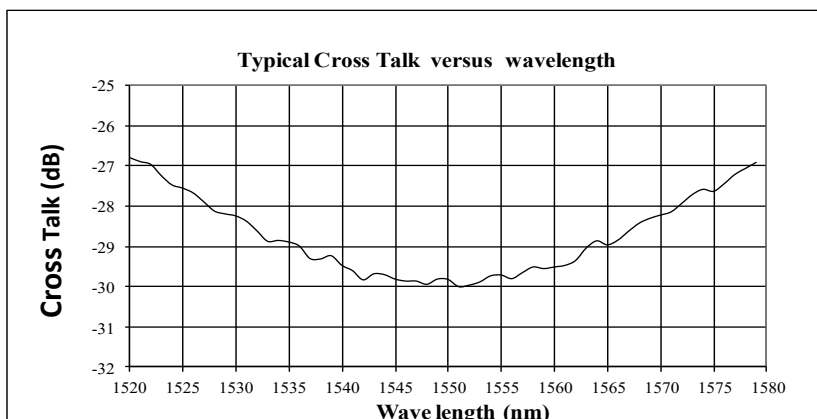
Typical Rise and Fall Optical Switching Profile (5ns)



Typical Optical Switching Repetition Profile (1MHz)



Typical Wavelength Dependence Profile



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Ordering Information (Part Number)

Prefix	Type	Wavelength ^[1]	Configuration	Repetition Rate	Fiber Type	Fiber Cover	Fiber Length	Connector ^{[2][3]}
NFNM-	1x1 = 0101 1x2 = 0102 1x4 = 0104 1x8 = 0108 1x12 = 0112 1x16 = 0116 Dual 1x2 = D1D2 2x10 = 0210	1060nm = 1 2000nm = 2 1310nm = 3 1480nm = 4 1550nm = 5 1625nm = 6 1750nm = A 780nm = 7 850nm = 8 650nm = E 550nm = F Special = 0	Single Stage 0.5W = 1 Single Stage 5W = H Single Stage 10W = J Special = 0	100kHz = 1 200kHz = 2 300kHz = 3 500kHz = 4 800kHz = 8 900kHz = 9 2MHz = B	SMF-28 = 1 HI1060 = 2 780HP = 3 PM1550 = 5 PM850 = 8 PM980 = 9 MM50/125 ^[4] =M 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 ST/PC = 6 LC/PC = 7 LC/APC = A E2000 APC = 9 LC/UPC = U MPO = Y Special = 0

[1]. Red Wavelength Bands are special orders. They use special crystals.

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

[3]. 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.

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

Red Color-marked is special order with a higher price and longer lead time.

Note:

- PM1550 fiber works well for 1310nm, PM1310 fiber choice costs extra

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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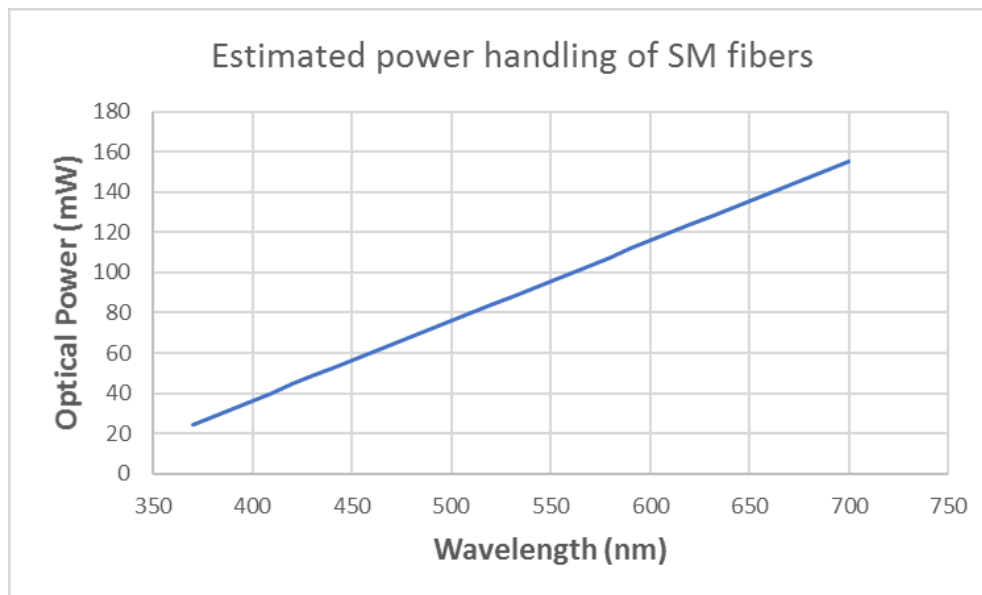
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Optical Power Handling vs Wavelength For Single-Mode Fibers



Electrical Driving Specification

Control signal Input: 0-5V through SMA connector
Power supply in driver: 110-220 AC
Power Consumption in driver: <10W

Operation Instructions

1. Connect the optical input and output fibers to the front-panel connectors.
2. Insert the power cable and switch on the unit using the power switch located next to the power inlet.
3. Connect the control signals to the SMA connectors.
4. The optical output will respond according to the applied TTL logic levels.

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Ethernet Remote Control with Python

Several options: Telnet, HTTP/JSON API, or VISA Raw Socket mode (SCPI over TCP/IP)

```
#####  
Telnet:  
  
import telnetlib  
  
HOST = "192.168.0.1"  
PORT = 23  
  
#####  
username = "admin"  
password="admin"  
#####  
tn=telnetlib.Telnet(HOST,PORT)  
  
reply=tn.read_until(b"username:",timeout=10)  
print(reply.decode("ascii"))#debug  
tn.write(username.encode("ascii")+b"\r\n")  
  
reply=tn.read_until(b"password:",timeout=10)  
print(reply.decode("ascii"))#debug  
tn.write(password.encode("ascii")+b"\r\n")  
  
reply=tn.read_until(b"telnet>",timeout=10)  
print(reply.decode("ascii"))#debug  
  
tn.write(b"setswitch 31 32 0 0\r\n")  
reply=tn.read_until(b"telnet>",timeout=10)  
print(reply.decode("ascii"))#debug  
  
tn.write(b"runswitch\r\n")  
reply=tn.read_until(b"telnet>",timeout=10)  
print(reply.decode("ascii"))#debug  
  
tn.write(b"quit\r\n")  
  
#####
```

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Ethernet Remote Control with Python (ending)

Several options: Telnet, HTTP/JSON API, or VISA Raw Socket mode (SCPI over TCP/IP)

```
#####
API:
import requests

BASE_URL = "
TOKEN = "TOKEN"
def api_post(path, payload):
    r = requests.post(
        BASE_URL + path,
        json=payload,
        headers={"X-Auth-Token": TOKEN},
        timeout=3,
    )
    r.raise_for_status()
    return r.json()

def api_get(path):
    r = requests.get(
        BASE_URL + path,
        headers={"X-Auth-Token": TOKEN},
        timeout=3,
    )
    r.raise_for_status()
    return r.json()

# Set port 3
print(api_post("/api/set_permanent_port", {"port": 3}))
# Read status
print(api_get("/api/status"))

#####
pyVISA:
import pyvisa

HOST = "192.168.0.1"
TOKEN = "TOKEN"

rm = pyvisa.ResourceManager()

inst = rm.open_resource(f"TCPIP0::{HOST}::5025::SOCKET")
inst.read_termination = "\n"
inst.write_termination = "\n"
inst.timeout = 2000 # ms

print("IDN:", inst.query("*IDN?").strip())

# Set port
inst.write("SWITCH:PERMANENTPORT 3")
print("PORT?:", inst.query("SWITCH:PERMANENTPORT?").strip())

# Status
print("STATUS:", inst.query("SWITCH:STATUS?").strip())

#####
```

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