NanoSpeed™
Premium Variable Fiber Optical Attenuator
(1MHz, 350-2350nm, SMF, PMF, Up To 20W)

(Protected by U.S. patent 7,403,677B1 and pending patents)

DATASHEET

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The Nano-Speed Premium Variable Fiber Optical Attenuator (NPOA) provides fast electrical control of optical power. It utilizes special electro-optic crystals that feature lower driving voltage, faster response, and broader wavelength coverage compared to the standard NSOA. This is achieved through a patented configuration activated by a voltage electrical control signal. The solid-state optical crystal design eliminates mechanical movement and organic materials, ensuring high reliability and fast response with minimal mechanical footprint. The NPOA Series Variable Optical Attenuators are designed to meet the most demanding operational requirements, offering ultra-high reliability and fast response times, as well as vibration insensitivity. Agiltron also provides customized electronic designs to meet special control requirements and applications. The NPOA is bidirectional, available in either normally-transparent mode (light passes through without applied voltage) or normally-opaque mode (light is blocked without applied voltage). The attenuation level depends on the stage, and the response speed is related to the attenuation level and driver power (repetition rate), with small attenuations reaching MHz response rates. The NP Series VOA is mounted on a specially designed electronic driving PCB board with a 0~5V control input optimized for various repetition rates.

Features

- Solid-State
- High speed
- Ultra-high reliability
- Low insertion loss
- Compact
- High optical power
- Vibration insensitive
- Unmatched low cost
- High volume production

Applications

- Optical sensor
- Communication systems
- Instrumentation

Specifications

Parameter		Min	Typical	Max	Unit
Central wavelength [1]		350		2330	nm
Insertion Loss [2]	580~750nm		2.5	3.5	dB
	780~960nm		1.2	2.5	
	1310-1620nm		1	1.5	
Attenuation Range [3]	Single stage	20	25	30	dB
PDL (SMF)			0.1	0.3	dB
PMD (SMF)			0.1	0.3	ps
Polarization Extinction Ratio (PER) (PMF)		18	25	30	dB
Resolution			Continuous		dB
Return Loss		45	50	60	dB
Fiber Type			SMF, Panda PM, or equivalent		
Driver Repeat Rate [3]	10kHz driver	DC	10		kHz
	200kHz driver	DC	200		
	800kHz driver	DC	1000		
Modulation frequency [4]				5	MHz
Optic Power Handling [5]	Normal power VOA		100		mW
	High power VOA		5	20	W
Operating Temperature		-5		70	°C
Storage Temperature		-40		85	°C

Notes:

[1] Operation bandwidth is ± 20nm approximately at the central wavelength. Beyond this bandwidth, the performance is reduced..

[2] Measured without connectors. Shorter than 580nm or longer than 1620 nm have higher losses

[3] Full attenuation is measured at 5kHz, which may be degraded at the high repeat rate.

[4] It is defined based on the driver's repeat rate. The modulation depth will be reduced as the frequency increases, from ~100% down to ~15% at 5MHz.

[5] Defined at 850nm. For shorter wavelength the value reduces. @1550nm 300mW

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: **The device mounted on the PCB is an OEM module designed solely for system integration, not for general use. Do not touch the PCB by hand, as electrostatic discharge can damage the chips even without power connected, and you may also experience an unpleasant electrical shock. For laboratory use, please purchase a benchtop metal-covered module.**

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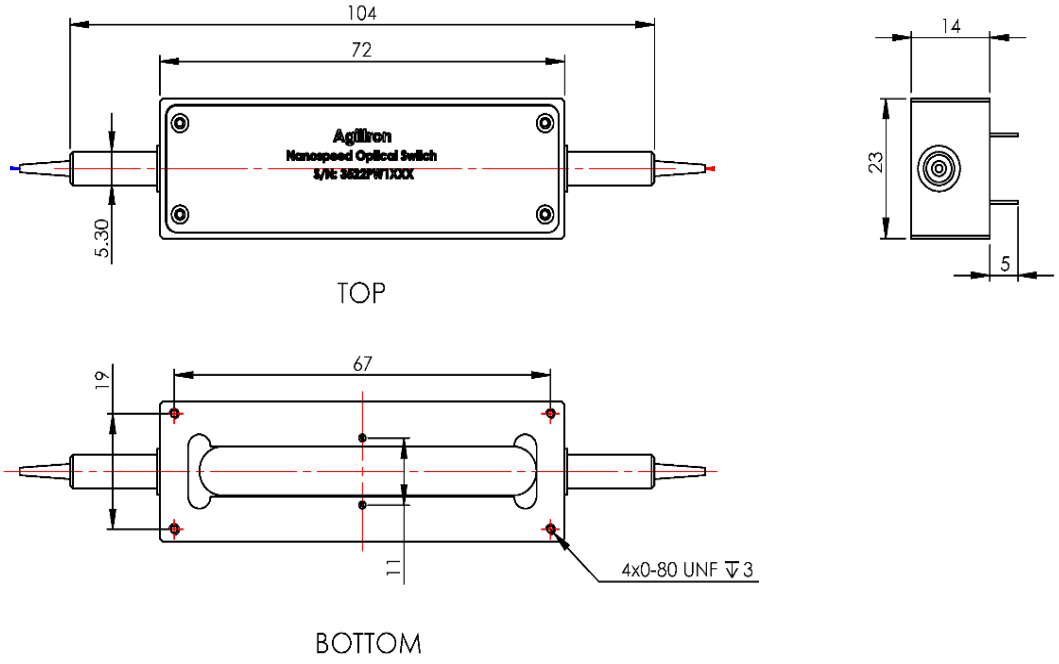
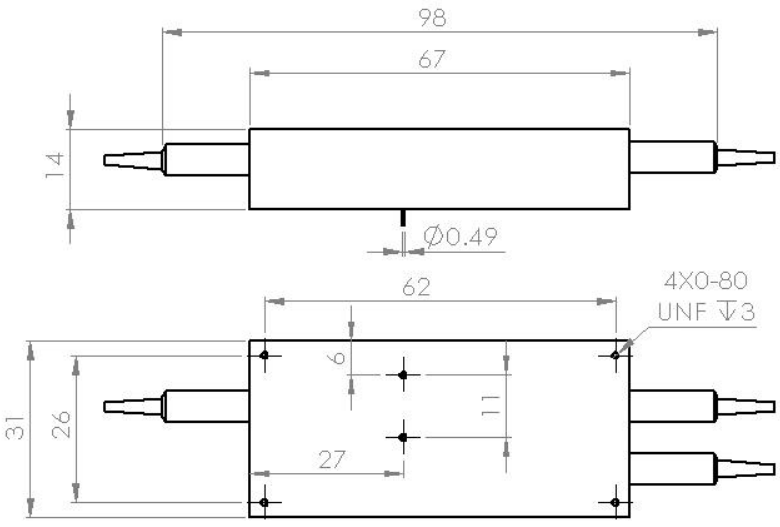
Mechanical Dimensions (mm)



Single Stage & Standard Power



High Power

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

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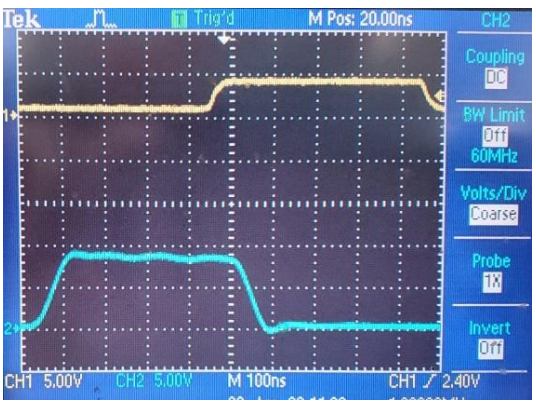
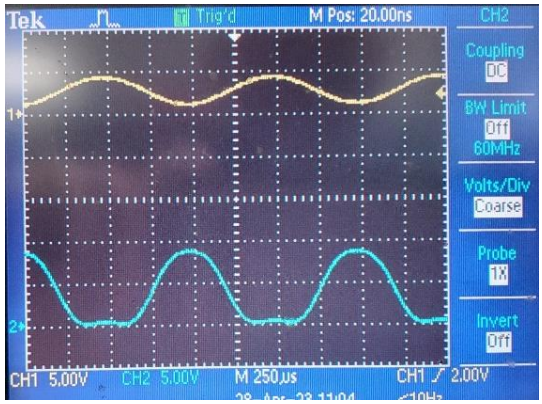
Typical 1MHz Response (full attenuation)

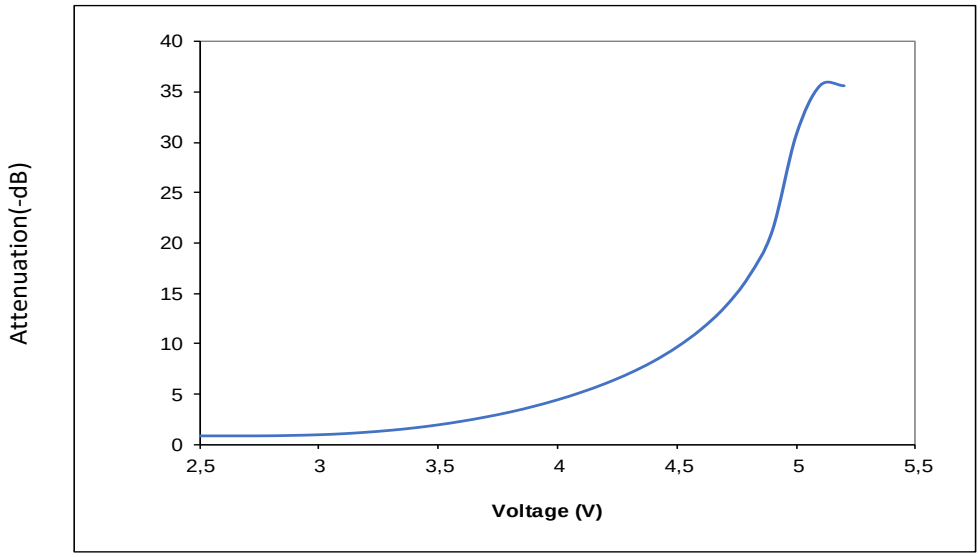
Electrical

Optical

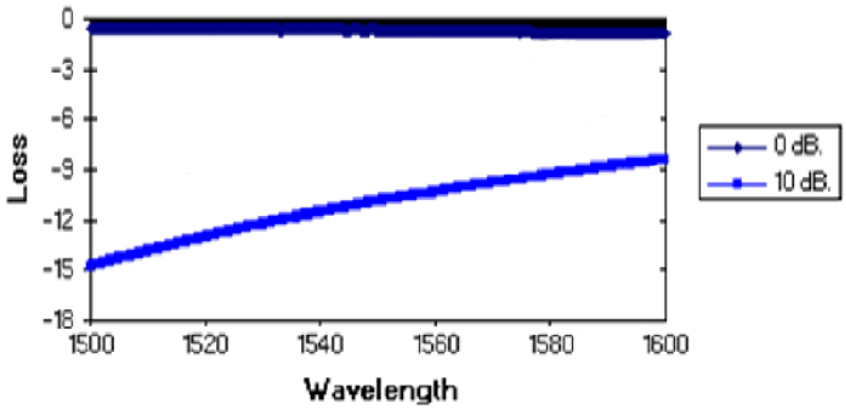




Typical Attenuation versus Control Voltage to Driver



Typical WDL @10dB attenuation



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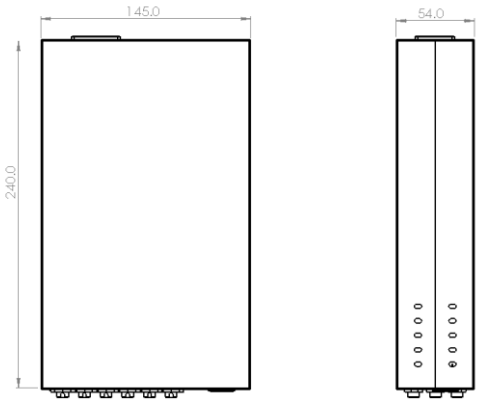
Driving Board Selection

Maximum Repetition Rate	Part Number (P/N)
100kHz (dual stage)	NVDR-SP2210121
200kHz (single stage)	NVDR-SP2210121
800kHz (single stage)	NVDR-SPH210121

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.

Benchtop Unit with Metal Enclosure and Power Supply



Ordering Information

	☐☐	☐	☐	1	☐	☐	☐	☐	☐	☐
Prefix	**Type**	**Wavelength**	**No Power**	**Stage**	**Fiber Type**	**Fiber Cover**	**Fiber Length**	**Connector**	**PER**	**Benchtop**
NPOA- [1] **NPHA -** [2]	Standard = 32 1W Power = 33 5W Power = 34 10W Power = 10 Special = 00	1550nm = 5 780nm = 7 850nm = 8 1310nm = 3 1060nm = 1 650nm = S 550nm = W 450nm = F 400nm = V Special = 0	Transparent = 1 Opaque = 2	Single = 1	SMF-28 = 1 HI1060 = 2 HI780 = 3 PM850 = 8 PM1550 = 5 PM980 = 9 SM850 = A SM600 = B SM450 = C SM400 = D SM980 = E PM780 = F PM630 = G PM460 = H PM405 = I	900um Tube = 3 Benchtop = B Special = 0	0.25m = 1 0.5m = 2 1.0 m = 3 Benchtop = B Special = 0	None = 1 FC/PC = 2 FC/APC = 3 SC/PC = 4 SC/APC = 5 ST/PC = 6 LC/PC = 7 LC/APC = A LC/UPC = U 5WFC/PC = H 5WFC/APC = J Special = 0	Non-PM fiber = N PER>18 = 1 PER>25 = 2 PER>29 = 3	Non = 1 Yes = 2

[1]. **NPOA** -- **P**remium, standard power V**OA**

[2]. **NPHA** -- **P**remium, **H**igh power (≥ 1W) VO**A**

Benchtop – Turn-key unit integrated with power supply and protected with metal casing having front fiber connectors (FC/APC)

Note:

"**transparent**" means no attenuation without applying a controlling voltage, the "**opaque**" means the highest attenuation without applying a controlling voltage.

Red indicates special order that is high cost at low volume with deep discount at high volume

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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, 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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