

MEMS Variable Attenuator up to 70dB

(750–2500 nm, SM, MM, PM, 0.3ms fast, 0.1dB repeatability, no drift, bidirectional)

(US patent 8,666,218 and other patents pending)



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Features

- 75dB Attenuation
- 0.1dB Repeatability
- Fast 0.3ms for 0.5dB change
- SM, PM, MM
- USB

Applications

- Test
- Power Regulation
- Channel Balance
- Instrumentation



The HAOA Series High-Attenuation Variable Optical Attenuator (VOA) provides fast response, highly repeatable attenuation settings, and excellent long-term stability. The high attenuation range is achieved by cascading multiple 2D VOAs in series. The HAOA supports single-mode, multimode, and polarization-maintaining fibers and operates over a broad wavelength range from 750 to 2400 nm. It is designed for direct PCB mounting and is controlled through two electrical pins located on the underside of the package.

Specifications

Parameter		Min	Typical	Max	Unit
Wavelength ^[0]		750		2500	nm
Attenuation ^[1]		55	65	75	dB
Insertion Loss ^[2]	Two Stage	0.6	1.2	1.5	dB
	Three Stage	0.8	1.6	2.2	
Polarization Dependent Loss ^[3]			0.15	0.5	dB
Wavelength Dependence Loss ^[3]			0.1	0.2	dB
Attenuation Range			50	65	dB
Driving Voltage		0	6	10	V
Accuracy/Repeatability	0.6-30dB		0.1	0.2	dB
	30-60dB		0.8	1	dB
	60-80dB		2	3	dB
Extinction Ratio (PM version only)		18	23	25	dB
Polarization Mode Dispersion (SM version only)			0.01	0.05	ps
Return Loss		55			dB
Optical Rise/Fall Response ^[4]		0.3	10	150	ms
Power Consumption				4	W
Optical Power Handling (CW) ^[5]			300	500	mW
Operating Temperature		-10		75	°C
Storage Temperature		-40		85	°C
Weight			30		g

Notes:

- [0]. Wavelength bandwidth match SM fiber types
- [1]. For SM fiber, MM fiber is about 35% less attenuation depth
- [2]. Without connector and at room temperature, each connector add about 0.3dB
- [3]. Within 40nm wavelength range
- [4]. 0.2dB/0.2ms, 1 dB/1ms, 3dB/10ms
- [5]. For wavelength >1550nm, shorter wavelength has lower power handling as the core size reduces.

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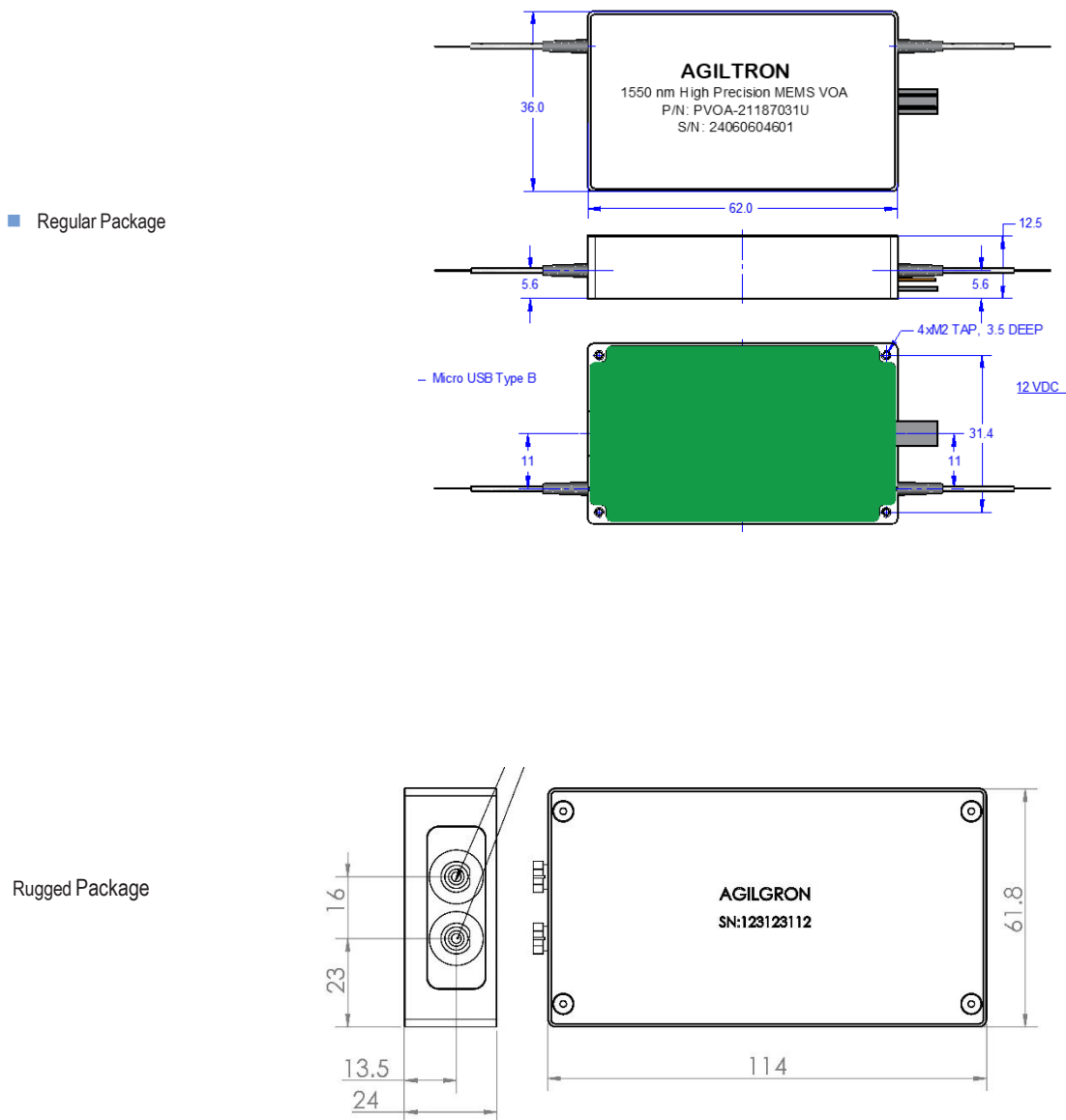


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Electrical Control Interface

The VOA can be controlled by a computer via a USB interface. It uses a Micro USB type B connector that also provide power to the VOA at the same time. The device accept UART command and recognized as a serial device by the PC.

Mechanical Footprint Dimensions (mm)



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

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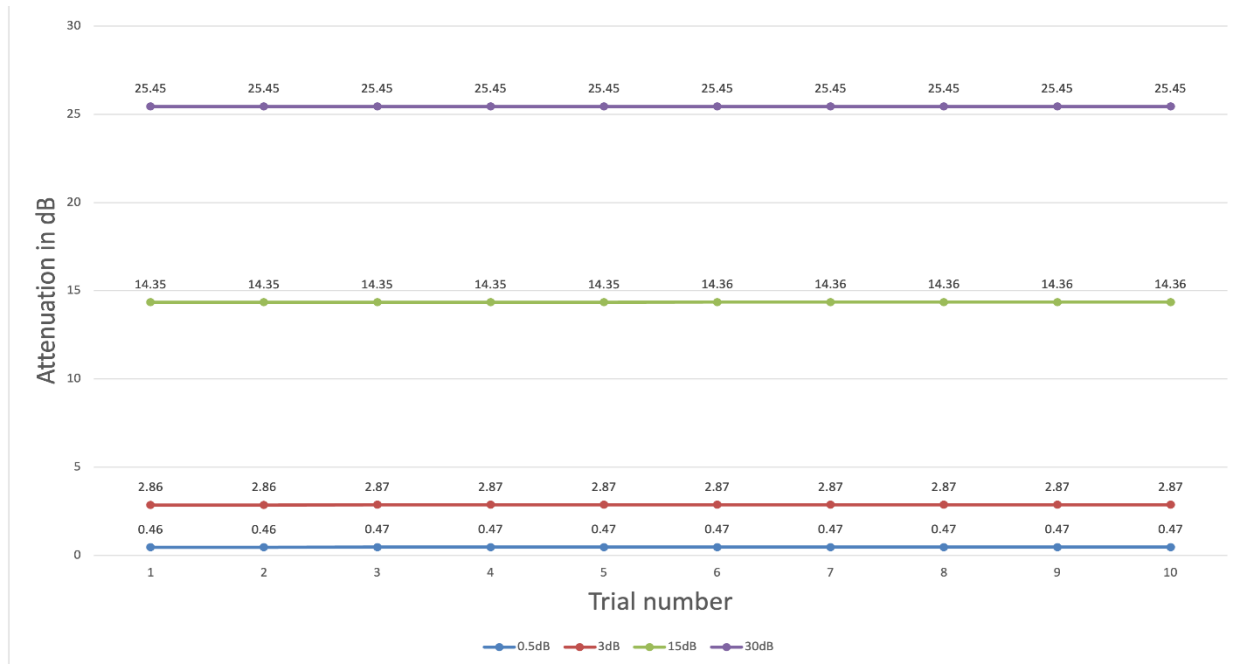
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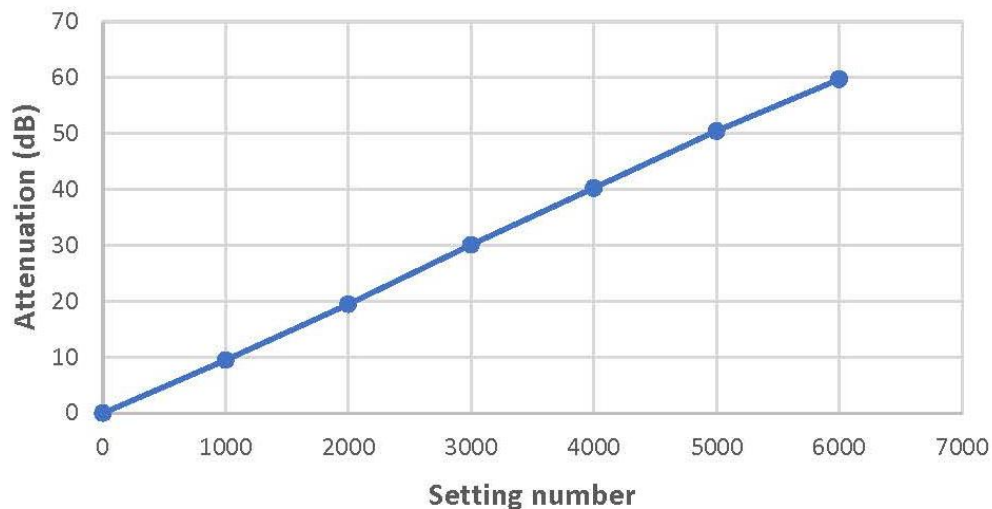


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Typical Stability



Typical Control Response



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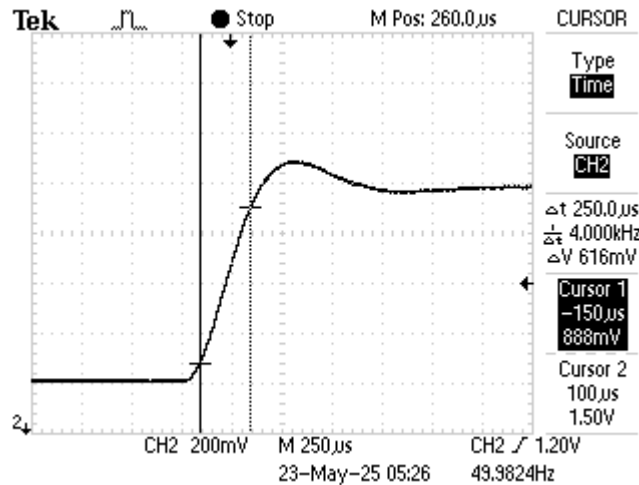
(US patent 8,666,218 and other patents pending)



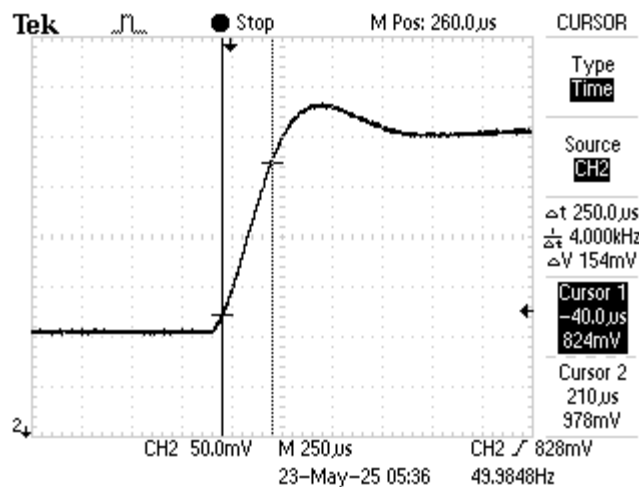
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Typical Optical Rise/Fall Time

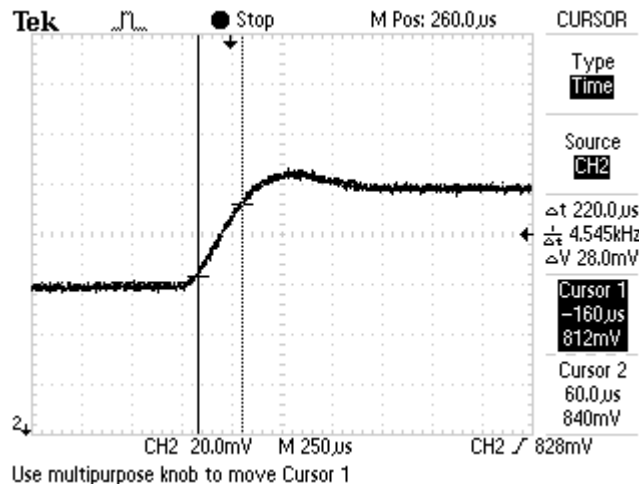
■ 1.5 – 4.5 dB



■ 3.5 – 4.5 dB



■ 4.3 – 4.5 dB



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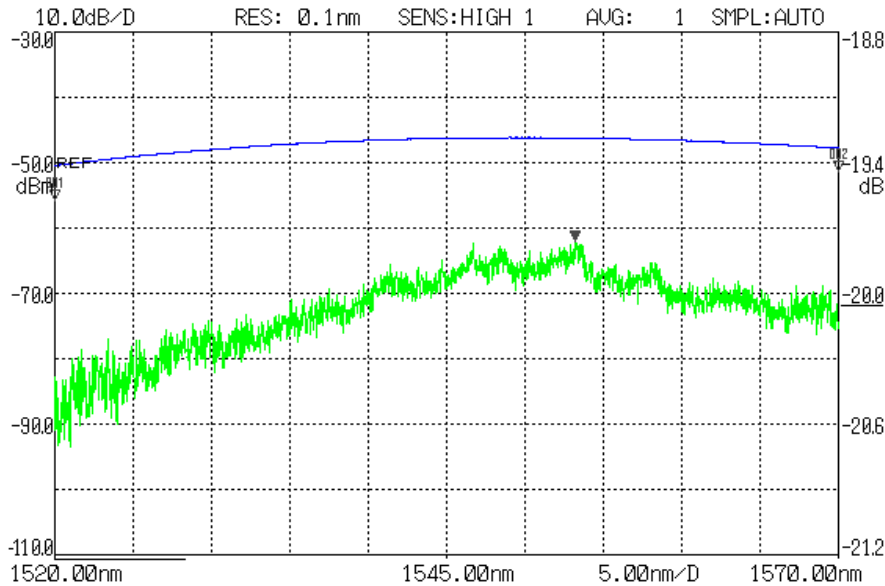
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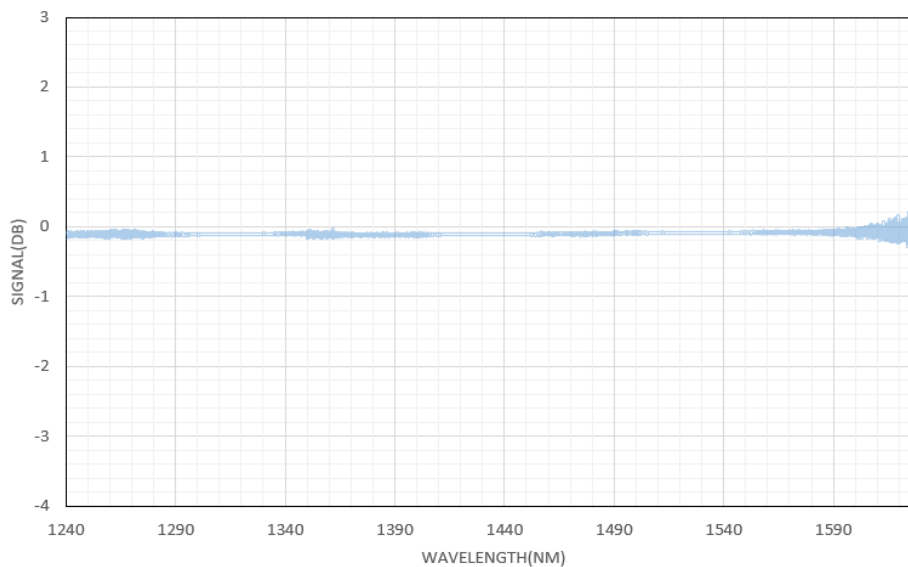


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Typical Wavelength Dependence @20dB Attenuation



Typical Insertion Loss vs Wavelength (1240-1630nm)



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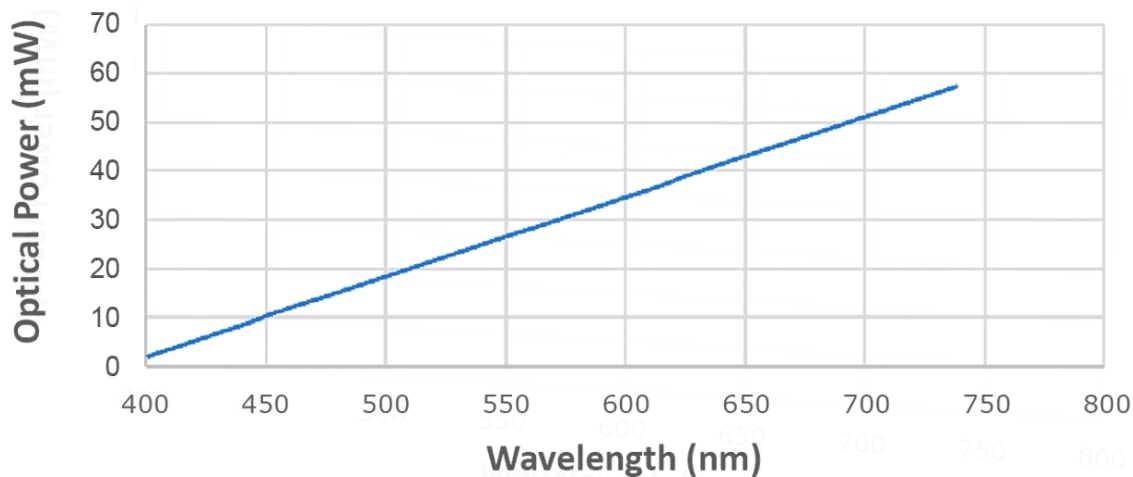
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Optical Power Handling vs Wavelength for Standard SM Fibers



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Ordering Information (Part Number)

	☐	2	☐	☐	☐	☐	☐	☐	☐
Prefix	Attenuation	Interface	Off State ^[1]	Wavelength	Package	Fiber Type	Fiber Cover	Fiber Length	Connector ^{[2][3]}
HAOA-	>60dB = 1 >70dB = 2	2 Pins = 2	Transparent = 1 Special = 0	1260~1650nm = 5 460nm = 3 630nm = 6 780nm = 7 850nm = 8 1060nm = 1 2000nm = 2	Regular = 1 Rugged = 2 Special = 0	SM 28 = 1 50/125 = 5 62.5/125 = 6 PM1550 = B 780HP = 7 Hi1060 = 2 PM780 = E PM980 = F SM460 = 4 SM600 = A PM460 = C SM2000 = G PM630 = D Special = 0	0.9mm tube = 3 Special = 0	0.25m = 1 0.5m = 2 1.0m = 3 Special = 0	None = 1 FC/PC = 2 FC/APC = 3 SC/PC = 4 SC/APC = 5 LC/PC = 7 LC/APC = A LC/UPC = U Special = 0

Note:

- [1]. “transparent” means no attenuation without applying a controlling voltage, the “opaque” means the highest attenuation without applying a controlling voltage.
- [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.

RED indicates special order

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.