Fiber Optical Variable Attenuator BNC

(direct drive, 450nm-2630nm)

DATASHEET

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Features

- High Repeatability
- Low Power
- Small

The VOAD series variable optical attenuators feature direct drive by a function generator having bandwidth up to 1.5 kHz, provide attenuation up to >30 dB. It is a convenient tool for laboratory use. Driving voltages of 0 to 10 V control optical transmission without polarity, which decreases with applied voltage with modulation up to 1.5 kHz. Most voltage sources, including power supplies, function generators, and digital-to-analog converters (DACs), can be used to control these electronic VOAs. The VOA is optically bidirectional. The VOAD is constructed using an electrostatic rotating mirror hermetically sealed with nitrogen, featuring high repeatability, low power consumption, and low cost. However, the device can be damaged by applied a voltage over 15V. The device's electrical character is capacitive without polarity.

Specifications

Parameter		Min	Typical	Max	Unit
Operation Wavelength	Single Mode	450		2300	nm
	Multimode	810-890		1260-1600	
Insertion Loss [1], [2]		0.5		5	dB
PDL (SM)				0.3	dB
Repeatability (0-30, @15dB)			0.1	0.2	dB
Wavelength Dependent Loss (@20dB)				0.63	dB
Extinction Ratio	PM fiber	16		30 [3]	dB
Repeatability (@10dB, 0-60 °C)	Uncompensated		0.3	0.5	dB
	Compensated		0.1	0.2	
Return Loss	SM, PM	50			dB
	MM	35			
Attenuation	SM, PM	40			dB
	MM	30			
Driving Voltage	SM, PM	0	5	7	V
	MM	0	5	9	
Response Time			0.3	1	ms
Repetition Rate			50	1500	Hz
Durability			10^{12}		cycle
Power Consumption (at maximum)				0.2	mW
ESD				500	V
Operating Temperature		-10		70	°C
Storage Temperature		-40		85	°C
Optical Power Handling [4]			300	400	mW

Notes:

[1]. The loss is related to the fiber core size and the connector mating. <1dB for 1230-1630nm. Above this band the fiber has high loss. Below this band, the loss is inversely proportional to fiber core size and connector mating (if center off then higher loss).

[2]. Multimode IL measured @ Light Source CPR < 14dB

[3]. 30dB PER is available with special order

[4]. The power handling is inversely proportional to fiber core size. 300mW for 1230-1630nm SM.

Rev 04/15/25

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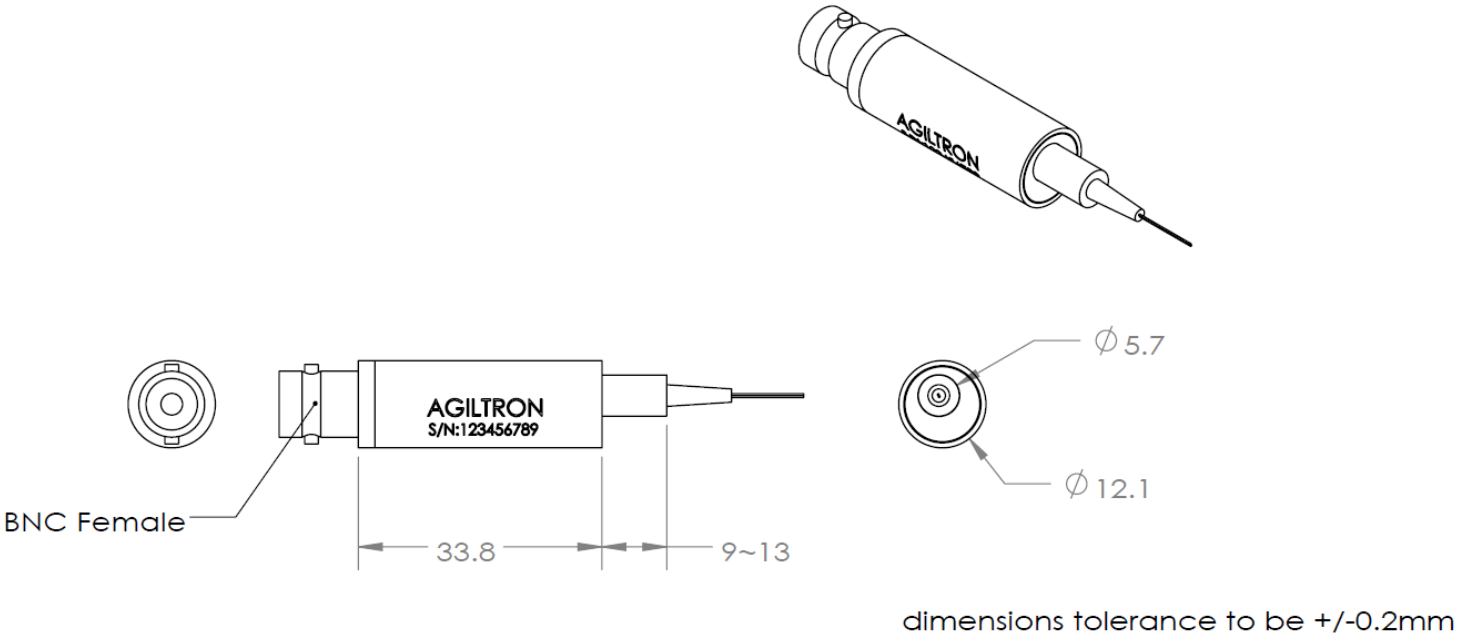
Mechanical Dimensions (mm)



dimensions tolerance to be +/-0.2mm

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

Electrical Driving Requirements

1) Capacitive load device, no polarity.
2) The maximum rating voltage is 10V

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Operation Manual

- Unpack the unit carefully
- Connect light source and detector. Either of the unit's fiber leads can be used as the input or output
- Use a BNC cable to connect a power supply or other voltage source to the unit, and then apply 0 to 8 V to control the attenuation. Please note that minimum attenuation and polarization-maintaining performance are highly dependent on connector alignment. Best performance is achieved when the optical connection is made by fusion splicing to the VOA's fiber leads, which requires removing the connectors.
- If connect to a function generator, making sure the setting is one polarity not + - driving.

Ordering Information (Part Number)

	T	☐	7	1	1	☐	3	1	☐
Prefix	**Non-Power State**	**Wavelength**	**Package**	**Type**	**Compensation**	**Fiber Type**	**Fiber Cover**	**Fiber Length**	**Connector[1]**
VOAD-	Transparent = T	1260~1650nm = 5 460nm = 3 630nm = 6 780nm = 7 850nm = 8 1060nm = 1 2000nm = 2	BNC = 7	Standard = 1 Special = 0	Non = 1	SMF-28 = 5 PM1550 = B MM 62.5/125 = 6 SM450 = 4 SM600 = A 780HP = 7 Hi1060 = 1 PM460 = C PM630 = D PM780 = E PM980 = F SM2000 = G	0.9mm tube = 3	0.5-1m = 1	FC/APC = 3

[1]. The connector cannot be installed directly onto bare fiber, as it 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 can remove this protective tube after testing. The optical power handling of a standard connector is less than 0.5 W for SM28 fiber and decreases further with smaller core fibers.

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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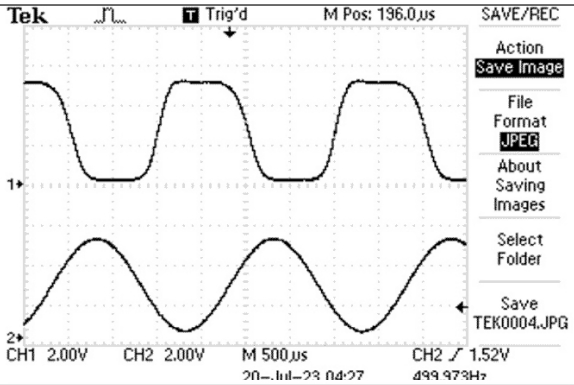
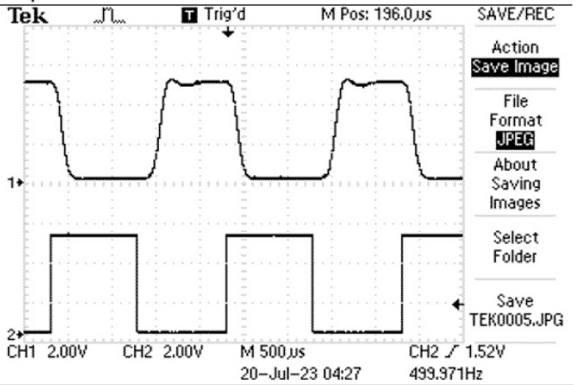
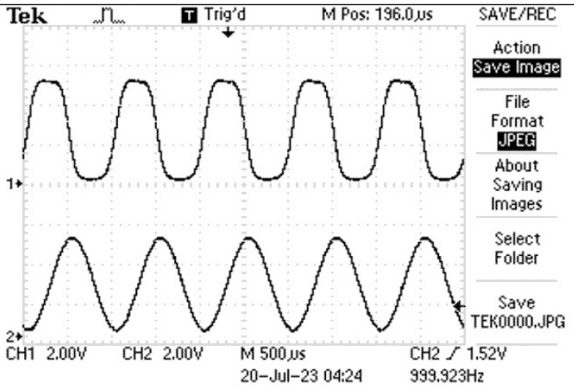
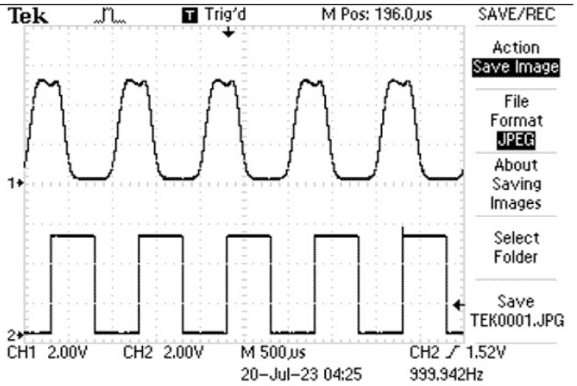
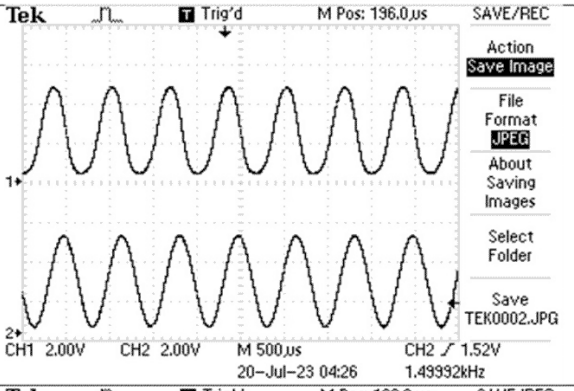
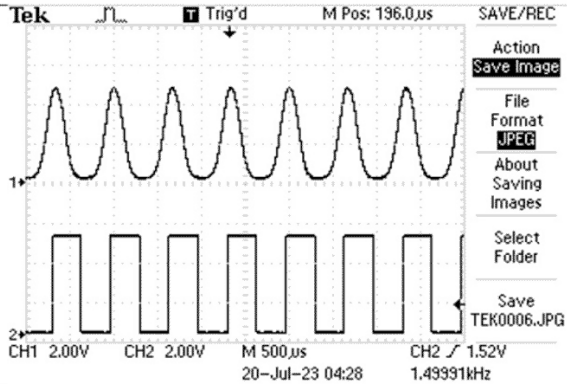
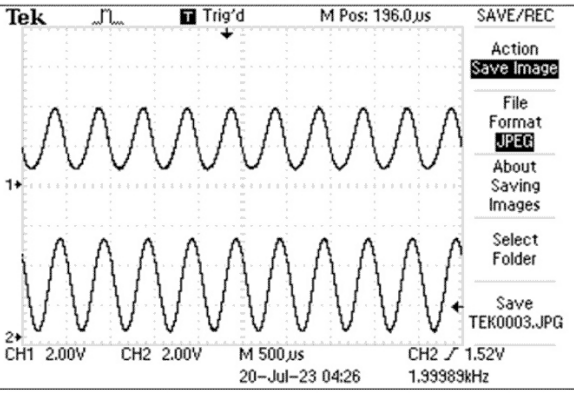
Typical Frequency Response for SM28 Fiber

Channel 1 : VOA signal; Channel 2: Drive signal (0 to 5V)

Freq(Hz)	Sine Wave	Square Wave
500		
1000		
1500		
2000		

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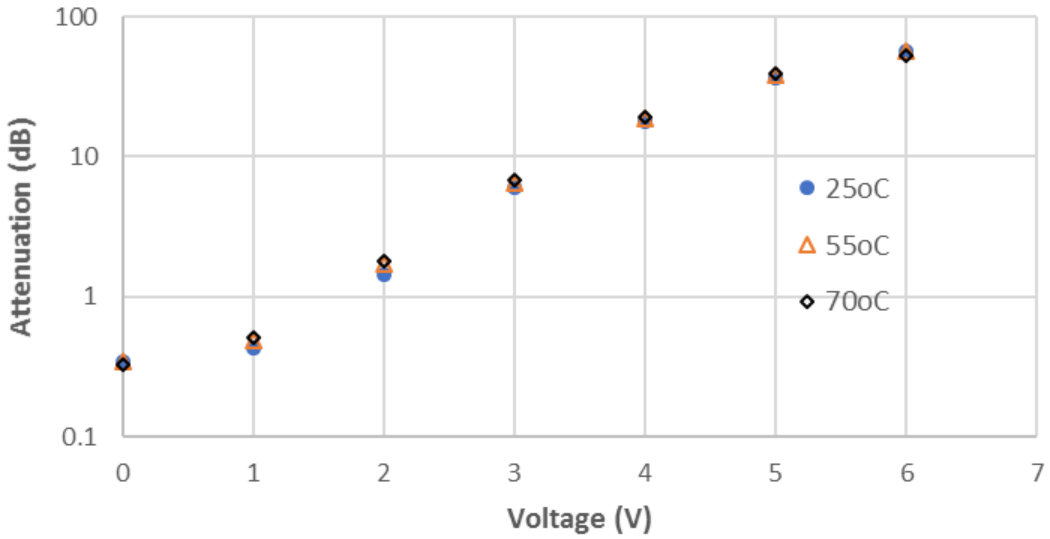
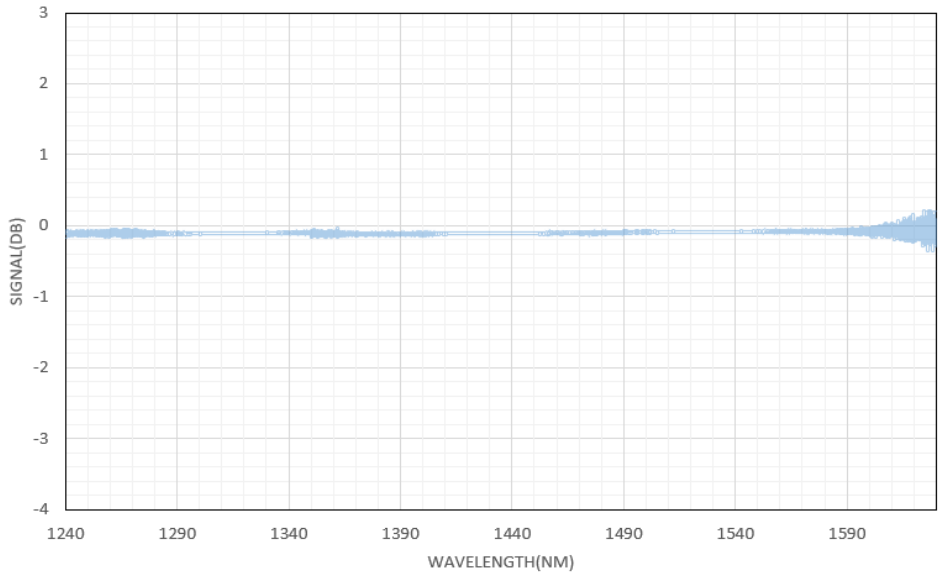
Typical Attenuation vs. Voltage at 25°C, 55°C, 70°C 1550nm SM



Typical Insertion Loss vs Wavelength (1240-1630nm)



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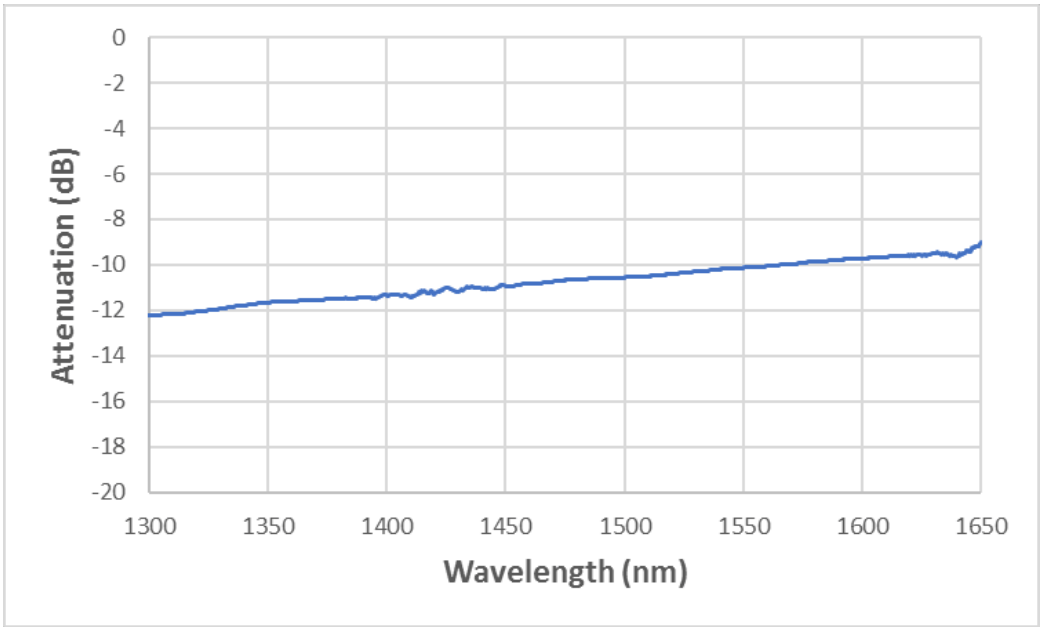
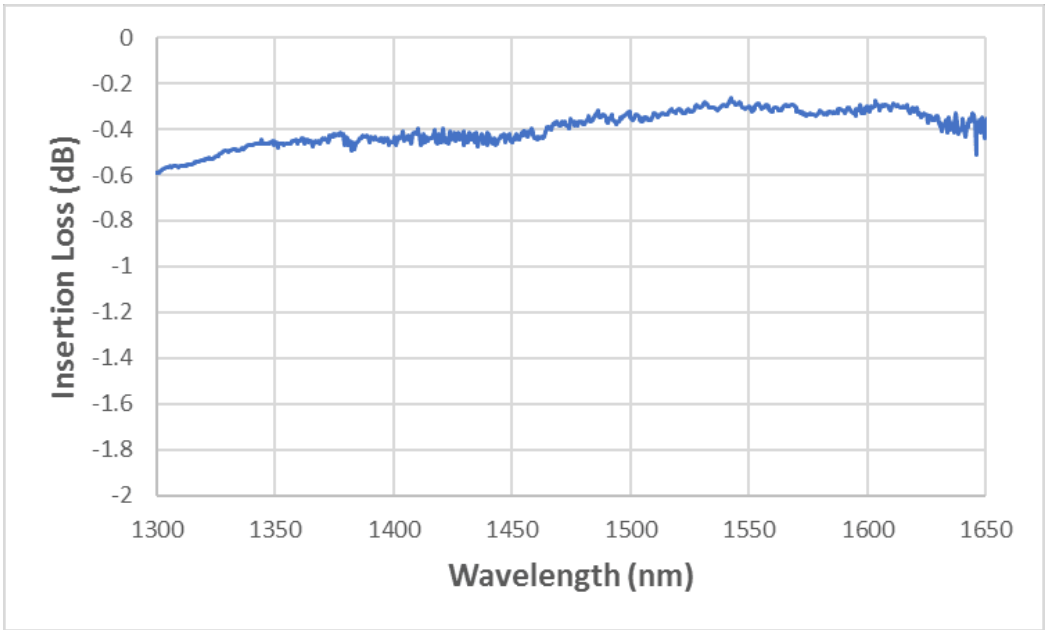
Wavelength Dependence 10 dB, 1550nm SM



Wavelength Dependence 0.5 dB, 1550nm SM



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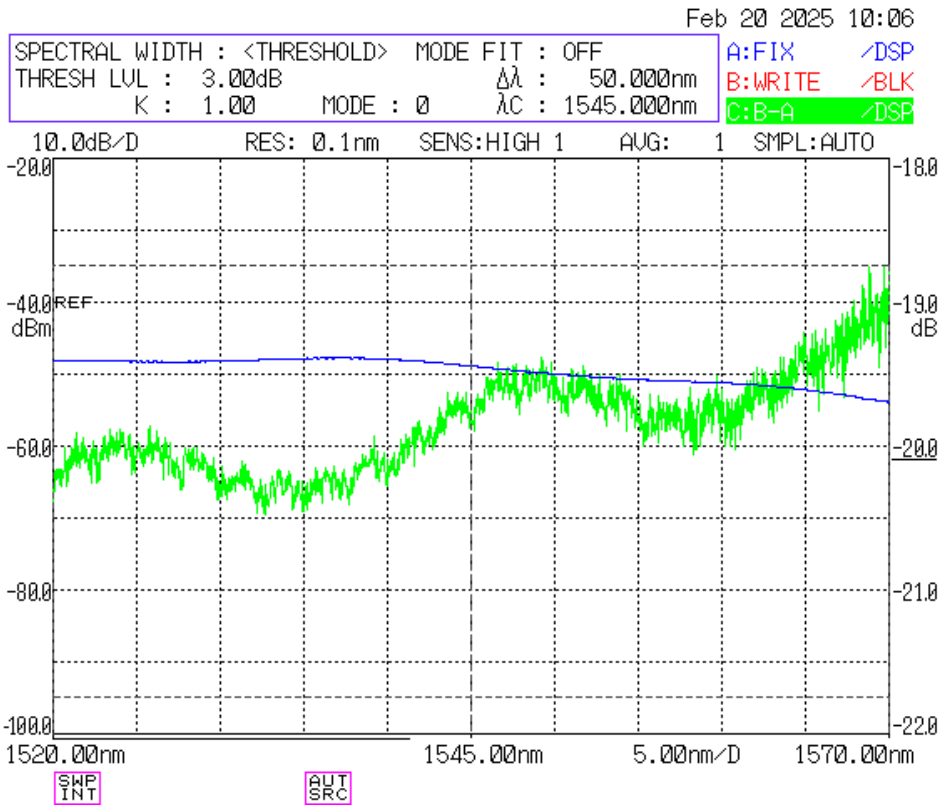
Typical Wavelength Dependence @20dB Attenuation



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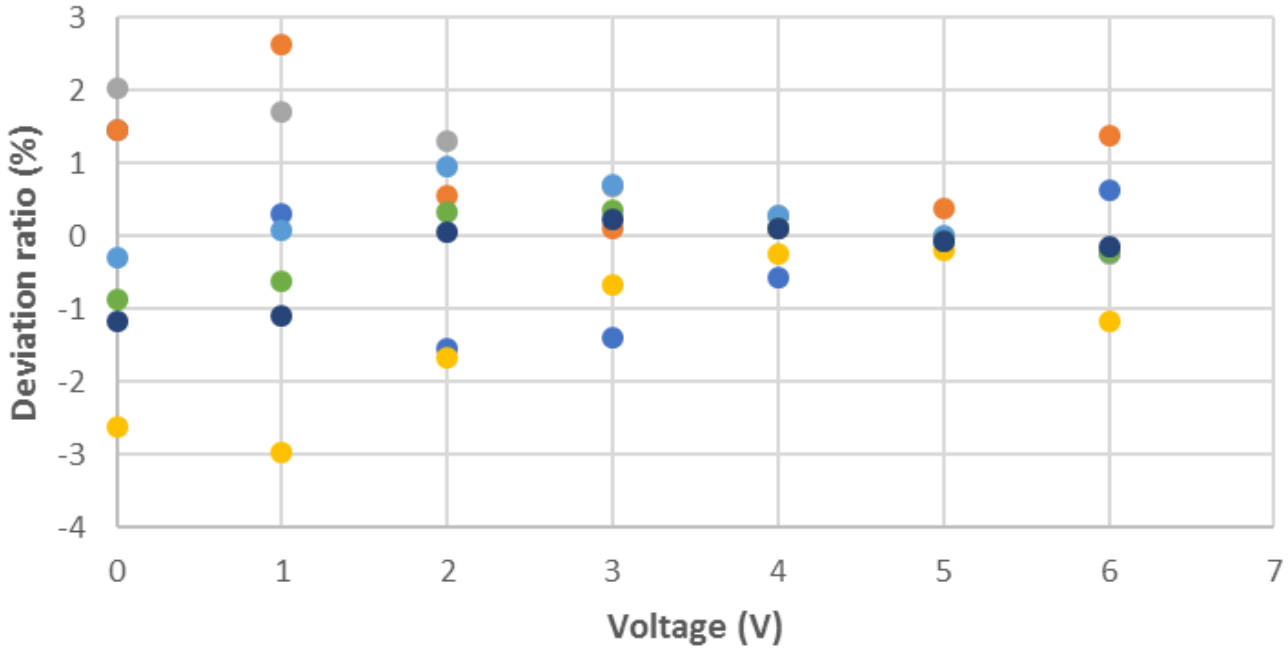
Typical Voltage Variable Attenuation Repeatability over 5days (5 colors) 1550nm SM



Optical Power Handling vs Wavelength for Standard SM Fibers