CrystaLatch™ Fiber Optic Polarization Switch

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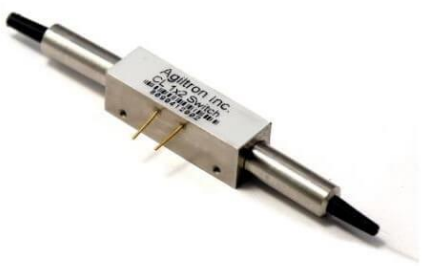

The CL Series polarization switch can quickly switch the incoming SOP between two orthogonal polarization states (SOPs). This is achieved using patented non-mechanical configurations and activated via an electrical control signal. Latching operation preserves the selected SOP after the drive signal has been removed. The all-solid-state CL polarization fiber optic switch features low insertion loss, high extinction ratio, fast switching, and extremely high reliability and repeatability. The input is PM fiber; the polarization is aligned with the slow axis. It is unidirectional.

The output could be either PM or SM fiber. For PM fiber, the connector key is aligned with the slow axis.

An electronic driver is available.

The magneto-optical crystals used in the CL switches have no fatigue nor drift effect.

Features

- No moving part
- Fast switching
- Low IL
- Miniature Size

Applications

- Test instrument
- Sensor

Specifications

Parameter		Min	Typical	Max	Unit
Operation Wavelength[1]		1520	1550	1580	nm
		1295	1310	1325	
Insertion Loss [2]	Single stage		0.7	1.0	dB
	Dual stage		1.2	1.5	
SOP Tolerance			± 1.0 [1]	± 2.5 [3]	degree
Return Loss		50	55		dB
Extinction Ratio	Single stage	18	25		dB
	Dual stage	30	35		
Optical Response (rise, fall)			10	20	µs
Repetition Rate				2K	Hz
Operating Temperature		-5		70	°C
Storage Temperature		-40		85	°C
Optical Power Handling			300	500	mW
				2 [4]	W
Durability		10^{15}			cycles

Notes:

[1]. Wider waveband version is available with the degraded performances in insertion loss and extinction ratio.

[2]. Measured at room temperature without connectors

[3]. It may be increased at temperature other than room temperature

[4]. High power version is available

RoHS COMPLIANT

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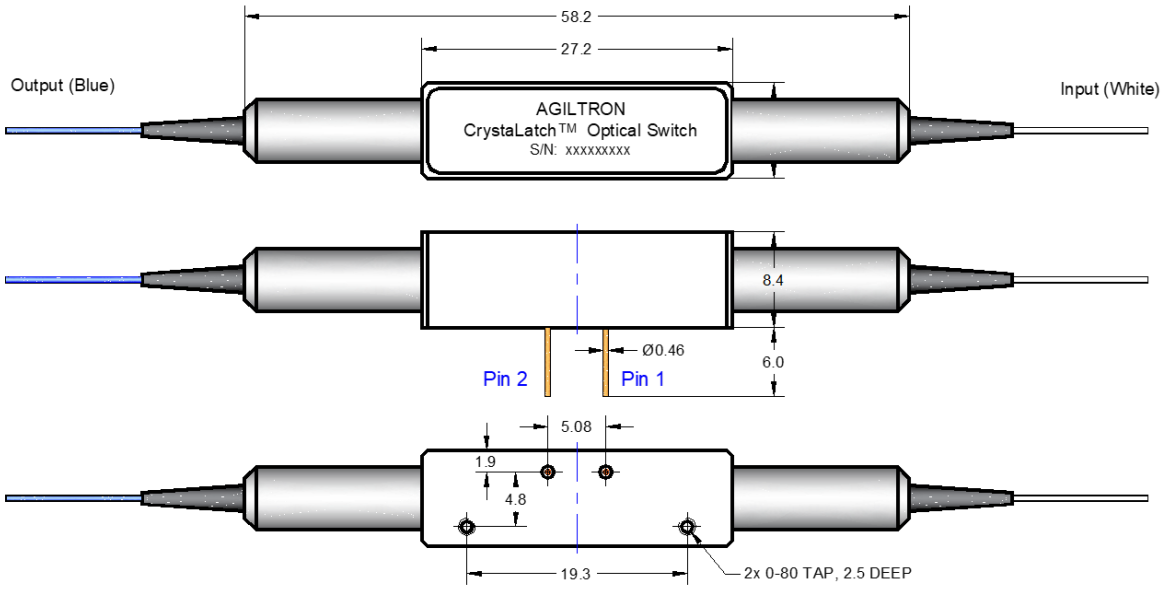
Mechanical Dimensions (Unit: mm)



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

Electrical Driving Information

The polarization switch is actuated by applying a polarity voltage pulse on a paired PINs. Applying one polarity pulse, the output light beam polarization is one status. Applying a reversed polarity pulse, the output light beam polarization is rotated by 90 degrees. The status is kept until the next pulse.

Parameter		Minimum	Typical	Maximum	Unit
Drive Pulse Voltage [1]	Single stage	2.3	2.5	2.7 [1]	V
	Dual stage	4.5	5.0	5.5	
Drive Current		110	140	195	mA
Pulse Duration		0.2	0.3	0.5	ms

[1]. Over this value will damage the device

Driving Table

Optical SOP	Pin 1	Pin 2
Original polarization	0	+
90^0 rotation	+	0

"+" is Voltage pulse.

Note:

The driving voltage value is transient voltage with a full load. The driver circuitry needs to provide sufficient current (~300mA) during the switching. Inside the switch core is an electromagnet with a residual magnetic field. The residual magnetic field will be established when an electrical current flows in one direction through the coil for a sufficiently long period. The residual magnetic field latches the switch state even without applying a voltage (the current flow stopped). Flowing a current in the opposite direction for a sufficient time changes the switch stage by establishing a reversal magnetic field. The coil is forgiving to the driver unless one burns it by applying a higher voltage or a current for too long (day). The switch can also be operated at high repetition rates of kHz, where the residual magnetic field may not be fully established.

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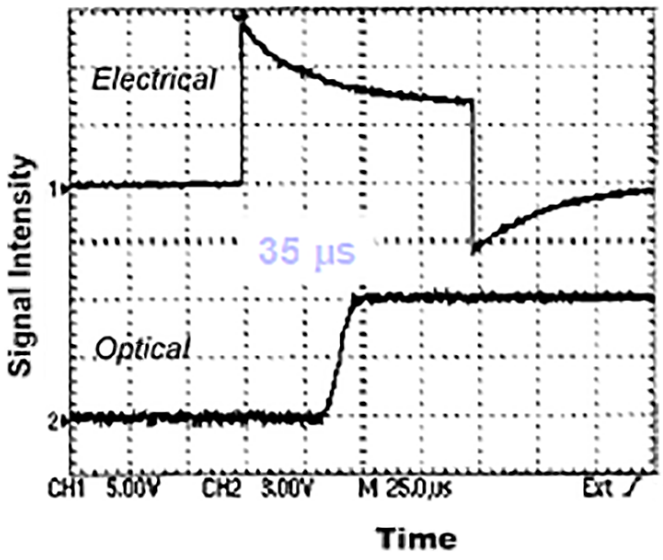
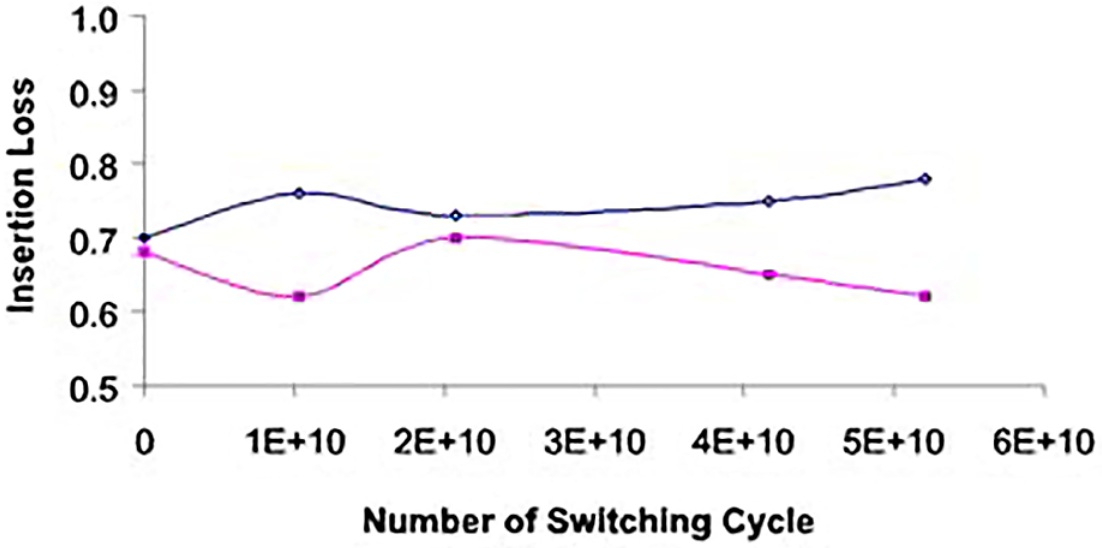
Typical Switching Response



Typical Loss Change of 1x2 vs Switching Numbers



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Ordering Information (Part Number)

	1 1	☐	☐	☐	☐	☐	☐	☐
Prefix	**Type**	**Configuration**	**Fiber coverage**	**Wavelength [1]**	**Input Fiber**	**Output Fiber**	**Fiber Length**	**Connector [2]**
CLPS-		Single stage = 1 Dual stage = 2	Bare fiber = 1 Loose tube = 3	1550 nm = 1 1310 nm = 3 Special = 0	PM 1550 = B PM 1310 = D Special = 0	PM 1550 = B SMF-28 = 1 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 ST/PC = 6 LC/PC = 7 LC/APC = A LC/UPC = U Special = 0

[1]. Wider bandwidth version is available under customization.

[2]. 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.

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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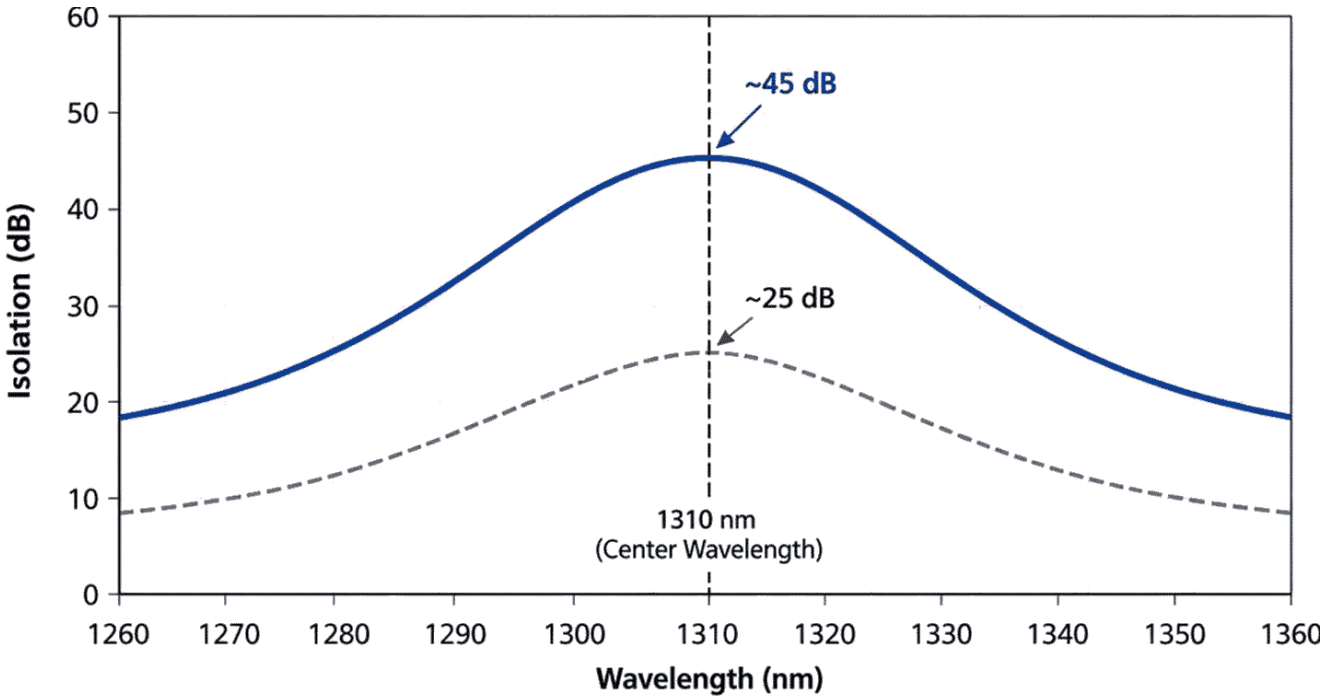
WDL for Single and Dual Stage



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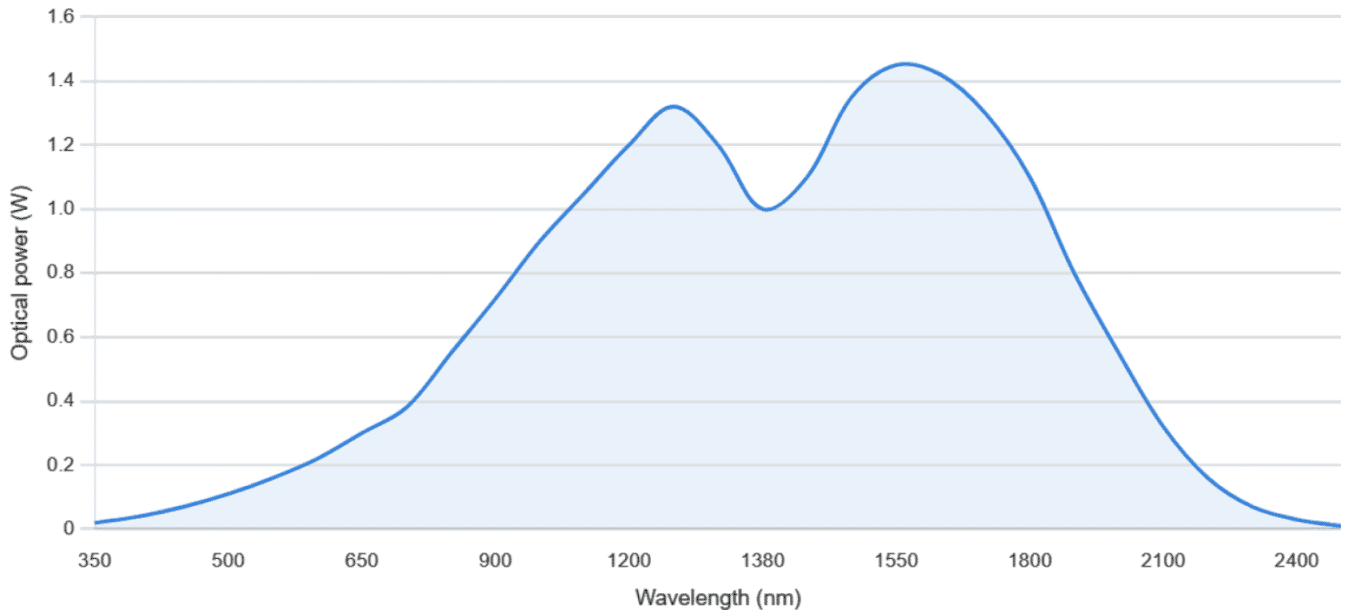
Regular Single Mode / Polarization Maintaining Fiber Optical Power Handing vs Wavelength



Single mode fiber optical power is limited by nonlinear effects in addition to absorption that increase loss and generate heat. The curve shows the approximate safe CW power envelope for standard single-mode fiber. Actual limits depend on fiber design, core size, length, and laser characteristics. Specialty fibers can significantly increase the power limit.

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