

# CrystaLatch™ 2x2 Fiber Optic Switch

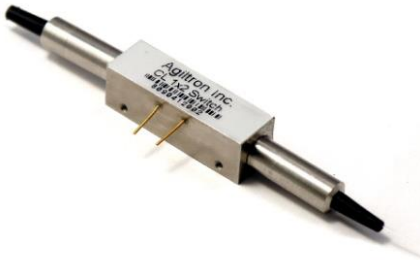
(SM, PM, Unidirectional, Bidirectional)

(Protected by U.S. patents 7224860, 6757101, 6577430 and pending patents)



DATASHEET

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## Features

- High speed
- High reliability
- Latching
- Low loss
- Direct drive
- Compact
- Low cost

## Applications

- Telcom
- Airplane
- Satellite
- Undersea
- LiDAR

The CL 2x2 Fiber Optical Switch redirects an incoming optical signal into a selected output fiber, which is achieved using patented non-mechanical configurations and activated via an electrical control signal. The latching operation preserves the selected optical path after the drive signal has been removed. The all solid state CL 1x1,1x2 fiberoptic switch features low insertion loss, high extinction ratio, high channel isolation, and extremely high reliability and repeatability. It is designed to meet the most demanding switching requirements of continuous operation without failure, over 25 years of longevity, operation under shock/vibration environment and large temperature variations, and fast response time.

The switch also has build-in circulator and isolator functions. An electronic driver is available for this series of switches.

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

## Specifications

Parameter	Min	Typical	Max	Unit
Operation Wavelength <sup>[1]</sup>	1520	1550	1580	nm
	1295	1310	1325	nm
Insertion Loss <sup>[2]</sup>		0.7	1.2	dB
Cross Talk	Bidirectional Series Switch	18	25	dB
	Unidirectional Series Switch	20	25	dB
PDL (SM Series Switch only)		0.1	0.2	dB
Extinction Ratio (PM Series Switch only)	18	25		dB
Return Loss	50	55		dB
Polarization Mode Dispersion		0.1	0.2	ps
Optical Switching Speed (rise, fall)	5		10	μs
Repetition Rate		2K		Hz
Durability	10 <sup>15</sup>			cycle
Operating Temperature	-5 (-40) <sup>[3]</sup>		70 (80) <sup>[4]</sup>	°C
Storage Temperature	-40		85	°C
Optical Power Handling		200	300	mW

### Notes:

- [1]. L band version available
- [2]. Measured without connectors.
- [3]. Special -40°C version available
- [4]. Special -80°C version available

**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](#):

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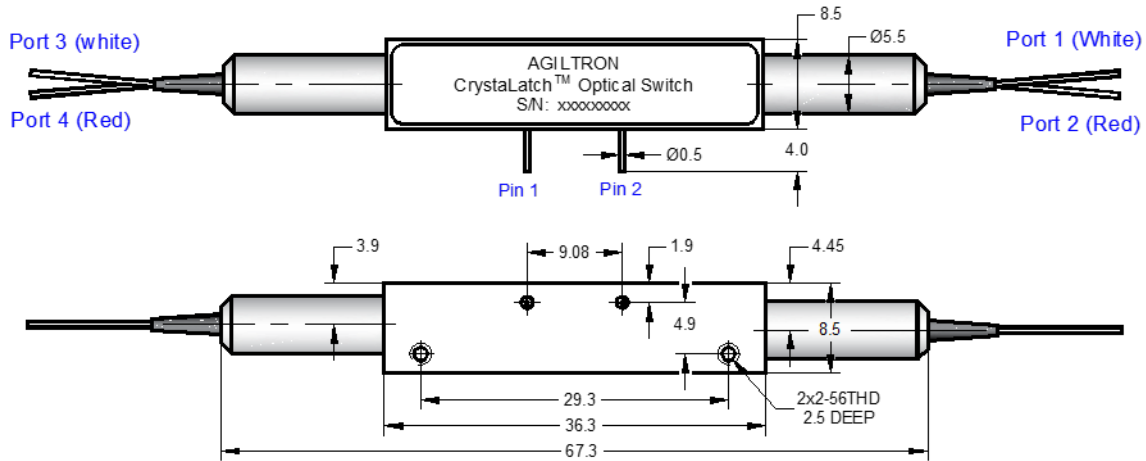
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### Mechanical Dimensions (Unit: mm)



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

### Electrical Driving Information

The switch is actuated by applying a voltage pulse. Applying one polarity pulse, one light path will be connected and latched to the position. Applying a reversed polarity pulse, another light path will be connected and latched to the position after pulse removed.

Parameter	Minimum	Typical	Maximum	Unit
Drive Voltage	2.25	2.5	2.75 <sup>[1]</sup>	V
Drive Current	110	140	195	mA
Pulse Duration	0.2	0.3	0.5	ms

[1]. Over this value will damage the device

Driving kit with USB and TTL interfaces and Windows™ GUI is available. We also offer RS232 interface as an option – please contact Agiltron sales.

#### Bidirectional Series Switch Driving Table

Optical Path	Pin 1	Pin 2
Port 1 → 3 (or Port 3 → 1) Port 2 → 4 (or Port 1 → 3)	0	2.5V Pulse
Port 1 → 4 (or Port 4 → 1) Port 2 → 3 (or Port 3 → 2)	2.5V Pulse	0

#### Unidirectional Series Switch Driving Table

Optical Path A	Pin 1	Pin 2
Port 1 → 3, Port 2 → 4	0	2.5V Pulse
Port 1 → 4, Port 2 → 3	2.5V Pulse	0

#### Unidirectional Series Switch Driving Table

Optical Path B	Pin 1	Pin 2
Port 3 → 1, Port 4 → 2	2.5V Pulse	0
Port 3 → 2, Port 4 → 1	0	2.5V 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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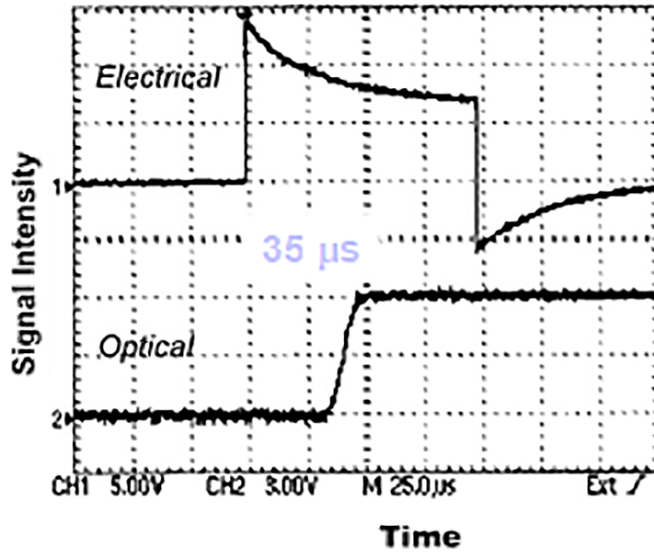
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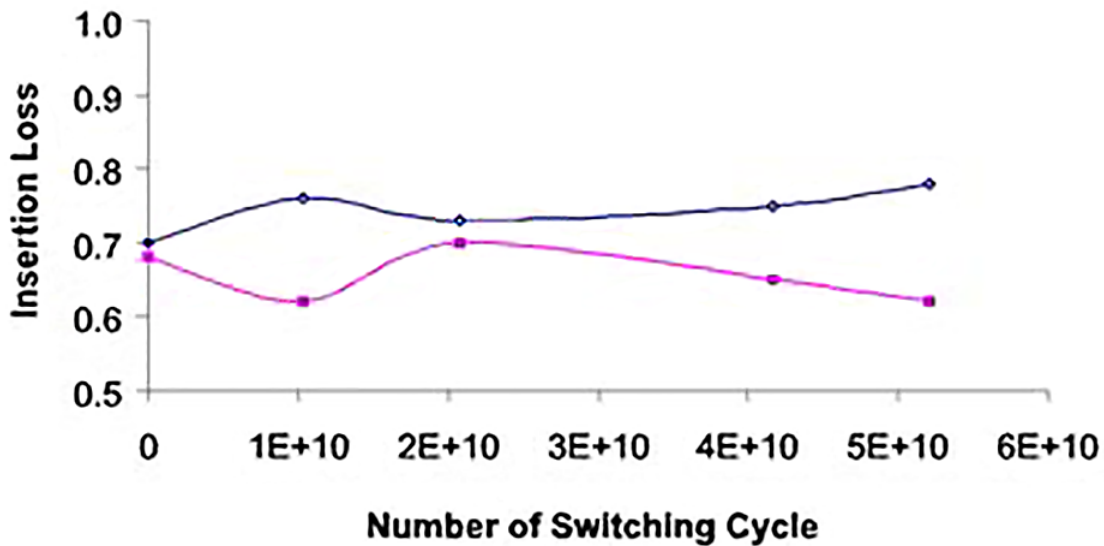


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### Typical Switching Response



### Typical Loss Change of 1x2 vs Switching Numbers



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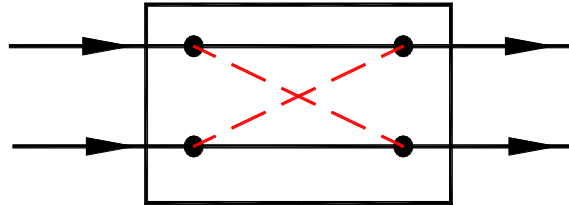
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### Functional Diagram



CL 2x2 Single Stage Switch

### Ordering Information

Prefix	Type	Wavelength	Switch	Package	Fiber Type	Fiber Cover	Fiber Length	Connector <sup>[5]</sup>
CLSW- <sup>[1]</sup>	2x2 = 22	1310 = 3	Single Stage = 1	Standard = 3	SMF-28 = 1	Bare fiber = 1	0.25m = 1	None = 1
CLPM- <sup>[2]</sup>	Special = 00	1550 = 5	Special = 0	-40°C Version = 5	PM 1550 = B	900 um tube = 3	0.5m = 2	FC/PC = 2
CLBD- <sup>[3]</sup>		Special = 0			Special = 0	Special = 0	1.0m = 3	FC/APC = 3
CLPB- <sup>[4]</sup>							Special = 0	SC/PC = 4
								SC/APC = 5
								ST/PC = 6
								LC/PC = 7
								Duplex LC/PC = 8
								LC/APC = A
								LC/UPC = U
								Special = 0

- [1]. **CLSW**: CrystaLatch 2x2 Single Stage SM **SW**ITCH.
- [2]. **CLPM**: CrystaLatch 2x2 Single Stage **PM** Switch.
- [3]. **CLBD**: CrystaLatch 2x2 Single Stage **BIDIRECTIONAL** Switch.
- [4]. **CLPB**: CrystaLatch 2x2 Single Stage **PM Bidirectional** Switch.
- [5]. There isn't any connector in high power switches. Please contact us for high power connectors.

#### 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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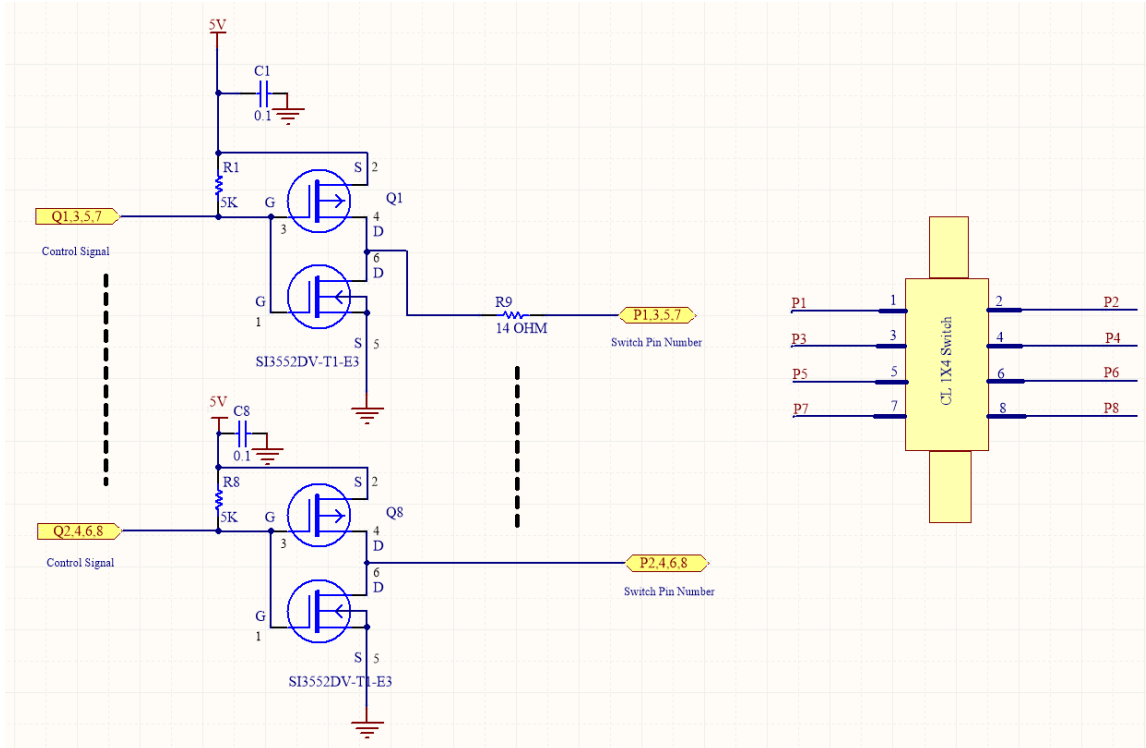
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### Driver Design Example for 1x4

A recommended +5VDC powered driving circuit is provided. The resistor network R1~R8 is to suppress the driving signal's voltage level to meet the "switch voltage" requirements. In specific applications, users can use lower voltage to eliminate the R1~R8. The Q1~Q8 is the control signal from either a function generator or a microcontroller general purpose I/O. The Q1-Q8 switching speed must meet the specific MOSFET switching requirement and CL 1x4 Switch specific requirement. Usually, the control signal speed is  $\leq 2\text{kHz}$ .



Usually, a clean power supply source will be sufficient. However, decoupling capacitors for the transistor supply rail are recommended depending on different applications. Minimum the current loop on the switching circuits will minimize the switching noise. For other layout recommendations, please refer to books or application notes from the IC manufacturer.