

LightBend™ High Power 3x3, 4x4 Series Fiber Optic Switch

(Bidirectional. SM, MM, PM, SM High power, MM High Power, PM High power)

(Protected by U.S. pending patents)



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The LightBend 4x4 Series fiber optic switch connects optical channels by redirecting any of four incoming optical signals into any of four output fibers. This is achieved using a patent-pending opto-mechanical configuration and is activated via an electrical control signal. The latching operation preserves the selected optical path after the drive signal has been removed. This new material-based, advanced design significantly reduces the sensitivity of moving part position, offering unprecedented high stability as well as an unmatched low cost. The LB 4x4 series Switch can be made of a variety of fibers, including SM, MM, and PM fibers, in standard or high-power versions. An electronic driver is available for this series of switches. The LightBend 4x4 series switch is bidirectional.

Specifications

Parameter	Min	Typical	Max	Unit
Operation Wavelength	780, 850, 980, 1060, 1310, 1550			nm
Insertion Loss		1.2	2.0	dB
Wavelength Dependent Loss		0.15	0.25	dB
PDL (SM)			0.15	dB
Extinction Ratio (PM)	18	25		dB
Cross Talk On/Off Ratio	SM, PM	50	55	dB
	MM	35	50	dB
Return Loss	SM, PM	50	55	dB
	MM	35	45	dB
Switching Time		4	10	ms
Repeatability			± 0.05	dB
Operating Voltage	4.5	5	6	VDC
Operating Current		30	60	mA
Voltage Pulse Width (Latching)		20		ms
Switching Type	Latching, Non-Latching			
Operating Temperature	-5		70	°C
Storage Temperature	-40		85	°C
Optical Power Handling	Standard	300	500	mW
	High Power	5	10 ^[3]	W
Fiber Type	SM	SMF-28, or equivalent		
	MM	MM 50/125, MM 62.5/125, or equivalent		
	PM	Panda 250 PM, 400 PM, or equivalent		

Notes:

[1]. Excluding connectors.

[2]. For LB Multimode series switch, Light source CPR<14 dB.

[3]. Continuous operation, for pulse operation call.

Warning: This device must use the reference circuit to driver otherwise it is unstable

Features

- Unmatched Low Cost
- Low Optical Distortions
- High Isolation
- High Reliability
- Epoxy-Free Optical Path

Applications

- Channel Blocking
- Configurable Add/Drop
- System Monitoring
- Instrumentation

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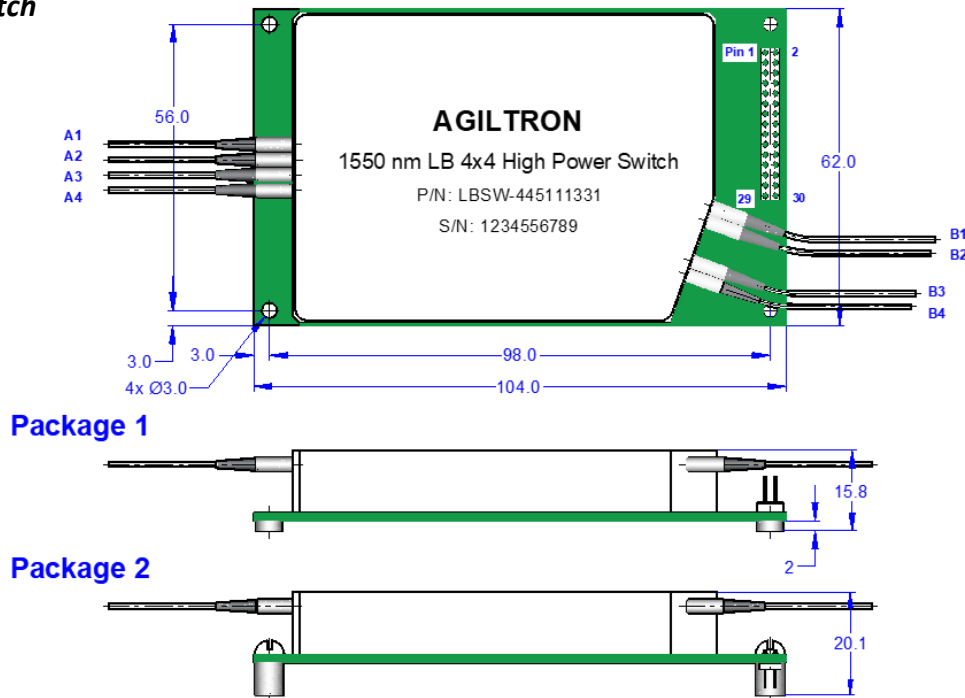
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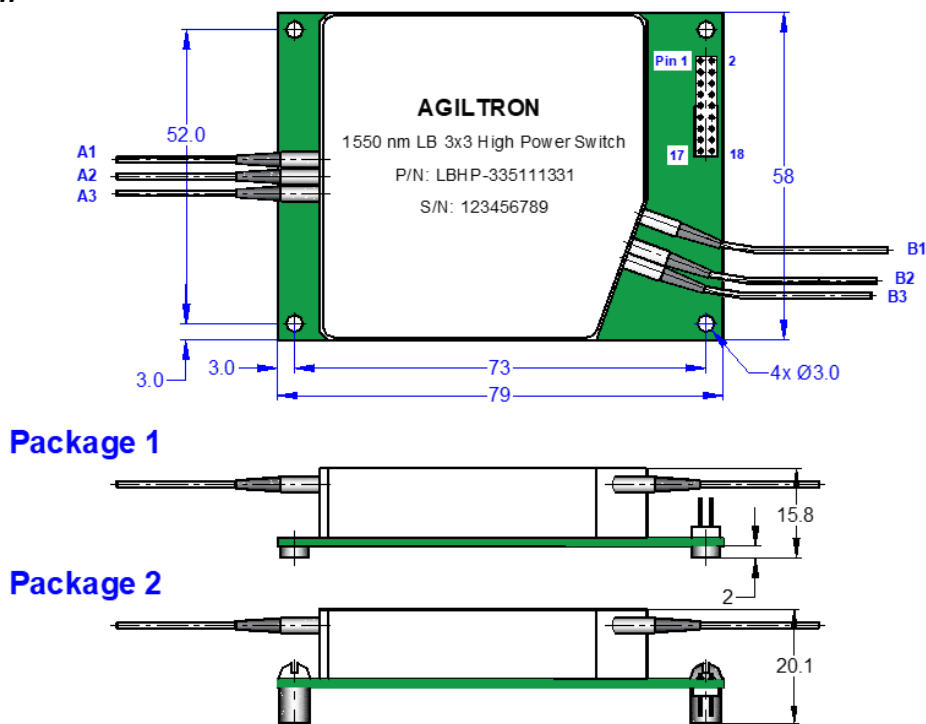
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Mechanical Dimensions (mm)

4x4 Switch

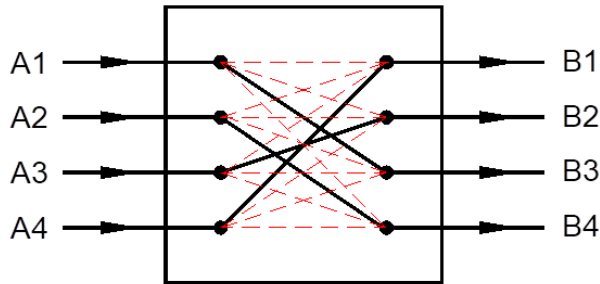


3x3 Switch

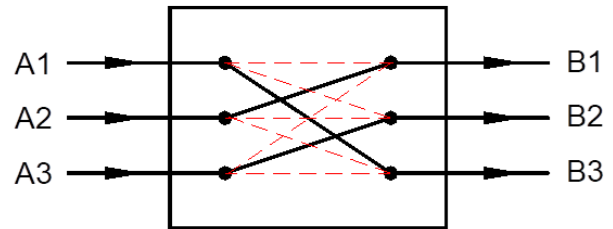


*Product dimensions may change without notice. This is sometimes required for non-standard specifications.

Functional Diagram



LB 4x4 Series Switch



LB 3x3 Series Switch

Electrical Driving Requirements

The load is a resistive coil which is activated by applying 5V (draw ~ 40mA). However, the current flow direction must be correct otherwise it will cancel the permanent magnet inside causing instability. We strongly recommend to use the reference circuit to avoid major issues. We offer pushbutton elevation driver for verifications or convenient income inspection.

Latching Type

Application Note: Applying a constant driving voltage increases stability. The switches can also be driven by a pulse mode using Agiltron recommended circuit for energy saving.

No	Optical Path	Connector Pin No.																													
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1	A1→B1, A2→B2, A3→B3, A4→B4	+	0	+	0	+	0	+	0	+	0	0	+	0	+	0	+	0	0	+	0	+	0	+	0	+	0	+	0	+	0
2	A1→B1, A2→B2, A3→B4, A4→B3	+	0	+	0	+	0	0	+	+	0	+	0			0	+	+	0	0	+	+	0	+	0	+	0	+	0	+	0
3	A1→B1, A2→B3, A3→B4, A4→B2	+	0	+	0	+	0	0	+	0	+	+	0	+	0	+	0	+	0			+	0			+	0	0	+	+	0
4	A1→B1, A2→B3, A3→B2, A4→B4	+	0	+	0	+	0	+	0	0	+	0	+	+	0	+	0	+	0			+	0	0	+	+	0	+	0	+	0
5	A1→B1, A2→B4, A3→B3, A4→B2	+	0	0	+	+	0	+	0			+	0	0	+	+	0	+	0			+	0			+	0	0	+	+	0
6	A1→B1, A2→B4, A3→B2, A4→B3	+	0	0	+	+	0	+	0			+	0	+	0	0	+	+	0			+	0	0	+	+	0	+	0	+	0
7	A1→B2, A2→B1, A3→B3, A4→B4	+	0	+	0	+	0	+	0	+	0	0	+	0	+	+	0	0	+	+	0	0	+	+	0	+	0	+	0	+	0
8	A1→B2, A2→B1, A3→B4, A4→B3	+	0	+	0	+	0	0	+	+	0	+	0			0	+	0	+	+	0	0	+	+	0	+	0	+	0	+	0
9	A1→B2, A2→B3, A3→B1, A4→B4	+	0	+	0	+	0	+	0	0	+	0	+	+	0	+	0	0	+	+	0			+	0	0	+	+	0	+	0
10	A1→B2, A2→B3, A3→B4, A4→B1	+	0	+	0	+	0	0	+	0	+	+	0	+	0	+	0	0	+	+	0			+	0		+	0	+	0	0
11	A1→B2, A2→B4, A3→B1, A4→B3	+	0	0	+	+	0	+	0			+	0	+	0	0	+	+	0	+	+	0			+	0	0	+	+	0	+
12	A1→B2, A2→B4, A3→B3, A4→B1	+	0	0	+	+	0	+	0			+	0	0	+	+	0	0	+	+	0			+	0		+	0	0	+	0
13	A1→B3, A2→B2, A3→B1, A4→B4	+	0	+	0	0	+	+	0	+	0	0	+	+	0	+	0			0	+			+	0	0	+	+	0	+	0
14	A1→B3, A2→B2, A3→B4, A4→B1	+	0	+	0	0	+	0	+	+	0	+	0	+	0	+	0			0	+			+	0		+	0	0	+	0
15	A1→B3, A2→B1, A3→B2, A4→B4	+	0	+	0	0	+	+	0	+	0	0	+	+	0	+	0			+	0	0	+	0	+	+	0	+	0	+	0
16	A1→B3, A2→B1, A3→B4, A4→B2	+	0	+	0	0	+	0	+	+	0	+	0	+	0	+	0			+	0	0	+	+	0	+	0	0	+	+	0
17	A1→B3, A2→B4, A3→B2, A4→B1	+	0	0	+	0	+	+	0	+	0	+	0	+	0	+	0							0	+			+	0	0	+
18	A1→B3, A2→B4, A3→B1, A4→B2	+	0	0	+	0	+	+	0	+	0	+	0	+	0	+	0							+	0	0	+	0	+	+	0
19	A1→B4, A2→B3, A3→B2, A4→B1	0	+	+	0			+	0	0	+	+	0	+	0	+	0							0	+			+	0	0	+
20	A1→B4, A2→B3, A3→B1, A4→B2	0	+	+	0			+	0	0	+	+	0	+	0	+	0							+	0	0	+	0	+	+	0
21	A1→B4, A2→B2, A3→B3, A4→B1	0	+	+	0			+	0	+	0	+	0	0	+	+	0			0	+			+	0			+	0	0	+
22	A1→B4, A2→B2, A3→B1, A4→B3	0	+	+	0			+	0	+	0	+	0	+	0	0	+			0	+			+	0	0	+	+	0	+	0
23	A1→B4, A2→B1, A3→B2, A4→B3	0	+	+	0			+	0	+	0	+	0	+	0	0	+			+	0	0	+	0	+	+	0	+	0	+	0
24	A1→B4, A2→B1, A3→B3, A4→B2	0	+	+	0			+	0	+	0	+	0	0	+	+	0			+	0	0	+		+	0	0	+	+	0	+

[1]. "+" is 4.5 ~ 6 V pulse, Typical is 5 V pulse. [2]. "0" is 0 V. [3]. The blank space means no electronic connection.

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Non-Latching Type

No	Optical Path	Connector Pin No.																														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
1	A1→B1, A2→B2, A3→B3, A4→B4											0	+	0	+					0	+											
2	A1→B1, A2→B2, A3→B4, A4→B3							0	+							0	+			0	+											
3	A1→B1, A2→B3, A3→B4, A4→B2							0	+	0	+																	0	+			
4	A1→B1, A2→B3, A3→B2, A4→B4									0	+	0	+											0	+							
5	A1→B1, A2→B4, A3→B3, A4→B2			0	+									0	+													0	+			
6	A1→B1, A2→B4, A3→B2, A4→B3			0	+											0	+							0	+							
7	A1→B2, A2→B1, A3→B3, A4→B4											0	+	0	+			0	+			0	+									
8	A1→B2, A2→B1, A3→B4, A4→B3							0	+							0	+	0	+			0	+									
9	A1→B2, A2→B3, A3→B1, A4→B4									0	+	0	+					0	+								0	+				
10	A1→B2, A2→B3, A3→B4, A4→B1							0	+	0	+							0	+											0	+	
11	A1→B2, A2→B4, A3→B1, A4→B3			0	+											0	+	0	+								0	+				
12	A1→B2, A2→B4, A3→B3, A4→B1			0	+									0	+			0	+											0	+	
13	A1→B3, A2→B2, A3→B1, A4→B4					0	+					0	+							0	+						0	+				
14	A1→B3, A2→B2, A3→B4, A4→B1					0	+	0	+											0	+									0	+	
15	A1→B3, A2→B1, A3→B2, A4→B4					0	+					0	+									0	+	0	+							
16	A1→B3, A2→B1, A3→B4, A4→B2					0	+	0	+													0	+						0	+		
17	A1→B3, A2→B4, A3→B2, A4→B1			0	+	0	+																	0	+					0	+	
18	A1→B3, A2→B4, A3→B1, A4→B2			0	+	0	+																			0	+	0	+			
19	A1→B4, A2→B3, A3→B2, A4→B1	0	+							0	+														0	+					0	+
20	A1→B4, A2→B3, A3→B1, A4→B2	0	+							0	+																0	+	0	+		
21	A1→B4, A2→B2, A3→B3, A4→B1	0	+											0	+					0	+										0	+
22	A1→B4, A2→B2, A3→B1, A4→B3	0	+													0	+			0	+						0	+				
23	A1→B4, A2→B1, A3→B2, A4→B3	0	+													0	+					0	+	0	+							
24	A1→B4, A2→B1, A3→B3, A4→B2	0	+											0	+							0	+						0	+		

[1]. "+" is 4.5 ~ 6 VDC, Typical is 5 VDC. [2]. "0" is 0 V. [3]. The blank space means no electronic connection.

Ordering Information (Part Number)

Prefix	Type	Wavelength	Switch	Power	Fiber Type	Fiber Cover	Fiber Length	Connector ^{[5][6]}
LBSW ^[1]	4x4 = 44	1060 = 1	Latching = 1	5W = 4	SMF-28 = 1	Bare fiber = 1	0.25m = 1	None = 1
LBPM ^[2]	4x3 = 43	1310 = 3	Non-latching = 2	10W = 5	MM 50/125 = 5	900um tube = 3	0.5m = 2	FC/PC = 2
LBHP ^[3]	4x2 = 42	1550 = 5		Special = 0	MM 62.5/125 = 6	Special = 0	1.0m = 3	FC/APC = 3
LBPH ^[4]	3x3 = 33	780 = 7			PM400 = A		Special = 0	SC/PC = 4
	3x2 = 32	850 = 8			PM1550 = B			SC/APC = 5
	Special = 00	980 = 9			Special = 0			ST/PC = 6
		Special = 0						LC/PC = 7
								Duplex LC/PC = 8
								LC/UPC = U
								Special = 0

[1]. **LBSW**: LightBend 4x4 **SW**itch.

[2]. **LBPM**: LightBend 4x4 **PM** Switch.

[3]. **LBHP**: LightBend 4x4 **High Power** Switch.

[4]. **LBPH**: LightBend 4x4 **PM High Power** Switch.

[5]. Regular fiber connector has PER ~22dB. Connector with PER >27 dB is available using special process

[6]. 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.

Note:

- PM1550 fiber works well for 1310nm

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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.

Driver Reference Design

