4-bit, 5-bit Solid State Variable Fiber Optical Time Delay
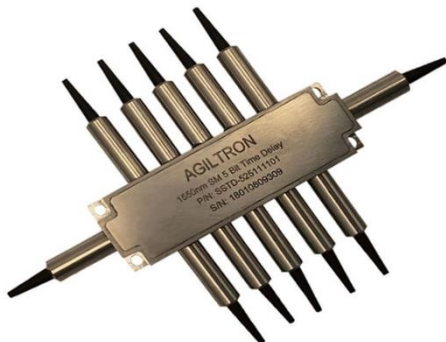
(patent pending)

The SSTD Series Photonic Time Delay provides a variable time delay over a long range up to the millisecond. This is accomplished by selectively routing optical signals through N fiber segments whose lengths increase successively by a power of 2. Since each switching element allows the signal to either connect or bypass a fiber segment, a delay T may be inserted, which can take any value (in increments of ΔT) up to the maximum value T. This is achieved using a patent-pending non-mechanical configuration and activated via an electrical control signal. Latching operation preserves the selected optical path after the drive signal has been removed. The solid-state configuration eliminates the need for mechanical movement and organic materials.

The device is designed to meet the most demanding switching requirements of ultra-high reliability and fast response time.

Features

- 4-Bit Resolution or more
- High Speed
- Non-Mechanical
- High Reliability
- Fail-Safe Latching
- Low Insertion Loss
- Low Power Consumption

Applications

- Phase-Array Antennas
- Instrumentation

Specifications

Parameter	Min	Typical	Max	Unit
Wavelength band	1520	1550	1580	nm
	1280	1310	1340	nm
Insertion Loss [1]	2.5	2.8	3.5	dB
Cross Talk	22	28	35	dB
Durability	10^{14}			cycles
Switching Time(fall, rise)		50	200	µs
Repetition Rate			1	kHz
Delay Time Range	n		m	s
Polarization Dependent Loss	0.15	0.25	0.45	dB
Fiber Segment Number	4		5	loop
Polarization Mode Dispersion [2]		0.1	0.2	ps
Polarization Extinction Ratio [3]	18	22	30	ps
Return Loss	50	55	60	dB
Operating Temperature	-5		70	°C
Optical Power Handling		400		mW
Storage Temperature	-40		85	°C
Fiber Length			1	m

Notes:

[1]. Insertion Loss Max value is 4.2 for 5 bits.

[2]. For None-PM Version

[3]. For PM Version

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]:
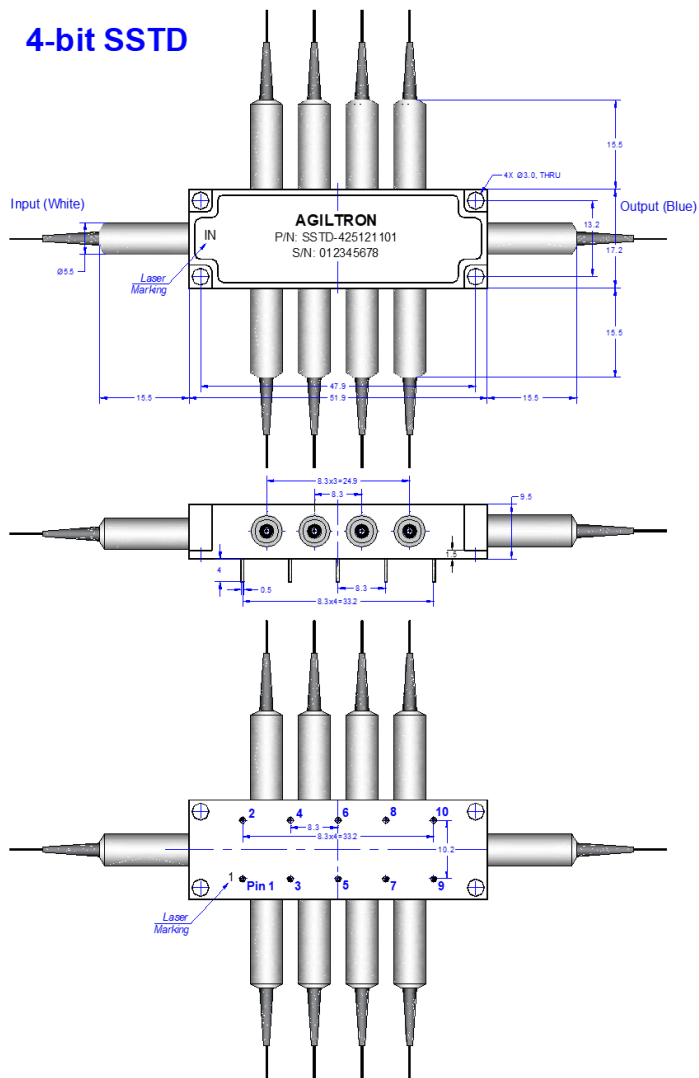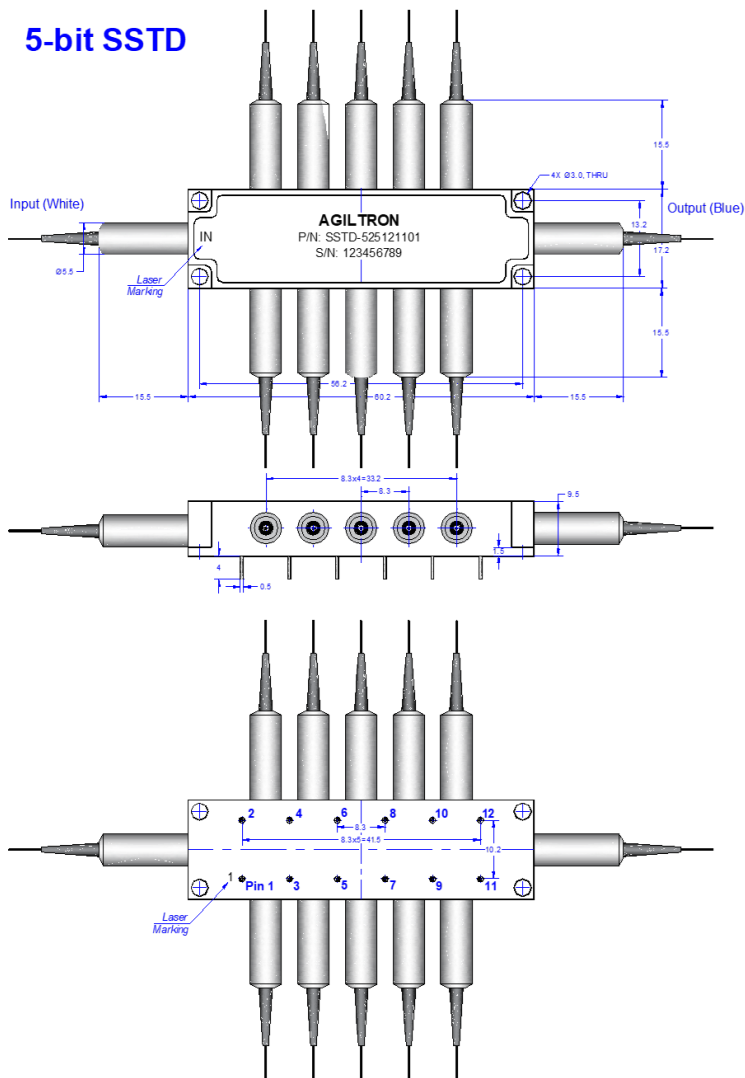
Rev 09/04/24

Mechanical Dimensions (mm)

4-bit SSTD

5-bit SSTD

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

Electrical Driving Requirements

Parameter	Minimum	Typical	Maximum	Unit
Switch Voltage	2.3	2.5	2.8	V
Switch Current	140	120	160	mA
Pulse Duration	0.2	0.3	0.5	ms

Evaluation kit with TTL and RS232 interfaces and Windows™ GUI also available.

Switch Position	Pin Group 1		Pin Group 2		Pin Group 3		Pin Group 4		Pin Group 5	
	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9	Pin 10
0 ΔT	+	-	-	+	-	+	-	+	+	-
1 ΔT	-	+	+	-	-	+	-	+	+	-
2 ΔT	+	-	+	-	+	-	-	+	+	-
3 ΔT	-	+	-	+	+	-	-	+	+	-
4 ΔT	+	-	-	+	+	-	+	-	+	-
5 ΔT	-	+	+	-	+	-	+	-	+	-
6 ΔT	+	-	+	-	-	+	+	-	+	-
7 ΔT	-	+	-	+	-	+	+	-	+	-
8 ΔT	+	-	-	+	-	+	+	-	-	+
9 ΔT	-	+	+	-	-	+	+	-	-	+
10 ΔT	+	-	+	-	+	-	+	-	-	+
11 ΔT	-	+	-	+	+	-	+	-	-	+
12 ΔT	+	-	-	+	+	-	-	+	-	+
13 ΔT	-	+	+	-	+	-	-	+	-	+
14 ΔT	+	-	+	-	-	+	-	+	-	+
15 ΔT	-	+	-	+	-	+	-	+	-	+

Electrical Driving Requirements (continue)

Switch Position	Pin Group 1		Pin Group 2		Pin Group 3		Pin Group 4		Pin Group 5		Pin Group 6	
	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9	Pin 10	Pin 11	Pin 12
0 ΔT	+	-	-	+	-	+	-	+	-	+	+	-
1 ΔT	-	+	+	-	-	+	-	+	-	+	+	-
2 ΔT	+	-	+	-	+	-	-	+	-	+	+	-
3 ΔT	-	+	-	+	+	-	-	+	-	+	+	-
4 ΔT	+	-	-	+	+	-	+	-	-	+	+	-
5 ΔT	-	+	+	-	+	-	+	-	-	+	+	-
6 ΔT	+	-	+	-	-	+	+	-	-	+	+	-
7 ΔT	-	+	-	+	-	+	+	-	-	+	+	-
8 ΔT	+	-	-	+	-	+	+	-	+	-	+	-
9 ΔT	-	+	+	-	-	+	+	-	+	-	+	-
10 ΔT	+	-	+	-	+	-	+	-	+	-	+	-
11 ΔT	-	+	-	+	+	-	+	-	+	-	+	-
12 ΔT	+	-	-	+	+	-	-	+	+	-	+	-
13 ΔT	-	+	+	-	+	-	-	+	+	-	+	-
14 ΔT	+	-	+	-	-	+	-	+	+	-	+	-
15 ΔT	-	+	-	+	-	+	-	+	+	-	+	-
16 ΔT	+	-	-	+	-	+	-	+	+	-	-	+
17 ΔT	-	+	+	-	-	+	-	+	+	-	-	+
18 ΔT	+	-	+	-	+	-	-	+	+	-	-	+
19 ΔT	-	+	-	+	+	-	-	+	+	-	-	+
20 ΔT	+	-	-	+	+	-	+	-	+	-	-	+
21 ΔT	-	+	+	-	+	-	+	-	+	-	-	+
22 ΔT	+	-	+	-	-	+	+	-	+	-	-	+
23 ΔT	-	+	-	+	-	+	+	-	+	-	-	+
24 ΔT	+	-	-	+	-	+	+	-	-	+	-	+
25 ΔT	-	+	+	-	-	+	+	-	-	+	-	+
26 ΔT	+	-	+	-	+	-	+	-	-	+	-	+
27 ΔT	-	+	-	+	+	-	+	-	-	+	-	+
28 ΔT	+	-	-	+	+	-	-	+	-	+	-	+
29 ΔT	-	+	+	-	+	-	-	+	-	+	-	+
30 ΔT	+	-	+	-	-	+	-	+	-	+	-	+
31 ΔT	-	+	-	+	-	+	-	+	-	+	-	+

Note:

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.

4-bit, 5-bit Solid State Variable Fiber Optical Time Delay

(patent pending)

Ordering Information

Prefix	Type	Wavelength	Configuration	Package	Fiber Type	Fiber Cover	Delay Range	Connector
	☐☐	☐	1	2	☐	☐	0	☐
SSTD-	4 Bits = 42 5 Bits = 52 Special = 00	1550nm = 5 1310nm = 3 Special = 0			SMF-28 = 1 PM1550 = 5 Special = 0	Bare fiber = 1 0.9mm tube = 3 Special = 0	Customized = 0	None = 1 FC/PC = 2 FC/APC = 3 SC/PC = 4 SC/APC = 5 ST/PC = 6 LC/PC = 7 LC/APC = 9 LC/UPC = U Special = 0

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.

P +1 781-935-1200   E sales@photonwares.com   W www.agiltron.com