LaserWave™ 550 300 Fibers

ofs
Leading Optical Innovations

High performance 50 micron multimode fibers optimized for 850 nm 10 Mb/s through 10 Gb/s laser-based applications.

Overview

Increasing bandwidth demands are driving the need for low cost 10 Gb/s connectivity in Local Area Networks, Storage Area Networks (SANs), and Central Office/Internet Data Centers. Multimode fiber systems have traditionally provided the lowest cost for short reach optical communications systems of up to 1 Gb/s data rates by enabling lower transceiver, connector, and cable termination costs. LaserWave laser-optimized multimode fibers are the first to extend the application of multimode fiber to support 10 Gb/s serial transmission to 550 meters with low cost 850 nm Vertical Cavity Surface Emitting Laser (VCSEL) transceivers. The 850 nm serial solution, using fiber within the specifications of LaserWave fiber, has been adopted by 10 Gigabit Ethernet, 10 Gigabit Fiber Channel, and the Optical Internetworking Forum (OIF).

For maximum network performance, reliability, and design flexibility, LaserWave fibers used in low-loss cabling systems can support extended reach beyond the rated length, as well as more connections and greater power margins.

Product Description

LaserWave 550 fiber was created by OFS to extend the system cost benefits of LaserWave fibers to ultra long building backbones and medium length campus backbones. It supports 10 Gb/s Ethernet, Fibre Channel, and OIF applications to 550 meters or more using low cost 850 nm VCSELs. The OFS patented MCVD process provides this extraordinary performance by producing a fiber with nearly zero differential mode delay and 4700 MHz-km of EMB, more than double the IEEE requirement for 10 Gb/s 300 meter support.

LaserWave 300 fiber is designed specifically to support 300 meter link lengths for 10 Gb/s applications. LaserWave 300 fiber features a DMD controlled core that assures 10 Gb/s support with 850 nm serial applications for distances of up to 300 meters. Its industry-standard 50 µm core size supports legacy applications like Ethernet, Token Ring, Fiber Distributed Data Interface (FDDI), and Fast Ethernet. The 50 µm core size is also directly compatible with laser-based applications like Gigabit Ethernet. In fact, LaserWave 300 fiber is first to support up to 1000 meters for low cost 850 nm VCSEL-based Gigabit Ethernet (1000BASE-SX) applications and also extends the reach of increasingly popular 2.5 Gb/s parallel applications.

Benefits:

- Seamless migration from 10 Mb/s to 10 Gb/s with no cabling system changes up to 550 meters.
- Enables lowest cost for legacy through 10 Gb/s applications, reducing optical system cost by 35% or more.
- Saves time, using a single fiber type that speeds cabling system administration and stands ready to support 10 Gb/s upgrades.
- Eliminates cumbersome and expensive mode-conditioning patch cords required for 1300 nm laser operation on traditional multimode fibers.
- Uses the same low cost connectors and installation practices as traditional multimode fiber.

Flex-10™ Coating for Multimode Fiber

OFS multimode fibers are made with a world-class draw process and our enhanced Flex-10 coating, designed to minimize induced attenuation that can occur in tight-buffer cable. Easy to strip and install, the coating offers outstanding performance in attenuation-sensitive 1 Gb/s and 10 Gb/s systems.

Applications

LaserWave Multimode Fiber is designed to enable low cost 10 Mb/s through 10 Gb/s connectivity for applications such as:

- Local Area Networks
- Storage Area Networks
- Equipment Rooms
- Data Centers
- Central Offices

LaserWave Fiber Provides 100% Functional System Reliability

LaserWave fiber provides improved performance above the minimum required by the standards. The OFS MCVD process used to manufacture LaserWave fibers eliminates the center defect problems that can plague fibers manufactured with other processes. The Inner DMD mask for LaserWave 300 fiber is expanded to a range from 0 to 18 µm radius versus the less stringent 5 to 18 µm radius allowed by TIA and IEC.

This reduces fundamental and very low-order mode DMD for improved operating margin and superior support of concentrated center-launch lasers. This results in LaserWave 300 fiber DMD up to 60% better than what the standard allows in the center portion of the fiber and improves system reliability margins versus other DMD controlled fibers.

OFS LaserWave fiber specifications exceed the reliability requirement of the IEEE 10 Gigabit Ethernet standard, providing assurance for 100% functional system reliability.

Product Specifications:

Specifications	
Core Diameter	50 ± 2.5 µm
Core Non-Circularity	≤ 5 %
Clad Diameter	125 ± 1 µm
Clad Non-Circularity	≤ 1 %
Core/Clad Concentricity Error (Offset)	≤ 1.5 µm
Coating Diameter	245 ± 10 µm
Coating Non-Circularity	≤ 5 %
Coating-Clad Concentricity Error (Offset)	≤ 8 µm
Tensile Proof Test	100 kpsi (0.69 GPa)
Coating Strip Force	Range: 0.5 - 1.0 lb_f (2.2 - 4.4 N) Typical: 0.7 lb_f (3.0 N)
Standard Reel Lengths	2.2 – 8.8 km
Optical Characteristics	
Attenuation at 850 nm at 1300 nm	 ≤ 2.4 dB/km ≤ 0.7 dB/km
Bandwidth	*See "Transmission Characteristics" Table*
Transmission Distance (Link Length) Support	*See "Application Support" Table*
Attenuation at 1380 nm minus attenuation at 1300 nm	≤ 1.0 dB/km
Attenuation Uniformity / Point Discontinuities at 850 nm and 1300 nm	≤ 0.08 dB
Numerical Aperture	0.20 ± 0.015
Chromatic Dispersion Zero Dispersion Wavelength (λ_0) Zero Dispersion Slope (S_0)	 1297 – 1316 nm ≤ 0.101 ps/nm^2-km
Group Refractive Index at 850 nm at 1300 nm	 1.483 1.479
Macrobend Attenuation 100 turns on a 75 mm mandrel at 850 nm and 1300 nm	≤ 0.5 dB
Environmental Characteristics	
Operating Temperature Range	-60° C to +85° C
Temperature Induced Attenuation at 850 nm and 1300 nm from -60° C to +85° C (5 24-hour cycles)	≤ 0.1 dB/km
Temperature and Humidity Induced Attenuation at 850 nm and 1300 nm from -10° C to +85° C, 94% RH (30 24-hour cycles)	≤ 0.1 dB/km
Accelerated Aging (Temperature) Induced Attenuation at 85° C for 30 days	≤ 0.1 dB/km
Water Immersion Induced Attenuation, 23° C for 30 days.	≤ 0.1 dB/km
Dynamic Fatigue Stress Corrosion Parameter (n_d)	≥ 18

Transmission Characteristics:

Minimum Bandwidth Specifications (MHz-km)

Wavelength (nm)	LaserWave Fiber 550	LaserWave Fiber 300	Typical 50 µm fiber	Typical 62.5 µm fiber
Laser EMB @ 850 nm[1]	4700	2000	Not Specified	Not Specified
Laser EMB @ 1310 nm	500	500	Not Specified	Not Specified
Overfilled @ 850 nm[2]	3500	1500	500	200
Overfilled @ 1300 nm[2]	500	500	500	500

[1] Effective Modal Bandwidth, per TIA/EIA-492AAAC and IEC 60793-2-10 for type A1a.2, ensured by DMD performance specifications for sources meeting launch conditions specified in 10 Gigabit Ethernet (IEEE 802.3ae), OIF OC-192/STM-64 VSR-4-04, and 10 Gigabit Fibre Channel (10GFC).

[2] Measured per TIA/EIA-455-204

DMD Specifications[3] (ps/m maximum)

The fiber shall meet at least one of the following 6 DMD Templates, which each consists of both an inner and outer mask specification, and the sliding mask specifications shown at right.

The requirements for LaserWave 300 are compliant with, but more stringent than the requirements of TIA-492AAAC, "Detail specification for 850-nm laser-optimized, 50-µm core diameter/125-µm cladding diameter class Ia graded-index multimode optical fibers."

Template Number	850 nm DMD-Inner Mask (ps/m) (Radius 0-18 µm)[1,2]	850 nm DMD-Outer Mask (ps/m) (Radius 0-23 µm)[2]
1	≤ 0.23	≤ 0.70
2	≤ 0.24	≤ 0.60
3	≤ 0.25	≤ 0.50
4	≤ 0.26	≤ 0.40
5	≤ 0.27	≤ 0.35
6	≤ 0.33	≤ 0.33

[1] OFS Inner Mask Radial specification is more stringent than the TIA/EIA-492AAAC requirement of 5-18 µm .

[2] OFS DMD measurement scanning steps are 1 µm, twice as stringent as the maximum 2 µm steps required by the TIA-FOTP-220 standard.

[3] Measured per DMD test methods TIA/EIA-455-220 and IEC 60793-1-49.

Note: Based on the TIA/EIA-492AAAC standard, the minimum effective modal bandwidth-length product for LaserWave fiber is ensured by combining this 50µm fiber with transmitters having a transmitter center wavelength (λ_c) meeting: $840 \leq \lambda_c \leq 860$ nm, and the following transmitter power distribution (per FOTP-203): Encircled Flux at radius 4.5µm ≤30%, and Encircled Flux at radius 19µm ≥86%.

Sliding Mask Specifications

In addition to meeting the DMD requirements of the table, LaserWave 300 fiber is the first to meet the new requirement that the maximum DMD mask width over any 6 µm interval between 7 and 19 µm offset positions shall be less than or equal to 0.25 ps/m:

Radial Interval	Mask Width (ps/m)
7-13 um	≤ 0.25
8-14 um	≤ 0.25
9-15 um	≤ 0.25
10-16 um	≤ 0.25
11-17 um	≤ 0.25
12-18 um	≤ 0.25
13-19 um	≤ 0.25

For more information on DMD, visit our website at www.ofsoptics.com and download our white paper, *Measuring Bandwidth of High-Speed Multimode Fiber.*

Application Support:

Application Support Examples Distance (Meters)[1]	LaserWave Fibers 550	LaserWave Fibers 300	Typical 50 µm 500/500 MHz-km	Typical 62.5 µm 200/500 MHz-km
10 Gigabit Ethernet (802.3ae)				
850 nm serial laser (10GBASE-SR) & (10GBASE-SW)	550[2]	320	82	33
1310 nm CWDM lasers (10GBASE-LX4)	300	300	300	300
Mode conditioning patch cord required for LX4?	No	No	Yes	Yes
1 Gigabit Ethernet				
850 nm serial laser (1000BASE-SX)	1040	970[3]	550	275
1310 nm serial laser (1000BASE-LX)	600	600	550	550
Mode conditioning patch cord required for LX?	No	No	Yes	Yes
100 Megabit Ethernet				
850 nm serial LED (100BASE-SX)	300	300	300	300
1310 nm serial LED (100BASE-FX)	2000	2000	2000	2000
10 Megabit Ethernet				
850 nm LED (10BASE-FL)	1250	1250	1250	2000
10 Gigabit Fibre Channel (10GFC Rev 3.0)				
850 nm serial laser (1200-M5E-SNS)	530[2]	320	82	33
1310 nm WWDM lasers (1200-M5-LC4S)	300	300	300	300
Mode conditioning patch cord required for LC4S?	No	No	Yes	Yes
1 Gigabit Fibre Channel				
850 nm serial laser (100-Mx-SNI)	970	920	500	300
10 Gigabit OIF OC-192 VSR				
850 nm serial (VSR-4-04)	550[2]	330	82	32
850 nm 4x2.5 Gb/s parallel (VSR-4-03)[4]	700	620	250	120

[1] Unless otherwise indicated, application support distances are based on standard total connection plus splice loss of 1.5 dB and cable attenuations of 3.5/1.5 dB/km at 850 nm and 1300 nm respectively. Lower-loss connectors, such as LCs, and lower cable attenuations can lead to longer supportable distances. Contact OFS for specific cable attenuation and connection plus splice loss necessary to support a target distance.

[2] Reach assuming 3.5 dB/KM maximum cabled attenuation at 850 nm plus 1.0 dB of total connection and splice loss, or 3.0 dB maximum cabled attenuation at 850 nm and 1.3 dB total connection and splice loss.

[3] 1000-meter reach assuming total connection plus splice loss of 0.9 dB.

[4] Assumes 1.5 dB of connection plus splice loss. Requires use of array connectors such as MTP or MPO.

For additional information please contact your sales representative. You can also visit our website at www.ofsoptics.com/ofs-fiber or call 1-888-fiberhelp. For regional assistance, contact:

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