LaserWave® 550/300 Multimode Fibers

ofs
A Furukawa Company

High performance 50 micron multimode fibers optimized for 850 nm laser-based applications to 10 Gb/s and beyond.

Overview

LaserWave® Laser-Optimized OM4/OM3 Fibers extend the application of multimode fiber to support transmission at 10 Gb/s and future speeds such as 40 and 100 Gb/s. Using low cost 850 nm Vertical Cavity Surface Emitting Laser (VCSEL) transceivers, these fibers support a wide variety of applications including 10 Gigabit Ethernet, Fibre Channel, InfiniBand, and the Optical Internetworking Forum (OIF) Interface Agreements.

Used in low-loss cabling systems, LaserWave Fiber can provide extended reach beyond the rated length, as well as more connections and greater power margins.

LaserWave Fiber meets and exceeds the specification requirements of both the EMBc and the more discriminating DMD mask methods for verifying Effective Modal Bandwidth.

Product Description

LaserWave 550 OM4 Fiber extends 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 (DMD) and 4700 MHz-km of EMB, more than double the IEEE requirement for 10 Gb/s 300 meter support.

LaserWave 300 OM3 Fiber is designed specifically to support 300 meter link lengths for 10 Gb/s applications. LaserWave 300 OM3 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, providing support up to 1000 meters for low cost 850 nm VCSEL-based Gigabit Ethernet (1000BASE-SX) applications. The fibers also extend the reach of 2.5 Gb/s parallel applications.

OFS Fiber is OM4-Ready

Features/Benefits:

- Provides seamless migration from legacy speeds to 10 Gb/s and beyond with no cabling system changes up to 550 meters
- Enables lowest cost for legacy applications through 10 Gb/s and beyond, 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.

Flex-10™ Coating for Multimode Fibers

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 OM4/OM3 Multimode Fiber is designed to enable low cost connectivity for 10 Mb/s through 100 Gb/s applications that include:

- Local Area Networks
- Storage Area Networks
- Data Centers
- High-Speed Computing and Super-computing Centers
- Central Offices.

Product Specifications

Physical Characteristics	50/125
Core Diameter	50 ± 2.5 µm
Core Non-Circularity	≤ 5 %
Clad Diameter	125 ± 1 µm
Clad Non-Circularity	≤ 1 %
Core/Clad Concentricity Error (Offset)	≤ 1.0 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 lbf (2.2 - 4.4 N)
	Typical: 0.7 lbf (3.0 N)
Standard Reel Lengths	2.2 – 8.8 km
Optical Characteristics	
Attenuation	
at 850 nm	≤ 2.3 dB/km
at 1300 nm	≤ 0.6 dB/km
Laser Bandwidth/EMB	***See Transmisison Characteristics Table***
Transmission Distance (Link Length) Support	***See Applications 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)	1295 – 1340 nm
Zero Dispersion Slope (S_0)	≤ 0.105 ps/nm^2-km ($1295 \le \lambda_0 \le 1310$ nm)
	≤ 0.000375 x ($1590 - \lambda_0$) ($1310 \le \lambda_0 \le 1340$ nm)
Group Refractive Index	
at 850 nm	1.483
at 1300 nm	1.479
Backscatter Coefficient	
at 850 nm	-68.4 dB
at 1300 nm	-75.8 dB
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)

	LaserWave 550 OM4 Fiber	LaserWave 300 OM3 Fiber
Laser EMB @ 850 nm[1]	4700	2000
Laser EMB @ 1310 nm	500	500
Overfilled @ 850 nm	3500	1500
Overfilled @ 1300 nm	500	500

[1] Effective Modal Bandwidth, per TIA/EIA-492AAAC and IEC 60793-2-10 for type A1a.2, ensured by EMBc or 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). LaserWave 550/300 OM4/OM3 Fiber meets the specification requirements of both the EMBc and the more discriminating DMD mask methods.

DMD Specifications (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 below.

The requirements for LaserWave 300 OM3 Fiber are compliant with, but more stringent than the requirements of TIA-492AAAC and IEC 60793-2-10.

Template Number	850 nm DMD-Inner Mask (ps/m) (Radius 0-18 µm) [2, 3]	850 nm DMD-Outer Mask (ps/m) (Radius 0-23 µm) [3]
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

Sliding Interval Masks: ≤ 0.25 ps/m

[2] OFS Inner Mask Radial specification is more stringent than the TIA/EIA-492AAAC and IEC 60793-2-10 requirement of 5-18 µm.

[3] OFS DMD measurement scanning steps are 1 µm, twice as stringent as the maximum 2 µm steps required by the standards.

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

Manufacturing and Quality Control

LaserWave OM4 and OM3 Fiber provides improved performance above the minimum required by the standards. OFS' advanced 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 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 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.

LaserWave Fiber meets and exceeds the specification requirements of both the EMBc and the more discriminating DMD mask methods for verifying Effective Modal Bandwidth. Both techniques are recognized and approved industry standards; however the DMD mask method allows for closer scrutiny of fiber characteristics, enabling LaserWave to be specified to more stringent DMD specifications than required by the standards. This provides increased performance and reliability for your network.

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

Applications 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	1000[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)	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.

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 (from inside the USA). For regional assistance, contact the global location closest to you.

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