



OPTICAL DEVICES

Mitsubishi Electric Optical Devices: The Key to Connecting Information Networks in the Future.

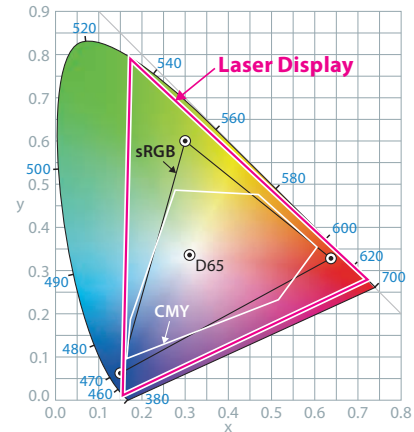


LASER DIODES FOR PROJECTORS

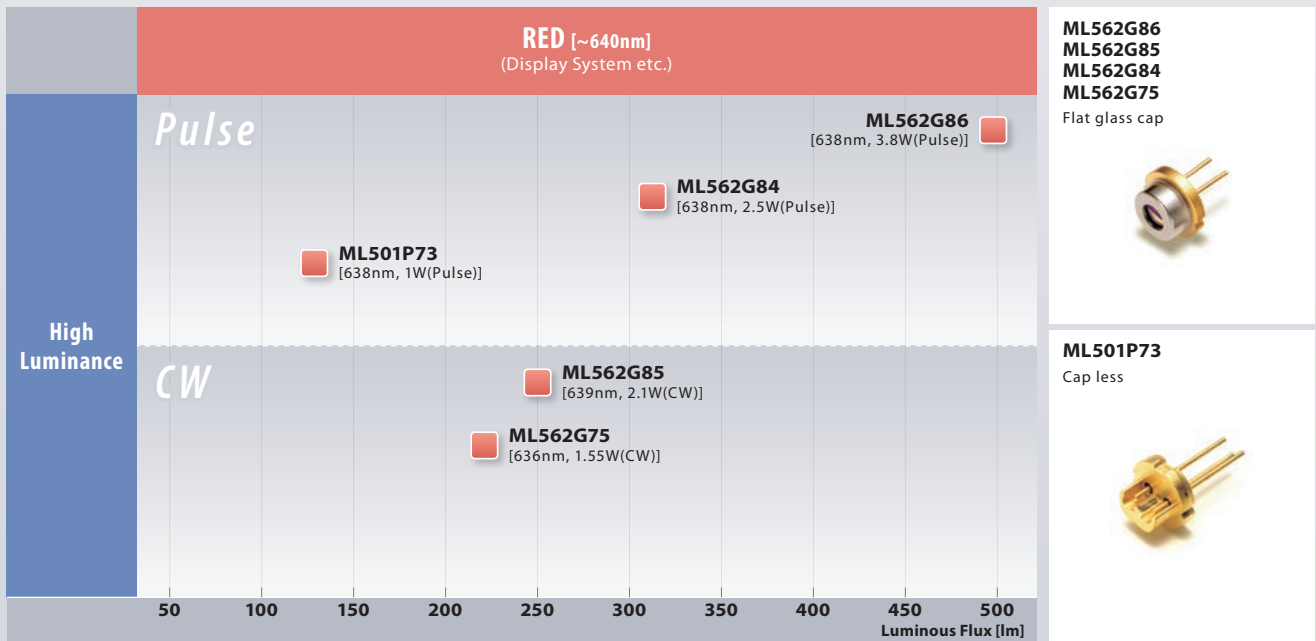
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638nm High-output Laser Diode for Projectors

Compared to LEDs, semiconductor lasers have lower power consumption, higher output and can be used with optical systems having a higher maximum aperture. These considerable advantages mean that they can be used for projectors that do not require focal adjustment. Mitsubishi Electric has a range of lasers available, including a multi-mode semiconductor laser with a wavelength below 640nm and 3.8W output (when pulse-driven), 2.1W output (when CW-driven) that provides highly visible, vibrant red colors for color projectors.



Selection map of Red Laser Diodes



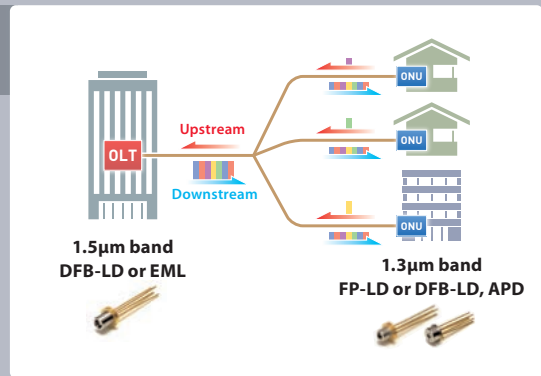
Line-up of Laser Diodes [Multi Transverse mode LD]

Type Number	Application	Wavelength [nm]	Output Power @CW [mW]	Output Power @Pulse [mW]	Case Temperature [°C]	Package
ML562G86	Display	638	-	3800	45	φ9.0mm TO Flat glass cap
ML562G84	Display	638	-	2500	45	φ9.0mm TO Flat glass cap
ML501P73	Display	638	500	1000	40	φ5.6mm TO Capless
ML562G85	Display	639	2100	-	45	φ9.0mm TO Flat glass cap
ML562G75	Display	636	1550	-	35	φ9.0mm TO Flat glass cap



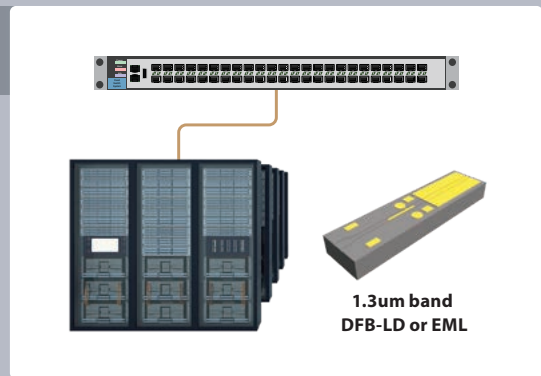
Optical Devices for Fiber-to-the-Home (FTTH)

As streaming music and video becomes a common service, there is growing interest in Fiber-to-the-Home (FTTH), an optical communication system that provides high-speed, stable bandwidths to each household. Since approximately 2010, Mitsubishi Electric has contributed to FTTH by providing optical devices such as FP-LD, DFB-LD, EML and APD. Currently, 10G-EPON and XG-PON, which are faster communication systems, are being installed. For the future, the standardization of HS-PON as a next-generation FTTH system is also being discussed. Mitsubishi Electric maintains its lead in FTTH applications through its corresponding product lineup and new product development.



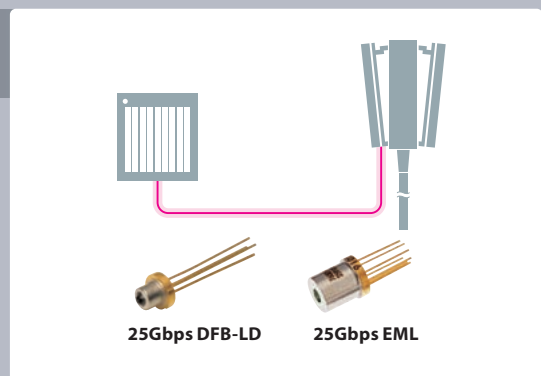
Optical Devices for Data Centers

Data centers have been expanding as a platform for storing and distributing digital contents such as SNS, photos, and videos on the ever-increasing Internet. In recent years, with the shift from on-premise-type to cloud-type storage, and the expansion of various cloud computing services, data centers are expected to grow as a platform that provides the foundation and infrastructure for cloud computing services. For the data center market, which requires advanced technologies, Mitsubishi Electric provides high-speed, low-power optical devices that contribute as the result of the unique characteristics of compound semiconductors.



Optical Devices for 5G Mobile Base Stations

Fifth-generation (5G) mobile communication system will offer ultrahigh-speed communication, low latency, and ultra-multiple connections. Accordingly, 5G mobile communication system is expected to become used widely around the world. With the increase in communication traffic, optical devices that support mobile base station networks are also required to operate at higher speeds, over a wider temperature range, and have higher reliability. Mitsubishi Electric utilizes the industry-standard TOS6 package to expand the connectivity of various products such as 25Gbps DFB and EML. We are also developing 100Gbps EML CAN for the future as well as services that will support the application and market growth of 5G mobile base stations, and is ready to support the market growth of 5G mobile base station applications in the future.



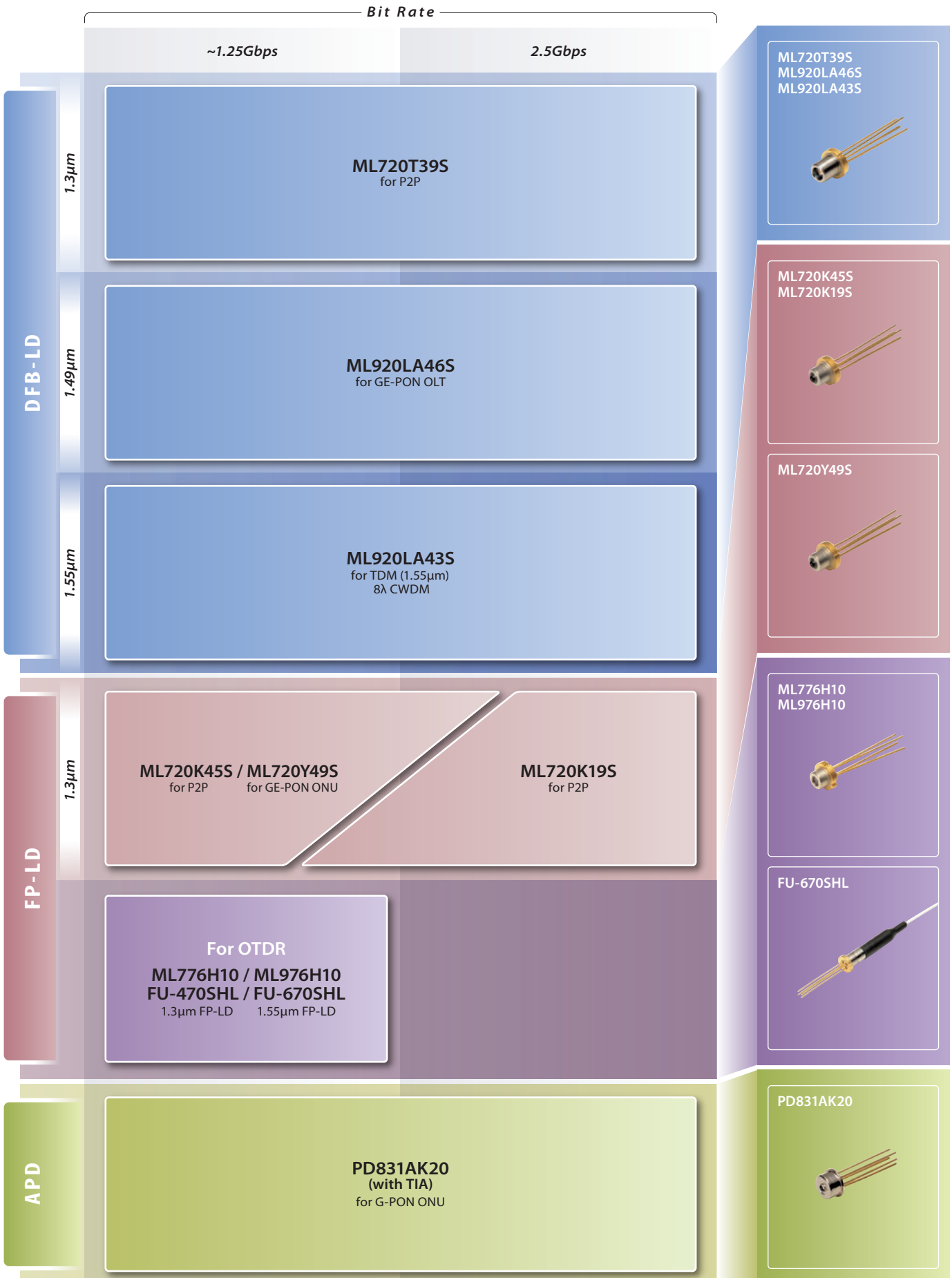
Terminology

- APC Angled Physical Contact
- APD Avalanche Photo Diode
- APD TIA Avalanche Photo Diode Trans Impedance Amplifier
- CFP Centum gigabit Form-factor Pluggable
- CPRI Common Public Radio Interface
- CWDM Coarse Wavelength Division Multiplexing
- Df Focal Distance
- DFB-LD Distributed FeedBack Laser Diode
- DWDM Dense Wavelength Division Multiplexing
- EAM Electro Absorption Modulator
- EML Electro absorption Modulator integrated Laser diode
- FP-LD Fabry-Perot Laser Diode
- FTTH Fiber To The Home

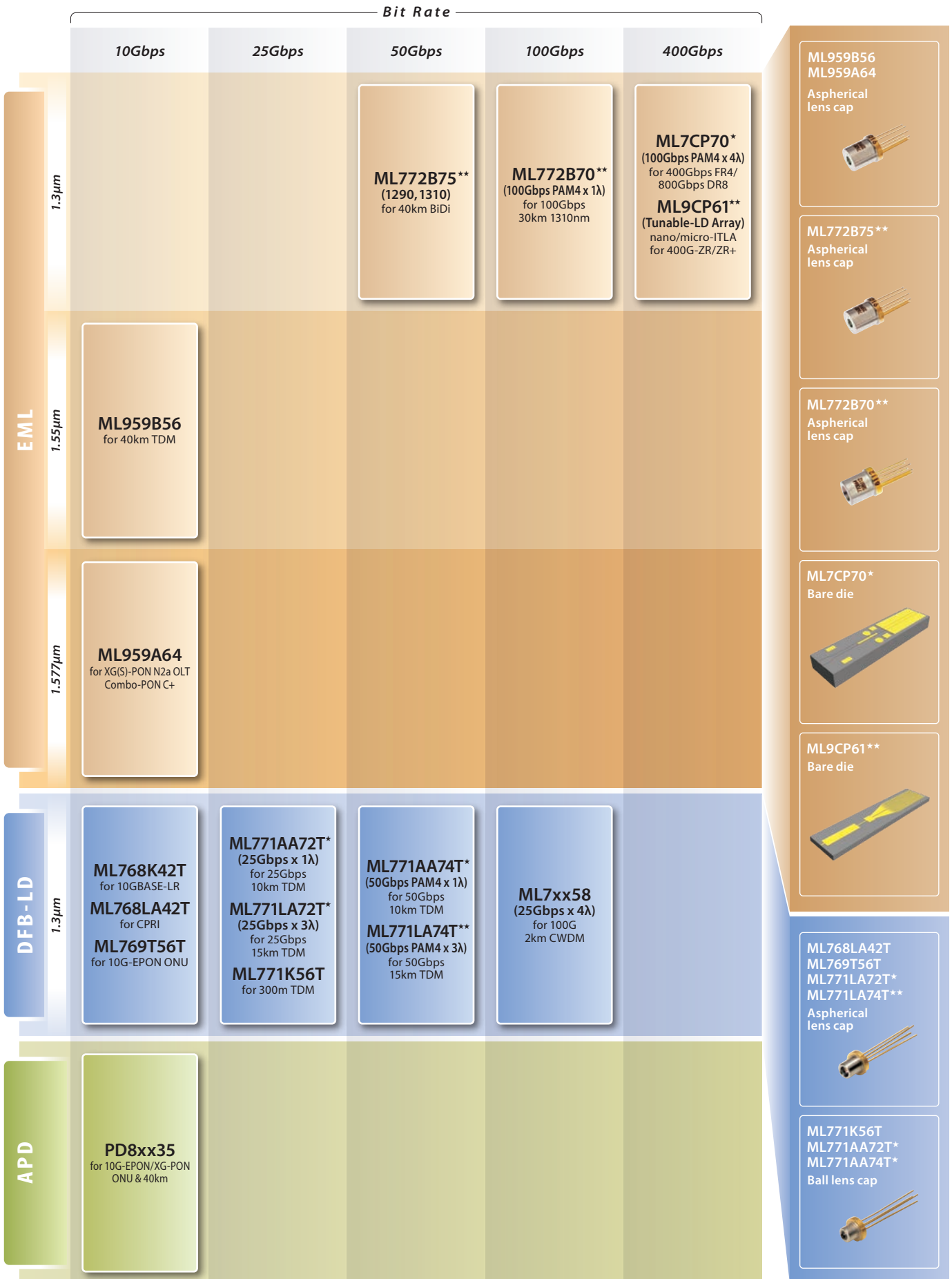
- G-PON Gigabit Passive Optical Network
- GE-PON Gigabit Ethernet Passive Optical Network
- HS-PON High-Speed Passive Optical Network
- ITLA Integrable Tunable Laser Assembly
- LC Lucent Connector
- LED Light Emitting Diode
- OLT Optical Line Terminal
- ONU Optical Network Unit
- OSFP Octal Small Form-factor Pluggable
- OTDR Optical Time Domain Reflectometer
- P2P Peer to Peer
- PAM4 4-level pulse amplitude modulation
- PC Physical Contact

- PD-TIA Photo Diode with Trans-Impedance Amplifier
- QSFP-DD Quad Small Form-factor Pluggable Double Density
- RoF Radio over Fiber
- ROSA Receiver Optical Sub-Assembly
- SC Single fiber Connector
- SDH Synchronous Digital Hierarchy
- SFP+ Small Form-factor Pluggable Plus
- SONET Synchronous Optical NETwork
- TOSA Transmitter Optical Sub-Assembly
- XFP 10 Gigabit small Form-factor Pluggable
- 10G-EPON 10 Gigabit Ethernet Passive Optical Network
- XG-PON 10 Gigabit Passive Optical Network
- XMD-MSA 10 Gbps Miniature Device Multi Source Agreement

Selection Map of OPTICAL DEVICES [Under 2.5Gbps]



Selection Map of OPTICAL DEVICES [Over 10Gbps]



*: New product ** : Under development

Line Up of LD / LD Modules [Under 2.5Gbps]

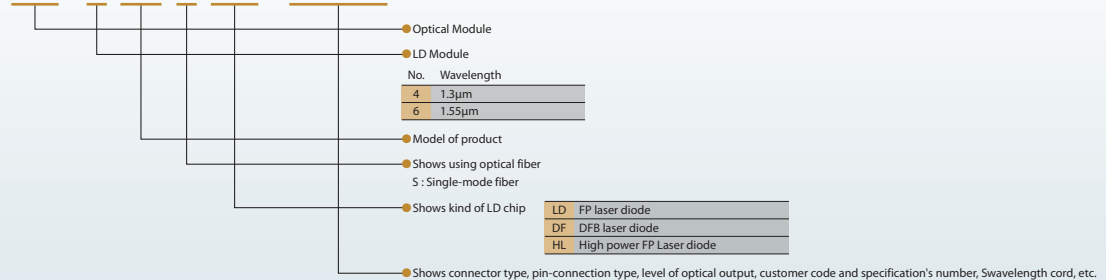
	Type Number	Chip Type	Package	Wavelength [nm]	Case Temp. [°C]	Features
2.5G	ML720T39S	DFB-LD	TO56-CAN	1310	-40~+95	P2P
	ML720K19S	FP-LD	TO56-CAN	1310	-40~+85	P2P
	ML920LA46S	DFB-LD	TO56-CAN	1490	-40~+85	G-PON OLT
	ML920LA43S	DFB-LD	TO56-CAN	1550 1470~1610 8λ CWDM	-20~+95 -10~+85	P2P 8λ CWDM
1.25G/ ~622M	ML720K45S	FP-LD	TO56-CAN	1310	-40~+85	P2P
	ML720Y49S	FP-LD	TO56-CAN	1310	-40~+85	GE-PON ONU, High coupling efficiency
For OTDR	FU-470SHL	FP-LD	Coaxial Pigtail	1310	-20~+70	OTDR
	FU-670SHL	FP-LD	Coaxial Pigtail	1550	-20~+70	OTDR
	ML776H10	FP-LD	TO56-CAN	1310	-40~+85	OTDR
	ML976H10	FP-LD	TO56-CAN	1550	-40~+85	OTDR

Line Up of APD [Under 2.5Gbps]

	Type Number	Chip Type	Package	Wavelength [nm]	Case Temp. [°C]	Features
2.5G	PD831AK20	APD	TO46-CAN	1490	-40~+85	Built-in TIA, G-PON ONU

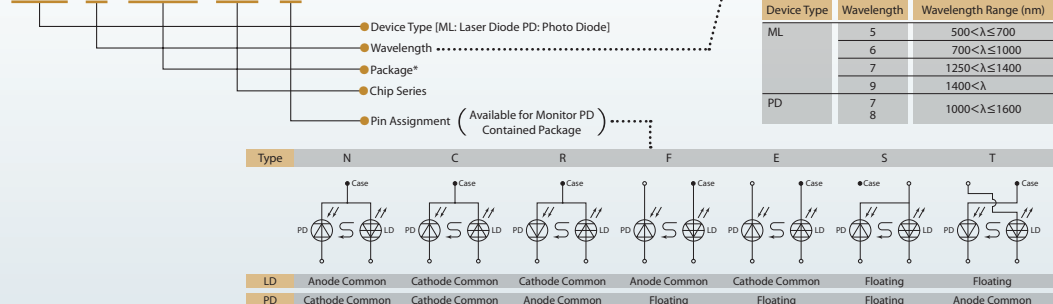
Type Name Definition of Optical Devices for Optical Communication Systems

FU - 6 70 S HL - 8M26



Type Name Definition of Laser and Photo Diodes

ML 7 68K 42 T



*Please contact our sales office about the selection packages.

Line Up of LD / LD Modules [Over 10Gbps]

	Type Number	Chip Type	Package	Wavelength [nm]	Case Temp. [°C]	Features
400G	ML7CP70*	EML	Bare die	1310	+5~+85	100Gbps PAM4, 800G DR8
				4λ CWDM	+25~+75	100Gbps PAM4 x 4λ, 400G FR4
	ML9CP61**	Tunable-LD array	Bare die	1527.994~1567.133	+25~+55	nano/micro-ITLA for 400G-ZR/ZR+ QSFP-DD/CFP2
100G	ML772B70**	EML	TO56-CAN	1310	-5~+80	100Gbps PAM4, 30km
	ML7xx58	DFB-LD	T.B.D.	4λ CWDM	-5~+75	25Gbps x 4λ
50G	ML772B75**	EML	TO56-CAN	1290, 1310	-40~+90	Bidirectional, 50Gbps PAM4, 40km
	ML771AA74T*	DFB-LD	TO56-CAN	1310	-40~+90	50Gbps PAM4, 10km, Df=6.6mm
	ML771LA74T**	DFB-LD	TO56-CAN	1270, 1310, 1330	-40~+90	Bidirectional, 50Gbps PAM4, 15km, Df=7.5mm
25G	ML771K56T	DFB-LD	TO56-CAN	1310	-40~+90	25Gbps, SFP28, 300m, Df=5.8mm
	ML771AA72T*	DFB-LD	TO56-CAN	1310	-40~+90	25Gbps, SFP28, 10km, Df=6.6mm
	ML771LA72T*	DFB-LD	TO56-CAN	1270, 1310, 1330	-40~+90	25Gbps, SFP28, 15km, Df=7.5mm
10G	ML959B56	EML	TO56-CAN	1550	-5~+80	XFP/SFP+, 40km
	ML959A64	EML	TO56-CAN	1577	-5~+80	XG(S)-PON N2a, OLT
	ML768K42T	DFB-LD	TO56-CAN	1310	-40~+95	10GBASE-LR, SONET/SDH
	ML768LA42T	DFB-LD	TO56-CAN	1270, 1330	-40~+95	CPRI
	ML769T56T	DFB-LD	TO56-CAN	1270	-40~+90	10G-EPON, ONU, Df=10.1mm

★: New product ★★: Under development

Line Up of APD [Over 10Gbps]

	Type Number	Chip Type	Package	Wavelength [nm]	Case Temp. [°C]	Features
10G	PD8xx35	APD	T.B.D.	1270~1577	-40~+95	10G-EPON/XG-PON, ONU & 40km

SAFETY CAUTIONS FOR USE OR DISPOSAL OF LISTED PRODUCTS

The warnings below apply to all products listed in this pamphlet.

WARNING	
Laser Beam	While the laser diode is on, it gives a laser beam. Even if we can't see a laser beam by its wavelength, penetration into the eye by a laser beam or its reflected light may cause eye injury. Prevent the irradiating part or its reflected light from entering the eyes.
Injury	Fiber fragments may cause injury. In cases of fiber bending or breakage, never touch the fragment.
GaAs	Gallium arsenide (GaAs) is used in these products. To avoid danger, strictly observe the following cautions. <ul style="list-style-type: none"> • Never place the products in your mouth. • Never burn or break the products, or use any type of chemical treatment to reduce them to gas or powder. • When disposing of the products, always follow the laws which apply, as well as your own company's internal waste treatment regulations.
Disposal of Flame-Retarded Fiber Core Wire	Flame retardant resin must be disposed of according to law of industrial waste in disposal place. This product is a bromine type flame-retarded resin, containing bromine compounds and antimony trioxide. All disposal operations should be conducted with full consideration of this content.

Mitsubishi Electric Semiconductors & Devices Website

www.MitsubishiElectric.com/semiconductors/



Keep safety first in your circuit designs!

- Mitsubishi Electric Corporation puts the maximum effort into making semiconductor products better and more reliable, but there is always the possibility that trouble may occur with them. Trouble with semiconductors may lead to personal injury, fire or property damage. Remember to give due consideration to safety when making your circuit designs, with appropriate measures such as (i) placement of substitutive, auxiliary circuits, (ii) use of non-flammable material or (iii) prevention against any malfunction or mishap.

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