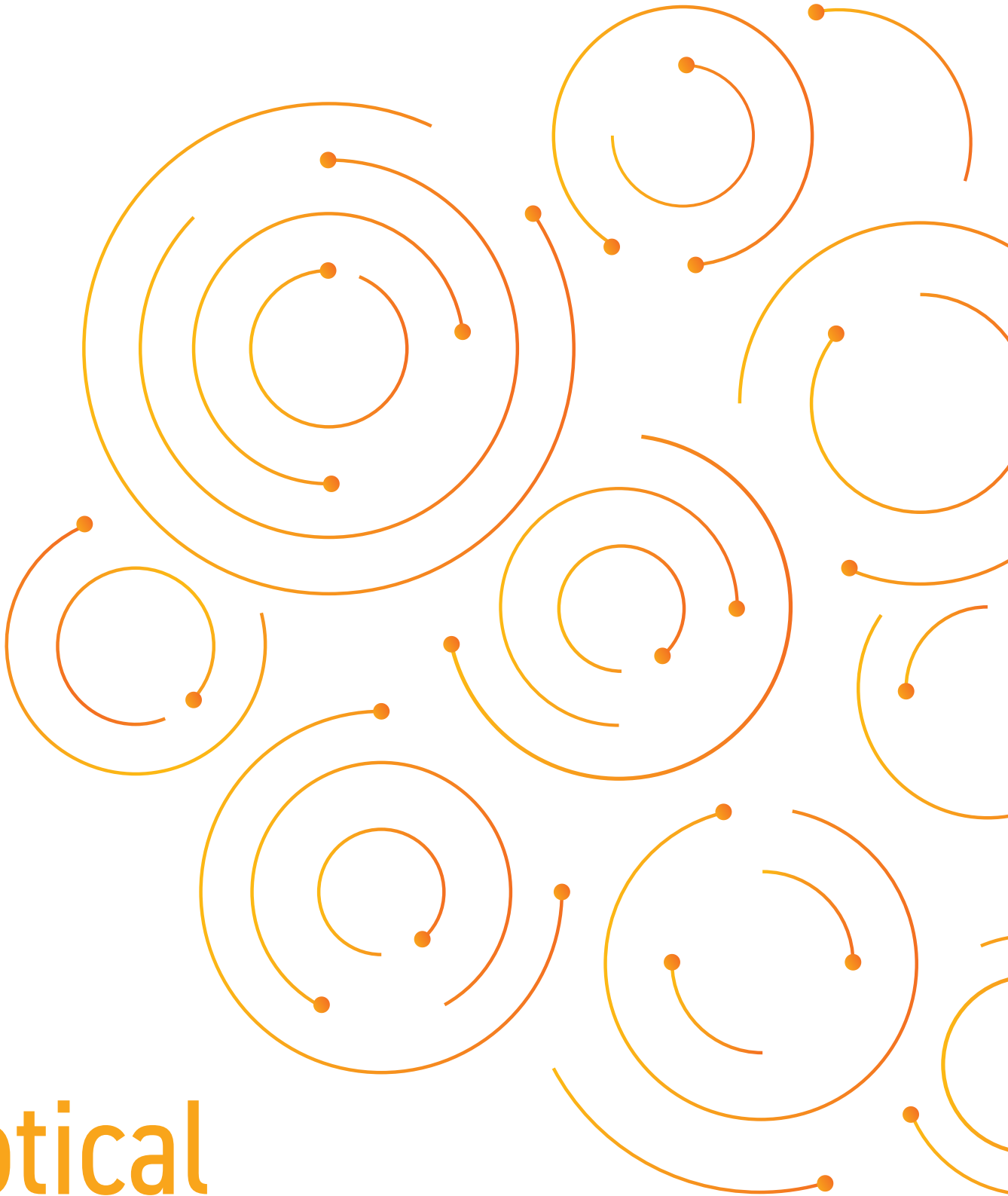


OPTICAL DEVICES



Optical Devices

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

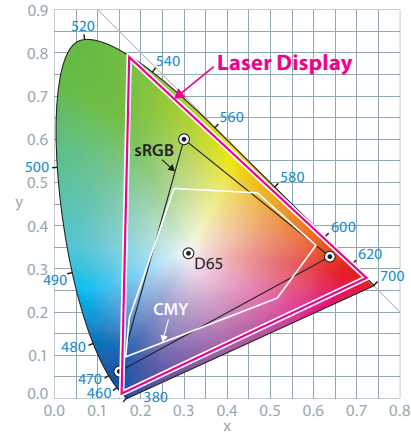
LASER DIODES FOR INDUSTRY & DISPLAY

Please visit our website for further details >>>

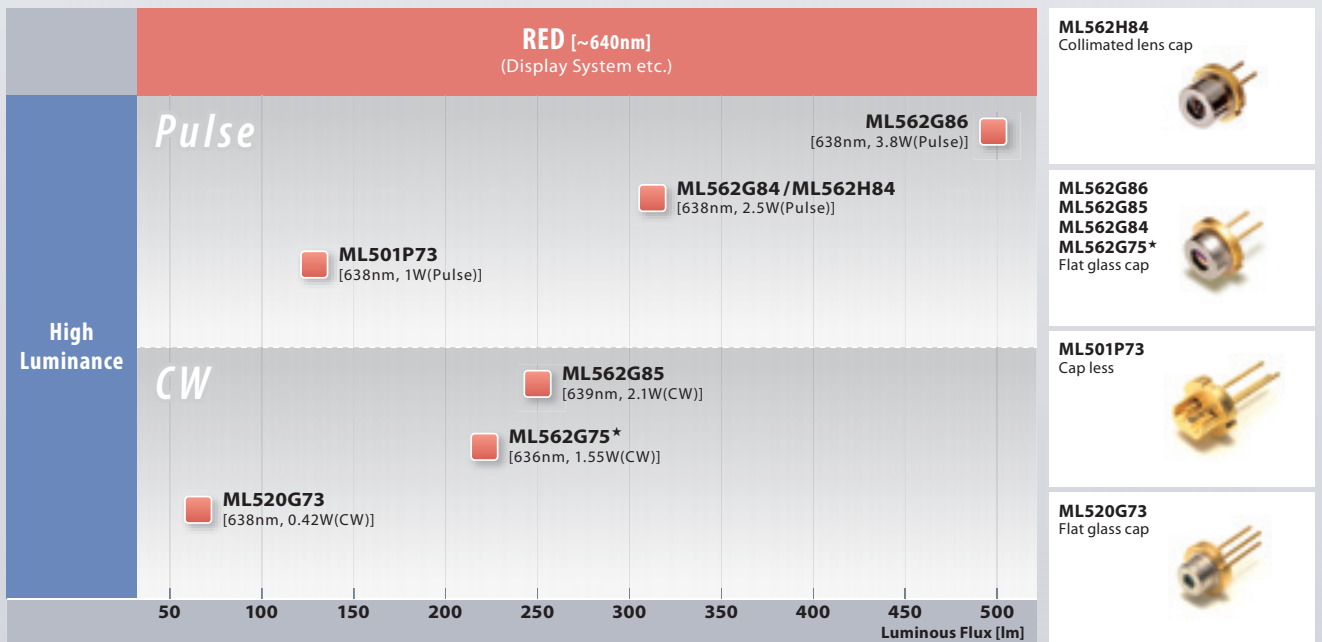


638nm High-output Laser Diode for Industry and Displays

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.



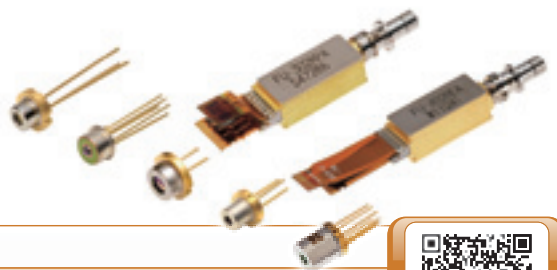
Selection map of Red Laser Diodes



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
ML562H84	Display	638	-	2500	45	φ9.0mm TO Colimated lens 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
ML520G73	Display	638	420	-	35	φ5.6mm TO Flat glass cap

★: New product

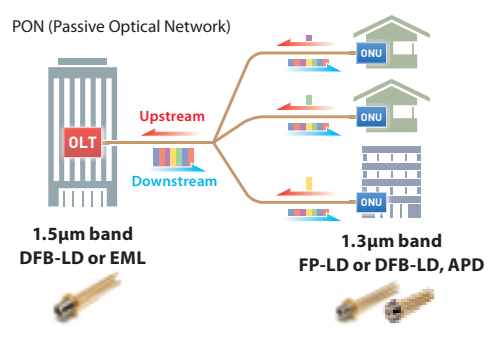


OPTICAL DEVICES FOR OPTICAL COMMUNICATION SYSTEMS

Please visit our website for further details >>>

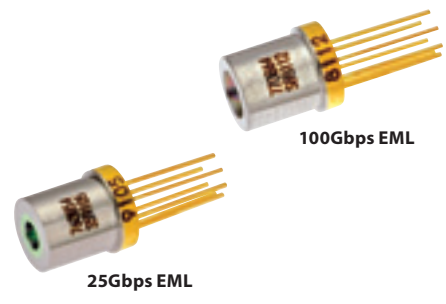
Laser Diodes and Photo Diodes for Fiber to the Home (FTTH)

GE-PON and G-PON are widely used in the FTTH fields in response to increasing data traffic caused by the Social Networking and the Cloud Computing. Our optical devices such as FP-LDs, DFB-LDs and APDs for GE-PON and G-PON have good delivery records. Next-generation high-speed FTTH such as 10G-EPON and XG-PON are being installed for commercial use, and other fiber-optic semiconductor products offered by the company's are contributing to the dissemination of optical fiber communications.



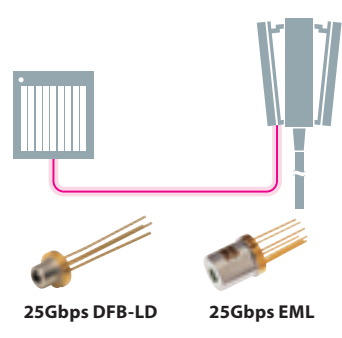
CAN EML Device for 25/100Gbps Transmission

Mitsubishi Electric has developed an electro-absorption modulation (EML) device with superior performance at high temperature and integrated it into a Peltier cooler, realizing a smaller package and lower power consumption. The T056 chassis—known for its excellent mass-production characteristics—is adopted. The products based on T056 package for many applications such as Ethernet / Sonet 40km, 80km, PON are available. Leading the industry, Mitsubishi Electric improve the bandwidth of the T0-CAN package in order to work with the new modulation format that is PAM4 by increasing the data transmission speed to 100Gbps per lambda. A simplified fabrication process improves customer productivity.



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 T056 package to expand the connectivity of various products such as 25Gbps DFB and EML, and is ready to support the market growth of 5G mobile base station applications in the future.



Terminology

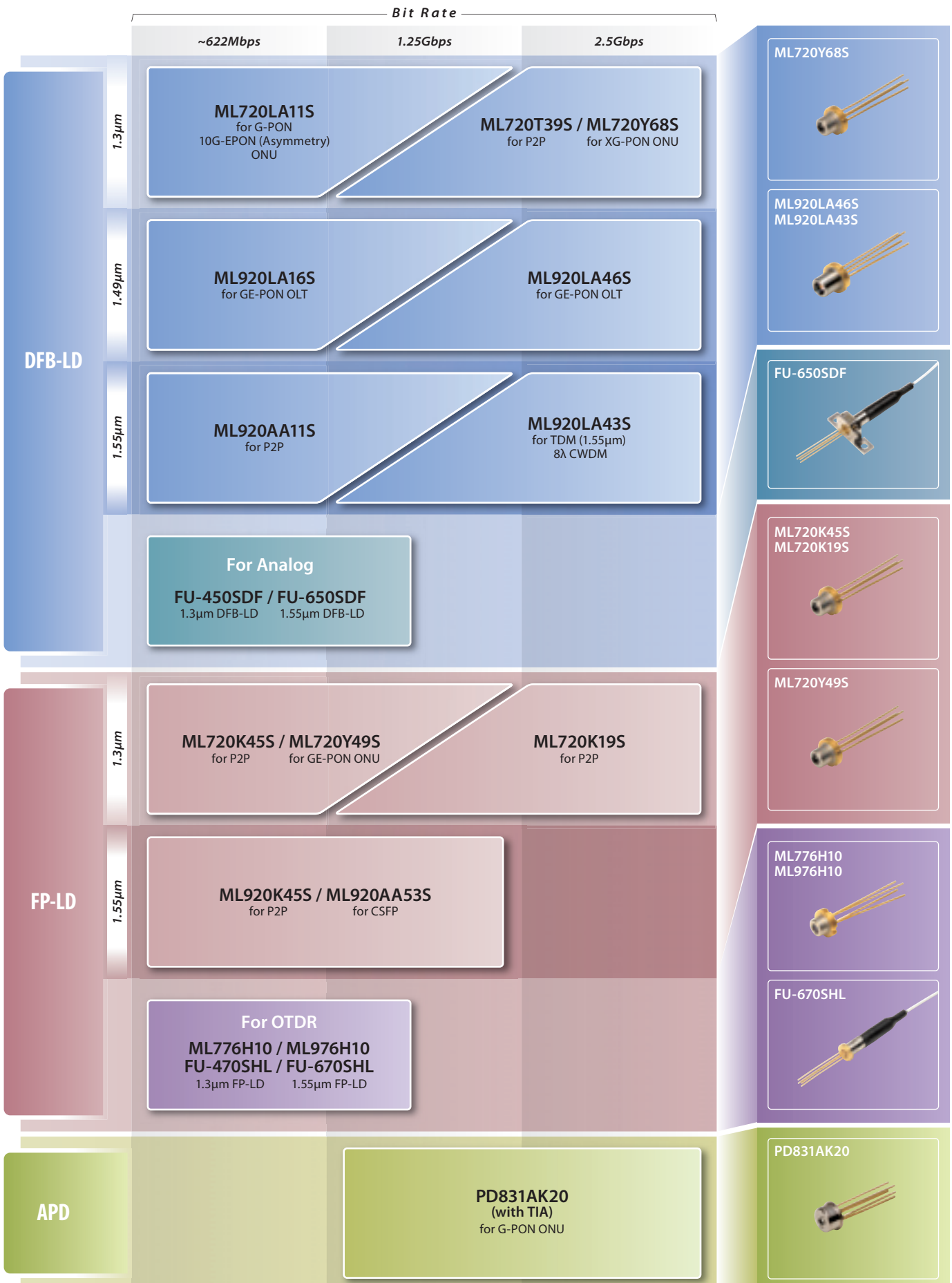
- APC Angled Physical Contact
- APD Avalanche Photo Diode
- APD TIA Avalanche Photo Diode Trans Impedance Amplifier
- B-PON Broadband Passive Optical Network
- CPRI Common Public Radio Interface
- CWDM Coarse Wavelength Division Multiplexing
- DFB-LD Distributed FeedBack Laser Diode
- DWDM Dense Wavelength Division Multiplexing
- EAM Electro Absorption Modulator
- EML Electro absorption Modulator integrated Laser diode
- ER Extended Reach
- FP-LD Fabry-Perot Laser Diode
- FR Fiber Reach
- FTTH Fiber To The Home

- G-PON Gigabit Passive Optical Network
- GE-PON Gigabit Ethernet Passive Optical Network
- LC Lucent Connector
- LED Light Emitting Diode
- LR Long Reach
- LRM Long Reach Multimode
- OLT Optical Line Terminal
- ONU Optical Network Unit
- 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
- 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
- VSR Very Short Reach
- X2 2nd Generation XENPAK
- XENPAK 10 Gigabit Ethernet Transceiver Package
- XFP 10 Gigabit small Form-factor Pluggable
- 10G-EPON 10 Gigabit Ethernet Passive Optical Network
- XG-PON 10 Gigabit Passive Optical Network
- XLMD-MSA 40 Gbps Miniature Device Multi Source Agreement
- XMD-MSA 10 Gbps Miniature Device Multi Source Agreement

OPTICAL DEVICES FOR OPTICAL COMMUNICATION SYSTEMS

Selection Map of OPTICAL DEVICES [Under 2.5Gbps]



Selection Map of OPTICAL DEVICES [Over 10Gbps]

		Bit Rate			
		10Gbps	25Gbps	100Gbps	400Gbps
EML	1.3μm		ML760B54-92A (1270, 1310) for 40km BiDi ML760B54-92C (9λ 1273 ~ 1309) for 40km LAN-WDM	FU-402REA-1/2 (28Gbps x 4λ) for 100Gbps 10/40km ML770B64** (100Gbps PAM4 x 1λ) for 100Gbps 10km 1310nm	ML7xx64* (100Gbps PAM4 x 4λ) for 400G 2km CWDM
	1.49μm	ML958H59 for Bidirectional (Df=10.2mm) 40km			
	1.55μm	ML959B56 for 40km TDM ML958N60 for 80km TDM ML958J60 for Bidirectional (Df=10.2mm) 80km			
	1.577μm	ML959A64 for XG(S)-PON N2a OLT Combo-PON C+			
DFB-LD	1.3μm	ML768K42T for 10GBASE-LR ML768LA42T for CPRI ML768T42T ML769T56T for 10G-EPON ONU	ML764AA58T for 10km TDM ML764K56T ML771K56T** for 300m TDM	ML7xx58 (25Gbps x 4λ) for 100G 2km CWDM	
APD		PD831AH28 for 10G EPON ONU & 40km TDM		FU-302RPA (25Gbps x 4λ) for 100Gbps 40km	



*: 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
	ML720Y68S	DFB-LD	TO56-CAN	1270	-20~+85	XG-PON ONU, High coupling efficiency
	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	-20~+95	P2P
	ML920LA43S	DFB-LD	TO56-CAN	1470~1610 8λ CWDM	-10~+85	8λ CWDM
1.25G/ ~622M	ML720LA11S	DFB-LD	TO56-CAN	1310	-40~+85	G-PON ONU, 10G-EPON (Asymmetry) ONU
	ML720K45S	FP-LD	TO56-CAN	1310	-40~+85	P2P
	ML720Y49S	FP-LD	TO56-CAN	1310	-40~+85	GE-PON ONU, High coupling efficiency
	ML920LA16S	DFB-LD	TO56-CAN	1490	-40~+85	GE-PON OLT
	ML920AA11S	DFB-LD	TO56-CAN	1550	-40~+85	P2P
	ML920K45S	FP-LD	TO56-CAN	1550	-40~+85	P2P
	ML920AA53S	FP-LD	TO56-CAN	1530	-40~+95	P2P, CSFP
For Analog	FU-450SDF	DFB-LD	Coaxial Pigtail	1310	-20~+85	CATV Return Path, RoF
	FU-650SDF	DFB-LD	Coaxial Pigtail	1550	-20~+85	CATV Return Path, RoF
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

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.

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

	Type Number	Chip Type	Package	Wavelength [nm]	Case Temp. [°C]	Features
400G	ML7xx64*	EML	TBD	4λ CWDM	+25~+75	100Gbps x 4λ, PAM4, 2km
100G	FU-402REA-1/2	EML	TOSA, LC Receptacle	LAN-WDM	-5~+80	28Gbps x 4λ
	ML770B64**	EML	TO56-CAN	1310	-5~+80	100Gbps x 1λ, PAM4, 10km
	ML7xx58	DFB-LD	TBD	4λ CWDM	+20~+70	25Gbps x 4λ
25G	ML760B54-92A	EML	TO56-CAN	1270, 1310	-40~+95	Bidirectional, 25Gbps, SFP28, 40km
	ML760B54-92C	EML	TO56-CAN	9λ 1273~1309	-40~+95	25Gbps, SFP28, 40km
	ML764AA58T	DFB-LD	TO56-CAN	1310	-40~+90	25Gbps, SFP28, 10km (Df=6.6mm)
	ML764K56T	DFB-LD	TO56-CAN	1310	-40~+90	25Gbps, SFP28, 300m (Df=5.8mm)
	ML771K56T**	DFB-LD	TO56-CAN	1310	-40~+90	25Gbps, SFP28, 300m, (Df=5.8mm)
10G	ML958H59	EML	TO56-CAN	1490	-5~+80	Bidirectional (Df=10.2mm) 40km
	ML959B56	EML	TO56-CAN	1550	-5~+80	XFP/SFP+ 40km
	ML958N60	EML	TO56-CAN	1550	-5~+80	XFP/SFP+ 80km
	ML958J60	EML	TO56-CAN	1550	-5~+80	Bidirectional (Df=10.2mm) 80km
	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
	ML768T42T	DFB-LD	TO56-CAN	1270	-5~+75	10G-EPON (Symmetry) ONU
	ML769T56T	DFB-LD	TO56-CAN	1270	-40~+90	10G-EPON ONU (Df=10.1mm)

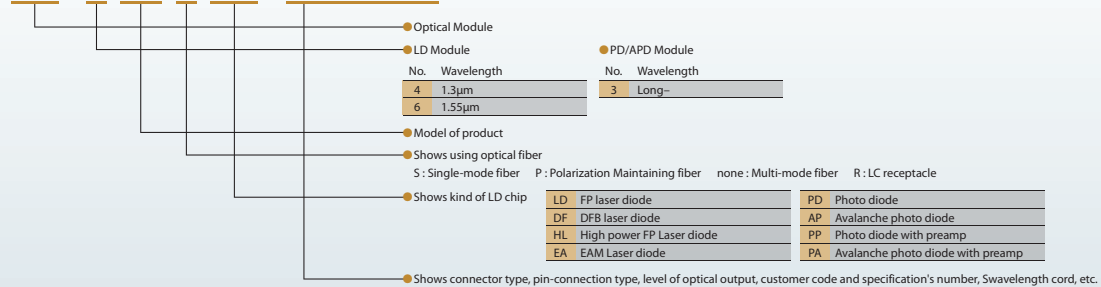
*: New product ** : Under development

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

	Type Number	Chip Type	Package	Wavelength [nm]	Case Temp. [°C]	Features
100G	FU-302RPA	APD	ROSA, LC Receptacle	LAN-WDM	-5~+80	25Gbps x 4λ, Built-in TIA, 40km
10G	PD831AH28	APD	TO46-CAN	1310 / 1577	-40~+90	Built-in TIA, 10G-EPON/XG-PON ONU & 40km

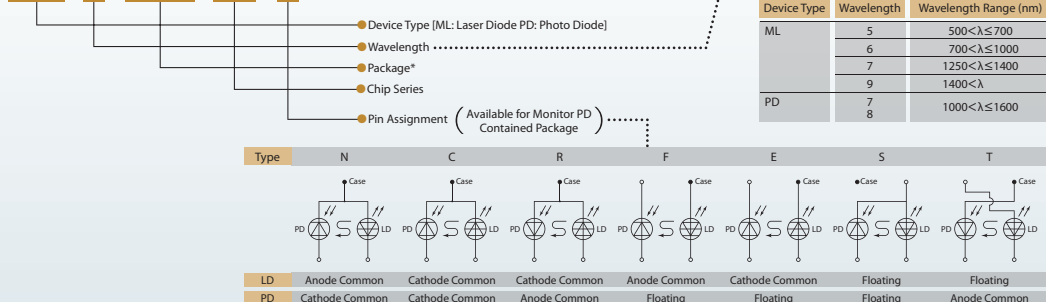
Type Name Definition of Optical Devices for Optical Communication Systems

FU - 6 50 S DF - FW1M15



Type Name Definition of Laser and Photo Diodes

ML 7 68K 42 T



*Please contact our sales office about the selection packages.

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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