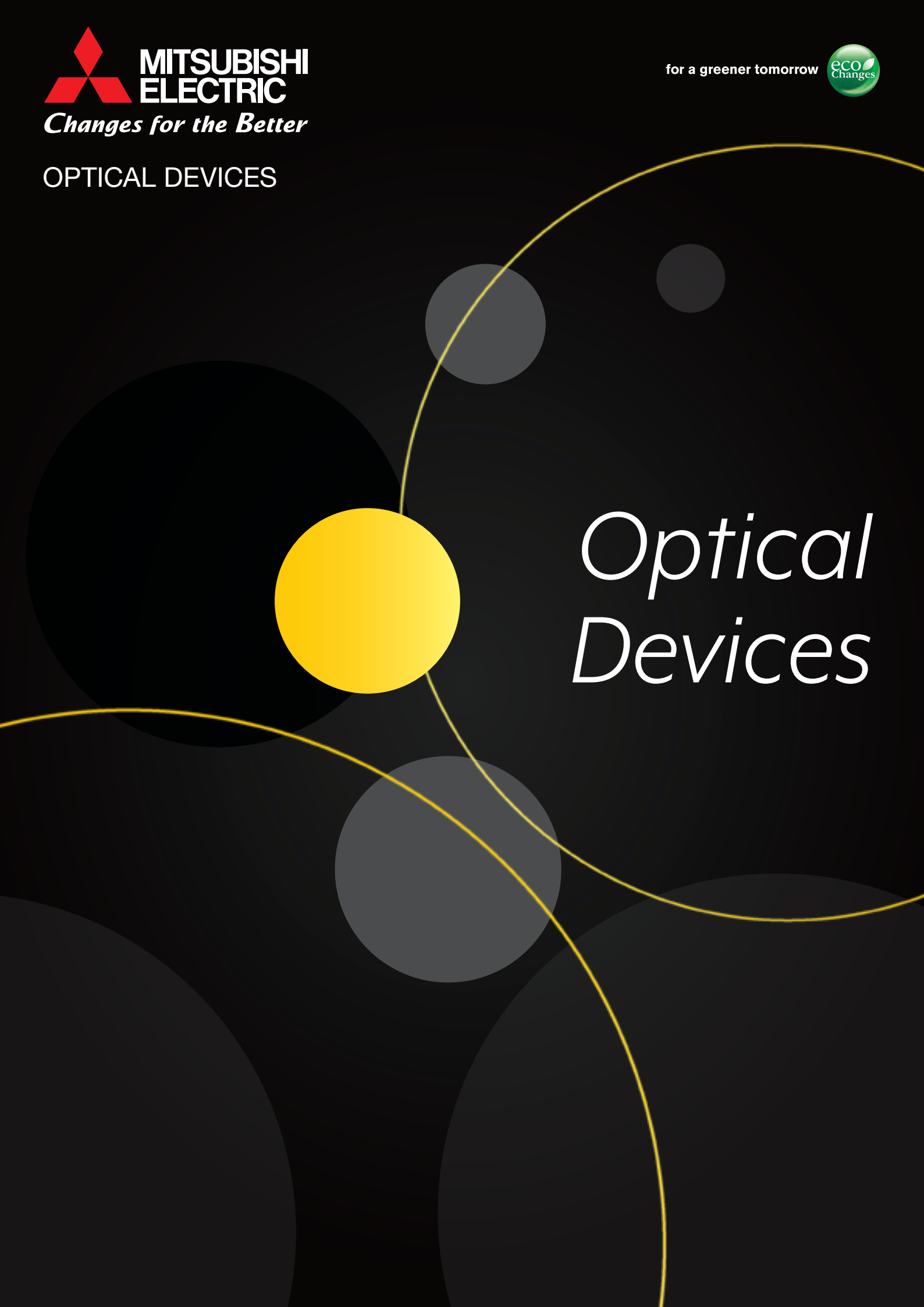


OPTICAL DEVICES



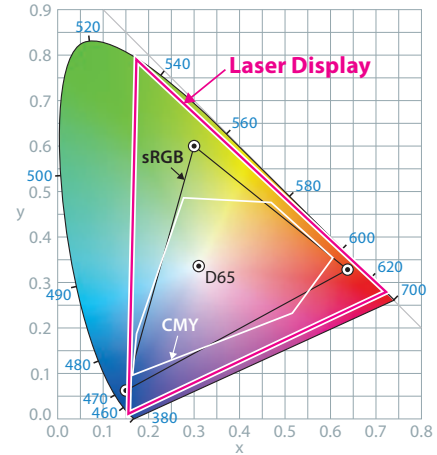
*Optical
Devices*

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

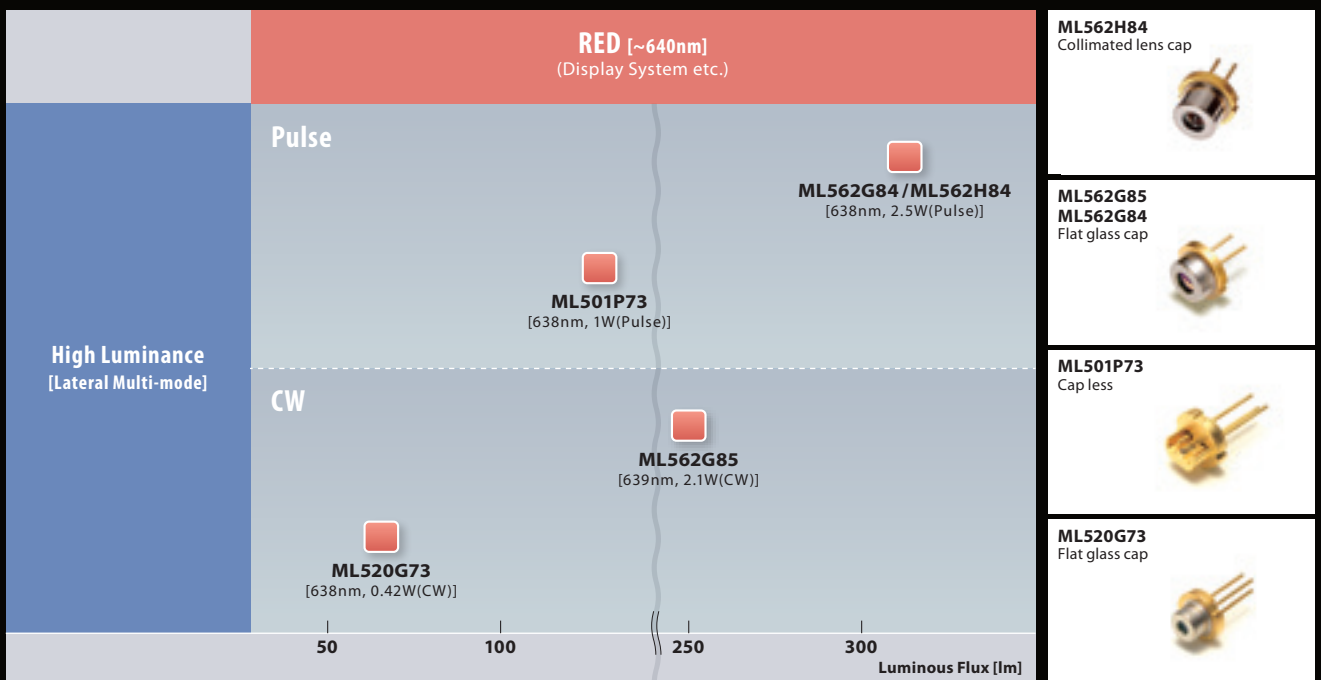
LASER DIODES FOR INDUSTRY & DISPLAY

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 2.5W 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

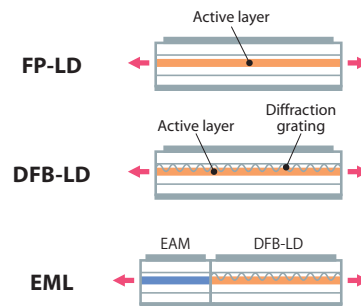
Type Number	Application	Wavelength [nm]	Output Power @CW [mW]	Output Power @Pulse [mW]	Case Temperature [°C]	Package
ML562G85	Display	639	2100	-	45	φ9.0mm TO Flat glass cap
ML562G84	Display	638	-	2500	45	φ9.0mm TO Flat glass cap
ML562H84	Display	638	-	2500	45	φ9.0mm TO Colimated lens cap
ML501P73	Display	638	500	1000	40	φ5.6mm TO Capless
ML520G73	Display	638	420	-	35	φ5.6mm TO Flat glass cap

OPTICAL DEVICES FOR OPTICAL COMMUNICATION SYSTEMS

DFB-LD: Distributed Feedback Laser Diode

DFB-LDs are semiconductor lasers that enable further and faster signal transmission than conventional FP-LDs through maintaining the oscillation spectrum in a single longitudinal mode (a single wavelength component). This is achieved by installing a minute periodic structure (diffraction grating) within the internal elements of the laser diode.

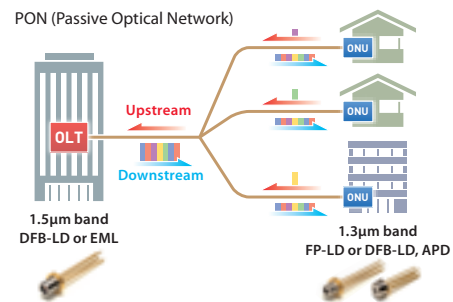
EMLs are also available, featuring an electro-absorption modulator (EAM) integrated in front of the DFB-LD, for even further transmission.



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.

In addition, next-generation FTTHs such as 10G-EPON and XG-PON are considered to introduce for future high-speed and large-capacity data communications. We also have products lineup for 10G-EPON and XG(S)-PON.



CAN EML Device for 10Gbps 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, DWDM, PON are available.



40km TDM	80km TDM	25km DWDM	20km OLT PON
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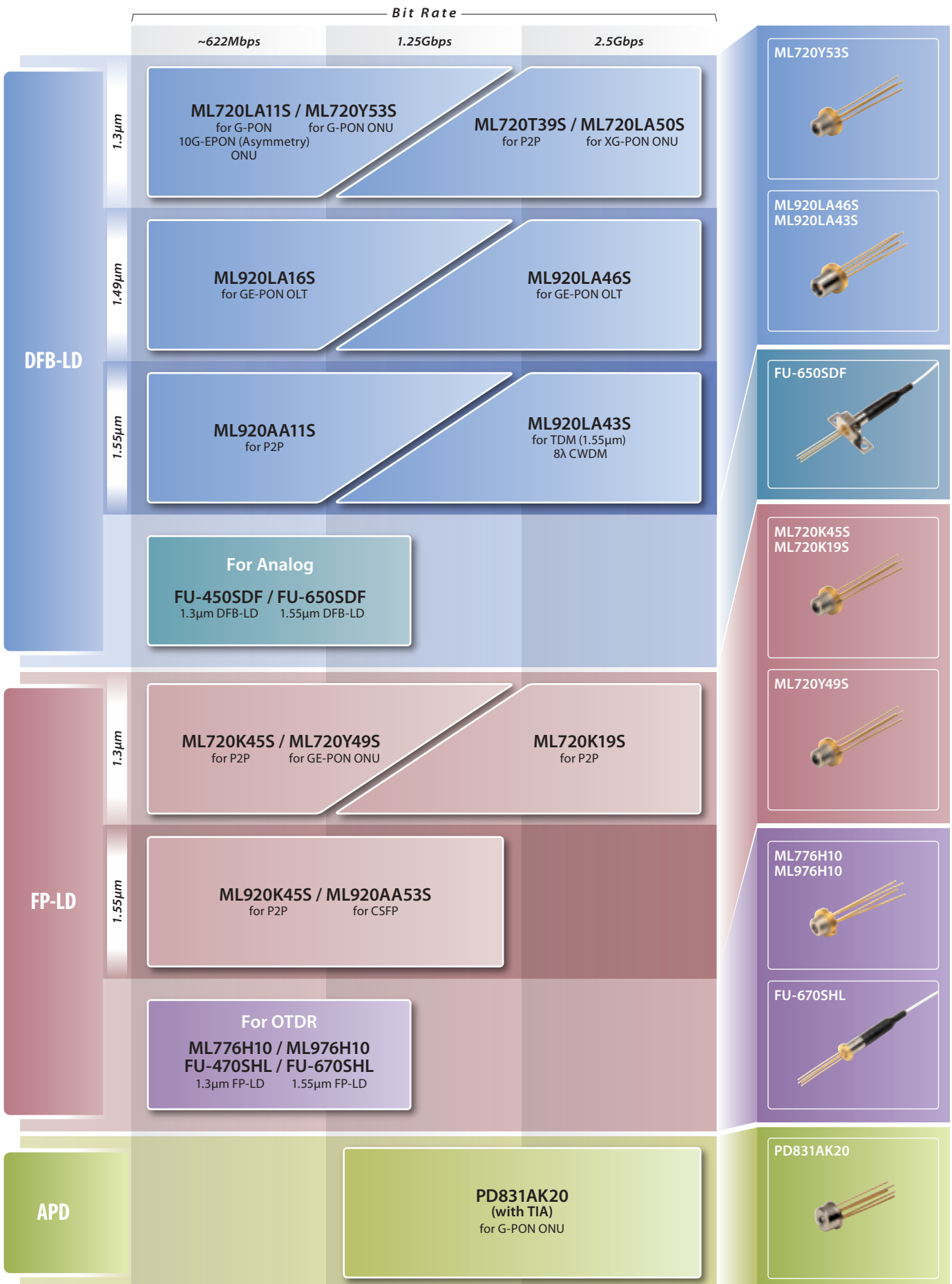
Terminology

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





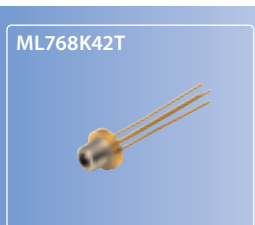

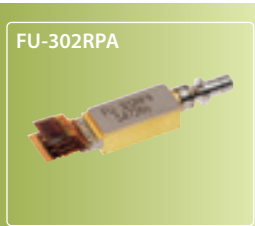

FTTH Fiber To The Home
G-PON Gigabit Passive Optical Network
GE-PON Gigabit Ethernet Passive Optical Network
LC Lucent Connector
LED Light Emitting Diode
LR Long Reach
LRM Long Reach Multimode
OLT Optical Line Terminal
ONU Optical Network Unit
OTDR Optical Time Domain Reflectometer
P2P Peer to Peer
PC 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

Selection Map of OPTICAL DEVICES [Under 2.5Gbps]



Selection Map of OPTICAL DEVICES [Over 10Gbps]

		Bit Rate					
		10Gbps	25Gbps	100Gbps	400Gbps		
EML	1.3 μ m		FU-411REA for 10km TDM	FU-402REA-1/2 (28Gbps x 4 λ) for 100Gbps 10/40km	FU-402REA-4** (50Gbps x 8 λ) for 10km		
	1.49 μ m	ML958K59 for Bidirectional (Df=12.2mm) 40km ML958H59 for Bidirectional (Df=10.2mm) 40km					
	1.55 μ m	ML958D56 for 40km TDM ML958N60 for 80km TDM ML958N63 for 25km DWDM				FU-411REA 	
	1.577 μ m	ML959A55* ML958K55 For 10G EPON OLT XG(S)-PON OLT				ML958K59 ML958H59 ML958D56 ML958N60 ML958N63 ML959A55 ML958K55 	
DFB-LD	1.3 μ m	ML768K42T for 10GBASE-LR ML768LA42T for CPRI ML768T42T for 10G-EPON ONU	ML764AA58T** for 2km TDM	ML7xx58** (25Gbps x 4 λ) for 100G 2km CWDM		ML768K42T 	
						ML768T42T ML768LA42T 	
APD		PD831AH28 for 10G EPON ONU & 40km TDM		FU-302RPA** (25Gbps x 4 λ) for 100Gbps 40km		FU-302RPA 	
		PD831W24 for 10G EPON ONU				PD831AH28 PD831W24 	

*: 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
	ML720LA50S	DFB-LD	TO56-CAN	1270	-40~+95	XG-PON ONU
	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
	ML720Y53S	DFB-LD	TO56-CAN	1310	-40~+85	G-PON 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
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	FU-402REA-4**	EML	TOSA, LC Receptacle	LAN-WDM	-5~+80	50Gbps x 8λ, PAM4
100G	FU-402REA-1/2	EML	TOSA, LC Receptacle	LAN-WDM	-5~+80	28Gbps x 4λ
	ML7xx58**	DFB-LD	TBD	4λ CWDM	+20~+70	25Gbps x 4λ
25G	FU-411REA	EML	TOSA, LC Receptacle	1310	-5~+80	28Gbps, XLMD-MSA Compliant
	ML764AA58T**	DFB-LD	TO56-CAN	1310	-40~+90	25Gbps
10G	ML958K59	EML	TO56-CAN	1490	-5~+80	Bidirectional (Df=12.2mm) 40km
	ML958H59	EML	TO56-CAN	1490	-5~+80	Bidirectional (Df=10.2mm) 40km
	ML958D56	EML	TO56-CAN	1550	-5~+80	XFP/SFP+ 40km
	ML958N60	EML	TO56-CAN	1550	-5~+80	XFP/SFP+ 80km
	ML958N63	EML	TO56-CAN	1550	-40~+95	25km DWDM
	ML958K55	EML	TO56-CAN	1577	-5~+80	10G EPON OLT, XG(S)-PON OLT
	ML959A55*	EML	TO56-CAN	1577	-5~+80	10G EPON OLT, XG(S)-PON 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	

*: New Product ***: Under Development

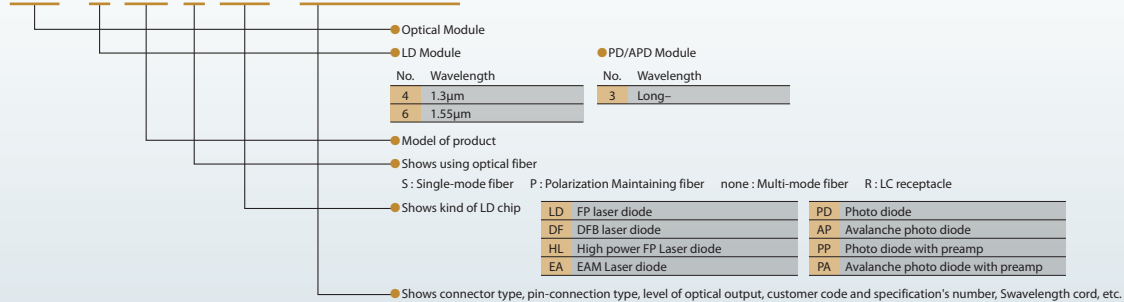
Line Up of APD / APD Modules [Over 10Gbps]

	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
	PD831W24	APD	TO46-CAN	1577	-40~+90	Built-in TIA, 10G-EPON/XG-PON ONU

***: Under Development

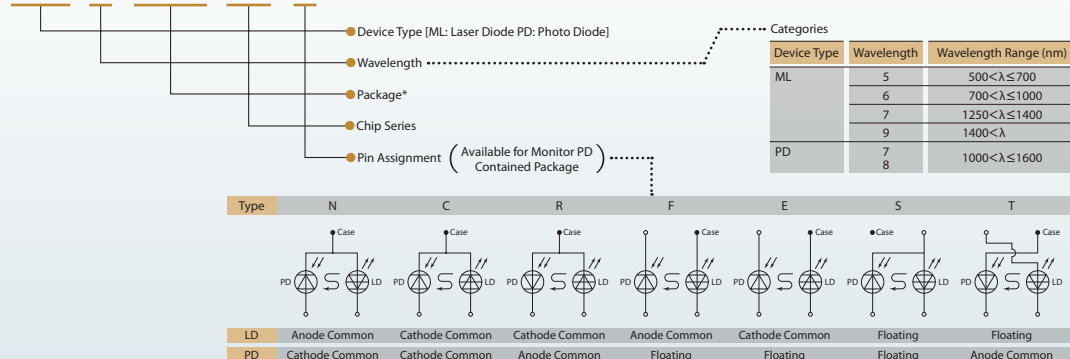
Type Name Definition of Optical Devices for Optical Communication Systems

FU-650SDF-FW1M15



Type Name Definition of Laser and Photo Diodes

ML768K42T



*Please contact our sales office about the selection packages.

Please visit our website for further details.

www.MitsubishiElectric.com

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- 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.

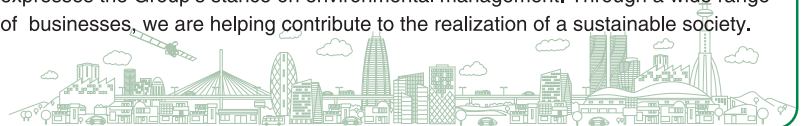
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for a greener tomorrow

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