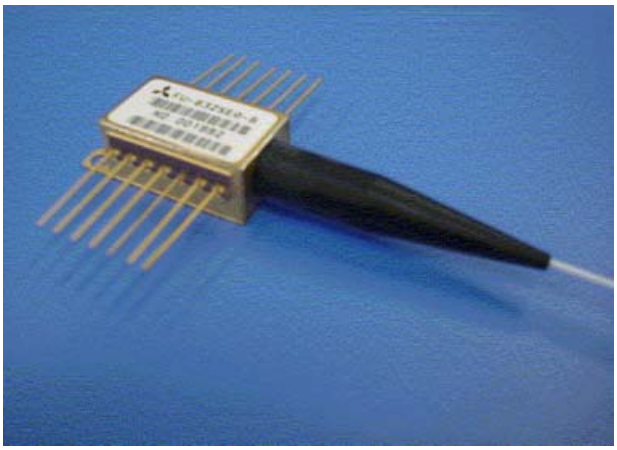
MITSUBISHI (OPTICAL DEVICES)

FU-632SEA-xx1Mxx

1.55 μm EAM-LD MODULE WITH SINGLEMODE FIBER PIGTAIL



DESCRIPTION

Module type FU-632SEA-x61Mxx/-x31Mxx is an electro-absorption modulator integrated DFB-LD module with single mode optical fiber.
This module is suitable for a light source of long haul 2.5Gb/s digital optical communication systems upto 640km.
This module is prepared in accordance with ITU-T recommendation wavelength channel plan for Dense-WDM systems.

FEATURES

- Input impedance is 50Ω
- Integrated Electroabsorption Modulator(EAM)
- Distributed feedback (DFB) Laser Diode
- Emission wavelength is the 1.55mm band
- Single-mode optical fiber pig-tail
- Built-in optical isolator
- Butterfly package
- Built-in thermal electric cooler

APPLICATION

2.5Gbps,6400ps/nm DWDM application
2.5Gbps,12800ps/nm DWDM application

ABSOLUTE MAXIMUM RATINGS (Tld=Tset)

Parameter		Symbol	Conditions	Rating	Unit
Laser diode	Optical output power	Pf	CW	6	mW
	Forward current	If	CW	200	mA
	Reverse voltage	Vrl	CW	2	V
Modulator	Reverse voltage	Vrm	-	5	V
	Forward voltage	Vfm	-	1	V
Photodiode for monitoring	Reverse voltage	Vrd	-	20	V
	Forward current	Ifd	-	2	mA
Thermoelectric cooler(Note 1)	Current	Ipe	-	1.5	A
	Voltage	Vpe	-	3	V
Operating case temperature		Tc	-	-20 to 70	°C
Storage temperature		Tstg	-	-40 to 85	°C

Note 1. Even if the thermoelectric cooler(TEC) is operated within the rated conditions, uncontrolled current loading or operation without heat sink may easily damage the module by exceeding the storage temperature range. Thermistor resistance should be properly monitored by the feedback circuit during TEC operation to avoid the catastrophic damage.

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ELECTRICAL/OPTICAL CHARACTERISTICS

(Tld=Tset, Tc=-20~70°C unless otherwise noted)

Parameter	Symbol	Test Conditions (Note 2)	Limits			Unit
			Min.	Typ.	Max.	
Laser operating Temperature	Tset	CW, If=Iop	20	-	35	°C
Threshold current	Ith	CW,Vm=0V	5	-	30	mA
Operating current	Iop	CW,Vm=0V	40	60	70	mA
Operating voltage	Vop	CW,Vm=0V,If=Iop	-	-	1.7	V
Input impedance	Zin	If=Iop	-	50	-	Ω
Optical output power from fiber end	Pf_ave	(Note3,4)	-2	-	+2.5	dBm
Light emission central spectral wavelength	λc	CW,Vm=0V,If=Iop, Tld=Tset	see Table 1.			nm
Center wavelength drift with case temperature	Δλc/ΔTc	CW,Vm=0V,APC Tld=Tset ,Tc=-20~70°C	-1	-	0	pm /°C
Side mode suppression ratio	Sr	(Note3,4)	35	40	-	dB
Spectral width	Δλcw	CW,Vm=0V,If=Iop	-	3	10	MHz
	Δλmod	(Note3,4)	-	0.05	0.1	nm
Relative intensity noise	RIN	CW,Vm=0V,If=Iop,2.5GHz	-	-155	-140	dB/H
Power penalty	Pp	(Note3,4) -x31Mxx @6400ps/nm	-	-	1.5	dB
		(Note3,4) -x61Mxx @12800ps/nm	-	-	1.5	dB
Extinction ratio	Ex	(Note3,4)	11	-	-	dB
Rise/Fall time	tr/tf	(Note3,4),20-80%	-	-	100	ps
Cutoff frequency	fc	If=Iop,Vm=-1V	3.5	-	-	GHz
RF return loss	S11	If=Iop,Vm=-1V,0~2GHz	10	-	-	dB
		If=Iop,Vm=-1V,2~3GHz	7	-	-	dB
Tracking error	Er	Tc=-20~70°C,APC, ATC (Note 5),Vm=0V	-	0.3	0.5	dB
Monitor current	Imon	(Note3,4)	0.1	-	1.5	mA
Dark current(PD)	Id	Vrd=5V,Tld=25°C	-	-	0.1	μA
Capacitance(PD)	Ct	Vrd=5V,Tld=25°C,f = 1MHz	-	10	-	pF
Optical isolation	Iso	Tc=25°C	35	-	-	dB
		Tc=-20~70°C	23	-	-	dB

Note 2. Vm is EAM bias level at CW condition, Vpp and Voff are EAM amplitude and EAM high level offset voltage respectively at modulated condition.

3. 2.48832Gb/s,NRZ,PRBS2^{23}-1,If=Iop,Vpp=2.5V,Voff= -0.2V,Tld=Tset, Back to back.

4. Optical return loss of the connectors should be greater than 40dB in order to get specified performance.

5. Er=MAX|10×log(Pf(Tc)/Pf(25°C))|

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THERMAL CHARACTERISTICS (Tld=Tset, Tc=-20~70°C)

Parameter	Symbol	Test Conditions	Limits			Unit
			Min.	Typ.	Max.	
Thermistor resistance	Rth	Tld=25°C	9.5	10	10.5	kΩ
B constant of Rth	B	-	-	3950	-	K
Cooler current	Ipe	If=Iop,Tld=Tset,Tc=70°C	-	0.7	1.2	A
Cooler voltage	Vpe	If=Iop,Tld=Tset,Tc=70°C	-	1.7	2.5	V

FIBER PIGTAIL SPECIFICATIONS

Parameter	Limits	Unit
Type	SM	-
Mode field diameter	9.3±1	μm
Cladding diameter	125±2	μm
Secondary coating outer diameter	0.9±0.1	mm
Connector type	FC , SC , LC *	-
Optical return loss of connector	40 (min)	dB

*FC/PC connector is for FU-632SEA-V31Mxx and -V61Mxx series.
SC/PC connector is for FU-632SEA-W31Mxx and -W61Mxx series.
LC connector is for FU-632SEA-T31Mxx and -T61Mxx series.

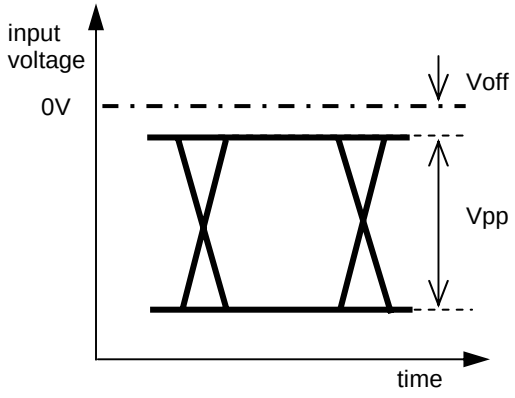

fig1. Definition of Electrical input

ORDERING INFORMATION

FU-632SEA- V 6 1 M 13

Wavelength Code : (See Table 1)

Transmission Distance
3: 6400ps/nm , **6:** 12800ps/nm

Fiber Connector Type
V: FC/PC , **W:** SC/PC
T: LC/PC (optional)

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Table 1. (All wavelengths are referred to vacuum. Tolerance is λc±0.05nm.)

Mitsubishi Wavelength Code	Frequency f (THz)	Wavelength λc (nm)	Type No.	
			6400ps/nm	12800ps/nm
9	196.00	1529.55	FU-632SEA-x31M9	FU-632SEA-x61M9
11	195.90	1530.33	FU-632SEA-x31M11	FU-632SEA-x61M11
13	195.80	1531.12	FU-632SEA-x31M13	FU-632SEA-x61M13
15	195.70	1531.90	FU-632SEA-x31M15	FU-632SEA-x61M15
17	195.60	1532.68	FU-632SEA-x31M17	FU-632SEA-x61M17
19	195.50	1533.47	FU-632SEA-x31M19	FU-632SEA-x61M19
21	195.40	1534.25	FU-632SEA-x31M21	FU-632SEA-x61M21
23	195.30	1535.04	FU-632SEA-x31M23	FU-632SEA-x61M23
25	195.20	1535.82	FU-632SEA-x31M25	FU-632SEA-x61M25
27	195.10	1536.61	FU-632SEA-x31M27	FU-632SEA-x61M27
29	195.00	1537.40	FU-632SEA-x31M29	FU-632SEA-x61M29
31	194.90	1538.19	FU-632SEA-x31M31	FU-632SEA-x61M31
33	194.80	1538.98	FU-632SEA-x31M33	FU-632SEA-x61M33
35	194.70	1539.77	FU-632SEA-x31M35	FU-632SEA-x61M35
37	194.60	1540.56	FU-632SEA-x31M37	FU-632SEA-x61M37
39	194.50	1541.35	FU-632SEA-x31M39	FU-632SEA-x61M39
41	194.40	1542.14	FU-632SEA-x31M41	FU-632SEA-x61M41
43	194.30	1542.94	FU-632SEA-x31M43	FU-632SEA-x61M43
45	194.20	1543.73	FU-632SEA-x31M45	FU-632SEA-x61M45
47	194.10	1544.53	FU-632SEA-x31M47	FU-632SEA-x61M47
49	194.00	1545.32	FU-632SEA-x31M49	FU-632SEA-x61M49
51	193.90	1546.12	FU-632SEA-x31M51	FU-632SEA-x61M51
53	193.80	1546.92	FU-632SEA-x31M53	FU-632SEA-x61M53
55	193.70	1547.72	FU-632SEA-x31M55	FU-632SEA-x61M55
57	193.60	1548.51	FU-632SEA-x31M57	FU-632SEA-x61M57
59	193.50	1549.32	FU-632SEA-x31M59	FU-632SEA-x61M59
61	193.40	1550.12	FU-632SEA-x31M61	FU-632SEA-x61M61
63	193.30	1550.92	FU-632SEA-x31M63	FU-632SEA-x61M63
65	193.20	1551.72	FU-632SEA-x31M65	FU-632SEA-x61M65
67	193.10	1552.52	FU-632SEA-x31M67	FU-632SEA-x61M67
69	193.00	1553.33	FU-632SEA-x31M69	FU-632SEA-x61M69
71	192.90	1554.13	FU-632SEA-x31M71	FU-632SEA-x61M71
73	192.80	1554.94	FU-632SEA-x31M73	FU-632SEA-x61M73
75	192.70	1555.75	FU-632SEA-x31M75	FU-632SEA-x61M75
77	192.60	1556.55	FU-632SEA-x31M77	FU-632SEA-x61M77
79	192.50	1557.36	FU-632SEA-x31M79	FU-632SEA-x61M79
81	192.40	1558.17	FU-632SEA-x31M81	FU-632SEA-x61M81
83	192.30	1558.98	FU-632SEA-x31M83	FU-632SEA-x61M83
85	192.20	1559.79	FU-632SEA-x31M85	FU-632SEA-x61M85
87	192.10	1560.61	FU-632SEA-x31M87	FU-632SEA-x61M87
89	192.00	1561.42	FU-632SEA-x31M89	FU-632SEA-x61M89
91	191.90	1562.23	FU-632SEA-x31M91	FU-632SEA-x61M91

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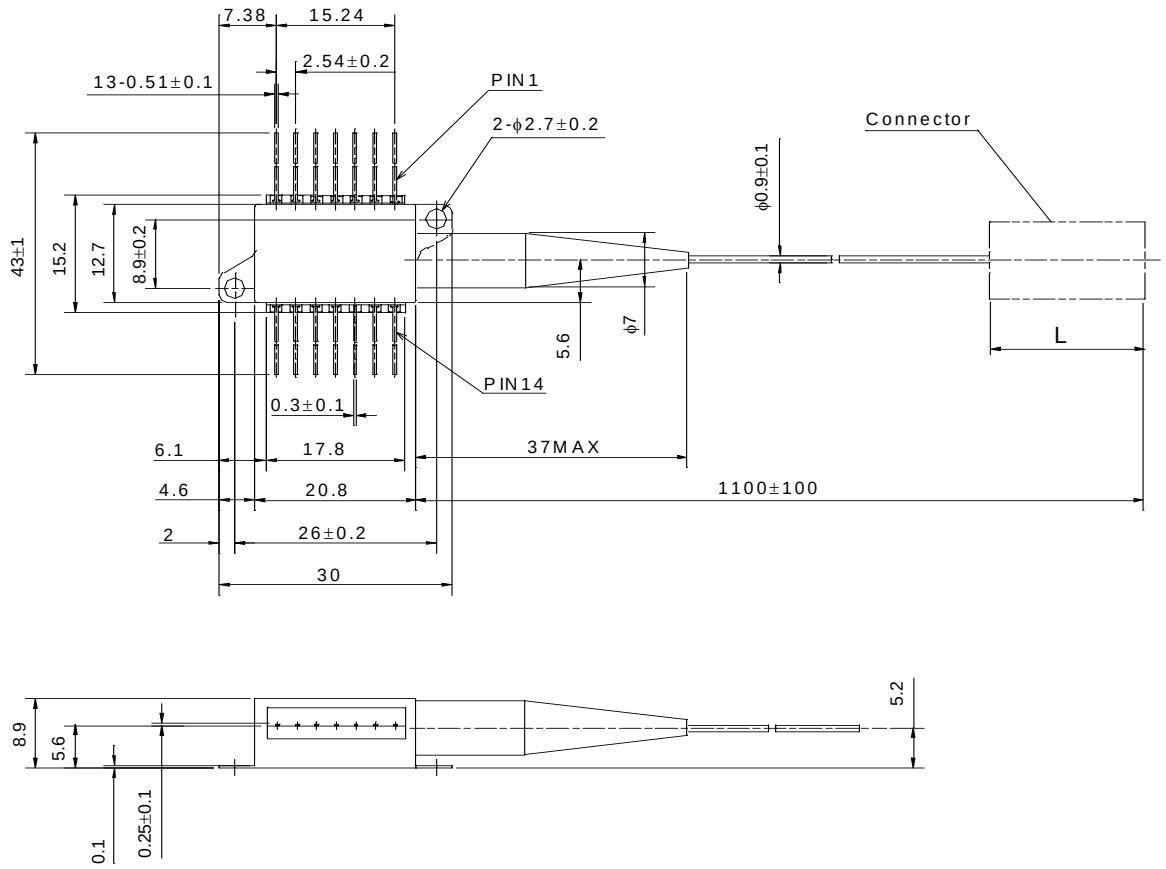
OUTLINE DIAGRAM

(Unit : mm)



Ideantified type number	Connector type	L
FU-632SEA-V31Mxx,V61Mxx	FC/PC	28REF
FU-632SEA-W31Mxx,W61Mxx	SC/PC	36REF
FU-632SEA-T31Mxx,T61Mxx	LC/PC	-

FU-632SEA-x31Mxx/FU-632SEA-x61Mxx

Safety Cautions for Use of Optoelectronic Devices

General:

Although the manufacturer is always striving to improve the reliability of its product, problems and errors may occur with semiconductor products. Therefore, the user's products are required to be designed with full safety regard to prevent any accidents that results in injury, death, fire or environmental damage even when semiconductor products happen to error. Especially it is recommended to take in consideration about redundancy, fire prevention, error prevention safeguards. And the following requirements must be strictly observed.

Warning!

1. Eye safety : Seminductor laser radiates laser light during operation. Laser light is very dangerous when shot directly into human eyes. Don't look at laser light directly, or through optics such as a lens. The laser light should be observed using the ITV camera, IR-viewer, or other appropriate instruments.

2. Product handling : The product contains GaAs (gallium arsenide). It is safe for regular use, but harmful to the human body if made into powder or steam. Be sure to avoid dangerous process like smashing, burning, chemical etching. Never put this product in one's mouth or swallow it.

3. Product disposal : This product must be disposed of as special industrial waste. It is necessary to separate it from general industrial waste and general garbage.

Handling Cautions for Optoelectronic Devices

1. General:

(1) The products described in this specification are designed and manufactured for use in general communication systems or electronic devices, unless their applications or reliability are otherwise specified. Therefore, they are not designed or manufactured for installation in devices or systems that may affect human life or that are used in social infrastructure requiring high reliability.

(2) When the customer is considering to use the products in special applications, such as transportation systems (automobiles, trains, vessels), medical equipments, aerospace, nuclear power control, and submarine repeaters or systems, please contact Mitsubishi Electric or an authorized distributor.

2. Shipping Conditions:

(1) During shipment, place the packing boxes in the correct direction, and fix them firmly to keep them immovable. Placing the boxes upside down, tilting, or applying abnormal pressure onto them may cause deformation in the electrode terminals, breaking of optical fiber, or other problems.

(2) Never throw or drop the packing boxes. Hard impact on the boxes may cause break of the devices.

(3) Take strict precautions to keep the devices dry when shipping under rain or snow.

3. Storage Conditions:

When storing the products, it is recommended to store them following the conditions described below without opening the packing. Not taking enough care in storing may result in defects in electrical characteristics, soldering quality, visual appearance, and so on. The main points are described below (if special storage conditions are given to the product in the specification sheet, they have priority over the following general cautions):

(1) Appropriate temperature and humidity conditions, i.e., temperature range between 5~30 C, and humidity between 40~60 percent RH, should be maintained in storage locations. Controlling the temperature and humidity within this range is particularly important in case of long-term storage for six months or more.

(2) The atmosphere should be particularly free from toxic gases and dust.

(3) Do not apply any load on the product.

(4) Do not cut or bend the leads of the devices which are to be stored. This is to prevent corrosion in the cut or bent part of the lead causing soldering problems in the customer's assembling process.

(5) Sudden change in temperature may cause condensation in the product or packing, therefore, such locations should be avoided for storing. Temperature in storage locations should be stable.

(6) When storing ceramic package products for extended periods of time, the leads may turn reddish due to reaction with sulfur in the atmosphere.

(7) Storage conditions for bare chip and unsealed products shall be stated separately because bare chip and unsealed products require stricter controls than package sealed products.

4. Design Conditions and Environment under Use:

(1) Avoid use in locations where water or organic solvents adhere directly to the product, or where there is any possibility of the generation of corrosive gas, explosive gas, dust, salinity, or other troublesome conditions. Such environments will not only significantly lower the reliability, but also may lead to serious accidents.

(2) Operation in excess of the absolute maximum ratings can cause permanent damage to the device. The customers are requested to design not to exceed those ratings even for a short time.

5. ESD Safety Cautions:

The optoelectronic devices are sensitive to static electricity (ESD, electro-static discharge). The product can be broken by ESD. When handling this product, please observe the following countermeasures:

<Countermeasures against Static Electricity and Surge>

To prevent break of devices by static electricity or surge, please adopt the following countermeasures in the assembly line:

(1) Ground all equipments, machinery jigs, and tools in the process line with earth wires installed in them. Take particular care with hot plates, solder irons and other items for which the commercial power supplies are prone to leakage.

(2) Workers should always use earth bands. Use of antistatic clothing, electric conductive shoes, and other safety equipment while at work is highly recommended.

(3) Use conductive materials for this product's container, etc.

(4) It is recommended that grounding mats be placed on the surfaces of assembly line workbench and the surrounding floor in work area, etc.

(5) When mounting this product in parts or materials which can be electrically charged (printed wiring boards, plastic products, etc.), pay close attention to the static electricity in those parts. ESD may damage the product.

(6) Humidity in working environment should be controlled to be 40 percent RH or higher.

These countermeasures are most general, and there is a need to carefully confirm the line before starting mass production using this product (in the trial production, etc.). It is extremely important to prevent surge, eliminate it rapidly, and prevent it from spreading.