

**Preliminary**

APPROVED	APPROVED	CHARGED
<i>T.Nambara</i>	<i>A.Adachi</i>	<b>T.Onodera</b>

Preliminary specification of 10Gbps EML module with GPO connector  
for WDM application

A	B	C	D
	x		
DATE		Approved	
4.Sep.'01		T.Nambara	

## FEATURES

- Input impedance is 50Ω
- Integrated Electro-absorption Modulator
- Distributed feedback(DFB) Laser Diode
- Emission wavelength is 1.55μm band
- Single mode optical fiber pigtail
- Built-in optical isolator
- Built-in thermoelectric cooler
- 7-pin Butterfly package with GPO connector

## 1. Absolute maximum ratings

Item		Symbol	Condition	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(Note1)	Current	Ipe	-	1.5	A
	Voltage	Vpe	-	3	V
Operating case temperature		Tc	-	-20~70	°C
Storage temperature		Tstg	-	-40~85	°C

## Note1

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.

2. Electrical and optical characteristics ( $\lambda=\lambda_c$ ,  $T_c=25^\circ\text{C}$ , unless otherwise noted)

Item	Symbol	Condition(Note2)	Min.	Typ.	Max.	Unit
Threshold current	I <sub>th</sub>	CW, V <sub>m</sub> =0V	5	-	30	mA
Operating current	I <sub>op</sub>	CW, V <sub>m</sub> =0V	50	70	100	mA
Operating voltage	V <sub>op</sub>	CW, I <sub>f</sub> =I <sub>op</sub> , V <sub>m</sub> =0V	-	-	1.7	V
Input impedance	Z <sub>in</sub>	I <sub>f</sub> =I <sub>op</sub>	-	50	-	$\Omega$
Optical output power from fiber end	P <sub>f</sub>	(Note 3,4)	-2	-	-	dBm
Side mode suppression ratio	S <sub>r</sub>	(Note 3,4)	35	40	-	dB
Relative intensity noise	RIN	CW, I <sub>f</sub> =I <sub>op</sub> , V <sub>m</sub> =0V, 10GHz	-	-	-135	dB/Hz
Power penalty	P <sub>p</sub>	(Note 3,4), 800ps/nm	-	-	2.0	dB
Extinction ratio	Ex	(Note 3,4)	10	-	-	dB
Rise/fall time	t <sub>r</sub> /t <sub>f</sub>	(Note 3,4), 20-80%	-	-	45	ps
Cutoff frequency	f <sub>c</sub>	I <sub>f</sub> =I <sub>op</sub> , V <sub>m</sub> =-1V	11	-	-	GHz
RF return loss	S <sub>11</sub>	I <sub>f</sub> =I <sub>op</sub> , V <sub>m</sub> =-1V, f $\leq$ 5GHz	10	15	-	dB
		I <sub>f</sub> =I <sub>op</sub> , V <sub>m</sub> =-1V, f $\leq$ 10GHz	5	7	-	dB
Tracking error	E <sub>r</sub>	I <sub>f</sub> =I <sub>op</sub> , T <sub>c</sub> =-20~70°C, Note 5	-	0.3	0.5	dB
Monitor current	I <sub>mon</sub>	I <sub>f</sub> =I <sub>op</sub> , V <sub>rd</sub> =-5V	0.1	-	1.5	mA
Dark current(PD)	I <sub>d</sub>	V <sub>rd</sub> =-5V	-	-	0.1	$\mu\text{A}$
Capacitance(PD)	C <sub>t</sub>	V <sub>rd</sub> =-5V	-	10	-	pF
Optical isolation	I <sub>so</sub>	T <sub>c</sub> =25°C	35	-	-	dB
		T <sub>c</sub> =-20~70°C	23	-	-	dB
Laser diode temperature	T <sub>ld</sub>	-	15	-	35	°C

Note 2 : V<sub>m</sub> is EAM bias voltage at CW condition, V<sub>pp</sub> and V<sub>off</sub> are EAM amplitude and EAM high level offset voltage respectively at modulation condition.

Note 3 : 9.95328Gbps, NRZ, PRBS2<sup>23</sup>-1, I<sub>f</sub>=I<sub>op</sub>, V<sub>pp</sub>=2.5V, V<sub>off</sub>=0V to -1V

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

Note 5 :  $E_r = \max | 10 \times \log [ P_f / P_f(25^\circ\text{C}) ] |$

## 3. Wavelength

Type No.	Wavelength(nm)	Type No.	Wavelength(nm)
FU-653SEA-2M11	1530.33	FU-653SEA-2M53	1546.92
FU-653SEA-2M12	1530.72	FU-653SEA-2M54	1547.32
FU-653SEA-2M13	1531.12	FU-653SEA-2M55	1547.72
FU-653SEA-2M14	1531.51	FU-653SEA-2M56	1548.11
FU-653SEA-2M15	1531.90	FU-653SEA-2M57	1548.51
FU-653SEA-2M16	1532.29	FU-653SEA-2M58	1548.91
FU-653SEA-2M17	1532.68	FU-653SEA-2M59	1549.32
FU-653SEA-2M18	1533.07	FU-653SEA-2M60	1549.72
FU-653SEA-2M19	1533.47	FU-653SEA-2M61	1550.12
FU-653SEA-2M20	1533.86	FU-653SEA-2M62	1550.52
FU-653SEA-2M21	1534.25	FU-653SEA-2M63	1550.92
FU-653SEA-2M22	1534.64	FU-653SEA-2M64	1551.32
FU-653SEA-2M23	1535.04	FU-653SEA-2M65	1551.72
FU-653SEA-2M24	1535.43	FU-653SEA-2M66	1552.12
FU-653SEA-2M25	1535.82	FU-653SEA-2M67	1552.52
FU-653SEA-2M26	1536.22	FU-653SEA-2M68	1552.93
FU-653SEA-2M27	1536.61	FU-653SEA-2M69	1553.33
FU-653SEA-2M28	1537.00	FU-653SEA-2M70	1553.73
FU-653SEA-2M29	1537.40	FU-653SEA-2M71	1554.13
FU-653SEA-2M30	1537.79	FU-653SEA-2M72	1554.54
FU-653SEA-2M31	1538.19	FU-653SEA-2M73	1554.94
FU-653SEA-2M32	1538.58	FU-653SEA-2M74	1555.34
FU-653SEA-2M33	1538.98	FU-653SEA-2M75	1555.75
FU-653SEA-2M34	1539.37	FU-653SEA-2M76	1556.15
FU-653SEA-2M35	1539.77	FU-653SEA-2M77	1556.55
FU-653SEA-2M36	1540.16	FU-653SEA-2M78	1556.96
FU-653SEA-2M37	1540.56	FU-653SEA-2M79	1557.36
FU-653SEA-2M38	1540.95	FU-653SEA-2M80	1557.77
FU-653SEA-2M39	1541.35	FU-653SEA-2M81	1558.17
FU-653SEA-2M40	1541.75	FU-653SEA-2M82	1558.58
FU-653SEA-2M41	1542.14	FU-653SEA-2M83	1558.98
FU-653SEA-2M42	1542.54	FU-653SEA-2M84	1559.39
FU-653SEA-2M43	1542.94	FU-653SEA-2M85	1559.79
FU-653SEA-2M44	1543.33	FU-653SEA-2M86	1560.20
FU-653SEA-2M45	1543.73	FU-653SEA-2M87	1560.61
FU-653SEA-2M46	1544.13	FU-653SEA-2M88	1561.01
FU-653SEA-2M47	1544.53	FU-653SEA-2M89	1561.42
FU-653SEA-2M48	1544.92	FU-653SEA-2M90	1561.83
FU-653SEA-2M49	1545.32	FU-653SEA-2M91	1562.23
FU-653SEA-2M50	1545.72	FU-653SEA-2M92	1562.64
FU-653SEA-2M51	1546.12	FU-653SEA-2M93	1563.05
FU-653SEA-2M52	1546.52	-	-

All wavelengths are referred to vacuum.

Tolerance is  $\lambda c \pm 0.05\text{nm}$ .

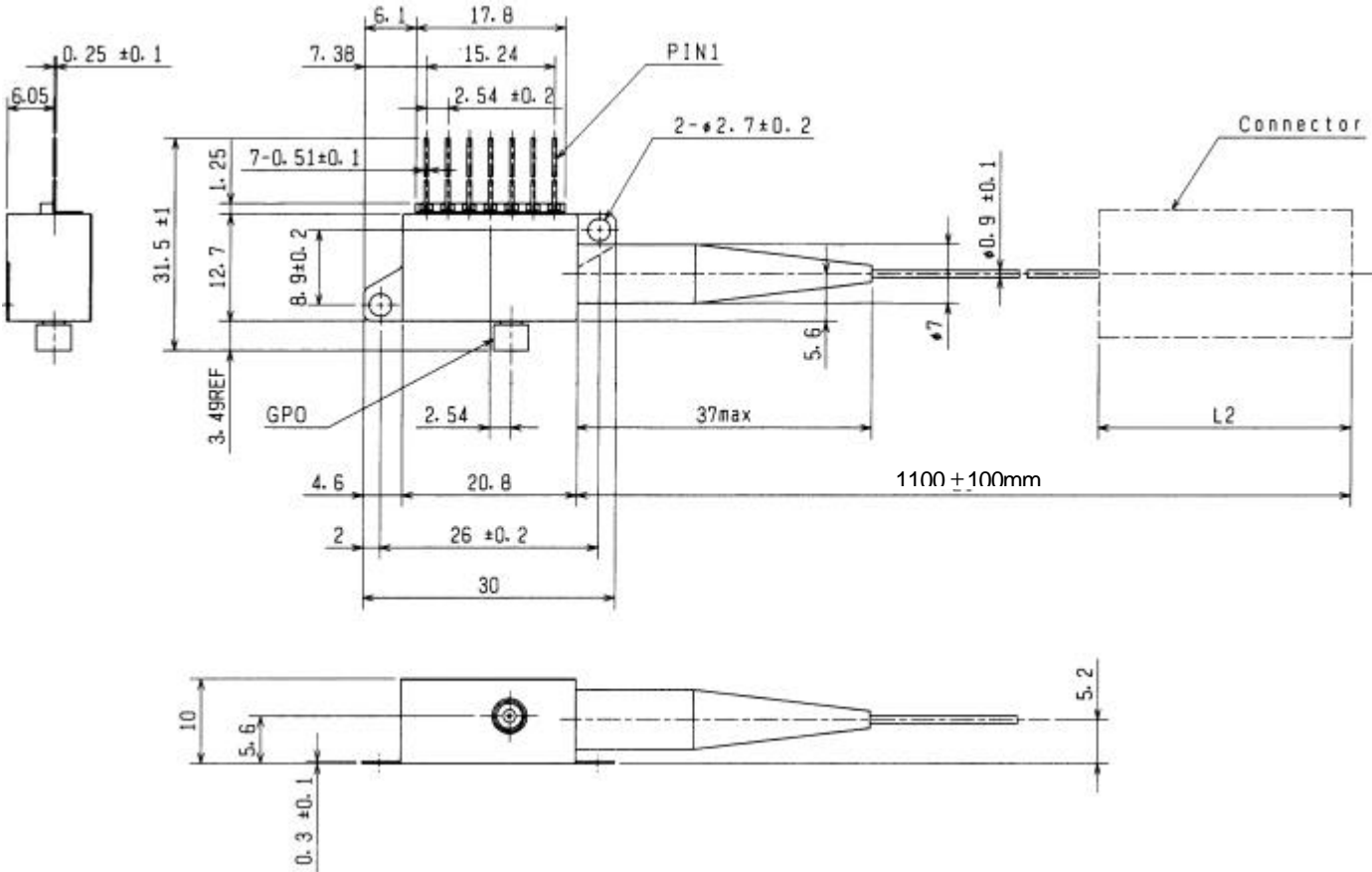
## Thermal characteristics

Item	Symbol	Condition(Note2)	Min.	Typ.	Max.	Unit
Thermistor resistance	Rth	T <sub>c</sub> =25°C,	9.5	10	10.5	kΩ
B constant of Rth	-	-	-	3950	-	K
Cooler current	I <sub>pe</sub>	I <sub>f</sub> =I <sub>op</sub> , T <sub>c</sub> =70°C	-	0.7	1.2	A
Cooler voltage	V <sub>pe</sub>	I <sub>f</sub> =I <sub>op</sub> , T <sub>c</sub> =70°C	-	1.7	2.5	V

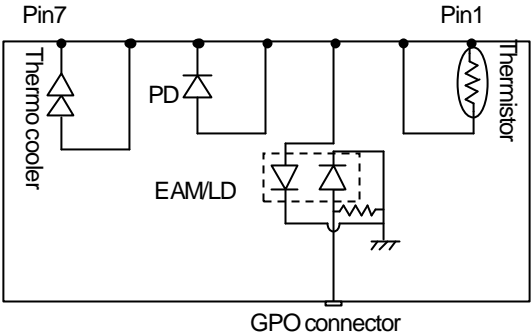
## 4. Fiber pigtail specification

Item	Specification	Unit
Type	SM	-
Mode field diameter	9.5±1	μm
Cladding diameter	125±2	μm
Secondary coating outer diameter	0.9±0.1	mm
Connector	See fig.1	-
Optical return loss of connector	40(min)	dB

Figure 1 Outline drawing



Connector type	Identical type number
No connector	FU-653SEA-2M**
FC/PC	FU-653SEA-V2M**
SC/PC	FU-653SEA-W2M**



Pin No.	Pin assignments
1	Thermistor
2	Thermistor
3	LD bias (Anode)
4	Monitor PD (Anode)
5	Monitor PD (Cathode)
6	Cooler (Anode)
7	Cooler (Cathode)