

**Preliminary**

APPROVED	APPROVED	APPROVED
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Preliminary specification of 10Gb/s EML module

Type No.=FU-653SEA-1M5 (Dispersion=1200ps/nm)

Type No.=FU-653SEA-1M6 (Dispersion=1600ps/nm)

A	B	C	D
	x		
DATE		Approved	
20.Nov.'01		T.Nambara	

## FEATURES

- Input impedance is 50Ω
- Integrated Electro-absorption Modulator
- Distributed feed-back(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

Parameter	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 (T<sub>ld</sub>=T<sub>c</sub>=25°C, unless otherwise noted)

Parameter	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	-	-	1.6	V	
Input impedance	Z <sub>in</sub>	I <sub>f</sub> =I <sub>op</sub>	-	50	-	Ω	
Optical output power from fiber end	P <sub>f</sub>	(Note 3,4)	-3	-	-	dBm	
Light emission central wavelength	λ <sub>c</sub>	(Note 3,4)	1530	1550	1565	nm	
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, f=10GHz	-	-	-135	dB/Hz	
Dispersion penalty	D <sub>p</sub>	(Note 3,4), D=1200ps/nm(60km fiber)	-	-	2.0	dB	FU-653SEA-1M5
		(Note 3,4), D=1600ps/nm(80km fiber)	-	-	2.0	dB	FU-653SEA-1M6
Extinction ratio	E <sub>x</sub>	(Note 3,4)	9.0	-	-	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	10	-	-	GHz	
RF return loss	S <sub>11</sub>	I <sub>f</sub> =I <sub>op</sub> , V <sub>m</sub> =-1V, f≤5GHz	10	15	-	dB	
		I <sub>f</sub> =I <sub>op</sub> , V <sub>m</sub> =-1V, f≤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	μA	
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	

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>=1.5~2.5V, V<sub>off</sub>=0 ~ -1V

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

Note 5 : E<sub>r</sub>=max | 10×log(P<sub>f</sub>/P<sub>f</sub>@25°C) |

## 3. Thermal characteristics

Item	Symbol	Condition(Note2)	Min.	Typ.	Max.	Unit
Thermistor resistance	Rth	Tc=Tld=25°C,	9.5	10	10.5	Ω
B constant of Rth	B	-	-	3950	-	K
Cooling capacity	ΔT	Tld=25°C	40	-	-	°C
Cooler current	Ipe	If=Iop, Tc=70°C	-	0.7	1.2	A
Cooler voltage	Vpe	If=Iop, Tc=70°C	-	1.7	2.5	V

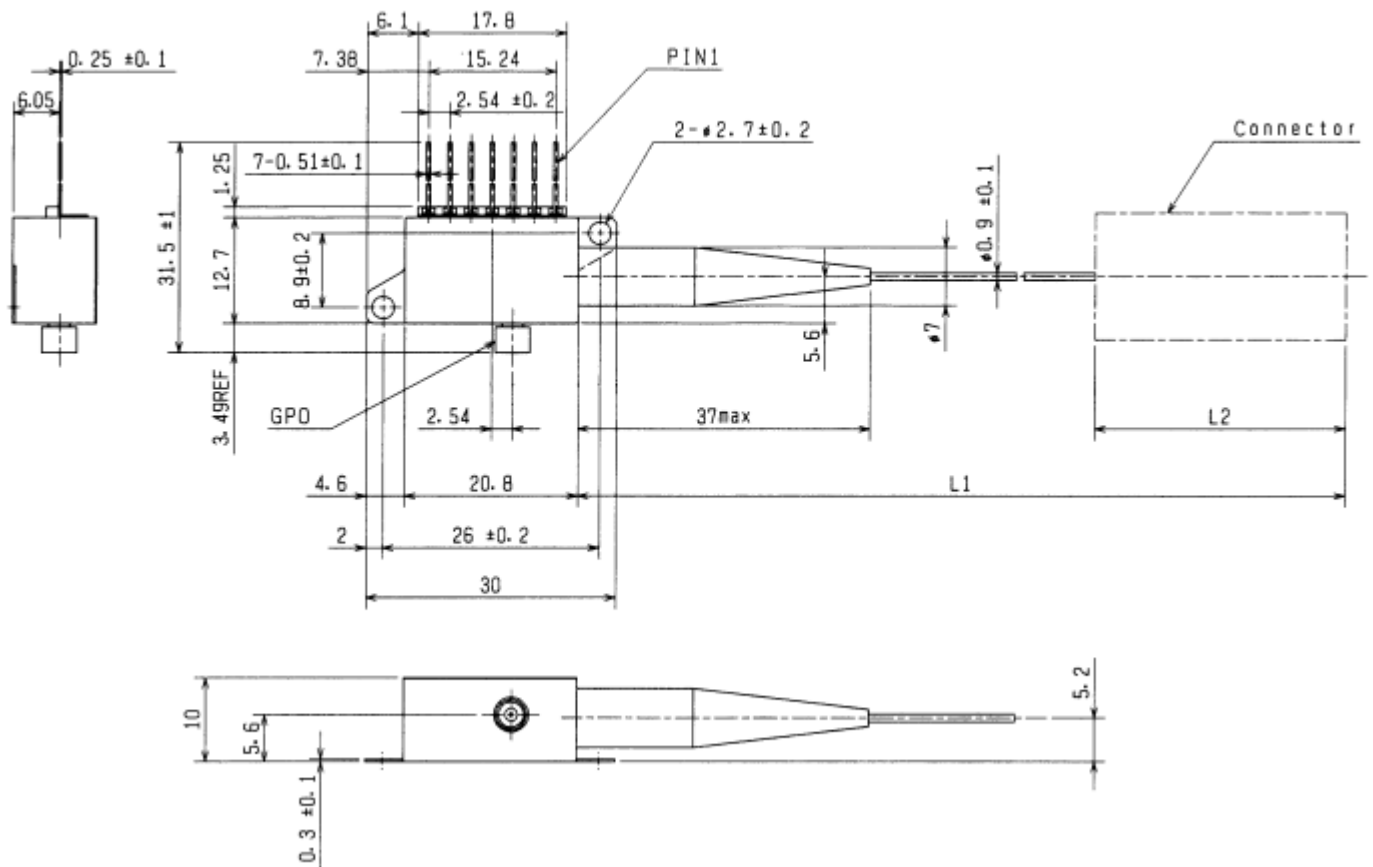
## 4. Fiber pigtail specification

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	Dispersion
No connector	FU-653SEA-1M5	1200ps/nm
	FU-653SEA-1M6	1600ps/nm
SC/PC	FU-653SEA-W1M5	1200ps/nm
	FU-653SEA-W1M6	1600ps/nm
FC/PC	FU-653SEA-V1M5	1200ps/nm
	FU-653SEA-V1M6	1600ps/nm

NOTES 1. TOLERANCES UNLESS NOTED ±0.5



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

