

25 September, 2002

Approved	Approved	Charged
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SPECIFICATION PROPOSAL
Wavelength-Selected Direct Modulated DFB-LD Module
FU-68SDF-x902MxxB

A	B	C	D
	x		
Date		Approved	
26 Sep.'02		T.Namabra	

MITSUBISHI ELECTRIC CORPORATION

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MITSUBISHI (OPTICAL DEVICES)

FU-68SDF-x902MxxB

**1.55 μm DFB-LD MODULE WITH SINGLEMODE FIBER PIGTAIL
(WAVELENGTH SELECTED, BIAS CIRCUIT INTEGRATED, DIGITAL APPLICATION)**

DESCRIPTION

Module type FU-68SDF-x902MxxB is a 1.55 μm DFB-LD module with polarization maintaining optical fiber. This module is suitable to a directly modulated light source for use in 2.5Gb/s digital optical communication systems.

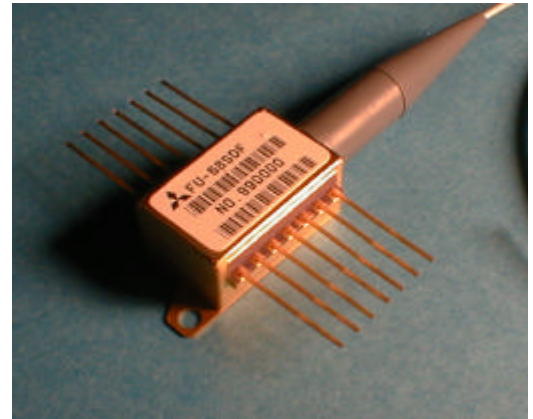
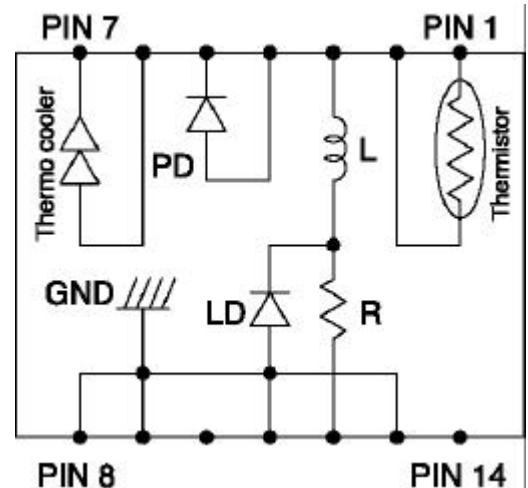
This module is prepared in accordance with ITU-T recommendation wavelength channel plan for Dense-WDM transmission.

FEATURES

- Long haul transmission (+3000ps/nm dispersion)
- Input impedance is 25 Ω
- Multi quantum wells (MQW) DFB Laser Diode module
- Emission wavelength is in full C band
- Polarization maintaining optical fiber pig-tail
- Built-in optical isolator
- Built-in thermal electric cooler
- Butterfly package
- With photodiode for optical output monitor

APPLICATION

High speed transmission systems (~2.5Gb/s)
Dense-WDM systems

**PIN INFORMATION**

PIN	FUNCTION
1	Thermistor
2	Thermistor
3	LD DC Bias (Cathode)
4	PD Anode
5	PD Cathode
6	Cooler Anode
7	Cooler Cathode
8	GND
9	GND
10	NC
11	LD Anode, GND
12	LD RF Input (Cathode)
13	LD Anode, GND
14	NC

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ABSOLUTE MAXIMUM RATINGS (Tld=Tset)

Parameter		Symbol	Conditions	Rating	Unit
Laser diode	Optical output power	Pf	CW	6	mW
	Forward current	If	CW	150	mA
	Reverse voltage	Vrl	-	2	V
Photodiode	Reverse voltage	Vrd	-	20	V
	Forward current	Ifd	-	2	mA
Thermo-electric cooler (Note)	Cooler current	Ipe	-	1.3	A
	Cooler voltage	Vpe	-	3.1	V
Operating case temperature		Tc	-	-20 ~ 70	°C
Storage temperature		Tstg	-	-40 ~ 85	°C

Note) Even if the thermo-electric cooler (TEC) is operated within the rated conditions, uncontrolled current loading or operation without heatsink 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.

ELECTRICAL/OPTICAL CHARACTERISTICS (Tld=Tset, Tc=25°C unless otherwise noted)

Parameter	Symbol	Test Conditions	Limits			Unit
			Min.	Typ.	Max.	
Threshold current	Ith	CW	-	10	25	mA
Optical output power at threshold current	Pth	CW, If=Ith	-	-	100	μW
Operating current	Iop	CW, Pf=2mW	-	40	65	mA
Operating voltage	Vop	CW, Pf=2mW	-	1.3	1.8	V
Input impedance	Zin	Pf=2mW	-	25	-	Ω
Light-emission central wavelength	λ_c	(Note 1)	See Ordering Information and Table 1			nm
Central wavelength drift with case temp.	$\Delta\lambda_c/\Delta T_c$	Tc=-20~70°C	-1	-	0	pm/°C
Laser operating temperature	Tset	-	20	-	35	°C
Spectral width	$\Delta\lambda$	(Note 1), -20dB	-	0.2	0.4	nm
Side mode suppression ratio	Sr	(Note 1)	33	40	-	dB
Dispersion penalty	Pp	(Note 1), at 10^{-10} BER, +3000ps/nm	-	-	2	dB
Cutoff frequency (-1.5dB optical)	fc	Pf=2mW	3.5	-	-	GHz
Rise and fall time (10~90%)	tr, tf	(Note 1)	-	-	150	psec
Relative intensity noise	Nr	CW, Pf=2mW, 0.5~3GHz	-	-155	-145	dB/Hz
Tracking error (Note 2)	Er	Tc=-20~70°C, APC, ATC	-	-	0.5	dB
Differential efficiency	η	CW, Pf=2mW	0.057	0.07	0.15	mW/mA
Linearity	$\Delta\eta$	CW, Pf=0.2~2.4mW, (Note 3)	-20	-	20	%
Monitor current	Imon	CW, Pf=2mW, Vrd=5V	0.1	-	2	mA
Optical isolation	Iso	Tc=25°C	35	-	-	dB
		Tc=-20~70°C	23	-	-	
Dark current (PD)	Id	Vrd=5V, Tc=-20~70°C	-	-	0.1	μA
Capacitance (PD)	Ct	Vrd=5V, f=1MHz	-	-	10	pF

Note 1) 2.48832Gb/s NRZ, 2^{23} -1, Pf_ave=1mW, Extinction ratio 9dB, optical return loss of the connectors should be greater than 40dB in order to ensure the specified performance.

Note 2) $E_r = \max[10 \times \log(P_f / P_{f@25^\circ\text{C}})]$

Note 3) Variation of the differential efficiency from the straight line between 0.2mW and 2.4mW.

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THERMAL CHARACTERISTICS (T_{ld}=T_{set}, T_c=-20~70°C)

Parameter	Symbol	Test Conditions	Limits			Unit
			Min.	Typ.	Max.	
Thermistor resistance	R _{th}	T _{ld} =25°C	9.5	10	10.5	k Ω
B constant of R _{th}	B	-	-	3950	-	K
Cooling capacity	ΔT	P _f =2mW, T _c =70°C	50	-	-	°C
Cooler current	I _{pe}	P _f =2mW, T _c =70°C, T _{ld} =T _{set}	-	0.6	1	A
Cooler voltage	V _{pe}	P _f =2mW, T _c =70°C, T _{ld} =T _{set}	-	1.2	2	V

FIBER PIGTAIL SPECIFICATIONS

Parameter	Limits	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	(Note 4)	-
Optical return loss of connector	40 (min)	dB

Note 4) SC/PC and FC/PC are available. Other connectors are also available for large quantities.

DOCUMENTATION (T_{ld}=T_{set})

- Fiber output power vs. Laser forward current at T_{ld}=T_{set} and T_c=25°C
- Threshold current (I_{th})
- Laser forward current (I_{op}) at P_f=2mW
- Laser forward voltage (V_{op}) at P_f=2mW
- Laser operating temperature (T_{set}) at λ_c (Note 5)
- Monitor current (I_{mon}) at P_f=2mW
- Thermistor resistance (R_{th})
- Cooler current (I_{pe}) at P_f=2mW and T_c=70°C
- Cooler voltage (V_{pe}) at P_f=2mW and T_c=70°C

Note 5) T_{set} is attached as a reference data. R_{th} should be used in order to tune the wavelength to the specified value accurately.

ORDERING INFORMATION**FU-68SDF- 902M B****I Code (See Table 1)****Connector Code**

Connector Code	Connector type	
W	SC/PC	Standard
V	FC/PC	Optional

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Table 1.

f [THz]	λ_c [nm]	λ code	f [THz]	λ_c [nm]	λ code
196.30	1527.22	3	192.80	1554.94	73
196.20	1527.99	5	192.70	1555.75	75
196.10	1528.77	7	192.60	1556.55	77
196.00	1529.55	9	192.50	1557.36	79
195.90	1530.33	11	192.40	1558.17	81
195.80	1531.12	13	192.30	1558.98	83
195.70	1531.90	15	192.20	1559.79	85
195.60	1532.68	17	192.10	1560.61	87
195.50	1533.47	19	192.00	1561.42	89
195.40	1534.25	21	191.90	1562.23	91
195.30	1535.04	23	191.80	1563.05	93
195.20	1535.82	25	191.70	1563.86	95
195.10	1536.61	27			
195.00	1537.40	29			
194.90	1538.19	31			
194.80	1538.98	33			
194.70	1539.77	35			
194.60	1540.56	37			
194.50	1541.35	39			
194.40	1542.14	41			
194.30	1542.94	43			
194.20	1543.73	45			
194.10	1544.53	47			
194.00	1545.32	49			
193.90	1546.12	51			
193.80	1546.92	53			
193.70	1547.72	55			
193.60	1548.51	57			
193.50	1549.32	59			
193.40	1550.12	61			
193.30	1550.92	63			
193.20	1551.72	65			
193.10	1552.52	67			
193.00	1553.33	69			
192.90	1554.13	71			

All wavelengths are referred to vacuum. Tolerance is $\lambda_c \pm 0.05 \text{ nm}$.

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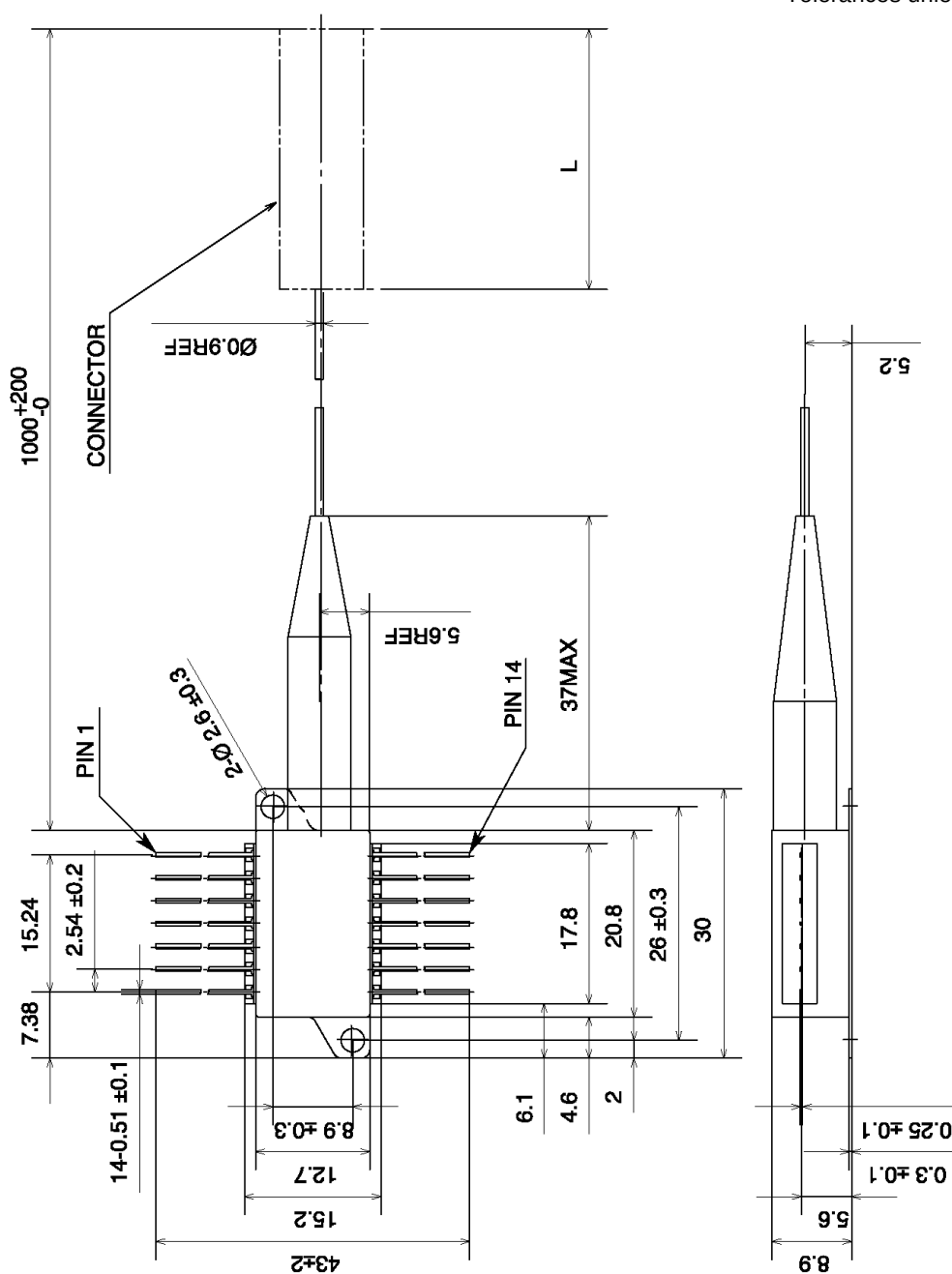
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OUTLINE DIAGRAM

Unit : mm

Tolerances unless noted ± 0.5



Identified type number	Connector type	L
FU-68SDF-W902MxxB	SC/PC	35REF
FU-68SDF-V902MxxB	FC/PC	28REF