

# TENTATIVE

MITSUBISHI (OPTICAL DEVICES)

## FU-68SDF-V802MxxxB

1.58  $\mu\text{m}$  (L-Band) DFB-LD MODULE WITH SINGLEMODE FIBER PIGTAIL  
(WAVELENGTH SELECTED, BIAS CIRCUIT INTEGRATED, DIGITAL APPLICATION)

### DESCRIPTION

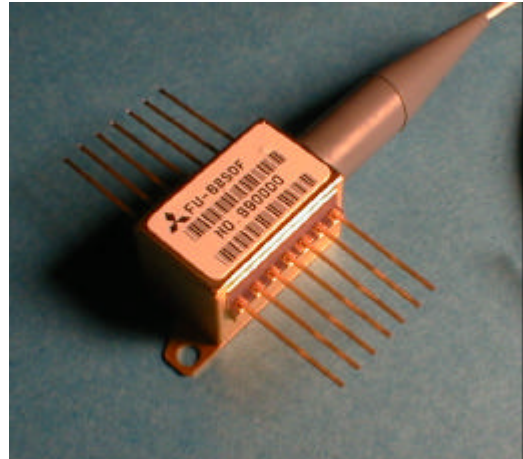
Module type FU-68SDF-V802MxxxB is a 1.58 $\mu\text{m}$  (L-Band) DFB-LD module with single-mode optical fiber.

This module is suitable to a directly modulated light source for use in 2.5Gb/s digital optical communication systems.

This module is prepared to expand the wavelength channels into L-Band for Dense-WDM transmission.

### FEATURES

- Multi quantum wells (MQW) DFB Laser Diode module
- Input impedance is 25 $\Omega$
- Emission wavelength is in 1.58 $\mu\text{m}$  band
- High-speed response
- 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

### OPTION

- Wavelength option:  
1565nm~1625nm are available

### ABSOLUTE MAXIMUM RATINGS (T<sub>ld</sub>=T<sub>set</sub>)

Parameter		Symbol	Conditions	Rating	Unit
Laser diode	Optical output power	Pf	CW	6	mW
	Forward current	I <sub>f</sub>	CW	150	mA
	Reverse voltage	V <sub>rl</sub>	-	2	V
Photodiode	Reverse voltage	V <sub>rd</sub>	-	20	V
	Forward current	I <sub>fd</sub>	-	2	mA
Thermo-electric cooler (Note)	Cooler current	I <sub>pe</sub>	-	1.3	A
	Cooler voltage	V <sub>pe</sub>	-	3.1	V
Operating case temperature		T <sub>c</sub>	-	-20 ~ 70	°C
Storage temperature		T <sub>stg</sub>	-	-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.

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(WAVELENGTH SELECTED, BIAS CIRCUIT INTEGRATED, DIGITAL APPLICATION)****ELECTRICAL/OPTICAL CHARACTERISTICS** (T<sub>ld</sub>=T<sub>set</sub>, T<sub>c</sub>=25°C unless otherwise noted)

Parameter	Symbol	Test Conditions	Limits			Unit
			Min.	Typ.	Max.	
Threshold current	I <sub>th</sub>	CW	-	10	25	mA
Optical output power at threshold current	P <sub>th</sub>	CW, I <sub>f</sub> =I <sub>th</sub>	-	-	100	$\mu\text{W}$
Operating current	I <sub>op</sub>	CW, P <sub>f</sub> =2mW	-	40	65	mA
Operating voltage	V <sub>op</sub>	CW, P <sub>f</sub> =2mW	-	1.3	1.8	V
Input impedance	Z <sub>in</sub>	P <sub>f</sub> =2mW	-	25	-	$\Omega$
Light-emission central wavelength	$\lambda_c$	(Note 1)	(Note 2)			nm
Central wavelength drift with case temp.	$\Delta\lambda_c/\Delta T_c$	T <sub>c</sub> =-20~70°C	-1	-	0	pm/°C
Laser operating temperature	T <sub>set</sub>	-	20	-	35	°C
Spectral width	$\Delta\lambda$	(Note 1), -20dB	-	0.2	0.4	nm
Side mode suppression ratio	S <sub>r</sub>	(Note 1)	33	40	-	dB
Dispersion penalty	P <sub>p</sub>	(Note 1), at 10 <sup>-10</sup> BER, +1800ps/nm	-	-	2	dB
Cutoff frequency (-1.5dB optical)	f <sub>c</sub>	P <sub>f</sub> =2mW	3.5	-	-	GHz
Rise and fall time (10~90%)	t <sub>r</sub> , t <sub>f</sub>	(Note 1)	-	-	150	psec
Relative intensity noise	N <sub>r</sub>	CW, P <sub>f</sub> =2mW, 0.5~3GHz	-	-155	-145	dB/Hz
Tracking error (Note 3)	E <sub>r</sub>	T <sub>c</sub> =-20~70°C, APC, ATC	-	-	0.5	dB
Differential efficiency	$\eta$	CW, P <sub>f</sub> =2mW	0.057	0.07	0.15	mW/ mA
Linearity	$\Delta\eta$	CW, P <sub>f</sub> =0.2~2.4mW, (Note 4)	-20	-	20	%
Monitor current	I <sub>mon</sub>	CW, P <sub>f</sub> =2mW, V <sub>rd</sub> =5V	0.1	-	2	mA
Optical isolation	I <sub>so</sub>	T <sub>c</sub> =25°C	35	-	-	dB
		T <sub>c</sub> =-20~70°C	23	-	-	
Dark current (PD)	I <sub>d</sub>	V <sub>rd</sub> =5V, T <sub>c</sub> =-20~70°C	-	-	0.1	$\mu\text{A}$
Capacitance (PD)	C <sub>t</sub>	V <sub>rd</sub> =5V, f=1MHz	-	-	10	pF

Note 1) 2.48832Gb/s NRZ, 2<sup>23</sup>-1, P<sub>f\_ave</sub>=1mW, Extinction ratio 10dB, optical return loss of the connectors should be greater than 40dB in order to ensure the specified performance.

Note 2) See Table 1.

Note 3)  $E_r = \max\{10 \times \log(P_f / P_{f@25^\circ\text{C}})\}$

Note 4) Variation of the differential efficiency from the straight line between 0.2mW and 2mW.

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**THERMAL CHARACTERISTICS (T<sub>ld</sub>=T<sub>set</sub>, T<sub>c</sub>=-20~70°C)**

Parameter	Symbol	Test Conditions	Limits			Unit
			Min.	Typ.	Max.	
Thermistor resistance	R <sub>th</sub>	T <sub>ld</sub> =25°C	9.5	10	10.5	kΩ
B constant of R <sub>th</sub>	B	-	-	3950	-	K
Cooling capacity	ΔT	P <sub>f</sub> =2mW, T <sub>c</sub> =70°C	50	-	-	°C
Cooler current	I <sub>pe</sub>	P <sub>f</sub> =2mW, T <sub>c</sub> =70°C, T <sub>ld</sub> =T <sub>set</sub>	-	0.6	1	A
Cooler voltage	V <sub>pe</sub>	P <sub>f</sub> =2mW, T <sub>c</sub> =70°C, T <sub>ld</sub> =T <sub>set</sub>	-	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	FC/PC	-
Optical return loss of connector	40 (min)	dB

**DOCUMENTATION (T<sub>ld</sub>=T<sub>set</sub>)**

- Fiber output power vs. Laser forward current at T<sub>ld</sub>=T<sub>set</sub> and T<sub>c</sub>=-20,25,70°C
- BER curves at 2.48832Gb/s modulation
- Threshold current (I<sub>th</sub>)
- Laser forward current (I<sub>op</sub>) at P<sub>f</sub>=2mW
- Laser forward voltage (V<sub>op</sub>) at P<sub>f</sub>=2mW
- Laser operating temperature (T<sub>set</sub>) at λ<sub>c</sub> (Note 5)
- Monitor current (I<sub>mon</sub>) at P<sub>f</sub>=2mW
- Thermistor resistance (R<sub>th</sub>)
- Cooler current (I<sub>pe</sub>) at P<sub>f</sub>=2mW and T<sub>c</sub>=70°C
- Cooler voltage (V<sub>pe</sub>) at P<sub>f</sub>=2mW and T<sub>c</sub>=70°C

Note 5) T<sub>set</sub> is attached as a reference data. R<sub>th</sub> should be used in order to tune the wavelength to the specified value accurately.

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Table 1.

Type number	$\lambda_c$ (nm)	Type number	$\lambda_c$ (nm)	Type number	$\lambda_c$ (nm)
FU-68SDF-V802M103B	1567.13	FU-68SDF-V802M139B	1582.02	FU-68SDF-V802M175B	1597.19
FU-68SDF-V802M104B	1567.54	FU-68SDF-V802M140B	1582.44	FU-68SDF-V802M176B	1597.62
FU-68SDF-V802M105B	1567.95	FU-68SDF-V802M141B	1582.85	FU-68SDF-V802M177B	1598.04
FU-68SDF-V802M106B	1568.36	FU-68SDF-V802M142B	1583.27	FU-68SDF-V802M178B	1598.47
FU-68SDF-V802M107B	1568.77	FU-68SDF-V802M143B	1583.69	FU-68SDF-V802M179B	1598.89
FU-68SDF-V802M108B	1569.18	FU-68SDF-V802M144B	1584.11	FU-68SDF-V802M180B	1599.32
FU-68SDF-V802M109B	1569.59	FU-68SDF-V802M145B	1584.53	FU-68SDF-V802M181B	1599.75
FU-68SDF-V802M110B	1570.01	FU-68SDF-V802M146B	1584.95	FU-68SDF-V802M182B	1600.17
FU-68SDF-V802M111B	1570.42	FU-68SDF-V802M147B	1585.36	FU-68SDF-V802M183B	1600.60
FU-68SDF-V802M112B	1570.83	FU-68SDF-V802M148B	1585.78	FU-68SDF-V802M184B	1601.03
FU-68SDF-V802M113B	1571.24	FU-68SDF-V802M149B	1586.20	FU-68SDF-V802M185B	1601.46
FU-68SDF-V802M114B	1571.65	FU-68SDF-V802M150B	1586.62	FU-68SDF-V802M186B	1601.88
FU-68SDF-V802M115B	1572.06	FU-68SDF-V802M151B	1587.04	FU-68SDF-V802M187B	1602.31
FU-68SDF-V802M116B	1572.48	FU-68SDF-V802M152B	1587.46	FU-68SDF-V802M188B	1602.74
FU-68SDF-V802M117B	1572.89	FU-68SDF-V802M153B	1587.88	FU-68SDF-V802M189B	1603.17
FU-68SDF-V802M118B	1573.30	FU-68SDF-V802M154B	1588.30	FU-68SDF-V802M190B	1603.60
FU-68SDF-V802M119B	1573.71	FU-68SDF-V802M155B	1588.73	FU-68SDF-V802M191B	1604.03
FU-68SDF-V802M120B	1574.13	FU-68SDF-V802M156B	1589.15	FU-68SDF-V802M192B	1604.46
FU-68SDF-V802M121B	1574.54	FU-68SDF-V802M157B	1589.57	FU-68SDF-V802M193B	1604.88
FU-68SDF-V802M122B	1574.95	FU-68SDF-V802M158B	1589.99	FU-68SDF-V802M194B	1605.31
FU-68SDF-V802M123B	1575.37	FU-68SDF-V802M159B	1590.41	FU-68SDF-V802M195B	1605.74
FU-68SDF-V802M124B	1575.78	FU-68SDF-V802M160B	1590.83	FU-68SDF-V802M196B	1606.17
FU-68SDF-V802M125B	1576.20	FU-68SDF-V802M161B	1591.26	FU-68SDF-V802M197B	1606.60
FU-68SDF-V802M126B	1576.61	FU-68SDF-V802M162B	1591.68	FU-68SDF-V802M198B	1607.04
FU-68SDF-V802M127B	1577.03	FU-68SDF-V802M163B	1592.10	FU-68SDF-V802M199B	1607.47
FU-68SDF-V802M128B	1577.44	FU-68SDF-V802M164B	1592.52	FU-68SDF-V802M200B	1607.90
FU-68SDF-V802M129B	1577.86	FU-68SDF-V802M165B	1592.95	FU-68SDF-V802M201B	1608.33
FU-68SDF-V802M130B	1578.27	FU-68SDF-V802M166B	1593.37	FU-68SDF-V802M202B	1608.76
FU-68SDF-V802M131B	1578.69	FU-68SDF-V802M167B	1593.79	FU-68SDF-V802M203B	1609.19
FU-68SDF-V802M132B	1579.10	FU-68SDF-V802M168B	1594.22	FU-68SDF-V802M204B	1609.62
FU-68SDF-V802M133B	1579.52	FU-68SDF-V802M169B	1594.64	FU-68SDF-V802M205B	1610.06
FU-68SDF-V802M134B	1579.93	FU-68SDF-V802M170B	1595.06	FU-68SDF-V802M206B	1610.49
FU-68SDF-V802M135B	1580.35	FU-68SDF-V802M171B	1595.49	FU-68SDF-V802M207B	1610.92
FU-68SDF-V802M136B	1580.77	FU-68SDF-V802M172B	1595.91	FU-68SDF-V802M208B	1611.35
FU-68SDF-V802M137B	1581.18	FU-68SDF-V802M173B	1596.34	FU-68SDF-V802M209B	1611.79
FU-68SDF-V802M138B	1581.60	FU-68SDF-V802M174B	1596.76		

All wavelengths are referred to vacuum.

Tolerance is  $\lambda_c \pm 0.05\text{nm}$ .

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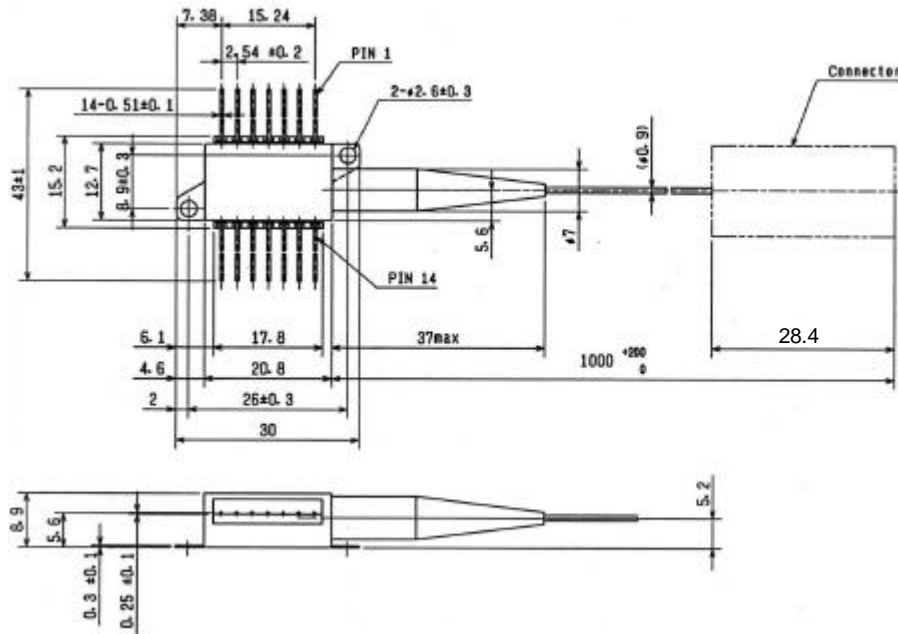
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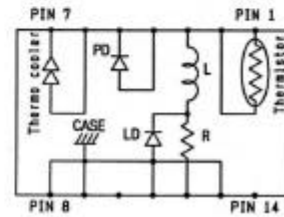
## OUTLINE DIAGRAM

(Unit : mm)

NOTES 1. TOLERANCES UNLESS NOTED+0.5



PIN	FUNCTION
1	THERMISTOR
2	THERMISTOR
3	LD BIAS (-)
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
13	LD ANODE, GND
14	NC



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