

July 12, 2001

Approved	Approved	Charged
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## Specification of wavelength monitor integrated DFB-LD module

Module type: FU-672PDF-V1MxxA

A	B	C	D
	x		
Date		Approved	
13.July '01		T.Nambara	

## MITSUBISHI ELECTRIC CORPORATION

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MITSUBISHI (OPTICAL DEVICES)  
**FU-672PDF-V1MxxA**

**WAVELENGTH MONITOR INTEGRATED 1.55  $\mu\text{m}$  DFB-LD MODULE  
 WITH POLARIZATION MAINTAINING FIBER PIGTAIL  
 (WAVELENGTH SELECTED, DIGITAL APPLICATION)**

**DESCRIPTION**

Module type FU-672PDF-V1MxxA is a wavelength monitor integrated 1.55 $\mu\text{m}$  DFB-LD module with polarization maintaining optical fiber.

This module is suitable to a CW light source for external modulator for use in 2.5Gb/s and 10Gb/s digital optical communication systems.

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

**FEATURES**

- Multi quantum wells (MQW) DFB Laser Diode module
- Emission wavelength is in 1.55 $\mu\text{m}$  band
- Polarization maintaining optical fiber pig-tail
- Built-in optical isolator
- Built-in thermal electric cooler
- Butterfly package
- With 2 photodiodes for wavelength monitor and optical output power monitor

**APPLICATION**

High speed transmission systems (~10Gb/s)  
 Dense-WDM systems

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

Parameter		Symbol	Conditions	Rating	Unit
Laser diode	Optical output power	Pf	CW	15	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 ~ 70	°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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**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
Operating current	I <sub>op</sub>	CW, P <sub>f</sub> =10mW	-	-	100	mA
Operating voltage	V <sub>op</sub>	CW, P <sub>f</sub> =10mW	-	-	1.8	V
Input impedance	Z <sub>in</sub>	P <sub>f</sub> =10mW	-	25	-	$\Omega$
Light-emission central wavelength	$\lambda_c$	CW, P <sub>f</sub> =10mW	(Note 1)			nm
Wavelength drift after 15 years	$\Delta\lambda_c$	CW, P <sub>f</sub> =10mW, APC, ATC, AFC (Note 2)	-30	-	30	pm
Laser operating temperature	T <sub>set</sub>	-	20	-	35	°C
Spectral line width	$\Delta f$	CW, P <sub>f</sub> =10mW	-	-	20	MHz
Side mode suppression ratio	S <sub>r</sub>	CW, P <sub>f</sub> =10mW	33	40	-	dB
Cut-off frequency (-1.5dB optical)	f <sub>c</sub>	P <sub>f</sub> =10mW	0.5	-	-	GHz
Polarization extinction ratio	E <sub>x</sub>	CW, P <sub>f</sub> =10mW	20	25	-	dB
Relative intensity noise	N <sub>r</sub>	CW, P <sub>f</sub> =10mW, 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> =10mW	0.1	-	-	mW/ mA
Power monitor current	I <sub>pm</sub>	CW, P <sub>f</sub> =10mW, V <sub>rd</sub> =5V	20	-	400	$\mu\text{A}$
Wavelength monitor current	I <sub>wm</sub>	CW, P <sub>f</sub> =10mW, V <sub>rd</sub> =5V	15	-	300	$\mu\text{A}$
Wavelength discriminator slope (Note 4)	D <sub>s</sub>	CW, P <sub>f</sub> =10mW, V <sub>rd</sub> =5V	-	0.09	-	$\mu\text{A}/\text{GHz}$
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	-	-	30	pF

Note 1) See Table 1.

Note 2) Includes case temperature variation and aging.

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

Note 4) See Figure 1.

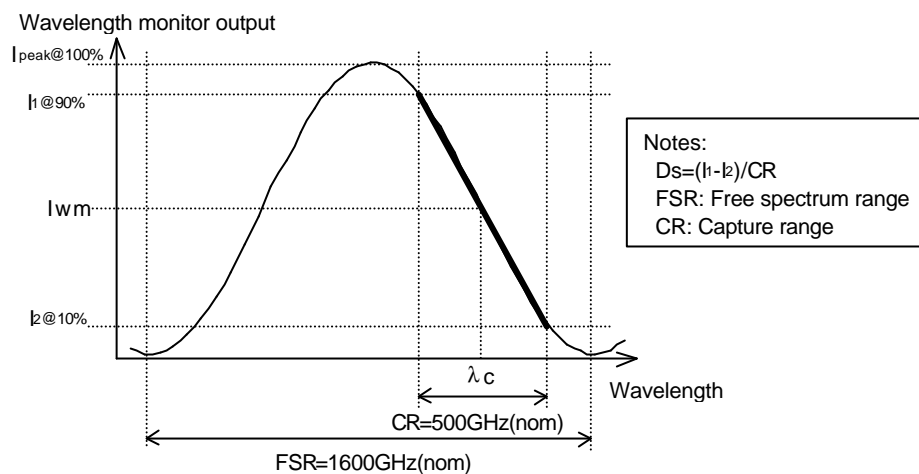


Figure 1. Wavelength discriminator curve

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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	k $\Omega$
B constant of R <sub>th</sub>	B	-	-	3950	-	K
Cooling capacity	$\Delta T$	P <sub>f</sub> =10mW, T <sub>c</sub> =70°C	50	-	-	°C
Cooler current	I <sub>pe</sub>	P <sub>f</sub> =10mW, 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> =10mW, 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	PM (Note 5)	-
Mode field diameter	10.5 $\pm$ 1	$\mu\text{m}$
Cladding diameter	125 $\pm$ 3	$\mu\text{m}$
Secondary coating outer diameter	0.9 $\pm$ 0.1	mm
Polarization axis	slow axis	-
Connector	FC/PC	-
Optical return loss of connector	40 (min)	dB

Note 5) PMF - Sumitomo Panda fiber (PM-155)

**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
- Threshold current (I<sub>th</sub>)
- Laser forward current (I<sub>op</sub>) at P<sub>f</sub>=10mW
- Laser forward voltage (V<sub>op</sub>) at P<sub>f</sub>=10mW
- Laser operating temperature (T<sub>set</sub>) at  $\lambda_c$  (Note 6)
- Power monitor current (I<sub>pm</sub>) at P<sub>f</sub>=10mW
- Wavelength monitor current (I<sub>wm</sub>) at P<sub>f</sub>=10mW,  $\lambda_c$
- Thermistor resistance (R<sub>th</sub>)
- Cooler current (I<sub>pe</sub>) at P<sub>f</sub>=10mW and T<sub>c</sub>=70°C
- Cooler voltage (V<sub>pe</sub>) at P<sub>f</sub>=10mW and T<sub>c</sub>=70°C

Note 6) 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-672PDF-V1M3A	1527.22	FU-672PDF-V1M36A	1540.16	FU-672PDF-V1M69A	1553.33
FU-672PDF-V1M4A	1527.60	FU-672PDF-V1M37A	1540.56	FU-672PDF-V1M70A	1553.73
FU-672PDF-V1M5A	1527.99	FU-672PDF-V1M38A	1540.95	FU-672PDF-V1M71A	1554.13
FU-672PDF-V1M6A	1528.38	FU-672PDF-V1M39A	1541.35	FU-672PDF-V1M72A	1554.54
FU-672PDF-V1M7A	1528.77	FU-672PDF-V1M40A	1541.75	FU-672PDF-V1M73A	1554.94
FU-672PDF-V1M8A	1529.16	FU-672PDF-V1M41A	1542.14	FU-672PDF-V1M74A	1555.34
FU-672PDF-V1M9A	1529.55	FU-672PDF-V1M42A	1542.54	FU-672PDF-V1M75A	1555.75
FU-672PDF-V1M10A	1529.94	FU-672PDF-V1M43A	1542.94	FU-672PDF-V1M76A	1556.15
FU-672PDF-V1M11A	1530.33	FU-672PDF-V1M44A	1543.33	FU-672PDF-V1M77A	1556.55
FU-672PDF-V1M12A	1530.72	FU-672PDF-V1M45A	1543.73	FU-672PDF-V1M78A	1556.96
FU-672PDF-V1M13A	1531.12	FU-672PDF-V1M46A	1544.13	FU-672PDF-V1M79A	1557.36
FU-672PDF-V1M14A	1531.51	FU-672PDF-V1M47A	1544.53	FU-672PDF-V1M80A	1557.77
FU-672PDF-V1M15A	1531.90	FU-672PDF-V1M48A	1544.92	FU-672PDF-V1M81A	1558.17
FU-672PDF-V1M16A	1532.29	FU-672PDF-V1M49A	1545.32	FU-672PDF-V1M82A	1558.58
FU-672PDF-V1M17A	1532.68	FU-672PDF-V1M50A	1545.72	FU-672PDF-V1M83A	1558.98
FU-672PDF-V1M18A	1533.07	FU-672PDF-V1M51A	1546.12	FU-672PDF-V1M84A	1559.39
FU-672PDF-V1M19A	1533.47	FU-672PDF-V1M52A	1546.52	FU-672PDF-V1M85A	1559.79
FU-672PDF-V1M20A	1533.86	FU-672PDF-V1M53A	1546.92	FU-672PDF-V1M86A	1560.20
FU-672PDF-V1M21A	1534.25	FU-672PDF-V1M54A	1547.32	FU-672PDF-V1M87A	1560.61
FU-672PDF-V1M22A	1534.64	FU-672PDF-V1M55A	1547.72	FU-672PDF-V1M88A	1561.01
FU-672PDF-V1M23A	1535.04	FU-672PDF-V1M56A	1548.11	FU-672PDF-V1M89A	1561.42
FU-672PDF-V1M24A	1535.43	FU-672PDF-V1M57A	1548.51	FU-672PDF-V1M90A	1561.83
FU-672PDF-V1M25A	1535.82	FU-672PDF-V1M58A	1548.91	FU-672PDF-V1M91A	1562.23
FU-672PDF-V1M26A	1536.22	FU-672PDF-V1M59A	1549.32	FU-672PDF-V1M92A	1562.64
FU-672PDF-V1M27A	1536.61	FU-672PDF-V1M60A	1549.72	FU-672PDF-V1M93A	1563.05
FU-672PDF-V1M28A	1537.00	FU-672PDF-V1M61A	1550.12	FU-672PDF-V1M94A	1563.45
FU-672PDF-V1M29A	1537.40	FU-672PDF-V1M62A	1550.52	FU-672PDF-V1M95A	1563.86
FU-672PDF-V1M30A	1537.79	FU-672PDF-V1M63A	1550.92	FU-672PDF-V1M96A	1564.27
FU-672PDF-V1M31A	1538.19	FU-672PDF-V1M64A	1551.32	FU-672PDF-V1M97A	1564.68
FU-672PDF-V1M32A	1538.58	FU-672PDF-V1M65A	1551.72	FU-672PDF-V1M98A	1565.09
FU-672PDF-V1M33A	1538.98	FU-672PDF-V1M66A	1552.12	FU-672PDF-V1M99A	1565.50
FU-672PDF-V1M34A	1539.37	FU-672PDF-V1M67A	1552.52		
FU-672PDF-V1M35A	1539.77	FU-672PDF-V1M68A	1552.93	FU-672PDF-V1M1A	(Note 7)

All wavelengths are referred to vacuum.

Note 7) Any ITU-T wavelength between 1527.22~1565.50nm.

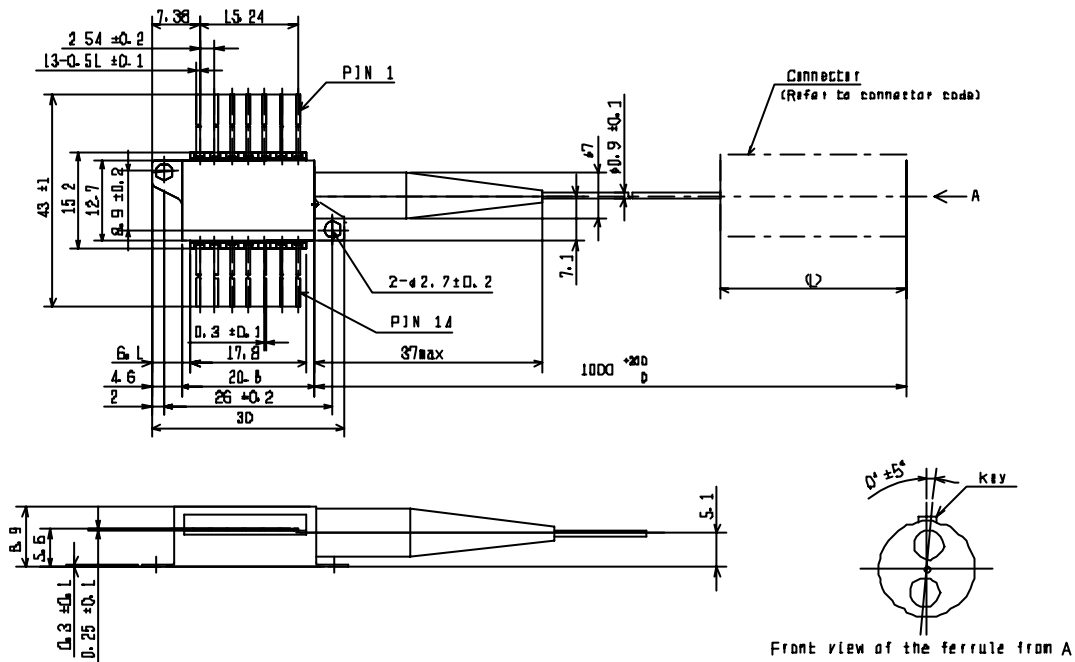
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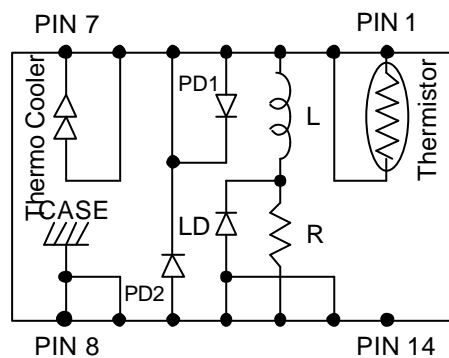
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**OUTLINE DIAGRAM**

(Unit : mm)

NOTE. TOLERANCES UNLESS NOTED  $\pm 0.5$  [mm]

Front view of the ferrule from A



PIN	FUNCTION
1	THERMISTOR
2	THERMISTOR
3	LD BIAS (-)
4	POWER MONITOR PD1 ANODE
5	COMMON PD CATHODE
6	COOLER ANODE
7	COOLER CATHODE
8	GND
9	GND
10	WAVELENGTH MONITOR PD2 ANODE
11	LD ANODE
12	LD RE
13	LD ANODE
14	NC

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