

June 20, 2001

Approved	Approved	Charged
		M.Sato

Specification of wavelength monitor integrated DFB-LD module

Module type: FU-675PDF-V2MxxA

A	B	C	D
	x		
Date		Approved	
01.06.20		Y.Hozumi	

MITSUBISHI ELECTRIC CORPORATION

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MITSUBISHI (OPTICAL DEVICES)

FU-675PDF-V2MxxA

**WAVELENGTH MONITOR INTEGRATED 1.55 μ m DFB-LD MODULE
WITH POLARIZATION MAINTAINING FIBER PIGTAIL
(WAVELENGTH SELECTED, DIGITAL APPLICATION)**

DESCRIPTION

Module type FU-675PDF-V2MxxA is a wavelength monitor integrated 1.55 μ 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 μ 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_{ld}=T_{set})

Parameter		Symbol	Conditions	Rating	Unit
Laser diode	Optical output power	Pf	CW	24	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 ~ 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_{ld}=T_{set}, T_c=25°C unless otherwise noted)

Parameter	Symbol	Test Conditions	Limits			Unit
			Min.	Typ.	Max.	
Threshold current	I _{th}	CW	-	10	25	mA
Operating current	I _{op}	CW, P _f =20mW	-	-	130	mA
Operating voltage	V _{op}	CW, P _f =20mW	-	-	2	V
Light-emission central wavelength	λ_c	CW, P _f =20mW	(Note 1)			nm
Wavelength drift after 15 years	$\Delta\lambda_c$	CW, P _f =20mW, APC, ATC, AFC (Note 2)	-30	-	30	pm
Laser operating temperature	T _{set}	-	15	-	35	°C
Spectral line width	Δf	CW, P _f =20mW	-	-	20	MHz
Side mode suppression ratio	S _r	CW, P _f =20mW	33	40	-	dB
Polarization extinction ratio	E _x	CW, P _f =20mW	20	25	-	dB
Relative intensity noise	N _r	CW, P _f =20mW, 0.5~3GHz	-	-155	-145	dB/Hz
Tracking error (Note 3)	E _r	T _c =-20~70°C, APC, ATC	-	-	0.5	dB
Differential efficiency	η	CW, P _f =20mW	0.15	-	-	mW/ mA
Power monitor current	I _{pm}	CW, P _f =20mW, V _{rd} =5V	35	-	700	μA
Wavelength monitor current	I _{wm}	CW, P _f =20mW, V _{rd} =5V	25	-	500	μA
Wavelength discriminator slope (Note 4)	D _s	CW, P _f =20mW, V _{rd} =5V	-	0.15	-	$\mu\text{A}/\text{GHz}$
Optical isolation	I _{so}	T _c =25°C	35	-	-	dB
		T _c =-20~70°C	23	-	-	
Dark current (PD)	I _d	V _{rd} =5V, T _c =-20~70°C	-	-	0.1	μA
Capacitance (PD)	C _t	V _{rd} =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.

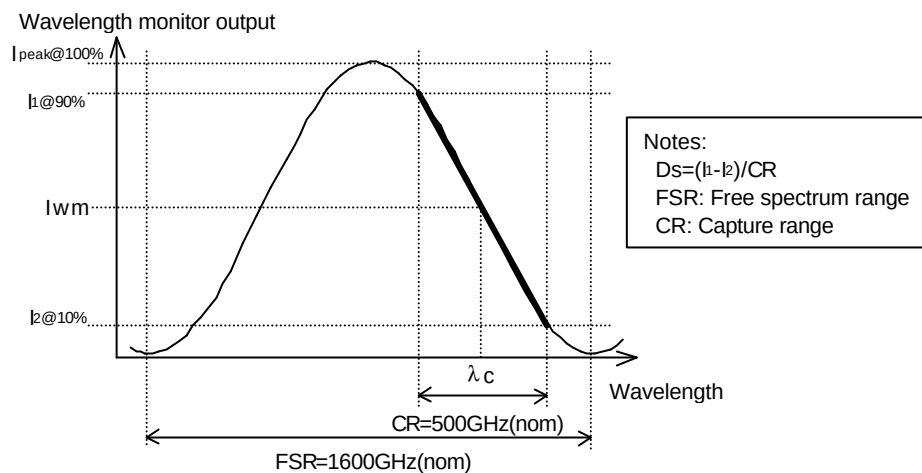


Figure 1. Wavelength discriminator curve

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THERMAL CHARACTERISTICS (Tld=Tset, Tc=-20~70°C)

Parameter	Symbol	Test Conditions	Limits			Unit
			Min.	Typ.	Max.	
Thermistor resistance	Rth	Tld=25°C	9.5	10	10.5	k Ω
B constant of Rth	B	-	-	3950	-	K
Cooling capacity	ΔT	Pf=20mW, Tc=70°C	55	-	-	°C
Cooler current	Ipe	Pf=20mW, Tc=65°C, Tld=Tset	-	0.7	1	A
		Pf=20mW, Tc=70°C, Tld=Tset	-	0.9	1.2	A
Cooler voltage	Vpe	Pf=20mW, Tc=65°C, Tld=Tset	-	1.4	2.3	V
		Pf=20mW, Tc=70°C, Tld=Tset	-	2	2.6	V

FIBER PIGTAIL SPECIFICATIONS

Parameter	Limits	Unit
Type	PM (Note 5)	-
Mode field diameter	10.5 $\pm$ 1	μm
Cladding diameter	125 $\pm$ 3	μm
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 (Tld=Tset)

- Fiber output power vs. Laser forward current at Tld=Tset and Tc=-20,25,70°C
- Threshold current (Ith)
- Laser forward current (Iop) at Pf=20mW
- Laser forward voltage (Vop) at Pf=20mW
- Laser operating temperature (Tset) at λ_c (Note 6)
- Power monitor current (Ipm) at Pf=20mW
- Wavelength monitor current (Iwm) at Pf=20mW, λ_c
- Thermistor resistance (Rth)
- Cooler current (Ipe) at Pf=20mW and Tc=70°C
- Cooler voltage (Vpe) at Pf=20mW and Tc=70°C

Note 6) Tset is attached as a reference data. Rth should be used in order to tune the wavelength to the specified value accurately.

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Table 1.

Type number	λ_c (nm)	Type number	λ_c (nm)	Type number	λ_c (nm)
FU-675PDF-V2M3A	1527.22	FU-675PDF-V2M36A	1540.16	FU-675PDF-V2M69A	1553.33
FU-675PDF-V2M4A	1527.60	FU-675PDF-V2M37A	1540.56	FU-675PDF-V2M70A	1553.73
FU-675PDF-V2M5A	1527.99	FU-675PDF-V2M38A	1540.95	FU-675PDF-V2M71A	1554.13
FU-675PDF-V2M6A	1528.38	FU-675PDF-V2M39A	1541.35	FU-675PDF-V2M72A	1554.54
FU-675PDF-V2M7A	1528.77	FU-675PDF-V2M40A	1541.75	FU-675PDF-V2M73A	1554.94
FU-675PDF-V2M8A	1529.16	FU-675PDF-V2M41A	1542.14	FU-675PDF-V2M74A	1555.34
FU-675PDF-V2M9A	1529.55	FU-675PDF-V2M42A	1542.54	FU-675PDF-V2M75A	1555.75
FU-675PDF-V2M10A	1529.94	FU-675PDF-V2M43A	1542.94	FU-675PDF-V2M76A	1556.15
FU-675PDF-V2M11A	1530.33	FU-675PDF-V2M44A	1543.33	FU-675PDF-V2M77A	1556.55
FU-675PDF-V2M12A	1530.72	FU-675PDF-V2M45A	1543.73	FU-675PDF-V2M78A	1556.96
FU-675PDF-V2M13A	1531.12	FU-675PDF-V2M46A	1544.13	FU-675PDF-V2M79A	1557.36
FU-675PDF-V2M14A	1531.51	FU-675PDF-V2M47A	1544.53	FU-675PDF-V2M80A	1557.77
FU-675PDF-V2M15A	1531.90	FU-675PDF-V2M48A	1544.92	FU-675PDF-V2M81A	1558.17
FU-675PDF-V2M16A	1532.29	FU-675PDF-V2M49A	1545.32	FU-675PDF-V2M82A	1558.58
FU-675PDF-V2M17A	1532.68	FU-675PDF-V2M50A	1545.72	FU-675PDF-V2M83A	1558.98
FU-675PDF-V2M18A	1533.07	FU-675PDF-V2M51A	1546.12	FU-675PDF-V2M84A	1559.39
FU-675PDF-V2M19A	1533.47	FU-675PDF-V2M52A	1546.52	FU-675PDF-V2M85A	1559.79
FU-675PDF-V2M20A	1533.86	FU-675PDF-V2M53A	1546.92	FU-675PDF-V2M86A	1560.20
FU-675PDF-V2M21A	1534.25	FU-675PDF-V2M54A	1547.32	FU-675PDF-V2M87A	1560.61
FU-675PDF-V2M22A	1534.64	FU-675PDF-V2M55A	1547.72	FU-675PDF-V2M88A	1561.01
FU-675PDF-V2M23A	1535.04	FU-675PDF-V2M56A	1548.11	FU-675PDF-V2M89A	1561.42
FU-675PDF-V2M24A	1535.43	FU-675PDF-V2M57A	1548.51	FU-675PDF-V2M90A	1561.83
FU-675PDF-V2M25A	1535.82	FU-675PDF-V2M58A	1548.91	FU-675PDF-V2M91A	1562.23
FU-675PDF-V2M26A	1536.22	FU-675PDF-V2M59A	1549.32	FU-675PDF-V2M92A	1562.64
FU-675PDF-V2M27A	1536.61	FU-675PDF-V2M60A	1549.72	FU-675PDF-V2M93A	1563.05
FU-675PDF-V2M28A	1537.00	FU-675PDF-V2M61A	1550.12	FU-675PDF-V2M94A	1563.45
FU-675PDF-V2M29A	1537.40	FU-675PDF-V2M62A	1550.52	FU-675PDF-V2M95A	1563.86
FU-675PDF-V2M30A	1537.79	FU-675PDF-V2M63A	1550.92	FU-675PDF-V2M96A	1564.27
FU-675PDF-V2M31A	1538.19	FU-675PDF-V2M64A	1551.32	FU-675PDF-V2M97A	1564.68
FU-675PDF-V2M32A	1538.58	FU-675PDF-V2M65A	1551.72	FU-675PDF-V2M98A	1565.09
FU-675PDF-V2M33A	1538.98	FU-675PDF-V2M66A	1552.12	FU-675PDF-V2M99A	1565.50
FU-675PDF-V2M34A	1539.37	FU-675PDF-V2M67A	1552.52		
FU-675PDF-V2M35A	1539.77	FU-675PDF-V2M68A	1552.93	FU-675PDF-V2M1A	(Note 7)

All wavelengths are referred to vacuum.

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

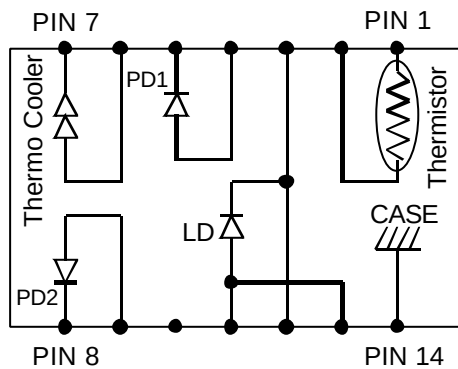
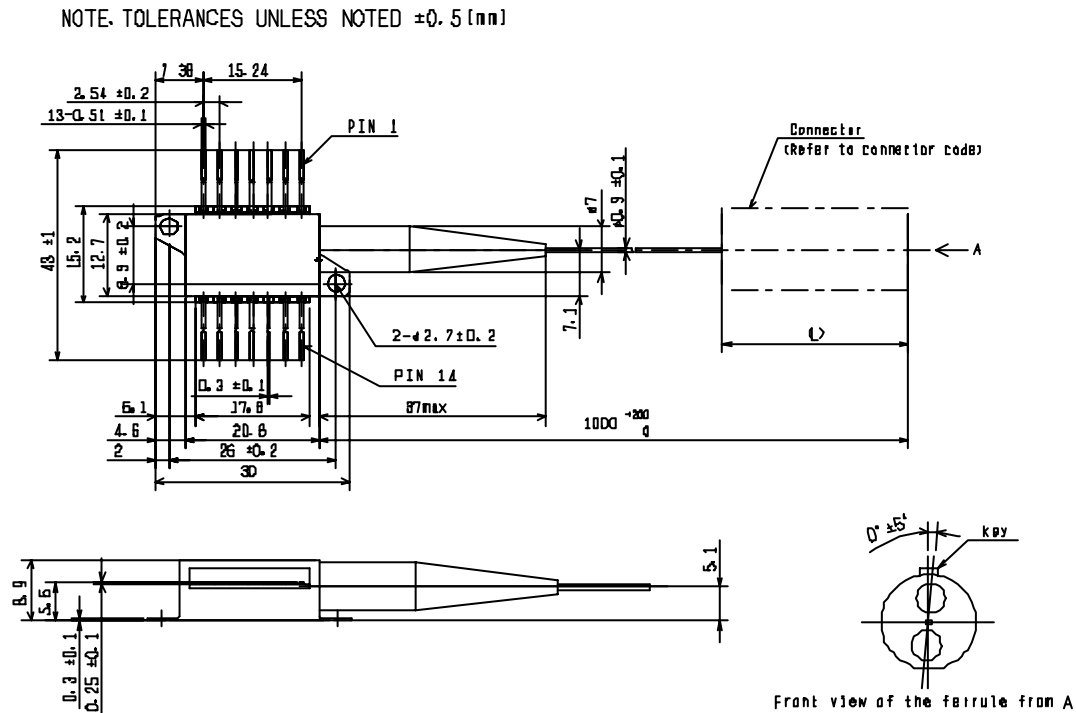
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**WAVELENGTH MONITOR INTEGRATED 1.55 μ m DF-LD MODULE
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OUTLINE DIAGRAM

(Unit : mm)



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

FU-675PDF-V2MxxA