

23 August, 2001

|                   |                   |          |
|-------------------|-------------------|----------|
| Approved          | Approved          | Charged  |
| <i>T. Nambara</i> | <i>H. Kiyosue</i> | Fujinawa |

|          |          |          |
|----------|----------|----------|
| Customer | Approved | Approved |
|          |          |          |

SPECIFICATION PROPOSAL  
for  
FU-68PDF-V620MxxB

(4ch, 150GHz range temperature tunable, Tc=-20~70degC)

|            |   |           |   |
|------------|---|-----------|---|
| A          | B | C         | D |
|            | x |           |   |
| Date       |   | Approved  |   |
| 24.Aug.'01 |   | T.Nambara |   |

MITSUBISHI (OPTICAL DEVICES)

**FU-68PDF-V620MxxB****1.55  $\mu\text{m}$  DFB-LD MODULE WITH POLARIZATION MAINTAINING FIBER PIGTAIL  
(WAVELENGTH SELECTED, BIAS CIRCUIT INTEGRATED, DIGITAL APPLICATION)****DESCRIPTION**

Module type FU-68PDF-V620MxxB is a 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 is prepared in accordance with ITU-T recommendation wavelength channel plan for Dense-WDM transmission.

**FEATURES**

- Multi quantum wells (MQW) DFB Laser Diode module
- Input impedance is 25 $\Omega$
- 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 photodiode for optical output monitor
- Temperature tunable 150GHz

**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         | 24       | 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>  | -          | 1.8      | A    |
|                               | Cooler voltage       | V <sub>pe</sub>  | -          | 4.8      | 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.

MITSUBISHI (OPTICAL DEVICES)

**FU-68PDF-V620MxxB****1.55  $\mu\text{m}$  DFB-LD MODULE WITH POLARIZATION MAINTAINING FIBER PIGTAIL  
(WAVELENGTH SELECTED, BIAS CIRCUIT INTEGRATED, DIGITAL APPLICATION)****ELECTRICAL/OPTICAL CHARACTERISTICS** (T<sub>ld</sub>=T<sub>set1</sub> or T<sub>set2</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> =20mW                                     | -        | -    | 130  | mA            |
| Operating voltage                        | V <sub>op</sub>              | CW, P <sub>f</sub> =20mW                                     | -        | -    | 2    | V             |
| Input impedance                          | Z <sub>in</sub>              | P <sub>f</sub> =20mW   | -        | 25   | -    | $\Omega$      |
| Light-emission central wavelength        | $\lambda_1$                  | CW, P <sub>f</sub> =20mW, T <sub>ld</sub> =T <sub>set1</sub> | (Note 1) |      |      | nm            |
|  | $\lambda_2$                  | CW, P <sub>f</sub> =20mW, T <sub>ld</sub> =T <sub>set2</sub> |          |      |      |               |
| 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>set1</sub>            | -  | 15       | -    | 35   | °C            |
|  | T <sub>set2</sub>            |  |          |      |      |               |
| Spectral line width                      | $\Delta f$                   | CW, P <sub>f</sub> =20mW                                     | -        | -    | 20   | MHz           |
| Side mode suppression ratio              | S <sub>r</sub>               | CW, P <sub>f</sub> =20mW                                     | 33       | 40   | -    | dB            |
| Cutoff frequency (-1.5dB optical)        | f <sub>c</sub>               | P <sub>f</sub> =20mW   | 0.5      | -    | -    | GHz           |
| Polarization extinction ratio            | E <sub>x</sub>               | CW, P <sub>f</sub> =20mW                                     | 20       | 25   | -    | dB            |
| Relative intensity noise                 | N <sub>r</sub>               | CW, P <sub>f</sub> =20mW, 0.5~3GHz                           | -        | -155 | -145 | dB/Hz         |
| Tracking error (Note 2)                  | E <sub>r</sub>               | T <sub>c</sub> =-20~70°C, APC, ATC                           | -        | -    | 0.5  | dB            |
| Differential efficiency                  | $\eta$                       | CW, P <sub>f</sub> =20mW                                     | 0.15     | -    | -    | mW/<br>mA     |
| Monitor current                          | I <sub>mon</sub>             | CW, P <sub>f</sub> =20mW, V <sub>rd</sub> =5V                | 0.2      | -    | 4    | 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) See Table 1.

Note 2) E<sub>r</sub>=max|10×log(P<sub>f</sub> / P<sub>f</sub>@25°C)|

MITSUBISHI (OPTICAL DEVICES)

# FU-68PDF-V620MxxB

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

## THERMAL CHARACTERISTICS ( $T_c=-20\sim 70^\circ\text{C}$ )

| Parameter             | Symbol     | Test Conditions                | Limits |      |      | Unit       |
|-----------------------|------------|--------------------------------|--------|------|------|------------|
|                       |            |                                | Min.   | Typ. | Max. |            |
| Thermistor resistance | Rth        | Tld=25°C                       | 9.5    | 10   | 10.5 | k $\Omega$ |
| B constant of Rth     | B          | -                              | -      | 3950 | -    | K          |
| Cooling capacity      | $\Delta T$ | Pf=20mW, Tc=70°C               | 55     | -    | -    | °C         |
| Cooler current        | Ipe        | Pf=20mW, Tc=70°C,<br>Tld=Tset1 | -      | -    | 1.5  | A          |
| Cooler voltage        | Vpe        | Pf=20mW, Tc=70°C,<br>Tld=Tset1 | -      | -    | 4    | V          |

## FIBER PIGTAIL SPECIFICATIONS

| Parameter                        | Limits      | Unit          |
|----------------------------------|-------------|---------------|
| Type                             | PM (Note 3) | -             |
| Mode field diameter              | 10.5+/-1    | $\mu\text{m}$ |
| Cladding diameter                | 125+/-3     | $\mu\text{m}$ |
| Secondary coating outer diameter | 0.9+/-0.1   | mm            |
| Polarization axis                | slow axis   | -             |
| Connector                        | FC/PC       | -             |
| Optical return loss of connector | 40 (min)    | dB            |

Note 3) PMF - Sumitomo Panda fiber (PM-155)

## DOCUMENTATION

- Fiber output power vs. Laser forward current at Tld=Tset2 and Tc=25°C
- Threshold current (Ith) at Tld=Tset2 and Tc=25°C
- Laser forward current (Iop) at Pf=20mW, Tld=Tset2 and Tc=25°C
- Laser forward voltage (Vop) at Pf=20mW, Tld=Tset2 and Tc=25°C
- Laser operating temperature (Tset1 and Tset2) (Note 4)
- Monitor current (Imon) at Pf=20mW, Tld=Tset2 and Tc=25°C
- Thermistor resistance (Rth1) at Pf=20mW, Tld=Tset1 and Tc=25°C
- Thermistor resistance (Rth2) at Pf=20mW, Tld=Tset2 and Tc=25°C
- Cooler current (Ipe) at Pf=20mW, Tld=Tset1 and Tc=70°C
- Cooler voltage (Vpe) at Pf=20mW, Tld=Tset1 and Tc=70°C

Note 4) Tset is attached as a reference data. Rth should be used in order to tune the wavelength to the specified value accurately.

MITSUBISHI (OPTICAL DEVICES)

**FU-68PDF-V620MxxB****1.55  $\mu\text{m}$  DFB-LD MODULE WITH POLARIZATION MAINTAINING FIBER PIGTAIL  
(WAVELENGTH SELECTED, BIAS CIRCUIT INTEGRATED, DIGITAL APPLICATION)**

Table 1.

| Type number       | $\lambda_1$ (nm) | $\lambda_2$ (nm) | Type number       | $\lambda_1$ (nm) | $\lambda_2$ (nm) |
|-------------------|------------------|------------------|-------------------|------------------|------------------|
| FU-68PDF-V620M07B | 1528.77          | 1529.94          | FU-68PDF-V620M51B | 1546.12          | 1547.32          |
| FU-68PDF-V620M08B | 1529.16          | 1530.33          | FU-68PDF-V620M52B | 1546.52          | 1547.72          |
| FU-68PDF-V620M09B | 1529.55          | 1530.72          | FU-68PDF-V620M53B | 1546.92          | 1548.11          |
| FU-68PDF-V620M10B | 1529.94          | 1531.12          | FU-68PDF-V620M54B | 1547.32          | 1548.51          |
| FU-68PDF-V620M11B | 1530.33          | 1531.51          | FU-68PDF-V620M55B | 1547.72          | 1548.91          |
| FU-68PDF-V620M12B | 1530.72          | 1531.90          | FU-68PDF-V620M56B | 1548.11          | 1549.32          |
| FU-68PDF-V620M13B | 1531.12          | 1532.29          | FU-68PDF-V620M57B | 1548.51          | 1549.72          |
| FU-68PDF-V620M14B | 1531.51          | 1532.68          | FU-68PDF-V620M58B | 1548.91          | 1550.12          |
| FU-68PDF-V620M15B | 1531.90          | 1533.07          | FU-68PDF-V620M59B | 1549.32          | 1550.52          |
| FU-68PDF-V620M16B | 1532.29          | 1533.47          | FU-68PDF-V620M60B | 1549.72          | 1550.92          |
| FU-68PDF-V620M17B | 1532.68          | 1533.86          | FU-68PDF-V620M61B | 1550.12          | 1551.32          |
| FU-68PDF-V620M18B | 1533.07          | 1534.25          | FU-68PDF-V620M62B | 1550.52          | 1551.72          |
| FU-68PDF-V620M19B | 1533.47          | 1534.64          | FU-68PDF-V620M63B | 1550.92          | 1552.12          |
| FU-68PDF-V620M20B | 1533.86          | 1535.04          | FU-68PDF-V620M64B | 1551.32          | 1552.52          |
| FU-68PDF-V620M21B | 1534.25          | 1535.43          | FU-68PDF-V620M65B | 1551.72          | 1552.93          |
| FU-68PDF-V620M22B | 1534.64          | 1535.82          | FU-68PDF-V620M66B | 1552.12          | 1553.33          |
| FU-68PDF-V620M23B | 1535.04          | 1536.22          | FU-68PDF-V620M67B | 1552.52          | 1553.73          |
| FU-68PDF-V620M24B | 1535.43          | 1536.61          | FU-68PDF-V620M68B | 1552.93          | 1554.13          |
| FU-68PDF-V620M25B | 1535.82          | 1537.00          | FU-68PDF-V620M69B | 1553.33          | 1554.54          |
| FU-68PDF-V620M26B | 1536.22          | 1537.40          | FU-68PDF-V620M70B | 1553.73          | 1554.94          |
| FU-68PDF-V620M27B | 1536.61          | 1537.79          | FU-68PDF-V620M71B | 1554.13          | 1555.34          |
| FU-68PDF-V620M28B | 1537.00          | 1538.19          | FU-68PDF-V620M72B | 1554.54          | 1555.75          |
| FU-68PDF-V620M29B | 1537.40          | 1538.58          | FU-68PDF-V620M73B | 1554.94          | 1556.15          |
| FU-68PDF-V620M30B | 1537.79          | 1538.98          | FU-68PDF-V620M74B | 1555.34          | 1556.55          |
| FU-68PDF-V620M31B | 1538.19          | 1539.37          | FU-68PDF-V620M75B | 1555.75          | 1556.96          |
| FU-68PDF-V620M32B | 1538.58          | 1539.77          | FU-68PDF-V620M76B | 1556.15          | 1557.36          |
| FU-68PDF-V620M33B | 1538.98          | 1540.16          | FU-68PDF-V620M77B | 1556.55          | 1557.77          |
| FU-68PDF-V620M34B | 1539.37          | 1540.56          | FU-68PDF-V620M78B | 1556.96          | 1558.17          |
| FU-68PDF-V620M35B | 1539.77          | 1540.95          | FU-68PDF-V620M79B | 1557.36          | 1558.58          |
| FU-68PDF-V620M36B | 1540.16          | 1541.35          | FU-68PDF-V620M80B | 1557.77          | 1558.98          |
| FU-68PDF-V620M37B | 1540.56          | 1541.75          | FU-68PDF-V620M81B | 1558.17          | 1559.39          |
| FU-68PDF-V620M38B | 1540.95          | 1542.14          | FU-68PDF-V620M82B | 1558.58          | 1559.79          |
| FU-68PDF-V620M39B | 1541.35          | 1542.54          | FU-68PDF-V620M83B | 1558.98          | 1560.20          |
| FU-68PDF-V620M40B | 1541.75          | 1542.94          | FU-68PDF-V620M84B | 1559.39          | 1560.61          |
| FU-68PDF-V620M41B | 1542.14          | 1543.33          | FU-68PDF-V620M85B | 1559.79          | 1561.01          |
| FU-68PDF-V620M42B | 1542.54          | 1543.73          | FU-68PDF-V620M86B | 1560.20          | 1561.42          |
| FU-68PDF-V620M43B | 1542.94          | 1544.13          | FU-68PDF-V620M87B | 1560.61          | 1561.83          |
| FU-68PDF-V620M44B | 1543.33          | 1544.53          | FU-68PDF-V620M88B | 1561.01          | 1562.23          |
| FU-68PDF-V620M45B | 1543.73          | 1544.92          | FU-68PDF-V620M89B | 1561.42          | 1562.64          |
| FU-68PDF-V620M46B | 1544.13          | 1545.32          | FU-68PDF-V620M90B | 1561.83          | 1563.05          |
| FU-68PDF-V620M47B | 1544.53          | 1545.72          | FU-68PDF-V620M91B | 1562.23          | 1563.45          |
| FU-68PDF-V620M48B | 1544.92          | 1546.12          | FU-68PDF-V620M92B | 1562.64          | 1563.86          |
| FU-68PDF-V620M49B | 1545.32          | 1546.52          | FU-68PDF-V620M93B | 1563.05          | 1564.27          |
| FU-68PDF-V620M50B | 1545.72          | 1546.92          | FU-68PDF-V620M94B | 1563.45          | 1564.68          |

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

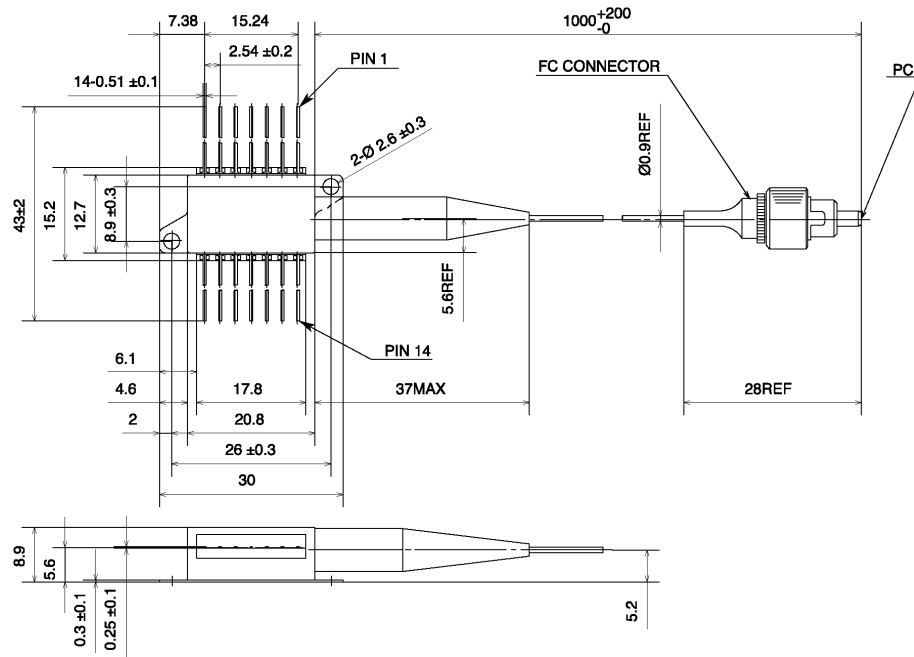
MITSUBISHI (OPTICAL DEVICES)

# FU-68PDF-V620MxxB

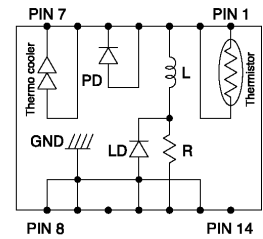
1.55 μm DFB-LD MODULE WITH POLARIZATION MAINTAINING FIBER PIGTAIL  
(WAVELENGTH SELECTED, BIAS CIRCUIT INTEGRATED, DIGITAL APPLICATION)

## OUTLINE DIAGRAM

Unit : mm  
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             |



FU-68PDF-V620MxxB