

MITSUBISHI (OPTICAL DEVICES)

# FU-68PDF-V510MxxxB

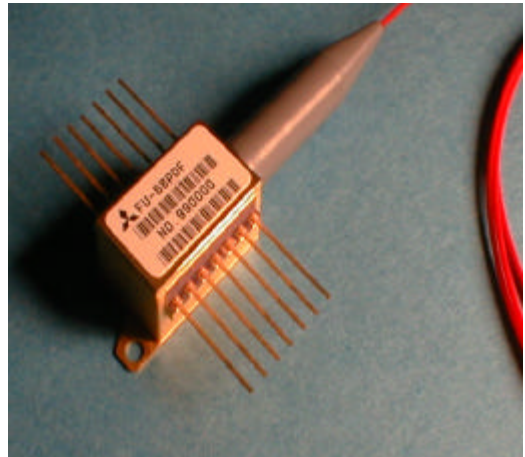
**1.58  $\mu\text{m}$  (L-Band) DFB-LD MODULE WITH POLARIZATION MAINTAINING FIBER PIGTAIL  
(WAVELENGTH SELECTED, BIAS CIRCUIT INTEGRATED, DIGITAL APPLICATION)**

## DESCRIPTION

Module type FU-68PDF-V510MxxxB is a 1.58 $\mu\text{m}$  (L-Band) 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 to expand the wavelength channels into L-Band for Dense-WDM transmission.

## FEATURES

- Input impedance is 25 $\Omega$
- Multi quantum wells (MQW) DFB Laser Diode module
- Emission wavelength is in 1.58 $\mu\text{m}$  band
- Polarization maintaining optical fiber pig-tail
- Built-in optical isolator
- Built-in thermal electric cooler
- Butterfly package
- With photodiode for optical output monitor



## APPLICATION

High speed transmission systems (~10Gb/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 | P <sub>f</sub>   | 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 ~ 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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**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            |
| 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 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            |
| Cutoff frequency (-1.5dB optical)        | f <sub>c</sub>               | P <sub>f</sub> =10mW                          | 2        | -    | -    | 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 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> =10mW                      | 0.1      | -    | -    | mW/<br>mA     |
| Monitor current                          | I <sub>mon</sub>             | CW, P <sub>f</sub> =10mW, V <sub>rd</sub> =5V | 0.2      | -    | 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) See Table 1.

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

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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,<br>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,<br>T <sub>ld</sub> =T <sub>set</sub> | -      | 1.2  | 2    | V          |

## FIBER PIGTAIL SPECIFICATIONS

| Parameter                        | Limits      | Unit          |
|----------------------------------|-------------|---------------|
| Type                             | PM (Note 3) | -             |
| Mode field diameter              | 11+/-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 (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 4)
- Monitor current (I<sub>mon</sub>) at P<sub>f</sub>=10mW
- 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 4) 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-68PDF-V510M103B | 1567.13          | FU-68PDF-V510M139B | 1582.02          | FU-68PDF-V510M175B | 1597.19          |
| FU-68PDF-V510M104B | 1567.54          | FU-68PDF-V510M140B | 1582.44          | FU-68PDF-V510M176B | 1597.62          |
| FU-68PDF-V510M105B | 1567.95          | FU-68PDF-V510M141B | 1582.85          | FU-68PDF-V510M177B | 1598.04          |
| FU-68PDF-V510M106B | 1568.36          | FU-68PDF-V510M142B | 1583.27          | FU-68PDF-V510M178B | 1598.47          |
| FU-68PDF-V510M107B | 1568.77          | FU-68PDF-V510M143B | 1583.69          | FU-68PDF-V510M179B | 1598.89          |
| FU-68PDF-V510M108B | 1569.18          | FU-68PDF-V510M144B | 1584.11          | FU-68PDF-V510M180B | 1599.32          |
| FU-68PDF-V510M109B | 1569.59          | FU-68PDF-V510M145B | 1584.53          | FU-68PDF-V510M181B | 1599.75          |
| FU-68PDF-V510M110B | 1570.01          | FU-68PDF-V510M146B | 1584.95          | FU-68PDF-V510M182B | 1600.17          |
| FU-68PDF-V510M111B | 1570.42          | FU-68PDF-V510M147B | 1585.36          | FU-68PDF-V510M183B | 1600.60          |
| FU-68PDF-V510M112B | 1570.83          | FU-68PDF-V510M148B | 1585.78          | FU-68PDF-V510M184B | 1601.03          |
| FU-68PDF-V510M113B | 1571.24          | FU-68PDF-V510M149B | 1586.20          | FU-68PDF-V510M185B | 1601.46          |
| FU-68PDF-V510M114B | 1571.65          | FU-68PDF-V510M150B | 1586.62          | FU-68PDF-V510M186B | 1601.88          |
| FU-68PDF-V510M115B | 1572.06          | FU-68PDF-V510M151B | 1587.04          | FU-68PDF-V510M187B | 1602.31          |
| FU-68PDF-V510M116B | 1572.48          | FU-68PDF-V510M152B | 1587.46          | FU-68PDF-V510M188B | 1602.74          |
| FU-68PDF-V510M117B | 1572.89          | FU-68PDF-V510M153B | 1587.88          | FU-68PDF-V510M189B | 1603.17          |
| FU-68PDF-V510M118B | 1573.30          | FU-68PDF-V510M154B | 1588.30          | FU-68PDF-V510M190B | 1603.60          |
| FU-68PDF-V510M119B | 1573.71          | FU-68PDF-V510M155B | 1588.73          | FU-68PDF-V510M191B | 1604.03          |
| FU-68PDF-V510M120B | 1574.13          | FU-68PDF-V510M156B | 1589.15          | FU-68PDF-V510M192B | 1604.46          |
| FU-68PDF-V510M121B | 1574.54          | FU-68PDF-V510M157B | 1589.57          | FU-68PDF-V510M193B | 1604.88          |
| FU-68PDF-V510M122B | 1574.95          | FU-68PDF-V510M158B | 1589.99          | FU-68PDF-V510M194B | 1605.31          |
| FU-68PDF-V510M123B | 1575.37          | FU-68PDF-V510M159B | 1590.41          | FU-68PDF-V510M195B | 1605.74          |
| FU-68PDF-V510M124B | 1575.78          | FU-68PDF-V510M160B | 1590.83          | FU-68PDF-V510M196B | 1606.17          |
| FU-68PDF-V510M125B | 1576.20          | FU-68PDF-V510M161B | 1591.26          | FU-68PDF-V510M197B | 1606.60          |
| FU-68PDF-V510M126B | 1576.61          | FU-68PDF-V510M162B | 1591.68          | FU-68PDF-V510M198B | 1607.04          |
| FU-68PDF-V510M127B | 1577.03          | FU-68PDF-V510M163B | 1592.10          | FU-68PDF-V510M199B | 1607.47          |
| FU-68PDF-V510M128B | 1577.44          | FU-68PDF-V510M164B | 1592.52          | FU-68PDF-V510M200B | 1607.90          |
| FU-68PDF-V510M129B | 1577.86          | FU-68PDF-V510M165B | 1592.95          | FU-68PDF-V510M201B | 1608.33          |
| FU-68PDF-V510M130B | 1578.27          | FU-68PDF-V510M166B | 1593.37          | FU-68PDF-V510M202B | 1608.76          |
| FU-68PDF-V510M131B | 1578.69          | FU-68PDF-V510M167B | 1593.79          | FU-68PDF-V510M203B | 1609.19          |
| FU-68PDF-V510M132B | 1579.10          | FU-68PDF-V510M168B | 1594.22          | FU-68PDF-V510M204B | 1609.62          |
| FU-68PDF-V510M133B | 1579.52          | FU-68PDF-V510M169B | 1594.64          | FU-68PDF-V510M205B | 1610.06          |
| FU-68PDF-V510M134B | 1579.93          | FU-68PDF-V510M170B | 1595.06          | FU-68PDF-V510M206B | 1610.49          |
| FU-68PDF-V510M135B | 1580.35          | FU-68PDF-V510M171B | 1595.49          | FU-68PDF-V510M207B | 1610.92          |
| FU-68PDF-V510M136B | 1580.77          | FU-68PDF-V510M172B | 1595.91          | FU-68PDF-V510M208B | 1611.35          |
| FU-68PDF-V510M137B | 1581.18          | FU-68PDF-V510M173B | 1596.34          | FU-68PDF-V510M209B | 1611.79          |
| FU-68PDF-V510M138B | 1581.60          | FU-68PDF-V510M174B | 1596.76          |                    |                  |

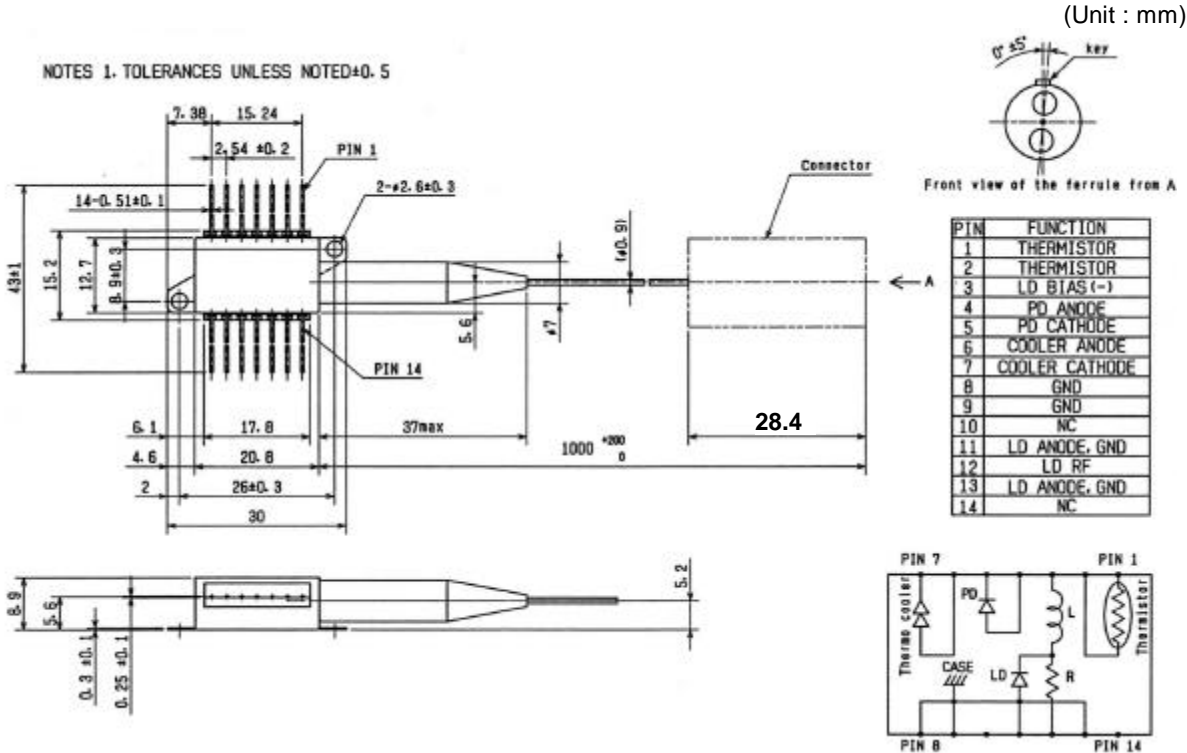
All wavelengths are referred to vacuum.

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

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**OUTLINE DIAGRAM**



FU-68PDF-V510MxxxB