

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

Preliminary

Specification of cooled and semi-cooled DFB-LD Module  
for 10Gb/s Applications  
(STM-64, OC192 and 10G Ethernet)

Module type :

FU-484SDF-x1Mxx (Cooled DFB-LD Module, Tc=-20~75°C, Tld=25°C)

FU-484SDF-x2Mxx (Semi-cooled DFB-LD Module, Tc=-20~85°C, Tld=0~65°C)

|           |   |           |   |
|-----------|---|-----------|---|
| A         | B | C         | D |
|           | x |           |   |
| Date      |   | Approved  |   |
| 9.Jan.'02 |   | T.Nambara |   |

MITSUBISHI ELECTRIC CORPORATION

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MITSUBISHI (OPTICAL DEVICES)

**FU-484SDF-x1Mxx, -x2Mxx**

**1.3 mm COOLED AND SEMICOOLED DFB-LD MODULE WITH SINGLEMODE FIBER PIGTAIL  
FOR 10Gb/s (BIAS CIRCUIT INTEGRATED, DIGITAL APPLICATION)**

**DESCRIPTION**

Module type FU-484SDF-x1Mxx and FU-484SDF-x2Mxx is a 1.3um Cooled DFB-LD module with single-mode optical fiber. This module is suitable to a light source for use in 10Gb/s digital optical communication systems.

**FEATURES**

- Input impedance is 50Ω
- Distributed feedback (DFB) Laser Diode
- Emission wavelength is the 1.3μm band
- Single-mode optical fiber pig-tail
- Built-in optical isolator
- Built-in bias T
- Built-in thermistor and thermoelectric cooler
- With photodiode for optical output monitor
- 7-pin Butterfly package with GPO connector

**APPLICATION**

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

**1. ABSOLUTE MAXIMUM RATINGS (Tc=25°C)**

| ITEM                         |                                    | SYMBOL | CONDITION | RATING                 | UNIT |
|------------------------------|------------------------------------|--------|-----------|------------------------|------|
| Laser diode                  | Optical output power               | Pf     | CW        | 6                      | mW   |
|                              | Forward current                    | If     | CW        | 100                    | mA   |
|                              | Reverse voltage                    | Vrl    | -         | 2                      | V    |
| Photo diode                  | Reverse voltage                    | Vrd    | -         | 20                     | V    |
|                              | Forward current                    | Ifd    | -         | 2                      | mA   |
| Thermoelectric cooler(Note1) | Current                            | Ipe    | -         | 1.5                    | A    |
|                              | Voltage                            | Vpe    | -         | 3                      | V    |
| Operating case temperature   | FU-484SDF-x1Mxx (Cooled type)      | Tc     | -         | -20 ~ 75 (Tld= 25)     | °C   |
|                              | FU-484SDF-x2Mxx (Semi-cooled type) | Tc     | -         | -20 ~ 85 (Tld= 0 ~ 65) | °C   |
| Storage temperature          |                                    | Tstg   | -         | -40 ~ 85               | °C   |

**Note1**

Even if the thermoelectric cooler (TEC) is operated within the rated conditions, uncontrolled current loading or operation without heat sink 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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**2. ELECTRICAL/ OPTICAL CHARACTERISTICS of FU-484SDF-x1Mxx**

(Tc=-20~75°C, Tld=25°C, unless otherwise noted)

| ITEM                                      | SYMBOL           | CONDITION                                            | MIN   | TYP  | MAX  | UNIT  |
|-------------------------------------------|------------------|------------------------------------------------------|-------|------|------|-------|
| Threshold current                         | Ith              | CW                                                   | -     | 10   | 25   | mA    |
| Optical output power at threshold current | Pth              | CW, I <sub>bias</sub> =Ith                           | -     | -    | 50   | μW    |
| Operating current                         | Iop              | CW, Pf=1mW                                           | -     | 30   | 50   | mA    |
| Operating voltage                         | Vop              | CW, Pf=1mW                                           | -     | 1.2  | 1.8  | V     |
| Input impedance                           | Zin              | -                                                    | -     | 50   | -    | Ω     |
| Optical output power from fiber end       | Pf               | CW, nominal                                          | -     | 1    | -    | mW    |
| Light-emission central wavelength         | λ <sub>c</sub>   | CW, Pf=1mW                                           | 1290  | 1310 | 1330 | nm    |
| Wavelength temperature coefficient        | λ <sub>ct</sub>  | -                                                    | -     | 0.09 | 0.1  | nm/°C |
| Spectral width                            | Δλ               | -20dB full width                                     | -     | -    | 0.8  | nm    |
| Side mode suppression ratio               | Sr               |                                                      | 35    | 45   | -    | dB    |
| Extinction ratio                          | Ex               |                                                      | -     | 6.5  | -    | dB    |
| Dispersion penalty                        | Pp               | 40ps/nm disp.                                        | -     | -    | 1.0  | dB    |
| Relative intensity noise                  | Nr               | CW, Pf=1mW                                           | -     | -145 | -130 | dB/Hz |
| Tracking error [Note 1]                   | Er               | CW, APC (I <sub>mon</sub> =Const.), ATC, Tc=-20~75°C | -     | 0.5  | 1.0  | dB    |
| Differential efficiency                   | η                | CW, Tc=25°C                                          | 0.005 | -    | 0.15 | mW/mA |
| Monitor current                           | I <sub>mon</sub> | CW, Pf=1mW, V <sub>rd</sub> =5V                      | 0.05  | -    | 1.5  | mA    |
| Optical isolation                         | Iso              | -                                                    | 20    | -    | -    | dB    |
| Dark current (PD)                         | I <sub>d</sub>   | V <sub>rd</sub> =5V                                  | -     | -    | 0.1  | μA    |
| Capacitance (PD)                          | C <sub>t</sub>   | V <sub>rd</sub> =5V, f=1MHz                          | -     | -    | 10   | pF    |
| Thermistor resistance                     | R <sub>th</sub>  | Tc=25°C                                              | 9.5   | 10   | 10.5 | kΩ    |
| B constant of R <sub>th</sub>             | B                | -                                                    | -     | 3950 | -    | K     |
| Cooler current                            | I <sub>pe</sub>  | If=Iop, Tc=75°C                                      | -     | 0.7  | 1.3  | A     |
| Cooler voltage                            | V <sub>pe</sub>  | If=Iop, Tc=75°C                                      | -     | 1.7  | 2.5  | V     |

[Note 1] Er=max | 10\*log(Pf / Pf@25°C) |

MITSUBISHI (OPTICAL DEVICES)

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FOR 10Gb/s (BIAS CIRCUIT INTEGRATED, DIGITAL APPLICATION)**

**3. ELECTRICAL/ OPTICAL CHARACTERISTICS of FU-484SDF-x2Mxx**

(Tc=-20~85°C, Tld=0~65°C, unless otherwise noted)

| ITEM                                      | SYMBOL           | CONDITION                                            | MIN   | TYP  | MAX  | UNIT  |
|-------------------------------------------|------------------|------------------------------------------------------|-------|------|------|-------|
| Threshold current                         | Ith              | CW, Tld=25°C                                         | -     | 10   | 25   | mA    |
| Optical output power at threshold current | Pth              | CW, I <sub>bias</sub> =Ith                           | -     | -    | 50   | μW    |
| Operating current                         | Iop              | CW, Pf=1mW, Tld=25°C                                 | -     | 30   | 50   | mA    |
| Operating voltage                         | Vop              | CW, Pf=1mW, Tld=25°C                                 | -     | 1.2  | 1.8  | V     |
| Input impedance                           | Zin              | -                                                    | -     | 50   | -    | Ω     |
| Optical output power from fiber end       | Pf               | CW, nominal                                          | -     | 1    | -    | mW    |
| Light-emission central wavelength         | λ <sub>c</sub>   | CW, Pf=1mW                                           | 1290  | 1310 | 1330 | nm    |
| Wavelength temperature coefficient        | λ <sub>ct</sub>  | -                                                    | -     | 0.09 | 0.1  | nm/°C |
| Spectral width                            | Δλ               | -20dB full width                                     | -     | -    | 0.8  | nm    |
| Side mode suppression ratio               | Sr               |                                                      | 35    | 45   | -    | dB    |
| Extinction ratio                          | Ex               |                                                      | -     | 6.5  | -    | dB    |
| Dispersion penalty                        | Pp               | 40ps/nm disp.                                        | -     | -    | 1.0  | dB    |
| Relative intensity noise                  | Nr               | CW, Pf=1mW                                           | -     | -145 | -130 | dB/Hz |
| Tracking error [Note 1]                   | Er               | CW, APC (I <sub>mon</sub> =Const.), ATC, Tc=-20~85°C | -     | 0.5  | 1.0  | dB    |
| Differential efficiency                   | η                | CW, Tld=25°C                                         | 0.005 | -    | 0.15 | mW/mA |
| Monitor current                           | I <sub>mon</sub> | CW, Pf=1mW, V <sub>rd</sub> =5V                      | 0.05  | -    | 1.5  | mA    |
| Optical isolation                         | Iso              | -                                                    | 20    | -    | -    | dB    |
| Dark current (PD)                         | I <sub>d</sub>   | V <sub>rd</sub> =5V                                  | -     | -    | 0.1  | μA    |
| Capacitance (PD)                          | C <sub>t</sub>   | V <sub>rd</sub> =5V, f=1MHz                          | -     | -    | 10   | pF    |
| Thermistor resistance                     | R <sub>th</sub>  | Tld=25°C                                             | 9.5   | 10   | 10.5 | kΩ    |
| B constant of R <sub>th</sub>             | B                | -                                                    | -     | 3950 | -    | K     |
| Cooler current                            | I <sub>pe</sub>  | Tc=85°C, Tld=65°C                                    | -     | -    | 1.0  | A     |
| Cooler voltage                            | V <sub>pe</sub>  | Tc=85°C, Tld=65°C                                    | -     | -    | 1.5  | V     |
| Power consumption of cooler               | P <sub>pe</sub>  | Tc=85°C, Tld=65°C                                    | -     | -    | 0.5  | W     |

[Note 1] Er=max | 10\*log(Pf / Pf@25°C) |

MITSUBISHI (OPTICAL DEVICES)

# FU-484SDF-x1Mxx, -x2Mxx

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FOR 10Gb/s (BIAS CIRCUIT INTEGRATED, DIGITAL APPLICATION)**

## 3. FIBER PIGTAIL SPECIFICATIONS

| ITEM                             | SPECIFICATION | UNIT          |
|----------------------------------|---------------|---------------|
| Type                             | SM            | -             |
| Mode field diameter              | $9.3 \pm 1$   | $\mu\text{m}$ |
| Cladding diameter                | $125 \pm 2$   | $\mu\text{m}$ |
| Jacket diameter                  | $0.9 \pm 0.1$ | mm            |
| Connector                        | See Table 1.  | -             |
| Optical return loss of connector | 40 (min)      | dB            |

Table 1.

(Unit; mm)

| Type number    | Connector type | Optical fiber length<br>L1 (Note 3) | Optical conector<br>length L2 (Note 3) |
|----------------|----------------|-------------------------------------|----------------------------------------|
| FU-484SDF-1M1  | None (Note 4)  | 1000+200/-0                         | -                                      |
| FU-484SDF-V1M1 | FC/PC          | 1000+200/-0                         | 28.4                                   |
| FU-484SDF-W1M1 | SC/PC          | 1000+200/-0                         | 34.5                                   |
| FU-484SDF-2M1  | None (Note 4)  | 1000+200/-0                         | -                                      |
| FU-484SDF-V2M1 | FC/PC          | 1000+200/-0                         | 28.4                                   |
| FU-484SDF-W2M1 | SC/PC          | 1000+200/-0                         | 34.5                                   |

Note 3) Optical fiber length "L1" and Optical conector length 'L2' is defined in OUTLINE DIAGRAMS.

Note 4) There are some cases where a connector for testing is shipped with the product.

Then the fiber length not including the connector is more than 1000mm.

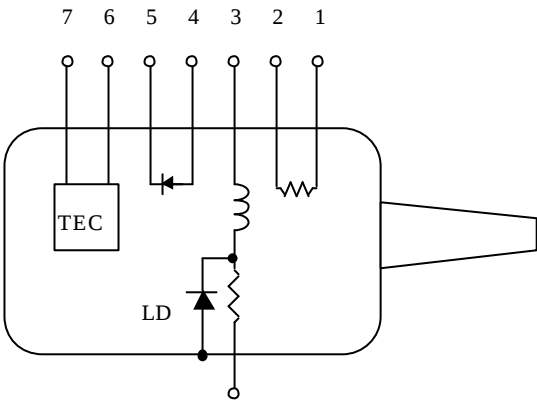
## DOCUMENTATION

- Threshold current ( $I_{th}$ ) at  $T_c=25^\circ\text{C}$
- Operating current ( $I_{op}$ ) at  $T_c=25^\circ\text{C}$
- Operating voltage ( $V_{op}$ ) at  $T_c=25^\circ\text{C}$
- Light-emission central wavelength ( $\lambda_c$ ) at  $T_c=25^\circ\text{C}$
- Monitor current ( $I_{mon}$ ) at  $T_c=25^\circ\text{C}$
- Optical output power from fiber end ( $P_f$ ) at  $T_c=25^\circ\text{C}$

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| Pin No. | Pin assignments      |
|---------|----------------------|
| 1       | Thermistor           |
| 2       | Thermistor           |
| 3       | LD DC bias (Cathode) |
| 4       | Monitor PD (Anode)   |
| 5       | Monitor PD (Cathode) |
| 6       | Cooler (Anode)       |
| 7       | Cooler (Cathode)     |

RF CONECTOR

Figure4.Pin Assignments

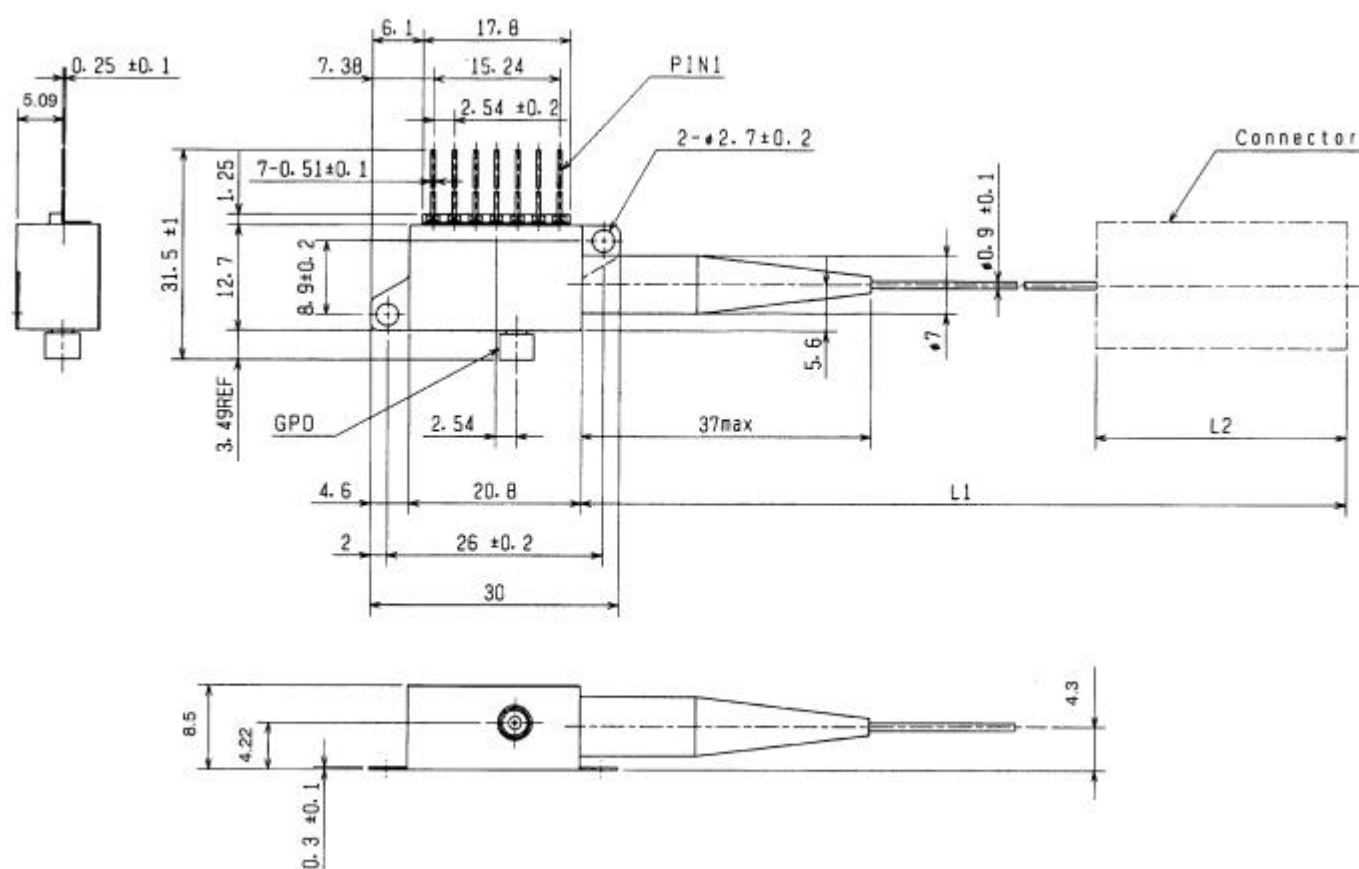
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## OUTLINE DIAGRAM

(Unit : mm)



FU-484SDF-x1Mxx, -x2Mxx