

| Approved                                                                                         | Approved                                                                                          | Charged      |
|--------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|--------------|
| <br>T. Nakamura | <br>H. Koyanagi | A. Takematsu |

## Specification for 1310nm DFB LD module

FU-48SDF-Y30M31B

FU-48SDF-Y30M51

FU-48SDF-Y30M52

FU-48SDF-Y30M53

FU-48SDF-Y30M54

FU-48SDF-Y30M55

| A        | B | C        | D |
|----------|---|----------|---|
|          | x |          |   |
| Date     |   | Approved |   |
| 00.01.13 |   | Nakamura |   |

MITSUBISHI ELECTRIC CORPORATION

MITSUBISHI (OPTICAL DEVICES)

**FU-48SDF-Y30M31B/51/52/53/54/55****1.3  $\mu$ m DFB-LD MODULE WITH SINGLEMODE FIBER PIGTAIL(CATV)****DESCRIPTION**

Module type FU-48SDF-Y30Mxx series has been developed for coupling a singlemode optical fiber and a 1.3  $\mu$ m wavelength InGaAsP DFB LD (Laser diode).

These modules are suitable light source for use in multi-channel long haul AM CATV systems.

**FEATURES**

- Distributed Feedback Laser Diode Module
- Suitable light source for CATV application
- Emission wavelength is in the 1.3 $\mu$ m band
- Built-in optical isolator
- Built-in thermal electric cooler
- Butterfly package

**APPLICATION**

CATV

**ABSOLUTE MAXIMUM RATINGS (T<sub>ld</sub>=25°C)**

| Parameter                  |                                     | Symbol | Conditions | Rating    | Unit |
|----------------------------|-------------------------------------|--------|------------|-----------|------|
| Laser diode                | Optical output power from fiber end | Pf     | CW         | 20        | mW   |
|                            | Forward current                     | If     | CW         | 150       | mA   |
|                            | Reverse voltage                     | Vrl    | -          | 2         | V    |
| Photodiode                 | Reverse voltage                     | Vrd    | -          | 20        | V    |
|                            | Forward current                     | Ifd    | -          | 2         | mA   |
| Cooler<br>(Note)           | VOLTAGE                             | Vpem   | -          | 2.4       | V    |
|                            | CURRENT                             | Ipem   | -          | 1.2       | A    |
| Operating case temperature |                                     | Tc     | -          | -20 to 65 | °C   |
| Storage temperature        |                                     | Tstg   | -          | -40 to 70 | °C   |

Note. Even if the thermo-electric 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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**FU-48SDF-Y30M31B/51/52/53/54/55****1.3  $\mu$ m DFB-LD MODULE WITH SINGLEMODE FIBER PIGTAIL(CATV)****ELECTRICAL/OPTICAL CHARACTERISTICS** (T<sub>ld</sub>=25°C, T<sub>c</sub>=25°C, unless otherwise noted)

| Parameter                   | Symbol           | Condition                                                                                               | Limits |      |      | Units |
|-----------------------------|------------------|---------------------------------------------------------------------------------------------------------|--------|------|------|-------|
|                             |                  |                                                                                                         | Min.   | Typ. | Max. |       |
| Threshold Current           | I <sub>th</sub>  | CW                                                                                                      | -      | 10   | 30   | mA    |
| Operating Current           | I <sub>op</sub>  | CW, I <sub>f</sub> =I <sub>op</sub> (Note1)                                                             | -      | 40   | 70   | mA    |
| Modulation Current          | I <sub>mod</sub> | I <sub>mod</sub> =I <sub>op</sub> -I <sub>th</sub>                                                      | -      | -    | 50   | mA    |
| Operating Voltage           | V <sub>op</sub>  | CW, I <sub>f</sub> =I <sub>op</sub>                                                                     | -      | 1.3  | 1.8  | V     |
| Input impedance             | Z <sub>in</sub>  | I <sub>f</sub> = I <sub>op</sub>                                                                        |        | 25   |      | ohm   |
| Output Power from Fiber End | P <sub>f</sub>   | CW, I <sub>f</sub> =I <sub>op</sub><br>-Y30M31B<br>-Y30M52<br>-Y30M53<br>-Y30M54<br>-Y30M55<br>-Y30M51  | 4      | 5    | 6    | mW    |
|                             |                  |                                                                                                         | 6      | 7    | 8    |       |
|                             |                  |                                                                                                         | 8      | 9    | 10   |       |
|                             |                  |                                                                                                         | 10     | 11   | 12   |       |
|                             |                  |                                                                                                         | 12     | 13   | 14   |       |
|                             |                  |                                                                                                         | 14     | -    | -    |       |
| Central Wavelength          | I <sub>c</sub>   | CW, I <sub>f</sub> =I <sub>op</sub>                                                                     | 1290   | 1310 | 1330 | nm    |
| Side Mode Suppression Ratio | S <sub>r</sub>   | CW, I <sub>f</sub> =I <sub>op</sub>                                                                     | 30     | 35   | -    | dB    |
| Cut-off Frequency           | f <sub>c</sub>   | I <sub>f</sub> = I <sub>op</sub>                                                                        | 2      | 3    | -    | GHz   |
| Composite Second Order      | CSO              | 79 channel loading<br>55.25MHz-547.25MHz<br>( 6MHz spacing )<br>I <sub>f</sub> =I <sub>op</sub> (Note2) | -      | -    | -60  | dBc   |
| Composite Triple Beat       | CTB              |                                                                                                         | -      | -    | -65  | dBc   |
| Carrier to Noise Ratio      | CNR              | -Y30M31B<br>-Y30M52<br>-Y30M53<br>-Y30M54<br>-Y30M55<br>-Y30M51                                         | 50     | -    | -    | dBc   |
|                             |                  |                                                                                                         | 49.5   | -    | -    |       |
|                             |                  |                                                                                                         | 50     | -    | -    |       |
|                             |                  |                                                                                                         | 50.5   | -    | -    |       |
|                             |                  |                                                                                                         | 51     | -    | -    |       |
|                             |                  |                                                                                                         | 51     | -    | -    |       |
| Optical Modulation Depth    | m                | -Y30M31B                                                                                                | 3.0    | 3.5  | 5    | %     |
|                             |                  | -Y30M51~55                                                                                              | 3.2    | 3.5  | 5    |       |
| RIN (Note 3)                | Nr2              | CW, I <sub>f</sub> =I <sub>op</sub><br>f=55.25MHz                                                       | -      | -160 | -155 | dB/Hz |
|                             | Nr78             | f=547.25MHz                                                                                             | -      | -160 | -155 | dB/Hz |
| Tracking Error(Note 4)      | E <sub>r</sub>   | T <sub>c</sub> =-20~65°C, APC, ATC                                                                      | -      | 0.3  | 0.5  | dB    |
| Differential Efficiency     | $\eta$           | I <sub>f</sub> =I <sub>op</sub> -Y30M31B                                                                | 0.1    | 0.2  | 0.35 | mW/mA |
|                             |                  | -Y30M52~55                                                                                              | 0.2    | 0.26 | -    |       |
|                             |                  | -Y30M51                                                                                                 | 0.24   | 0.33 | -    |       |
| Monitor Current             | I <sub>mon</sub> | CW, I <sub>f</sub> =I <sub>op</sub> , V <sub>rd</sub> =5V                                               | 0.1    | -    | 3    | mA    |
| Dark current( PD )          | I <sub>d</sub>   | V <sub>rd</sub> =5V                                                                                     | -      | 0.1  | 1    | mA    |
| Capacitance ( PD )          | C <sub>t</sub>   | V <sub>rd</sub> =5V, f=1MHz                                                                             | -      | 10   | 20   | pF    |
| Isolation                   | I <sub>so</sub>  | T <sub>c</sub> = 0 to 65°C                                                                              | 25     | 37   | -    | dB    |

Note 1. I<sub>f</sub> : LD forward current

Note 2. Detailed test conditions;

Type -Y30M31B, 52 : 8.5dB Optical loss includes 15km fiber loss.

Type -Y30M53, 54, 55, 51 : 12dB Optical loss includes 26.5km fiber loss.

Receiver responsivity=0.9A/W

Input equivalent noise current=7pA/(Hz)<sup>1/2</sup>

Optical return loss of the connectors should be greater than 50dB in order to get the specified performance.

Note 3. Relative intensity noise does not include shot noise of receiver.

Note 4. E<sub>r</sub> = MAX [10\* log (P<sub>f</sub>/P<sub>f</sub>(25°C))]

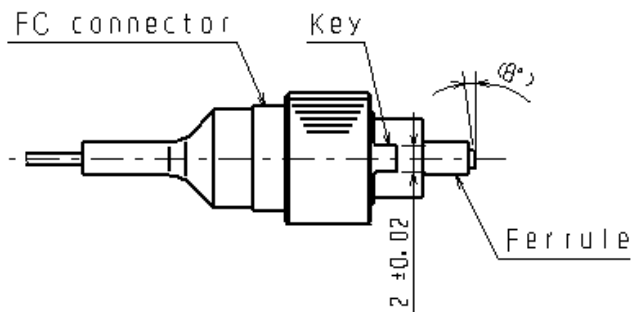
MITSUBISHI (OPTICAL DEVICES)

**FU-48SDF-Y30M31B/51/52/53/54/55****1.3  $\mu\text{m}$  DFB-LD MODULE WITH SINGLEMODE FIBER PIGTAIL(CATV)****THERMAL CHARACTERISTICS** (T<sub>ld</sub>=25°C, T<sub>c</sub>=-20~+65°C)

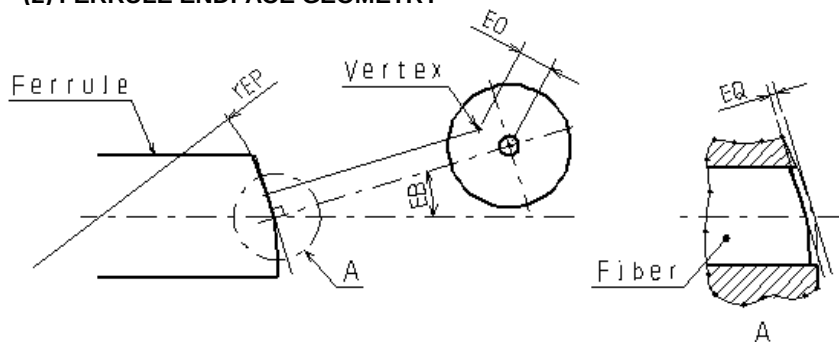
| Parameter                           | Symbol          | Conditions            | Limits |      |      | Units      |
|-------------------------------------|-----------------|-----------------------|--------|------|------|------------|
|                                     |                 |                       | 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 thermistor resistance | B               | -                     | -      | 3950 | -    | K          |
| Cooling capacity                    | $\Delta T$      | T <sub>c</sub> =65°C  | 40     | -    | -    | K          |
| Cooler current                      | I <sub>pe</sub> | $\Delta T$ =40K       | -      | 0.6  | 1    | A          |
| Cooler voltage                      | V <sub>pe</sub> | $\Delta T$ =40K       | -      | 1.2  | 2    | V          |

**OPTICAL FIBER SPECIFICATION**

| Parameter            | Limits                                                                                     | Unit          |
|----------------------|--------------------------------------------------------------------------------------------|---------------|
| Type                 | SM                                                                                         | -             |
| Mode field diameter  | 9.5 $\pm$ 1                                                                                | $\mu\text{m}$ |
| Cladding diameter    | 125 $\pm$ 2                                                                                | $\mu\text{m}$ |
| Jacket diameter      | 0.9 typ.                                                                                   | mm            |
| Fiber pintail length | L <sub>fiber</sub> =1000+200/-0<br>(L <sub>fiber</sub> is defined in the outline drawing.) | mm            |

**CONNECTOR SPECIFICATION****(1) CONNECTOR PARTS**

| Part         | Marker | Part No. |
|--------------|--------|----------|
| FC connector | SEIOH  | PF11A    |
| Ferrule      | GIKEN  | FF3A     |

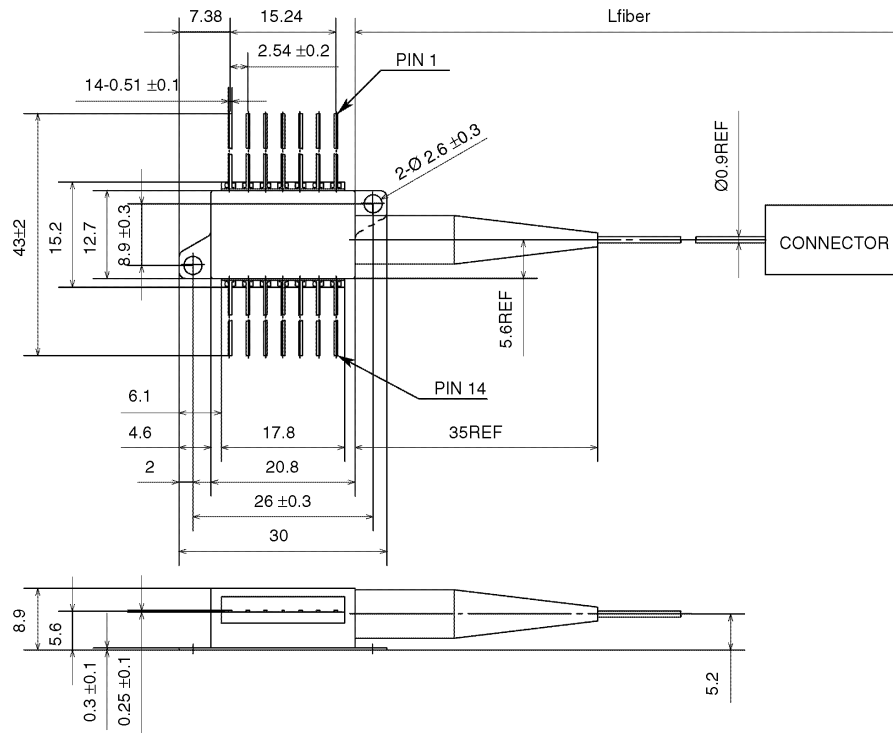
**(2) FERRULE ENDFACE GEOMETRY**

| Reference | Dimensions           |
|-----------|----------------------|
| EB        | 8°                   |
| EO        | 50 $\mu\text{m}$ MAX |
| rEP       | 5~12mm               |
| EQ        | $\pm 0.1\mu\text{m}$ |

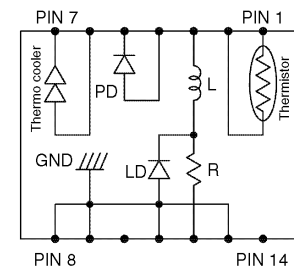
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**FU-48SDF-Y30M31B/51/52/53/54/55****1.3  $\mu\text{m}$  DFB-LD MODULE WITH SINGLEMODE FIBER PIGTAIL(CATV)****OUTLINE DIAGRAM**

(Unit : mm)



| 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-48SDF-Y30M31B/51/52/53/54/55**