

| Approved | Approved | Charged |
|--------------------|------------------|------------------------|
| <i>H. Watanabe</i> | <i>R. Adachi</i> | T.Fujita N.Sekimoto |

Preliminary*

Specification for 10Gb/s EML module with driver

Module type: FU-193SEA

| | | | |
|-------------|---|------------|---|
| A | B | C | D |
| | x | | |
| Date | | Approved | |
| 12 Feb.2003 | | H.Watanabe | |

* Mitsubishi Electric Corp. reserves the right to change product design and specification without notice.

FU-193SEA

1.55 μ m EA MODULATOR INTEGRATED DFB-LD MODULE WITH DRIVER
(10Gb/s DIGITAL APPLICATION)

DESCRIPTION

Module type FU-193SEA is a 1.55 μ m EA modulator integrated DFB-LD module with EA driver, and optical output end is receptacle type connected with SC/PC connector.

This module is suitable to a light source for use in 10Gb/s digital optical communication systems.

**FEATURES**

- Input impedance is 50 Ω
- Integrated Electro-absorption Modulator
- Distributed feed-back(DFB) Laser Diode
- Emission wavelength is 1.55 μ m band
- Built-in EA Driver
- Built-in optical isolator
- Built-in thermoelectric cooler
- Optical output end is SC/PC receptacle type
- Case is floating

ABSOLUTE MAXIMUM RATINGS

| Parameter | | Symbol | Conditions | Rating | Unit |
|------------------------------|-----------------------------------|------------------------------|------------|--------|------|
| Laser diode | Forward current | I _f | CW | 200 | mA |
| | Reverse voltage | V _{rl} | CW | 2 | V |
| Modulator | Reverse voltage | V _{rm} | - | 5 | V |
| | Forward voltage | V _{fm} | - | 1 | V |
| Photodiode for monitoring | Reverse voltage | V _{rd} | - | 20 | V |
| | Forward current | I _{fd} | - | 2 | mA |
| Thermoelectric cooler(Note1) | Current | I _{pem} | - | 1.5 | A |
| | Voltage | V _{pem} | - | 3.2 | V |
| Driver IC | Voltage | V _{EE_m} | - | -6~0 | V |
| | Current | I _{EE_m} | - | 500 | mA |
| | EA modulation voltage | V _{MOD_m} | - | -6.5~0 | V |
| | EA offset voltage control voltage | V _{OF_{Sm}} | - | -6.5~0 | V |
| | Cross point control Voltage | V _{CR_{Sm}} | - | -6~0 | V |
| Operating case temperature | | T _c | - | 0~75 | °C |
| Storage temperature | | T _{stg} | - | -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.

FU-193SEA

1.55 mm EA MODULATOR INTEGRATED DFB-LD MODULE WITH DRIVER
(10Gb/s DIGITAL APPLICATION)

ELECTRICAL/OPTICAL CHARACTERISTICS (T_{ld}=T_c=25°C, unless otherwise noted)

| Parameter | Symbol | Conditions | Limits | | | Unit |
|---------------------------------------|---------------------------------------|--------------------------------------|----------------------|------|----------------------|------|
| | | | Min. | Typ. | Max. | |
| Threshold current | I _{th} | CW | 5 | - | 30 | mA |
| Operating current | I _{op} | (Note 2,3) | - | - | 100 | mA |
| Operating voltage | V _{op} | (Note 2,3) | - | - | 1.7 | V |
| Operating power | P _{op} | (Note 2,3) | -1 | 0 | 2 | dBm |
| Light emission central wavelength | λ _c | (Note 2,3) | 1530 | 1550 | 1570 | nm |
| Side mode suppression ratio | S _r | (Note 2,3) | 35 | - | - | dB |
| Dispersion penalty | D _p | (Note 2,3), D=800ps/nm | - | - | 2.0 | dB |
| Extinction ratio | E _x | (Note 2,3) | 9 | - | - | dB |
| Driver IC supply voltage | V _{EE} | - | -5.5 | -5.2 | -4.9 | V |
| Driver IC supply current | I _{EE} | - | - | 250 | 300 | mA |
| EA modulation voltage control voltage | V _{MOD} | - | V _{EE} | - | V _{EE} +1.0 | V |
| EA offset voltage control voltage | V _{OFS} | - | V _{EE} | - | V _{EE} +2.2 | V |
| Cross point control voltage | V _{CRS} | - | V _{EE} +0.7 | - | V _{EE} +2.2 | V |
| Data input voltage | D _{in} , \overline{D}_{in} | Differential | 0.4 | - | 1.0 | V |
| Rise/fall time | t _r /t _f | (Note 2,3), 20-80% | - | - | 45 | ps |
| RF return loss | S ₁₁ | f≤10GHz | 5 | 7 | - | dB |
| Tracking error | E _r | (Note 2,3,4), T _c =0-75°C | - | - | 1.0 | dB |
| Monitor current | I _{mon} | (Note 2,3), V _{rd} =-5V | 0.05 | - | 1.5 | mA |
| Dark current(PD) | I _d | V _{rd} =-5V | - | - | 0.1 | μA |
| Capacitance(PD) | C _t | V _{rd} =-5V | - | 10 | - | pF |
| Optical isolation | I _{so} | T _c =25°C | 20 | - | - | dB |

Note 2 : 10.709225Gb/s, NRZ, PRBS 2³¹-1, P_{ave}=P_{op}, cross point=50%, with 4th BESSEL filter.

Note 3 : Optical return loss of the connectors should be greater than 40dB in order to get specified performance.

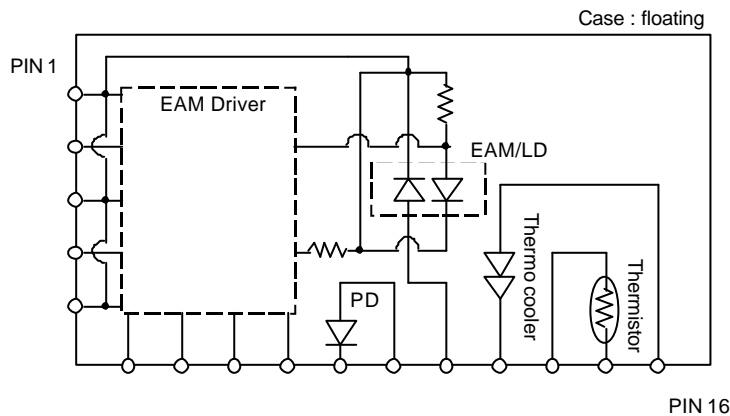
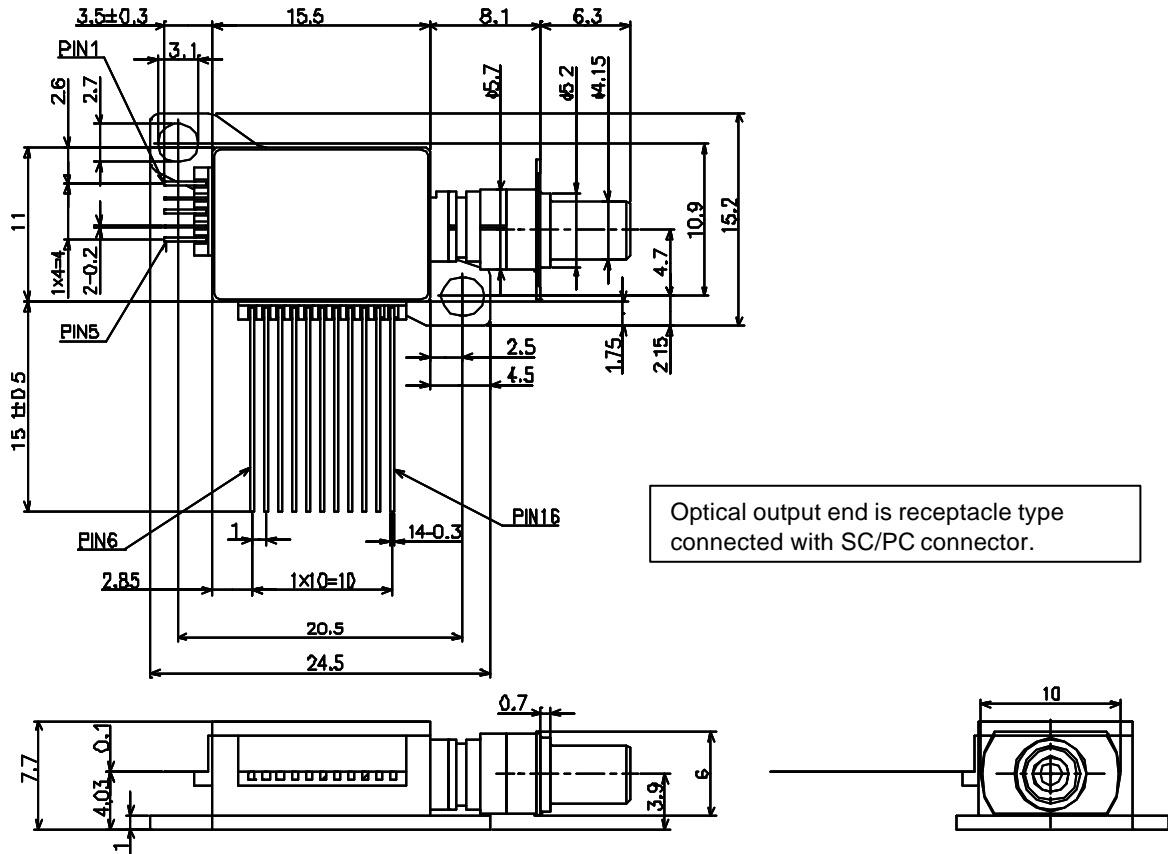
Note 4 : E_r=max | 10×log(P_f/P_l@25°C) |.

THERMAL CHARACTERISTICS

| Parameter | Symbol | Conditions | Limits | | | Unit |
|-------------------------------|-----------------|--|--------|------|------|------|
| | | | Min. | Typ. | Max. | |
| Thermistor resistance | R _{th} | T _c =T _{ld} =25°C | 9.5 | 10 | 10.5 | kΩ |
| B constant of R _{th} | B | - | - | 3950 | - | K |
| Cooler current | I _{pe} | (Note 2,3), T _c =75°C, T _{ld} =25°C | - | 0.9 | 1.2 | A |
| Cooler voltage | V _{pe} | (Note 2,3), T _c =75°C, T _{ld} =25°C | - | 2.8 | 3.0 | V |

FU-193SEA

1.55 mm EA MODULATOR INTEGRATED DFB-LD MODULE WITH DRIVER
(10Gb/s DIGITAL APPLICATION)



| Pin | Function | Pin | Function |
|-----|------------------|-----|----------------------|
| 1 | FLOATING GND | 9 | V _{OFFS} |
| 2 | DATA | 10 | MONITOR PD (CATHODE) |
| 3 | FLOATING GND | 11 | MONITOR PD (ANODE) |
| 4 | DATA | 12 | LD BIAS (ANODE) |
| 5 | FLOATING GND | 13 | COOLER (CATHODE) |
| 6 | V _{CRS} | 14 | THERMISTOR |
| 7 | V _{EE} | 15 | THERMISTOR |
| 8 | V _{MOD} | 16 | COOLER (ANODE) |