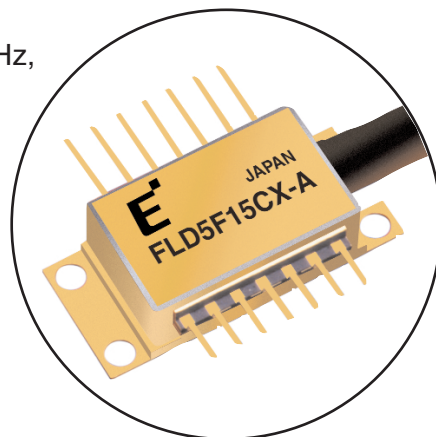


## FEATURES

- Direct Modulated DFB Laser for WDM systems
- Optimized for Long Distance Transmission (Dispersion 3200ps/nm)
- Peak wavelength 1527.99 to 1563.05nm (C Band: 191.8 to 196.2THz, 100GHz spacing)
- Output Power: 10mW
- 14-pin Butterfly type package
- Power monitor PIN-PD (InGaAs), Thermistor, cooler
- Built-in optical isolator
- Single mode fiber

## APPLICATIONS

This laser is intended for the application of 2.5 Gb/s long haul Dense Wavelength Division Multiplexing (DWDM). Transmission spans of 3200ps/nm are possible.



## DESCRIPTION

This high power laser is capable of 2.5 Gb/s transmission. It is packaged in a “butterfly” type module. The module employs a high efficiency optical coupling system, coupling the laser output through a built-in optical isolator into a single mode fiber pigtail. The module also includes a monitor photodiode, a thermoelectric cooler (TEC), and thermistor. This device is designed for use in DWDM direct modulation transmission systems. Selected wavelengths specified to the ITU-T grid are available.

### ABSOLUTE MAXIMUM RATINGS (T<sub>C</sub>=25°C, unless otherwise specified)

| Parameter                        | Symbol            | Condition     | Ratings |      | Unit |
|----------------------------------|-------------------|---------------|---------|------|------|
|                                  |                   |               | Min.    | Max. |      |
| Storage Temperature              | T <sub>stg</sub>  | -             | -40     | +85  | °C   |
| Operating Case Temperature       | T <sub>op</sub>   | -             | -20     | +70  | °C   |
| Optical Output Power             | P <sub>f</sub>    | CW            | -       | 12.0 | mW   |
| LD Forward Current               | I <sub>F</sub>    | CW            | -       | 150  | mA   |
| LD Reverse Voltage               | V <sub>R</sub>    | -             | -       | 2    | V    |
| Photodiode Reverse Voltage       | V <sub>DR</sub>   | -             | -       | 20   | V    |
| Photodiode Forward Current       | I <sub>PF</sub>   | -             | -       | 10   | mA   |
| Cooler Voltage                   | V <sub>C</sub>    | Cooling       | -       | 2.5  | V    |
|                                  |                   | Heating       | -2.5    | -    |      |
| Cooler Current                   | I <sub>C</sub>    | Cooling       | -       | 1.4  | A    |
|                                  |                   | Heating       | -0.9    | -    |      |
| Thermistor Temperature           | T <sub>th</sub>   | ATC Operation | -20     | +70  | °C   |
| Lead Soldering Time              | T <sub>sold</sub> | 260°C         | -       | 10   | sec  |
| Environmental Operating Humidity | X <sub>op</sub>   | Top<30°C      | -       | 95   | %    |
| Environmental Storage Humidity   | X <sub>st</sub>   | Tstg<30°C     | -       | 95   | %    |

## OPTICAL AND ELECTRICAL CHARACTERISTICS (T<sub>L</sub>=T<sub>set</sub>, T<sub>C</sub>=25°C, BOL, unless otherwise specified)

| Parameter                                  | Symbol                          | Conditions                                    | Limits |          |       | Unit  |
|--------------------------------------------|---------------------------------|-----------------------------------------------|--------|----------|-------|-------|
|                                            |                                 |                                               | Min.   | Typ.     | Max.  |       |
| Laser Set Temperature                      | T <sub>set</sub>                | -                                             | 20     | -        | 35    | °C    |
| Threshold Current                          | I <sub>th</sub>                 | CW                                            | 4      | -        | 40    | mA    |
| Forward Voltage                            | V <sub>FDC</sub>                | CW, I <sub>F</sub> =30 mA, pin 12, 13         | -      | 1.6      | 1.75  | V     |
| Series Resistance                          | R <sub>S</sub>                  | CW, pin 12, 13                                | 22     | 25       | 28    | Ω     |
| Optical Output Power                       | P <sub>f</sub>                  | CW                                            | 10.0   | -        | -     | mW    |
| Slope Efficiency                           | η                               | CW, P <sub>f</sub> =10mW                      | 0.14   | -        | -     | mW/mA |
| Threshold Power                            | P <sub>th</sub>                 | CW, I <sub>F</sub> =I <sub>th</sub>           | -      | -        | 150   | μW    |
| Tracking Error (Note 1)                    | TE                              | Im-APC, T <sub>C</sub> =-20 to 70°C           | -0.5   | -        | +0.5  | dB    |
| Monitor Current                            | I <sub>m</sub>                  | CW, P <sub>f</sub> =10mW, V <sub>DR</sub> =5V | 0.25   | -        | 2.5   | mA    |
| Photodiode Dark Current                    | I <sub>D</sub>                  | V <sub>DR</sub> =5V                           | -      | 2        | 100   | nA    |
| Photodiode Capacitance                     | C <sub>t</sub>                  | V <sub>DR</sub> =5V, f=1 MHz                  | -      | -        | 10    | pF    |
| Photodiode Cutoff                          | f <sub>cm</sub>                 | V <sub>DR</sub> =5V, 50Ω load                 | 100    | -        | -     | MHz   |
| Peak Wavelength                            | λ <sub>p</sub>                  | Note (2)                                      |        | Note (4) |       | nm    |
| Wavelength Drift                           | Δλ                              | Note (2), after 20 years                      | -100   | -        | +100  | pm    |
| Wavelength Stability with Case Temperature | dλ/dT <sub>C</sub>              | T <sub>C</sub> =-20 to +70°C                  | -1.0   | -        | +1.0  | pm/°C |
| Side Mode Suppression                      | S <sub>r</sub>                  | Note (2)                                      | 35     | 40       | -     | dB    |
| Spectral Width (-20dB)                     | δλ                              | Note (2)                                      | -      | -        | 0.3   | nm    |
| Rise/Fall Time                             | T <sub>r</sub> , T <sub>f</sub> | 20% to 80%                                    | -      | -        | 0.125 | nsec  |
| Cutoff Frequency                           | f <sub>c</sub>                  | P <sub>f</sub> =10mW, -3 dB                   | 3.5    | -        | -     | GHz   |
| RF Return Loss                             | S <sub>11</sub>                 | f=50 MHz to 2 GHz                             | 8      | -        | -     | dB    |
|                                            |                                 | f=2 GHz to 3 GHz                              | 6      | -        | -     | dB    |
|                                            |                                 | f=3 GHz to 5 GHz                              | 3      | -        | -     | dB    |

OPTICAL AND ELECTRICAL CHARACTERISTICS ( $T_L = T_{set}$ ,  $T_L$ : Laser Temperature,  $T_C = 25^\circ\text{C}$ , BOL, unless otherwise specified)

| Parameter                | Symbol   | Test Conditions                                                        | Limit |         |      | Unit      |
|--------------------------|----------|------------------------------------------------------------------------|-------|---------|------|-----------|
|                          |          |                                                                        | Min.  | Typ.    | Max. |           |
| Cooler Current           | $I_C$    | $T_L = T_{set}$ ,<br>$P_f = 10\text{mW}$ ,<br>$T_C = 70^\circ\text{C}$ | -     | -       | 1.0  | A         |
| Cooler Voltage           | $V_C$    |                                                                        | -     | -       | 2.4  | V         |
| Cooler Power             | $P_C$    |                                                                        | -     | -       | 2.4  | W         |
| Thermistor Resistance    | $R_{tr}$ | $T_L = 25^\circ\text{C}$                                               | 9.5   | 10.0    | 10.5 | $k\Omega$ |
| Thermistor B Constant    | B        |                                                                        | 3270  | 3450    | 3630 | K         |
| Optical Isolation        | $I_s$    | $T_C = -20$ to $70^\circ\text{C}$                                      | 25    | 35      | -    | dB        |
| Relative Intensity Noise | RIN      | $f = 2.5$ GHz<br>$P_f = 10$ mW, ORL=24 dB                              | -     | -       | -140 | dB/Hz     |
| Kink                     | $K_{ns}$ | up to 12mW                                                             |       | No Kink |      | -         |
| Power Penalty            | PP       | Note (2)                                                               | -     | -       | 2.0  | dB        |

Note 1.  $TE = 10 \cdot \log\{P_f(T_{case})/P_f(T_C = 25^\circ\text{C})\}$  (dB)

Note 2. 2.5 Gb/s NRZ,  $P_{peak} = 10.0\text{mW}$ ,  $R_{ext} = 8.2\text{dB}$ , PRBS= $2^{23}-1$ ,

Note 3. Bit rate=2.48832 Gb/s, PRBS= $2^{23}-1$ , Dispersion=3200ps/nm,  $P_{peak} = 10\text{mW}$ ,  
 $R_{ext} = 8.2\text{dB}$  (min.)

Receiver: Eudyna Standard Receiver

Note 4. The selected wavelengths available are listed in Fig. 8

Fig. 1 Forward Current vs Output Power

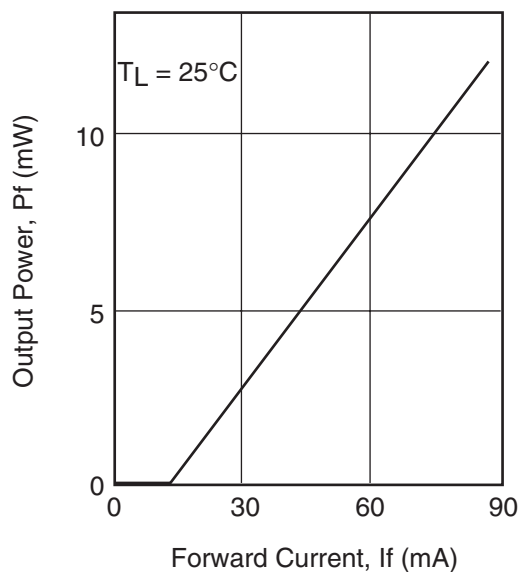


Fig. 2 Frequency Response

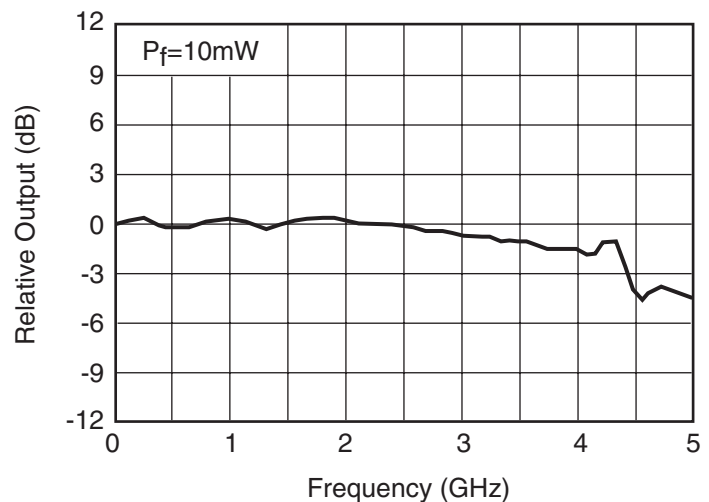


Fig. 3 RF Return Loss

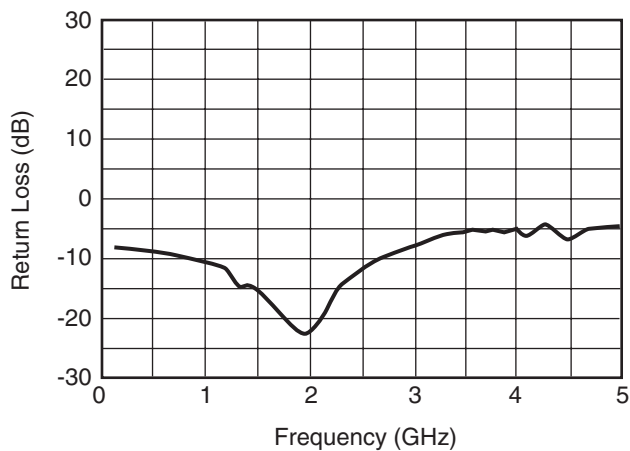


Fig. 4 Cooler Voltage -Current

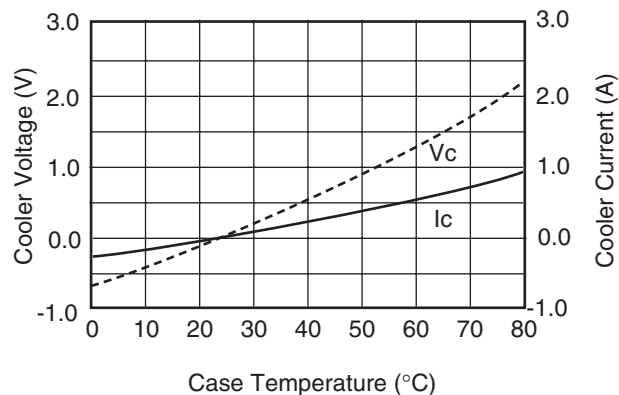


Fig. 5 Spectrum

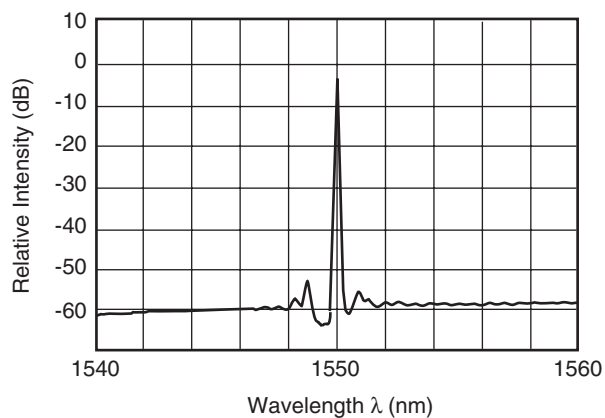


Fig. 6 Temperature Dependence of Wavelength (ACC Operation)

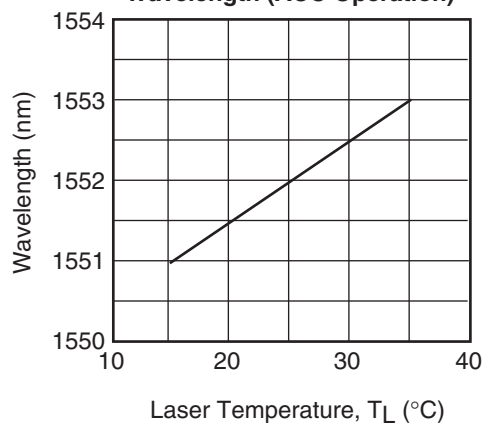


Fig. 7 Transmission Characteristics

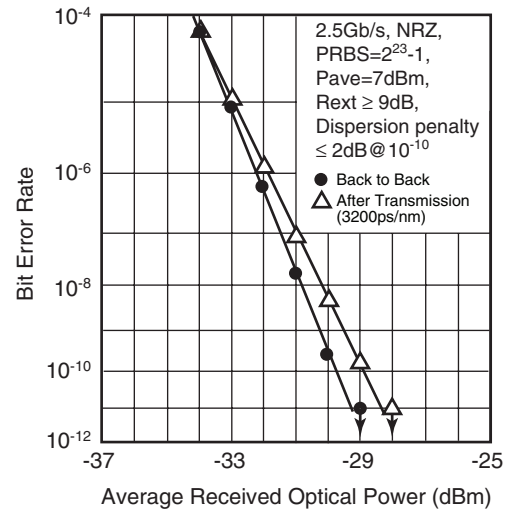


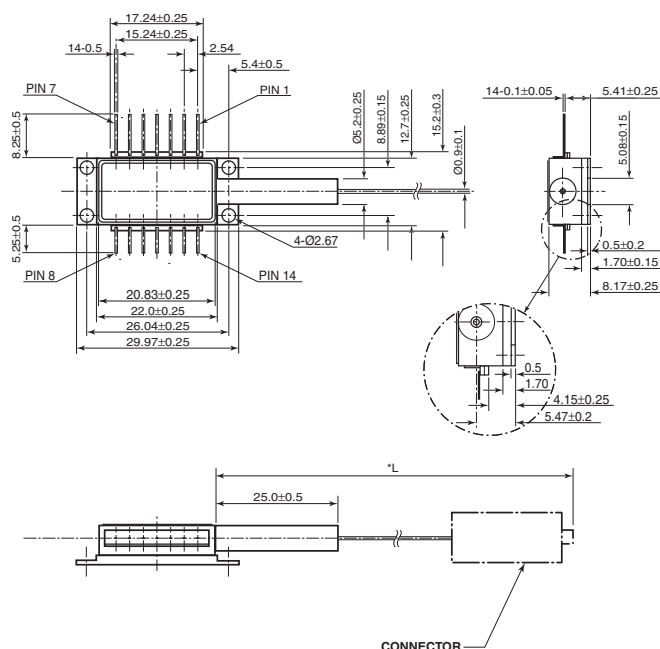
Fig. 8 Wavelength Table

| Part Number     | Wavelength (nm)<br>(TL=Tset)<br>(in vacuum) | Tolerance (nm) |
|-----------------|---------------------------------------------|----------------|
| FLD5F15CX-A9620 | 1527.99                                     | ±0.1           |
| -A9610          | 1528.77                                     | ±0.1           |
| -A9600          | 1529.55                                     | ±0.1           |
| -A9590          | 1530.33                                     | ±0.1           |
| -A9580          | 1531.12                                     | ±0.1           |
| -A9570          | 1531.90                                     | ±0.1           |
| -A9560          | 1532.68                                     | ±0.1           |
| -A9550          | 1533.47                                     | ±0.1           |
| -A9540          | 1534.25                                     | ±0.1           |
| -A9530          | 1535.04                                     | ±0.1           |
| -A9520          | 1535.82                                     | ±0.1           |
| -A9510          | 1536.61                                     | ±0.1           |
| -A9500          | 1537.40                                     | ±0.1           |
| -A9490          | 1538.19                                     | ±0.1           |
| -A9480          | 1538.98                                     | ±0.1           |
| -A9470          | 1539.77                                     | ±0.1           |
| -A9460          | 1540.56                                     | ±0.1           |
| -A9450          | 1541.35                                     | ±0.1           |
| -A9440          | 1542.14                                     | ±0.1           |
| -A9430          | 1542.94                                     | ±0.1           |
| -A9420          | 1543.73                                     | ±0.1           |

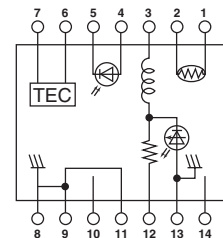
|        |         |      |
|--------|---------|------|
| -A9410 | 1544.53 | ±0.1 |
| -A9400 | 1545.32 | ±0.1 |
| -A9390 | 1546.12 | ±0.1 |
| -A9380 | 1546.92 | ±0.1 |
| -A9370 | 1547.72 | ±0.1 |
| -A9360 | 1548.51 | ±0.1 |
| -A9350 | 1549.32 | ±0.1 |
| -A9340 | 1550.12 | ±0.1 |
| -A9330 | 1550.92 | ±0.1 |
| -A9320 | 1551.72 | ±0.1 |
| -A9310 | 1552.52 | ±0.1 |
| -A9300 | 1553.33 | ±0.1 |
| -A9290 | 1554.13 | ±0.1 |
| -A9280 | 1554.94 | ±0.1 |
| -A9270 | 1555.75 | ±0.1 |
| -A9260 | 1556.55 | ±0.1 |
| -A9250 | 1557.36 | ±0.1 |
| -A9240 | 1558.17 | ±0.1 |
| -A9230 | 1558.98 | ±0.1 |
| -A9220 | 1559.79 | ±0.1 |
| -A9210 | 1560.61 | ±0.1 |
| -A9200 | 1561.42 | ±0.1 |
| -A9190 | 1562.23 | ±0.1 |
| -A9180 | 1563.05 | ±0.1 |

## "CX" PACKAGE

UNIT: mm



| Grounded Type |                           |
|---------------|---------------------------|
| PIN #         | FUNCTION                  |
| 1.            | Thermistor                |
| 2.            | Thermistor                |
| 3.            | Laser DC Bias (-)         |
| 4.            | Monitor (Anode)           |
| 5.            | Monitor (Cathode)         |
| 6.            | Thermoelectric Cooler (+) |
| 7.            | Thermoelectric Cooler (-) |
| 8.            | Case Ground               |
| 9.            | Case Ground               |
| 10.           | N.C.                      |
| 11.           | Case Ground               |
| 12.           | Laser Modulation (-)      |
| 13.           | Case Ground               |
| 14.           | N.C.                      |



For further information please contact:

### Eudyna Devices USA Inc.

2355 Zanker Rd.  
San Jose, CA 95131-1138, U.S.A.  
TEL: (408) 232-9500  
FAX: (408) 428-9111  
[www.us.eudyna.com](http://www.us.eudyna.com)

### Eudyna Devices Europe Ltd.

Network House  
Norreys Drive  
Maidenhead, Berkshire SL6 4FJ  
United Kingdom  
TEL: +44 (0) 1628 504800  
FAX: +44 (0) 1628 504888

### Eudyna Devices Asia Pte Ltd.

Hong Kong Branch  
Rm. 1101, Ocean Centre, 5 Canton Rd.  
Tsim Sha Tsui, Kowloon, Hong Kong  
TEL: +852-2377-0227  
FAX: +852-2377-3921

### Eudyna Devices Inc.

Sales Division  
1, Kanai-cho, Sakae-ku  
Yokohama, 244-0845, Japan  
TEL: +81-45-853-8156  
FAX: +81-45-853-8170

## CAUTION

Eudyna Devices Inc. products contain **gallium arsenide (GaAs)** which can be hazardous to the human body and the environment. For safety, observe the following procedures:

- Do not put this product into the mouth.
- Do not alter the form of this product into a gas, powder, or liquid through burning, crushing, or chemical processing as these by-products are dangerous to the human body if inhaled, ingested, or swallowed.
- Observe government laws and company regulations when discarding this product. This product must be discarded in accordance with methods specified by applicable hazardous waste procedures.

Eudyna Devices Inc. reserves the right to change products and specifications without notice. The information does not convey any license under rights of Eudyna Devices Inc. or others.

© 2004 Eudyna Devices USA Inc.  
Printed in U.S.A.