

## FEATURES

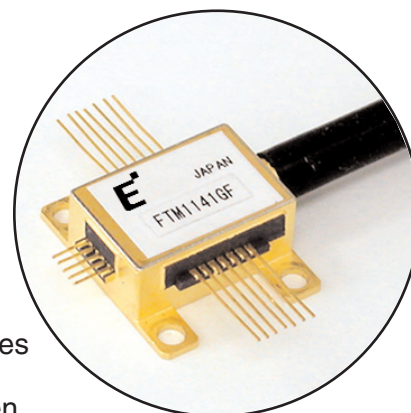
- Driver integrated 10Gb/s MI-DFB module for 800ps/nm optical transmission
- MI-DFB-LD (Modulator Integrated DFB Laser Diode) is included
- Modulator driver IC is included
- Built-in optical isolator, PIN-Photo diode for monitor, thermistor and thermo-electric cooler
- 800ps/nm (40km)

## DESCRIPTION

The FTM1141GF was developed to reduce the size and technical complexity of 10Gb/s optical board designs. This product, which includes a driver and modulator integrated laser in one package, eliminates the customer concerns regarding how to handle the RF interfacing between these two components on his board. By co-packaging these components a solution has also been achieved that offers greatly reduced board space.

This reduction in space is critical for next generation transponder applications.

The FTM1141GF has been designed with a differential co-planar electrical interface which allows for easy interfacing to RF lines on PC boards. The package and pinout are part of a multi-source agreement. This product is designed for 40km SONET/SDM applications and single channel drop links in DWDM systems.



## ABSOLUTE MAXIMUM RATINGS (Top=25°C, Unless otherwise specified)

| Parameter                                  | Symbol                               | Condition                    | Rating                            |                                  | Unit            |
|--------------------------------------------|--------------------------------------|------------------------------|-----------------------------------|----------------------------------|-----------------|
|                                            |                                      |                              | Min.                              | Max.                             |                 |
| Storage Temperature                        | T <sub>stg</sub>                     |                              | -40                               | 85                               | °C              |
| Operating Case Temperature                 | T <sub>op</sub> (T <sub>c</sub> )    |                              | 0                                 | 75                               | °C              |
| Optical Output Power                       | P <sub>f</sub>                       | CW                           | -                                 | 5                                | mW              |
| Laser Forward Current                      | I <sub>f</sub>                       | CW                           | -                                 | 150                              | mA              |
| Laser Reverse Voltage                      | V <sub>R</sub>                       | CW                           | -                                 | 2                                | V               |
| Power Supply Voltage                       | V <sub>SS</sub>                      |                              | -6.5                              | 0.3                              | V               |
| Modulator (Mod) modulation Control Voltage | V <sub>m</sub>                       |                              | -6.5                              | V <sub>SS</sub> +1.2<br>(max0.3) | V               |
| Mod Bias Control Voltage                   | V <sub>b</sub>                       |                              | -6.5                              | V <sub>SS</sub> +2.4<br>(max0.3) | V               |
| Cross Point Control Voltage                | V <sub>x1</sub> , (V <sub>x2</sub> ) |                              | V <sub>SS</sub> -4.8<br>(min-6.5) | V <sub>SS</sub> +2.4<br>(max0.3) | V               |
| Data Input Voltage                         | D <sub>in</sub> , D <sub>inB</sub>   | Differential<br>(AC-coupled) | -                                 | 1.6                              | V <sub>pp</sub> |
| ESD Tolerance                              | V <sub>esd</sub>                     | Note (1-1)                   | -                                 | 50                               | V               |
| ESD Tolerance                              | V <sub>esd</sub>                     | Note (1-2)                   | -                                 | 200                              | V               |
| Photodiode Forward Current                 | I <sub>DF</sub>                      |                              | -                                 | 1                                | mA              |
| Photodiode Reverse Voltage                 | V <sub>DR</sub>                      |                              | -                                 | 10                               | V               |
| TEC Voltage                                | V <sub>c</sub>                       | Cooling                      | -                                 | 2.5                              | V               |
|                                            |                                      | Heating                      | -2.5                              | -                                |                 |
| TEC Current                                | I <sub>c</sub>                       | Cooling                      | -                                 | 1.5                              | A               |
|                                            |                                      | Heating                      | -0.9                              | -                                |                 |
| Thermistor Temperature                     | T <sub>th</sub>                      | ATC operation                | 0                                 | +75                              | °C              |
| Lead Soldering Time                        |                                      | 260°C MAX                    | -                                 | 10                               | sec             |

OPTICAL SPECIFICATIONS (TLD=25°C, Tc=0 to 75°C and BOL, unless otherwise specified)  
LASER DIODE AND MODULATOR CHARACTERISTICS

| Parameter                   | Symbol           | Condition                                   | Limit |            |      | Unit |
|-----------------------------|------------------|---------------------------------------------|-------|------------|------|------|
|                             |                  |                                             | Min.  | Typ.       | Max. |      |
| Threshold Current           | I <sub>th</sub>  | CW                                          | -     | -          | 25   | mA   |
| Operating Current           | I <sub>op</sub>  | P <sub>f</sub> =P <sub>op</sub>             | 40    | 70         | 100  | mA   |
| Optical Output Power        | P <sub>op</sub>  | Note (2a)                                   | -1    | -          | +2   | dBm  |
| Forward Voltage             | V <sub>F</sub>   | CW                                          | -     | -          | 2.2  | V    |
| Extinction Ratio            | R <sub>ext</sub> | P <sub>f</sub> =P <sub>op</sub> , Note (2a) | 8.2   | -          | -    | dB   |
| Peak Wavelength             | W <sub>p</sub>   | P <sub>f</sub> =P <sub>op</sub> , Note (2a) | 1530  | -          | 1565 | nm   |
| Side Mode Suppression Ratio | SSR              | P <sub>f</sub> =P <sub>op</sub> , CW        | 35    | -          | -    | dB   |
| Optical Rise Time           | t <sub>r</sub>   | Note (3), 20% to 80%                        | -     | -          | 30   | psec |
| Optical Fall Time           | t <sub>f</sub>   | Note (3), 20% to 80%                        | -     | -          | 30   | psec |
| Optical Isolation           | I <sub>s</sub>   |                                             | 25    | -          | -    | dB   |
| Tracking Error              | TE               | Note (2a)                                   | -0.5  | -          | +0.5 | dB   |
| Input Return Loss           | S <sub>11</sub>  | 130MHz to 10GHz, T <sub>c</sub> =25°C       | 6     | 10         | -    | dB   |
| Dispersion Penalty          | dP               | Note (2)                                    | -     | -          | 2.0  | dB   |
| Eye Pattern Mask            | Msk              | Note (2a), 500 counts                       |       | Error Free |      |      |

## MONITOR DIODE CHARACTERISTICS

| Parameter                 | Symbol         | Condition                                             | Limit |      |      | Unit |
|---------------------------|----------------|-------------------------------------------------------|-------|------|------|------|
|                           |                |                                                       | Min.  | Typ. | Max. |      |
| Monitor Current           | I <sub>m</sub> | I <sub>F</sub> =I <sub>op</sub> , V <sub>DR</sub> =5V | 100   | -    | 1500 | μA   |
| Monitor Dark Current      | I <sub>d</sub> | V <sub>DR</sub> =5V                                   | -     | 2    | 100  | nA   |
| Monitor Diode Capacitance | C <sub>t</sub> | V <sub>DR</sub> =5V, f=1MHz                           | -     | 5    | 15   | pF   |

## TEC &amp; THERMISTOR CHARACTERISTICS

| Parameter             | Symbol          | Condition | Limit |      |      | Unit |
|-----------------------|-----------------|-----------|-------|------|------|------|
|                       |                 |           | Min.  | Typ. | Max. |      |
| TEC Current           | I <sub>c</sub>  | Note (4)  | -     | -    | 1.4  | A    |
| TEC Voltage           | V <sub>c</sub>  | Note (4)  | -     | -    | 2.5  | V    |
| TEC Power Consumption | P <sub>c</sub>  | Note (4)  | -     | -    | 3.5  | W    |
| Thermistor Resistance | R <sub>th</sub> | TLD=25°C  | -     | 10   | -    | kΩ   |
| Thermistor B Constant | B               |           | 3270  | 3450 | 4000 | K    |

## DRIVER IC CHARACTERISTICS

| Parameter                                  | Symbol                               | Condition                 | Limit                |      |                      | Unit            |
|--------------------------------------------|--------------------------------------|---------------------------|----------------------|------|----------------------|-----------------|
|                                            |                                      |                           | Min.                 | Typ. | Max.                 |                 |
| Driver IC Supply Voltage                   | V <sub>SS</sub>                      |                           | -5.5                 | -5.2 | -5.0                 | V               |
| Driver IC Supply Current                   | I <sub>SS</sub>                      |                           | -                    | -    | 285                  | mA              |
| Modulator (Mod) Modulation Control Voltage | V <sub>m</sub>                       |                           | V <sub>SS</sub>      | -    | V <sub>SS</sub> +1.0 | V               |
| Mod Bias Control Voltage                   | V <sub>b</sub>                       |                           | V <sub>SS</sub>      | -    | V <sub>SS</sub> +2.2 | V               |
| Cross Point (XP) Control Voltage           | V <sub>x1</sub> , (V <sub>x2</sub> ) | X <sub>p</sub> =50%       | V <sub>SS</sub> +0.8 | -    | V <sub>SS</sub> +2.2 | V               |
| Data Input Voltage                         | Din, DinB                            | Differential (AC Coupled) | 0.5                  | -    | 1.0                  | V <sub>pp</sub> |

Note (1-1): Pin No. 3,4,5,6,7,9,11

Note (1-2): Pin No. 1,2,8,10,12-19

Note (2): Eudyna Test System

(a) Drive Condition

Bit Rate: 9.95328 Gb/s

Word Pattern: PRBS=2<sup>31</sup>-1

Mark Density: 50%

Laser Bias Current: I<sub>op</sub>

Laser Temperature(TLD): 25°C

Eye Pattern Mask: ITU-T Eye mask for STM-64

(b) Fiber Dispersion

800ps/nm

(c) Dispersion Penalty

Bit Error Rate=10<sup>-12</sup>

Note (3): Eudyna Test System

V<sub>b</sub>, V<sub>m</sub>, V<sub>x1</sub>(V<sub>x2</sub>) is set to make Pop and Rext within the specification

Note (4): Eudyna Test System

Operating Case Temperature: T<sub>c</sub>=+75°C

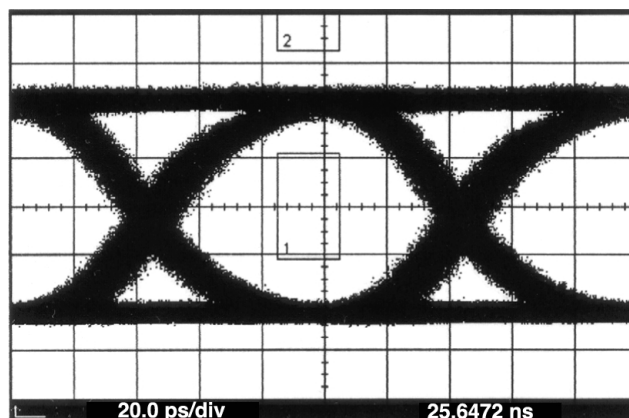
Laser Temperature:

25°C

Optical Output Power:

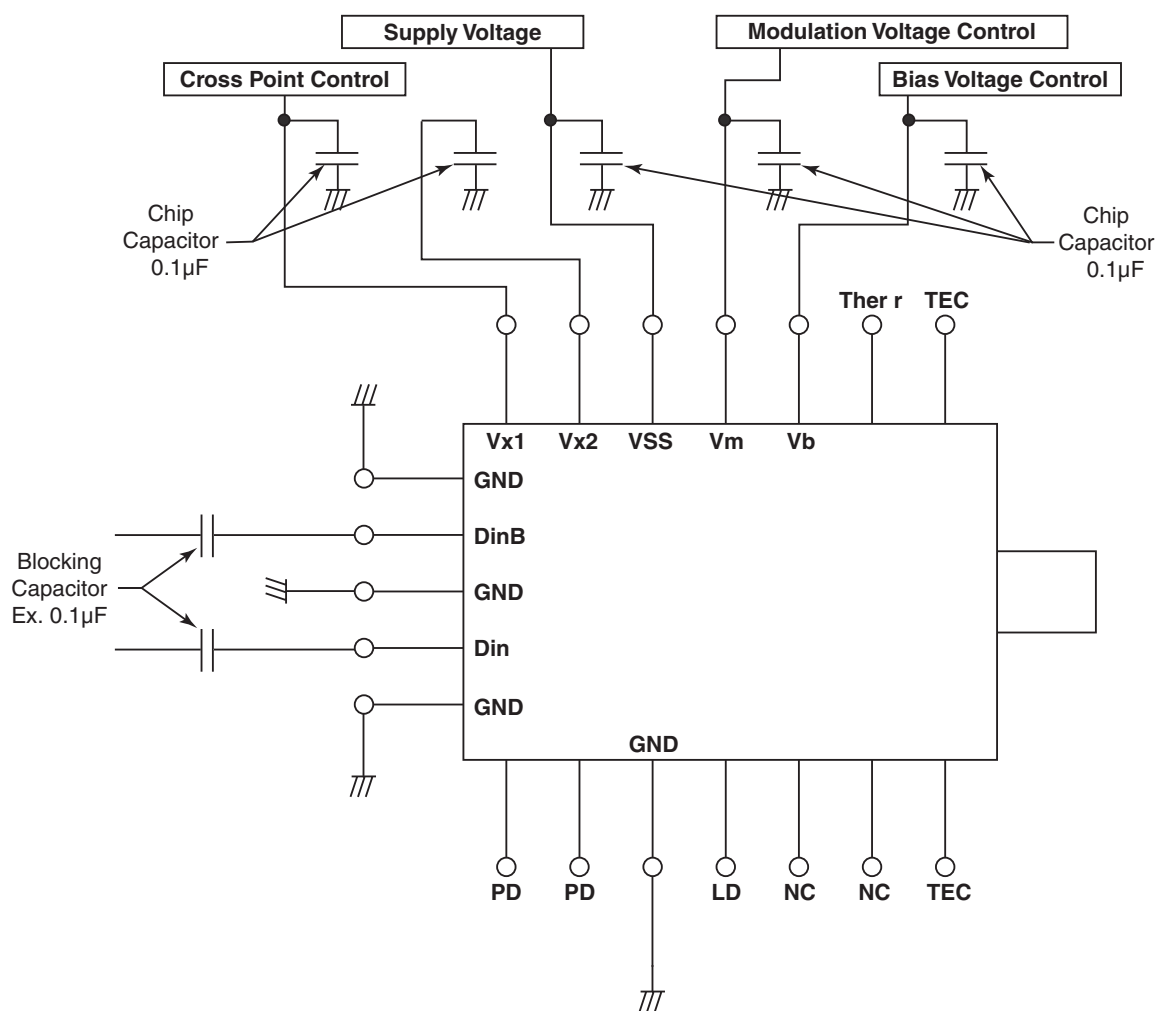
P<sub>f</sub>=Pop, Note (2a)

Typical Output Waveform  
Back to Back (with Filter)



9.95328Gb/s, NRZ, PRBS=2<sup>31</sup>-1, TLD=TC=25°C

## Typical Application for Driver IC

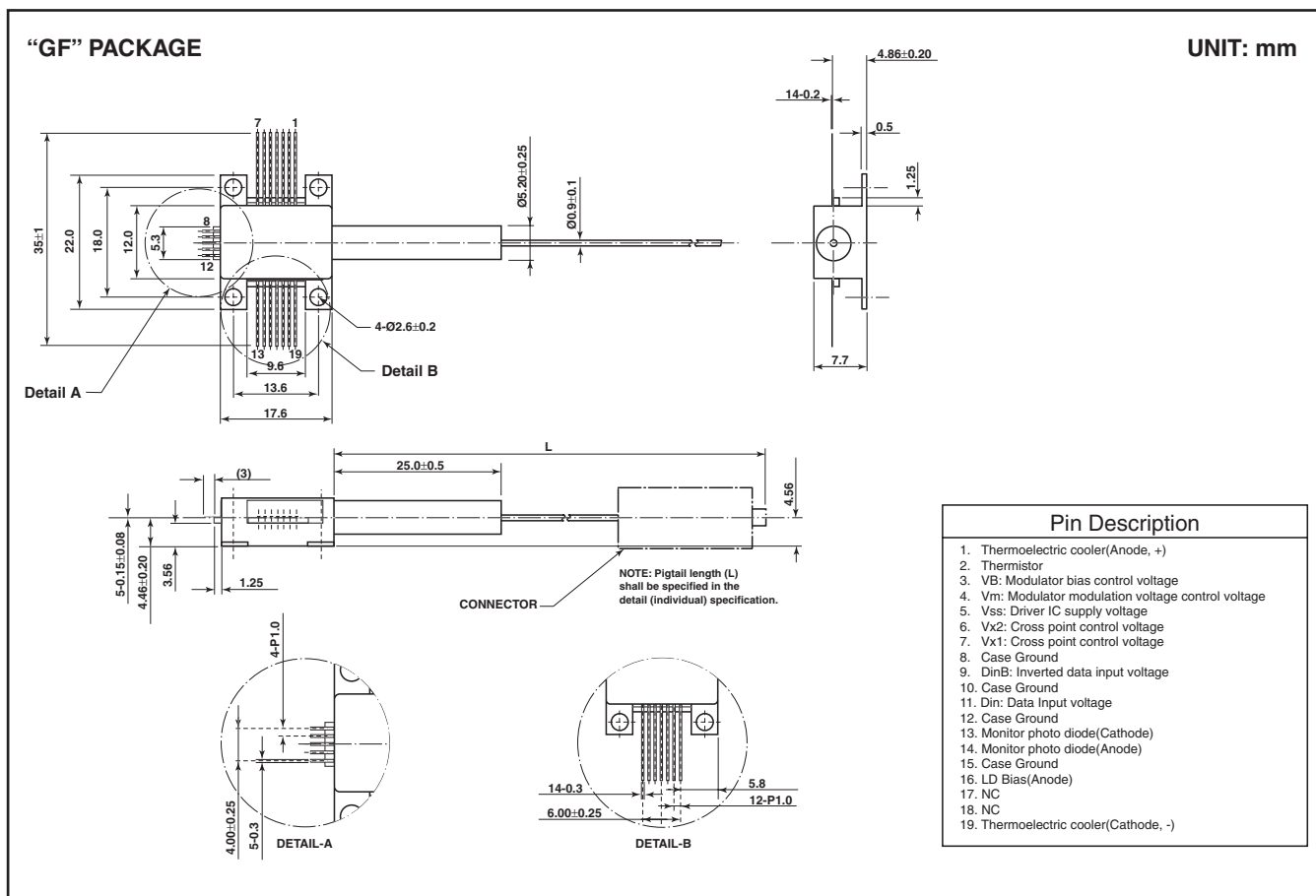


For stable operation:

- 8-1. To prevent a dependence of "Cross point" on the supply voltage VSS,
  - (1) Use an external voltage source of -3.8V for "Vx2", or
  - (2) Control the voltage of "Vx1", so that the voltage difference "Vx1-Vx2" remain constant.
- 8-2. To prevent a dependence of "Modulation control voltage" on the supply voltage VSS, control the voltage of "Vm", so that the difference "Vm-VSS" remain constant.
- 8-3. To prevent a dependence of "Bias control voltage" on the supply voltage VSS, control the voltage of "Vb", so that the difference "Vb-VSS" remain constant.

# Driver Integrated 10Gb/s MI-DFB LD Module

# FTM1141GF



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