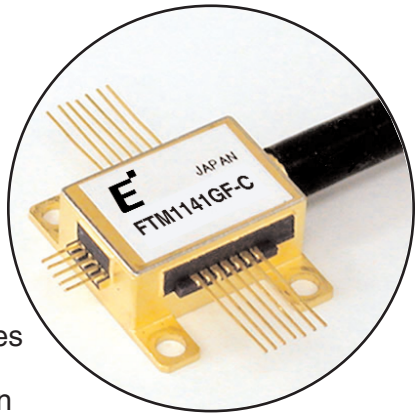
# Driver Integrated 10Gb/s MI-DFB LD Module

# FTM1141GF-C

## FEATURES

- Driver integrated 10Gb/s MI-DFB module for 1600ps/nm optical transmission
- MI-DFB-LD (Modulator Integrated DFB Laser Diode) is installed
- Modulator driver IC is installed
- Built-in optical isolator, PIN-Photo diode for monitor, thermistor and thermo-electric cooler
- 1600ps/nm (80km)




## DESCRIPTION

The FTM1141GF-C 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-C 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 80km SONET/SDH applications and single channel drop links in DWDM systems.

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

| Parameter | Symbol | Condition | Limits | | Unit |
|---|---|---|---|---|---|
| | | | Min. | Max. | |
| **Storage Temperature** | $T_{stg}$ | | -40 | 85 | °C |
| **Operating Case Temperature** | $T_{op(Tc)}$ | | 0 | 75 | °C |
| **Optical Output Power** | Pf | CW | - | 5 | mW |
| **Laser Forward Current** | If | CW | - | 150 | mA |
| **Laser Reverse Voltage** | VR | CW | - | 2 | V |
| **Power Supply Voltage** | $V_{ss}$ | | -6.5 | 0 | V |
| **Modulator (Mod) Modulation Control Voltage** | Vm | | -6.5 | $V_{ss}$+1.2 (max0) | V |
| **Mod Bias Control Voltage** | $V_b$ | | -6.5 | $V_{ss}$+2.4 (max0) | V |
| **Cross Point Control Voltage** | Vx1,(Vx2) | | $V_{ss}$-4.8 (min-6.5) | $V_{ss}$+2.4 (max0) | V |
| **Data Input Voltage** | Din, DinB | Differential (AC-coupled) | - | 1.6 | Vpp |
| **ESD Tolerance** | Vesd | Note (1-1) | - | 50 | V |
| **ESD Tolerance** | Vesd | Note (1-2) | - | 200 | V |
| **Photodiode Forward Current** | - | | - | 1 | mA |
| **Photodiode Reverse Voltage** | VDR | | - | 10 | V |
| **TEC Voltage** | Vc | Cooling | - | 2.5 | V |
| | | Heating | -1.0 | - | |
| **TEC Current** | Ic | Cooling | - | 1.5 | A |
| | | Heating | -0.5 | - | |
| **Thermistor Temperature** | Tth | ATC operation | 0 | +75 | °C |
| **Lead Soldering Time** | - | 260°C MAX | - | 10 | sec |

## OPTICAL SPECIFICATIONS ($T_{LD}$=25°C, $T_{op}$=0 to 75°C and BOL, unless otherwise specified)

### LASER DIODE AND MODULATOR CHARACTERSITICS

| Parameter | Symbol | Condition | Limit | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | |
| Threshold Current | Ith | CW | - | - | 25 | mA |
| Operating Current | Iop | Pf=Pop | 40 | 70 | 100 | mA |
| Optical Output Power | Pop | Note (2a) | +1.0 | - | +3.5 | dBm |
| Forward Voltage | VF | CW, $I_F$=$I_{op}$ | - | 1.4 | 2.2 | V |
| Extinction Ratio | Rext | Pf=Pop, Note (2a) | 9.0 | - | - | dB |
| Peak Wavelength | Wp | Pf=Pop, Note (2a) | 1530 | - | 1565 | nm |
| Side Mode Suppresion Ratio | SSR | $I_F$=Pop, CW | 35 | - | - | dB |
| Optical Rise Time | Tr | Note (3), 20% to 80% | - | - | 30 | psec |
| Optical Fall Time | Tf | Note (3), 20% to 80% | - | - | 30 | psec |
| Optical Isolation | Is | | 25 | - | - | dB |
| Tracking Error | TE | Note (2a) | -0.5 | - | +0.5 | dB |
| Input Return Loss | S11 | 130KHz to 10GHz | 6 | - | - | 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 | Im | $I_F$=$I_{op}$, VDR=5V | 100 | - | 1500 | μA |
| Monitor Dark Current | Id | VDR=5V | - | 2 | 100 | nA |
| Monitor Diode Capacitance | Ct | VDR=5V, f=1MHz | - | 5 | 15 | pF |

### TEC & THERMISTOR CHARACTERISTICS

| Parameter | Symbol | Condition | Limit | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | |
| TEC Current | Ic | Note (4) | - | - | 1.0 | A |
| TEC Voltage | Vc | Note (4) | - | - | 2.0 | V |
| TEC Power Consumption | Pc | Note (4) | - | - | 2.0 | W |
| Thermistor Resistance | Rth | TLD=25°C | - | 10 | - | kΩ |
| Thermistor B Constant | B | 25/75°C | 3270 | 3450 | 3630 | K |

## DRIVER IC CHARACTERISTICS

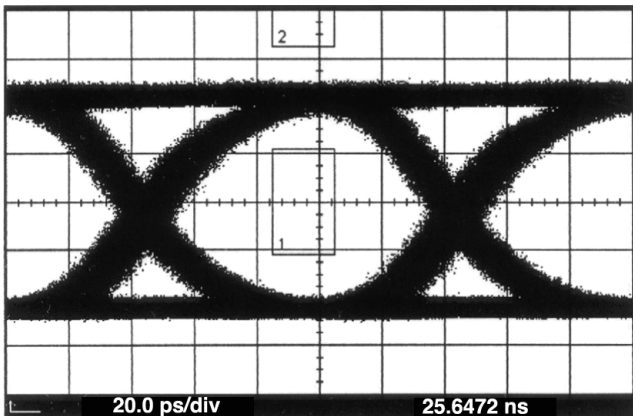
| Parameter | Symbol | Condition | Limit | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | |
| **Driver IC Supply Voltage** | Vss | | -5.5 | -5.2 | -4.9 | V |
| **Driver IC Supply Current** | Iss | | - | - | 285 | mA |
| **Modulator (Mod) Modulation Control Voltage** | Vm | | $V_{ss}$ | - | $V_{ss}$ +1.0 | V |
| **Mod Bias Control Voltage** | Vb | | $V_{ss}$ | - | $V_{ss}$ +2.2 | V |
| **Cross Point (XP) Control Voltage** | Vx1, (Vx2) | Xp=50% | $V_{ss}$ +0.8 | - | $V_{ss}$ +2.2 | V |
| **Data Input Voltage** | Din, DinB | Differential (AC Coupled) | 0.5 | - | 1.0 | Vpp |

Note (1-1): Pin No. 3,4,5,6,7,9,11 (Human Body Model)
Note (1-2): Pin No. 1,2,8,10,12-19 (Human Body Model)
Note (2): Eudyna Test System
(a) Drive Condition
Bit Rate: 9.95328 Gb/s
Word Pattern: PRBS=$2^{31}$-1
Mark Density: 50%
Laser Bias Current: $I_{op}$
Laser Temperature(TLD): 25°C
Eye Pattern Mask: ITU-T Eye mask for STM-64
(b) Fiber Dispersion
1600ps/nm
(c) Dispersion Penalty
Bit Error Rate=$10^{-12}$

Note (3): Eudyna Test System
Vb, Vm, Vx1(Vx2) is set to make Pop and Rext within the specification

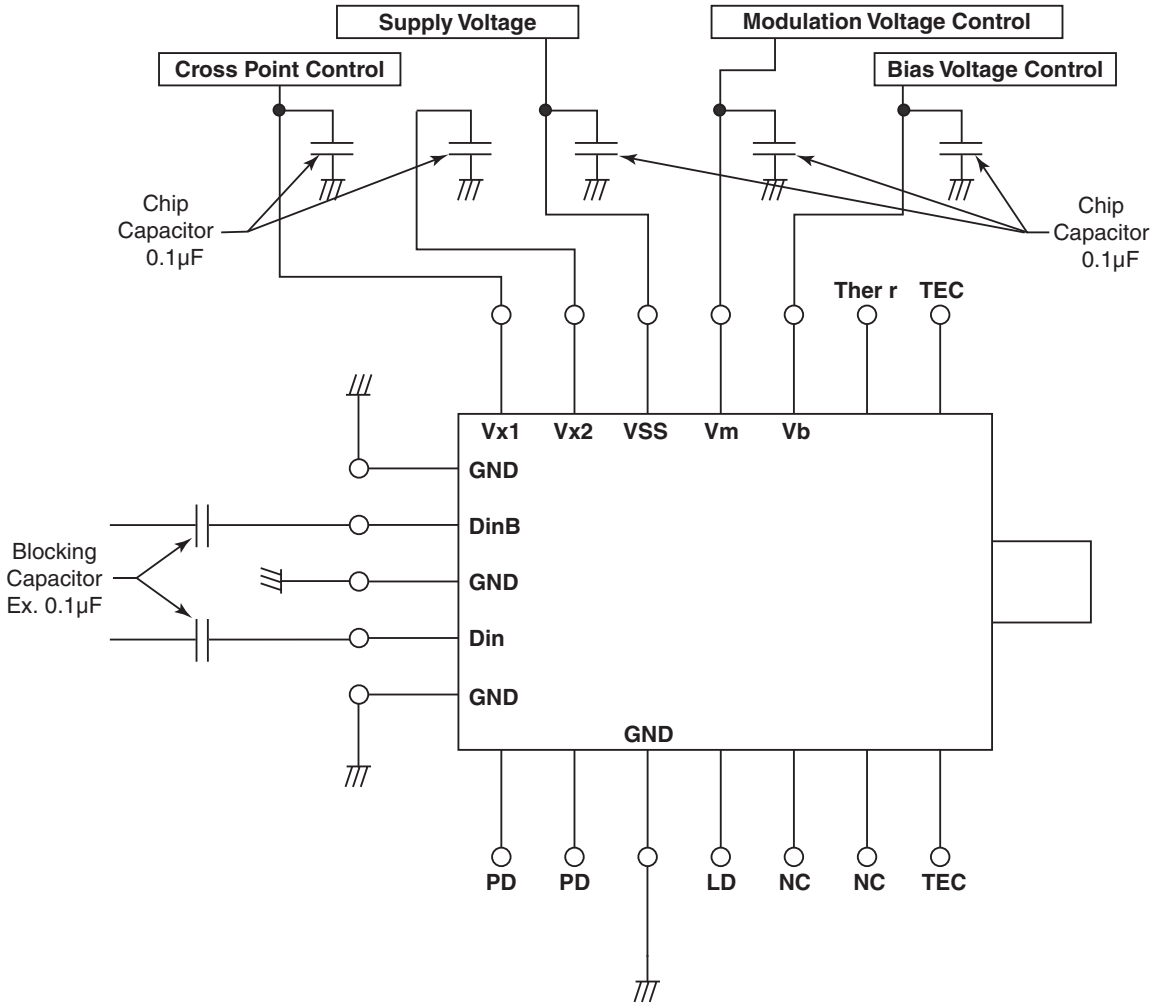
Note (4): Eudyna Test System
Operating Case Temperature: $T_{op}$=+75°C
Laser Temperature: 25°C
Optical Output Power: Pf=Pop, Note (2a)

Typical Output Waveform
Back to Back (with Filter)




9.95328Gb/s, NRZ, PRBS=$2^{31}$-1, TLD=TC=25°C

Typical Application for Driver IC



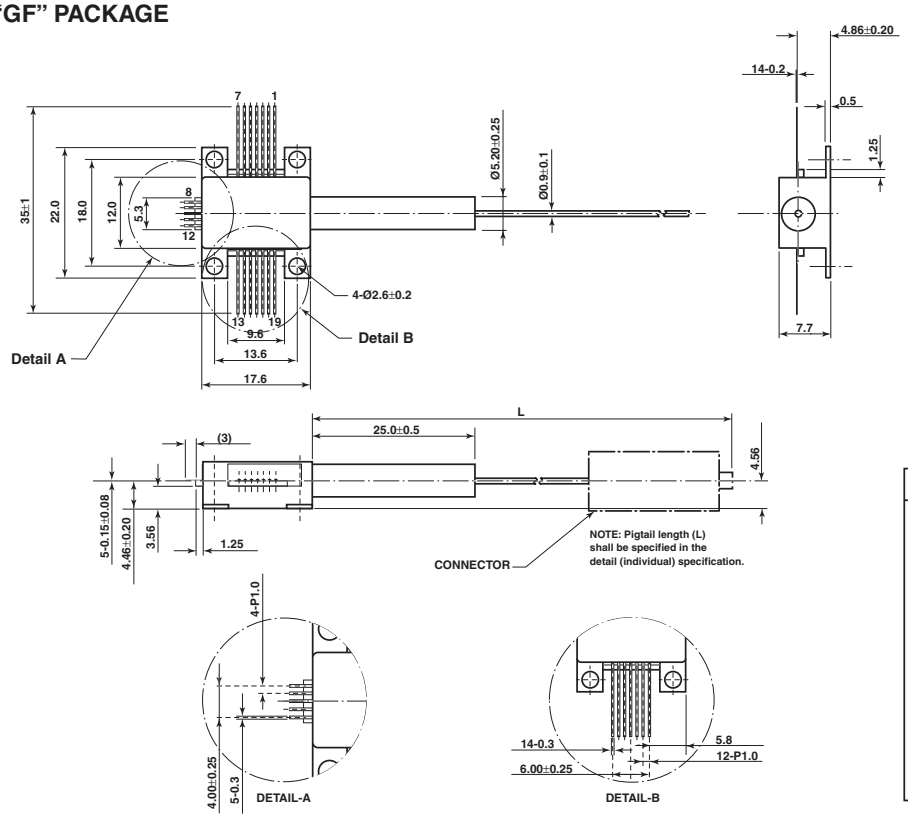

For stable operation:

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.

**"GF" PACKAGE** **UNIT: mm**




| Pin Description |
|---|
| 1. Thermoelectric cooler(Anode, +) |
| 2. Thermistor |
| 3. Vb: Modulator bias control voltage |
| 4. Vm: Modulator modulation voltage control voltage |
| 5. Vss: Driver IC supply voltage |
| 6. Vx2: Cross point control voltage |
| 7. Vx1: Cross point control voltage |
| 8. Case Ground |
| 9. DinB: Inverted data input voltage |
| 10. Case Ground |
| 11. Din: Data Input voltage |
| 12. Case Ground |
| 13. Monitor photo diode(Cathode) |
| 14. Monitor photo diode(Anode) |
| 15. Case Ground |
| 16. LD Bias(Anode) |
| 17. NC |
| 18. NC |
| 19. Thermoelectric cooler(Cathode, -) |

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- **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.**