

Specification

Small Form Factor Pluggable

Duplex LC Receptacle – SFP+

Optical Transceivers

1 Gigabit / 10 Gigabit

1000BASE-SX / 10GBASE-SR



Ordering Information

TAS-A1JH1-P11

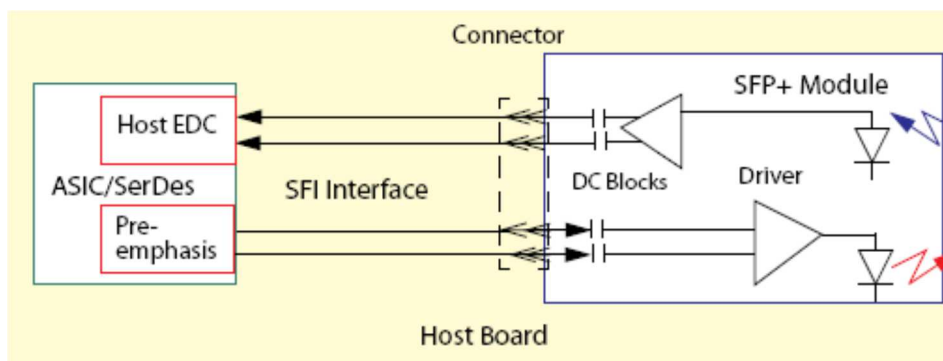
| Model Name | Voltage | Category | Device type | LOS | Temperature | Distance |
|---------------|---------|-----------|--------------|--------|-------------|-----------------------------------|
| TAS-A1JH1-P11 | 3.3V | With DDMI | 850 nm VCSEL | LVTTTL | 0°C ~ +70°C | 33m / 82m /300m (OM1/ OM2/OM3) |

Features

- 10Gb/s serial optical interface compliant to 802.3ae 10GBASE-SR
- FC 2G/4G/8G compatible, hardware/software rate select function implemented
- 1G/10G dual rate function
- Electrical interface compliant to SFF-8431 specifications for enhanced 8.5 and 10 Gigabit small form factor pluggable module “SFP+”
- Compliant with SFP MSA with LC receptacle
- 850nm VCSEL transmitter, PIN photo-detector
- 2-wire interface for management specifications compliant with SFF 8472 digital diagnostic monitoring interface for optical transceivers
- Operating case temperature : 0 to 70°C
- All-metal housing for superior EMI performance
- Low power consumption
- Advanced firmware allow customer system information to be stored in transceiver
- Cost effective SFP+ solution, enables higher port densities and greater bandwidth
- RoHS compliant

Applications

- Data Center Interconnect
- Enterprise Ethernet LAN Networks
- Fiber Channel Storage Area Networks



General Description

This 850 nm VCSEL 10Gigabit SFP+ transceiver is designed to transmit and receive optical data over 50 / 125 μm or 62.5 / 125 μm multimode optical fiber.

| Fiber type | 850nm OFL Bandwidth | Supported Distances (meters) |
|------------------------|---------------------|------------------------------|
| 62.5 μm MMF | 160MHz-km | 2 to 26 |
| | OM1 200MHz-km | 2 to 33 |
| 50 μm MMF | 400 MHz-km | 2 to 66 |
| | OM2 500MHz-km | 2 to 82 |
| | OM3 2000MHz-km | 2 to 300 |

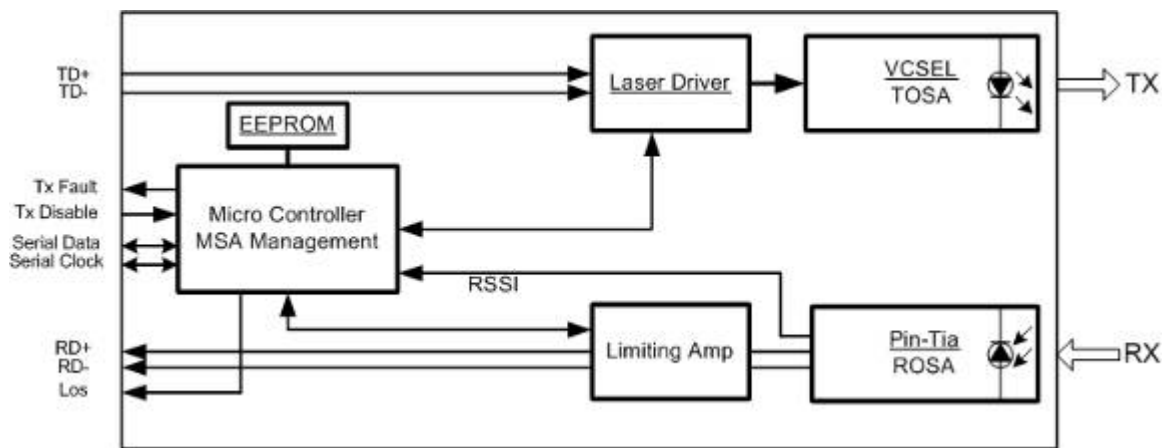
The SFP+ SR module electrical interface is compliant to SFI electrical specifications. The transmitter input and receiver output impedance is 100 Ohms differential. Data lines are internally AC coupled. The module provides differential termination and reduce differential to common mode conversion for quality signal termination and low EMI. SFI typically operates over 200 mm of improved FR4 material or up to about 150mm of standard FR4 with one connector.

The transmitter converts 10Gbit/s serial PECL or CML electrical data into serial optical data compliant with the 10GBASE-SR standard. An open collector compatible Transmit Disable (Tx_Dis) is provided. A logic "1," or no connection on this pin will disable the laser from transmitting. A logic "0" on this pin provides normal operation. The transmitter has an internal automatic power control loop (APC) to ensure constant optical power output across supply voltage and temperature variations. An open collector compatible Transmit Fault (TFault) is provided. TX_Fault is a module output contact that when high, indicates that the module transmitter has detected a fault condition related to laser operation or safety. The TX_Fault output contact is an open drain/collector and shall be pulled up to the Vcc_Host in the host with a resistor in the range 4.7-10 k Ω . TX_Disable is a module input contact. When TX_Disable is asserted high or left open, the SFP+ module transmitter output shall be turned off. This contact shall be pulled up to VccT with a 4.7 k Ω to 10 k Ω resistor.

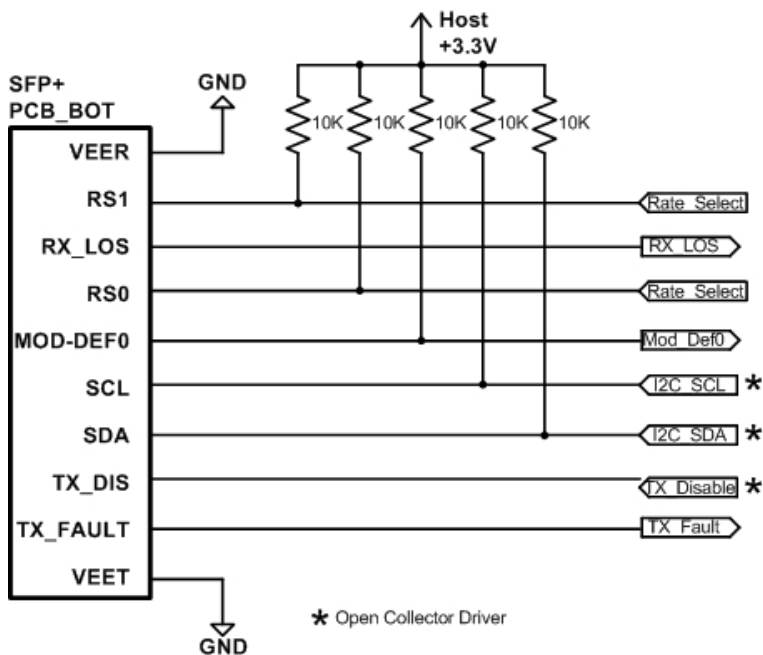
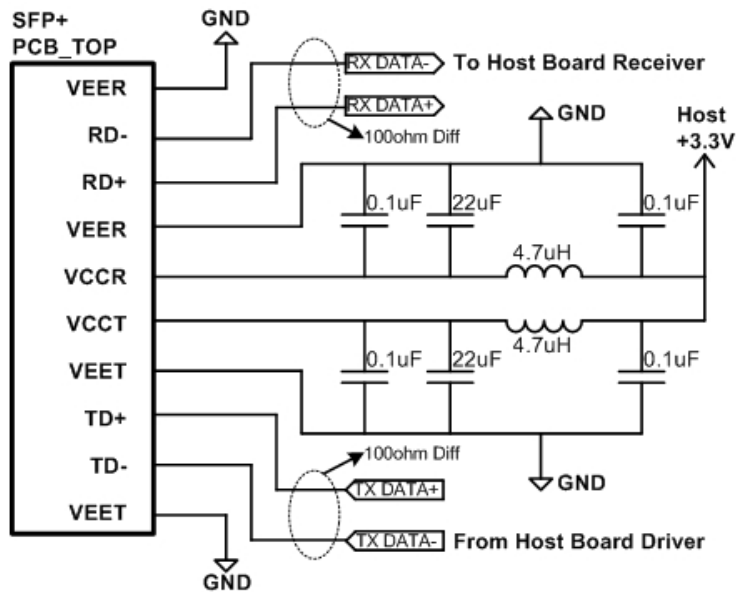
The receiver converts 10Gbit/s serial optical data into serial PECL/CML electrical data. An open collector compatible Loss of Signal is provided. Rx_LOS when high indicates an optical signal

level below that specified in the relevant standard. The Rx_LOS contact is an open drain/collector output and shall be pulled up to Vcc_Host in the host with a resistor in the range 4.7-10 kΩ, or with an active termination. Power supply filtering is recommended for both the transmitter and receiver. The Rx_LOS signal is intended as a preliminary indication to the system in which the SFP+ is installed that the received signal strength is below the specified range. Such an indication typically points to non-installed cables, broken cables, or a disabled, failing or a powered off transmitter at the far end of the cable.

Transceiver Block Diagram



Proposed Applications Schematics



Pin Definition and Descriptions

The SFP+ modules are hot-pluggable. Hot pluggable refers to plugging in or unplugging a module while the host board is powered. The SFP+ host connector is a 0.8 mm pitch 20 position right angle improved connector specified by SFF-8083, or stacked connector with equivalent with equivalent electrical performance. Host PCB contact assignment is shown in Figure 1 and contact definitions are given in Table 1. SFP+ module contacts mates with the host in the order of ground, power, followed by signal as illustrated by Figure 2 and the contact sequence order listed in Table 1.

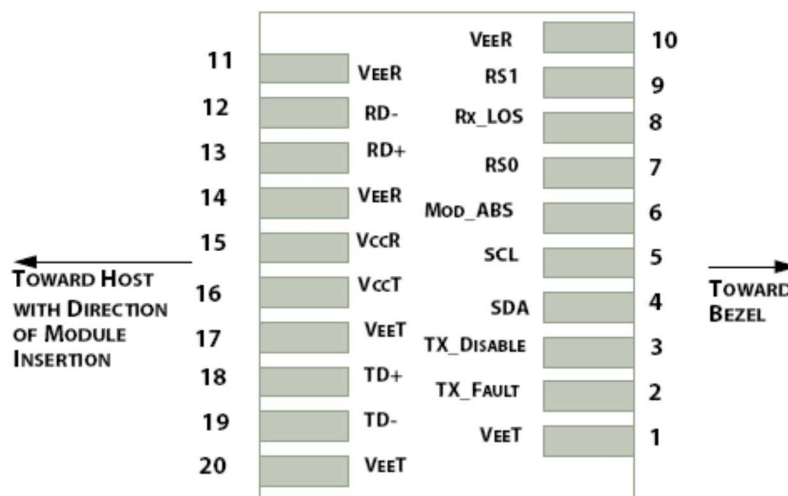


Figure 1: Module Interface to Host

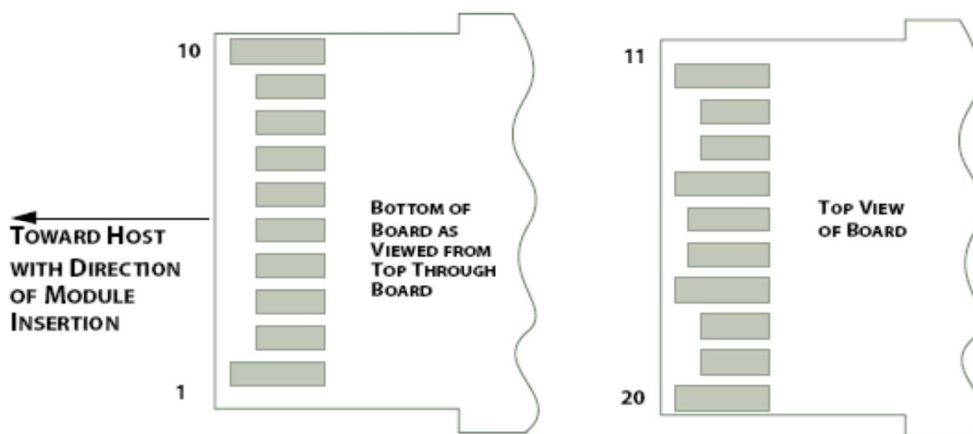


Figure 2: Module Contact Assignment

| PIN | Logic | Symbol | Name / Description | Note |
|-----|------------|----------|--|------|
| 1 | | VeeT | Module Transmitter Ground | 1 |
| 2 | LVTTTL-O | TX_Fault | Module Transmitter Fault | |
| 3 | LVTTTL-I | TX_Dis | Transmitter Disable; Turns off transmitter laser output | |
| 4 | LVTTTL-I/O | SDA | 2-Wire Serial Interface Data Line | 2 |
| 5 | LVTTTL-I | SCL | 2-Wire Serial Interface Clock | 2 |
| 6 | | MOD_DEF0 | Module Definition, Grounded in the module | |
| 7 | LVTTTL-I | RS0 | Receiver Rate Select, default is high for 8G/10G application, when set to low by system, transceiver will set the bandwidth to under 4.25G to improve the sensitivity at low data rate | |
| 8 | LVTTTL-O | RX_LOS | Receiver Loss of Signal Indication Active LOW | |
| 9 | LVTTTL-I | RS1 | Transmitter Rate Select, default input is high for 8G/10G application, when set to low by system, transceiver will set the TX optical output to be compliant with low data rate fibre channel specifications | |
| 10 | | VeeR | Module Receiver Ground | 1 |
| 11 | | VeeR | Module Receiver Ground | 1 |
| 12 | CML-O | RD- | Receiver Inverted Data Output | |
| 13 | CML-O | RD+ | Receiver Data Output | |
| 14 | | VeeR | Module Receiver Ground | 1 |
| 15 | | VccR | Module Receiver 3.3 V Supply | |
| 16 | | VccT | Module Transmitter 3.3 V Supply | |
| 17 | | VeeT | Module Transmitter Ground | 1 |
| 18 | CML-I | TD+ | Transmitter Non-Inverted Data Input | |
| 19 | CML-I | TD- | Transmitter Inverted Data Input | |
| 20 | | VeeT | Module Transmitter Ground | 1 |

Table 1: SFP+ Module PIN Definition
Note:

1. Module ground pins GND are isolated from the module case.
2. Shall be pulled up with 4.7K-10Kohms to a voltage between 3.15V and 3.45V on the host board.

Absolute Maximum Ratings

These values represent the damage threshold of the module. Stress in excess of any of the individual Absolute Maximum Ratings can cause immediate catastrophic damage to the module even if all other parameters are within Recommended Operating Conditions.

| Parameters | Symbol | Min. | Max. | Unit |
|----------------------------|------------------|------|------|------|
| Power Supply Voltage | V _{CC} | 0 | 3.6 | V |
| Storage Temperature | T _s | -40 | 85 | °C |
| Operating Case Temperature | T _{op} | 0 | 70 | °C |
| Relative Humidity | RH | 5 | 95 | % |
| RX Input Average Power | P _{max} | - | 1.5 | dBm |

Recommended Operating Environment

Recommended Operating Environment specifies parameters for which the electrical and optical characteristics hold unless otherwise noted.

| Parameters | Symbol | Min. | Typical | Max | Unit |
|----------------------------|-----------------|-------|---------|-------|------|
| Power Supply Voltage | V _{CC} | 3.135 | 3.3 | 3.465 | V |
| Operating Case Temperature | T _{op} | 0 | 25 | 70 | °C |

Optical Characteristics

The following optical characteristics are defined over the Recommended Operating Environment unless otherwise specified.

| Parameter | Symbol | Min. | Typical | Max | Unit | Notes |
|----------------------------------|-------------------|------|---------|-----|------|------------------|
| Transmitter | | | | | | |
| Center Wavelength | λ | 840 | 850 | 860 | nm | |
| Average Optical Power (RS1=High) | P _{avgH} | -6.5 | - | -1 | dBm | >4.25G Data rate |
| Average Optical Power (RS1=Low) | P _{avgL} | -8 | - | -3 | dBm | ≤4.25G Data rate |
| Laser Off Power | P _{off} | - | - | -30 | dBm | |
| Extinction Ratio (RS1=High) | ERH | 3.5 | - | - | dB | >4.25G datarate |

| | | | | | | |
|--------------------------------------|-------|-----|-----|-------|-------|------------------|
| Extinction Ratio (RS1=Low) | ERL | 9 | - | - | dB | ≤4.25G Data rate |
| Transmitter Dispersion Penalty | TDP | - | - | 3.9 | dB | |
| Relative Intensity Noise | RIN | - | - | -128 | dB/Hz | 12dB reflection |
| Optical Return Loss Tolerance | | - | - | 12 | dB | |
| Receiver | | | | | | |
| Center Wavelength | λ | 840 | 850 | 860 | nm | |
| Receiver Sensitivity (OMA, RS0=High) | SensH | - | - | -11.1 | dBm | >4.25G datarate |
| Receiver Sensitivity (OMA, RS0=Low) | SensL | - | - | -17.1 | dBm | ≤4.25G datarate |
| Los Assert | LosA | -30 | - | - | dBm | |
| Los Dessert | LosD | - | - | -12 | dBm | |
| Los Hysteresis | LosH | 0.5 | - | - | dB | |
| Overload | Pmax | - | - | -1 | dBm | |
| Receiver Reflectance | | - | - | -12 | dB | |

Digital Diagnostic Functions

The following digital diagnostic characteristics are defined over the Recommended Operating Environment unless otherwise specified. It is compliant to SFF8472 Rev10.2 with internal calibration mode. For external calibration mode please contact our sales staff.

| Parameter | Symbol | Min. | Max | Unit | Notes |
|---------------------------------------|-----------|-------|------|------|-----------------|
| Temperature monitor absolute error | DMI_Temp | -3 | 3 | °C | Over temp |
| Laser power monitor absolute error | DMI_TX | -3 | 3 | dB | |
| RX power monitor absolute error | DMI_RX | -3 | 3 | dB | -1dBm to -12dBm |
| Supply voltage monitor absolute error | DMI_VCC | -0.08 | 0.08 | V | Full range |
| Bias current monitor | DMI_Ibias | -10% | 10% | mA | |

Electrical Characteristics

The following electrical characteristics are defined over the Recommended Operating Environment unless otherwise specified.

| Parameter | Symbol | Min. | Typical | Max | Unit | Notes |
|---|---------|------|---------|------|------|----------|
| Data Rate | | - | 10.3125 | - | Gbps | |
| Power Consumption | | - | 600 | 800 | mW | |
| Transmitter | | | | | | |
| Single Ended Output Voltage Tolerance | | -0.3 | - | 4 | V | |
| AC common mode voltage tolerance | | 15 | - | - | mV | |
| Tx Input Diff Voltage | VI | 180 | | 700 | mV | |
| Tx Fault | VoL | -0.3 | | 0.4 | V | At 0.7mA |
| Data Dependent Input Jitter | DDJ | | | 0.1 | UI | |
| Data Input Total Jitter | TJ | | | 0.28 | UI | |
| Receiver | | | | | | |
| Single Ended Output Voltage Tolerance | | -0.3 | - | 4 | V | |
| Rx Output Diff Voltage | Vo | 300 | | 850 | mV | |
| Rx Output Rise and Fall Time (20% to 80%) | Tr / Tf | 30 | | | ps | |
| Total Jitter | TJ | | | 0.7 | UI | |
| Deterministic Jitter | DJ | | | 0.42 | UI | |

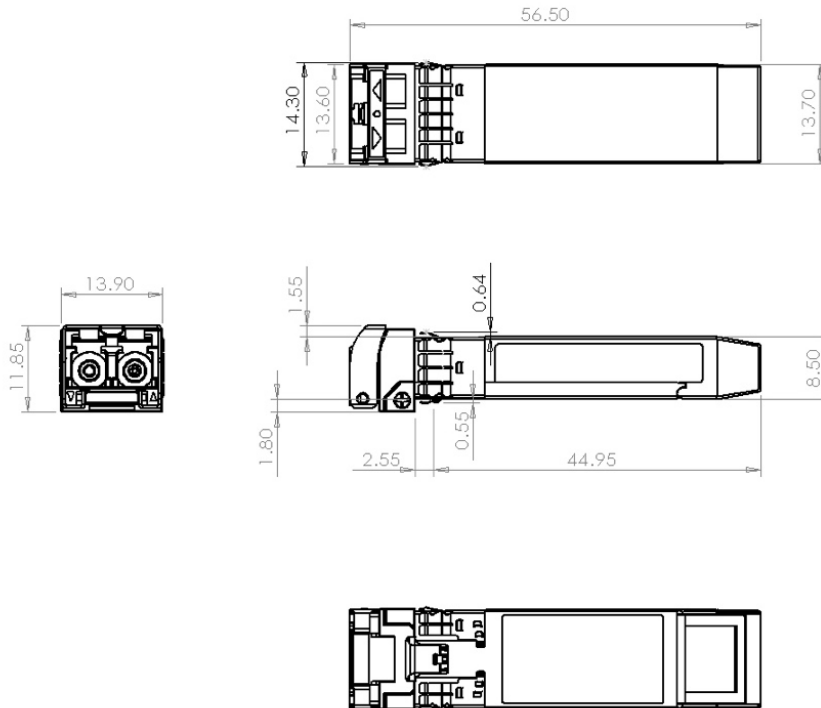
Control And Status I/O Timing Characteristics

Timing characteristics of control and status I/O are included in bellow Table, which is also defined in SFF-8431.

| Parameter | Symbol | Min | Max | Unit | Condition |
|---|----------------|-----|-----|------|--|
| TX Disable Assert Time | t_off | | 10 | μs | Time from rising edge of TX Disable to when the optical output falls below 10% of nominal |
| TX Disable Negate Time | t_on | | 1 | ms | Time from falling edge of TX Disable to when the modulated optical output rises above 90% of nominal |
| Time to initialize, including reset of TX_Fault | t_init | | 300 | ms | From power on or negation of TX Fault using TX Disable |
| TX Fault Assert Time | t_fault | | 100 | μs | Time from fault to TX fault on. |
| TX Disable to reset | t_reset | 10 | | μs | Time TX Disable must be held high to reset TX_fault |
| LOS Assert Time | t_loss_on | | 100 | μs | Time from LOS state to RX LOS assert |
| LOS Deassert Time | t_loss_off | | 100 | μs | Time from non-LOS state to RX LOS deassert |
| Rate-Select Change Time | t_ratesel | | 10 | μs | Time from rising or falling edge of Rate Select input until receiver bandwidth is in conformance with appropriate specification. |
| Serial ID Clock Rate | f_serial_clock | | 100 | kHz | |

Mechanical

Comply to SFF-8432 rev. 5.0, the improved Pluggable form factor specification.



ESD

Normal ESD precautions are required during the handling of this module. This transceiver is shipped in ESD protective packaging. It should be removed from the packaging and handled only in an ESD protected environment.

LASER Safety

This is a Class 1 Laser Product according to IEC / EN 60825-1: 2014 (Third Edition). This product complies with 21 CFR 1040.10 and 1040.11 except for deviations pursuant to Laser Notice No. 50, dated (June 24, 2007)

Rate Select Control

RX and TX rates can be independently controlled by either hardware input pins or via register writes. Module electrical input pins 7 and 9 are used to select RX and TX rate respectively. Status of each logic level is reflected to register byte 110 bit 4 and 5 on address A2h as shown in the diagram below. RX and TX rates can also be controlled by register writes to byte 110 bit 3 and 118 bit 3. Power on default of these bits are logic low. Hardware and software control inputs are OR'd to allow flexible control.

| RS0 Control Input | | RX Operation |
|-------------------|----------|-----------------|
| Hardware | Software | |
| 0 | 0 | 1.25G |
| 0 | 1 | 10G |
| 1 | 0 | 10G |
| 1 | 1 | 10G |

| RS1 Control Input | | TX Operation |
|-------------------|----------|-----------------|
| Hardware | Software | |
| 0 | 0 | 1.25G |
| 0 | 1 | 10G |
| 1 | 0 | 10G |
| 1 | 1 | 10G |

Contact Information

Formerica OptoElectronics Inc.

5F-11, No.38, Taiyuan St., Zhubei City,
Hsinchu County 30265, Taiwan

Tel: +886-3-5600286

Fax: +886-3-5600239

San Diego, CA

Tel: 1-949-466-8069

inquiry@formericaoe.com

www.formericaoe.com