



Product Specification Multi-Rate 2G/4G/8G FC SCFF 850nm Limiting Transceiver TRX08GVP2540

APPLICATIONS

2G/4G/8G Fiber Channel

MergeOptics SCFF optical transceiver TRX08GVP2540 is built to a small cubic form factor (SCFF) that is mechanically modified from the SFP+ form factor. Its 11pin electrical interface complies with specifications in SFP+ MSA (SFF-8431) for high speed interface, including a 2 wire serial interface similar to I2C interface and power supply. It is RoHS 6/6 complaint per Directive 2002/95/EC and laser safety class 1 compliant per IEC/CDRH. The sub watt power consumption and the compact size allow system design with high port density.



SUPPORTED STANDARDS

| Application | | Standard | | | Data Rate |
|------------------|---------|---------------|--------------|-------------|-----------|
| 8G Fibre Channel | FC-PI-4 | 800-M5E-SN-I, | 800-M5-SN-S, | 800-M6-SN-S | 8.5 GBd |
| 4G Fibre Channel | FC-PI-4 | 400-M5E-SN-I, | 400-M5-SN-I, | 400-M6-SN-I | 4.25 GBd |
| 2G Fibre Channel | FC-PI-4 | 200-M5F-SN-I | 200-M5-SN-I | 200-M6-SN-I | 2 125 GRd |

FEATURES & BENEFITS

- Small Cubic Form Factor (SCFF)
- 11pin electrical interface
- Complies with 2G/4G/8G FC
- Digital diagnostic through 2 wire serial interface (SFP+ compatible)
- SFP+ compatible SFI high speed electrical interface
- Low power consumption at <0.6W.
- Transmission of up to 150m over OM3 MMF at 8G FC
- 0°C to +70°C case operating temperature
- ▶ 850nm VCSEL laser
- Duplex LC connector
- SCFF is UL certified for use in Low Power Systems (LPS).
- Laser safety class 1
- RoHS 6/6 compliant





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► ELECTRICAL CHARACTERISTICS

Absolute Maximum Ratings

| Rating | Conditions | Symbol | Min | Max | Units |
|-----------------------------|----------------|------------------|-------------|-----|-------|
| Storage Ambient Temperature | | $artheta_{stg}$ | - 40 | +85 | °C |
| Powered Case Temperature | | ϑ_{c} | 0 | +75 | °C |
| Operating Relative Humidity | Non condensing | RH | 0 | 95 | % |
| Supply Voltage Range | | V _{CC3} | -0.5 | 4.0 | V |

Any stress beyond the maximum ratings may result in permanent damage to the device. Specifications are guaranteed only under recommended operating conditions.

Recommended Operating Conditions

| Description | Conditions | Symbol | Min | Тур | Max | Unit |
|-----------------------------------|-------------------|--------------------|-------|-----|-------|------|
| Operating Case Temperature | altitude of < 3km | ϑ_{Case} | 0 | | 70 | °C |
| Power Supply Voltage | | V _{CC3} | 3.135 | 3.3 | 3.465 | V |
| High Speed Data Rate | | | 2.125 | 8.5 | | GBd |
| 2 Wire Serial Interface Data Rate | | | | | 400 | kHz |

Low Speed Characteristics

| Description | Conditions | Symbol | Min | Тур | Max | Unit |
|----------------------------|------------|-----------------------|-----|-----|-----|------|
| Supply Current (Tx and Rx) | | Icc @ V _{cc} | | 145 | 170 | mA |
| Total Power Consumption | | | | 477 | 600 | mW |
| | | | | | | |

SFI Transmitter Input Electrical Characteristics

| Description | Conditions | Symbol | Min | Тур | Max | Unit |
|-------------------------------------|------------|-----------------|-------|-----|------|------|
| Input Data Rate | | | 2.125 | 8.5 | | GBd |
| Differential Input Voltage Swing | | V _{ID} | 175 | | 1200 | mVpp |
| Differential Input Impedance | | Z _d | 80 | 100 | 120 | Ω |
| AC Common Mode Voltage Tolerance | | | 15 | | | mV |

SFI Receiver Output Electrical Characteristics

| Description | Conditions | Symbol | Min | Тур | Max | Unit |
|--------------------------------------|------------|-----------------|-------|-----|------|-------------|
| Output Data Rate | | | 2.125 | 8.5 | | GBd |
| Differential Output Voltage Swing 1) | | V _{OD} | 300 | 580 | 850 | mVpp |
| Differential Output Impedance | | Z _d | 80 | 100 | 120 | Ω |
| Output AC Common Mode Voltage | | | | | 7.5 | mV (RMS) |
| Data Output Total Jitter | | | | | 0.7 | UI (p-p) |
| Data Output Deterministic Jitter | | | | | 0.42 | UI (p-p) |

¹⁾ Typ is at module default setting





▶ OPTICAL CHARACTERISTICS

Optical Transmitter

| Description | Conditions | Symbol | Min | Тур | Max | Unit |
|------------------------------------|------------|------------------|-------|------|------|-------|
| Center wavelength | | λ | 840 | 850 | 860 | nm |
| RMS spectral width | | Δλ | | | 0.65 | nm |
| Average launch power | | P _{avg} | -7.3 | | -0.5 | dBm |
| Optical Modulation Amplitude (OMA) | | P _{OMA} | 0.302 | 0.61 | | mW |
| Extinction Ratio | | ER | 3.5 | 5.0 | | dB |
| Relative Intensity Noise | | RIN | | | -128 | dB/Hz |

Optical Receiver

| Description | Conditions | Symbol | Min | Тур | Max | Unit |
|---|-------------|----------------------|-----|-------|-------|------|
| Unstressed receiver sensitivity in OMA | @ 8.5Gb/s | P _{IN-OMA} | | -14.0 | -11.2 | dBm |
| (PRBS 2 ³¹ -1, BER< 10 ⁻¹²) | @ 4.25Gb/s | | | -16.5 | -12.1 | dBm |
| | @ 2.125Gb/s | | | -16.0 | -13.1 | dBm |
| Stressed receiver sensitivity in OMA (PRBS 2 ³¹ -1, BER< 10 ⁻¹²) | @ 8.5Gb/s | P _{IN-OMA} | | -11.8 | -8.2 | dBm |
| Max average input power (overload) | | | | | 0 | dBm |
| LOS assert | | P _{av-as} | -30 | -21 | | dBm |
| LOS de-assert | | P _{av-deas} | | -18 | -15 | dBm |
| Hysteresis | | | 1.5 | 2.7 | | dB |

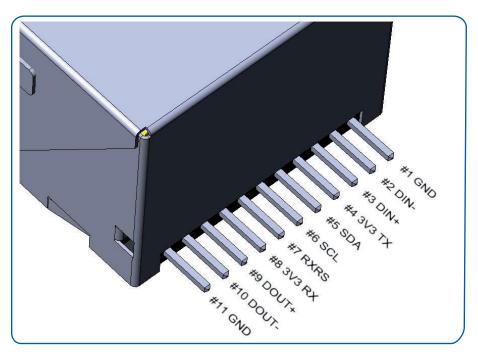




▶ APPLICATION INFORMATION

Electrical Connector

The electrical interface at the back-end of the SCFF module has 11 pins. The pin configuration is as follows:



Pin Description

| Pin | Logic | Symbol | Description | Plug Sequence | Notes |
|-----|-------|--------|--|------------------|-------|
| 1 | | GND | Ground | 1 | 1 |
| 2 | CML-I | DIN- | Transmitter Inverted Data Input; AC coupled | 1 | |
| 3 | CML-I | DIN+ | Transmitter Non-Inverted Data Input; AC coupled | 1 | |
| 4 | | 3V3TX | 3.3V TX Vcc +/- 5% | 1 | 2 |
| 5 | | SDA | 2 wire serial interface | 1 | |
| 6 | | SCL | data / clock line must be pull up on host board | 1 | |
| 7 | | RXRS | Rate setting pin for the RX; pull up with 47kOhm in Module | 1 | 3 |
| 8 | | 3V3RX | 3.3V RX Vcc +/- 5% | 1 | 2 |
| 9 | CML-O | DOUT+ | Receiver non-inverted output data; AC coupled | 1 | |
| 10 | CML-O | DOUT- | Receiver inverted output data; AC coupled | 1 | |
| 11 | | GND | Ground | 1 | 1 |

¹⁾ GND is common for signal and power supply in the SCFF module. All module voltages are referenced to this potential unless otherwise noted. Connect these directly to the host board signal-common ground plane.

^{2) 3}V3RX and 3V3TX are the receiver and transmitter power supplies and shall be applied concurrently. The connector pins are each rated for a maximum current of 500 mA.

³⁾ When pin 7 is set "low", the module is suitable for Rx signaling rates less than or equal to 4.25Gb. When the RxRs is set "high", the module is suitable for Rx signaling rates > 4.25Gb. For further details please refer to documents SFF-8431, SFF-8079 and SFF-8089





▶ APPLICATION INFORMATION

Application Schematics

Recommended electrical connections to transceiver are shown below.

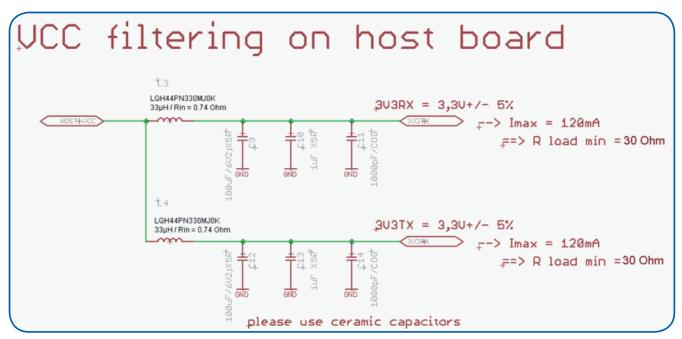
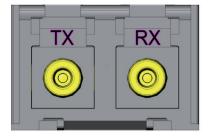


Figure 1: Recommended host board power supply filtering

Optical Interface



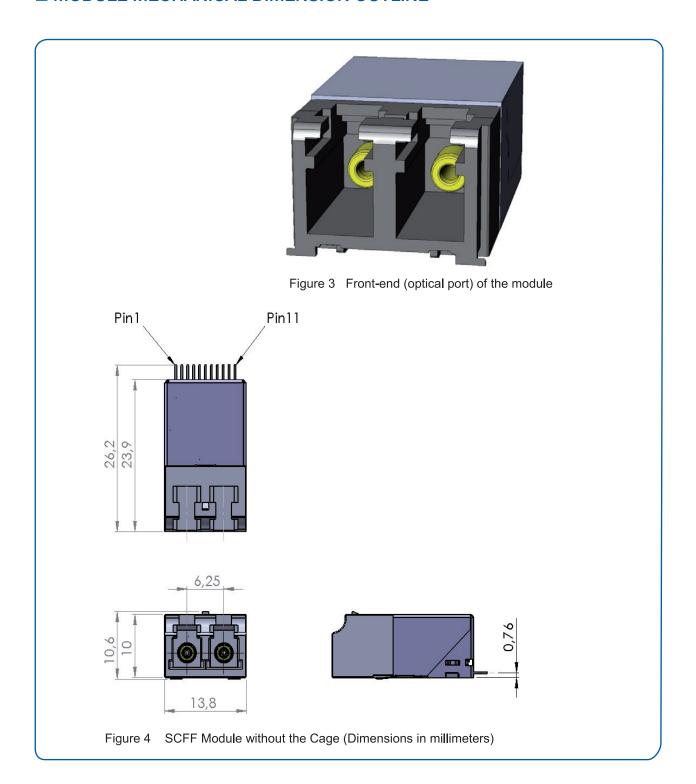
Optical port on the SCFF module is a duplex LC connector. The TX is located on the left hand side and the RX to the right hand side, when looked into the optical port while keeping the latch holder topside.

Figure 2





► MODULE MECHANICAL DIMENSION OUTLINE



► ORDERING INFORMATION

| Application | Standard | Part Number |
|-------------------------|--|--------------|
| 20/40/90 Fibre Observed | FC-PI-4: 800-M5E-SN-I, 800-M5-SN-S, 800-M6-SN-S | TRX08GVP2540 |
| 2G/4G/8G Fibre Channel | 400-M5E-SN-I, 400-M5-SN-I, 400-M6-SN-I 200-M5E-SN-I, 200-M5-SN-I, 200-M6-SN-I | 1RX00GVP2040 |





■ INTERFACING THE TRANSCEIVER THROUGH SERIAL INTERFACE

Communication is done by a serial 2-wire interface compatible to the I2C bus protocol. Refer to SFF-8472 for a more detailed register explanation of the registers:

| Base Address A0h | | | | | |
|------------------|--|--|--|--|--|
| Register | Content | | | | |
| 0 - 95 | Serial Transceiver ID as defined in SFP MSA | | | | |
| 96 - 127 | MergeOptics Specific | | | | |
| 128 - 255 | Reserved | | | | |

| Base Address A2h | | | | | |
|------------------|---|--|--|--|--|
| Register | Content | | | | |
| 0 - 55 | Alarm & Warnings Thresholds & Limits | | | | |
| 56 - 95 | External calibration constants (not used) | | | | |
| 96 – 119 | Values from real time diagnostic monitoring | | | | |
| 120 – 127 | Not used | | | | |
| 128 – 247 | Customer specific, writable area | | | | |
| 248 - 255 | Not used | | | | |

Module Identifier & Specific Data

Refer to SFF-8472 and a separate Mergeoptics application note for detailed register map and data.

Digital Optical Monitoring

The transceiver offers the ability to monitor important module parameter during operation. All five parameters listed below are continuously monitored for getting information about the current module status. All data is calibrated internally; there is no need for external post processing.

Temperature

Internally measured temperature data is represented as two's complement of a signed 16-bit value in increments of 1/256 °C over a range of -40 to +100 °C. Accuracy is better than +/-3 °C

Supply Voltage (VCC)

Internally measured supply voltage. Represented as a 16-bit unsigned integer with the voltage defined as the full 16 bit value (0 - 65535) with LSB equal to 100 μ Volt, which yields to a total range of 0 to +6.55 Volts. Accuracy is better than +/-3%.

Laser Bias Current

The VCSEL bias current is represented as a 16 bit unsigned integer with the current defined as the full 16-bit value (0 – 65535) with LSB equal to 2 μ A, valid range is 0 to 20 mA. Accuracy is better than +/-10%.

Optical Transmitter Power

TX output power measurement is based on internal monitor diode feedback. Represented as a 16-bit unsigned integer with the power defined as the full 16 bit value (0 – 65535) with LSB equal to 0.1 μ W. Accuracy is better than +/-3dB over a range of Pav_{min} to Pav_{max}.

Receiver Optical Power

RX input power measurement is based on photodiode diode current. Represented as a 16-bit unsigned integer with the power defined as the full 16 bit value (0-65535) with LSB equal to 0.1 μ W. Accuracy is better than +/-3dB over a range of -12dBm to -1dBm.

Digital Diagnostic Monitoring Accuracy

| Parameter | Conditions | Symbol | Min | Тур | Max | Units |
|-----------------|-------------------------|-----------------|-----|------|-----|-------|
| TX output power | | ΔP_{Tx} | -3 | ±0.5 | 3 | dBm |
| RX input power | sensitivity to overload | ΔP_{Rx} | -3 | ±0.5 | 3 | dBm |

Note: min and max specs are met over specified full temperature and voltage range. Typ shows typical values at room temperature and nominal supply voltage.





■ RELATED INFORMATION & COMPLIANCE

| Requirements | Standard | | | |
|--------------|---|--|--|--|
| RoHS | RoHS 6/6 Directive 2002/95/EC Amendment 4054 (2005/747/EC) | | | |

| Requirements | Standard | Value |
|----------------------------|--|-------|
| ESD (Electrical connector) | JEDEC JESD22-A114-B | 1kV |
| ESD (Module case) | Air Discharge EN61000-4-2 criterion B | 15kV |
| ESD (Module case) | Contact Discharge EN61000-4-2 criterion B | 8kV |

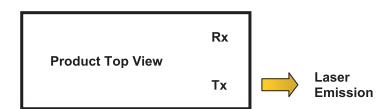
EYE SAFETY

This laser based multimode transceiver is a Class 1 product. It complies with IEC 60825-1 Ed.2: 2007 and FDA performance standards for laser products (21 CFR 1040.10 and 1040.11) except for deviations pursuant to Laser Notice 50, dated June 24, 2007.

CLASS 1 LASER PRODUCT DO NOT VIEW DIRECTLY WITH OPTICAL INSTRUMENTS

Caution: use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation.

Note: All adjustments have been made at the factory prior to shipment of the devices. No maintenance or alteration to the device is required. Tampering with or modifying the performance of the device will result in voided product warranty. Failure to adhere to the above restrictions could result in a modification that is considered an act of "manufacturing", and will require, under law, recertification of the modified product with the U.S. Food and Drug Administration (ref. 21 CFR 1040.10



(as defined by IEC: 7 mm aperture at 70 mm distance)

Wavelength ≥840 nm Accessible Emission Limit <743 μW

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