



## 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-P1-4	800-M5E-SN-I, 800-M5-SN-S,	800-M6-SN-S		8.5 GBd
4G Fibre Channel	FC-P1-4	400-M5E-SN-I, 400-M5-SN-I,	400-M6-SN-I		4.25 GBd
2G Fibre Channel	FC-P1-4	200-M5E-SN-I, 200-M5-SN-I,	200-M6-SN-I		2.125 GBd

#### 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		$\vartheta_{stg}$	-40	+85	°C
Powered Case Temperature		$\vartheta_c$	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	Typ	Max	Unit
Operating Case Temperature	altitude of < 3km	$\vartheta_{Case}$	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	Typ	Max	Unit
Supply Current (Tx and Rx)		$I_{CC} @ V_{CC}$		145	170	mA
Total Power Consumption				477	600	mW

### SFI Transmitter Input Electrical Characteristics

Description	Conditions	Symbol	Min	Typ	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	$\Omega$
AC Common Mode Voltage Tolerance			15			mV

### SFI Receiver Output Electrical Characteristics

Description	Conditions	Symbol	Min	Typ	Max	Unit
Output Data Rate			2.125	8.5		GBd
Differential Output Voltage Swing <sup>1)</sup>		$V_{OD}$	300	580	850	mVpp
Differential Output Impedance		$Z_d$	80	100	120	$\Omega$
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	Typ	Max	Unit
Center wavelength		$\lambda$	840	850	860	nm
RMS spectral width		$\Delta\lambda$			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

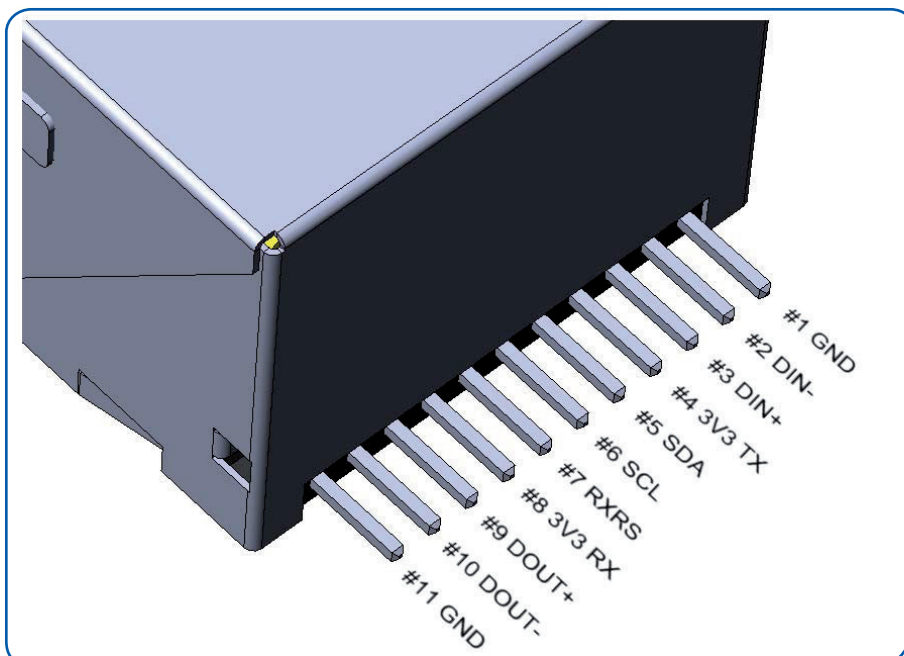
### Optical Receiver

Description	Conditions	Symbol	Min	Typ	Max	Unit
Unstressed receiver sensitivity in OMA (PRBS $2^{31}-1$ , BER < $10^{-12}$ )	@ 8.5Gb/s	$P_{IN-OMA}$		-14.0	-11.2	dBm
	@ 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 data / clock line must be pull up on host board	1	
6		SCL		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) 3V3RX 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.

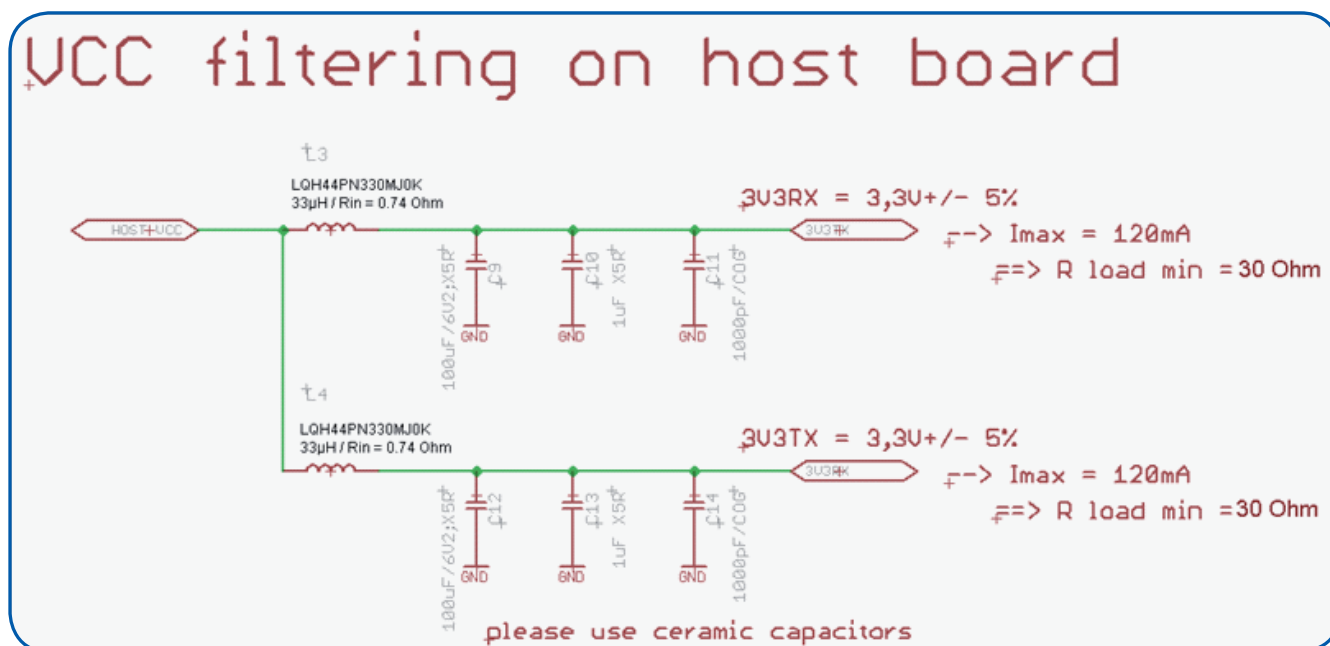
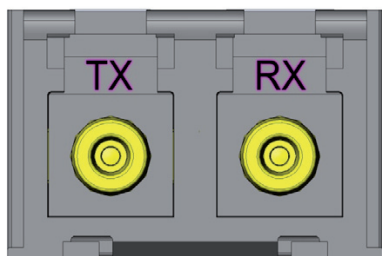


Figure 1 : Recommended host board power supply filtering

### 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



Figure 3 Front-end (optical port) of the module

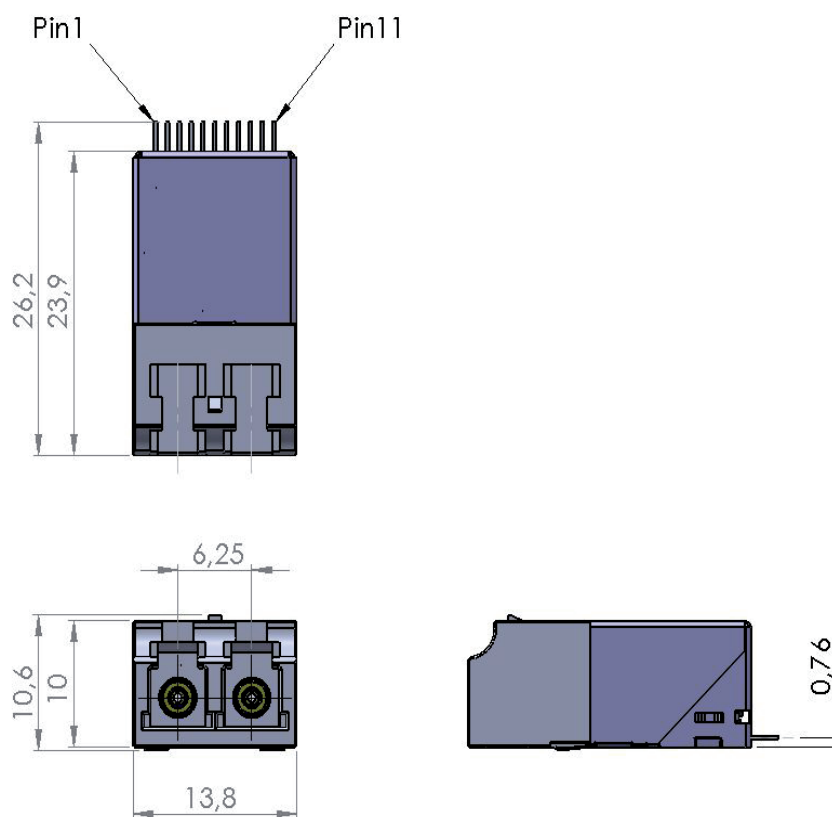


Figure 4 SCFF Module without the Cage (Dimensions in millimeters)

## ORDERING INFORMATION

Application	Standard	Part Number
2G/4G/8G Fibre Channel	FC-PI-4: 800-M5E-SN-I, 800-M5-SN-S, 800-M6-SN-S 400-M5E-SN-I, 400-M5-SN-I, 400-M6-SN-I 200-M5E-SN-I, 200-M5-SN-I, 200-M6-SN-I	TRX08GVP2540

## ■ 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 µVolt, 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 µA, 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 µW. Accuracy is better than +/-3dB over a range of  $P_{av_{min}}$  to  $P_{av_{max}}$ .

### 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 µW. Accuracy is better than +/-3dB over a range of -12dBm to -1dBm.

## Digital Diagnostic Monitoring Accuracy

Parameter	Conditions	Symbol	Min	Typ	Max	Units
TX output power		$\Delta P_{Tx}$	-3	±0.5	3	dBm
RX input power	sensitivity to overload	$\Delta P_{Rx}$	-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

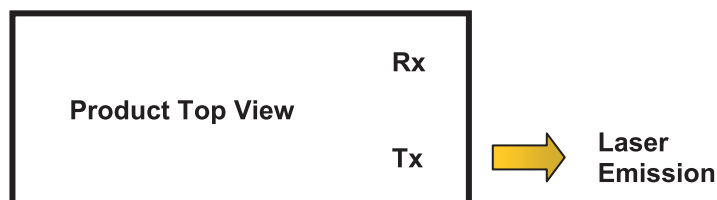
## EYE SAFETY

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)



Wavelength	≥840 nm
Accessible Emission Limit (as defined by IEC: 7 mm aperture at 70 mm distance)	<743 μW

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