

## TRP-03 & TRP-12

### OC-03/STM-1 & OC-12/STM-4 LC Small Form-factor Pluggable (SFP) Multi-mode Transceivers



#### Features

- ☑ Fully Compliant with Small Form Factor Pluggable (SFP) Multi-Source Agreement
- ☑ Fully Compliant with ATM and compatible with SONET/SDH OC-3 (155Mb/s) & OC-12 (622 Mb/s)
- ☑ Distance up to 2km @ 156 Mb/s
- ☑ Distance up to 500m @ 622 Mb/s
- ☑ Hot-pluggable
- ☑ - 40°C to + 85°C operating temperature, ("A" Option)
- ☑ Excellent EMI & ESD protection
- ☑ Loss of Signal output
- ☑ TX Disable input
- ☑ Duplex LC Connector interface
- ☑ Single + 3.3 V supply voltage

#### Description

The TRP-03 & TRP-12 Small Form-factor Pluggable (SFP) fiber optic transceiver offers a simple and convenient way to interface PCBs to multi-mode fiber optic cables. Many performance versions are available which are fully compliant with ATM and compatible with SONET/SDH standards for OC-3/STM-1 and OC-12/STM-4.

The TRP-03 & TRP-12 uses the SFP 20-pin connector to allow hot plug capability. Thus, the system designer can make configuration changes or maintenance simply by plugging in different type of converters without removing the power supply from the host system.

The transceivers offer two different types of release latches, Wrap Around latch and Standard latch. Both latches are conformance to Small Form-factor Pluggable (SFP)

multisource agreement. The special Wrap Around latch is designed to offer an easy and convenient way to release the module.

The transmitter incorporates a highly reliable 1300 nm LED and a driver circuit which converts data to light. The receiver features a transimpedance amplifier IC with internal AGC for high sensitivity and wide dynamic range. The transmitter and receiver DATA interface are AC coupled internally. An LV-TTL Transmitter Disable control input and Loss of Signal output interface are also provided.

The transceiver operates from a single +3.3V power supply over an operating temperature range of 0°C to +70°C, for -40°C to +85°C consult factory. The package is made of plastic and metal cover.

#### Absolute Maximum Ratings

Parameter		Symbol	Minimum	Maximum	Units
Storage Temperature		$T_{st}$	- 40	+ 85	°C
Operating Temperature	"A" option	$T_{op}$	- 40	+ 85	°C
	"B" option		0	+ 70	
Supply Voltage		$V_{DD}$	0	+ 5.0	V

## TRP-03

### Transmitter Performance Characteristics (over Operating Case Temperature)

Parameter	Symbol	Minimum	Typical	Maximum	Units
Data Rate	$B$	50	156	266	Mb/s
Optical Output Power <sup>1</sup>	$P_o$	- 19.0	- 16.0	- 14.0	dBm
Center Wavelength	$\lambda_c$	1270	-	1380	nm
Spectral Width (FWHM)	$\Delta\lambda_{FWHM}$	-	-	200	nm
Optical Rise and Fall Time (10% to 90%)	$t_r, t_f$	-	2.5	3.0	ns
Extinction Ratio	$P_{hi}/P_{lo}$	10	-	-	dB
Transmitter OFF Power	$P_{OFF}$	-	-	- 45.0	dBm
Random Jitter (peak-to-peak)	$RJ$	-	-	0.52	ns
Duty Cycle Distortion (peak-to-peak)	$DCD$	-	-	0.6	ns

<sup>1</sup> Measured average power coupled into 62.5/125  $\mu\text{m}$ , 0.275 NA graded-index multimode fiber.  
The minimum power specified is at Beginning-of-Life (BOL).

### Receiver Performance Characteristics (over Operating Case Temperature)

Parameter	Symbol	Minimum	Typical	Maximum	Units
Data Rate	$B$	50	156	266	Mb/s
Receiver Sensitivity ( $2.5 \times 10^{-10}$ BER) <sup>1</sup>	$P_{min}$	- 30.0	- 33.0	-	dBm
Maximum Input Optical Power ( $2.5 \times 10^{-10}$ BER) <sup>1</sup>	$P_{max}$	- 14.0	- 12.0	-	dBm
Signal Detect Thresholds	Increasing Light Input	$P_{sd+}$	-	- 30.0	dBm
	Decreasing Light Input	$P_{sd-}$	- 45.0	-	
Signal Detect Hysteresis		-	1.0	-	dB
Signal Detect Timing Delay	Increasing Light Input	$t_{sd+}$	-	100	$\mu\text{s}$
	Decreasing Light Input	$t_{sd-}$	-	350	
Wavelength of Operation	$\lambda$	1100	-	1600	nm

<sup>1</sup> Specified in Average Optical Input Power and measured at 156 Mb/s and 1300 nm wavelength with  $2^{23}-1$  PRBS.

### Ordering Information

Model Name		Latch Type
0°C to 70°C Operating	- 40°C to +85°C Operating	
TRP-03B	TRP-03A	Wrap Around
TRP-03BS	TRP-03AS	Standard

## TRP-12

### Transmitter Performance Characteristics (over Operating Case Temperature)

Parameter	Symbol	Minimum	Typical	Maximum	Units
Data Rate	$B$	50	622	700	Mb/s
Optical Output Power <sup>1</sup>	$P_o$	- 20.0	- 18.0	- 14.0	dBm
Center Wavelength	$\lambda_c$	1270	-	1380	nm
Spectral Width (FWHM)	$\Delta\lambda_{FWHM}$	-	140	200	nm
Optical Rise and Fall Time (10% to 90%)	$t_r, t_f$	-	1.0	1.25	ns
Extinction Ratio	$P_{hi}/P_{lo}$	10	-	-	dB
Random Jitter (peak-to-peak)	$RJ$	-	-	0.15	ns
Duty Cycle Distortion (peak-to-peak)	$DCD$	-	-	0.4	ns

<sup>1</sup> Measured average power coupled into 62.5/125  $\mu\text{m}$ , 0.275 NA graded-index multimode fiber.  
The minimum power specified is at Beginning-of-Life (BOL).

### Receiver Performance Characteristics (over Operating Case Temperature)

Parameter	Symbol	Minimum	Typical	Maximum	Units
Data Rate	$B$	50	622	700	Mb/s
Receiver Sensitivity ( $10^{-10}$ BER) <sup>1</sup>	$P_{min}$	- 26.0	- 28.0	-	dBm
Maximum Input Optical Power ( $10^{-10}$ BER) <sup>1</sup>	$P_{max}$	- 14.0	- 12.0	-	dBm
Signal Detect Thresholds	Increasing Light Input	$P_{sd+}$	-	-	dBm
	Decreasing Light Input	$P_{sd-}$	- 40.0	-	
Signal Detect Hysteresis		-	1.0	-	dB
Signal Detect Timing Delay	Increasing Light Input	$t_{sd+}$	-	-	$\mu\text{s}$
	Decreasing Light Input	$t_{sd-}$	-	-	
Wavelength of Operation	$\lambda$	1100	-	1600	nm

<sup>1</sup> Specified in Average Optical Input Power and measured at 622 Mb/s and 1300 nm wavelength with  $2^{23}-1$  PRBS.

### Ordering Information

Model Name		Latch Type
0°C to 70°C Operating	- 40°C to +85°C Operating	
TRP-12B	TRP-12A	Wrap Around
TRP-12BS	TRP-12AS	Standard

## TRP-03 & TRP-12

### Transmitter Electrical Interface (over Operating Case Temperature Range)

Parameter	Symbol	Minimum	Typical	Maximum	Units
Input Voltage Swing (TD+ & TD-) <sup>1</sup>	$V_{PP-DIF}$	0.50	-	2.4	V
Input HIGH Voltage (TX DISABLE) <sup>2</sup>	$V_{IH}$	$V_{cc} - 1.3$	-	$V_{cc} + 0.3$	V
Input LOW Voltage (TX DISABLE) <sup>2</sup>	$V_{IL}$	0	-	0.8	V

<sup>1</sup> Differential peak-to-peak voltage.  
<sup>2</sup> There is an internal 4.7K to 10Kohm pullup resistor to VccT.

### Receiver Electrical Interface (over Operating Case Temperature Range)

Parameter	Symbol	Minimum	Typical	Maximum	Units
Output Voltage Swing (RD+ & RD-) <sup>1</sup>	$V_{PP-DIF}$	0.60	-	2.0	Vp-p
Output HIGH Voltage (LOS) <sup>2</sup>	$V_{OH}$	$V_{CC} - 1.3$	-	$V_{CC} + 0.3$	V
Output LOW Voltage (LOS) <sup>2</sup>	$V_{OL}$	0	-	0.5	V

<sup>1</sup> Differential peak-to-peak voltage across external 100 ohm load.  
<sup>2</sup> Open Collector compatible, 4.7 K to 10 Kohm pullup to Vcc (Host Supply Voltage).

### Electrical Power Supply Characteristics (over Operating Case Temperature Range)

Parameter	Symbol	Minimum	Typical	Maximum	Units
Supply Voltage	$V_{cc}$	3.13	3.3	3.47	V
Supply Current	$I_{cc}$	-	185	245	mA

### Module Definition

Module Definition	MOD-DEF0 pin 6	MOD-DEF1 pin 5	MOD-DEF2 pin 4	Interpretation by Host
4	TTL LOW	SCL	SDA	Serial module definition protocol

### Application Notes

**Electrical interface:** All the signal interfaces are compliant with MultiSource Agreement specification. The high speed DATA interface is differential AC-coupled internally with 0.022μF. It can be connected to 3.3 V SERDES IC directly. All the low speed control and sense output signals are open collector TTL compatible. Therefore, proper pull-up resistor (4.7 K to 10 KΩ) is required.

**Loss of Signal (LOS):** The Loss of Signal circuit monitors the level of the incoming optical signal and generates a logic HIGH when insufficient photocurrent is produced.

**TX DISABLE:** When the TX DISABLE pin is at logic HIGH, the transmitter optical output is disabled (less than -45 dBm).

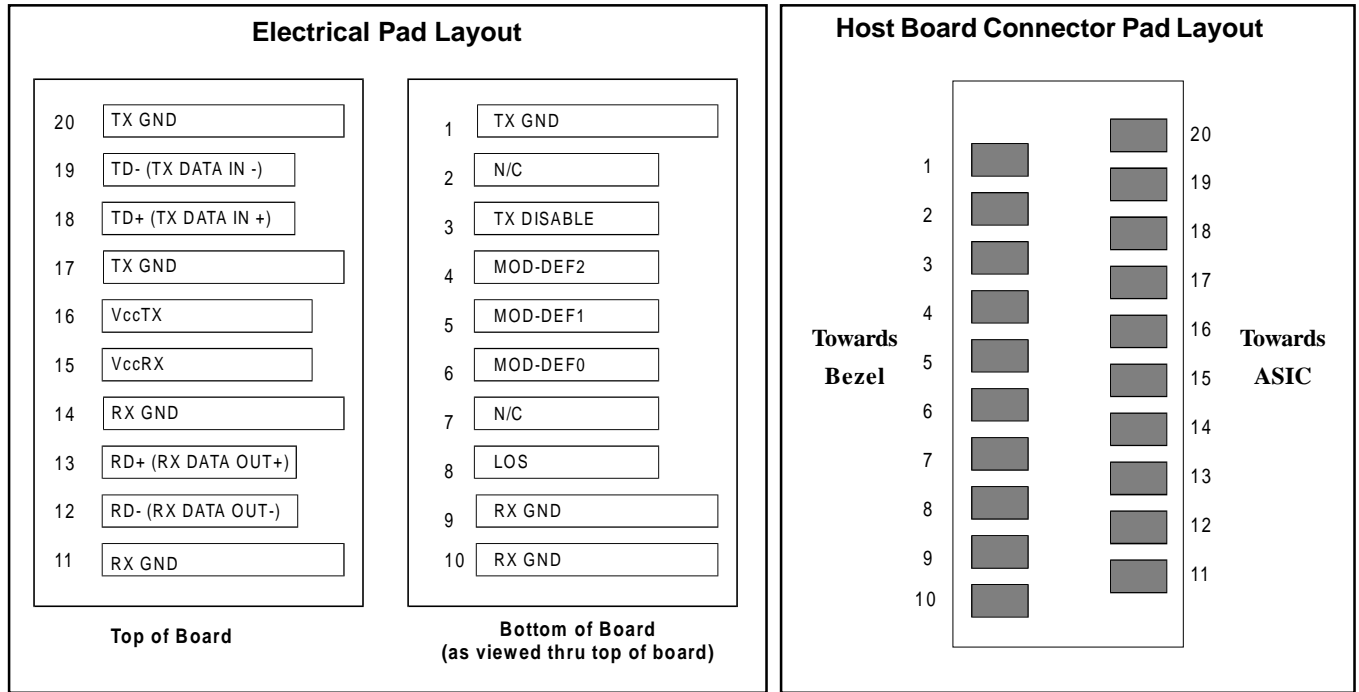
**Serial Identification:** The module definition of SFP is indicated by the 3 module definition pins MOD-DEF0, MOD-DEF1 and MOD-DEF2. Module Definition 4 specifies a serial definition protocol. For this definition, upon power up, MOD-DEF1:2

appear as NC (no connect) and MOD-DEF0 is TTL LOW. When the host system detects this condition, it activates the serial protocol. The protocol uses the 2-wire serial CMOS E<sup>3</sup>PROM protocol of the ATMEL AT24C01A/02/04 family of components. When the serial protocol is activated, the serial clock signal (SCL) is generated by the host. The negative edge clocks data from the SFP. The serial data signal (SDA) is for serial data transfer. The host uses SDA in conjunction with SCL to mark the start and end of serial protocol activation.

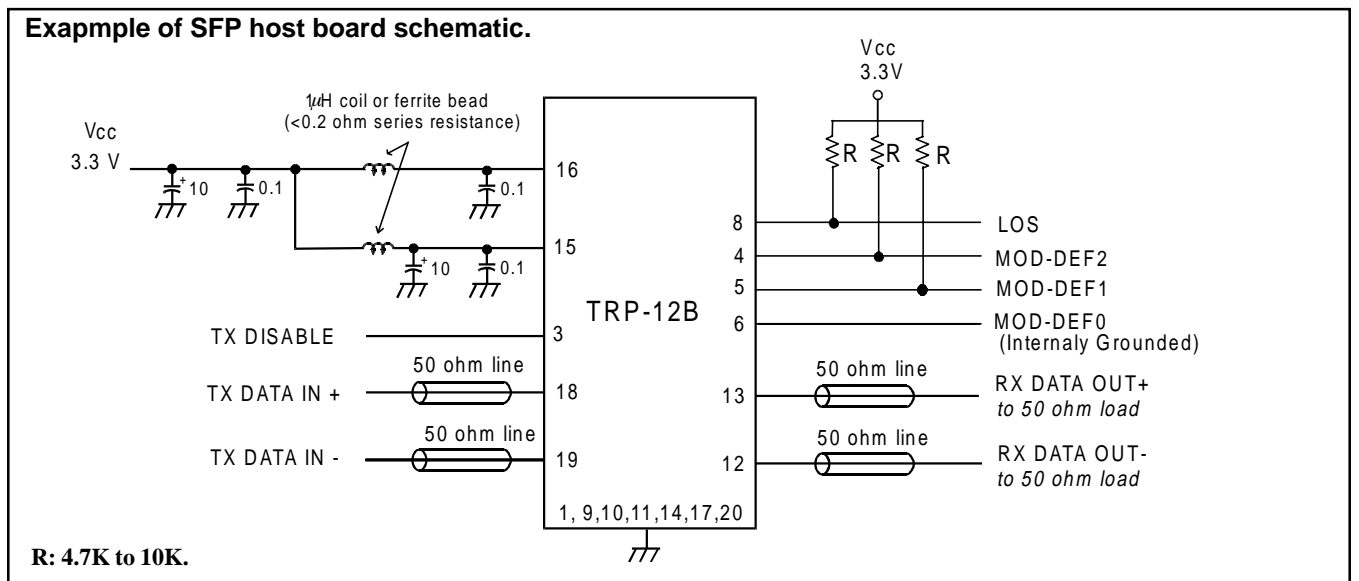
The data transfer protocol and the details of the mandatory and vender specific data structures are defined in Small Form-Factor Pluggable (SFP) Transceiver MultiSource Agreement.

**Power supply and grounding:** The power supply line should be well-filtered. All 0.1 μF power supply bypass capacitors should be as close to the transceiver module as possible.

## TRP-03 & TRP-12

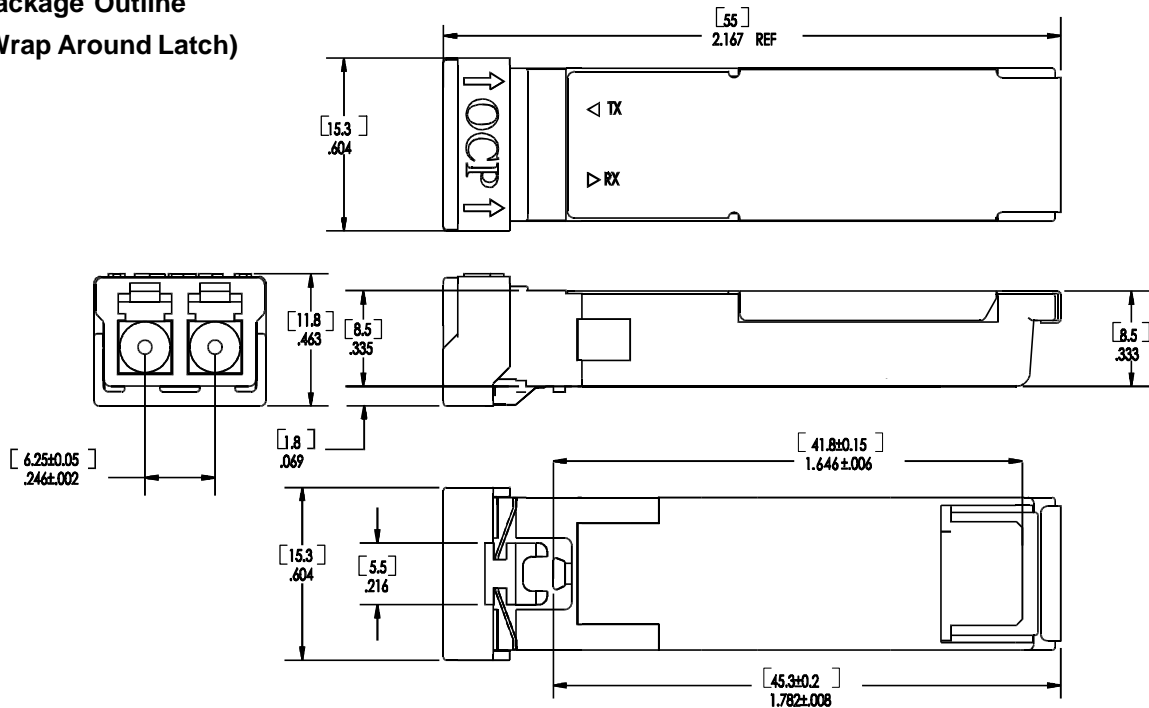


**Exapmple of SFP host board schematic.**



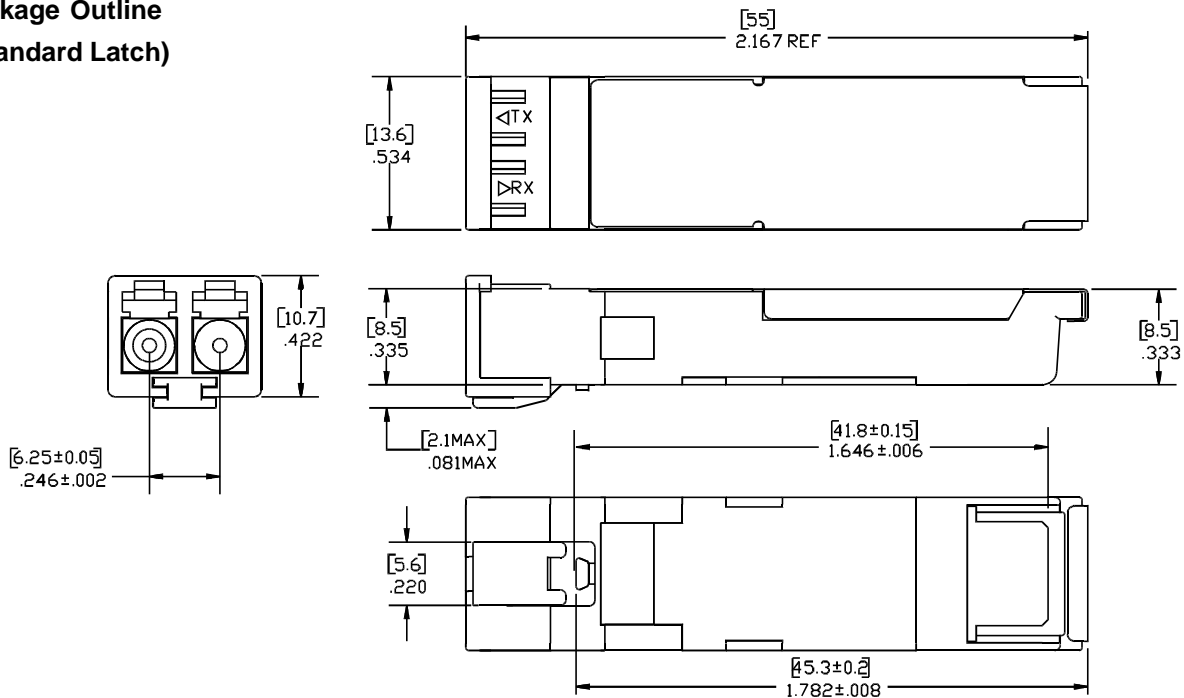
## TRP-03 & TRP-12

### Package Outline (Wrap Around Latch)



Dimension in inches [mm]

### Package Outline (Standard Latch)



Dimension in inches [mm]

For further information, please refer to applications notes for SFP transceivers.

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