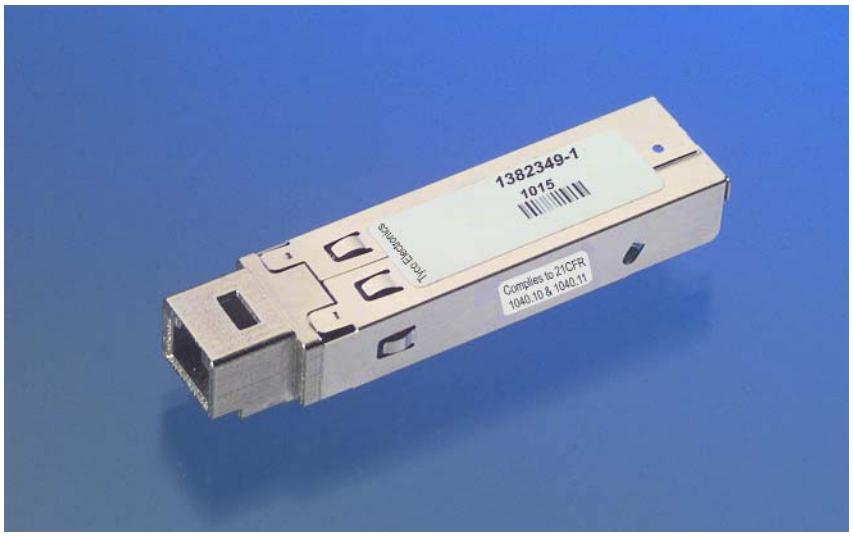
Gigabit Fibre Channel Multimode SFP MT-RJ Transceiver

Product Facts

- Conforms to Fibre Channel FC-PI Specifications
- Complies with Small Form-factor Pluggable (SFP) Multi-Source Agreement (MSA)
- High density MT-RJ connector interface
- Dual data rate
- Operates to 500 m with 50/125 µm or 300 m with 62.5/125 µm fiber
- Hot pluggable
- Single +3.3-volt power supply
- PECL and LVPECL AC-coupled data Interface
- Transmitter uses 850nm vertical cavity surface emitting laser (VCSEL)
- Class 1 Laser Safe per FDA/CDRH and IEC 60825-1
- UL 60950 recognized
- Compatible with standard Fibre Channel chipsets.
- Units are supplied with dust plugs
- Mates to MSA compliant Host Connector and Cage Assembly

Applications

- Mass Storage
- High Speed Peripheral Interface
- RAID Systems
- High Bandwidth Intersystem and Intrasystem links
- Point-to-point links



Tyco Electronics, recognizing the market need for higher optical port density, is developing an entire product platform of Tyco Electronics' Small Form-factor Pluggable (SFP) transceivers with the popular MT-RJ connector. These transceivers are less than half the width of the functionally similar GBICs and simply plug into a SFP compatible surface mount connector and cage on the customer board. The smaller size and 0.64-inch port-to-port centerline spacing enables equipment manufacturers to cost-effectively double the fiber optic port density of a given product.

Tyco Electronics' Fibre Channel SFP MT-RJ Transceiver 1382349-1 is a short wavelength fiber optic transceiver module for use in Fibre Channel and high-speed proprietary link applications. This transceiver sends and receives pre-encoded data over a pair of 62.5µm or 50µm core multimode optical fibers. The module, which operates from a single +3.3V power supply, contains separate AC-coupled transmitter and receiver sections that have PECL/LVPECL compatible data interfaces. Tyco Electronics also offers a wide variety of Small Form Factor (SFF) and Small Form-factor Pluggable (SFP) transceivers for both singlemode and multimode applications.

Tyco Electronics' Fibre Channel SFP MT-RJ Transceiver has been extensively tested to comply with the Fibre Channel industry standard. The VCSEL-based transmitter is certified to be Class 1 laser safe, as defined by U.S. and international standards. The modules have been designed with grounding and shielding features that minimize EMI susceptibility and radiated emissions. Units are supplied with dust plugs.

Gigabit Fibre Channel Multimode SFP MT-RJ Transceiver (Continued)

Fibre Channel Multimode SFP MT-RJ Transceiver

Part Number 1382349-1

Transmitter Performance Specifications:

(T_C=0 to 70°C, V_{CC}-V_{EE}=3.135 to 3.465V DC)

Parameter	Symbol	Notes	Min	Typ	Max	Units
Operating Data Rate			–	–	1.0625	Gb/s
Optical Output (avg.)	P_{OUT}	1,2	-10	–	-4	dBm
Extinction Ratio	–	3	9	–	–	dB
Optical Modulation	OMA	4	0.156	–	–	mW
Transmit Disabled Optical Output (avg.)	$P_{OUT\ DIS}$		–	–	-30	dBm
Center Wavelength	λ_{OUT}	5	770	845	860	nm
Spectral Width (RMS)	$\Delta\lambda$	5	–	–	1.0	nm
Relative Intensity Noise	RIN_{12}	6	–		-116	dB/Hz
Deterministic Jitter	DJ	7,8	–	–	84.7	ps
Total Jitter	TJ	7	–	–	169.4	ps
Output Rise Time	t_{TLH}	8,9	–	–	300	ps
Output Fall Time	t_{THL}	8,9	–	–	300	ps
Pk-Pk Differential Input Voltage	V_{DIFF}	10	500	–	2000	mV
Transmit Fault Voltage Levels						
Tx_Fault_On		11	2	–	V_{CC}+ .3	V
Tx_Fault_Off		11	0	–	0.8	V
Transmit Disable Voltage Levels						
Tx Disabled		–	2.0	–	3.465	V
Tx Enabled		–	0	–	0.8	V
Power Supply Voltage	V_{CC} - V_{EE}	–	3.135	3.3	3.465	V
Supply Current	I_{CC}	–	–	44	60	mA
Operating Temperature	T_C	–	0	–	70	°C

Note: All optical measurements made through a short patch cable, between 2 and 5 meters in length, using 62.5 µm multimode fiber unless stated otherwise.

1. Meets Class 1 laser safety requirements of IEC 60825-1 and IEC 60825-2 and U.S. Department of Health Services 21 CFR 1040.10 and 1040.11 when operated within the specified temperature and power supply ranges.
2. Transmitter optical output power measured per TIA/EIA 455-95. Transmitter modulated with a valid 8b/10b data pattern. Specification applies for both 50 µm and 62.5 µm core multimode fiber.
3. Extinction ratio measured per TIA/EIA 526-4A with a repeating K28.7 data pattern.
4. Optical Modulation Amplitude (OMA) values are peak-to-peak measured per FC-PI Standard.
5. Center wavelength and spectral width measured per TIA/EIA 455-127 using optical spectrum analyzer with a valid 8b/10b data pattern.
6. RIN measured per ANSI X.230-1994 annex A with valid 8b/10b data pattern. RF power meter and current meter test set replaced with microwave spectrum analyzer and calibrated high-speed photoreceiver. Single mode fiber in test procedure replaced with multimode patch cable. Polarization rotator omitted.
7. DJ and TJ measured per FC-PI.
8. Measured from 20% to 80% points on rising and falling edge of transmitted waveform.
9. Transmitter optical waveform characteristics comply with the eye diagrams shown in this document.
10. Compatible with 10 K, 10 KH and 100 K ECL, PECL and LVPECL.
11. Open Collector/Drain output

Gigabit Fibre Channel Multimode SFP MT-RJ Transceiver (Continued)

Fibre Channel Multimode SFP MT-RJ Transceiver

Part Number 1382349-1

Receiver Performance Specifications:

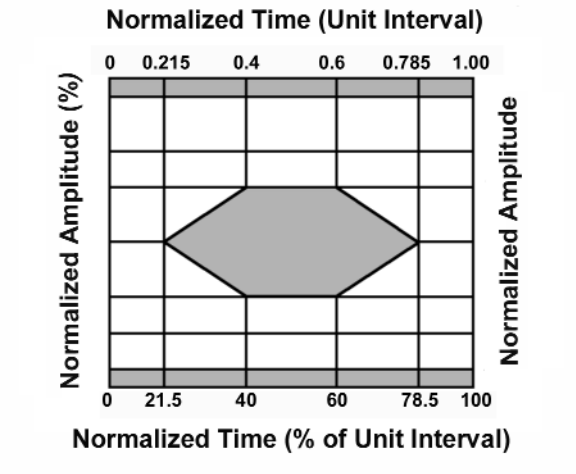
(TC=0 to 70°C, V_{CC}-V_{EE}=3.135 to 3.465V DC)

Parameter	Symbol	Notes	Min	Typ	Max	Units
Operating Data Rate			–	–	1.0625	Gb/s
Average Received Power	P_{IN}	–	–	–	0	dBm
Optical Modulation Amplitude	OMA	1	0.031	–		mW
Stressed Receiver Sensitivity (OMA)						
50 µm Fiber	–	2	0.055	–	–	mW
62.5 µm Fiber	–	2	0.067	–	–	mW
Electrical 3 dB Cut-Off	3 dB f_C	2	–	–	1.5	GHz
Electrical 10 dB Cut-Off	10 dB f_C	2	–	–	3	GHz
Optical wavelength	λ_{IN}	–	770	–	860	nm
Return Loss	–	3	12	–	–	dB
Receiver Loss of Signal Output Voltage	LOS					
Assert	V_A	4	2	–	V_{CC}+ .3	V
Deassert	V_D	4	0	–	0.8	V
Rx LOS Power Levels (avg.)						
Assert	P_A	–	-31	–	–	dBm
Deassert	P_D	–	–	–	-17	dBm
Hysteresis	–	–	0.5	–	–	dB
Power Supply Voltage	V_{CC} - V_{EE}	–	3.135	3.3	3.465	V
Supply Current	I_{CC}	-	-	85	100	mA
Operating Temperature	T_C	-	0	-	70	°C

Note: All optical measurements made through a short patch cable, between 2 and 5 meters in length, using 62.5 µm multimode fiber unless stated otherwise.

1. Optical Modulation Amplitude values are Peak-to-Peak.
2. Per FC-PI Standard.
3. Return loss measured per TIA/EIA 455-107.
4. This is an open drain output that should be pulled up with a 4.7K ohm - 10K ohm resistor on the host board. Pull-up voltage level should be between 2.0 V and Vcc + 0.3 V per the SFP MSA.

Gigabit Fibre Channel Multimode SFP MT-RJ Transceiver (Continued)



NOTE: Transmitter optical waveform characteristics including rise time, fall time, pulse undershoot, pulse overshoot, and ringing comply with this eye diagram. These characteristics are controlled to help prevent excessive degradation of the receiver sensitivity. The eye mask test is performed using a receiver with a fourth-order Bessel Thompson filter.

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	TX_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 LOS assert
LOS Deassert Time	T_Loss_Off		100	µs	Time from non-LOS state to LOS deassert
Serial ID Clock Rate	F_Serial_Clock		100	kHz	

NOTE: For details on timing requirements of control and status I/O parameters, and module interface and data field descriptions, please refer to the SFP MSA, Appendix B Electrical Interface guidelines.

Absolute Maximum Ratings:

Parameter	Symbol	Units	Min	Max
Storage Temperature	T_S	°C	-40	85
Data Input Voltage	V_{INPUT}	V	-0.5	V_{CC}
Differential Input Voltage	V_{DIFF}	V	–	2.4
Supply Voltage	V_{CC}-V_{EE}	V	-0.2	5.0

Regulatory Compliance:

Agency	Test Method	Listing Document
FDA	CDRH 21-CFR 1040 Class 1	Accession Number: 9122051-08
TUV	EN60825-1:1994+A11:1996 EN60825-2:1994+A1 EN60950:1992+A1+A2+A3+A4+A11	TUV Product Services Laser Class I Protection Class III TUV Certificate Number: B020546940003
UL / c UL us	UL60950	E141081

ESD Testing:

Test	Test Method	Procedure
ESD1	JEDEC/EIA JESD22-A-114-A (C=100 pF, R=1500 ohm - Human body model)	Pulses applied to each pin and Ground at 1 KV
ESD2	25 KV maximum air discharge (simulates human body discharge into a DUT)	40 discharges are applied per DUT (10 at each of the top, nose, right, and left). Each module is tested with both power ON and OFF

NOTE All products which contain a laser must comply with government regulations for laser safety. In the U.S., the applicable standard is FDA 21 CFR 1040. In other parts of the world, IEC 60825-1 applies. These transceivers were designed and tested to the requirements of the above standards and found to be in compliance with class 1 laser safety limits. When operated within the limits specified in this document, this product conforms to IEC 60825-1: 1993 + A1 : 1997 + A2: 2001, class 1 laser product, requirements.

CAUTION! Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

Gigabit Fibre Channel Multimode SFP MT-RJ Transceiver (Continued)

Pad Description:

Symbol	Pad #	Function
$V_{EE}T$	1	Signal Ground. Directly connect to ground. [SEE NOTE 1].
Tx_Fault	2	Transmitter Fault. This is an open collector output that should be pulled up with a 4.7K - 10KΩ resistor on the host board. [SEE NOTE 2].
Tx_Disable	3	Transmitter Disable Input. Module disables on high or open. The input is pulled up within the module with a 4.7K - 10KΩ resistor. Its states are: Low (0 - 0.8V) : Transmitter on (>0.8, <2.0V) : Undefined High (2.0 - 3.465V) : Transmitter Disabled Open: Transmitter Disabled.
MOD-DEF2	4	Module Definition 2. This is the data line of two wire serial interface for serial ID. This pad should be pulled up with a 4.7K - 10KΩ resistor on the host board. [SEE NOTE 2].
MOD-DEF1	5	Module Definition 1. This is the clock line of two wire serial interface for serial ID. This pad should be pulled up with a 4.7K - 10KΩ resistor on the host board. [SEE NOTE 2].
MOD-DEF0	6	Module Definition 0. MOD-DEF0 is grounded by the module to indicate that the module is present. The pad should be pulled up with a 4.7K - 10KΩ resistor on the host board. [SEE NOTE 2].
Rate Select	7	This function is not implemented and the pad is floating. Per the SFP MSA, this is an optional input used to control the receiver bandwidth for multiple data rate operation.
LOS	8	Loss of Signal. This is an open collector output that should be pulled up with a 4.7K - 10KΩ resistor on the host board. [SEE NOTE 2]. Normal operation is when LOS is Deasserted. Abnormally low receive signal level is indicated by LOS Asserted.
$V_{EE}R$	9	Signal Ground. Directly connect to ground. [SEE NOTE 1].
$V_{EE}R$	10	Signal Ground. Directly connect to ground. [SEE NOTE 1].
$V_{EE}R$	11	Signal Ground. Directly connect to ground. [SEE NOTE 1].
RD-	12	Received Data Out Bar. Output is internally AC coupled. Use SerDes chip IC manufacturer's termination recommendation to achieve a 50 Ω termination impedance.
RD+	13	Received Data Out. Output is internally AC coupled. Use SerDes chip IC manufacturer's termination recommendation to achieve a 50 Ω termination impedance.
$V_{EE}R$	14	Signal Ground. Directly connect to ground. [SEE NOTE 1].
$V_{CC}R$	15	Receiver Power Supply. Connect as shown in the Recommended Host Board Supply Filtering Network. [SEE NOTE 3].
$V_{CC}T$	16	Transmitter Power Supply. Connect as shown in the Recommended Host Board Supply Filtering Network. [SEE NOTE 3].
$V_{EE}T$	17	Signal Ground. Directly connect to ground. [SEE NOTE 1].
TD+	18	Transmitter Data In. Input is internally AC coupled. There is an internal 100 Ω resistor across TD+ and TD-, which provides a 50 Ω termination for each data input.
TD-	19	Transmitter Data In Bar. Input is internally AC coupled. There is an internal 100 Ω resistor across TD+ and TD-, which provides a 50 Ω termination for each data input.
$V_{EE}T$	20	Signal Ground. Directly connect to ground. [SEE NOTE 1].

NOTE 1: Transmitter and receiver grounds are connected together inside the transceiver module.
NOTE 2: Pull-up voltage between 2.0V and VccT + 0.3V
NOTE 3: $V_{CC}T$ and $V_{CC}R$ are separate inside the transceiver module.

Figure 2: Transceiver Pad Descriptions

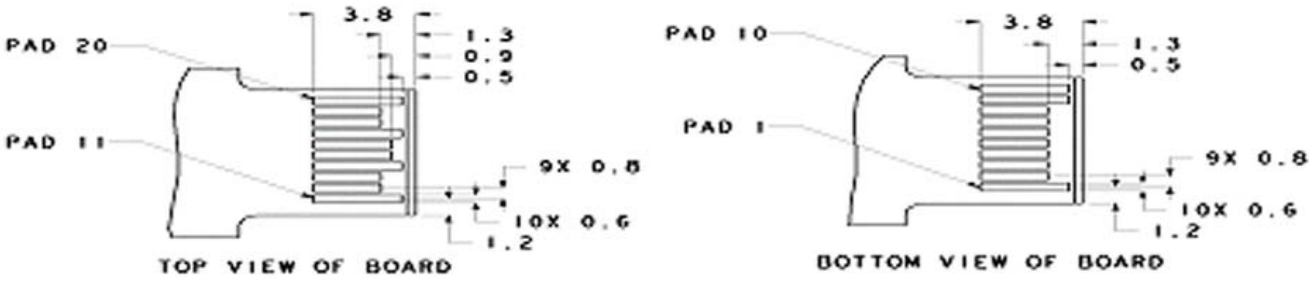
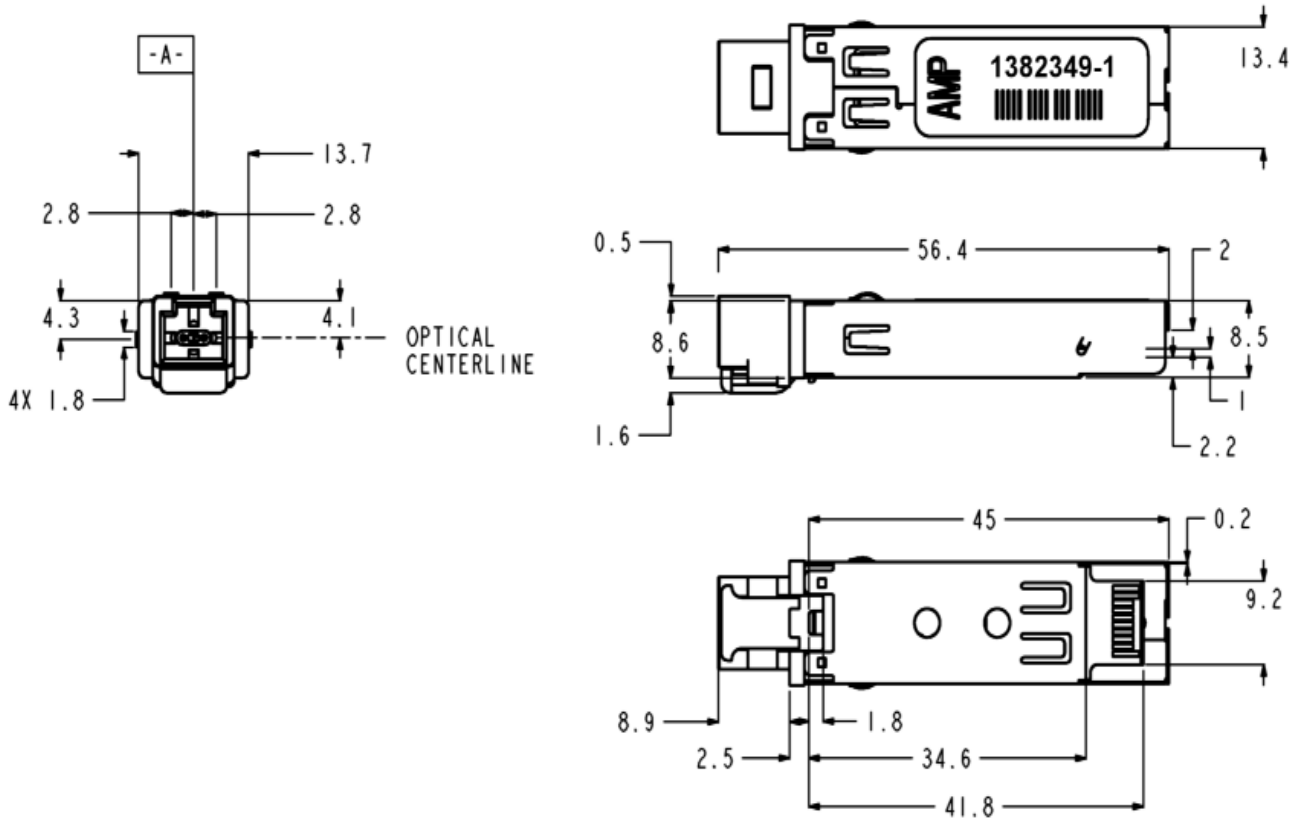


Figure 2: Transceiver Outline Descriptions



Note: All dimensions are in mm.

IMPORTANT: PLEASE REFER TO THE TYCO ELECTRONICS CUSTOMER DRAWING 1382349-1 FOR TRANSCEIVER HOUSING DIMENSIONS AND TOLERANCES. CALL 1-800-522-6752 FOR 24HR FAX OR GO ON LINE AT: http://www.tycoelectronics.com.

Figure 4: SFP MSA Recommended Circuit Board Layout

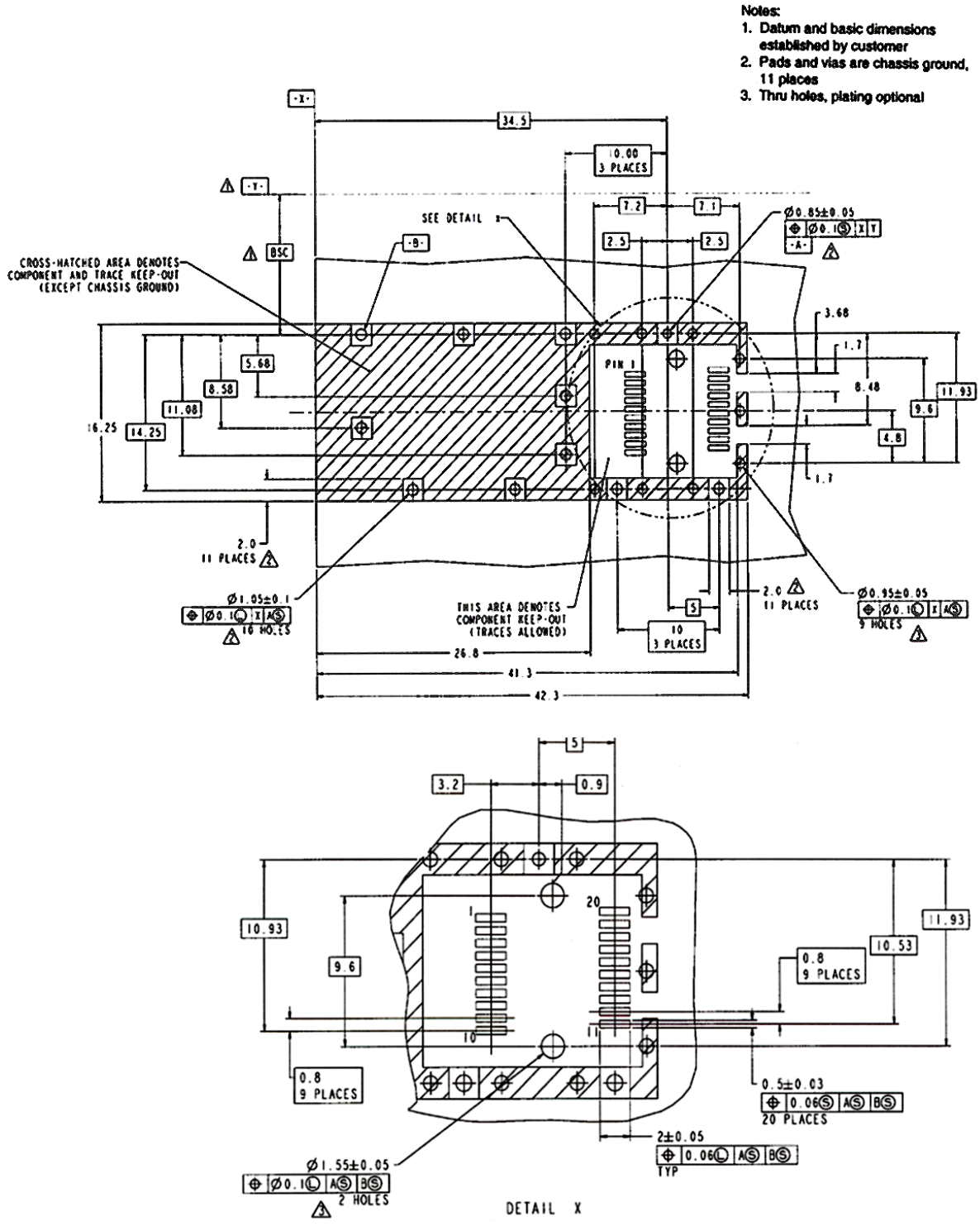
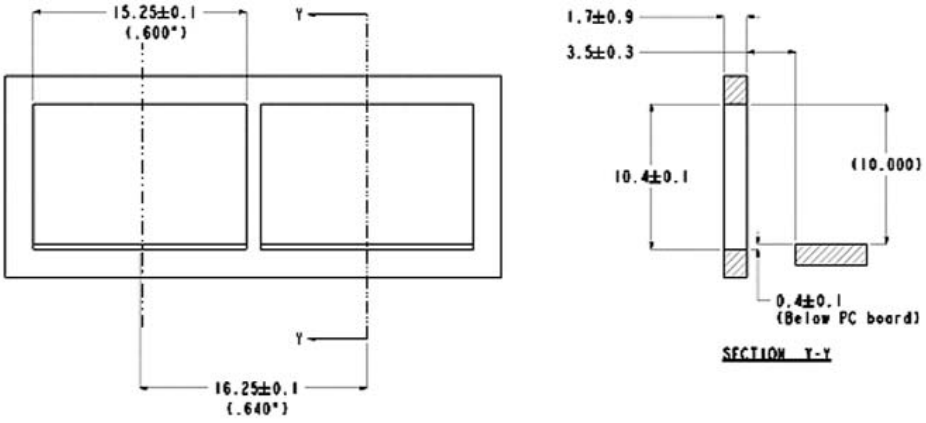
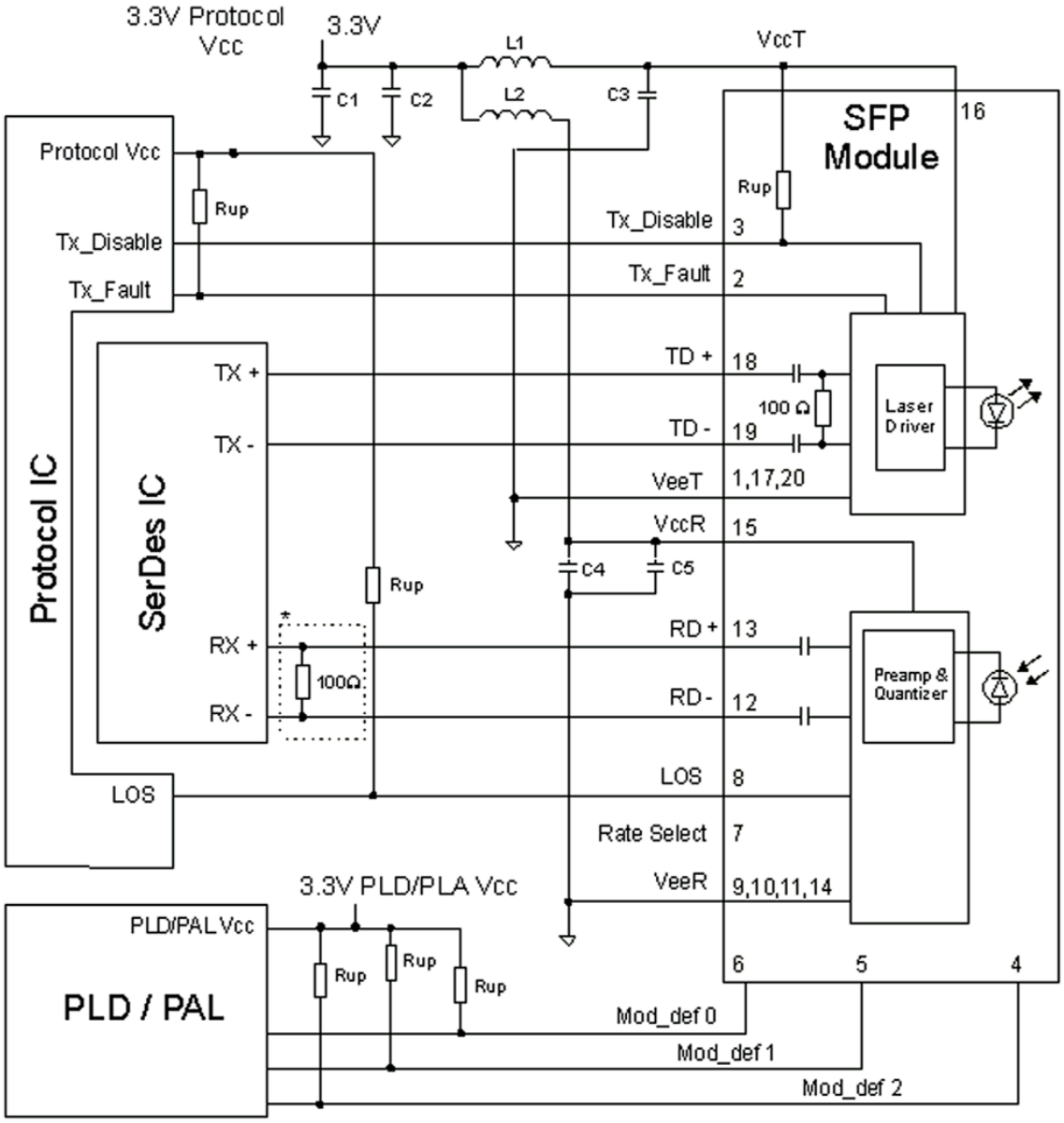


Figure 5: SFP MSA Recommended Bezel Opening



Note: Minimum pitch illustrated. All dimensions are in mm only.

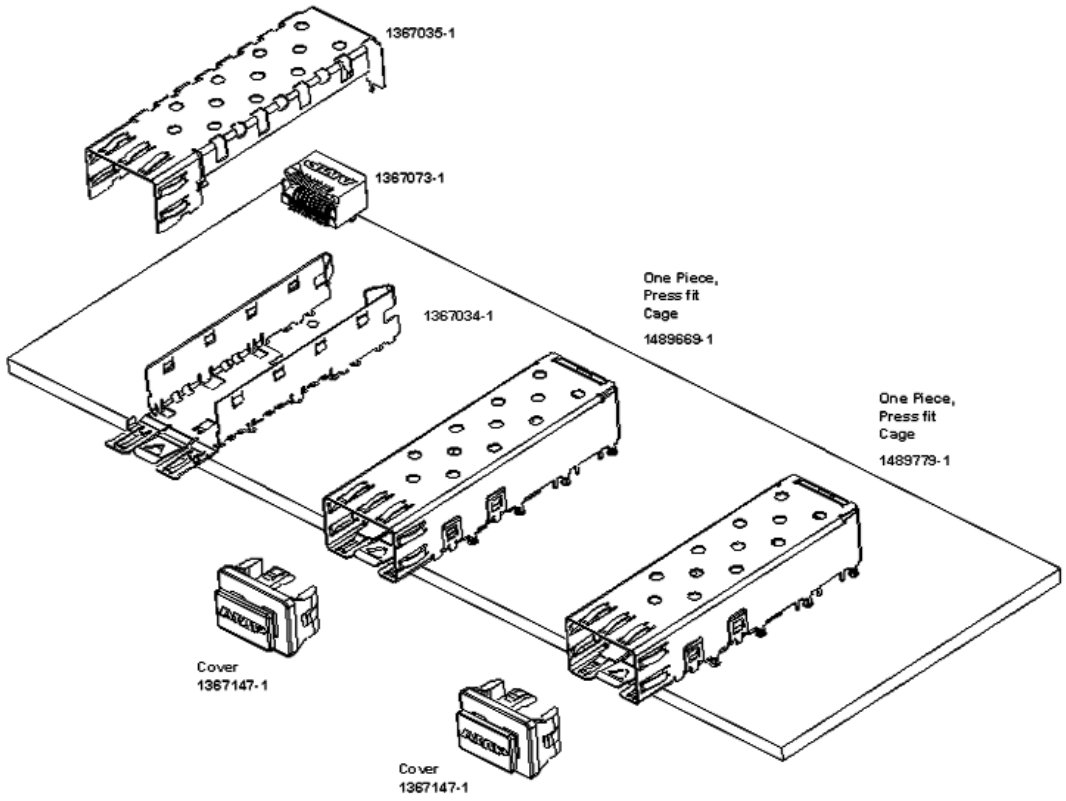
Figure 6: Recommended Termination and Power Supply Filtering



*Use SERDES IC manufacturer's termination recommendation.
C1=C4 = 10 µF
C2=C3=C5 = 0.1 µF
Note: X7*R* or better MLC types are recommended for all capacitors
L1=L2 = 1 µH .... 4.7 µH, max 1.0 Ω [Ferrite inductors may be used]
Rup = 4.7 KΩ .... 10 KΩ

NOTE: TO IMPROVE EMI, THE SIGNALS TO THE CONNECTOR SHOULD BE SHUT OFF WHEN THE TRANSCEIVER IS REMOVED.

Related Products:



Related Documents:

SFP Connector & Cage Assembly Application Specification 114-13017
Fibre Channel Multimode SFP MT-RJ Transceiver Application Specification 114-13082

FOR DETAILED INFORMATION ON ALL TYCO ELECTRONICS FIBER OPTIC TRANSCEIVERS, PLEASE VISIT OUR WEB-SITE AT:

http://www.tycoelectronics.com/fiberoptics