SPLC-20-4-1-B-R6 Optical Gigabit Ethernet / Fibre Channel
850nm SFP – 1.25 / 1.0625 GBaud – +3.3V

FEATURES

- 1.25/1.0625 Gbaud Gigabit Ethernet / Fibre Channel compliant
- Compliant with IEEE 802.3z 1000BASE_SX specification for optical links
- Compliant with ANSI X3T11 Fibre Channel specification
- Compliant with MSA SFP specification
- 100Ω differential AC coupled CML outputs
- Die Cast Metal Housing
- Hot pluggable
- Single +3.3V Power Supply
- Serial ID functionality
- RoHS Compliant

ORDERING INFORMATION

SPLC – 20 – 4 – 1 – B – R6

RELEASE ACTUATOR
B – Bail Actuator

WAVELENGTH
1 = 850nm (Multimode)

COMMUNICATIONS PROTOCOL
4 = GbE / FC, 1.25/1.0625 GBaud

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PRODUCT OVERVIEW

The SPLC-20-4-1-B-R6 pluggable transceiver module is a high performance integrated duplex data link for bi-directional communication over multimode optical fiber. It is compliant with the MSA Small Form Factor Pluggable (SFP) specification. The SPLC-20-4-1-B-R6 is specifically designed for high speed Gigabit Ethernet/Fibre Channel applications. The Stratos Lightwave SFP transceiver is hot pluggable which allows a suitably designed enclosure to be changed from one type of external interface to another simply by plugging in a SFP having the alternative external interface. The SPLC-20-4-1-B-R6 operates at +3.3V. This optoelectronic transceiver module is a Class 1 Laser product compliant with FDA Radiation Performance Standards, 21 CFR Subchapter J. This component is also Class 1 Laser compliant according to the International Safety Standard IEC-825-1.

SHORT WAVELENGTH LASER

The use of short wavelength VCSELs (Vertical Cavity Surface Emitting Lasers) and high volume production processes has resulted in a low cost, high performance data link which communicates reliably at distances of 550m over 50µm multimode fiber with data transfer rates up to 1.25GBaud.

MODULE SPECIFICATIONS - ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	MIN	MAX	UNITS	NOTES
Storage Temperature	Tstg	-40	+85	°C	
Supply Voltage	$V_{CC}T$, $V_{CC}R$		6.0	V	VCC - ground
Data AC Voltage	Tx+, Tx-		2.6	Vpp	Differential
Data DC Voltage	Tx+, Tx-	-10	10	Vpk	V(Tx+ or Tx-) - ground

MODULE SPECIFICATIONS - RECOMMENDED OPERATING CONDITIONS

PARAMETER	SYMBOL	MIN	TYP	MAX	UNITS	NOTES
Operating Case Temperature	Tc	-5		+80	°C	
Supply Voltage	$V_{DD}T$, $V_{DD}R$	+3.0	+3.3	+3.6	VDC	
Baud Rate	BRate	1.0625		1.25	GBaud	

SPLC-20-4-1-B-R6 Optical Gigabit Ethernet / Fibre Channel
850nm SFP – 1.25 / 1.0625 GBaud – +3.3V

MODULE SPECIFICATIONS – ELECTRICAL

-5°C<Tc<+80°C;+3.0V<Vcc<+3.6V

PARAMETER	SYMBOL	MIN	TYP	MAX	UNITS	NOTES
Supply Current	Icc		180	250	mA	Tc = 25°C, Vcc = +3.3 V
				300	mA	-5°C<Tc<+80°C;+3.15V<Vcc<+3.45V
Surge Current	Isurge			30	mA	Surge above steady state value
TRANSMITTER						
PECL / CML Inputs (Differential)		400		2500	mVpp	AC coupled inputs
Input Impedance (Differential)	Zin	85	100	115	ohms	Rin > 100 kohms @ DC
Tx_DISABLE Input Voltage - High	ViH	2		3.45	V	
Tx_DISABLE Input Voltage - Low	ViL	0		0.8	V	
Tx_FAULT Output Voltage -- High	VtoH	Vcc-0.5		Vcc+0.3	V	Io = 400µA; Host Vcc
Tx_FAULT Output Voltage -- Low	VtoL	0		0.8	V	Io = -4.0mA
RECEIVER						
CML Outputs (Differential)		400	800	1200	mVpp	AC Coupled Outputs
Output Impedance (Differential)	Zout	85	100	115	ohms	
Rx_LOS Output Voltage - High	VroH	Vcc-0.5		Vcc+0.3	V	Io = 400µA; Host Vcc
Rx_LOS Output Voltage - Low	VroL	0		0.8	V	Io = -4.0mA
Total Jitter [pk - pk]	TJ			130	ps	Measured with 2^7 - 1 PRBS
MOD_DEF (0:2)	VoH	2.5		Vcc+0.3	V	With Serial ID
	VoL	0		0.5	V	

MODULE SPECIFICATIONS – OPTICAL

-5°C<Tc<+80°C;+3.0V<Vcc<+3.6V

PARAMETER	SYMBOL	MIN	TYP	MAX	UNITS	NOTES
50µm Core Diameter MMF		550	1000		m	BER<1.0E-12 @ 1.25/1.0625Gbaud
62.5µm Core Diameter MMF		300	500		m	BER<1.0E-12 @ 1.25/1.0625Gbaud
TRANSMITTER						
Optical Center Wavelength	λ	830	850	860	nm	
Spectral Width	Δλ			0.85	nm	RMS
Optical Transmit Power	Popt	-9.5		-3	dBm	Average @ 8500nm
Optical Modulation Amplitude	OMA	180			µW	pk-pk
Extinction Ratio	ER	9			dB	P1/P0
Relative Intensity Noise	RIN			-117	dB/Hz	
Total Jitter [Pk - Pk]	TJ			170	ps	Measured with 2^7 - 1 PRBS
Output Rise/Fall Time	t_R, t_F			260	ps	20-80%; Measured unfiltered
RECEIVER						
Optical Input Wavelength	λ	770		860	nm	
Optical Input Power	Pr	-17		0	dBm	BER<1.0E-12 @ 1.25/1.0625GBaud
Optical Modulation Amplitude	OMA	31			µW	pk-pk
Optical Return Loss	ORL	12			dB	
RX_LOS --- Asserted	Pa	-29			dBm	Measured on transition -- Low to High
RX_LOS --- Deasserted	Pd			-17	dBm	Measured on transition -- High to Low
RX_LOS --- Hysteresis	Pa - Pd		1.5	5	dB	

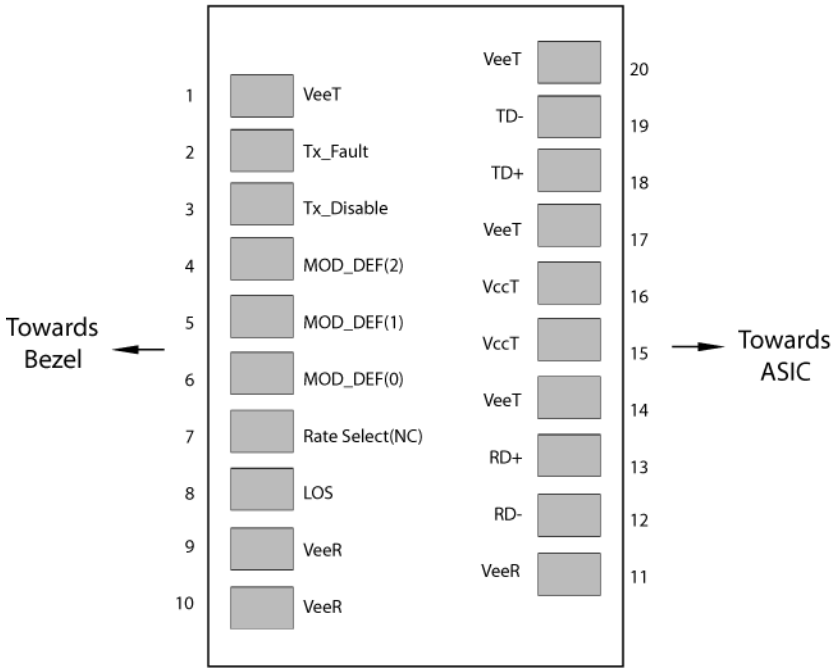


Figure 1 Diagram of Host Board Connector Block Pin Numbers and Names

PIN NO.	NAME	FUNCTION	PLUG SEQ.	NOTES
PIN 1	VeeT	Transmitter Ground	1	
PIN 2	TX_FAULT	Transmitter Fault Indication	3	Note 1
PIN 3	TX_DISABLE	Transmitter Disable	3	Note 2: Module Disables on high or open
PIN 4	MOD_DEF (2)	Module Definition 2	3	Note 3,2: Wire Serial ID interface
PIN 5	MOD_DEF (1)	Module Definition 1	3	Note 3,2: Wire Serial ID interface
PIN 6	MOD_DEF (0)	Module Definition 0	3	Note 3: Grounded Module
PIN 7	RATE SELECT	Not Connected	3	Note 4
PIN 8	LOS	Loss of Signal	3	Note 5
PIN 9	VeeR	Receiver Ground	1	Note 6
PIN 10	VeeR	Receiver Ground	1	Note 6
PIN 11	VeeR	Receiver Ground	1	Note 6
PIN 12	RD-	Inverted Received Data out	3	Note 7
PIN 13	RD+	Non-Inverted Received Data out	3	Note 7
PIN 14	VeeR	Receiver Ground	1	Note 6
PIN 15	VccR	Receiver Power	2	+3.3V ±9%, Note 8
PIN 16	VccT	Transmitter Power	2	+3.3V ±9%, Note 8
PIN 17	VeeT	Transmitter Ground	1	Note 6
PIN 18	TD+	Non-inverted Data In	3	Note 9
PIN 19	TD-	Inverted Data In	3	Note 9
PIN 20	VeeT	Transmitter Ground	1	Note 6

Plug Sequence: Pin engagement sequence during hot plugging

NOTES:

(1) TX FAULT: is an open collector/drain output which should be pulled up with a 4.7K – 10K ohm resistor on Host board. Pull up voltage between 2.0V and VccT, R+0.3V. When high, output indicates a laser fault of some kind. Low indicates normal operation. In the low state, the output will be pulled to < 0.8V.

(2) TX DISABLE: is an input that is used to shut down the transmitter optical output. It is pulled up within the module with a 4.7K – 10K ohm resistor. The states are:

Low (0 – 0.8V): Transmitter ON
(>0.8, <2.0V): Undefined
High (2.0 – 3.465V): Transmitter Disabled
Open: Transmitter Disabled

(3) MOD-DEF 0,1,2: These are the module definition pins. They should be pulled up with 4.7K – 10K ohm resistor on the host board. Pull up voltage between 2.0V and VccT, R+0.3V.

MOD-DEF 0 is grounded by the module to indicate that the module is present
MOD-DEF 1 is the clock input of the 2-wire serial interface for serial ID and DDMI.
MOD-DEF 2 is the data input of the 2-wire serial interface serial ID and DDMI.

(4) RATE SELECT: This is an optional input used to control the receiver bandwidth for compatibility with multiple data rates (most likely Fibre Channel 1X and 2X rates). **This signal in not Implemented in the Stratos Lightwave SFP transceiver**. The SFP transceiver is designed to be rate agile which means that it is interoperable with both the 1x and 2x Fibre Channel and Gigabit Ethernet transceivers.

(5) LOS (Loss of Signal) is an open collector/drain output which should be pulled up with a 4.7K – 10K ohm resistor. Pull up voltage between 2.0V and VccT, R+0.3V. When high, this output indicates the received optical signal power is below the receiver sensitivity. Low indicates normal operation. In the low state, the output will be pulled to < 0.8V.

(6) VeeR and **VeeT** may be internally connected within the SFP module.

(7) RD-/+: These are the differential receiver signal outputs. They are AC coupled 100ohm differential lines which should be terminated with 100ohm (differential) at the user SERDES. The AC coupling is done inside the module and is thus not required on the host board. The voltage swing on these lines will be between 400 and 1200mVpp differential (200-600mVpp single ended) when properly terminated (Figure 2).

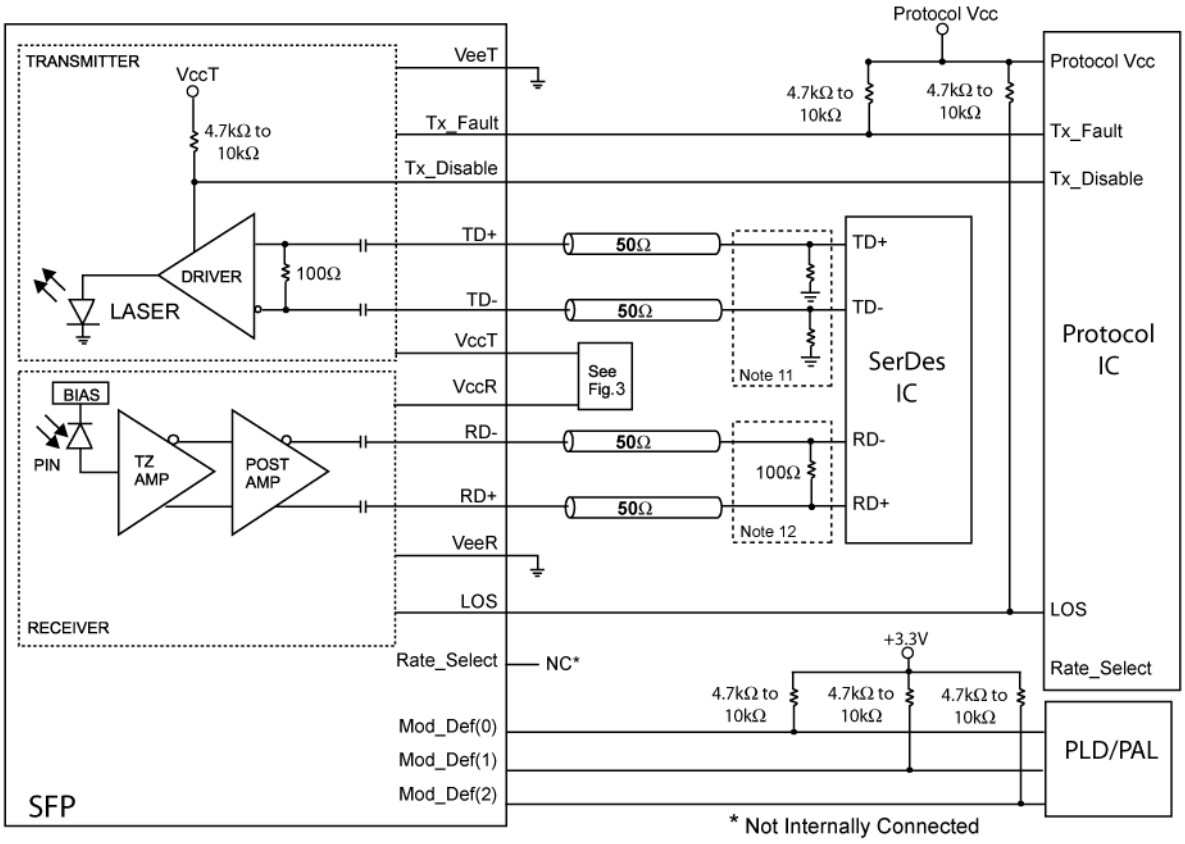
(8) VccR and **VccT:** are the receiver and transmitter power supplies. They are defined as 3.3V±9% at the SFP connector pin. Maximum supply current is 300mA. Recommended host board power supply filtering is shown in figure 3A. When the recommended supply filtering network is used, hot plugging of the SFP module will result in an inrush current of no more than 30mA greater than the steady state value. VccR and VccT may be internally connected within the SFP module.

(9) TD-/+: are the differential transmitter signal inputs. They are AC coupled differential lines with a 100ohm differential termination inside the module. The AC coupling is done inside the module and is thus not required on the host board. The inputs will accept a swing of 400 – 2500 mVpp differential (200-1250mVpp single ended), though it is recommended that values between 500 and 1200mVpp differential (250-600 mVpp single ended) be used for best EMI performance.

TERMINATION CIRCUITS

Inputs to the SPLC-20 transmitter are AC coupled and internally terminated with 100 ohms differential. These modules can operate with CML or PECL logic levels. The input signal must have at least a 400mV peak-to-peak differential signal swing. Output from the receiver section of the module is AC coupled CML level and is expected to drive into a 50 ohm load. Different termination strategies may be required depending on the particular SERDES chip set used. The SPLC-20 product family is designed with AC coupled data inputs and outputs to provide the following advantages:

- ■ Close positioning of SERDES with respect to transceiver; thus reduces EMI at gigabit speeds.
- ■ Minimum number of external components.
- ■ Internal termination reduces the potential for unterminated stubs which would otherwise increase jitter and reduce transmission margin.



Subsequently, this affords the customer the ability to optimally locate the SERDES as close to the SPLC-20 as possible and save valuable real estate. At gigabit rates this can provide a significant advantage resulting in better transmission performance and accordingly better signal integrity. Figure 2 illustrates the recommended transmit and receive data line terminations.

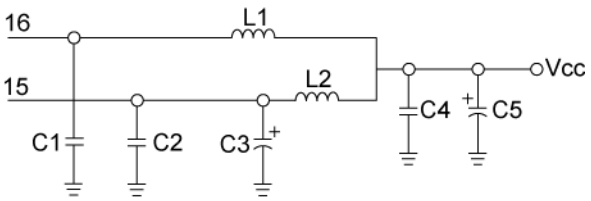
Notes:

11. Consult the SERDES manufacturer's applications information for biasing required for Tx outputs. Some serializer outputs are internally biased and may not need external bias resistors.

12. Consult SERDES manufacturer's data sheet and application data for appropriate receiver input biasing network.

POWER COUPLING

A suggested layout for power and ground connections is given in figure 3 below. Connections are made via separate voltage and ground planes. The mounting posts are at case ground and should not be connected to circuit ground. The ferrite bead should provide an impedance of 220Ω at 100MHz. Bypass capacitors should be placed as close to the 20 pin connector as possible.



VALUES:
C1, C2, C4 = 0.1µF
C3, C5 = 10µF, Tantalum
L1, L2 = Impedance of 220Ω at 100MHz

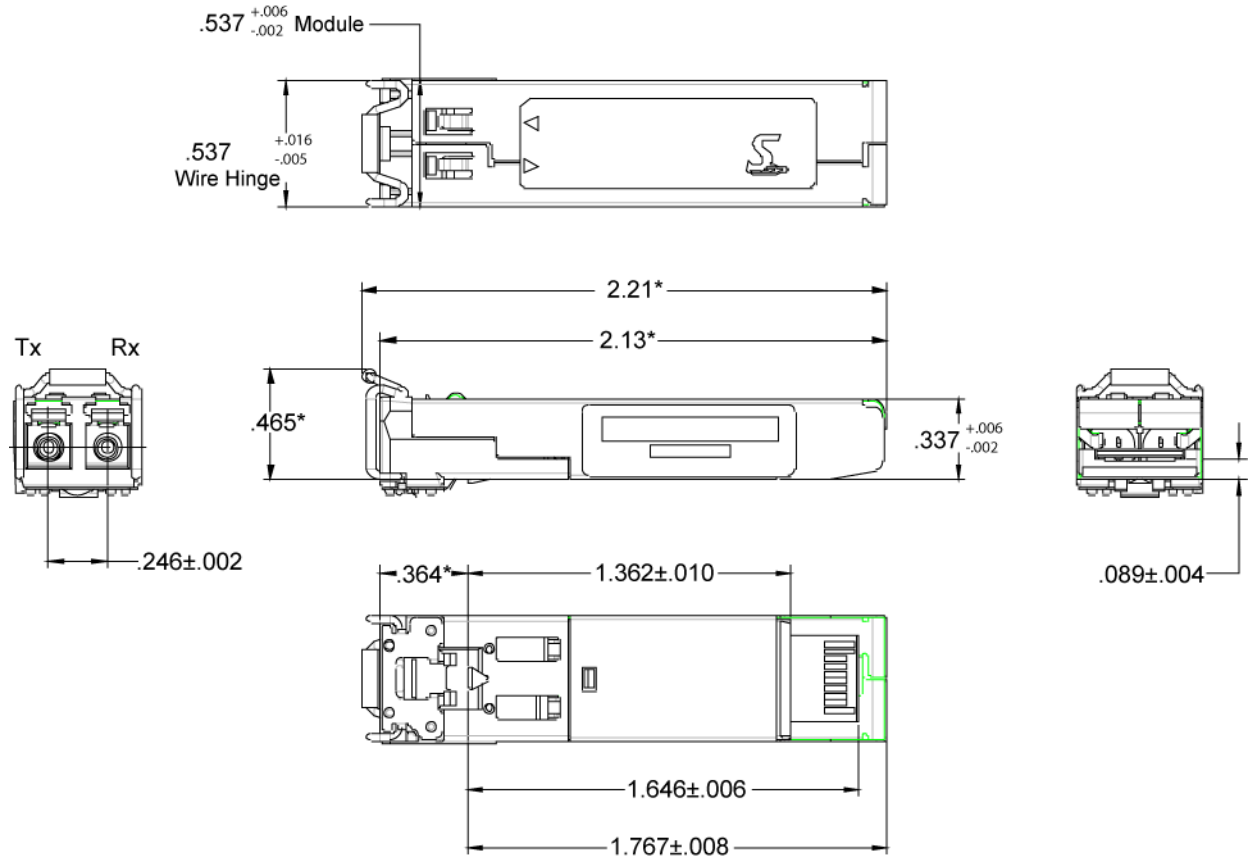
SFP TIMING PARAMETERS

The timing parameters for SFP management are shown below.

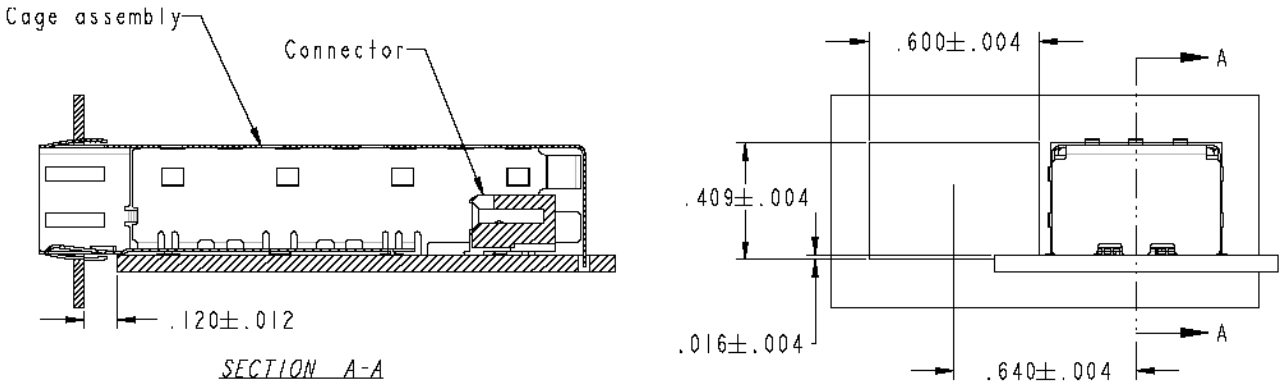
PARAMETER	SYMBOL	MIN.	MAX.	UNIT	CONDITIONS
TX_DISABLE assert time	t_off		10	µsec	Timing from rising edge of TX_DISABLE to when the optical output falls below 10% of nominal
TX_DISABLE negate time	t_on		1	ms	Timing from falling edge of TX_DISABLE ro when the modulated optical output rises above 90% of nominal
Time to initialize includes 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
RX_LOS Assert time	t_loss_on		100	µs	Time from LOS state to RX_LOS assert
RX_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	Timing 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	

Table 1: Timing parameters for SFP management

MECHANICAL DIMENSIONS and PANEL CUTOUT (inches) – BAIL ACTUATOR



NOTE:
* DIMENSIONS ARE FOR REFERENCE ONLY



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