10Gb/s SFP Optical Transceiver Module

SPP5200SR-GL-M

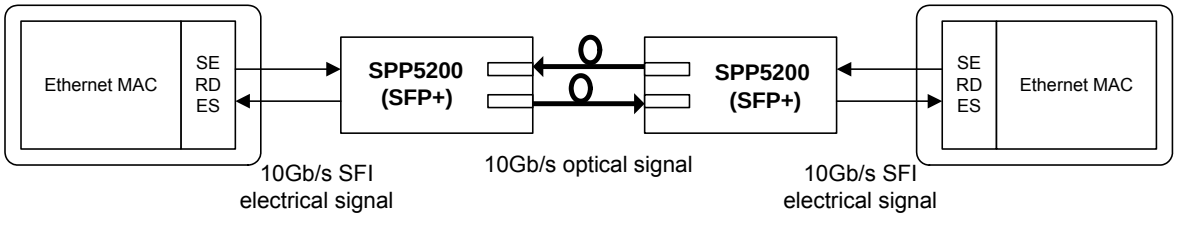
(10GBASE-SR & Multi-Protocol, 850nm VCSEL, PIN-PD)

Features

- 10Gb/s Serial Optical Interface
  - High quality/reliability optical device and sub-assemblies
  - 850nm VCSEL laser for up to MMF 300m and high sensitivity PIN photodiode with TIA
  - 10GBase-SR & multi-protocol compliance
- SFP+ MSA Compliant
  - Compliant with SFF 8431 for electrical interface
    - SFI High Speed electrical interface
    - Tx_Disable and Rx_LOS function supported
  - Compliant with SFF 8432 for mechanical interface
    - SFP Mechanical Interface for easy removal
    - Duplex LC Receptacle
  - Compliant with SFF 8742 for 2-wire interface for management and diagnostic monitor
- Protocol
  - IEEE802.3ae 10 Gigabit Ethernet with LAN PHY/WAN PHY and FEC rate
  - FC-PI-4 10G Fiber Channel and FEC rate
- Power Supply Consumption
  - Less than 1W with single 3.3V power supply
  - -5 to 85 degree Celsius operation (SPP5200SR-GL-M)
- RoHS6 compliant

Applications

- 10GE Ethernet switches and routers
- 10GE Storage
- 10GFC system
- Inter Rack Connection
- Other high speed data connections



Application Block Diagram

1. General Description

The SPP5200SR-GL-M is a very compact 9.9 to 10.5Gb/s optical transceiver module for serial optical communication applications at 10GBase-SR or other multi-protocol. Also its operation case temperature range is specified under -5 to 85 degree Celsius for SPP5200SR-GL , which converts a 10Gb/s serial electrical data stream to 10Gb/s optical output signal and a 10Gb/s optical input signal to 10Gb/s serial electrical data streams. The high speed 10Gb/s electrical interface is fully compliant with SFI specification of SFF-8431.

The SPP5200SR-GL-M is designed for Ethernet LAN/WAN, 10GFC and FEC rate applications. The high performance 850nm VCSEL transmitter and high sensitivity PIN receiver provide superior performance for such multi-protocol at up to 300m links.

The fully SFP+ MSA compliant form factor provides hot pluggability, easy optical port upgrades and low EMI emission.

Table 1. Fiber compliance

SFP+ type	Wavelength [nm]	Cable Type	Core Size (micron)	Modal Bandwidth [MHz/km]	Cable distance
10GB-SR	850	MMF	62.5 62.5 50.0 50.0 50.0	160 200 400 500 2000	26m(FDDI-Grade) 33m(OM1) 66m 82m(OM2) 300m(OM3)
10GFC	850	MMF	62.5 50.0 50.0	200 500 2000	33m 82m 300m

2. Functional Description

The SPP5200SR-GL-M contains a duplex LC connector for the optical interface and a 20-pin connector for the electrical interface. Figure 2.1 shows the functional block diagram of SPP5200SR-GL-M SFP Transceiver.

Transmitter Operation

The transceiver module receives 10Gb/s electrical data and transmits the data as an optical signal. The transmitter output can be turned off by Tx disable signal, TX_DIS pin. When TX_DIS is asserted High, Transmitter is turned off.

Receiver Operation

The received optical signal is converted to serial electrical data signal. The RX_LOS signal indicates insufficient optical power for reliable signal reception at the receiver.

Management Interface

A 2-wire interface (SCL, SDA) is used for serial ID, digital diagnostics and other control /monitor functions.

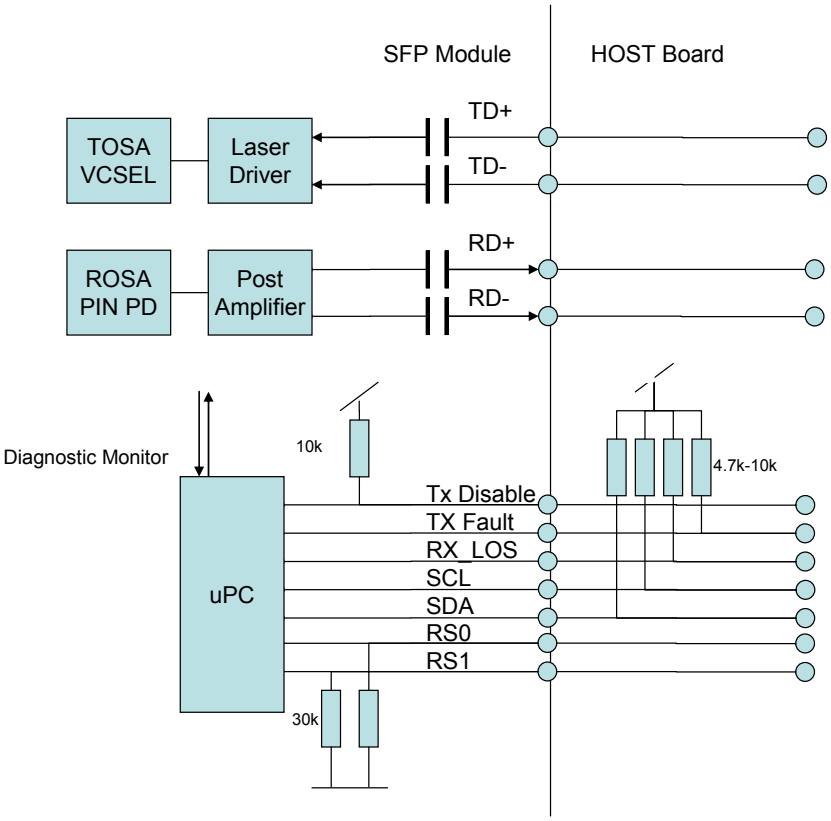


Figure 2.1 Functional Block Diagram

3. Package Dimensions

Figure 3.1 shows the package dimensions of SPP5200SR-GL-M, which is designed to be complaint with SFP MSA specification. Package dimensions are specified in SFF-8432.

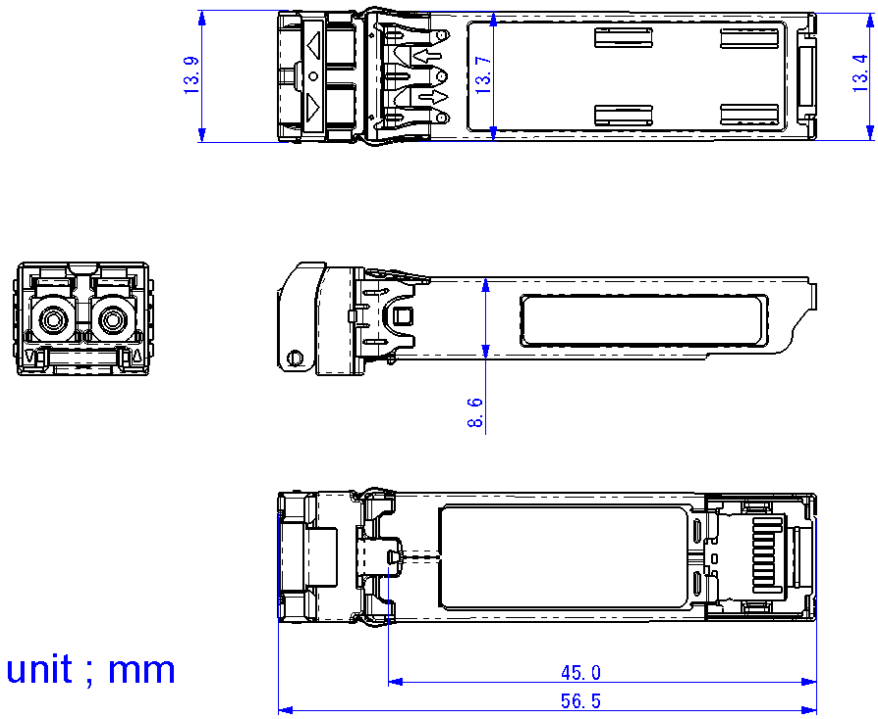


Figure 3.1 Package dimensions

4. Pin Assignment and Pin Description

4.1. SFP Transceiver Electrical Pad Layout

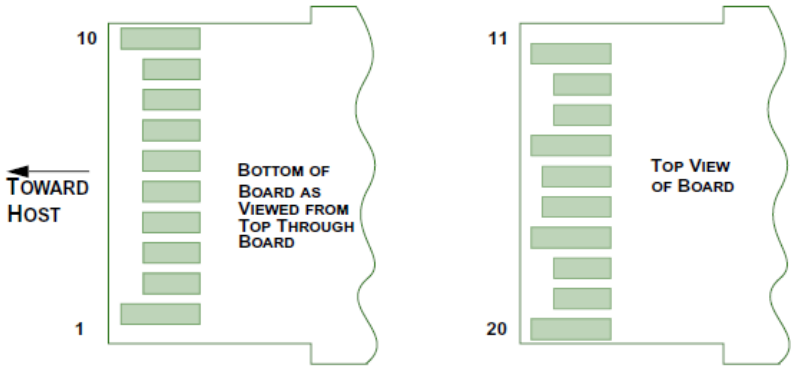


Figure 4.1 SFP Transceiver Electrical Pad Layout

4.2. Host PCB SFP Pinout

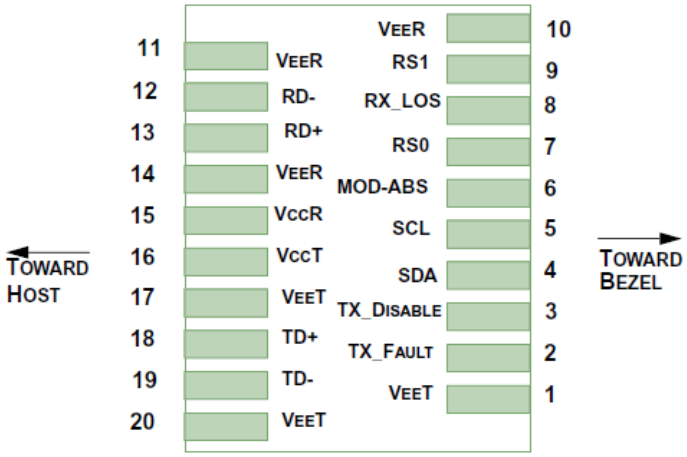


Figure 4.2 Host PCB SFP Pinout

4.3. Pin Descriptions

Table 4.3. Pin Description

Pin#	Name	Logic	Description	Power Sequence Order	Note
1	VeeT		Module Transmitter Ground	1st	1
2	Tx_Fault	LVTTL-O	Module Transmitter Fault	3rd	2
3	Tx_Disable	LVTTL-I	Transmitter Disable,Turns off transmitter laser output	3rd	3
4	SDA	LVTTL-I/O	2 Wire Serial Interface Data Line(Same as MOD-DEF2 as defined in the INF-8074i)	3rd	
5	SCL	LVTTL-I/O	2 Wire Serial Interface Data Line(Same as MOD-DEF1 as defined in the INF-8074i)	3rd	
6	MOD_ABS		Module Absent, connected to VeeT or VeeR in the module	3rd	2
7	RS0	LVTTL-I	Rate Select 0 (not functional for 10GE type)	3rd	
8	RX_LOS	LVTTL-O	Receiver Loss of Signal Indication	3rd	2
9	RS1	LVTTL-I	Rate Select 1 (not functional for 10GE type)	3rd	
10	VeeR		Module Receiver Ground	1st	1
11	VeeR		Module Receiver Ground	1st	1
12	RD-	CML-O	Receiver Inverted Data Output	3rd	
13	RD+	CML-O	Receiver Non-Inverted Data Output	3rd	
14	VeeR		Module Receiver Ground	1st	1
15	VccR		Module Receiver 3.3V Supply	2nd	
16	VccT		Module Transmitter 3.3V Supply	2nd	
17	VeeT		Module Transmitter Ground	1st	1
18	TD+	CML-I	Transmitter Non-Inverted Data Input	3rd	
19	TD-	CML-I	Transmitter Inverted Data Input	3rd	
20	VeeT		Module Transmitter Ground	1st	1

Note

1: Module ground pins are isolated from the module case and chassis ground within the module.

2: Shall be pulled up with 4.7k to 10k ohm to a voltage between 3.15V and 3.45V on the host board.

3: Shall be pulled up with 4.7k to 10k ohm to VccT in the module.

5. Absolute Maximum Ratings and Recommended Operating Conditions

Table 5.1. Absolute Maximum Ratings

Parameter	Symbol	Min	Max	Unit	Note
Strage Temperature	Tst	-40	85	degC	
Relative Humidity (non-condensation)	RH	-	85	%	
Operating Case Temperature	Topc	-5	85	degC	1
Supply Voltage	VccR/VccT	-0.5	3.6	V	
Voltage on LVTTL Input	Vilvttl	-0.5	VCC3+0.5	V	
LVTTL Output Current	Iolvttl	-	15	mA	
Voltage on Open Collector Output	Voco	0	6	V	
Receiver Input Optical Power(Average)	Mip	-	0	dBm	

Note:

1: Typical Ta: -10 to 60degC with 1.5m/s airflow

Table 5.2. Recommended Operating Conditions and Supply Requirements

Parameter	Symbol	Min	Max	Unit	Note
Operating Case Temperature	Topc	-5	85	degC	
Relative Humidity(non-condensing)	Rhop	-	85	%	
Power Supply Voltage	VccR/VccT	3.135	3.465	V	
Total Power Consumption	Pd	-	1.0	W	1

Note:

1: The inrush current meets SFF-8431 level-I operation.

6. Electrical Interface

6.1. High Speed Electrical Interface

SFI Application Reference model

Figure 6.1.1. shows the high speed electrical interface (SFI) compliance points.

SFI electrical interface is specified for each compliance point in the SFP MSA specification.

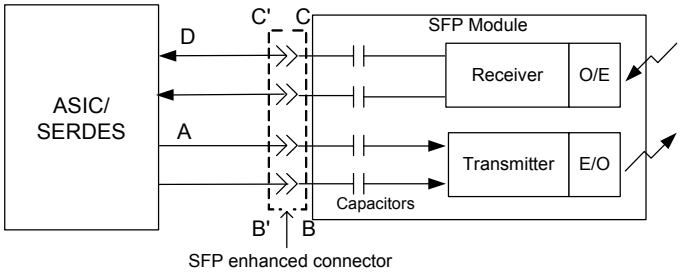


Figure 6.1.1. SFI Application Reference Model

SFI Module Transmitter Input Electrical Interface Specification at B' and Calibrated B"

Table 6.1.1. SFI Transmitter Input Electrical Specification at B'

Parameter B'	Symbol	Condition	Min	Typ.	Max.	Unit
Single Ended Output Voltage Tolerance		Referenced to VeeT	-0.3		4.0	V
AC common Input S-parameter		Note 1	15			mV
Differential Input S-parameter (note 1)	SDD11	0.01-4.1GHz			Note 2	dB
		4.1-11.1GHz			Note 3	dB
Reflected Differential to Common Mode Conversion	SCD11	0.01-11.1GHz			-10	dB

Note 1. Measured at B" with Host Compliance Board and Module Compliance Board pair.

2. Maximum Reflection Coefficient given by equation SDD11(dB)= -12 + 2*SQRT(f), with f in GHz.

3. Maximum Reflection Coefficient given by equation SDD11(dB)= -6.3+13Log10(f/5.5), with f in GHz

Table 6.1.2. SFI Transmitter Input Electrical Specification at B”

Parameter B”	Symbol	Condition	Min	Typ.	Max.	Unit
Crosstalk Source Rise/Fall time (20% to 80%)	Tr, Tf	Note 1, 2		34		ps
Crosstalk Source Amplitude (p-p differential)		Note 1, 2		1000		mV
AC Common Mode Voltage		Note 3			15	mV(RMS)
Total Jitter	TJ				0.28	UIpp
Data Dependent Jitter	DDJ			0.10		UIpp
Pulse Width Shrinkage Jitter	DDPWS			0.055		UIpp
Uncorrelated Jitter	UJ	Note 4		0.023		UIrms
Eye Mask Figure 6.1.2	X1		0.12			UI
	X2		0.33			UI
	Y1		95			mV
	Y2		350			mV

Note 1. Measured at C" with Host Compliance Board and Module Compliance Board pair.

2. Since the minimum module output transition time is faster than the crosstalk transition time the amplitude of crosstalk source is increased to achieve the same slew rate.

3. The tester is not expected to generate this common mode voltage however its output must not exceed this value.

4. It is not possible to have the worst UJ and DDJ simultaneously and meet the TJ specifications if the UJ is all Gaussian.

SFI Module Receiver Output Electrical Interface Specification at C'

Table 6.1.3. SFI Receiver Output Electrical Specification at C'

Parameter – C'	Symbol	Conditions	Min	Typ	Max	Units
Crosstalk source rise/fall time (20% to 80%)	Tr, Tf	Note 1		34		ps
Crosstalk Source Amplitude Differential (p-p)		Note 2		700		mV
Termination Mismatch at 1 MHz	ΔZ_M				5	%
Single Ended Output Voltage Tolerance			-0.3		4.0	V
Output AC Common Mode Voltage					7.5	mV (RMS)
Differential Output S-parameter (Note 3)	SDD22	0.01-4.1GHz			Note 2	dB
		4.1-11.1GHz			Note 3	dB
Common Mode Output Reflection Coefficient (Note 5)	SCC22	0.01-2.5GHz			Note 4	dB
		2.5-11.1GHz			-3	dB

Note 1 : Measured at B" with the Host Compliance Board and Module Compliance Board pair.

2 : Reflection Coefficient given by equation SDD22(dB)< -12 + 2 × SQRT(f), with f in GHz.

3 : Reflection Coefficient given by equation SDD22(dB)< -6.3 + 13 × log10(f/5.5), with f in GHz.

4 : Reflection coefficient given by equation SCC22(dB) < -7 + 1.6 × f, with f in GHz.

Table 6.1.4. SFP+ Limiting Output Jitter and Eye Mask Specification at C'

Parameter – C'	Symbol	Conditions	Min	Typ	Max	Units
Output rise/fall time (20% to 80%)	Tr, Tf		28			ps
Total Jitter	TJ				0.70	UIpp
99% Jitter	J2	Note 1			0.42	UIpp
Eye Mask	X1		0.35			UI
Figure 6.1.3	Y1		150			mV
	Y2		425			mV

Note 1 : J2 is defined from the 0.5th to the 99.5th percentile of the jitter histogram.

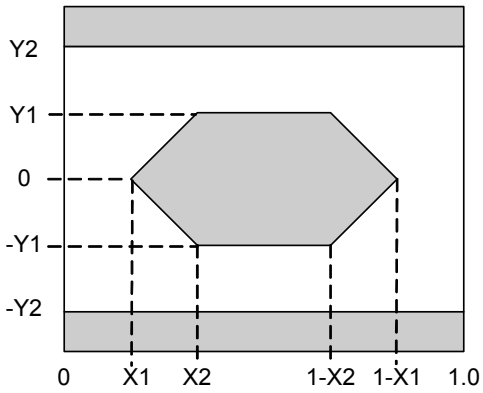


Figure 6.1.2.
Transmitter Input Eye Mask

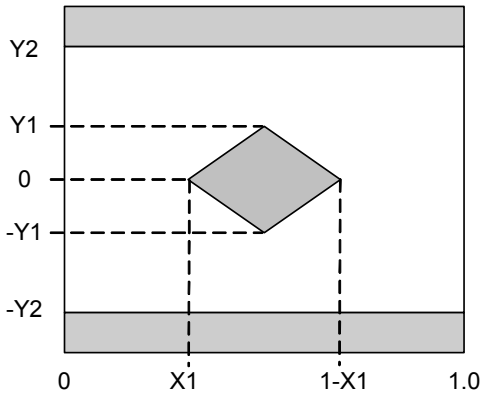


Figure 6.1.3.
Receiver Output Eye Mask

6.2. Low speed Electrical Interface

SPP5200SR-GL-M low speed interface is based on 2-wire interface. Management memory map is based on SFF-8472.

2-wire Electrical Specifications

Parameter	Symbol	Min	Max	Unit
Host 2-wire Vcc	Vcc_host	3.14	3.46	V
SCL and SDA	V_{OL}	0.0	0.40	V
	V_{OH}	Vcc_host-0.5	Vcc_host+0.3	V
SCL and SDA	V_{IL}	-0.3	VccT*0.3	V
	V_{IH}	VccT*0.7	VccT+0.5	V
Input current on the SCL and SDA contacts		-10	10	uA
Capacitance on SCL and SDA I/O contact			14	pF

2-wire Timing Specifications

Parameter	Symbol	Min	Max	Unit
Clock Frequency	f_{SCL}	0	400	kHz
Clock Pulse Width Low	t_{LOW}	1.3		us
Clock Pulse Width High	t_{HIGH}	0.6		us
Time bus free before new transmission can start	t_{BUF}	20		us
START Hold Time	$t_{HD, STA}$	0.6		us
START Set-up Time	$t_{SU, STA}$	0.6		us
Data In Hold Time	$t_{HD, DAT}$	0		us
Data In Set-up Time	$t_{SU, DAT}$	0.1		us
Input Rise Time (100kHz)	$t_{R, 100}$		1000	ns
Input Rise Time (400kHz)	$t_{R, 400}$		300	ns
Input Fall Time (100kHz)	$t_{F, 100}$		300	ns
Input Fall Time (400kHz)	$t_{F, 400}$		300	ns
STOP Set-up Time	$t_{SU, STO}$	0.6		us
Serial Interface Clock Holdoff "Clock Stretching" (Note 1)	t_clock_hold		500	us

Note 1 : If the serial clock (SCL) is more than 100kHz, the SCL is held in line low (clock stretching) during an 2-WIRE SERIAL INTERFACE read or white operation.

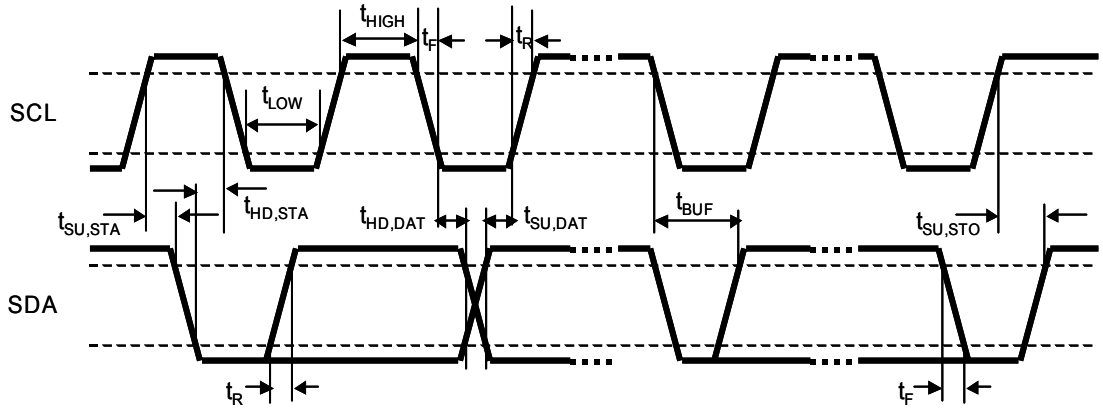


Figure 6.1.4. SFP+ Timing Diagram

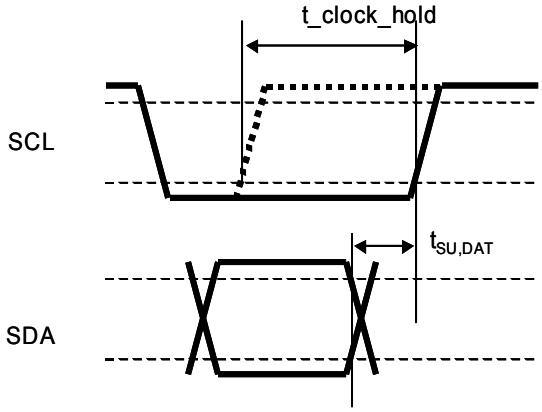


Figure 6.1.5. Detail of Clock Stretching

7. Optical Interface

Optical Interfaces of SPP5200SR-GL-M are defined in the IEEE802.3ae(10GBASE-SR) and FC-FI-4(10GFC).

Optical Transmitter

Parameter	Symbol	Min	Typ	Max	Unit
Signaling Speed (LAN PHY) (WAN PHY) (10GFC)		-	10.3125 9.95328 10.51875		Gb/s
Signaling spped variation from nominal (max)		-100		+100	ppm
Center wavelength		840		860	nm
RMS spectral width	λrms	Refer to Table 7.1			nm
Average launched power	Pave	-7.3		-1.3	dBm
OMA	Poma	Refer to Table 7.1 and Figure 7.2			dBm
Transmitter and dispersion penalty				3.9	dB
Average launch power of Tx OFF				-30	dBm
Extinction ratio		3.0			dB
RIN OMA				-128	dB/Hz
Optical Return Loss Tolerance				12	dB
Eye mask(X1,X2,X3,Y1,Y2,Y3)	(0.25,0.40,0.45,0.25,0.28,0.40) Note 1				

Trade-offs are available between spectral width, center wavelength and minimum optical modulation amplitude. Refer Table.7.1 and Figure 7.2.

Note 1: Refer to Figure 7.1.

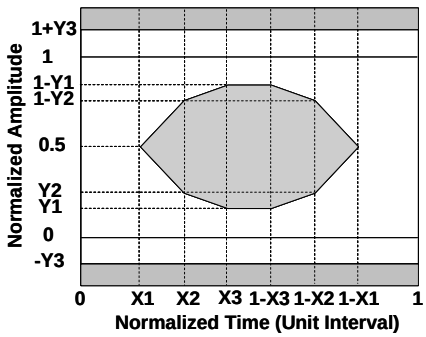


Figure.7.1. Transmission eye mask definition

Table7.1: Minimum OMA as a function of Center Wavelenghth and Spectral Width

	RMS Spectral width (nm)								
Center Wavelength(nm)	Up to 0.05	0.05 to 0.1	0.1 to 0.15	0.15 to 0.2	0.2 to 0.25	0.25 to 0.3	0.3 to 0.35	0.35 to 0.4	0.4 to 0.45
840 to 842	-4.2	-4.2	-4.1	-4.1	-3.9	-3.8	-3.5	-3.2	-2.8
842 to 844	-4.2	-4.2	-4.2	-4.1	-3.9	-3.8	-3.6	-3.3	-2.9
844 to 846	-4.2	-4.2	-4.2	-4.1	-4.0	-3.8	-3.6	-3.3	-2.9
846 to 848	-4.3	-4.2	-4.2	-4.1	-4.0	-3.8	-3.6	-3.3	-2.9
848 to 850	-4.3	-4.2	-4.2	-4.1	-4.0	-3.8	-3.6	-3.3	-3.0
850 to 852	-4.3	-4.2	-4.2	-4.1	-4.0	-3.8	-3.6	-3.4	-3.0
852 to 854	-4.3	-4.2	-4.2	-4.1	-4.0	-3.9	-3.7	-3.4	-3.1
854 to 856	-4.3	-4.3	-4.2	-4.1	-4.0	-3.9	-3.7	-3.4	-3.1
856 to 858	-4.3	-4.3	-4.2	-4.1	-4.0	-3.9	-3.7	-3.5	-3.1
858 to 860	-4.3	-4.3	-4.2	-4.2	-4.1	-3.9	-3.7	-3.5	-3.2

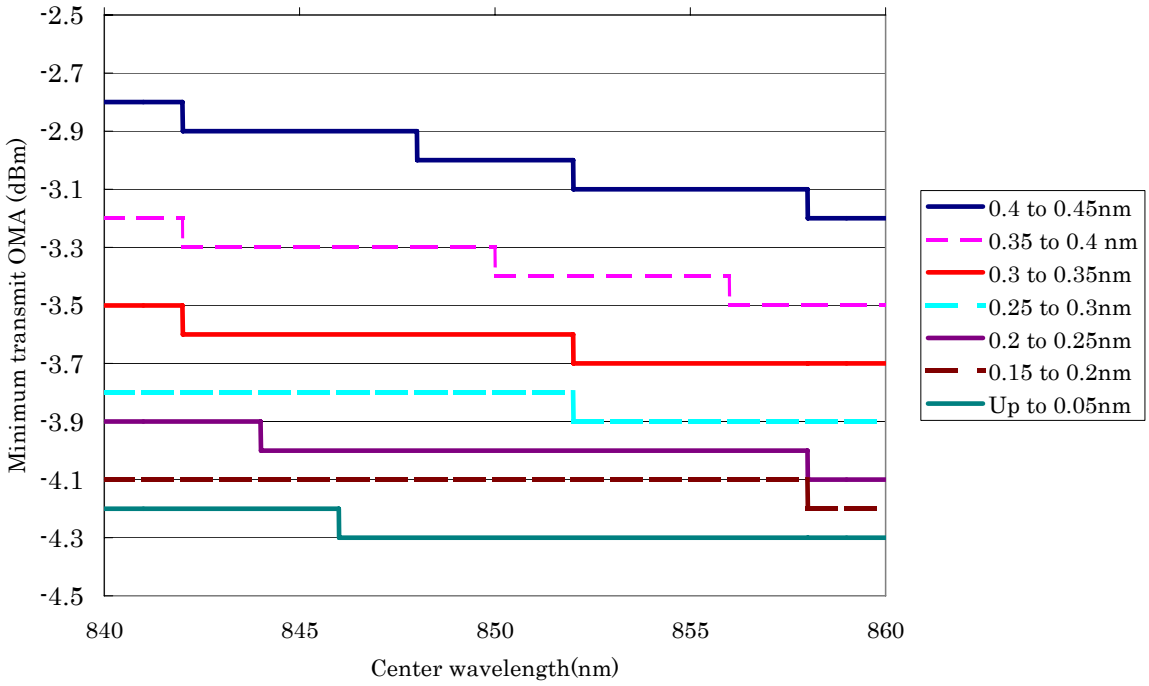


Figure 7.2:Trade-offs OMA-Center wavelength

Optical Receiver

Parameter	Symbol	Min	Typ	Max	Unit
Wavelength		840		860	nm
Signaling Speed (LAN PHY) (WAN PHY) (10GFC)			10.3125 9.95328 10.51875		Gb/s
Signaling speed variation from nomimal (max)		-100		+100	ppm
Average receiver power		-9.9		-1.0	dBm
Receiver sensitivity in OMA				-11.1	dBm
Receiver Reflectance				-12	dB
Stressed receiver sensitivity in OMA				-7.5	dBm
Vertical eye closure penalty		3.5			dB
Stressed ey jitter		0.3			UIpp
Receive electrical 3dB upper cutoff frequency				12.3	GHz

Note 1 : Receiver sensitivity is informative. Stressed receiver sensitivity shall be measured with conformance test signal for BER=10^-12.

LOS Assert/De-assert Level

	Rx Average Power Sensitivity (unstressed) [dBm]	Rx_LOS Assert Min [dBm] Note 1	Rx_LOS Assert Max [dBm] Note 2	Rx_LOS De^Assert Max [dBm] Note 3
10GE-SR	-9.9	-30	-16	-13
10FFC-SW	-9.9			

Note 1 : The Rx_LOS alarm is asserted when the optical input power level is below the specified value.

2 : The Rx_LOS alarm is not asserted until the optical input power level is below the specified value.

3 : The Rx_LOS alarm is de-asserted when the optical power level ia above the specified value.

8. Electrical and Optical I/O Signal Relationship

Table.8.1. TX_DIS vs. Optical Output Power

TX_DIS	Optical Output Power
Low (V_{IL}=-0.3 to 0.8V)	Enabled
High (V_{IH} =2.0 to VCC3+0.3V)	Disabled (<-30dBm)

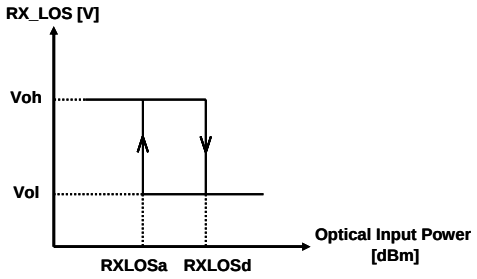


Figure.8.1. Optical Input Power vs. RX_LOS

9. User Interface

9.1. SFP Mechanical Interface

SFP Mechanical Interface is specified in the SFF-8432. Also, bail latch system is adequate for the particular specification.

9.2. Management Interface

SFP 2-Wire Serial Interface Protocol

SFP 2-wire serial interface is specified in the SFF-8472.

The SFP 2-wire serial interface is used for serial ID, digital diagnostics, and certain control functions. The 2-wire serial interface is mandatory for all SFP modules.

The 2-wire serial interface address of the SFP module is A0h and A2h. In order to access to a specific module on the 2-wire serial bus, the SFP has a MOD_ABS (module absent pin). This pin, which is pulled down in the module, must be held low to notify a module installation and to allow communication over 2-wire serial interface.

SFP Management Interface

SFP Managed interface is specified in the SFF-8472.

The Figure 9.2. shows the structure of the memory map. The normal 256 Byte address space is divided into lower and upper blocks of 128 Bytes. The lower block of 128 Byte is always directly available and is used for the diagnostics and control functions that must be

accessed repeatedly. Multiple blocks of memories are available in the upper 128 Bytes of the address space. These are individually addressed through a table select Byte which the user enters into a location in the lower address space. The upper address space tables are used for less frequently accessed functions and control space for future standards definition.

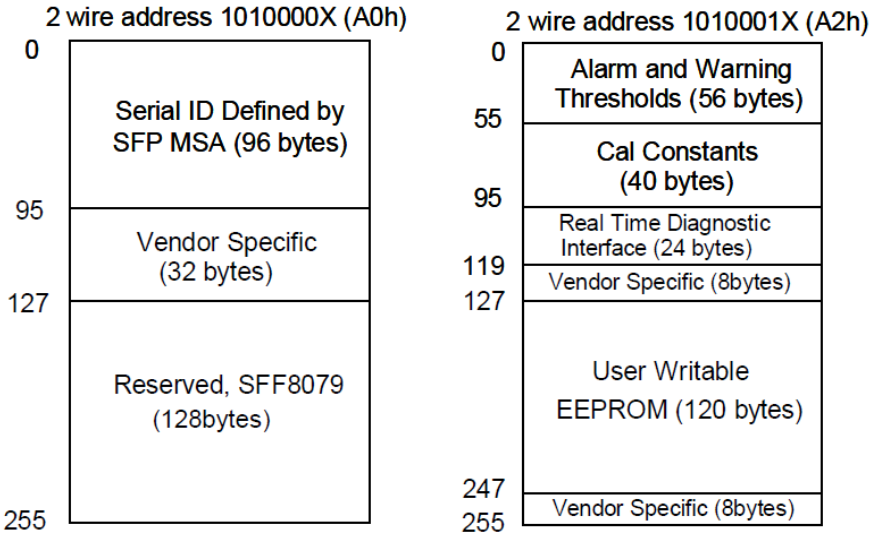


Figure 9.1. 2-wire Serial Interface Memory Map

To identify multi-sourcing OSA, vendor revision byte can be utilized as described memory map table.

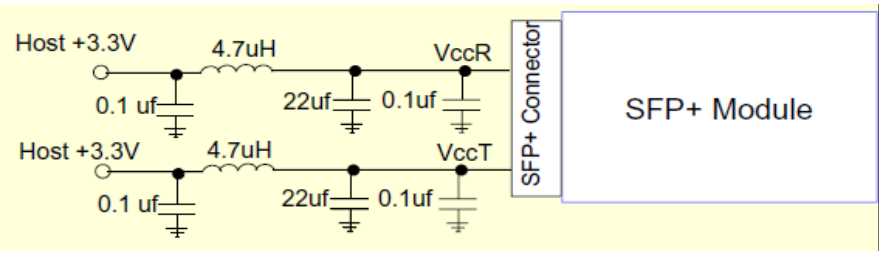


Figure 9.2 Supply Filter

9.3. Serial ID Memory Map (Data Field – Address A0h)

Address	Size (Bytes)	Name	Hex	ASC	Description
0	1	Identifier	03		SFP module
1	1	Ext.Identifier	04		Serial ID module
2	1	Connector	07		LC Connector
3	8	Transceiver	10		10GE BASE-SR
4			00		
5			00		
6			00		
7			00		
8			00		
9			00		
10			00		
11	1	Encoding	06		64B66B
12	1	BR-Min	67		10.3Gbps
13	1	BR-Max	00		unspecified
14	1	Length(SMF)-km	00		not support SMF
15	1	Length(E-50 µm)	00		not support SMF
16	1	Length(50 µm)	08		82m for OM2
17	1	Length(62.5 µm)	02		26m for OM1
18	1	Length(Copper)	00		not support copper
19	1	Length(OM3)	1E		300m for OM3
20	16	Vendor name	53	S	
21			75	u	
22			6D	m	
23			69	i	
24			74	t	
25			6F	o	
26			6D	m	
27			6F	o	
28			45	E	
29			6C	l	
30			65	e	
31			63	c	
32			74	t	
33			72	r	
34			69	i	
35			63	c	
36	1	Reserved	00		
37	3	Vendor OUI	00		
38			00		
39			5F		
40	16	Vendor PN	53	S	
41			50	P	
42			50	P	
43			35	5	
44			32	2	
45			30	0	
46			30	0	
47			53	S	
48			52	R	
49			2D	-	
50			47	G	
51			4C	L	
52			2D	-	
53			4D	M	
54			20		
55			20		
56	4	Vendor rev	41	A	*1
57			20		
58			20		
59			20		
60	2	Wavelength	03		
61			52		
62	1	Reserved	00		
63	1	CC_BASE	xx		Check Code *2

Address	Size (Bytes)	Name	Hex	ASC	Description
64	2	Options	00		Power Class 1, limit Receiver Output
65			1A		TxDisable, TxFault , LOS implemented
66	1	BR,max	00		
67	1	BR,min	00		
68	16	Verdor SN	xx		
69			xx		
70			xx		
71			xx		
72			xx		
73			xx		
74			xx		
75			xx		
76			xx		
77			xx		
78			xx		
79			xx		
80			xx		
81			xx		
82			xx		
83			xx		
84	8	Date Code	xx		
85			xx		
86			xx		
87			xx		
88			xx		
89			xx		
90			xx		
91			xx		
92	1	Diagnostis Monitoring Type	68		Internal cal , Average Power
93	1	Enhanced Options	F0		Alarm/Warning flags, Soft TxDisable, Soft TxFault, Soft RxLOS implemented
94	1	SFF-8472 Compliance	03		Rev.10.0
95	1	CC_EXT	xx		Check Code *3
96-127	32	Vender Specific	00		
128-255	128	Reserved	00		

*1 : Revision level for part number provided by vendor (ASCII). Variable.
And it identifies OSA source. (ex. Rev. A : prime source, Rev. A2 : second source)
*2 : Checksum of Add.0 to 62
*3 : Checksum of Add.64 to 94

9.4. Alarm/Warming threshold

A2h address	Meaning	Unit	SPP5200SR-M
0-1	Temperature High Alarm	deg	90
2-3	Temperature Low Alarm	deg	-10
4-5	Temperature High Warning	deg	85
6-7	Temperature Low Warning	deg	-5
8-9	Voltage High Alarm	V	3.63
10-11	Voltage Low Alarm	V	2.97
12-13	Voltage High Warning	V	3.465
14-15	Voltage Low Warning	V	3.135
16-17	Tx Bias High Alarm	mA	15 (TBD)
18-19	Tx Bias Low Alarm	mA	2 (TBD)
20-21	Tx Bias High Warning	mA	14 (TBD)
22-23	Tx Bias Low Warning	mA	2.4(TBD)
24-25	Tx Power High Alarm	dBm	1.5
26-27	Tx Power Low Alarm	dBm	-11.3
28-29	Tx Power High Warning	dBm	-1.5
30-31	Tx Power Low Warning	dBm	-7.3
32-33	Rx Power High Alarm	dBm	2
34-35	Rx Power Low Alarm	dBm	-13.9
36-37	Rx Power High Warning	dBm	-1
38-39	Rx Power Low Warning	dBm	-9.9

Note.

- Alarm /Warming flag is linked to TxFault by default setting.
- Tx Bias Alarm/Warming is describing both prime OSA source. The parentheses value is second source case.

9.5. Digital Diagnostic Monitor Accuracy

The following characteristics are defined over recommended operating conditions.

Parameter	**Accuracy**	**Unit**
Internally measured transceiver temperature	+/- 3	deg.C
Internally measured transceiver supply voltage	+/- 3	%
Measured Tx bias current	+/- 10	%
Measured Tx output power	+/- 2	dB
Measured Rx received average optical power	+/- 3	dB

10. RoHS COMPLIANCY

Compliancy versus requirements contained inside the following reference document is guaranteed:"Directive 2002/95/EC of 27 January 2003 on the restriction of the use of certain hazardous substances in electrical and electronic equipment from official journal of European Union (European Parliament and of the Council). This product is Compliant at RoHS-6/6 level and contains no leaded solders.

11. Qualification Testing

SPP5200SR-GL-M 10Gb/s transceiver is qualified to Sumitomo Electric Industries internal design and manufacturing standards. Telecordia GR-468-CORE reliability test standards, using methods per MIL-STD-883 for mechanical integrity, endurance, moisture, flammability and ESD thresholds, are followed.

12. Laser Safety Information

SPP5200SR-GL-M transceiver uses a semiconductor laser system that is classified as Class 1 laser products per the Laser Safety requirements of FDA/CDRH, 21 CFR1040.10 and 1040.11. These products have also been tested and certified as Class 1 laser products per IEC 60825-1:2001 International standards.

Caution

If this product is used under conditions not recommended in the specification or is used with unauthorized revision, the classification for laser product safety is invalid. Reclassify the product at your responsibility and take appropriate safety measures.

13. Electromagnetic Compatibility

EMI (Emission)

SPP5200SR-GL-M is designed to meet FCC Class B limits for emissions and noise immunity per CENELEC EN50 081 and 082 specifications.

RF Immunity

SPP5200SR-GL-M has an immunity to operate when tested in accordance with IEC 61000-4-3 (80- 1000MHz, Test Level 3) and GR-1089.

Electrostatic Discharge (ESD) Immunity

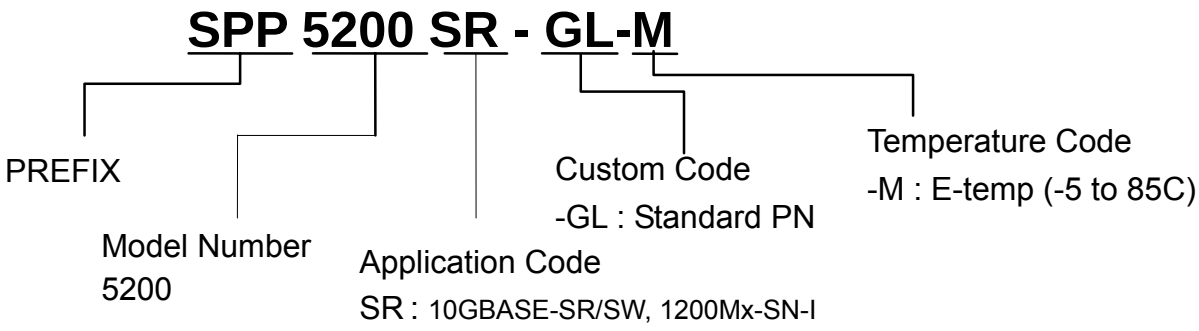
SPP5200SR-GL-M has an immunity against direct and indirect ESD when tested accordance with IEC 61000-4-2.

14. Firmware vertion

This product contains the firmware to control and monitor the module. Sumitomo Electric may upgrade the firmware version without advance notice as far as such would be upper compatible. When customers should prefer to have the current firmware version, Sumitomo Electric will accommodate such request and will assign customized part number for this purpose.

15. Ordering Information

15.1. Part Numbering System



15.2. Ordering Number Code

Table 13-1. SPP5200SR Application Code

Part Number	Temperature Range	Distance	Fiber	E/O	O/E	Telcordia GR-253	ITU-T	IEEE 802.3	ANSI
SPP5200SR-GL-M	-5 to 85 deg.C	300m	MMF	VCSEL 850nm	PIN	-	-	10GBASE-SR	1200-Mx-SN-I

16. Label information (Top label)

17. Contact Information

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