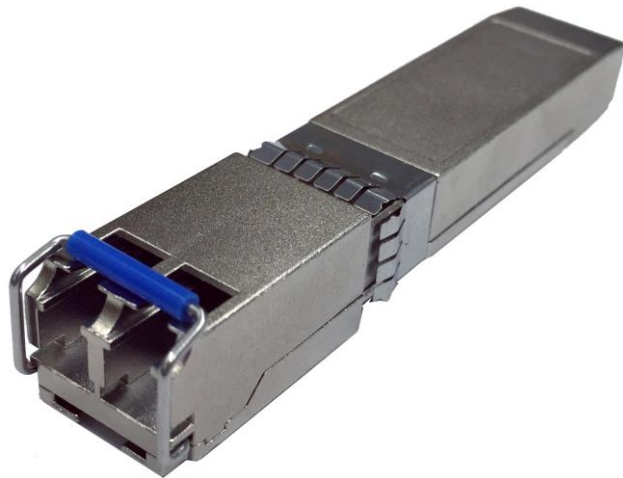


Specification

Small Form Factor Pluggable
Duplex LC Receptacle – SFP



C- Band Tunable
1550 nm Single Mode Optical Transceivers
1.25 Gbps Distance: 0~40 km

Features

- **Command interface for remote wavelength tuning and stabilization auxiliary management and control channel (AMCC)**
- **Self tunability i.e. automatic channel selection in WDM links**
- **Compliant with SFP MSA**
- **Data Rate 1.25Gbps**
- **Tunable VCSEL and APD ROSA**
- **Applicable for up to 40 km G.652 SMF connection with no dispersion compensation**
- **LC duplex receptacle**
- **Low power consumption (< 1.5W)**
- **Hot Pluggable**
- **All-metal housing for superior EMI performance**
- **Built in digital diagnostic functions**
- **ROHS Compliant**
- **Fully Telcordia GR 468 qualified (pending)**
- **Laser class 1 (pending)**

Absolute Maximum Ratings

Parameter	Symbol	Min	Typ	Max	Unit
Storage temperature	T _s	-40		85	°C
Supply voltage	V _{CC}	0		4	V
Operating Relative Humidity	-	5		95	%

Operating Conditions

Parameter	Symbol	Min	Typ	Max	Unit
Supply Voltage	V _{CC}	3.15	3.3	3.45	V
Operating Case temperature (C-Version)	T _c	0		70	°C
Operating Case temperature (E-Version)	T _c	-20		85	°C
Operating Case temperature (I-Version)	T _c	-40		85	°C
Total Current (Transmitter + Receiver)	I _{CC}	-	300	450	mA

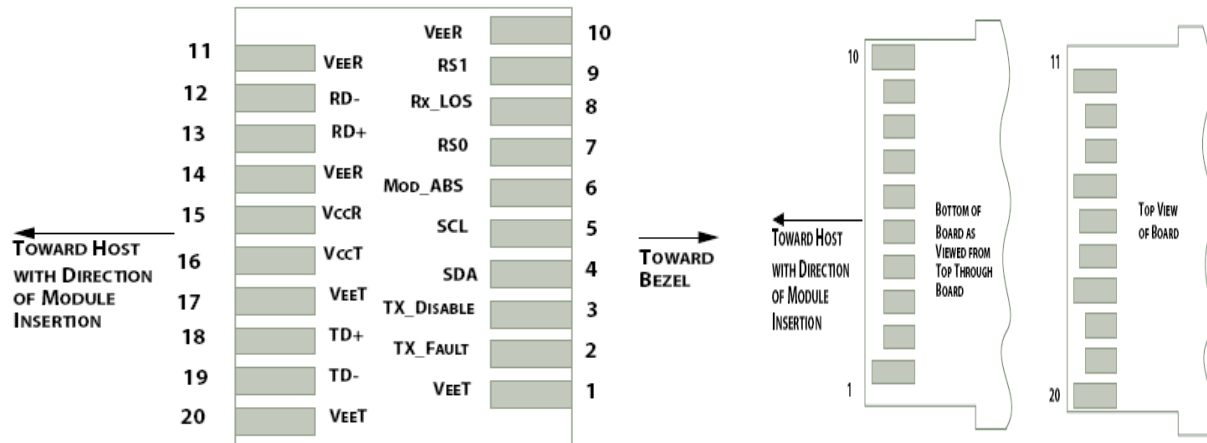
Transmitter Specifications (under operation conditions)

Parameter	Symbol	Min	Typ	Max	Unit
Optical Characteristics					
Output Optical Power (AMCC on)	P _{out}	-4		+2	dBm
Extinction Ratio (AMCC on)	ER	7		--	dB
Power difference between channels			4		dB
Frequency band		see part numbering scheme			
Frequency grid			100		GHz
Relative Intensity Noise	RIN	--	-140	-128	dB/Hz
Output Eye	Compliant with IEEE802.3z eye mask				
Max. P _{out} TX-DISABLE Asserted	P _{OFF}	--	--	-30	dBm
Electrical Characteristics					
Differential Input Voltage	V _{DIFF}	200	--	700	mV
Tx_Disable_Input_High	V _{DISH}	2.0	--	V _{CC} +0.3	V
Tx_Disable_Input_Low	V _{DISL}	0	--	0.8	V

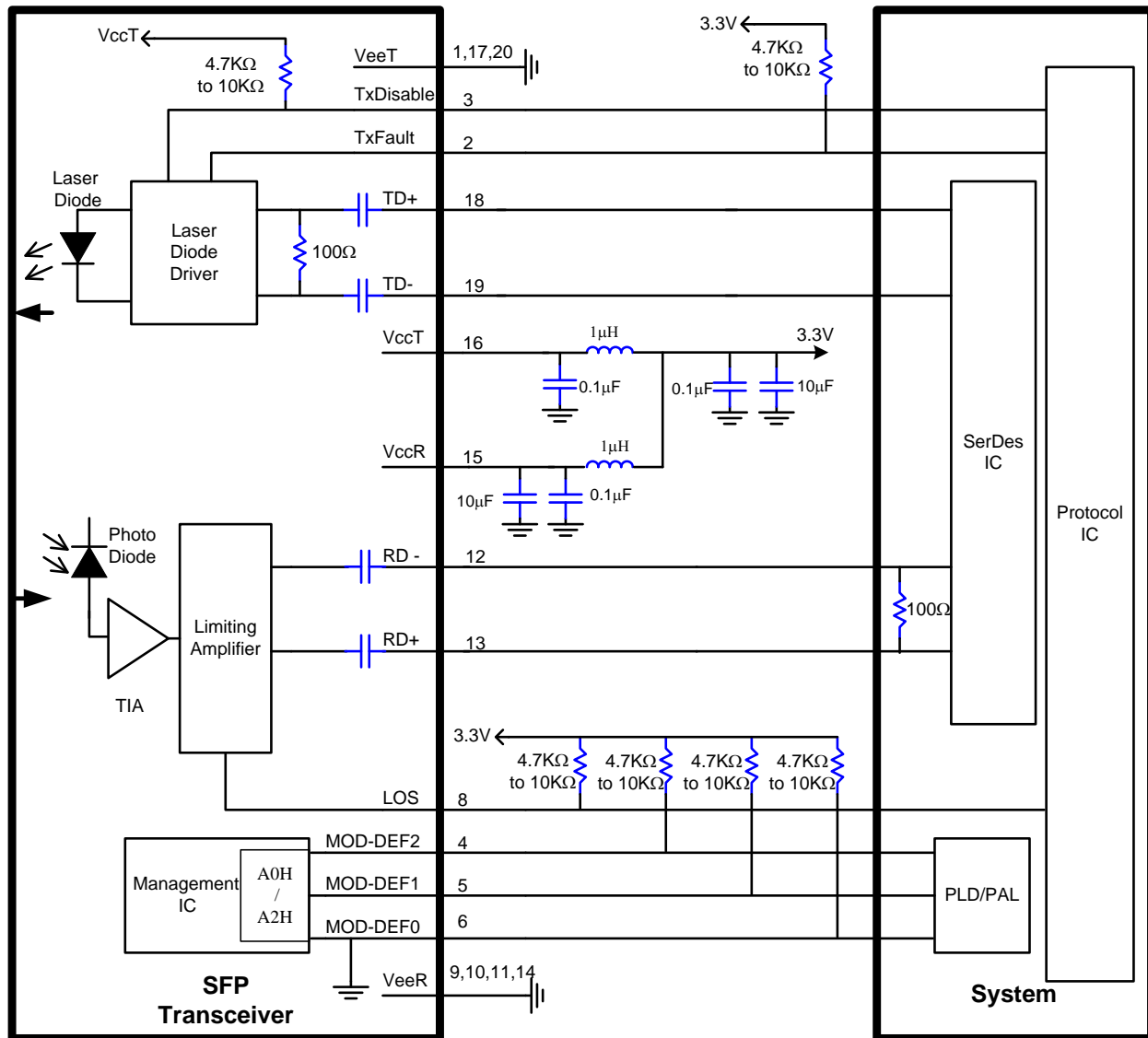
Receiver Specifications (under operating conditions)

Parameter	Symbol	Min	Typ	Max	Unit
Optical Characteristics					
Maximum Optical Input Power (APD)	P _{SATIN}	-10	--	--	dBm
Receiver Sensitivity (APD) 1.25 Gbps AMCC on	P _{SEN}		-24	t.b.d.	dBm
AMCC dynamic range		-22		-15	dBm
Operating Center Wavelength	λ_c	1531	--	1561	nm
LOS – Asserted	P _{SA}	t.b.d.	--		dBm
LOS – De-asserted	P _{SD}	--	--	t.b.d.	dBm
LOS – Hysteresis	P _{SH}	t.b.d.	--	--	dB
Electrical Characteristics					
Differential Output Voltage	V _{DIFF}	200	--	800	mV
LOS Output Voltage -High	V _{SDL}	2.0	--	V _{CC} +0.3	V
LOS Output Voltage -Low	V _{SDH}	0	--	0.8	V

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

Pin Definition and Descriptions


Pin	Name	Input-Output /Level	Description	Ref.
1	VEET	Power	Transmitter ground	
2	TXFault	Output	Laser failure indication (1=Laser Failure)	
3	Tx_DIS	Input/LVTTL	Transmitter Disable Control (1=Output Disable)	
4	MOD-DEF(2)	Input/Output	SDA, I2C communication data interface	
5	MOD-DEF(1)	Input	SCL, I2C communication clock interface	
6	MOD-DEF(0)	Output	Module present. Ground inside module.	
7	Rate Select 0	-	No connection.	
8	RxLOS	Output/LVTTL	Receiver loss of signal (1=Los of signal)	
9	Rate Select 1	-	No connection.	
10	VEER	Power	Receiver ground	
11	VEER	Power	Receiver ground	
12	RD-	Output/LVPECL	Inverted receiver data output	
13	RD+	Output/LVPECL	Non-inverted receiver data output	
14	VEER	Power	Receiver ground	
15	VCCR	Power	Receiver power supply	
16	VCCT	Power	Transmitter power supply	
17	VEET	Power	Transmitter ground	
18	TD+	Input/LVPECL	Transmitter non-inverted data input	
19	TD-	Input/LVPECL	Transmitter inverted data input	
20	VEET	Power	Transmitter ground	

Recommended Circuit Diagram


Build in capacitors: 100nF

Content in 2-Wire Address A0H

Address	HEX	Name of Field	Description
00	03	Identifier	SFP
01	04	Extended Identifier	SFP
02	07	Connector type	LC
03	00	10G Ethernet Compliance Codes	Not compliant
04	00	SONET Compliance Codes	Not compliant
05	00	SONET Compliance Codes	Not compliant
06	02	Ethernet Compliance Codes	1000BASE-LX
07	10	Fiber Channel link length	Long Distance
08	10	Fiber Channel transmitter technology	Longwave Laser(LL)
09	01	Fiber Channel transmission media	Single Mode
10	01	Fiber Channel speed	100 MBytes/sec
11	01	Encoding codes	8B/10B
12	0D	Nominal Bit Rate (units of 100Mbps)	1300Mbps
13	00	Rate identifier	Unspecified
14	28	Link length supported for 9um fiber	40 (units of km)
15	FF	Link length supported for 9um fiber	400 (units of 100m)
16	00	Link length supported for 50um,OM2	N/A (units of 10m)
17	00	Link length supported for 62.5um,OM1	N/A(units of 10m)
18	00	Link length supported for copper	N/A (units of 1m)
19	00	Link length supported for 50um,OM3	N/A (units of 10m)
20 ~ 35	42,41,4E,44,57,49,44,54, 48,31,30,20,20,20,20,20	Vendor Name	BANDWIDTH10
36	00	Unallocated	
37 ~ 39	00,00,00	Vendor OUI	Unspecified
40 ~ 55	42,57,31,30,2D,31,35,35, 30,2D,30,31,54,47,41,43	Part Number	see scheme i.e. BW10-1550-01TGAC
56 ~ 59	00,00,00,00	Vendor Revision number	Unspecified
60 ~ 61	06,0E	Laser Wavelength	1550nm
62	00	Unallocated	
63		CC_BASE:	Check sum of byte 0 ~ 62
64	00	Options	
65	1A	Options	TX-DIS, TX_FAULT, RX-LOS
66	00	Bit Rate, max.	Unspecified
67	00	Bit Rate, min.	Unspecified
68 ~ 83	Serial Number	Serial Number	
84 ~ 89	yy/mm/dd	Date Code	
90 ~ 91	20,20	Vendor specific lot code	Unspecified
92	68	Diagnostic Monitoring Type	Internal calibration
93	F0	Enhanced Options (soft)	Alarm/Warning flags, Soft TxDisable, Soft TxFault, Soft RxLOS implemented
94	03	SFF-8472 Compliance	Rev10.2
95		CC_EXT	Check sum of byte 64 ~ 94
96~127		Vendor specific	

Content in 2-Wire Address A2H

Add	Bytes	Name	Hex	Real Value
00-01	2	Temp High Alarm*		78°C (C-Version) 85°C (E Version) 85°C (I Version)
02-03	2	Temp Low Alarm*		-8°C (C-Version) -20°C (E Version) -40°C (I Version)
04-05	2	Temp High Warning*		73°C (C-Version) 82°C (E Version) 82°C (I Version)
06-07	2	Temp Low Warning*		-3°C (C-Version) -17°C (E Version) -37°C (I Version)
08-09	2	Voltage High Alarm	88B8	3.50V
10-11	2	Voltage Low Alarm	7918	3.10V
12-13	2	Voltage High Warning	86C4	3.45V
14-15	2	Voltage Low Warning	7B0C	3.15V
16-17	2	Bias High Alarm	2710	20mA
18-19	2	Bias Low Alarm	00FA	0.5mA
20-21	2	Bias High Warning	2328	18mA
22-23	2	Bias Low Warning	01F4	1mA
24-25	2	TX Power High Alarm ¹	3E0D	4dBm
26-27	2	TX Power Low Alarm ¹	063F	-6dBm
28-29	2	TX Power High Warning ¹	312D	3dBm
30-31	2	TX Power Low Warning ¹	07CF	-5dBm
32-33	2	RX Power High Alarm	03E8	-10dBm
34-35	2	RX Power Low Alarm	0027	-24dBm
36-37	2	RX Power High Warning	031A	-11dBm
38-39	2	RX Power Low Warning	0032	-23dBm
40-55	16	Reserved	00	-
56-59	4	RX_PWR(4)	00000000	0
60-63	4	RX_PWR(3)	00000000	0
64-67	4	RX_PWR(2)	00000000	0
68-71	4	RX_PWR(1)	3F800000	1
72-75	4	RX_PWR(0)	00000000	0
76-77	2	TX_I(Slope)	0100	1
78-79	2	TX_I(Offset)	0000	0
80-81	2	TX_PWR(Slope)	0100	1
82-83	2	TX_PWR(Offset)	0000	0

84-85	2	T(Slope)	0100	1
86-87	2	T(Offset)	0000	0
88-89	2	V(Slope)	0100	1
90-91	2	V(Offset)	0000	0
92-94	3	Reserved	00	-
95	1	Checksum		-

1) Not supported

I2C Commands for frequency management

Reading Tuning Information

Current channel:

Get from A4H_92.

Module tuning range:

Get from A4H_FB : Start of channel number

A4H_FC : End of channel number

Example Return data = 1Eh is channel #30 (EX: CH30 is 193.0 THz). Return data is in hex format.

A2	84	132 40	Lasers First Frequency (THz) Hi
A2	85	133 80	Lasers First Frequency (THz) Lo
A2	86	134 0E	Lasers First Frequency (GHz*10) Hi
A2	87	135 7E	Lasers First Frequency (GHz*10) Lo
A2	88	136	Lasers Last Frequency (THz) Hi
A2	89	137	Lasers Last Frequency (THz) Lo
A2	8A	138	Lasers Last Frequency (GHz*10) Hi
A2	8B	139	Lasers Last Frequency (GHz*10) Lo
A2	8C	140	Laser's minimum supported grid spacing (GHz*10) Hi
A2	8D	141	Laser's minimum supported grid spacing (GHz*10) Lo

Setting Channel

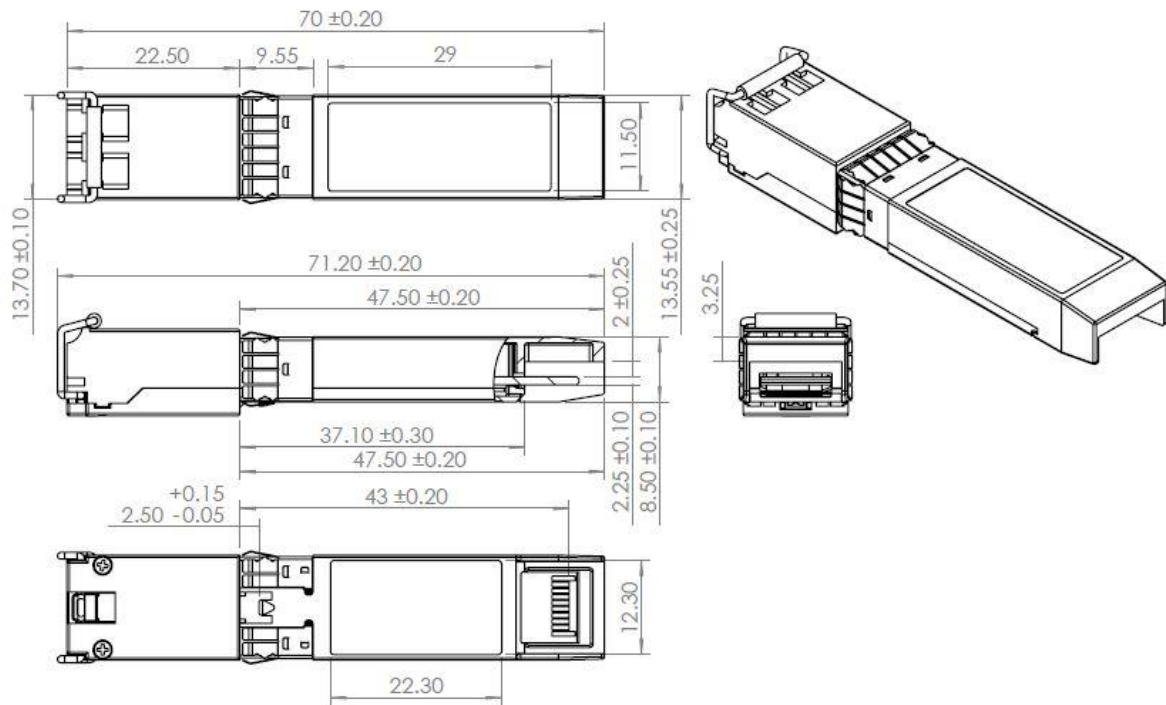
Step 1: Write address A2H_7C = xx (xx = 00h ~ 3Eh, total 63 channels)

Step 2: Write address A2H_7D = 33h

Step 3: Write address A2H_7E = 66h

Note: Channel is input in 2-digit hex format. For Example, 1Eh is channel #30 (EX: CH30 is 193.0 THz)

Also, conformant to MSA SFF-8690 for setting the channel

Mechanical Outlines (units: mm)

Order Information:
Part Number

BW10	-	www	-	ss	T	S	A	C
		Wave-length (see below)		Bitrate (Gbps) 01 = 1.25	Tunable	Feature S: Standard G: with AMCC	Receiver Type A: APD	Temperature Grade (°C) C: 0~70 E: -20 ~ 85 I: -40 ~ 85

Wavelength Description

www	Frequency (THz)	Note
1550	Not specified	Supports 9 arbitrary channels on 100GHz grid
GB01	192.0- 192.8	100GHz ITU-T G.694.1
GB02	192.8- 193.6	100GHz ITU-T G.694.1
GB03	193.6- 194.4	100GHz ITU-T G.694.1
GB04	194.4- 195.2	100GHz ITU-T G.694.1
GB05	195.2- 196.0	100GHz ITU-T G.694.1