

Features



- Simplex SC/APC Connector, Integrated Diplexer Transceiver
- Compliant with ITU-TG.9807.1 XGS-PON (N1/N2/E1)
- Support 10Gbps bidirectional traffic capability.
- 1270nm Burst-Mode Transmitter with DFB Laser
- 1577nm Continuous-Mode Receiver with APD-TIA
- Power consumption <3W,
- Support Sleep mode
- Compliant with SFF-8431/ SFF-8472/ GR-468
- Single 3.3V Power Supply
- Commercial and Industrial Temperature Available
- Support Ethernet interface HSGMII / 2500BASE-X (2.5 Gbit/s)
SGMII / 1000BASE-X (1 Gbit/s)

Software Features

- Compliant with ITU-T G.988 GPON OMCI Management
- Support 4K MAC entries
- Support IGMP/MLDV2 and multicast delivered
- Support advanced data features such as VLAN tag manipulation, classification and filtering
- Compliance with ITU-T G.8262 SyncE
- Compliance with IEEE 1588v2
- Support ToD / 1PPS
- Support " Plug-and-play" via auto-discovery and Configuration
- Support Dying Gasp notification
- Support Rogue ONU Detecting
- Data transferring at wire-speed for all packet size
- Support Jumbo frames up to 9840 Bytes

Description

Source Photonics 10G PON SFP+ w/MAC is an Optical Network Terminal (ONT) with Small Form-factor Pluggable (SFP+) packaging. The 10G PON SFP+ w/MAC integrates a bi-directional (max 10Gbit/s) optical transceiver function and 2nd layer function. By being plugged into the customer premise equipment (CPE) with standard SFP port directly, the 10GPON MAC provides multi-protocol link to the CPE without requiring separate power Supply.

The 10GPON MAC supports a sophisticated ONT management system, including alarms, provisioning, DHCP and IGMP functions for a stand-alone IPTV solution at the ONT. It can be managed from the OLT using G.988 OMCI. The 10GPON MAC fits into existing communications equipment, providing service providers with a smoothly upgrading to 10GPON.

The 10G PON SFP+ w/MAC solution vastly decreases the installation costs of deploying fiber access in MDUs and enables service providers to improve their revenue streams while decreasing OPEX.

Block Diagram

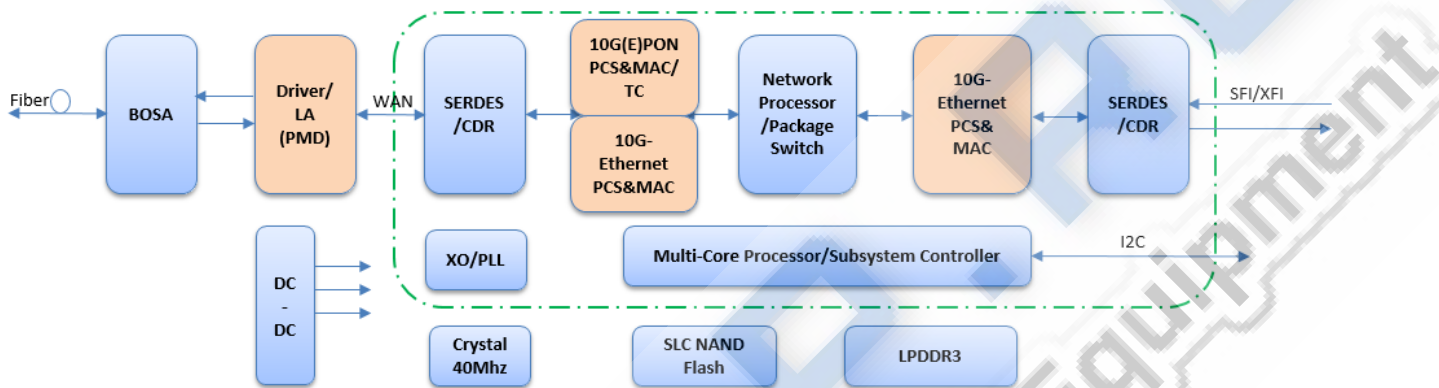


Figure 1 Block Diagram

Regulatory Compliance

Table 1 – Regulatory Compliance

Feature	Standard	Performance
Electrostatic Discharge (ESD) to the Electrical Pins	MIL-STD-883E Method 3015.7	Class 1 (>500V)
Electrostatic Discharge (ESD) to the Duplex LC Receptacle	IEC 61000-4-2	Compatible with standards
Electromagnetic Interference (EMI)	FCC Part 15 Class B EN55022 Class B (CISPR 22B)	Compatible with standards
Laser Eye Safety	FDA 21CFR 1040.10 and 1040.11 EN60950, EN (IEC) 60825-1,2	Compatible with Class I laser product.
RoHS	2011/65/EC	Compatible with Standards With exemption:7C(1)

Absolute Maximum Ratings

Table 2 – Absolute Maximum Ratings

Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
Storage Temperature	T _s	-40	-	+85	° C	
Operating Voltage	V _{CC}	3.14	3.30	3.46	V	
Operating Relative Humidity	RH	5	-	85	%	

Recommended Operating Conditions

Table 3 – Recommended Operating Conditions

Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
Operating Case Temperature	T _C	-40	-	85	° C	I Temp
		0		70	° C	C Temp
Total Tx and Rx Supply Current	I _{CC}	-		960	mA	
Power Dissipation	P _D	-	-	3	W	
Bit Rate(Tx)	BR		9.953		Gbps	
Bit Rate(Rx)	BR		9.953		Gbps	
Transmission Distance	TD	-	-	20	km	

Optical Characteristics

Table 4 – Optical Characteristics

Transmitter 10G						
Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
Center Wavelength Range	λ_{C}	1260	1270	1280	nm	
Average Output Power	P _{OUT}	4	-	9	dBm	
Average Output Power (Laser Off)	P _{OUT-OFF}	-	-	-45	dBm	
Side Mode Suppression Ratio	SMSR	30	-	-	dB	
Spectral Width (-20dB)	λ_{20}	-	-	1	nm	
Extinction Ratio	ER	6	-	-	dB	
Transmitter Output Eye	Compliant with G.9807.1 FigureB.9.4					
Receiver 10G						
Center Wavelength Range	λ_{C}	1570	1575	1580	nm	
Overload	PSAT	-8	-	-	dBm	
Sensitivity(BOL Full temp)	Sen	-	-	-28.5	dBm	1
Bit Error Ratio		10E-3				
Loss of Signal Assert Level	Plosa	-45	-	-	dBm	
Loss of Signal Deassert Level	Plosd	-	-	-30	dBm	
Isolation (1400~1560nm)		35	-	-	dB	
Isolation(1600~1675nm)		35	-	-	dB	
Isolation(1575~1580nm)		34.5				

Notes:

1. Measured with a PRBS 2³¹-1 test pattern @9.9532Gbps and ER=6dB, BER ≤10⁻³

Electrical Characteristics

Table 5 – Electrical Characteristics

Transmitter						
Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
Data Input Differential Swing	V _{IN}	190	-	1000	mVp-p	
Input Differential Impedance	Z _{IN}	80	100	120	Ω	
Transmitter Disable Voltage - Low	V _{TDIS, L}	0		0.8	V	
Transmitter Disable Voltage - High	V _{TDIS, H}	2.0		V _{CC}	V	
Power Down Voltage _Low	V _{PDL}	0		0.8		
Power Down Voltage _High	V _{PDH}	2.0		V _{CC}		
TX Fault Assert Time	T _{FAULT_on}	-	-	50	ms	
TX Fault Reset Time	T _{FAULT_RESET}	10	-	-	μs	
Burst Turn On Time	T _{BURST-ON}			512	ns	
Burst Turn Off Time	T _{BURST-OFF}			512	ns	
TX Power Down Assert Time	T _{PD assert}			512	ns	1
TX Power Down De-assert Time	T _{PD recover}			512	ns	2
Receiver						
Data Output Differential Swing	V _{OUT}	450		850	mV _{P-P}	
Loss of Signal (LOS) Assert Time	T _{LOSA}	-	-	100	μs	
Loss of Signal(LOS) Deassert Time	T _{LOSD}	-	-	100	μs	
Output Differential Impedance	R _{OUT}	80	100	120	Ω	
RX-LOS	V _{OL}	0	-	0.4	V	
	V _{OH}	2.4		V _{CC}	V	

Notes:

1. Measured to 10% of final supply current
2. Measured to 90% of final supply current

Pin Definitions

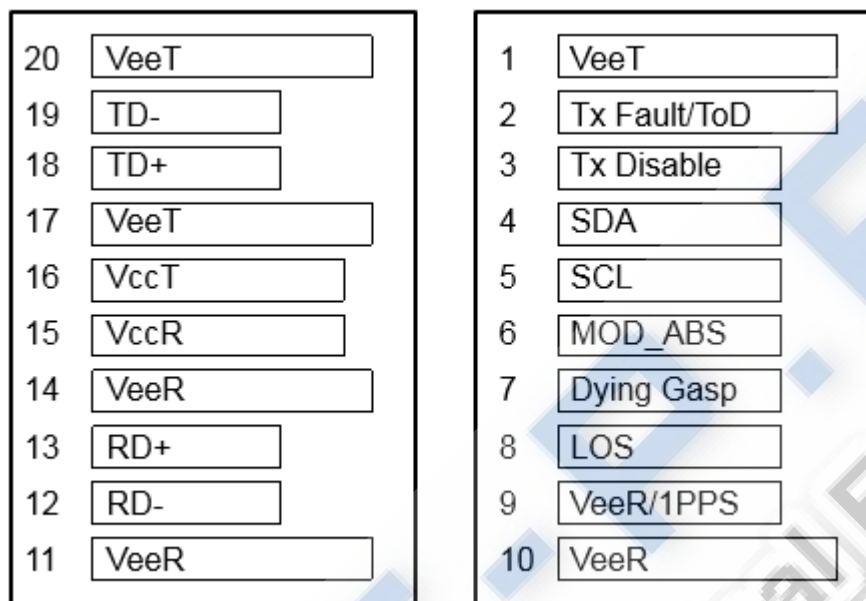


Figure 2, Pin Assignment

Table 6 – Pin definitions

Pin	Symbol	Logic	Name/Description	Note
1	VeeT	NA	Module Transmitter Ground	
2	Tx Fault/ToD	LVTTL-O	Tx Fault/Time of Day	1
3	TX_DISABLE	LVTTL-I	Transmitter Shut-off	
4	SDA	LVTTL-I/O	2-Wire Serial Interface Data Line (MOD-DEF2)	2
5	SCL	LVTTL-I	2-Wire Serial Interface Clock (MOD-DEF1)	2
6	MOD_ABS	NA	Module Absent, connected to VeeT or VeeR in the module	
7	DYING GASP	LVTTL-I	Dying Gasp message indicator	3
8	LOS	LVTTL-O	Loss of Signal	
9	VeeR/1PPS	LVTTL-O	Module Receiver Ground /1 Pulse per second/ Module Receiver Ground	4
10	VeeR	NA	Module Receiver Ground	
11	VeeR	NA	Module Receiver Ground	
12	RXD-	CML-O	Receiver Inverted Data Output	
13	RXD+	CML-O	Receiver Non-Inverted Data Output	
14	VeeR	NA	Module Receiver Ground	
15	VccR	NA	Module Receiver 3.3V Supply	
16	VccT	NA	Module Transmitter 3.3V Supply	
17	VeeT	NA	Module Transmitter Ground	
18	TXD+	CML-I	Transmitter Non-Inverted Data Input, CML, 100ohm differential impedance	

19	TXD-	CML-I	Transmitter Inverted Data Input, CML, 100ohm differential impedance	
20	VeeT	NA	Module Transmitter Ground	

Note:

1. Default Factory Mode is Tx Fault. For Small Cell type of applications, during Activation/ provisioning, it will be software configured to ToD.
2. This PIN is an open collector/drain output pin and shall be pulled up with 4.7K-10K ohms to a Host_Vcc on the host board.
3. PIN7 can support Dying Gasp function. Dying Gasp function is managed by software. If software turn off the dying gasp function, no influence to the module if logical "0" or "1". If software turn on the function, no influence to the module if logical "1"; if logical "0", the module will report dying gasp to OLT and the module will repeating restart.
4. Default Factory Mode is Veer. For Small Cell type of applications, during Activation/ provisioning, it will be software configured to 1PPS.

Mechanical Diagram

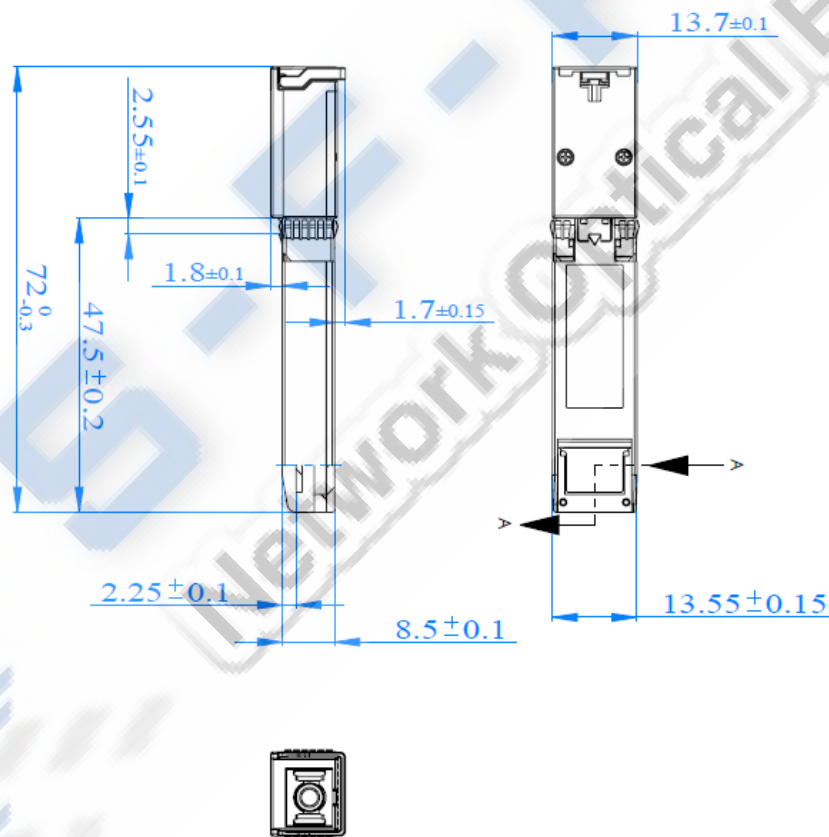


Figure 3, Mechanical Diagram

Recommended Host Board Power Supply Circuit

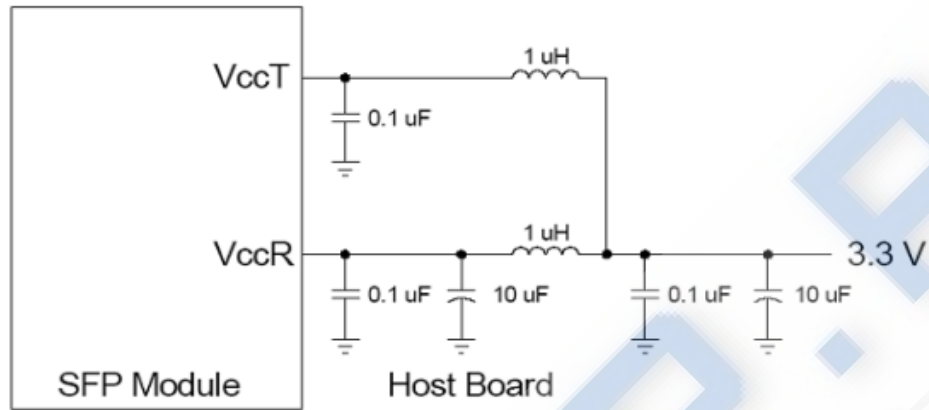


Figure 4, Recommended Host Board Power Supply Filtering Network

EEPROM Information

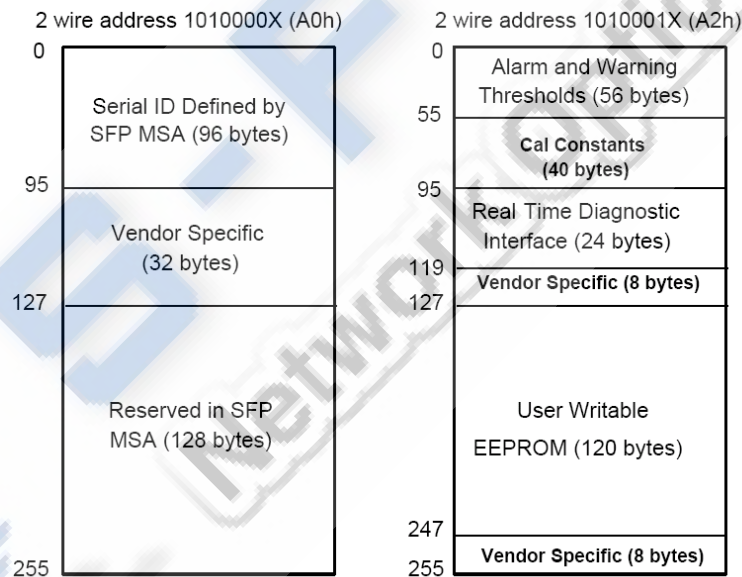


Figure 5, EEPROM Diagram

Table 7 –EEPROM Memory Content (A0h)

Addr.	Field Size (Bytes)	Name of Field	Hex	Description
0	1	Identifier	03	SFP transceiver
1	1	Ext. Identifier	04	MOD4
2	1	Connector	01	SC
3-10	8	Transceiver	00 00 00 80 00 00 00 00	
11	1	Encoding	06	NRZ

12	1	BR, Nominal	67	
13	1	Rate Identifier	00	
14	1	Length(SMF,km)	14	20(km)
15	1	Length (SMF)	C8	200(100m)
16	1	Length (50um)	00	Not Support MMF
17	1	Length (62.5um)	00	Not Support MMF
18	1	Length (Copper)	00	Not Support Copper
19	1	Length (OM3)	00	Not support OM3 fiber
20-35	16	Vendor name	53 4F 55 52 43 45 50 48 4F 54 4F 4E 49 43 53 20	"SOURCEPHOTONICS"(ASCII)
36	1	Transceiver	00	
37-39	3	Vendor OUI	00 1F 22	
40-55	16	Vendor PN	XXXXXXXX	"SPPS2710SN2C(I)MFA"(ASCII)
56-59	4	Vendor Rev	31 20 20 20	
60-61	2	Wavelength	04 F6	Tx wavelength:1270nm
62	1	Reserved	00	
63	1	CC_BASE	xx	Check sum of byte 0-62
64-65	2	Options	00 1A	Tx disable TX-FAULT; RX-LOS
66	1	BR, max	00	
67	1	BR, min	00	
68-83	16	Vendor SN	xx xx xx xx xx xx xx xx xx xx xx xx xx xx xx xx	ASCII
84-91	8	Date code	xx xx xx xx xx xx 20 20	Year(2 bytes),Month(2 bytes), Day(2 bytes)
92	1	Diagnostic Monitoring Type	68	Compliant with SFF-8472 V10.3 Internally Calibrated Received power measurement type -Average Power
93	1	Enhanced Options	F0	Diagnostics (Optional Alarm/warning flags) Soft TX_FAULT monitoring implemented. Soft RX_LOS monitoring implemented
94	1	SFF-8472 Compliance	08	Indicates the revision of SFF-8472 with which the transceiver complies. Value depends on module features.
95	1	CC_EXT	xx	Check sum of byte 64-94
96-255	64	Vendor Specific		

Table 8 –EEPROM Memory Content (A2h)

Addr.		Field Size (Bytes)	Name of Field	Hex	Description
0	00	2	Temp High Alarm	55 00 64 00	85°C(C-temp) 100°C(I temp)

2	02	2	Temp Low Alarm	F1 00 C9 00	-15°C(C-temp) 55°C(I temp)
4	04	2	Temp High Warning	50 00 5F 00	80°C(C-temp) 95°C(I temp)
6	06	2	Temp Low Warning	F6 00 CE 00	-10°C(C-temp) -50°C(I temp)
8	08	2	Voltage High Alarm	8C A0	3.6V
10	0A	2	Voltage Low Alarm	75 30	3.0V
12	0C	2	Voltage High Warning	87 8C	3.47V
14	0E	2	Voltage Low Warning	77 EC	3.07V
16	10	2	Bias High Alarm	C3 50	100mA
18	12	2	Bias Low Alarm	01 F4	1mA
20	14	2	Bias High Warning	AF C8	90mA
22	16	2	Bias Low Warning	03 E8	2mA
24	18	2	TX Power High Alarm	FF FF	8.16dBm
26	1A	2	TX Power Low Alarm	31 2D	1dBm
28	1C	2	TX Power High Warning	FF FF	8.16dBm
30	1E	2	TX Power Low Warning	37 2D	1.5dBm
32	20	2	RX Power High Alarm	09 CF	-6dBm
34	22	2	RX Power Low Alarm	00 07	-31dBm
36	24	2	RX Power High Warning	07 CB	-7dBm
38	26	2	RX Power Low Warning	00 0A	-30dBm
40-45	28-2 D	6	Reserved	xx xx xx xx xx xx	
46-55	2E-3 7	10	Reserved	00....000	Reserved
56	38	4	RX_PWR(4) Calibration	00 00 00 00	4th order RSSI calibration coefficient
60	3C	4	RX_PWR(3) Calibration	00 00 00 00	3rd order RSSI calibration coefficient
64	40	4	RX_PWR(2) Calibration	00 00 00 00	2nd order RSSI calibration coefficient
68	44	4	RX_PWR(1) Calibration	3F 80 00 00	1st order RSSI calibration coefficient
72	48	4	RX_PWR(0) Calibration	00 00 00 00	0th order RSSI calibration coefficient
76	4C	2	TX_I(Slope) Calibration	01 00	Slope for Bias calibration
78	4E	2	TX_I(Offset) Calibration	00 00	Offset for Bias calibration
80	50	2	TX_PWR(Slope) Calibration	01 00	Slope for TX Power calibration
82	52	2	TX_PWR(Offset) Calibration	00 00	Offset for TX Power calibration
84	54	2	T(Slope) Calibration	01 00	Slope for Temperature calibration
86	56	2	T(Offset) Calibration	00 00	Offset for Temperature

					calibration, in units of 256ths C
88	58	2	V(Slope) Calibration	01 00	Slope for VCC calibration
90	5A	2	V(Offset) Calibration	00 00	Offset for VCC calibration
92	5C	3	Reserved	00 00 00	Reserved
95	5F	1	Checksum	xx	Checksum
96	60	2	Transceiver Temperature	xx xx	Temperature in C/256
98	62	2	Supply Voltage	xx xx	Vcc
100	64	2	TX Bias Current	xx xx	BIASMON
102	66	2	TX Optical Output Power	xx xx	Back facet monitor
104	68	2	RX Optical Input Power	xx xx	RSSI
106	6A	2	Reserved	00 00	Reserved
108	6C	2	Reserved	00 00	Reserved
110	6E.7	1bit	TX_DIS State	x	Soft TX disable state
	6E.6	1bit	Soft TX Disable	x	Write bit that allows software disable laser output.
	6E.5	1bit	Reserved.	0	Reserved
	6E.4	1bit	Rate Select State	0	NOT SUPPORTED.
	6E.3	1bit	Rate Select	0	NOT SUPPORTED.
	6E.2	1bit	TX_FAULT	x	Digital state of the TX Fault Output
	6E.1	1bit	Rx LOS	x	Digital state of the Rx LOS Output
	6E.0	1bit	Data Ready Bar	x	Indicates transceiver has achieved power up and data is ready.
111	6F.7	1bit	Reserved	0	Reserved
	6F.6	1bit	Reserved	0	Reserved
	6F.5	1bit	Reserved	0	Reserved
	6F.4	1bit	Reserved	0	Reserved
	6F.3	1bit	Reserved	0	Reserved
	6F.2	1bit	Reserved	x	Reserved
	6F.1	1bit	Reserved	0	Reserved
	6F.0	1bit	Reserved	x	Reserved
112	70.7	1bit	Temperature too high alarm	x	Temperature too high alarm
	70.6	1bit	Temperature too low alarm	x	Temperature too low alarm
	70.5	1bit	VCC too high alarm	x	VCC too high alarm
	70.4	1bit	VCC too low alarm	x	VCC too low alarm
	70.3	1bit	BIASMON too high alarm	x	BIASMON too high alarm
	70.2	1bit	BIASMON too low alarm	x	BIASMON too low alarm
	70.1	1bit	TX Power too high alarm	x	TX Power too high alarm
	70.0	1bit	TX Power too low alarm	x	TX Power too low alarm
113	71.7	1bit	RX Power too high alarm	x	RX Power too high alarm
	71.6	1bit	RX Power too low alarm	x	RX Power too low alarm

	71.5	1bit	Reserved	x	
	71.4	1bit	Reserved interrupt status bit	x	Reserved interrupt status bit
	71.3	1bit	Reserved interrupt status bit	x	Reserved interrupt status bit
	71.2	1bit	Reserved interrupt status bit	x	Reserved interrupt status bit
	71.1	1bit	Reserved interrupt status bit	x	Reserved interrupt status bit
	71.0	1bit	Reserved interrupt status bit	x	Reserved interrupt status bit
114	72	1	Reserved	00	Reserved
115	73	1	Reserved	00	Reserved
116	74.7	1bit	Temperature too high warning	x	Temperature too high warning
	74.6	1bit	Temperature too low warning	x	Temperature too low warning
	74.5	1bit	VCC too high warning	x	VCC too high warning
	74.4	1bit	VCC too low warning	x	VCC too low warning
	74.3	1bit	BIASMON too high warning	x	BIASMON too high warning
	74.2	1bit	BIASMON too low warning	x	BIASMON too low warning
	74.1	1bit	TX Power too high warning	x	TX Power too high warning
	74.0	1bit	TX Power too low warning	x	TX Power too low warning
117	75.7	1bit	RX Power too high warning	x	RX Power too high warning
	75.6	1bit	RX Power too low warning	x	RX Power too low warning
	75.5	1bit	Reserved interrupt status bit	0	Reserved interrupt status bit
	75.4	1bit	Reserved interrupt status bit	0	Reserved interrupt status bit
	75.3	1bit	Reserved interrupt status bit	0	Reserved interrupt status bit
	75.2	1bit	Reserved interrupt status bit	0	Reserved interrupt status bit
	75.1	1bit	Reserved interrupt status bit	0	Reserved interrupt status bit
	75.0	1bit	Reserved interrupt status bit	0	Reserved interrupt status bit
118	76	1	Reserved	00	Reserved
119	77	1	Reserved	00	Reserved
120	78	8	Vendor Specific	00 00 00 00 00 00 00 00	Vendor Specific

Table 9 – Digital Diagnostic Specification (A2h)

Data Address	Parameter	Range	Accuracy
96-97	Temperature(I temp)	-40 to 85° C	±3° C
	Temperature(C temp)	0~70° C	
98-99	Vcc Voltage	2.97 ~ 3.63	±3%
100-101	Bias Current	0 to 120mA(Note)	±10%
102-103	TX Power	4 to 9dBm	±3dB
104-105	RX Power	-28.5 to -8dBm	±3dB

Note: Only for continuous mode

Order Information

Table 10 – Order Information

Part No.	Application	Data Rate	Laser Source Fiber Type	Temp Range
SPPS-27-10S-N2-IMFA	XGS PON ONU SFP+ w/MAC	TX:9.953Gb/s	1270nm DFB	-40 to 85° C
SPPS-27-10S-N2-CMFA		RX: 9.953Gb/s	SMF	0~70° C

Warnings

Handling Precautions: This device is susceptible to damage as a result of electrostatic discharge (ESD). A static free environment is highly recommended. Follow guidelines according to proper ESD procedures.

Laser Safety: Radiation emitted by laser devices can be dangerous to human eyes. Avoid eye exposure to direct or indirect radiation.

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