SPS-34-24T-HP-TDFO

Features

- Simplex SC/APC Connector, Integrated Diplexer Transceiver
- SFP MSA, digital diagnostics SFF-8472 Compliant
- Compliant to FSAN G.984.2 Specifications
- 1244 Mbps Tx, 2488 Mbps Rx Asymmetric Data Rate
- Operating case temperature: -40~85°C
- Subscriber location identifier （SLID）
- PON Link Status notification
- Dying Gasp notification support
- Response the TX power shut-down command from OLT when OLT detect anomaly
- TC Layer GEM encapsulation mode
- OMCI support per ITU-T G.988
- 28 dB link budget; Class B+, 20 km reach
- Compliant to IEC-60825 Class 1 laser diode
- RoHS compliant
- Internal Calibration

Description

Source Photonics SPS-34-24T-HP-TDFO is a G.984.2 (GPON) Optical Network Terminal (ONT) with Small Form-factor Pluggable (SFP) packaging. The SPS-34-24T-HP-TDFO integrates a bi-directional optical transceiver function and GPON MAC function. By being plugged into the customer premise equipment (CPE) with standard SFP port directly, the SPS-34-24T-HP-TDFO provides an asymmetric 1.244Gbps upstream / 2.488 Gbps downstream GPON uplink to the CPE without requiring separate power supply.

The SPS-34-24T-HP-TDFO supports a sophisticated ONT management system, including alarms, provisioning, DHCP and IGMP functions for a stand-alone IPTV solution at the ONT.

The SPS-34-24T-HP-TDFO can be managed from the OLT over the GPON using G.988 OMCI.

The SPS-34-24T-HP-TDFO fits seamlessly into existing communications equipment, providing service providers with a smooth upgrade to GPON. The SPS-34-24T-HP-TDFO 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

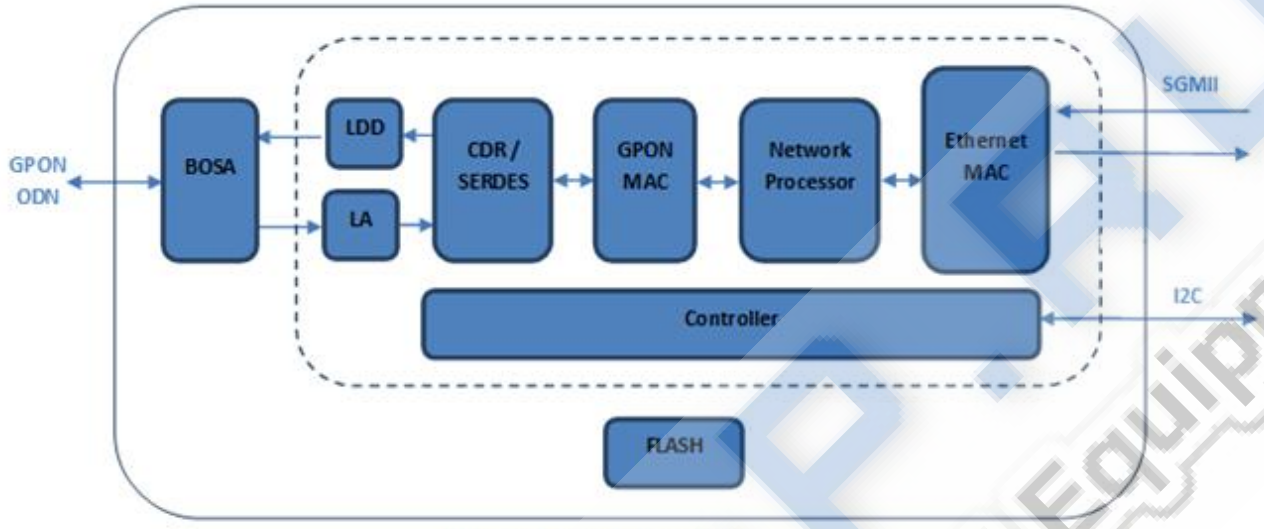

Figure 1, Block Diagram

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 for data pins, >2000V for other pins)
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) VCCI Class B	Compatible with standards
Immunity	IEC 61000-4-3	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	Compliant with standards

Absolute Maximum Ratings

Table 2 – Absolute Maximum Ratings

Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
Storage Temperature	T_S	-40	-	+85	°C	
Supply Voltage	V_{CC}_Rx	-0.3	-	+4.2	V	
	V_{CC}_Tx	-0.3	-	V_{CC}_Rx+1	V	
Operating Relative Humidity	RH	5	-	95	%	

Recommended Operating Conditions

Table 3 – Recommended Operating Conditions

Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
Operating Case Temperature	T_C	-40	-	85	°C	
Operating Voltage	V_{CC}	3.14	3.30	3.46	V	
Total Tx and Rx Supply Current	I_{CC}	-	400	600	mA	
Power Dissipation	P_D	-	-	2	W	
Bit Rate(Tx)	BR	-	1244.16	-	Mbps	
Bit Rate(Rx)	BR	-	2488.32	-	Mbps	
Transmission Distance	TD	-	-	20,000	m	

Optical Characteristics

Table 4 – Optical Characteristics

Transmitter						
Parameter	**Symbol**	**Min.**	**Typical**	**Max.**	**Unit**	**Notes**
Center Wavelength Range	λ_C	1290	1310	1330	nm	
Average Output Power	P_{0UT}	0.5	-	5	dBm	
Average Output Power (Laser Off)	$P_{0UT-OFF}$	-	-	-40	dBm	
Side Mode Suppression Ratio	SMSR	30	-	-	dB	
Spectral Width (-20dB)	λ_{20}	-	-	1	nm	
Extinction Ratio	ER	10	-	-	dB	1
Optical Rise and Fall Time(20%-80%)	T_R/T_F	-	-	250	ps	
Jitter Generation	JG	-	-	0.2	UI	2
Transmitter Output Eye	Compliant with G.984.2 Figure 3					
Receiver						
Center Wavelength Range	λ_C	1480	1490	1500	nm	
Overload		-8	-	-	dBm	
Sensitivity	Sen	-28	-	-	dBm	3
Signal Detect Assertion Level	SDA	-	-	-29	dBm	
Signal Detect De-Assertion Level	SDD	-45	-	-	dBm	
Hysteresis	$P_{SDA-SDD}$	0.5	-	-	dB	
1310nm Tx to 1490nm Rx Crosstalk		-	-	-47	dB	
1555nm Rx to 1490nm Isolation		30	-	-	dB	
(1550-1560nm) Ext to 1490 Rx Isolation		34	-	-	dB	
Back Reflection @ 1310nm		-	-	-12	dB	

Back Reflection @ 1490nm		-	-	-27	dB	
Rx Reflectance		-	-	-20	dB	
1530nm to 1490nm Rx Isolation		7	-	-	dB	
1539nm to 1490nm Rx Isolation		22	-	-	dB	
1625nm to 1490nm Rx Isolation		22	-	-	dB	

Notes:

1. Measured by Ethernet package with random payload.
2. 4kHz to 10MHz
3. Measured with Ethernet package with random payload and ER=8.2dB, BER =10^{-12}.

Electrical Characteristics

Table 5 – Electrical Characteristics

Transmitter						
Parameter	**Symbol**	**Min.**	**Typical**	**Max.**	**Unit**	**Notes**
Differential Data Input Voltage	$V_{IN,P-P}$	300	-	1800	mVpp	4
Input Differential Impedance	Z_{IN}	-	100	-	Ω	5
Tx Burst Enable Time	T_{BURST_EN}	-	-	12.86	ns	6
Tx Burst Disable Time	T_{BURST_DIS}	-	-	12.86	ns	6
Tx Disable Assert Time	T_{DIS_A}	-	-	10	μs	
Tx Disable De-assert Time	T_{DIS_D}	-	-	1	ms	
Receiver						
Differential Output Voltage		300	-	1200	mV	7
Signal Detect Output HIGH Voltage	V_{SD_High}	2.4	-	-	V	8
Signal Detect Output LOW Voltage	V_{SD_Low}	0	-	0.8	V	9
Data Output Rise and Fall Time	T_R/T_F	-	160	-	ps	

Notes:

4. TXD+/-. AC-coupled.
5. TXD+/-.
6. 16 bits data @1244Mbps
7. CML output, AC coupled(0.1μF)
8. LVTTL with internal 1kΩ pull up resistor. Asserts HIGH when input data amplitude is above threshold.
9. LVTTL. De-asserts LOW when input data amplitude is below threshold.

Pin Definitions

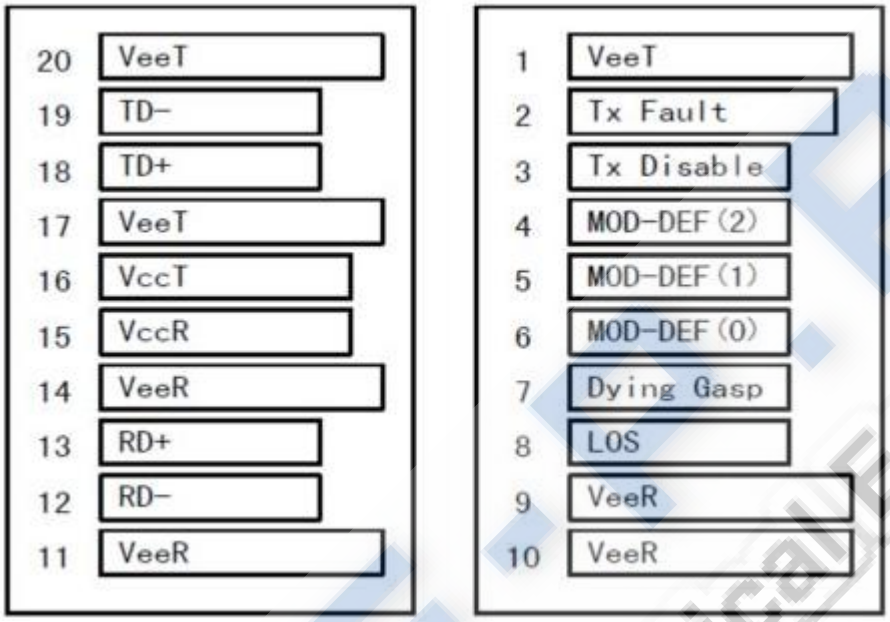

Figure 2, Pin Assignment

Table 6 – Pin definitions

Pin	Symbol	Logic	Name/Description	Note
1	VeeT	NA	Module Transmitter Ground	
2	Tx Fault	LVTTL-O	Transmitter fault indication	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	NA	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	$V_{CC}R$	NA	Module Receiver 3.3V Supply	
16	$V_{CC}T$	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. This PIN default solution is TX Fault based on SFP MSA and Source Photonics can also support ToD if customer require.

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. This PIN default solution is VeeR based on SFP MSA and Source Photonics can also support 1PPS if customer require.

Mechanical Diagram

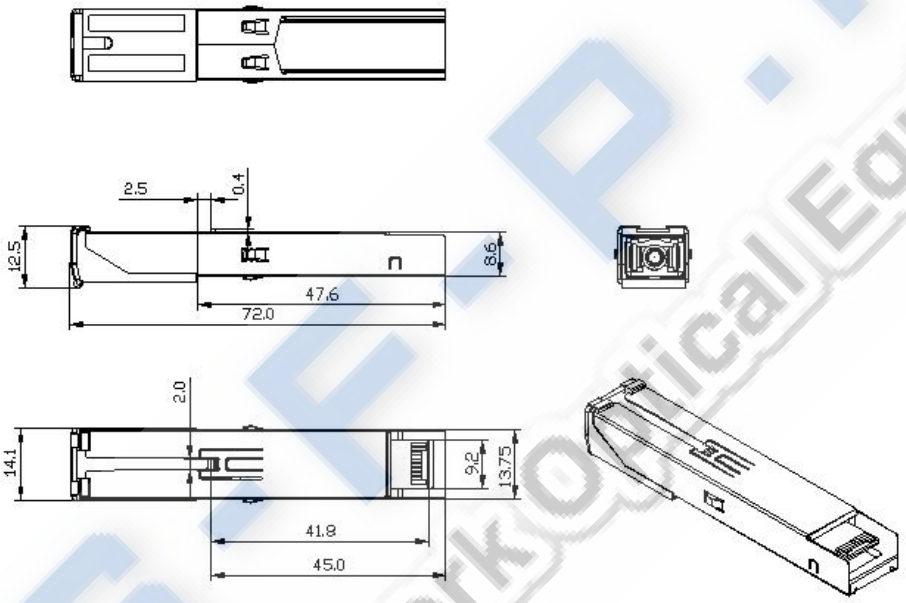

Figure 3, Mechanical Diagram

Recommended Host Board Power Supply Circuit

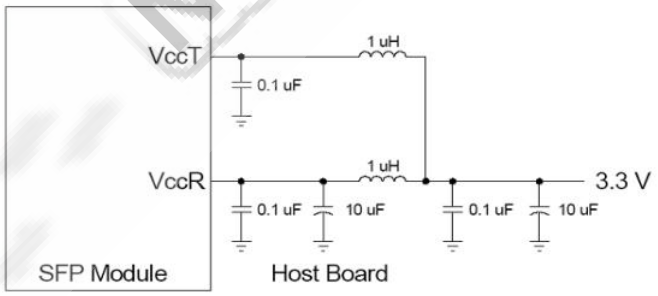

Figure 4, Recommended Host Board Power Supply Filtering Network

EEPROM Information

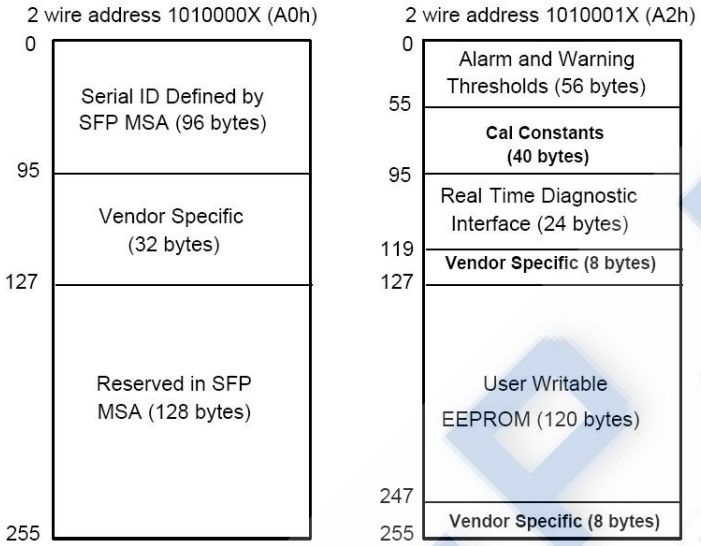

Figure 5, EEPROM Diagram

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 00 00 00 00 00	
11	1	Encoding	03	NRZ
12	1	BR, Nominal	0C	1.244Gbps
13	1	Reserved	00	
14	1	Length (9um)-km	14	20(km)
15	1	Length (9um)	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	Reserved	00	
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	Reserved	00	
37-39	3	Vendor OUI	00 00 00	
40-55	16	Vendor PN	53 50 53 33 34 32 34 54 48 50 54 44 46 4F 20 20	“SPS3424THPTDFO” (ASCII)
56-59	4	Vendor Rev	xx xx 20 20	ASCII(“30 31 20 20” means 1.0 Revision)
60-61	2	Wavelength	05 1E	Tx wavelength:1310nm

62	1	Reserved	00	
63	1	CC_BASE	xx	Check sum of byte 0-62
64-65	2	Options	00 1A	64 = 0x00, reserved 65 = 0x1A, TX_DISABLE/ TX_FAULT/RX_LOS supported
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	05	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	5F 00	95℃（I temp）
2	02	2	Temp Low Alarm	CE 00	-50℃（I temp）
4	04	2	Temp High Warning	5A 00	90℃（I temp）
6	06	2	Temp Low Warning	D3 00	-45℃（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	88 B8	3.5V
14	0E	2	Voltage Low Warning	79 18	3.1V
16	10	2	Bias High Alarm	AF C8	90mA
18	12	2	Bias Low Alarm	00 00	0mA
20	14	2	Bias High Warning	88 B8	70mA
22	16	2	Bias Low Warning	00 00	0mA
24	18	2	TX Power High Alarm	F6 77	8dBm
26	1A	2	TX Power Low Alarm	15 F7	-2.5dBm
28	1C	2	TX Power High Warning	C3 C6	7dBm

30	1E	2	TX Power Low Warning	1B A7	-1.5dBm
32	20	2	RX Power High Alarm	0C 5A	-5dBm
34	22	2	RX Power Low Alarm	00 08	-31dBm
36	24	2	RX Power High Warning	09 CF	-6dBm
38	26	2	RX Power Low Warning	00 0A	-30dBm
40-45	28-2D	6	MAC address	xx xx xx xx xx xx	MAC Address
46-55	2E-37	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	ROGUE ONU alarm	x	ROGUE ONU alarm, "0" = no ROGUE ONU alarm, "1" = ROGUE alarm
	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	-40 to 85°C	±3°C
98-99	Vcc Voltage	0 to Vcc	±3%
100-101	Bias Current	0 to 100mA(Note)	±10%
102-103	TX Power	0.5 to 5dBm	±2dB
104-105	RX Power	-30 to -8dBm	±2dB

Note: Only for continuous mode

Order Information

Table 10 – Order Information

Part No.	Application	Data Rate	Laser Source Fiber Type	Temp Range
SPS-34-24T-HP-TDFO	GPON ONT	TX:1244.16Mb/s RX:2488.32Mb/s	1310nm DFB SMF	-40 to 85°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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