Features

- IEEE 802.3ah™-2004 1000BASE-PX20 GEPON ONU side application
- China EPON standard OAM control
- Single SMF 1310nm/1490nm bi-directional transmission with symmetric 1.25Gbps upstream/downstream
- Up to 32 subscribers within 20km radius
- "Plug-and-play" via auto-discovery and configuration
- Optical link measurement and diagnosis
- Secure access via Access Control List (ACL)
- Triple Churning Key decryption
- IEEE 802.3ah Forward Error Correction (FEC)
- Highly flexible 802.1Q VLAN support
- 802.1p/q support
- Advanced QoS functions enable billing by Service Level Agreement (SLA)
- IGMP Snooping
- 1.5MB of integrated packet buffering
- Operating case temperature: -30~75°C
- RoHS compliance

Description

Source Photonics SPS-34-GB-P2-EDFM is an IEEE 802.3ah-compliant Ethernet Passive Optical Network (EPON) Optical Network Units (ONU) with Small Form-factor Pluggable (SFP) packaging. The SPS-34-GB-P2-EDFM integrates a bi-directional optical transceiver function and an EPON MAC function. By being plugged into the customer premise equipment (CPE) with standard SFP port directly, the SPS-34-GB-P2-EDFM provides a symmetric 1.25Gbps upstream/downstream EPON uplink to the CPE without requiring separate power supply.

The SPS-34-GB-P2-EDFM supports all the functions needed to comply with the China standard for EPON.

The SPS-34-GB-P2-EDFM supports a sophisticated ONU management system, including alarms, provisioning, DHCP and IGMP functions for a stand-alone IPTV solution at the ONU.

The SPS-34-GB-P2-EDFM can be managed from the OLT over the EPON using 802.3ah standard OAM messaging and China OAM extensions.

The SPS-34-GB-P2-EDFM fits seamlessly into existing communications equipment, providing service providers with a smooth upgrade to EPON. The SPS-34-GB-P2-EDFM solution vastly decreases the installation costs of deploying fiber access in MDUs and enables service providers to improve their revenue streams while decreasing OPEX.
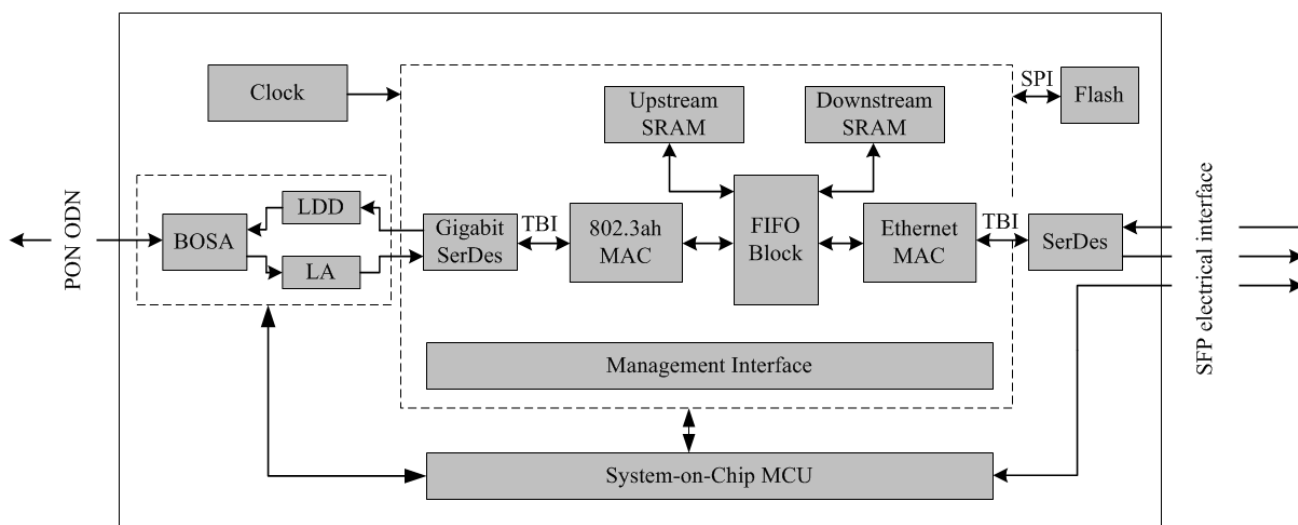
Block Diagram

Figure 1, SPS-34-GB-P2-EDFM Block Diagram

Regulatory Compliance

Table 1 - Absolute Maximum Ratings

Feature	Standard	Performance
Electrostatic Discharge (ESD) to the Electrical Pins	MIL-STD-883E Method 3015.7	Class 1(>500 V)
Electrostatic Discharge (ESD) to the SC Receptacle	IEC 61000-4-2	Compatible with standards
Electromagnetic Interference (EMI)	FCC Part 15 Class B EN55022 Class B (CISPR 22B)	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.
Component Recognition	UL and CSA	Compliant with standards
RoHS	2002/95/EC 4.1&4.2 2005/747/EC	Compliant with standards [note]

Note:

In light of item 5 in Annex of 2002/95/EC, "Pb in the glass of cathode ray tubes, electronic components and fluorescent tubes." and item 13 in Annex of 2005/747/EC, "Lead and cadmium in optical and filter glass.", the two exemptions are being concerned for Source Photonics transceivers, because Source Photonics transceivers use glass, which may contain Pb, for components such as lenses, windows, isolators, and other electronic components.

Absolute Maximum Ratings

Table 2 - Absolute Maximum Ratings

Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
Storage Ambient Temperature	T_S	-40	-	85	°C	
Operating Case Temperature	T_C	-30		75	°C	1
Operating Relative Humidity	RH	5		95	%	
Power Supply Voltage	V_{CC}	0		4	V	
Input Voltage		GND		V_{CC}	V	
Receiver Damaged Threshold		7			dBm	

Note 1: When ambient temperature is above 60°C, airflow at rate higher than 1m/sec is required.

Recommended Operating Conditions

Table 3 – Recommended Operating Conditions

Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
Power Supply Voltage	V_{CC}	3.13	3.3	3.47	V	
Operating Case Temperature	T_C	-30		75	°C	
Operating Relative Humidity	RH	5		95	%	
Power Dissipation	P_D		2000	2475	mW	
Data Rate			1.25		Gbit/s	
Data Rate Drift		-100		+100	PPM	

Optical Characteristics

Table 4 – Optical Characteristics

Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
Transmitter						
Centre Wavelength	λ_C	1260		1360	nm	
RMS Spectral Width	$\Delta\lambda$			3	nm	
Average Launch Power	P_{OUT}	-1		4	dBm	1
Average Launch Power-OFF Transmitter	P_{OFF}			-45	dBm	
Extinction Ratio	EX	9			dB	2
Total Jitter	TJ			0.35	UI	2
Rise/Fall Time (20%-80%)	T_R/T_F			260	ps	2,3
$RIN_{15}OMA$				-115	dB/Hz	
Optical Return Loss Tolerance				15	dB	

Optical Eye Mask	Compliant With IEEE Std 802.3ah™-2004					2,4
Receiver						
Operating Wavelength	λ_C	1480		1500	nm	
Sensitivity	P_{SEN}			-26	dBm	5
Saturation	P_{SAT}	-3			dBm	
Signal-Detected Assert Level	P_{SDA}			-27	dBm	6
Signal-Detected Deassert Level	P_{SDD}	-39			dBm	7
Signal-Detected Hysteresis	P_{SDA}- P_{SDD}	0.5		6	dBm	
Receiver Reflectance				-12	dB	

Notes:

1. The optical power is launched into 9/125um SMF.
2. Measured by Ethernet package with random payload.
3. Measured with the Bessel-Thompson filter OFF.
4. Transmitter eye mask definition {0.22UI, 0.375UI, 0.20UI, 0.20UI, 0.30UI}.
5. Measured with Ethernet package with random payload and ER=9dB, BER =10^{-12}.
6. An increase in optical power above the specified level will cause the Signal Detect output to switch from a low state to a high state.
7. A decrease in optical power below the specified level will cause the Signal Detect output to switch from a high state to a low state.

Electrical Characteristics

Table 5 – Electrical Characteristics

Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
Supply Current	I_{cc}			750	mA	
Tx_Data Input Differential Swing	V_{IN}	200		1600	mVp-p	1
Tx_Disable Voltage - Low	$V_{TDIS, L}$	0		0.8	V	2
Tx_Disable Voltage - High	$V_{TDIS, H}$	2.0		Vcc	V	
Input Differential Impedance	Z_{IN}	90	100	110	Ω	
Rx_Data Output Differential Swing	V_{OUT}	400		1600	mV_{P-P}	3
Rx_Loss of Signal Voltage - Low	$V_{LOS, L}$	0		0.4	V	4
Rx_ Loss of Signal Voltage - High	$V_{LOS, H}$	2.4		V_{CC}	V	

Notes:

1. Compatible with LVPECL input, AC coupled internally.
2. TX Disable (See Pin Function Definitions).
3. LVPECL output, AC coupled internally, guaranteed in the full range of input optical power (-3dBm to -26dBm).
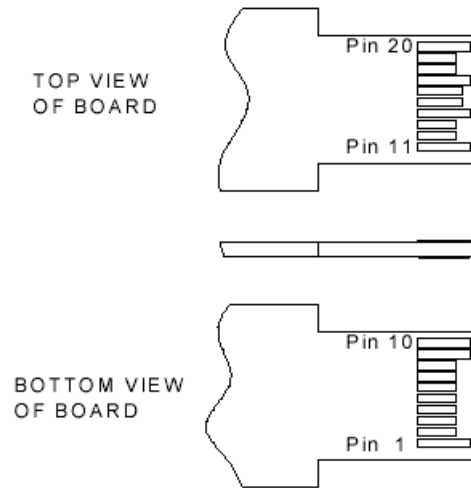4. LOS (See Pin Function Definitions).

Pin Definitions

Figure 2, SFP Pin View (Golden Finger)

Table 6 –Pin Function Definitions

Pin	Name	Description	Notes
1	$V_{ee}T$	Transmitter Ground	
2	TX Fault	Transmitter Fault Indication	1
3	TX Disable	Transmitter Disable	2
4	MOD-DEF2	Module Definition 2	3
5	MOD-DEF1	Module Definition 1	3
6	MOD-DEF0	Module Definition 0	3
7	Dying Gasp	Dying Gasp Indication	4
8	LOS	Loss of Signal	5
9	$V_{ee}R$	Receiver Ground	
10	$V_{ee}R$	Receiver Ground	
11	$V_{ee}R$	Receiver Ground	
12	RD-	Inv. Receiver Data Out	6
13	RD+	Receiver Data Out	
14	$V_{ee}R$	Received Ground	
15	$V_{cc}R$	Receiver Power	7
16	$V_{cc}T$	Transmitter Power	
17	$V_{ee}T$	Transmitter Ground	
18	TD+	Transmit Data In	8
19	TD-	Inv. Transmit Data In	
20	$V_{ee}T$	Transmitter Ground	

Notes:

1. TX Fault is an open collector/drain output, which should be pulled up with a 4.7K-10KΩ resistor on the host board. Pull up voltage between 2.0V and $V_{cc}T$, 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 4.7-10 KΩ resistor. Its 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-DEF0,1,2. These are the module definition pins. They should be pulled up with a 4.7K-10KΩ resistor on the host board. The pull-up voltage shall be $V_{cc}T$ or $V_{cc}R$.

   MOD-DEF0 is grounded by the module to indicate that the module is present

   MOD-DEF1 is the clock line of two-wire serial interface for serial ID

   MOD-DEF2 is the data line of two-wire serial interface for serial ID

4. Power fail warning. If the SPS-34-GB-P2-EDFM is about to lose power, this function detects the situation and sends a signal to warn the optical line terminal (OLT) about the impending line drop.

5. LOS (Loss of Signal) is an open collector/drain output, which should be pulled up with a 4.7K-10KΩ resistor. Pull up voltage between 2.0V and $V_{cc}T$, R+0.3V. When high, this output indicates the received optical power is below the worst-case receiver sensitivity (as defined by the standard in use). Low indicates normal operation. In the low state, the output will be pulled to < 0.8V.

6. These are the differential receiver outputs. They are DC coupled 100 Ω differential lines which should be terminated with 100 Ω (differential) at the user SERDES.

7. $V_{cc}R$ and $V_{cc}T$ are the receiver and transmitter power supplies. They are defined as 3.3V±5% at the SFP connector pin. Inductors with DC resistance of less than 1Ω should be used in order to maintain the required voltage at the SFP input pin with 3.3V supply voltage. When the recommended supply filtering network is used, hot plugging of the SFP transceiver module will result in an inrush current of no more than 30 mA greater than the steady state value.

8. These are the differential transmitter inputs. They are AC coupled differential lines with 100Ω differential termination inside the module. The AC coupling is done inside the module and is thus not required on the host board.
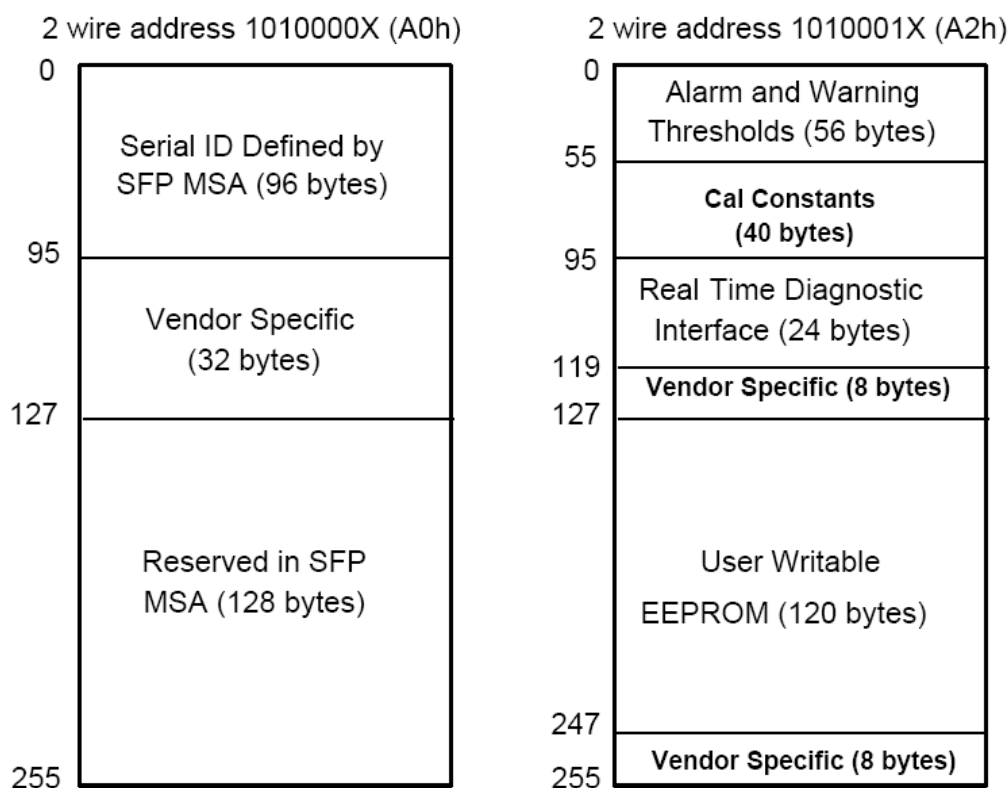
EEPROM Information

Figure 3, 2-wire Serial Digital Diagnostic Memory Map

Table 7 –EEPROM Serial ID Memory Contents (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	BASE-PX
11	1	Encoding	01	8B10B
12	1	BR, Nominal	0D	1.25Gbps
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 47 42 50 32 45 44 46 4D 20 20 20	"SPS34GBP2EDFM" (ASCII)
56-59	4	Vendor Rev	xx xx 20 20	ASCII("31 30 20 20" means 1.0 Revision)
60-61	2	Wavelength	05 1E	1310nm Laser Wavelength
62	1	Reserved	00	
63	1	CC_BASE	xx	Check sum of byte 0-62
64-65	2	Options	00 1A	LOS, LAS_FAIL and TX_DISABLE
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 V9.5 Internally Calibrated Received power measurement type -Average Power
93	1	Enhanced Options	F0	Diagnostics (Optional Alarm/warning flags) Soft TX_DISABLE control and monitoring implemented Soft TX_FAULT monitoring implemented Soft RX_LOS monitoring implemented
94	1	SFF-8472 Compliance	02	Diagnostics Compliance(SFF-8472 V9.5)
95	1	CC_EXT	xx	Check sum of byte 64-94
96	1	Vendor Specific		
97	1	Vendor Specific		
98	1	Vendor Specific		
99	1	Vendor Specific		
100	1	Vendor Specific		
101	1	Vendor Specific		
102	1	Vendor Specific		
103	1	Vendor Specific		
104-113	10	Vendor Specific		
114-115	2	Vendor Specific		
116	1	Vendor Specific		
117-126	10	Vendor Specific		
127	1	Vendor Specific		
128-255	128	Vendor Specific		

Note: The "xx" byte should be filled in according to practical case. For more information, please refer to the related document of SFF-8472 Rev 9.5.

Table 8 – Digital Diagnostic Specification (A2h)

Data Address	Parameter	Range	Accuracy
96-97	Temperature	-30 to 110°C	±3°C
98-99	Vcc Voltage	2.8V to 3.8V	±3%
100-101	Bias Current	0 to 60mA(Note)	±10%
102-103	TX Power	-2 to 4dBm	±3dB
104-105	RX Power	-27 to -2dBm	±2dB

Note: Only for continuous mode

Table 9 – MAC Communication (A2h)

Addr.	Field Size (Bytes)	Name of Field	Hex	Description
128	1	Command	01	Reset MAC
			02	Get MAC Registered Information
			03	Force open laser when un-registered
			04	Force close laser when un-registered
			05	Force close laser when registered
			06	Restore laser state when registered
129	1	Command Execute Status	11	Command is executing
			12	Command execute fail
			55	Command execute success
130-175	46	Command Execute Result(Only valid when command execute success)	xx…xx	For command "Get TK3715 Registered Information", will return ASCII "Registered" or "LOS"
			00…00	Unused for other commands

Note : Before starting communication with MAC, Offset 127 of A2 address must be write 0x05; After communication with MAC, Offset 127 of A2 address should be write to 0x00.

Mechanical Diagram
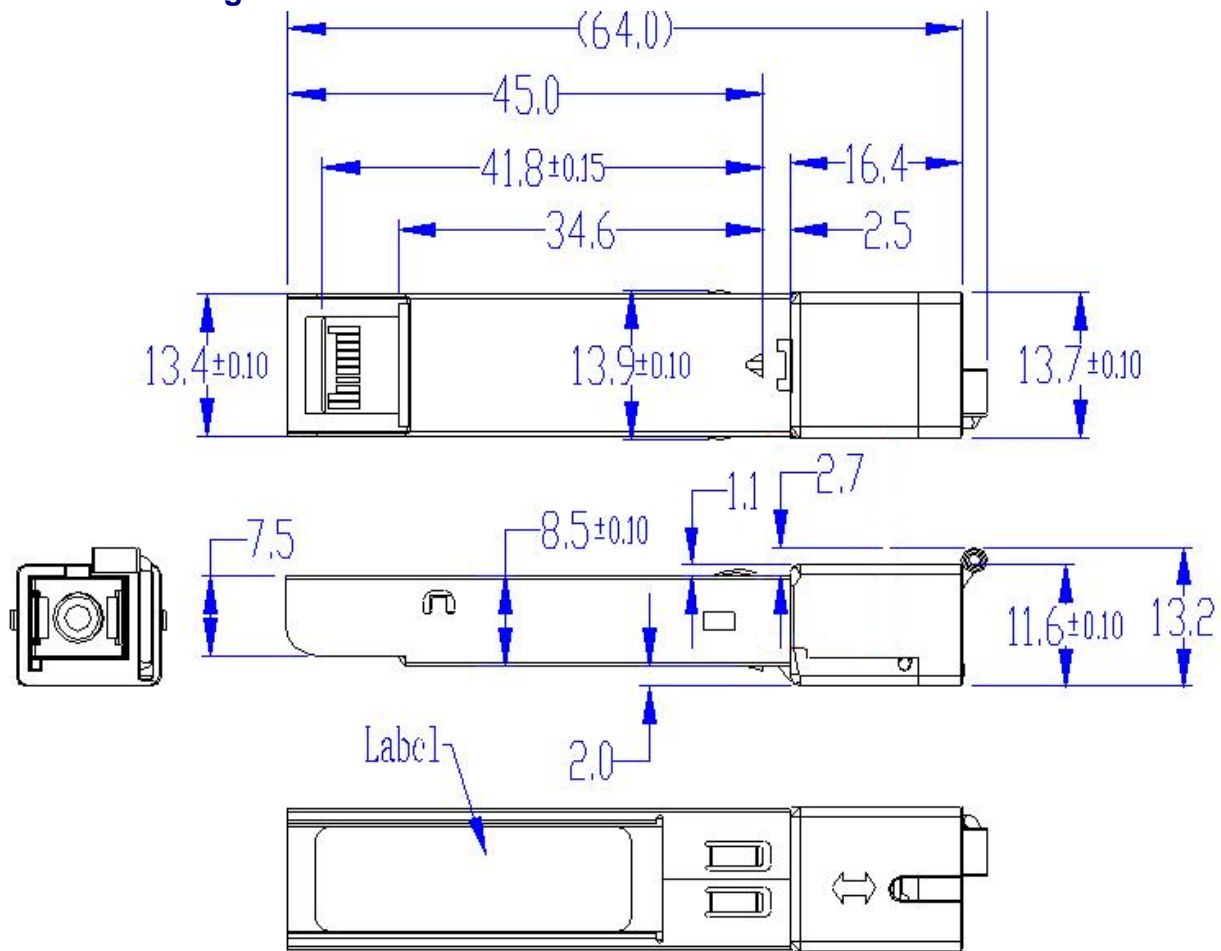
Figure 4 Mechanical Diagram

Order Information

Table 10 – Order Information

Part No.	Application	Data Rate	Fiber Type
SPS-34-GB-P2-EDFM	1000BASE-PX20 ONU	1.25Gb/s symmetric	SMF

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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