

### SPS-2371W-CXX0G / SPS-2371BW-CXX0G

(RoHS Compliant)

### 10.3 Gbps / 70 km / CWDM Digital Diagnostic LC SFP+ SINGLE-MODE TRANSCEIVER

#### FEATURES

- Up to 10.3125 Gb/s Bi-directional Data Links
- Compliant to SFP+ MSA
- Compliant to IEEE 802.3ae 10GBASE-ZR/ZW
- Maximum Link Length of 70 km
- Temperature-stabilized CWDM EML Transmitter
- SFF-8472 Digital Diagnostic Function
- AC/AC Coupling according to MSA
- Single +3.3 V Power Supply
- RoHS Compliant
- 0 to 70°C Operating: SPS-2371W-CXX0G
- -5 to 85°C Operating: SPS-2371BW-CXX0G
- Class 1 Laser International Safety Standard IEC-60825 Compliant

#### APPLICATIONS

- 10GBASE-ZR/ZW
- 10G SONET OC-192 / STM-64
- 70 km 10G Fibre Channel

#### DESCRIPTION

The SPS-2371 W-CXX0G series single mode transceiver is a small form factor pluggable module for bi-directional serial optical data communications such as IEEE 802.3ae 10GBASE-ZR/ZW. It is with the SFP 20-pin connector to allow hot plug capability. Digital diagnostic functions are available via an I<sup>2</sup>C. This module is designed for single mode fiber and operates at a nominal wavelength of CWDM wavelength. There are eight center wavelengths available from 1470 nm to 1610 nm, with each step 20 nm. The transmitter section uses a temperature-stabilized CWDM electrical-modulated laser (EML) and is a class 1 laser compliant according to International Safety Standard IEC-60825. The receiver section uses an integrated InGaAs avalanche photodiode preamplifier (IDP) mounted in an optical header and a limiting post-amplifier IC.

#### LASER SAFETY

This single mode transceiver is a Class 1 laser product. It complies with IEC-60825 and FDA 21 CFR 1040.10 and 1040.11. The transceiver must be operated within the specified temperature and voltage limits. The optical ports of the module shall be terminated with an optical connector or with a dust plug.

#### ORDER INFORMATION

P/No.	Bit Rate (Gb/s)	10GBASE	Power Budget (dB)	Wavelength (nm)	Package	Temp. (°C)	RoHS Compliant
SPS-2371W-CXX0G	10.3	ER / EW	>23	CWDM*	SFP+ with DMI	0 to 70	Yes
SPS-2371BW-CXX0G	10.3	ER / EW	>23	CWDM*	SFP+ with DMI	-5 to 85	Yes

CWDM\* Wavelength (0 to 70°C)

Central Wavelength	Min. (nm)	Typ. (nm)	Max. (nm)	Label	Central Wavelength	Min. (nm)	Typ. (nm)	Max. (nm)	Label
-C470	1464.5	1470	1477.5	C47	-C550	1544.5	1550	1557.5	C55
-C490	1484.5	1490	1497.5	C49	-C570	1564.5	1570	1577.5	C57
-C510	1504.5	1510	1517.5	C51	-C590	1584.5	1590	1597.5	C59
-C530	1524.5	1530	1537.5	C53	-C610	1604.5	1610	1617.5	C61

CWDM\*: 8 Wavelengths from 1470 nm to 1610 nm, each step 20 nm.

Absolute Maximum Ratings					
Parameter	Symbol	Min	Max	Units	Notes
Storage Temperature	Tstg	-40	85	°C	
Relative Humidity	RH	5	85	%	Non-condensing
Operating Case Temperature	Topr	0	70	°C	SPS-2371W-CXX0G
		-5	85		SPS-2371BW-CXX0G
Power Supply Voltage	Vcc	-0.5	3.6	V	
Receiver Input Optical Power	Mip		-4	dBm	Average power

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Recommended Operating Conditions					
Parameter	Symbol	Min	Typ	Max	Units / Notes
Power Supply Voltage	V <sub>CC</sub>	3.135	3.3	3.465	V
Operating Case Temperature	T <sub>opr</sub>	0 -5		70 85	°C / SPS-2371W-CXX0G °C / SPS-2371BW-CXX0G
Relative Humidity	RH	5	85	%	Non-condensing
Power Supply Current	I <sub>CC(TX+RX)</sub>		330	500	mA / SPS-2371W-CXX0G
			330	650	mA / SPS-2371BW-CXX0G
Data Rate		9.95	10.3125		Gb/s

Transmitter Optical Specifications (0°C < T <sub>opr</sub> < 70°C, 3.13V < V <sub>CC</sub> < 3.47V)						
Parameter	Symbol	Min	Typ	Max	Units	Notes
Average Launch Power	P <sub>O, AVG</sub>	0		4	dBm	1
Output Center Wavelength	λ	λ <sub>c</sub> -5.5	λ <sub>c</sub>	λ <sub>c</sub> +7.5	nm	2
Output Spectrum Width	Δλ	---		1	nm	-20 dB width
Extinction Ratio	ER	8.2			dB	
Side Mode Suppression Ratio	SMSR	30			dB	
Relative Intensity Noise	RIN			-128	dB/Hz	
Average Launch Power of OFF Transmitter				-30	dBm	

1. Output power is power coupled into a 9/125 μm single-mode fiber.
2. ITU-T G.694.2 CWDM wavelength from 1470 nm to 1610 nm, each step 20 nm.

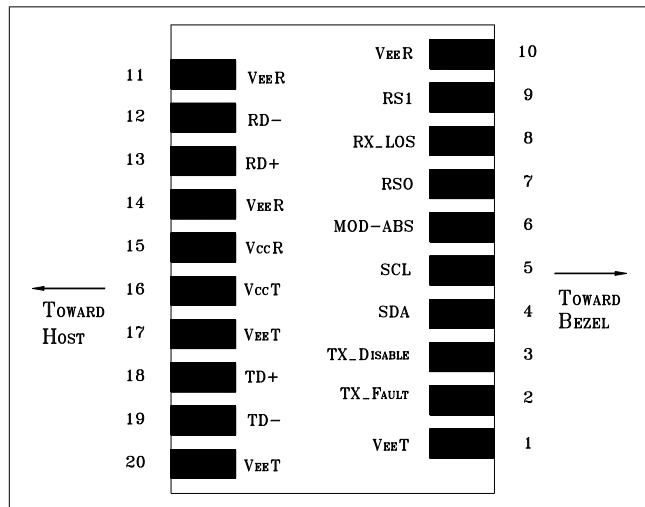
Receiver Optical Specifications (0°C < T <sub>opr</sub> < 70°C, 3.13V < V <sub>CC</sub> < 3.47V)						
Parameter	Symbol	Min	Typ	Max	Units	Notes
Sensitivity				-23	dBm	3
Receiver Overload	P <sub>MAX</sub>	-7	---		dBm	
LOS -- Deasserted	LOS <sub>D</sub>	---	---	-23	dBm	Transition: low to high
LOS -- Asserted	LOS <sub>A</sub>	-35	---	---	dBm	Transition: high to low
Wavelength of Operation	λ <sub>c</sub>	1260		1620	nm	
Optical Return Loss	ORL			-27	dB	

3. Measured with average power; BER < 10<sup>-12</sup> and PRBS 2<sup>31</sup>-1.

Electrical Characteristics						
Parameter	Symbol	Min	Typ	Max	Units	Notes
<b>High-Speed Signal (CML) Interface Specification</b>						
Input Data Rate		9.95	10.3125		Gb/s	
Differential Input Impedance	R <sub>in</sub>		100		Ω	
Differential Data Input Amplitude		120		820	mV <sub>pp</sub>	Internally AC coupled
Output Data Rate		9.95	10.3125		Gb/s	
Differential Output Impedance	R <sub>out</sub>		100		Ω	
Differential Data Output Amplitude		350	600	850	mV <sub>pp</sub>	Internally AC coupled
<b>Low-Speed Signal (LVTTTL) Interface Specification</b>						
Input High Voltage		2.0		V <sub>CC</sub> +0.3	V	
Input Low Voltage		GND		0.8	V	
Output High Voltage		2.4		V <sub>CC</sub>	V	
Output Low Voltage		GND		0.5	V	

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CONNECTION DIAGRAM



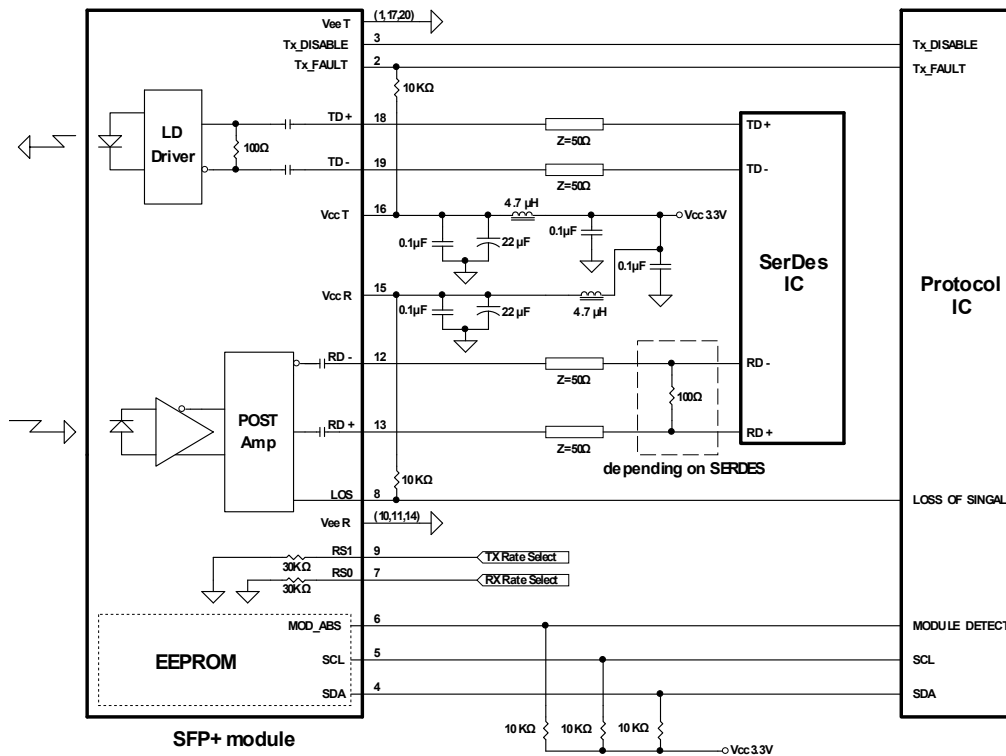
PIN	Signal Name	Description	PIN	Signal Name	Description
1	V <sub>EE</sub> T	Transmitter Signal Ground	11	V <sub>EE</sub> R	Receiver Signal Ground
2	TX_Fault	Transmitter Fault Indication. Logic “1” Output = Laser Fault. Logic “0” Output = Normal Operation	12	RD-	Inverse Receiver Data Out
3	TX_Disable	Logic “1” Input (or no connection) = Laser off, Logic “0” = Laser on.	13	RD+	Receiver Data Out
4	SDA	Modulation Definition 2 – Two wires serial ID Interface	14	V <sub>EE</sub> R	Receiver Signal Ground
5	SCL	Modulation Definition 1 – Two wires serial ID Interface	15	V <sub>CC</sub> R	Receiver Power – 3.3V±5%
6	MOD-ABS	Modulation Definition 0 – Ground in Module	16	V <sub>CC</sub> T	Transmitter Power – 3.3V±5%
7	RS0	RX Rate Select (LVTTL). This pin has an internal 30k pulldown to ground. A signal on this pin will not affect module performance.	17	V <sub>EE</sub> T	Transmitter Signal Ground
8	RX_LOS	Loss of Signal Out (OC).	18	TD+	Transmitter Data In
9	RS1	TX Rate Select (LVTTL). This pin has an internal 30k pulldown to ground. A signal on this pin will not affect module performance.	19	TD-	Inverse Transmitter Data In
10	V <sub>EE</sub> R	Receiver Signal Ground	20	V <sub>EE</sub> T	Transmitter Signal Ground

MODULE DEFINITION

Module Definition	PIN 4	PIN 5	PIN 6	Interpretation by Host
4	SDA	SCL	MOD-ABS	Serial module definition protocol

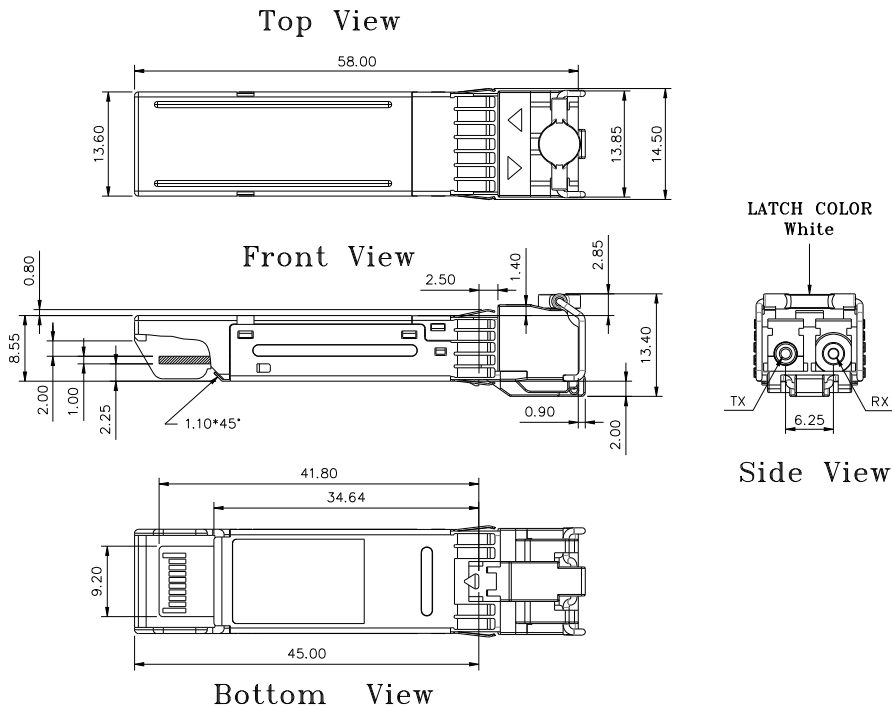
Module Definition 4 specifies a serial definition protocol. For this definition, upon power up, SDA and SCL appear as no connection (NC) and MOD-ABS is TTL LOW. When the host system detects this condition, it activates the serial protocol. The protocol uses the 2-wire serial CMOS E<sup>2</sup>PROM protocol of the ATMEL AT24C01A/02/04 family of components.

## RECOMMENDED CIRCUIT SCHEMATIC



## PACKAGE DIAGRAM

Units in mm



**Note:** Specifications subject to change without notice.

### REVISION HISTORY

Version	Subject	Release Date
1.0	Initial datasheet	2011/12/1
2.0	Change LOS Deasserted to -23 dBm	2017/5/2
2.1	Update Package Diagram	2017/9/15
3.0	Add SPS-2371BW-CXX0G	2018/11/7
4.0	Update Package Diagram	2021/1/20