
SPS-2502W-CXX0G / SPS-2502BW-CXX0G / SPS-2502AW-CXX0G (RoHS Compliant)
25GE / 2 km / CWDM Digital Diagnostic SFP28 LC SINGLE-MODE TRANSCEIVER

FEATURES

- Up to 25.78 Gbps Bi-directional Data Links
- Compliant with SFF-8402 SFP28 MSA
- Support 25GBASE
- Support CPRI Option 10 @ 24.33Gbps
- Built-in dual CDR
- 8.3 Power Budget at Least
- Uncooled 6-Wavelength CWDM DFB LD: from 1270 nm to 1370 nm
- SFF-8472 Digital Diagnostic Function
- AC/AC Coupling according to MSA
- Single +3.3 V Power Supply
- RoHS Compliant
- 0 to 70°C Operation: SPS-2502W-CXX0G
- -10 to 85°C Operation: SPS-2502BW-CXX0G
- -40 to 85°C Operation: SPS-2502AW-CXX0G
- Class 1 Laser International Safety Standard IEC-60825 Compliant
- Enhanced EWRAP and OWRAP operational features
- CDR auto sensing

DESCRIPTION

The SPS-2502W-CXX0G series single mode transceiver is a small form factor pluggable module for bi-directional serial optical data communications such as 25G Ethernet and CPRI Option 10. It is with the SFP+ 20-pin connector to allow hot plug capability. Digital diagnostic functions are available via an I²C. This module is designed for single mode fiber and operates at a nominal wavelength of CWDM wavelength. The transmitter section uses a CWDM multiple quantum well DFB laser and is a class 1 laser compliant according to International Safety Standard IEC-60825. The receiver section uses an integrated InGaAs detector preamplifier (IDP) mounted in an optical header and a rate selection clock data recovery (CDR) 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.

APPLICATIONS

- 25G Ethernet
- CPRI Option 10

ORDER INFORMATION

P/No.	Bit Rate (Gb/s)	25GBASE	CPRI	Power Budget (dB)	Wavelength (nm)	Package	Case Temp (°C)	RoHS Compliant
SPS-2502W-CXX0G	Up to 25.78	LR	Option 10	> 8.3	CWDM*	SFP28 with DMI	0 to 70	Yes
SPS-2502BW-CXX0G	Up to 25.78	LR	Option 10	> 8.3	CWDM*	SFP28 with DMI	-10 to 85	Yes
SPS-2502AW-CXX0G	Up to 25.78	LR	Option 10	> 8.3	CWDM*	SFP28 with DMI	-40 to 85	Yes

CWDM* Wavelength

Central Wavelength	Min. (nm)	Typ. (nm)	Max. (nm)	Label	Central Wavelength	Min. (nm)	Typ. (nm)	Max. (nm)	Label
-C270	1264.5	1270	1277.5	C27	-C330	1324.5	1330	1337.5	C33
-C290	1284.5	1290	1297.5	C29	-C350	1344.5	1350	1357.5	C35
-C310	1304.5	1310	1317.5	C31	-C370	1364.5	1370	1377.5	C37

CWDM*: 6 wavelengths from 1270 nm to 1370 nm, each step 20 nm.

Absolute Maximum Ratings					
Parameter	Symbol	Min	Max	Units	Notes
Storage Temperature	T _{stg}	-40	85	°C	
Relative Humidity	RH	5	85	%	Non-condensing
Operating Case Temperature	T _{opr}	0 -10 -40	70 85 85	°C	SPS-2502W-CXX0G SPS-2502BW-CXX0G SPS-2502AW-CXX0G
Power Supply Voltage	V _{cc}	-0.5	3.6	V	

Recommended Operating Conditions					
Parameter	Symbol	Min	Typ	Max	Units / Notes
Power Supply Voltage	V _{cc}	3.135	3.3	3.465	V
Operating Case Temperature	T _{opr}	0 -10 -40		70 85 85	°C / SPS-2502W-CXX0G °C / SPS-2502BW-CXX0G °C / SPS-2502AW-CXX0G
Relative Humidity	RH	5		85	% / Non-condensing
Power Supply Current	I _{CC(TX+RX)}		270	340	mA / SPS-2502W-CXX0G mA / SPS-2502BW-CXX0G
			270	500	mA / SPS-2502AW-CXX0G
Data Rate			25.78		Gb/s

Transmitter Optical Specifications (0°C < T _{opr} < 70°C, 3.13V < V _{cc} < 3.47V)						
Parameter	Symbol	Min	Typ	Max	Units	Notes
Average Launch Power	P _{O,AVG}	-2		2	dBm	1
Output Center Wavelength	λ	λ _c - 5.5	λ _c	λ _c + 7.5	nm	2
Output Spectrum Width	Δλ	---		1	nm	-20 dB width
Side Mode Suppression Ratio	SMSR	30			dB	
Extinction Ratio	ER	3.0			dB	
Relative Intensity Noise	RIN			-130	dB/Hz	
Optical Return Loss Tolerance	ORL			20	dB	
Transmitter Reflectance	R _T			-26	dB	
Average Launch Power of OFF Transmitter				-30	dBm	

- Output power is power coupled into a 9/125 μm single-mode fiber.
- ITU-T G.694.2 CWDM wavelength from 1270 nm to 1370 nm, each step 20 nm.

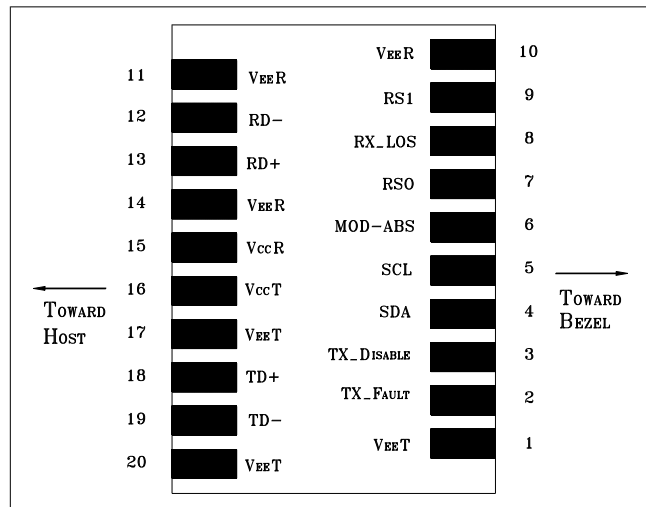
Receiver Optical Specifications (0°C < T _{opr} < 70°C, 3.13V < V _{cc} < 3.47V)						
Parameter	Symbol	Min	Typ	Max	Units	Notes
Sensitivity, Average	Sens			-10.3	dBm	3
Receiver Overload	P _{MAX}	2			dBm	3
LOS – Deasserted	LOS _D	---	---	-14	dBm	Transition: low to high
LOS – Asserted	LOS _A	-24	---	---	dBm	Transition: high to low
Wavelength of Operation	λ _c	1260		1380	nm	
Receiver Reflectance	R _R			-26	dB	

- Measured @ BER < 5E-5 and PRBS 2³¹-1.

Electrical Characteristics						
Parameter	Symbol	Min	Typ	Max	Units	Notes
High-Speed Signal (CML) Interface Specification						
Input Data Rate			25.78		Gb/s	
TX Clock Tolerance		-100		+100	ppm	4
Differential Input Impedance	Rin		100		Ω	
Differential Data Input Amplitude		150		1000	mVpp	Internally AC coupled
Output Data Rate		8.5	25.78		Gb/s	
RX Clock Tolerance		-100		+100	ppm	4
Differential Output Impedance	Rout		100		Ω	
Differential Data Output Amplitude		350	600	700	mVpp	Internally AC coupled
Low-Speed Signal (LVTTTL) Interface Specification						
Input High Voltage		2.0		Vcc+0.3	V	
Input Low Voltage		GND		0.8	V	
Output High Voltage		2.4		Vcc	V	
Output Low Voltage		GND		0.5	V	

4. Clock tolerance for 25.78Gb/s.

CONNECTION DIAGRAM



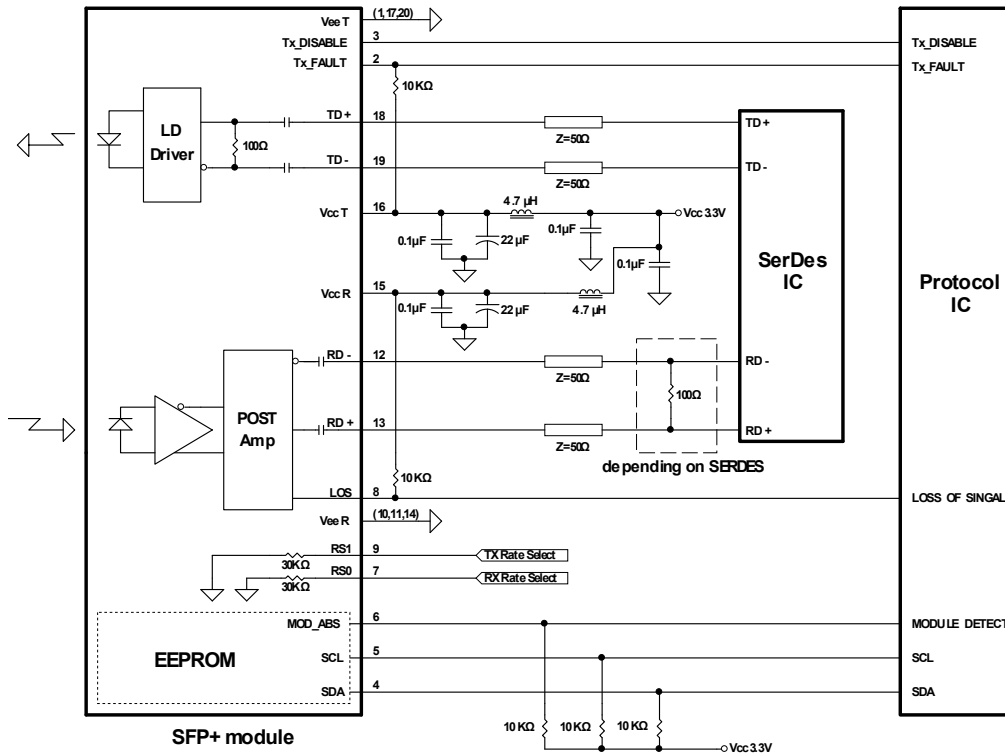
PIN	Signal Name	Description	PIN	Signal Name	Description
1	V _{EE} T	Transmitter Signal Ground	11	V _{EE} R	Receiver Signal Ground
2	TX_Fault	Transmitter Fault Indication. Logic “1” Output = Laser Fault. Logic “0” Output = Normal Operation	12	RD-	Inverse Receiver Data Out
3	TX_Disable	Logic “1” Input (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 _{EE} R	Receiver Signal Ground
5	SCL	Modulation Definition 1 – Two wires serial ID Interface	15	V _{CC} R	Receiver Power – 3.3V±5%
6	MOD-ABS	Modulation Definition 0 – Ground in Module	16	V _{CC} T	Transmitter Power – 3.3V±5%
7	RS0	RX Rate Select: This pin has an internal 30k pulldown to ground. A signal on this pin will not affect module performance.	17	V _{EE} T	Transmitter Signal Ground
8	RX_LOS	Loss of Signal Out (OC).	18	TD+	Transmitter Data In
9	RS1	TX Rate Select: 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 _{EE} R	Receiver Signal Ground	20	V _{EE} 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 connector (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 E²PROM protocol of the ATMEL AT24C01A/02/04 family of components.

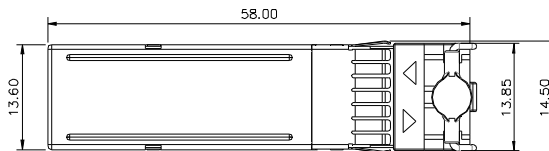
RECOMMENDED CIRCUIT SCHEMATIC



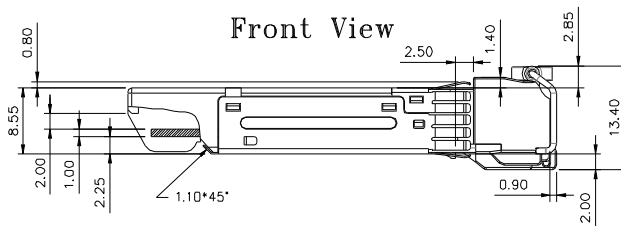
PACKAGE DIAGRAM

Units in mm

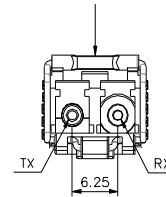
Top View



Front View

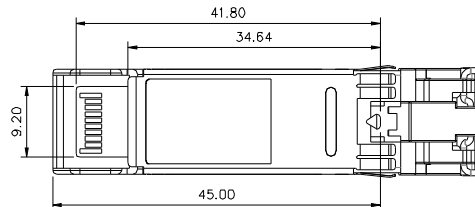


LATCH COLOR
Blue



Side View

Bottom View



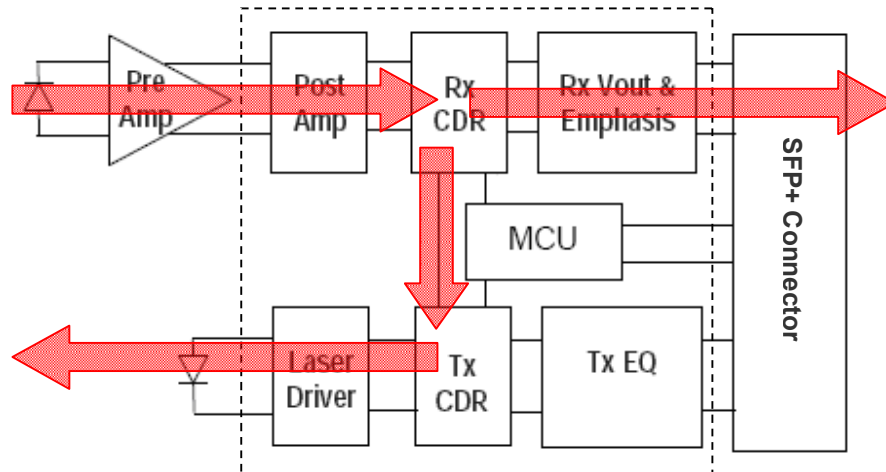
Note: Specifications subject to change without notice.

WRAP AND BYPASS CDR OPERATION FUNCTIONS - SOFT CONTROL (Address A2h, Byte 111).

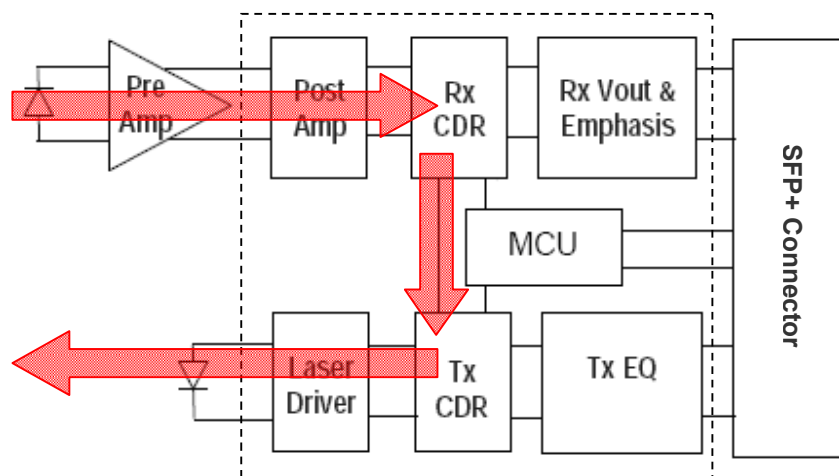
To assist with local host or remote diagnostic and optimization sequences, electrical and optical wrap functions can be enabled. Optical wrap (OWRAP) takes the received optical signal through CDRs and retransmits it optically out. Electrical wrap (EWRAP) takes the received electrical signal through CDRs and retransmits it electrically out. Optional forward functions can be transmitted outbound the wrapped information via i2c control.

Byte	Bit	Name	Description
	4-7	Reserved	Reserved.
	3	OWRAP Forward Enable Bit	When set in combination with OWRAP Enable, OWRAP Forward routes incoming SFP+ Rx optical data to both the Tx optical output and the Rx electrical output. Enabling sets bit 2 and clears all other bits in byte 111.
	2	OWRAP Enable Bit	When set, OWRAP routes incoming SFP+ Rx optical data to the Tx optical output. Enabling clears all other bits in byte 111.
	1	EWRAP Forward Enable Bit	When set in combination with EWRAP Enable, EWRAP Forward routes incoming SFP+ Tx electrical data to both Rx electrical output and Tx optical output. Enabling sets bit 0 and clears all other bits in byte 111.
	0	EWRAP Enable Bit	When set, EWRAP Enable routes incoming SFP+ Tx electrical data to the Rx electrical output. Enabling clears all other bits in byte 111.

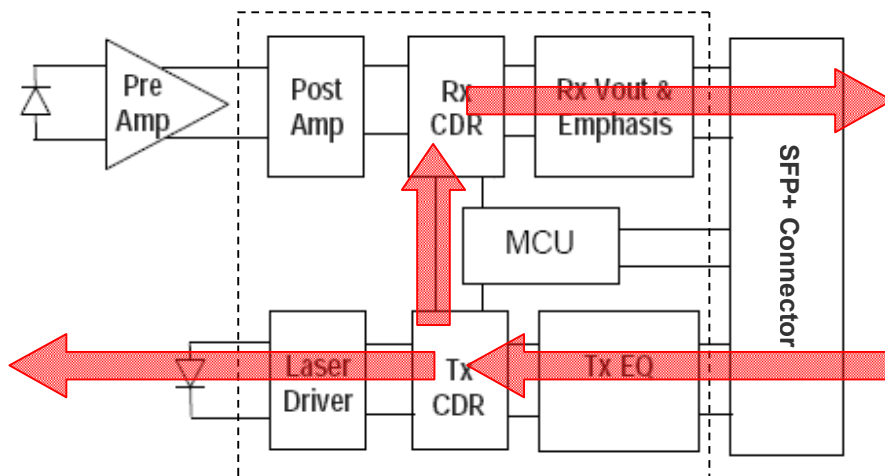
OWRAP FORWARD ENABLE MODE (I2C CONTROLLED)



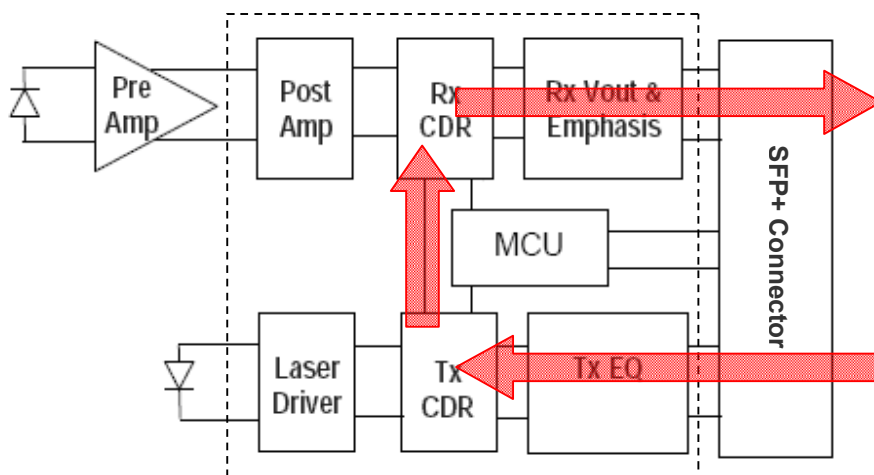
OWRAP ENABLE MODE (I2C CONTROLLED)



EWRAP FORWARD ENABLE MODE (I2C CONTROLLED)



EWRAP ENABLE MODE (I2C CONTROLLED)



EEPROM Series ID Memory Contents (Address A0h)

Addr.	Hex	ASCII	Note	Addr.	Hex	ASCII	Note	Addr.	Hex	ASCII	Note	Addr.	Hex	ASCII	Note		
0	03		SFP28	32	20			64	18		Power Level 1, w/ CDR, Uncooled Tx, Txdis, Txfault, LOS	96	00		Vendor specific EEPROM		
1	04			33	20			65	1A			97	00				
2	07		LC	34	20			66	67			98	00				
3	00			35	20			67	00			99	00				
4	00			36	03		25GBASE-LR Vendor IEEE OUI	68			Serial number: each piece with different serial number	100	00				
5	00			37	00			69				101	00				
6	00			38	0E			70				102	00				
7	00			39	FA			71				103	00				
8	00			40	53	S		Part Number	72				104	00			
9	00			41	50	P			73				105	00			
10	00			42	53	S			74				106	00			
11	06		64B/66B	43	2D	-			75				107	00			
12	FF		> 25.4 Gbps	44	32	2			76				108	00			
13	00			45	35	5			77				109	00			
14	02		2km	46	30	0	78				110	00					
15	14		2km	47	32	2	79				111	00					
16	00			48	57	W	80				112	00					
17	00			49	2D	-	81				113	00					
18	00			50	43	C	82			114	00						
19	00			51	3X	X	83			115	00						
20	4F	O	Vendor name	52	3X	X	Revision, depended on version	84		Y	Date Code	116	00				
21	50	P		53	30	0		85		Y		117	00				
22	54	T		54	47	G		86		M		118	00				
23	4F	O		55	20			87		M		119	00				
24	57	W		56	30	0		88		D		120	00				
25	41	A		57	30	0		89		D		121	00				
26	59	Y		58	30	0		90	20			122	00				
27	20			59	31	1		91	20			123	00				
28	20			60				CWDM	92	68			Monitoring	124	00		
29	20			61					93	F0			Soft Control and Monitoring	125	00		
30	20		62	00		Reserved	94	08		SFF-8472 V12.3	126	00					
31	20		63			Checksum 0-62	95			Checksum 64-94	127	00					

EEPROM Series ID Memory Contents (Address A2h)

Addr.	Hex	Note	Addr.	Hex	Note	Addr.	Hex	Note	Addr.	Hex	Note
0	4B	Temp. High Alarm (75°C)	32	4D	Rx Power High Alarm (3dBm)	64	00	For External Cal.	96		Real Time Temp. MSB
1	00		33	F1		65	00		For External Cal.	97	
2	FB	Temp. Low Alarm(-5°C)	34	02	Rx Power Low Alarm (-12.3dBm)	66	00	For External Cal.	98		Real Time Vcc MSB
3	00		35	4D		67	00		For External Cal.	99	
4	49	Temp. High Warming(73°C)	36	3D	Rx Power High Warming (2dBm)	68	3F	For External Cal.	100		Real Time Tx Bias MSB
5	00		37	E9		69	80		For External Cal.	101	
6	00	Temp. Low Warming (0°C)	38	03	Rx Power Low Warming(-10.3dBm)	70	00	For External Cal.	102		Real Time Tx Pwr MSB
7	00		39	A5		71	00		For External Cal.	103	
8	8C	Voltage High Alarm (3.6V)	40	00	Reserved	72	00	For External Cal.	104		Real Time Rx Pwr MSB
9	A0		41	00	Reserved	73	00		For External Cal.	105	
10	75	Voltage Low Alarm(3.0V)	42	00	Reserved	74	00	For External Cal.	106		Reserved
11	30		43	00	Reserved	75	00		For External Cal.	107	
12	88	Voltage High Warming(3.5V)	44	00	Reserved	76	01	For External Cal.	108		Reserved
13	B8		45	00	Reserved	77	00		For External Cal.	109	
14	79	Voltage Low Warming (3.1V)	46	00	Reserved	78	00	For External Cal.	110		Tx Dis, Tx Fault, Rx Los
15	18		47	00	Reserved	79	00		For External Cal.	111	
16	AF	Tx Bias High Alarm(90mA)	48	00	Reserved	80	01	For External Cal.	112		Alarm Flag
17	C8		49	00	Reserved	81	00		For External Cal.	113	
18	03	Tx Bias Low Alarm(2mA)	50	00	Reserved	82	00	For External Cal.	114		Reserved
19	E8		51	00	Reserved	83	00		For External Cal.	115	
20	9C	Tx Bias High Warming(80mA)	52	00	Reserved	84	01	For External Cal.	116		Warming Flag
21	40		53	00	Reserved	85	00		For External Cal.	117	
22	07	Tx Bias Low Warming(4mA)	54	00	Reserved	86	00	For External Cal.	118		RS1 Select
23	D0		55	00	Reserved	87	00		For External Cal.	119	
24	4D	Tx Power High Alarm (3dBm)	56	00	For External Cal.	88	01	For External Cal.	120		Vendor Specific
25	F1		57	00	For External Cal.	89	00		For External Cal.	121	
26	13	Tx Power Low Alarm(-3dBm)	58	00	For External Cal.	90	00	For External Cal.	122		
27	94		59	00	For External Cal.	91	00		For External Cal.	123	
28	3D	Tx Power High Warming(2dBm)	60	00	For External Cal.	92	00	For External Cal.	124		
29	E9		61	00	For External Cal.	93	00		For External Cal.	125	
30	18	Tx Power Low Warming (-2dBm)	62	00	For External Cal.	94	00	For External Cal.	126		
31	6A		63	00	For External Cal.	95			Check Sum	127	

Note: Address 128 – 247: customer R/W eeprom. Address 248 – 255: Vendor Specific.

REVISION HISTORY

Version	Subject	Release Date
1.0	Initial datasheet	2019/6/14
2.0	Add two CWDM wavelengths 1350 nm and 1370nm	2020/4/30
3.0	Add SPS-2502AW-CXX0G	2021/1/21