

### SPS-2110VWG / SPS-2110BVWG / SPS-2110AVWG

(RoHS Compliant)

### 12 Gb/s / 1310 nm Medium Power SM Video Digital Diagnostic SFP+ Transceiver

#### FEATURES

- SMPTE 2082, SMPTE 424M, SMPTE 292M, SMPTE 259M, and DVB-ASI Compatible
- Hot-Pluggable SFP Footprint LC Optical Transceiver
- Small Form-Factor Pluggable (SFP) MSA compatible
- Speed up to 12 Gb/s
- Distance up to 10 km for 12G-SDI
- Reclocker built-in
- Support Video Pathological Patterns for HD-SDI, 3G-SDI, 6G-SDI, and 12G-SDI
- SFF-8472 Digital Diagnostic Function
- Single +3.3 V Power Supply
- RoHS Compliant
- 0 to 70°C Operation: SPS-2110VWG
- -10 to 85°C Operation: SPS-2110BVWG
- -40 to 85°C Operation: SPS-2110AVWG
- Class 1 Laser International Safety Standard IEC-60825 Compliant

#### APPLICATIONS

- SMPTE 2082 Compliant Electrical-to-Optical Interfaces
- High-density Video Routers

#### DESCRIPTION

The SPS-2110VWG series is a single mode transceiver module designed to transmit/receive optical serial digital signals as defined in SMPTE 2082, SMPTE 424M, SMPTE 292M, SMPTE 259M, and DVB-ASI. It supports up to 12Gbps and is specifically designed to transmit the pathological patterns for HD-SDI, 3G-SDI, 6G-SDI, and 12G-SDI. 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. The transmitter section uses a 1310 nm 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 limiting post-amplifier IC. A maximum distance of 10 km is achievable with 12Gbps pathological signals.

#### 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.	Type	Bit Rate (Gb/s)	TX		RX		Package	Temp (°C)	RoHS Compliant
			λ (nm)	Power (dBm)	λ (nm)	Sen. (dBm)			
SPS-2110VWG	Transceiver	Up to 12	1310 DFB	1 to -5	1260/1620	-2 to -13	LC SFP+ with DMI	0 to 70	Yes
SPS-2110BVWG	Transceiver	Up to 12	1310 DFB	1 to -5	1260/1620	-2 to -13	LC SFP+ with DMI	-10 to 85	Yes
SPS-2110AVWG	Transceiver	Up to 12	1310 DFB	1 to -5	1260/1620	-2 to -13	LC SFP+ with DMI	-40 to 85	Yes

#### Absolute Maximum Ratings

Parameter	Symbol	Min	Max	Units	Notes
Storage Temperature	Tstg	-40	85	°C	
Operating Case Temperature	Topr	0	70	°C	SPS-2110VWG SPS-2110BVWG SPS-2110AVWG
		-10	85		
		-40	85		
Power Supply Voltage	Vcc	-0.5	3.6	V	

#### Recommended Operating Conditions

Parameter	Symbol	Min	Typ	Max	Units / Notes
Power Supply Voltage	Vcc	3.13	3.3	3.47	V
Operating Case Temperature	Topr	0		70	°C / SPS-2110VWG
		-10		85	°C / SPS-2110BVWG
		-40		85	°C / SPS-2110AVWG
Power Supply Current	I <sub>CC</sub> (TX+RX)		500	550	mA
Data Rate			11.88		Gb/s

Transmitter Optical Specifications (0°C < Topr < 70°C, 3.13V < Vcc < 3.47V)						
Parameter	Symbol	Min	Typ	Max	Units	Notes
Average Launch Power	PO, Avg	-5		1	dBm	1
Output Center Wavelength	$\lambda_c$	1260	1310	1360	nm	
Output Spectrum Width	$\sigma_\lambda$			1	nm	-20 dB width
Side Mode Suppression Ratio	SMSR	30			dB	
Extinction Ratio	ER	3.5				
Relative Intensity Noise	RIN			-128	dB/Hz	
Average Launch Power of OFF Transmitter				-30	dBm	

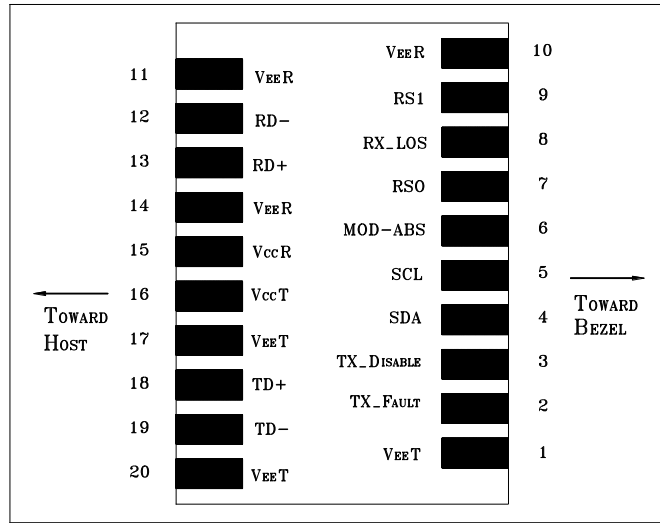
1. Output power is power coupled into a 9/125  $\mu\text{m}$  single-mode fiber.

Receiver Optical Specifications (0°C < Topr < 70°C, 3.13V < Vcc < 3.47V)						
Parameter	Symbol	Min	Typ	Max	Units	Notes
Sensitivity@11.88Gb/s	Sen			-13	dBm	2
Sensitivity@6Gb/s	Sen			-14	dBm	2
Sensitivity@2.97Gb/s	Sen			-14	dBm	2
Sensitivity@1.485Gb/s	Sen			-14	dBm	2
Receiver Overload	P <sub>MAX</sub>	-2	---		dBm	
LOS -- Deasserted	LOS <sub>D</sub>	---	---	-14	dBm	Transition: low to high
LOS -- Asserted	LOS <sub>A</sub>	-30	---	---	dBm	Transition: high to low
LOS Hysteresis	Hys	0.5	2		dB	
Wavelength of Operation	$\lambda_c$	1260		1620	nm	

2. Measured with pathological pattern @ 1310nm; BER < 10<sup>-12</sup>.

Electrical Characteristics						
Parameter	Symbol	Min	Typ	Max	Units	Notes
<b>High-Speed Signal (CML) Interface Specification</b>						
Input Data Rate			11.88		Gb/s	
Differential Input Impedance	Rin		100		$\Omega$	
Output Data Rate			11.88		Gb/s	
Differential Output Impedance	Rout		100		$\Omega$	
<b>Low-Speed Signal (LVTTTL) Interface Specification</b>						
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	

### CONNECTION DIAGRAM



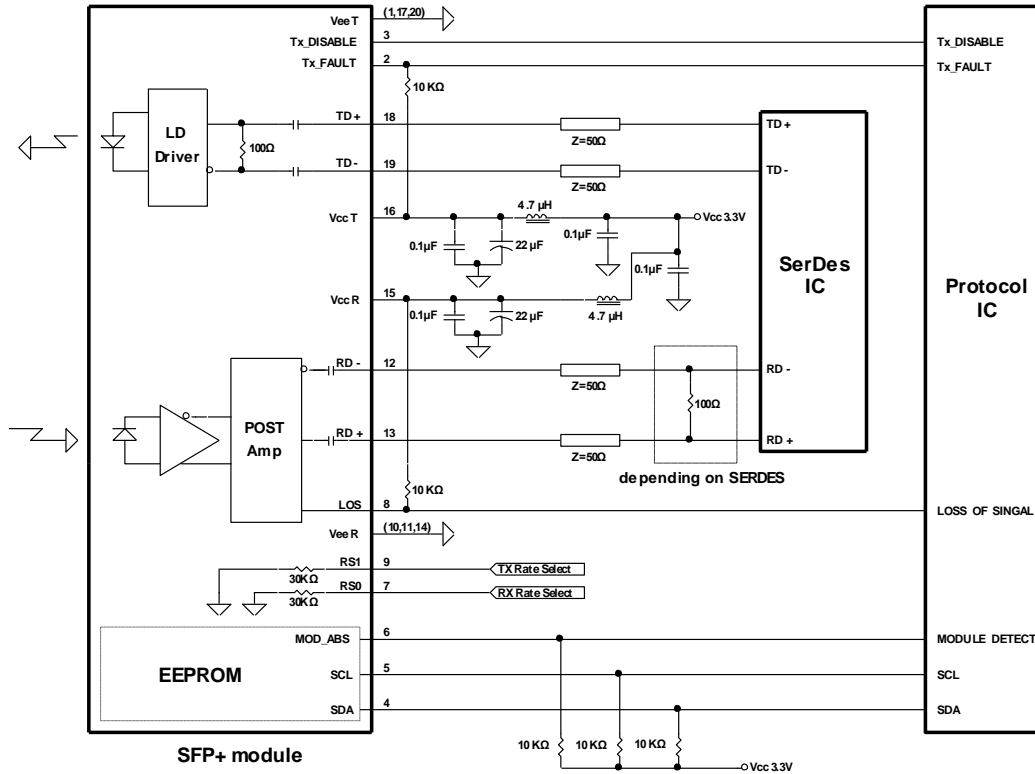
PIN	Signal Name	Description	PIN	Signal Name	Description
1	VEET	Transmitter Signal Ground	11	VEER	Receiver Signal Ground
2	TX_Fault	Transmitter Fault Indication. Logic "1" Output = Laser Fault. Logic "0" Output = Normal Operation	12	RD-	Inverse Receiver Data Out
3	TX_Disable	Logic "1" Input (or no connection) = Laser off, Logic "0" = Laser on.	13	RD+	Receiver Data Out
4	SDA	Modulation Definition 2 – Two wires serial ID Interface	14	VEER	Receiver Signal Ground
5	SCL	Modulation Definition 1 – Two wires serial ID Interface	15	VccR	Receiver Power – 3.3V±5%
6	MOD-ABS	Modulation Definition 0 – Ground in Module	16	VccT	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	VEET	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	VEER	Receiver Signal Ground	20	VEET	Transmitter Signal Ground

### Module Definition

Module Definition	MOD-DEF2 PIN 4	MOD-DEF1 PIN 5	MOD-DEF0 PIN 6	Interpretation by Host
4	SDA	SCL	LV-TTL Low	Serial module definition protocol

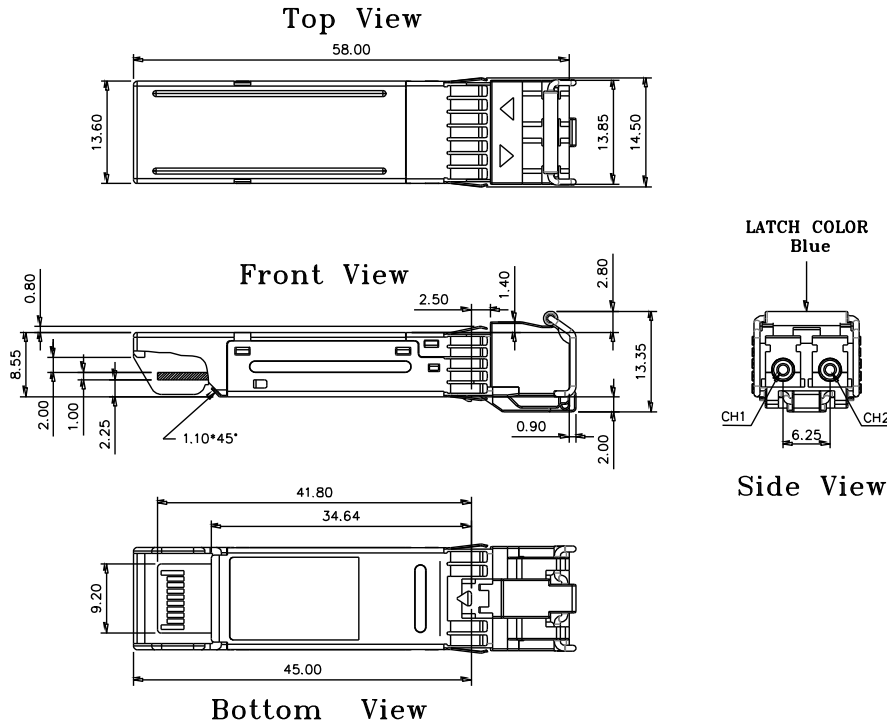
Module Definition 4 specifies a serial definition protocol. For this definition, upon power up, MOD-DEF(1:2) appear as no connector (NC) and MOD-DEF(0) is TTL LOW. When the host system detects this condition, it activates the serial protocol. The protocol uses the 2-wire serial CMOS E<sup>2</sup>PROM 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.

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**REVISION HISTORY**

Version	Subject	Release Date
1.0	Initial datasheet	2017/5/19
2.0	1. Add "Reclocker built-in". 2. Revise power supply current 3. Revise recommended circuit schematic 4. Revise package diagram	2017/11/23
3.0	Update sensitivity specification as -13dBm @ 12G and -14dBm @ 6G/3G/1.5G	2019/1/25
4.0	Add SPS-2110BVWG , SPS-2110AVWG	2022/12/1