

SPM-4100RWG / SPM-4100BRWG / SPM-4100ARWG (RoHS Compliant)  
**6.144 Gbps / 850 nm Digital Diagnostic Multi-Rate CPRI MM SFP+**

## FEATURES

- CPRI / OBSAI Compatible Optical Interface
- 1G to 6.25G Multi-rate Specification
- Complaint to SFP+ MSA
- Link Distance
  - 300 m links with OM3 MMF Cables
  - 82 m links with OM2 MMF Cables
  - 33 m links with OM1 MMF Cables
- SFF-8472 Digital Diagnostic Function
- AC/AC Coupling according to MSA
- Single +3.3 V Power Supply
- RoHS Compliant
- 0 to 70°C Operating: SPM-4100RWG
- -10 to 85°C Operating: SPM-4100BRWG
- -40 to 85°C Operating: SPM-4100ARWG
- Class 1 Laser International Safety Standard IEC 60825 Compliant

## APPLICATIONS

- Radio Base Station
- OBSAI rates 6.144 Gb/s, 3.072 Gb/s, and 1.563 Gb/s
- CPRI rates 6.144Gb/s, 4.9152 Gb/s, 2.4576 Gb/s, and 1.2288 Gb/s

## ORDER INFORMATION

P/No.	Bit Rate (Gb/s)	Distance (m)	Wavelength (nm)	Package	Temp. (°C)	RoHS Compliant
SPM-4100RWG	1 to 6.25	300 / 82/ 33*	850 VCSEL	SFP+ with DMI	0 to 70	Yes
SPM-4100BRWG	1 to 6.25	300 / 82/ 33*	850 VCSEL	SFP+ with DMI	-10 to 85	Yes
SPM-4100ARWG	1 to 6.25	300 / 82/ 33*	850 VCSEL	SFP+ with DMI	-40 to 85	Yes

\*: 300m for OM3 MMF , 82m for OM2 MMF and 33 m for OM1 MMF.

Absolute Maximum Ratings					
Parameter	Symbol	Min	Max	Units	Notes
Storage Temperature	Tstg	-40	85	°C	
Operating Case Temperature	Topr	0	70	°C	SPM-4100RWG
		-10	85		SPM-4100BRWG
		-40	85		SPM-4100ARWG
Operating Relative Humidity	RH	5	95	%	Non condensing
Power Supply Voltage	Vcc	0	4	V	

Recommended Operating Conditions					
Parameter	Symbol	Min	Typ	Max	Units / Notes
Power Supply Voltage	Vcc	3.14	3.3	3.46	V
Operating Case Temperature	Topr	0		70	°C / SPM-4100RWG
		-10		85	°C / SPM-4100BRWG
		-40		85	°C / SPM-4100ARWG
Power Supply Current	I <sub>CC(TX+RX)</sub>		135	180	mA

## DESCRIPTION

The SPM-4100RWG series is a 1 to 6.25Gb/s multi-mode transceiver module for serial optical data communication applications for a radio base station system. 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 multi-mode fiber and operates at a nominal wavelength of 850 nm. The transmitter section uses a Vertical Cavity Surface Emitted Laser (VCSEL) and is a Class 1 laser compliant according to International Safety Standard IEC 60825. The receiver section uses an integrated GaAs detector preamplifier (IDP) mounted in an optical header and a limiting post-amplifier IC.

## LASER SAFETY

This multi-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.

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Data Rate		1		6.25	Gb/s
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**Transmitter Optical Specifications (0°C < Topr < 70°C, 3.13V < Vcc < 3.47V)**

Parameter	Symbol	Min	Typ	Max	Units	Notes
Average Launch Power	$P_{O,AVG}$	-8.2		-1	dBm	1
Optical Modulation Amplitude	$P_{O,OMA}$	-5.2			dBm	
Extinction Ratio	ER	3.0			dB	
Output Center Wavelength	$\lambda_c$	840		860	nm	
Output Spectrum Width	$\sigma_\lambda$			0.65	nm	RMS ( $\sigma$ )
Average Launch Power of TX Off				-30	dBm	
Relative Intensity Noise	RIN			-128	dB/Hz	

1. Output power is power coupled into a 50/125  $\mu\text{m}$  multi-mode fiber.

**Receiver Optical Specifications (0°C < Topr < 70°C, 3.13V < Vcc < 3.47V)**

Parameter	Symbol	Min	Typ	Max	Units	Notes
Sensitivity	Sens			-12	dBm	2, average power
Receiver Overload	$P_{MAX}$	-1.0	---		dBm	
LOS -- Deasserted	$LOS_D$	---	---	-12	dBm	Transition: low to high
LOS -- Asserted	$LOS_A$	-20	---	---	dBm	Transition: high to low
Wavelength of Operation	$\lambda_c$	840		860	nm	
Optical Return Loss	ORL			-12	dB	

2. A valid 8B/10B encoded input is required for receiver sensitivity specification.

**Electrical Characteristics**

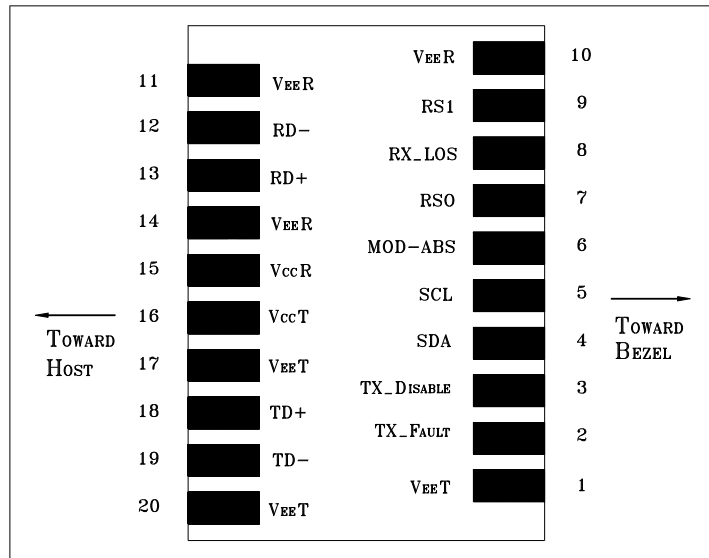
Parameter	Symbol	Min	Typ	Max	Units	Notes
<b>High-Speed Signal (CML) Interface Specification</b>						
Input Data Rate		1		6.25	Gb/s	
Differential Input Impedance	$R_{in}$		100		$\Omega$	
Differential Data Input Amplitude		150		700	mVpp	Internally AC coupled
Output Data Rate		1		6.25	Gb/s	
Differential Output Impedance	$R_{out}$		100		$\Omega$	
Differential Data Output Amplitude		350	600	700	mVpp	Internally AC coupled
<b>Low-Speed Signal (LVTTTL) Interface Specification</b>						
Input High Voltage		2.0		$V_{cc}+0.3$	V	
Input Low Voltage		GND		0.8	V	
Output High Voltage		2.4		$V_{cc}$	V	
Output Low Voltage		GND		0.5	V	

**LINK LENGTH**

Data Rate / Standard	Fiber Type	Model Bandwidth @ 850nm (MHz-km)	Distance Range (m)
6.144 Gb/s	62.5/125 $\mu\text{m}$ MMF	160	26 (FDDI-Graded)
	62.5/125 $\mu\text{m}$ MMF	200	33 (OM1)
	50/125 $\mu\text{m}$ MMF	400	66
	50/125 $\mu\text{m}$ MMF	500	82 (OM2)
	50/125 $\mu\text{m}$ MMF	2000	300 (OM3)

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### CONNECTION DIAGRAM



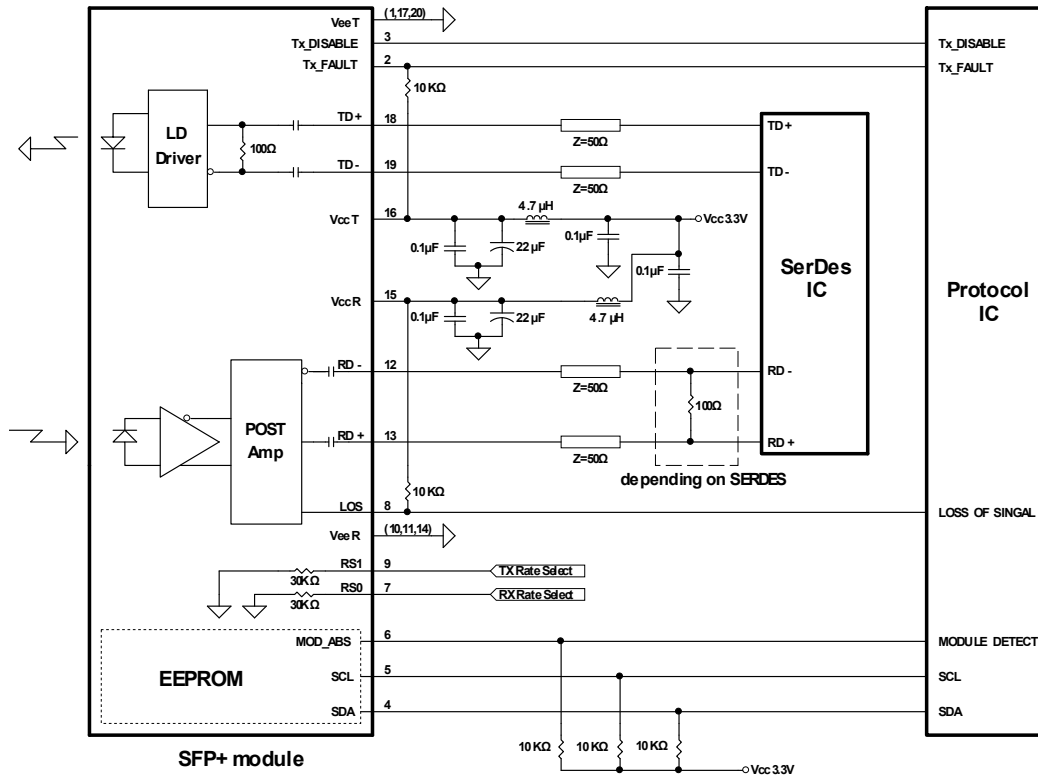
PIN	Signal Name	Description	PIN	Signal Name	Description
1	V <sub>EE</sub> T	Transmitter Signal Ground	11	V <sub>EE</sub> R	Receiver Signal Ground
2	TX_Fault	Transmitter Fault Indication. Logic “1” Output = Laser Fault. Logic “0” Output = Normal Operation	12	RD-	Inverse Receiver Data Out
3	TX_Disable	Logic “1” Input (or no connection) = TX off, Logic “0” = TX 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 Absent, connected to V <sub>EE</sub> T or V <sub>EE</sub> R in the module.	16	V <sub>CC</sub> 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 <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. 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 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 E<sup>2</sup>PROM protocol of the ATMEL AT24C01A/02/04 family of components.

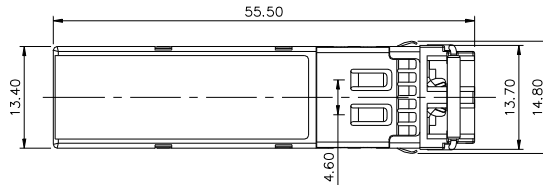
### RECOMMENDED CIRCUIT SCHEMATIC



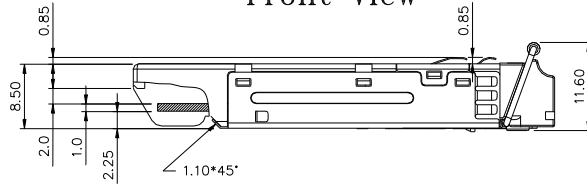
### PACKAGE DIAGRAM

Units in mm

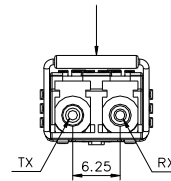
Top View



Front View

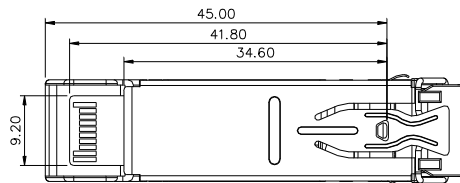


LATCH COLOR  
BLACK



Side View

Bottom View



Note: Specifications subject to change without notice.

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**REVISION HISTORY**

Version	Subject	Release Date
1.0	Initial datasheet	2009/7/1
2.0	Extend data rate from 1 Gb/s to 6.25Gb/s	2010/9/1
3.0	Update RX LOS asserted/deasserted	2011/9/1
3.1	Add 6.144Gb/s to CPRI rates	2017/9/15