

SPS-4140RWG / SPS-4140BRWG / SPS-4140ARWG

(RoHS Compliant)

6.144 Gbps / 1310 nm / 40 km Digital Diagnostic Multi-Rate CPRI SM SFP+

FEATURES

- CPRI / OBSAI Compatible Optical Interface
- 1G to 6.25G Multi-rate Specification
- Complaint to SFP+ MSA
- Link Distance up to 40 km SMF
- 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-4140RWG
- -10 to 85°C Operating: SPS-4140BRWG
- -40 to 85°C Operating: SPS-4140ARWG
- 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

DESCRIPTION

The SPS-4140RWG series is a 1 to 6.25 Gb/s single-mode transceiver module for serial optical communications 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 I²C. This module is designed for single mode fiber and operates at a nominal wavelength of 1310 nm. 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.

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) | Distance (km) | Wavelength (nm) | Package | Temp. (°C) | RoHS Compliant |
|---------------------|-----------------|---------------|-----------------|---------------|------------------|----------------|
| SPS-4140RWG | 1 to 6.25 | 20 | 1310 DFB | SFP+ with DMI | 0 to 70 | Yes |
| SPS-4140BRWG | 1 to 6.25 | 20 | 1310 DFB | SFP+ with DMI | -10 to 85 | Yes |
| SPS-4140ARWG | 1 to 6.25 | 20 | 1310 DFB | 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 -10 -40 | 70 85 85 | °C | SPS-4140RWG SPS-4140BRWG SPS-4140ARWG |
| Operating Relative Humidity | RH | 5 | 95 | % | Non condensing |
| 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 -10 -40 | | 70 85 85 | °C / SPS-4140RWG °C / SPS-4140BRWG °C / SPS-4140ARWG |
| Power Supply Current | I _{CC(TX+RX)} | | 250 | 300 | mA |
| Data Rate | | 1 | | 6.25 | 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 | $P_{O, Avg}$ | 1 | | 4 | dBm | 1 |
| Extinction Ratio | ER | 3.5 | | | mW | |
| Output Center Wavelength | λ_c | 1260 | 1310 | 1360 | nm | |
| Output Spectrum Width | σ_λ | | | 1 | nm | -20 dB width |
| Side Mode Suppression Ratio | SMSR | 30 | | | dB | |
| Optical Rise / Fall Time | t_r / t_f | | | 70 | ps | 20 % to 80 %, unfiltered |
| Relative Intensity Noise | RIN | | | -128 | dB/Hz | |
| Average Launch Power of OFF Transmitter | | | | -30 | dBm | |

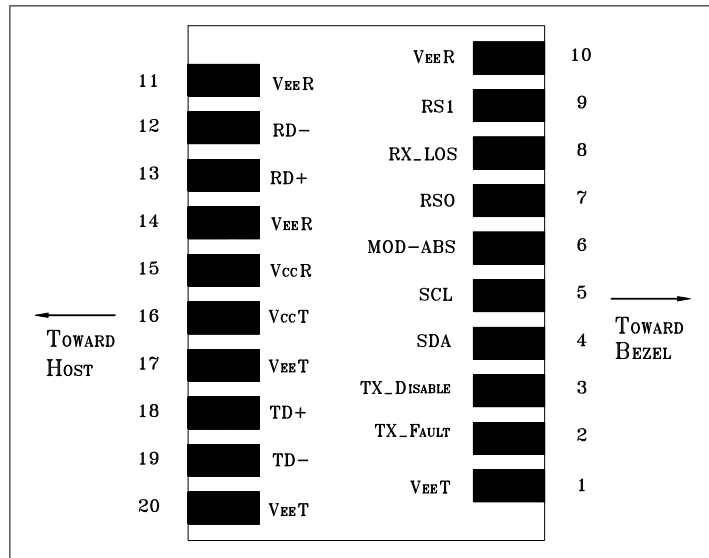
1. Output power is power coupled into a 9/125 μ m single-mode fiber.

| Receiver Optical Specifications (0°C < Topr < 70°C, 3.13V < Vcc < 3.47V) | | | | | | |
|--|-------------|------|-----|------|-------|-------------------------|
| Parameter | Symbol | Min | Typ | Max | Units | Notes |
| Sensitivity | Sens | | | -15 | dBm | 2, average power |
| Receiver Overload | P_{MAX} | 0.5 | --- | | dBm | |
| LOS -- Deasserted | LOS_D | --- | --- | -16 | dBm | Transition: low to high |
| LOS -- Asserted | LOS_A | -30 | --- | --- | dBm | Transition: high to low |
| Wavelength of Operation | λ_c | 1260 | | 1565 | 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 |
| High-Speed Signal (CML) Interface Specification | | | | | | |
| Input Data Rate | | 1 | | 6.25 | Gb/s | |
| Differential Input Impedance | R_{in} | | 100 | | Ω | |
| Differential Data Input Amplitude | | 150 | | 1200 | mVpp | Internally AC coupled |
| Output Data Rate | | 1 | | 6.25 | Gb/s | |
| Differential Output Impedance | R_{out} | | 100 | | Ω | |
| Differential Data Output Amplitude | | 350 | 600 | 700 | mVpp | Internally AC coupled |
| Low-Speed Signal (LVTTTL) Interface Specification | | | | | | |
| 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 | |

CONNECTION DIAGRAM



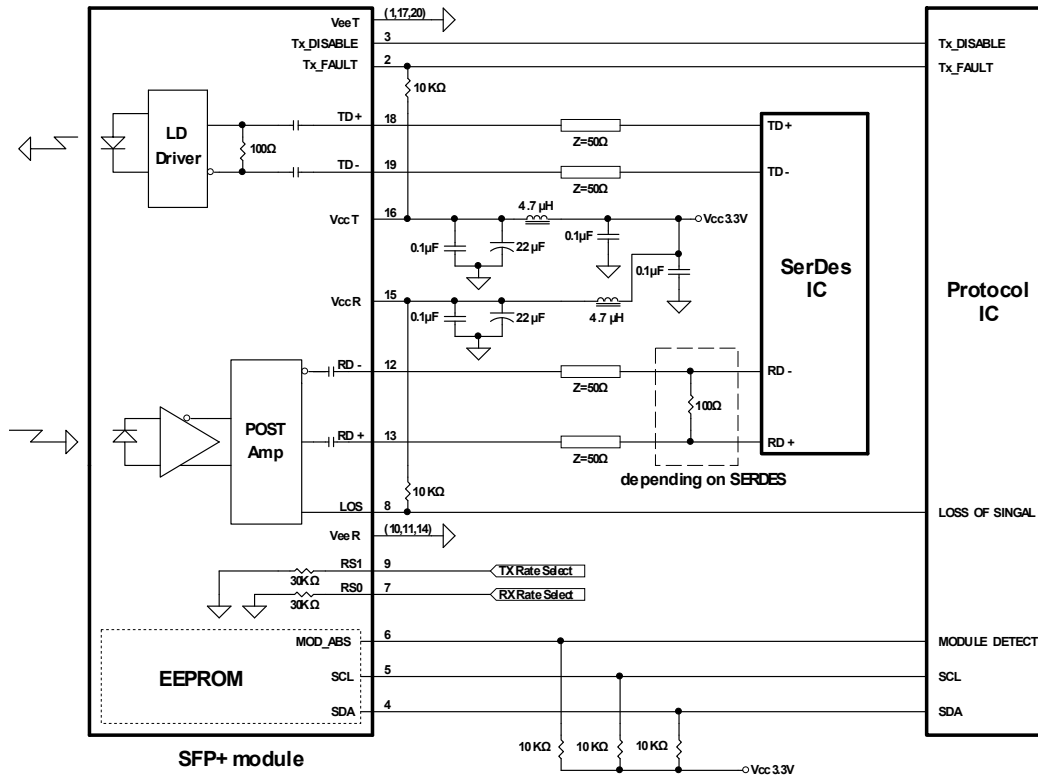
| PIN | Signal Name | Description | PIN | Signal Name | Description |
|-----|-------------------|---|-----|-------------------|-----------------------------|
| 1 | V _{EE} T | Transmitter Signal Ground | 11 | V _{EE} R | Receiver Signal Ground |
| 2 | TX_Fault | Transmitter Fault Indication. Logic “1” 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 (LVTTL). 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 (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 _{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.

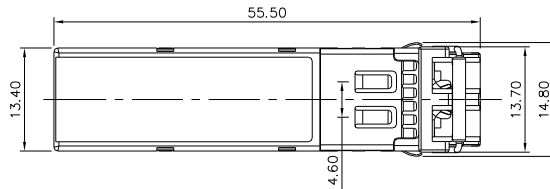
RECOMMENDED CIRCUIT SCHEMATIC



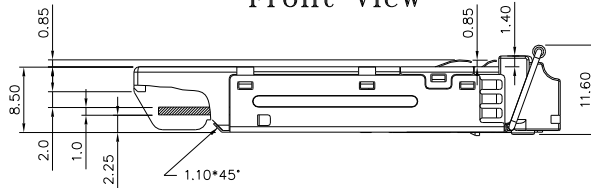
PACKAGE DIAGRAM

Units in mm

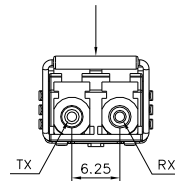
Top View



Front View

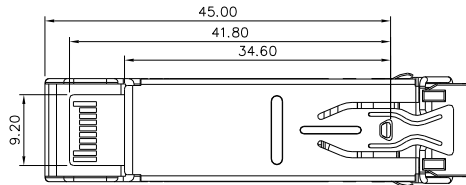


LATCH COLOR
BLUE : SM



Side View

Bottom View



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 |
| 2.1 | Add 6.144Gb/s to CPRI rates | 2017/9/15 |
| | | |
| | | |