

## SPS-9350VW-1T1RG

**(RoHS Compliant)**

**1550 nm / 3 Gb/s Medium Power Optical SM Digital Diagnostic Transmitter/Receiver**

### FEATURES

- | SMPTE 297-2006 Compatible
- | Speed from 50 Mbps to 3Gbps with up to 50 km Single-mode Fiber
- | Distance up to 50 km for 3G-SDI
- | **Support Video Pathological Patterns for SD-SDI, HD-SDI and 3G-SDI**
- | Single Transmitter with Simplex LC
- | Single Receiver with Simplex LC
- | Based on Industry Standard SFP
- | SFF-8472 Digital Diagnostic Function
- | TTL Laser Disable Input
- | TTL TX\_Fault Output
- | TTL RX\_LOS Output
- | Single +3.3 V Power Supply
- | RoHS-6 Compliant
- | 0 to 70°C Operation
- | Hot Pluggable
- | Class 1 Laser International Safety Standard IEC-60825 Compliant

### DESCRIPTION

The SPS-9350VW-1T1RG is a optical single mode transmitter/receiver module designed to transmit/receive optical serial digital signals as defined in SMPTE 297-2006. It supports from 50 Mbps to 3 Gbps and is specifically designed for transmitted the SMPTE 259M, SMPTE 344M, SMPTE 292M and SMPTE 424M SDI pathological patterns. 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. It is with 1550 nm DFB laser transmitters. The transmitter can transmit signal from 50 Mbps to 3 Gbps with up to 50 km of single-mode fiber. A maximum distance of 50 km is achievable with 3Gbps 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.

### APPLICATIONS

- | SMPTE 297-2006 Compliant Electrical-to-Optical Interfaces
- | High-density Video Routers

### ORDER INFORMATION

| P/No.                   | Type      | Bit Rate (Mb/s) | TX       |             | RX        |            | Package         | Temp (°C) | RoHS Compliant |
|-------------------------|-----------|-----------------|----------|-------------|-----------|------------|-----------------|-----------|----------------|
|                         |           |                 | λ (nm)   | Power (dBm) | λ (nm)    | Sen. (dBm) |                 |           |                |
| <b>SPS-9350VW-1T1RG</b> | 1-TX+1-RX | 50 to 3000      | 1550 DFB | 4 to 0      | 1260/1620 | 0 to -20   | LC SFP with DMI | 0 to 70   | Yes            |

### RELATED PRODUCTS

| P/No.          | Type | Bit Rate (Mb/s) | TX       |             | RX        |            | Package         | Temp (°C) | RoHS Compliant |
|----------------|------|-----------------|----------|-------------|-----------|------------|-----------------|-----------|----------------|
|                |      |                 | λ (nm)   | Power (dBm) | λ (nm)    | Sen. (dBm) |                 |           |                |
| SPS-9350VW-2TG | 2-TX | 50 to 3000      | 1550 DFB | 4 to 0      |           |            | LC SFP with DMI | 0 to 70   | Yes            |
| SPS-9350VW-1TG | 1-TX | 50 to 3000      | 1550 DFB | 4 to 0      |           |            | LC SFP with DMI | 0 to 70   | Yes            |
| SPS-9110VW-2RG | 2-RX | 50 to 3000      |          |             | 1260/1620 | 0 to -20   | LC SFP with DMI | 0 to 70   | Yes            |
| SPS-9110VW-1RG | 1-RX | 50 to 3000      |          |             | 1260/1620 | 0 to -20   | LC SFP with DMI | 0 to 70   | Yes            |

### LINK DISTANCE

| Transmitter  | Receiver   | SDI    | Bit Rate  | Max. Link Distance (km) |
|--|--|--------|-----------|-------------------------|
| SPS-9350VW-2TG or<br>SPS-9350VW-1TG or<br>SPS-9350VW-1T1RG | SPS-9110VW-2RG or<br>SPS-9110VW-1RG or<br>SPS-9110VW-1T1RG | 3G-SDI | 2.97Gbps  | 50                      |
|  |  | HD-SDI | 1.485Gbps | 50                      |
|  |  | SD-SDI | 270Mbps   | 50                      |

## Absolute Maximum Ratings

Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

| Absolute Maximum Ratings   |        |     |     |        |                |
|----------------------------|--------|-----|-----|--------|----------------|
| Parameter                  | Symbol | Min | Max | Units  | Notes          |
| Storage Temperature        | Tstg   | -40 | 85  | °C     |                |
| Operating Case Temperature | Tc     | 0   | 70  | °C     |                |
| Power Supply Voltage       | Vcc    | 0   | 4   | V      |                |
| ESD Tolerance on all pins  |        |     | 1   | KV HBM |                |
| Relative Humidity          | ---    | 5   | 95  | % RH   | non-condensing |

| Recommended Operating Conditions |        |      |     |      |               |
|----------------------------------|--------|------|-----|------|---------------|
| Parameter                        | Symbol | Min  | Typ | Max  | Units / Notes |
| Power Supply Voltage             | Vcc    | 3.13 | 3.3 | 3.47 | V             |
| Operating Case Temperature       | Tc     | 0    |     | 70   | °C            |
| Baud Rate                        |        | 50   |     | 3000 | Mb/s          |
| Power Supply Current             | Icc    |      | 200 | 300  | mA            |

| Transmitter Specifications (0°C < Tc < 70°C, 3.13V < Vcc < 3.47V) |                                   |      |      |         |       |                    |
|---|-----------------------------------|------|------|---------|-------|--------------------|
| Parameter   | Symbol                            | Min  | Typ  | Max     | Units | Notes              |
| <b>Optical</b>  |                                   |      |      |         |       |                    |
| Optical Transmit Power  | Po                                | 0    |      | 4       | dBm   | 1                  |
| Output Center Wavelength  | $\lambda$                         | 1480 | 1550 | 1580    | nm    |                    |
| Output Spectrum Width   | $\Delta\lambda$                   | ---  |      | 1       | nm    | -20 dB width       |
| Side Mode Suppression Ratio                                       | SMSR                              | 30   |      |         | dB    |                    |
| Extinction Ratio  | ER                                | 5    | 7.5  |         | dB    |                    |
| Relative Intensity Noise  | RIN                               |      |      | -120    | dB/Hz |                    |
| Optical Rise Time / Fall Time                                     | tr / tf                           |      |      | 135     | ps    | 2, SMPTE 424M      |
|   |                                   |      |      | 270     | ps    | 2, SMPTE 292M      |
|   |                                   |      |      | 800     | ps    | 2, SMPTE 344M      |
|   |                                   |      |      | 1.5     | ns    | 2, SMPTE 259M      |
| <b>Electrical</b>   |                                   |      |      |         |       |                    |
| Differential Input Voltage  | V <sub>IH</sub> - V <sub>IL</sub> | 200  |      | 1200    | mVp-p | AC coupled input   |
| Disable Input Voltage -- Low                                      | V <sub>TDIS,L</sub>               | 0    |      | 0.8     | V     | TX Output Enabled  |
| Disable Input Voltage -- High                                     | V <sub>TDIS,H</sub>               | 2.0  |      | Vcc+0.3 | V     | TX Output Disabled |
| Output TX_Fault -- Low  | V <sub>OL</sub>                   | 0    |      | 0.5     | V     |                    |
| Output TX_Fault -- High   | V <sub>OH</sub>                   | 2.5  |      | Vcc+0.3 | V     |                    |
| SCL, SDA  | V <sub>OH</sub>                   | 2.5  |      | Vcc+0.3 | V     |                    |
|   | V <sub>OL</sub>                   | 0    |      | 0.5     | V     |                    |

1. Output power is power coupled into a 9/125  $\mu$ m single mode fiber.
2. 20% to 80%, unfiltered.

| Receiver Specifications (0°C < Tc < 70°C, 3.13V < Vcc < 3.47V) |        |      |     |      |       |                                    |
|--|--------|------|-----|------|-------|------------------------------------|
| Parameter  | Symbol | Min  | Typ | Max  | Units | Notes                              |
| <b>Optical</b>   |        |      |     |      |       |                                    |
| Wavelength of Operation  |        | 1260 | --- | 1620 | nm    |                                    |
| Sensitivity for SMPTE 424M<br>2.97 Gb/s                        | Sen    | 0    | --- | -18  | dBm   | Pathological                       |
|  |        | 0    | --- | -20  | dBm   | PRBS 2 <sup>23</sup> -1, BER=1E-12 |
| Sensitivity for SMPTE 292M<br>1.485 Gb/s                       | Sen    | 0    | --- | -20  | dBm   | Pathological                       |
|  |        | 0    | --- | -21  | dBm   | PRBS 2 <sup>23</sup> -1, BER=1E-12 |
| Signal Detect -- Asserted                                      | Pa     | ---  | --- | -20  | dBm   | Transition: low to high            |
| Signal Detect -- Deasserted                                    | Pd     | -29  | --- | ---  | dBm   | Transition: high to low            |
| Signal detect -- Hysteresis                                    |        | 1    |     | 6    | dB    |                                    |

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|                               |                 |     |     |                      |       |  |
|-------------------------------|-----------------|-----|-----|----------------------|-------|--|
| Optical Return Loss           |                 |     | -27 |                      | dB    |  |
| <b>Electrical</b>             |                 |     |     |                      |       |  |
| CML Output (Differential)     |                 | 550 | 660 | 850                  | mVp-p | AC coupled output                        |
| Optical Rise Time / Fall Time | tr / tf         |     |     | 135                  | ps    | 3, SMPTE 424M                            |
|                               |                 |     |     | 270                  | ps    | 3, SMPTE 292M                            |
|                               |                 |     |     | 800                  | ps    | 3, SMPTE 344M                            |
|                               |                 |     |     | 1.5                  | ns    | 3, SMPTE 259M                            |
| Output LOS Voltage -- Low     | V <sub>OL</sub> | 0   |     | 0.5                  | V     | I <sub>OL</sub> =-1.6mA, 1 TTL unit load |
| Output LOS Voltage -- High    | V <sub>OH</sub> | 2.5 |     | V <sub>CC</sub> +0.3 | V     | I <sub>OH</sub> =40μA, 1 TTL unit load   |
| SCL, SDA                      | V <sub>OH</sub> | 2.5 |     | V <sub>CC</sub> +0.3 | V     |  |
|                               | V <sub>OL</sub> | 0   |     | 0.5                  | V     |  |

3. 20% to 80%, unfiltered.

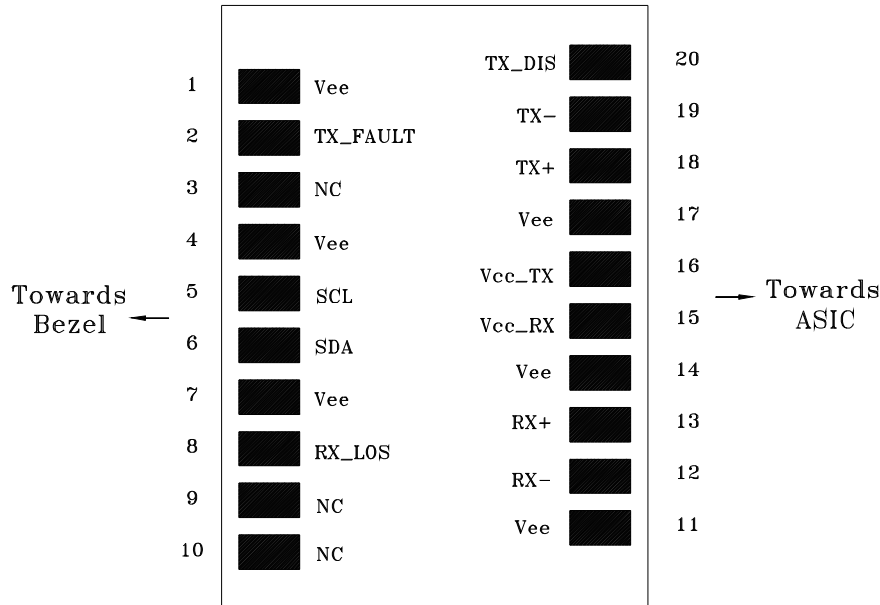
## MODULE DEFINITION

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

Module Definition 4 specifies a serial definition protocol. For this definition, upon power up, SCL and SDA appear as no connector (NC). 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.

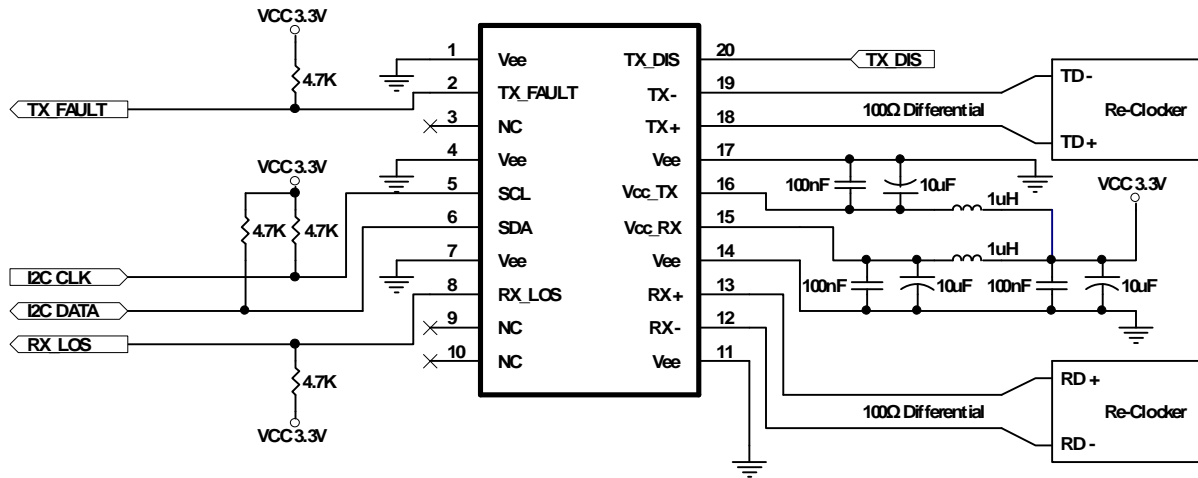
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CONNECTION DIAGRAM



| PIN | Name     | Function  | Notes  |
|-----|----------|---|--|
| 1   | Vee      | Signal Ground   |  |
| 2   | TX_Fault | Transmitter Fault Indicator (Active high, open-drain)       |  |
| 3   | NC       | No Connection   |  |
| 4   | Vee      | Signal Ground   |  |
| 5   | SCL      | Serial I <sup>2</sup> C Clock                               |  |
| 6   | SDA      | Serial I <sup>2</sup> C Data                                |  |
| 7   | Vee      | Signal Ground   |  |
| 8   | RX_LOS   | Receiver Loss of Signal Indicator (Active high, open-drain) |  |
| 9   | NC       | No Connection   |  |
| 10  | NC       | No Connection   |  |
| 11  | Vee      | Signal Ground   |  |
| 12  | RX-      | Negative Differential Output                                |  |
| 13  | RX+      | Positive Differential Output                                |  |
| 14  | Vee      | Signal Ground   |  |
| 15  | Vcc RX   | Power Supply  | +3.3V±5%, Internal connected   |
| 16  | Vcc TX   | Power Supply  |  |
| 17  | Vee      | Signal Ground   |  |
| 18  | TX+      | Positive Transmitter Data In                                | AC coupled differential lines with 100 ohm differential termination inside the module              |
| 19  | TX-      | Negative Transmitter Data In                                |  |
| 20  | TX_DIS   | Transmitter Disable   | Internal 4.7 kΩ pull-up. The bias current and modulation current are turned off if TX1_DIS = HIGH. |

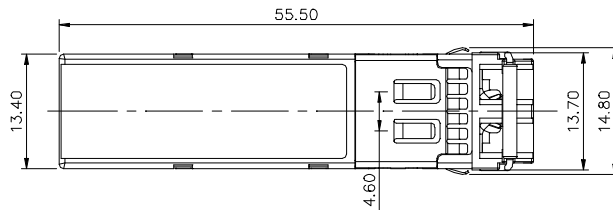
## RECOMMENDED CIRCUIT SCHEMATIC



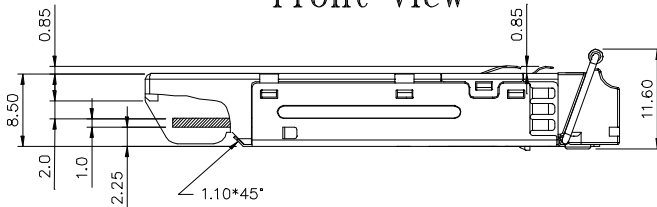
1. Consult the Chipset manufacturer's applications information for biasing required for TX outputs. Some chipset outputs are internally biased and may not need external bias resistor.

## PACKAGE DIAGRAM (Units in mm)

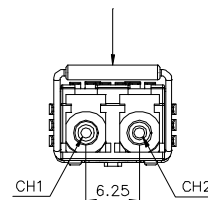
Top View



Front View

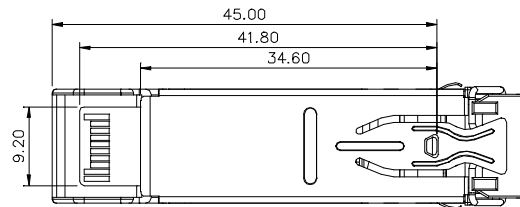


LATCH COLOR  
BLUE



Side View

Bottom View



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## REVISION HISTORY

| Version | Subject           | Release Date |
|---------|-------------------|--------------|
| 1.0     | Initial datasheet | 2009/3/1     |
|         |                   |              |
|         |                   |              |
|         |                   |              |

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