

# Technical Datasheet

## SFP-SX-AU-C

### HP ARUBA® Compatible 1000Base-SX SFP Transceiver

Hot Pluggable, +3.3V, LC Duplex, 850nm, up to 550m, Commercial Temperature

#### FEATURES

- Up to 1.25Gb/s Data Links
- Hot-Pluggable
- Duplex LC connector
- Up to 550m on 50/125µm MMF
- 850nm VCSEL laser transmitter
- Single +3.3V Power Supply
- Low power dissipation <1W typically
- Commercial Operating Temperature Range: 0°C to 70°C
- RoHS compliant and Lead Free

#### APPLICATIONS

- Metro/Access Networks
- 1.25Gb/s 1000Base-SX Ethernet
- 1 × Fibre Channel
- Other Optical Links

#### DESCRIPTION

ATGBICS® Compatible SFP-SX-AU-C Transceiver is a high-performance, cost-effective module which has a duplex LC optics interface. Standard AC coupled CML for high-speed signal and LVTTL control and monitor signals. The receiver section uses a PIN receiver and the transmitter uses a 850nm VCSEL laser, up to 8dB link budget ensure this module 1000Base Ethernet 550m application.

#### Absolute Maximum Ratings

| Parameter             | Symbol          | Min. | Typical | Max. | Unit |
|-----------------------|-----------------|------|---------|------|------|
| Operating Temperature | T <sub>o</sub>  | 0    |         | 70   | °C   |
| Storage Temperature   | T <sub>s</sub>  | -40  |         | 85   | °C   |
| Supply Voltage        | V <sub>cc</sub> | -0.5 |         | 4    | V    |
| Relative Humidity     | RH              | 0    |         | 85   | %    |

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## Recommended Operating Environment:

| Parameter             | Symbol             | Min.  | Typical | Max.                | Unit |
|-----------------------|--------------------|-------|---------|---------------------|------|
| Operating Temperature |                    | 0     |         | 70                  | °C   |
| Supply Voltage        | V <sub>CC</sub>    | 3.135 |         | 3.465               | V    |
| Supply Current        | I <sub>CC</sub>    |       |         | 300                 | mA   |
| Inrush Current        | I <sub>surge</sub> |       |         | I <sub>CC</sub> +30 | mA   |
| Maximum Power         | P <sub>max</sub>   |       |         | 1                   | W    |

## Electrical Characteristics (T<sub>OP</sub> = 0 to 70°C, V<sub>CC</sub> = 3.135 to 3.465 Volts)

| Parameter                      | Symbol                | Min.                  | Typical | Max.                 | Unit  | Notes |
|--------------------------------|-----------------------|-----------------------|---------|----------------------|-------|-------|
| <b>Transmitter Section:</b>    |                       |                       |         |                      |       |       |
| Input differential impedance   | R <sub>in</sub>       | 90                    | 100     | 110                  | Ω     | □     |
| Single ended data input swing  | V <sub>in PP</sub>    | 250                   |         | 1200                 | mVp-p |       |
| Transmit Disable Voltage       | V <sub>D</sub>        | V <sub>CC</sub> – 1.3 |         | V <sub>CC</sub>      | V     | 2     |
| Transmit Enable Voltage        | V <sub>EN</sub>       | V <sub>EE</sub>       |         | V <sub>EE</sub> +0.8 | V     |       |
| Transmit Disable Assert Time   | T <sub>dessert</sub>  |                       |         | 10                   | us    |       |
| <b>Receiver Section:</b>       |                       |                       |         |                      |       |       |
| Single ended data output swing | V <sub>out,p p</sub>  | 250                   |         | 800                  | mv    | 3     |
| LOS Fault                      | V <sub>losfault</sub> | V <sub>CC</sub> – 0.5 |         | V <sub>CC_host</sub> | V     | 5     |
| LOS Normal                     | V <sub>los norm</sub> | V <sub>EE</sub>       |         | V <sub>EE</sub> +0.5 | V     | 5     |
| Power Supply Rejection         | PSR                   | 100                   |         |                      | mVpp  | 6     |

### Notes:

1. AC coupled.
2. Or open circuit.
3. Into 100 Ohm differential termination.
4. 20 – 80%
5. LOS is LVTTTL. Logic 0 indicates normal operation; logic 1 indicates no signal detected.
6. All transceiver specifications are compliant with a power supply sinusoidal modulation of 20Hz to 1.5MHz up to specified value applied through the power supply filtering network shown on page 23 of the Small Form-factor Pluggable (SFP) Transceiver Multi-Source Agreement (MSA), September 14, 2000.

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Optical Parameters (T<sub>OP</sub> = 0 to 70°C, VCC = 3.135 to 3.465 Volts)

| Parameter   | Symbol  | Min. | Typical | Max.              | Unit      | Note |
|---|---|------|---------|-------------------|-----------|------|
| <b>Transmitter Section:</b>                         |   |      |         |                   |           |      |
| Center Wavelength                                   | $\lambda_c$                                       | 840  | 850     | 860               | nm        |      |
| Spectral Width (RMS)                                | $\sigma_{RMS}$                                    |      |         | 0.85              | nm        |      |
| Optical Output Power                                | P <sub>out</sub>                                  | -9   |         | -3                | dBm       | 1    |
| Extinction Ratio                                    | ER  | 9    |         |                   | dB        |      |
| Optical Rise/Fall Time                              | t <sub>r</sub> / t <sub>f</sub>                   |      |         | 260               | ps        | 2    |
| Relative Intensity Noise                            | RIN   |      |         | -120              | dB/H<br>z |      |
| Output Eye Mask                                     | Compliant with IEEE802.3 z (class 1 laser safety) |      |         |                   |           |      |
| <b>Receiver Section:</b>                            |   |      |         |                   |           |      |
| Optical Input Wavelength                            | $\lambda_c$                                       | 770  |         | 860               | nm        |      |
| Receiver Overload                                   | P <sub>ol</sub>                                   | 0    |         |                   | dBm       | 4    |
| RX Sensitivity                                      | Sen   |      |         | -17               | dBm       | 4    |
| RX_LOS Assert                                       | LOS <sub>A</sub>                                  | -35  |         |                   | dBm       |      |
| RX_LOS De-assert                                    | LOS <sub>D</sub>                                  |      |         | -18               | dBm       |      |
| RX_LOS Hysteresis                                   | LOS <sub>H</sub>                                  | 0.5  |         |                   | dB        |      |
| <b>General Specifications:</b>                      |   |      |         |                   |           |      |
| Data Rate   | BR  |      | 1250    |                   | Mb/s      |      |
| Bit Error Rate                                      | BER   |      |         | 10 <sup>-12</sup> |           |      |
| Max. Supported Link Length on 50/125µm MMF@1250Gb/s | L <sub>MAX</sub>                                  |      | 550     |                   | m         |      |
| Total System Budget                                 | LB  | 8    |         |                   | dB        |      |

Notes:

1. The optical power is launched into MMF.
2. 20-80%.
3. Jitter measurements taken using Agilent OMNIBERT 718 in accordance with GR-253.
4. Measured with PRBS 2<sup>7-1</sup> at 10<sup>-12</sup> BER

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## Pin Assignment

Diagram of Host Board Connector Block Pin Numbers and Name



Diagram of Host Board Connector Block Pin Numbers and Names

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## Pin Function Definitions

| Pin No | Name        | Function                     | Plug Seq | Notes |
|--------|-------------|------------------------------|----------|-------|
| 1      | VeeT        | Transmitter Ground           | 1        | 1     |
| 2      | TX Fault    | Transmitter Fault Indication | 3        |       |
| 3      | TX Disable  | Transmitter Disable          | 3        | 2     |
| 4      | MOD-DEF2    | Module Definition            | 2        | 3     |
| 5      | MOD-DEF1    | Module Definition 1          | 3        | 3     |
| 6      | MOD-DEF0    | Module Definition 0          | 3        | 3     |
| 7      | Rate Select | Not Connected                | 3        | 4     |
| 8      | LOS         | Loss of Signal               | 3        | 5     |
| 9      | VeeR        | Receiver Ground              | 1        | 1     |
| 10     | VeeR        | Receiver Ground              | 1        | 1     |
| 11     | VeeR        | Receiver Ground              |          | 1     |
| 12     | RD-         | Inv. Received Data Out       | 3        | 6     |
| 13     | RD+         | Received Data Out            | 3        | 6     |
| 14     | VeeR        | Receiver Ground              | 3        | 1     |
| 15     | VccR        | Receiver Power               | 2        | 1     |
| 16     | VccT        | Transmitter Power            | 2        |       |
| 17     | VeeT        | Transmitter Ground           | 1        |       |
| 18     | TD+         | Transmit Data In             | 3        | 6     |
| 19     | TD-         | Inv. Transmit In             | 3        | 6     |
| 20     | VeeT        | Transmitter Ground           | 1        |       |

### Notes:

1. Circuit ground is internally isolated from chassis ground.
2. Laser output disabled on TDIS >2.0V or open, enabled on TDIS <0.8V.
3. Should be pulled up with 4.7k - 10 kohms on host board to a voltage between 2.0V and 3.6V. MOD\_DEF (0) pulls line low to indicate module is plugged in.
4. Rate select is not used
5. LOS is open collector output. Should be pulled up with 4.7k – 10 kohms on host board to a voltage between 2.0V and 3.6V. Logic 0 indicates normal operation; logic 1 indicates loss of signal.
6. AC Coupled

## SFP Module EEPROM Information and Management

The SFP modules implement the 2-wire serial communication protocol as defined in the SFP -8472. The serial ID information of the SFP modules can be accessed through the I<sup>2</sup>C interface at address A0h.

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## EEPROM Serial ID Memory Contents (A0h)

| Data Address              | Length (Byte) | Name of Length | Description and Contents  |
|---------------------------|---------------|----------------|---|
| <b>Base ID Fields</b>     |               |                |   |
| 0                         | 1             | Identifier     | Type of Serial transceiver (03h=SFP)  |
| 1                         | 1             | Reserved       | Extended identifier of type serial transceiver (04h)  |
| 2                         | 1             | Connector      | Code of optical connector type (07=LC)  |
| 3-10                      | 8             | Transceiver    |   |
| 11                        | 1             | Encoding       | NRZ(03h)  |
| 12                        | 1             | BR, Nominal    | Nominal baud rate, unit of 100Mbps  |
| 13-14                     | 2             | Reserved       | (0000h)   |
| 15                        | 1             | Length(9um)    | Link length supported for 9/125um fiber, units of 100m  |
| 16                        | 1             | Length(50um)   | Link length supported for 50/125um fiber, units of 10m  |
| 17                        | 1             | Length(62.5um) | Link length supported for 62.5/125um fiber, units of 10m  |
| 18                        | 1             | Length(Copper) | Link length supported for copper, units of meters   |
| 19                        | 1             | Reserved       |   |
| 20-35                     | 16            | Vendor Name    | SFP vendor name: ATGBICS  |
| 36                        | 1             | Reserved       |   |
| 37-39                     | 3             | Vendor OUI     | SFP transceiver vendor OUI ID   |
| 40-55                     | 16            | Vendor PN      | Part Number: "SFP-SX-AU-C" (ASCII)  |
| 56-59                     | 4             | Vendor rev     | Revision level for part number  |
| 60-62                     | 3             | Reserved       |   |
| 63                        | 1             | CCID           | Least significant byte of sum of data in address 0-62   |
| <b>Extended ID Fields</b> |               |                |   |
| 64-65                     | 2             | Option         | Indicates which optical SFP signals are implemented (001Ah = LOS, TX_FAULT, TX_DISABLE all supported) |
| 66                        | 1             | BR, max        | Upper bit rate margin, units of %   |
| 67                        | 1             | BR, min        | Lower bit rate margin, units of %   |
| 68-83                     | 16            | Vendor SN      | Serial number (ASCII)   |
| 84-91                     | 8             | Date code      | Manufacturing date code   |
| 92-94                     | 3             | Reserved       |   |
| 95                        | 1             | CCEX           | Check code for the extended ID Fields (addresses 64 to 94)  |

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| Vendor Specific ID Fields |     |          |                                 |
|---------------------------|-----|----------|---------------------------------|
| 96-127                    | 32  | Readable | Vendor specific date, read only |
| 128-255                   | 128 | Reserved | Reserved for SFF-8079           |

## Regulatory Compliance

The SFP-SX-AU-C complies with international Electromagnetic Compatibility (EMC) and international safety requirements and standards (see details in Table following).

|   |  |  |
|---|--|--|
| Electrostatic Discharge (ESD) to the Electrical Pins      | MIL-STD-883E Method 3015.7   | Class 1(>1000 V)                       |
| Electrostatic Discharge (ESD) to the Duplex LC Receptacle | IEC 61000-4-2 GR-1089-CORE   | Compatible with standards              |
| Electromagnetic Interference (EMI)                        | FCC Part 15 Class B<br>EN55022 Class B (CISPR 22B)<br>VCCI Class B | Compatible with standards              |
| Laser Eye Safety  | FDA 21CFR 1040.10 and 1040.11<br>EN60950, EN (IEC) 60825-1,2       | Compatible with Class 1 laser product. |

## Recommended Circuit



**SFP Host Recommended Circuit**

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## Mechanical Dimensions (units: mm)



**Mechanical Drawing**