

# Technical Datasheet

## FN-TRAN-SFP+GC-C

### Fortinet® Compatible 10GBase-T SFP+ Transceiver

Hot Pluggable, +3.3V, Cat 6a/7 Cable, up to 30m, Commercial Temperature

#### FEATURES

- Supports 10GBase-T / 5GBase-T / 2.5GBase-T / 1000base-T
- Hot-pluggable SFP footprint
- Supports Links up to 30m using Cat 6a/7 Cable
- SFF-8431 and SFF-8432 MSA Compliant
- IEEE 802.3az Compliant
- Low Power Consumption (2.5W MAX at 30m)
- Commercial Operating Temperature Range: 0 to 70°C
- Fast Retrain EMI Cancellation Algorithm
- Low EMI Emissions
- I2C 2-Wire Interface for Serial ID and PHY Register Access
- Auto-negotiates with other 10GBase-T PHYs
- Supports 100/1000Base-T using Cat 5e cable or better
- MDI/MDIX Crossover
- Multiple Loopback Modes for Testing and Troubleshooting
- Built-in Cable Monitoring and Link
- Cable Length Measurements
- Robust Die Cast Housing
- Bail Latch Style ejector mechanism
- Unshielded and Shielded cable support

#### DESCRIPTION

ATGBICS® Compatible FN-TRAN-SFP+GC-C copper transceiver module is a high-performance integrated duplex data link for bi-directional communication over copper cable. It is specifically designed for high-speed communication links that require 10 Gigabit Ethernet over Cat 6a/7.

SFP+ 10GBASE-T Copper Small Form Pluggable (SFP) transceivers are based on the SFP Multi Source Agreement (MSA). They are compatible with the 10GBase-T / 5GBase-T / 2.5GBase-T / 1000base-T standards as specified in IEEE Std 802.3. SFP+ 10GBASE-T uses the SFP's RX\_LOS pin for link indication. If pull up SFP's TX\_DISABLE pin, PHY IC be reset.

# Technical Datasheet

## CABLE LENGTH

Standard	Cable	Reach	Host Port
10GBase-T	CAT6A	30m	XFI
5GBase-T/2.5GBase-T	CAT5E	50m	5GBase-R/2.5GBase-X
1000base-T	CAT5E	100m	1000base-FX

## SFP TO HOST CONNECTOR PIN OUT

Pin	Symbol	Name/Description	Ref.
1	VEET	Transmitter Ground (Common with Receiver Ground)	1
2	TFAULT	Transmitter Fault. Not supported.	
3	TDIS	Transmitter Disable. Laser output disabled on high or open.	2
4	MOD_DEF(2)	Module Definition 2. Data line for Serial ID.	3
5	MOD_DEF(1)	Module Definition 1. Clock line for Serial ID.	3
6	MOD_DEF(0)	Module Definition 0. Grounded within the module.	3
7	Rate Select	No connection required	
8	LOS	High indicates no linked. low indicates linked.	4
9	VEER	Receiver Ground (Common with Transmitter Ground)	1
10	VEER	Receiver Ground (Common with Transmitter Ground)	1
11	VEER	Receiver Ground (Common with Transmitter Ground)	1
12	RD-	Receiver Inverted DATA out. AC Coupled	
13	RD+	Receiver Non-inverted DATA out. AC Coupled	
14	VEER	Receiver Ground (Common with Transmitter Ground)	1
15	VCCR	Receiver Power Supply	
16	VCCT	Transmitter Power Supply	
17	VEET	Transmitter Ground (Common with Receiver Ground)	1
18	TD+	Transmitter Non-Inverted DATA in. AC Coupled.	
19	TD-	Transmitter Inverted DATA in. AC Coupled.	
20	VEET	Transmitter Ground (Common with Receiver Ground)	1

### Notes:

1. Circuit ground is connected to chassis ground
2. PHY disabled on  $T_{DIS} > 2.0V$  or open, enabled on  $T_{DIS} < 0.8V$
3. Should be pulled up with 4.7k - 10k Ohms 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. LVTTTL compatible with a maximum voltage of 2.5V.

# Technical Datasheet



Figure 1. Diagram of host board connector block pin numbers and names

### +3.3V VOLT ELECTRICAL POWER INTERFACE

The SFP+ 10GBASE-T has an input voltage range of  $3.3V \pm 5\%$ . The 4V maximum voltage is not allowed for continuous operation.

+3.3 Volt Electrical Power Interface						
Parameter	Symbol	Min	Typ	Max	unit	Notes/Conditions
Supply Current	Is		700	900	mA	3.0W max power over full range of voltage and temperature. See caution note below
Input Voltage	Vcc	3.13	3.3	3.47	V	Referenced to GND
Maximum Voltage	Vmax			4	V	
Surge Current	Isurge		TBD		mA	Hot plug above steady state current. See caution note below

Caution: Power consumption and surge current are higher than the specified values in the SFP MSA

# Technical Datasheet

## LOW-SPEED SIGNALS

MOD\_DEF(1) (SCL) and MOD\_DEF(2) (SDA), are open drain CMOS signals (see section VII, "Serial Communication Protocol"). Both MOD\_DEF(1) and MOD\_DEF(2) must be pulled up to host\_Vcc

### Low-Speed Signals, Electronic Characteristics

Parameter	Symbol	Min	Max	unit	Notes/Conditions
<b>SFP Output LOW</b>	VOL	0	0.5	V	4.7k to 10k pull-up to host_Vcc, measured at host side of connector
<b>SFP Output HIGH</b>	VOH	host_Vcc -0.5	host_Vcc +0.3	V	4.7k to 10k pull-up to host_Vcc, measured at host side of connector
<b>SFP Input LOW</b>	VIL	0	0.8	V	4.7k to 10k pull-up to Vcc, measured at SFP side of connector
<b>SFP Input HIGH</b>	VIH	2	Vcc +0.3	V	4.7k to 10k pull-up to Vcc, measured at SFP side of connector

## HIGH-SPEED ELECTRICAL INTERFACE

All high-speed signals are AC-coupled internally.

High-Speed Electrical Interface, Transmission Line-SFP						
Parameter	Symbol	Min	Typ	Max	unit	Notes/Conditions
<b>Line Frequency</b>	fL		125		MHz	5-level encoding, per IEEE 802.3
<b>Tx Output Impedance</b>	Zout,TX		100		Ohm	Differential, for all frequencies between 1MHz and 125MHz
<b>Rx Input Impedance</b>	Zin,RX		100		Ohm	Differential, for all frequencies between 1MHz and 125MHz

# Technical Datasheet

High-Speed Electrical Interface, Host-SFP						
Parameter	Symbol	Min	Typ	Max	unit	Notes/Conditions
Single ended data input swing	Vinsing	250		1200	mV	Single ended
Single ended data output swing	Voutsing	350		800	mV	Single ended
Rise/Fall Time	T <sub>r</sub> , T <sub>f</sub>		175		psec	20%-80%
Tx Input Impedance	Z <sub>in</sub>		50		Ohm	Single ended
Rx Output Impedance	Z <sub>out</sub>		50		Ohm	Single ended

## GENERAL SPECIFICATIONS

General						
Parameter	Symbol	Min	Typ	Max	unit	Notes/Conditions
Data Rate	BR	1		10	Gb/sec	IEEE 802.3 compatible. See Notes 1,2 below

Notes:

1. Clock tolerance is  $\pm 50$  ppm

## ENVIRONMENTAL SPECIFICATIONS

Automatic crossover detection is enabled. External crossover cable is not required

Parameter	Symbol	Min	Typ	Max	unit	Notes/Conditions
Operating Temperature	Top	0		70	°C	Case temperature
Storage Temperature	T <sub>sto</sub>	-40		85	°C	Ambient temperature

## SERIAL COMMUNICATION PROTOCOL

All SFPs support the 2-wire serial communication protocol outlined in the SFP MSA. These SFPs use an MCU, can be accessed with address of A0h.

Parameter	Symbol	Min	Typ	Max	unit	Notes/Conditions
I <sup>2</sup> C Clock Rate		0		200	kHz	

# Technical Datasheet

## MECHANICAL SPECIFICATIONS (UNIT: mm)

