

### FN-TRAN-SFP+SR-C

### Fortinet® Compatible 10Gb/s SFP+ SR Transceiver

Hot Pluggable, Duplex LC, +3.3V, 850nm, VCSEL MMF 300m DDM

#### **FEATURES**

- Supports 9.95 to 11.3Gb/s bit rates
- Hot-Pluggable
- Duplex LC connector
- 850nm VCSEL transmitter, PIN photodetector
- MMF links up to 300m @ OM3 and 400m @ OM4
- 2-wire interface for management specifications compliant with SFF 8472 digital diagnostic monitoring interface
- Power Supply: +3.3V
- Power consumption<1W
- Temperature Range: 0 ~ 70°C
- RoHS compliant

#### **APPLICATIONS**

- 10GBASE-SR/SW Ethernet
- SONET OC-192 / SDH
- 10G Fibre Channel

#### **DESCRIPTION**

ATGBICS® Compatible FN-TRAN-SFP+SR-C Transceiver is a very compact 10Gb/s optical transceiver module for serial optical communication applications at 10Gb/s. The FN-TRAN-SFP+SR-C converts a 10Gb/s serial electrical data stream to 10Gb/s optical output signal and a 10Gb/s optical input signal to 10Gb/s serial electrical data streams. The high speed 10Gb/s electrical interface is fully compliant with SFI specification.

The high performance 850nm VCSEL transmitter and high sensitivity PIN receiver provide superior performance for Ethernet applications at up to 300m links.

The SFP+ Module is compliant with SFF-8431, SFF-8432 and IEEE 802.3ae 10GBASE-SR. Digital diagnostics functions are available via a 2-wire serial interface, as specified in SFF-8472. The fully SFP compliant form factor provides hot pluggability, easy optical port upgrades and low EMI emission.



### **Absolute Maximum Ratings**

Parameter	Symbol	Min.	Typical	Max.	Unit
Storage Temperature	Ts	-40		+85	°C
Case Operating Temperature	TA	0		70	°C
Maximum Supply Voltage	Vcc	-0.5		4	V
Relative Humidity	RH	0		85	%

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

Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
Supply Voltage	Vcc	3.135		3.465	V	
Supply Current	Icc			250	mA	
Power Consumption	Р			1	W	
Transmitter Section:						
Input differential impedance	Rin		100		Ω	1
Tx Input Single Ended DC Voltage Tolerance (Ref VeeT)	V	-0.3		4	V	
Differential input voltage swing	Vin,pp	180		700	mV	2
Transmit Disable Voltage	V <sub>D</sub>	2		Vcc	V	3
Transmit Enable Voltage	V <sub>EN</sub>	Vee		Vee+0.8	V	
Receiver Section:						
Single Ended Output Voltage Tolerance	V	-0.3		4	V	
Rx Output Diff Voltage	Vo	300		850	mV	
Rx Output Rise and Fall Time	Tr/Tf	30			ps	4
LOS Fault	V <sub>LOS</sub> fault	2		Vcc <sub>ноsт</sub>	V	5
LOS Normal	V <sub>LOS norm</sub>	Vee		Vee+0.8	V	5

- 1. Connected directly to TX data input pins. AC coupling from pins into laser driver IC.
- 2. Per SFF-8431 Rev 3.0
- 3. Into 100 ohms differential termination.
- 4. 20%~80%
- 5. LOS is an open collector output. Should be pulled up with  $4.7k 10k\Omega$  on the host board. Normal operation is logic 0; loss of signal is logic 1. Maximum pull-up voltage is 5.5V.



Optical Parameters ( $T_{OP} = 0$  to  $70^{\circ}$ C, VCC = 3.135 to 3.465 Volts)

Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
Transmitter Section:						
Center Wavelength	λt	840	850	860	nm	
RMS spectral width	$\lambda_{RMS}$			4	nm	
Average Optical Power	Pavg	-7.3		-1	dBm	1
Optical Power OMA	Poma		-1.5		dBm	
Laser Off Power	Poff			-30	dBm	
Extinction Ratio	ER	3.5			dB	
Transmitter Dispersion Penalty	TDP			3.9	dB	2
Relative Intensity Noise	Rin			-128	dB/Hz	3
Optical Return Loss Tolerance		20			dB	
Receiver Section:						
Center Wavelength	λr	840		860	nm	
Receiver Sensitivity (OMA)	Sen			-11.1	dBm	4
Stressed Sensitivity (OMA)	Sen <sub>st</sub>			-7.5	dBm	4
Los Assert	LOSA	-30		-	dBm	
Los Dessert	LOS₀			-12	dBm	
Los Hysteresis	LOS <sub>H</sub>	0.5			dB	
Overload	Sat	0			dBm	5
Receiver Reflectance	Rrx			-12	dB	

#### Notes:

- 1. Average power figures are informative only, per IEEE802.3ae.
- 2. TWDP figure requires the host board to be SFF-8431 compliant. TWDP is calculated using the Matlab code provided in clause 68.6.6.2 of IEEE802.3ae.
- 3. 12dB reflection.
- 4. Conditions of stressed receiver tests per IEEE802.3ae. CSRS testing requires the host board to be SFF-8431 compliant.
- 5. Receiver overload specified in OMA and under the worst comprehensive stressed condition.

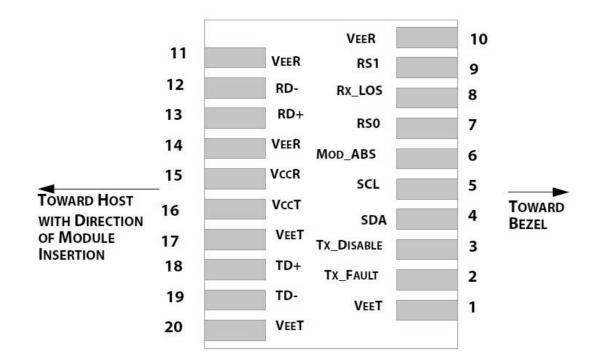


### **Timing Characteristics**

Parameter	Symbol	Min.	Typical	Max.	Unit
TX_Disable Assert Time	t_off			10	us
TX_Disable Negate Time	t_on			1	ms
Time to Initialize Include Reset of TX_FAULT	t_int			300	ms
TX_FAULT from Fault to Assertion	t_fault			100	us
TX_Disable Time to Start Reset	t_reset	10			us
Receiver Loss of Signal Assert Time	T <sub>A</sub> ,RX_LOS			100	us
Receiver Loss of Signal Deassert Time	T <sub>d</sub> ,RX_LOS			100	us
Rate-Select Change Time	t_ratesel			10	us
Serial ID Clock Time	t_serial- clock			100	kHz

### **Pin Assignment**

Diagram of Host Board Connector Block Pin Numbers and Name





#### **Pin Function Definitions**

PIN No	Name	Function	Notes
1	VeeT	Module transmitter ground	1
2	Tx Fault	Module transmitter fault	2
3	Tx Disable	Transmitter Disable; Turns off transmitter laser output	3
4	SDL	2 wire serial interface data input/output (SDA)	
5	SCL	2 wire serial interface clock input (SCL)	
6	MOD- ABS	Module Absent, connect to VeeR or VeeT in the module	2
7	RS0	Rate select0, optionally control SFP+ receiver. When high, input data rate >4.5Gb/ s; when low, input data rate <=4.5Gb/s	
8	LOS	Receiver Loss of Signal Indication	4
9	RS1	Rate select0, optionally control SFP+ transmitter. When high, input data rate >4.5Gb/s; when low, input data rate <=4.5Gb/s	
10	VeeR	Module receiver ground	1
11	VeeR	Module receiver ground	1
12	RD-	Receiver inverted data out put	
13	RD+	Receiver non-inverted data out put	
14	VeeR	Module receiver ground	1
15	VccR	Module receiver 3.3V supply	
16	VccT	Module transmitter 3.3V supply	
17	VeeT	Module transmitter ground	1
18	TD+	Transmitter inverted data out put	
19	TD-	Transmitter non-inverted data out put	
20	VeeT	Module transmitter ground	1

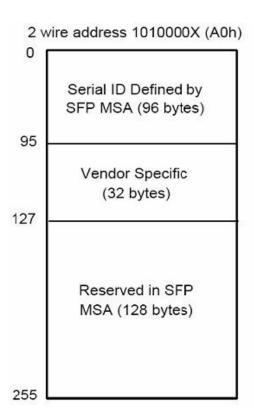
- 1. The module ground pins are isolated from the module case.
- 2. This pin is an open collector/drain output pin and is pulled up with 4.7K-10Kohms to Host\_Vcc on the host board.
- 3. This pin is pulled up with 4.7K-10Kohms to VccT in the module.
- 4. This pin is an open collector/drain output pin and is pulled up with 4.7K-10Kohms to Host\_Vcc on the host board.



#### **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 and Digital Diagnostic Monitor parameters can be accessed through the I<sup>2</sup>C interface at address A0h and A2h. The memory is mapped in Table 1. Detailed ID information (A0h) is listed in Table 2. And the DDM specification at address A2h. For more details of the memory map and byte definitions, please refer to the SFF-8472, "Digital Diagnostic Monitoring Interface for Optical Transceivers". The DDM parameters have been internally calibrated.

Table 1 - Digital Diagnostic Memory Map (Specific Data Field Descriptions)



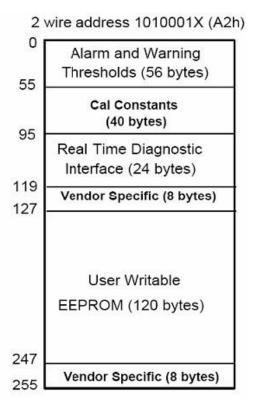




Table 2 - EEPROM Serial ID Memory Contents (A0h)

Address	Data	Length	Name of	Description and Contents	
0         1         Identifier         Type of Serial transceiver (03h=SFP)           1         1         Reserved (04h)         Extended identifier of type serial transceiver (04h)           2         1         Connector         Code of optical connector type (07=LC)           3-10         8         Transceiver         10G Base-SR           11         1         Encoding         64B/66B           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 fibre, units of 100m           16         1         Length(50um)         Link length supported for 50/125um fibre, units of 10m           17         1         Length(62.5um)         Link length supported for 62.5/125um fibre, 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 PN         Part Number: "FN-TRAN-SFP+SR-C" (ASCII)           40-55         16			Length		
1				T (0 ) (1) (00) 05D)	
Connector   Code of optical connector type (07=LC)					
3-10         8         Transceiver         10G Base-SR           11         1         Encoding         64B/66B           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 fibre, units of 100m           16         1         Length(62.5um)         Link length supported for 50/125um fibre, units of 10m           17         1         Length(62.5um)         Link length supported for 62.5/125um fibre, units of 10m           18         1         Length(Copper)         Link length supported for copper, units of meters           19         1         Reserved           36         1         Reserved           37-39         3         Vendor Name         SFP vendor name: ATGBICS           36         1         Reserved           40-55         16         Vendor PN         Part Number: "FN-TRAN-SFP+SR-C" (ASCII)           40-55         16         Vendor PN         Revision level for part number           60-62         3         Reserved           63-3         1         CCID         Least significant byte of sum of data in address o-62		1	Reserved	(04h)	
11         1         Encoding         64B/66B           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 fibre, units of 100m           16         1         Length(50um)         Link length supported for 50/125um fibre, units of 10m           17         1         Length(Copper)         Link length supported for 62.5/125um fibre, 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: "FN-TRAN-SFP+SR-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 o-62           Extended ID Fields         2         Option <th>2</th> <th>1</th> <th>Connector</th> <th>Code of optical connector type (07=LC)</th>	2	1	Connector	Code of optical connector type (07=LC)	
12	3-10	8	Transceiver	10G Base-SR	
13-14 2 Reserved (0000h)  15 1 Length(9um) Link length supported for 9/125um fibre, units of 100m  16 1 Length(50um) Link length supported for 50/125um fibre, units of 10m  17 1 Length(62.5um) Link length supported for 62.5/125um fibre, 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: "FN-TRAN-SFP+SR-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  Extended ID Fields  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 OEM's Manufacturing date code  92-94 3 Reserved  95 1 CCEX Check code for the extended ID Fields (addresses 64 to 94)	11	1	Encoding	64B/66B	
15	12	1	BR, Nominal	Nominal baud rate, unit of 100Mbps	
100m  16	13-14	2	Reserved	(0000h)	
of 10m  17	15	1	Length(9um)		
Units of 10m		1	<u> </u>	of 10m	
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: "FN-TRAN-SFP+SR-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  Extended ID Fields 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 OEM's Manufacturing date code 92-94 3 Reserved 95 1 CCEX Check code for the extended ID Fields (addresses 64 to 94)	17	1	Length(62.5um)	units of 10m	
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40-55 16 Vendor PN Part Number: "FN-TRAN-SFP+SR-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  Extended ID Fields  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 OEM's Manufacturing date code  92-94 3 Reserved  95 1 CCEX Check code for the extended ID Fields (addresses 64 to 94)	36	1	Reserved		
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Extended ID Fields  64-65  Coption  Indicates which optical SFP signals are implemented (001Ah = LOS, TX_FAULT, TX_DISABLE all supported)  BR, max  Upper bit rate margin, units of %  BR, min  Lower bit rate margin, units of %  84-91  Bate code  Date code  OEM's Manufacturing date code  P2-94  Reserved  Check code for the extended ID Fields (addresses 64 to 94)	56-59	4	Vendor rev	Revision level for part number	
Extended ID Fields  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 OEM's Manufacturing date code  92-94  3 Reserved  95  1 CCEX Check code for the extended ID Fields (addresses 64 to 94)	60-62	3	Reserved		
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 OEM's Manufacturing date code  92-94 3 Reserved  95 1 CCEX Check code for the extended ID Fields (addresses 64 to 94)	63	1	CCID	9	
implemented (001Ah = LOS, TX_FAULT, TX_DISABLE all supported)  66	Extended II	D Fields			
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68-83 16 Vendor SN Serial number (ASCII)  84-91 8 Date code OEM's Manufacturing date code  92-94 3 Reserved  95 1 CCEX Check code for the extended ID Fields (addresses 64 to 94)	66	1	BR, max	Upper bit rate margin, units of %	
84-91 8 Date code OEM's Manufacturing date code  92-94 3 Reserved  95 1 CCEX Check code for the extended ID Fields (addresses 64 to 94)	67	1	BR, min	Lower bit rate margin, units of %	
92-94 3 Reserved  95 1 CCEX Check code for the extended ID Fields (addresses 64 to 94)	68-83	16	Vendor SN	Serial number (ASCII)	
95 1 CCEX Check code for the extended ID Fields (addresses 64 to 94)	84-91	8	Date code	OEM's Manufacturing date code	
(addresses 64 to 94)	92-94	3	Reserved		
Vendor Specific ID Fields	95	1	CCEX		
• ** * * * * * * * * * * * * * * * * *	Vendor Spe	Vendor Specific ID Fields			



96-127	32	Readable	OEM specific date, read only
128-255	128	Reserved	Reserved for SFF-8079

### **Digital Diagnostic Monitor Characteristics**

Data Address	Parameter	Accuracy	Unit
96-97	Transceiver Internal Temperature	±3.0	°C
98-99	VCC3 Internal Supply Voltage	±3.0	%
100-101	Laser Bias Current	±10	%
102-103	Tx Output Power	±3.0	dBm
104-105	Rx Input Power	±3.0	dBm

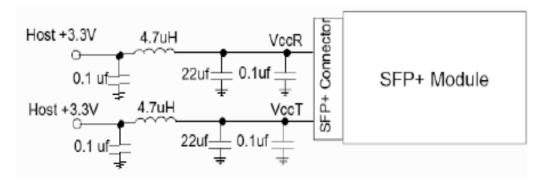
### **Regulatory Compliance**

The FN-TRAN-SFP+SR-C complies with international Electromagnetic Compatibility (EMC) and international safety requirements and standards (see details in Table following).

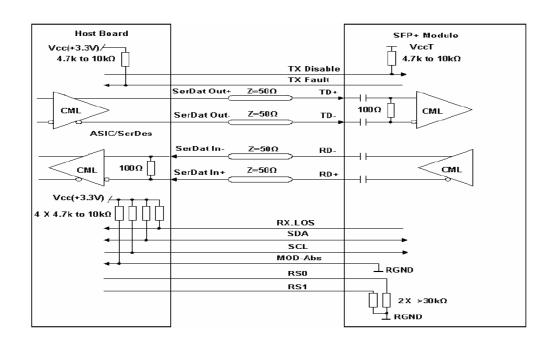
Electrostatic Discharge (ESD) to the Electrical Pins	MIL-STD-883E Method 3015.7	Class 1(>1000 V)
Electrostatic Discharge (ESD) to the Duplex LC Receptacle	IEC 61000-4-2 GR-1089-CORE	Compatible with standards
Electromagnetic Interference (EMI)	FCC Part 15 Class B EN55022 Class B (CISPR 22B) VCCI Class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



#### **Recommended Circuit**



**Recommended Host Board Power Supply Circuit** 



**Recommended High-speed Interface Circuit** 



#### **Mechanical Dimensions**

