



Product Name	GAOTek SFP Fiber Optical Module
Product SKU	GAOTek-SCT-128
Product URL	https://gaotek.com/product/gaotek-sfp-fiber-optical-module/

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Contents

1. Product Features:.....	3
2. Applications:	3
3. Description :	3
4. Transceiver functional diagram :	4
5. Absolute Maximum Ratings :	4
6.Recommended Operating Conditions :	4
7. Optical and Electrical Characteristics :	5
8. Timing and Electrical :	6
9. Pin Assignment:.....	7
10. Pin Function Definitions :	8
11.EEPROM Information and Management	10
11.1 Digital Diagnostic Memory Map (Specific Data Field Descriptions) :	11
11.2 . EEPROM Serial ID Memory Contents (A0h):	12
12.Digital Diagnostic Monitor Characteristics :	13
13.Regulatory Compliance :	13
14.Recommended Interface Circuit:	14
15. Mechanical Dimensions :	15
16. Ordering Information :	15
17. λ C Wavelength Guide : 100GHz ITU Grid, C Band:.....	16



GAOTek SFP Fiber Optical Module

1. Product Features:

- Supports up to 10.7Gbps bit rates
- Hot-pluggable SFP+ footprint
- 100GHz ITU, C Band DWDM Cooled EML laser and APD photodiode, Up to 80km for SMF transmission
- Compliant with SFP+ MSA and SFF-8472 with duplex LC receptacle
- Compatible with RoHS
- Single +3.3V power supply
- Real Time Digital Diagnostic Monitoring
- Operating case temperature: Commercial 0 to +70°C, Industrial -40 to +85°C

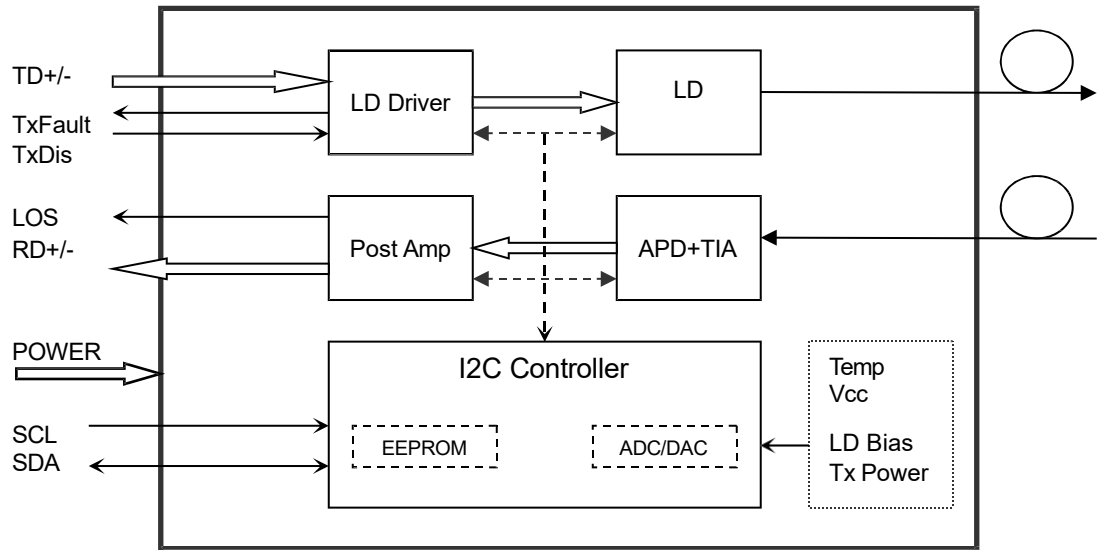
2. Applications:

- 10Gbps DWDM Optical systems
- 10GBASE-ZR at 10.3125Gbps
- 10GBASE-ZW at 9.953Gbps
- 10X Fibre Channel
- LTE systems
- Other Optical links

3. Description:

The SFP+ transceivers are high-performance, cost-effective modules supporting data rate of 10Gbps and 80km transmission distance with SMF. The transceiver consists of three sections: a Cooled EML laser transmitter, an APD photodiode integrated with a trans-impedance preamplifier (TIA) and MCU control unit. All modules satisfy class I laser safety requirements. The transceivers are compatible with SFP Multi-Source Agreement and SFF-8472 digital diagnostics functions.

4. Transceiver functional diagram:



5. Absolute Maximum Ratings:

Parameter	Symbol	Min.	Typical	Max.	Unit
Storage Temperature	TS	-40		+85	°C
Maximum Supply Voltage	Vcc	-0.5		4.5	V
Relative Humidity	RH	5		85	%

6. Recommended Operating Conditions:

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Case Operating Temperature	Commercial	0	-	+70	°C	Without air flow
	Industrial	-40	-	+85		
Power Supply Voltage	VCC	3.135	3.3	3.465	V	
Power Supply Current	ICC	-		600	mA	
Data Rate	BR	8.0	10.3	10.7	Gbps	
Transmission Distance	TD		-	80	km	
Coupled fiber	Single mode fiber					9/125um SMF

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7. Optical and Electrical Characteristics:

Parameter	Symbol	Min	Typical	Max	Unit	Notes
Transmitter						
Centre Wavelength	λ_c	1528.77		1563.86	nm	
Spectral Width (-20dB)	$\Delta\lambda$			1	nm	
Side-Mode Suppression Ratio	SMSR	30	-		dB	
Average Output Power	P _{Out}	0		+4	dBm	1
Extinction Ratio	ER	6			dB	
Data Input Swing Differential	V _{IN}	180		850	mV	2
Input Differential Impedance	Z _{IN}	90	100	110	Ω	
TX Disable	Disable	2.0		V _{cc}	V	
	Enable	0		0.8	V	
TX Fault	Fault	2.0		V _{cc}	V	
	Normal	0		0.8	V	
Receiver						
Centre Wavelength	λ_c	1450		1620	nm	
Receiver Sensitivity				-23	dBm	3
Receiver Overload		-7			dBm	3
LOS De-Assert	LOSD			-24	dBm	
LOS Assert	LOSA	-35			dBm	
LOS Hysteresis		0.5			dB	
Data Output Swing Differential	V _{out}	300		900	mV	4
LOS	High	2.0		V _{cc}	V	
	Low			0.8	V	

Notes:

1. The optical power is launched into SMF.
2. PECL input, internally AC-coupled and terminated.
3. Measured with a PRBS 2³¹-1 test pattern @10312Mbps, BER ≤ 1 × 10⁻¹²
4. Internally AC-coupled.

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8. Timing and Electrical:

Parameter	Symbol	Min	Typical	Max	Unit
Tx Disable Negate Time	t_on			2	ms
Tx Disable Assert Time	t_off			100	µs
Time To Initialize, including Reset of Tx Fault	t_init			300	ms
Tx Fault Assert Time	t_fault			100	µs
Tx Disable To Reset	t_reset	10			µs
LOS Assert Time	t_loss_on			100	µs
LOS De-assert Time	t_loss_off			100	µs
Serial ID Clock Rate	f_serial_clo ck		100	400	KHz
MOD_DEF (0:2)-High	VH	2		Vcc	V
MOD_DEF (0:2)-Low	VL			0.8	V

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9. Pin Assignment:

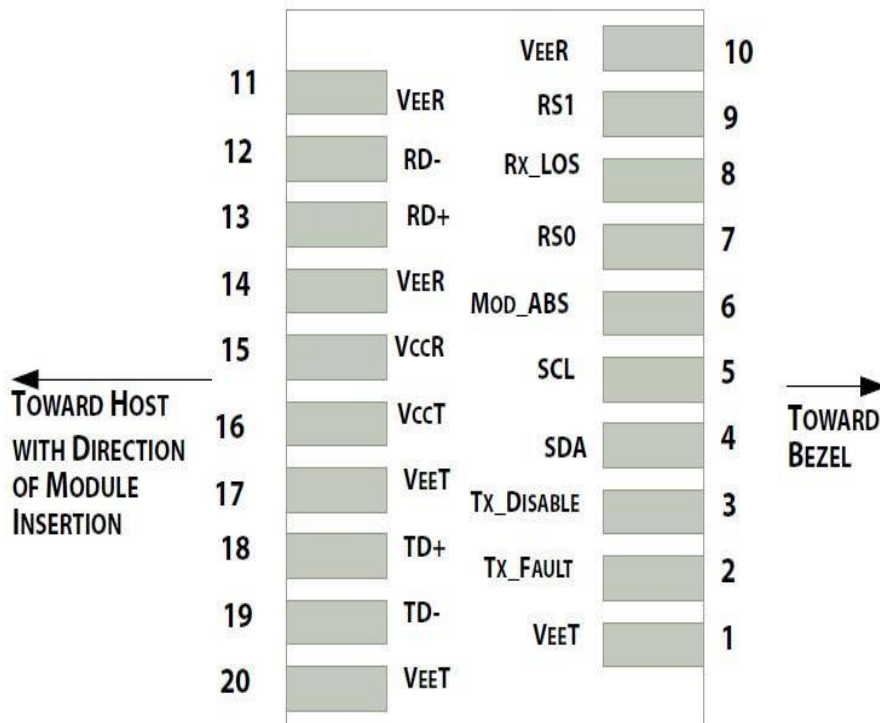


Diagram of Host Board Connector Block Pin Numbers and Name



10. Pin Function Definitions :

Pin	Signal Name	Description	Plug Seq.	Notes
1	V _{EE} T	Transmitter Ground	1	
2	TX FAULT	Transmitter Fault Indication	3	Note 1
3	TXDISABLE	Transmitter Disable	3	Note 2
4	SDA	SDA Serial Data Signal	3	
5	SCL	SCL Serial Clock Signal	3	
6	MOD_ABS	Module Absent. Grounded within the module	3	
7	RS0	Not Connected	3	
8	LOS	Loss of Signal	3	Note 3
9	RS1	Not Connected	3	
10	V _{EE} R	Receiver ground	1	
11	V _{EE} R	Receiver ground	1	
12	RD-	Inv. Received Data Out	3	Note 4
13	RD+	Received Data Out	3	Note 4
14	V _{EE} R	Receiver ground	1	
15	V _{CC} R	Receiver Power Supply	2	
16	V _{CC} T	Transmitter Power Supply	2	
17	V _{EE} T	Transmitter Ground	1	
18	TD+	Transmit Data In	3	Note 5
19	TD-	Inv. Transmit Data In	3	Note 5
20	V _{EE} T	Transmitter Ground	1	

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Notes:

Plug Seq.: Pin engagement sequence during hot plugging.

- 1) TX Fault is an open collector output, which should be pulled up with a 4.7k~10k Ω resistor on the host board to a voltage between 2.0V and $V_{cc}+0.3V$. Logic 0 indicates normal operation; Logic 1 indicates a laser fault of some kind. In the low state, the output will be pulled to less than 0.8V.
- 2) Laser output disabled on TDIS >2.0V or open, enabled on TDIS <0.8V.
- 3) LOS is open collector output. Should be pulled up with 4.7k~10k Ω on host board to a voltage between 2.0V and 3.6V. Logic 0 indicates normal operation; logic 1 indicates loss of signal.
- 4) RD-/+ : These are the differential receiver outputs. They are internally AC-coupled 100 differential lines which should be terminated with 100 Ω (differential) at the user SERDES.
- 5) TD-/+ : These are the differential transmitter inputs. They are internally AC-coupled, differential lines with 100 Ω differential termination inside the module.



11.EEPROM Information and Management:

The SFP+ transceivers support the 2-wire serial communication protocol as defined in the SFP MSA.

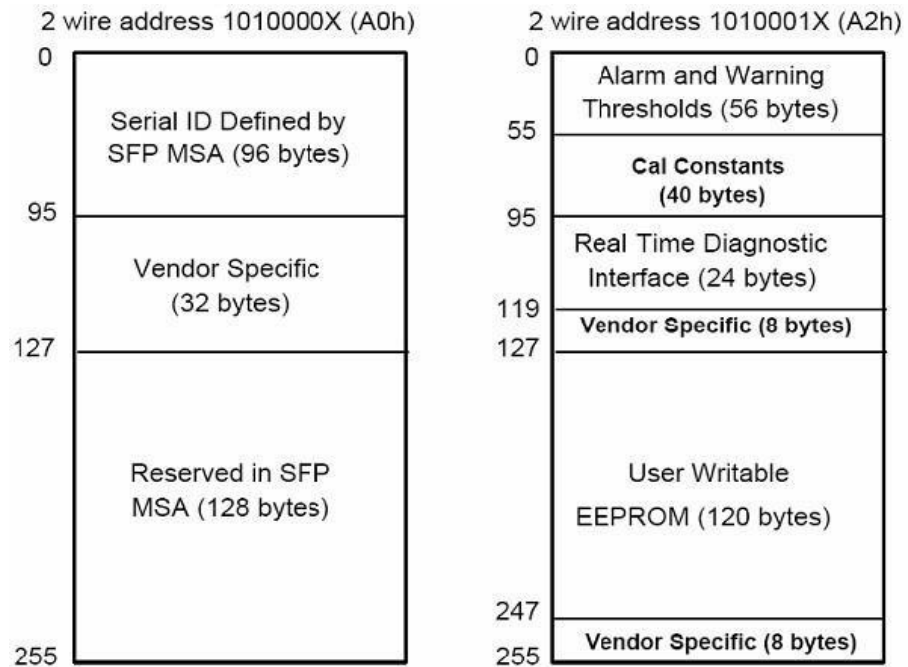
The standard SFP serial ID provides access to identification information that describes the transceiver's capabilities, standard interfaces, manufacturer, and other information.

Additionally, The SFP+ transceivers provide a unique enhanced digital diagnostic monitoring interface, which allows real-time access to device operating parameters such as transceiver temperature, laser bias current, transmitted optical power, received optical power and transceiver supply voltage. It also defines a sophisticated system of alarm and warning flags, which alerts end-users when particular operating parameters are outside of a factory set normal range.

The SFP MSA defines a 256-byte memory map in EEPROM that is accessible over a 2-wire serial interface at the 8 bit address 1010000X (A0h).The digital diagnostic monitoring interface makes use of the 8 bit address 1010001X (A2h), so the originally defined serial ID memory map remains unchanged.

The operating and diagnostics information is monitored and reported by a Digital Diagnostics Transceiver Controller (DDTC) inside the transceiver, which is accessed through a 2-wire serial interface. When the serial protocol is activated, the serial clock signal (SCL, Mod Def 1) is generated by the host. The positive edge clocks data into the SFP transceiver into those segments of the E2PROM that are not write-protected. The negative edge clocks data from the SFP transceiver. The serial data signal (SDA, Mod Def 2) is bi-directional for serial data transfer. The host uses SDA in conjunction with SCL to mark the start and end of serial protocol activation. The memories are organized as a series of 8-bit data words that can be addressed individually or sequentially.

11.1 Digital Diagnostic Memory Map (Specific Data Field Descriptions):





11.2 . EEPROM Serial ID Memory Contents (A0h):

Data Address	Length (Byte)	Name of Length	Description and Contents
Base ID Fields			
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	10G Base-XX
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 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
36	1	Reserved	
37-39	3	Vendor OUI	SFP+ transceiver vendor OUI ID
40-55	16	Vendor PN	Part Number
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	Manufacturing date code
92-94	3	Reserved	
95	1	CCEX	Check code for the extended ID Fields (addresses 64 to 94)
Vendor Specific ID Fields			
96-127	32	Readable	Vendor specific data, read only
128-255	128	Reserved	Reserved for SFF-8079

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12. Digital Diagnostic Monitor Characteristics:

Data Address	Parameter	Accuracy	Unit	Range
96-97	Transceiver Internal Temperature	±3.0	°C	0 to +70
98-99	VCC3 Internal Supply Voltage	±3.0	%	3.0 to 3.6
100-101	Laser Bias Current	±10	%	0 to 100
102-103	Tx Output Power	±3.0	dB	-1 to +5
104-105	Rx Input Power	±3.0	dB	-23 to -6

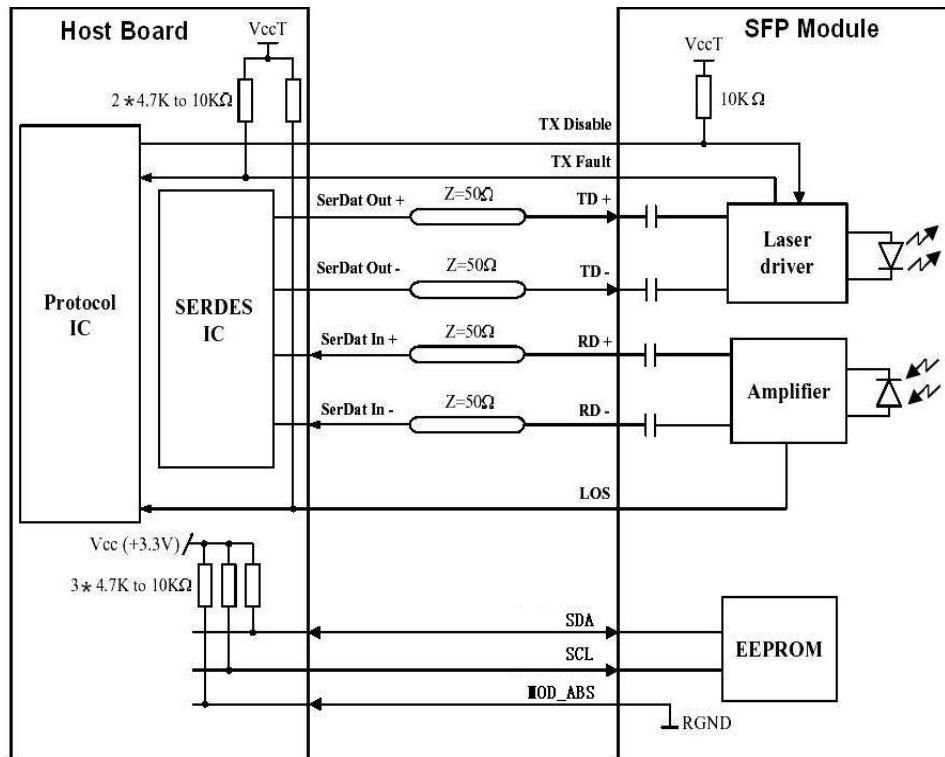
13. Regulatory Compliance:

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

Feature	Reference	Performance
Electrostatic discharge (ESD)	IEC/EN 61000-4-2	Compatible with standards
Electromagnetic Interference (EMI)	FCC Part 15 Class B EN 55022 Class B (CISPR 22A)	Compatible with standards
Laser Eye Safety	FDA 21CFR 1040.10, 1040.11 IEC/EN 60825-1,2	Class 1 laser product
Component Recognition	IEC/EN 60950, UL	Compatible with standards
ROHS	2002/95/EC	Compatible with standards
EMC	EN61000-3	Compatible with standards

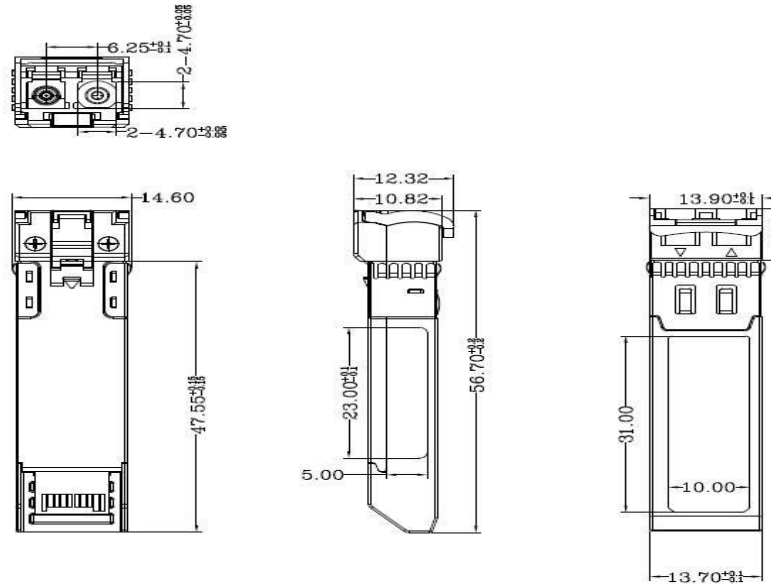
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14. Recommended Interface Circuit:



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15. Mechanical Dimensions:



Unit: mm

16. Ordering Information:

Ordering P/Ns	Description				
LADX-DxxS-ZR	10Gb/s DWDM SFP+ Transceiver Commercial Temperature	80K M	DD M,	LC/UP C	Receptacle,

Notes:

1. In the part number, xx refers to the ITU Channel Product Code.
2. Default case operating temperature is 0 ~ +70°C. If you need -40 ~ +85°C products, add "I" after Part Number.
3. If you need more customized services, please contact us.



17. λ C Wavelength Guide : 100GHz ITU Grid, C Band:

ITU Channel Product Code	Frequency (THz)	Wavelength	ITU Channel Product Code	Frequency (THz)	Wavelength
17	191.70	1563.86	40	194.00	1545.32
18	191.80	1563.05	41	194.10	1544.53
19	191.90	1562.23	42	194.20	1543.73
20	192.00	1561.42	43	194.30	1542.94
21	192.10	1560.61	44	194.40	1542.14
22	192.20	1559.79	45	194.50	1541.35
23	192.30	1558.98	46	194.60	1540.56
24	192.40	1558.17	47	194.70	1539.77
25	192.50	1557.36	48	194.80	1538.98
26	192.60	1556.55	49	194.90	1538.19
27	192.70	1555.75	50	195.00	1537.40
28	192.80	1554.94	51	195.10	1536.61
29	192.90	1554.13	52	195.20	1535.82
30	193.00	1553.33	53	195.30	1535.04
31	193.10	1552.52	54	195.40	1534.25
32	193.20	1551.72	55	195.50	1533.47
33	193.30	1550.92	56	195.60	1532.68
34	193.40	1550.12	57	195.70	1531.90
35	193.50	1549.32	58	195.80	1531.12
36	193.60	1548.51	59	195.90	1530.33
37	193.70	1547.72	60	196.00	1529.55
38	193.80	1546.92	61	196.10	1528.77
39	193.90	1546.12	-	-	-

Warnings :

Handling Precautions: This transceiver is susceptible to damage as a result of electrostatic discharge (ESD). A static free environment is highly recommended. Follow guidelines according to proper ESD procedures. Laser Safety: Radiation emitted by laser devices can be dangerous to human eyes. Avoid eye exposure to direct or indirect radiation.

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