

10Gb/s SFP+ Tunable DWDM 80km Transceiver

HC-ALT81x

Features

Up to 11.3Gb/s data links

Monolithically integrated full C-band tunable transmitter and APD receiver

50 GHz ITU channel spacing with integrated wavelength locker

Up to 80km on 9/125μm SMF

Smart Features: Self-Negotiation, Remote DDM, Remote WL Locking

Hot-pluggable SFP+ footprint

Duplex LC/UPC type pluggable optical interface

RoHS-10 compliant and lead-free

Support Digital Monitoring interface

Single +3.3V power supply

Compliant with SFF+MSA and SFF-8472 SFF-8431, SFF-8690 and G.698.1

Metal enclosure, for lower EMI

Meet ESD requirements, resist 8KV direct contact voltage

Case operating temperature Commercial: 0 ~ +70°C Extended: -10 ~ +80°C Industrial: -40 ~ +85°C



Applications

DWDM 10GBASE-ZR/ZW & 10GEthernet

10G CPRI, eCPRI

DWDM CSTM-64

10G Fiber Channel

Wavelength Selection: C-band λ c Wavelength Guide Pin Descriptions

Channel (xx)	Wavelength (nm)	Frequency (THZ)	Channel (xx)	Wavelength (nm)	Frequency (THZ)
13	1567.13	191.30	37	1547.72	193.70
H3	1566.72	191.35	J7	1547.32	193.75
14	1566.31	191.40	38	1546.92	193.80
H4	1565.90	191.45	J8	1546.52	193.85
15	1565.50	191.50	39	1546.12	193.90
H5	1565.09	191.55	J9	1545.72	193.95
16	1564.68	191.60	40	1545.32	194.00
H6	1564.27	191.65	K0	1544.92	194.05
17	1563.86	191.70	41	1544.53	194.10
H7	1563.45	191.75	K1	1544.13	194.15
18	1563.05	191.80	42	1543.73	194.20
H8	1562.64	191.85	K2	1543.33	194.25
19	1562.23	191.90	43	1542.94	194.30
H9	1561.83	191.95	K3	1542.54	194.35
20	1561.42	192.00	44	1542.14	194.40
I0	1561.01	192.05	K4	1541.75	194.45
21	1560.61	192.10	45	1541.35	194.50
I1	1560.20	192.15	K5	1540.95	194.55
22	1559.79	192.20	46	1540.56	194.60
I2	1559.39	192.25	K6	1540.16	194.65
23	1558.98	192.30	47	1539.77	194.70
I3	1558.58	192.35	K7	1539.37	194.75
24	1558.17	192.40	48	1538.98	194.80
I4	1557.77	192.45	K8	1538.58	194.85

25	1557.36	192.50	49	1538.19	194.90
I5	1556.96	192.55	K9	1537.79	194.95
26	1556.55	192.60	50	1537.40	195.00
I6	1556.15	192.65	L0	1537.00	195.05
27	1555.75	192.70	51	1536.61	195.10
I7	1555.34	192.75	L1	1536.22	195.15
28	1554.94	192.80	52	1535.82	195.20
I8	1554.54	192.85	L2	1535.43	195.25
29	1554.13	192.90	53	1535.04	195.30
I9	1553.73	192.95	L3	1534.64	195.35
30	1553.33	193.00	54	1534.25	195.40
J0	1552.93	193.05	L4	1533.86	195.45
31	1552.52	193.10	55	1533.47	195.50
J1	1552.12	193.15	L5	1533.07	195.55
32	1551.72	193.20	56	1532.68	195.60
J2	1551.32	193.25	L6	1532.29	195.65
33	1550.92	193.30	57	1531.90	195.70
J3	1550.52	193.35	L7	1531.51	195.75
34	1550.12	193.40	58	1531.12	195.80
J4	1549.72	193.45	L8	1530.72	195.85
35	1549.32	193.50	59	1530.33	195.90
J5	1548.91	193.55	L9	1529.94	195.95
36	1548.51	193.60	60	1529.55	196.00
J6	1548.11	193.65	M0	1529.16	196.05
Non-ITU	Peak wavelength between 1529.16nm-1567.13nm				

Absolute Maximum Ratings

It has to be noted that the operation in excess of any individual absolute maximum ratings might cause permanent damage to this module.

Parameter	Symbol	Min	Max	Unit	Notes
Storage Temperature	T _s	-40	85	°C	
Power Supply Voltage	V _{CC}	-0.5	3.6	V	
Relative Humidity (non-condensation)	RH	5	95	%	
Damage Threshold	TH _d	0		dBm	

Recommended Operating Conditions

Parameter	Symbol	Min	Typical	Max	Unit	Notes
Operating Case Temperature	T _{OP}	0		70	°C	commercial
		-20		85		extended
		-40		85		Industrial
Power Supply Voltage	V _{CC}	3.135	3.3	3.465	V	
Data Rate			10.3125	11.3	Gb/s	
Control Input VoltageHigh		2		V _{CC}	V	
Control Input Voltage Low		0		0.8	V	
Link Distance (SMF)	D			80	km	9/125um

General Description

HC -ALT81x tunable transceiver is an integrated fiber optic transceiver that provides a high-speed serial link at signaling rates from 9.95 Gb/s to 11.3 Gb/s. The module complies with the 10 Gigabit Enhanced Small Form Factor Pluggable (SFP+) multisource agreement-MSA

(SFF-8431) and SFF-8432, SFF-8690, SFF-8472. It complies with the ITU-T G.698.1 standard with 50 GHz channel spacing for SONET/SDH, IEEE DWDM 10GBASE-ZR for 80 km reach (Ethernet), and DWDM 10GFC for 80 km reach (Fiber Channel) applications.

The transceiver integrates the receiver and transmitter path on one module. The transceiver contains a C-band-tunable integrated Mach-Zehnder (MZ) laser, enabling data transmission over single-mode fiber through an industry-standard LC connector. On the receiver side, the 10 G/bps data stream is recovered from an APD/trans-impedance amplifier, and passed to an output driver.

This module features a hot-pluggable electrical interface.

HC-ALT81x 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, and 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 8bit address 1010000X (A0h). The digital diagnostic monitoring interface makes use of the 8bit address 1010001X (A2h), so the originally defined serial ID memory map remains unchanged.

Pin Assignment and Pin Description

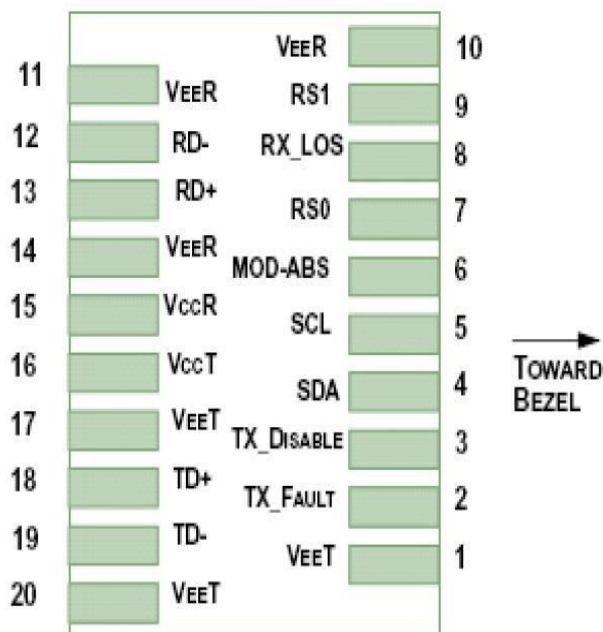


Figure1. Diagram of host board connector block pin numbers and names

Pin	Symbol	Name/Description	Notes
1	V_{EET}	Transmitter Ground (Common with Receiver Ground)	1
2	T_{FAULT}	Transmitter Fault.	2
3	T_{DIS}	Transmitter Disable. Laser output disabled on high or open.	3
4	SDA	2-wire Serial Interface Data Line	4
5	SCL	2-wire Serial Interface Clock Line	4
6	MOD_ABS	Module Absent. Grounded within the module	4
7	RS0	Rate Select 0	5
8	LOS	Loss of Signal indication. Logic 0 indicates normal operation.	6
9	RS1	No connection required	
10	V_{EER}	Receiver Ground (Common with Transmitter Ground)	1
11	V_{EER}	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	V_{EER}	Receiver Ground (Common with Transmitter Ground)	1
15	V_{CCR}	Receiver Power Supply	
16	V_{CCT}	Transmitter Power Supply	
17	V_{EET}	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	V_{EET}	Transmitter Ground (Common with Receiver Ground)	1

Notes:

1. Circuit ground is internally isolated from chassis ground.
2. TFAULT is an open collector/drain output, which should be pulled up with a 4.7kΩ-10kΩ resistor on the host

board if intended for use. Pull up voltage should be between 2.0V to $V_{cc} + 0.3V$. A high output indicates a transmitter fault caused by either the TX bias current or the TX output power exceeding the preset alarm thresholds. A low output indicates normal operation. In the low state, the output is pulled to $<0.8V$.

3. Laser output disabled on TDIS $>2.0V$ or open, enabled on TDIS $<0.8V$.

4. Should be pulled up with 4.7k Ω -10k Ω on host board to a voltage between 2.0V and 3.6V. MOD_ABS pulls line low to indicate module is plugged in.

5. Internally pulled down per SFF-8431 Rev 4.1.

LOS is open collector output. It should be pulled up with 4.7k Ω -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.

Electrical Characteristics

The following electrical characteristics are defined over the Recommended Operating Environment unless otherwise specified.

Parameter	Symbol	Min.	Typ.	Max	Unit	Notes
Power Consumption	p			2.8	W	
Supply Current	I _{cc}			892	mA	
Transmitter						
Single-ended Input Voltage Tolerance	V _{cc}	-0.3		4.0	V	
AC Common Mode Input Voltage Tolerance (RMS)		15			mV	
Differential Input Voltage Swing	V _{in,pp}	120		820	mV _{pp}	
Differential Input Impedance	Z _{in}	90	100	110	Ohm	1
Transmit Disable Assert Time				10	us	
Transmit Disable Voltage	V _{dis}	$V_{cc}-1.3$		V_{cc}	V	
Transmit Enable Voltage	V _{en}	V _{ee}		$V_{ee} + 0.8$	V	2
Receiver						
Differential Output Voltage Swing	V _{out,pp}	350		850	mV _{pp}	
Differential Output Impedance	Z _{out}	90	100	110	Ohm	3

Data output rise/fall time	Tr/Tf	28			ps	4
LOS Assert Voltage	VlosH	Vcc-1 .3		Vcc	V	5
LOS De-assert Voltage	VlosL	Vee		Vee +0.8	V	5
Power Supply Rejection	PSR	100			mVpp	6

Notes:

1. Connected directly to TX data input pins. AC coupled thereafter.
2. Or open circuit.
3. Input 100 ohms differential termination.
4. These are unfiltered 20-80% values.
5. Loss of Signal is LVTTL. Logic 0 indicates normal operation; logic 1 indicates no signal detected.

Receiver sensitivity is compliant with power supply sinusoidal modulation of 20 Hz to 1.5 MHz up to specified value applied through the recommended power supply filtering network

Optical Characteristics

The following optical characteristics are defined over the Recommended Operating Environment unless otherwise specified.

Parameter	Symbol	Min.	Typical	Max	Unit	Notes
Transmitter						
Optical Wavelength	λ_c	1529.1 6		1567.13	nm	1
Center Wavelength Spacing			50		GHz	
Optical Spectral Width	$\Delta\lambda$			1	nm	
Side Mode Suppression Ratio	SMSR	30			dB	
Average Optical Power	P _{AVG}	0		5	dBm	2
Optical Extinction Ratio	ER	8.2			dB	
Transmitter and Dispersion Penalty	TDP			3	dB	

Transmitter OFF Output Power	POff			-30	dBm	
Frequency stability (BOL)	-1.5			1.5	GHz	
Frequency stability (EOL)	-2.5			2.5	GHz	
Transmitter Eye Mask		Compliant with IEEE802.3ae				
Receiver						
Center Wavelength	λ_c	1270		1610	nm	
Receiver Sensitivity (Average Power)	Sen.			-23	dBm	3
Input Saturation Power(overload)	Psat	-8			dBm	
LOS Assert	LOSA	-35			dB	
LOS De-assert	LOSD			-26	dBm	
LOS Hysteresis	LOSH	0.5			dBm	

Notes:

1. corresponds to approximately 0.4 nm.
2. Class 1 Laser Safety per FDA/CDRH and IEC-825-1 regulations.
3. Measured with Light source 1529.16~1567.13nm, ER>8.2dB; BER≤1E-12 @PRBS=2³¹ -1 NRZ.
- 4.

Digital Diagnostic Functions

The following digital diagnostic characteristics are defined over the Recommended Operating Environment unless otherwise specified. It is compliant to SFF-8472 Rev10.2 with internal calibration mode. For external calibration mode please contact our sales staff.

Parameter	Symbol	Min.	Max	Unit	Notes
Temperature monitor absolute error	DMI_Temp	-3	3	℃	Over operating temp
Supply voltage monitor absolute error	DMI_VCC	-0.15	0.15	V	Full operating range
RX power monitor absolute error	DMI_RX	-3	3	dB	

Bias current monitor	DMI_bias	-10%	10%	mA	
TX power monitor absolute error	DMI_TX	-3	3	dB	

Mechanical Dimensions

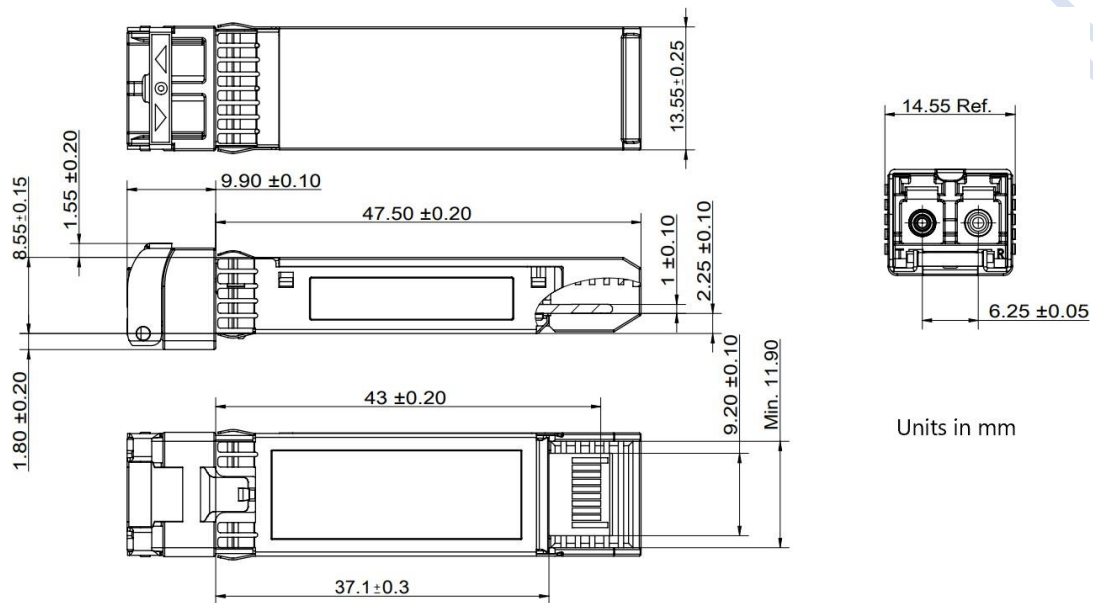


Figure2. Mechanical Outline

Ordering Information

Part Number	Data Rate (Gb/s)	Wavelength (nm)	Transmission Distance(km)	Temperature (°C) (Operating Case)
HC-ALT81C	10.3125	Refer to wavelength selection	80	0~70 commercial
HC-ALT81E	10.3125		80	-10~80 extended
HC -ALT81I	10.3125		80	-40~85 Industrial