400GBASE-LR4 10km QSFP-DD Optical Transceiver with DDM	IP-ATLK10EC4C

PRODUCT FEATURES

- QSFPDD MSA compliant
- 8X53.125Gb/s electrical interface
- 4 independent parallel optical channels
- Supports 425Gb/s aggregate bit rate
- Dual LC optical connector
- Hot Pluggable
- 10km link on SMF single-mode Fiber
- Maximum power consumption 12 Watts
- Case Operating Temperature: Commercial: 0 to 70ºC

APPLICATIONS

- High performance computing interconnect
- Data Centers
- Cloud Networks

COMPLIANCE

- QSFP-DD MSA
- IEEE802.3bs
- RoHS 2.0

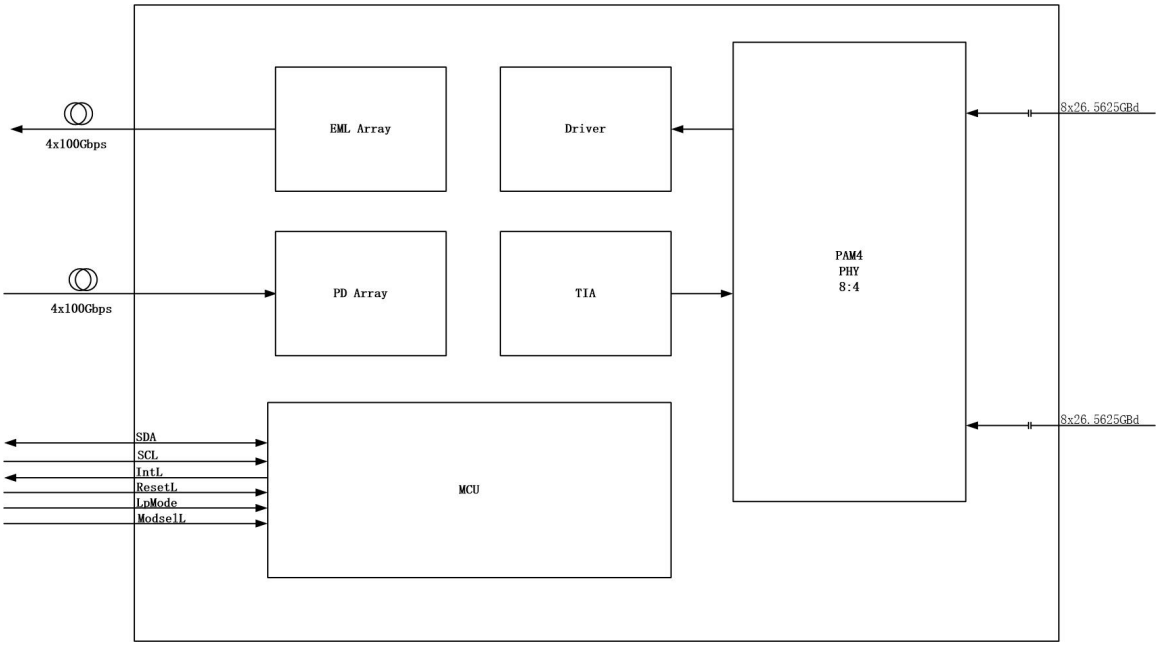
Ordering information

Part Number	Data Rate (Gb/s)	Media	Wavelength(nm)	Operating distance(km)	Temperature(℃)
IP-ATLK10EC4C	400	SMF	1310	10	0~70

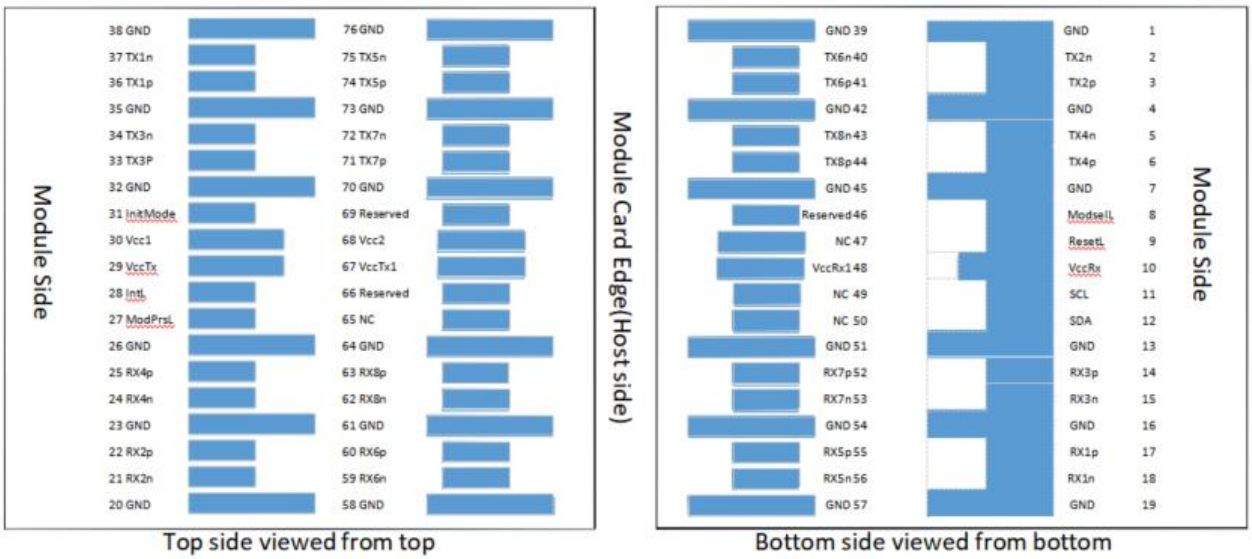
PRODUCT DESCRIPTION

IP-ATLK10EC4C is a QSFP-DD Optical transceiver for 4x100Gb/s optical links. It meets the requirements of QSFP-DD MSA, operates from a 3.3V DC power supply and is offered in the commercial temperature range. The module has an aggregate link bandwidth in excess of 4x100Gb/s by multiplexing of 4 CWDM optical lanes, each lane capable of transmitting PAM4 53.125GBd over 10km on SMF optical fiber. It is fabricated with a rugged die cast metal housing and cage assembly. The device is Class I laser safety compliant and meets the EU Directive 2002/95/EC for RoHS compliance.

1. Block Diagram



2. Pin Diagram



3. Pin Descriptions

Pin	Symbol	Description	Note
1	GND	Ground	
2	Tx2n	Transmitter Inverted Data Input	
3	Tx2p	Transmitter Non Inverted Data Input	
4	GND	Ground	
5	Tx4n	Transmitter Inverted Data Input	
6	Tx4p	Transmitter Non Inverted Data Input	
7	GND	Ground	
8	ModselL	Module Select	
9	ResetL	Module Reset	
10	VCC Rx	Receiver +3.3V DC Power Supply	
11	SCL	I2C Serial Clock	
12	SDA	I2C Serial Data	
13	GND	Ground	
14	Rx3p	Receiver Non Inverted Differential Output	
15	Rx3n	Receiver Inverted Differential Output	
16	GND	Ground	
17	Rx1p	Receiver Non Inverted Differential Output	
18	Rx1n	Receiver Inverted Differential Output	
19	GND	Ground	
20	GND	Ground	
21	Rx2n	Receiver Inverted Differential Output	
22	Rx2p	Receiver Non Inverted Differential Output	
23	GND	Ground	
24	Rx4n	Receiver Inverted Differential Output	
25	Rx4p	Receiver Non Inverted Differential Output	
26	GND	Ground	
27	ModPrsL	Module Present	
28	IntL	Interrupt	
29	VCC Tx	Transmitter +3.3V DC Power Supply	
30	VCC1	+3.3V DC Power Supply	
31	Init Mode	Initialization Mode	
32	GND	Ground	
33	Tx3p	Transmitter Non Inverted Data Input	
34	Tx3n	Transmitter Inverted Data Input	
35	GND	Ground	
36	Tx1p	Transmitter Non Inverted Data Input	
37	Tx1n	Transmitter Inverted Data Input	
38	GND	Ground	
39	GND	Ground	
40	Tx6n	Transmitter Inverted Data Input	
41	Tx6p	Transmitter Non Inverted Data Input	
42	GND	Ground	
43	Tx8n	Transmitter Inverted Data Input	

44	Tx8p	Transmitter Non Inverted Data Input	
45	GND	Ground	
46	Reserved	No connect	
47	NC	No connect	
48	VCC Rx1	+3.3V DC Power Supply	
49	NC	No connect	
50	NC	No connect	
51	GND	Ground	
52	Rx7p	Receiver Non Inverted Differential Output	
53	Rx7n	Receiver Inverted Differential Output	
54	GND	Ground	
55	Rx5p	Receiver Non Inverted Differential Output	
56	Rx5n	Receiver Inverted Differential Output	
57	GND	Ground	
58	GND	Ground	
59	Rx6n	Receiver Inverted Differential Output	
60	Rx6p	Receiver Non Inverted Differential Output	
61	GND	Ground	
62	Rx8n	Receiver Inverted Differential Output	
63	Rx8p	Receiver Non Inverted Differential Output	
64	GND	Ground	
65	NC	No Connect	
66	Reserved	No Connect	
67	VCCTx1	+3.3V DC Power Supply	
68	VCC2	+3.3V DC Power Supply	
69	Reserved	No Connect	
70	GND	Ground	
71	Tx7p	Transmitter Non Inverted Data Input	
72	Tx7n	Transmitter Inverted Data Input	
73	GND	Ground	
74	Tx5p	Transmitter Non Inverted Data Input	
75	Tx5n	Transmitter Inverted Data Input	
76	GND	Ground	

4. 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.	Typ.	Max.	Unit	Note
Storage Temperature	T_S	-40		85	ºC	
Storage Ambient Humidity	H_A	0		85	%	
Maximum Supply Voltage	V_{CC}	-0.5		3.6	V	
Receiver Damage Threshold, each lane	Damage	4.5			dBm	

5. Recommended Operating Conditions

Parameter	Symbol	Min	Typical	Max	Unit	Note
Operating Case Temperature	Tcase	0		70	℃	
Supply Voltage	V_{CC}	3.135	3.3	3.465	V	
Relative Humidity	RH	5		85	%	
Data Rate (Optical)	DRO		4*106.25		Gbp	
Data Rate (Electrical)	DRE		4*106.25		Gbp	
Operating Distance				10	km	

6. Electrical Characteristics

400GBASE-LR4 Operation (EOL, Tcase=0~70℃ ,VCC = 3.135~3.465 V)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Supply Voltage	V_{CC}	3.14	3.3	3.46	V	
Supply Current	I_{CC}			3.82	A	
Module total power	P	-	-	12	W	
Transmitter						
Signaling Rate per Lane		26.5625±100ppm			GBaud	
Tx_Data Differential Input Voltage	V_{IN}	-	-	900	mV	
Tx_Data Differential Input Impedance	Z_{IN}	90	100	110	Ω	
Receiver						
Signaling Rate per Lane		26.5625±100ppm			GBaud	
Rx_Data Differential Output Voltage	V_{OUT}	-	-	900	mV	
Rx_Data Differential Output Impedance	Z_{OUT}	90	100	110	Ω	

7. Optical Characteristics

400GBASE-LR4 Operation(EOL, Tcase = 0 ~70℃ ,V_{CC} = 3.135 to 3.465 V)

Parameter	Symbol	Min	Typ	Max	Units	Notes
Transmitter						
PAM4 Signaling rate, each lane			53.125		GBaud	±100ppm
Transmitter Type		CWDM EML				
Average Total Optical Power	P_{TOTAL}	-	-	10	dBm	
Average Launch Power, each lane	P_{OUT}	-3.3	-	4	dBm	
Optical Output with Tx OFF, each lane	P_{OFF}	-	-	-20	dBm	
Center Wavelength, each Lane	λ	1264.5-1277.5			nm	
		1284.5-1297.5				
		1304.5-1317.5				
		1324.5-1337.5				
Extinction Ratio	ER	3.5	-	-	dB	
OMA per Channel	OMA	-0.3		3.7	dBm	
Optical RL Tolerance	ORL	-	-	17.1	dB	

Side Mode Suppression Ratio	SMSR	30			dB	
Transmitter and dispersion eye closure for PAM4, each lane	TDECQ			3.4	dB	
RIN17.1OMA				-136	dB/Hz	
Transmit Reflectance	RFL	-	-	-26	dB	
Receiver						
Receiver Type		CWDM and PIN/TIA				
Damage threshold	PD	4.5	-	-	dBm	
Receive sensitivity OMAouter, Each Lane	PIN	Max (-4.6, SECQ-6.0)			dBm	1
Receive power, each lane (OMA outer) (max)	PINouter			3.7	dBm	
Average receive power, each Lane	P_{IN}	-7.3	-	3.5	dBm	2
Receive Reflectance	RFL	-	-	-26	dB	
Difference in receive power between any two lanes (OMAouter) (max)	P_{dif}			4.1	dB	
Center Wavelength	λ	1264.5-1277.5 1284.5-1297.5 1304.5-1317.5 1324.5-1337.5			nm	For each optical Port
Rx_LOS of Signal - Assert	PA	-20	-	-	dBm	
Rx_LOS of Signal - Deassert	PD	-	-	-9	dBm	

Notes:

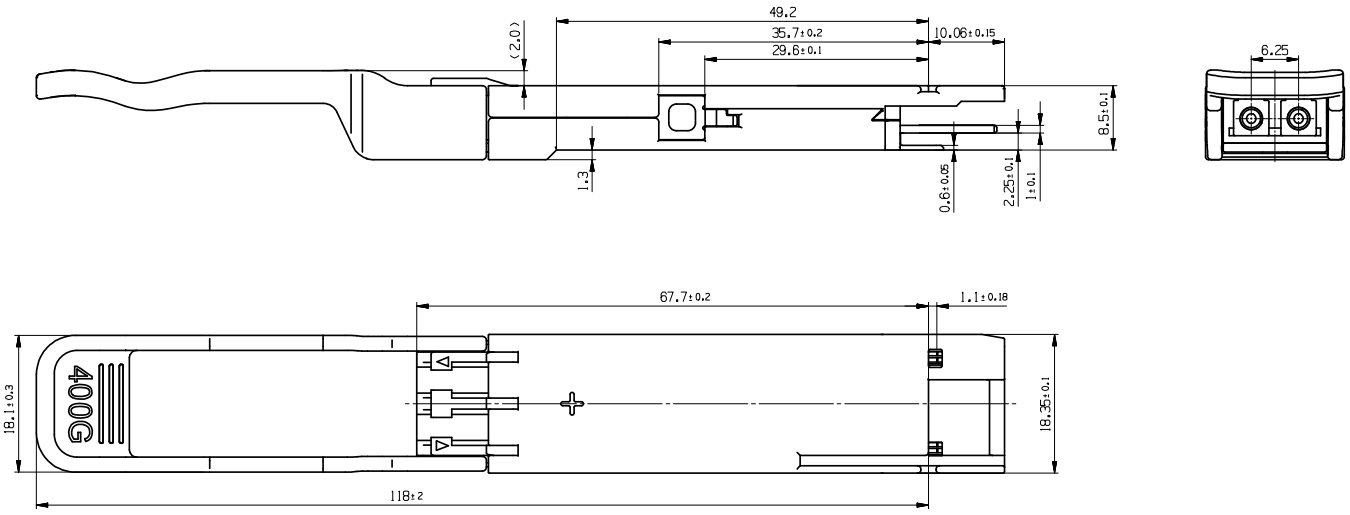
1. Receive sensitivity OMA outer, each lane (max) is informative and is defined for a transmitter with a value of SECQ up to 3.4dB.
2. Average receive power, each lane (min) is informative and not the principal indicator of signal strength. A receive power below this value can't be compliant; however, a value above this do not ensure compliance.

8. Digital Diagnostic Monitoring Functions

IP-ATLK10EC4C support the I2C-based Diagnostic Monitoring Interface (DMI). The host can access real-time performance of transmitter and receiver optical power, temperature, supply voltage and bias current.

Parameter	Accuracy	Unit
Case Temperature	±3	℃
Supply Voltage	±3%	V
Tx Optical Power	±3	dB
Rx Optical Power	±3	dB

9. Mechanical Specifications



10. Regulatory Compliance

Feature	Reference	Performance
EMC	EN61000-3	Compatible with standards
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, EC/EN 60825-2	Class 1 laser product
Component Recognition	IEC/EN 60950, L 60950	Compatible with standards
RoHS	2002/95/EC	Compatible with standards

11. Contact Information

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12. Revision History

Version No.	Date	Description
1.0	Feb. 02, 2021	Preliminary datasheet
1.1	Oct. 8,2021	Update contact Information
1.2	Sep. 25, 2023	Correct data rate unit
1.3	Jun.30, 2024	Update contact information.