

## 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
- 2km link on SMF single-mode Fiber
- Maximum power consumption 12 Watts
- Case Operating Temperature: Commercial: 0 to 70°C

## APPLICATIONS

- High performance computing interconnect
- Data Centers
- Cloud Networks

## COMPLIANCE

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

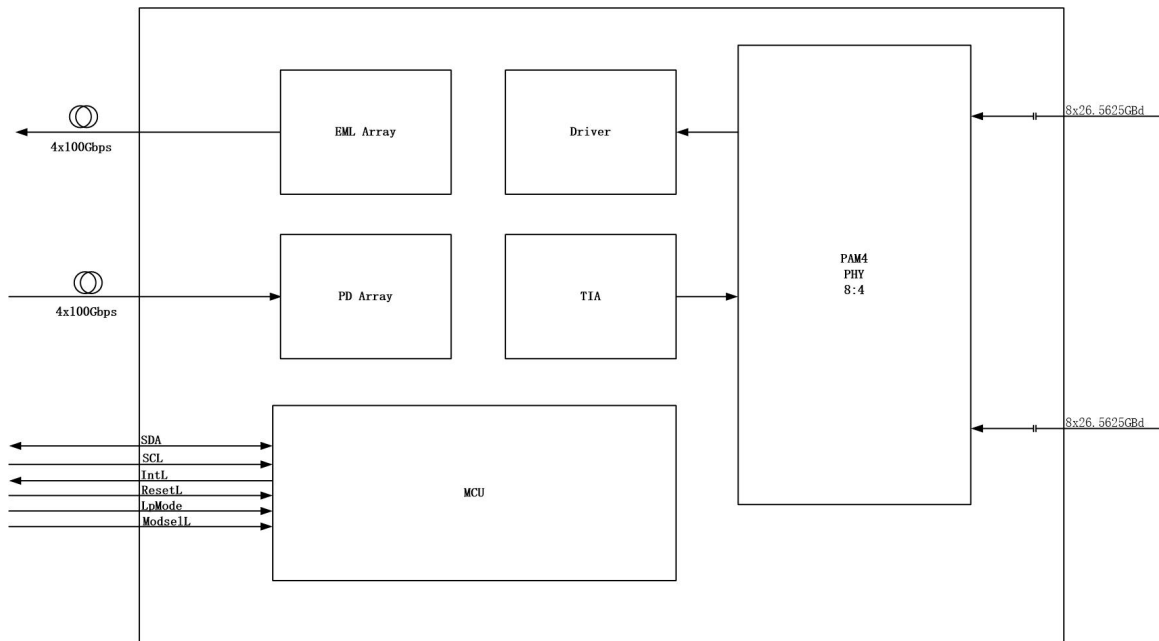
## Ordering information

| Part Number   | Data Rate (Gb/s) | Media | Wavelength(nm) | Operating distance(km) | Temperature(°C) |
|---------------|------------------|-------|----------------|------------------------|-----------------|
| IP-ATLK02EC4C | 400              | SMF   | 1310           | 2                      | 0~70            |

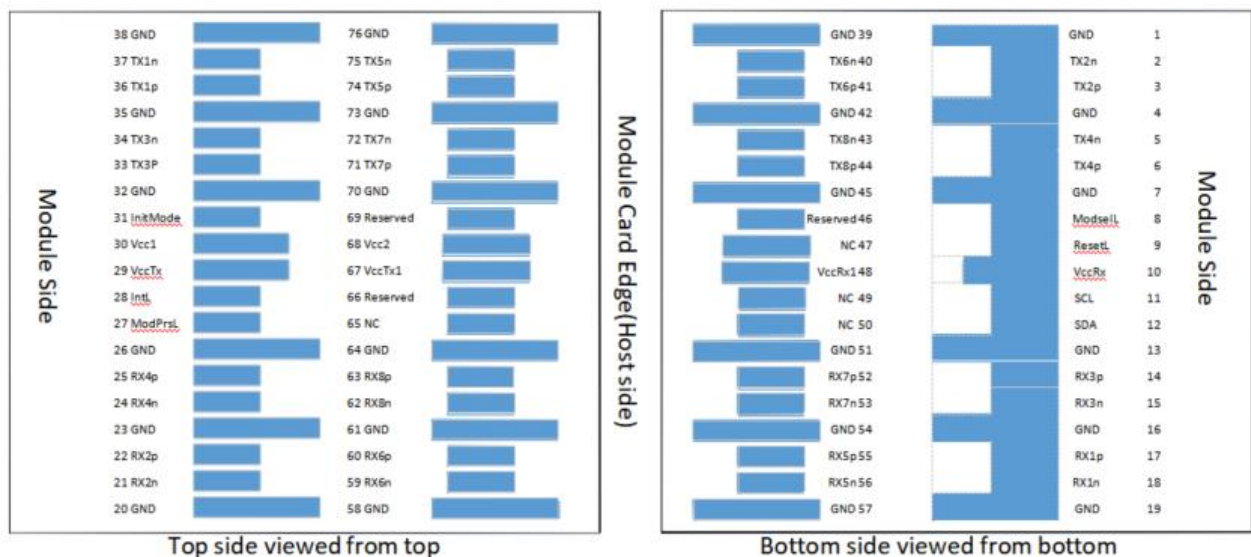
## PRODUCT DESCRIPTION

IP-ATLK02EC4C 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 2km 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 <sub>s</sub>  | -40  |      | 85   | °C   |      |
| Storage Ambient Humidity             | H <sub>A</sub>  | 0    |      | 85   | %    |      |
| Maximum Supply Voltage               | V <sub>CC</sub> | -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 | T <sub>case</sub> | 0     |          | 70    | °C   |      |
| Supply Voltage             | V <sub>CC</sub>   | 3.135 | 3.3      | 3.465 | V    |      |
| Relative Humidity          | RH                | 5     |          | 85    | %    |      |
| Data Rate (Optical)        | DRO               |       | 8*53.125 |       | Gbps |      |
| Data Rate (Electrical)     | DRE               |       | 8*53.125 |       | Gbps |      |
| Operating Distance         |                   |       |          | 2     | km   |      |

## 6. Electrical Characteristics

### 400GBASE-FR4 Operation (EOL, T<sub>case</sub>=0~70°C, V<sub>CC</sub> = 3.135~3.465 V)

| Parameter                             | Symbol           | Min.           | Typ. | Max. | Unit  | Note |
|---------------------------------------|------------------|----------------|------|------|-------|------|
| Supply Voltage                        | V <sub>CC</sub>  | 3.14           | 3.3  | 3.46 | V     |      |
| Supply Current                        | I <sub>CC</sub>  |                |      | 3.82 | A     |      |
| Module total power                    | P                | -              | -    | 12   | W     |      |
| <b>Transmitter</b>                    |                  |                |      |      |       |      |
| Signaling Rate per Lane               |                  | 26.5625±100ppm |      |      | GBaud |      |
| Tx_Data Differential Input Voltage    | V <sub>IN</sub>  | -              | -    | 900  | mV    |      |
| Tx_Data Differential Input Impedance  | Z <sub>IN</sub>  | 90             | 100  | 110  | Ω     |      |
| <b>Receiver</b>                       |                  |                |      |      |       |      |
| Signaling Rate per Lane               |                  | 26.5625±100ppm |      |      | GBaud |      |
| Rx_Data Differential Output Voltage   | V <sub>OUT</sub> | -              | -    | 900  | mV    |      |
| Rx_Data Differential Output Impedance | Z <sub>OUT</sub> | 90             | 100  | 110  | Ω     |      |

## 7. Optical Characteristics

### 400GBASE-FR4 Operation(EOL, T<sub>case</sub> = 0 ~70°C, V<sub>CC</sub> = 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 <sub>TOTAL</sub> | -             | -      | 9.3 | dBm   |         |
| Average Launch Power, each lane       | P <sub>OUT</sub>   | -3.3          | -      | 3.5 | dBm   |         |
| Optical Output with Tx OFF, each lane | P <sub>OFF</sub>   | -             | -      | -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 OMA <sub>outer</sub> , Each Lane                            | PIN                  | Max (-4.6, SECQ-6.0) |   |      | dBm   | 1                     |
| Receive power, each lane (OMA outer) (max)                                      | PIN <sub>outer</sub> |                      |   | 3.7  | dBm   |                       |
| Average receive power, each Lane  | p                    | -7.3                 | - | 3.5  | dBm   | 2                     |
| Receive Reflectance   | RFL                  | -                    | - | -26  | dB    |                       |
| Difference in receive power between any two lanes (OMA <sub>outer</sub> ) (max) | P <sub>dif</sub>     |                      |   | 4.1  | dB    |                       |
| Center Wavelength   | λ                    | 1264.5-1277.5        |   |      | nm    | For each optical Port |
|   |                      | 1284.5-1297.5        |   |      |       |                       |
|   |                      | 1304.5-1317.5        |   |      |       |                       |
|   |                      | 1324.5-1337.5        |   |      |       |                       |
| Rx_ LOS of Signal - Assert  | PA                   | -20                  | - | -    | dBm   |                       |
| Rx_ LOS of Signal - Deassert  | PD                   | -                    | - | -9   | dBm   |                       |

Notes:

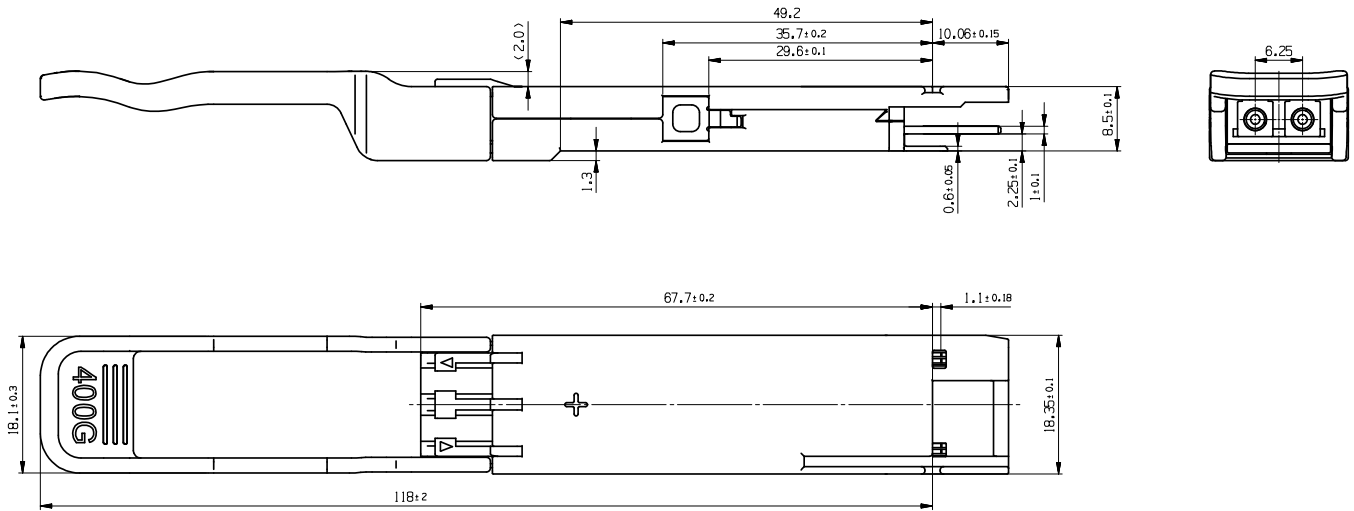
1. Receive sensitivity OMA<sub>outer</sub>, each lane (max) is informative and is defined for a transmitter with a value of SECQ up to 3.4dB.
2. Average receive power, each lane (min) is informative and not the principal indicator of signal strength. A receive power below this value can't be compliant;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

## 8. Digital Diagnostic Monitoring Functions

IP-ATLK02EC4C 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       | °C   |
| 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<br>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         | Jun.30, 2024  | Update contact information. |

