**AP1H4X-MM85xxM**

 **QSFP28 100Gb/s to 4 SFP28 Active Optical Cable**

**Features**

* Support 100GBASE-SR4,InfiniBand EDR
* Multi rate of up to 100Gbps
* QSFP28 interface compliant with SFF-8636
* SFP+ interface compliant with SFF-8431 and SFF- 8472
* Single power supply 3.3V
* Distance up to 50m over MMF
* Operating case temp 0°C to +70 °C
* RoHS compliant

**Applications**

* 100GBASE-SR4
* InfiniBand QDR, EDR
* Datacom and Telecom switch and router backplane connections

**Description**

Photonics Valley’s AP1H4X-MM85xxM is active optical cable assemblies with QSFP28 to 4 SFP28 hot pluggable connectors. Enjoys low power consumption. It is suitable for short distance and offer a cost-effective way to connect within racks and across adjacent racks. Its length is up to 100m over OM3.

**Ordering information**

|  |  |
| --- | --- |
| AP1H4X-MM8501M | 100GBase QSFP28 to 4\*25G SFP28 AOC 1 meter |
| AP1H4X-MM8502M | 100GBase QSFP28 to 4\*25G SFP28 AOC 2 meter |
| AP1H4X-MM8503M | 100GBase QSFP28 to 4\*25G SFP28 AOC 3 meter |
| AP1H4X-MM8505M | 100GBase QSFP28 to 4\*25G SFP28 AOC 5 meter |
| AP1H4X-MM8510M | 100GBase QSFP28 to 4\*25G SFP28 AOC 10 meter |
| AP1H4X-MM8520M | 100GBase QSFP28 to 4\*25G SFP28 AOC 20 meter |
| AP1H4X-MM8530M | 100GBase QSFP28 to 4\*25G SFP28 AOC 30 meter |

**Absolute Maximum Ratings**

The operation in excess of any absolute maximum ratings might cause permanent damage to this module.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Parameter** | **Symbol** | **Min** | **Typical** | **Max** | **Unit** |
| Supply Voltage | Vcc3 | -0.5 | - | +3.6 | V |
| Storage Temperature | TS | -10 | - | +70 | °C |
| Operating Humidity | RH | +5 | - | +85 | % |

**Recommended Operating Conditions**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Parameter** | **Symbol** | **Min** | **Typical** | **Max** | **Unit** |
| Operating Case Temperature | TC | 0 | - | +70 | °C |  |
| Power Supply Voltage | Vcc | 3.14 | 3.3 | 3.47 | V |  |
| Power Dissipation | PD | - | - | 2.5 | W | 1 |
| Bit Rate per lane | BR | 10.3125 | 25.78125 | - | Gbps |  |

**Electrical Characteristics of QSFP28**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Parameter** | **Symbol** | **Min.** | **Typ.** | **Max.** | **Units** | **Notes** |
| ModSelL | Module Select | VOL | 0 | - | 0.8 | V |  |
| Module Unselect | VOH | 2.5 | - | VCC | V |  |
| LPMode | Low Power Mode | VIL | 0 | - | 0.8 | V |  |
| Normal Operation | VIH | 2.5 | - | VCC+0.3 | V |  |
| ResetL | Reset | VIL | 0 | - | 0.8 | V |  |
| Normal Operation | VIH | 2.5 | - | VCC+0.3 | V |  |
| ModPrsL | Normal Operation | VOL | 0 | - | 0.4 | V |  |
| IntL | Interrupt | VOL | 0 | - | 0.4 | V |  |
| Normal Operation | VoH | 2.4 | - | VCC | V |  |
| **Electrical transmitter Characteristics** |
| Differential Date Input Swing | Vin，p-p | 200 | - | 1600 | mV |  |
| Output Differential Impedance | Zin | 90 | 100 | 110 | ohm |  |
| **Electrical Receiver Characteristics** |
| Differential Data Output Swing | Vout | 200 | - | 800 | mV |  |
| Bit Error Rate | BER | - | - | 5E-5 | - | 1 |
| Input Differential Impedance | ZD | 90 | 100 | 110 | ohm |  |

**Notes:**  All parameters are specified under the recommended operating conditions with PRBS2^31-1@25.78125Gbps data pattern unless otherwise specified.

**Electrical Characteristics of SFP28**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Parameter** | **Symbol** | **Min.** | **Typ.** | **Max.** | **Units** | **Notes** |
|  **Electrical Transmitter Characteristics** |
| Differential Data Input Swing | Vin,P-P | 200 | - | 1600 | mVPP |  |
| Input Differential Impedance | ZIN | 90 | 100 | 110 | Ohm |  |
| Tx\_Fault | Normal Operation | VOL | 0 | - | 0.8 | V |  |
| Transmitter Fault | VOH | 2.0 | - | VCC | V |  |
| Tx\_Disable | Normal Operation | VIL | 0 | - | 0.8 | V |  |
| Laser Disable | VIH | 2.0 | - | VCC+0.3 | V |  |
| **Electrical Receiver Characteristics** |
| Differential Date Output | Vout | 400 | - | 800 | mV |  |
| Bit Error Rate | BER | - | - | E-12 | - |  |
| Output Differential Impedance | ZD | 90 | 100 | 110 | ohm |  |
| Rx\_LOS | Normal Operation | VOL | 0 | - | 0.8 | V |  |
| Lose Signal | VoH |  2.0 | - | VCC | V |  |

**Interface Circuit**

**PIN Arrangement**



**Pin Function Definition for QSFP28**

|  |  |  |  |
| --- | --- | --- | --- |
| **Pin** | **Symbol** | **Name/Description** | **Notes** |
| 1 | GND | Ground | 1 |
| 2 | Tx2n | Transmitter Inverted Data Input |  |
| 3 | Tx2p | Transmitter Non-Inverted Data Input |  |
| 4 | GND | Ground | 1 |
| 5 | Tx4n | Transmitter Inverted Data Input |  |
| 6 | Tx4p | Transmitter Non-Inverted Data Input |  |
| 7 | GND | Ground | 1 |
| 8 | ModSelL | Module Select |  |
| 9 | ResetL | Module Reset |  |
| 10 | Vcc Rx | +3.3V Power Supply Receiver |  |
| 11 | SCL | 2-wire serial interface clock |  |
| 12 | SDA | 2-wire serial interface data |  |
| 13 | GND | Ground | 1 |
| 14 | Rx3p | Receiver Non-Inverted Data Output |  |
| 15 | Rx3n | Receiver Inverted Data Output |  |
| 16 | GND | Ground | 1 |
| 17 | Rx1p | Receiver Non-Inverted Data Output |  |
| 18 | Rx1n | Receiver Inverted Data Output |  |
| 19 | GND | Ground | 1 |
| 20 | GND | Ground | 1 |
| 21 | Rx2n | Receiver Inverted Data Output |  |
| 22 | Rx2p | Receiver Non-Inverted Data Output |  |
| 23 | GND | Ground | 1 |
| 24 | Rx4n | Receiver Inverted Data Output |  |
| 25 | Rx4p | Receiver Non-Inverted Data Output |  |
| 26 | GND | Ground | 1 |
| 27 | ModPrsL | Module Present |  |
| 28 | IntL | Interrupt |  |
| 29 | Vcc Tx | +3.3V Power supply transmitter |  |
| 30 | Vcc1 | +3.3V Power supply |  |
| 31 | LPMode | Low Power Mode |  |
| 32 | GND | Ground | 1 |
| 33 | Tx3p | Transmitter Non-Inverted Data Input |  |
| 34 | Tx3n | Transmitter Inverted Data Input |  |
| 35 | GND | Ground | 1 |
| 36 | Tx1p | Transmitter Non-Inverted Data Input |  |
| 37 | Tx1n | Transmitter Inverted Data Input |  |
| 38 | GND | Ground | 1 |

**Notes:** All Circuit ground is internally isolated from chassis ground.



**Pin Function Definition for SFP28**

|  |  |  |  |
| --- | --- | --- | --- |
| **Pin** | **Symbol** | **Name/Description** | **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 | SDA | 2-Wire Serial Interface Data Line (MOD-DEF2) |  |
| 5 | SCL | 2-Wire Serial Interface Clock (MOD-DEF1) |  |
| 6 | MOD\_ABS | Module Absent, connected to VEET or VEER in the module | 2 |
| 7 | RS0 | Rate Select 0, optionally controls SFP+ module receiver | 4 |
| 8 | RX\_LOS | Receiver Loss of Signal Indication (In FC designated as Rx\_LOS and in Ethernet designated as NOT Signal Detect) | 2 |
| 9 | RS1 | Rate Select 1, optionally controls SFP+ module transmitter | 4 |
| 10 | VEER | Module Receiver Ground | 1 |
| 11 | VEER | Module Receiver Ground | 1 |
| 12 | RD- | Receiver Inverted Data Output |  |
| 13 | RD+ | Receiver Non-Inverted Data Output |  |
| 14 | VEER | Module Receiver Ground | 1 |
| 15 | VCCR | Module Receiver 3.3 V Supply |  |
| 16 | VCCT | Module Transmitter 3.3 V Supply |  |
| 17 | VEET | Module Transmitter Ground | 1 |
| 18 | TD+ | Transmitter Non-Inverted Data Input |  |
| 19 | TD- | Transmitter Inverted Data Input |  |
| 20 | VEET | Module Transmitter Ground | 1 |

Note:

1. The module ground pins are isolated from the module case.
2. The pins shall be pulled up with 4.7K-10Kohms to a voltage between 3.14V and 3.46V on host board.
3. The pin is pulled up to VCCT with a 4.7K-10KΩ resistor in the module.
4. See SFF-8472 Rev12.2 Table 10-2.

**Mechanical Design**



 **Cable length & Tolerance**

|  |  |
| --- | --- |
| **Cable Length / m** | **Tolerance/ cm** |
| ≤1.0 | +5/-0 |
| 1.0＜L≤4.5 | +15/-0 |
| 4.5＜L≤14.5 | +30/-0 |
| ＞14.5 | +2%/-0 |

**Breakout Cable Nominal Length**

|  |  |
| --- | --- |
| **Total Length / m** | **Breakout Point Measured from SFP28 / m** |
| 1 | 0.7 |
| 2 | 1.4 |
| 3 | 2 |
| ≥5 | 3 |

**Regulatory Compliance**

|  |  |  |
| --- | --- | --- |
| **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  |

**Appendix A. Document Revision**

|  |  |  |
| --- | --- | --- |
| **Version No.**  | **Date**  | **Description**  |
| 1.0  | 2019-3-1  | Preliminary datasheet  |