

TITLE 400G QSFP-DD Active Copper Cable PAM4	DOC No. RFD-20231220007-001	
	REVISION : 01	AUTHORIZED BY : Andy Yang
	DATE : 2023.12.20	CLASSIFICATION : CONFIDENTIAL

1. General Description

QSFP-DD active copper cable assembly feature sixteen differential copper pairs, providing eight data transmission channels at speeds up to 56Gbps(PAM4) per channel, and meets 400G Ethernet and InfiniBand High Data Rate(HDR) requirements. Available in a broad range of wire gages from 26AWG through 30AWG-this 400G copper cable assembly features low insertion loss and low cross talk.

QSFP-DD uses PAM4 signals for transmission, which doubles the rate. However, there are more stringent requirements for cable insertion loss. For detailed requirements, please see High Speed Characteristics.

2. PRODUCT FEATURES

- Compatible with IEEE 802.3bj and IEEE 802.3cd
- Supports aggregate data rates of 400Gbps(PAM4)
- Optimized construction to minimize insertion loss and cross talk
- Pull-to-release slide latch design
- Straight and break out assembly configurations available
- Customized cable braid termination limits EMI radiation
- Customizable EEPROM mapping for cable signature
- 26AWG through 30AWG cable
- Up to 7 meter transmission for Ethernet and 5 meter for HDR
- 3.3V Power supply
- Power Consumes 0.15W per active channel
- EQ programmable
- Temperature Range: 0~ 70 °C

TITLE 400G QSFP-DD Active Copper Cable PAM4	DOC No. RFD-20231220007-001	
	REVISION : 01	AUTHORIZED BY : Andy Yang
	DATE : 2023.12.20	CLASSIFICATION : CONFIDENTIAL

3. PRODUCT DESCRIPTION

3.1 PRODUCT NAME

400G QSFP-DD Active Copper Cable PAM4

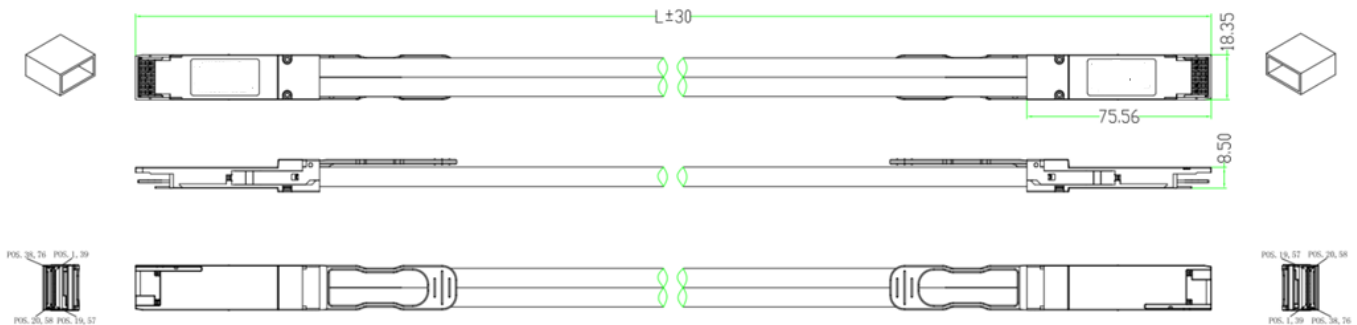
JPC P/N	Length(m)	Cable AWG	Description
P56**7A00**M-1	1.0m – 3.0m	30 AWG	400G QSFP-DD to QSFP-DD ACC 30AWG **m
P56**7B00**M-1	4.0m – 5.0m	28 AWG	400G QSFP-DD to QSFP-DD ACC 28AWG **m
P56**7C00**M-1	6.0m – 7.0m	26 AWG	400G QSFP-DD to QSFP-DD ACC 26AWG **m

Note-1 : ** Indicates the customer code.

Note-2 : ** Indicates the length.

3.2 DIMENSIONS, MATERIALS, PLATINGS AND MARKING

The connector is compatible with the QSFP-DD specification.



4. APPLICABLE DOCUMENTS AND SPECIFICATIONS

- Switches, servers and routers
- Data Center networks
- Storage area networks

TITLE 400G QSFP-DD Active Copper Cable PAM4	DOC No. RFD-20231220007-001	
	REVISION : 01	AUTHORIZED BY : Andy Yang
	DATE : 2023.12.20	CLASSIFICATION : CONFIDENTIAL

- High performance computing
- Telecommunication and wireless infrastructure
- Medical diagnostics and networking
- Test and measurement equipment 400G
- Ethernet (IEEE 802.3cd)
- InfiniBand HDR

5. Absolute Maximum Ratings & Recommended Operating Conditions

5.1 General Product Characteristics

QSFP-DD ACC Specifications	
Number of Lanes	Tx8 & Rx8
Channel Data Rate	53.125Gbps
Operating Temperature	0 to + 70°C
Storage Temperature	-40 to + 85°C
Supply Voltage	3.3 V nominal
Electrical Interface	76pins edge connector
Management Interface	Serial, I ² C

5.2 High Speed Characteristics

Parameter	Symbol	Min	Typical	Max	Unit	Note
Differential Impedance	TDR	90	100	110	Ω	
Insertion loss	SDD21	-17.16			dB	At 13.28 GHz
Differential Return Loss	SDD11			See 1	dB	At 0.05 to 4.1 GHz
	SDD22			See 2	dB	At 4.1 to 19 GHz
Common-mode to common-mode output return loss	SCC11 SCC22			-2	dB	At 0.2 to 19 GHz

TITLE 400G QSFP-DD Active Copper Cable PAM4	DOC No. RFD-20231220007-001	
	REVISION : 01	AUTHORIZED BY : Andy Yang
	DATE : 2023.12.20	CLASSIFICATION : CONFIDENTIAL

Differential to common-mode return loss	SCD11 SCD22			See 3	dB	At 0.01 to 12.89 GHz
				See 4		At 12.89 to 19 GHz
Differential to common Mode Conversion Loss	SCD21- SDD21			-10	dB	At 0.01 to 12.89 GHz
				See 5		At 12.89 to 15.7 GHz
				-6.3		At 15.7 to 19 GHz

Notes:

1. Reflection Coefficient given by equation $SDD11(dB) < -16.5 + 2 \times \text{SQRT}(f)$, with f in GHz
2. Reflection Coefficient given by equation $SDD11(dB) < -10.66 + 14 \times \log_{10}(f/5.5)$, with f in GHz
3. Reflection Coefficient given by equation $SCD11(dB) < -22 + (20/25.78)*f$, with f in GHz
4. Reflection Coefficient given by equation $SCD11(dB) < -15 + (6/25.78)*f$, with f in GHz
5. Reflection Coefficient given by equation $SCD21(dB) < -27 + (29/22)*f$, with f in GHz

6. Pin-out Definition:

QSFP-DD Pin Function Definition

Pin	Logic	Symbol	Description
1		GND	Ground
2	CML-I	Tx2n	Transmitter Inverted Data Input
3	CML-I	Tx2p	Transmitter Non-Inverted Data Input
4		GND	Ground
5	CML-I	Tx4n	Transmitter Inverted Data Input
6	CML-I	Tx4p	Transmitter Non-Inverted Data Input
7		GND	Ground
8	LVTTTL-I	ModSelL	Module Select
9	LVTTTL-I	ResetL	Module Reset

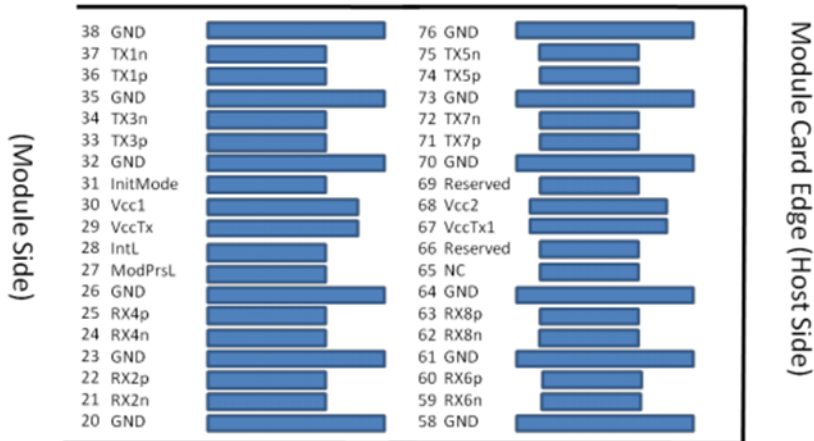
TITLE 400G QSFP-DD Active Copper Cable PAM4	DOC No. RFD-20231220007-001	
	REVISION : 01	AUTHORIZED BY : Andy Yang
	DATE : 2023.12.20	CLASSIFICATION : CONFIDENTIAL

10		Vcc Rx	+3.3V Power Supply Receiver
11	LVC MOS-	SCL	2-wire serial interface clock
	I/O		
12	LVC MOS-	SDA	2-wire serial interface data
	I/O		
13		GND	Ground
14	CML-O	Rx3p	Receiver Non-Inverted Data Output
15	CML-O	Rx3n	Receiver Inverted Data Output
16		GND	Ground
17	CML-O	Rx1p	Receiver Non-Inverted Data Output
18	CML-O	Rx1n	Receiver Inverted Data Output
19		GND	Ground
20		GND	Ground
21	CML-O	Rx2n	Receiver Inverted Data Output
22	CML-O	Rx2p	Receiver Non-Inverted Data Output
23		GND	Ground
24	CML-O	Rx4n	Receiver Inverted Data Output
25	CML-O	Rx4p	Receiver Non-Inverted Data Output
26		GND	Ground
27	LVTTL-O	ModPrsL	Module Present
28	LVTTL-O	IntL	Interrupt
29		Vcc Tx	+3.3V Power supply transmitter
30		Vcc1	+3.3V Power supply
31	LVTTL-I	LPMode	Low Power Mode
32		GND	Ground
33	CML-I	Tx3p	Transmitter Non-Inverted Data Input
34	CML-I	Tx3n	Transmitter Inverted Data Input
35		GND	Ground
36	CML-I	Tx1p	Transmitter Non-Inverted Data Input
37	CML-I	Tx1n	Transmitter Inverted Data Input
38		GND	Ground
39		GND	Ground
40	CML-I	Tx6n	Transmitter Inverted Data Input
41	CML-I	Tx6p	Transmitter Non-Inverted Data Input
42		GND	Ground
43	CML-I	Tx8n	Transmitter Inverted Data Input
44	CML-I	Tx8p	Transmitter Non-Inverted Data Input
45		GND	Ground

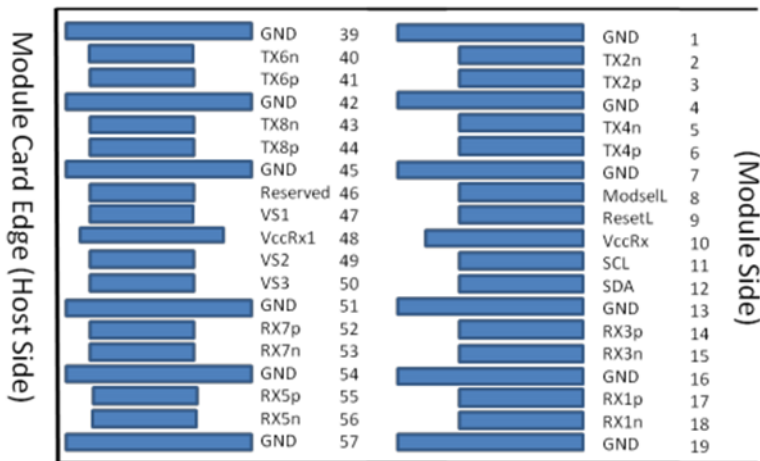
TITLE 400G QSFP-DD Active Copper Cable PAM4	DOC No. RFD-20231220007-001	
	REVISION : 01	AUTHORIZED BY : Andy Yang
	DATE : 2023.12.20	CLASSIFICATION : CONFIDENTIAL

46		Reserved	
47		VS1	
48		VccRx1	+3.3V Power supply
49		VS2	
50		VS3	
51		GND	Ground
52	CML-O	Rx7p	Receiver Non-Inverted Data Output
53	CML-O	Rx7n	Receiver Inverted Data Output
54		GND	Ground
55	CML-O	Rx5p	Receiver Non-Inverted Data Output
56	CML-O	Rx5n	Receiver Inverted Data Output
57		GND	Ground
58		GND	Ground
59	CML-O	Rx6n	Receiver Inverted Data Output
60	CML-O	Rx6p	Receiver Non-Inverted Data Output
61		GND	Ground
62	CML-O	Rx8n	Receiver Inverted Data Output
63	CML-O	Rx8p	Receiver Non-Inverted Data Output
64		GND	Ground
65		NC	
66		Reserved	
67		VccTx1	+3.3V Power supply
68		VCC2	+3.3V Power supply
69		Reserved	
70		GND	Ground
71	CML-I	Tx7p	Transmitter Non-Inverted Data Input
72	CML-I	Tx7n	Transmitter Inverted Data Input
73		GND	Ground
74	CML-I	Tx5p	Transmitter Non-Inverted Data Input
75	CML-I	Tx5n	Transmitter Inverted Data Input
76		GND	Ground

TITLE 400G QSFP-DD Active Copper Cable PAM4	DOC No. RFD-20231220007-001	
	REVISION : 01	AUTHORIZED BY : Andy Yang
	DATE : 2023.12.20	CLASSIFICATION : CONFIDENTIAL



Top side viewed from top



Bottom side viewed from bottom



TITLE 400G QSFP-DD Active Copper Cable PAM4	DOC No. RFD-20231220007-001	
	REVISION : 01	AUTHORIZED BY : Andy Yang
	DATE : 2023.12.20	CLASSIFICATION : CONFIDENTIAL

Regulatory Compliance

Feature	Test Method	Performance
Electrostatic Discharge (ESD) to the Electrical	MIL-STD-883C Method 3015.7	Class 1(>2000 Volts)
Electromagnetic Interference(EMI)	FCC Class B	Compliant with Standards
	CENELEC EN55022 Class B	
	CISPR22 ITE Class B	
RF Immunity(RFI)	IEC61000-4-3	Typically Show no Measurable Effect from a 10V/m Field Swept from
RoHS Compliance	RoHS Directive 2011/65/EU and it's Amendment Directives (EU) 2015/863	RoHS (EU) 2015/863 compliant
REACH Compliance	REACH Regulation (EC) No 1907/2006	REACH (EC) No 1907/2006 compliant

7.Modification History

Rev.	Comments	Date	Originator	Approval
01	Preliminary Draft	2023.12.20	Andy Yang	Mike Sun