

### PRODUCT FEATURES

- Twinax Direct-Attach Cable, Passive
- QSFP28 to QSFP28 Connectors
- Length: 50cm to 5 Meters
- Compliant with SFF-8665
- Compliant with IEEE 802.3b
- Up to 100Gb/s data rates
- Ultra-low crosstalk for improved performance
- Low insertion loss
- Tested in an end-to-end system
- Compliant with RoHS
- EMI radiation Switches, servers and routers
- Data Center networks
- Storage area networks
- High performance computing
- Telecommunication and wireless infrastructure
- Medical diagnostics and networking
- Test and measurement equipment



### GENERAL

HPC Optics' passive copper cables provide robust connections for leading edge 100Gb/s systems. Passive copper cables require no additional power to ensure quality connectivity. The 100Gb/s passive copper cables are fully compliant with SFF-8436 specification and provide connectivity between devices using QSFP28 ports. The cables fill the need for short, cost-effective connectivity in the data center. HPC Optics' high-quality solutions provide a power-efficient replacement for active power connectivity such as fiber optic cables for short distances. Optimizing systems to operate with HPC Optics' 100Gb/s passive copper cables significantly reduces power consumption and EMI emission.

## Recommended Operation Condition

Parameter	Symbol	Min	Max	Unit
Operating Case Temperature	Topc	-20	85	degC
Storage Temperature	Tst	-40	85	degC
Relative Humidity (non-condensation)	RS	35	60	%
Supply Voltage	VCC3	3.135	3.465	V
Voltage on LVTTTL Input	Vilvttl	-0.3	VCC3 +0.2	V
Power Supply Current	ICC3		10	mA
Total Power Consumption	Pd	-	0.03	W

**Notes:**

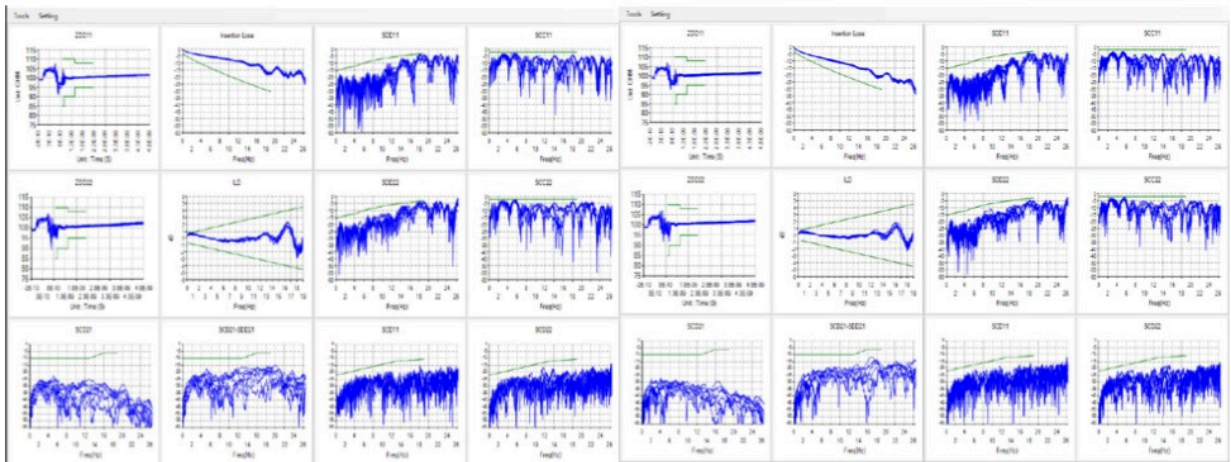
Stress or conditions exceed the above range may cause permanent damage to the device.

This is a stress rating only and functional operation of the device at these or any other conditions above those listed in the operational sections of this specification is not applied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

## Frequency Domain

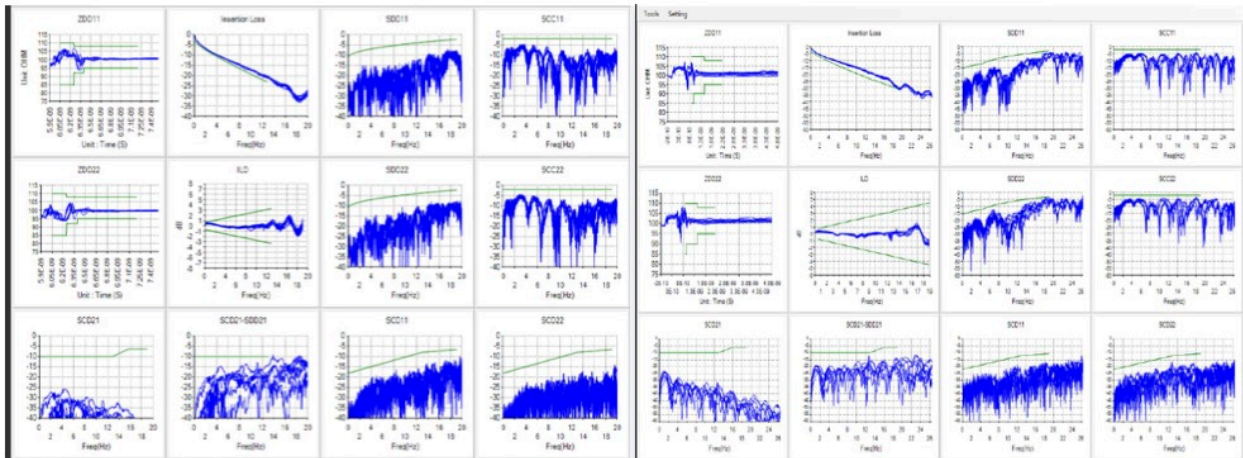
Item	Test Parameter	IEEE802.3bj Specification
1	Differential Insertion Loss (SDD21)	Maximum insertion loss at 12.8906Ghz -22.48dB Minimum insertion loss at 12.8906Ghz -8dB
2	Differential Insertion Loss (SDD21)	Maximum insertion loss at 12.8906Ghz -22.48dB Minimum insertion loss at 12.8906Ghz -8dB
3	Differential Return Loss (SDD22)	-16.5+2xSQRT(f) @ 0.01 to 4.1GHz -10.66+14xLog10(f/5.5) @4.1 to 19GHz
4	Differential Return Loss (SDD11)	-16.5+2xSQRT(f) @ 0.01 to 4.1GHz -10.66+14xLog10(f/5.5) @4.1 to 19GHz
5	Common Mode Reflection (SCC22)	-2dB @ 0.01 to 19GHz
6	Common Mode Reflection (SCC11)	-2dB @ 0.01 to 19GHz
7	Common Mode Conversion (SCD22)	-22+(20/25.78)*(f) @ 0.01 to 12.89GHz -15+(6/25.78)*(f) @ 12.9 to 19GHz
8	Common Mode Conversion (SCD11)	-22+(20/25.78)*(f) @ 0.01 to 12.89GHz -15+(6/25.78)*(f) @ 12.9 to 19GHz
9	Differential to Common Mode Conversion Loss (SCD12)	-10dB @ 0.01 to 12.89GHz -27+(29/22)*(f) @ 12.9 to 15.7GHz -6.3dB @ 15.71 to 19GHz
10	Differential to Common Mode Conversion Loss (SCD21)	-10dB @ 0.01 to 12.89GHz -27+(29/22)*(f) @ 12.9 to 15.7GHz -6.3dB @ 15.71 to 19GHz

## Typical Operation Characteristics



**QSFP28 30AWG 1M-30WG**

**QSFP28 30AWG 2M-30AWG**



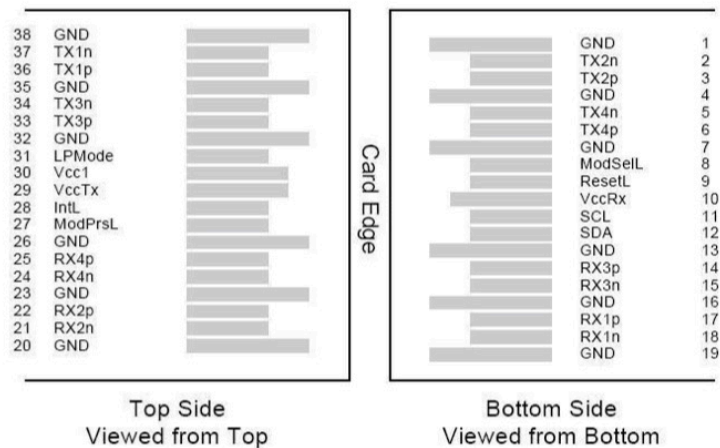
**QSFP28 28AWG 3M-30AWG**

**QSFP28 26AWG 5M-26AWG**

## Host board Connector Pinout

**Figure 1: MSA compliant Connector**





**Figure 2: Pin Definitions.**

Pin	Logic	Symbol	Name/Description	Note
1		GND	Ground	1
2	CML-I	Tx2n	Transmitter Inverted Data Input	
3	CML-I	Tx2p	Transmitter Non-Inverted Data output	
4		GND	Ground	1
5	CML-I	Tx4n	Transmitter Inverted Data Input	
6	CML-I	Tx4p	Transmitter Non-Inverted Data output	
7		GND	Ground	1
8	LVTLL-I	ModSelL	Module Select	
9	LVTLL-I	ResetL	Module Reset	
10		VccRx	+ 3.3V Power Supply Receiver	2
11	LVC MOS-I/O	SCL	2-Wire Serial Interface Clock	
12	LVC MOS-I/O	SDA	2-Wire Serial Interface Data	
13		GND	Ground	
14	CML-O	Rx3p	Receiver Non-Inverted Data Output	
15	CML-O	Rx3n	Receiver Inverted Data Output	
16		GND	Ground	1
17	CML-O	Rx1p	Receiver Non-Inverted Data Output	
18	CML-O	Rx1n	Receiver Inverted Data Output	
19		GND	Ground	1
20		GND	Ground	1
21	CML-O	Rx2n	Receiver Inverted Data Output	
22	CML-O	Rx2p	Receiver Non-Inverted Data Output	
23		GND	Ground	1
24	CML-O	Rx4n	Receiver Inverted Data Output	1
25	CML-O	Rx4p	Receiver Non-Inverted Data Output	
26		GND	Ground	1

27	LVTTTL-O	ModPrsL	Module Present	
28	LVTTTL-O	IntL	Interrupt	
29		VccTx	+3.3 V Power Supply transmitter	2
30		Vcc1	+3.3 V Power Supply	2
31	LVTTTL-I	LPMODE	Low Power Mode	
32		GND	Ground	1
33	CML-I	Tx3p	Transmitter Non-Inverted Data Input	
34	CML-I	Tx3n	Transmitter Inverted Data Output	
35		GND	Ground	1
36	CML-I	Tx1p	Transmitter Non-Inverted Data Input	
37	CML-I	Tx1n	Transmitter Inverted Data Output	
38		GND	Ground	1

Notes:

1. GND is the symbol for signal and supply (power) common for QSFP modules. All are common within the QSFP module and all module voltages are referenced to this potential otherwise noted. Connect these directly to the host board signal common ground plane.
2. Vcc Rx, Vcc1 and Vcc Tx are the receiver and transmitter power suppliers and shall be applied concurrently. Recommended host board power supply filtering is shown below. Vcc Rx, Vcc1 and Vcc Tx may be internally connected within the QSFP transceiver module in any combination. The connector pins are each rated for a maximum current of 500mA.

## 2 - wire Management Interface

The transceivers provide management two - wire interface and the management memory map is specified by SFF-8636.

### EEPROM Map

Part Number			CAB-ZQP/ZQP-PxM EEPROM	
Device Lower Page LMM				
<u>DATA Address (DEC)</u>	<u>DATA Address (HEX)</u>	<u>Value (HEX)</u>	<u>Name of Field</u>	<u>Description</u>
0	0	0X11	Identifier (See SFF-8024 Transceiver Management)	QSFP28 or later (SFF-8665 et al.) *2
1	1	0X07	Revision Compliance	SFF-8636 Rev 2.5, 2.6 and 2.7
2	2	0X06	Status Indicators	Page 00h only
3-21	3-15	0X00	Interrupt Flags	not specified
22-33	16-21	-	Free Side Device Monitors	Free Side Device Monitors
34-81	22-51	0X00	Channel Monitors	not specified
82-85	52-55	0X00	Reserved	not specified
86-98	56-62	0X00	Control	not specified
99	63	0X00	Reserved	Reserved

218	DA	0X20		
219	DB	0X20		
220	DC	0X00	Diagnostic Monitoring Type	Unspecified
221	DD	0X00	Enhanced Options	Unsupported
222	DE	0X67	BR, Nominal	25750Mb
223	DF	0X61	CC_EXT	
224	E0	0XFF	Vendor Specific	
225	E1	0XFF		
226	E2	0XFF		
227	E3	0XFF		
228	E4	0XFF		
229	E5	0XFF		
230	E6	0XFF		
231	E7	0XFF		
232	E8	0XFF		
233	E9	0XFF		
234	EA	0XFF		
235	EB	0XFF		
236	EC	0XFF		
237	ED	0XFF		
238	EE	0XFF		
239	EF	0XFF		
240	F0	0XFF		
241	F1	0XFF		
242	F2	0XFF		
243	F3	0XFF		
244	F4	0XFF		
245	F5	0XFF		
246	F6	0XFF		
247	F7	0XFF		
248	F8	0XFF		
249	F9	0XFF		
250	FA	0XFF		
251	FB	0XFF		
252	FC	0XFF		
253	FD	0XFF		
254	FE	0XFF		
255	FF	0XFF		

140	8C	0XFF	BR, Nominal	25500Mb
141	8D	0X00	Rate Select Compliance	Unspecified
142	8E	0X00	Length (SMF)	Unsupported
143	8F	0X00	Length (OM3 50um)	Unsupported
144	90	0X00	Length (OM2 50um)	Unsupported
145	91	0X00	Length (OM1 62.5um)	Unsupported
146	92	0X01	Length (Passive or Active cable or OM4 50um)	xM
147	93	0XA0	Device Technology	Copper cable unequalized No wavelength control Uncooled transmitter device Pin detector Transmitter not tunable
148	94	0X31	Vendor Name	
149	95	0X30		
150	96	0X47		
151	97	0X74		
152	98	0X65		
153	99	0X6B		
154	9A	0X20		
155	9B	0X20		
156	9C	0X20		
157	9D	0X20		
158	9E	0X20		
159	9F	0X20		
160	A0	0X20		
161	A1	0X20		
162	A2	0X20		
163	A3	0X20		
164	A4	0X1F	Extended Module code Values	EDR FDR QDR DDR SDR
165	A5	0X00	Vendor OUI	
166	A6	0X00		
167	A7	0X00		
168	A8	0X43	Vendor PN	CAB-ZQP/ZQP-PxM
169	A9	0X41		
170	AA	0X42		
171	AB	0X2D		
172	AC	0X5A		
173	AD	0X51		
174	AE	0X50		
175	AF	0X2F		
176	B0	0X5A		



177	B1	0X51		
178	B2	0X50		
179	B3	0X2D		
180	B4	0X50		
181	B5	0X31		
182	B6	0X4D		
183	B7	0X20		
184	B8	0X30		
185	B9	0X31	Vendor Rev	01
186	BA	0X00	Wavelength or Copper cable	
187	BB	0X00	Attenuation	
188	BC	0X00	Wavelength tolerance or	
189	BD	0X00	Copper Cable Attenuation	
190	BE	0X55	Max case Temp.	85°C
191	BF	0X95	CC_BASE	
192	C0	0X0B	Link Codes	100GBASE-CR4 or 25GBASE-CR CA-25G-L
193	C1	0X00		Unspecified
194	C2	0X00	Options	Unspecified
195	C3	0X00		Unspecified
196	C4	0X41		
197	C5	0X50		
198	C6	0X46		
199	C7	0X31		
200	C8	0X36		
201	C9	0X31		
202	CA	0X35		
203	CB	0X31		
204	CC	0X30	Vendor SN	SN
205	CD	0X33		
206	CE	0X34		
207	CF	0X38		
208	D0	0X47		
209	D1	0X55		
210	D2	0X20		
211	D3	0X20		
212	D4	0X31		
213	D5	0X36		
214	D6	0X30	Date Code	日期
215	D7	0X35		
216	D8	0X31		
217	D9	0X32		



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229	E5	0XFF		
230	E6	0XFF		
231	E7	0XFF		
232	E8	0XFF		
233	E9	0XFF		
234	EA	0XFF		
235	EB	0XFF		
236	EC	0XFF		
237	ED	0XFF		
238	EE	0XFF		
239	EF	0XFF		
240	F0	0XFF		
241	F1	0XFF		
242	F2	0XFF		
243	F3	0XFF		
244	F4	0XFF		
245	F5	0XFF		
246	F6	0XFF		
247	F7	0XFF		
248	F8	0XFF		
249	F9	0XFF		
250	FA	0XFF		
251	FB	0XFF		
252	FC	0XFF		
253	FD	0XFF		
254	FE	0XFF		
255	FF	0XFF		

## Mechanical Specifications

Parameter	Mechanical			Unit
	Minimum	Typical	Maximum	
Cable Diameter (26AWG)		0.385		Inches
Bend Radius (26AWG)	1.925			Inches
Cable Diameter (28AWG)		0.329		Inches
Bend Radius (28AWG)	1.649			Inches
Cable Diameter (30 AWG)		0.271		Inches
Bend Radius (30 AWG)	1.355			Inches
Within Pair Skew			100	ps/10m
Cable Insertion Loss		18.52		dB/5m
Bulk Cable Time Delay			5.2	ns/m
Bulk Cable Impedance	95	100	105	Ohms
Insertion Force	/		40	N
Withdrawal Force	/		30	N
Retention Force	90		/	N
Durability	50 Cycles		/	/

## Mechanical Dimensions

