



Datasheet: Transceiver

QSFP28-100G-DAC-xM QSFP28 100G Passive Copper Cable Assembly

Key Features

- Compliant with SFF-8665
- Compliant with IEEE 802.3bj
- Up to 100Gb/s data rates
- Ultra low crosstalk for improved performance
- Low insertion loss
- BER better than 10⁻¹⁵
- Serial numbers printed on each end
- Tested in an end-to-end system
- RoHS compliant

Base Code

Part number	Description
QSFP28-100G-DAC-xM	QSFP28 Passive Copper Cable with full real-time digital diagnostic monitoring

Introduction

ProLabs QSFP28-100G-DAC-XM 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. ProLabs QSFP28-100G-DAC-XM 100Gb/s passive copper cables fill the need for short, cost-effective connectivity in the data centre.

ProLabs high-quality solutions provide a power-efficient replacement for active power connectivity such as fibre optic cables for short distances.

Optimizing systems to operate with ProLabs QSFP28-100G-DAC-XM 100Gb/s passive copper cables significantly reduces power consumption and EMI emission.

The Low Smoke Zero Halogen (LSZH) design fully complies with the European Union Restriction of Hazardous Substances (RoHS) directive and similar North American safety and environmental standards.



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Ordering Information

OEM Manufacturer	ProLabs SKU	Product Description
Dell Force10	DAC-QSFP28-100G-1M-C	100G QSFP28 Passive Cable 1m
Generic	QSFP28-100G-DAC-1M-NC	100G QSFP28 Passive Cable 1m
Dell Force10	DAC-QSFP28-100G-3M-C	100G QSFP28 Passive Cable 3m
Generic	QSFP28-100G-DAC-3M-NC	100G QSFP28 Passive Cable 3m

Specifications

Recommended Operation Condition

Parameter	Symbol	Min	Max	Unit
Operating Case Temperature	Topc	0	70	degC
Storage Temperature	Tst	-40	125	degC
Relative Humidity (non-condensation)	RS	-	85	%
Supply Voltage	VCC3	3.135	3.465	V
Voltage on LVTTTL Input	Vilvttl	-0.3	VCC3 +0.2	V
Power Supply Current	ICC3	0.001	-	mA
Total Power Consumption	Pd	-	0.003	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.



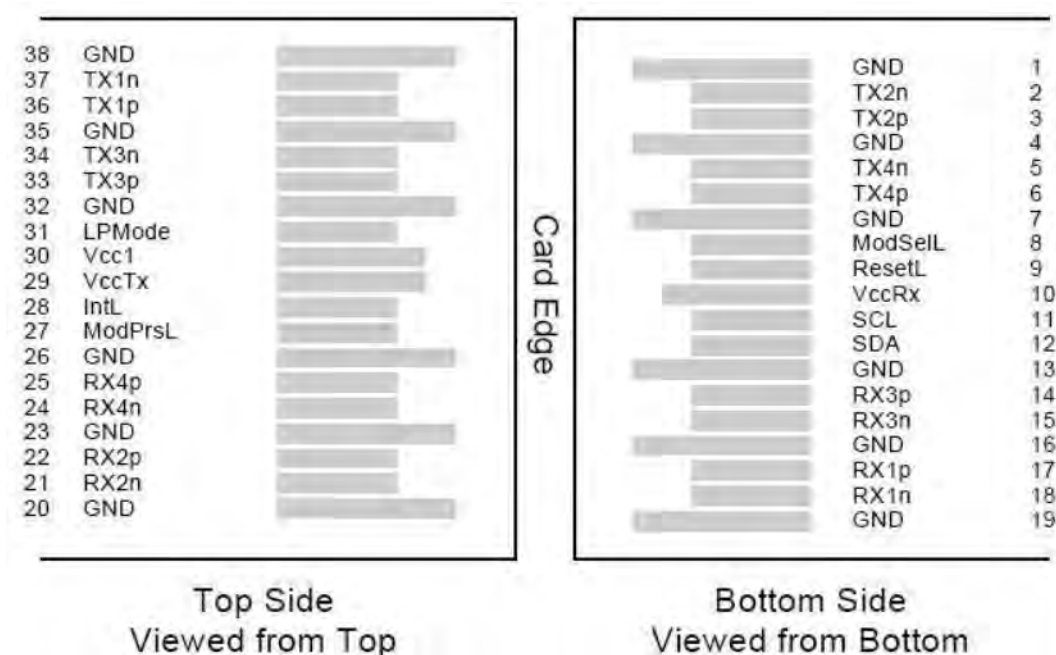
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Frequency Domain

Item	Test Parameter	IEEE802.3bj Specification
1	Differential Insertion Loss (SDD21)	Minimum insertion loss at 12.8906Ghz -8dB 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

Host board Connector Pinout

Figure 1s: MSA compliant Connector





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Time Domain

Item	Test Parameter	Specification (Proposal)
1	Intra-Skew* 1M 1.5M~2M 2.5M~3M	20ps Max 25ps Max 30ps Max
2	Impedance Rise time: 14ps (20%~80%)	100 +/- 10 Ohm
3	Insertion Loss* (SDD21)for 1M	a) 0.6GHz : -2.11 dBn Max b)1.25GHz : -2.88 dB Max c)2.50GHz : -3.78 dB Max d)3.25GHz : -4.95 dB Max e)5.0GHz : -5.82 dB Max
3	Insertion Loss* (SDD21) for 1.5M	a) 0.6GHz : -2.13 dB Max b) 1.25GHz : -3.24 dB Max c)2.50GHz : -4.44 dB Max d)3.25GHz : -5.99 dB Max e)5.0GHz : -6.90 dB Max
3	Insertion Loss* (SDD21) for 2M	a)0.6GHz : -2.32 dB Max b)1.25GHz : -3.76 dB Max c)2.50GHz : -5.26 dB Max d)3.25GHz : -7.20dB Max e) 5.0GHz : -8.14 dB Max
3	Insertion Loss* (SDD21) for 2.5M	a) 0.6GHz : -2.58 dB Max b)1.25GHz : -3.74 dB Max c)2.50GHz : -5.27 dB Max d)3.25GHz : -6.15dB Max e)5.0GHz : -8.38 dB Max
3	Insertion Loss* (SDD21) for 3M	a)0.6GHz : -2.86 dB Max b)1.25GHz : -4.24 dB Max c)2.50GHz : -6.02 dB Max d)3.25GHz : -6.99 dB Max e)5.0GHz : -9.5 dB Max



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Figure 2 : Pin Definitions

Pin#	Logic	Symbol	Name/Description	Notes
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	
12	LVC MOS-I/O	SDA	2-Wire Serial Interface	
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	LVTTL-O	ModPrsL	Module Present	
28	LVTTL-O	IntL	Interrupt	
29		VccTx	+3.3 V Power Supply transmitter	2
30		Vcc1	+3.3 V Power Supply	2
31	LVTTL-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



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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.

Memory Map

In addition to the electrical loopback function, this loopback module provides an MSA standard 2-wire serial communication interface to digital diagnostics and preloaded 256kB EEPROM memory maps; both standard and custom memory maps are available.



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EEPROM Map

Device 0xA0			
Address (Dec)	Value (Hex)	Name of Field (as per SFF-8436)	Description of data code
0	0D	ID and status	
1-2	05 06	Status	
3-21	0	Interrupt Flags	00h
22-33	0	Module Monitors	00h
34-81	0	Channel Monitors	00h
82-85	0	Reserved	00h
86-97	0	Control	00h
98-99	0	Reserved	00h
100-106	0	Module and Channel Mask	00h
107-118	0	Reserved	00h
119-122	0	Password Change Entry Area (Optional)	00h
123-126	0	Password Entry Area (Optional)	00h
127	0	Page Select Byte	00h
128	11	Identifier	11 = QSFP28
129	0	Ext. Identifier	00h = Power Class 1, No CLEI, No CDR
130	23	Connector	23h = No Separable connector
131	0B	Transceiver Reserved	100GBA SE-CR4
132	0		00h = not specified
133	0		00h = not specified
134	0		00h = not specified
135	41		00h = not specified
136	80		00h = not specified
137	80		00h = not specified



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138	0		00h = not specified
139	0	Encoding	00h = not specified
140	FF	Nominal bit rate (unit: 100M bps)	FF= 25.5G/bps
141	0	Reserved	00h = not specified
142	0	Length(SMF)	00h = not specified
143	0	Length (E-50µm)	00h = not specified
144	0	Length (50 µm)	00h = not specified
145	0	Length (62.5 µm)	00h = not specified
146	Length in meters	Cable Length(Copper)	Fill in length in units of 1 meter
147	A0	Device Tech	A0h = Copper Cable Un equalizer
148-163	31 30 47 74 65 6B 20 20 20 ...	Vendor name	Fill in "ProLabs" Extra Bytes are filled with space (20h)
164	7	Extended Transceiver Codes	00h = not specified
165	0	Vendor OUI[0]	ProLabs OUI Code
166	2	Vendor OUI[1]	
167	C9	Vendor OUI[2]	
168	51	QSFP28 Vendor Part Number (ASCII)	Fill in ProLabs P/N "QSFP28-100G-1M" Extra Bytes are filled with space (20h)
169	53		
170	46		
171	50		
172	32		
173	38		
174	2D		
175	31		
176	30		
177	30		
178	47		
179	2D		
180	31		
181	4D		
182	20		
183	20		
184-185	ProLabs 's Rev	QSFP28 Vendor Revision Number (ASCII)	Fill in ProLabs Rev. Extra Bytes are filled with space (20h)
186	Attenuation 2.5GHz	Copper Cable Attenuation	Fill in attenuation @ 2.5GHz in dB
187	Attenuation 5.0GHz		Fill in attenuation @ 5.0GHz in dB
188-189	0	Wavelength Tolerance	00h
190	46	Max Case Temperature	46 = 70C
191	Check Sum	Check Code for Base ID Fields	Fill in Check Sum
192	0	Options	00h = not specified
196-211	Manufacturer's S/N	Serial Number provided by Vendor (ASCII)	Fill in manufacturer's S/N Extra Bytes are filled with space (20h)
212-213	Year	Vendor's manufacturing data code	ASCII code, Two low order digits of year.(00 = 2000)



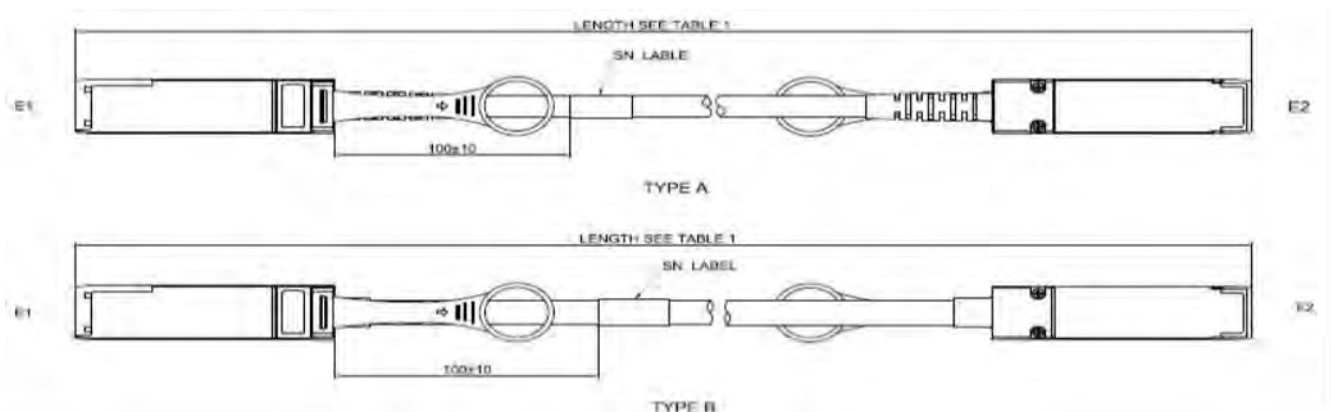
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214-215	Month		ASCII code, digits of month.(01= Jan through 12 = Dec)
216-217	Day		ASCII code, day of month.(01~31)
218-219	Lot Number	Date Code[L]	ASCII code, Vendor Specific lot code
220	0	Diagnostic Monitoring Type	00h = not specified
221	0	Enhanced Options	00h = not specified
222	0	Reserved	Reserved
223	Check Sum	Check code for Extended ID fields	Fill in Check Sum
224-255	0	Vendor Specific ID Fields	0

Mechanical Specifications

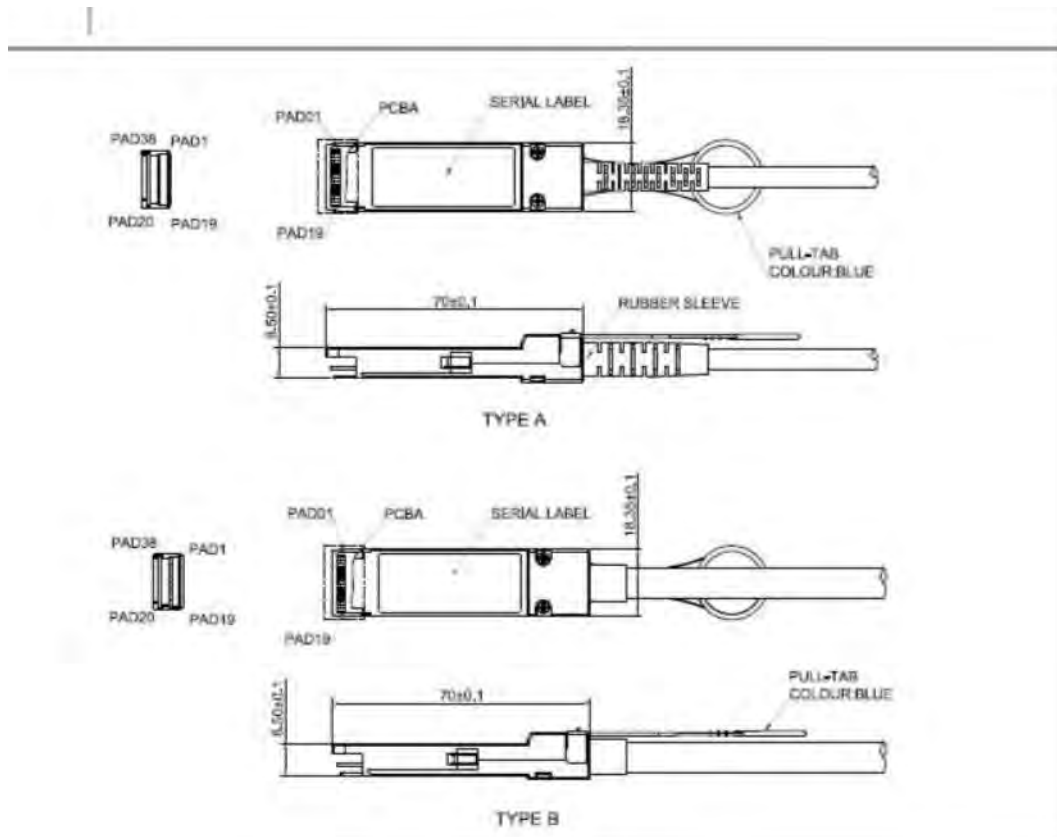
Parameter	Minimum	Typical	Maximum	Unit
Cable Diameter (26AWG)		0.385		Inches
Bend Radius (26AWG)	1.925			Inches
Cable Diameter (30 AWG)		0.271		Inches
Bend Radius (30 AWG)	1.35			Inches
Within Pair Skew			100	ps/10m
Cable Insertion Loss		29.77		dB/5m
Bulk Cable Time Delay			5.2	ns/m
Bulk Cable Impedance	95	100	105	Ohms
Insertion Force	/		40	N
Withdrawal Force	/		30	N
Retention Force	90		/	N
Durability	50 Cycles		/	/

Mechanical Dimensions (Type A for 30AWG, Type B for 26AWG)





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Ordering Information

100G QSFP28 Copper Cable Assemblies, Passive

Length	Data Rate	P/N	AWG			Length Tolerance
1m	100G	QSFP28-100G-DAC-1M	/	26	30	+0.1/-0.0m
1.5M	100G	QSFP28-100G-DAC-1.5M	/	26	30	+0.1/-0.0m
2M	100G	QSFP28-100G-DAC-2M	/	26	30	+0.1/-0.0m
2.5M	100G	QSFP28-100G-DAC-2.5M	/	26	30	+0.1/-0.0m
3M	100G	QSFP28-100G-DAC-3M	/	26	/	+0.3/-0.3m