

# All you want to know 100G Optical Transceivers



With the growing demand for bandwidth from fast-growing cloud services and data centers, 100G networks are growing rapidly. Before deciding to design a product or purchasing a 100G optical transceiver, you should understand the type and characteristics of the 100G optical transceivers to be able to make better judgments and choices. Here we will provide a comprehensive introduction about 100G optical transceivers for all of you.

## Standards of 100G Transceivers

Since the advent of the 100G network, IEEE, multi-source Protocol (MSA) and so on proposed a variety of standards for the 100G optical transceiver. In these standards, the PSM4 and CWDM4 standards developed by MSA industry organizations are more suitable for 100G QSFP28 optical transceivers in the market. The following table shows the details of the 100G optical transceiver standard.

Standards	Group	Media Type	Protocols	Form	Wavelengths	Connector	Tx(dBm)	Rx(dBm)	FEC	Distance
100G-SR10	IEEE 802.3ba	24-core MPO, parallel multi-mode fiber, 10 receivers and 10 transmitters,850nm	100G/OTU4	CFP	10x850nm	MPO	+2.4(Max) -7.6(Min)	+2.4(Max) -9.5(Min)	No	100m @OM3 150m @OM4
100G-SR4	IEEE 802.3bm	12-core MPO, parallel multi-mode fiber, 4 receivers and 4 transmitters,850nm	100G	QSFP28	4x850nm	MPO	+2.4(Max) -8.4(Min)	+2.4(Max) -10.3(Min)	Yes	100m @OM4
100G-eSR4	IEEE 802.3bm	12-core MPO, parallel multi-mode fiber, 4 receivers and 4 transmitters,850nm	100G	QSFP28	4x850nm	MPO	+2.4(Max) -8.4(Min)	+2.4(Max) -9.2(Min)	Yes	200m @OM3 300m @OM4
100G-LR4	IEEE 802.3ba	Duplex LC, single-mode fiber, 1310nm, 4x25G WDM	100GE/OTU4	QSFP28	1296/1300/1304/1309nm	LC	+4.5(Max) -4.3(Min)	+4.5(Max) -10.6(Min)	No	10km @SMF
100G-ER4	IEEE 802.3ba	Duplex LC, single-mode fiber, 1310nm, 4x25G WDM	100GE/OTU4	QSFP28	1296/1300/1304/1309nm	LC	+6.5(Max) -0.7(Min)	-3.5(Max) -18.7(Min)	Yes	40km @SMF
100G-ZR4	IEEE 802.3ba	Duplex LC, single-mode fiber, 1310nm, 4x25G WDM	100GE/OTU4	QSFP28	1296/1300/1304/1309nm	LC	+6.5(Max) +2(Min)	-3.5(Max) -28(Min)	Yes	80km @SMF
100G-PSM4	PSM4 MSA	12-core MPO, parallel multi-mode fiber, 4 receivers and 4 transmitters, 1310nm	100GE	QSFP28	4x1310nm	MPO	+2(Max) -5.5(Min)	+2(Max) -10.2(Min)	Yes	500m @SMF
100G-CWDM4	CWDM MSA	Duplex LC, single-mode fiber, 1271-1310nm, 4 x 25G CWDM	100GE	QSFP28	1271/1291/1311/1331nm	LC	+2.5(Max) -6.5(Min)	+2.5(Max) -11.5(Min)	Yes	2km @SMF
100Ge-CWDM4	CWDM MSA	Duplex LC, single-mode fiber, 1271-1310nm, 4 x 25G CWDM	100GE	QSFP28	1271/1291/1311/1331nm	LC	+2.5(Max) -6.5(Min)	+2.5(Max) -13.5(Min)	Yes	10km @SMF
100G-SWDM	SWDM MSA	Duplex LC, multi-mode fiber, 850-950nm, 4 x 25G WDM	100GE	QSFP28	850/880/910/940nm	LC	-3(Max) -5.5(Min)	+3.4(Max) -9.5(Min)	Yes	100m @OM4 150m @OM5
100G-eSWDM4	SWDM MSA	Duplex LC, multi-mode fiber, 850-950nm, 4 x 25G WDM	100GE	QSFP28	850/880/910/940nm	LC	-3(Max) -5.5(Min)	+3.4(Max) -11.5(Min)	Yes	300m @OM4 400m @OM5
100G-CLR4	CLR4 MSA	Duplex LC, single-mode fiber, 1271-1310nm, 4 x 25G CWDM	100GE	QSFP28	1271/1291/1311/1331nm	LC	2.3(Max) -6.5(Min)	2.5(Max) -8.5(Min)	Option	2km @SMF
100G-FR1	IEEE 802.3cu	Duplex LC, 1310nm, single lambda, PAM4	100GE	QSFP28	1310nm	LC	+4(Max) -2.4(Min)	+4.5(Max) -6.4(Min)	Yes	2km @SMF
100G-DR1	IEEE 802.3cd	Duplex LC, 1310nm, single lambda, PAM4	100GE	QSFP28	1310nm	LC	+4(Max) -2.9(Min)	+4(Max) -5.9(Min)	Yes	500m @SMF
100G-LR1	IEEE 802.3cu	Duplex LC, 1310nm, single lambda, PAM4	100G	QSFP28	1310nm	LC	+4.5(Max) -1.4(Min)	+4.5(Max) -7.7(Min)	Yes	10km @SMF

Notes:

1,Fiberroad may make changes at any time to the products or specifications contained herein without notice, pls contact with our sales for more details.



## How to choose an appropriate one

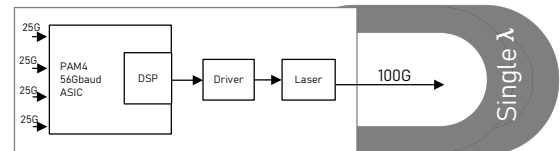
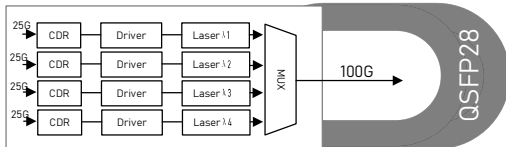
Intra Data Center		Inter Data Center			
100m-400m	500m	2km	10km	40m	80km
100G-SR10/SR4 100G-SWDM 100G-eSWDM	100G-PSM4 100G-DR1	100G-CWDM4 100G-CLR4 100G-FR1	100G-LR4 100G-LR1	100G-ER4	100G-ZR4

■ @MMF

■ @SMF

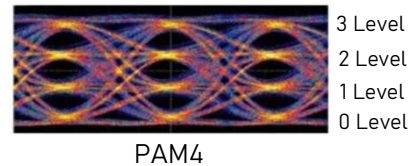
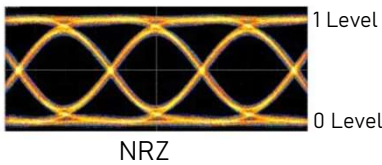
## Different block diagrams between 100G-LR1 and 100G-LR4 QSFP28

We list a typical example to see what differences in between optics technique . Therefore you could well know why generate SR4,PSM4,CWDM4 standards in generally.



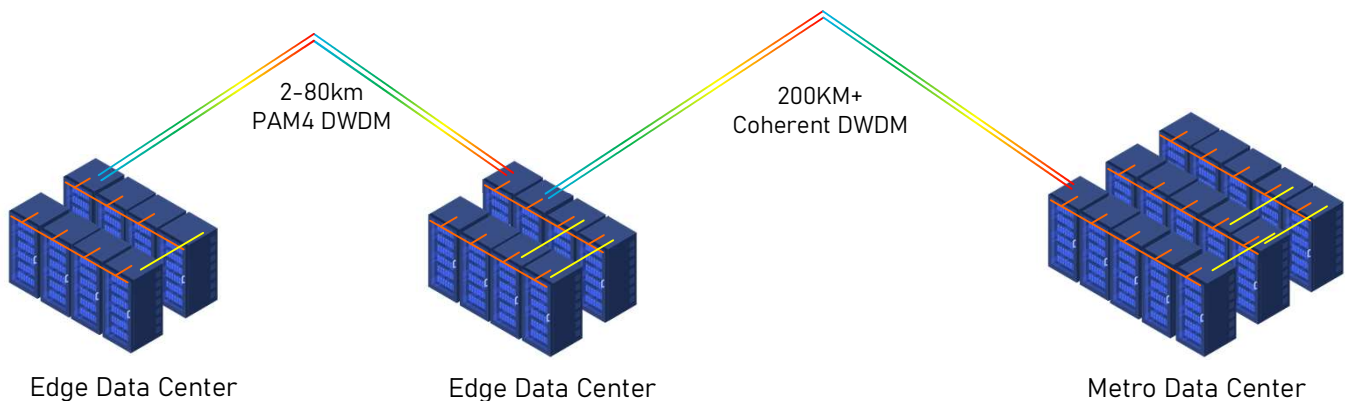
Notes:

- 1, Block Diagram for reference only
- 2, Single direction only



NRZ and PAM4 Modulation(Source: <http://globaltek.us.com/awg6010/>)

## 100G DWDM solution for Data Center Interconnection



**Edge DC:** The reaches for this category range from 2 km to 80km. These links are generally latency limited and used to connect regional, distributed data centers. DCI optical technology options include direct detection and coherent, both of which are implemented using the DWDM transmission format in the C-Band (192 THz to 196 THz window) of the optical fiber. Direct-detection modulation formats are amplitude modulated, have simpler detection schemes, consume lower power, cost less, and in most cases need external dispersion compensation. For 100 Gbps, a 4-level pulse amplitude modulation (**PAM4**), direct-detection format is a cost-effective approach for DCI-Edge applications. The PAM4 modulation format has twice the capacity of the traditional non-return-to-zero (NRZ) modulation format. For the next-generation 400-Gbps (per wavelength) DCI systems, a 60-Gbaud, 16-QAM coherent format is the leading contender

**Metro DC:** As a group, this category lumps fiber distances beyond DCI-Edge up to 3,000 km for terrestrial links and longer for subsea. Coherent modulation format is used for this category, and the modulation type may be different for the diverse distances. **Coherent** modulation formats are also amplitude and phase modulated, need a local oscillator laser for detection, require sophisticated digital signal processing, consume more power, have a longer reach, and are more expensive than direct detection or NRZ approaches.

