

# 4L-Q100DR1-005

QSFP28 100GBASE-DR1, 1310nm, Single Lambda, SM, DDM, LC, 500m



## Applications

- Compliant with 100GBASE-DR1 Ethernet
- Up to 50Gbaud PAM4Rate
- Datacenter backbones
- High-speed servers
- SAN, Routers, Hubs, Load Balancer
- High-performance Computing Clusters
- Other optical links

## Features

- QSFP28 100G Optical Transceiver
- QSFP28 MSA Compliant
- 100G Lambda MSA 100G-DR
- Up to 500m links on SMF
- DFB laser (EML) transmitter
- Duplex LC receptacles
- Digital Diagnostic Monitoring
- RoHS-6 and Lead Free
- Operating temperature: 0°C ~ +70°C

## Description

The 4L-Q100DR1-005 is a QSFP28 full duplex transceiver module for singlemode fiber (SMF) with a single lambda of 100Gbps for up to 500m optical data communications. The module incorporates one channel optical signal, on 1310nm center wavelength, operating at 50Gbaud data rate. The transmitter path incorporates an EML Driver integrated in the DSP and a cooled EML together.

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On the receiver path, the input optical signal is coupled to a Pin photodiode detector. A DSP based gearbox is used to convert 4x25Gbps NRZ signals to 1x50Gbaud PAM4 signal. Also a 4-channel retimer and FEC block are integrated in this DSP. The electrical interface is compliant with IEEE 802.3cd and QSFP28 MSA in the transmitting and receiving directions, and optical interface is compliant to IEEE 802.3cd and 100G Lambda MSA with Duplex LC connector. The module has a maximum power consumption of 4.0W. The product is designed with form factor, optical/electrical connection and digital diagnostic interface according to the QSFP28 Multi-Source Agreement (MSA). It has been designed to meet the harshest external operating conditions including temperature, humidity and EMI interference

## Functional Description

This product converts the 4-channel of 100Gbps aggregated NRZ electrical input data into one channel of 50Gbaud PAM4 optical signal (light) on 1310nm center wavelength through a DSP based gearbox, by a driven cooled Electro-absorption Modulated DFB Laser (EML). The light propagates out of the transmitter into an SMF fiber. The receiver module accepts the 50Gbaud PAM4 optical signal input, and converts it into a 50Gbaud PAM4 electrical signal via a linear amplifier. And then convert the 50Gbaud PAM4 signal into 4 channels of 25Gbps NRZ signals. Figure 1 shows the functional block diagram of this product.

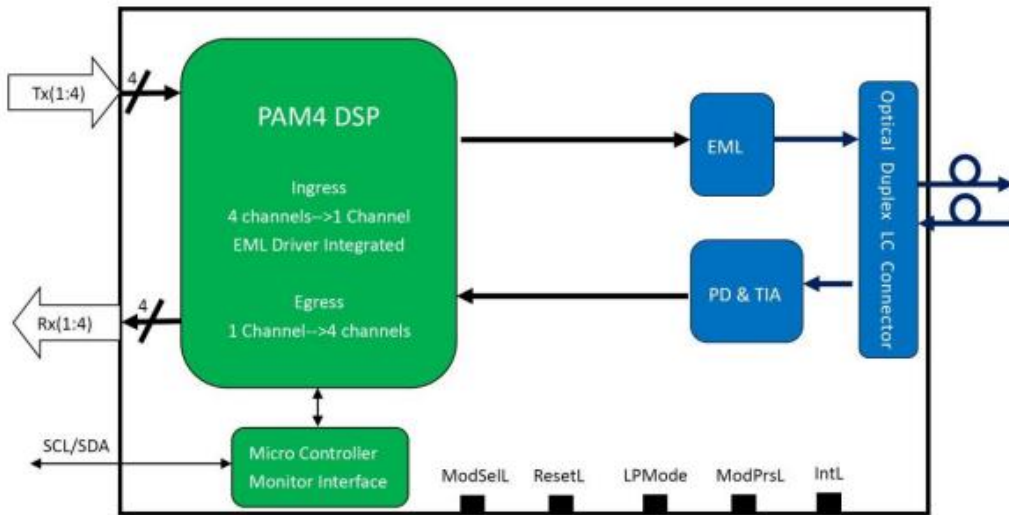
A single +3.3V power supply is required to power up this product. Both power supply pins VccTx and VccRx are internally connected and should be applied concurrently. As per MSA specifications the module offers seven low speed hardware control pins (including the 2-wire serial interface): ModSelL, SCL, SDA, ResetL, LPMode, ModPrsL and IntL.

Module Select (ModSelL) is an input pin. When held low by the host, this product responds to 2-wire serial communication commands. The ModSelL allows the use of this product on a single 2-wire interface bus – individual ModSelL lines must be used.

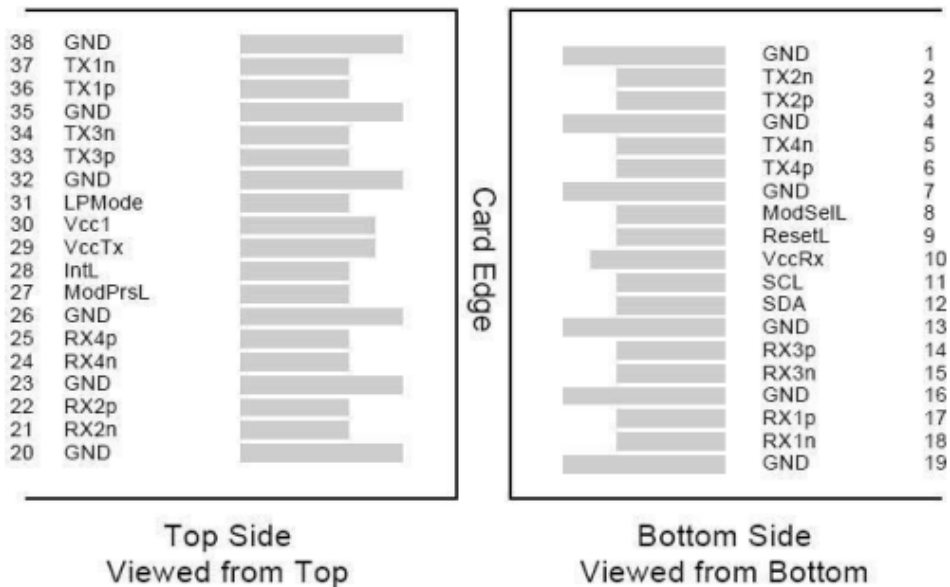
Serial Clock (SCL) and Serial Data (SDA) are required for the 2-wire serial bus communication interface and enable the host to access the memory map.

The ResetL pin enables a complete reset, returning the settings to their default state, when a low level on the ResetL pin is held for longer than the minimum pulse length. During the execution of a reset the host shall disregard all status bits until it indicates a completion of the reset interrupt. The product indicates this by posting an IntL (Interrupt) signal with the Data\_Not\_Ready bit negated in the memory map.

## Transceiver Block Diagram



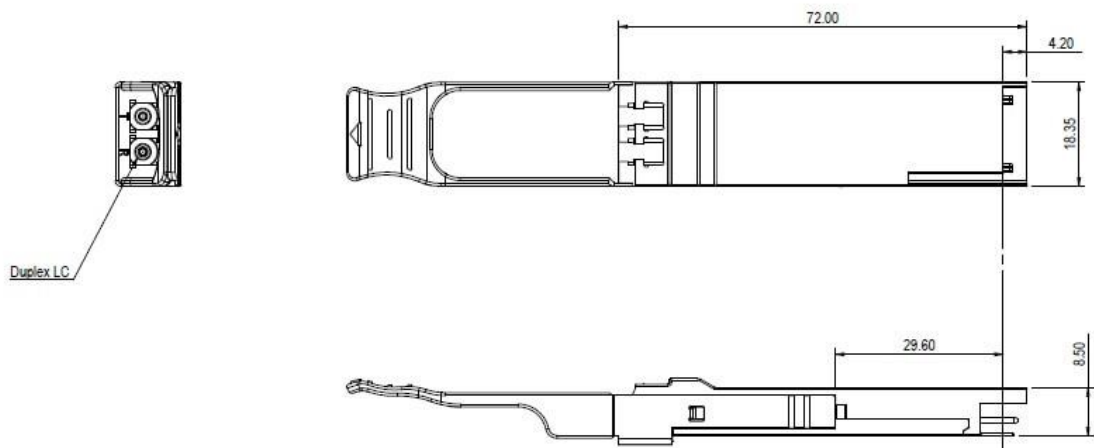
## Pin Assignment



## General Specifications – Absolute Maximum Ratings

Parameter	Symbol	Min	Typ	Max
Max Link Length	L <sub>max</sub>			500m on SMF
Supply Voltage	V <sub>cc</sub>	-0.5		3.6
Storage Temperature	T <sub>s</sub>	-40°C		85°C
Case Operating Temperature	T <sub>OP</sub>	0°C		70°C
Relative Humidity	RH	0		85
Receiver Damage Threshold	TH <sub>D</sub>	5		
Bit Rate (GBaud)	BR		53.125	
Bit Error Ratio – pre FEC	BER			2.4x10 <sup>-4</sup>
Bit Error Ratio – post FEC	BER			1x10 <sup>-12</sup>

## Mechanical Specifications



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## Optical Specifications - Transmitter

Parameter	Symbol	Min	Typ	Max	Unit	
Signaling Speed per lane (NRZ)		25.78125±100ppm			Gb/s	
Optical Data Rate (PAM4)		53.125			GBaud	
Center Wavelength		1304.5	1310	1317.5	nm	
Average Launch Power	P <sub>TX</sub>	-2.4			4	dBm
Outer Optical Modulation Amplitude	P <sub>OMA</sub>	-0.8			4.2	dB
Transmitter and Dispersion Eye Closure for PAM4	TDECQ				3.4	dB
Launch Power in OMA minus TDECQ	ER	-2.2 (ER>4.5dB) -1.9 (ER<4.5dB)				dB
Side Mode Suppression Ratio	SMSR	30				dB
Relative Intensity Noise	RIN				-136	dB/Hz
Transmitter Reflectance	R <sub>t</sub>				-26	dB
Optical Return Loss Tolerance	TOL				15.5	dB
Average Launch Power of OFF Transmitter	P <sub>off</sub>				-15	dBm
LOS Assert Level	LOSA				50	mV
LOS Deassert Level	LOSD				100	mV

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## Optical Specifications – Receiver

Parameter	Symbol	Min	Typ	Max	Unit
Signaling Speed per lane			25.78125±100ppm		Gb/s
Optical Data Rate (PAM4)			53.125		GBaud
Center Wavelength	$\lambda_c$	1304.5	1310	1317.5 10	nm
Average Receive Power	PRX	-5.9		4.0	dBm
Receiver Damage Threshold		5			dBm
Receiver Reflectance				-26	dB
Stressed Receiver Sensitivity	SRS			-1.9	dBm
LOS Assert	LOS <sub>A</sub>	-15			dBm
LOS De-Assert	LOS <sub>D</sub>			-8.9	dBm
LOS Hysteresis	LOS <sub>H</sub>	0.5			dB

## Electrical Specifications - Transmitter

Parameter	Symbol	Min	Typ	Max	Unit
Differential data input swing	vIN_PP			900	mV
Transmit disable voltage	V <sub>D</sub>	V <sub>CC</sub> -1.3		v <sub>CC</sub>	V
Transmit enable voltage	vEN	v <sub>EE</sub>		V <sub>EE</sub> +0.8	V

## Electrical Specifications - Receiver

Parameter	Symbol	Min	Typ	Max	Unit
Differential data output swing	vOUT_PP	400		800	mV
Data output rise time (20%-80%)	t <sub>r</sub>		9.5		ps
Data output fall time (20%-80%)	t <sub>f</sub>		9.5		ps
LOS Fault	LOS <sub>A</sub>	V <sub>CC</sub> -1.3		v <sub>CC_HOST</sub>	V
LOS Normal	LOS <sub>D</sub>	v <sub>EE</sub>		V <sub>EE</sub> +0.5	V

## Ordering Information

Part Number	Description
4L-Q100DR1-005	QSFP28 100GBASE-DR1, 1310nm, Single Lamda, SM, FEC, DDM, LC, 500m
4L-Q100FR1-02	QSFP28 100GBASE-FR1, 1310nm, Single Lamda, SM, FEC, DDM, LC, 2km
4L-Q100LR1-10	QSFP28 100GBASE-LR1, 1310nm, Single Lamda, SM, FEC, DDM, LC, 10km

### Note

This modules have been tested by 4LAN on equipment like Cisco, Juniper, Dell, HP, Mikrotik, Huawei, and other brands. The equipment brand must be informed before shipping the order, so the transceivers are reprogrammed to the corresponding brand.

### Contact Information

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