

PRODUCT FEATURES

- QSFP28 MSA compliant
- 4x25Gb/s or 4x28Gb/s electrical interface
- Supports 103.125Gb/s and 111.81Gb/s aggregate bit rate
- Up to 10km transmission on single mode fiber
- LC duplex connector
- 4-lane DFB and 4-lane Pin
- Commercial case temperature: 0°C to 70°C
- Single 3.3V power supply
- Maximum power consumption 3.5 Watts

APPLICATIONS

- 100GBASE-CWDM4 Ethernet
- Telecom networking
- OTN OTU4
- Data Center Interconnect

COMPLIANCE

- QSFP28 MSA
- SFF-8665
- IEEE802.3ba
- RoHS2.0

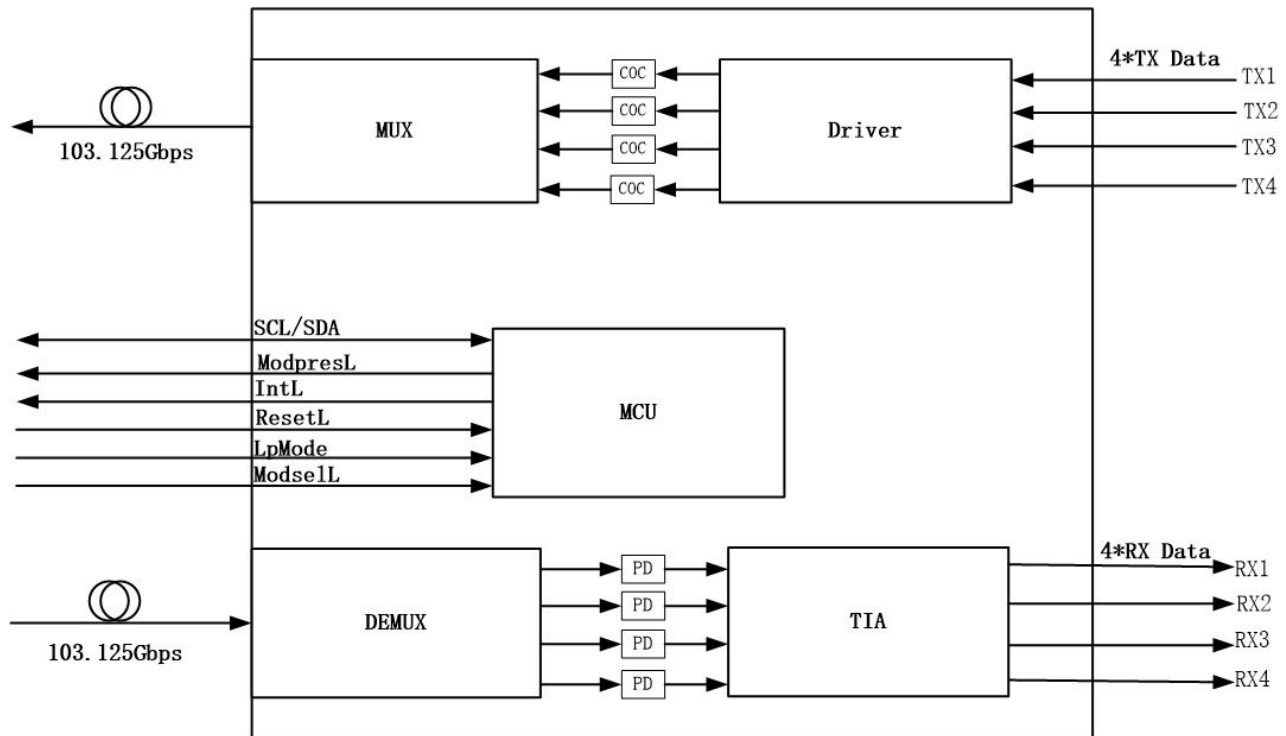
Ordering information

Part Number	Data Rate(Gb/s)	Media	Wavelength(nm)	Operating distance(km)	Temperature(°C)
IP-CALK10BC4CD	103.125	SMF	CWDM	10	0~70

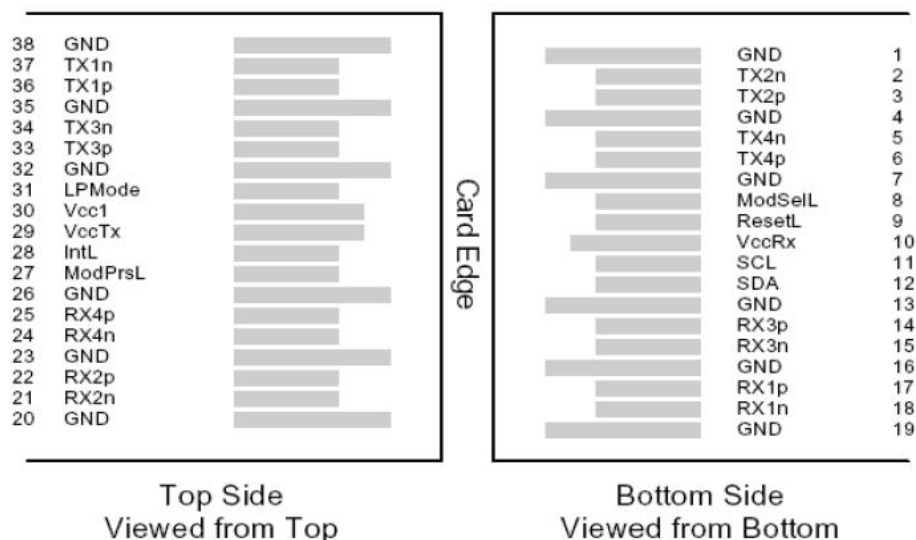
PRODUCT DESCRIPTION

IP-CALK10BC4CD is designed for 10km optical communication applications. This module contains 4-lane DFB optical transmitter, 4-lane optical receiver and module management block including 2 wire serial interfaces. The optical signals are multiplexed to a single-mode fiber through an industry standard LC connector.

1. Block Diagram



2. Pin Diagram



QSFP28 38pin connector (SFF 8665)

3. Pin Descriptions

Pin	Symbol	Name/Description	Notes
1	GND	Ground	1
2	Tx2n	Transmitter Inverted Data Input	
3	Tx2p	Transmitter Non-Inverted Data Input	
4	GND	Ground	1
5	Tx4n	Transmitter Inverted Data Input	
6	Tx4p	Transmitter Non-Inverted Data Input	
7	GND	Ground	1
8	ModSelL	Module Select	
9	ResetL	Module Reset	
10	Vcc Rx	+3.3V Power supply receiver	
11	SCL	2-wire serial interface clock	
12	SDA	2-wire serial interface data	
13	GND	Ground	1
14	Rx3p	Receiver Non-Inverted Data Output	
15	Rx3n	Receiver Inverted Data Output	
16	GND	Ground	1
17	Rx1p	Receiver Non-Inverted Data Output	
18	Rx1n	Receiver Inverted Data Output	
19	GND	Ground	1
20	GND	Ground	1
21	Rx2n	Receiver Inverted Data Output	
22	Rx2p	Receiver Non-Inverted Data Output	
23	GND	Ground	1
24	Rx4n	Receiver Inverted Data Output	
25	Rx4p	Receiver Non-Inverted Data Output	
26	GND	Ground	1
27	ModPrSL	Module Present	
28	IntL	Interrupt	
29	Vcc Tx	+3.3V Power supply transmitter	
30	Vcc1	+3.3V Power supply	
31	LPMode	Low Power Mode	
32	GND	Ground	1
33	Tx3p	Transmitter Non-Inverted Data Input	
34	Tx3n	Transmitter Inverted Data Input	
35	GND	Ground	1
36	Tx1p	Transmitter Non-Inverted Data Input	
37	Tx1n	Transmitter Inverted Data Input	
38	GND	Ground	1

Note:

1. Circuit ground is internally isolated from chassis ground.

4. Absolute Maximum Ratings

It has to be noted that the operation in excess of any individual absolute maximum ratings might cause permanent damage to this module.

Parameter	Symbol	Min	Typical	Max	Unit	Note
Maximum Supply Voltage	V _{CC}	0		3.6	V	
Storage Temperature	T _s	-40		85	°C	
Relative Humidity	RH	0		85	%	

5. Recommended Operating Conditions

100GBASE-CWDM4 10km QSFP28 Optical Transceiver with DDM IP-CALK10BC4CD

Parameter	Symbol	Min	Typical	Max	Unit	Note
Operating Case Temperature	T _{case}	0		70	°C	
Supply Voltage	V _{cc}	3.135	3.3	3.465	V	
Relative Humidity	RH	5		85	%	
Data Rate (Optical)	DRO		4*25.78125		Gbps	
Data Rate (Electrical)	DRE		4*25.78125		Gbps	
Link Distance				10	km	

6. Electrical Characteristics

100GBASE-CWDM4 Operation (EOL, TOP = 0 ~70°C , V_{cc} = 3.135 to 3.465 V)

Parameter	Symbol	Min	Typical	Max	Unit	Note
Power Dissipation				3.5	W	
Supply Current	I _{cc}			1.12	A	
Transmitter						
Data Rate, each lane			25.78125		Gbps	
			27.95250		Gbps	
Differential Voltage pk-pk	V _{pp}			900	mV	
Input differential impedance	R _{in}		100		Ohm	
Differential Termination Resistance Mismatch				10	%	
Receiver						
Data Rate, each lane			25.78125		Gbps	
			27.95250		Gbps	
Output differential impedance	R _{out}		100		Ohm	
Differential Termination Resistance Mismatch				10	%	
Differential output voltage	V _{out, pp}	400	600	800	mV	

7. Optical Characteristics

7.1 100GBASE-CWDM4 Operation (EOL, TOP = 0 ~70°C , V_{cc} = 3.135 to 3.465V)

Parameters	Symbol	Min	Typical	Max	Unit	Notes
Transmitter						
Signal Speed per Lane	BR	25.78125 ± 100 ppm			Gb/s	
Transmit wavelength	λ ₀	1264.5	1271	1277.5	nm	
	λ ₁	1284.5	1291	1297.5	nm	
	λ ₂	1304.5	1311	1317.5	nm	
	λ ₃	1324.5	1331	1337.5	nm	
Side-Mode Suppression Ratio	SMSR	30			dB	
Total Average Launch Power	P _{total}			8.5	dBm	
Average launch power, each lane	P _{out}	-6.5		2.5	dBm	
Optical Modulation Amplitude (OMA), each lane	P _{OMA}	-4		2.5	dBm	
Launch power OFF per lane				-30	dBm	
Transmitter and Dispersion Penalty (TDP), each lane	TDP			3.0	dB	
Extinction Ratio (ER)	ER	3.5			dB	
Transmitter eye mask definition	{0.31, 0.40, 0.45, 0.34, 0.38, 0.4}					1

100GBASE-CWDM4 10km QSFP28 Optical Transceiver with DDM IP-CALK10BC4CD

{X1, X2, X3, Y1, Y2, Y3}						
Mask margin		15			%	1
Receiver						
Signal Speed per Lane	BR	25.78125 ± 100 ppm			Gb/s	
Receive wavelength	λ_0	1264.5	1271	1277.5	nm	
	λ_1	1284.5	1291	1297.5	nm	
	λ_2	1304.5	1311	1317.5	nm	
	λ_3	1324.5	1331	1337.5	nm	
Damage threshold, each lane		3.5			dBm	
Average receive power, each lane		-11.5		2.5	dBm	
Unstressed Receiver Sensitivity (OMA) per Lane				-10	dBm	2
Receive power, each lane(OMA)				2.5	dBm	
Receiver reflectance				-26	dB	
LOS Assert		-24		-13.6	dBm	
LOS De-Assert				-11.6	dBm	
LOS Hysteresis		0.5		6	dB	

Notes:

1.Hit ratio 5×10^{-5} .

2.Sensitivity is specified at BER@5E-5.

7.2 OUT4 Operation (EOL, TOP = 0 ~70°C , V_{CC} = 3.135 to 3.465 V)

Parameters	Symbol	Min	Typical	Max	Unit	Notes
Transmitter						
Signal Speed per Lane	BR	27.9525 ± 100 ppm			Gb/s	
Transmit wavelength	λ_0	1264.5	1271	1277.5	nm	
	λ_1	1284.5	1291	1297.5	nm	
	λ_2	1304.5	1311	1317.5	nm	
	λ_3	1324.5	1331	1337.5	nm	
Side-Mode Suppression Ratio	SMSR	30			dB	
Total Average Launch Power	P _{total}			8.5	dBm	
Average launch power, each lane	P _{out}	-6.5		2.5	dBm	
Optical Modulation Amplitude (OMA), each lane	P _{OMA}	-4		2.5	dBm	
Launch power OFF per lane				-30	dBm	
Transmitter and Dispersion Penalty (TDP), each lane	TDP			3.0	dB	
Extinction Ratio (ER)	ER	3.5			dB	
Transmitter eye mask definition {X1, X2, X3, Y1, Y2, Y3}	{0.31, 0.40, 0.45, 0.34, 0.38, 0.4}					1
Mask margin		15			%	1
Receiver						
Signal Speed per Lane	BR	27.9525 ± 100 ppm			Gb/s	
Receive wavelength	λ_0	1264.5	1271	1277.5	nm	
	λ_1	1284.5	1291	1297.5	nm	
	λ_2	1304.5	1311	1317.5	nm	
	λ_3	1324.5	1331	1337.5	nm	
Damage threshold, each lane		3.5			dBm	
Average receive power, each		-11.5		2.5	dBm	

lane						
Unstressed Receiver Sensitivity (OMA) per Lane				-10	dBm	2
Receive power, each lane(OMA)				2.5	dBm	
Receiver reflectance				-26	dB	
LOS Assert		-24		-13.6	dBm	
LOS De-Assert				-11.6	dBm	
LOS Hysteresis		0.5		6	dB	

Notes:

1.Hit ratio 5×10^{-5} .

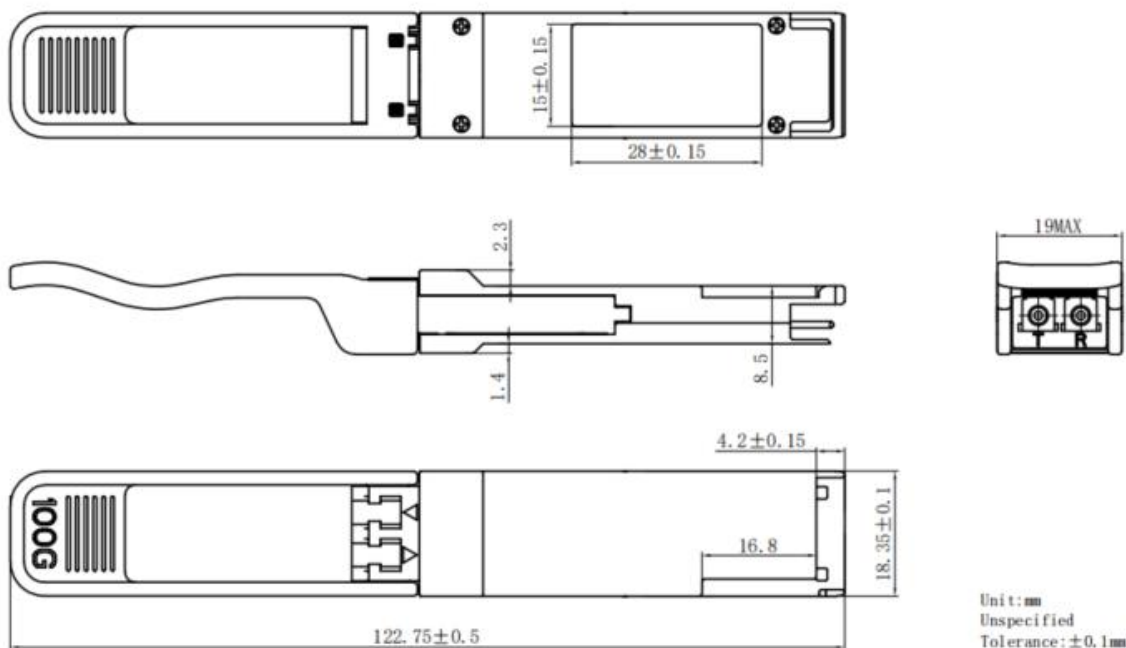
2.Sensitivity is specified at BER@5E-5.

8. Digital Diagnostic Monitoring Functions

IP-CALK10BC4CD support the I2C-based Diagnostic Monitoring Interface (DMI) defined in document SFF-8665. The host can access real-time performance of transmitter and receiver optical power, temperature, supply voltage and bias current.

Parameter	Accuracy	Unit
Case Temperature	± 3	$^{\circ}\text{C}$
Supply Voltage	$\pm 3\%$	V
Tx Bias Current	$\pm 10\%$	mA
Tx Optical Power	± 3	dB
Rx Optical Power	± 3	dB

9. Mechanical Specifications



10. Regulatory Compliance

Feature	Reference	Performance
EMC	EN61000-3	Compatible with standards
Electrostatic Discharge (ESD)	IEC/EN 61000-4-2	Compatible with standards
Electromagnetic Interference (EMI)	FCC Part 15 Class B EN 55022 Class B (CISPR 22A)	Compatible with standards
Laser Eye Safety	FDA 21CFR 1040.10, 1040.11 IEC/EN 60825-1, EC/EN 60825-2	Class 1 laser product
Component Recognition	IEC/EN 60950, L 60950	Compatible with standards
RoHS	2011/65/EU	Compatible with standards

11. Contact Information

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12. Revision History

Version No.	Date	Description
1.0	Oct. 27, 2023	Preliminary datasheet
1.1	Jun.30, 2024	Update contact information.