

PRODUCT FEATURES

- 4x25Gb/s or 4x28Gb/s electrical interface
- Supports 103.125Gb/s and 111.81Gb/s aggregate bit rate
- Up to 40km transmission on single mode fiber
- LC duplex connector
- EML TOSA and APD ROSA
- Commercial case temperature: 0 °C to 70°C
- Single 3.3V power supply
- Maximum power consumption 5 Watts

APPLICATIONS

- 100GE Ethernet
- OTN OTU4 4L1-9C1F
- Telecom networking
- Data Center Interconnect

COMPLIANCE

- QSFP28 MSA
- SFF-8665
- IEEE802.3
- RoHS 2.0

Ordering information

Part Number	Data Rate (Gb/s)	Media	Wavelength(nm)	Operating distance(km)	Temperature(°C)
IP-CALK40E31CD	103.125/111.81	SMF	LAN-WDM	40	0~70

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3. Pin Descriptions

Pin	Symbol	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 Non-Inverted Data Output	
25	Rx4p	Receiver 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	5		85	%	

5. Recommended Operating Conditions

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	%	
Operating Distance				40	km	

6. Electrical Characteristics

100GBASE-ER4 Operation (EOL, TOP = 0 ~70°C , V_{cc} = 3.135 to 3.465 V)

Parameter	Symbol	Min	Typical	Max	Unit	Notes
Power Dissipation				5	W	
Supply Current	I_{cc}			1.4450	A	1
Transmitter						
Data Rate, each lane			25.78125		Gbps	2
			27.95250		Gbps	3
Differential Voltage pk-pk	V_{pp}			900	mV	4
Common Mode Voltage	V_{cm}	-350		2850	mV	
Transition time	T_r/T_f	10			ps	20%~80%
Input differential impedance	R_{in}		100		Ohm	
Differential Termination Resistance Mismatch				10	%	
Eye width	EW15	0.46			UI	
Eye height	EH15	95			mV	
Receiver						
Data Rate, each lane			25.78125		Gbps	2
			27.95250		Gbps	3
Output differential impedance	R_{out}		100		Ohm	
Differential Termination Resistance Mismatch				10	%	4
Differential output voltage	V_{outpp}			900	mV	
Eye width	EW15	0.57			UI	
Eye height	EH15	228			mV	

Notes:

1. Steady state.
2. For 100GBASE-ER4 application.
3. For OTU4 application.
4. At 1 MHz.

7. Optical Characteristics

7.1 100GBASE-ER4 Operation (EOL,TOP = 0 ~70℃,V_{cc} = 3.135 to 3.465 V)

Parameters	Symbol	Min	Typical	max	Unit	Notes
Transmitter						
Signal Speed per Lane	BR	25.78125 ± 100 ppm			Gb/s	
Transmit wavelength	λ0	1294.53		1296.59	nm	
	λ1	1299.02		1301.09	nm	
	λ2	1303.54		1305.63	nm	
	λ3	1308.09		1310.19	nm	
Total Average Launch Power	P _T			12.5	dBm	
Average launch power, each lane	Pavg	1.0		6.5	dBm	
Difference in launch power between any two lanes(Average and OMA)	Ptx,diff			3	dB	
Launch power OFF per lane	P _{off}			-30	dBm	
Side-Mode Suppression Ratio	SMSR	30			dB	
Extinction Ratio (ER)	ER	7			dB	
RIN20 OMA	RIN			-130	dB/Hz	
Optical return loss tolerance	RLT			20	dB	
Transmitter reflectance	T _R			-12	dB	
Transmitter eye mask definition {X1,X2, X3, Y1, Y2, Y3}	{0.25, 0.4, 0.45, 0.25, 0.28, 0.4}					1
Receiver						
Signaling Speed per Lane	BR	25.78125 ± 100 ppm			Gb/s	
Receive wavelength	λ0	1294.53		1296.59	nm	
	λ1	1299.02		1301.09	nm	
	λ2	1303.54		1305.63	nm	
	λ3	1308.09		1310.19	nm	
Damage threshold, each lane	Pdamage	-2.5			dBm	
Average receive power, each lane		-23		-3.5	dBm	
Receives sensitivity, each lane	SEN			-16	dBm	2
Receiver reflectance				-26	dB	
LOS Assert	LosA	-35			dBm	
LOS De-Assert	LosDA			-22	dBm	
LOS Hysteresis	LosH	0.5			dB	

Notes:

- 1.Measured with a PRBS 2³¹-1 test pattern @25.78125, Hit ratio≤5E-5.
- 2.Measured with a PRBS 2³¹-1 test pattern @25.78125 Gb/s, BER≤1E-12.

7.2 OTU4 Operation (EOL,TOP = 0 ~70℃,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	λ0	1294.53		1296.59	nm	
	λ1	1299.02		1301.09	nm	
	λ2	1303.54		1305.63	nm	

	λ_3	1308.09		1310.19	nm	
Total Average Launch Power	P_{total}			12.5	dBm	
Average launch power, each lane	P_{out}	1.0		6.5	dBm	
Difference in launch power between any two lanes(Average and OMA)				3	dB	
Launch power OFF per lane				-30	dBm	
Side-Mode Suppression Ratio	SMSR	30			dB	
Extinction Ratio (ER)	ER	8			dB	
Optical return loss tolerance	ORLT			20	dB	
Transmitter reflectance	T_R			-12	dB	
Transmitter eye mask definition {X1,X2, X3, Y1, Y2, Y3}	{0.25, 0.4, 0.45, 0.25, 0.28, 0.4}					1
Mask margin		5			%	1
Receiver						
Signaling Speed per Lane	BR	27.9525 $\pm$ 100 ppm			Gb/s	
Receive wavelength	λ_0	1294.53		1296.59	nm	
	λ_1	1299.02		1301.09	nm	
	λ_2	1303.54		1305.63	nm	
	λ_3	1308.09		1310.19	nm	
Damage threshold, each lane	P_{damage}	-2.5			dBm	
Average receive power, each lane		-23		-3.5	dBm	
Receiver sensitivity (AOP), each lane	SEN			-16	dBm	2
Receiver reflectance				-26	dB	
LOS Assert	LosA	-33			dBm	
LOS De-Assert	LosDA			-22	dBm	
LOS Hysteresis	LosH	0.5			dB	

Notes:

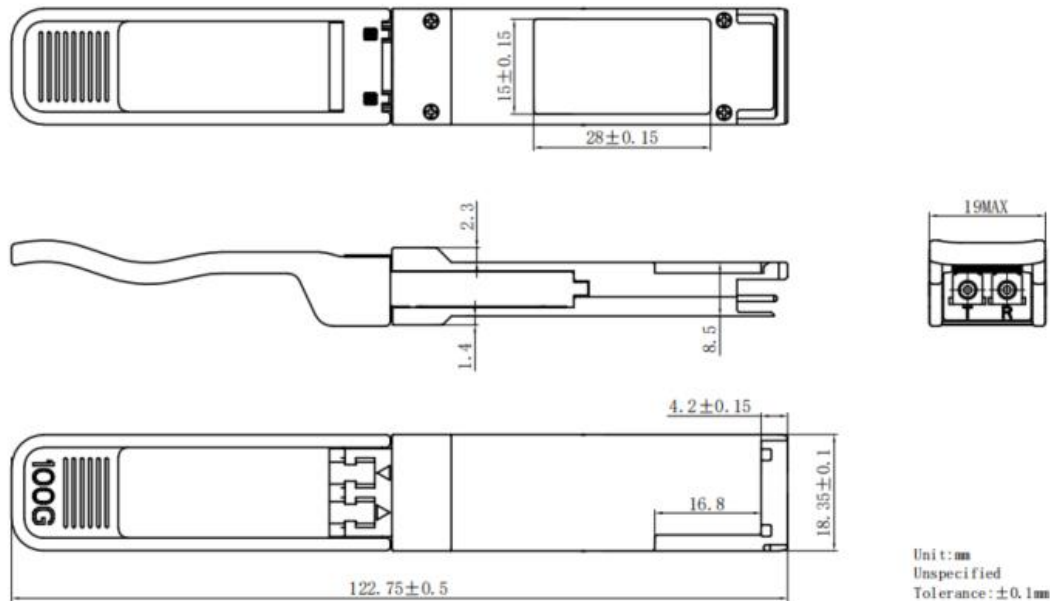
- 1.Measured with a PRBS 2³¹-1 test pattern @27.9525Gb/s, Hit ratio $\leq$ 5E-5.
- 2.Measured with a PRBS 2³¹-1 test pattern @27.9525Gb/s, BER $\leq$ 1E-6.

7. Digital Diagnostic Monitoring Functions

IP-CALK40E31CD support the I2C-based Diagnostic Monitoring Interface (DMI) defined in document SFF-8636. 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	°C
Supply Voltage	$\pm 3\%$	V
Tx Bias Current	$\pm 10\%$	mA
Tx Optical Power	± 3	dB
Rx Optical Power	± 3	dB

8. Mechanical Specifications



9. 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	2002/95/EC	Compatible with standards

10. Contact Information

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11. Revision History

Version No.	Date	Description
1.0	Mar. 12,2024	Preliminary datasheet
1.1	Jun.30, 2024	Update contact information.

