100GBASE-ER4 40km QSFP28 Optical Transceiver with DDM	IP-CALK40E31C

PRODUCT FEATURES

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

APPLICATIONS

- 100GE Ethernet
- Telecom networking
- Data Center Interconnect

COMPLIANCE

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

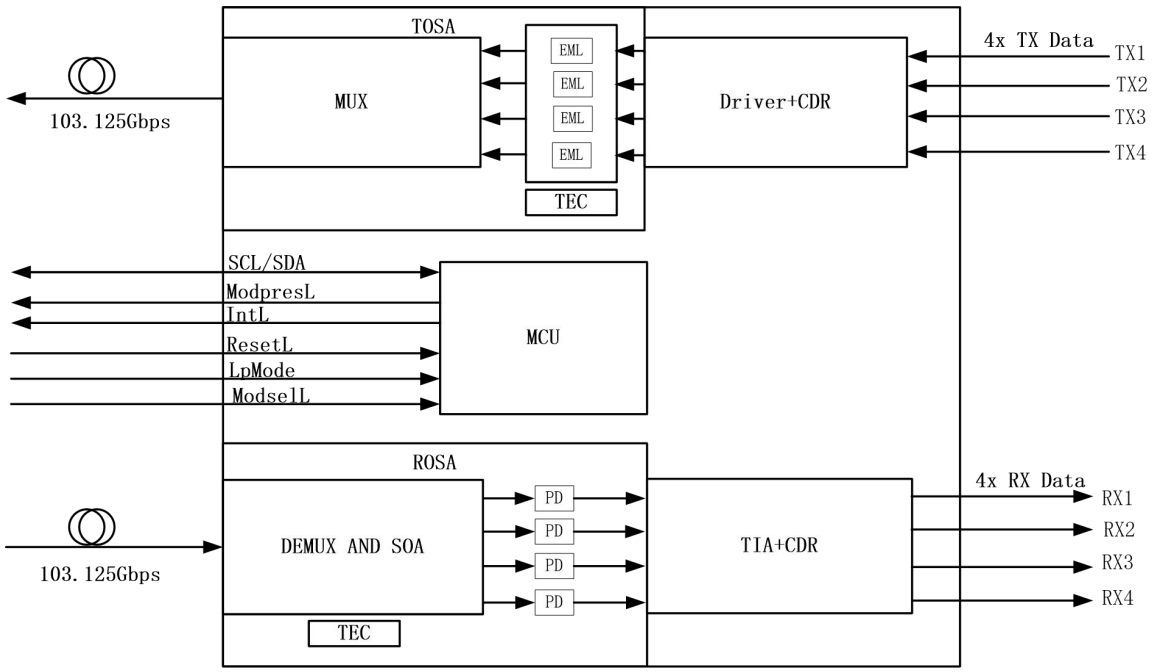
Ordering information

Part Number	Data Rate (Gb/s)	Media	Wavelength(nm)	Operating distance(km)	Temperature(℃)
IP-CALK40E31C	103.125	SMF	LAN-WDM	40	0~70

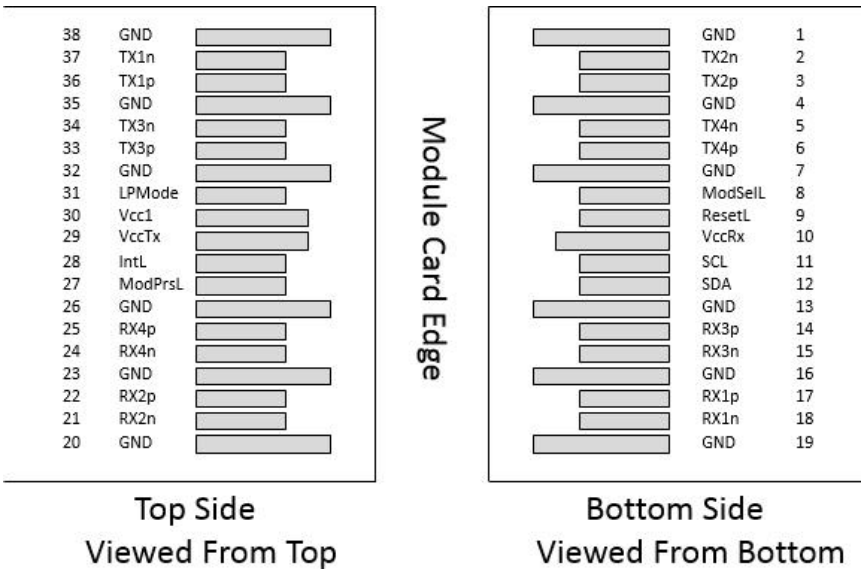
PRODUCT DESCRIPTION

IP-CALK40E31C is designed for 40km optical communication applications. This module contains 4-lane EML 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



MSA compliant Connector

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}	-0.5		3.6	V	
Storage Temperature	T_s	-40		85	℃	
Relative Humidity	RH	5		85	%	

5. Recommended Operating Conditions

Parameter	Symbol	Min	Typical	Max	Unit	Note
Operating Case Temperature	T_{case}	0		70	℃	
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	
Operating Distance				40	km	

6. Electrical Characteristics

100GBASE-ER4 Operation (EOL, TOP = 0 ~70℃ ,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
Differential Voltage pk-pk	Vpp			900	mV	3
Common Mode Voltage	Vcm	-350		2850	mV	
Transition time	Trise/Tfall	10			ps	
Receiver						
Data Rate, each lane			25.78125		Gbps	2
Common Mode Noise, RMS	Vrms			17.5	mV	
Differential output voltage swing	Vout, pp			900	mV	
Eye width	EW15	0.57			UI	
Eye height	EH15	228			mV	
Differential Termination Resistance Mismatch				10	%	3
Transition time	Trise/Tfall	12			ps	

Notes:
1. Steady state.
2. For 100GBASE-ER4 application.
3. At 1 MHz.

7. Optical Characteristics

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

Parameter	Symbol	Min	Typical	Max	Unit	Notes
Transmitter						
Signaling Speed per Lane			25.78125		Gbps	
Lane Wavelength	L0	1294.53	1295.56	1296.59	nm	
	L1	1299.02	1300.05	1301.09	nm	
	L2	1303.54	1304.58	1305.63	nm	
	L3	1308.09	1309.14	1310.19	nm	
Total Average Launch Power	P_T			12.5	dBm	1
Average Launch Power per Lane,	Pavg	1		6.5	dBm	1
OMA, each Lane	P_{OMA}	0		6.5	dBm	1
Difference in launch power between any two lanes (Average and OMA) between any Two Lanes (OMA)	Ptx,diff			3	dB	
Average Output Power (Laser Turn off)	P_{off}			-30	dBm	
Side Mode Suppression Ratio	SMSR	30			dB	
Extinction Ratio	ER	7			dB	
RIN20OMA	RIN			-130	dB/Hz	
Optical Return Loss Tolerance	TOL			20	dB	
Transmitter Reflectance	R_T			-12	dB	
Optical Eye Mask	{0.25,0.4, 0.45, 0.25, 0.28, 0.4}				%	2
Receiver						
Signaling rate, each lane			25.78125		Gbps	
Center Wavelength Lane 0	λ0	1294.53	1295.56	1296.59	nm	
Center Wavelength Lane 1	λ1	1299.02	1300.05	1301.09	nm	
Center Wavelength Lane 2	λ2	1303.54	1304.58	1305.63	nm	
Center Wavelength Lane 3	λ3	1308.09	1309.14	1310.19	nm	
Damage threshold, each lane	Pdamage	-2.5			dBm	
Average Receive Power, each lane		-23		-3.5	dBm	
Receiver sensitivity Average, each lane	SEN			-16	dBm	3
Receiver sensitivity (OMA), each lane	SEN_OMA			-13.5	dBm	ER=10dB
Receiver reflectance				-26	dB	
Los Assert	LosA	-35			dBm	
Los De-assert	LosDA			-22	dBm	
Los Hysteresis	LosH	0.5			dB	

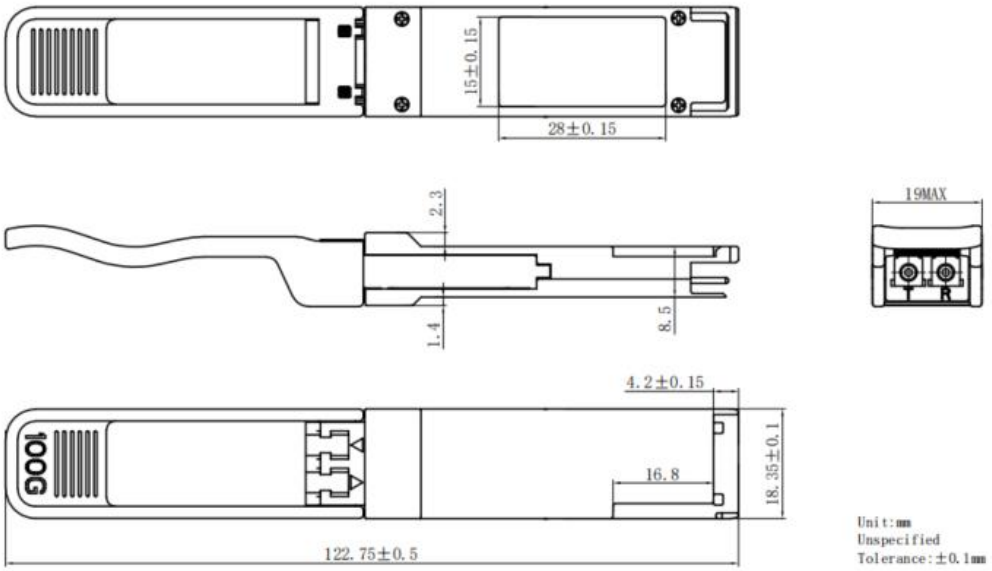
Notes:
1.The optical power is launched into SMF.
2.Measured with a PRBS 2^{31}-1 test pattern @25.78125, Hit ratio≤5E-5.
3.Measured with a PRBS 2^{31}-1 test pattern @25.78125 Gb/s, BER≤1E-12.

8. Digital Diagnostic Monitoring Functions

IP-CALK40E31C 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	℃
Supply Voltage	±3%	V
Tx Bias Current	±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	2002/95/EC	Compatible with standards

11. Contact Information

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12. Revision History

Version No.	Date	Description
1.0	May. 17, 2021	Preliminary datasheet
1.1	Jan. 15, 2024	Update TX Power and RX Sensitivity
1.2	Mar. 12,2024	Update LOSA, add OMA sensitivity
1.3	Jun.30, 2024	Update contact information.