


TSQS-131HG10E-LC Optical Transceiver

Single-Mode 100GBASE-LR4 Transceiver, With Diagnostic Monitoring
Duplex QSFP28 100G Ethernet 10Km Transceiver

Features

- Supports 103Gbps
- I2C interface with integrated Digital Diagnostic Monitoring
- 4*25Gbps DFB-based LAN-WDM transmitter
- PIN and TIA array on the receiver side
- 4x25G electrical interface
- Single 3.3V Power Supply and Power dissipation < 4W
- Distance up to 10km over SMF
- Duplex LC receptacles
- Operating case temperature: 0°C~+70°C
- RoHS Compliant 



Applications

- 100GBASE-LR4 100G Ethernet

Production Description

This product is a 100Gb/s transceiver module designed for optical communication applications compliant to 100GBASE-LR4 of the IEEE P802.3ba standard. The module converts 4 input channels of 25Gb/s electrical data to 4 channels of LAN WDM optical signals and then multiplexes them into a single channel for 100Gb/s optical transmission. Reversely on the receiver side, the module de-multiplexes a 100Gb/s optical input into 4 channels of LAN WDM optical signals and then converts them to 4 output channels of electrical data. The central wavelengths of the 4 LAN WDM channels are 1295.56, 1300.05, 1304.58 and 1309.14 nm as members of the LAN WDM wavelength grid defined in IEEE 802.3ba. The high performance cooled LAN WDM DFB transmitters and high sensitivity PIN receivers provide superior performance for 100Gigabit Ethernet applications up to 10km links and compliant to optical interface with IEEE802.3ba Clause 88 100GBASE-LR4 requirements. The product is designed with form factor, optical/electrical connection and digital diagnostic interface according to the QSFP+ Multi-Source Agreement (MSA). It has been designed to meet the harshest external operating conditions including temperature, humidity and EMI interference.

Absolute Maximum Ratings

These values represent the damage threshold of the module. Stress in excess of any of the individual Absolute Maximum Ratings can cause immediate catastrophic damage to the module even if all other parameters are within Recommended Operating Conditions.

Parameters	Symbol	Min.	Max.	Unit
Power Supply Voltage	VCC	-0.5	+3.6	V
Storage Temperature	Tc	-40	+85	°C
Relative Humidity	RH	0	85	%

Recommended Operating Environment

Parameter	Symbol	Min	Typical	Max	Unit
Power Supply Voltage	VCC	3.15	3.30	3.45	V
Supply current	Icc	-	-	1160	mA
Operating Case Temperature	Tca	0	-	70	°C

Electrical Characteristics

Parameter	Symbol	Min.	Typical	Max	Unit
Transmitter					
Input differential impedance ¹	Rin	-	100	-	Ω
Single-ended Input Voltage Tolerance	-	-0.3	-	4.0	V
AC Common Mode Input Voltage Tolerance	-	15	-	-	mV
Differential Input Voltage	-	50	-	-	mV
Differential Input Voltage swing, per lane	Vin	190	-	1000	mV
Receiver					
Output differential impedance ¹	Rout	-	100	-	Ω
Differential Output Swing, per lane ²	Vout	300	-	900	mV
AC Common Mode Output Voltage Tolerance	-	-	-	7.5	mV
Single-ended Output Voltage	-	-0.3	-	4.0	V

Notes:

[1] AC coupled.

[2] Into 100 ohm differential termination.

Transmitter Specifications – Optical

Parameter	Symbol	Min	Typical	Max	Unit
Bit Rate per Lane ¹	DR	25.78125 ± 100ppm			Gb/s

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Data Rate Variation	-	-100	-	100	ppm
Lane_0 Center Wavelength	λ_0	1294.53	1295.56	1296.59	nm
Lane_1 Center Wavelength	λ_1	1299.02	1300.05	1301.09	nm
Lane_2 Center Wavelength	λ_2	1303.54	1304.58	1305.63	nm
Lane_3 Center Wavelength	λ_3	1308.09	1309.14	1310.19	nm
Total Average Output Power	Po	-	-	10.5	dBm
Average Launch Power each Lane ^{2&7}	-	-4.3	-	4.5	dBm
Optical Modulation Amplitude (OMA) each Lane	OMA	-1.3	-	4.5	dBm
Difference in launch power between any two lanes (OMA)	-	-	-	5	dB
Launch power in OMA minus TDP, each lane	OMA-TDP	-2.3	-	-	dBm
Transmitter and dispersion penalty (TDP), each lane	TDP	-	-	2.2	dB
Extinction Ratio	ER	4	-	-	dB
Side-mode Suppression ratio	SMSR	30	-	-	dB
Average launch power of OFF transmitter per lane	Poff	-	-	-30	dBm
Transmitter Reflectance	-	-	-	-12	dB
Optical Return Loss Tolerance	ORL	-	-	20	dB
Transmitter eye mask definition {X1, X2, X3, Y1, Y2, Y3} ³	{0.25, 0.4, 0.45, 0.25, 0.28, 0.4}				

Receiver Specifications – Optical

Parameter	Symbol	Min	Typical	Max	Unit
Bit Rate per Channel ⁴	DR	25.78125 ± 100ppm			Gb/s
Data Rate Variation	-	-100	-	100	ppm
Lane_0 Center Wavelength	λ_0	1294.53	1295.56	1296.59	nm
Lane_1 Center Wavelength	λ_1	1299.02	1300.05	1301.09	nm
Lane_2 Center Wavelength	λ_2	1303.54	1304.58	1305.63	nm
Lane_3 Center Wavelength	λ_3	1308.09	1309.14	1310.19	nm
Average Receive Power per Lane ^{5&7}	RXPOW	-10.6	-	4.5	dBm
Receive Power (OMA) per Lane	-	-	-	4.5	dBm
Receive Sensitivity in OMA per Lane	Rsen	-	-	-8.6	dBm
Stressed Receiver Sensitivity (OMA) per Lane ⁶	RXSRS	-	-	-6.8	dBm
Optical Return Loss	ORL	-	-	-26	dB
LOS Assert	Lsa	-25	-	-	dBm
LOS DE-Assert	Lda	-	-	-12	dBm

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LOS Hysteresis	Lh	0.5	-	-	dB
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Notes:

- [1] Transmitter consists of 4 lasers operating at 25.78Gb/s each.
- [2] Minimum value is informative.
- [3] Hit ratio 5×10^{-5} .
- [4] Receiver consists of 4 photodetectors operating at 25.78Gb/s each.
- [5] Minimum value is informative, equals min TxOMA with infinite ER and max channel insertion loss.
- [6] SRS is measured with vertical eye closure penalty of 1.8 dB max, J2 of 0.30 UI, and J9 of 0.47 UI.
- [7] Power value and power accuracy are with all channels on.

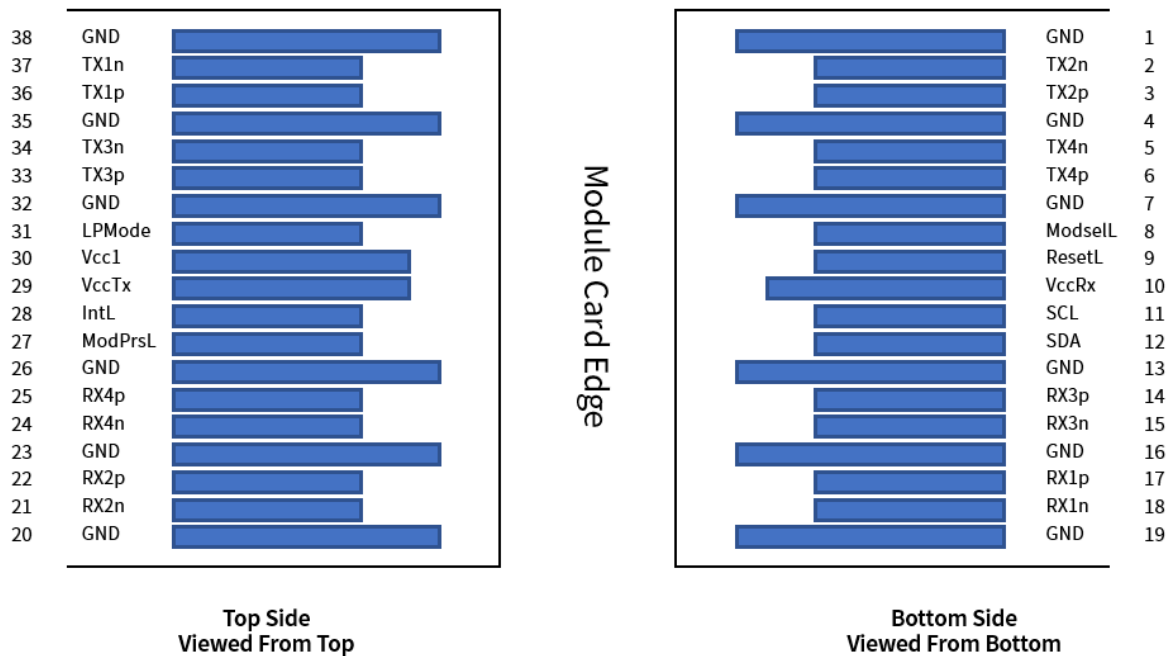
General Specifications

Parameter	Symbol	Min	Typical	Max	Unit
Bit Rate (all wavelengths combined) ¹	BR	-	-	103.1	Gb/s
Bit Error Ratio @25.78Gb/s ²	BER	-	-	10^{-12}	-
Maximum Supported Distances					
Fiber Type	-	-	-	-	-
SMF per G.652	Lmax	-	-	10	km

Notes:

- [1] Supports 100GBASE-LR4 per IEEE 802.3ba.
- [2] Tested with a $2^{31} - 1$ PRBS.

Qsfp28 Transceiver Electrical Pad Layout



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Pin Definition

Pin	Symbol	Name/Description
1	GND	Ground
2	Tx2n	Transmitter Inverted Data Input
3	Tx2p	Transmitter Non-Inverted Data Input
4	GND	Ground
5	Tx4n	Transmitter Inverted Data Input
6	Tx4p	Transmitter Non-Inverted Data Input
7	GND	Ground
8	ModSelL	Module Select
9	ResetL	Module Reset
10	VCC Rx	+3.3 V Power supply receiver
11	SCL	2-wire serial interface clock
12	SDA	2-wire serial interface data
13	GND	Ground
14	Rx3p	Receiver Non-Inverted Data Output
15	Rx3n	Receiver Inverted Data Output
16	GND	Ground
17	Rx1p	Receiver Non-Inverted Data Output
18	Rx1n	Receiver Inverted Data Output
19	GND	Ground
20	GND	Ground
21	Rx2n	Receiver Inverted Data Output
22	Rx2p	Receiver Non-Inverted Data Output
23	GND	Ground
24	Rx4n	Receiver Inverted Data Output
25	Rx4p	Receiver Non-Inverted Data Output
26	GND	Ground
27	ModPrsL	Module Present
28	IntL	Interrupt
29	VCC Tx	+3.3 V Power supply transmitter
30	VCC1	+3.3 V Power Supply
31	LPMODE	Low Power Mode
32	GND	Ground

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33	Tx3p	Transmitter Non-Inverted Data Input
34	Tx3n	Transmitter Inverted Data Input
35	GND	Ground
36	Tx1p	Transmitter Non-Inverted Data Input
37	Tx1n	Transmitter Inverted Data Input
38	GND	Ground

Ordering Information

Part Number	Product Description
TSQS-131HG10E-LC	QSFP28 100G LR4 10Km Ethernet 0°C ~ +70°C

References

1. SFF-8636 Specification for QSFP28.
2. Ethernet 100GBASE-LR4

Important Notice

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