

Specification

100 - Gbps QSFP28 Pluggable

Optical Transceiver Module

100GBASE-LR4 Pull-Tab



Ordering Information

TGW-Q14BB-FCQ

Model Name	Voltage	Category	Device type	Temperature	Distance	Latch Type
TGW-Q14BB-FCQ	3.3V	With DDMI	LWDM DFB	0°C ~+70°C	10km	Pull TAB

Features

- Compliant to IEEE 802.3ba and 100GBASE-LR4 standard.
- QSFP28 MSA compliant.
- Up to 25Gbps data rate per wavelength.
- Up to 10km transmission on single mode fiber (SMF).
- Operating case temperature : 0 ~ 70°C
- Maximum 4.0W operation power
- LC duplex connector.
- RoHS compliant.

Applications

- 100GBASE-LR4 Ethernet Links
- Infiniband QDR and DDR interconnects
- Client-side 100G Telecom connections

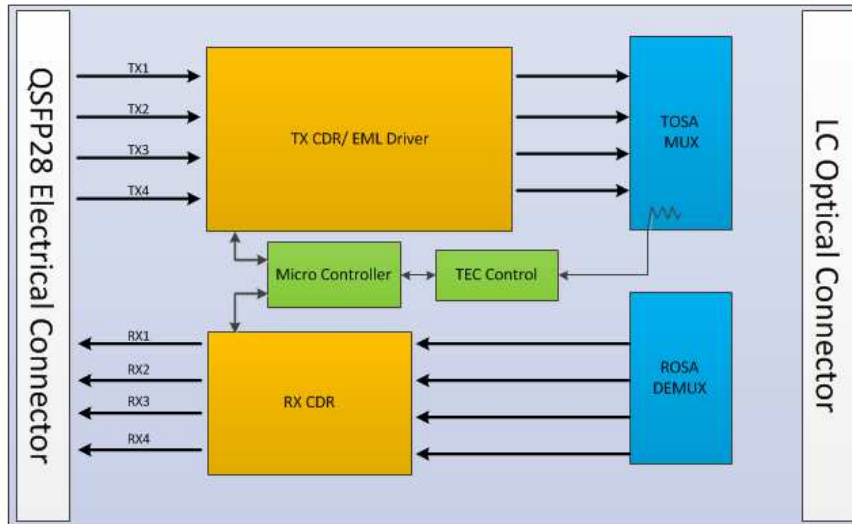
General Description

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.

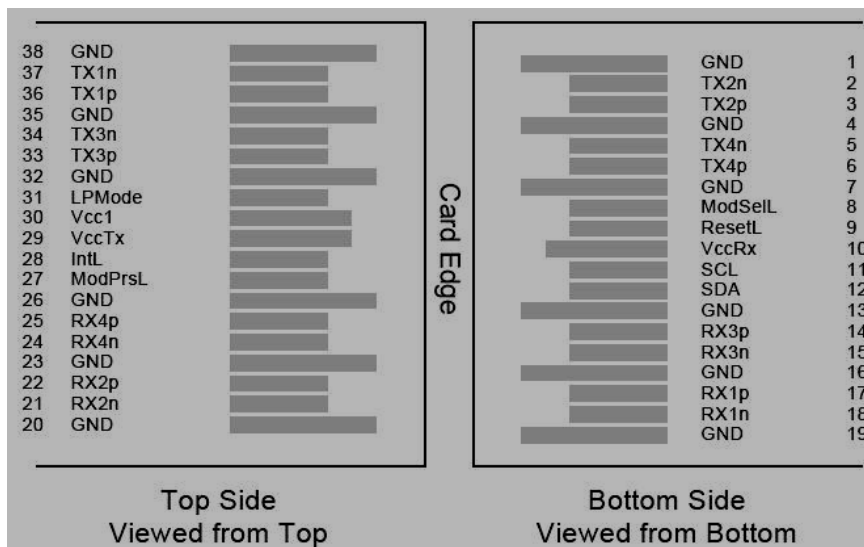
The central wavelengths of the 4 LAN WDM channels are 1295.56, 1300.05, 1304.58 and 1309.14 nm as members of the LAN WDM wavelength grid defined in IEEE 802.3ba. The high performance cooled LAN WDM EA-DFB transmitters and high sensitivity PIN receivers provide superior performance for 100Gigabit Ethernet 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.

Transceiver Block Diagram



Pin Assignment and Pin Description



Pin Definitions

PIN	Logic	Symbol	Name/Description	Note
1		GND	Ground	1
2	CML-I	Tx2n	Transmitter Inverted Data Input	
3	CML-I	Tx2p	Transmitter Non-Inverted Data output	
4		GND	Ground	1
5	CML-I	Tx4n	Transmitter Inverted Data Input	
6	CML-I	Tx4p	Transmitter Non-Inverted Data output	
7		GND	Ground	1
8	LVTLL-I	ModSelL	Module Select	
9	LVTLL-I	ResetL	Module Reset	
10		VccRx	+3.3V Power Supply Receiver	2
11	LVC MOS-I/O	SCL	2-Wire Serial Interface Clock	
12	LVC MOS-I/O	SDA	2-Wire Serial Interface Data	
13		GND	Ground	
14	CML-O	Rx3p	Receiver Non-Inverted Data Output	
15	CML-O	Rx3n	Receiver Inverted Data Output	
16		GND	Ground	1
17	CML-O	Rx1p	Receiver Non-Inverted Data Output	
18	CML-O	Rx1n	Receiver Inverted Data Output	
19		GND	Ground	1
20		GND	Ground	1
21	CML-O	Rx2n	Receiver Inverted Data Output	
22	CML-O	Rx2p	Receiver Non-Inverted Data Output	
23		GND	Ground	1
24	CML-O	Rx4n	Receiver Inverted Data Output	1
25	CML-O	Rx4p	Receiver Non-Inverted Data Output	
26		GND	Ground	1
27	LVTTL-O	ModPrsL	Module Present	
28	LVTTL-O	IntL	Interrupt	
29		VccTx	+3.3 V Power Supply transmitter	2
30		Vcc1	+3.3 V Power Supply	2
31	LVTTL-I	LPMMode	Low Power Mode	
32		GND	Ground	1
33	CML-I	Tx3p	Transmitter Non-Inverted Data Input	
34	CML-I	Tx3n	Transmitter Inverted Data Output	

35		GND	Ground	1
36	CML-I	Tx1p	Transmitter Non-Inverted Data Input	
37	CML-I	Tx1n	Transmitter Inverted Data Output	
38		GND	Ground	1

Notes:

1. GND is the symbol for signal and supply (power) common for the QSFP28 module. All are common within the module and all module voltages are referenced to this potential unless otherwise noted. Connect these directly to the host board signal common groundplane.
2. VccRx, Vcc1 and VccTx are the receiving and transmission power suppliers and shall be applied concurrently. Recommended host board power supply filtering is shown in Figure 3 below. Vcc Rx, Vcc1 and VccTx may be internally connected within the module in any combination. The connector pins are each rated for a maximum current of 1000mA.

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	Max	Unit	Note
Storage Temperature	T _s	-40	85	°C	
Relative Humidity (non-condensation)	RH	0	85	%	
Operating Case Temperature	T _{op}	0	70	°C	
Damage Threshold, each Lane	DT	5.5		dBm	
Supply Voltage	VCC	-0.5	3.6	V	

Recommended Operating Conditions and Power Supply Requirements

Parameter	Symbol	Min	Typ.	Max	Unit
Operating Case Temperature	T _{OP}	0		70	°C
Power Supply Voltage	V _{CC}	3.14	3.30	3.47	V
Data Rate, each Lane			25.78125		Gb/s
Control Input Voltage High		2		V _{cc}	V
Control Input Voltage Low		0		0.8	V
Link Distance with G.652	D	0.002		10	Km

Optical Characteristic

Parameter	Symbol	Min.	Typ.	Max	Unit	Notes
Wavelength Assignment	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	
Transmitter						
Side-mode Suppression Ratio	SMSR	30			dB	
Total Average Launch Power	PT			10.5	dBm	
Average Launch Power, each Lane	PAVG	-4.3		4.5	dBm	
Optical Modulation Amplitude, each Lane	POMA	-1.3		4.5	dBm	1
Difference in Launch Power between any two Lanes (OMA)	Ptx,diff			5	dB	
Launch Power in OMA minus Transmitter and Dispersion Penalty (TDP), each Lane		-2.3			dBm	
TDP, each Lane	TDP			2.2	dB	
Extinction Ratio	ER	4			dB	
Relative Intensity Noise	RIN			-130	dB/Hz	
Optical Return Loss Tolerance	TOL			20	dB	
Transmitter Reflectance	RT			-12	dB	
Transmitter Eye Mask Definition {X1, X2, X3, Y1, Y2, Y3}		{0.25,0.4,0.45,0.25,0.28,0.4}				
Average Launch Power OFF Transmitter, each Lane	Poff			-30	dBm	

Parameter	Symbol	Min.	Typ.	Max	Unit	Notes
Receiver						
Damage Threshold, each Lane	DT	5.5			dBm	2
Total Average Receive Power				10.5	dBm	
Average Power at Receiver Input, each Lane		-10.6		4.5	dBm	
Receiver Power (OMA), each Lane				4.5	dBm	
Stressed Receiver Sensitivity in OMA, each Lane				-6.8	dBm	3
Receiver Sensitivity, each Lane	Sens			-8.6	dBm	
Difference in Receive Power between any two Lanes (OMA)	Prx, diff			5.5	dB	
LOS Assert	LOSA		-18		dBm	
LOS Deassert	LOSD		-15		dBm	
LOS Hysteresis	LOSH	0.5			dB	
Receive Electrical 3 dB upper Cutoff Frequency, each Lane	Fc			31	GHz	
Conditions of Stress Receiver Sensitivity Test (Note 4)						
Vertical Eye Closure Penalty, each Lane			1.8		dB	
Stressed Eye J2 Jitter, each Lane			0.3		UI	
Stressed Eye J9 Jitter, each Lane			0.47		UI	

Notes:

1. Even if the TDP <1 dB, the OMA min must exceed the minimum value specified here.
2. The receiver shall be able to tolerate, without damage, continuous exposure to a modulated optical input signal having this power level on one lane. The receiver does not have to operate correctly at this input power.
3. Measured with conformance test signal at receiver input for BER = 1x10⁻¹².
4. Vertical eye closure penalty and stressed eye jitter are test conditions for measuring stressed receiver sensitivity. They are not characteristics of the receiver.

Electrical Characteristics

The following electrical characteristics are defined over the Recommended Operating temperature and supply voltage unless otherwise specified.

Parameter	Symbol	Min.	Typ.	Max	Unit	Notes
Power Consumption				4.0	W	
Supply Current	I _{cc}			1.21	A	
Transceiver Power-on Initialization Time				2000	ms	1
Transmitter(each Lane)						
Single-ended Input Voltage Tolerance (Note 2)		-0.3		4	V	Referred to TP1 signal common
AC Common Mode Input Voltage Tolerance		15			mV	RMS
Differential Input Voltage Swing Threshold		50			mV _{pp}	LOSA Threshold
Differential Input Impedance	Z _{in}	90	100	110	ohm	
Differential Input Swing	V _{in, pp}	190		700	mV _{pp}	
Receiver (each Lane)						
Single-ended Output Voltage		-0.3		4.0	V	Referred to signal common
AC Common Mode Output Voltage				7.5	mV	RMS
Differential Output Impedance	Z _{out}	90	100	110	ohm	
Differential Output Voltage Swing	V _{out, pp}	300		850	mV _{pp}	

Notes:

1. Power-on Initialization Time is the time from when the power supply voltages reach and remain above the minimum recommended operating supply voltages to the time when the module is fully functional.
2. The single ended input voltage tolerance is the allowable range of the instantaneous input signals.

Digital Diagnostic Functions

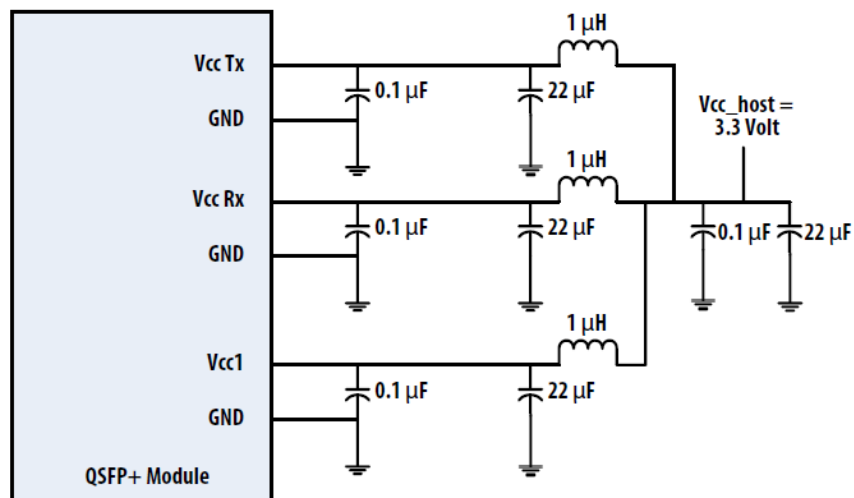
The following digital diagnostic characteristics are defined over the normal operating conditions unless otherwise specified.

Parameter	Symbol	Min.	Max	Unit	Notes
Temperature monitor absolute error	DMI_Temp	-3	3	°C	Over temperature
Supply voltage monitor absolute error	DMI_VCC	-0.1	0.1	V	Over range
Channel RX power monitor absolute error	DMI_RX_Ch	-2	2	dB	1
Channel Bias current monitor	DMI_Ibias_Ch	-10%	10%	mA	
Channel TX power monitor absolute error	DMI_TX_Ch	-2	2	dB	1

Notes:

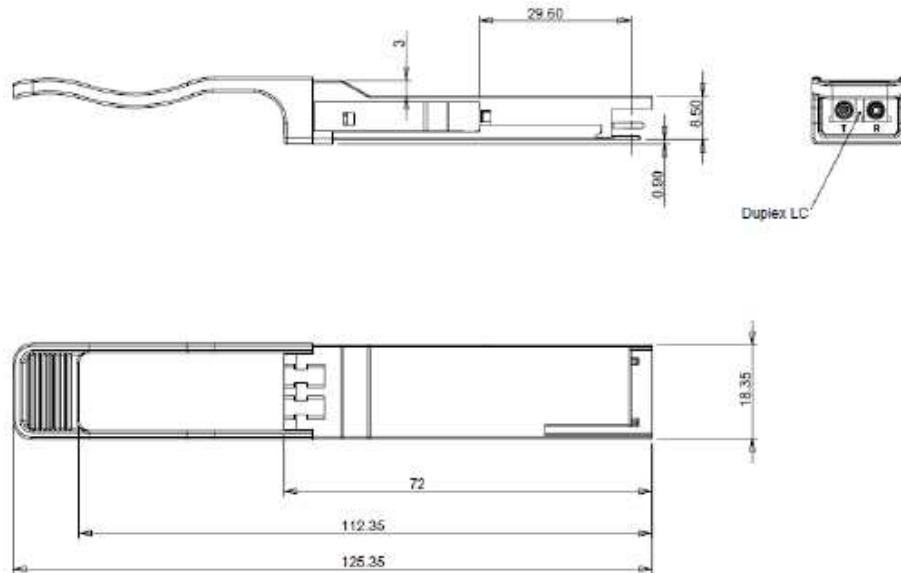
Due to measurement accuracy of different single mode fibers, there could be an additional +/- 1 dB fluctuation, or a +/- 3 dB total accuracy.

Recommended Power Supply Filter



Mechanical Design Diagram

Unit: mm



ESD

Normal ESD precautions are required during the handling of this module. This transceiver is shipped in ESD protective packaging. It should be removed from the packaging and handled only in an ESD protected environment.

Laser Safety

This is a laser class 1 product according to IEC/EN 60825-1:2014 (Third Edition). This product complies with 21 CFR 1040.10 and 1040.11 except for deviations pursuant to Laser Notice No. 50, dated June 24, 2007.



Contact Information

Formerica OptoElectronics Inc.

5F-11, No.38, Taiyuan St., Zhubei City,

Hsinchu County 30265, Taiwan

Tel: +886-3-5600286

Fax: +886-3-5600239

San Diego, CA

Tel: 1-949-466-8069

inquiry@formericaoe.com

www.formericaoe.com