

100G QSFP28 LR1 10 km Transceiver

QSFP28 Series



- **QSFP28 MSA compliant**
- **IEEE 802.3cu compliant**
- **Optical light source: single channel 1310nm EA-DFB LD**
- **Optical receiver: single channel PIN photo detector**
- **Max. power consumption 4 W**
- **Up to 10 km transmission on single-mode fiber**
- **Operating case temperature: 0 °C to 70 °C**
- **LC connector**
- **Single 3.3V power supply**
- **RoHS 2.0 compliant**

Ascent's QSFP28 100G LR1 Ethernet module is a transceiver module designed for 10km optical communication applications, and it is compliant with IEEE 802.3cd and QSFP28 MSA standard.

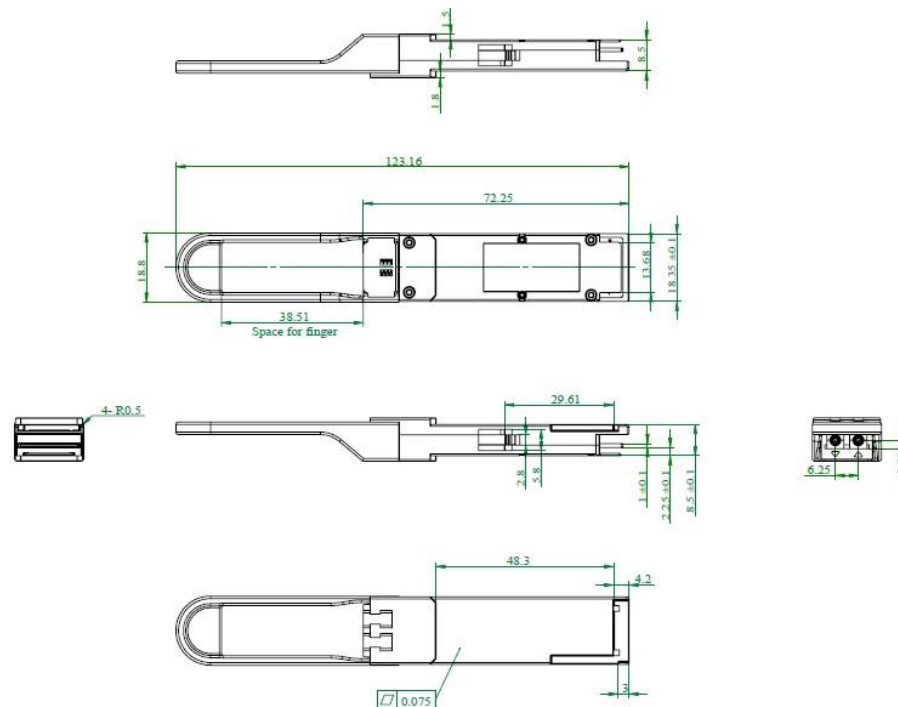
QSFP28-100G-LR10 can be used in Data Centers, High-speed interconnects within and between switches, routers and transport equipment, Server-Server Clusters, Super-computing interconnections and other network applications.

This module incorporates one channel optical signal, on 1310nm center wavelength, operating at 50G baud data rate. The transmitter path incorporates an EML Driver integrated in the DSP and a cooled EML together. On the receiver path, the input optical signal is coupled to a Pin photodiode detector. It is designed with form factor, optical/electrical connection and digital diagnostic interface according to the QSFP28 Multi-Source Agreement (MSA). It has been designed to meet the harshest external operating conditions including temperature, humidity and EMI interference.

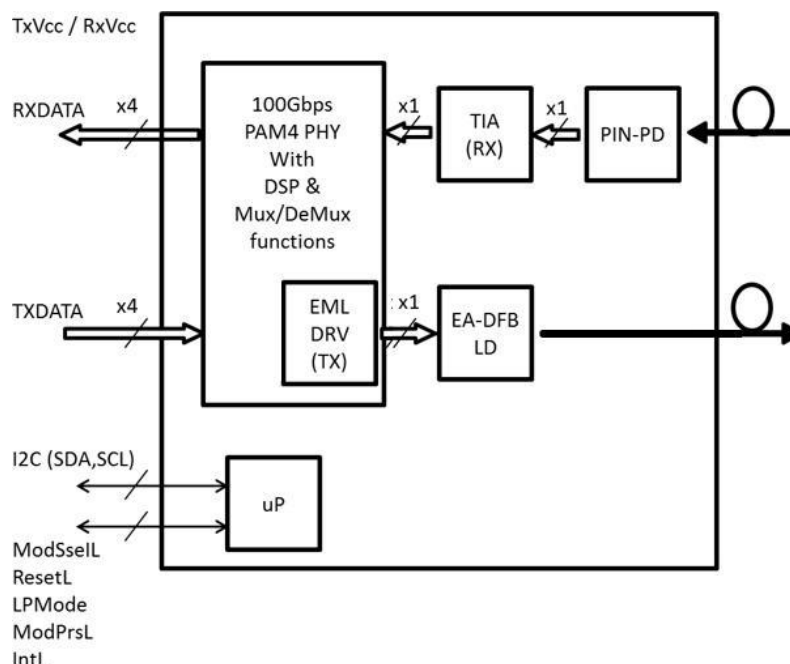
Key Features

- Compliant with QSFP28 Standard: SFF-8636 Rev 2.10a
- Compliant with IEEE802.3cu D3.2 100GBASE-LR1
- High speed I/O electrical interface (CAUI-4)
- Single 3.3V Supply Voltage
- Maximum power consumption 4.5W
- 0-70 °C Case Operating Temperature
- 1311nm EML laser and PIN Receiver
- Hermetically sealed TO Based design
- QSFP28 MSA package with duplex LC connector
- Two Wire Serial Interface with Digital Diagnostic Monitoring
- KP4 FEC termination inside module
- Supporting 10km reach of single mode fiber
- Complies with EU Directive 2011/65/EU (RoHS compliant)
- Class 1 Laser

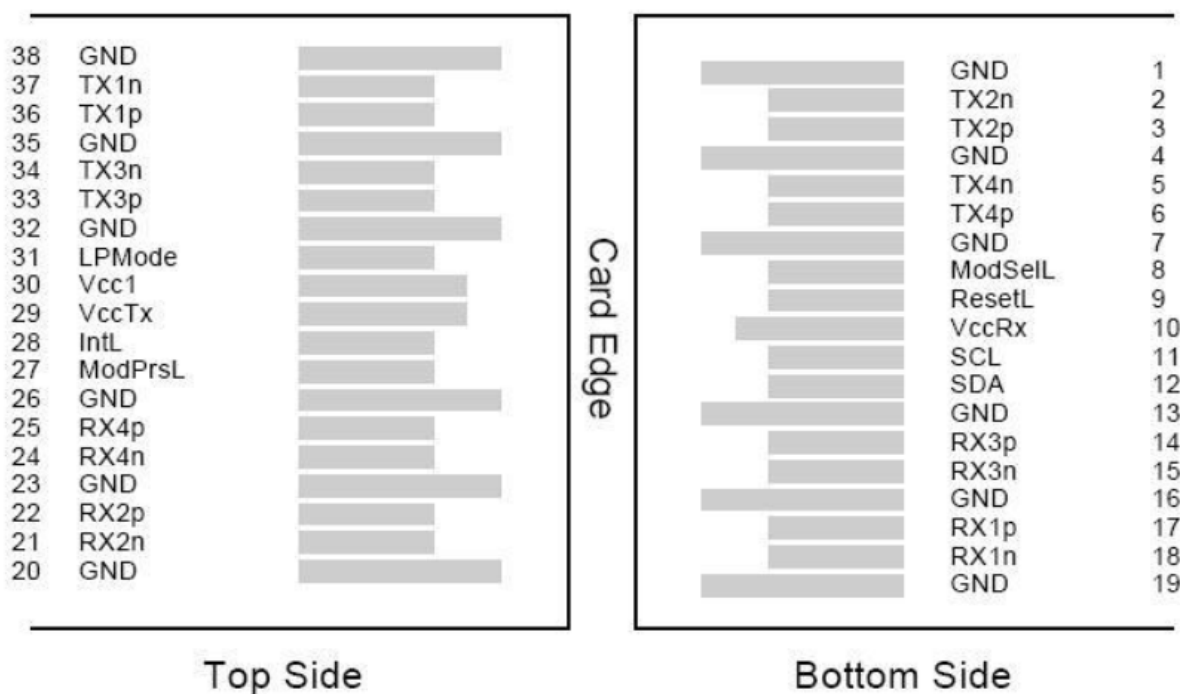
Outline Diagram



Host-Transceiver Block Diagram



Pin Assignment



Pin out of Connector Block on Host Board

Pin	Symbol	Name/Description	Note
1	GND	Transmitter Ground (Common with Receiver Ground)	1
2	Tx2n	Transmitter Inverted Data Input	
3	Tx2p	Transmitter Non-Inverted Data output	
4	GND	Transmitter Ground (Common with Receiver Ground)	1
5	Tx4n	Transmitter Inverted Data Input	
6	Tx4p	Transmitter Non-Inverted Data output	
7	GND	Transmitter Ground (Common with Receiver Ground)	1
8	ModSelL	Module Select	
9	ResetL	Module Reset	
10	VccRx	3.3V Power Supply Receiver	2
11	SCL	2-Wire serial Interface Clock	
12	SDA	2-Wire serial Interface Data	
13	GND	Transmitter Ground (Common with Receiver Ground)	
14	Rx3p	Receiver Non-Inverted Data Output	
15	Rx3n	Receiver Inverted Data Output	
16	GND	Transmitter Ground (Common with Receiver Ground)	1
17	Rx1p	Receiver Non-Inverted Data Output	
18	Rx1n	Receiver Inverted Data Output	
19	GND	Transmitter Ground (Common with Receiver Ground)	1
20	GND	Transmitter Ground (Common with Receiver Ground)	1
21	Rx2n	Receiver Inverted Data Output	
22	Rx2p	Receiver Non-Inverted Data Output	
23	GND	Transmitter Ground (Common with Receiver Ground)	1
24	Rx4n	Receiver Inverted Data Output	1
25	Rx4p	Receiver Non-Inverted Data Output	
26	GND	Transmitter Ground (Common with Receiver Ground)	1
27	ModPrsl	Module Present	
28	IntL	Interrupt	
29	VccTx	3.3V power supply transmitter	2
30	Vcc1	3.3V power supply	2
31	LPMODE	Low Power Mode, not connect	
32	GND	Transmitter Ground (Common with Receiver Ground)	1
33	Tx3p	Transmitter Non-Inverted Data Input	
34	Tx3n	Transmitter Inverted Data Output	
35	GND	Transmitter Ground (Common with Receiver Ground)	1
36	Tx1p	Transmitter Non-Inverted Data Input	
37	Tx1n	Transmitter Inverted Data Output	
38	GND	Transmitter Ground (Common with Receiver Ground)	1

Notes:

1. GND is the symbol for signal and supply (power) common for QSFP+ modules. All are common within the QSFP+ module and all module voltages are referenced to this potential unless otherwise noted. Connect these directly to the host board signal common ground plane.
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 below. Vcc Rx, Vcc1 and Vcc Tx may be internally connected within the QSFP+ transceiver module in any combination. The connector pins are each rated for a maximum current of 500 mA.

Specifications

Absolute Maximum Ratings

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Storage Temperature	TS	-40	-	+85	°C	
Supply Voltage	VCC	-0.3	-	3.6	V	
Relative Humidity (Non-Condensing)	RH	5	-	95	%	
Data Input Voltage – Differential	V _{DIP} -V _{DIN}	-	-	1.0	V	
Control Input Voltage	V _I	-0.3	-	V _{CC} +0.3	V	
Control Output Current	I _O	-20	-	20	mA	

Recommended Operating Conditions

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Operating Case Temperature	T _{OPR}	0	-	70	°C	
Power Supply Voltage	V _{CC}	3.135	3.3	3.465	V	
Instantaneous Peak Current at Hot Plug	I _{CC_IP}	-	-	1800	mA	
Sustained Peak Current at Hot Plug	I _{CC_SP}	-	-	1485	mA	
Maximum Power Dissipation	P _D	-	-	4.5	W	1
Maximum Power Dissipation, Low Power Mode	P _{DLP}	-	-	1.5	W	
Signaling Rate	SR	-	53.125	-	GBd	
Control Input Voltage High	V _{IH}	V _{CC} *0.7	-	V _{CC} +0.3	V	
Control Input Voltage Low	V _{IL}	-0.3	-	V _{CC} *0.3	V	
Two Wire Serial Interface Clock Rate	-	-	-	400	kHz	
Power Supply Noise	-	-	-	66	mVpp	2
Rx Differential Data Output Load	-	-	100	-	ohms	
Operating Distance	-	2	-	10000	m	

Notes:

1. With power supply voltage 3.3 V.
2. 10Hz -10MHz

Optical and Electrical Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Transmitter						
Wavelength	λ_c	1304.5	1311	1317.5	nm	
Side Mode Suppression Ratio	SMSR	30	-	-	dB	
Average Optical Launch Power	P_{OUT}	-1.9	-	4.8	dBm	1
Average Launch Power of OFF Transmitter	P_{OUT_OFF}	-	-	-15	dBm	
Extinction Ratio	ER	3.5	-	-	dB	
Outer Optical Modulation Amplitude	OMA_{outer}	-	-	5	dBm	
Outer Optical Modulation Amplitude for TDECQ < 1.4 dB		1.1	-	-	dBm	
Outer Optical Modulation Amplitude for 1.4 dB ≤ TDECQ ≤ 3.4 dB		-0.3+ TDECQ	-	-	dBm	
Transmitter and Dispersion Eye Closure	TDECQ	-	-	3.4	dB	
Transmitter eye closure for PAM4 (TECQ)	TECQ	-	-	3.4	dB	
TDECQ - TECQ	-	-	-	2.5	dB	
Over/Under-Shoot	-	-	-	22	%	
Transmitter Power Excursion	-	-	-	2.8	dBm	
RIN15.6OMA	RIN	-	-	-136	dB/Hz	
Optical return loss tolerance	ORLT	-	-	15.6	dB	
Transmitter transition time		-	-	17	ps	
Transmitter reflectance	TR	-	-	-26	dB	
Receiver						
Wavelength	λ_c	1304.5	1311	1317.5	nm	
Damage Threshold		5.8	-	-	dBm	
Average Receive Power		-8.2	-	4.8	dBm	2
Receive Power (OMA_{outer})	RP	-	-	5	dBm	
Receiver Reflectance	RR	-	-	-26	dB	
Receiver Sensitivity (OMA_{outer})	RS					
for TECQ < 1.4 dB		-	-	-6.1	dBm	
for 1.4 dB ≤ TECQ ≤ 3.4 dB		-	-	-7.5+ TECQ	dBm	
Stressed Receiver Sensitivity	SRS	-	-	-4.1	dBm	3
Stressed Receiver Sensitivity Test Conditions						
Stressed eye closure for PAM4 (SECQ)	SECQ	-	-	3.4	dB	

Notes:

1. Average launch power is informative and not the principal indicator of signal strength.
2. Average receive power (min) is informative and not the principal indicator of signal strength.
3. Measured with conformance test signal at TP3 for the BER = 2.4×10^{-4} .

Electrical Specifications High Speed Signal

Compliant with IEEE 802.3 CAUI-4

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Receiver (Module Output)						
AC Common-Mode Output Voltage (RMS)		-	-	17.5	mV	
Differential Output Voltage		-	-	900	mV	
Eye Width		0.57	-	-	UI	
Eye Height Differential		228	-	-	mV	
Vertical Eye Closure		-	-	5.5	dB	
Differential Termination Mismatch		-	-	10	%	
Transition Time (20% to 80%)		12	-	-	ps	
DC Common Mode Voltage		-350	-	2850	mV	
Transmitter (Module Input)						
Differential pk-pk Input Voltage Tolerance		900	-	-	mV	
Differential Termination Mismatch		-	-	10	%	
Single-Ended Voltage Tolerance Range		-0.4	-	3.3	V	
DC Common Mode Voltage		-350	-	2850	mV	

Electrical Specification Low Speed Signal

Compliant with SFF-8679 Rev 1.8

Parameter	Symbol	Min.	Max.	Unit	Condition
Module Output SCL and SDA	VOL	0	0.4	V	
	VOH	Vcc-0.5	Vcc+0.3	V	
Module Input SCL and SDA	VIL	-0.3	Vcc*0.3	V	
	VIH	Vcc*0.7	Vcc+0.5	V	
LPMode/TxDis, ResetL, and ModSelL	VIL	-0.3	0.8	V	
	VIH	2	Vcc+0.3	V	
ModPrsL and IntL/RxLOSL	VOL	0	0.4	V	
	VOH	Vcc-0.5	Vcc+0.3	V	

Digital Diagnostics

Parameter	Range	Accuracy	Unit	Calibration
Temperature	0 to 70	±3	°C	Internal
Voltage	0 to VCC	±3%	V	Internal
Tx Bias Current	0 to 100	±10%	mA	Internal
Tx Output Power	-1.9 to +4.8	±3	dB	Internal
Rx Receive Power	-8.2 to +4.8	±3	dB	Internal

Ordering Information

Product Name	Product Description
QSFP28-100G-LR10	QSFP28 Plug-in, 100GBASE-LR1, Single Channel 1310nm, 10km Optical Transceiver, LC, DOM

Contact Information



Ascent Communication Technology Ltd

AUSTRALIA

140 William Street, Melbourne
Victoria 3000, AUSTRALIA
Phone: +61-3-8691 2902

CHINA

Unit 1933, 600 Luban Road
200023, Shanghai CHINA
Phone: +86-21-60232616

EUROPE

Pfarrer-Bensheimer-Strasse 7a
55129 Mainz, GERMANY
Phone: +49 (0) 6136 926 3246

HONG KONG SAR

Unit 9, 12th Floor, Wing Tuck Commercial Centre
177 Wing Lok Street, Sheung Wan, HONG KONG
Phone: +852-2851 4722

USA

2710 Thomes Ave
Cheyenne, WY 82001, USA
Phone: +1-203 816 5188

VIETNAM

15 /F TTC Building, Duy Tan Street
Cau Giay Dist., Hanoi, VIETNAM
Phone: +84 243 795 5917

WEB: www.ascentcomtec.com

EMAIL: sales@ascentcomtec.com

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