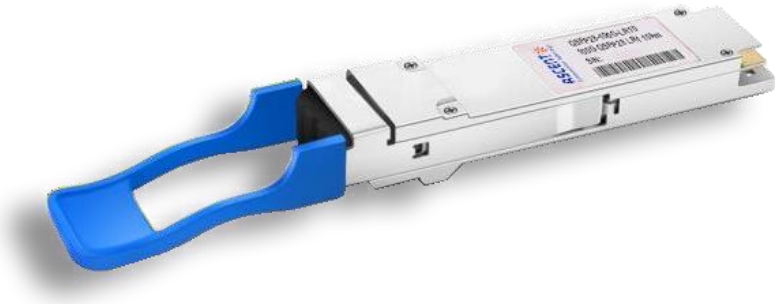
100G QSFP28 LR1 10 km Single Channel

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 4.5 W
- Up to 10 km transmission on single-mode fiber
- LC connector
- Single 3.3V power supply
- RoHS 2.0 compliant

Ascent's QSFP28 100G LR1 Ethernet module is a transceiver module designed for 10 km 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

- QSFP28 MSA compliant
- IEEE 802.3cu compliant
- Optical light source: single channel 1310nm EA-DFB LD
- Optical receiver: single channel PIN photo detector
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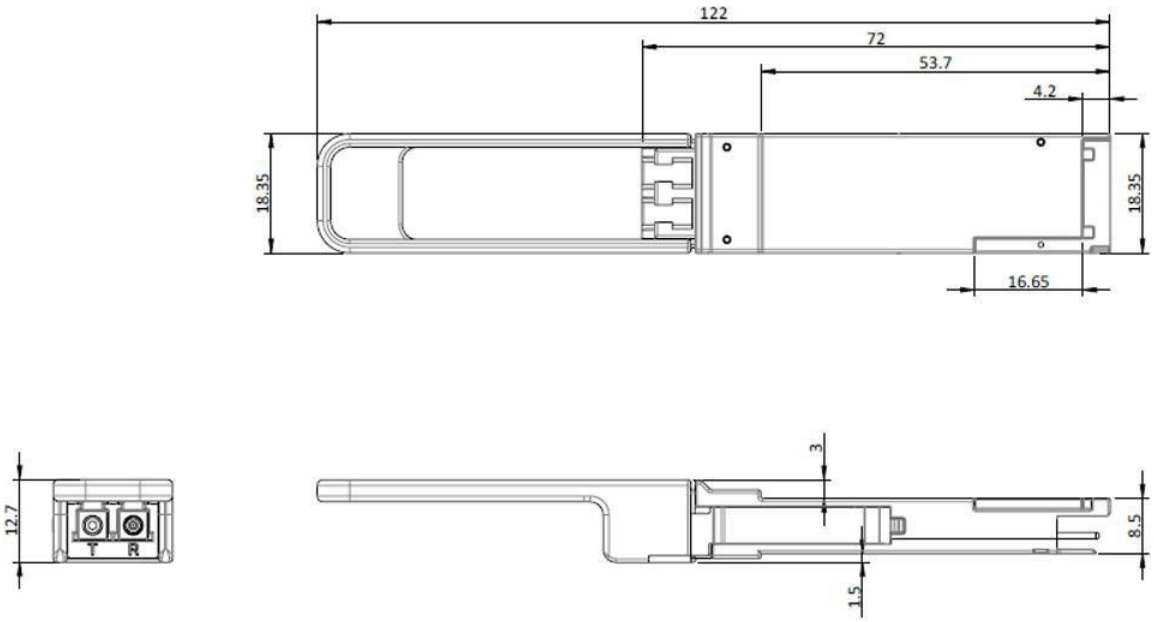
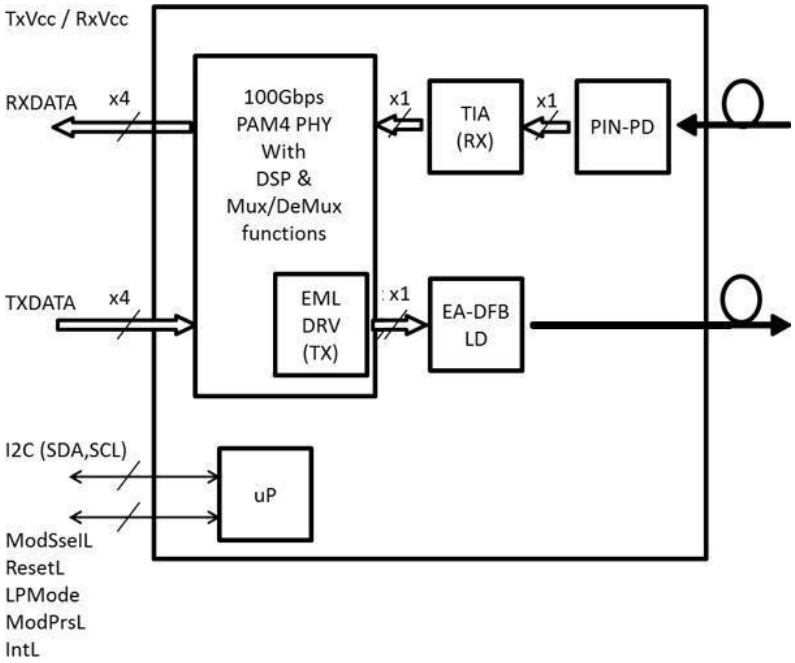
Outline Diagram



Host-Transceiver Block Diagram



Digital Diagnostic Monitoring Functions

QSFP28-100G-LR10 supports 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.

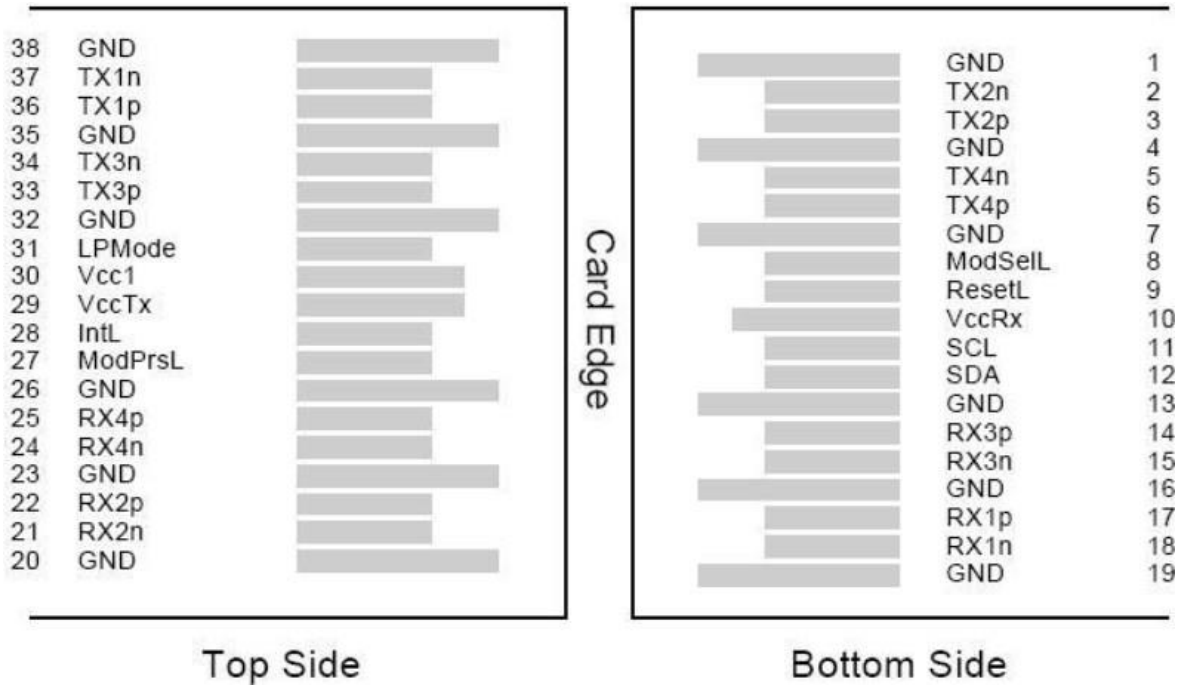
Performance item	**Data Address**		
	Alarm & Warning	**Alarm & Warning thresholds**	**Monitor**
Module Temperature	Lowpage 6	Page03 (128-135)	Lowpage (22-23)
Module Voltage	Lowpage 7	Page03 (144-151)	Lowpage (26-27)
Bias Current	Lowpage (11-12)	Page03 (184-191)	Lowpage (42-49)
Transmitter Optical Power	Lowpage (13-14)	Page03 (192-199)	Lowpage (50-57)
Receiver Optical Power	Lowpage (9-10)	Page03 (176-183)	Lowpage (34-41)

ESD Design

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 otherwise handled in an ESD protected environment utilizing standard grounded benches, floor mats, and wrist straps.

Parameter	**Threshold**	**Notes**
ESD of High-Speed Pins	1KV	Human Body Model
ESD of Low-Speed Pins	2KV	Human Body Model
Air Discharge During Operation	15KV	
Direct Contact Discharges to the Case	8KV	

Pin Assignment



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

Pin	Symbol	Name/Description	Note
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

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.	Typ.	Max.	Unit	Note
Maximum Supply Voltage	Vcc	-0.3	3.3	3.6	V	
Storage Temperature	Ts	-40		85	°C	
Relative Humidity	Rh	0		85	%	1
Optical Receiver Input				5.5	dBm	Average

Note: Non-condensing.

Operating Environments

Electrical and optical characteristics below are defined under this operating environment, unless otherwise specified.

Parameter	Symbol	Min.	Typ.	Max.	Unit.	Note
Operating Case Temperature	Top	0		70	°C	
Power Supply Voltage	Vcc	3.135	3.3	3.465	V	
Power Supply Current				1154.4	mA	Steady state
Data Rate per Lane			25.78125		Gbit/s	
Data Rate Accuracy		-100		100	ppm	
Link Distance with G.652				10	km	

Electrical Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Module Supply Current	Icc			1.212	A	
Power Consumption	P			4.50	W	
Data Rate, each Lane		25.78125 ppm ± 100 ppm			GBd	
Transmitter						
Differential Input Voltage pk-pk	Vpp	900			mV	
Common Mode Voltage	Vcm	-350	2850		mV	
Single-Ended Input Voltage		-0.4 to 3.3			V	
Tolerance Range Differential			10		%	At 1 MHz
Termination Resistance Mismatch						
Transition Time		12			ps	20%-80%
Receiver						
AC Common-Mode Output Voltage (RMS)			17.5		mV	
Overload Differential Voltage pk-pk	Vpp		900		mV	
Eye Width at 10^{-15} Probability	EW15	0.57			UI	
Eye Height at 10^{-15} Probability	EH15	228			mV	
Vertical Eye Closure			5.5		dB	
Common Mode Voltage	Vcm	-350	2850		mV	
Differential Termination Resistance Mismatch			10		%	

Optical Characteristics

Parameter	Min.	Typ.	Max.	Unit
Transmitter				
Data Rate	53.125 ppm ± 100 ppm			GBd
Modulation Format	PAM4			
Transmitter Wavelengths	1304.5	1311	1317.5	nm
Average Launch Power	-1.4		4.5	dBm
Optical Modulation Amplitude (OMA)	0.7		4.7	dBm
Extinction Ratio (ER)	3.5			dB
Side Mode Suppression Ratio (SMSR)	30			dB
Launch Power in OMA minus TDECQ	-0.7 (ER ≥ 4.5dB) -0.6 (ER < 4.5dB)			dBm
TDECQ-10log 10(Ceq)			3.4	dB
Transmitter and Dispersion Eye Closure for PAM4, (TDECQ)			3.4	dB
Transmitter Transition Time			17	ps
Optical Return Loss Tolerance			15.6	dB
Transmitter Reflectance			-26	dB
Average Launch Power of OFF Transmitter			-15	dBm
RIN15.6 OMA (Max.)			-136	dB/Hz
Receiver				
Data Rate	53.125 ± 100 ppm			GBd
Modulation Format	PAM4			
Receiver Wavelengths	1304.5	1311	1317.5	nm
Damage Threshold	5.0			dBm
Average Receiver Power	-7.1		4.0	dBm
Receiver Power (OMA)			4.2	dBm
Receive Sensitivity (OMA Outer) (Max.)			-4.5	dBm
Stressed Receiver Sensitivity (OMA Outer) (Max.)[1]			-5.9+TECQ -2.5	dBm
LOS Assert	-15			dBm
LOS De-Assert		-8.6		dBm
LOS Hysteresis	0.5			dB
Receiver Reflectance		-26		dB
Conditions Of Stressed Receiver Sensitivity[2]				
Stressed Eye Closure for PAM4 (SECQ), Lane Under Test		3.4		dB

Notes:

1. Measured with conformance test signal for BER = 2.4×10^{-4}.
2. There test conditions are for measuring stressed receiver sensitivity. They are not characteristics of the receiver.

Ordering Information

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

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