

# Alpha Bridge AQSFP28-100G- DR1 Datasheet



### Features

- QSFP28 MSA compliant
- Support 53.125Gb/s
- 100G Lambda MSA 100G-DR Specification compliant
- Up to 500m transmission on single mode fiber (SMF) with FEC
- 4x25G electrical interface (OIF CEI-28G-VSR)
- Maximum power consumption 4W
- LC duplex connector
- Commercial case temperature range of 0°C to 70°C
- Single 3.3V power supply
- RoHS compliant

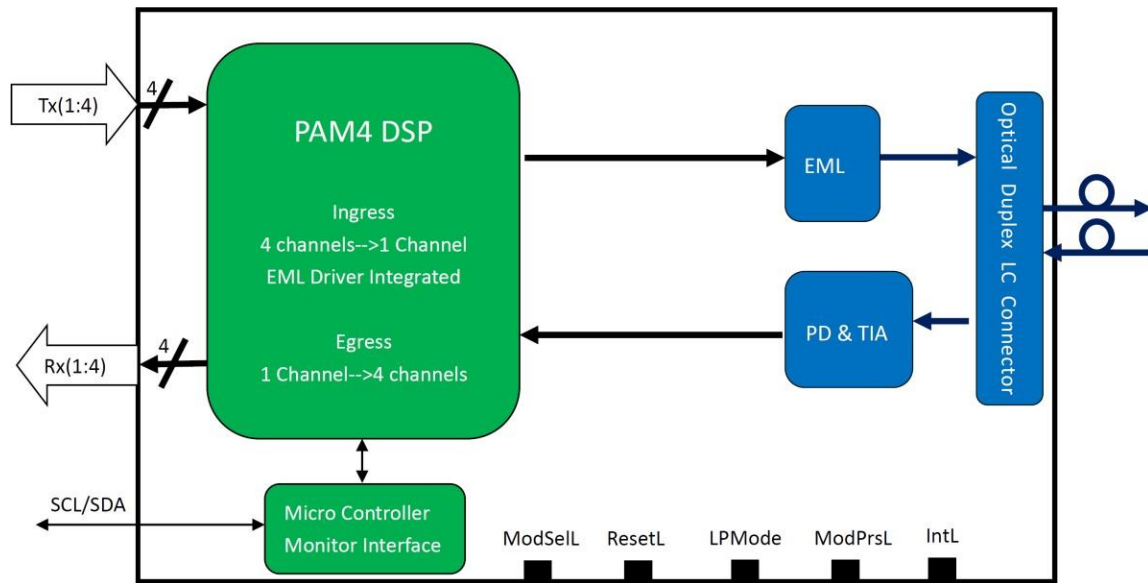
### Application

- 100G Ethernet
- Data Center Interconnect
- Enterprise networking

### Description

This product is a transceiver module designed for 500m optical communication applications. The module incorporates one channel optical signal, on 1310nm center wavelength, operating at 50Gbaud 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. A DSP based gearbox is used to convert 4x25Gbps NRZ signals to 1x50Gbaud PAM4 signal. Also a 4-channel retimer and FEC block are integrated in this DSP. The electrical interface is compliant with IEEE 802.3cd and QSFP28 MSA in the transmitting and receiving directions, and optical interface is compliant to IEEE 802.3cd and 100G Lambda MSA with Duplex LC connector. The module has a maximum power consumption of 4.0W.

The product is designed with form factor, optical/electrical connection and digital diagnostic interface according to the QSP28 Multi-Source Agreement (MSA). It has been designed to meet the harshest external operating conditions including temperature, humidity and EMI interference.



### Absolute Maximum Ratings

Parameter	Symbol	Min.	Typ.	Max.	Units	Note
Storage Temperature	$T_S$	-40		85	$^{\circ}\text{C}$	
Operating Case Temperature	$T_{OP}$	0		70	$^{\circ}\text{C}$	
Maximum Supply Voltage	$V_{CC}$	-0.5		3.6	V	
Relative Humidity (Non-condensing)	$RH$	0		85	%	
Damaged Threshold	$THd$	5.5			dBm	

### Recommended Operating Conditions

Parameter	Symbol	Min.	Typ.	Max.	Units	Note
Supply Voltage	$V_{CC}$	3.135	3.3	3.465	V	
Case Temperature	$T_{op}$	0		70	$^{\circ}\text{C}$	
Electrical Data Rate, each Lane			25.78125		Gb/s	
Optical Data Rate (PAM4)			53.125		Gb/s	
Data Rate Accuracy		-100		100	ppm	
Pre-FEC Bit Error Ratio				$2.4 \times 10^{-4}$		
Post-FEC Bit Error Ratio				$1 \times 10^{-12}$		1
Control Input Voltage-High		2		$V_{CC}$	V	
Control Input Voltage-Low		0		0.8	V	

Link Distance with G.652	<i>D</i>	0.002		500	m	2
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**Notes:**

1. FEC feature is embedded in the module.
2. FEC required to be turned on to support maximum transmission distance.

### Diagnostics Monitoring

<i>Parameter</i>	<i>Symbol</i>	<i>Accuracy</i>	<i>Unit</i>	<i>Notes</i>
Temperature monitor absolute error	DMI_Temp	± 3	°C	
Supply voltage monitor absolute error	DMI_VCC	± 0.1	V	
Channel RX power monitor absolute error	DMI_RX_Ch	± 2	dB	1
Channel Bias current monitor	DMI_Ibias_Ch	± 10%	mA	
Channel TX power monitor absolute error	DMI_TX_Ch	± 2	dB	1

**Note:**

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

### Optical Characteristics

<i>Parameter</i>	<i>Symbol</i>	<i>Min.</i>	<i>Typ.</i>	<i>Max.</i>	<i>Units</i>	<i>Note</i>
Center Wavelength	$\lambda_t$	1304.5		1317.5	nm	
<b>Transmitter</b>						
Side Mode Suppression Ration	<i>SMSR</i>	30			dB	
Average Launch Power, each lane	<i>PAVG</i>	-2.4		4	dBm	1
OMA, each lane	<i>POMA</i>	-0.8		4.2	dBm	2
Launch Power in OMA <sub>outer</sub> Minus TDECQ		-2.2			dBm	For ER $\geq 4.5$ dB
		-1.9				For ER $\leq 4.5$ dB

Transmitter and Dispersion eye Closure for PAM4 (TDECQ)	<i>TDECQ</i>		3.4		dB	
TDECQ-10*log <sub>10</sub> (C <sub>eq</sub> )				3.4	dB	3
Extinction Ratio	<i>ER</i>	3.5			dB	<b>Page 4 of 9</b>

RIN <sub>17.1</sub> OMA	<i>RIN</i>			-136	dB/Hz	
Optical Return Loss Tolerance	<i>TOL</i>			15.5	dB	
Transmitter Reflectance	<i>R<sub>T</sub></i>			-26	dB	
Transmitter Transition Time				17	ps	
Average Launch Power OFF	<i>P<sub>off</sub></i>			-15	dBm	
LOS Assert Level	<i>LOSA</i>		50		mV	4
LOS De-assert Level	<i>LOSD</i>		100		mV	
<b>Receiver</b>						
Damage Threshold	$\Lambda_r$	5			dBm	5
Average Receiver Power		-5.9		4	dBm	6
Receiver Power (OMA)				4.2	dBm	
Receiver Sensitivity (OMA)	<i>SEN</i>			Equation (1)	dBm	7
Stressed Receiver Sensitivity (OMA)	<i>SRS</i>			-1.9	dBm	8
Receiver Reflectance	<i>R<sub>R</sub></i>			-26	dB	
LOS Assert	<i>LOSA</i>	-15			dBm	9
LOS De-assert	<i>LOSD</i>			-8.9	dBm	
LOS Hysteresis	<i>LOSH</i>	0.5			dB	
<b>Conditions of Stress Receiver Sensitivity Test (Note 10)</b>						
Stressed Eye Closure for PAM4 (SECQ)				3.4	dB	
SECQ-10*log <sub>10</sub> (C <sub>eq</sub> )				3.4	dB	

**Notes:**

1. Average launch power (min) is informative and not the principal indicator of sign strength. A transmitter with launch power below this value cannot be compliant; however, a value above this does not ensure compliance.
2. Even if the TDECQ < 1.4dB for an extinction ratio of  $\geq 5$ dB or TDECQ < 1.1dB for an extinction ratio of < 5dB, the OMA<sub>outer</sub> (min), must exceed the minimum value specified here.
3. C<sub>eq</sub> is a coefficient defined in IEEE Std 802.3-2018 clause 121.8.5.3 which accounts for reference equalizer noise enhancement.
4. Average receive power (min) is informative and not the principal indicator of signal strength. A received power below this value cannot be compliant; however, a value above this does not ensure compliance.
5. 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.

6. Receiver sensitivity ( $OMA_{outer}$ ) (max) is informative and is defined for a transmitter with a value of SECQ up to 3.4dB. It should meet Equation (1), which is illustrated in Figure 4.

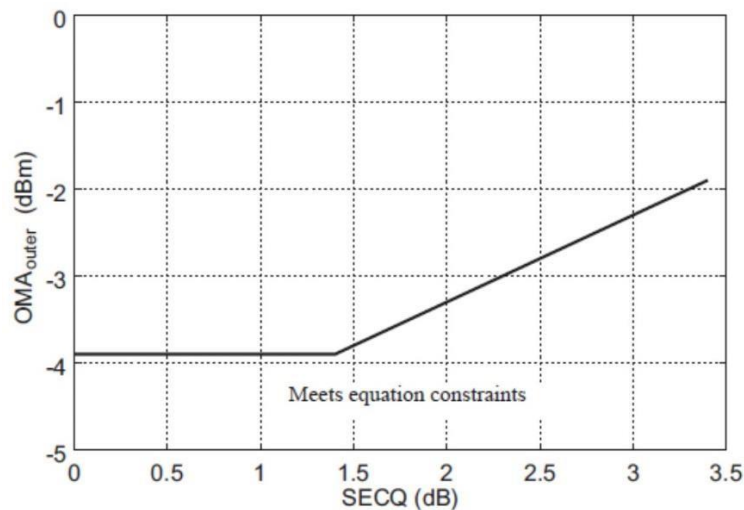
$$RS = \max(-3.9, SECQ - 5.3) \text{ dBm}$$

Where:

RS is the receiver sensitivity.

SECQ is the SECQ of the transmitter used to measure the receiver sensitivity.

7. Measured with conformance test signal at TP3 for the BER equal to  $2.4 \times 10^{-4}$ .
8. These test conditions are for measuring stressed receiver sensitivity. They are not characteristics of the receiver.



### Electronical Characteristics

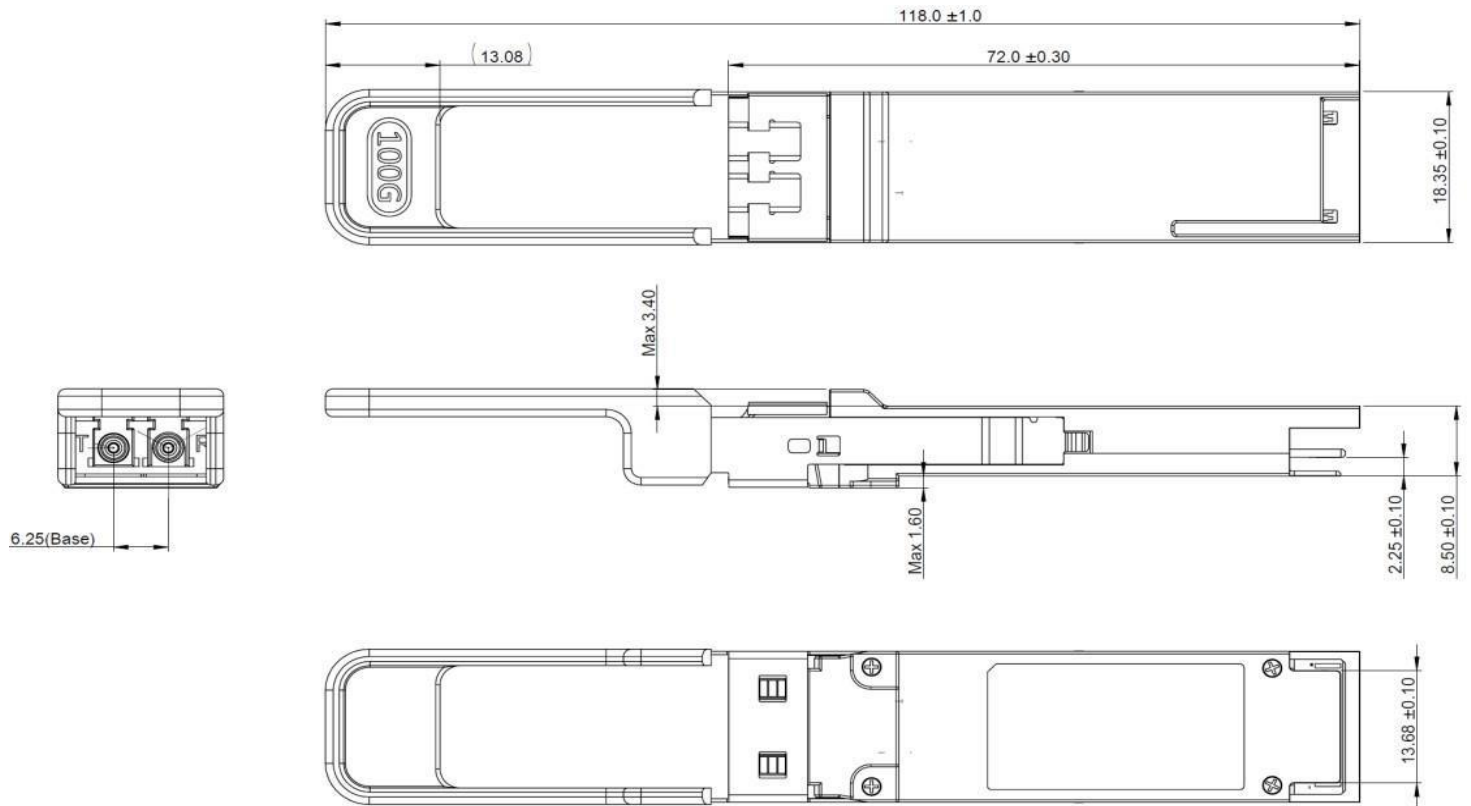
Parameter	Symbol	Min.	Typ.	Max.	Units	Note
Power Consumption				4.0	W	
Supply Current	$I_{cc}$			1.21	A	
<b>Transmitter (each Lane)</b>						
Overload Differential Voltage pk-pk	$TP1a$	900			mV	
Common Mode Voltage ( $V_{cm}$ )	$TP1$	-350		2850	mV	1
Differential Termination Resistance Mismatch	$TP1$			10	%	At 1MHz
Differential Return Loss (SDD11)	$TP1$	See CEI-28G-VSR Equation13-19			dB	

Common Mode to Differential conversion and Differential to Common Mode conversion (SDC11, SCD11)	<i>TP1</i>	See CEI-28G-VSR Equation13-20		dB	
Stressed Input Test	<i>TP1a</i>	See CEI-28G-VSR Section 3.11.2.1			
<b>Receiver (each Lane)</b>					
Differential Voltage pk-pk	<i>TP4</i>		900	mV	
Common Mode Voltage (Vcm)	<i>TP4</i>	-350	2850	mV	1
Common Mode Noise, RMS	<i>TP4</i>		17.5	mV	
Differential Termination Resistance Mismatch	<i>TP4</i>		10	%	At 1MHz
Differential Return Loss (SDD22)	<i>TP4</i>	See CEI-28G- VSR Equation13-19		dB	
Common Mode to Differential conversion and Differential to Common Mode conversion (SDC22, SCD22)	<i>TP4</i>	See CEI-28G- VSR Equation13-21		dB	
Common Mode Return Loss (SCC22)	<i>TP4</i>		-2	dB	2
Transition Time, 20 to 80%	<i>TP4</i>	9.5		ps	
Vertical Eye Closure (VEC)	<i>TP4</i>		5.5	dB	
Eye Width at 10 <sup>-15</sup> probability (EW15)	<i>TP4</i>	0.57		UI	
Eye Height at 10 <sup>-15</sup> probability (EH15)	<i>TP4</i>	228		mV	

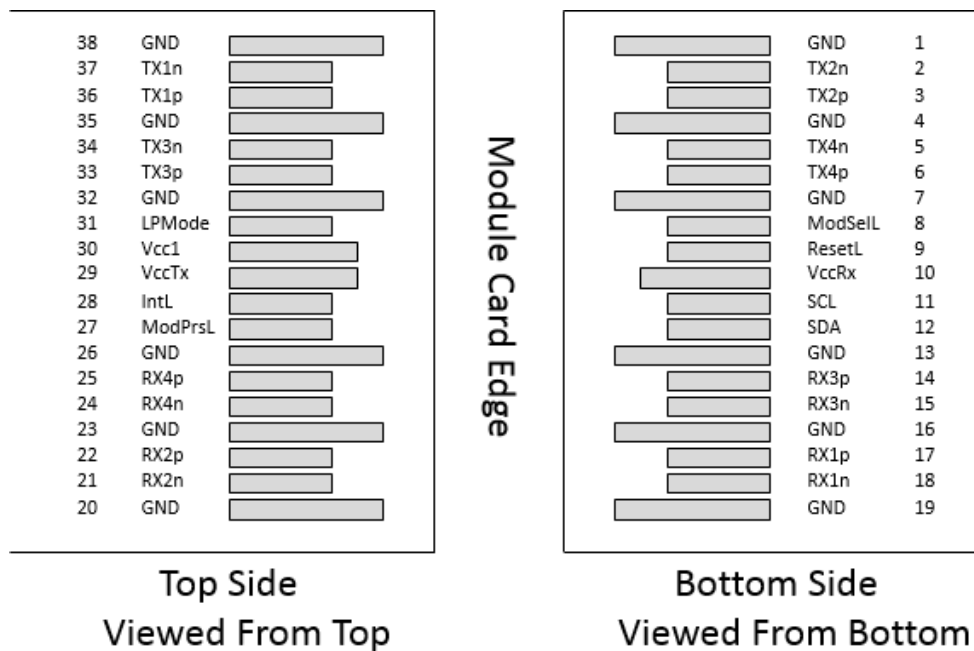
Note:

1. Vcm is generated by the host. Specification includes effects of ground offset voltage.
2. From 250MHz to 30GHz.

### Block Diagram of Transceiver





**Pin Assignment (MSA compliant connector)**


**Note: Dimensions are in mm, All Dimensions are 0.2mm unless otherwise specified**

**Pin Descriptions**

Pin	Symbol	Name/Description	Notes
1	GND	Transmitter Ground	1
2	Tx2n	Transmitter Inverted Data Input	
3	Tx2p	Transmitter Non-Inverted Data output	
4	GND	Transmitter Ground	1
5	Tx4n	Transmitter Inverted Data Input	
6	Tx4p	Transmitter Non-Inverted Data output	
7	GND	Transmitter 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	Receiver Ground	1
14	Rx3p	Receiver Non-Inverted Data Output	
15	Rx3n	Receiver Inverted Data Output	
16	GND	Receiver Ground	1
17	Rx1p	Receiver Non-Inverted Data Output	
18	Rx1n	Receiver Inverted Data Output	
19	GND	Receiver Ground	1
20	GND	Receiver Ground	1
21	Rx2n	Receiver Inverted Data Output	
22	Rx2p	Receiver Non-Inverted Data Output	
23	GND	Receiver Ground	1
24	Rx4n	Receiver Inverted Data Output	
25	Rx4p	Receiver Non-Inverted Data Output	
26	GND	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	1
33	Tx3p	Transmitter Non-Inverted Data Input	
34	Tx3n	Transmitter Inverted Data Output	
35	GND	Transmitter Ground	1
36	Tx1p	Transmitter Non-Inverted Data Input	
37	Tx1n	Transmitter Inverted Data Output	
38	GND	Transmitter Ground	1

Notes:


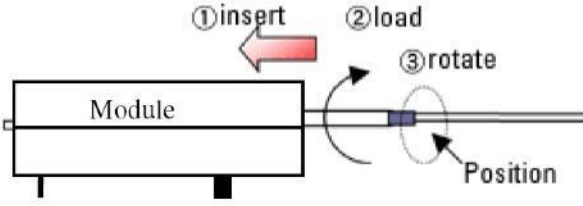
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1. GND is the symbol for signal and supply (power) common for the QSFP28 module. All are common within the module and all module voltages are referenced to this potential unless otherwise noted. Connect these directly to the host board signal common 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 in Figure 3 below. Vcc Rx, Vcc1 and Vcc Tx may be internally connected within the QSFP28 transceiver module in any combination. The connector pins are each rated for a maximum current of 1000mA.

### Optical Receptacle Cleaning Recommendations :

All fiber stubs inside the receptacle portions were cleaned before shipment. In the event of contamination of the optical ports, the recommended cleaning process is the use of forced nitrogen. If contamination is thought to have remained, the optical ports can be cleaned using a NTT international Cletop® stick type and HFE7100 cleaning fluid. Before the mating of patch-cord, the fiber end should be cleaned up by using Cletop® cleaning cassette.

Cleaning of patch-cord	Cleaning of fiber stub
	 <ol style="list-style-type: none"> <li>1. Insert Ensure that stick is held straight when inserting into sleeve.</li> <li>2. Load Apply sufficient pressure (approx 600-700g) to ensure ferrule a little depressed in sleeve.</li> <li>3. Rotate Rotate stick clockwise 4-5 times, while ensuring direct contact with ferrule end-face is maintained.</li> </ol> <p><i>Notice: Number of possible wipes: Maintenance (repair) ~1 use / piece Equipment construction: 4 uses / piece (max.)</i></p>

Note: The pictures were extracted from NTT-ME website. And the Cletop® is a trademark registered by NTT-ME

### Ordering information:

Model Number	Part Number	Voltage	Temperature
AQSFP28-100G-DR1	OPCW-S40-13-CR	3.3V	0°C to 70 °C

Note: All information contained in this document is subject to change without notice.