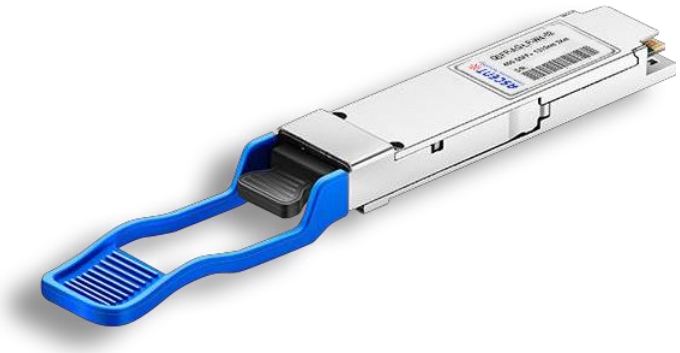
40GBASE-UNIV QSFP+ MMF and SMF Transceiver

QSFP+ Series



- 40G Ethernet over MMF and SMF
- Compatible with 40GBASE-UNIV QSFP+
- Supports up to 41.2 Gb/s aggregate bit rate
- Up to 2 km transmission distance over SMF
- Up to 150 m transmission distance on OM3
- Hot-pluggable
- Built-in digital diagnostic functions
- Compliant with IEEE 802.3ba
- RoHS-6 compliant

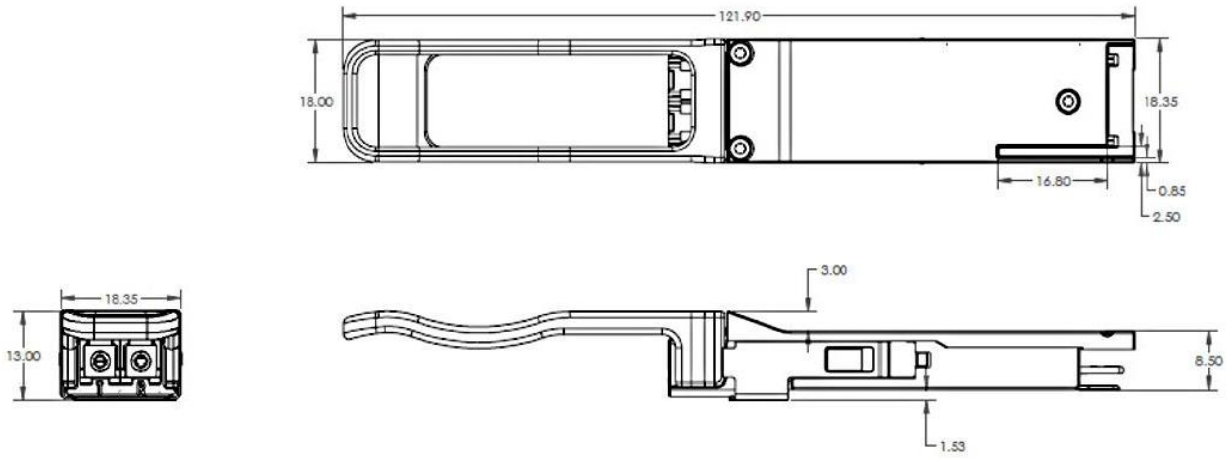
Ascent's QSFP-AQ-LP-W4-02U is a transceiver module designed for 2 km (SMF) / 150 m (MMF) optical communication applications. They are compliant with the IEEE 802.3ba 40GBASE-LR4 standard referred to as LM4. The module converts 4 input channels (ch) of 10 Gb/s electrical data to 4 CWDM optical signals, and multiplexes them into a single channel for 40 Gb/s optical transmission. On the receiver side, the module optically de-multiplexes a 40 Gb/s input into 4 CWDM channel signals, and converts them into 4 channels of output electrical data.

Key Features

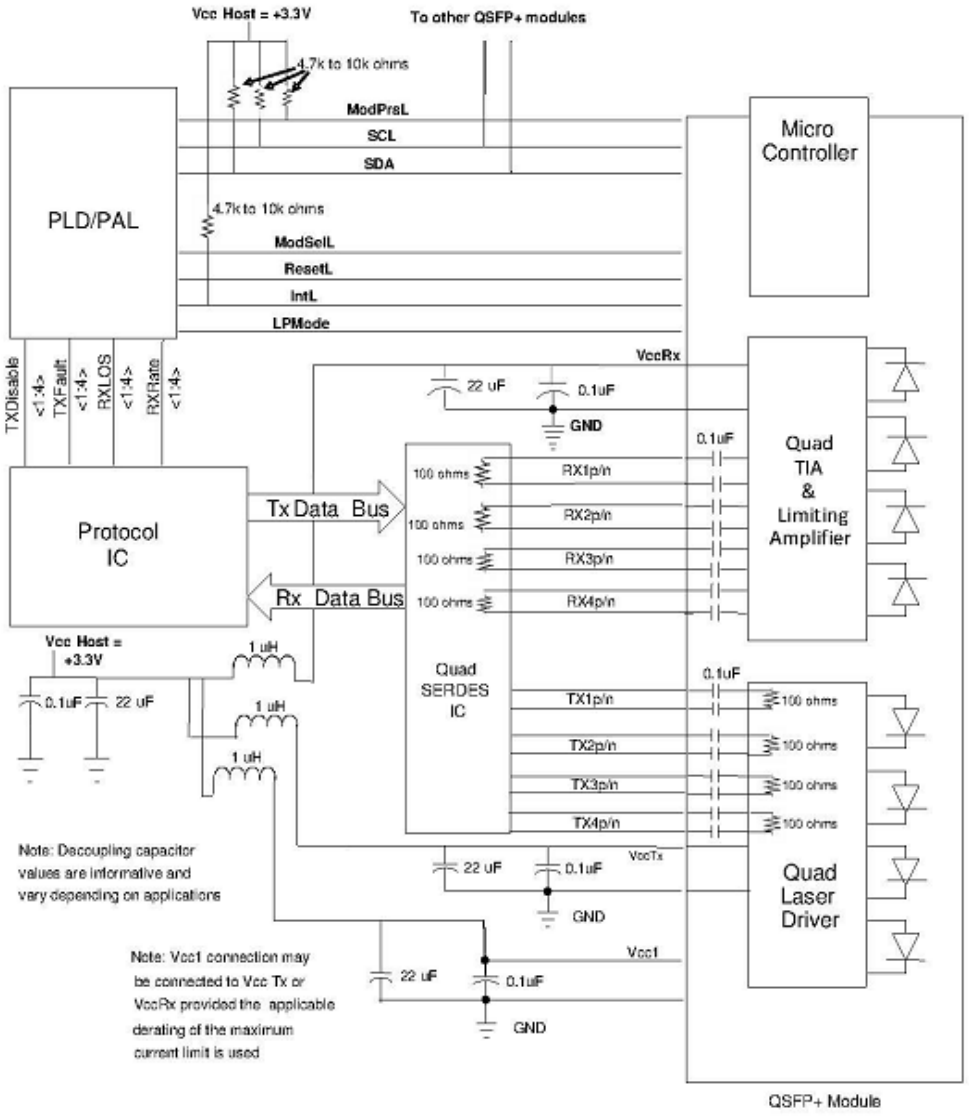
- Hot-pluggable QSFP+ form factor
- Operates over duplex multi-mode and single-mode fiber with dual LC receptacles
- Supports 41.2 Gbs/ aggregate bit rate
- Up to 2 km transmission distance over SMF
- Up to 150 m transmission distance on OM3
- Hot-pluggable QSFP+ form factor
- Uncooled 4x 10 Gb/s CWDM transmitter
- XLPPI electrical interface
- Built-in digital diagnostic functions, including Tx/Rx power monitoring
- Case operating temperature range: 0 °C to +70 °C
- Power dissipation < 3.5 W
- Compliant with IEEE 802.3ba
- RoHS compliant

Outline Dimensions

The mechanical specifications are compliant to the QSFP+ MSA transceiver module specifications



Host-Transceiver Interface Block Diagram



Pin Assignment

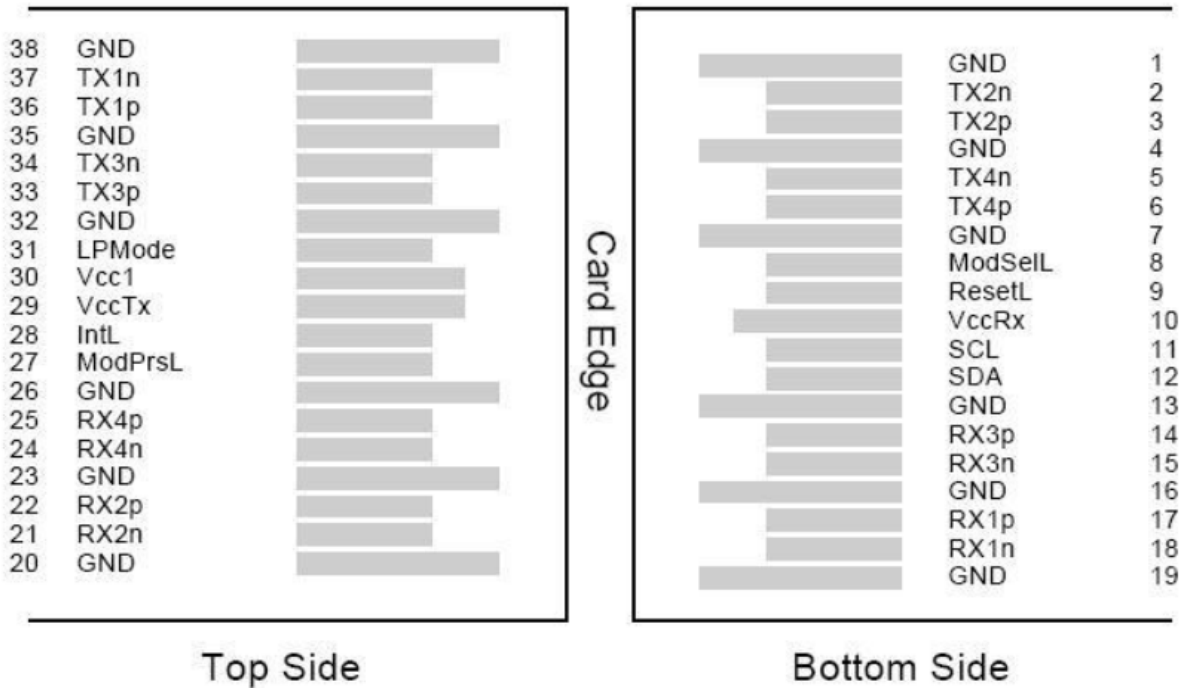


Figure 1 – Pin out of Connector Block on Host Board

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 500mA.

Specifications

General Product Characteristics

Item	Value	Notes
Module Form Factor	QSFP+	
Maximum Aggregate Data Rate	41.2 Gb/s	
Maximum Data Rate per Lane	10.3125 Gb/s	
Protocols Supported	40G Ethernet	
Electrical Interface and Pin-out	38-pin edge connector	Pin-out as defined by the QSFP+ MSA
Maximum Power Consumption	3.5 W	
Management Interface	Serial, I2C-based, 400 kHz maximum frequency	As defined by the QSFP+ MSA

Data Rate Specifications

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Bit Rate per Lane	BR			10.313	Gb/sec	1
Bit Error Ratio	BER			10^{-12}		2
Link Distance on OM3	d			150	m	
Link Distance on OM4	d			160	m	
Link Distance on SMF	d			2000	m	

Notes:

1. Adapted from 40GBASE-LR4, IEEE 802.3ba
2. Tested with a PRBS 2^{31}-1 test pattern.

Absolute Maximum Ratings

Item	Symbol	Min.	Typ.	Max.	Unit	Notes
Maximum Supply Voltage	Vcc1, VccTx, VccRx	-0.5		4	V	
Storage Temperature	Ts	-40		85	°C	
Case Operating Temperature	Top	0		70	°C	
Relative Humidity	RH	0		85	%	Non-condensing
Damage Threshold, per Lane	DT	3.4			dBm	

Electrical Characteristics (TOP = 0 °C to 70°C, VCC = 3.1 V to 3.47 V)

Item	Symbol	Min.	Typ.	Max.	Unit	Notes
Supply Voltage	Vcc1, VccTx, VccRx	3.1		3.47	V	
Supply Current	Icc			1.13	A	
Transmit Turn-On Time				2000	ms	1
Transmitter (per Lane)						
Single-Ended Input Voltage Tolerance	VinT	-0.3		4.0	V	
Differential Data Input Swing	Vin,pp	120		1200	mVpp	2
Differential Input Threshold			50		mV	
AC Common Mode Input Voltage Tolerance (RMS)		15			mV	
Differential Input Return Loss	Per IEEE P802.3ba, Section 86A.4.1.1				dB	3
J2 Jitter Tolerance	Jt2	0.17			UI	
J9 Jitter Tolerance	Jt9	0.29			UI	
Data Dependent Pulse Width Shrinkage	DDPWS	0.07			UI	
Eye Mask Coordinates {X1, X2, Y1, Y2}		0.11, 0.31, 95, 350			UI mV	4
Receiver (per Lane)						

Single-Ended Output Voltage		-0.3	4.0	V	
Differential Data Output Swing	Vout,pp	0	800	mVpp	5
AC Common Mode Output Voltage (RMS)			7.5	mV	
Termination Mismatch at 1 MHx			5	%	
Differential Output Return Loss	Per IEEE P802.3ba, Section 86A.4.2.1			dB	3
Common Mode Output Return Loss	Per IEEE P802.3ba, Section 86A.4.2.2			dB	3
Output Transition Time, 20% To 80%		28		ps	
J2 Jitter Output	Jo2		0.42	UI	
J9 Jitter Output	Jo9		0.65	UI	
Eye Mask Coordinates #1		0.29, 0.5		UI	4
{X1, X2, Y1, Y2}		150, 425		mV	
Power Supply Ripple Tolerance	PSR	50		mVpp	

Notes:

1. From power-on and end of any fault conditions.
2. After internal AC coupling. Self-biasing 100 Ω differential input.
3. 10 MHz to 11.1 GHz range
4. Hit ratio = 5 x 10^{-5}
5. AC coupled with 100 Ω differential output impedance.

Optical Characteristics (TOP = 0 to 70°C, VCC = 3.1 to 3.47 V)

Item	Symbol	Min.	Typ.	Max.	Unit	Notes
Transmitter (per Lane)						
Signaling Speed per Lane				11.2	GBd	1
Lane Center Wavelengths (Range)		1264.5-1277.5			nm	
		1284.5-1297.5				
		1304.5-1317.5				
		1324.5-1337.5				
Total Average Launch Power	Pout			8.3	dBm	
Average Launch Power per Lane, MMF	TXPx	-7.0		4.3	dBm	
Average Launch Power per Lane, SMF	TXPx	-10.0		2.3	dBm	2
Transmit OMA per Lane, MMF	TxOMA	-3.0		4.8	dBm	
Transmit OMA per Lane, SMF	TxOMA	-6.0		3.5	dBm	3
Transmitter Dispersion Penalty, MMF	TXP-TDP			4.7	dBm	
Transmitter Dispersion Penalty, SMF	TXP-TDP			2.6	dBm	
Average Launch Power of OFF Transmitter, per Lane				-30	dBm	
Relative Intensity Noise	RIN			-128	dB/Hz	4

Sidemode Suppression Ratio	SSRmin	30		dB	
Optical Extinction Ratio	ER	3.5		dB	
Optical Return Loss Tolerance			20	dB	
Transmitter Reflectance			-12	dB	
Transmitter Eye Mask Definition {X1, X2, X3, Y1, Y2, Y3}		(0.25, 0.4, 0.45, 0.25, 0.28, 0.4)			
Jitter Generation		Per OTL3.4 section 4.14.1			
Receiver (per Lane)					
Signaling Speed per Lane			11.2	GBd	5
Lane Center Wavelengths (Range)		1264.5-1277.5 1284.5-1297.5 1304.5-1317.5 1324.5-1337.5		nm	
Receive Power (OMA) per Lane, MMF	RxOMA		4.8	dBm	
Receive Power (OMA) per Lane, SMF	RxOMA		3.3	dBm	
Damage Threshold per Lane	PMAX		5.5	dBm	
Average Receive Power per Lane, MMF	RXPx	-10.0	4.3	dBm	
Average Receive Power per Lane, SMF	RXPx	-13.7	2.3	dBm	6
Receiver Sensitivity (OMA) per Lane, MMF	Rxsens		-10.5	dBm	
Receiver Sensitivity (OMA) per Lane, SMF	Rxsens		-10.5	dBm	7
Stressed Receiver Sensitivity (OMA) per Lane, MMF	SRS		-5.0	dBm	
Stressed Receiver Sensitivity (OMA) per Lane, SMF	SRS		-8.5	dBm	
Return Loss	RL		-20	dB	
Vertical Eye Closure Penalty, per Lane			3.6	dB	
Receive Electrical 3 Db Upper Cutoff Frequency, per Lane			12.3	GHz	
LOS De-Assert	LOSD		-12	dBm	8
LOS Assert	LOSA	-28		dBm	8
LOS Hysteresis		1		dB	

Notes:

1. Transmitter consists of 4 lasers operating at 10.3 Gb/s each.
2. Minimum value is informative.
3. Even if TDP < 0.5 dB (MMF) or TDP < 0.8 dB (SMF), TxP - TDP must be greater than this value.
4. RIN is scaled by 10 * log(10/4) to maintain SNR outside of transmitter.
5. Receiver consists of 4 photodetectors operating at up to 10.3 Gb/s each.
6. Minimum value is informative, equals min. TxOMA with infinite ER and max. channel insertion loss.
7. SMF receiver sensitivity guaranteed by design, but not measured in production.
8. LOS Assert and De-Assert values are informative and may vary between MMF and SMF uses.

Ordering Information

Product Name	Product Description
QSFP-AQ-LP-W4-02U	QSFP+ Plug-in, 40 GBASE-UNIV, 2 km @ SMF, 150m @ MMF, 4 CWDM wavelength (1271, 1291, 1311, 1331 nm), LC

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

Ver. ACT_QSFP-AQ-LP-W4-02U_Datasheet_V1d_Jul_2020