400G QSFP112 DR4-DR4+ PAM4 Optical Transceiver

Jabil 400 Gb/s DR4/DR4+ QSFP112 Optical Transceiver is a small form-factor, high speed, and low power consumption product targeted for use in optical interconnects for data communications applications. The high bandwidth module supports 400G Ethernet and InfiniBand connections over single-mode multifiber MPO-12 links up to 2 km.

FEATURES

- Compliant with IEEE 802.3-2022, IEEE 802.3df 400GBASE-DR4-2 optical interface specification for use in 400G or 4x100G breakout applications up to 2 km
- Electrical interface compliant with IEEE 802.3ck 400GAUI-4
- Compact Type 2 QSFP112 form factor for high faceplate density in networking equipment
- Compatibility with single-mode optical connectors and cable infrastructures
- Operating temperature range: 0 to -70°C
- CMIS-compliant management interface with full module diagnostics and control through I2C
- Single 3.3V Power supply
- Power consumption < 9W
- RoHS-6 Compliance

APPLICATIONS

- Ethernet and InfiniBand data center applications
- 400GbE connectivity or 4x100GbE breakout connectivity for large-scale cloud and enterprise data centers
- Ethernet switch, router, and client-side telecom interfaces

STANDARDS

- QSFP112 MSA
- IEEE 802.3-2022, IEEE 802.3df, IEEE 802.3ck

For additional information, visit jabil.com

ABSOLUTE MAXIMUM RATINGS

Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute maximum rated conditions for extended periods may affect device reliability.

PARAMETER	SYMBOL	MIN	MAX	UNITS
Storage Temperature	Tstg	-40	+85	ºC
Case Operating Temperature	TOP	0	70	ºC
Relative Humidity – Storage (*)	RHS	5	95	%
Relative Humidity - Operating	RHO	5	85	%
DC Supply Voltage	V_{CC}	-	3.6	V
ESD (HBM)	V_{ESD}	-1k	1k	V
Differential Input Voltage	$V_{in\text{-}pp}$	-	900	mVpp
Receiver Input Optical Power	P_{IN} (max)	-	+3.5	dBm

(*) not condensing

RECOMMENDED OPERATING CONDITIONS

PARAMETER	SYMBOL	MIN	TYP	MAX	UNITS
Case Operating Temperature	TCASE	0	30	70	°C
DC Supply Voltage	V_{CC}	3.135	3.3	3.465	V
Power Supply Noise Tolerance (*)		-	-	50	mVpp

(*) At input to recommended power supply filter

Electrical Characteristics

TRANSMITTER ELECTRICAL CHARACTERISTICS (TP1)

PARAMETER	SYMBOL	MIN	TYP	MAX	UNITS
Data modulation type		PAM4			
Data rate, each lane	BR	106.24	106.25	106.26	Gbps
Baud/symbol rate, each lane	BR	53.12	53.125	53.13	Gbd
DC common mode voltage	V_{in_CM}	-350	-	2850	mV
Differential pk-pk input voltage tolerance		750			mV
Differential to common mode input return loss	SDC11	as per 802.3ck 120G-2			
Effective return loss	ERL	8.5			dB
Differential termination mismatch		-	-	10	%
Module stressed input test		as per 802.3ck 120G.3.4.3			
Single-ended voltage tolerance	V_{in_SE}	-0.4	-	3.3	V

RECEIVER ELECTRICAL CHARACTERISTICS (TP4)

PARAMETER	SYMBOL	MIN	TYP	MAX	UNITS
Data modulation type		PAM4			
Data rate, each lane	BR	106.24	106.25	106.26	Gbps
Baud/symbol rate, each lane	BR	53.12	53.125	53.13	Gbd
DC common mode voltage	$V_{out\_AC\text{-}CM}$	-350	-	2850	mV
Peak-to-peak AC common-mode voltage, low frequency		-	-	32	mV
Peak-to-peak AC common-mode voltage, full band		-	-	80	mV
Differential peak-to-peak output voltage, short mode		-	-	600	mV
Differential peak-to-peak output voltage, short mode				845	mV
Eye height	EH	15	-	-	mV
Vertical eye closure		-		12	mV
Effective return loss		-	8.5	-	mV
Common to differential mode conversion return loss	SCD22	as per 802.3ck 120G-1			
Differential termination mismatch		-	-	10	%
Transition time (20-80%)	Trf	8.5	-	-	ps

Optical Characteristics

DR4 Module

TRANSMITTER OPTICAL CHARACTERISTICS (TP2) – DR4

PARAMETER	SYMBOL	MIN	TYP	MAX	UNITS	NOTES
Data modulation type			PAM4			
Data rate, each lane	BR	106.24	106.25	106.26	Gbps	
Baud/symbol rate, each lane	BR	53.12	53.125	53.13	Gbd	
Lane wavelengths	WL	1304.5	1311	1317.5	nm	
Side Mode Suppression Ratio	SMSR	30	-	-	dB	
Average optical output power, each lane	Pave	-2.9	-	4	dBm	
Optical Modulation Amplitude, each lane	OMA_{outer}	-0.8	-	4.2	dBm	
Launch power in OMAouter minus TDECQ, each lane		-2.2	-	-	dBm	
Transmitter dispersion and eye closure penalty, each lane	TDECQ	-	-	3.4	dB	
Extinction Ratio	ER	3.5	-	-	dB	
Average optical output power of OFF transmitter, each lane		-	-	-15	dBm	
Transmitter reflectance		-	-	-26	dB	1
RIN17.1OMA	RIN	-	-	-136	dB/Hz	
Optical return loss tolerance	ORLT	-	-	21.4	dB	
Operating link reach		2	-	500	m	

(1) Transmitter reflectance is defined looking into the transmitter

RECEIVER OPTICAL CHARACTERISTICS (TP3) – DR4

PARAMETER	SYMBOL	MIN	TYP	MAX	UNITS	NOTES
Data modulation type			PAM4			
Data rate, each lane	BR	106.24	106.25	106.26	Gbps	
Baud/symbol rate, each lane	BR	53.12	53.125	53.13	Gbd	
Lane wavelengths	WL	1304.5	1311	1317.5	nm	
Average receive power, each lane		-5.9	-	4	dBm	
Receive power in OMAouter, each lane		-	-	4.2	dBm	
Damage threshold, each lane		-	-	5	dBm	1
Receiver reflectance		-	-	-26	dB	
Unstressed receiver sensitivity (OMAouter), each lane	URS		max(-3.9, SECQ-5.3)		dBm	2
Stressed receiver sensitivity (OMAouter), each lane	SRS	-	-	-1.9	dBm	
Stressed eye closure for PAM4 (SECQ), each lane	SECQ		3.4		dB	3
OMAouter of each aggressor lane			4.2		dBm	3

(1) The receiver is able to tolerate, without damage, continuous exposure to a signal having this average optical power level.
(2) Unstressed receiver sensitivity is informative and is defined via the equation given, for a test transmitter SECQ up to 3.4 dB.
(3) These test conditions are for measuring stressed receiver sensitivity. They are not characteristics of the receiver.

DR4+ Module

TRANSMITTER OPTICAL CHARACTERISTICS (TP2) – DR4+

PARAMETER	SYMBOL	MIN	TYP	MAX	UNITS	NOTES
Data modulation type			PAM4			
Data rate, each lane	BR	106.24	106.25	106.26	Gbps	
Baud/symbol rate, each lane	BR	53.12	53.125	53.13	Gbd	
Lane wavelengths	WL	1304.5	1311	1317.5	nm	
Side mode suppression ratio	SMSR	30	-	-	dB	
Average optical output power, each lane	Pave	-2.9	-	4	dBm	
Optical Modulation Amplitude, each lane for TDECQ < 1.4 dB	OMA_{outer}	-0.1	-	4.2	dBm	
Optical Modulation Amplitude, each lane for 1.4 dB < TDECQ < 3.4 dB	OMA_{outer}	–1.5 + TDECQ	-	4.2	dBm	
Extinction Ratio	ER	3.5	-	-	dB	
Average optical output power of OFF transmitter, each lane		-	-	-15	dBm	
Transmitter reflectance		-	-	-26	dB	1
RIN17.1OMA	RIN	-	-	-136	dB/Hz	
Optical Return Loss Tolerance	ORLT	-	-	21.4	dB	
Operating link reach		2	-	2000	m	

(1) Transmitter reflectance is defined looking into the transmitter.

RECEIVER OPTICAL CHARACTERISTICS (TP3) – DR4+

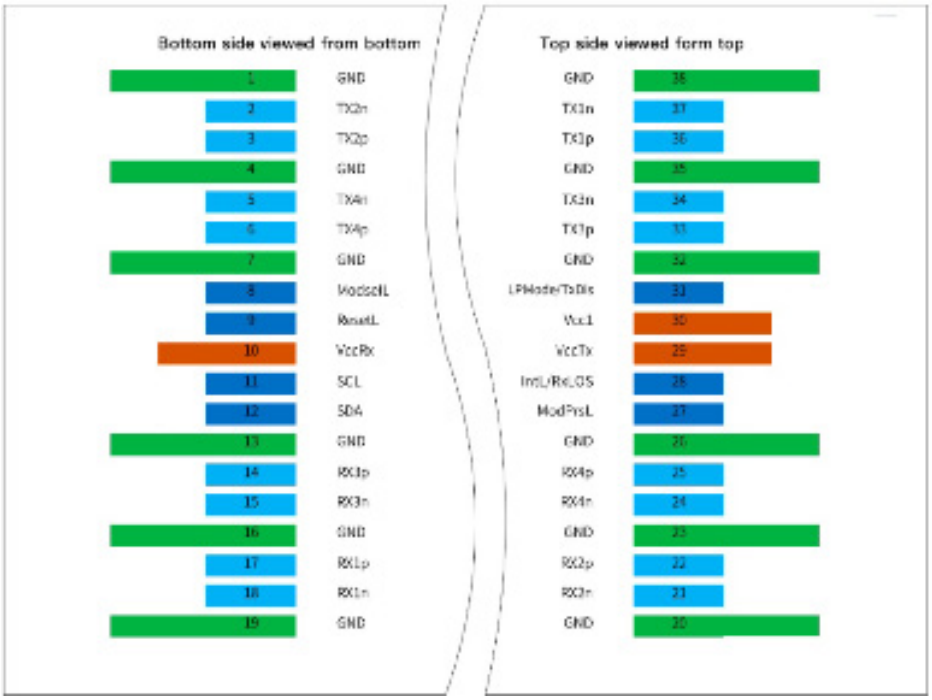
PARAMETER	SYMBOL	MIN	TYP	MAX	UNITS	NOTES
Data modulation type			PAM4			
Data rate, each lane	BR	106.24	106.25	106.26	Gbps	
Baud/symbol rate, each lane	BR	53.12	53.125	53.13	Gbd	
Lane wavelengths	WL	1304.5	1311	1317.5	nm	
Average receive power, each lane	-	-6.9	-	4	dBm	
Receive power in OMAouter, each lane	-	-	-	4.2	dBm	
Damage threshold, each lane	-	-	-	5	dBm	1
Receiver reflectance	-	-	-	-26	dB	
Unstressed receiver sensitivity (OMAouter), each lane for TECQ < 1.4 dB	URS	-	-	-4.3	dBm	2
Unstressed receiver sensitivity (OMAouter), each lane for 1.4 dB < TECQ < 3.4 dB	-	-	-	-5.7 + TECQ	dBm	
Stressed receiver sensitivity (OMAouter), each lane	SRS	-	-	-2.3	dBm	
Stressed eye closure for PAM4 (SECQ), each lane	SECQ		3.4		dB	3
OMAouter of each aggressor lane	-		4.2		dBm	3

(1) The receiver is able to tolerate, without damage, continuous exposure to a signal having this average optical power level.
(2) Unstressed receiver sensitivity is informative and is defined via the equation given, for a test transmitter SECQ up to 3.4 dB.
(3) These test conditions are for measuring stressed receiver sensitivity. They are not characteristics of the receiver.

Electrical PIN Assignment

The optical transceiver electrical interface and pinout are compliant with the QSFP112 MSA specification. Figure below shows the module connector pad layout.

MODULE ELECTRICAL CONTACT ASSIGNMENT



Power Supply

Power supply specifications for the module are defined below. The module is compliant with QSFP112 Power Class 8.

PARAMETER	SYMBOL	MIN	TYP	MAX	UNITS
Power supply voltages VccTx, VccRx (*)	VCC	3.135	3.3	3.465	V
Module inrush – instantaneous peak duration	T_ip	-	-	50	µs
Module inrush – initialization time	T_init	-	-	500	ms

(*) Measured Including ripple, droop, and noise below 100 kHz.

LOW POWER MODE

PARAMETER	SYMBOL	MIN	TYP	MAX	UNITS
Power Consumption	P_lp	-	-	1.5	W
Instantaneous peak current at hot plug	Icc_ip_lp	-	-	600	mA
Sustained peak current at hot plug	Icc_sp_lp	-	-	495	mA
Steady state current	Icc_lp	-	-	478	mA

HIGH POWER MODE

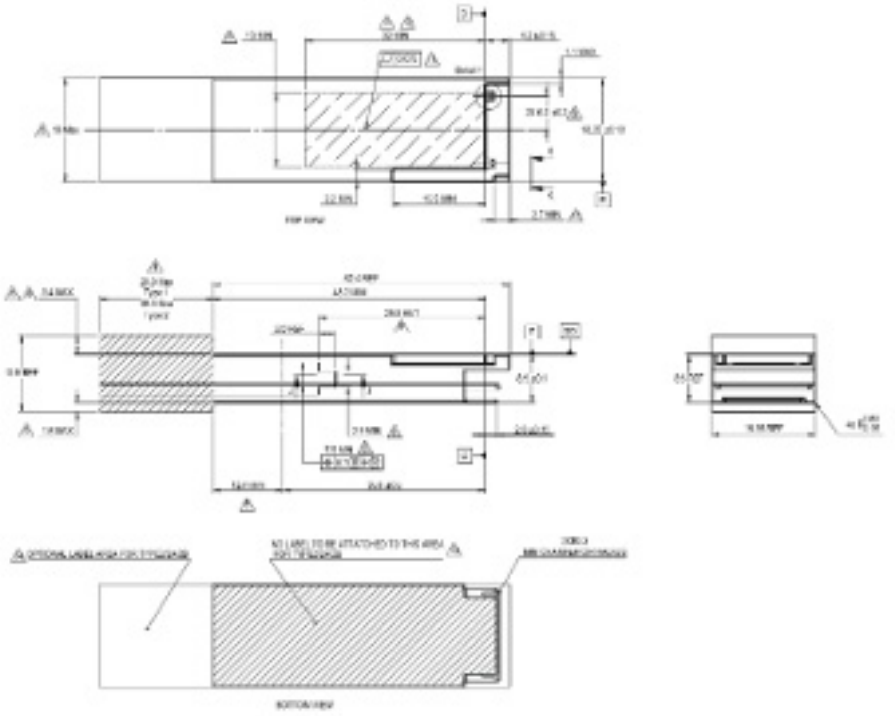
PARAMETER	SYMBOL	MIN	TYP	MAX	UNITS
Power Consumption	P_8	-	8	9	W
Instantaneous peak current at hot plug	Icc_ip_8	-	-	3600	mA
Sustained peak current at hot plug	Icc_sp_8	-	-	2970	mA
Steady state current	Icc_8	-	-	6000	mA

Management Interface

The module is compliant with QSFP112 Management Interface specification and its referred OIF Common Management Interface Specification (CMIS).

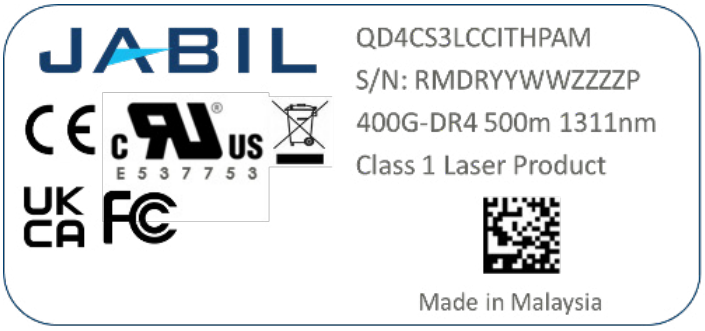
Mechanical Specifications

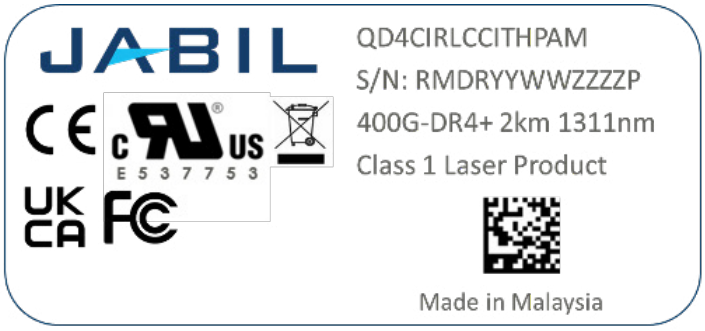
The module is compliant with QSFP112 mechanical specifications for a Type-2 module. The module electrical connector is compliant with QSFP112 specifications. The module optical connector is a standard MPO-12 receptacle (APC) compliant with IEC-61754-7 and EIA/TIA-604-5-D.



Label Specification

The following printed label is attached to the product (note that the certification labels will be added/removed according to requests and certification process results):





Regulatory and Compliance

EMC — Immunity	• EN 55024 (EU) • IEC EN 61000-4-3 (International)	• EMC Directive 89/336/EEC • IEC /CISPR/24
EMC — Emission	• CISPR 22, class B (Comité International Spécial des Perturbations Radioélectriques--CISPR; Special international committee on radio interference. International). • AS/NZS CISPR22 (Australia/New Zealand)	• VCCI-03 (Japan) • FCC 47 CFR Part 15, class B (US) • ICES-003, Issue 4 (Canada) • EN 55022 (EU) • EMC Directive 2004/108/EEC (EU)
ESD Threshold	Per MIL-STD 883C Method 3015.4 or ANSI/ESDA/JEDEC JS-001-2012 (component level) • IEC EN 61000-4-2; +/- 8kV contact, +/- 15kV air	
Product Safety	• UL Recognized Component: UL 60950-1 (2nd Ed.) Information Technology Equipment; CAN/CSA-C22.2 No. 60950-1 (2007) Information Technology Equipment; UL94-V0 flammability • CB Certificate: IEC 60950-1 (2005 +A1:2009) Information Technology Equipment	
Fire Safety	• PCB material must be fully compliant to UL796; Temperature class B (IEC 60085); flammability class V-0- UL94) • Cables and connectors must have a flammability ratings of V0- UL94; Service temp.≥90 C • Label materials must have a flammability ratings of V0- UL94; Service temp.≥90 C • Optical fibers must have a flammability ratings of V0- UL94; Service temp.≥85 C	

Optical Safety	• FDA/CDRH certified with accession number, Class 1 laser product:
	  • U.S. 21 CFR 1040;
	  • UL mark
	• UL Certificate:
	  • IEC 60825-1:2014;
	  • EN 60825-1:2014 + A11:2021
		• Complies with 21 CFR 1040.10 and 1040.11 except for conformance with IEC 60825-1 Ed. 3., as described in Laser Notice No. 56, dated May 8, 2019
		• Caution – Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure

RoHS	• 2002/95/EC and the revised and recast Directive 2011/65/EC (RoHS) Restriction on Hazardous Substances • 2006/1907/EC (REACH) Registration, Evaluation, Authorization of Chemicals	• JIG 101-A, JIG 101-B Joint Industry Guide Japanese Material Composition Declaration • CAITEC SJ/T 11363-2006 Requirements for Concentration Limits for Certain Hazardous Substances in Electronic Information Products (China RoHS) • Complies with RoHS II Directive 2011/65/EU

For additional information, visit jabil.com

Ordering Information

JABIL PART NUMBER	FORM FACTOR	RATE	REACH	RECEPTACLE	TEMP RANGE
QD4CS3LCCxxHPAM	QSFP112	425G	500m	MPO-12	C-Temp
QD4CIRLCCxxHPAM	QSFP112	425G	2km	MPO-12	C-Temp

Document Version

VERSION	DATE	NOTES
1.0	07/18/2024	Initial release

Manufacturer's Address

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About Jabil

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