



HydraX™ QSFP-DD 400G FR4 LC Duplex 2KM

Design Reference

QSFP-DD MSA Type2
IEEE 802.3bs

Application

Data Center
High Speed Ethernet

Working Condition

Operation Temperature
0°C ~ +70°C
Storage Temperature
-40°C ~ +85°C
Relative humidity
5% ~ 85%

Safety and EMI

Protection of over voltage



4 CWDM lanes MUX/DEMUX design with 106.25 Gbps per lane of data rate

100G Lambda MSA 400G FR4 specification compliant

Up to 2km transmission on singlemode fiber

Cooled EML Laser with PIN receiver

8×53.125 Gbps electrical interface(400GAUI-8)

Single +3.3V power supply

Maximum power consumption 12W

Duplex LC port

RoHS compliant

General Description

The QDD-21400020AFFR4H1D is a transceiver with the advantage of high performance and low consumption. Which supports transmission distance up to 2km over SM fiber. The module incorporates 4 independent channels with center wavelength CWDM4 1271/1291/1311/1331nm, operating at 100Gbps per channel. The module supports commercial operating temperature, and the specification is compliant with 100G Lambda MSA 400G FR4 technical specification and the electrical interface is compliant with IEEE 802.3bs and QSFP-DD MSA

Absolute Maximum Ratings

Parameter	Symbol	Min	Typ	Max	Unit	Notes
Maximum Supply Voltage	Vcc	-0.5		+3.6	V	

Recommended Operating Conditions

Parameter	Symbol	Min	Typ	Max	Unit	Notes
Power Supply Voltage	Vcc	3.135	3.30	3.465	V	
Data Rate Each Lane	/	/	26.5625	/	GBd	
Link Distance	D	0.002		2	km	



Transceiver Electrical Characteristics

Parameter	Test Point	Min	Typ	Max	Unit	Notes
Module Supply Current	I _{cc}	/	/	3636	mA	/
Power Dissipation	PD	/	/	12	W	/
Transmitter						
Signaling Rate, each Lane	/	26.5625 ± 100ppm			GBd	/
Input Differential Impedance	Z _{IN}	/	100	/	Ω	/
Differential Data Input Swing	V _{IN} , P-P	210	/	900	mVP-P	1
Differential Termination Mismatch	TP1	/	/	10	%	/
Differential Input Return Loss	TP1	IEEE 802.3 2015 Equation (83E-5)		/	/	dB
Differential to Common Mode Input Return Loss	TP1	IEEE 802.3-2015 Equation (83E-6)		/	/	dB
Module Stressed Input Test	TP1a	Refer IEEE 802.3bs 120E.3.4.1			/	2
Single-ended voltage tolerance range	TP1a	-0.4 to 3.3			V	/
DC common mode voltage	TP1	-350	/	2850	mV	3
Receiver						
Signaling Rate, each lane	TP4	26.5625 ± 100 ppm			GBd	/
Output Differential Impedance	TP4	/-	100	/	Ω	/
Differential termination mismatch	TP4	/	/	10	%	/
Differential Data Output Swing	TP4	/	/	900	mVP-P	/
AC Common Mode Output Voltage, RMS	TP4	/	/	17.5	mV	/
Differential output return loss	TP4	IEEE 802.3-2015 Equation (83E-2)		/	/	/
Common to differential mode conversion	TP4	IEEE 802.3-2015 Equation (83E-3)		/	/	/
Near-end eye width, all 3 eyes	TP4	/			0.265	/
Near-end eye height, all 3 eyes	TP4	/			70	/
Far-end eye width, all 3 eyes	TP4	/	0.2	/	UI	/
Far-end eye height, all 3 eyes	TP4	/	30	/	mV	/
Far-end pre-cursor ISI ratio	TP4	-4.5	/	2.5	%	/
Transition time	TP4	9.5	/	/	ps	/
DC common mode voltage	TP1	-350	/	2850	mV	3
Notes: 1. With the exception to IEEE 802.3bs 120E.3.1.2 that the pattern is PRBS31Q or scrambled idle 2. Meets BER specified in IEEE 802.3bs 120E.1.1 3. DC common mode voltage generated by the host. Specification includes effects of ground offset voltage						



Transmitter Optical Characteristics

Parameter	Symbol	Min	Typ	Max	Unit	Notes
PAM4 signaling rate per lane	/	/	53.125±100 ppm		GBd	
Lane Wavelength (Range)	λ_0	1264.5	1271	1277.5	nm	/
	λ_1	1284.5	1291	1297.5		/
	λ_2	1304.5	1311	1317.5		/
	λ_3	1324.5	1331	1337.5		/
Side-mode suppression ratio	SMSR	30	/	/	dB	/
Total average launch power	/	/	/	9.3	dBm	/
Average launch power per lane	Pa	-3.3	/	3.5	dBm	1
Outer Optical Modulation Amplitude per lane	OMA _{outer}	/0.3	/	3.7	dBm	2
Difference in launch power between any two lanes(OMA _{outer})	/	/	/	4	dB	/
Launch power in OMA _{outer} minus TDECQ, each lane(min): For extinction ratio ≥ 4.5 dB For extinction ratio < 4.5 dB	/	-1.7 -1.6	/	/	dBm	/
Transmitter and dispersion penalty eye closure for PAM4(TDECQ) per lane	TDECQ	/	/	3.4	dB	/
TDECQ $-10 \times \log_{10}(\text{Ceq})$, each lane	/	/	/	3.4	dB	4
Average launch power of OFF transmitter, each lane	P _{off}	/	/	-20	dBm	/
Extinction ratio	ER	3.5	/	/	dB	/
Transmitter transition time	/	/	/	17	ps	/
RIN17.1 OMA	RIN	/	/	-136	dB/Hz	/
Optical return loss tolerance	TOL	/	/	17.1	dB	/
Transmitter reflectance	T _{RL}	/	/	-26	dB	3

Notes:

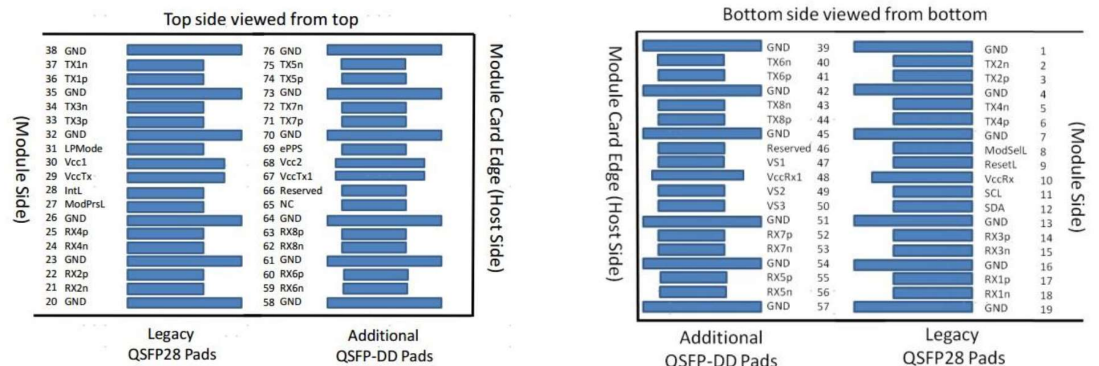
- 1: Average launch power, each lane (min) is informative and not the principal indicator of signal strength. A transmitter with launch power below this value cannot be compliant; however, a value above this does not ensure compliance.
- 2: Even if the TDECQ < 1.4 dB for an extinction ratio of ≥ 4.5 dB or TDECQ < 1.3 dB for an extinction ratio of < 4.5 dB, the OMA_{outer} (min) must exceed this value.
- 3: Transmitter reflectance is defined looking into the transmitter.
- 4: Ceq is a coefficient defined in IEEE Std 802.3-2018 clause 121.8.5.3 which accounts for reference equalizer noise enhancement.



Receiver Optical Characteristics

Parameter	Symbol	Min	Typ	Max	Unit	Notes
PAM4 signaling rate per lane	/	/	53.125±100 ppm		GBd	
Lane Wavelength (Range)	λ_0	1264.5		1277.5	nm	/
	λ_1	1284.5		1297.5		/
	λ_2	1304.5		1317.5		/
	λ_3	1324.5		1337.5		/
Damage threshold, each lane	/	4.5	/	/	dBm	1
Average receive power, each lane	/	-7.3	/	3.5	dBm	2
Receive power, each lane (OMAouter)	/	/	/	3.7	dBm	/
Difference in receive power between any two lanes (OMAouter)	/	/	/	4.1	dB	/
Receiver reflectance	/	/	/	-26	dB	/
Receiver sensitivity (OMAouter), each lane	/	/	/	Equation (1)	dBm	3
Stressed receiver sensitivity (OMAouter), each lane	/	/	/	-2.6	dBm	4
Conditions of stressed receiver sensitivity test: Stressed eye closure for PAM4 (SECQ), lane under test SECQ $-10 \times \log_{10}(\text{Ceq})$, lane under test (max) OMAouter of each aggressor lane		/	3.4 1.5	3.4	dB dB dBm	5
Notes: 1. The receiver shall be able to tolerate, without damage, continuous exposure to an optical signal having this average power level. The receiver does not have to operate correctly at this input power. 2. Average receive power, each lane (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. 3. Receiver sensitivity (OMAouter), each lane (max) is informative and is defined for a transmitter with a value of SECQ up to 3.4 dB. Receiver Sensitivity should meet Equation(1), which is illustrated in Figure1. $RS = \max(-4.6, \text{SECQ}-6.0)$ dBm(1) 4. Measured with conformance test signal at TP3 for the BER equal to 2.4×10^{-4} 5. Ceq is a coefficient defined in IEEE Std 802.3-2018 clause 121.8.5.3 which accounts for reference equalizer noise enhancement.						

Pin Description





RoHS₂ **FC** **CE**
2011/65/EU