

Applications

- 400G Ethernet
- Infiniband Interconnects
- Datacenter Enterprise Networking

Features

- QSFP-DD MSA compliant
- Parallel 4 optical lanes
- 100G Lambda MSA 100G-LR Specification compliant
- Up to 10 km transmission on single mode fiber (SMF) with FEC
- 8x53.125 Gb/s electrical interface (400GAUI-8)
- Data rate 106.25 Gbps (PAM4) per channel
- Maximum power consumption 12 W
- MPO-12 connector
- Single +3.3 V power supply
- RoHS compatible
- Operating case temperature 0 °C to +70 °C (Standard)

Description

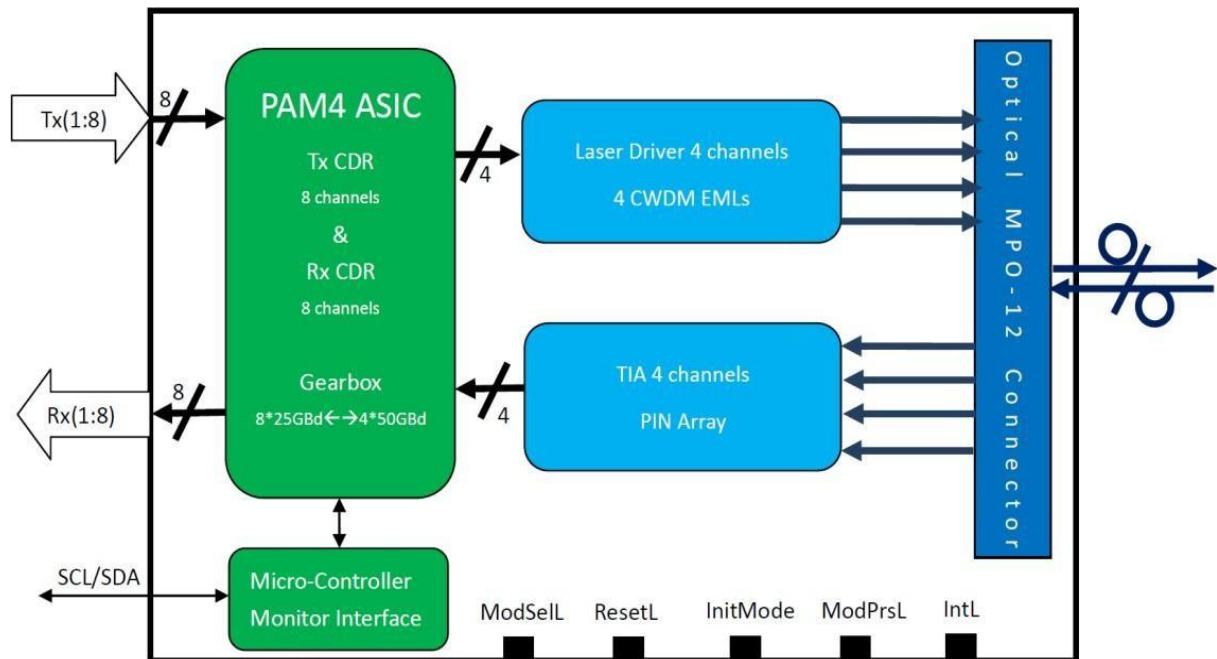
This product is a 400 Gb/s Quad Small Form Factor Pluggable – double density (QSFP-DD) optical module designed for 10 km optical communication applications. The module converts 8 channels of 50 Gb/s (PAM4) electrical input data to 4 channels of parallel optical signals, each capable of 100 Gb/s operation for an aggregate data rate of 400 Gb/s.

Reversely, on the receiver side, the module converts 4 channels of parallel optical signals of 100 Gb/s each channel for an aggregate data rate of 400 Gb/s into 8 channels of 50 Gb/s (PAM4) electrical output data.

An optical fiber cable with an MTP/MPO-12 connector can be plugged into the module receptacle. Proper alignment is ensured by the guide pins inside the receptacle. The cable usually cannot be twisted for proper channel to channel alignment. Electrical connection is achieved through a QSFP-DD MSA-compliant edge type connector.

The product is designed with form factor, optical/electrical connection and digital diagnostic interface according to the QSFP-DD Multi-Source Agreement (MSA) Type 2. It has been designed to meet the harshest external operating conditions including temperature, humidity and EMI interference.

Block Diagram



Absolute Maximum Ratings

Parameter	Symbol	Min	Max	Unit
Storage Temperature	T_S	-40	85	$^{\circ}\text{C}$
Operating Case Temperature	T_{OP}	0	70	$^{\circ}\text{C}$
Relative Humidity (non-condensation)	RH	0	85	%
Damage Threshold, each Lane	TH_d	5.5		dBm
Supply Voltage	V_{CC}	-0.5	3.6	V

It has to be noted that the operation in excess of any individual absolute maximum ratings might cause permanent damage to this module.

Recommended Operating Conditions

Parameter	Symbol	Min	Typical	Max	Unit	Notes
Operating Case Temperature	T_{OP}	0		70	$^{\circ}\text{C}$	
Supply Voltage	V_{CC}	3.135	3.3	3.465	V	
Data Rate, each Lane			26.5625		GBd	PAM4
Data Rate Accuracy		-100		100	ppm	
Pre-FEC Bit Error Ratio				2.4×10^{-4}		
Post-FEC Bit Error Ratio				1×10^{-12}		1
Link Distance	D	0.002		10	km	2

Notes

1. FEC provided by host system.
2. FEC required on host system to support maximum transmission distance

Optical Specifications

Parameter	Symbol	Min	Typical	Max	Units	Notes
Center Wavelength	λ_c	1304.5	1310	1317.5	nm	
Transmitter						
Data Rate, each Lane		53.125 \pm 100 ppm			GBd	
Modulation Format		PAM4				
Side-mode Suppression Ratio	SMSR	30			dB	
Average Launch Power, each Lane	PAVG	-1.4		4.5	dBm	1
Outer Optical Modulation Amplitude (OMA _{outer}), each Lane	POMA	0.7		4.7	dBm	2
Launch Power in OMA _{outer} minus TDECQ, each Lane for ER \geq 4.5dB for ER < 4.5dB		-0.7 -0.6			dB	
Transmitter and Dispersion Eye Closure for PAM4 (TDECQ), each Lane	TDECQ			3.4	dB	
TDECQ – 10*log ₁₀ (Ceq), each Lane				3.4	dB	3
Extinction Ratio	ER	3.5			dB	
RIN _{17.1OMA}	RIN			-136	dB/Hz	
Optical Return Loss Tolerance	TOL			15.6	dB	
Transmitter Reflectance	RT			-26	dB	
Transmitter Transition Time				17	ps	
Average Launch Power of OFF Transmitter, each Lane	Poff			-15	dBm	
Receiver						
Data Rate, each Lane		53.125 \pm 100 ppm			GBd	
Modulation Format		PAM4				
Damage Threshold, each Lane	THd	5.5			dBm	4
Average Receive Power, each Lane		-7.7		4.5	dBm	5
Receive Power (OMA _{outer}), each Lane				4.7	dBm	
Receiver Sensitivity (OMA _{outer}), each Lane	SEN			Equation (1)	dBm	6
Stressed Receiver Sensitivity (OMA _{outer}), each Lane	SRS			-4.1	dBm	7
Receiver Reflectance	RR			-26	dB	
LOS Assert	LOSA	-15			dBm	
LOS De-assert	LOSD			-10.7	dBm	
LOS Hysteresis	LOSH	0.5			dB	
Conditions of Stress Receiver Sensitivity Test (Note 8)						
Stressed Eye Closure for PAM4 (SECQ), Lane under Test			3.4		dB	

SECQ – $10 \cdot \log_{10}(\text{Ceq})$, Lane under Test				3.4	dB	
---	--	--	--	-----	----	--

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 the minimum value specified here.
3. Ceq 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, 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.
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}) is informative and is defined for a transmitter with a value of SECQ up to 3.4 dB. Receiver sensitivity should meet Equation (1)

$$RS = \max(-6.1, SEE - 7.5) \text{ dBm} \quad (1)$$

Where:

RS is the receiver sensitivity, and

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 2.4×10^{-4} .
8. These test conditions are for measuring stressed receiver sensitivity. They are not characteristics of the receiver.

Electrical Specifications

Parameter	Test Point	Min	Typical	Max	Units	Notes
Power Consumption				12	W	
Supply Current	Icc			3.64	A	
Transmitter (each Lane)						
Signaling Rate, each Lane	TP1	26.5625 ± 100 ppm			GBd	
Differential pk-pk Input Voltage Tolerance	TP1a	900			mVpp	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	See IEEE 802.3bs 120E.3.4.1				2
Single-ended Voltage Tolerance Range (Min)	TP1a	-0.4 to 3.3			V	
DC Common Mode Input Voltage	TP1	-350		2850	mV	3
Receiver (each Lane)						
Signaling Rate, each lane	TP4	26.5625 ± 100 ppm			GBd	
Differential Peak-to-Peak Output Voltage	TP4			900	mVpp	
AC Common Mode Output Voltage, RMS	TP4			17.5	mV	
Differential Termination Mismatch	TP4			10	%	
Differential Output Return Loss	TP4	IEEE 802.3-2015 Equation (83E-2)				
Common to Differential Mode Conversion Return Loss	TP4	IEEE 802.3-2015 Equation (83E-3)				
Transition Time, 20% to 80%	TP4	9.5			ps	
Near-end Eye Symmetry Mask Width (ESMW)	TP4		0.265		UI	
Near-end Eye Height, Differential	TP4	70			mV	
Far-end Eye Symmetry Mask Width (ESMW)	TP4		0.2		UI	
Far-end Eye Height, Differential	TP4	30			mV	
Far-end Pre-cursor ISI Ratio	TP4	-4.5		2.5	%	
Common Mode Output Voltage (Vcm)	TP4	-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.1.1.12.89-19 GJz
3. DC common mode voltage generated by the host. Specification includes effects of ground offset voltage
4. These electrical characteristics are defined over the Recommended Operating Environment unless otherwise specified.

Ordering information¹

Part number	Product Description
XKSSF4-10PY	QSFP-DD SMF LR 4x100G Transceiver, 10 km, MPO, 0-70°C, DDM

Notes

¹ For accurate order specification please contact XenOpt reseller before placing an order. The content of this document is subject to change without notice. XenOpt does not guarantee errorless or outdated information.

Please specify any compatibility requirements at time of ordering. Standard MSA compatible pluggable components may not work or some function of these components may not be available in devices that require customized compatible devices. Pluggable components compatible with one type of communications equipment may not work in other type of communications equipment.

Important Notice

Performance figures, data and any illustrative material provided in this data sheet are typical and must be specifically confirmed in writing by XenOpt before they become applicable to any particular order or contract. In accordance with the XenOpt policy of continuous improvement specifications may change without notice.

The product image is only for reference purpose

The publication of information in this data sheet does not imply freedom from patent or other protective rights of XenOpt or others. Further details are available from any XenOpt sales representative.

To find out more, please contact:

XenOpt

www.xenopt.com