

# SV-QSFP-100G-LR4F

100GBase aggregating 4 x duplex LWDM (1295.6 nm, 1300.1 nm, 1304.6 nm, and 1309.1nm) with DDM, distance up to 10km



## Features

- Hot pluggable QSFP28 MSA form factor
- Compliant to IEEE 802.3ba 100GBASE-LR4, ITU G.959.1, and CFP-MSA- HW-Specification
- Supports 103.1Gb/s and 112Gb/s aggregate bit rates
- Up to 10km reach for G.652 SMF
- Single +3.3V power supply
- Operating case temperature: 0~70°C
- Transmitter: cooled 4x28Gb/s LAN WDM EML TOSA (1295.56, 1300.05, 1304.58, 1309.14nm)
- Receiver: 4x28Gb/s PIN ROSA
- 4x28G electrical interface (OIF CEI-28G-VSR)
- Maximum power consumption 4.5W
- Duplex LC receptacle
- RoHS-6 compliant

## Applications

- 100GBASE-LR4 100G Ethernet
- OTN OTU4 4I1-9D1F

Part number	Description
<b>SV-QSFP-100G-LR4F</b>	Starview QSFP28 100Gbps module 100GBase aggregating 4 x duplex LWDM (1295.6 nm, 1300.1 nm, 1304.6 nm, and 1309.1nm) wavelengths SM (LC) with Digital Diagnostic Monitoring (DDM), distance up to 10km with Forward Error Correction (FEC), supporting 100GE and OTU-4

## Absolute Maximum Ratings

Parameter	Symbol	Min.	Typ.	Max.	Unit
Storage Temperature	T <sub>s</sub>	-40	85		°C
Operating Case Temperature	T <sub>OP</sub>	0	70		°C
Power Supply Voltage	V <sub>CC</sub>	-0.5	3.6		V
Relative Humidity (non-condensation)	RH	0	85		%
Damage Threshold, each Lane	TH <sub>d</sub>	5.5			dBm

## Recommended Operating Conditions and Power Supply Requirements

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Operating Case Temperature	T <sub>OP</sub>	0		70	°C	
Power Supply Voltage	V <sub>CC</sub>	3.135	3.3	3.465	V	
Data Rate, each Lane (100GE)			25.78125		Gb/s	
Data Rate Accuracy (100GE)		-100		100	ppm	
Data Rate, each Lane (OTU4)			27.95249		Gb/s	
Data Rate Accuracy (OTU4)		-20		20	ppm	
Control Input Voltage High		2		V <sub>CC</sub>	V	
Control Input Voltage Low		0		0.8	V	
Link Distance with G.652	D	0.002		10	km	

## Optical Characteristics

### Optical Characteristics for IEE802.3 100GBASE-LR4

QSFP28 100GBASE-LR4						
Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Data Rate, each Lane			25.78125		Gb/s	
Data Rate Accuracy		-100		100	ppm	
Lane Wavelength	L0	1294.53	1295.56	1296.59	nm	
	L1	1299.02	1300.05	1301.09	nm	
	L2	1303.54	1304.58	1305.63	nm	
	L3	1308.09	1309.14	1310.19	nm	
Transmitter						
SMSR	SMSR	30			dB	
Total Average Launch Power	P <sub>T</sub>			10.5	dBm	
Average Launch Power, each Lane	P <sub>AVG</sub>	-4.3		4.5	dBm	
OMA, each Lane	P <sub>OMA</sub>	-1.3		4.5	dBm	1

Difference in Launch Power between any Two Lanes (OMA)	Ptx,diff	5	dB	
Launch Power in OMA minus Transmitter and Dispersion Penalty (TDP), each Lane		-2.3		dBm
TDP, each Lane	TDP	2.2	dB	
Extinction Ratio	ER	4	dB	
RIN <sub>20</sub> OMA	RIN	-130	dB/Hz	
Optical Return Loss Tolerance	TOL	20	dB	
Transmitter Reflectance	R <sub>T</sub>	-12	dB	
Average Launch Power OFF Transmitter, each Lane	Poff	-30	dBm	
Eye Mask{X1, X2, X3, Y1, Y2, Y3}		{0.25, 0.4, 0.45, 0.25, 0.28, 0.4}		2
<b>Receiver</b>				
Damage Threshold, each Lane	TH <sub>d</sub>	5.5	dBm	
Total Average Receive Power		10.5	dBm	
Average Receive Power, each Lane		-10.6	4.5	dBm
Receive Power (OMA), each Lane			4.5	dBm
Receiver Sensitivity (OMA), each Lane	SEN	-8.6	dBm	
Stressed Receiver Sensitivity (OMA), each Lane		-6.8	dBm	3
Receiver Reflectance	R <sub>R</sub>	-26	dB	
Difference in Receive Power between any Two Lanes (OMA)	Prx,diff	5.5	dB	
LOS Assert	LOSA	-30	dBm	
LOS Deassert	LOSD	-13	dBm	
LOS Hysteresis	LOSH	0.5	dB	
Receiver Electrical 3 dB upper Cutoff Frequency, each Lane	F <sub>c</sub>	31	GHz	
<b>Conditions of Stress Reliever Sensitivity Test Note(4)</b>				
Vertical Eye Closure Penalty, each Lane		1.8	dB	
Stressed Eye J2 Jitter, each Lane		0.3	UI	
Stressed Eye J9 Jitter, each Lane		0.47	UI	

Note(1): Even if TDP < 1 dB, the OMA min must exceed the minimum value specified here.

Note(2): Hit ratio 5x10<sup>-5</sup>.

Note(3): Measured with conformance test signal at receiver input for BER = 1x10<sup>-12</sup>.

Note(4): Vertical eye closure penalty, stressed eye J2 jitter, and stressed eye J9 jitter are test conditions for measuring stressed receiver sensitivity. They are not characteristics of the receiver.

## Optical Characteristics for ITU G.959.1 OTU4 411-9D1F

QSFP28 OTU4 411-9D1F						
Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Data Rate, each Lane			27.95249		Gb/s	
Data Rate Accuracy		-20		20	ppm	
Lane Wavelength	L0	1294.53	1295.56	1296.59	nm	
	L1	1299.02	1300.05	1301.09	nm	
	L2	1303.54	1304.58	1305.63	nm	
	L3	1308.09	1309.14	1310.19	nm	
Transmitter						
SMSR	SMSR	30			dB	
Transmitter parameters for an optical output with ER > 4dB						
Total Average Launch Power	P <sub>T</sub>			10	dBm	
Average Launch Power, each Lane	P <sub>AVG</sub>	-0.6		4	dBm	
Extinction Ratio	ER	4		6.5	dB	
Transmitter parameters for an optical output with ER > 7dB						
Total Average Launch Power	P <sub>T</sub>			8.9	dBm	
Average Launch Power, each Lane	P <sub>AVG</sub>	-2.5		2.9	dBm	
Extinction Ratio	ER	7			dB	
Difference in Launch Power between any Two Lanes (Average)	P <sub>tx,diff</sub>			5	dB	
Optical Return Loss	ORL	20			dB	
Average Launch Power OFF Transmitter, each Lane	P <sub>off</sub>			-30	dBm	
Eye Mask {X1, X2, X3, Y1, Y2, Y3}			{0.25, 0.4, 0.45, 0.25, 0.28, 0.4}			1
Receiver						
Damage Threshold, each Lane	TH <sub>d</sub>	5.5			dBm	
Receiver parameters for an optical input with ER > 4dB						
Total Average Receive Power				10	dBm	
Average Receive Power, each Lane		-6.9		4	dBm	
Equivalent Sensitivity (Average), each Lane				-8.4	dBm	2
Receiver parameters for an optical input with ER > 7dB						
Total Average Receive Power				8.9	dBm	
Average Receive Power, each Lane		-8.8		2.9	dBm	
Equivalent Sensitivity (Average), each Lane				-10.3	dBm	2
Optical Path Penalty				1.5	dB	
Receiver Reflectance	R <sub>R</sub>			-26	dB	
Difference in Receive Power between any Two Lanes (Average)	P <sub>rx,diff</sub>			5.5	dB	
LOS Assert	LOSA		-18		dBm	
LOS Deassert	LOSD		-15		dBm	
LOS Hysteresis	LOSH	0.5			dB	

Note(1): Hit ratio  $5 \times 10^{-5}$ .

Note(2): Specified at a BER of  $10^{-6}$  (pre-FEC), per ITU-T G.sup39.

## Digital Diagnostics Functions

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Temperature monitor absolute error	DMI_Temp	-3		+3	degC	Over operating temperature range
Supply voltage monitor absolute error	DMI_VCC	-0.1		0.1	V	Over full operating range
Channel RX power monitor absolute error	DMI_RX_Ch	-2		2	dB	1
Channel Bias current monitor	DMI_Ibias_Ch	-10%		10%	mA	
Channel TX power monitor absolute error	DMI_TX_Ch	-2		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

## Electrical Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Power Consumption				4.5	W	
Supply Current	I <sub>cc</sub>			1.36	A	
Transmitter (each lane)						
Overload Differential Voltage pk-pk	TP1a	900			mV	
Common Mode Voltage (V <sub>cm</sub> )	TP1	-350		2850	mV	1
Differential Termination Resistance Mismatch	TP1			10	%	At 1MHz
Differential Return Loss (SDD11)	TP1			See CEI-28G-VSR Equation 13-19	dB	
Common Mode to Differential conversion and Differential to Common Mode conversion (SDC11, SCD11)	TP1			See CEI-28G-VSR Equation 13-20	dB	
Stressed Input Test	TP1a		See CEI-28G-VSR Section 13.3.11.2.1			
Receiver(each lane)						
Differential Voltage, pk-pk	TP4			900	mV	
Common Mode Voltage (V <sub>cm</sub> )	TP4	-350		2850	mV	1
Common Mode Noise, RMS	TP4			17.5	mV	
Differential Termination Resistance Mismatch	TP4			10	%	At 1MHz
Differential Return Loss (SDD22)	TP4			See CEI-28G-VSR Equation 13-19	dB	
Common Mode to Differential conversion and Differential to	TP4			See CEI-28G-VSR	dB	

Common Mode conversion (SDC22, SCD22)			Equation 13-21		
Common Mode Return Loss (SCC22)	TP4		-2	dB	2
Transition Time, 20 to 80%	TP4	9.5		ps	
Vertical Eye Closure (VEC)	TP4		5.5	dB	
Eye Width at 10 <sup>-15</sup> probability (EW15)	TP4	0.57		UI	
Eye Height at 10 <sup>-15</sup> probability (EH15)	TP4	228		mV	

Note(1): Vcm is generated by the host. Specification includes effects of ground offset voltage.

Note(2): From 250MHz to 30GHz.