

# SV-QSFP-100G-ER4F

100GBase aggregating 4 x duplex CWDM (1295.6 nm, 1300.1 nm, 1304.6 nm, and 1309.1nm) wavelengths SM (LC) with DDM, distance up to 40km, supporting OTU-4



## Features

- Hot pluggable QSFP28 MSA form factor
- Compliant to Ethernet 100GBASE-ER4 Lite and OTN OTU4 4L1-9C1F Lite
- Supports 103.1Gb/s and 112Gb/s aggregate bit rates
- Up to 30km reach for G.652 SMF without FEC
- Up to 40km reach for G.652 SMF with FEC
- Single +3.3V power supply
- Operating case temperature: 0~70oC
- Transmitter: cooled 4x28Gb/s LAN WDM EML TOSA (1295.56, 1300.05, 1304.58, 1309.14nm)
- Receiver: 4x28Gb/s APD ROSA
- 4x28G electrical interface (OIF CEI-28G-VSR)
- Maximum power consumption 4.5W
- Duplex LC receptacle
- RoHS-6 compliant

## Applications

- 100GBASE-ER4 100G Ethernet
- OTN OTU4 4L1-9C1F

Part number	Description
SV-QSFP-100G-ER4F	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 40km 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>	-3.0			dBm

## Recommended Operating Conditions

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			25.78125		Gb/s	
Data Rate Accuracy		-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 (without FEC)	D1			30	km	1
Link Distance with G.652 (with FEC)	D2			40	km	1

Note(1): Depending on actual fiber loss/km (link distance specified is for fiber insertion loss of 0.4dB/km)

## Optical Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
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>	-2.9		4.5	dBm	
OMA, each Lane	P <sub>OMA</sub>	0.1		4.5	dBm	1
Difference in Launch Power between any Two Lanes (OMA)	P <sub>tx,diff</sub>			3.6	dB	
Launch Power in OMA minus Transmitter and Dispersion Penalty (TDP), each Lane		-0.65			dBm	
TDP, each Lane	TDP			2.5	dB	
Extinction Ratio	ER	7			dB	
RIN <sub>20OMA</sub>	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	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}		
<b>Receiver</b>				
Damage Threshold, each Lane	TH <sub>d</sub>	-3.0	dBm	3
Average Receive Power, each Lane		-16.9	-4.9	dBm For 30km link distance
Average Receive Power, each Lane		-20.9	-4.9	dBm For 40km link distance
Receive Power (OMA), each Lane			-1.9	dBm
Receiver Sensitivity (OMA), each Lane	SEN1		-14.65	dBm for BER = 1x10 <sup>-12</sup>
Stressed Receiver Sensitivity (OMA), each Lane			-12.65	dBm for BER = 1x10 <sup>-12</sup>
Receiver Sensitivity (OMA), each Lane	SEN2		-18.65	dBm for BER = 1x10 <sup>-12</sup>
Stressed Receiver Sensitivity (OMA), each Lane			-16.65	dBm for BER = 1x10 <sup>-12</sup>
Receiver Reflectance	R <sub>R</sub>		-26	dB
Difference in Receive Power between any Two Lanes (OMA)	Prx,diff		3.6	dB
LOS Assert	LOSA		-26	dBm
LOS Deassert	LOSD		-24	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		1.5		dB
Stressed Eye J2 Jitter, each Lane		0.3		UI
Stressed Eye J9 Jitter, each Lane		0.47		UI

Note(1): The minimum average launch power spec is based on ER not exceeding 9.5dB and transmitter OMA higher than 0.1dBm.

Note(2): Even if the TDP < 0.75 dB, the OMA min must exceed the minimum value specified here.

Note(3): 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.

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 4L1-9C1F Lite

QSFP28 OTU4 4L1-9C1F Lite						
Parameter	Symbol	Min	Typical	Max	Units	Notes
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	
Total Average Launch Power	$P_T$			10.5	dBm	
Average Launch Power, each Lane	$P_{AVG}$	-1.1		4.5	dBm	
Difference in Launch Power between any Two Lanes (Average)	$P_{tx,diff}$			3.6	dB	
Extinction Ratio	ER	7			dB	
$RIN_{20OMA}$	RIN			-130	dB/Hz	
Optical Return Loss		20			dB	
Average Launch Power OFF Transmitter, each Lane	$P_{off}$			-30	dBm	
Eye Mask{X1, X2, X3, Y1, Y2, Y3}		{0.25, 0.4, 0.45, 0.25, 0.28, 0.4}				
Receiver						
Damage Threshold, each Lane	$TH_d$	-3.0			dBm	1
Average Receive Power, each Lane		-15.1		-4.9	dBm	for 30km Link Distance
Average Receive Power, each Lane		-19.1		-4.9	dBm	for 40km Link Distance
Equivalent Sensitivity (Average), each Lane	SEN1			-16.6	dBm	for BER = $1 \times 10^{-12}$
Equivalent Sensitivity (Average), each Lane	SEN2			-20.6	dBm	for BER = $5 \times 10^{-5}$

Optical Path Penalty			1.5	dB
Receiver reflectance			-26	dB
Difference in Receive Power between any Two Lanes (Average)	Prx,diff		3.6	dB
LOS Assert	LOSA		-26	dBm
LOS Deassert	LOSD		-24	dBm
LOS Hysteresis	LOSH	0.5		dB
Receiver Electrical 3 dB upper Cutoff Frequency, each Lane	Fc		31	GHz

Notes:

1.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.

## 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	Icc			1.36	A	
Transmitter (each lane)						
Overload Differential Voltage pk-pk	TP1a	900			mV	
Common Mode Voltage (Vcm)	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 (Vcm)	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 Common Mode conversion (SDC22, SCD22)	TP4		See CEI-28G-VSR Equation 13-21	dB	
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.