

100G FR1 QSFP28 Transceiver

Features

- Compliant with QSFP28 Standard SFF-8636 Rev 2.10a . Compliant with 100G Lambda MSA 100G-FR Rev 2.0
- High speed I/O electrical interface (CAUI-4)
- Single 3.3V Supply Voltage
- Maximum power consumption 4W
- 0-70 °C Case Operating Temperature
- 1311nm EML laser and PIN Receiver Array
- QSFP28 MSA package with duplex LC connector
- Two Wire Serial Interface with Digital Diagnostic Monitoring
- Complies with EU Directive 2011/65/EU (RoHS compliant)
- Class 1 Laser

Absolute Maximum Ratings

Table 1 – Absolute Maximum Ratings

Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
Storage Temperature	TS	-40	-	+85	°C	
Supply Voltage	VCC	-0.3	-	3.6	V	
Relative Humidity (non-condensing)	RH	5	-	95	%	
Data Input Voltage – Differential	IVDIP-VDINI	-	-	1.0	V	
Control Input Voltage	VI	-0.3	-	Vcc+0.5	V	
Control Output Current	IO	-20	-	20	mA	

Recommended Operating Conditions

Table 2 – Recommended Operating Conditions

Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
Operating Case Temperature	T _{OPR}	0	-	70	°C	
Power Supply Voltage	VCC	3.135	3.3	3.465	V	
Instantaneous peak current at hot plug	ICC_IP	-	-	1600	mA	
Sustained peak current at hot plug	ICC_SP	-	-	1320	mA	
Maximum Power Dissipation	PD	-	-	4	W	1
Maximum Power Dissipation, Low Power Mode	PDLP	-	-	1.5	W	
Signalling Rate	SR	-	53.125	-	GBd	
Control Input Voltage High	VIH	VCC*0.7	-	VCC+0.3	V	
Control Input Voltage Low	VIL	-0.3	-	VCC*0.3	V	
Two Wire Serial Interface Clock Rate	-	-	-	400	kHz	
Power Supply Noise	-	-	-	66	mVpp	10Hz -10MHz
Rx Differential Data Output Load	-	-	100	-	ohms	
Operating Distance	-	2	-	2000	m	

Note 1: with power supply voltage 3.3V.

Optical and Electrical Characteristics

Table 3 – Transmitter Optical Specifications

Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
Wavelength	λ_C	1304.5	1311	1317.5	nm	
Side mode suppression ratio	SMSR	30	-	-	dB	
Average Optical Launch Power	POUT	-2.4	-	4	dBm	
Average Launch Power Tx_Off	POUT_OFF	-	-	-15	dBm	
Extinction Ratio	ER	3.5	-	-	dB	
Outer Optical Modulation Amplitude	OMOuter	-0.2	-	4.2	dBm	
Launch Power in OMOuter minus TDECQ for ER $\geq$ 4.5dB	OMOuter-TDECQ	-1.6	-	-	dBm	
Launch Power in OMOuter minus TDECQ for ER < 4.5dB	OMOuter-TDECQ	-1.5	-	-	dBm	
Transmitter and dispersion eye closure	TDECQ	-	-	3.4	dB	
TDECQ – $10 \cdot \log_{10}(C_{eq})$		-	-	3.4	dB	
Transmitter transition time		-	-	17	ps	
RIN17.1OMA	RIN	-	-	-136	dB/Hz	
Optical return loss tolerance	ORLT	-	-	17.1	dB	
Transmitter reflectance	TR	-	-	-26	dB	

Table 4 – Receiver Optical Specifications

Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
Wavelength	λ_C	1304.5	1311	1317.5	nm	
Damage Threshold		5.5	-	-	dBm	
Average receive power		-6.4	-	4.5	dBm	
Receive power (OMOuter)	RP	-	-	4.7	dBm	
Receiver reflectance	RR	-	-	-26	dB	
Receiver sensitivity (OMOuter)	RS			max(-4.5, SECQ-5.9)	dBm	
Stressed receiver sensitivity	SRS	-	-	-2.5	dBm	
Stressed Receiver Sensitivity Test Conditions:						
Stressed eye closure for PAM4 (SECQ)	SECQ	-	3.4	-	dB	
SECQ – $10 \cdot \log_{10}(C_{eq})$		-	-	3.4	dB	

Table 5 – Electrical Specifications

Low-Speed Signal: Compliant to SFF-8679

High-Speed Signal: Compliant to CAUI-4 (IEEE 802.3-2018)

Transmitter (Module Input)						
Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
Differential Data Input Amplitude	VIN,P-P	95	-	900	mVpp	Note 1
Differential Termination Mismatch		-	-	10	%	
LPMode, Reset and ModSelL	VIL	-0.3	-	Vcc*0.3	V	
	VIH	VCC*0.7	-	VCC+0.3	V	
Receiver (Module Output)						
Differential Data Output Amplitude	VOUT,P-P	250	-	900	mVpp	Note 1
Differential Termination Mismatch		-	-	10	%	
Output Rise/Fall Time, 20%~80%	TR	9.5	-	-	ps	
ModPrsL and IntL	VOL	0	-	0.4	V	IOL=4mA
	VOH	VCC-0.5	-	VCC+0.3	V	IOL=-4mA

Note 1: Amplitude customization beyond these specs is dependent on validation in customer system

Support for 100GAUI-4 at 26.5625 Gbd when using KP4 FEC in chip-to-module interface.

Table 6 – Timing for QSFP28 Soft Control and Status Functions

Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
Initialization Time	t_init	-	-	15	s	Note 1
Reset Init Assert Time	t_reset_init	10	-	-	μs	
Serial Bus Hardware Ready Time	t_serial	-	-	2000	ms	
Monitor Data Ready Time	t_data	-	-	2000	ms	
Reset Assert Time	t_reset	-	-	15	s	Note 1
LPMode Assert Time	ton_LPMode	-	-	100	μs	
LPMode De-assert Time	toff_LPMode	-	-	15	s	Note 1
IntL Assert Time	ton_IntL	-	-	200	ms	
IntL Deassert Time	toff_IntL	-	-	500	μs	
Rx LOS Assert Time	ton_lol	-	-	100	ms	
Tx Fault Assert Time	ton_Txfault	-	-	200	ms	
Flag Assert Time	ton_flag	-	-	200	ms	
Mask Assert Time	ton_mask	-	-	100	ms	
Mask Deassert Time	toff_mask	-	-	100	ms	
Application or Rate Select Change Time	t_ratesel	-	-	N/A	ms	Note 2
Power_override or Power-set Assert Time	ton_Pdown	-	-	100	ms	
Power_override or Power-set De-assert Time	toff_Pdown	-	-	15	s	Note 1

Note 1: DSP limitation.

Note 2: This feature is unsupported.

Table 7 – I/O Timing for Squelch & Disable

Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
Rx Squelch Assert Time	ton_Rxsq			500	ms	Note
Rx Squelch Deassert Time	toff_Rxsq			15	s	Note
Tx Squelch Assert Time	ton_Txsq			400	ms	
Tx Squelch Deassert Time	toff_Txsq			1500	ms	Note
Tx Disable Assert Time	ton_txdis			100	ms	
Tx Disable Deassert Time	toff_txdis			400	ms	
Rx Output Disable Assert Time	ton_rxdis			100	ms	
Rx Output Disable Deassert Time	toff_rxdis			100	ms	
Squelch Disable Assert Time	ton_sqdis			100	ms	
Squelch Disable Deassert Time	toff_sqdis			100	ms	

Note: DSP limitation.

Table 8 – Digital Diagnostics

Parameter	Range	Accuracy	Unit	Calibration
Temperature	0 to 70	±3	°C	Internal
Voltage	0 to VCC	3%	V	Internal
Tx Bias Current (Each Lane)	0 to 100	10%	mA	Internal
Tx Output Power (Each Lane)	-2.4 to 4.0	±3	dB	Internal
Rx Power (Each Lane)	-6.4 to 4.5	±3	dB	Internal

Table 9 – Pin Definitions

Pin	Logic	Symbol	Description	Plug Sequence	Notes
1		GND	Ground	1	1
2	CML-I	Tx2n	Transmitter Inverted Data Input	3	
3	CML-I	Tx2p	Transmitter Non-Inverted Data Input	3	
4		GND	Ground	1	1
5	CML-I	Tx4n	Transmitter Inverted Data Input	3	
6	CML-I	Tx4p	Transmitter Non-Inverted Data Input	3	
7		GND	Ground	1	1
8	LVTTL-I	ModselL	Module Select	3	
9	LVTTL-I	ResetL	Module Reset	3	
10		Vcc Rx	+3.3V Power Supply Receiver	2	2
11	LVC MOS-I/O	SCL	2-wire serial interface clock	3	
12	LVC MOS-I/O	SDA	2-wire serial interface data	3	
13		GND	Ground	1	1
14	CML-O	Rx3p	Receiver Non-Inverted Data Output	3	
15	CML-O	Rx3n	Receiver Inverted Data Output	3	
16		GND	Ground	1	1
17	CML-O	Rx1p	Receiver Non-Inverted Data Output	3	
18	CML-O	Rx1n	Receiver Inverted Data Output	3	
19		GND	Ground	1	1
20		GND	Ground	1	1
21	CML-O	Rx2n	Receiver Inverted Data Output	3	
22	CML-O	Rx2p	Receiver Non-Inverted Data Output	3	
23		GND	Ground	1	1
24	CML-O	Rx4n	Receiver Inverted Data Output	3	
25	CML-O	Rx4p	Receiver Non-Inverted Data Output	3	

26		GND	Ground	1	1
27	LVTTL-O	ModPrsL	Module Present	3	
28	LVTTL-O	IntL	Interrupt	3	
29		Vcc Tx	+3.3V Power supply transmitter	2	2
30		Vcc1	+3.3V Power supply	2	2
31	LVTTL-I	LPMode	Low Power Mode	3	
32		GND	Ground	1	1
33	CML-I	Tx3p	Transmitter Non-Inverted Data Input	3	
34	CML-I	Tx3n	Transmitter Inverted Data Input	3	
35		GND	Ground	1	1
36	CML-I	Tx1p	Transmitter Non-Inverted Data Input	3	
37	CML-I	Tx1n	Transmitter Inverted Data Input	3	
38		GND	Ground	1	1

Note1: GND is the symbol for signal and supply (power) common for the QSFP+ module. All are common within the QSFP+ module and all module voltages are referenced to this potential unless otherwise noted. Connect these directly to the host board signal-common ground plane.

Note2: Vcc Rx, Vcc1 and Vcc Tx are the receiver and transmitter power supplies and shall be applied concurrently.

Mechanical Diagram

