

50GBASE-LR QSFP28 Optical Transceiver, (KWQG10)

Hot Pluggable Single mode Dual LC, +3.3V

Features

- Compliant with QSFP28 Standard:
SFF-8665 Revision 1.9 with timing in table 7 and 8 in this document , SFF-8636 Revision 2.9
- Compliant with IEEE 802.3cd_D3p5 50GBASE-LR
- Compliant with IEEE802.3 50GAUI-2 C2M electrical interface
- Single 3.3V Supply Voltage
- Maximum power consumption 3.5W
- 0-70 °C Case Operating Temperature
- DML laser and PIN Receiver
- 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	T _s	-40	-	+85	°C	
Supply Voltage	V _{CC}	-0.5	-	3.6	V	
Relative Humidity (non-condensing)	RH	5	-	85	%	

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	V _{CC}	3.135	3.3	3.465	V	
Instantaneous peak current at hot plug	I _{CC_IP}	-	-	1400	mA	Per pin
Sustained peak current at hot plug	I _{CC_SP}	-	-	1155	mA	Per pin
Maximum Power Dissipation	P _D	-	-	3.5	W	
Maximum Power Dissipation, Low Power Mode	P _{DLP}	-	-	1.5	W	
Data Rate	DRL	-	26.5625	-	GBaud/s	
		-	26.5625x2	-	Gbit/s	
Two Wire Serial Interface Clock Rate	-	-	-	400	kHz	
Power Supply Noise Tolerance	-	-	-	66	mVpp	

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Rx Differential Data Output Load	-	-	100	-	ohms	
Operating Distance	-	2	-	10000	m	

Optical and Electrical Characteristics

Table 3 – Transmitter Optical Specifications

Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
Wavelength	λ	1304.5	1311	1317.5	nm	
Side-mode suppression ratio	SMSR	30			dB	
Average launch power	P _{OUT}	-4.5	-	4.2	dBm	
Average launch power of OFF transmitter	P _{OUT_OFF}	-	-	-30	dBm	
Outer Optical Modulation Amplitude (OMA _{outer})	P _{OUTL}	-1.5	-	4	dBm	
Extinction ratio	ER	3.5	-	-	dB	
Launch power in OMA _{outer} minus TDECQ	OMA-TDECQ	-2.9	-	-	dBm	
Transmitter and dispersion eye closure for PAM4 (TDECQ)	TDECQ	-	-	3.2	dB	Note 1
Spectrum wavelength	λ_{-20}	-	-	1	nm	
Optical return loss tolerance	ORLT	-	-	15.6	dB	
RIN _{15.6OMA}	RIN	-	-	-132	dB/Hz	
Transmitter reflectance		-	-	-26	dB	

Note: Measured with a PRBS2¹⁵-1 test pattern @53.125Gbps, 10km fiber.

Table 4 – Receiver Optical Specifications

Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
Wavelength	λ	1304.5	1311	1317.5	nm	
Receiver sensitivity (OMA _{outer})				max(-8.4; SECQ - 9.8)	dBm	Note 2
Stressed receiver sensitivity (OMA _{outer})	-	-	-	-6.6	dBm	
Conditions of stressed receiver sensitivity test:						
Stressed eye closure for PAM4 (SECQ)	-	-	-	3.2	dB	
Damage Threshold	P _{damage}	5.2	-	-	dBm	
Average Receive Power	-	-10.8	-	4.2	dBm	
Receive power (OMA _{outer})	OMA	-	-	4	dBm	

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Receiver Reflectance	RXR	-	-	-26	dB	
LOS assert	LOSA	-30			dBm	
LOS de-assert	LOSD			-11	dBm	
LOS hysteresis	LOSH	0.5			dB	

Note 1: Measured with a PRBS²³¹-1 test pattern @53.125Gbps, BER $\leq 2.4E-4$.

Note 2: IEEE 802.3cd clause 139 equation 139-2.

Table 5 – Electrical Specifications

High-Speed Signal: Compliant to 50GAUI-2 C2M (IEEE 802.3cd)

Low-Speed Signal: Compliant to SFF-8679

Transmitter (Module Input)						
Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
Differential Data Input Amplitude	$V_{IN,P-P}$	-	-	900	mVpp	Note 1
Differential Termination Mismatch		-	-	10	%	
LPMode, Reset and ModSelL	V_{IL}	-0.3	-	0.8	V	
	V_{IH}	2	-	$V_{CC}+0.3$	V	
Receiver (Module Output)						
Differential Data Output Amplitude	$V_{OUT,P-P}$	-	-	900	mVpp	Note 1
Differential Termination Mismatch		-	-	10	%	
Output Rise/Fall Time, 20%~80%	T_R	12	-	-	ps	
ModPrsL and IntL	V_{OL}	0	-	0.4	V	$I_{OL}=4mA$
	V_{OH}	$V_{CC}-0.5$	-	$V_{CC}+0.3$	V	$I_{OL}=-4mA$

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

Table 6 – Digital Diagnostics

Parameter	Range	Accuracy	Unit	Calibration
Temperature	0 to 70	± 3	$^{\circ}C$	Internal
Voltage	0 to V_{CC}	$\pm 3\%$	V	Internal
Tx Bias Current	0 to 100	$\pm 10\%$	mA	Internal
Tx Output Power	-4.5 to 4.2	± 3	dB	Internal
Rx Power	-10.8 to 4.2	± 3	dB	Internal

Table 7 – Control and status timing requirement

Item	symbol	Min	Max	Unit
Initialization time	t_{init}		10	s
Reset Init Assert Time	t_{reset_init}	10		us

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Serial Bus Hardware Ready Time	t_serial		2	s
Monitor Data Ready Time	t_data		2	s
Reset Assert Time	t_reset		10	s
LPMode Assert Time	ton_LPMode		100	ms
LPMode De-assert Time	toff_LPMode		10	s
IntL Assert Time	ton_IntL		200	ms
IntL Deassert Time	toff_IntL		500	us
Rx LOS Assert Time	ton_los		100	ms
Flag Assert Time	ton_flag		200	ms
Mask Assert Time	ton_mask		100	ms
Mask Deassert Time	toff_mask		100	ms
Power_over-ride or Power-set Assert Time	ton_Pdown		100	ms
Power_over-ride or Power-set Deassert Time	toff_Pdown		10	s

Table 8 – Squelch and disable timing

Item	symbol	Min	Max	Unit
Rx Squelch Assert Time	ton_Rxsq		15	ms
Rx Squelch Deassert Time	toff_Rxsq		350	ms
Tx Squelch Assert Time	ton_Txsq		400	ms
Tx Squelch Deassert Time	toff_Txsq		400	ms
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		350	ms
Squelch Disable Assert Time	ton_sqdis		100	ms
Squelch Disable Deassert Time	toff_sqdis		100	ms

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	3
6	CML-I	Tx4p	Transmitter Non-Inverted Data Input	3	3
7		GND	Ground	1	1
8	LVTTL-I	ModselL	Module Select	3	

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9	LVTTTL-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	3
15	CML-O	Rx3n	Receiver Inverted Data Output	3	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	3
25	CML-O	Rx4p	Receiver Non-Inverted Data Output	3	3
26		GND	Ground	1	1
27	LVTTTL-O	ModPrsL	Module Present	3	
28	LVTTTL-O	IntL	Interrupt	3	
29		Vcc Tx	+3.3V Power supply transmitter	2	2
30		Vcc1	+3.3V Power supply	2	2
31	LVTTTL-I	LPMODE	Low Power Mode	3	
32		GND	Ground	1	1
33	CML-I	Tx3p	Transmitter Non-Inverted Data Input	3	3
34	CML-I	Tx3n	Transmitter Inverted Data Input	3	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

Note 1: 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.

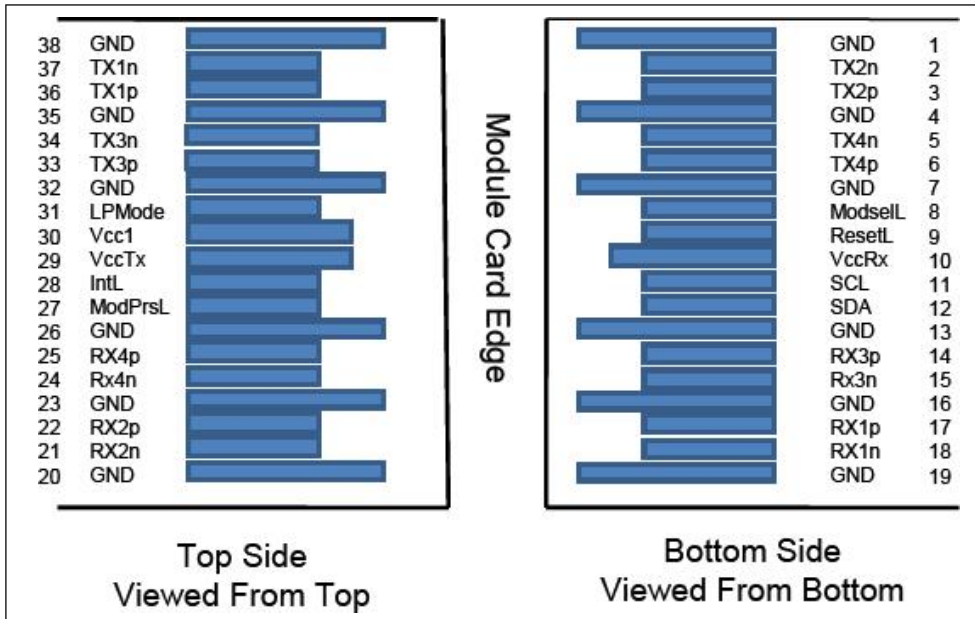
Connect these directly to the host board signal-common ground plane.

Note 2: Vcc Rx, Vcc1 and Vcc Tx are the receiver and transmitter power supplies and shall be applied concurrently.

Note 3: Not used.

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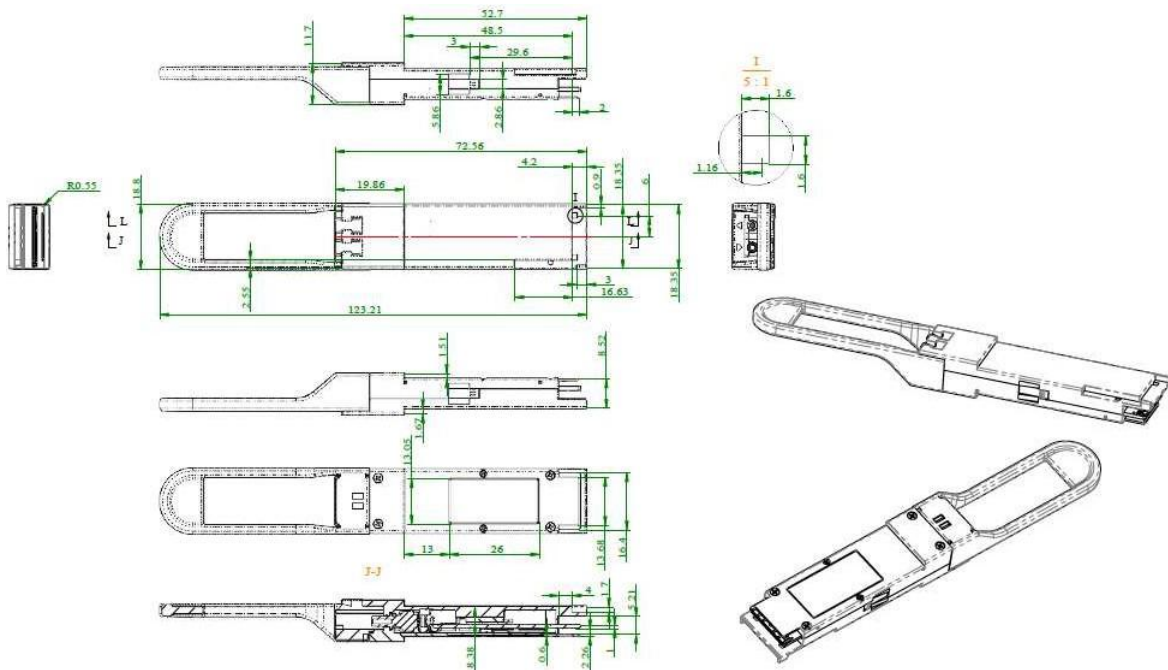
QSFP+ Module Pad Layout



Recommended Host Board Power Supply Filtering

See SFF-8679

Mechanical Diagram



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Order Information

Table 10 – Order Information

Part No.	Application	Data Rate	Laser Source	Fiber Type
KWQG10	50GBASE-LR	53.125 Gb/s	DML Laser	SMF