

QSFP28 AOC 100G MMF 850nm Transceiver

AQPA9NxxADLN0778



Applications

- 100Gb/s Ethernet 100GBASE-SR4
- Fiber channel 4xFC (4x 25.78125Gbps)
- Infiniband EDR interconnects
- Proprietary multi-channel links

Features

- QSFP28 Type AOC Transceiver
- 850nm VCSEL
- 100Gb/s aggregated bidirectional data throughput
- Contain clock and data recovery (CDR)
- 2m-40m transmission with MMF
- 3.3V single power supply
- Power consumption < 3.5 W
- Infiniband EDR / 100G Base-SR4
- Digital diagnostic functions (Via I²C)
- Compliant with QSFP28 MSA SFF-8665
- IEEE 802.3bm 100GBASE SR4
- Compliant with RoHS
- Compliant with UL & TUV

Ordering Information

Form Factor	Date Rate	Media	Distance	Wavelength (nm)	Voltage (V)	Coupling	DDM (Y/N)	Temperature (°C)	Part Number
QSFP28 AOC	100G	MMF	2m	850	3.3	AC/AC	Y	0 ~ +70	AQPA9N02ADLN0778
QSFP28 AOC	100G	MMF	2.5m	850	3.3	AC/AC	Y	0 ~ +70	AQPA9N2AADLN0778
QSFP28 AOC	100G	MMF	3m	850	3.3	AC/AC	Y	0 ~ +70	AQPA9N03ADLN0778
QSFP28 AOC	100G	MMF	3.5m	850	3.3	AC/AC	Y	0 ~ +70	AQPA9N3AADLN0778
QSFP28 AOC	100G	MMF	4m	850	3.3	AC/AC	Y	0 ~ +70	AQPA9N04ADLN0778
QSFP28 AOC	100G	MMF	4.5m	850	3.3	AC/AC	Y	0 ~ +70	AQPA9N4AADLN0778
QSFP28 AOC	100G	MMF	5m	850	3.3	AC/AC	Y	0 ~ +70	AQPA9N05ADLN0778
QSFP28 AOC	100G	MMF	5.5m	850	3.3	AC/AC	Y	0 ~ +70	AQPA9N5AADLN0778
QSFP28 AOC	100G	MMF	6m	850	3.3	AC/AC	Y	0 ~ +70	AQPA9N06ADLN0778

80-21-0778 REV A003

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Ordering Information

Form Factor	Date Rate	Media	Distance	Wavelength (nm)	Voltage (V)	Coupling	DDM (Y/N)	Temperature (°C)	Part Number
QSFP28 AOC	100G	MMF	6.5m	850	3.3	AC/AC	Y	0 ~ +70	AQPA9N6AADLN0778
QSFP28 AOC	100G	MMF	7m	850	3.3	AC/AC	Y	0 ~ +70	AQPA9N07ADLN0778
QSFP28 AOC	100G	MMF	7.5m	850	3.3	AC/AC	Y	0 ~ +70	AQPA9N7AADLN0778
QSFP28 AOC	100G	MMF	8m	850	3.3	AC/AC	Y	0 ~ +70	AQPA9N08ADLN0778
QSFP28 AOC	100G	MMF	8.5m	850	3.3	AC/AC	Y	0 ~ +70	AQPA9N8AADLN0778
QSFP28 AOC	100G	MMF	9m	850	3.3	AC/AC	Y	0 ~ +70	AQPA9N09ADLN0778
QSFP28 AOC	100G	MMF	9.5m	850	3.3	AC/AC	Y	0 ~ +70	AQPA9N9AADLN0778
QSFP28 AOC	100G	MMF	10m	850	3.3	AC/AC	Y	0 ~ +70	AQPA9N10ADLN0778
QSFP28 AOC	100G	MMF	11m	850	3.3	AC/AC	Y	0 ~ +70	AQPA9N11ADLN0778
QSFP28 AOC	100G	MMF	12m	850	3.3	AC/AC	Y	0 ~ +70	AQPA9N12ADLN0778
QSFP28 AOC	100G	MMF	13m	850	3.3	AC/AC	Y	0 ~ +70	AQPA9N13ADLN0778
QSFP28 AOC	100G	MMF	14m	850	3.3	AC/AC	Y	0 ~ +70	AQPA9N14ADLN0778
QSFP28 AOC	100G	MMF	15m	850	3.3	AC/AC	Y	0 ~ +70	AQPA9N15ADLN0778
QSFP28 AOC	100G	MMF	16m	850	3.3	AC/AC	Y	0 ~ +70	AQPA9N16ADLN0778
QSFP28 AOC	100G	MMF	17m	850	3.3	AC/AC	Y	0 ~ +70	AQPA9N17ADLN0778
QSFP28 AOC	100G	MMF	18m	850	3.3	AC/AC	Y	0 ~ +70	AQPA9N18ADLN0778
QSFP28 AOC	100G	MMF	19m	850	3.3	AC/AC	Y	0 ~ +70	AQPA9N19ADLN0778
QSFP28 AOC	100G	MMF	20m	850	3.3	AC/AC	Y	0 ~ +70	AQPA9N20ADLN0778
QSFP28 AOC	100G	MMF	21m	850	3.3	AC/AC	Y	0 ~ +70	AQPA9N21ADLN0778
QSFP28 AOC	100G	MMF	22m	850	3.3	AC/AC	Y	0 ~ +70	AQPA9N22ADLN0778
QSFP28 AOC	100G	MMF	23m	850	3.3	AC/AC	Y	0 ~ +70	AQPA9N23ADLN0778
QSFP28 AOC	100G	MMF	24m	850	3.3	AC/AC	Y	0 ~ +70	AQPA9N24ADLN0778
QSFP28 AOC	100G	MMF	25m	850	3.3	AC/AC	Y	0 ~ +70	AQPA9N25ADLN0778
QSFP28 AOC	100G	MMF	26m	850	3.3	AC/AC	Y	0 ~ +70	AQPA9N26ADLN0778
QSFP28 AOC	100G	MMF	27m	850	3.3	AC/AC	Y	0 ~ +70	AQPA9N27ADLN0778

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AQPA9NxxADLN0778
Ordering Information

Form Factor	Date Rate	Media	Distance	Wavelength (nm)	Voltage (V)	Coupling	DDM (Y/N)	Temperature (°C)	Part Number
QSFP28 AOC	100G	MMF	28m	850	3.3	AC/AC	Y	0 ~ +70	AQPA9N28ADLN0778
QSFP28 AOC	100G	MMF	29m	850	3.3	AC/AC	Y	0 ~ +70	AQPA9N29ADLN0778
QSFP28 AOC	100G	MMF	30m	850	3.3	AC/AC	Y	0 ~ +70	AQPA9N30ADLN0778
QSFP28 AOC	100G	MMF	31m	850	3.3	AC/AC	Y	0 ~ +70	AQPA9N31ADLN0778
QSFP28 AOC	100G	MMF	32m	850	3.3	AC/AC	Y	0 ~ +70	AQPA9N32ADLN0778
QSFP28 AOC	100G	MMF	33m	850	3.3	AC/AC	Y	0 ~ +70	AQPA9N33ADLN0778
QSFP28 AOC	100G	MMF	34m	850	3.3	AC/AC	Y	0 ~ +70	AQPA9N34ADLN0778
QSFP28 AOC	100G	MMF	35m	850	3.3	AC/AC	Y	0 ~ +70	AQPA9N35ADLN0778
QSFP28 AOC	100G	MMF	36m	850	3.3	AC/AC	Y	0 ~ +70	AQPA9N36ADLN0778
QSFP28 AOC	100G	MMF	37m	850	3.3	AC/AC	Y	0 ~ +70	AQOP9N37ADLN0778
QSFP28 AOC	100G	MMF	38m	850	3.3	AC/AC	Y	0 ~ +70	AQOP9N38ADLN0778
QSFP28 AOC	100G	MMF	39m	850	3.3	AC/AC	Y	0 ~ +70	AQOP9N39ADLN0778
QSFP28 AOC	100G	MMF	40m	850	3.3	AC/AC	Y	0 ~ +70	AQOP9N40ADLN0778

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Absolute Maximum Ratings

Parameter	Symbol	Conditions	Min	Max	Unit
Storage Temperature	T _s	--	-40	+85	°C
Storage Relative Humidity	RH	Non condensing	0	85	%
Supply Voltage	V _{cc}	--	-0.5	3.6	V

Recommended Operating Conditions

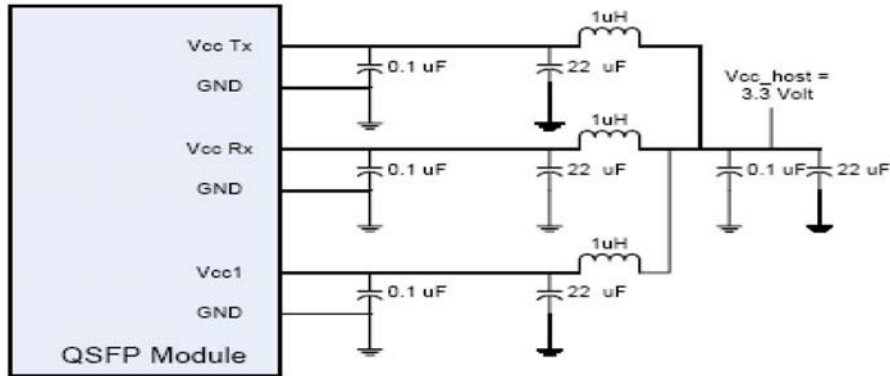
Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Operating Temperature (Case)	T _c	--	0	--	70	°C
Supply Voltage	V _{cc}	--	3.13	3.3	3.47	V
Supply Current	I _{cc}	--	--	--	1000	mA
Data Rate	DR	--	--	100	--	Gbps
Distance		--	--	--	40	m

Electrical Characteristics

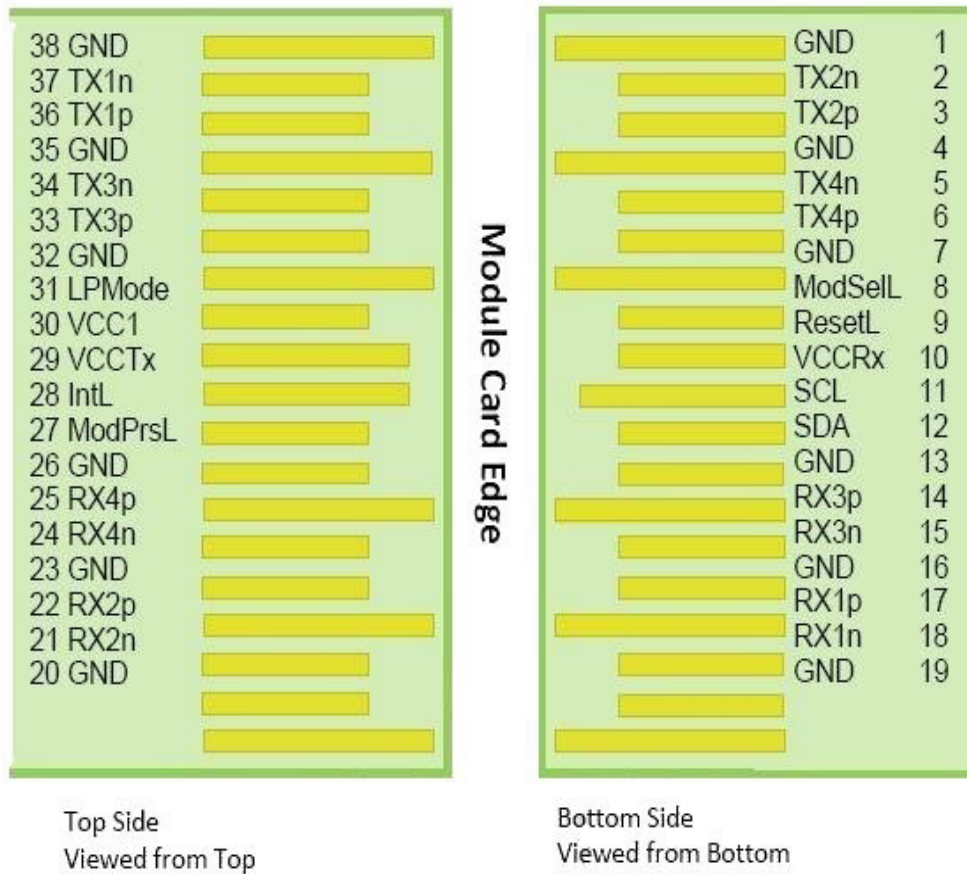
Transmitter Electrical Characteristics						
Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Data Input Differential Peak-to Peak Voltage Swing	V _{in,pp}	--	20	--	1200	mVpp
High speed Differential Input Voltage (CML)	V _{CML,DI}	AC-Coupled, peak to peak	0.5	--	1.6	V
Low speed Input Voltage-Low (LVCOMS)	V _{LVCMOS,IL}	--	-0.3	--	V _{cc} *0.3	V
Low speed Input Voltage-High (LVCOMS)	V _{LVCMOS,IH}	--	V _{cc} *0.7	--	V _{cc} +0.5	V
Low speed Input Voltage-Low (LVTTTL)	V _{LVTTTL,IL}	--	-0.3	--	0.8	V
Low speed Input Voltage-High (LVTTTL)	V _{LVTTTL,IH}	--	2	--	V _{cc} +0.3	V
Receiver Electrical Characteristics						
Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Data Output Differential Peak-to Peak Voltage Swing(AC-Coupled)	ΔV _{DO pp}		200	-	1100	mVpp
High speed Differential Input Voltage (CML)	V _{CML,DO}	AC-Coupled, peak to peak	0.8	--	1.6	V
Low speed Input Voltage-Low (LVCOMS)	V _{LVCMOS,OL}	--	0	--	0.4	V
Low speed Input Voltage-High (LVCOMS)	V _{LVCMOS,OH}	--	V _{cc} -0.5	--	V _{cc} +0.3	V
Low speed Input Voltage-Low (LVTTTL)	V _{LVTTTL,OL}	--	0	--	0.4	V
Low speed Input Voltage-High (LVTTTL)	V _{LVTTTL,OH}	--	V _{cc} -0.5	--	V _{cc} +0.3	V

Note: Measured with PRBS 2³¹ -1 at 10⁻¹² BER

Recommended Host Board Power Supply Circuit Filter



Pin Description



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Pin Function Definitions

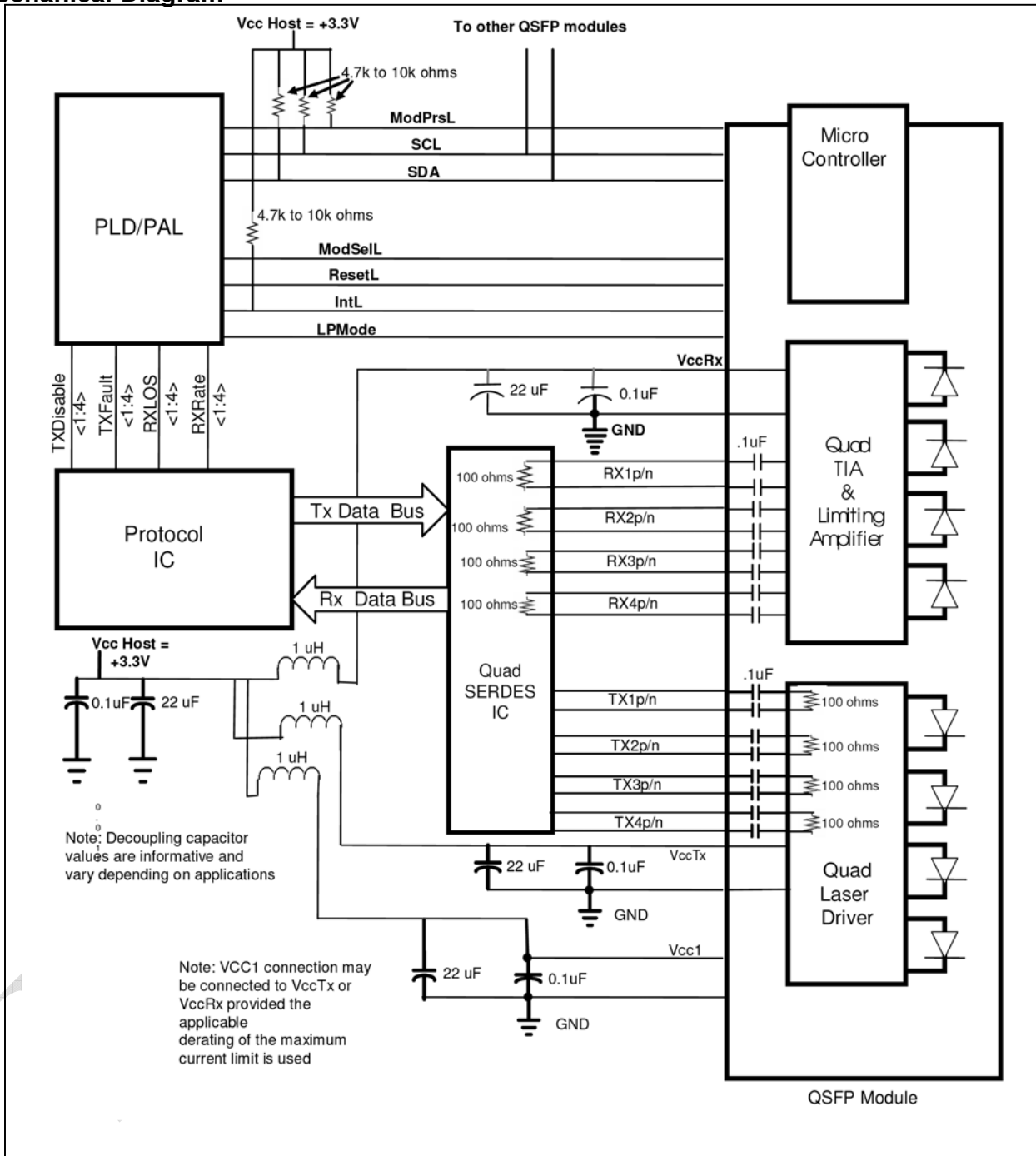
Pin No.	Pin Name	Symbol	Function/Description	Plug Sequence	Note
1	GND	Ground		1	1
2	CML-I	Tx2n	Transmitter Inverted Data Input	3	
3	CML-I	Tx2p	Transmitter Non-Inverted Data Input	3	
4	GND	Ground		1	1
5	CML-I	Tx4n	Transmitter Inverted Data Input	3	
6	CML-I	Tx4p	Transmitter Non-Inverted Data Input	3	
7	GND	Ground		1	1
8	LVTTL-I	ModSelL	Module Select	3	
9	LVTTL-I	ResetL	Module Reset	3	
10	Vcc Rx	Rx	+3.3V Power Supply Receiver	2	2
11	LVCMOSI/O	SCL	2-wire serial interface clock	3	
12	LVCMOSI/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	Tx	+3.3V Power supply transmitter	2	2
30	Vcc1	+3.3V	+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

- GND is the symbol for signal and supply (power) common for the QSFP28 module. All are common within the QSFP28 module and all module voltages are referenced to this potential unless otherwise noted. Connect these directly to the host board signal-common ground plane.
- Vcc Rx, Vcc1 and Vcc Tx are the receiver and transmitter power supplies and shall be applied concurrently. Requirements defined for the host side of the Host Edge Card Connector are listed in Table 6. Recommended host board power supply filtering is shown in Figure 4. Vcc Rx Vcc1 and Vcc Tx may be internally connected within the QSFP28 Module module in any combination. The connector pins are each rated for a maximum current of 500 mA. This contact is an input contact with a 4.7 kΩ to 10k Ohms pull up to VccT inside the module.

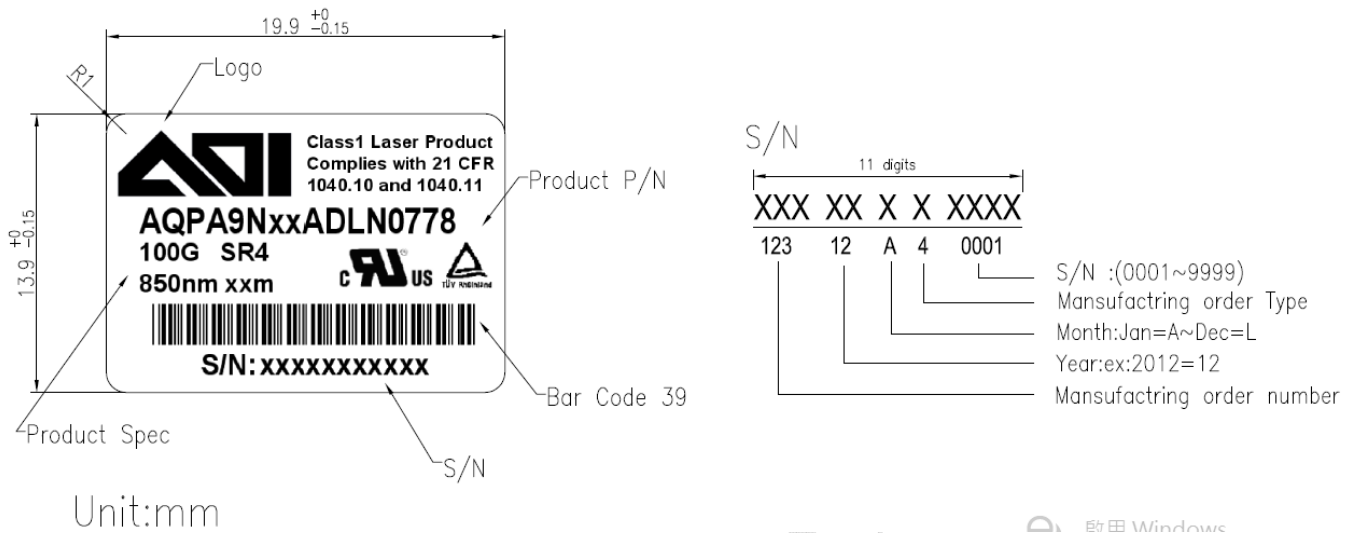
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Recommended Interface Circuit

Mechanical Diagram



Module Label Diagram



Prelim

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EEPROM Memory contents Address A0h

	AOI	AQPA9NxxADLN0778	AY130	XX
Add	Name of field	Description	ACSII	HEX
128	Identifier	11:QSFP28		11
129	Ext. Identifier	QSFP Transceiver ,C0: Power Max 3.5W		XX
130	Connector	0B:Optical Pigtail		0B
131	Transceiver	80: The Extended Specification Compliance Codes are maintained in the Transceiver Management section of SFF-8024 Table 4-4 (The extended information show in Byte 192)		XX
132		SONET Compliance codes		00
133		SAS/SATA compliance codes		00
134		Gigabit Ethernet compliance codes		00
135		Fiber Channel Compliant codes		00
136		Fiber Channel link length		00
137		Fiber Channel transmission media		00
138		Fiber Channel Speed		00
139	Encoding	05: 64B/66B, (see SFF-8024 Table 4-2)		05
140	BR, Nominal	100Mbps/unit -> HEX FF:25.78125G / each channel (over 25.4G reference Byte 222)		XX
141	Ext. RateSelect	bit7-2:0 reserved bit1:0 no QSFP+ Rate Select Version2 bit0:0 no QSFP+ Rate Select Version1 (see Table 6-18)		00
142	Length(9um, SMF)	1km /unit -> HEX		00
143	Length (50um, OM3)	2m /unit -> HEX		XX
144	Length (50um, OM2)	1m /unit -> HEX		00
145	Length (62.5um, OM1)	1m /unit -> HEX		XX
146	Length (52um, OM4) / Length (Copper)	2m /unit -> HEX / 1m /unit -> HEX		00
147	Device Tech	Device technology		00
148	Vendor name	QSFP Vendor Name (ASCII)	A	41
149			O	4F
150			I	49
151				20
152				20
153				20
154				20
155				20
156				20
157				20



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158				20
159				20
160				20
161				20
162				20
163				20
164	Ext. Transceiver	Ext. Transceiver (see Table 6-21) 10:EDR		XX
165	Vendor OUI	SFP Vendor IEEE company ID, No ID set "00"		00
166				00
167				00
168	Vendor PN	SFP Vendor Part Number (ASCII)	A	41
169			Q	51
170			P	50
171			A	41
172			9	39
173			N	4E
174			x	XX
175			x	XX
176			A	41
177			D	44
178			L	4C
179			N	4E
180			0	30
181			7	37
182			7	37
183			8	38
184	Vendor rev	Hardware Revision (HEX) Ver B	B	XX
185				XX
186	Wavelength	Nominal laser wavelength (Wavelength = value / 20 in nm) 4268:850nm		42
187				68
188	Wavelength Tolerance	Guaranteed range of laser wavelength (+/- value) from Nominal wavelength. (Wavelength Tol. = value/200 in nm) 07D0:10nm		07
189				D0
190	Max Case Temp	Maximum Case Temperature 46:70°C		46
191	CC_BASE	Check Sum (128-190)		XX

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192	Options (see Table 6-22)	Reference Extended: The Extended Specification Compliance Codes are maintained in the Transceiver Management section of SFF-8024 (see Table 6-17) 10G/40G/100G Ethernet 02:100G BASE-SR4 (see Table 4-4)		XX
193		bit7-4:0 reserved bit3:0 no TX Input Equalization Auto Adaptive Capable bit2:0 no TX Input Equalization Fixed Programmable Settings bit1:0 no RX Output Emphasis Fixed Programmable Settings bit0:0 no RX Output Amplitude Fixed Programmable Settings		00
194		bit7:0 no TX CDR On/Off Control bit6:0 no RX CDR On/Off Control bit5:1 Tx CDR Loss of Lock (LOL) Flag bit4:1 Rx CDR Loss of Lock (LOL) Flag bit3:0 no Rx Squelch Disable bit2:0 no Rx Output Disable capable bit1:0 no Tx Squelch Disable bit0:0 no Tx Squelch		XX
195		bit7:1 memory page02 bit6:0 no memory page01 bit5:0 no RATE_SELECT bit4:1 TX_DISABLE bit3:1 TX_FAULT bit2:0 no TX Squelch bit1:0 no TX Loss bit0:0 reserved		98
196	Vendor SN	Vendor SN (ASCII)		XX
197				XX
198				XX
199				XX
200				XX
201				XX
202				XX
203				XX
204				XX
205				XX
206				XX
207				XX
208				XX
209				XX
210				XX

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211				XX
212	Date code	Year (ASCII)		XX
213				XX
214				XX
215		Month (ASCII)		XX
216				XX
217		Day (ASCII)		XX
218				XX
219	Blank		20	20
220	Diagnostic Monitoring Type	bit3:1 = Average power / 0 = OMA bit2:1 Transmitter power measurement others:0 reserved (see Table 6-24)		XX
221	Enhanced Options	bit7-4:0 Reserved bit3:0 no Rate Select bit2:0 no Application select bit1-0:0 reserved (see Table 6-25)		00
222	BR, Nominal	250Mbps/unit -> HEX 67: 25.78125G / each channel		XX
223	CC_EXT	Check Sum 64 to 94 byte		XX
224	Read-only	Vendor name : AOI (PM suggest)	A	41
225			O	4F
226			I	49
227				20
228				20
229		w	XX	
230		x	XX	
231		y	XX	
232		z	XX	
233			00	
234			00	
235			00	
236			00	
237			00	
238			00	
239			00	
240			00	
241		00		
242		00		
243		00		
244		00		
245		00		



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246				00
247				00
248				00
249				00
250				00
251				00
252		FW Check sum		C9
253				CD
254	FW Version	02 00 = V2.00		02
255				00

Preliminary

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Regulatory Compliance

Item	Standard
Electromagnetic Interference (EMI)	FCC Part 15 Class B EN55022 Class B (CISPR 22B) VCCI Class B
ESD (Module case)	Contact Discharge EN61000-4-2 criterion B
ESD (Module case)	Air Discharge EN61000-4-2 criterion B
ESD (Electrical connector)	JEDEC JESD22-A114-B
RoHS	2011/65/EU
Laser Eye Safety	FDA 21CFR 1040.10 and 1040.11
Component Recognition	UL and TUV

Laser Safety Information

All versions of this laser are Class 1 laser products per IEC¹/EN² 60825-1. Users should observe safety precautions such as those recommended by ANSI³ Z136.1, ANSI Z36.2 and IEC 60825-1.

This product conforms to FDA (CDRH) 21 CFR 1040.10 and 1040.11 except for deviations of laser safety class designation pursuant to ['Laser Notice No.50'](#).

Product labeling:

Class 1 Laser Product
Compliance with 21 CFR
1040.10 and 1040.11

If labeling is not affixed to the module due to size constraints; then rather, labeling is placed on the outside of the shipping box.

This product is not shipped with a power supply.

Caution: use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

Certifications

UL	60950-1 (E243407)
TUV	EN60950-1, EN 60825-1, EN 60825-2

Documentation is available upon request.

(1) IEC is a registered trademark of the International Electrotechnical Commission

(2) Within Europe the IEC standard has been adopted as a European Normative standard known as EN 60825, and each European country will have its own version of this standard, for example, the British Standards version known as BS EN 60825. There can be small differences between the different countries versions of EN 60825, and these are in part caused by the process of translating the standard into the native language of that country.

(3) ANSI is a registered trademark of the American National Standards Institute

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