Product Specification

1~100m 200G QSFP56 to 200G QSFP56 Active Optical Cable

PN:Q200-Q200-A



Features

- compatible 200G Ethernet connectivity
- 212.5 Gb/s aggregate raw line rate per direction
- 4 × 53.125 Gb/s PAM4 electrical and optical lanes
- 4-channel full-duplex active optical cable
- 26.5625 GBd symbol rate per lane
- 850 nm VCSEL transmitter and PIN receiver arrays
- Multimode fiber (MMF) transmission
- 200GAUI-4 host electrical interface
- Available cable lengths from 1 m to 100 m
- Hot-pluggable QSFP56 interfaces
- Single +3.3 V power supply
- Maximum power consumption per end: ≤4.5 W
- SFF-8636-compliant I²C management interface with digital diagnostic monitoring (DDM)
- Commercial operating case temperature range: 0°C to +70°C

Compliance

- QSFP56 MSA / SFF-8665
- IEEE 802.3bs / IEEE 802.3cd
- RoHS complian

Applications

- 200G Ethernet
- AI/ML and GPU Computing Networks
- High-Performance Computing (HPC)
- Data Center and Cloud Networking
- Switch-to-Server and Switch-to-HCA Interconnection

Description

The Q200-HDR-A is a high-performance Active Optical Cable (AOC) designed for 200G InfiniBand HDR and Ethernet interconnections in AI computing, high-performance computing, and hyperscale data center environments. Featuring QSFP56 connectors on both ends, the cable supports four 53.125 Gb/s PAM4 lanes in each direction, providing 200G nominal connectivity with an aggregate raw line rate of 212.5 Gb/s per direction.

Each end integrates a four-channel 850 nm VCSEL transmitter array and a PIN photodiode receiver array. The host electrical interface follows the 200GAUI-4 architecture, with each lane operating at a 26.5625 GBd PAM4 symbol rate. The optical transmission path uses multimode fiber (MMF), providing high-bandwidth connectivity over distances of up to 100 m.

The integrated active optical architecture combines optical transmitters, receivers, and fiber into a single pluggable cable assembly, eliminating the need for separate optical transceivers and external fiber patch cords. This design provides low-latency, high-speed connectivity while simplifying installation and cable management in high-density networking environments.

The Q200-HDR-A operates from a single +3.3 V power supply at each end, with maximum power consumption of 4.5 W per end. Its SFF-8636-compliant management interface supports EEPROM-based product identification and digital diagnostic monitoring, providing host-readable operating information.

Available in lengths from 1 m to 100 m, the Q200-HDR-A is suitable for connections between InfiniBand HDR switches, network adapters, servers, and other compatible 200G networking equipment. It also supports compatible 200G Ethernet applications based on IEEE 802.3cd

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Product performance Specifications

1、Absolute Maximum Ratings

Parameter	Symbol	Min	Typ.	Max	Unit
Storage Temperature	TS	-40		+85	°C
Maximum Supply Voltage	VCC	-0.5		+3.6	V
Relative Humidity	RH	0		85	%

2、Recommended Operating Conditions

Parameter	Symbol	Min	Typ.	Max	Unit
Operating Case Temperature	TC	0	25	+70	°C
Power Supply Voltage	VCC	3.135	3.3	3.465	V
Aggregate Line Bit Rate	DR		212.5		Gb/s

Line Bit Rate per Lane	BR		53.125		Gb/s
Signaling Rate per Lane	SR		26.5625 ±100ppm		GBd
Modulation Format			PAM4		
Available Cable Length	L	1		100	m

3、Power Supply and Electrical Specifications

Parameter	Symbol	Min	Typ.	Max	Unit
Power Supply Voltage	VCC	3.135	3.3	3.465	V
Power Consumption per End	PC			4.5	W
Electrical Lane Configuration			4 TX / 4 RX		lanes

4、Host Electrical Interface

Parameter	Specification
Host Electrical Interface	200GAUI-4
Electrical Lane Count	4 TX + 4 RX
Line Bit Rate per Lane	53.125Gb/s
Signaling Rate per Lane	26.5625GBd ±100ppm
Modulation Format	PAM4
Differential Impedance	100Ω nominal

5、Transmitter Electrical Characteristics

Parameter	Symbol	Min	Typ.	Max	Unit
Signaling Rate per Lane	SR		26.5625 ±100ppm		GBd
AC Common-Mode Input Voltage Tolerance (RMS)	VCM			20	mV
Differential Input Impedance	Zin	90	100	110	Ω
Differential Input Voltage Amplitude	Vin,pp		900		mVp-p
Differential Termination Mismatch				10	%
DC Common-Mode Input Voltage	VCM	-350		2850	mV

6、Receiver Electrical Characteristics

Parameter	Symbol	Min	Typ.	Max	Unit
Signaling Rate per Lane	SR		26.5625 ±100ppm		GBd
AC Common-Mode Output Voltage (RMS)	VCM			20	mV
Differential Output Impedance	Zout	90	100	110	Ω
Differential Output Voltage Amplitude	Vout,pp		900		mVp-p
Near-End Eye Symmetry Mask Width	ESMW	0.265			UI
Near-End Differential Eye Height	EH	70			mV
Far-End Eye Symmetry Mask Width	ESMW	0.2			UI
Far-End Differential Eye Height	EH	30			mV
Differential Termination Mismatch				10	%
Transition Time (20% to 80%)	Tr, Tf			9.5	ps
DC Common-Mode Output Voltage	VCM	-350		2850	mV

7、Transmitter Optical Characteristics — Per Lane

Parameter	Symbol	Min	Typ.	Max	Unit
Optical Lane Count			4		lanes
Optical Line Bit Rate per Lane	BR		53.125		Gb/s
Optical Signaling Rate per Lane	SR		26.5625		GBd
Modulation Format			PAM4		
Center Wavelength	λC	840	850	860	nm
Transmitter Type			VCSEL Array		

8、Receiver Optical Characteristics — Per Lane

Parameter	Symbol	Min	Typ.	Max	Unit
Optical Lane Count			4		lanes
Optical Line Bit Rate per Lane	BR		53.125		Gb/s
Optical Signaling Rate per Lane	SR		26.5625		GBd
Modulation Format			PAM4		

Receiver Wavelength Range	λR	840	850	860	nm
Receiver Type			PIN Photodiode Array		

9、FEC and BER Specifications

Parameter	Symbol	Specification
Pre-FEC Bit Error Ratio	BER	≤2.4 × 10^{-4}
Test Pattern		PRBS31Q
Test Signaling Rate		26.5625GBd
Modulation Format		PAM4

10、Management Interface Specifications

Parameter	Specification
Management Interface	SFF-8636
Management Communication	2-wire serial interface
I²C Clock Frequency	Up to 400kHz
Digital Diagnostic Monitoring	Supported

11、Cable and Mechanical Characteristics

Parameter	Specification
Cable Type	Active Optical Cable (AOC)
Connector — Both Ends	QSFP56
Cable Configuration	200G QSFP56 to 200G QSFP56
Internal Fiber Type	Multimode Fiber (MMF)
Optical Architecture	4-channel parallel optics
Transmitter Type	850nm VCSEL Array
Receiver Type	PIN Photodiode Array
Available Cable Length	1–100m
Hot-Pluggable	Yes

12、Environmental and Regulatory Specifications

Parameter	Specification
Operating Case Temperature	0°C to +70°C
Storage Temperature	-40°C to +85°C
Relative Humidity	0% to 85%
Supply Voltage	+3.3V nominal
RoHS	Compliant

Pin-out Definition

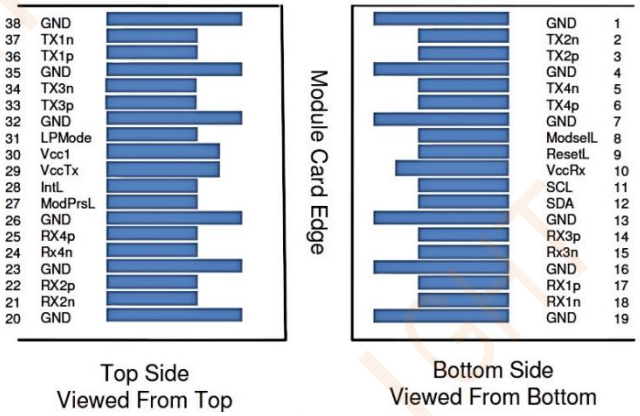


Figure4: Pin view

Pin Function Definitions

Pin	Logic	Symbol	Description	Note
1		GND	Ground	1
2	CML-I	Tx2n	Transmitter Inverted Data Input	3
3	CML-I	Tx2p	Transmitter Non-Inverted Data Input	3
4		GND	Ground	1
5	CML-I	Tx4n	Transmitter Inverted Data Input	3
6	CML-I	Tx4p	Transmitter Non-Inverted Data Input	3
7		GND	Ground	1
8	LVTTL-I	ModSelL	Module Select	4
9	LVTTL-I	ReSelL	Module Select	4
10		Vcc Rx	+3.3V Power Supply Receiver	2
11	LVCMOS-I/O	SCL	2-wire serial interface clock	4
12	LVCMOS-I/O	SDA	2-wire serial interface data	4
13		GND	Ground	1
14	CML-O	Rx3p	Receiver Non-Inverted Data Output	3
15	CML-O	Rx3n	Receiver Inverted Data Output	3
16		GND	Ground	1

17	CML-O	Rx1p	Receiver Non-Inverted Data Output	3
18	CML-O	Rx1n	Receiver Inverted Data Output	3
19		GND	Ground	1
20		GND	Ground	1
21	CML-O	Rx2n	Receiver Inverted Data Output	3
22	CML-O	Rx2p	Receiver Non-Inverted Data Output	3
23		GND	Ground	1
24	CML-O	Rx4n	Receiver Inverted Data Output	3
25	CML-O	Rx4p	Receiver Non-Inverted Data Output Ground	3
26		GND	Ground	1
27	LVTTL-O	ModPrsL	Module Present	4
28	LVTTL-O	IntL	Interrupt	4
29		Vcc Tx	+3.3V Power supply transmitter	2
30		Vcc1	+3.3V Power supply	2
31	LVTTL-I	LPMode	Low Power Mode	4
32		GND	Ground	1
33	CML-I	Tx3p	Transmitter Non-Inverted Data Input	3
34	CML-I	Tx3n	Transmitter Inverted Data Input	3
35		GND	Ground	1
36	CML-I	Tx1p	Transmitter Non-Inverted Data Input	3
37	CML-I	Tx1n	Transmitter Inverted Data Input	3
38		GND	Ground	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. Requirements defined for the host side of the Host Edge Card Connector are listed in Table. Recommended host board power supply filtering is shown in Host board power supply circuit. Vcc Rx Vcc1 and Vcc Tx may be internally connected within the QSFP module in any combination. The connector pins are each rated for a maximum current of 500 mA.

Note3: High-speed signal interfaces require differential pairs (e.g. TX1+/TX1-) with tightly matched impedances (typically 100Ω).

Note4: The management and control signals are based on LVTTL level logic and are used for functions such as module selection and reset.

Monitoring Specification

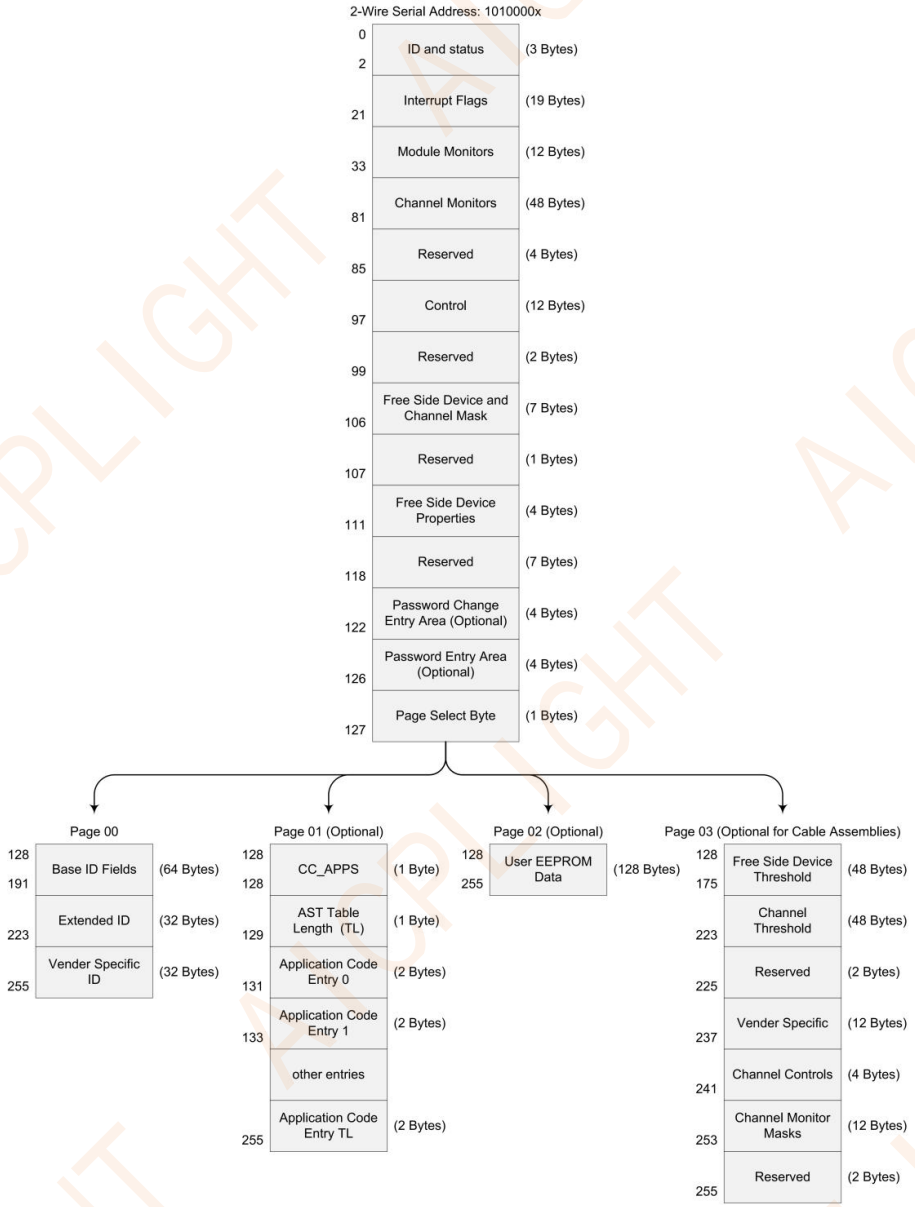


Figure5: Memory map

Memory map Table

Byte	Unit	Name	Description
			Lower Page 00h
0	1	Identifier	Type of transceiver,Page 00h Byte 0 and Page 00h Byte 128 shall contain the same parameter values.
1	1	Status	Revision Compliance
2	1	Status	Status indicators

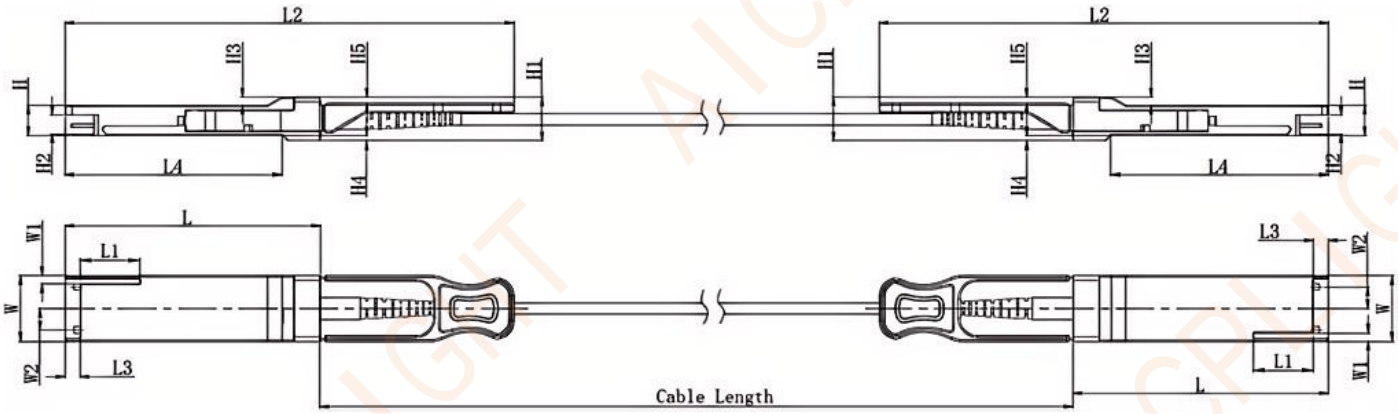
3-21	19	Interrupt Flags	Consist of interrupt flags for LOS, Tx Fault, warnings and alarms. The non-asserted state shall be 0b.
22	1	Temperature MSB	Internally measured temperature (MSB)
23	1	Temperature LSB	Internally measured temperature (LSB)
24-25	2	Reserved	Reserved
26	1	Supply Voltage MSB	Internally measured supply voltage (MSB)
27	1	Supply Voltage LSB	Internally measured supply voltage (LSB)
28-29	2	Reserved	Reserved
30-33	4	Vendor Specific	Vendor Specific
34	1	Rx1 Power MSB	Internally measured Rx1 input power
35	1	Rx1 Power LSB	
36	1	Rx2 Power MSB	Internally measured Rx2 input power
37	1	Rx2 Power LSB	
38	1	Rx3 Power MSB	Internally measured Rx3 input power
39	1	Rx3 Power LSB	
40	1	Rx4 Power MSB	Internally measured Rx4 input power
41	1	Rx4 Power LSB	
42	1	Tx1 Bias MSB	Internally measured Tx1 bias
43	1	Tx1 Bias LSB	
44	1	Tx2 Bias MSB	Internally measured Tx2 bias
45	1	Tx2 Bias LSB	
46	1	Tx3 Bias MSB	Internally measured Tx3 bias
47	1	Tx3 Bias LSB	
48	1	Tx4 Bias MSB	Internally measured Tx4 bias
49	1	Tx4 Bias LSB	
50	1	Tx1 Power MSB	Internally measured Tx1 Power
51	1	Tx1 Power LSB	
52	1	Tx2 Power MSB	Internally measured Tx2 Power
53	1	Tx2 Power LSB	
54	1	Tx3 Power MSB	Internally measured Tx3 Power
55	1	Tx3 Power LSB	
56	1	Tx4 Power MSB	Internally measured Tx4 Power
57	1	Tx4 Power LSB	
58-65	8	Reserved	Reserved channel monitor set 4
66-73	8	Reserved	Reserved channel monitor set 5
74-81	8	Vendor Specific	Vendor Specific
82-85	4	Reserved	Reserved
86-99	14	Control	Control
100-106	7	Free Side Device and Channel Masks	Free Side Device and Channel Masks
107-110	4	Free Side Device Properties	Free Side Device Properties

111-112	2	Assigned for use by PCI Express	Used for: - The PCI Express External Cable Specification - The PCI Express OCuLink Specification
113-117	4	Free Side Device Properties	Free Side Device Properties
118	1	Reserved	Reserved
119-122	4	Password Change Entry Area	Password Change Entry Area
123-126	4	Password Entry Area	Password Entry Area
127	1	Page Select Byte	Page Select Byte
Upper Page 00h			
128	1	Identifier	Identifier Type of free side device.(See SFF-8024 Transceiver Management)
129	1	Ext. Identifier	Extended Identifier of free side device. Includes power classes, CLEI codes, CDR capability.
130	1	Connector Type	Code for media connector type. (See SFF-8024 Transceiver Management)
131-138	8	Specification Compliance	Code for electronic or optical compatibility.
139	1	Encoding	Code for serial encoding algorithm. (See SFF-8024 Transceiver Management)
140	1	Signaling rate, nominal	Nominal signaling rate, units of 100 MBd. For rate > 25.4 GBd, set this to FFh and use Byte 222.
141	1	Extended Rate Select Compliance	Tags for extended rate select compliance.
142	1	Length (SMF)	Link length supported at the signaling rate in byte 140 or page 00h byte 222, for SMF fiber in km *. A value of 1 shall be used for reaches from 0 to 1 km.
143	1	Length (OM3 50 um)	Link length supported at the signaling rate in byte 140 or page 00h byte 222, for EBW 50/125 um fiber (OM3), units of 2 m *
144	1	Length (OM2 50 um)	Link length supported at the signaling rate in byte 140 or page 00h byte 222, for 50/125 um fiber (OM2), units of 1 m *
145	1	Length (OM1 62.5 um) or Copper Cable Attenuation	Link length supported at the signaling rate in byte 140 or page 00h byte 222, for 62.5/125 um fiber (OM1), units of 1 m *, or copper cable attenuation in dB at 25.78 GHz.
146	1	Length (passive copper or active cable or OM4 50 um)	Length of passive or active cable assembly (units of 1 m) or link length supported at the signaling rate in byte 140 or page 00h byte 222, for OM4 50/125 um fiber (units of 2 m) as indicated by Byte 147. See 6.3.12.
147	1	Device technology	Device technology
148-163	16	Vendor name	Free side device vendor name (ASCII)
164	1	Extended Module	Extended Module codes for InfiniBand.
165-167	3	Vendor OUI	Free side device vendor IEEE company ID.
168-183	16	Vendor PN	Part number provided by free side device vendor(ASCII)
184-185	2	Vendor rev	Revision level for part number provided by the vendor(ASCII)

186-187	2	Wavelength or Copper Cable Attenuation	Nominal laser wavelength (wavelength=value/20 in nm) or copper cable attenuation in dB at 2.5 GHz (Byte 186) and 5.0 GHz (Byte 187)
188-189	2	Wavelength tolerance or Copper Cable Attenuation	The range of laser wavelength (+/- value) from nominal wavelength. (wavelength Tol. =value/200 in nm) or copper cable attenuation in dB at 7.0 GHz (Byte 188) and 12.9 GHz (Byte 189)
190	1	Max case temp	Maximum case temperature
191	1	CC_BASE	Check code for base ID fields (Bytes 128-190)
192	1	Link codes	Extended Specification Compliance Codes (See SFF-8024)
193-195	3	Options	Optional features implemented.
196-211	16	Vendor SN	Serial number provided by vendor.(ASCII)
212-219	8	Date Code	Vendor's manufacturing date code.
220	1	Diagnostic Monitoring Type	Indicates which type of diagnostic monitoring is implemented (if any) in the free side device. Bit 1,0 Reserved.
221	1	Enhanced Options	Indicates which optional enhanced features are implemented in the free side device.
222	1	CC_EXT	Check code for the Extended ID Fields (Bytes 192-222)
224-255	32	Vendor Specific	Vendor Specific EEPROM
Page 02h (Optional)			
128-255	128	User EEPROM Data	
Page 03h (Optional)			
128-129	2	Temp High Alarm	MSB at lower byte address
130-131	2	Temp Low Alarm	MSB at lower byte address
132-133	2	Temp High Warning	MSB at lower byte address
134-135	2	Temp Low Warning	MSB at lower byte address
136-143	8	Reserved	Reserved
144-145	2	Vcc High Alarm	MSB at lower byte address
146-147	2	Vcc Low Alarm	MSB at lower byte address
148-149	2	Vcc High Warning	MSB at lower byte address
150-151	2	Vcc Low Warning	MSB at lower byte address
152-159	8	Reserved	Reserved
160-175	16	Vendor Specific	Vendor Specific
176-177	2	Rx Power High Alarm	MSB at lower byte address
178-179	2	Rx Power Low Alarm	MSB at lower byte address
180-181	2	Rx Power High Warning	MSB at lower byte address
182-183	2	Rx Power Low Warning	MSB at lower byte address
184-185	2	Tx Bias High Alarm	MSB at lower byte address
186-187	2	Tx Bias Low Alarm	MSB at lower byte address
188-189	2	Tx Bias High Warning	MSB at lower byte address
190-191	2	Tx Bias Low Warning	MSB at lower byte address
192-193	2	Tx Power High Alarm	MSB at lower byte address
194-195	2	Tx Power Low Alarm	MSB at lower byte address
196-197	2	Tx Power High Warning	MSB at lower byte address

198-199	2	Tx Power Low Warning	MSB at lower byte address
200-207	8	Reserved	Reserved thresholds for channel parameter set 4
208-215	8	Reserved	Reserved thresholds for channel parameter set 5
216-223	8	Vendor Specific	Vendor Specific
224	1	Tx EQ & Rx Emphasis Magnitude ID	Tx EQ & Rx Emphasis Magnitude ID
225	1	Rx output amplitude support indicators	Rx output amplitude support indicators
226-229	4	Control options advertising	Control options advertising
230-241	12	Optional Channel Controls	Optional Channel Controls
242-247	6	Channel Monitor Masks	Channel Monitor Masks
248-249	2	Reserved	Reserved channel monitor masks set 4
250-251	2	Reserved	Reserved channel monitor masks set 5
252-255	4	Reserved	Reserved

Mechanical Dimension



Note:

Diameter: 3mm

- Minimum bend radius:30 mm
- Cable color:Aqua
- When L≤1m, the tolerance is +70/-0 mm
- When 1 m<L<7 m, the tolerance is +100/-0 mm
- When L≥7 m,the tolerance is +2%L/-0

Handling and Safety Precautions:

- ESD Precautions: Follow standard ESD handling procedures when handling or installing the AOC.
- Bend Radius: Do not bend the cable below the specified minimum bend radius of 30 mm.
- Cable Handling: Avoid excessive pulling, twisting, crushing, or other mechanical stress on the cable.
- Installation and Removal: Use the pull tab or release mechanism when removing the AOC. Do not pull directly on the cable.
- Connector Protection: Keep the electrical connector contacts clean and protected from dust and contamination when not installed.
- Optical and Laser Safety: The optical fibers and optical engines are permanently integrated within the AOC assembly. Do not disassemble, modify, or attempt to service the internal optical components.

Ordering Information

PN	Description
Q200-Q200-A1	200G QSFP56 to 200G QSFP56 Active Optical Cable,1m
Q200-Q200-A5	200G QSFP56 to 200G QSFP56 Active Optical Cable,5m
Q200-Q200-A10	200G QSFP56 to 200G QSFP56 Active Optical Cable,10m
Q200-Q200-A15	200G QSFP56 to 200G QSFP56 Active Optical Cable,15m
Q200-Q200-A20	200G QSFP56 to 200G QSFP56 Active Optical Cable,20m
Q200-Q200-A30	200G QSFP56 to 200G QSFP56 Active Optical Cable,30m
Q200-Q200-A50	200G QSFP56 to 200G QSFP56 Active Optical Cable,50m
Q200-Q200-A100	200G QSFP56 to 200G QSFP56 Active Optical Cable,100m

Note: Other cable lengths from 1m to 100m are available upon request.