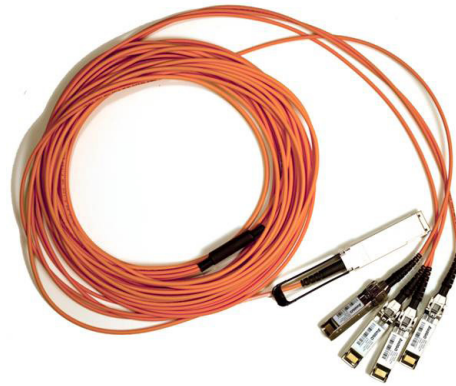


# AFBR-71ERxxZ

## QSFP+ to 4× SFP+ Breakout Active Optical Cable



### Data Sheet



#### Description

The Avago Technologies AFBR-71ERxxZ is a Four-Channel, Pluggable, Parallel, Fiber-Optic QSFP+ Active Optical Cable (AOC) to 4× SFP+ Active Optical Cable break-out solution. This Breakout cable is intended for 40G to 4× 10G applications.

This AOC is a high performance cable for short-range multi-lane data communication and interconnect applications. It integrates four data lanes in each direction with 40 Gbps aggregate bandwidth. Each lane can operate at 10.3125 Gbps. These cables also support 4 x 10G Infini-Band QDR applications and are backwards compatible to the 4 × 5G IB DDR and 4 × 2.5G IB single IB SDR applications.

This product is leveraged from Avago Technologies QSFP+ to QSFP+ Active Optical Cable product (AFBR-7QERxxZ) and SFP+ Active Optical Cable product (AFBR-2CARxxZ). Where applicable, consult these respective datasheets

This AOC incorporates Avago Technologies' proven integrated circuit and VCSEL technology to provide reliable long life, high performance, and consistent service.

#### Applications

- 40GbE and 10GbE break-out applications for Datacom switch and router connections
- 40G to 4×10G density applications for Datacom and Proprietary protocol applications

#### Features

##### QSFP+ AOC end:

- Compliant to the 40GBASE-SR4 and XLPII Specification per IEEE 802.3ba-2010 and supporting 40G-IB-QDR / 20G-IB-DDR / 10G-IB-SDR applications
- Compliant to the industry standard SFF-8436 QSFP+ Specification
- Power Level 1: Max Power < 1.5 W
- Operate at 10.3125 Gbps per channel with 64b/66b encoded data for 40GbE application and at 10 Gbps with 8b/10b compatible encoded data for 40G-IB-QDR application

##### Each 4× SFP+ end:

- Compliant to the electrical specifications per SFF-8431 Specifications for Enhanced Small Form Factor Pluggable Module
- Mechanical specifications per SFF Committee SFF-8432 Improved Pluggable Form factor "IPF"
- Maximum power dissipation 350 mW

##### Active Optical Cable Assembly:

- 0 to 70 °C case temperature operating range
- Proven High Reliability 850 nm technology: Avago VCSEL transmitter and Avago PIN receiver
- Hot pluggable for ease of servicing and installation
- Two Wire Serial (TWS) interface
- Utilizes optical fiber for high density and thin, lightweight cable management

## Part Numbers

AFBR-71ERxxZ

40GbE QSFP+ to 4× 10GbE SFP+ Breakout AOC

Where xx = cable length in meters: 01, 03, 05, 07, 10, 15 and 20

### Transmitter

For details on the QSFP+ Transmitter: See Datasheet for AFBR-7QERxxZ (QSFP+ Active Optical Cable)

For details on the SFP+ Transmitter: See Datasheet for AFBR-2CARxxZ (SFP+ Active Optical Cable)

### Receiver

For details on the QSFP+ Receiver: See Datasheet for AFBR-7QERxxZ (QSFP+ Active Optical Cable)

For details on the SFP+ Receiver: See Datasheet for AFBR-2CARxxZ (SFP+ Active Optical Cable)

### CAUTION!

There are no user serviceable parts nor maintenance requirements for the AFBR-71ERxxZ. All mechanical adjustments are made at the factory prior to shipment. Tampering with, modifying, misusing or improperly handling the AFBR-71ERxxZ will void the product warranty. It may also result in improper operation and possibly overstress the device. Performance degradation or device failure may result. Operating above maximum operating conditions or in a manner inconsistent with its design and function may result in exposure to hazardous light radiation and may constitute an act of modifying or manufacturing a laser product. Persons performing such an act are required by law to recertify and re-identify the laser product under the provisions of U.S. 21 CFR (Subchapter J) and TUV.

### Customer Manufacturing Processes

This AOC is pluggable and is not designed for aqueous wash, IR reflow, or wave soldering processes.

### Regulatory & Compliance Issues

Various standards and regulations apply to the cables. These include eye-safety, EMC, ESD and RoHS. See the Regulatory Section for details, including component recognition. Note: The transmitter is a Class 1M laser product – In the event of fiber breakage, **DO NOT VIEW RADIATION DIRECTLY WITH OPTICAL INSTRUMENTS**. See Regulatory Compliance Table for details.

### Electrostatic Discharge (ESD)

The AFBR-71ERxxZ is compatible with ESD levels found in typical manufacturing and operating environments. In the normal handling and operation of optical cables, ESD is of concern in two circumstances. The first case is during handling of the AOC before inserting it into a compliant cage. To protect the device, it is important to use normal ESD handling precautions. These include the use of grounded wrist straps, workbenches and the floor wherever an optical cable is handled. The second case to consider is static discharges to the exterior of the host equipment chassis after installation. If the optical interface is exposed to the exterior of host equipment cabinet, the optical cable may be subject to system level ESD requirements.

### Handling and Cleaning

The Active Cable-end can be damaged by exposure to current surges and over voltage events. Care should be taken to restrict exposure to the conditions defined in the Absolute Maximum Ratings. Wave soldering, reflow soldering and/or aqueous wash process with the modules on board are not recommended. Normal handling precautions for electrostatic discharge sensitive devices should be observed.

## Absolute Maximum Ratings

Stress in excess of any of the individual Absolute Maximum Ratings can cause immediate catastrophic damage to the AOC even if all other parameters are within Recommended Operation Conditions. It should not be assumed that limiting values of more than one parameter can be applied to the AOC concurrently. Exposure to any of the Absolute Maximum Ratings for extended periods can adversely affect reliability.

Parameter	Symbol	Min	Max	Units	Reference
Storage Temperature	T <sub>s</sub>	-40	85	°C	
3.3 V Power Supply Voltage	V <sub>CC</sub>	-0.3	3.6	V	
Data Input Voltage – Single Ended		-0.3	4	V	
Data Input Voltage – Differential	V <sub>dip</sub> - V <sub>din</sub>		1.0	V	1
Low Speed Control Input Voltage	V <sub>i</sub>	-0.5	V <sub>CC</sub> +0.5, 3.6	V	
Low Speed Control Output Current	I <sub>o</sub>	-20	20	mA	
Relative Humidity	RH	5	85	%	

## Recommended Operating Conditions

Recommended Operating Conditions specify parameters for which the electrical characteristics hold unless otherwise noted. Electrical characteristics are not defined for operation outside the Recommended Operating Conditions, reliability is not implied and damage to the module may occur for such operation over an extended period of time.

Parameter	Symbol	Min	Typ	Max	Units	Reference
Case Temperature	T <sub>c</sub>	0		70	°C	2
3.3 V Power Supply Voltage	V <sub>CC</sub>	3.135	3.3	3.465	V	
Signal Rate per Channel			10.3125		GBd	3
Control* Input Voltage High	V <sub>ih</sub>	2		V <sub>CC</sub> +0.3	V	
Control* Input Voltage Low	V <sub>il</sub>	-0.3		0.8	V	
Two Wire Serial (TWS) Interface Clock Rate				400	kHz	
Power Supply Noise				50	mVpp	4
Receiver Differential Data Output Load			100		Ohms	

\* Control signals, LVTTTL (3.3 V) compatible

1. This is the maximum voltage that can be applied across the differential inputs without damaging the input circuitry.
2. The position of case temperature measurement is shown in AFBR-7QERxxZ Datasheet (QSFP+) and AFBR-2CARxxZ Datasheet (SFP+)
3. 64b/66b coding is assumed
4. Power Supply Noise is defined as the peak-to-peak noise amplitude over the frequency range at the host supply side of the recommended power supply filter with the module and recommended filter in place. Voltage levels including peak-to-peak noise are limited to the recommended operating range of the associated power supply. See AFBR-7QERxxZ Datasheet (QSFP+) and AFBR-2CARxxZ Datasheet (SFP+) for respective recommended power supply filter.

## Active Cable-End Electrical Characteristics

The following characteristics are defined over the Recommended Operating Conditions unless otherwise noted. Typical values are for  $T_c = 40\text{ }^\circ\text{C}$ ,  $V_{CC} = 3.3\text{ V}$

Parameter	Symbols	Min	Typ	Max	Units	Reference
QSFP+ 40G Active Cable-End Power Consumption				1.5	W	
QSFP+ 40G Active Cable-End Power Supply Current				475	mA	
SFP+ 10G Active Cable-End Power Consumption				0.35	W	
SFP+ 10G Active Cable-End Power Supply Current				87	mA	

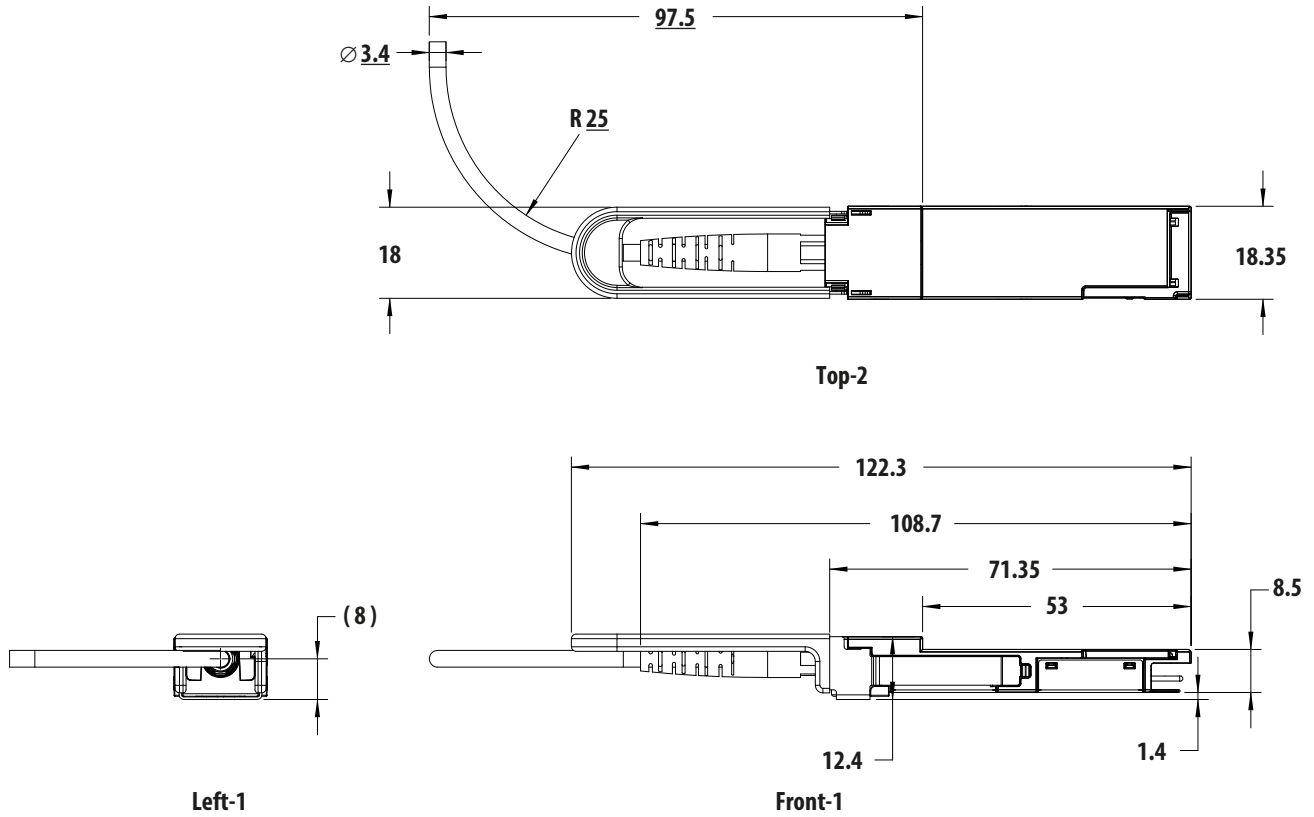
Refer to the QSFP+ AOC Datasheet **AV02-3542EN DS AFBR-7QERxxZ** for the following information:

- QSFP+ AOC-end Transmitter Electrical Characteristics
- QSFP+ AOC-end Receiver Electrical Characteristics
- QSFP+ AOC Regulator Compliance
- QSFP+ Pad Layout
- QSFP+ AOC-end Case Temperature Measurement Point
- QSFP+ AOC-end Recommended Host Board Power Supply Filter
- TWS Interface Bus Timing
- QSFP+ AOC-end Low Speed Control Interface, I/O Timing for Control and Status Functions & Memory Map

Refer to SFP+ AOC Datasheet **AV02-4397EN DS AFBR-2CARxxZ** for the following information:

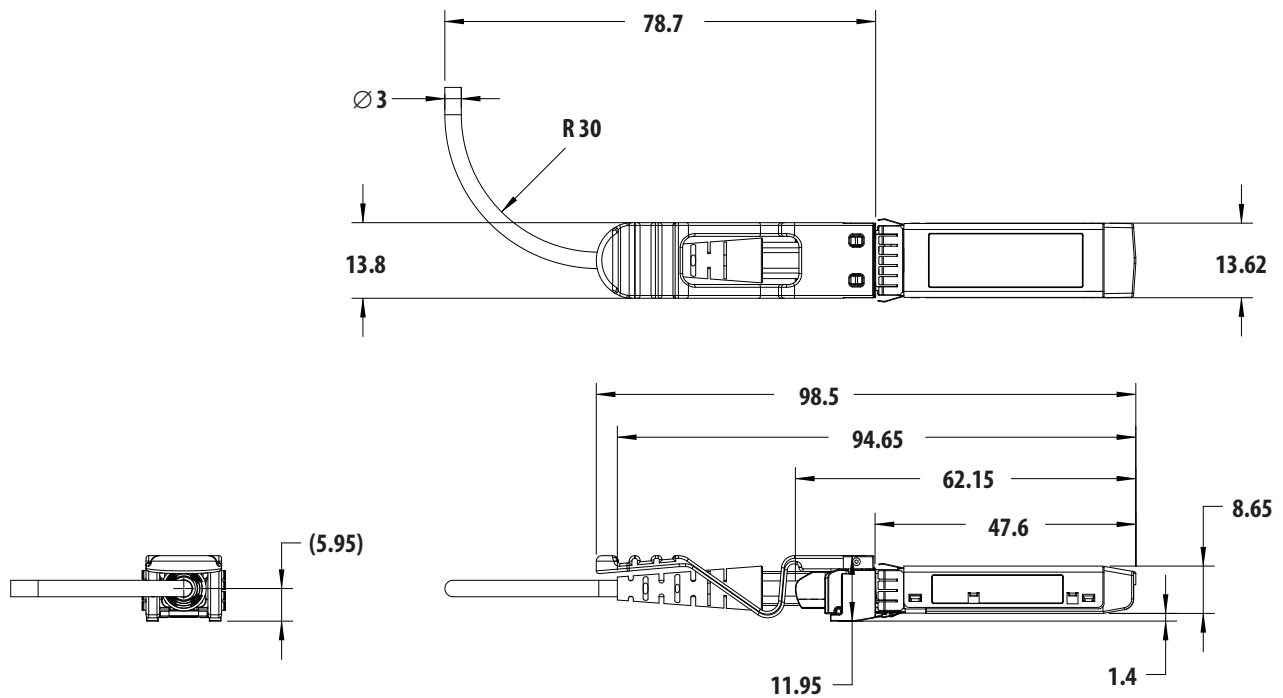
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## Package Outline



Dimensions in Millimeters

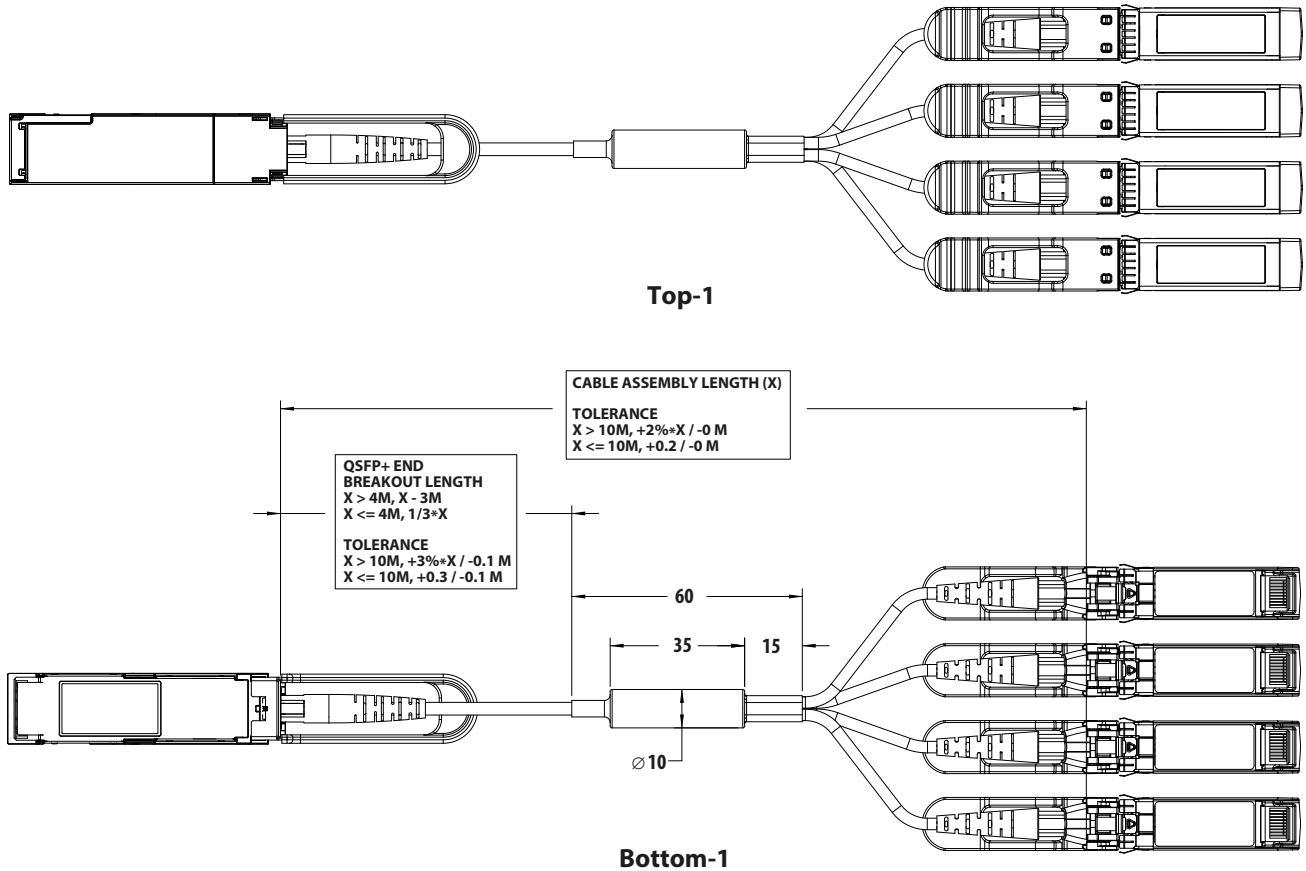
Figure 1. Mechanical Package Outline, Connector and Bend Radius for QSFP+ AOC-end



Dimensions in Millimeters

Figure 2. Mechanical Package Outline, Connector and Bend Radius for SFP+ AOC-end

## Mechanical Dimensions



### Dimensions in Millimeters

**Figure 3. QSFP+ to 4x SFP+ Breakout Details**

If the total cable length is greater than 4 m, then the breakout will be at point 3 m away from the QSFP+ end  
 E.g., 10 meter cable will have 7 m QSFP+, 3 m SFP+ breakout

If the total cable length X is less than 4 m, then the breakout will be at a point  $X * 1/3$  from QSFP+ end  
 E.g., 3 meter cable will have 1 m QSFP+, 2 m SFP+ breakout

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 AV02-3844EN - January 21, 2015

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