ADH-Tech *ADH Technology Co. Ltd .*

Datasheet

HDMI 2.0 Hybrid Active Optical Cable

(Preliminary)

Document Revision History

Date Edited	Rev.	Author	Pages	Change Description

1. Purpose

This document validates solely for the product of ADH-Tech, HDMI 2.0 Hybrid Active Optical Cable (AOC.) This document provides basic information and electronic characteristics for customer reference only, and subjects to change without notice.

2. Description

The product of HDMI 2.0 hybrid AOC has advanced optical fiber technology to extend the high-speed HDMI link length over 100-feets at data rate running up to 6-Gbps per channel (HDMI2.0) with superior image quality. This AOC is extremely easy to use for users with just plug-and-play to HDMI connector and very low power with no external power plug needed. In addition, unlike the heavy and inflexible property via traditional copper cables, the notable fiber technology brings the benefits with not only longer distance, but zero-loss and high-quality resolution, light cable weight, flexible and ultra-small bending radius of only 57-mm. This HDMI Active Hybrid Cable can be widely deployed in home theater, convention center, outdoor advertising or broadcasting, and so on, for high-definition video & audio display applications.

3. Feature

- **Plug-and-Play with users friendly**
  - No External Power Required
  - No Customer Setting for the Cable
- **Over 100 feet Maximum cable length**
  - Custom Length Available upon Request
- **HDMI 2.0 Maximum 6 Gbps per channel**
  - Aggregate data rate of 18-Gbps
- **Hybrid optical cable with fiber and copper wire**
  - Light Weight, Slim and Flexible Cable
- **Ultra-small bending radius**
  - Minimum Bending Radius of 57mm

4. Applications & Supported Resolution

Home Theater
Security Systems
Conference Room
LED Sign Boards
Auditorium
Medical Imaging Equipment Display
Blue-ray, 3D video, Projector, Set-top box, DVR, Game Consoles and Computer
Panel Information Displays for Airports, Stadiums and Outdoor Advertising
Supported Resolution: 4K UltraHD (60P, 8 bit 4:4:4 or 12bit 4:2:2), and backward compatible to 4K2K, 3D Full HD 1920 x 1080, 1080p deep color, 1080i, 720p, and 480p.

5. Absolute Maximum Rating

Not necessarily applied together. Exceeding these values may cause permanent damage. Functional operation under these conditions is not implied.

Parameter	Min	Typical	Max	Unit	Note
+5V Supply Voltage	-0.3	5.0	6.0	V	
Storage Temperature	-20		70	℃	
Relative Humidity (Non-Condensing)	10		80	—	

6. Specifications

Parameter	Min	Typical	Max	Unit	Note
General Operation Condition					
Operating Temperature	0		50	℃	
Signaling Bit Rate per Lane on D0, D1, D2	0.25		6.0	Gbps	
HDMI Connector Type	Type A				
High-Speed TMDS Lanes (Player Side (TP1) as Signal Input, 3.4Gbps < Rbit < 6Gbps)					
Singled-Ended High Level Voltage on D0, D1, D2	AVcc-400		AVcc+10	mV	
Singled-Ended Low Level Voltage on D0, D1, D2	AVcc-1000		AVcc-400	mV	
Singled-Ended High Level Voltage on CLK	AVcc-400		AVcc+10	mV	
Singled-Ended Low Level Voltage on	AVcc-1000		AVcc-200	mV	

CLK					
Absolute Input Differential Amplitude	400		1560	mV	
CLK Duty Cycle	40		60	%	
TMDS Clock Rate	85		150	MHz	
Differential Input Impedance	90	100	110	ohm	
High-Speed TMDS Lanes (Sink Side as Signal Output (TP2), 3.4Gbps < Rbit < 6Gbps)					
Sink Common Mode Voltage (as 8×50 ohm termination resistors)	3.1		3.5	V	1
Absolute Output Differential Amplitude	150		1200	mV	
Differential Vertical Eye Opening	Per Figure 6-4, 6-5, & Table 6-5			mV	2
Differential Horizontal Eye Opening	Per Figure 6-4, 6-5, & Table 6-5			Tbit	2

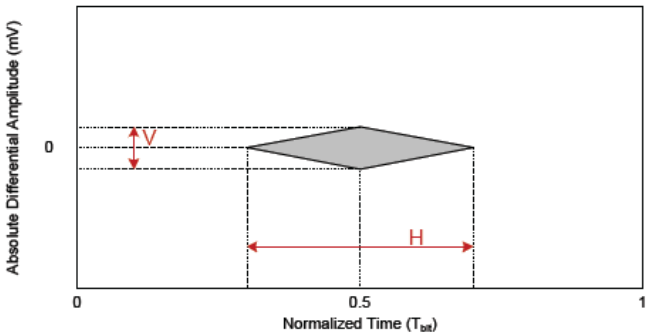


Figure 6-4: Eye diagram at TP2_EQ

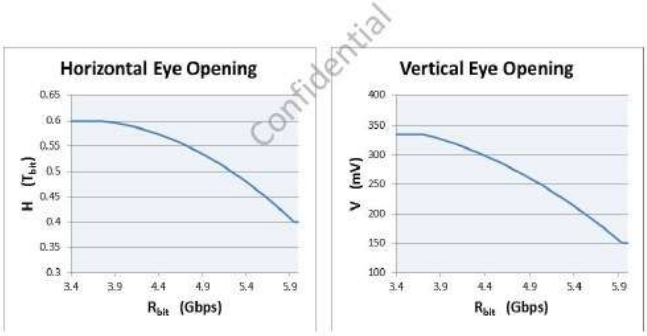


Figure 6-5: Plots of the Functions defining horizontal and vertical dimensions for the eye diagram at TP2_EQ

Table 6-5: Functions defining horizontal and vertical dimensions for the eye diagram at TP2_EQ

TMDS Bit Rate (Gbps)	H (T_{bit})	V (mV)
3.4 < R_{bit} ≤ 3.712	0.6	335
3.712 < R_{bit} < 5.94	-0.0332 R_{bit}^2 + 0.2312 R_{bit} + 0.1998	-19.66 R_{bit}^2 + 106.74 R_{bit} + 209.58
5.94 ≤ R_{bit} ≤ 6.0	0.4	150

Notes:

1. The output common voltage (AVcc) in the Display end is pulled-up by sink with 50-ohm for each TMDS lanes. The sink has to be well suppressed the supply voltage noise less than 100mV at any time.
2. The differential vertical and horizontal eye openings are specified with NO reference cable equalizer (EQ) applied. Because of superior linkage through optical fibers, the output eye is not degraded over length. Therefore, the adaptive reference cable EQ is normally very low or auto-disabled over many TV display or projector related sinks. In most cases, the effective eye, emitting from this hybrid AOC, can be characterized by the below clear eye as a good reference.

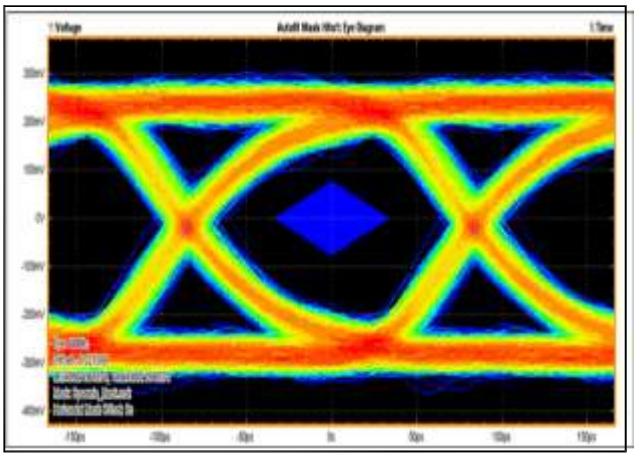


Fig. Reference Hybrid AOC Output Eye (@ 6Gbps & Zero EQ Gain)

Parameter	Min	Typical	Max	Unit	Note
Low-Speed Communication Lanes — CEC					
Voltage Drop over Cable Length			0.2	V	@20m
Low-Speed Communication Lanes — DDC of I2C					
DDC Pull-up Resistors of Source Side		47K		ohm	
DDC Pull-up Resistors of Sink Side		2K		ohm	
SCL Clock Frequency		100K		Hz	
DDC Communication	Fully support bi-directional EDID and HDCP2.2 communication				
Low-Speed Communication Lanes — +5V Power					
5V Voltage from HDMI Source	4.8		5.3	V	
Current Consumption from Source		130	200	mA	3
Power Supply Noise from HDMI 5V Source (V_{noise})			200	mVpp	$0 < f_{noise} <$ 10GHz
Voltage Drop over Cable Length			0.2	V	@20m
Low-Speed Communication Lanes — HPD					
Voltage Drop over Cable Length			0.2	V	@20m

Notes:

3. This AOC is powered by HDMI 5V from HDMI SOURCE / PLAYER. The SOURCE has to supply at least 200-mA per its HDMI 5V Power Pin to empower this active cable. Otherwise, the black-image could be found due to abnormal powering condition of this cable. Per our investigation, most commercially available players or amplifiers can support this power. In addition, the supplied 5V quality from HDMI source has to be especially cared, like its DC power drop or ripples from power supply noise rejection. Some commercially HDMI sources with those above-mentioned 5V non-stability issues may lead to random image / sound noise by using this HDMI AHC. Contact ADH-Tech if the customer encounters this issue.

7. HDMI Connector Pin Assignment

Connector of this HDMI 2.0 Hybrid AOC is fully compliant with HDMI Type-A standard with pin assignment shown in the below.

Tab. HDMI Connector Physical Layer Interface

Pin	Symbol	Definition
1	CH2+	TMDS Data Signal Channel 2 Positive
2	GND	TMDS Data Signal Channel 2 Shield
3	CH2-	TMDS Data Signal Channel 2 Negative
4	CH1+	TMDS Data Signal Channel 1 Positive
5	GND	TMDS Data Signal Channel 1 Shield
6	CH1-	TMDS Data Signal Channel 1 Negative
7	CH0+	TMDS Data Signal Channel 0 Positive
8	GND	TMDS Data Signal Channel 0 Shield
9	CH0-	TMDS Data Signal Channel 0 Negative
10	CLK+	TMDS Clock Channel Positive
11	GND	TMDS Clock Channel Shield
12	CLK-	TMDS Clock Channel Negative
13	CEC	Consumer Electronics Control
14	Utility	Not Used
15	SCL	I^2C-bus SCL
16	SDA	I^2C-bus SDA
17	GND	DDC/CEC Ground
18	+5V Power	+5V Power
19	HPD	Hot Plug Detect

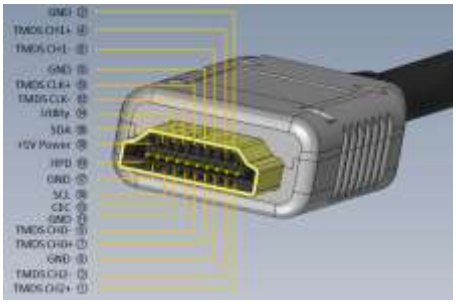
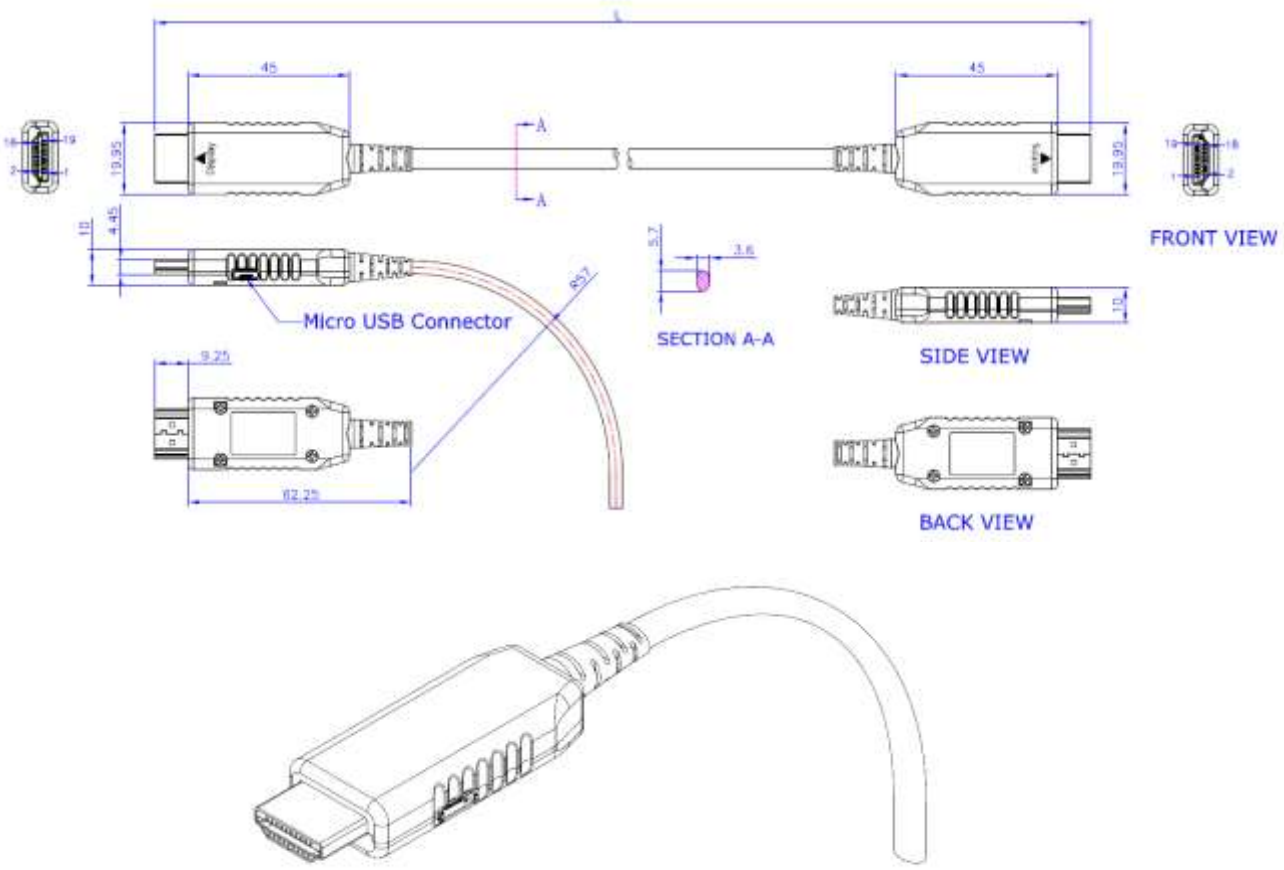


Fig. HDMI Type-A Connector

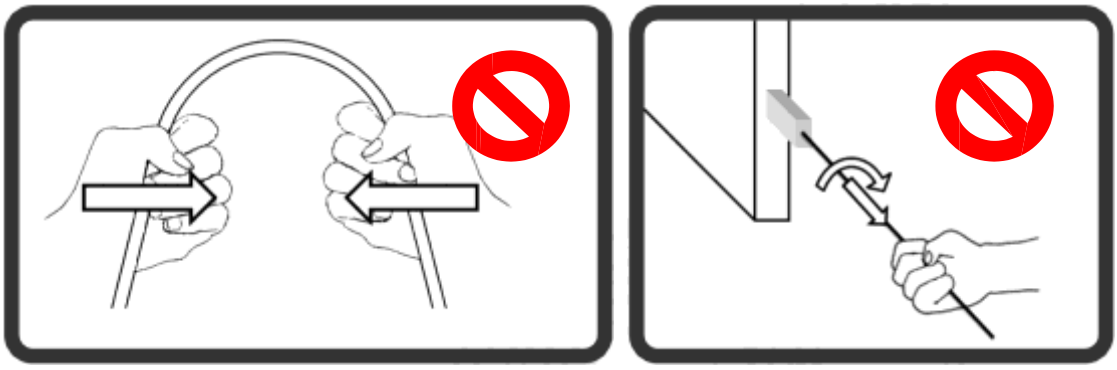
8. Physical Dimension



Unit: mm

9. Handling

- Care should be taken to restrict exposure to the conditions defined in the Absolute Maximum Ratings.
- Put the product in an even and stable location. If the product falls down or drops, it may cause an injury or malfunction.



- The cable must not be subject to extremely bending during installation or while in operation. If you bend the cable at a radius less than the cable minimum bend radius, the cable may get permanently damaged. (referring left picture)
- Don’t twist or pull by force ends of the cable. It may cause malfunction. (referring right picture)

10. Special Note

- To keep system working properly, always connect the cable **“Source”** end toward A/V source devices such as DVD player…etc. and always connect the cable **“Display”** end toward A/V sink devices such as TV...etc.
- This cable doesn’t support HEAC (HDMI Ethernet and Audio Return Channel).