



High-Definition Multimedia Interface

High-Definition Multimedia Interface™ (HDMI) is a connection standard which carries uncompressed high-definition digital video, up to 8 separate channels of uncompressed digital audio and command control. While there are many benefits to the HDMI standard, the following are the most common.

HDMI Benefits by Target Market

- » **Consumers** — A one cable solution make connections simpler
- » **CE Manufactures** — A lower cost, and standard method, of connecting components
- » **Movie Studios** — A means to protect content
- » **PC Manufactures** — A bridged gap between consumer electronics and personal computers
- » **Everyone** — A standard that allows upgrades to allow unforeseen future technologies

In December of 2002, those goals were realized as the HDMI 1.0 standard and the HDMI connector. HDMI was created as a forward-looking specification with the ability to be updated as further market requirements arose. This is a benefit in that HDMI continues to evolve to meet future digital connection demands.

HDMI Version Updates

1.1 Added support for DVD Audio

1.2 Added support for SACD Audio

Permitted PC applications to use only RGB color space

1.3 Increases bandwidth to 10.2Gbps

Offers support for 16-bit color, increased refresh rates (ex. 120 Hz), support for 1440p/ WQXGA resolutions

Supports xvYCC color space standard

Adds features to automatically correct audio video synchronization (lip sync)

Adds mini connector

Adds support for Dolby® TrueHD and DTS-HD Master Audio standards

HDMI Connections

| | | | |
|--------|-------------------|--------|---------------------------|
| Pin 1 | TMDS Data2+ | Pin 11 | TMDS Clock Shield |
| Pin 2 | TMDS Data2 Shield | Pin 12 | TMDS Clock- |
| Pin 3 | TMDS Data2- | Pin 13 | CEC |
| Pin 4 | TMDS Data1+ | Pin 14 | Reserved (N.C. on device) |
| Pin 5 | TMDS Data1 Shield | Pin 15 | SCL |
| Pin 6 | TMDS Data1- | Pin 16 | SDA |
| Pin 7 | TMDS Data0+ | Pin 17 | DDC/CEC Ground |
| Pin 8 | TMDS Data0 Shield | Pin 18 | +5 V Power |
| Pin 9 | TMDS Data0- | Pin 19 | Hot Plug Detect |
| Pin 10 | TMDS Clock+ | | |

HDMI Bandwidth Requirements

The bandwidth sent through the HDMI chips and cabling are dependent upon the format of the digital signal. A simple way to calculate the video bandwidth of a digital cable is by the following formula :

$$\text{Bandwidth} = \text{Signal Resolution} * \text{Frame Rate} * \text{Color Depth}$$

| Format | Horizontal Pixels | Vertical Pixels | Pixels / Frame | Frames / Second | Color Depth (Bits / pixel) | Bandwidth Mbps (MHz) |
|--------------|-------------------|-----------------|----------------|-----------------|----------------------------|----------------------|
| 480 60p 8b | 640 | 480 | 307,200 | 60 | 8 | 147 (5) |
| 720 60p 8b | 1280 | 720 | 921,600 | 60 | 8 | 442 (15) |
| 1080 60i 8b | 1920 | 540 | 1,036,800 | 60 | 8 | 498 (17) |
| 1080 60p 8b | 1920 | 1080 | 2,073,600 | 60 | 8 | 995 (33) |
| 1080 60p 12b | 1920 | 1080 | 2,073,600 | 60 | 12 | 1493 (50) |

HDMI Cable Length

DVI is limited to a maximum of 15 feet (5 meters), while HDMI is designed to perform better over longer lengths; up to about 50 feet (15 meters). The maximum cable length is highly dependent on both the bandwidth as well as the DVI or HDMI cable build-quality.

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