

The World Leader in High-Performance Signal Processing Solutions

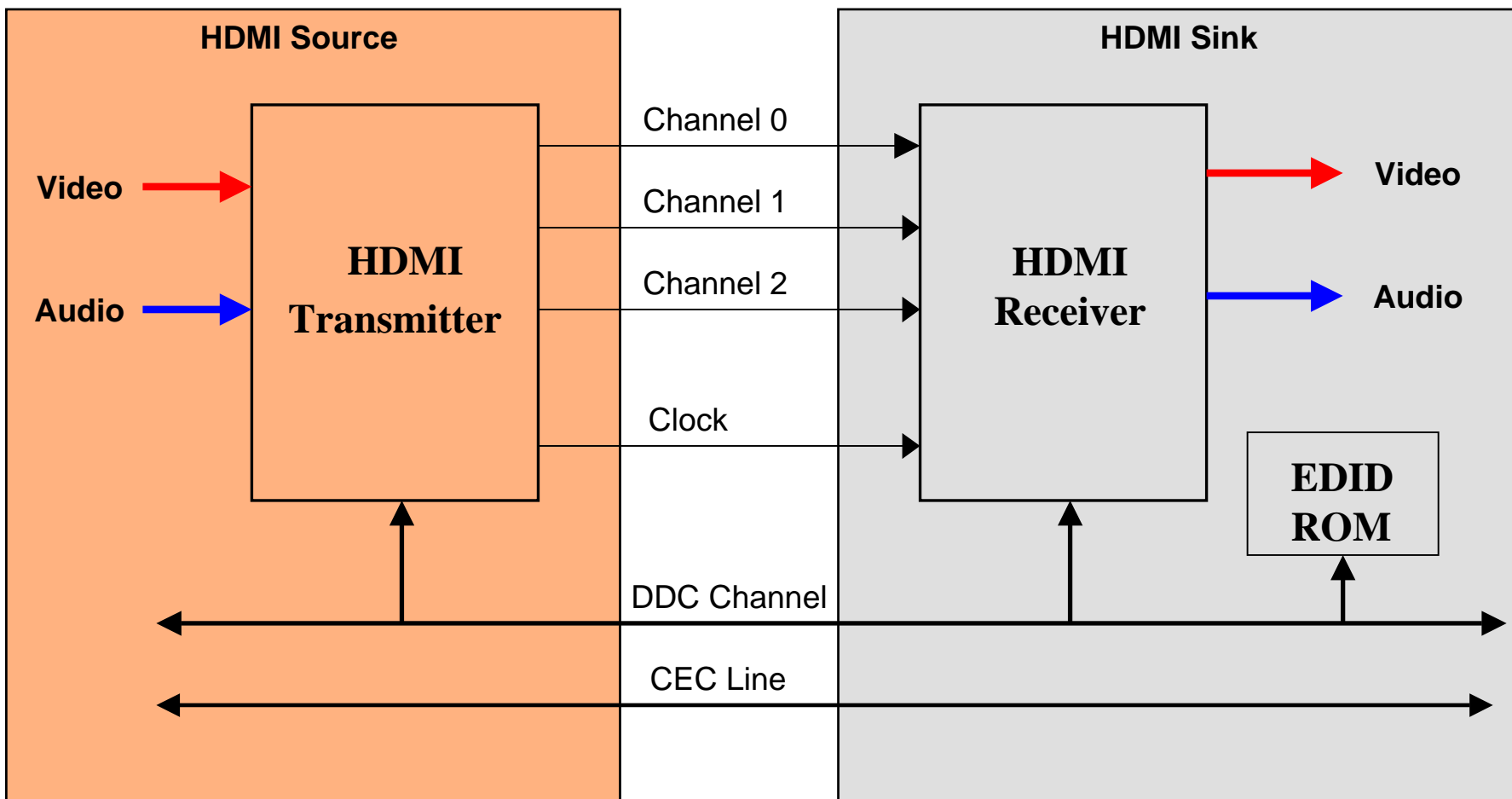


High Definition Multimedia Interface (HDMI)

What is HDMI?

- ◆ **Digital interface defined around DVI 1.0 that transmits video and audio on the same physical channel.**
- ◆ **Interface defined for use in the consumer market space.**
 - Requires separate licensing from that of DDWG's DVI.
 - Allows DVI/HDMI products to be sold in consumer products
- ◆ **Supports the use of HDCP copy protection.**
- ◆ **Utilizes VESA's Display Data Channel to read E-EDID from a display.**
- ◆ **Defines a different connector from that used on DVI.**
- ◆ **Supports optional CEC (Consumer Electronics Control), which allows high level control of all A/V products in a user environment.**

HDMI System

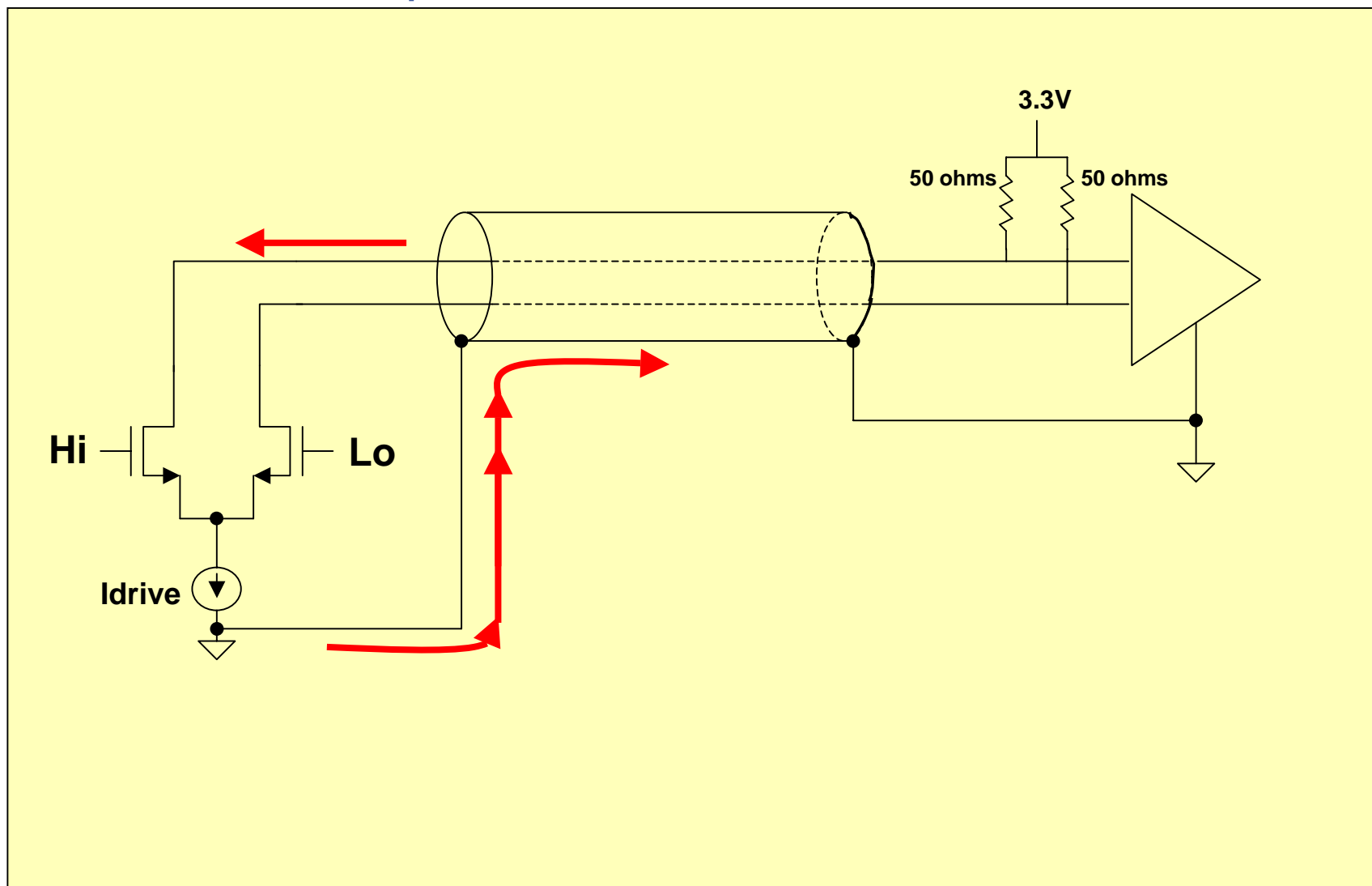




DVI 1.0: The Physical Interface

- ◆ **Digital Visual Interface (DVI) was developed by a group called the Digital Display Working Group or DDWG for the PC market.**
- ◆ **The interface is a high speed digital serial interface based on Transition Minimized Differential Signaling or TMDS.**
 - **Source synchronous architecture. Uses a separate channel to transmit the clock.**
 - **Used to provide variable data rates to handle the various VESA supported display resolutions.**
- ◆ **A complete connection from the source to the sink devices uses three data channels (RGB/YCbCr) and a clock.**

DVI 1.0: Simplified View of Link

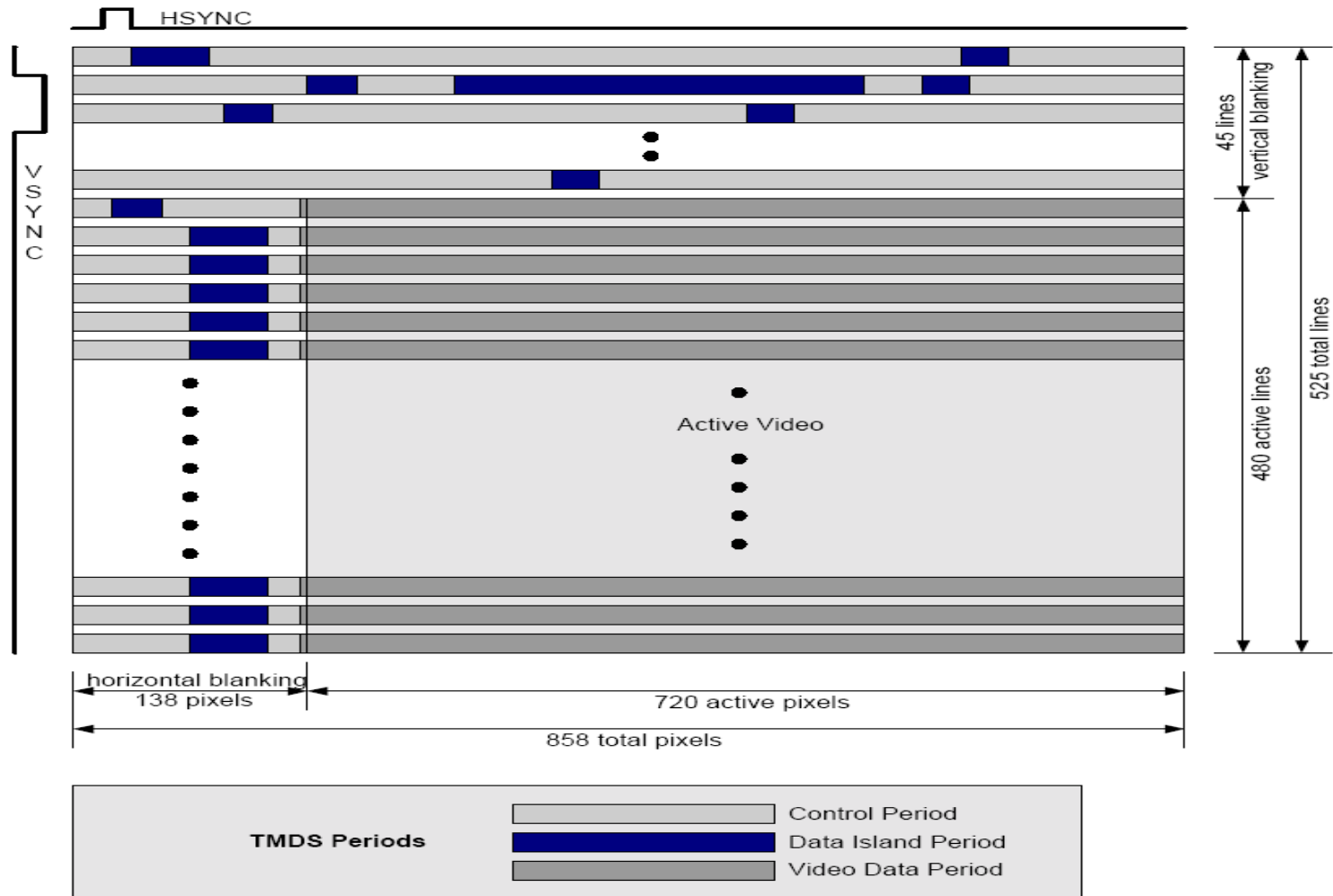




HDMI = DVI + Audio

- ◆ **Using the DVI physical link to transmit video/graphics**
- ◆ **Audio is added as a logical layer to the DVI phy.**
 - Digital audio processed into packets of data
 - These packets are scheduled for transmission during existing horizontal and vertical blanking times within a frame.
- ◆ **In addition, HDMI implements a packet called an infoFrame.**
 - InfoFrames are structures defined in the EIA-861B specification
 - EIA-861B is spec for DTV and uncompressed high speed digital interfaces.

HDMI = DVI + Audio





What is HDMI Data?

- ◆ **There are three categories of data that is transmitted via an HDMI link.**
 - **Video Data – Video pixel data (8b data encoded to 10b), and Guard Bands (fixed 10b pattern)**
 - **Data Island – Packet data, which can be either audio samples or Infoframes (TERC4 encoded, 4b encoded to 10b) as well as its own Guard Band (fixed 10b pattern).**
 - **Control – Control period coding, in which we find HSYNC, VSYNC (2b to 10b encoding) and a Preamble (used to determine whether subsequent data is video or data island)**



Transmission of Video/Graphics

- ◆ **HDMI transmits 24bit pixel data via three separate channels.**
- ◆ **Pixel rates supported are 25MHz to 165MHz.**
 - This is exactly the same as single link DVI 1.0
- ◆ **Also supports video rates below 25MHz e.g. 13.5MHz for 480i NTSC signals.**
 - Achieves this through a “pixel-repetition” scheme.
- ◆ **Can handle pixel data in RGB, YCbCr (4-4-4), YCbCr (4-2-2) formats.**
 - In all cases 24 bits of data per pixel clock are transmitted.



Transmission of Audio

- ◆ **Basic Audio is provided via an IEC60958 audio stream at 33kHz, 44.1kHz, or 48kHz.**
 - **Accommodates any normal stereo audio stream.**
- ◆ **Optionally this stream can be sent as a single channel at 192kHz.**
- ◆ **Can support IEC61937 compressed formats as found in surround-sound, Dolby Digital, etc. at rates up to 192kHz.**



Infoframes and HDMI

- ◆ **EIA/CEA-861B specifies a special packet called an infoframe**
- ◆ **HDMI sources and sinks are expected to use two basic infoframes.**
 - **AVI (Auxiliary Video Information) Infoframe**
 - ◆ **Communicates Colorimetry, Picture aspect ratio, Pixel-Repetition factor, RGB or YCbCr indicator, and others specified within 861B standard.**
 - **Audio Infoframe**
 - ◆ **Communicates, Channel count, Coding Type, Sample size, Sample frequency, Channel allocation and other audio specific information.**
- ◆ **There are other types of infoframes that are supported by the 861B standard, but are optional with respect to HDMI specification.**