

# A Complete Guide to the Digital Video Interface

Anthony van Winkle  
(DataPro International)



## What Is DVI ?

DVI stands for (D)igital (V)ideo (I)nterface. DVI is a popular form of video interface technology made to maximize the quality of flat panel LCD monitors and modern video graphics cards. It is a replacement for the P&D Plug & Display standard, and a step up from the digital-only DFP format for older flat panels. DVI cables are becoming increasingly popular with video card manufacturers, and most cards nowadays include both a VGA and a DVI output port.

In addition to being used as the standard computer interface, the DVI standard was, for a short while, the digital transfer method of choice for HDTV, EDTV, Plasma Display, and other ultra-high-end video displays for TV, movies, and DVDs. Likewise, even a few top-end DVD players have featured DVI outputs in addition to the high-quality analog Component Video. The digital market is now swinging towards the HDMI interface for high-definition media delivery, and DVI is being again constrained to the computer market.

## What Are The DVI Formats ?

There are three types of DVI connections: DVI-Digital, DVI-Analog, and DVI-Integrated (Digital & Analog):

### DVI-D - True Digital Video

DVI-D cables are used for direct digital connections between source video (namely, video cards) and digital LCD (or rare CRT) monitors. This provides a faster, higher-quality image than with analog, due to the nature of the digital format. All video cards initially produce a digital video signal, which is converted into analog at the VGA output. The analog signal travels to the monitor and is re-converted back into a digital signal. DVI-D eliminates the analog conversion process and improves the connection between source and display.



### DVI-A - High-Res Analog

DVI-A cables are used to carry a DVI signal to an analog display, such as a CRT monitor or budget LCD. The most common use of DVI-A is connecting to a VGA device, since DVI-A and VGA carry the same signal. There is some quality loss involved in the digital to analog conversion, which is why a digital signal is recommended whenever possible.

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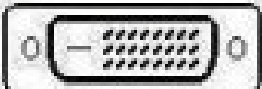

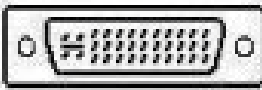
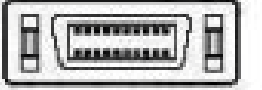
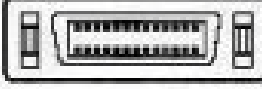
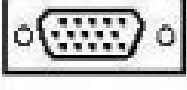
## DVI-I - The Best of Both Worlds

DVI-I cables are integrated cables which are capable of transmitting either a digital-to-digital signal or an analog-to-analog signal. This makes it a more versatile cable, being usable in either digital or analog situations.





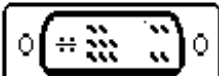
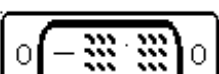
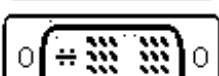
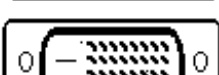
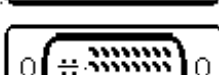
Like any other format, DVI digital and analog formats are non-interchangeable. This means that a DVI-D cable will not work on an analog system, nor a DVI-A on a digital system. To connect an analog source to a digital display, you'll need a VGA to DVI-D electronic convertor; to connect a digital output to an analog monitor, you'll need to use a DVI-D to VGA convertor.

## Connector for DVI, DFP, EVC & SVGA

	DVI-I (DVI Digital & Analog) Single Link
	DVI-I (DVI Digital & Analog) Dual Link
	DVI-D (DVI Digital) Single Link
	DVI-D (DVI Digital) Dual Link
	DVI-A (DVI Analog)
	EVC (P&D), used primarily on projectors
	DFP, HPCN20, Early Digital only connector
	DFP, HPCN26, Early Digital only connector
	Super VGA, HD15, Analog only

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-  VGA (analog only)
-  DFP (digital only)
-  DVI-A (analog only)
-  DVI-D single-link (digital only)
-  DVI-I single-link (digital + analog)
-  DVI-D dual-link (digital only)
-  DVI-I dual-link (digital + analog)



DVI-I (Single Link)



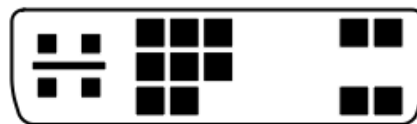
DVI-I (Dual Link)



DVI-D (Single Link)



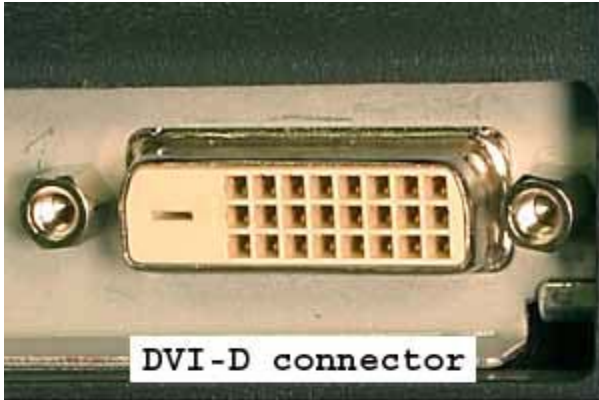
DVI-D (Dual Link)



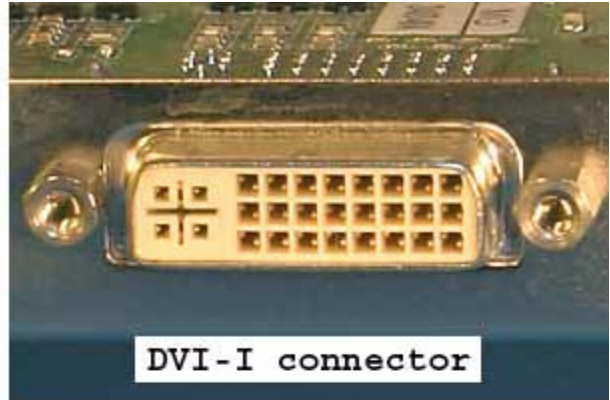
DVI-A

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DVI-D connector



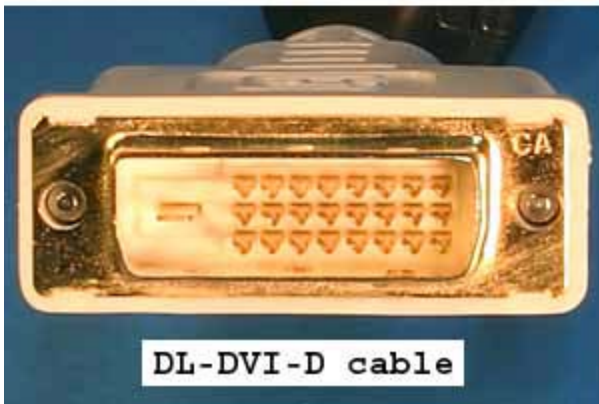
DVI-I connector



DVI-D cable



DVI-I cable



DL-DVI-D cable



DL-DVI-I cable



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CR-HD01



DVI (18+1) MALE TO FEMALE  
\*NICKEL PLATED\*

CR-HD02



DVI (24+1) MALE TO MALE  
\*Gold plated With Ferrites\*

CR-HD03



HDMI 19P MALE TO DVI (18+1) MALE  
\*Gold plated With Ferrites\*

CR-HD04



VGA MALE TO DVI MALE  
\*Gold plated\*

CR-HD05



HDMI 19P MALE TO HDMI 19P MALE  
\*Gold plated With Nylon Cover Outside\*

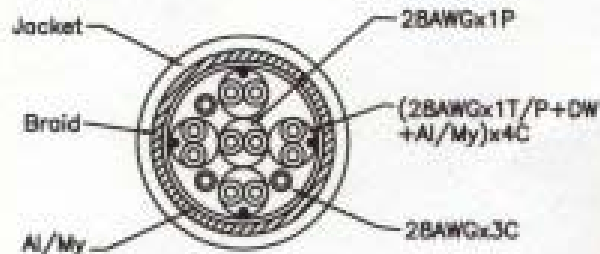
CR-HD06



HDMI 19P MALE TO HDMI 19P MALE  
\*Nickel plated With Blue Nylon cover\*

NOTE: 1. Cable Specification:

UL20276 [(28AWG\*1T/p+DW+AL/MY)\*4C  
+28AWG\*1P+28AWG\*3C] +AL/MY+BD  
Jacket Color : PMS Black 3U 2X



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## What Are Single And Dual Links ?

The Digital formats are available in DVI-D Single-Link and Dual-Link as well as DVI-I Single-Link and Dual-Link format connectors. These DVI cables send information using a digital information format called TMDS (transition minimized differential signaling). Single link cables use one TMDS 165Mhz transmitter, while dual links use two. The dual link DVI pins effectively double the power of transmission and provide an increase of speed and signal quality; i.e. a DVI single link 60-Hz LCD can display a resolution of 1920 x 1200, while a DVI dual link can display a resolution of 2560 x 1600.

## How Far Is The DVI Maximum Length?

The official DVI specification mandates that all DVI equipment must maintain a signal at 5 meters (16 feet) in length. But many manufacturers are putting out much stronger cards and bigger monitors, so the maximum length possible is never exact.

Although the mandated DVI spec is 5 meters, we do carry cables up to 25 feet, and have successfully extended them even longer than that (although results do vary depending on hardware). For guaranteed signal quality on long runs, you should consider using a powered DVI signal booster.

Despite common belief, there is such thing as signal loss in digital pictures. When a DVI run is unstable, you may see artifacts and "stuck" pixels on your display; further degradation tends to flicker out or shake, and the ultimate sign of loss is a blank display. In-house tests on varying equipment have produced strong signals up to 9 and 10 meters long. Tests at 12 meters generally resulted in signal loss and an unusable image on the display, and anything longer rendered no image at all.

Keep in mind that when using DVI-I cables at extensive lengths, you may not be seeing a digitally-clear image on your screen. Because analog has a much longer run, your display may auto-switch once the digital signal is too weak. For this reason, long runs are best done with VGA (for analog) or HDMI (for digital). If you have no option other than DVI, make sure you're getting the best image by using DVI-D cables and verifying that your display is set to digital input.

## How Do I Know Which Cable To Use?

Determining which type of DVI cable to use for your products is critical in getting the right cable the first time. Check both of the female DVI plugs to determine what signals they are compatible with.

- If one or both connections are DVI-D, you need a DVI-D cable.
- If one or both connections are DVI-A, you need a DVI-A cable.
- If one connection is DVI and the other is VGA, and the DVI is analog-compatible, you need a DVI to VGA cable or a DVI/VGA adaptor.
- If both connections are DVI-I, you may use any DVI cable, but a DVI-I cable is recommended.
- If one connection is analog and the other connection is digital, there is no way to connect them with a single cable. You'll have to use an electronic convertor box, available in either analog VGA to digital DVI or digital DVI to analog VGA.

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- If you still have questions, look at our DVI cable guide for an easy-to-use chart to help you find the right cable for you.

## How To Recognize A DVI Cable

There are two variables in every DVI connector, and each represents one characteristic.

1. The flat pin on one side denotes whether the cable is digital or analog:
  - A flat pin with four surrounding pins is either DVI-I or DVI-A
  - A flat pin alone denotes DVI-D
2. The pinsets vary depending on whether the cable is single-link, dual-link, or analog:
  - Two separated 9-pin sets (rows of 6) for a single-link cable
  - A solid 24-pin set (rows of 8) for a dual-link cable
  - A separated 8-pin and 4-pin set is for DVI-A.

## DVI Connector Guide

DVI-D Single Link  
Digital Only



Two sets of nine pins, and a solitary flat blade

DVI-A  
Analog Only



One set of eight pins and one set of four pins, with four contacts around the blade

DVI-I Single Link  
Digital & Analog



Two sets of nine pins and four contacts around the blade

DVI-D Dual Link  
Digital Only



Three rows of eight pins and a solitary flat blade

DVI-I Dual Link  
Digital & Analog



Three rows of eight pins and four contacts around the blade

## What Kind of DVI Cable do I Need?

The variety of DVI connection types can be confusing, and if you use the wrong type of cable for the connection you need to make, your video won't get through. This article is meant to help you figure out just what type of connection will, or won't, work with your devices which have DVI sockets.

## Two Signal Types

In general, there are only two signal types which run through DVI connectors. The two types are digital and analog, and they are incompatible with one another. If you use a DVI cable to connect a device that sends out only digital signals to a device that accepts only analog signals, or vice versa,

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you'll get no signal; so the first question you have to answer is whether your devices can talk to each other at all.

## The Digital Signal: "DVI-D"

The digital signal type that runs through a DVI cable is sometimes referred to as DVI-D. This format is completely incompatible with any analog signal format, and therefore cannot be connected to anything that doesn't also handle DVI-D or HDMI. If the socket on your device is a DVI-D socket (that is, if it lacks the four pin sockets for an analog signal which surround the broad flat "ground" pin; see photo at right) then this port will only handle DVI-D signals. It cannot be connected to any analog source, such as component video, composite video, VGA, or the like. It can, however, be connected to an HDMI device by using a DVI/HDMI cable.

But some devices which support DVI-D may not have a DVI-D socket. Instead, they may have a DVI-I socket, which does have four pin sockets around the flat ground pin. When a device has a DVI-I socket, it may be any of three types, and which of these it is can ordinarily be determined by consulting your user's manual:

(1) DVI-D only; this device has no signal available on the analog pins, but uses a DVI-I socket only to allow a DVI-I cable to be used.



(2) DVI-A only; this device has no DVI-D digital signal available, and is simply using a DVI socket as a port for accepting a regular analog signal format (usually RGBHV, which would include VGA). The device may be connected to any RGBHV device, using a DVI-I cable, a DVI/VGA cable, or a DVI breakout to five separate lines for R, G, B, H and V.

(3) True DVI-I; this device has both analog and digital capability through this port. It may autosense, using a digital signal if present or an analog signal if no digital signal is found, or the digital/analog mode may have to be selected manually by a switch or menu selection.



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## The Analog Signal: "DVI-A"

As we've indicated, a device which has the DVI-I style connection, with pins for an analog DVI-I Plug: RGBHV signal, may accept RGBHV signals through the analog port. If this is the case, then it can be connected to a regular analog computer monitor signal (usually using a DVI to VGA adapter) or to any other RGBHV device (using, as appropriate, either a DVI to VGA adapter or a DVI breakout adapter which splits the signal out to five separate lines.

## What Kind of Cable do I Need?

Once you know whether your devices are compatible, selecting a cable to connect them is relatively simple. While there are DVI-I cables available, which will handle both analog and digital signals in one cable, there is no good reason to use one; in any application, only the digital or the analog part of a DVI-I cable will get used, and it's crowded enough inside a DVI cable without adding a bunch of redundant cables to the bundle.

## DVI Digital Connection Options

If your signal will be digital, you should use a digital-only cable. If both devices use DVI connections, then you will want a regular DVI-D cable. If one end is DVI and the other HDMI, you'll want a DVI-D to HDMI cable.

## DVI Analog Connection Options

If you're running a relatively short length--say, ten feet or less--of cable, the handiest way to make the connection is to use a one-piece adapter cable. We offer cables with a DVI plug on one end, and a VGA ("HD15," or "DB15") plug on the other, as well as cables with a DVI plug on one end and five male BNC plugs on the other. Alternatively, if you have a VGA cable you want to use in this application, you can purchase a little hardshell DVI/VGA adapter and use that with your existing cable.

If your run will be longer, we suggest using a full-sized set of RGBHV cables to make the connection, terminated with male BNCs at one end, together with a breakout adapter with a male DVI plug and five female BNCs at the other. Many people don't like to use adapters, and we're often asked whether this will contribute to signal loss. The answer is a definite no; the whole point of going to a full-sized cable, in fact, is to minimize signal loss. The loss associated with running any significant distance in miniature cable of the type that will fit a DVI plug is much greater than the loss associated with making a BNC/BNC connection along the line, and not only is the total attenuation loss lower using full-sized cables, but the loss of signal quality from impedance mismatch is far lower; it's simply much easier to maintain tight impedance tolerance in a full-sized cable than in a miniature cable, because the dimensions are easier to control