

220-1101

Connectors

Cables & Connectors

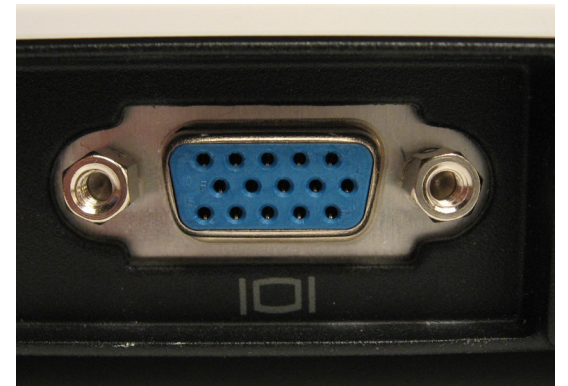
- Port – Generic name for any connection to motherboard or device
- Cable – the device between two ports

Video Cable and Connectors

- Need to know
 - VGA
 - DVI (all types)
 - HDMI
 - Mini-HDMI
 - Display Port

VGA

- Video Graphics Array
- Old technology - 1987
- Still used today
- Ports often coloured blue
- 15 pin D-Subminiature Connector
- Analog signals



DVI

- Digital Visual Interface
- 1999
- Not D connector
- DVI-A is analog only
 - Better than VGA
 - Can get converters to VGA
 - Blade is analog ground
- DVI-D is digital only
 - Cables must support at least 4.5M distance
- DVI-I is analog and digital
 - Cables must support at least 4.5M distance
 - Not for converting between Analog and Digital
- DVI-D and DVI-I can be Dual Link
 - higher speed and quality
 - Greater resolutions
- <https://www.displayninja.com/dvi-i-vs-dvi-d/>



DVI-I (Single Link)



DVI-D (Single Link)



DVI-I (Dual Link)



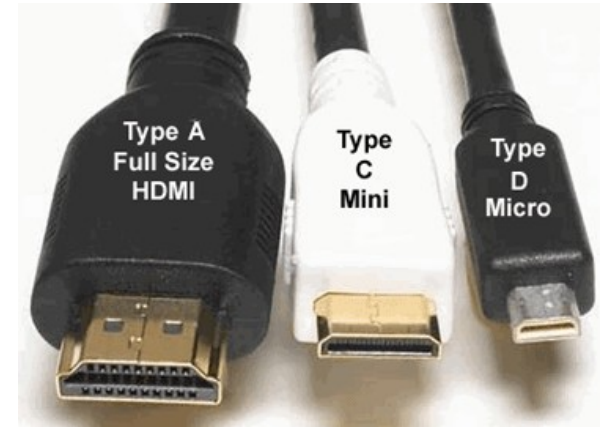
DVI-D (Dual Link)



DVI-A

HDMI

- High Definition Multimedia Interface
 - Only digital
 - 2002
 - Supports CEC feature
 - Consumer Electronics Council
 - Remote control signal support
 - Standard and High Speed Cables
 - Standard – 720p and 1080i
 - High Speed – 1080p, 4K and 3D



Differences between HDMI Ports

3 Types of HDMI Interface

Please carefully confirm your device and choose the corresponding type



Standard HDMI Connector Type A



Mini HDMI Connector Type C



Micro HDMI Connector



Standard HDMI

L: 10mm W: 14mm H: 4.5mm

Commonly used in TV, PC, Projector



Mini HDMI

L: 7mm W: 10mm H: 2mm

Commonly used in MP4, Pad, Camera



Micro HDMI

L: 5.5mm W: 6mm H: 0.2mm

Commonly used in Smart phones, Pads

HDMI

- V1.4
 - Introduced capability for controlling systems
 - 3D support
 - 4K at 30Hz refresh
 - 1080 at 120Hz refresh
 - Anti vibration Type E locking connector



HDMI

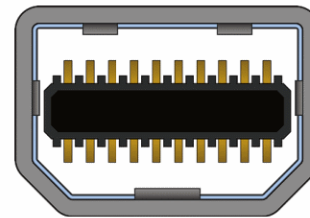
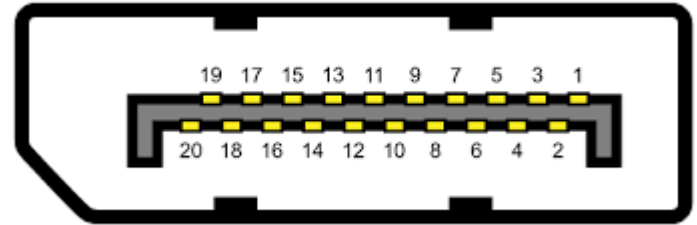
- V2.0
 - 4K at 60Hz
 - 21:9 aspect ratio
 - 32 channel audio
- V2.1
 - Called 48G (48 Gbps bandwidth)
 - Backwards compatible
 - 4K, 8K, and 10K refresh rate at 120Hz
- Compatible with DVI-D and DVI-I
 - Audio and remote control capability is lost

HDMI

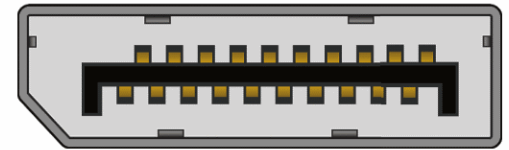
- HDMI to VGA requires powered converter
- Cable composition (quality) determine max length. 30M is possible.

Display Port

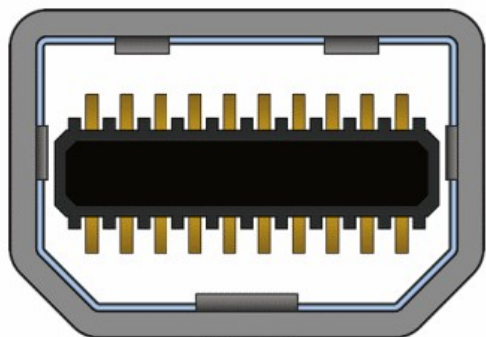
- Defined by Video Electronics Standards Association (VESA)
- 2008
- Replacement for VGA and DVI
 - Backwards compatible
- 3m length for passive
- 33m length for active
- Video but also carries audio
- Latch mechanism
- MDP – Mini DisplayPort



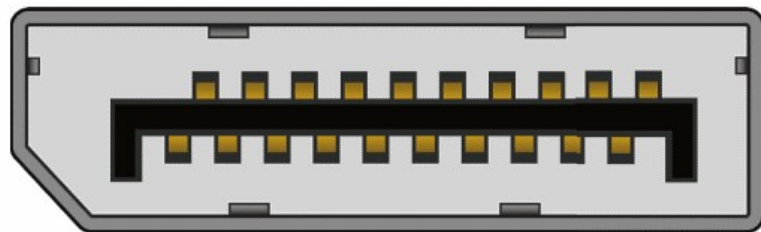
Mini DisplayPort



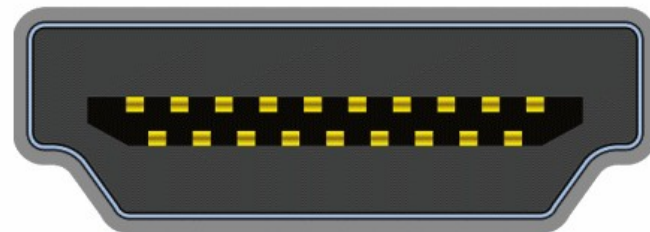
DisplayPort



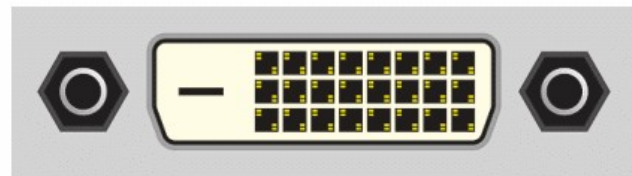
Mini DisplayPort



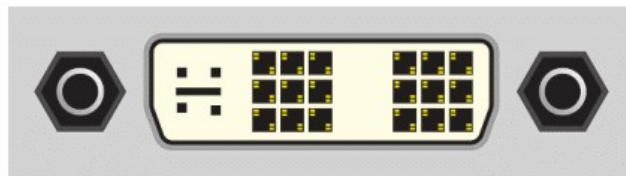
DisplayPort



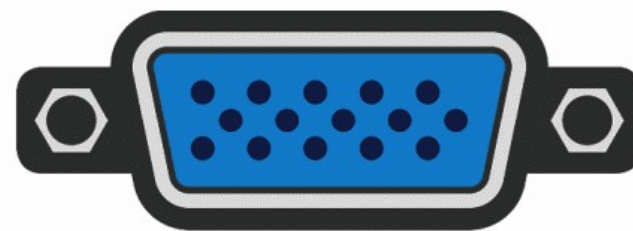
HDMI



Dual-link DVI



DVI-I



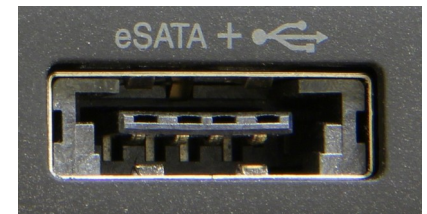
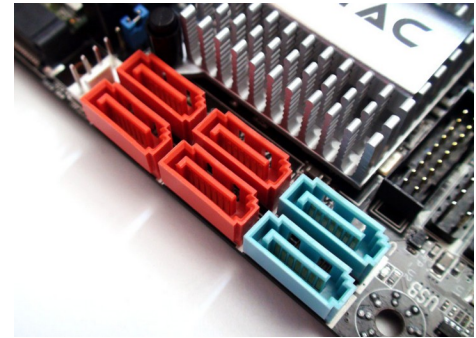
VGA

Hard Drive Cables and Connectors

- Connectors can be Onboard (Motherboard) or Offboard (via an adapter)
- Plugs are also called headers

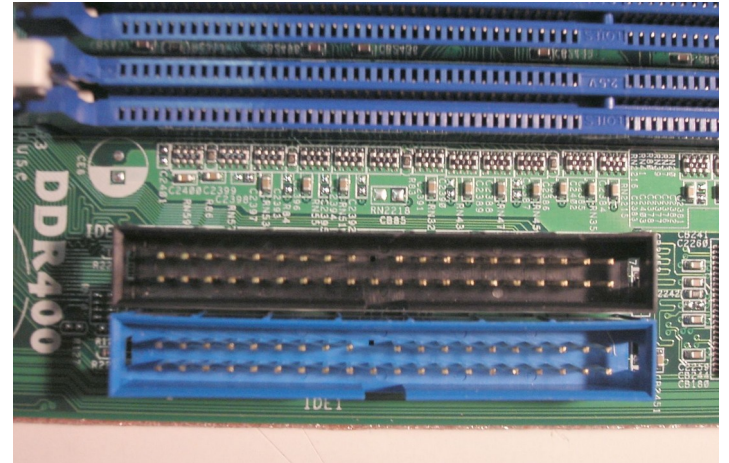
SATA

- Serial Advanced Technology Attachment
- Internal and external
- eSATA can support 15 devices but not power
 - Solved by Power over eSATA or eSATAp
- SATA I – 1.5Gb/s
- SATA II – 3Gb/s
- SATA III – 6Gb/s



PATA

- Parallel Advanced Technology Attachment
- Formerly IDE (Integrated Drive Electronics)
- 40 Pin – Pin 1 often Red
- Maximum 2 drives per cable
 - Master at End
 - Slave in middle



SCSI

- Small Computer System Interface
 - Storage devices primarily
 - Servers
 - Expensive
 - Originally SCSI parallel interface (SPI)
 - Serial Attached SCSI (SAS)



SAS

- 15000rpm drives
- Initiator
 - Similar to controller. Sends and receives data.
 - 128 targets can be connected
- Target
 - A device, typically a HDD
- Service Delivery Subsystem
 - Carries signals between Initiator and Target
- Expander
 - Allows multiple Initiators to be combined into one Service Delivery Subsystem
 - Can support upto 16256 devices

SAS Speeds

- SAS-1
 - 3 Gbps
- SAS-2
 - 6 Gbps
- SAS-3
 - 12 Gbps
- SAS-4
 - 22.5 Gbps

USB

- Universal Serial Bus
 - Host controller can have 127 devices
 - Reality is that you will never get to this many!
- A hub counts as one device
- USB 1.1 12 Mbps
- USB 2.0 480 Mbps
- USB 3.0 5 Gbps
- USB 3.1 10 Gbps
- USB 3.2 20 Gbps
- USB 4.0 40 Gbps



More USB

- USB 1.x and 2.0 up to 5m
- USB 3.x up to 3m



USB 4

- Based upon Thunderbolt 3
- Support for DisplayPort and PCIe tunneling
 - <https://www.techpowerup.com/review/usb4-guide-info-technology-details/2.html>
- Support for dual 4K displays or one 8K display
- Compatible with Thunderbolt 3 and 4 devices
- Backward compatibility to USB 2.0
- USB-C connector

USB Power

- Charging ports for devices
- USB Power Delivery (PD)
- Smartphone needs about 7.5 Watts to charge
- Laptop computers need about 60+ Watts

USB Power

- USB Battery Charging 1.0
 - 2007 - 5v, 1.5A (7.5W)
- USB Battery Charging 1.2
 - 2010 - 5V, 5A (20W)
- USB Power Delivery 1.0
 - 2012 - 20V, 5A (100W)
- USB Power Delivery 2.0
 - 2014 - 5V, 3A (15W)
- USB Power Delivery 3.0
 - 2015 - 20V, 5A (100W)
- USB Power Delivery 3.1
 - 2021 - 48V, 5A (240W)

Lightning

- Apple connector
- 8 Pin connector
- Not keyed



Thunderbolt

- Intel and Apple collaboration
- Primarily display
- 3m length
- Daisy chain 6 levels deep
- Monitors alone or at end of a chain
- Converters to DVI, VGA, and HDMI
- 4K, 3840 x 2160

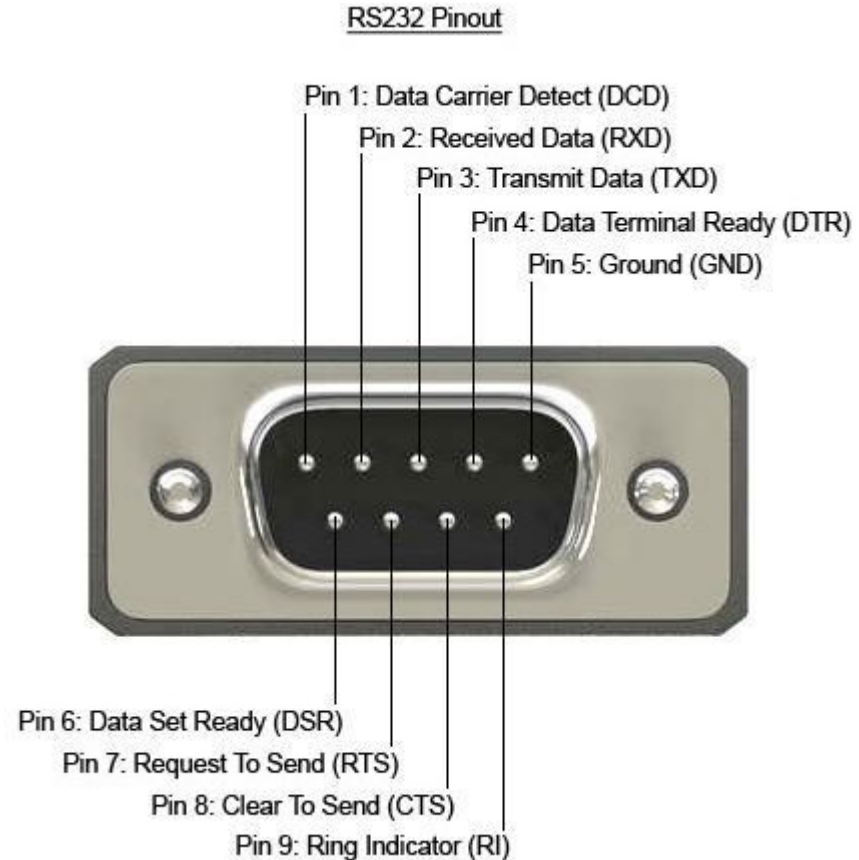


Thunderbolt Standards

- Thunderbolt 1
 - 2011. 10 gbps. Mini Display Port
- Thunderbolt 2
 - 2013. 20 gbps. Mini Display Port.
- Thunderbolt 3
 - 2015. 40 gbps. USB-C. Includes 10 gbps Ethernet Support
- Thunderbolt 4
 - 2020. 40 gbps. USB-C. Supports 2x 4K displays or 1x 8K display.
 - 32 gbps PCIe

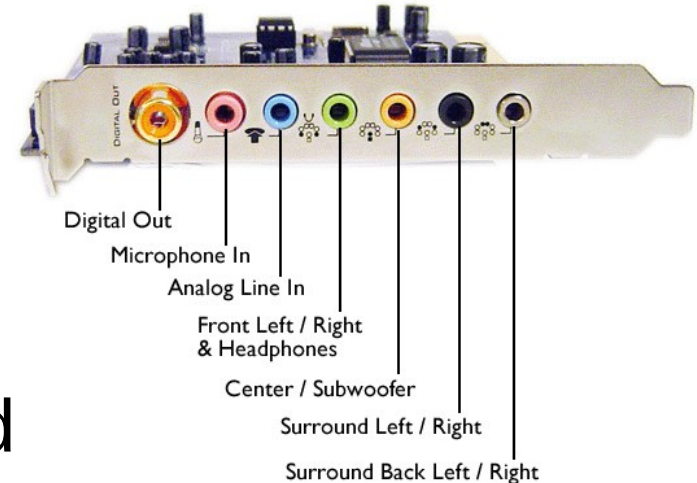
Serial Ports

- Low speed communication
- Only male connector on PC
- DB-9
- RS232 is a standard
- Rarely found today



Other Connectors

- Firewire
 - IEEE 1394
 - Rival to USB originally
 - 3.2 Gbps
- Analog Sound
 - 3.5mm jack
 - Combined input and output tod



Other Connectors

- Audio and video
 - Not at same time though
- Coaxial Cables
- Composite Video (Yellow)
- Component Video
 - luma y (uncoloured signal)
 - Pb and Pr (provide colour info)
 - Often called YPbPr
 - Digital version YCbCr



PS/2

- Personal System 2
- Small 6 pin mini-DIN
- Keyboard – Purple
- Mouse – Green
- Replaced by USB



Display Connectors

- Coaxial Cable

- Copper cable with a central conducting core surrounded with an insulator, shielding, and a jacket.
- Data signals are sent through the core.
- The shielding and jacket reduce EMI.



Display Connectors

- BNC (Bayonet Neill Concelman)
 - Connector most often used with coaxial cable.
 - Can connect radio equipment, aviation electronics, video signals, and other data signals.
 - Two versions: single strand and double strand.



Display Connectors

- miniDin-4
 - Used for S-Video connections.
 - S-Video is analogue
 - Two signals: brightness and colour.
 - (Note miniDin-6 used as PS-2 i/f on IBM-PC)
- <https://www.youtube.com/watch?v=iFO3EiQbNJ8>



Video Adapters and Converters



DVI to HDMI



DVI to VGA



Thunderbolt to DVI



HDMI to VGA

Resolution	Number of Pixels	Aspect Ratio	Standard	Typical Application
320 x 200	64,000	8:5	CGA	Original IBM PC color display
640 x 480	307,200	4:3	VGA	Older CRT monitors
800 x 600	480,000	4:3	SVGA	Low-resolution monitors and projectors
1,024 x 768	786,432	4:3	XGA	15" and 17" CRTs / LCDs; the most popular screen resolution on the web from 2009 - 2011
1280 x 720	921,600	16:9	HDTV	720p HD
1,280 x 1,024	1,310,720	5:4	SXGA	17" and 19" CRTs / LCDs
1,600 x 1,200	1,920,000	4:3	UXGA	De facto high-resolution standard for 20" LCDs and 21" high-end CRTs
1,600 x 900	1,440,000	16:9	HD+	Popular for 17.3" laptops
1,920 x 1,080	2,073,600	16:9	FHD	Full HD 1080p; BluRay; high-end laptops
1,680 x 1,050	1,764,000	16:10	WSXGA+	22" widescreen monitors
1,920 x 1,200	2,304,000	16:10	WUXGA	Popular tablet screen size; business projectors