

Audio & Video Formats for Digital Media

Audio Formats

Audio Formats can be broken down into three main categories. Uncompressed formats, [lossless compression](#) formats, and [lossy compression](#).

Uncompressed audio formats (often referred to as PCM formats) are just as the name suggests — formats that use no compression. This means all the data is available, at the risk of large file sizes. A WAV audio file is an example of an uncompressed audio file.

Lossless compression applies compression to an uncompressed audio file, but it doesn't lose information or degrade the quality of the digital audio file. The WMA audio file format uses lossless compression.

Lossy compression will result in some loss of data as the compression algorithm eliminates redundant or unnecessary information — basically it tosses what it sees as irrelevant information. Lossy compression has become popular online because of its small file size, it is easier to transmit over the Internet. MP3 and Real Audio files uses a lossy compression.

Common Windows-compatible Audio Formats

MP3 (.mp3)

[MP3](#) is the name of the file extension and also the name of the type of file for [MPEG](#), audio layer 3. Layer 3 is one of three coding schemes (layer 1, layer 2 and layer 3) for the compression of audio signals. Layer 3 uses perceptual audio coding and psychoacoustic compression to remove all superfluous information (more specifically, the redundant and irrelevant parts of a sound signal. The stuff the human ear doesn't hear anyway). It also adds a MDCT (Modified Discrete Cosine Transform) that implements a filter bank, increasing the frequency resolution 18 times higher than that of layer 2. The result in real terms is layer 3 shrinks the original sound data from a CD (with a bit rate of 1411.2 kilobits per one second of stereo music) by a factor of 12 (down to 112-128kbps) without sacrificing sound quality.

WMA - Windows Media Audio (.wma)

Short for Windows Media Audio, [WMA](#) is a Microsoft file format for encoding digital audio files similar to MP3 though can compress files at a higher rate than MP3. WMA files, which use the ".wma" file extension, can be of any size compressed to match many different connection speeds, or bandwidths.

WAV (.wav)

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[WAV](#) is the format used for storing sound in files developed jointly by Microsoft and IBM. Support for WAV files was built into Windows 95 making it the de facto standard for sound on PCs. WAV sound files end with a .wav extension and can be played by nearly all Windows applications that support sound.

Real Audio (.ra .ram .rm)

Real Audio is a proprietary format, and is used for streaming audio that enables you to play digital audio files in real-time. To use this type of file you must have RealPlayer (for Windows or Mac), which you can download for free. Real Audio was developed by RealNetworks.

MIDI - Musical Instrument Digital Interface (.mid)

Short for musical instrument digital interface, [MIDI](#) is a standard adopted by the electronic music industry for controlling devices, such as synthesizers and sound cards, that emit music. At minimum, a MIDI representation of a sound includes values for the note's pitch, length, and volume. It can also include additional characteristics, such as attack and delay time.

Ogg (.ogg)

[Ogg](#) is an audio compression format, comparable to other formats used to store and play digital music, but differs in that it is free, open and unpatented. It uses Vorbis, a specific audio compression scheme that's designed to be contained in Ogg.

Recommended Reading: See more formats in [Webopedia's Audio Category](#).

Converting Between Different Audio Formats

With a slew of software applications available today, consumers can convert one digital audio file format to virtually any other. many of the programs available today offer standard burning or converting tools to enable consumers to create CDs on their computer which can be played in home or car stereos. Usually these tools will convert or burn uncompressed WAV PCM, compressed WAV , MP3, and Ogg Vorbis.

Did You Know...

Marketing firm iSuppli predicts that total MP3 player shipments will expand to 132 million units in 2009, rising at a compound annual growth rate (CAGR) of 29.1% from 36.8 million in 2004. [\[iSuppli\]](#)

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Key Terms To Understanding Digital Audio Formats

[digital audio](#)

Refers to the reproduction and transmission of sound stored in a digital format. This includes CDs as well as any sound files stored on a computer.

[data compression](#)

Storing data in a format that requires less space than usual.

[lossless compression](#)

Refers to data compression techniques in which no data is lost.

[lossy compression](#)

Refers to data compression techniques in which some amount of data is lost. Lossy compression technologies attempt to eliminate redundant or unnecessary information

Video Formats

<http://www.reelseo.com/overview-digital-video-file-formats/#divx>

Digital video formats

There are many many digital video formats in the consumer and professional worlds. For example, all of the following can record and/or playback some form of digital video ...

- Computer
- DVD video disc
- DVD ROM
- CD ROM
- Cable TV
- Satellite TV
- DV camcorder
- Games console
- Video mobile phone

But they do NOT all use the same data file formats.

Sony DigiBeta camcorder

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Compressed and uncompressed video formats

The [data rate](#) produced by the lens and CCD system of a digital video camera/camcorder can be huge. Therefore it is common for "lower" priced video systems to reduce or compress video data to more manageable file sizes.

Uncompressed video formats

Uncompressed video has the potential for the greatest quality but can be very large. There are a number of professional broadcast quality **uncompressed** digital video formats including Sony DigiBeta and Arri, but these require specialist hardware and software. Standard Macs and PCs are not powerful enough. DigiBeta, and formats like it, are used to film TV programmes such as news, reality TV, soaps and game shows etc. One edited the files are compressed for broadcast/delivery systems.

Compressed video formats

What is a codec?

To reduce file size in order to help storage, processing, editing and transferring systems, most video formats involve the use of compression software at the point of capture/filming. After editing, the video may be further compressed more "aggressively" when being prepared for publishing. The compression software is called a codec ([more here](#)).

Compressed video file and data formats are often identified by the codec they employ. A codec will ...

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- compress the data inside a camera/camcorder as soon as the data leaves the CCD (which converts light into binary) and before storing it, and then later de-compress it for viewing and editing
- further compress video files ready for broadcast and delivery (cable, satellite, DVD etc), once the edit is complete

Processes that involve codecs include ...

- recording/filming to the video tape in a camcorder
- storage on the hard disc of a computer
- burning a DVD
- transmission over the internet
- broadcast via satellite or cable
- transfer to a portable device (eg iPod or mobile phone)
- replay of video

2 types of video compression

There are many different open source and commercially licensed codecs but most fall into one of two categories ...

1. Intraframe (i-frame). Each frame is treated like a still image and compressed using a codec such as JPEG or Red's Redcode.
2. Interframe. At a pre-determined interval a keyframe is fully recorded and then subsequent frames are compared to it. Only the differences in these subsequent frames are recorded. MPeg compression employs this process.

Quality & file size

The more video is compressed ...

- The smaller the file size (easier to store and transfer)
- The lower the data rate (easier to replay and stream)
- The worse the quality

The compression settings you choose when preparing video will depend upon ...

- The CPU power of the target computer (which will need to compress, decompress and display video files).
- The duration of the video

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- The capacity of the media it will be stored on (floppy, CDRom, DVDRom etc?).
- The bandwidth of the connection (if on a web site)

Where can video codecs be located??

Video codecs may be located in several places ...

- Camcorders and cameras have "hard codec" chips
- Computer system folders (so called "soft codecs" such as the ones that QuickTime and Windows Media Player provide)
- Browser plug-ins (usually utilise system installed soft codecs)
- Video PCI expansion cards often have "hard codec" chips similar to those found in DV camcorders
- DVD players have "hard codec" chips to decompress the MPEG-2 video files that DVD discs carry
- Set top boxes for satellite and cable TV
- Games consoles
- Mobile phones
- iPod's

Because a camcorder/camera is where video is first captured and compressed, the codecs they use often determine the codec used throughout the complete edit. There is a comprehensive round-up of current [camcorder and codec technologies here](#).

Standard definition

Standard definition is basically anything that isn't HD and includes DV, MPeg 1 and lower resolutions of MPeg 2.

The most popular semi-pro and amateur SD video production format is **DV**. Read about the DV [format](#) here and by viewing our PDF on [DV Signal Flow](#).

Incidentally, audio CDs do not use codecs because the data size of digital audio files is small enough to fit on a CD without being compressed. MP3 audio however, is highly compressed. Click here for an article on [digital audio file formats](#).

HD (hi-definition)

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High definition video has "splintered" into many differing file formats, such as AVCHD. [More on hi-def is here.](#)

Example file formats & codecs

Unlike the world of digital audio, where 2 uncompressed file formats (.wav, .aif) and 1 compressed file format (MP3) dominate, digital video is a minefield.

NOTE: You may wish to read an explanation of the difference between [file formats and codecs](#) before you continue reading.

Here are SOME of the digital video data file and codec formats ...

Data file type	Codec(s)	Filming / Camcorder?	Editing?	Delivery?
DV	DV codec	Yes	PC & Mac editing	No, must be converted first
MPEG-1	MPEG-1	No	No	CD ROM & web
MPEG-2 (SD DVD, digital, cable & satellite TV)	MPEG-2	Yes	No	Satellite & cable TV broadcast, HDV and DVD video discs
AVCHD	MPEG-4/H.264	Yes	Yes	YouTube, HTML5 (some browsers)
QuickTime (.mov)	Multiple	Some	Yes	QuickTime Player
-	Sorenson	No	No	CDROM, DVDROM, web
MPEG-4	Includes many codec variants including H.264	Yes	Yes	Everything ... from HD DVD, digital TV to mobile phones, PSP, iPod etc
divX	Appears to use an MPEG-4 variant codec	No	No	CDROM, DVDROM, web
-	xVid	No	No	CDROM, DVDROM, web
-	3GPP	No	No	Mobile phones

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Windows Media (.wmv)	Multiple	No	Yes	Windows Media Player
Flash (.swf)	On2 VP6, MPEG-4/H264, WebM	-	-	Flash player, HTML 5 (some browsers)
Ogg Theora	On2 VP3.2	No	No	HTML 5 (some browsers)
WebM	On2 VP8 and Ogg Vorbis	No	No	Google owned open source format for web. Not yet universally supported by all browser developers

Hi-Def: [For a comprehensive round-up of hi-def camcorders & codecs click here.](#)

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