



CHR MOTION™

*for the
Chrome 20 Series*

A
*S3 Graphics
White Paper*

Scope

This document discusses the Chromotion 3.0 features available with S3 Graphics' Chrome 20 Series graphics processors for desktop and mobile systems.

Chromotion 3.0

S3 Graphics continues to expand its Chromotion video technology, introducing Chromotion 3.0 for the Chrome 20 Series of graphics processors. Offering enhanced consumer options for smooth, high quality DVD and TV/PVR playback and for viewing streaming video content over the internet, Chromotion 3.0 features enhance the ability to use the PC to play the latest 3D games and to use any of the 18 DTV ATSC and DVB digital TV formats to display and play on home entertainment HDTV systems. With Chromotion 3.0 technology, the amount of annoying artifacts and imperfections found on traditional PC-based video systems are greatly reduced. WMV-HD[™] motion compensation decoding and MPEG2-HD IDCT and motion compensation is performed in hardware to minimize CPU utilization and offer great visual quality. ArtisticLicense[™] Effects processing offers the ability to do professional video editing.

The S3 Graphics' Chrome 20 Series and its Chromotion 3.0 technology raise the video quality standard for the PC video system by delivering dramatic enhancements. With Chromotion 3.0 and the Chrome 20 Series processors, consumers can now have a great HDTV experience as well as do all the tasks that they are accustomed to doing on a traditional PC; such as email, web browsing, etc.

Chromotion 3.0 Highlights

Features available with S3 Graphics' Chrome 20 Series processors include:

- **WMV-HD Motion Compensation H/W Acceleration –**
Reduces CPU utilization when decoding Windows Media Video - High Definition (WMV-HD) files.
- **MPEG-2 HD IDCT and Motion Compensation H/W Acceleration –**
Reduces CPU utilization when decoding MPEG2-HD files.
- **Video Deblocking –**
Removes blocking artifacts inherent in low bit rate images.
- **ChromoVision –**
Displays full screen video on secondary HDTV display while a windows display of the video in front of the Windows desktop is on the primary CRT or DVI display.
- **HDTV Format –**
Supports all 18 DTV ATSC and DVB formats.
- **Adaptive Per-Pixel De-Interlacing –**
Produces superior image quality for both still and motion images using a high quality De-Interlacing process.
- **Video Scaling, including PanelSharp™ Expansion –**
Provides a wide range of scaling capabilities for modern standard and wide flat panel displays.
- **ChromoVision Modes with Non-Linear Scaling (Enhanced Zoom) –**
Scales a standard 4:3 image to fill a wide-screen 16:9 HDTV display with excellent image quality.
- **ChromoColor –**
Provides adjustment controls for the brightness, contrast, hue, and saturation of the display of video.
- **ChromoColor Tonal Adjustment –**
Allows fine-tuning of luma values for the video display with controls for black point and white point enhancement.
- **ArtisticLicense Effects –**
Allows high quality video image enhancements; including Sharpening, Soft Focus, Embossing, and Neon Edge effects.

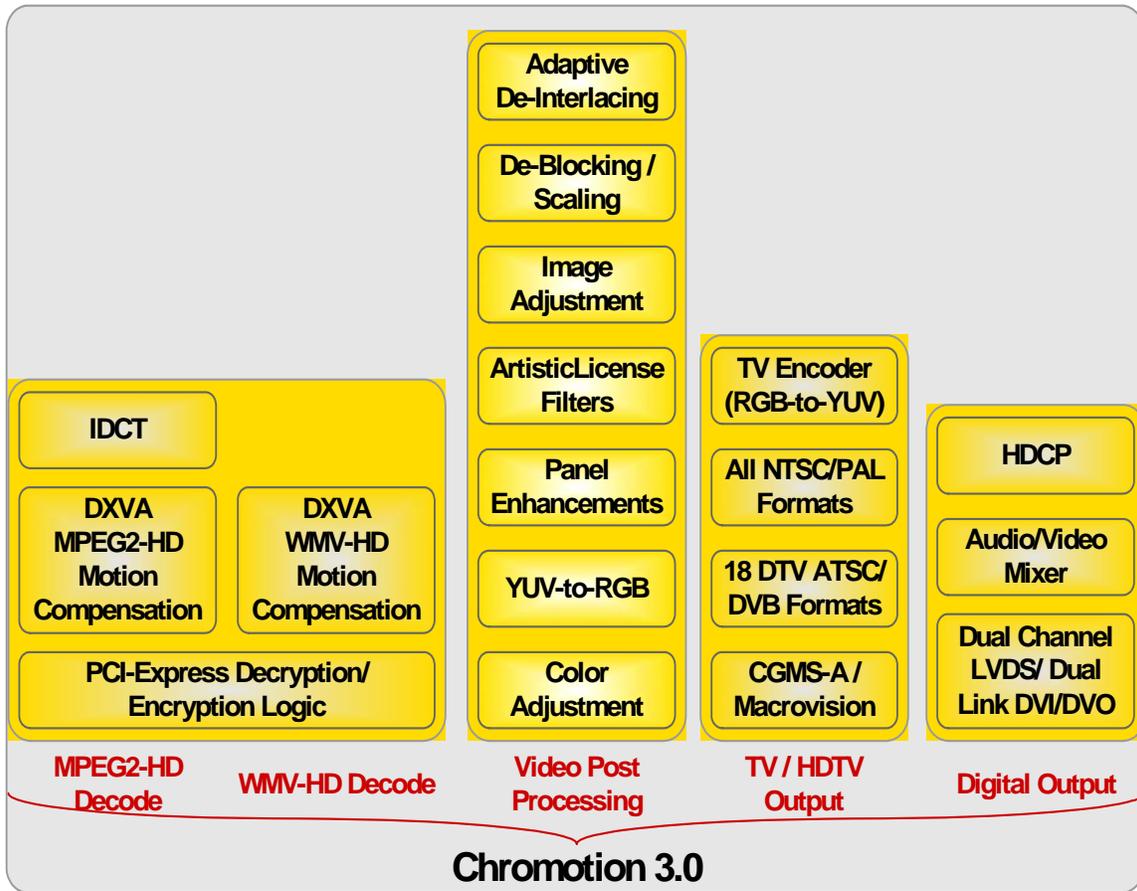


Figure 1. Key Components of Chromotion

Chromotion Decode

Windows Media Video - High Definition (WMV-HD) Decoding

The Windows Media Video – High Definition (WMV-HD) encoding process allows a higher compression ratio than traditional MPEG-2 encoding processes. This efficient compression algorithm enables consumer-quality video both over the internet and within applications.

As with most encoding processes, WMV-HD also produces some inherent visual artifacts. Therefore, a decoder must perform a number of advanced processes to be able to produce an image which results in a good viewing experience for the user. These decoding processes can be done either in hardware or software or with a combination of both. When done in software, CPU utilization increases dramatically, performance decreases, and the result is often less than high quality video. For example, on a mainstream platform using a mainstream CPU, the WMV-HD decoding process done through software can utilize as much as 30% more CPU resources than when the decoding is done utilizing hardware acceleration in the graphics processor as shown in the figure below. This frees the CPU to be used for other processes while playing WMV-HD files, which will give the viewer a full viewing experience.

By efficiently performing WMV-HD advanced motion compensation decode in hardware, Chromotion 3.0 dramatically reduces CPU utilization, increases performance, and improves the viewing of WMV-HD videos on high quality HDTV displays.

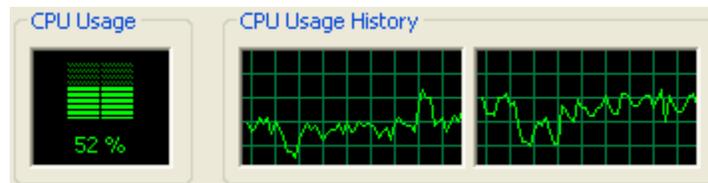


Figure 2. CPU Utilization of DXVA WMV-HD without H/W Acceleration using the latest MP10

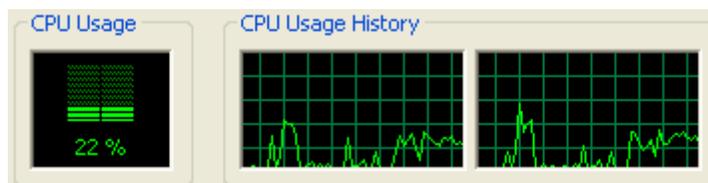


Figure 3. CPU Utilization of DXVA WMV-HD with H/W Acceleration using the latest MP10

MPEG2-HD IDCT and Motion Compensation

During the MPEG2-HD encoding process, a mathematical function called a discrete cosine transform (DCT) is applied to all of the MPEG2-HD video content. During the decode process, the CPU is used to do the inverse, the discrete cosine transform (IDCT). Now, to offload the CPU workload, a high performance graphics processor does the IDCT through its IDCT engine, reversing the entire DCT process during MPEG2-HD decoding, and decompressing the image for display on the screen. Now part of the decode workload is off loaded from the CPU to the graphics processor's IDCT engine.

Once S3 Graphics' IDCT engine, which has been optimized for Microsoft's DirectX Video Acceleration (DXVA) standard, completes the IDCT process for the residual data, its motion compensation engine comes into play to generate the final fully decoded video images. Motion compensation is reversing motion estimation which is one of the encoding stages. Motion estimation uses a concept known as predictive coding. Typically, only a fraction of an image changes from frame to frame, which makes it quite easy to predict future frames from previous frames. Motion estimation is used as part of the predictive process. If an image sequence includes moving objects, then their motion within the scene can be measured, and this information may be used to predict the content of frames in sequence. Motion compensation is the most time consuming stage of the decoding. S3 Graphics' motion compensation engine minimizes the extra overhead associated with decoding of MPEG2-HD video files and allows maximum efficiency during DVD playback.

The examples below show CPU utilization on a mainstream system when decoding MPEG2-HD without and with hardware acceleration.

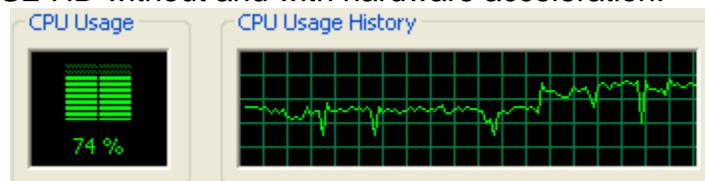


Figure 4. CPU Utilization of MPEG2-HD decoding without H/W Acceleration with latest MP10

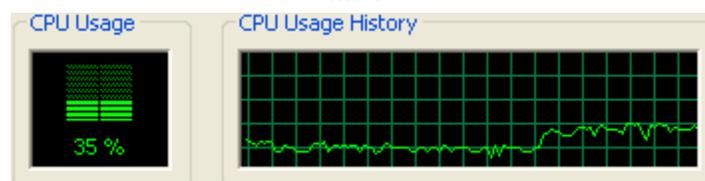


Figure 5. CPU Utilization of MPEG2-HD decoding with H/W Acceleration with latest MP10

As can be seen from the above Figures, with IDCT and Motion Compensation, H/W acceleration, CPU utilization can be reduced by approximately 40%. This frees up the CPU to be able to do other processes to give the viewer a great HDTV experience.

Video Deblocking

Traditional block-based video encoders, such as H.261, H.264, MPEG-1, MPEG-2, and MPEG-4, can generate annoying blocky artifacts. Discontinuities at block boundaries ultimately lead to image quality issues. In low bit rate encoding applications, such as web-based video, the inter-block correlations are especially vulnerable to loss with any decode technology which relies on block-based motion-compensated prediction, discrete cosine transformation, and coarse quantization.

Chromotion 3.0 includes video deblocking filters for removing block artifacts and for improving visual quality during low bit rate video playback. The filters are usually computationally intensive, so a slider bar on the S3Chromo utility Deblocking tab allows the User to vary the amount of deblocking from a low of 0 to a high of 7.



Figure 6. S3Chromo Utility: Deblocking Filters Tab

Chromotion for TV and HDTV

HDTV Formats

Chromotion 3.0 supports all 18 DTV ATSC and DVB formats, including 1080p:

Vertical Lines	Pixels	Aspect Ratio	Picture Rate
1080	1920	16:9	60i, 30p, 24p
720	1280	16:9	60i, 30p, 24p
480	704	16:9 and 4:3	60p, 60i, 30p, 24p
480	640	4:3	60p, 60i, 30p, 24p

Adaptive Per-Pixel De-Interlacing

Digital displays, like HDTVs (plasma and LCD) and DVI (LCD-flat panel) monitors, ultimately require a progressive scan signal to operate properly. If they receive an interlaced signal, it must be converted to a progressive scan signal before it can be displayed on the digital monitor.

Interlaced video images are made up of fields. Each field contains half of the number of lines needed to make up one complete frame of video. A field consists of either the even or odd lines of the original image. During interlace display scanning the screen is refreshed in two top-to-bottom passes such that the lines scanned in one pass are positioned between the lines drawn in the previous pass. Digital displays use progressive scanning, which means that they render all lines in a single top-to-bottom pass, which requires twice as much data per pass as interlaced scanning. Therefore, the video data format must be converted from one that is compatible with interlaced fields to one that provides progressive frames prior to rendering on a digital display. The process of translating received interlaced video signals into a progressive scan format for output and display on any digital display is called de-interlacing.

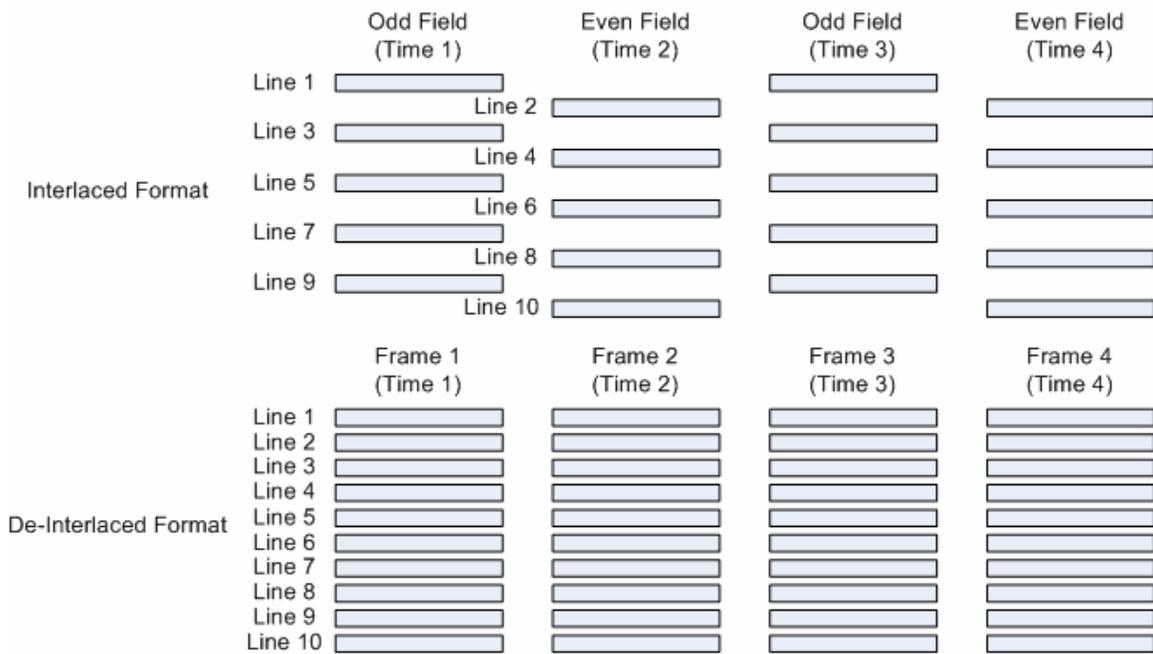


Figure 7. Interlaced Format versus De-Interlaced Format

There are two straightforward and basic methods of de-interlacing an interlaced video image for display on a progressive scan monitor: **“Bob”** and **“Weave.”**

“Bob” (intra-field spatial interpolation) is the process of completely discarding one of the fields in an interlaced video data. Either all the odd or all the even fields are discarded. Using the fields that remain, interpolation is performed between the lines to generate an entire non-interlaced frame for the progressive scan monitor. This method includes no reference to the discarded fields.

“Weave” (merging) is the process of combining the odd and even fields of an interlaced video image to generate the entire non-interlaced frame for the progressive scan monitor.

Each method is simple to implement and has been around in the video industry for some time now, but each introduces some visual artifacts which leads to poor image quality.

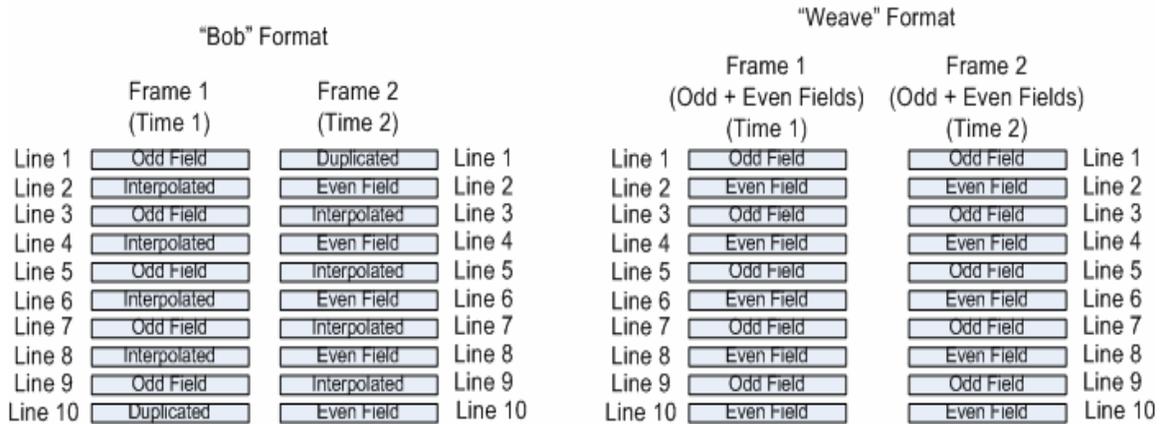


Figure 8. Bob and Weave

“Bob” works well for images that are in motion but not for still images. If, for example, interlaced source video is 480i (NTSC format), then the Bob method would just use the 240 scan lines of either the odd or even field and interpolate between the lines to generate a non-interlaced 480 line frame to display on the progressive scan monitor. The result is that the vertical resolution is decreased by half. Although this method works well, it can produce shimmering artifacts which create fuzziness and loss in detail in the vertical picture resolution. Artifacts are most obvious when text and stationary objects/logos are overlaid on live video. On some images objects may appear to bounce up and down. These artifacts may be worsened with frame rate conversion, such as converting from 60 Hz to 72 Hz, etc.

“Weave” is perfectly adapted for still images because it uses all of the information available and thus generates the best possible image. While it works well with still images, it creates annoying feathering (combing) artifacts with motion video. Fast video and text scrolling can become unbearable. Commonly known as “feathering,” the vertical edges of moving objects in the image look like feathers. When an image is moving, any attempts to weave the fields will result in significant motion artifacts. Because the recording is performed in an interlaced manner, the two source fields that make up a complete frame are not recorded at the same time. Each frame is recorded as an odd field from one point in time, and then as an even field recorded 1/60 of a second later (for NTSC). A car moving at 60 mph will move by almost 1.5 ft. in this time, so that vertical edges in the odd and even fields will be separated by an equivalent distance. Simply combining fields causes the errors in the image called “combing” or “feathering” artifacts.

A simple solution to the problem of deciding whether to implement either the “bob” or “weave” process is to switch between the two processes, depending on whether or not there is motion between the two fields. On a field-by-field basis, using a simple motion calculation, this technique would detect when the image is moving and implement the “bob” process and detect when the image is still and switch to the “weave” process. This sounds like a good solution to the simple “bob” or “weave” options that result in visual artifacts; unfortunately, most frames contain a mixture of both motion and still images, and whichever process is selected, artifacts are possible in those portions of the image for which the process is not optimized.

S3 Graphics’ Chromotion 3.0 provides a more precise technology to determine the optimal scanning process, and provides superior de-interlacing on a pixel-by-pixel basis.

Because most images contain a mix of still and moving regions, Chromotion 3.0’s per-pixel adaptive de-interlacing technology looks at fields on a pixel-by-pixel basis and optimally determines whether to “bob” or “weave” on a pixel-by-pixel basis, based on the detected motion for that precise pixel. This advanced algorithm looks at pixels from the previous field, from the next field, and from the current field, and mathematically determines if there is motion. Thus it generates an appropriate, corresponding pixel for the current frame. Because this superior algorithm looks at the image on a pixel-by-pixel basis rather than on a field-by-field or block-by-block basis, it eliminates the visual artifacts in moving objects and preserves full resolution of non-moving portions of the screen. The result is a high quality crisp image, even on a HDTV progressive display.

ChromoVision

In a dual display configuration (where the same image appears on both displays, and where the secondary display is either a HDTV or TV), a user may wish to view video in borderless full screen mode on the secondary HDTV/TV display, while still retaining the desktop look and feel on the primary display for normal use.

S3 Graphics' ChromoVision allows automatic borderless full screen video playback on a secondary HDTV/TV display, while a windowed version on the desktop appears on the primary display configured in dual monitor mode. This configuration must be set up properly and enabled in the S3 Graphics Display Properties utility. When the User is in a dual monitor mode and ChromoVision has been enabled, ChromoVision will be automatically activated in borderless full screen mode on the secondary HDTV/TV display, whenever a ChromoVision qualified video stream is playing. ChromoVision will be automatically deactivated, whenever a user switches to a device configuration that is not compatible with ChromoVision.

The primary display can have a windowed version of the borderless full screen video image that is on the secondary HDTV/TV display. When ChromoVision is active, the windowed video image on the primary display can be moved, re-sized, minimized, and maximized without having any effect on the ChromoVision borderless full screen image on the secondary HDTV/TV display. Because the ChromoVision image is full screen, application control panels (such as Media Player, WinDVD, PowerDVD, and CinePlayer) will not be visible on the ChromoVision secondary HDTV/TV display. They will only be visible on the primary display.

When multiple video streams are detected, the video stream in use by the first application that starts video playback will be the owner of the ChromoVision capability. ChromoVision works with hardware and software overlays, as well as VMR video. Any applied Chromotion gamma adjustments selected from the S3Color Plus ChromoColor utility, or video effects, or deblocking filters selected from the S3Chromo utility, will affect both the windowed video image on the desktop of the primary display and the borderless full screen video image on the secondary HDTV/TV display.

On a standard TV, the full screen video image resolution will be a maximum of 1024x768 for all desktop modes 1024x768 or greater. Even when the primary display is rotated using the S3Rotate utility, the ChromoVision video always displays in a landscape orientation on the secondary HDTV/TV.



Primary Display with Windowed Video



ChromoVision Full Screen Video on Secondary Display

Figure 9. ChromoVision Full Screen Video

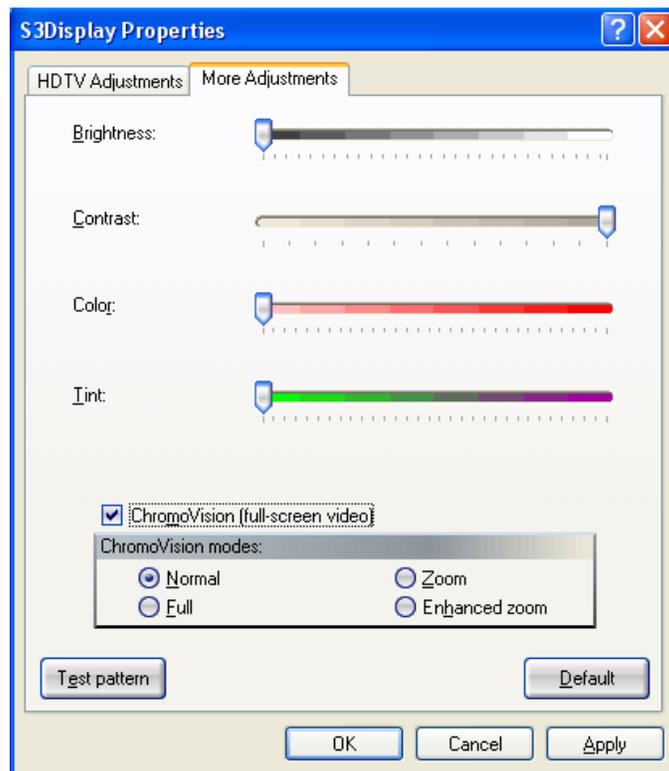


Figure 10. ChromoVision checkbox on S3Display TV or HDTV More Adjustments Tab

Video Scaling

When watching video content on a computer monitor, users often want to change the size of their video display window. Changing the size of the video display window using hardware acceleration is known as scaling. Scaling an image to an arbitrary size requires high quality scaling engines to prevent aliasing artifacts when down-scaling and to retain sharpness when up-scaling.

Chromotion 3.0 includes a variety of enhanced video scaling technologies to enable the sharpest and smoothest possible video playback within non-natively scaled windows and full screens. These include:

- Programmable Kernel Filter,
- PanelSharp Expansion,
- Enhanced Zoom non-linear expansion, and
- ChromoVision Modes - for 16:9 wide screen display of 4:3 images.

Programmable Kernel Filter

The Chromotion video engine includes a programmable kernel filter that supports scaling in hardware. By using a selection set of pixels from the source image and color data from close corresponding pixels, the filter uses a special algorithm to estimate the target color at a given pixel in the final destination image. The programmability of this filter allows extra flexibility for fine tuning scaling algorithms.

PanelSharp Expansion

PanelSharp Expansion upscaling technology provides improved quality for an upscaled destination pixel. This method was designed to provide a crisp graphics or text edge and to avoid the blurriness on graphics images, including video, introduced by many popular multi-tap filters.

The basic idea behind this methodology is to stretch an image in a manner similar to the way a rubber band might be stretched. This method avoids the creation of any undesirable artifact halos that might be introduced using a multi-tap filter. This method may appear similar to linear interpolation, but it's not. PanelSharp Expansion produces results which are much sharper than linear interpolation.

S3 Graphics software will control the activation of PanelSharp expansion and will own the decision whether to apply PanelSharp technology or to use alternate traditional expansion techniques.

Enhanced Zoom Non-Linear Scaling

Converting a 4:3 aspect ratio standard definition video to a 16:9 wide aspect ratio high definition video involves scaling an image to contain as much as six times the number of pixels it had originally. How this is done determines the quality of the scaled image. There are many different methods of scaling an NTSC video image which has an aspect ratio of 4:3, to fit the high definition technology of an HDTV, which has an aspect ratio of 16:9. Each method differs in the level of computational involvement. High computational methods may impact video quality.

One technique is to directly scale the NTSC 4:3 image to fit the vertical aspect of the HDTV 16:9 display. This will produce black bands on the two sides of the HDTV display as a NTSC 4:3 image is close to being square while a 16:9 HDTV display is more rectangular in shape. This requires very little computational power and therefore is very low cost. But the visual result is a waste of the high quality 16:9 HDTV display.



Figure 11. Original 4:3 Image



Figure 12. 4:3 Image Fit on 16:9 Display

Another technique is to also linearly stretch the 4:3 image in the horizontal direction to a more rectangular 16:9 image to remove the black bands on the two sides. Unfortunately, this technique distorts the overall 16:9 image so that thin people, for example, look fat. This requires some computational power. Although it adds little cost in terms of system resources, the visual result is not acceptable.



Figure 13. 4:3 Image with Simple Linear Horizontal Scaling to fit 16:9 Display

One of the more advanced techniques is non-linear scaling. In this technique, the middle portion of a NTSC 4:3 image is untouched, but the right and left sides of the image are stretched to fill the 16:9 HDTV display. The middle of the 16:9 HDTV image does not appear distorted at all, but the image is increasingly distorted on the right and left sides of the display. This distortion pattern is usually acceptable, as the human visual system typically focuses on the middle of a screen and not on the edges. Non-linear scaling requires a lot of computational power. The extra resources needed may add more cost to the overall system. The visual result is a pleasing image.



Figure 14. Enhanced Zoom 4:3 Image with Non-Linear Horizontal Scaling to Fit 16:9 Display

Enhanced Zoom is available when ChromoVision is enabled and the secondary display is a wide-screen device. User selection is through the Enhanced Zoom option in the ChromoVision Modes selection area on the HDTV More Adjustments tab of the S3Display utility.

S3 Graphics' Enhanced Zoom capability, introduced with Chromotion 3.0, efficiently implements non-linear scaling without adding additional cost to the overall system.

ChromoVision Modes

The ChromoVision Modes radio buttons appear on the HDTV More Adjustments tab of the S3Display utility, above the ChromoVision selection box. When ChromoVision is enabled and the secondary device is a wide screen HDTV display, ChromoVision Modes provide preset options for normal and linear image scaling. Additionally, Enhanced Zoom non-linear scaling will be accessible.

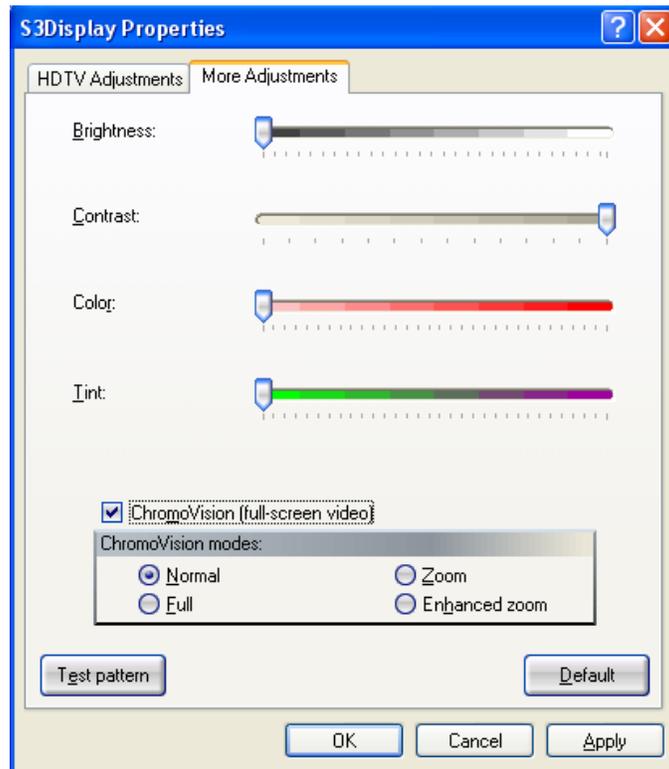


Figure 15. ChromoVision Modes Control on HDTV Adjustments Tab

ChromoVision Mode options available for selection will include:

- Normal** Use **Normal** to display a 4:3 source image on a 16:9 wide screen display with no scaling and no change to the aspect ratio. With **Normal** view, vertical black bars will appear on both sides of the 4:3 image to fill the unused areas of the 16:9 wide screen HDTV display.
- Zoom** Use **Zoom** to display a letterboxed 4:3 source image which would otherwise show black bars all around the 16:9 wide screen image (such as a 4:3 letterbox DVD). **Zoom** uses equal amounts of horizontal and vertical linear scaling to expand the image to fill the wide screen 16:9 area. There is no change to the aspect ratio.
- Full** Use **Full** to display a 4:3 image source material that has been horizontally compressed during encoding, such as anamorphic DVDs that are *Enhanced for 16:9*. **Full** uses linear scaling to horizontally and vertically stretch the 4:3 source image to fit the 16:9 wide screen display. This option changes the aspect ratio.
- Enhanced Zoom** Use non-linear **Enhanced Zoom** to display a standard 4:3 source material that has not been horizontally compressed during encoding. **Enhanced Zoom** uses S3 Graphics' customized non-linear scaling algorithms to provide optimal horizontal expansion of standard 4:3 source images onto the 16:9 wide screen displays. **Enhanced Zoom** is designed to provide less expansion in the central image area where viewers usually focus their attention. This option changes the aspect ratio.

Video Image Controls

The following Chromotion components include user-accessible controls for adjustment and manipulation of video images.

ChromoColor for Gamma Adjustment

There are two basic issues to consider when attempting to produce a color image that will faithfully reproduce the correct data (color, hue, saturation, intensity) on a display. The first issue is to properly compensate for the inherent physical properties of the display hardware itself (Gamma Correction). The second is to deal with data streams that have been previously altered for a specific and different viewing environment (Gamma Adjustment).

Gamma Correction for Display

The displays that are everywhere – from CRTs, to DVI monitors, to LCD panels, to TVs, to HDTVs – are all inherently non-linear devices. The intensity of brightness reproduced at the screen of a display is not proportional to its applied voltage. Display intensity has a power-law response to applied voltage: intensity reproduced at the face of the display is approximately the applied voltage, raised to some fixed power. The numerical value of the exponent of this power function is known as gamma. Thus, some sort of gamma correction is required to achieve linearity of the voltage-to-intensity response curve. Gamma correction can be thought of as the process of applying an inverse power transfer function of $1/\text{gamma}$ to the intensity, thus compensating for this non-linearity and enabling a user to reproduce an accurate intensity for a certain display.

Gamma standardization is limited for flat panel (LCD and Plasma) displays; such as DVI monitors, LCD displays, some TV, and some HDTV monitors. Gamma settings will vary between panel sizes, types, and manufacturers. Therefore, trying to get good quality color images reproduced on flat panel displays is very difficult without some sort of gamma correction and/or adjustment. S3 Graphics' Chromotion 3.0 implements gamma correction and gamma adjustment for full screen images through the use of a color look-up table (CLUT). The CLUT is loaded with a default gamma value to do the gamma correction. The user can adjust the gamma through the S3GammaPlus utility. S3 Graphics implements two sets of CLUTs, one for the primary display and one for the secondary display. This allows independent gamma correction/adjustment for the two independent displays; such as CRT and LCD or LCD and HDTV, etc.



Figure 16. S3Gamma Plus Utility Control Panel

TV and HDTV video images are usually viewed in a dim environment and are therefore encoded with that assumption using a particular gamma for a certain type of display. The viewing environments typical of computers are usually bright. When a video image is encoded according to a known TV video standard, it implicitly carries this assumption of a dim viewing environment; such as the living room in the evening, as well as the gamma for a certain type of display, TV. If the video image that is created for a dim viewing environment is transmitted and viewed in a bright viewing environment, then the video image may show excessive contrast. Gamma adjustment can be used to compensate for these different viewing environments.

Gamma Adjustment for Video

Chromotion 3.0 allows gamma adjustment on a video window that is independent of the full screen graphics data for the display.

Because there are inherent gamma differences between graphics and video data, viewing video data with graphics gamma settings, usually is not appropriate. This is especially true when viewing windowed video using common computer applications.

S3Color Plus ChromoColor allows a user to adjust the brightness, contrast, hue, and saturation of the display of video. Custom schemes can be created by a user and saved for re-use.

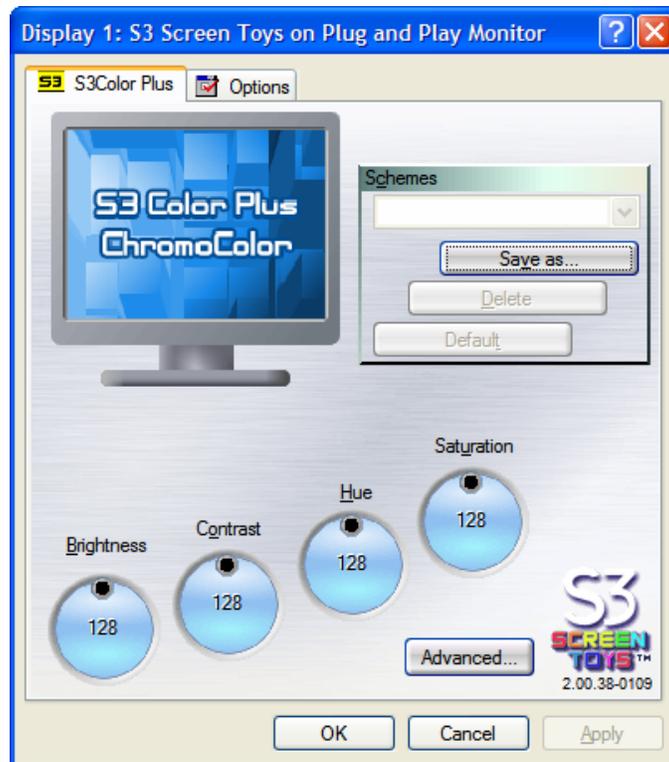


Figure 17. S3Color Plus ChromoColor Utility Control Panel

ChromoColor Tonal Adjustments

Tonal Adjustments controls allow user adjustment of the Y (Luma or brightness) range for video data provided in YUV, YCbCr, and YPbPr formats. Tonal Adjustments options are available through the Advanced Button on the S3Color Plus ChromoColor utility.

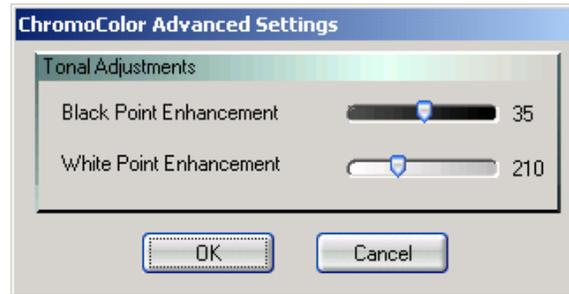


Figure 18. S3Color Plus ChromoColor Tonal Adjustments Dialog

Two slider bars are provided. The thumb on each slider will initially be set to the range of the original video image. The left side of the Black Point Enhancement slider with a value of 0 represents black (the lack of brightness), while the right side of the White Point Enhancement slider with a value of 255 represents full Luma (maximum brightness).

The slider thumbs are used to set threshold levels to limit the range of shadows (darks) and highlights (lights). For example, if the range is 0 (dark) to 255 (light), and the User sets the shadow threshold by moving the thumb to 35 and moves the highlight threshold to 210, then the range of available Luma will be adjusted to 35-210. All values below 35 will be treated as if they were 0 and all highlights brighter than 210 will be treated as if they were 255. Thus, the effective range of values is clipped. To avoid reduction in the contrast range of the picture, after black and white point adjustment, all pixels are remapped to the original range (that is, from 35-210 to 0-255). Adjusting black point or white point prior to the remapping will shift the center of the histogram to the left or right respectively.

The following examples illustrate the type of tonal and value adjustment possible with the S3 Graphics' Tonal Adjustments controls for White and Black Point Enhancement.

Increasing white or decreasing black will lighten the overall luma of the video image. Decreasing white or increasing black will darken the overall luma of the video image. Black and White Point adjustments can be combined for a wide range of effects.



Figure 19. Original Image



Figure 20. White Point Enhancement Increased



Figure 21. Black Point Enhancement Decreased



Figure 22. White Point Enhancement Decreased



Figure 23. Black Point Enhancement Increased

The results of these manipulations are most noticeable in the shadows and highlights areas of the images. When the Black Point Enhancement value is decreased, shadows are lightened. Increasing the Black Point Enhancement darkens the shadows. Decreasing the White Point Enhancement lightens the highlights in the image, while increasing the White Point Enhancement darkens the highlights.

ArtisticLicense Effects

S3 Graphics' Chromotion ArtisticLicense filters offer the consumer access to high quality image enhancement effects for motion video images. Real-time video image processing allows users to visualize their art work on a monitor and select a particular filter (or filters) best suited to their creative needs. ArtisticLicense Effects are controlled using slider bars found in the S3Chromo utility.

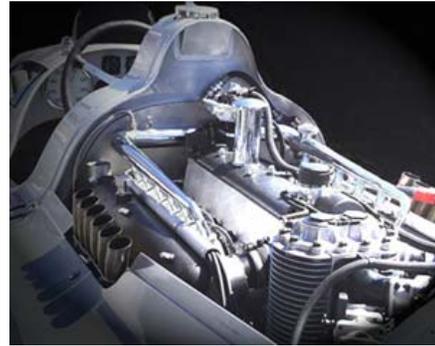


Figure 24. Original Image

Sharpening Effect

This effect focuses blurry video images and improves clarity by increasing the contrast of adjacent pixels.

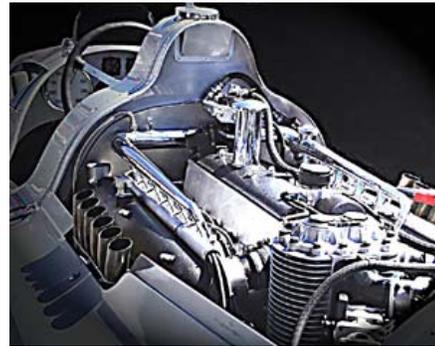


Figure 25. Image with Sharpening Effect

Soft Focus Effect

This effect gives video images a dreamy and glossy soft focus. Soft Focus produces a warm glow, softening details and diminishing noise and artifacts. It is ideal for creating a warm and subtle glow to video images. It also gives DVD playback on LCD panels a film-like appearance.

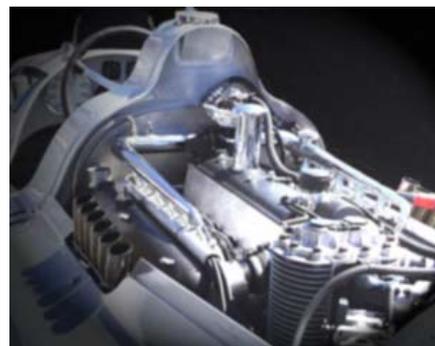


Figure 26. Image with Soft Focus Effect

Embossed Effect

This effect makes a video image appear raised or stamped by converting its entire fill color to gray and tracing the edges with a color. The degree of embossing can be controlled through the S3Chromo utility slider.



Figure 27. Image with Embossed Effect

Neon Edge Effect

This effect identifies the edges of color in a video image and adds a neon-like glow to them. As with the other filters, a Neon Edge slider bar is located within the S3Chromo utility on the ArtisticLicense Effects tab, and allows user control of the amount of neon edge effect.



Figure 28. Image with Neon Edge Effect

All ArtisticLicense Effects are accessible on the S3Chromo Utility ArtisticLicense Effects tab.



Figure 29. S3Chromo Utility ArtisticLicense Effects Tab

Conclusion

S3 Graphics' Chrome 20 Series with its Chromotion 3.0 video technology delivers a wide variety of enhancements for video images. With Chromotion 3.0 and the Chrome 20 Series processors, consumers can have a great HDTV experience using their traditional desktop or mobile PC.