69030

Dual Display Graphic Controller

Software Application Note Revision 1.0

September 1999

N D A

C O N F I D E N T I A L

P R E L I M I N A R Y

CHIPS

Revision History

Revision	Date	By	Comment
1.0	9/1/99	SH/DAK	Initial Release

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1 Introduction

The 69030 is the newest product in the Intel family of portable graphic accelerators that provides 4 megabytes of high performance Synchronous Dynamic Random Access Memory (SDRAM) for the graphics frame buffer. Based on the proven HiQVideo™ embedded graphics accelerator core, the 69030 combines state-of-the-art display controller capabilities with low power consumption and high performance. The result is a highly integrated solution for mainstream embedded notebooks and industrial PCs.

This 69030 application note has three purposes:

1. It describes the software feature support of the Intel 69030 Graphic Controller.
2. It describes the process for switching 69030 display modes in different operating systems using the Chips display property sheets.
3. It provides register level processes for setting the available display modes.

2 Software Feature Support

This section describes the feature support of the 69030:

- Display Mode Capabilities
- Operating System Support
- Display Overlay Capabilities
- Video Port Capabilities
- Hardware Cursors and Popup Support
- Panning Support
- Automatic Display Detection

2.1 Display Mode Capabilities

The 69030 can drive two separate displays through independent display output pipelines. The independent displays can operate with different timings and display either the same or different images depending on the display mode.

2.1.1 Single Display Mode

The Single Display Mode has the capability to display to a CRT, Flat Panel or TV output device. In addition, the Single Display Mode can simultaneously output the same display to the CRT and LCD panel. However, when in this “simultaneous” mode, the output to the display devices cannot be optimized for each output display device and a “best fit” timing is set to accommodate both output devices.

2.1.2 Single Display Dual Timing Mode

In Single Display Dual Timing Mode, the 69030 can simultaneously output the same display to a combination of two output devices. However, with Single Display Dual Timing Mode each output display device can be optimized to the best timings for each output device. Thus, a higher quality display can be achieved for each output device.

2.1.3 Dual Display Mode

The Dual Display Mode also displays to a combination of two output devices. Like the Single Display Dual Timing Mode, the timings for the display output device can be optimized. Unlike the Single Display Dual Timing Mode, the images displayed on the output devices are different. This capability allows an image or desktop to span across two output devices.

2.2 Multiple Operating System Support

The 69030 supports the following operating systems with display drivers and utilities. Where noted, additional support has been added to utilize the special display mode capabilities of the 69030.

- Windows 95 Release 2 (with additional 69030 mode support)

- Windows 98 (with Multimonitor Support and additional 69030 mode support)
- Windows NT 4.0 (with additional 69030 mode support)
- Windows NT 5.0

2.3 Display Overlay Capability

An overlay is simply a separate image, typically included within a separate window that lies on top of a portion of the display. The 69030 can support up to two overlays depending on the selected display mode.

2.3.1 Single Display Mode

In Single Display Mode, two overlays are supported. With two separate overlays, each overlay can display an independent image (Figure 2.1).

Display1

Figure 2.1 Single Display Mode with two overlays

2.3.2 Single Display Dual Timing Mode

In Single Display Dual Timing Mode, two overlays are supported. However, the same overlay image must be displayed on each output display device to maintain the same single display. This requires each output display device to use one of the two overlays (Figure 2.2).

Figure 2.2 Single Display Dual Timing Mode

2.3.3 Dual Display Mode

In Dual Display Mode for Windows 95 and Windows NT, essentially only one overlay is supported. This limitation is necessary because the overlay spans two output devices when it crosses from one output display device to the other output display device (Figure 2.3). As the overlay image crosses over, the portion of the overlay on one device requires a hardware overlay implementation and the portion of the overlay on the other output device also requires a hardware overlay implementation. Thus two hardware overlays are in use; but essentially, it is only one overlay image that is seen.

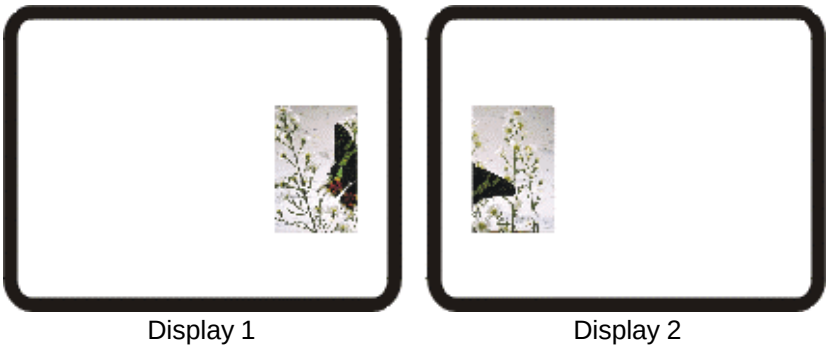


Figure 2.3 Dual Display Mode with two separate overlays

2.4 Video Port Capabilities

A video port is an interface that handles the transfer of video between a PC card and a graphics controller. The Video Port Manager (VPM) is an open software interface specification that allows applications to be developed that can support any graphics controller that provides a dedicated video path into the controller. It is supported for Windows 95 and NT 4.0 in the Single Display Mode configuration only. The VPM supports only one overlay.

The Microsoft Video Port Extensions (VPE) is a software interface supported by the 69030. The VPE interface allows a client to manage any video port and display hardware without direct knowledge of vendor-specific details. Only one video port input overlay is available to capture a video stream, but an additional overlay is available to support video playback.

2.5 Hardware Cursors and Popups

A hardware cursor is a cursor displayed and used without altering the main image stored in the frame buffer. The 69030 supports two hardware cursors, one for each output display device.

In the Single Display Mode, only one hardware cursor is implemented for the single display.

In the Single Display Dual Timing Mode, two hardware cursors are implemented. However, identical cursors must be displayed on each output display device to maintain the common single display. This causes each output display device to use one of the two hardware cursors.

In the Dual Display Mode, only one hardware cursor is supported. This limitation is necessary because the cursor spans two output devices when it crosses from one output display device to the other output display device. As the cursor crosses over, the portion of the cursor on one device requires a hardware cursor implementation and the portion of the cursor on the other output device also requires a hardware cursor implementation. Thus two hardware cursors are in use; one hardware cursor per display output device, but only one cursor is seen.

A popup screen is a small area of screen (for example 32x32 or 128x128 pixels) overlaying the display screen. Popup screens are supported only on the Flat Panel Display. There is no driver support required for the popup screens. All popup support is provided via the video and system BIOS. The BIOS supports up to eight popups in the 69030. There is no change from the popup support provided with the 69000.

2.6 Panning

Panning adds the ability to view images greater than the actual display size of a panel. If the desktop size is greater than the panel size, the desktop will pan with the mouse to reveal portions of the desktop, which cannot be viewed due to the display size of the panel. For the specified display mode the following rules apply:

- *Single Display Mode* - the image pans if the desktop size is greater than the output display device's size.

- *Single Display Mode* - for the "simultaneous" configuration, the desktop pans on both devices if the desktop size is greater than the panel size.

- *Single Display Dual Timing Mode* - the display monitor always displays the entire image but the image pans if the desktop size is greater than the output display device's size. In the case of a LCD panel and TV, the available resolutions are limited to resolutions less than or equal to the LCD panel size. Thus, the panel will never pan and the TV will be allowed to pan.

- *Dual Display Mode* - The CRT display always displays the entire image but the image pans if the desktop size is greater than the output display device's size. In the case of a LCD panel and TV the available resolutions will be limited to resolutions less than or equal to the LCD panel size. Thus, the panel will never pan and the TV will be allowed to pan.

2.7 Automatic Display Detection

This function provides output display device detection on boot. The software "remembers" the existing display state on reboot if there are no changes to the display output devices. However, if a change to the available output display devices occurs, the display mode automatically switches to a valid single output display device configuration.

3 69030 Mode Support for Windows 95

The additional mode support available with the 69030 for the Windows 95 operating system can be found in the display property sheet. This section describes how to access the property sheet and use the features of the 69030.

3.1 Accessing the Display Properties Window

Access the display properties window through the Windows desktop. Click on My Computer|Control Panel|Display. Then select the CHIPS tab.

3.2 Selecting the Display Mode

In the Chips tab, select the desired display mode in the Multiple Monitor Display Information drop-down list box. The Chips property sheet changes depending on the selection.

Figure 3.1 Selecting a Display Mode in Windows 95

3.3 Single Display Mode Property Sheet

If you select the Single Display Mode and press the Apply button, the property sheet in Figure 3.2 appears. A brief explanation of the features available for this display mode is provided in this section.

Figure 3.2 Single Display Mode Property Sheet

3.3.1 Multiple Monitor Display Information Section

This section provides information about the current display mode.

Current Multiple Display Mode drop-down list box:

This box shows the current display mode selected. When the list box is dropped down, a list of other available display modes is shown.

Current Mode text**:**

This text describes the current resolution and color depth.

More Information button**:**

This button opens another window that lists the display driver files and attributes as shown in Figure 3.3.

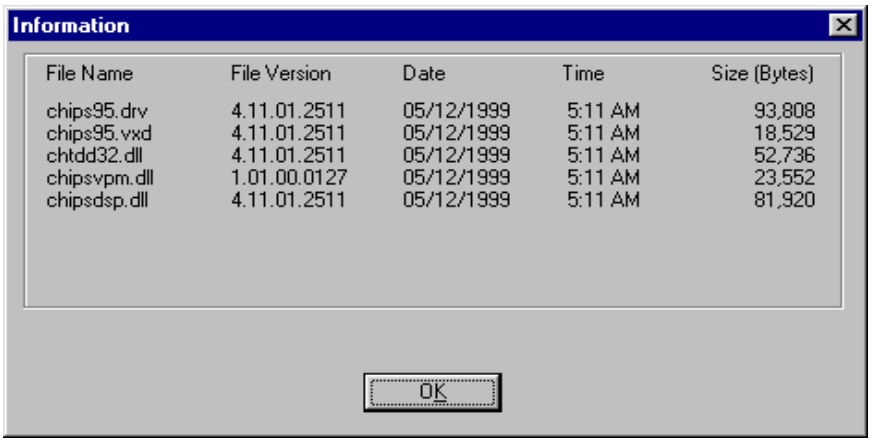


Figure 3.3 Lists of the display driver files and attributes

Adjust button:

This button runs a Gamma correction utility (Figure 3.4). Gamma correction is designed to correct non-linear characteristics of monitors so that people can see color pictures and movies more clearly. Gamma correction provides the following capabilities for 64K and 16M color modes:

- **Adjust Graphics Color:** Adjust the color for all the graphics windows.
- **Adjust Video Color:** Adjust the color for the movie that uses direct draw overlay.
- **Adjust Graphics and Video Color:** Adjust both graphics and video color.

To select a capability right click on the Gamma correction utility in the desired color depth and resolution. Each resolution and color depth combination can have its own Gamma correction. Gamma correction values are "remembered" by the software so there is no need to re-optimize the color settings once a setting has been chosen.

Figure 3.4 Gamma Correction adjustment

bitmap display:

The bitmap display in the Multiple Monitor Display Information Section provides a preview of the display mode to be selected. This bitmap provides an example of a display mode before the mode has been set with the Apply button. If no changes have been made to the current mode, this bitmap displays the current display mode state.

3.3.2 Display Device Section

This section contains the possible output devices available for the particular mode chosen.

For Single Display Mode, the choices are a CRT, LCD, TV, or BOTH. Both is the Single Display “simultaneous” mode which selects both the CRT and the LCD panel to display simultaneously.

3.3.3 CHIPS TV Control Section

Selecting the TV radio button from the Display Device section enables the Chips TV Control section. This section provides the ability to choose the TV signal format of NTSC or PAL.

3.3.4 Additional Features

Stretch Checkbox

Stretches the desktop display to fill the full screen size of the panel.

3.4 Single Display Dual Timing Mode Property Sheet

If you select the Single Display Dual Timing Mode option from the drop-down list box, and press the Apply button, the property sheet in Figure 3.5 appears. A brief explanation of the features available for this display mode is provided in this section.

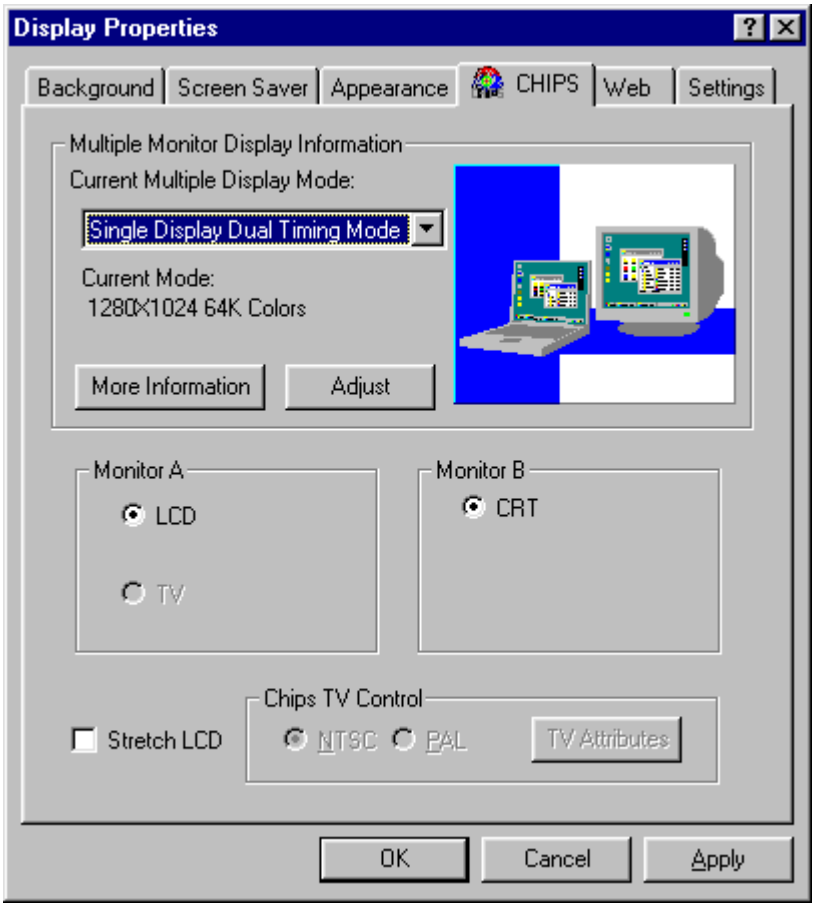


Figure 3.5 Single Display Dual Timing Mode Property Sheet

3.4.1 Multiple Monitor Display Information Section

This section provides information about the current display mode.

Current Multiple Display Mode drop-down list box**:**

This box shows the current display mode selected. When the list box is dropped down, a list of other available display modes is shown.

Current Mode text**:**

This text describes the current resolution and color depth.

More Information button**:**

This button opens another window that lists the display driver files and attributes as shown in Figure 3.6.

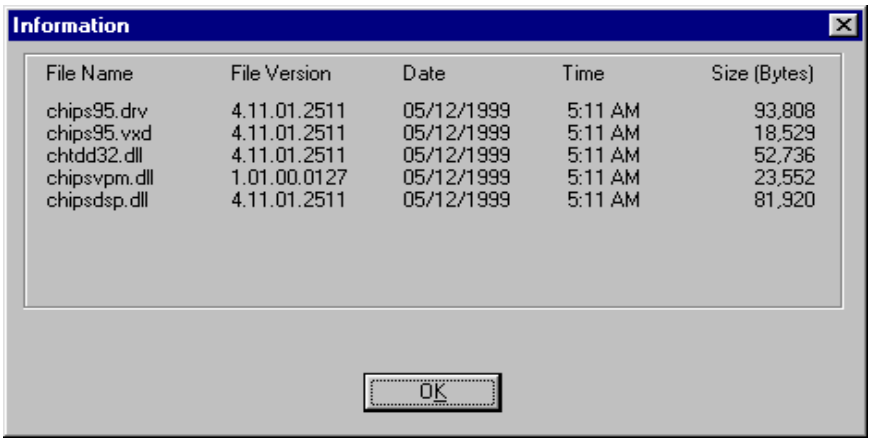


Figure 3.6 Lists of the display driver files and attributes

Adjust button:

This button runs a Gamma correction utility (Figure 3.7). Gamma correction is designed to correct non-linear characteristics of monitors so that people can see color pictures and movies more clearly. Gamma correction provides the following capabilities for 64K and 16M color modes:

Adjust Graphics Color: Adjust the color for all the graphics windows

Adjust Video Color: Adjust the color for the movie that uses direct draw overlay.

Adjust Graphics and Video Color: Adjust both graphics and video color.

To select a capability right click on the Gamma correction utility in the desired color depth and resolution. Each resolution and color depth combination can have its own Gamma correction. Gamma correction values are "remembered" by the software so there is no need to re-optimize the color settings once a setting has been chosen.

Figure 3.7 Gamma Correction adjustment

bitmap display:

The bitmap display in the Multiple Monitor Display Information section provides a preview of the display mode to be selected. This bitmap provides an example of a display mode before the mode has been set with the Apply button. If no changes have been made to the current mode, this bitmap displays the current display mode state.

3.4.2 Monitor A and Monitor B Sections

This section lists the possible output display device configurations. Selecting a device from the monitor A section alters the choices available in the monitor B section. When you select the device output configuration, press the apply button to accept and enable the configuration.

3.4.3 CHIPS TV Control Section

Selecting the TV radio button from the Monitor A section enables the Chips TV Control section. This section provides the ability to choose the TV signal format of NTSC or PAL.

3.4.4 Additional Features

Stretch Checkbox

Stretches the desktop display to fill the full screen size of the panel.

3.5 Dual Display Mode Property Sheet

If you select the Dual Display Mode option from the drop-down list box, and press the Apply button, the property sheet in Figure 3.8 appears. A brief explanation of the features available for this display mode is provided in this section.

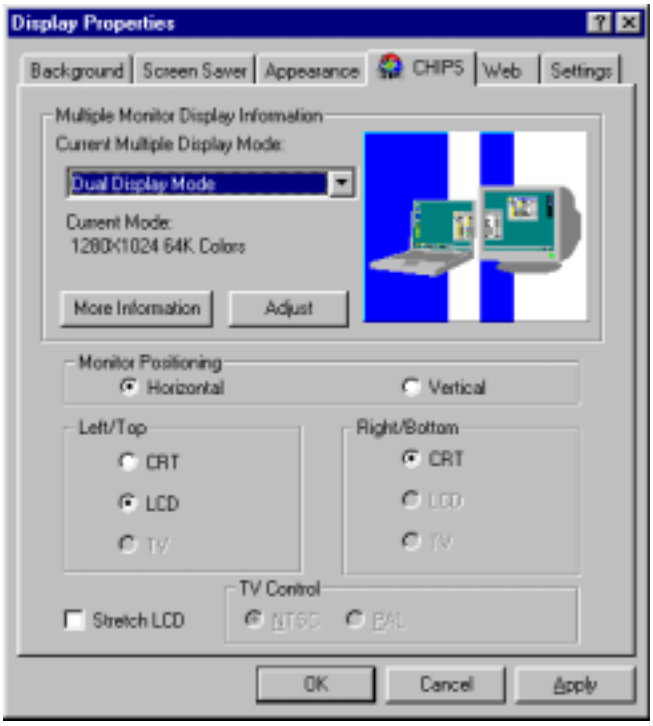


Figure 3.8 Dual Display Mode Property Sheet

3.5.1 Multiple Monitor Display Information Section

This section provides information about the current display mode.

Current Multiple Display Mode drop-down list box**:**

This box shows the current display mode selected. When the list box is dropped down, a list of other available display modes is shown.

Current Mode text**:**

This text describes the current resolution and color depth.

More Information button**:**

This button opens another window that lists the display driver files and attributes as shown in Figure 3.9.

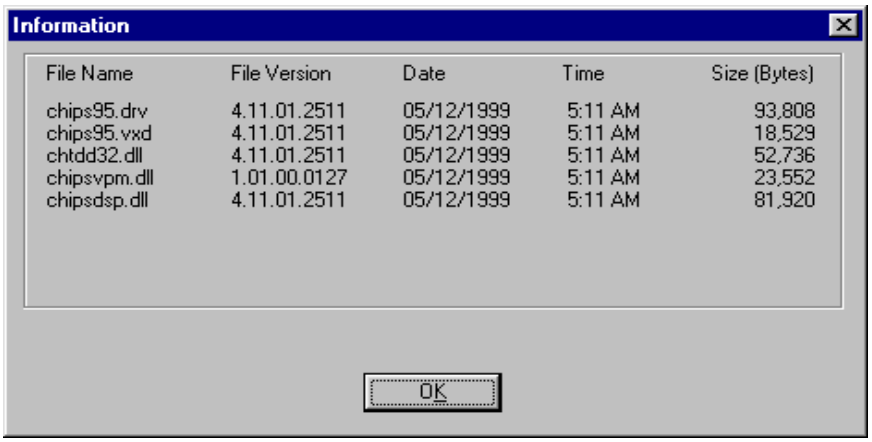


Figure 3.9 Lists of the display driver files and attributes

Adjust button:

This button runs a Gamma correction utility (Figure 3.10). Gamma correction is designed to correct non-linear characteristics of monitors so that people can see color pictures and movies more clearly. Gamma correction provides the following capabilities for 64K and 16M color modes:

- **Adjust Graphics Color:** Adjust the color for all the graphics windows
- **Adjust Video Color:** Adjust the color for the movie that uses direct draw overlay.
- **Adjust Graphics and Video Color:** Adjust both graphics and video color.

To select a capability right click on the Gamma correction utility in the desired color depth and resolution. Each resolution and color depth combination can have its own Gamma correction. Gamma correction values are "remembered" by the software so there is no need to re-optimize the color settings once a setting has been chosen.

Figure 3.10 Gamma Correction adjustment

bitmap display:

The bitmap display in the Multiple Monitor Display Information section provides a preview of the display mode to be selected. This bitmap provides an example of a display mode before the mode has been set with the Apply button. If no changes have been made to the current mode, this bitmap displays the current display mode state.

3.5.2 Monitor Positioning Section

This section determines how the Windows desktop will span the two output display devices. If Horizontal is chosen, one output display device will display the left half of the desktop and the other device will display the right half of the desktop. If Vertical is chosen, one output display device will display the top half of the desktop and the other device will display the bottom half of the desktop.

3.5.3 Left/Top and Right/Bottom Sections

This section lists the possible output display device configurations. Once you select the device output configuration for the left or top display, the valid output display devices for the right or bottom display are shown. Once you select the device output configuration, press the Apply button to accept and enable the configuration.

3.5.4 CHIPS TV Control Section

Selecting the TV radio button from the Left/Top or Right/Bottom section enables the Chips TV Control section. This section provides the ability to choose the TV signal format of NTSC or PAL.

3.5.5 Additional Features

Stretch Checkbox

Stretches the desktop display to fill the full screen size of the panel.

4 Property Sheet Mode Support for Windows NT 4.0

The additional mode support available with the 69030 for the Windows NT 4.0 operating system can be found in the display property sheet. This section describes how to access the property sheet and utilize the features of the 69030.

4.1 Accessing the Display Properties Window

Access the display properties window through the Windows desktop. Click on My Computer|Control Panel|Display. Then select the CHIPS tab.

4.2 Selecting the Display Mode

In the Chips tab, select the desired display mode in the drop-down list box in the Multiple Monitor Display Information Section. The Chips property sheet changes depending on the selection made.

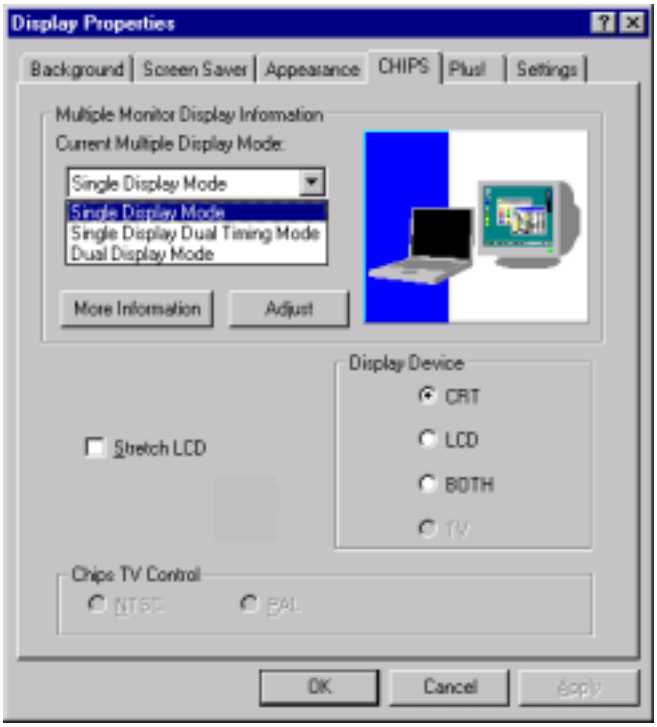


Figure 4.1 Display Mode Selection for Windows NT 4.0

4.3 Single Display Mode Property Sheet

If you select the Single Display Mode option from the drop-down list box, and press the Apply button, the property sheet appears as shown in Figure 4.2 below. A brief explanation of the features available for this display mode is provided in this section.

Figure 4.2 Display Properties for Windows NT 4.0

4.3.1 Multiple Monitor Display Information Section

This section provides information about the current display mode.

Current Multiple Display Mode drop-down list box**:**

This box shows the current display mode selected. When the list box is dropped down, a list of other available display modes is shown.

Current Mode text**:**

This text describes the current resolution and color depth.

More Information button**:**

This button opens another window that lists the display driver files and attributes as shown in Figure 4.3.

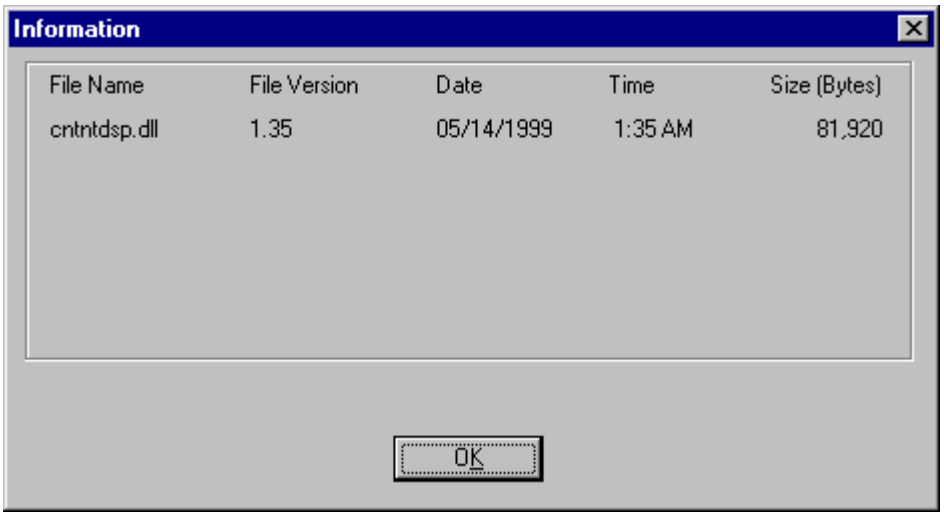


Figure 4.3 Lists of the display driver files and attributes

Adjust button:

This button runs a Gamma correction utility (Figure 4.4). Gamma correction is designed to correct non-linear characteristics of monitors so that people can see color pictures and movies more clearly. Gamma correction provides the following capabilities for 64K and 16M color modes:

- **Adjust Graphics Color:** Adjust the color for all the graphics windows.
- **Adjust Video Color:** Adjust the color for the movie that uses direct draw overlay.
- **Adjust Graphics and Video Color:** Adjust both graphics and video color.

To select a capability right click on the Gamma correction utility in the desired color depth and resolution. Each resolution and color depth combination can have its own Gamma correction. Gamma correction values are "remembered" by the software so there is no need to re-optimize the color settings once a setting has been chosen.

Figure 4.4 Gamma Correction for Windows NT 4.0

bitmap display:

The bitmap display in the Multiple Monitor Display Information section provides a preview of the display mode to be selected. This bitmap provides an example of a display mode before the mode has been set with the Apply button. If no changes have been made to the current mode, this bitmap displays the current display mode state.

4.3.2 Display Device Section

This section contains the possible output devices available for the particular mode chosen. For Single Display Mode, the choices are a CRT, LCD, TV, or BOTH. Both is the Single Display “simultaneous” mode which selects both the CRT and the LCD panel to display simultaneously.

4.3.3 CHIPS TV Control Section

Selecting the TV radio button from the Display Device section enables the Chips TV Control section. This section provides the ability to choose the TV signal format of NTSC or PAL.

4.3.4 Additional Features

Stretch Checkbox

Stretches the desktop display to fill the full screen size of the panel.

4.4 Single Display Dual Timing Mode Property Sheet

If you select the Single Display Dual Timing Mode option from the Drop-down list Box, and press the Apply button, the property sheet in Figure 4.5 appears. A brief explanation of the features available for this display mode is provided in this section.

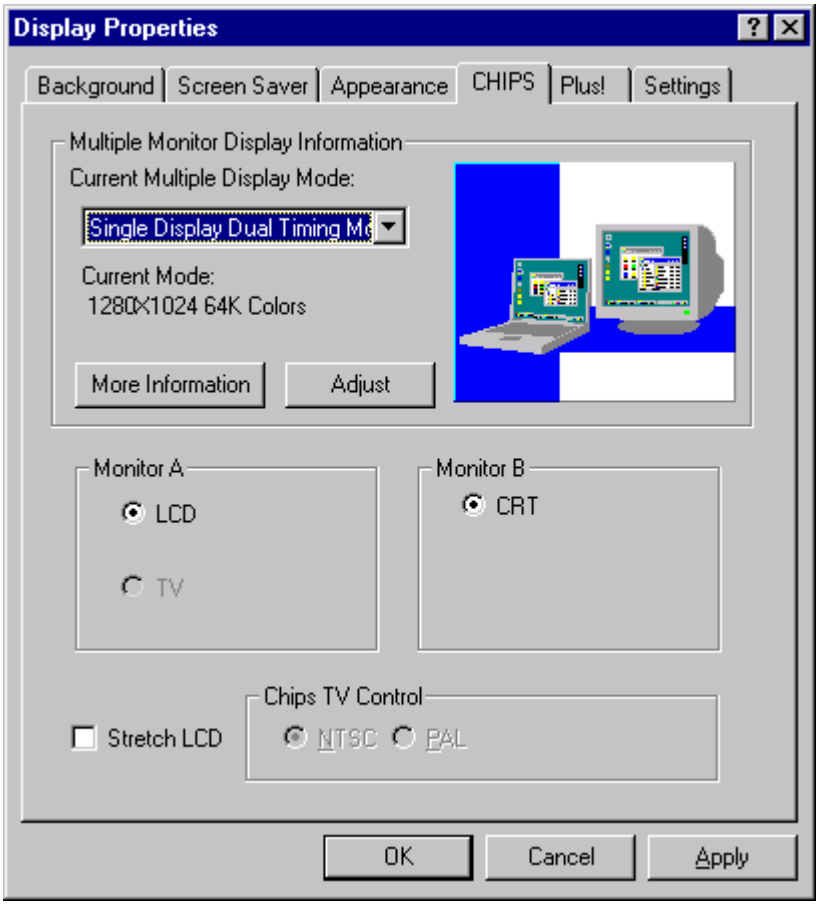


Figure 4.5 Single Display Dual Timing Mode Property Sheet

4.4.1 Multiple Monitor Display Information Section

This section provides information about the current display mode.

Current Multiple Display Mode drop-down list box**:**

This box shows the current display mode selected. When the list box is dropped down, a list of other available display modes is shown.

Current Mode text**:**

This text describes the current resolution and color depth.

More Information button**:**

This button opens another window that lists the display driver files and attributes as shown in Figure 4.6.

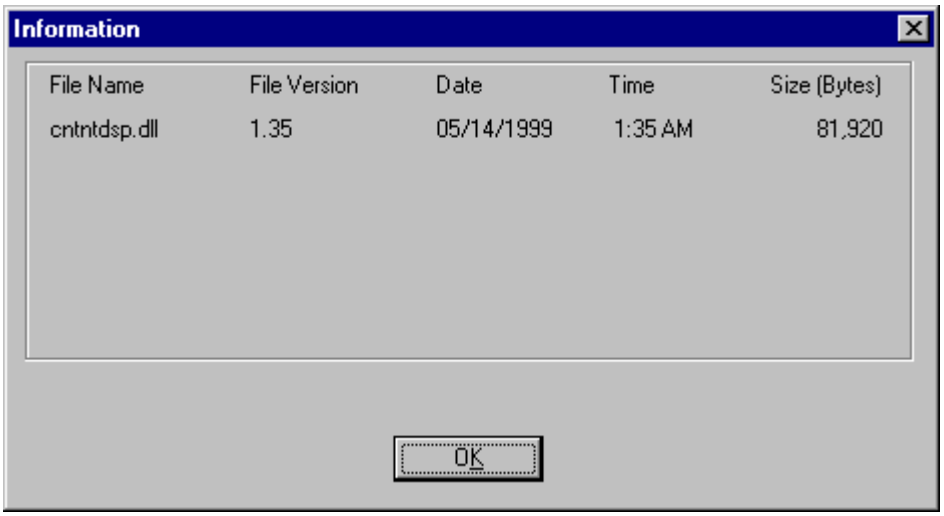


Figure 4.6 Lists of the display driver files and attributes

Adjust button:

This button runs a Gamma correction utility (Figure 4.7). Gamma correction is designed to correct non-linear characteristics of monitors so that people can see color pictures and movies more clearly. Gamma correction provides the following capabilities for 64K and 16M color modes:

- **Adjust Graphics Color:** Adjust the color for all the graphics windows.
- **Adjust Video Color:** Adjust the color for the movie that uses direct draw overlay.
- **Adjust Graphics and Video Color:** Adjust both graphics and video color.

To select a capability right click on the Gamma correction utility in the desired color depth and resolution. Each resolution and color depth combination can have its own Gamma correction. Gamma correction values are "remembered" by the software so there is no need to re-optimize the color settings once a setting has been chosen.

Figure 4.7 Gamma Correction for Windows NT 4.0

bitmap display:

The bitmap display in the Multiple Monitor Display Information section provides a preview of the display mode to be selected. This bitmap provides an example of a display mode before the mode has been set with the Apply button. If no changes have been made to the current mode, this bitmap displays the current display mode state.

4.4.2 Monitor A and Monitor B Sections

This section lists the possible output display device configurations. Selecting a device from the monitor A section alters the choices available in the monitor B section. Once the device output configuration is selected, press the apply button to accept and enable the configuration.

4.4.3 CHIPS TV Control Section

Selecting the TV radio button from the Monitor A section enables the Chips TV Control section. This section provides the ability to choose the TV signal format of NTSC or PAL.

4.4.4 Additional Features

Stretch Checkbox

Stretches the desktop display to fill the full screen size of the panel.

4.5 Dual Display Mode Property Sheet

If you select the Dual Display Mode option from the Drop-down list Box, and press the Apply button, the property sheet in Figure 4.8 appears. A brief explanation of the features available for this display mode is provided in this section.

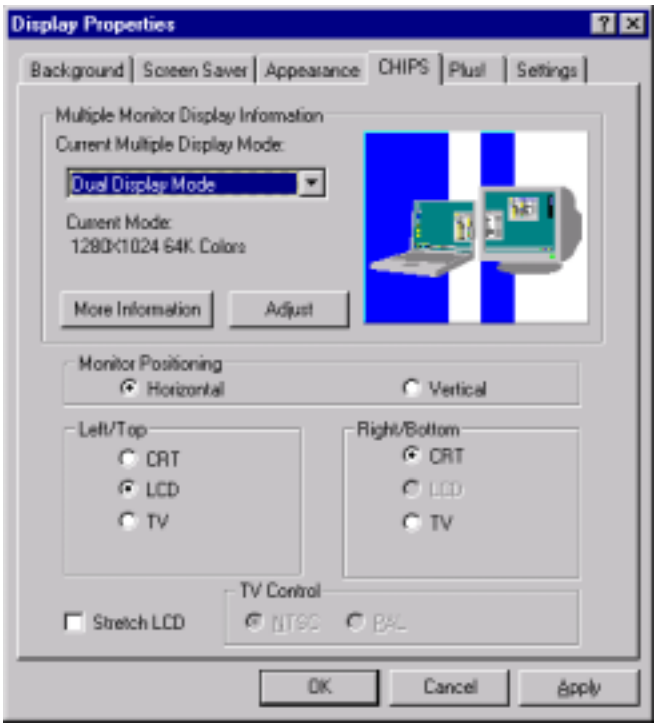


Figure 4.8 Dual Display Mode Property Sheet

4.5.1 Multiple Monitor Display Information Section

This section provides information about the current display mode.

Current Multiple Display Mode drop-down list box**:**

This box shows the current display mode selected. When the list box is dropped down, a list of other available display modes is shown.

Current Mode text**:**

This text describes the current resolution and color depth.

More Information button**:**

This button opens another window that lists the display driver files and attributes as shown in Figure 4.9.

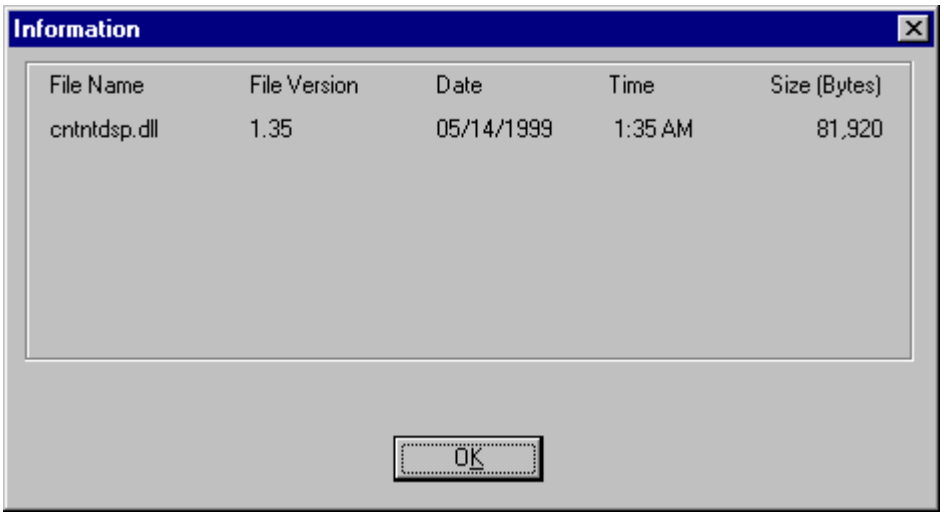


Figure 4.9 Lists of the display driver files and attributes

Adjust button:

This button runs a Gamma correction utility (Figure 4.10). Gamma correction is designed to correct non-linear characteristics of monitors so that people can see color pictures and movies more clearly. Gamma correction provides the following capabilities for 64K and 16M color modes:

- **Adjust Graphics Color:** Adjust the color for all the graphics windows.
- **Adjust Video Color:** Adjust the color for the movie that uses direct draw overlay.
- **Adjust Graphics and Video Color:** Adjust both graphics and video color.

To select a capability right click on the Gamma correction utility in the desired color depth and resolution. Each resolution and color depth combination can have its own Gamma correction. Gamma correction values are "remembered" by the software so there is no need to re-optimize the color settings once a setting has been chosen.

Figure 4.10 Gamma Correction adjustment

bitmap display:

The bitmap display in the Multiple Monitor Display Information section provides a preview of the display mode to be selected. This bitmap provides an example of a display mode before the mode has been set with the Apply button. If no changes have been made to the current mode, this bitmap displays the current display mode state.

4.5.2 Monitor Positioning Section

This section determines how the Windows desktop will span the two output display devices. If you choose Horizontal, one output display device will display the left half of the desktop and the other device will display the right half of the desktop. If you choose Vertical, one output display device will display the top half of the desktop and the other device will display the bottom half of the desktop.

4.5.3 Left/Top and Right/Bottom Sections

This section lists the possible output display device configurations. Once the device output configuration is selected for the left or top display, the valid output display devices for the right or bottom display are shown. Once the device output configuration is selected, press the Apply button to accept and enable the configuration.

4.5.4 CHIPS TV Control Section

Selecting the TV radio button from the Left/Top or Right/Bottom section enables the Chips TV Control section. This section provides the ability to choose the TV signal format of NTSC or PAL.

4.5.5 Additional Features

Stretch Checkbox

Stretches the desktop display to fill the full screen size of the panel.

5 Property Sheet Mode Support for Windows 98

The additional mode support available with the 69030 for the Windows 98 operating system can be found in the display property sheet. This section describes how to access the property sheet and use the features of the 69030.

5.1 Utilizing the 69030 Display Mode Support

To use the additional mode support available with the 69030 be sure the second monitor is disabled in the display settings property sheet. Click on My Computer|Control Panel|Display and select the Settings tab. Right click on the “2” monitor and uncheck the Enabled line from the pop-up list if it is checked. Finally, right click on the “1” monitor to have the Windows property sheet tabs reflect the information corresponding to monitor “1”.

5.2 Accessing the Display Properties Window

Access the display properties window through the Windows desktop. Click on My Computer|Control Panel|Display and select the settings tab. Click the Advanced button and choose the Chips tab.

5.3 Selecting the Display Mode

When you select the Chips tab, drop-down the list box in the Multiple Monitor Display Information Section to reveal the display modes available with the 69030 and Windows 98. The Chips property sheet changes depending on the selection.

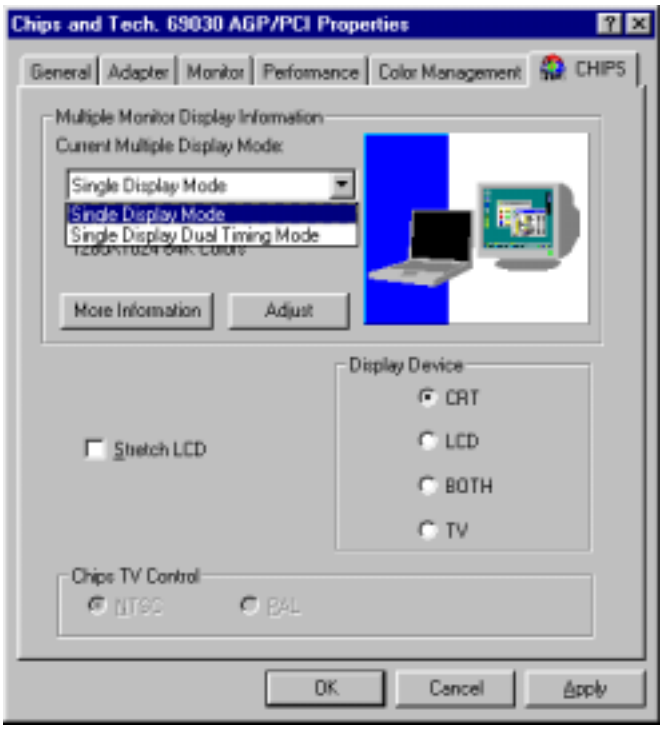


Figure 5.1 Mode Selection for Windows 98

5.4 Single Display Mode Property Sheet

If you select the Single Display Mode option from the Drop-down list Box, and press the Apply button, the property sheet appears as shown in Figure 5.2 below. A brief explanation of the features available for this display mode is provided in this section.

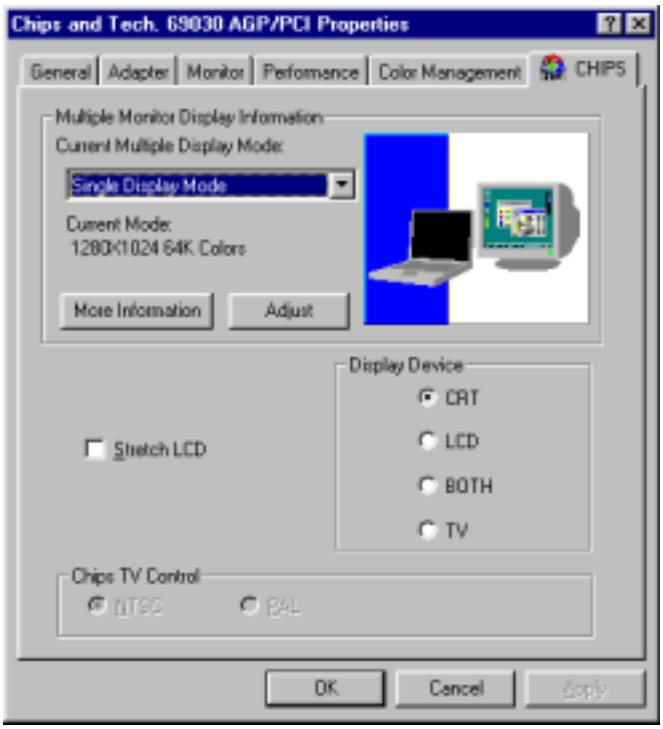


Figure 5.2 Single Display Mode Selection for Windows 98

5.4.1 Multiple Monitor Display Information Section

This section provides information about the current display mode.

Current Multiple Display Mode drop-down list box**:**

This box shows the current display mode selected. When the list box is dropped down, a list of other available display modes is shown.

Current Mode text**:**

This text describes the current resolution and color depth.

More Information button**:**

This button opens another window that lists the display driver files and attributes as shown in Figure 5.3.

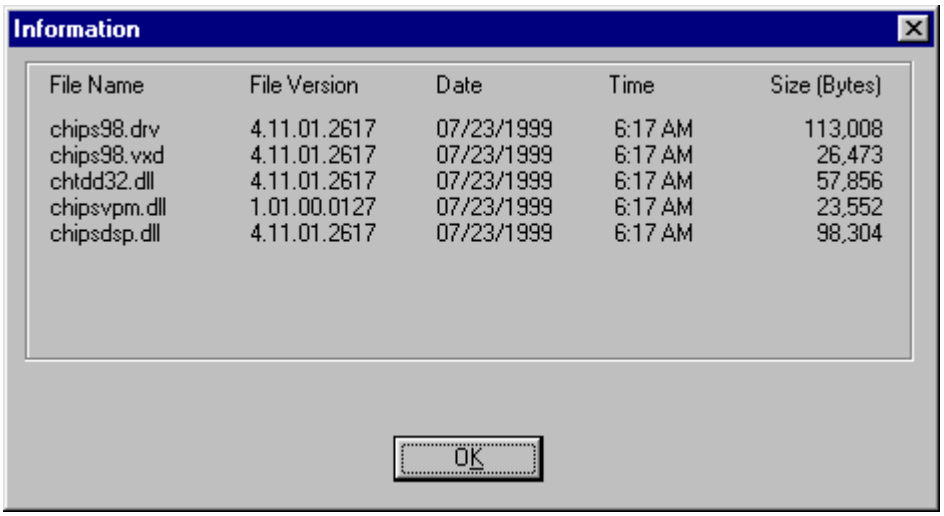


Figure 5.3 Lists of the display driver files and attributes

Adjust button**:**

This button runs a Gamma correction utility (Figure 5.4). Gamma correction is designed to correct non-linear characteristics of monitors so that people can see color pictures and movies more clearly. Gamma correction provides the following capabilities for 64K and 16M color modes:

- **Adjust Graphics Color:** Adjust the color for all the graphics windows.
- **Adjust Video Color:** Adjust the color for the movie that uses direct draw overlay.
- **Adjust Graphics and Video Color:** Adjust both graphics and video color.

To select a capability right click on the Gamma correction utility in the desired color depth and resolution. Each resolution and color depth combination can have its own Gamma correction. Gamma correction values are "remembered" by the software so there is no need to re-optimize the color settings once a setting has been chosen.

Figure 5.4 Gamma Correction for Windows 98

Bitmap display:

The bitmap display in the Multiple Monitor Display Information section provides a preview of the display mode to be selected. This bitmap provides an example of a display mode before the mode has been set with the Apply button. If no changes have been made to the current mode, this bitmap displays the current display mode state.

5.4.2 Display Device Section

This section contains the possible output devices available for the particular mode chosen. For Single Display Mode, the choices are a CRT, LCD, TV, or BOTH. Both is the Single Display “simultaneous” mode which selects both the CRT and the LCD panel to display simultaneously.

5.4.3 CHIPS TV Control Section

Selecting the TV radio button from the Display Device section enables the Chips TV Control section. This section provides the ability to choose the TV signal format of NTSC or PAL.

5.4.4 Additional Features

Stretch Checkbox

Stretches the desktop display to fill the full screen size of the panel.

5.5 Single Display Dual Timing Mode Property Sheet

If you select the Single Display Dual Timing Mode option from the Drop-down list Box, and press the Apply button, the property sheet appears as shown in Figure 5.5 below. A brief explanation of the features available for this display mode is provided in this section.

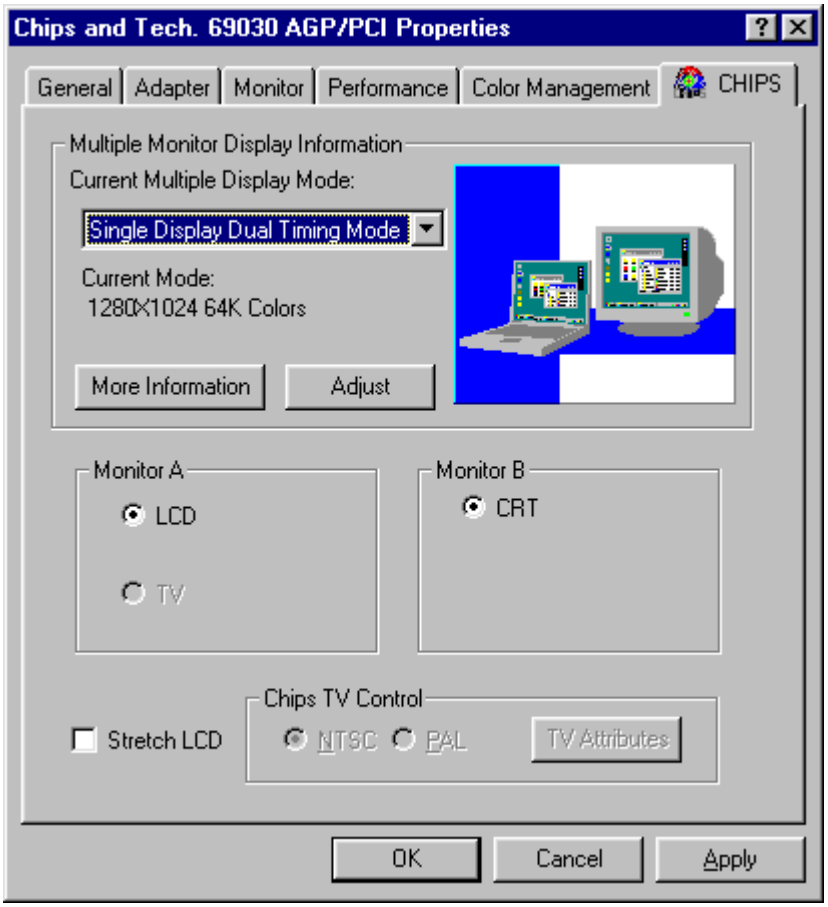


Figure 5.5 Single Display Dual Timing Mode for Windows 98

5.5.1 Multiple Monitor Display Information Section

This section provides information about the current display mode.

Current Multiple Display Mode drop-down list box**:**

This box shows the current display mode selected. When the list box is dropped down, a list of other available display modes is shown.

Current Mode text**:**

This text describes the current resolution and color depth.

More Information button**:**

This button opens another window that lists the display driver files and attributes as shown in Figure 5.6.

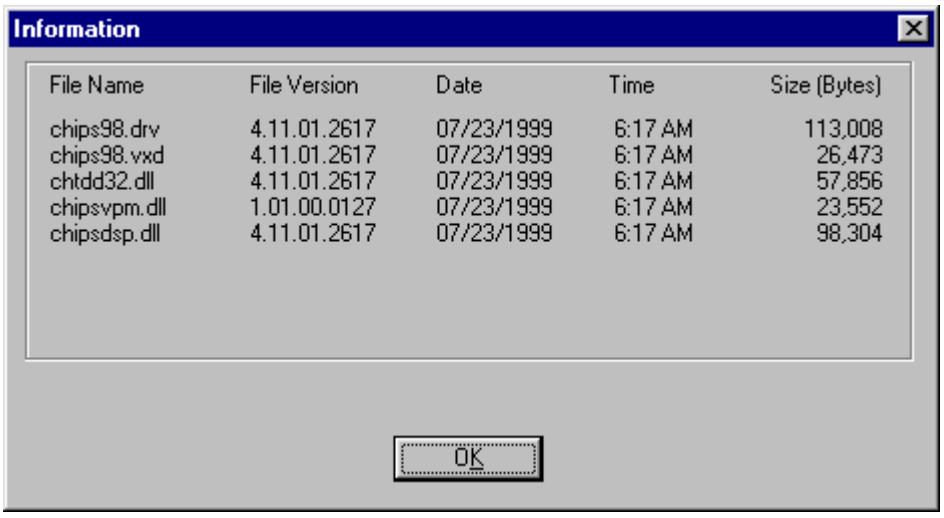


Figure 5.6 Lists of the display driver files and attributes

Adjust button**:**

This button runs a Gamma correction utility (Figure 5.7). Gamma correction is designed to correct non-linear characteristics of monitors so that people can see color pictures and movies more clearly. Gamma correction provides the following capabilities for 64K and 16M color modes:

- **Adjust Graphics Color:** Adjust the color for all the graphics windows.
- **Adjust Video Color:** Adjust the color for the movie that uses direct draw overlay.
- **Adjust Graphics and Video Color:** Adjust both graphics and video color.

To select a capability right click on the Gamma correction utility in the desired color depth and resolution. Each resolution and color depth combination can have its own Gamma correction. Gamma correction values are "remembered" by the software so there is no need to re-optimize the color settings once a setting has been chosen.

Figure 5.7 Gamma Correction, multiple monitors, for Windows 98

Bitmap display:

The bitmap display in the Multiple Monitor Display Information section provides a preview of the display mode to be selected. This bitmap provides an example of a display mode before the mode has been set with the Apply button. If no changes have been made to the current mode, this bitmap displays the current display mode state.

5.5.2 Monitor A and Monitor B Sections

This section lists the possible output display device configurations. Selecting a device from the monitor A section alters the choices available in the monitor B section. Once the device output configuration is selected, press the Apply button to accept and enable the configuration.

5.5.3 CHIPS TV Control Section

Selecting the TV radio button from the Monitor A section enables the Chips TV Control section. This section provides the ability to choose the TV signal format of NTSC or PAL.

5.5.4 Additional Features

Stretch Checkbox

Stretches the desktop display to fill the full screen size of the panel.

5.6 Windows 98 Multi-Monitor Support with the 69030

Windows 98 provides multiple monitor support. Since Dual Mode support is redundant in Windows 98; there is no Dual Mode 69030 support provided with Windows 98. However, to switch from Windows 98 multi-monitor mode to the 69030 single display modes requires an additional step.

5.6.1 Enabling Multi-Monitor Support

To enable multi-monitor support in Windows 98, first go to the Chips property sheet tab. From the Windows desktop click on My Computer|Control Panel|Display and select the settings tab. Click the Advanced button and choose the Chips tab. Select the Single Display Mode setting from the drop-down list box in the Multiple Monitor Display Information section. Make sure the “BOTH” button is not selected in the Display Device section. If it is selected make another choice and select the Apply button. Once the Single Display mode setting is activated, the Windows 98 multi-monitor support will function normally. If the Single Display Mode setting is not activated, or the Display Device section is set to “BOTH” it will be impossible to enable monitor two in the Display Properties’ Settings tab.

5.6.2 Enabling the 69030 mode support

To enable the 69030 mode support, first go to the Windows Display Properties Settings tab. From the Windows desktop click on My Computer|Control Panel|Display and select the settings tab. Right click on the “2” monitor and uncheck the Enabled line from the pop-up list. Next, right click on the “1” monitor to have the Windows property sheet tabs reflect the information corresponding to monitor “1”. From the Settings tab, click on the Advanced button and select the Chips tab. Use the drop-down list box in the Multiple Monitor Display Information section to select the desired mode support. Click the Apply button to accept.

6 69030 Register Classes

The 69030 supports dual independent display output pipelines by providing register features not available in the 69000. The 69030 has three classes of registers:

- Shared
- Shadowed
- Control registers.

The shared registers support hardware that is shared by both pipelines. They are accessible from either pipeline and affect both pipelines.

The shadowed registers support hardware that belongs to one pipeline or the other. The shadowed registers are one register composed of a shadow of that register for each pipeline. Each shadow of a register affects only the pipeline with which it is associated. Shadowed registers are intended to be accessed independently of each other, allowing each display output pipeline to be optimized for its display device.

The control registers are registers that control access to the shadowed registers. Since the shadowed registers contain independent values, there must be a control method for distinguishing which register shadow is to be altered. This is determined by the settings of the control registers.

6.1 Shadowed/Shared Register Classification

The registers available with the 69030 have a distinction of being either shared or shadowed. The following table 2 lists the classification of each shadowed/shared register for the 69030.

Table 6.1 69030 Shadowed/Shared Register Classification

Shadowed for Pipeline A	Shared	Shadowed for Pipeline B
FCR		FCR
Bits 7-6 and 3-2 of MSR	Bits 5-4 and 1-0 of MSR	Bits 7-6 and 3-2 of MSR
Bit 7 of ST00	Bits 6-0 of ST00	Bit 7 of ST00
ST01		ST01
CR00 to CR70		CR00 to CR70
No equivalent here		CR71 onward
	SR00	
SR01		SR01
	SR02 to SR07	
	GR00 to GR05	
Bit 0 of GR06	Bits 7-1 of GR06	Bit 0 of GR06
	GR07 to GR08	
AR00 to AR14		AR00 to AR14
DACMASK		DACMASK
DACSTATE		DACSTATE

Shadowed for Pipeline A	Shared	Shadowed for Pipeline B
DACRX		DACRX
DACWX		DACWX
DACDATA		DACDATA
	XR00 to XR08	
XR09		XR09
	XR0A to XR3F	
XR40		XR40
	XR41 to XR7F	
XR80 to XR82		XR80 TO XR82
	XR83 to XR9F	
XRA0 to XRA7		XRA0 TO XRA7
	XRA8 to XRC7	
XRC8 to XRCB		XRC8 to XRCB
	XRCC to XRCF	
bits 4 and 2-1 of XRD0	Bits 7-5 and 0 of XRD0	Bits 4 and 2-1 of XRD0
	XRD1 to XRDF	
XRE0 to XRE3		XRE0 to XRE3
	XRE4 to XRFF	
FR00-FR01		FR00 to FR01
	FR02 to FR06	
FR07 onward		No equivalent here
	MR00 to MR18	
Bits 7-6 and 4-0 of MR1E		Bits 7-6 and 4-0 of MR1E
MR1F to MR42		MR1F to MR42
MR43 to MR44		MR43 to MR44
Bits 7-6 and 4-0 of MR9E		Bits 7-6 and 4-0 of MR9E
MR9F to MRC2		MR9F to MRC2
	BR00 to BR0F	
	ER00 to ER0F	

Note: The I/O and memory mapped register space shadowing capabilities do not apply to the PCI configuration register that are accessible only via the PCI configuration space. Also, there is only one frame buffer and it is not shadowed.

6.2 Pipeline Control Registers

The 69030 contains two control registers which determine the pipeline register access:

1. I/O Space Shadowing register (IOSS)

2. Memory Space Shadowing register (MSS).

The accessibility of the I/O addressable registers for a particular pipeline is set through the IOSS register. The IOSS register determines which pipeline shadowed register values return for an I/O read. The IOSS register provides the capability of setting the I/O write access to either, both, or neither pipeline. The following table defines the IOSS register.

Table 6.2 IOSS Register

	7	6	5	4	3	2	1	0
A & B	Reserved (000)			Index Write En (0)	Index A/B Select (0)	Rd Select (0)	I/O Space Reg Write Sel & Read-Mode Ctrl (00)	

Bit 4 Enables (1)/Disables (0) write access (independent of which pipeline is selected).

Bit 3 Selects pipeline A (0) or pipeline B (1) indices for I/O register access

Bit 2 Sets pipeline A (0) or pipeline B (1) as readable from the I/O space

Bit 1-0 Sets I/O write access to neither pipeline (00), pipeline A (01), pipeline B (10), or both pipelines (11).

The accessibility of the memory mapped I/O registers for a particular pipeline is set through the MSS register. The MSS register determines which pipeline shadowed register values return for a memory mapped I/O read. The MSS register provides the capability of setting the memory mapped I/O write access to either, both, or neither pipeline. The following table defines the MSS register.

Table 6.3 MSS Register

	7	6	5	4	3	2	1	0
A & B	Reserved (000)				Memory Shad En (0)	A/B Reg Read (0)	Pipe A Reg Write (0)	Pipe B Reg Write (0)

Bit 3 when disabled (0), pipeline A registers map to memory offsets 400000 through 7FFFFF and pipeline B registers map to memory offsets C00000 through FFFFFF. When enabled (1), bits 2-0 determine the accessibility of the pipeline registers through memory.

Bit 2 selects pipeline A (0) or pipeline B (1) as readable through offsets 400000 through 7FFFFF and C00000 through FFFFFF.

Bit 1 when enabled (1), you can write to pipeline A register offsets 400000 through 7FFFFF and C00000 through FFFFFF. Otherwise, you cannot write to registers exclusive to pipeline A.

Bit 0 when enabled (1), you can write to pipeline B registers offsets 400000 through 7FFFFF and C00000 through FFFFFF. Otherwise, you cannot write to registers exclusive to pipeline B.

6.3 Pipeline Assignment Registers

The Control registers MSS and IOSS determine pipeline register access. The output device associated with the pipeline is determined by the Pipeline Enable and Timing Select (FR01) and the Output Enable and Assignment registers (FR02).

The Pipeline Enable and Timing Select register (FR01) determines the timing registers associated with each pipeline. It is a shadowed register that can only be accessed after the IOSS or MSS register has been properly set. The following table defines the Pipeline Enable and Timing Select Register.

Table 6.4 Pipeline Enable and Timing Select Register

	7	6	5	4	3	2	1	0
A	Reserved (0000)				DCLK Select (10)		Pipe A En & Timing Sel (01)	
B	Reserved (000000)						Pipe B En & Timing Sel (01)	

FR01 register definition for pipeline A:

Bit 3-2 Determines the dot clock selection for pipeline A according to the following table. If the CR timing registers have not been selected for pipeline A in bit 1-0.

Table 6.5 Pipeline A FR01 Register

Bits 3 2	**Dot Clock Synthesizer Selected**
0 0	DCLK 0
0 1	DCLK 1
1 0	DCLK 2
1 1	Reserved

Note: The MSR register controls the clock selection for pipeline A if the CR timing registers are selected in Bit 1-0.

Bit 1-0 Determines which pipelines are enabled and what timing registers are selected according to the following table.

Table 6.6 MSR Register

Bits 1 0	**Dot Clock Synthesizer Selected**
0 0	Pipeline disabled
0 1	Pipeline enabled and CR timing registers selected
1 0	Pipeline enabled and FR timing registers selected

FR01 register definition for pipeline B:

Bit 1-0 Determines which pipelines are enabled and which timing registers are selected according to the following table.

Table 6.7 Pipeline B FR01 Register

Bits 1 0	**Dot Clock Synthesizer Selected**
0 0	Pipeline disabled

Bits 1 0	Dot Clock Synthesizer Selected
0 1	Pipeline enabled and CR timing registers selected

The Output Enable and Assignment Register (FR02) determines when and what output signals are driven on each pipeline. It is a shared register that can be accessed from either pipeline. The following table is the definition of the Output Enable and Assignment Register.

Table 6.8 Output Enable and Assignment Register

	7	6	5	4	3	2	1	0
A & B	Reserved (00)		Direct Fp Interface En (0)	CRT Output En (0)	Reserved (000)			CRT Out Assign (0)

Bit 5 – Enables (1)/Disables (0) the flat panel interface.

Bit 4 – Enables (1)/Disables (0) the CRT output.

Bit 0 – Assigns the CRT DAC outputs to pipeline A (0) or pipeline B (1).

7 Display Configuration Examples

The 69030 has two independent display pipelines with three display mode configurations:

1. Single display mode
2. Single display dual timing mode
3. Dual display

The following examples demonstrate how to configure the display modes.

7.1 Single Display Mode Initialization

The Single Display Mode is compatible with the Intel 69000 Graphic Controller.

- Table 7.1 outlines the steps for displaying an image on the flat panel.
- Table 7.2 outlines the steps for displaying an image on the CRT.
- Table 7.3 outlines the steps for displaying an image on the CRT using pipe B.

Table 7.1 Steps for Displaying an Image on a Flat Panel Display Using Pipe A

IOSS	1Eh	Set pipeline register access to B
FR01	00h	Disable pipeline B
IOSS	11h	Set pipeline register access to A
LOAD REGISTERS		Load the register values for the desired mode (i.e. same register settings used by the 69000)
FR01	02h/06h/0Ah	Select FR timing registers and DCLK
FR02	20h	Enable the flat panel interface for pipe A

Table 7.2 Steps for Displaying an Image on a CRT Display Using Pipe A

IOSS	1Eh	Set pipeline register access to B
FR01	00h	Disable pipeline B
IOSS	11h	Set pipeline register access to A
LOAD REGISTERS		Load the register values for the desired mode (i.e. same register settings used by the 69000)
FR01	01h	Select CR timing registers
SET	MSR[3,2]	Use the MSR register to select the DCLK
FR02	10h	Enable the CRT output for pipe A

Table 7.3 Steps for Displaying an Image on a CRT Display Using Pipe B

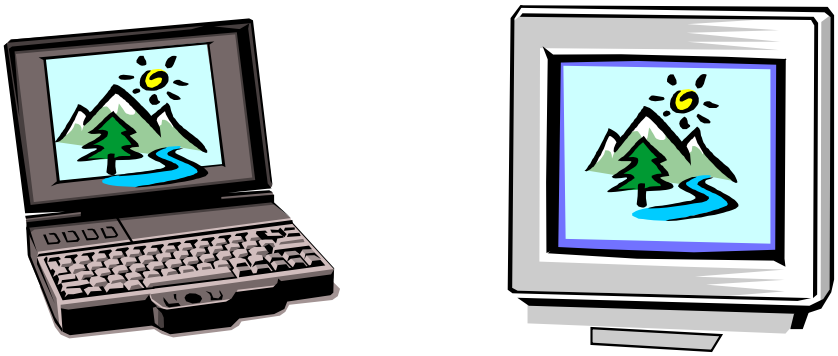
IOSS	11h	Set pipeline register access to A
FR01	00h	Disable pipeline A
IOSS	1Eh	Set pipeline register access to B
LOAD REGISTERS		Load the register values for the desired mode (i.e. same register settings used by the 69000)
FR01	01h	Select CR timing registers
SET	MSR[3,2]	Use the MSR register to select the DCLK
FR02	11h	Enable the CRT output for pipe B

7.2 Single Display Dual Timing Mode Initialization

The following table outlines the steps for displaying on both the CRT and flat panel simultaneously. In this single display dual timing mode, the resolution and color depth must remain the same for both pipelines to display the same image. However, the timings for the pipelines are independent of each other and can be altered to provide the best possible output for the display device.

Table 7.4 Steps for Displaying on the CRT and Flat Panel Simultaneously

IOSS	11h	Set pipeline register access to A
LOAD REGISTERS		Load the register values for the desired mode (i.e. same register settings used by the 69000)
FR01	02h/06h/0Ah	Select FR timing registers and DCLK
LOAD REGISTERS		Load the register values for the desired mode (i.e. same register settings used by the 69000 and same mode as above)
IOSS	1Eh	Set pipeline register access to B
FR01	01h	Select CR timing registers
SET	MSR[3,2]	Use the MSR register to select the DCLK
FR02	00h	Make sure CRT output is disabled before assigning it to a pipeline
FR02	31h	Enable the CRT output on pipe B and enable the flat panel on pipe A

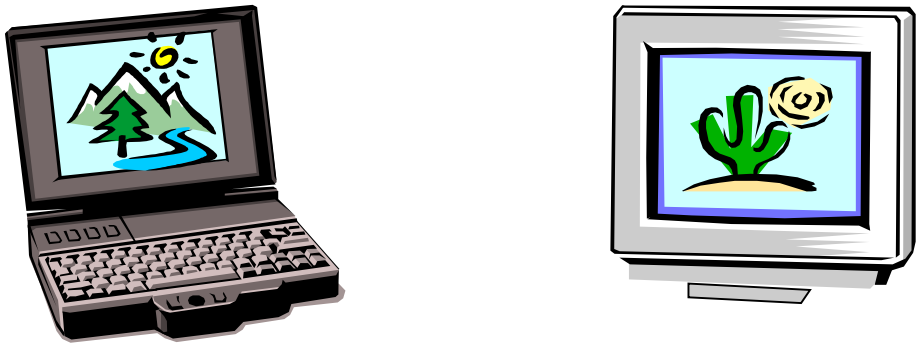


7.3 Dual Display Mode Initialization

The following table outlines the steps for displaying on both the CRT and flat panel simultaneously with different displays and different timings.

Table 7.5 Steps for Displaying CRT and Flat Panel Simultaneously with Different Displays and Timings

IOSS 11h	Set pipeline register access to A
LOAD REGISTERS	Load the register values for the desired mode (i.e. same register settings used by the 69000)
FR01 02h/06h/0Ah	Select FR timing registers and DCLK
LOAD REGISTERS	Load the register values for the desired mode (i.e. same register settings used by the 69000)
IOSS 1Eh	Set pipeline register access to B
FR01 01h	Select CR timing registers
SET MSR[3,2]	Use the MSR register to select the DCLK
FR02 00h	Make sure CRT output is disabled before assigning it to a pipeline
FR02 31h	Enable the CRT output on pipe B and enable the flat panel on pipe A
SET CR0C, CR0D, CR40	Point to a different location in the video memory to display a separate image



8 Limitations

- The flat panel display is only supported on pipeline A.
- You must disable the CRT output before switching the CRT output from one pipeline to the other.
- You must enable the pipeline with FR01 [1,0] before you make any pipeline register changes.
- You cannot display Mode 3+ simultaneously with TV because there is only one font table available.
- Digital TV is only supported in Single Display mode and only on pipeline A.

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