

Intel® 810 and 815 Chipset Family Dynamic Video Memory Technology

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Table of Contents

1. DVMT OVERVIEW	4
1.1 Legacy VGA Memory	4
1.2 DVMT Video Memory Size for the <u>PV 4.x</u> Graphics Drivers	4
1.3 DVMT Video Memory Size for the <u>PV 5.x</u> and <u>PV 6.0 – PV 6.6</u> Graphics Drivers	6
1.3.1 Maximum Video Memory Allocation	6
1.3.2 Memory Reporting for Windows* XP	6
2. REPORTED VIDEO MEMORY WITH PV 1.X – 6.X GRAPHICS DRIVERS	7
2.1 Video BIOS POST (Power On Self Test) message	7
2.2 System BIOS POST message	7
2.3 Windows NT/2000/XP Operating System “Adapter” Tab	7
2.4 “Version” Tab	7
2.5 “Graphics Accelerator” Tab	8
2.6 Microsoft* DirectX* Diagnostic Tool	8
2.7 Video Memory Checks in DirectX* Games	8

1. DVMT Overview

Dynamic Video Memory Technology (DVMT) enables optimum graphics and memory performance through Direct AGP and highly efficient memory utilization. DVMT ensures the most efficient use of all available memory – regardless of frame buffer presence or main memory sizing – for maximum 2D/3D graphics performance. DVMT dynamically responds to system requirements and applications allocating the proper amount of display and texturing memory upon operating system boot or real time. For example, a 3D application might require more texture memory to enhance the richness of 3D objects. The operating system views the integrated graphics driver as an application, which uses Direct AGP to request re-allocation of additional memory for 3D applications and returns memory when no longer required.

DVMT allocates video memory based on the needs of the system and current application. The amount of video memory allocated by DVMT is not configurable by the user.

This document applies to the graphics drivers for the entire Intel® 810 chipset family and Intel® 815 chipset family. This includes the following products:

- Intel 810 chipset
- Intel 810E chipset
- Intel 810E2 chipset
- Intel 815 chipset
- Intel 815E chipset
- Intel 815EM chipset

1.1 Legacy VGA Memory

DVMT is a unique architecture that initially only uses 1 MB from the system's physical memory. This 1 MB is required for legacy VGA graphics support and compatibility. Upon boot the BIOS allocates 1 MB out of main memory for VGA graphics. An example of when VGA graphics memory is needed would be when the system is running under MS-DOS* and there is no graphics driver loaded. Once the Windows* operating system loads, this 1 MB is not visible to the operating system.

1.2 DVMT Video Memory Size for the PV 4.x Graphics Drivers

Upon initialization of the operating system, DVMT examines the operating system, main memory size, and display cache or Graphics Performance Accelerator (GPA) to determine the best video memory size for the operating system and integrated graphics subsystem.

The following tables illustrate how much memory is allocated under various operating systems, with and without display cache or a GPA:

Table 1. Total Graphics Memory *With 4 MB Display Cache or GPA* PV 4.x Drivers

System Memory Size	32MB	64MB	128MB or greater
Windows 98	(5 + 4) = 9MB	(8 + 4) = 12MB	(8 + 4) = 12MB
Windows NT*4.0	N/A	(8 + 4) = 12MB	(8 + 4) = 12MB
Windows 2000	N/A	(8 + 4) = 12MB	(8 + 4) = 12MB

Table 2. Total Graphics Memory Without 4 MB Display Cache or GPA PV 4.x Drivers

System Memory Size	32MB	64MB	128MB or greater
Windows* 98	6MB	10MB	10MB
Windows NT*4.0	N/A	9MB	9MB
Windows 2000	N/A	9MB	10MB

Note: The above values in both tables do not include the 1 MB allocated for VGA memory.

Once loaded, the operating system and graphics driver allocate the buffers that the driver needs for performing graphics functions. The total graphics memory includes space for commands, the frame buffer (resolution), the Z-buffer, GDI data, and off-screen memory. When display cache or a GPA (4MB) is installed, the Z-buffer and GDI data are managed directly by the driver from this memory, avoiding real-time operating system memory manager calls, thereby improving performance.

If the system does not contain display cache or a GPA is not installed, the Z-Buffer and GDI data are allocated to system memory. In this configuration, DVMT will reduce the amount of graphics memory allocated from system memory to ensure the best usability and performance of the operating system and graphics subsystem. Figures 1 and 2 show that when display cache or a GPA is available, this “local memory” is used for the Z-buffer and GDI data. When in a configuration without display cache or a GPA, this “local memory” is moved into system memory. Also, when there is no display cache and a GPA is not installed, for example in a 32 MB system, the total graphics memory is reduced to ensure usability of the operating system. This is done by reducing the frame buffer size to 2.5 MB, as noted in figure 2 below. In this configuration, 24-bit color is not supported above 1024 x 768 screen resolution.

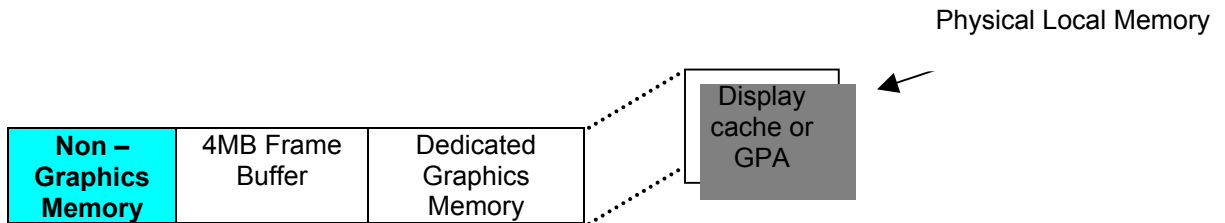


Figure 1. Memory Model With Display cache or GPA

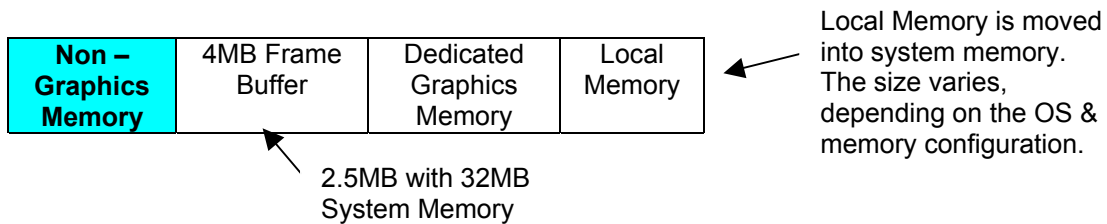


Figure 2. Memory Model Without Display cache or GPA

1.3 DVMT Video Memory Size for the PV 5.x and PV 6.0 – PV 6.6 Graphics Drivers

Upon initialization of the operating system, DVMT examines the operating system, main memory size, and the display cache or Graphics Performance Adapter (GPA) to determine the best video memory size for the operating system and integrated graphics subsystem. Additional optimizations were made on the PV 5.x and PV 6.0 through PV 6.6 drivers to further enhance performance over the PV 4.x drivers.

The following tables illustrate how much dedicated memory is initially allocated under various operating systems, with and without display cache or GPA for the PV 5.x and PV 6.0 – PV 6.6 drivers.

Table 1. Minimum Graphics Memory *With 4 MB Display Cache or GPA* for PV 5.x/6.0-6.6 Drivers

System Memory Size	32MB	64MB	128MB or greater
Windows* 98	(5 + 4) = 9MB	(6 + 4) = 10MB	(6 + 4) = 10MB
Windows Me	5 + 4) = 9MB	(6 + 4) = 10MB	(6 + 4) = 10MB
Windows NT*4.0	N/A	(6 + 4) = 10MB	(6 + 4) = 10MB
Windows 2000	N/A	(6 + 4) = 10MB	(6 + 4) = 10MB
Windows XP	N/A	N/A	(6 + 4) = 10MB

Table 2. Minimum Graphics Memory *Without 4 MB Display Cache or GPA* PV 5.x/6.0-6.6 Drivers

System Memory Size	32MB	64MB	128MB or greater
Windows* 98	6MB	10MB	12MB
Windows* Me	6MB	10MB	12MB
Windows* NT*4.0	N/A	7MB	10MB
Windows* 2000	N/A	7MB	10MB
Windows* XP	N/A	N/A	10MB

Note: The above values in both tables do not include the 1 MB allocated for VGA memory. Windows Me* is supported in the PV 5.1 and later drivers. Windows XP* is supported in the PV 6.4.1 and later drivers.

1.3.1 Maximum Video Memory Allocation

DVMT allocates additional video memory at application run time, depending on system configurations and application requirements up to a total of 32MB. The amount of system memory used for graphics could be as high as 32MB but will never fall below the minimums described in tables 1 and 2 of section 1.3. The video memory allocated beyond the minimum is dynamically allocated and will fluctuate as application demand for graphics memory increases or decreases. Graphics intensive applications such as games and multimedia applications are examples of applications that may require additional system memory to be allocated for graphics. Video memory allocation is transparent to the user.

1.3.2 Memory Reporting for Windows* XP

Starting with the **PV 6.6** graphics drivers, under Windows XP only, the video memory size reported in the Microsoft* DirectX* Diagnostic Tool (Section 2.6) is always “32 MB.” This graphics driver change is to support applications and games that use the same method as the DirectX Diagnostic Tool to determine the amount of video memory. Microsoft Plus! for Windows XP is one such application. The actual total video memory remains the same as in previous graphics driver versions and has not increased. The driver footprint remains as described in tables 1 and 2 of section 1.3.

2. Reported Video Memory with PV 1.x – 6.x Graphics Drivers

In systems containing Intel chipsets with integrated graphics, several messages or displays concerning “video memory size” may be shown. Below are descriptions of the messages displayed by the operating system, video BIOS, graphics driver, and games.

2.1 Video BIOS POST (Power On Self Test) message

On some systems, a “video memory size” message in the video BIOS “splash” or “boot” message is shown when the system begins to boot. This message displays the amount of main system memory that will be used solely for legacy VGA memory. MS-DOS*, for example, requires this memory for video display. The video BIOS will use either 512 KB or 1 MB for legacy VGA memory, based on system BIOS settings or the settings of the system or motherboard manufacturer. From the operating system’s perspective, this memory is removed from the system, so that it is invisible to the operating system. For example, a 64 MB system using a 1 MB setting in the system BIOS will report 63MB of total system memory.

2.2 System BIOS POST message

During POST, some system BIOS’s display the amount of ***physical*** “Display Cache” or the size of the GPA in the system. This will be either 0MB or 4MB.

2.3 Windows NT/2000/XP Operating System “Adapter” Tab

Microsoft Windows NT 4.0, Windows 2000 and Windows XP operating systems contain an “Adapter” tab that is located in the “Display Properties” / “Settings” / “Advanced” dialog in Windows 2000 and Windows XP and is located in the “Display Properties” / “Settings” / “Adapter” dialog in Windows NT 4.0. This tab displays the maximum amount of frame-buffer memory possible by the graphics device. This does not indicate whether display cache or a GPA is present.

2.4 “Version” Tab

PV 4.x and previous graphics drivers include this Intel custom tab. PV 5.x and later do not include this tab. The “Version” tab displays “Memory Size” and a number. This tab displays the amount of memory totally dedicated to local memory for display. This can be as low as 1MB, depending on the operating system and the amount of total system memory. This page was not designed to display physical display cache (or GPA) memory information.

The “Memory Size” reported under Windows NT or Windows 2000 with any memory configuration is 4MB if display cache or a GPA is present. However, when the GPA is not installed, the “Memory Size” reported varies, depending on the operating system and memory configuration. Since this does not include all the sources of video memory, the amount listed will not be the same as in Table 1 and 2.

The following table indicates how much memory is reported by the “Version” tab under the various Windows* operating systems:

Table 3. Version Tab Memory Reported by OS and Memory Size.

Version Tab Memory Size Reported with Display Cache or GPA			Version Tab Memory Size Reported with Display Cache or GPA		
32MB	64MB	128MB or greater	32MB	64MB	128MB or greater

Operating System						
Windows 95	4MB	4MB	4MB	NP	NP	NP
Windows 95 OSR2.1	4MB	4MB	4MB	1MB	2MB	2MB
Windows 95 OSR2.5	4MB	4MB	4MB	1MB	2MB	2MB
Windows 98 SE	4MB	4MB	4MB	1MB	2MB	2MB
Windows* NT* 4.0	NP	4MB	4MB	NP	1MB	1MB
Windows 2000	NP	4MB	4MB	NP	1MB	2MB

Note: NP = No Version tab displayed

2.5 “Graphics Accelerator” Tab

PV 5.x through 6.2 graphics drivers include this Intel custom tab. This tab is not included in PV 6.3 and later graphics drivers. There are different versions of this tab in the PV 5.x and PV 6.0 through PV 6.2 graphics drivers.

The version of this tab that is in PV 5.x includes a “Video Memory” section. The information in this section reflects the amount of display cache or GPA memory available. If there is no display cache or GPA card installed, the values will all be “0 Bytes.” Since this does not include all the sources of video memory, the amount listed will not be the same as in Table 1 and 2.

The version of this tab that is in PV 6.0 through 6.2 does not include a “Video Memory” section.

2.6 Microsoft* DirectX* Diagnostic Tool

The Microsoft* DirectX* Diagnostic Tool is included in most versions of Windows. On the “Display” tab of this utility, there is an item labeled: “Approx. Total Memory.” The amount of video memory listed on this tab varies between Windows versions, DirectX versions, graphics driver versions, and the current video mode. In most configurations, the amount reported will be between 4 MB and 8 MB. Since this does not include all the sources of video memory, the amount listed will not be the same as in Table 1 and 2.

2.7 Video Memory Checks in DirectX* Games

Some games that use DirectX* for graphics display will check for available video memory in order to confirm that the system meets the minimum requirements to run the game. There are a number of different methods used to determine available video memory:

- Some games use a DirectX call to get the amount of local video memory. Games that use this method to check for 8 MB or more of local video memory may fail to install or run with DVMT.
- Some games may request that *only* local video memory be allocated for performance reasons. With DVMT, only non-local video memory may be available for the game, resulting in the game failing to run.

In most cases, a patch for the game can correct either of these issues.

A list of known games that have issues such as these is available on the Intel Support Site: <http://support.intel.com/support/graphics/intel815/tti007.htm>