Intel® 852/855 Chipset GMCH Dynamic Video Memory Technology 2.1

White Paper

January 2003

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Revision History

Revision.	Description	Date
1.0	Initial Release.	August 2002
1.1	Addition of Intel® 855 Chipset	January 2003

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1 Introduction

This document describes the memory allocation and usage model for the 852/855 chipset with the PV 12.x Display Drivers. This document assumes that the reader already has an understanding of the feature set of the Intel® 852/855 chipset.

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2 Overview

2.1 Dynamic Video Memory Technology

Dynamic Video Memory Technology (DVMT) is an enhancement of the UMA concept, wherein the optimum amount of memory is allocated for balanced graphics and system performance, through Direct AGP known as Non-Local Video Memory (NLVM), and a highly efficient memory utilization scheme. DVMT ensures the most efficient use of available memory – regardless of frame buffer or main memory sizing – for maximum 2D/3D graphics performance. DVMT dynamically responds to system requirements and applications demands by allocating the proper amount of display, texturing, and buffer memory after the operating system has booted. For example, a 3D application when launched may require more vertex buffer memory to enhance the complexity of objects, or more texture memory to enhance the richness of the 3D environment. The operating system views the integrated Graphics driver as an application, which uses Direct AGP to request allocation of additional memory for 3D applications, and returns the memory to the Operating System when no longer required.

2.2 Legacy VGA/SVGA Memory

In addition to DVMT, 852/855 chipset also supports the selection of four different sizes of pre-allocated memory: 1 MB, 8 MB, 16 MB or 32 MB. This amount is chosen via the system BIOS setup as a setup option. This pre-allocated memory selection is supplied for legacy VGA and SVGA Graphics support and compatibility.

Upon boot, the system BIOS will pre-allocate the amount selected (1 MB, 8 MB, 16 MB or 32 MB) from the top of the main system memory, and this will be dedicated for VGA/SVGA Graphics. An example of when VGA Graphics Memory is needed includes usage for High-Resolution Games and Applications run from a DOS or Legacy Operating System, where there is no Intel DVMT Graphics Driver loaded. Once the operating system boots this pre-allocated memory is not seen, and is not visible by the operating system. The 852/855 chipset Integrated Graphics device will treat this memory as a true dedicated frame buffer. If an operating system is booted with an Intel graphics driver loaded, the graphics driver will then reclaim the pre-allocated memory for use, but the operating system may never use this memory, and it is not available to applications except as graphics memory.

Note: The BIOS pre-allocates memory that the OS is not aware of, nor is the OS capable of reclaiming this memory. The Intel DVMT Graphics Driver allocates by requesting memory, from the OS, through OS supported memory allocation methods.

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3 DVMT 2.1 Graphics Memory Footprint

Upon operating system initialization, the PV 12.x graphics drivers determines the size of memory needed and will make additional memory requests to achieve the amount needed for the Display and Application graphics memory operational footprint.

3.1 Factors in Footprint Variance

The 852/855 chipset UMA memory footprint is determined using several factors. It varies widely depending on several key factors. Two key factors are system resources and system activity. The 852/855 chipset memory footprint is not static, and it will vary in size as system requirements and demands vary. For example, when running a DVD in a window on the desktop, then memory is needed for the DVD and the background desktop, but when running a DVD full screen, then the desktop frame-buffer may be discarded, or allowed to be paged back to disk. This is the most efficient memory utilization. A DVD is just one of many activities that could effect memory allocation. This section will describe some of the factors that aid in the request made to the OS for page locked memory. The OS does not always grant graphics driver's memory request.

3.2 Base Allocations

Part of the graphics memory allocation is independent on system activity. These are base allocations that the driver request at the time it loads. For the 852/855 chipset, the driver allocates 204 kB for the command ring buffer and cursor/context on all operating systems. Once loaded, the operating system and graphics driver allocates the buffers that the driver needs for performing graphics operations. The total graphics footprint allocates memory for commands, the frame buffer (resolution), the Z-buffer, GDI data and off-screen memory. The total DVMT graphics footprint in system memory is capped to an upper-limit ensuring the best usability and performance of the OS, applications and graphics. The memory allocation limits are documented in Table 1.

Table 1. Graphics Memory Allocations

System Memory	Maximum Memory Allocated for Graphics
0 MB – 127 MB	Not Supported; Not Validated
128 MB – 255 MB	32 MB
256 MB – Max Memory	64 MB

In the following scenarios formulas will be given to help calculate what the driver may request for graphics memory.

Note: The driver utilizes pre-allocated memory before it makes request to the OS and the memory calculated below is in addition to the 204 kB that is allocated once the driver is loaded.

Table 2. Acronym Definition

Abbreviation	Definition
PDTH	Primary Desktop Height
PDTW	Primary Desktop Width
PDTCD	Primary Desktop Color Depth (Bytes)
SDTH	Secondary Desktop Height
SDTW	Secondary Desktop Width
SDTCD	Secondary Desktop Color Depth (Bytes)
DVDH	DVD Height
DVDW	DVD Width
DVDCD	DVD Color Depth (Bytes)
GH	Game Height
GW	Game Width
GCD	Game Color Depth (Bytes)

3.3 Desktop (Shell/User-Interface only) Memory Requirements

Table 3. Desktop Only Memory Usage

Idle Desktop Scenario	Formula	Comments
Single Pipe Idle Desktop	(PDTH x PDTW x PDTCD)	
Dual Pipe Idle Desktop	(PDTH x PDTW x PDTCD) + (SDTH x SDTW x SDTCD)	This takes into account both desktops.

3.4 DVD Scenarios

Table 4. DVD Memory Usage

DVD Scenario	Formula	Comments
Single Pipe DVD in Window	(PDTH x PDTW x PDTCD) + (DVDH x DVDW x DVDCD)	This takes into account the desktop and DVD that is playing.
Single Pipe Full Screen DVD	(DVDH x DVDW x DVDCD)	We can discard the desktop because it cannot be seen.
Dual Pipe DVD in Window	(PDTH x PDTW x PDTCD) + (DVDH x DVDW x DVDCD) + (SDTH x SDTW x SDTCD)	This takes into account both desktops and the DVD.
Dual Pipe Full Screen DVD	(DVDH x DVDW x DVDCD) + (SDTH x SDTW x SDTCD)	The primary desktop can be discarded because the DVD is full screen.

3.5 3D Game Scenarios (3D Applications)

Table 5. 3D Game (3D Applications) Memory Usage

Game Scenario	Formula	Comments
Single Pipe Game in Window	(PDTH x PDTW x PDTCD) + 4*(GH x GW x GCD)	This takes into account the desktop and the game that is being played. **Note:** The game could be triple buffered and utilize the Z/W buffer. That is why there is a 4X multiplier.
Single Pipe Full Screen Game	4*(GH x GW x GCD)	We can discard the desktop because it cannot be seen.
Dual Pipe Game in Window	(PDTH x PDTW x PDTCD) + 4*(GH x GW x GCD) + (SDTH x SDTW x SDTCD)	This takes into account both desktops and the Game.
Dual Pipe Full Screen DVD	4*(GH x GW x GCD) + (SDTH x SDTW x SDTCD)	The primary desktop can be discarded because the Game is full screen.

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4 Reported Video Memory

In systems using an Intel Direct AGP chipset, such as the 852/855 chipset with PV 12.x Display Drivers, end users will be presented with various display messages concerning "video memory size". This section describes the messages displayed by the operating system, video BIOS and driver.

4.1 Video BIOS POST Message

Users may first be presented with "video memory size" messaging in the video BIOS "splash" or "boot" message. This message displays the amount of main system memory that will be used solely for video BIOS purposes. DOS, for example, will use only this memory for display. Video BIOS will use either 1 MB, 8 MB, 16 MB or 32 MB based on system BIOS settings. From the operating system perspective, this memory is logically removed from the system so that it is invisible (for example, a 128-MB system using an 8MB setting in system BIOS will report 120-MB of TOTAL system memory). This is the pre-allocated memory already mentioned in Section 2.2.

4.2 System BIOS POST Message

During POST, some system BIOS displays the amount of Local Memory installed in the system. This may be 1 MB, 8 MB, 16 MB or 32 MB depending on pre-allocated memory.

4.3 Microsoft* Windows NT* 4.0, Windows* 2000, and Windows* XP Operating System "Display Adapter" Property Page

Microsoft* Windows NT* 4.0, Windows* 2000 and Windows* XP operating systems contain a standard display property page that is displayed when the "Adapter" tab (with NO icon) is selected. This page displays the maximum amount memory possible that can be utilized for graphics. For systems that have 128 MB of system memory, the value will be 32 MB. For systems with 256MB and above, the value will be 64 MB.