



# Intel<sup>®</sup> 865G Chipset Dynamic Video Memory Technology

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## Revision History

Release	Date	Comments
1.0	May 2003	Final Draft

# 1. Introduction

This document describes the Memory Allocation and Usage Model for the Intel® 865G Chipset with the PV 13.x Display Drivers. This document assumes that the reader already has an understanding of the feature set of the Intel® 865G chipset.

Note: this document is accurate to current feature sets, and does not mention future or proposed new features or functionality.

## 2. Overview

### 2.1 Dynamic Video Memory Technology

This document describes the method of memory allocation where Operating System, Application and Graphics Memory come from the one unified System Memory pool known as **Unified Memory Architecture (UMA)**.

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

While DVMT is a unique architecture, that can use a variable amount of the system memory, for Graphics and System Operation, adjusting the balance depending on demand. The Intel® 865G Chipset also supports the selection of three different sizes of pre-allocated memory: 1MB, 8MB, or 16MB. 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 (1MB, 8MB, or 16MB) from the top of the main system memory, and this will be dedicated for VGA/SVGA Graphics. Example of when VGA Graphics Memory is needed includes usage for High-Resolution Games and Applications run from a DOS or a legacy OS, 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 Intel® 865G 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 pre-allocated memory will then be reclaimed for use by the Graphics driver, 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.

### 3. DVMT 2.0 Graphics Memory Footprint

The driver determines the size of the pre-allocated memory needed and will make additional Non-Local Video Memory requests to achieve the amount needed for the Display and Application graphics memory operational footprint.

#### 3.1 Factors in Footprint Variance

The Intel® 865G UMA memory footprint varies and is determined using several factors. The key factors are system resources and system activity. Unlike the Intel® 81x family the Intel® 865G memory footprint is not static. 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 Intel® 865G platform, the driver allocates 204KB for the command ring buffer and cursor/context buffer memory 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.

#### 3.3 Maximum Allocations

When all Graphics Memory is being allocated from system 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 Intel® 865G platform supports a minimum of 128 MB of system memory. With **128 MB** of system memory, the Intel® 865G Graphics driver will limit the Graphics memory footprint to **32 MB**.

With **greater than or equal to 192MB** of system memory, the Intel® 865G Graphics driver will limit the Graphics memory footprint to **64 MB**.

### 3.4 Memory Allocation examples

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 204KB that is allocated once the driver is loaded.

#### 3.4.1 Acronym Definition

Abbreviation	Definition
PDTH	Primary Desktop Height
PDTW	Primary Desktop Width
PDTCD	Primary Desktop Color Depth (Bytes: 8bit = 1 Byte, 16bit = 2 Bytes, 32bit = 4 Bytes)
DVDH	DVD Height
DVDW	DVD Width
DVDCD	DVD Color Depth (Bytes)
GH	Game Height
GW	Game Width
GCD	Game Color Depth (Bytes)

Table 1. Acronyms

#### 3.4.2 Memory Requirements Formulas

Scenario	Formula	Comments
Idle Desktop	$(PDTH \times PDTW \times PDTCD)$ 800 x 600 x 2 = 960000 Bytes, 937.5Kb	Desk only memory usage. 800x600 @16bit color = ~ 1 Mb
DVD in Window	$(PDTH \times PDTW \times PDTCD) + (DVDH \times DVDW \times DVDCD)$	This takes into account the desktop and DVD that is playing.
Full Screen DVD	$(DVDH \times DVDW \times DVDCD)$	We can discard the desktop because it cannot be seen.
Game in Window	$(PDTH \times PDTW \times PDTCD) + 4*(GH \times GW \times GCD)$	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.
Full Screen Game	$4*(GH \times GW \times GCD)$	We can discard the desktop because it cannot be seen.

Table 2. Memory Usage

## 4. Reported Video Memory

In systems using an Intel® DirectAGP chipset, such as when using Intel® 865G Chipset with PV 13.x Display Drivers, end users will be presented with various messages/displays 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 1MB, 8MB, or 16MB of memory based on system BIOS settings. From the operating system’s perspective, this memory is logically removed from the system so that it is invisible. For example, a system which has 128MB of main system memory installed with an 8MB UMA system BIOS setting will report 120MB of TOTAL system memory. This is the pre-allocated memory already mentioned in section 2.2

### 4.2 Windows NT4 / 2000 / XP Display Properties “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.

### 4.3 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 Windows 98 configurations, the amount reported would typically be .5 MB to 5 MB or higher, depending on screen resolution and applications running.

On Windows 2000 and Windows XP only, the video memory size reported in the Microsoft\* DirectX\* Diagnostic Tool 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 reported memory will be 32 MB, even if system memory is more than 128 MB.

### 4.4 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 in Windows 98 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.