

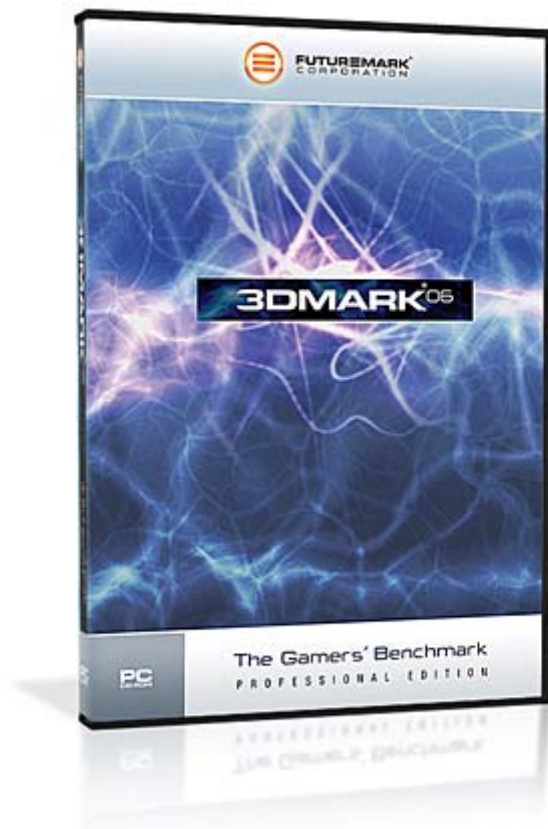


FUTUREMARK[®]
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3DMARK[®]06

The Hardware Reviewer's Guide v1.0 for 3DMark06

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Nicklas Renqvist
Futuremark[®] Corporation

Kappelitie 6 D
FIN-02200 Espoo
FINLAND



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Introduction

This document is an in-depth guide written for professional hardware reviewers when using 3DMark06 for graphics card or CPU reviews. It helps you to properly setup consistent benchmark runs and avoid pitfalls in today's changed benchmarking landscape.

It is very important that consumers who read hardware reviews can trust the benchmark numbers. Being the publisher of the world's most popular benchmarking software, we want to make sure that you have all the information and tools at your disposal that enable you to obtain those trusted results.

Futuremark Approved Drivers

On November 11th 2003, Futuremark started to maintain a list of approved drivers for benchmarking with the latest version of 3DMark03 (Build 3.6.0), 3DMark05 (Build 1.2.0) and 3DMark06 (Build 1.0.0). These actions were necessary because various application specific optimizations were found in some graphics card drivers. These application specific optimizations in drivers invalidate results. Futuremark wants to make sure that you can continue to use our products and know that you can trust the results you will get. The list of approved drivers is found here:

<http://www.futuremark.com/community/drivers/?approved>

3DMark06 Minimum System Recommendations

- DirectX® 9 compatible graphics adapter with support for Pixel Shader 2.0 or later, and graphics memory of 256 MB or above.*
- Intel® or AMD® compatible processor running on 2.5 GHz or above.
- 1GB system memory or more.
- 1.5GB of free hard disk space.
- Windows® XP operating system with the latest Service Pack and updates installed.
- DirectX 9.0c (December 2005) installed with the latest updates.
- Microsoft Internet Explorer 6 installed, for some 3DMark functionality.
- Microsoft Excel 2000, 2003 or XP for some 3DMark functionality.
- Microsoft DirectX 9.0c (December 2005) System Development Kit is required to run the image quality test using the reference rasterizer.

* In order to run the HDR/SM3.0 graphics tests, a DirectX 9 compatible graphics adapter with support for Pixel Shader 3.0, 16 bit floating point textures and 16 bit floating point blending is required.

It is possible that 3DMark06 will run on PCs that do not meet the requirements above, but the benchmark performance may be seriously affected. For example, insufficient video memory will result in texture swapping - this will cause fluctuations during the tests, reducing the reliability of the generated scores.



Preparation

Before going to the actual testing procedures, please do the following:

- Make a clean install of Windows XP.
- Use the Windows Update to make sure that all latest updates are applied.
- Unless you already have installed the latest DirectX 9.0c version (December 2005), it can be downloaded here:
 - <http://www.microsoft.com/downloads/details.aspx?FamilyId=3F2828FA-0E3C-4837-AFC0-6C67DCAA54BF&displaylang=en>
- Download and install the latest drivers and BIOS version for your motherboard chipset.
- Download & install the latest Futuremark Approved graphics card drivers for your graphics card. A list of all driver can be found here <http://www.futuremark.com/community/drivers/?approved>
- Download and install the latest version of 3DMark06 (currently Build 1.0.0)
 - Full Install: <http://www.futuremark.com/download/?3dmark06.shtml>
- Make sure that the BIOS settings are all set for maximum performance, such as AGP transfer rate, AGP Aperture size, memory timings etc.

IMPORTANT: It is not recommended to use any other drivers (beta, unofficial, leaked etc) than those listed, since otherwise we cannot guarantee the comparability of results.

You can get a valid and comparable 3DMark06 result only by using the combination of 3DMark06 Build 1.0.0 and approved drivers. Results gained with any other drivers are not valid and such results will not be used in any official online top-lists or services.

Basic Testing Procedure

Please follow these steps to run the benchmark:

1. Make sure that you have installed all the latest drivers & updates for your system.
2. Restart the computer before running the benchmark and after making any driver/hardware changes.
3. Set all your display properties settings to "Application Specific" under Direct3D. That includes any LOD Bias settings, filter settings, anti-aliasing settings, or any other quality altering settings. The only exception is V-Sync. During all tests, 3DMark06 will instruct the graphics adapter drivers to disable V-Sync OFF. However, some driver revisions and older pieces of hardware will ignore such instructions. We therefore recommend that users make additional checks to guarantee that V-Sync is always disabled when benchmarking.
4. Close any open applications, background programs and automated tasks such as antivirus utilities, email software, online chat applications etc. Some applications in the background might cause the benchmark to stall for a short moment which may affect the result.
5. Repeat each test at least three times. When using the 3DMark test repeat functionality, each test is repeated the set amount of times and the given result is the average of the repetitions. This will help to ensure that the effect that any anomalous result has on the final result is kept to a minimum.
6. Do not attempt to initiate any other system activity while 3DMark06 is running. If you do, the program may exit (loose focus) or the result may be affected.
7. Always use the exact same system when comparing various graphics cards, and same graphics cards & drivers when comparing different CPU's. It is important to thoroughly uninstall graphics card drivers prior to benchmarking another graphics card in the same system.



Additional Testing Recommendations

These measures help to ensure that your results are consistent.

1. Compare hardware and detailed settings only by running benchmarks on "clean" systems. In order to make this easier, it is recommended to make a "ghost" image of your system. This operation can be done using various back-up applications such as Norton Ghost (http://www.symantec.com/sabu/ghost/ghost_personal/) that can restore a system configuration to an exact format for each testing run.
2. Disable the System Restore feature on Windows XP. For more detailed information about System Restore, please refer to the Microsoft Knowledge Base article Q267951 (<http://support.microsoft.com/support/kb/articles/Q267/9/51.ASP>).
3. Disable any networking connections and file sharing during the benchmark run. Any network activity might affect the tested system and its performance.
4. It is highly recommended that you only use the latest official version of DirectX. Please note that no beta versions of DirectX are supported by Futuremark and should not be used when benchmarking with 3DMark06.
5. Make sure you have all the latest updates installed for your operating system. Use the "Windows Update" from your operating system start menu for more information.

Default Settings

In order to keep the reported scores comparable, we highly recommend that the default setting is used for baseline results in addition to the possible other reported results. Referring to the default settings will make comprehending the results easier for the mainstream end users who run 3DMark06 on their own systems. Please make sure that any image-enhancing features such as Anti-Aliasing or Anisotropic Filtering are not forced on from the graphics cards' control panel.

The default settings in 3DMark06 are as follows:

- 1280 x 1024 resolution (except the CPU tests which are locked at 640 x 480)
- 32-bit colour depth (8-bit RGBA channels).
- 24-bit z-buffer with an 8-bit stencil.
- DXT1 and 3 compressed texture formats and DXT5 for normal map compression.
- No anti-aliasing.
- Optimal texture filtering.
- Highest supported shader model available.
- Partial precision is used where allowed in the shaders.
- Hardware shadow mapping enabled if supported by the hardware.
- Post-processing enabled.
- Hardware accelerated vertex shaders (dependent on hardware support).
- Mipmaps not colored.
- Hardware FP16 filtering (dependent on hardware support).
- Single test run benchmarking.
- Time-based benchmarking mode (except the CPU tests which are locked as frame-based).



Publishing Results

Only those 3DMark results obtained with 3DMark06 build 1.0.0 and Futuremark approved graphics card drivers are valid scores. They may be published according to the rules and requirements found in the software's end user license agreement.

Generally, you will need to identify the exact system setup that was used for benchmarking. This is important so that your readers – and other benchmarkers – can replicate the results if they want. This adds a great deal of credibility to your review.

Especially, the exact driver version, with which the scores have been obtained, must be clearly presented in conjunction with the score. It is also recommended to clearly point out if any of the graphics cards have been overclocked!

We also offer a free service for Advanced & Professional Edition users that many reviewers have already found very useful: Submit the result to the Online ResultBrowser, and provide your readers with a compare URL. If the review/article includes more than one result, using the MultiCompare feature in the Online ResultBrowser may be very useful. For more detailed information about the MultiCompare, go here http://service.futuremark.com/servlet/Index?pageid=/orb/multicompare_help

Please refer to the license agreement for more detailed information about publishing results. There are situations when for example new unannounced hardware is in for preview, and the manufacturer has shipped non-public drivers with the package. In that situation it is not allowed to post 3DMark06 results unless Futuremark has approved the use of those specific drivers. Please contact Futuremark if you receive new hardware for review with beta/unofficial non-WHQL drivers and want to publish 3DMark06 results.

CPU Tests

3DMark06 comes with two CPU tests. When comparing CPUs, it is suggested to keep the graphics card and drivers the same. For example: If you want to compare AMD Athlon 64 X2 4400+ vs. Intel Pentium D 840, please use the same graphics card & drivers in the two different systems. It is also recommended to use same or as similar as possible memory & memory speeds. Otherwise the graphics card performance / memory may affect the CPU score, which invalidates any comparability. The CPU tests found in 3DMark06 are less GPU bound than the ones in any previous 3DMark's, but it is still highly recommended to use the same graphics card & drivers when comparing various CPU's.

Using Image Quality Enhancing Features

If you want to run a benchmark run using Anisotropic Filtering and/or Anti-Aliasing, please only use the settings found within 3DMark06. That way you can be sure that the correct type of filtering and/or Anti-Aliasing will be applied. It is recommended to verify that the selected type of filtering and/or Anti-Aliasing actually was in use during the benchmark run. In order to do this, simply take a screen shot and compare the image against a reference rasterizer image.

Only results using default settings can be verified by Futuremark, so using any image enhancing feature(s) needs to be verified by the user / reviewer.

IMPORTANT: In the driver's control panel, set the display adapter's AF & AA properties to "Application Specific" or similar.



Image Quality Comparison Tool

3DMark06 has a very useful image capture system built in for extensive image quality comparisons. This feature is available for Advanced and Professional Edition users only. The system can render any frame from any tests, or a sequence from any test. The images are stored into your 3DMark06/iq folder as frame based numbered .bmp files. By comparing the image rendered with the hardware and the Reference Rasterizer, you can easily spot any possible rendering anomalies/differences. It is highly recommended to include in any public presentation at least 1 frame from each game test, and the same frame rendered by the Reference Rasterizer for comparison.

Texture Filtering Test Tool

3DMark06 Advanced and Professional Editions also ship with a Filtering & Anti-Aliasing Tool, from which any user can view and study the graphics cards' filtering and anti-aliasing capabilities & quality. It is again important to have the graphics card drivers' settings at "default" in the control panel, and only use the settings found in the Filtering Test tool.

More information about the Image Quality Tool and Filtering Tool can be found on 3DMark06 Whitepaper. The Whitepaper can be downloaded from <http://www.futuremark.com/products/3dmark06/>

Graphs

The Graphs tool records per frame runtime statistics of selected game tests with selected settings, and draws a MS Excel graph of the recorded data. The available settings are the same as those available in Benchmark Settings, but you can additionally select which test to run and what statistics to record. All three game tests are available for collecting per frame runtime statistics.

Screen shots

You can easily take screen shots for publishing or comparison by pressing F12 at any time when running any part of the program. All screenshots are automatically captured and stored into your 3DMark06/shots folder as sequentially numbered .bmp files.

NOTE: Taking a screenshot during a benchmark run affects your test result by a temporary performance drop. Therefore the result of the current test will be discarded, when you take a screenshot.



More Information

For more information about the use of 3DMark06 (such as Command Line Options, Batch Run etc.) please refer to the Help file found in 3DMark06 installation folder. We have also posted several documents about 3DMark06, the technical parts of it, our approved drivers, driver optimization guidelines etc. All the documents can be downloaded from <http://www.futuremark.com/products/3dmark06/>

Any Questions Unanswered?

If you have any questions about the 3DMark06, or need more information about anything of the above, please don't hesitate to contact us at:

Futuremark Corporation, <http://www.futuremark.com>

Mr. Nicklas Renqvist

Benchmark Development Architect

Email: nick@futuremark.com

Futuremark Corporation

Kappelitie 6 D

FIN-02200 Espoo

FINLAND

Tel: +358-20 759 8250

Fax: +358-20 759 8251

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