



RADEON 9700

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RADEON 9700 Design Goals

The Best Graphics Chip on the Planet

- Schedule
- Performance
 - High Bandwidth
 - Parallelism
 - Efficiency
 - Highest overall performance
- Image Quality (SMOOTHVISION™ 2.0)
 - Multisample Antialiasing
 - Anisotropic Texture Filtering
- Features
 - DX9
 - OpenGL 2.0



RADEON 9700 Performance

Key design elements for best performance:
High Bandwidth, Parallelism, & Efficiency

High Bandwidth

- AGP 8x provides 2 GB/sec transfers to or from the CPU or system memory.
- 310 MHz 256-bit DDR Memory Interface provides 20 GB/sec access to the Frame Buffer
- Internal 256-bit data busses for Color, Texture and Z

Parallelism

- 4 Vertex Engines running at 325MHz provides 325 Mtriangles/sec (4 clocks per vertex per engine)
- 8 Pixels/Clock Rasterization Architecture running at 325MHz provides a peak fill rate of 2.6 Gpix/sec



RADEON 9700 Performance (cont.)

Efficiency

Graphics systems tend to be Memory Bandwidth limited. The RADEON™ 9700 is no exception. So it is important to use the bandwidth efficiently.

- Hierarchical and Early Z checking allows pixels to be rejected *before* the pixel shader. This is *very* important when shader programs are long.
- Color, Texture and Z caches reduce memory bandwidth utilization. Benefit from spacial and temporal locality.
- Lossless Color and Z data compression reduce memory bandwidth utilization.
- Compressed Textures can be utilized to reduce memory bandwidth utilization.
- Fast Color and Z clears eliminate need to access memory for clears



Image Quality (SMOOTHVISION™ 2.0)

Performance matters too

Pixel antialiasing and anisotropic texture filtering improve image quality only if they are enabled.

Just going to higher resolutions isn't the answer for improved image quality.

- Artifacts due to poor texture sampling remain.
- Dynamic antialiasing artifacts are still very visible.

Sufficient performance for high resolution display, high quality texture filtering, *and* antialiasing is needed.

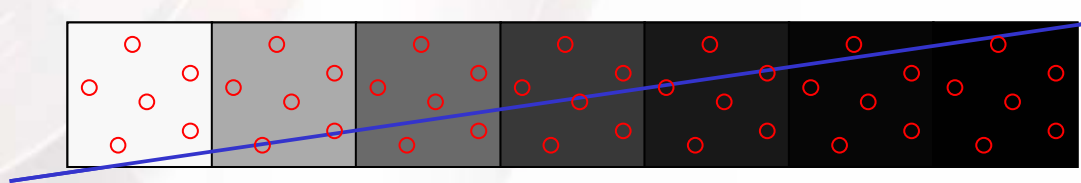
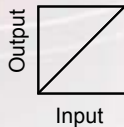
The RADEON™ 9700 was architected to do all three simultaneously.



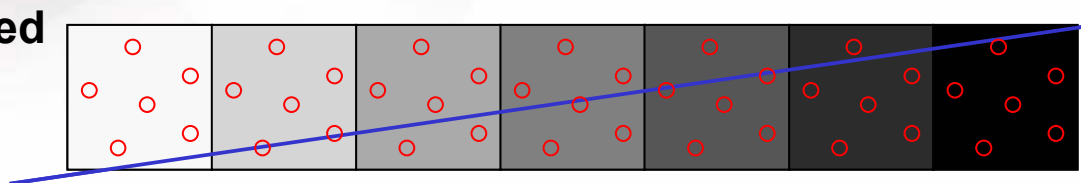
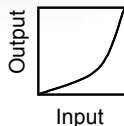
Anti-Aliasing (SMOOTHVISION™ 2.0)

- Non-Grid Programmable Multi-Sampling
 - 2, 4, or 6 samples per pixel
 - Sample positions provide the maximum quality per sample
 - Lossless Z and Color compression minimizes bandwidth cost of higher sample counts.
- Per Sample Gamma Correction
 - Takes gamma into account when blending samples
 - Creates smoother edge transitions

Standard Edge Gradient



Gamma Corrected Edge Gradient



Anisotropic Filtering (SMOOTHVISION™ 2.0)

- Improved Adaptive Algorithm
 - Up to 16 Trilinear Samples (128-tap)
 - Calculates optimal number of samples for each pixel
 - Delivers full image quality benefit while conserving memory bandwidth



Transform & Lighting Engine

- Fully shader-based (no HW fixed-function)
- 4 parallel Vertex Shader engines
- Setup engine rates up to 325Mtri/s
- Vector/scalar instruction pairing
- Point sprite primitives
- Supports 6 user clip planes
- Supports 16 vertex streams
 - All new vertex data formats



RADEON 9700 Features - Vertex Shaders

- DirectX® 9.0 support with 2.0 vertex shaders
- 256 instructions (~64K with flow control)
- 256 constants
- 32 temporary registers
- Static flow control
 - 16 instructions (jumps, loops, subs)
 - Max. 256 loop iterations



RADEON 9700 Features - Pixel Engine

- DX 9.0 support with 2.0 pixel shaders
- 8 parallel pixel pipes
- Good quality fast anisotropic filtering
- New FP texture formats
 - 16-bit floats (1, 2, 4 channels)
 - 32-bit floats (1, 2, 4 channels)
- New integer texture formats
 - 10-bit signed/unsigned (i.e. A2B10G10R10)
 - 16-bit signed/unsigned (1, 2, 4 channels)
- Gamma corrected textures (sRGB)



RADEON 9700 Features - Pixel Shaders

- 16 textures
- 32 texture instructions
- 64 arithmetic instructions
- 32 temporary registers
- 32 constants
- Programmable mip-map bias
- Per-pixel depth value output
- Floating point calculations (96-bit precision)



RADEON 9700 Features - Multiple Render Target

- Up to 4 independent render targets
- Supports render targets of different formats
- The only restriction is identical dimensions and bit depth



RADEON 9700 Features - Two-Sided Stencil

- Optimization for Shadow Volume technique
- Specifies different stencil tests and operations for front and back facing triangles
- Supported under Direct3D® and OpenGL



RADEON 9700 Other Features

- HYPER Z™ III
 - Hierarchical-Z
 - Fast Z-clears
 - Z-compression
 - Early Z test
- FULLSTREAM™
- VIDEOSHADER™
- TRUFORM™ 2
- MPEG2 decoding and encoding

