AMD 780G

an x86 chipset with advanced integrated GPU

Hot Chips 2008

Niles Burbank
AMD
Agenda

- Evolving PC expectations
- AMD 780G Overview
- Design Challenges
- Video Playback Support
- Display Capabilities
- Power Optimizations
Evolving Expectations of Mainstream PCs

Traditional Usage Models
- Email
- Productivity applications
- Web browsing
- Energy consumption not a major consideration

Emerging Usage Models
- Content creation
- Gaming
- HD video playback
- Social networking
- Energy consumption an important purchase consideration

Customers increasingly demand more media capabilities, more multitasking, and lower power - and remain value conscious.
AMD 780G Overview

Performance
- DirectX®10 Core, HyperTransport 3

HD Video
- Enhanced UVD Block
  - MPEG2, H.264, VC1

Scalability
- ATI Hybrid Graphics

Control
- AMD OverDrive™ *

Energy Efficiency
- 55nm, Low Power, Low Noise

Connectivity
- PCIe Gen.2, 12xUSB, 6xSATA

Display
- HDMI, DVI, Display Port

* AMD product warranty does not cover damages caused by overclocking even if overclocking is enabled with AMD overdrive™ software.
AMD 780G Platform Architecture

- HyperTransport 3.0
- Fully Integrated Solution HDCP + Audio
- Two Independent Display Controllers
- DVI, HDMI, DP, VGA
- 12x USB 2.0
- PCI Interface
- Display Cache Gen 2
- SATA 6X
- PATA
- Audio

NOTE: This diagram represents the architecture of the AMD 780G Platform, highlighting key components and interfaces.
The AMD 780G Die

- 205 million transistors
- TSMC 55nm process
- 64mm² die size
- 1.0-1.1V core operating range
Design Challenges

- **Aggressive schedule requirements**
  - Fixed market window in early 2008
  - Several key new features deemed mandatory by customers

- **Demanding power and cost targets**
  - No room for compromise on layout efficiency
  - No flexibility to defer power management features

- **New process technology and new IP**
  - 55nm TSMC process, new versions of many key blocks

- **Meeting speed targets at 1.1V**
  - Graphics core operation at 500MHz to meet performance goals
  - HyperTransport and PCI Express at standardized frequencies
Graphics Technology

- DirectX 10/SM4.0 3D engine at 500 MHz
- 3D engine based on ATI Radeon™ HD 2400 discrete GPU
  - Features 40 stream processing units
- UVD engine offloads tasks from the CPU
  - For H.264/VC1 content, engine acts as a slice-level decoder
  - For MPEG2 content, the UVD engine acts as an IDCT-level decoder
- Full ATI Avivo™ engine for video post processing
Unified Video Decoder (UVD) in AMD 780G

- Dedicated HW decoder for Blu-ray
  - H.264, VC-1, MPEG-2

- AMD 780G Supports the Maximum HD Spec
  - Up to 40 Mbps with full interactivity

- Helps reduce power consumption and system noise
  - By offloading both CPU and GPU
Video Decode Data Flow in AMD 780G platform

Blu-ray Player Application

VC-1
H.264
MPEG-2

UVD

Entropy Decode → Inverse Transform → Motion Comp → Other filters

CABAC Reverse Entropy → Inverse Transform → Motion Comp → In-loop De-blocking

Inverse Discrete Cosine Transform → Motion Comp

Post Processing
(De-interlacing, CSC, Scaling)

Plane Composition

Presentation
New interfaces

- First implementation of DisplayPort integrated with a graphics core
  
  2.7GHz interface

- First implementation of HyperTransport 3.0 in an IGP product
  
  2.6GHz interface

- First implementation of PCI Express Gen 2 in an IGP product
  
  5.0 GHz interface
Display Connectivity

- Single VGA output up to 2048x1536
- Dual channel LVDS support up to WUXGA
- DVI up to 2560 x 1600
- HDMI up to 1080P with 48KHz audio
- DisplayPort up to 2560x1600
- Dual independent display controllers
- Full GPU support for HDCP with on-die keys
HyperTransport Interface

- Support for HyperTransport 3.0
- 16 Bit Upstream/Downstream
- Support for Centralized Link Management Control (CLMC)
- Link width changes based on power state
- Support for LS2 low power state
More Performance – But Less Power

AMD Chipset Evolution
1st 55nm IGP Chipset in Industry

- 30nm: 2.00W, 52 Million Transistors
- 10nm: 1.80W, 72 Million Transistors
- 80nm: 1.40W, 205 Million Transistors
- 5nm: 0.95W, 205 Million Transistors

Legend:
- Transistors
- Power

Idle Power (Watts)
- 0.0
- 0.5
- 1.0
- 1.5
- 2.0

Millions of Transistors
- 0
- 50
- 100
- 150
- 200
- 250

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Power Innovations

- Introduction of deep sleep state for GPU
- Powershift technology
  3D engine scales its clock rate with no performance degradation
- Pervasive use of clock gating
  reduces dynamic power
- High Vt transistors reduces leakage significantly
  More than 50% of the transistors used are high Vt
Display Cache reduces Power

- Helps reduce power and improve performance
  - 16-bit DDR2/DDR3 interface
  - Support high speeds without need for power hungry termination
- Power savings achieved by storing “primary surface” in display cache
- Innovative tri-mode memory allocation
  - Display cache only
  - Interleaved
  - UMA shared
In Summary

Market expectations of PCs are changing
  • More media rich usage models
  • More multitasking

Met this challenge using new technologies from AMD’s IP portfolio
  • DirectX 10 graphics core
  • Unified Video Decoder for HD video playback
  • PCI Express 2.0, DisplayPort 1.1 & HyperTransport 3.0 interfaces

Applied proven & new techniques to limit power
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