



VIA K8 Series
Powering the AMD64 Revolution

White Paper

VIA Technologies, Inc.
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Introduction: Powering the AMD64 Revolution

AMD64 Architecture

The revolutionary AMD64 architecture extends the long-established x86 instruction set architecture to support 64-bit processing, defining a new class of computing. Full compatibility with both 32-bit and 64-bit computing provides the industry's most scalable platform, allowing users to seamlessly migrate from 32-bit architecture to the superior performance of 64-bit architecture as and when their computing needs dictate.



The need to evolve to 64-bit technology is primarily driven by high-performance applications that require large amounts of physical and virtual memory. Current 32-bit computers can provide a maximum of 4GB of addressable memory, while 32-bit operating systems only support about 2GB of memory. As digital media and digital content creation plays an increasingly important role in users' computing requirements, the transition to 64-bit software will bring vital performance benefits. Applications that will benefit from a migration to AMD64 architecture include:

- Power hungry digital media applications such as digital video and music production, editing and encoding, as well as real-time media streaming solutions.
- Demanding enterprise class applications, including data asset management, engineering, graphics rendering and CAD based design.
- Managing a significant number of simultaneous users, such as numerous thin-client solutions and large databases.
- Applications that demand the highest mathematical precision and floating-point performance, including modeling, simulation, statistics and financial analysis, as well as data encryption and compression.

The first AMD64 processors, the AMD Opteron™ processor for servers and workstations, and the upcoming AMD Athlon™ 64 processor for the performance and mainstream desktop segments, are the first milestones in establishing this new class of computing. 64-bit software will be fully compatible with these processors, allowing customers to enjoy the technical superiority of 64-bit architecture without sacrificing legacy x86 compatibility.

VIA: Delivering Long-Term Leadership on the AMD Platform

VIA brings established leadership credentials to the AMD64 platform with its unrivaled track record as the number one supplier of advanced core logic solutions for the AMD Athlon™ XP, AMD Athlon, and AMD Duron processors. From the 1999 introduction of the VIA KX133 to the recently released VIA KT600, VIA has played a vital role in the evolution of the AMD Socket A platform ever since its inception, pioneering the implementation of cutting-edge technologies such as PC133, DDR266, DDR333,

DDR400, AGP8X, USB2.0 and integrated Serial ATA/RAID, to complement the performance of successive versions of the AMD Athlon processor.

As the only chipset supplier to provide solutions to cover all market segments, including server/workstation, performance desktop/enthusiast, mainstream desktop, and mobile, VIA has enjoyed unparalleled support from OEMs, System Integrators, and motherboard manufacturers. In fact, more of the world's leading motherboard makers and OEMs choose VIA than any other AMD compatible chipset supplier.

VIA K8 Series: The Most Scalable Platform for the AMD64 Architecture

Overview

Leveraging its unique V-MAP architecture, which delivers full pin-to-pin compatibility and a unified driver set, VIA has developed the most comprehensive range of platform solutions for the AMD Opteron and forthcoming AMD Athlon 64 processors through its new VIA K8 Series Chipsets.

In addition to the high-performance K8T800, supporting a choice single or dual Opteron processors as well as the forthcoming AMD Athlon 64, and the K8M800 and K8N800, the world's first integrated solutions for AMD64 desktops and notebooks, the VIA K8 Series delivers market leading performance and features such as Hyper8™ technology, AGP8X, and V-RAID, the world's first native South Bridge Serial ATA/RAID controller, to the AMD64 platform. It also covers all key market segments, maximizing flexibility for motherboard manufacturers and OEMs while minimizing development processes and costs and ensuring rapid time-to-market. Furthermore, VIA's pioneering unified driver set, the VIA Hyperion 4in1 drivers, optimize system stability and performance for all systems running Microsoft® Windows® operating systems. The complete VIA K8 Series for the AMD64 platform is summarized in Figure 1 overleaf.

Figure 1: VIA K8 Series Segmentation

Chipset & Processor Platform	Target Segment
<p>VIA K8T800 Chipset and AMD Opteron™ Processor</p> 	 <ul style="list-style-type: none"> • Dual/Single Processor Servers • Dual/Single Processor Workstations
<p>VIA K8T800 Chipset and AMD Athlon™ 64 Processor</p> 	 <ul style="list-style-type: none"> • Enthusiast/Performance Desktop • Media Centers
<p>VIA K8M800 Chipset and AMD Athlon™ 64 Processor</p> 	 <ul style="list-style-type: none"> • Mainstream Desktop
<p>VIA K8N800 Chipset and AMD Athlon™ 64 Mobile Processor</p> 	 <ul style="list-style-type: none"> • Full size Mobile • Thin & Light Mobile

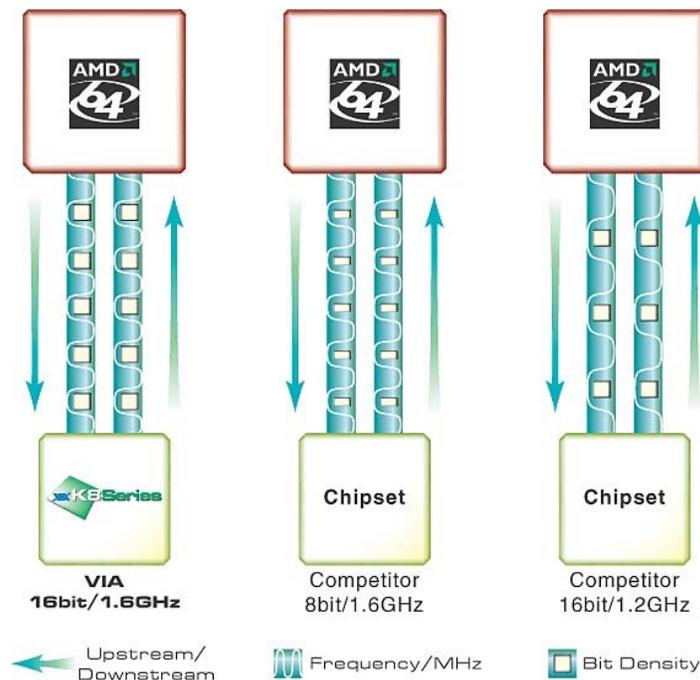
VIA K8 Series North Bridge Options

The VIA K8 Series offers a choice of pin-to-pin compatible K8T800 or K8M800 North Bridges with the advanced new VT8237 South Bridge and a wide array of networking, connectivity, and multimedia companion chips to provide the most scalable and full-featured AMD64 server, workstation and desktop platform from a single vendor.

In addition to an AGP8X port for blistering graphics performance, both the VIA K8T800 and VIA K8M800 North Bridges are designed to optimize the performance and data integrity of the AMD Opteron and AMD Athlon 64 processors through their support for VIA's unique Hyper8™ technology, which enables the industry's first full 16-bit/1.6GHz¹ implementation of the HyperTransport bus for the AMD64 platform.

With the massive data loads conveyed by a 16-bit/1.6GHz HyperTransport bus, the propensity for bus noise and signal interference between the processor and chipset increases significantly, thereby decreasing signal integrity to unmanageable levels. To deal with the high level of signal interference, other chipset vendors have had to reduce the data load of the HyperTransport bus, either through a reduction in bus speed from 1.6GHz to 1.2GHz, or by reducing the size of data packages from 16 bits to 8 bits, as shown in Figure 2 below.

Figure 2: VIA Hyper8 Technology Implementation



¹ The double data rate HyperTransport bus allows an 800MHz bus to provide an effective system bus speed of 1.6GHz.

VIA's Hyper8 technology eliminates signal interference on the HyperTransport bus to ensure maximum signal quality, removing the need to scale down bus speed or data package size. This enables a full-spec 16-bit/1.6GHz link between processor and chipset and the only true implementation of the HyperTransport bus available on the AMD64 platform today, allowing AMD64 processor based systems to achieve their full performance potential.



As Table 1 shows, by leveraging Hyper8 technology to implement a full 16-bit/1.6GHz HyperTransport link between the Chipset's North Bridge and AMD64 processor, VIA K8 Series based systems are able to provide up to 6.4GB/s of system bandwidth, offering a significant performance advantage over other AMD64 chipset solutions currently available.

Table 1: Industry Comparison of HyperTransport Implementations

	Frequency	Bit Density	Total Bandwidth
VIA K8-Series	1.6GHz	16-bit	6.4GB/s
Competitor	1.2GHz	16-bit	4.8GB/s
Competitor	1.6GHz	8-bit	3.2GB/s

Featuring the integrated UniChrome2 graphics engine, the VIA K8M800 and low power K8N800 support 8MB to 64MB UMA frame buffer memory, as well as such advanced features as DuoView™ and a built-in hardware MPEG-2 video decoder, to ensure superior mainstream desktop and notebook graphics and video performance.

VIA K8 Series South Bridge Options

In combination with the VIA VT8237 South Bridge, VIA K8 Series North Bridges enable the latest in cutting edge storage, I/O and multimedia features. With the only native Serial RAID controller for the AMD64 platform, the VIA VT8237 provides high-speed 150MB/s dual channel connections to Serial ATA Hard Drives, while retaining support for up to four Parallel ATA-133 devices. System designers can also combine optimum data transfer rates and maximized data integrity through V-RAID. With support for multiple RAID Level 0, RAID Level 1, RAID 0+1², and JBOD configurations, the revolutionary V-RAID software interface with easy installation and manageability for system integrators and end users.

² RAID Level 0+1 requires four Serial ATA drives; support for the two additional drives can only be implemented with two external Serial ATA ports enabled through a SATALite PHY. See Figure 5. Please see the VIA VT8237 South Bridge White Paper (July 2003) for further information.

Figure 3: VIA VT8237 South Bridge Architecture



The VIA VT8237 also features integrated 10/100Mbps Fast Ethernet and up to eight high-speed USB 2.0 ports, and has a high-throughput V-Link interconnect running at speeds of up to 533 MB/s between the North and South Bridge.

The VIA VT8237 delivers exceptional surround sound capabilities through its support for VIA Vinyl™ and high-resolution VIA Vinyl Gold Audio, providing an unrivaled choice of market leading integrated and onboard audio solutions. The VIA Vinyl integrated 5.1 surround sound utilizes the VIA Vinyl AC '97 audio controller and VIA Six-TRAC codec, while VIA Vinyl Gold onboard 7.1 surround sound features the VIA Envy24PT controller, the VIA Six-TRAC codec, plus an additional DAC. VIA Vinyl Gold Audio is the only onboard audio solution with 8-channel immersion audio and 24/96 resolution digital outputs currently available.

VIA K8 Series Companion Chip Options

VIA K8 Series Chipsets can also be coupled with a wide variety of advanced VIA Gigabit Ethernet, high resolution eight-channel audio, 1394, TV-Out, and PCI-X companion chips to further expand the performance and features of AMD64 systems and servers. VIA's portfolio of companion chips includes the following solutions:

VIA Networking Gigabit Ethernet

VIA offers the highest-performance single chip Gigabit Ethernet solution for the AMD64 platform available today, allowing for easier integration at the motherboard design level and enhanced data throughput for a complete range of home and enterprise level networking applications. This flexible 10/100/1000 compatible solution features the advanced and easy to use GigaCheck™ software interface, which allows users to monitor connection speed and link quality.



Advanced Connectivity Options

Motherboard makers and OEMs can deliver flexible levels of multimedia connectivity via companion chips such as the VIA VT6307 1394 controller and the VIA VT1622 TV-Out chip.



VIA VPX2 for Servers and Workstations

The new VIA VPX2 companion chip with high throughput HDIT® Interface provides support for ultra high-bandwidth expansion, via two 133MHz PCI-X slots, or maximized connectivity via 12 standard PCI connections. The dual channel VPX2 solution also allows simultaneous support for AGP8X and PCI-X, effectively enabling PCI-X expansion capabilities for the high-end workstation segment. Supported configurations are:

- 2 slots x 133MHz
- 4 slots x 100MHz
- 8 slots x 66MHz
- 12 slots x 33MHz



VIA K8T800 + AMD Opteron Processor Platform

Overview

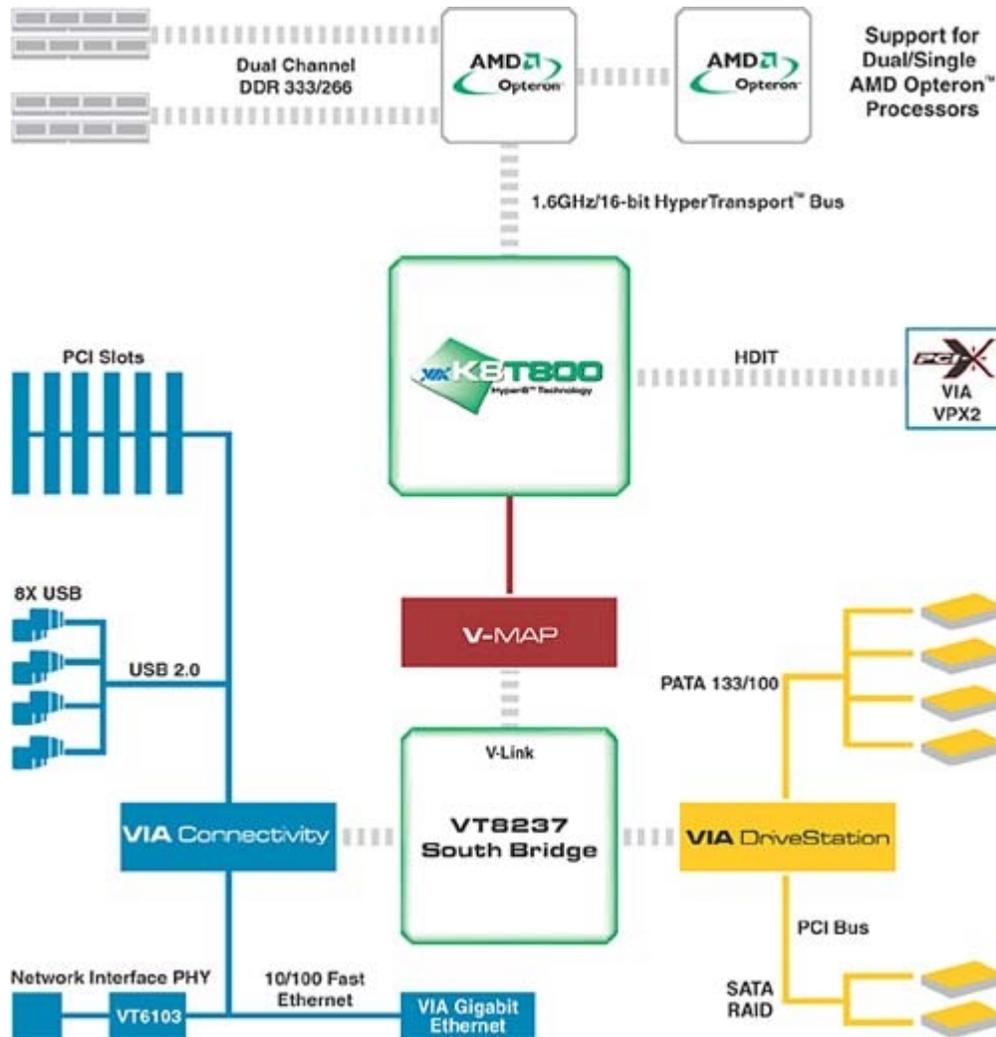
The VIA K8T800 chipset is the first dual processing capable chipset with AGP8X support for the AMD Opteron processor, providing the most scalable solution for a wide variety of advanced 64-bit server and workstation design applications. The combination of the VIA K8T800's advanced architecture, dual DDR333 SDRAM support through the processor, and VIA's unique Hyper8™ technology, enabling the industry's first full 16-bit/1.6GHz implementation of the HyperTransport bus, ensures a platform capable of dealing with today's most demanding and power-hungry enterprise applications, including digital content creation, graphics rendering, CAD based design, and data asset management.

AGP8X and AGP Pro support allows system designers to accommodate the latest professional class 3D graphics cards for advanced workstation applications, while the integrated V-RAID in the VT8237 South Bridge ensures optimum HDD performance and data integrity through its support for a choice of RAID Level 0, RAID Level 1, and RAID Level 0+1 configurations. Connectivity options are further enhanced with support for up to eight high-speed USB 2.0 ports and high-throughput 10/100Mb/s Ethernet in the VT8237 South Bridge.

By implementing the VIA VPX2 companion chip, system designers can also provide support for ultra high-bandwidth expansion using two 133MHz PCI-X slots, or maximized connectivity with up to twelve standard PCI connections, without sacrificing full AGP8X support.

Figure 4 overleaf shows the full complement of features and technologies that the VIA K8T800 brings to the single/dual AMD Opteron Processor workstation platform, while Figure 5 represents the configuration for the single/dual AMD Opteron processor server platform.

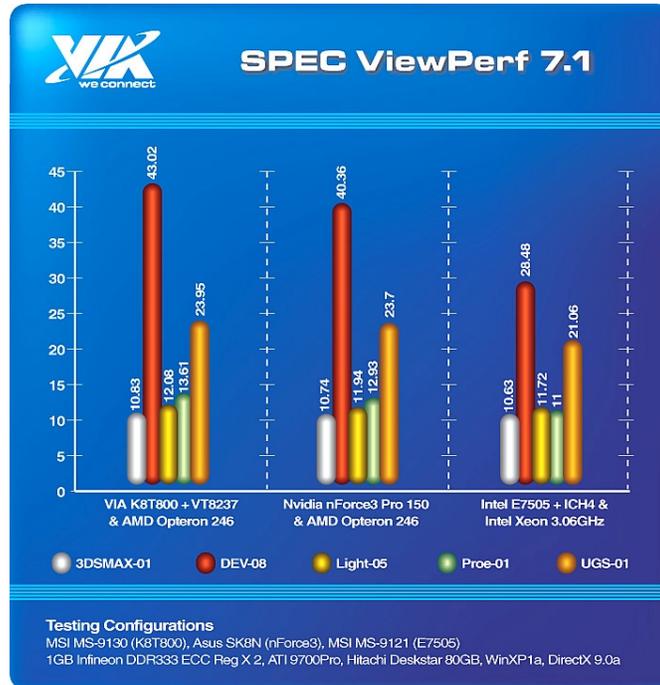
Figure 5: VIA K8T800 Single/Dual AMD Opteron Processor Server Platform



VIA K8T800 + AMD Opteron Processor Performance

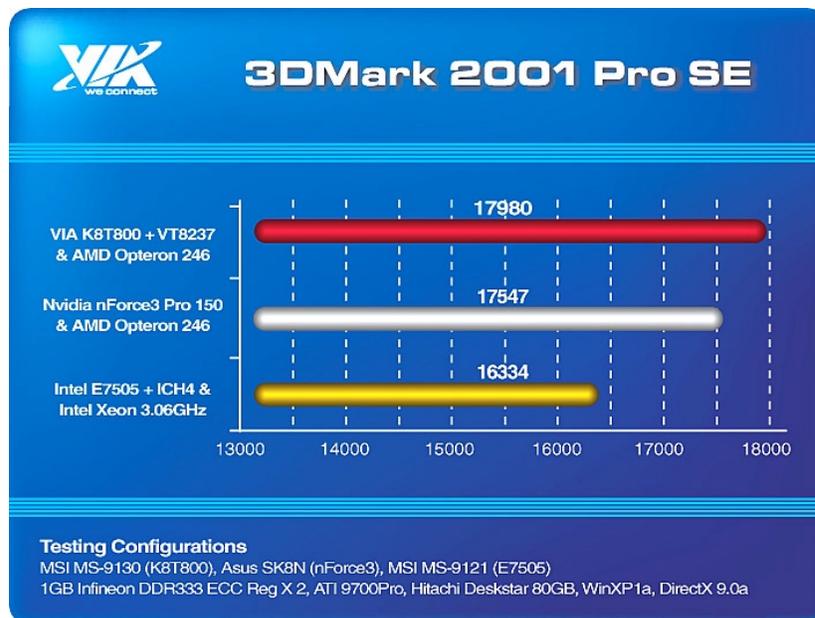
As is shown in Figure 6, the VIA K8T800 delivers market-leading performance across a wide spectrum of SPEC ViewPerf 7.1 workstation benchmark applications.

Figure 6



The VIA K8T800 also outperforms alternative chipset solutions when running mainstream 3D graphics applications, as demonstrated in Figure 7.

Figure 7



VIA K8T800 + AMD Athlon 64 Processor Platform

Overview

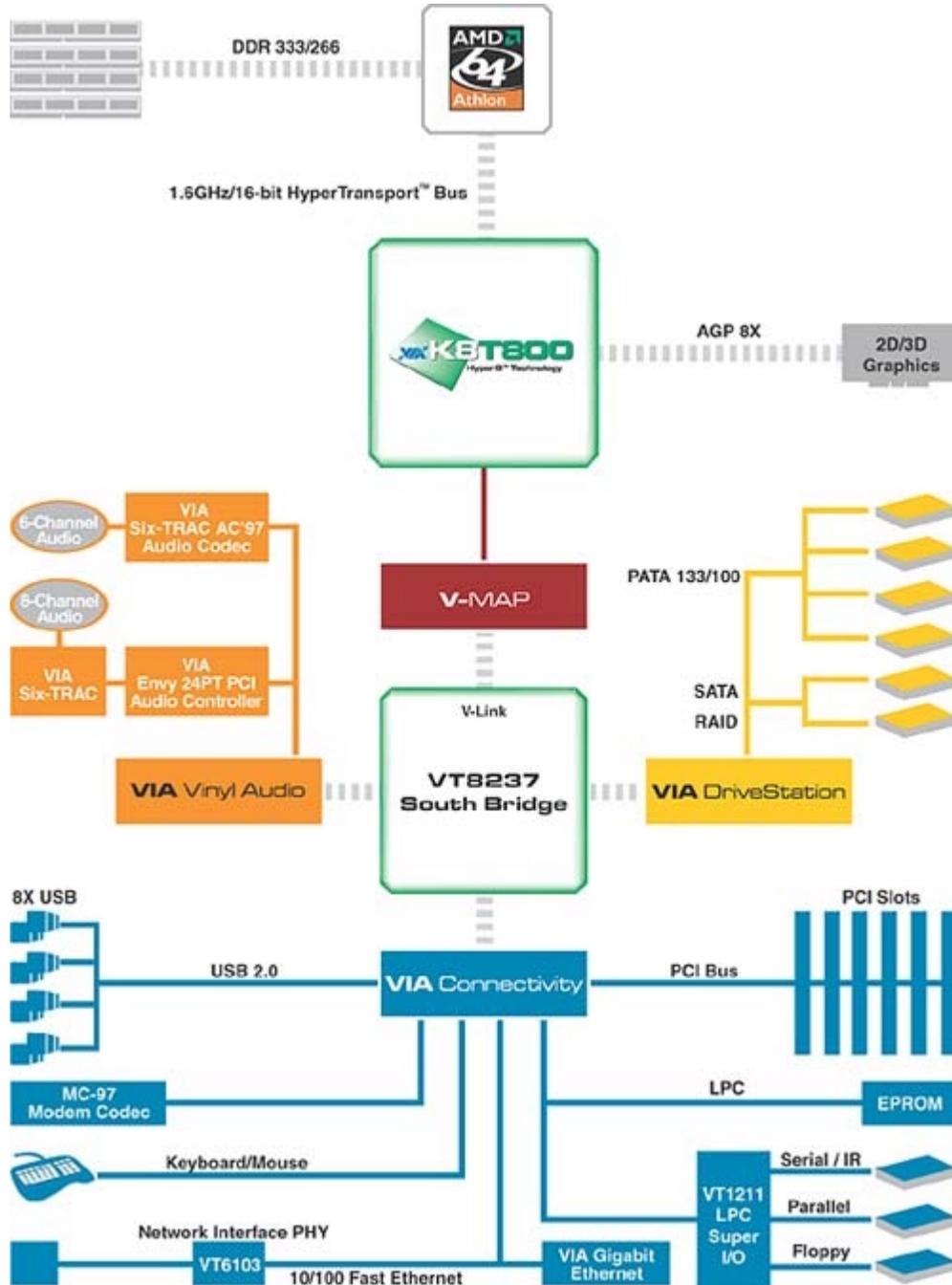
The first fully featured chipset ready for upcoming AMD Athlon 64 processors, the VIA K8T800 chipset is the ideal platform for a wide range of desktop solutions, including consumer, corporate, enthusiast, media center, and entry-level server/workstation. With its well established performance credentials on the AMD Opteron processor platform, the K8T800 chipset combines VIA's unique Hyper8™ technology, enabling the industry's first full 16-bit/1.6GHz implementation of the HyperTransport bus, and AGP8X with the industry's most advanced suite of storage and multimedia technologies, enabling solutions capable of dealing with today's most demanding digital media applications. Furthermore, motherboard manufacturers and OEMs benefit from being able to directly transfer an established chipset to their forthcoming Athlon 64 product lines, reducing the design-in process and ensuring fast time-to-market.

The integrated V-RAID function of the VT8237 South Bridge ensures optimum HDD performance and data integrity by offering a choice of RAID Level 0, RAID Level 1, and RAID Level 0+1 configurations. Furthermore, the revolutionary V-RAID software interface allows easy installation and management of RAID arrays, as well as on-the-fly storage upgrades, and is compatible with a broad range of Windows and Linux operating systems. Connectivity to the latest digital multimedia devices is provided for, with support for up to eight high-speed USB 2.0 ports and high-throughput 10/100Mb/s Ethernet in the VT8237 South Bridge.

The VIA VT8237 is also optimized for an unparalleled high definition digital experience, through exceptional surround sound capabilities. The option of VIA Vinyl™ and ultra high-resolution VIA Vinyl Gold Audio ensures unrivaled integrated and onboard audio solutions.

Figure 8 overleaf shows the full complement of features and technologies that the VIA K8T800 brings to the AMD Athlon 64 Processor performance desktop platform.

Figure 8: VIA K8T800 & AMD Athlon 64 Processor Performance Desktop Platform



VIA K8M800 + AMD Athlon 64 Processor Platform

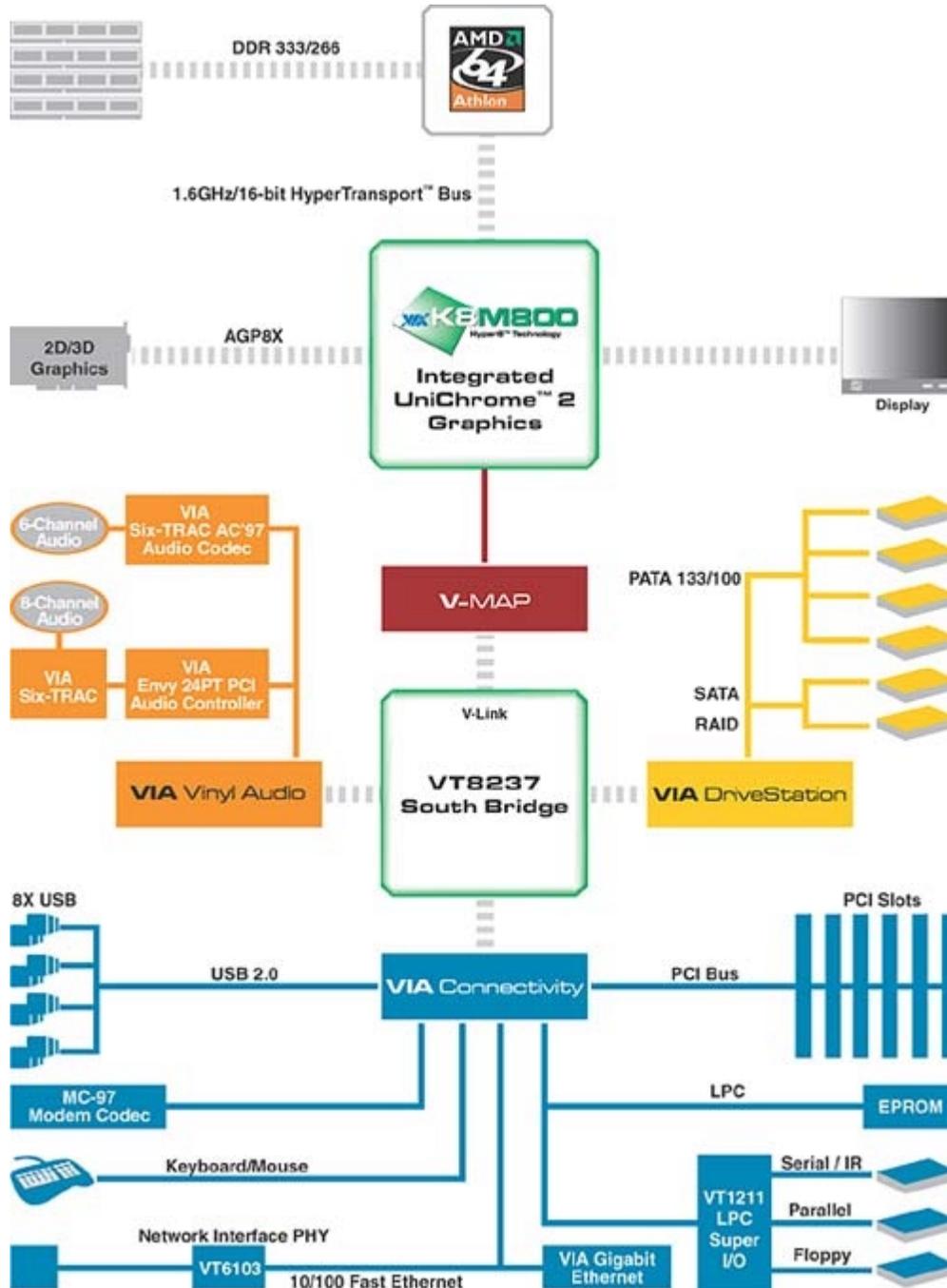
Overview

The feature packed VIA K8M800 chipset builds upon the established performance pedigree of the VIA K8T800 chipset, and integrates market-leading UniChrome2™ graphics to provide the perfect platform for AMD Athlon 64 processor based mainstream PCs. The new UniChrome2 2D/3D graphics engine brings new levels of digital media performance to mainstream and value conscious desktop segments, featuring a host of high-definition digital media technologies, including a full MPEG-2 video decoder for silky smooth DVD playback and DuoView™ for dual display systems to maximize productivity. The K8M800 chipset also supports an AGP8X port, allowing OEMs and system designers full design flexibility in configuring their products to meet a broad spectrum of price points.

In addition to high definition digital media support through the UniChrome2 graphics engine, the K8M800 maintains the high performance architecture of the K8T800 chipset with its support for DDR333 SDRAM and VIA's unique Hyper8™ technology, which enables the industry's first full 16-bit/1.6GHz implementation of the HyperTransport bus. Paired with the VIA VT8237 South Bridge, the VIA K8M800 brings support for high performance storage technologies including Serial ATA and V-RAID to the mainstream PC market for the first time, while support for up eight high-speed USB 2.0 ports and high-throughput 10/100Mb/s Ethernet ensures effortless connectivity. Furthermore, system designers will be able to offer an unparalleled high definition digital surround sound capabilities on mainstream desktop PCs, through the advanced VIA Vinyl™ Audio suite.

Figure 9 overleaf shows the full complement of features and technologies that the VIA K8M800 brings to the AMD Athlon 64 Processor performance desktop platform.

Figure 9: VIA K8M800 & AMD Athlon 64 Processor Mainstream Desktop Platform



VIA K8N800 + AMD Athlon 64 Mobile Processor Platform

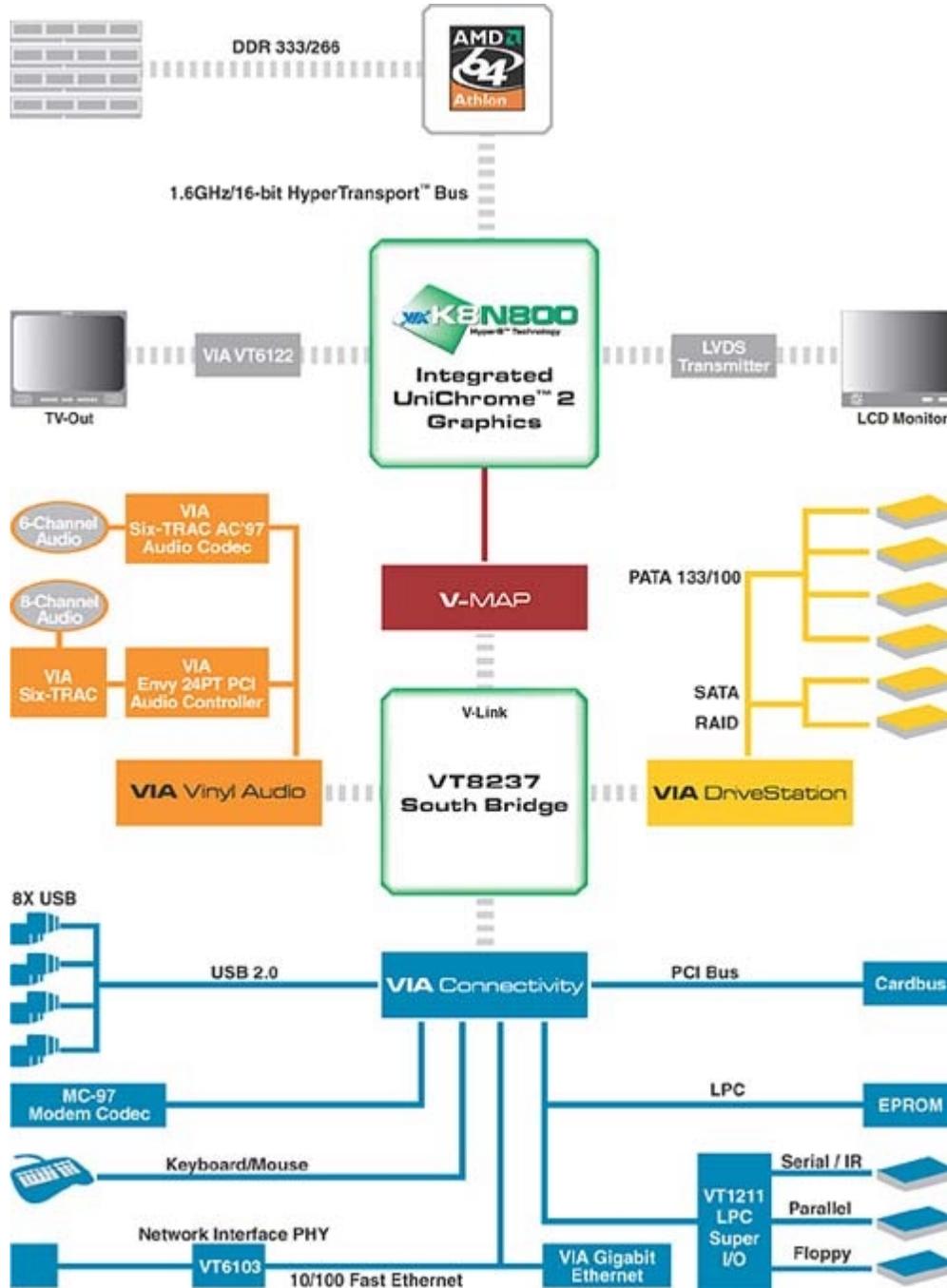
Overview

The industry's first chipset for upcoming AMD Athlon 64 Mobile processors, the VIA K8N800 chipset will power a new generation of high-performance, full-size notebooks as well as lower-power, thin and light notebooks. Featuring the new UniChrome2 2D/3D graphics engine, the K8N800 chipset enables a new standard in digital media performance for the mobile segment, with full MPEG-2 video decoding for silky smooth DVD playback and advanced DuoView™ technology for dual display support.

Featuring support for DDR333 memory and VIA's unique Hyper8™ technology, which enables the industry's first full 16-bit/1.6GHz implementation of the HyperTransport bus, the VIA K8N800 chipset provides the necessary headroom to efficiently deal with today's more demanding productivity and digital media applications. The VIA VT8237 supports forthcoming internal and external Serial ATA drives, as well as existing ATA133 drives, and provides a host of advanced connectivity options, with support for up to eight USB2.0 ports and high-throughput 10/100Mb/s Ethernet. For the first time, the mobile segment will be able to benefit from high definition digital surround sound capabilities, courtesy of the VIA VT8237 South Bridge's VIA Vinyl™ Audio suite. Performance flexibility for AMD Athlon 64 Mobile processor based notebooks is ensured with support for external AGP expansion.

Figure 10 overleaf shows the full complement of features and technologies that the VIA K8N800 brings to the AMD Athlon 64 Mobile Processor notebook platform.

Figure 10: VIA K8N800 & Athlon 64 Mobile Processor Notebook Platform



VIA K8 Series: Powering the AMD64 Revolution

The AMD64 revolution is already under way as the AMD Opteron processor makes significant inroads into the server market, with system administrators realizing the performance benefits of 64-bit computing in enterprise class applications such as corporate network and database management. The upcoming launch of the AMD Athlon 64 processor is another exciting stage in the onset of 64-bit computing. Able to run the installed base of 32-bit applications, AMD64 technology will ensure a seamless migration to 64-bit computing for the mainstream, as more software becomes available that takes advantage of the extra processing power.

VIA has been working alongside AMD at every step of this transition, ensuring that the K8 Series of chipsets is optimized to power the AMD64 revolution. VIA has built upon the success and established reputation of its market-leading AMD chipsets to introduce the new VIA K8 Series, the industry's most comprehensive portfolio of high-performance chipsets for powering a complete range of AMD Opteron and AMD Athlon 64 processors. The VIA K8 Series covers all market segments, from dual AMD Opteron processor based servers and workstations, to AMD Athlon 64 processor based performance desktops, as well as a new generation of powerful notebooks based on the AMD Athlon 64 Mobile processor.

The VIA K8 Series brings the advanced Hyper8 technology to the AMD64 platform, a superior implementation of the HyperTransport bus that enables market-leading throughput with maximum signal quality, making the most of this advanced technology and providing users with the best 64-bit computing experience.

Paired with the new VIA VT8237 South Bridge, VIA K8 Series North Bridges bring a host of cutting edge storage, I/O and multimedia features to the AMD64 platform, including an industry first native Serial RAID controller, for optimum data transfer rates and maximized data integrity. In addition to advanced connectivity options such as integrated 10/100Mbps Fast Ethernet and high-speed USB 2.0, the VIA VT8237 delivers high-definition surround sound capabilities through its support for VIA Vinyl™ and high-resolution VIA Vinyl Gold Audio, providing an unrivaled choice of market leading integrated and onboard audio solutions.

Benefiting from a uniquely scalable architecture, which includes a wide selection of VIA companion chips to expand performance and feature sets, motherboard manufacturers and OEMs are able to tailor solutions to meet the specific needs of varying market segments. Furthermore, VIA's innovative V-MAP system architecture ensures pin-to-pin compatibility and a unified driver set between VIA chipsets, enabling reduced design processes and faster time-to-market.

VIA has played a key role in the evolution of previous AMD processor platforms, having led the way with technologies such as PC133, DDR, AGP8X, USB2.0, Serial ATA and Serial RAID. VIA's aggressive future roadmap for K8 Series chipsets will see VIA once again first to market with the latest technologies and playing an integral role in the continued evolution of the AMD64 platform, providing flexibility for motherboard partners and future-proofing desktops for years to come.