intel.

Mobile Pentium® III Processor and 440BX AGPset

Performance Brief

September 2000

Executive Summary

The Intel® mobile Pentium® III processor is Intel's most advanced and powerful processor for notebook PCs, offering several new features for maximum performance, productivity, and manageability. With all the power needed for the next generation of Internet-enabled software, the mobile Pentium III processor will continue to deliver an exceptional experience for laptop users well into the future.

Using Intel's advanced 0.18-micron process technology, the Intel mobile Pentium III processor is offered at fixed speeds of 500 MHz, 450 MHz, and 400 MHz while still offering lower power for long battery life. The Intel mobile Pentium III processor featuring Intel SpeedStep™ technology is offered at 850 MHz, 800 MHz, 750 MHz, 700 MHz, 650 MHz, and 600 MHz. The Intel mobile Pentium III processor featuring Intel SpeedStep technology is also offered at 600 MHz low-voltage. Other Pentium III processor performance advancements include the addition of new Internet Streaming SIMD instructions, an Advanced Transfer Cache architecture, and a processor system bus speed of 100 MHz. These features are offered in BGA2, micro-PGA2, and mobile module connector 2 (MMC2) form factors. All of these technologies make it possible to offer this outstanding performance in mobile PCs available in a variety of shapes and sizes.

Intel mobile Pentium III processor featuring Intel SpeedStep technology is the next dramatic step towards achieving near desktop performance. This exciting new processor has two performance modes and allows real-time dynamic switching of the voltage and frequency between the modes. This occurs by switching the bus ratios, core operating voltage, and core processor speeds without resetting the system.

The two performance modes are the Maximum Performance mode and the Battery Optimized Performance mode. The Maximum Performance mode operates on a higher frequency and provides near desktop performance. The Battery Optimized Performance mode provides the best balance between performance and battery life and operates at a lower frequency.

The Intel mobile Pentium III processor delivers excellent performance for all PC software and is fully compatible with existing Intel Architecture-based software. The mobile Pentium III processor featuring Intel SpeedStep technology takes laptop power into the future by offering performance headroom for business, media, communications, and Internet applications. Software designed for the mobile Pentium III processor unleashes its full multimedia capabilities, including full-screen and full-motion video, realistic graphics, and an enhanced, exciting Internet experience.

A mobile Pentium III processor used with an Intel 440BX AGPset provides a proven, balanced platform from full-size notebooks to thin and light notebooks, with outstanding performance and compatibility for today's demanding applications, and plenty of headroom to remain productive for years to come. The 440BX AGPset has already established itself as the best combination of compatibility, affordability, and performance for the demands of high-performance laptops, and its compatibility with the mobile Pentium III processor promises to extend that track record well into the future.

Modern laptop systems are used to run a broad range of software applications. Multimedia, 3D, and Internet application use has increased, and this trend is anticipated to continue in the future. For this reason, a wide range of benchmarks should be considered when evaluating processor and system performance. PC users and buyers should consider the entire Spectrum of Performance, which includes productivity, multimedia, 3D, and Internet performance. See Figure1.

Figure 1. The Spectrum of Performance
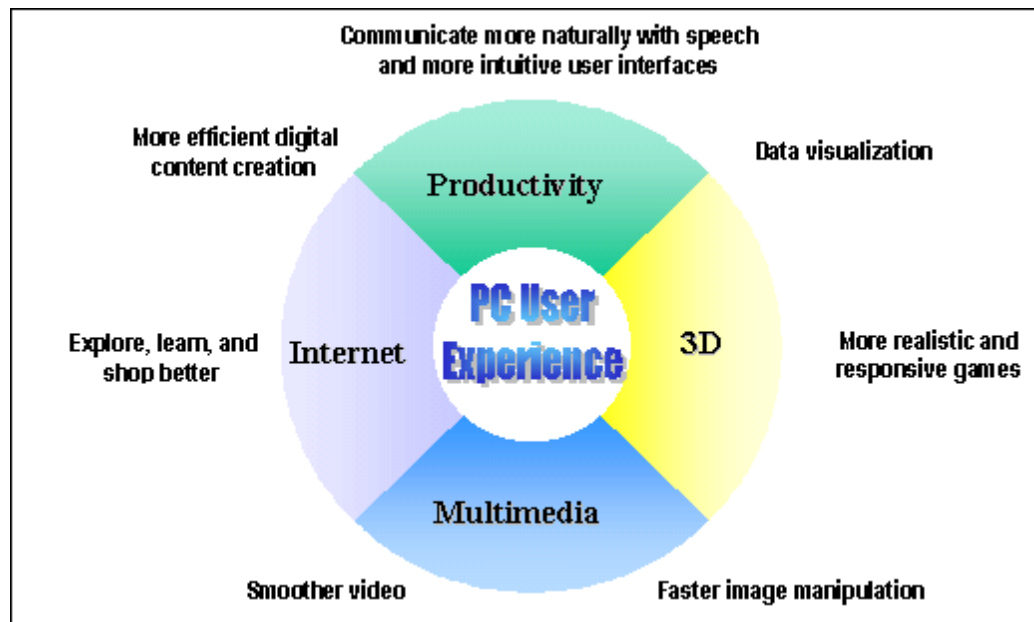
Systems based on mobile Pentium III processors also include the latest features to simplify system management, decrease power consumption, and lower the total cost of ownership for large and small business environments. The mobile Pentium III processor offers great performance for today's and tomorrow's applications, as well as the quality, reliability, and compatibility that is expected from the world's leading microprocessor company.

The Intel 440BX AGPset is the first chipset designed to optimize Dual Independent Bus (DIB) performance for 3D, video, and Internet applications. Already widely deployed at 66 MHz on existing mobile Pentium II processor-based systems, the 440BX AGPset also supports a 100-MHz system bus and 100-MHz SDRAM to complement the mobile Pentium III processor speeds. Businesses can use it to make the most of their legacy investments, while easily qualifying it as the platform of choice for new mobile Pentium III processor-based systems.

This Performance Brief introduces the mobile Pentium III processor featuring Intel SpeedStep technology, explains the technologies that make it work, examines the purpose and methods behind the industry's most useful benchmarks, and shows how the mobile Pentium III processor currently performs on each. As new benchmarks are introduced, this performance brief will be updated appropriately.

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1.0   Introduction

The Intel mobile Pentium III processor provides exceptional power for high-performance, mainstream, thin and light, and mini- notebooks. It offers speed, compatibility, and reliability for today's productivity, multimedia, 3D, and Internet applications on today's operating systems. In addition, new multitasking, manageability, security, and architectural enhancements make the mobile Pentium III processor the perfect choice for businesses preparing to enter the emerging Personal Enterprise Computing environment.

The new Intel mobile Pentium III processor featuring Intel SpeedStep technology at 850 MHz, 800 MHz, 750 MHz, 700 MHz, 650 MHz, 600 MHz, and low voltage 600 MHz delivers customizable high-performance computing on a notebook. In the Maximum Performance mode, the notebook can run the most complex business and Internet applications with speeds comparable to a desktop system. When powered by a battery, the processing frequency drops to the lower Battery Optimized Performance mode frequency to conserve battery life while maintaining a high-level of performance. In the Battery Optimized Performance mode, the mobile Pentium III processor featuring Intel SpeedStep technology at 850 MHz will drop to a frequency of 700 MHz, 800 MHz will drop to a frequency of 650 MHz, 750 MHz will drop to a frequency of 600 MHz, 700 MHz will drop to 550 MHz, the 650 MHz will drop to 500 MHz, and the 600 MHz will drop to 500 MHz. Using manual override, the frequency can be boosted back to Maximum Performance mode when on the battery. This allows the user to customize performance.

When a mobile Pentium III processor is used in conjunction with an Intel 440BX AGPset, the resulting platform provides reliable, balanced performance for today's mainstream notebook PCs, with headroom to remain productive as new applications emerge in the years to come. The 440BX AGPset is already widely deployed on mobile Pentium III processor-based systems. With its 66/100 MHz system bus, Advanced Graphics Port (AGP), and Quad Port Acceleration (QPA), businesses can use this proven platform to preserve their legacy investments while laying a solid foundation for the future.

This brief provides performance results for the following Intel mobile Pentium III processors at speeds of 450 MHz and above, while using an Intel 440BX AGPset and running a variety of benchmarks, and comparing the results with the mobile Pentium III processor at 400 MHz:

- Mobile Pentium III processor at 450 MHz

- Mobile Pentium III processor at 500 MHz

- Mobile Pentium III processor at 550 MHz[1]

- Mobile Pentium III processor at 600 MHz

- Mobile Pentium III processor at 650 MHz

- Mobile Pentium III processor at 700 MHz

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[1] The Intel mobile Pentium III processor is not offered at 550 MHz. This performance brief includes the performance at 550 MHz since the mobile Pentium III processor featuring Intel SpeedStep technology at 700 MHz drops to a speed of 550 MHz in the Battery Optimized Performance mode respectively.

- Mobile Pentium III processor at 750 MHz

- Mobile Pentium III processor at 800 MHz

- Mobile Pentium III processor at 850 MHz

When evaluating the performance of a microprocessor or system, it is important to obtain the complete performance picture. Today's PC user runs a broad spectrum of productivity, 3D, multimedia, and Internet software:

- Productivity software includes applications such as word processing, presentation, and personal finance programs.

- Multimedia software includes audio, video, imaging, and creativity applications.

- 3D software includes gaming, modeling, and simulation applications.

- Internet applications include Internet browsers, as well as 3D and multimedia Web content.

A processor and system should deliver the highest performance across the entire Spectrum of Performance including Productivity, Multimedia, 3D, and Internet.

This report provides benchmark results for the Intel mobile Pentium III processor family. Modern, industry-standard benchmarks were chosen to demonstrate capabilities across the Spectrum of Performance. The benchmarks include:

- Productivity performance can be measured using system-level benchmarks such as BAPCO*'s SYSmark* 2000.

- Multimedia performance can be compared with Futuremark's* MultimediaMark* 99 benchmark.

- 3D performance can be measured with the 3D Winbench* 2000 Processor Test and floating-point benchmarks such as Ziff-Davis*' WinBench* 99–FPU WinMark*.

- Java aspects of the Internet experience can be measured by BACPO*'s SYSmark*J

Intel is committed to using the most robust and relevant benchmarks in characterizing the performance of its products, and Intel will adapt this mix over time as newer benchmarks are introduced into the PC market.

System performance does not depend on the microprocessor alone. Hardware and software system components—such as the operating system, the graphics and I/0 subsystems, application software, and memory—may significantly affect benchmark results. For this reason, this Performance Brief illustrates mobile Pentium III processor performance on a consistent system configuration. Details of the system configuration used for the benchmarks throughout this brief can be found in Appendix A.

2.0　　　　Spectrum of Performance

When evaluating the performance of a microprocessor or system, it is important to obtain the complete performance picture. A processor and system should deliver high performance across the entire Spectrum of Performance including Productivity, Multimedia, 3D, and Internet.

2.1　　　　Productivity Benchmarks

Productivity software includes applications such as word processing presentation and personal finance. Popular, industry-standard productivity benchmarks include:

System Level Benchmarks:

- SYSmark* 2000
- Winstone* 99

2.2　　　　Multimedia Benchmarks

Multimedia benchmarks are designed specifically to represent the activities of end users working with video, audio, and imaging technologies such as MPEG1*, Dolby* Digital Sound, AVI, PC imaging, and video conferencing. A benchmark that falls under this category is:

- MultimediaMark* 99

2.3　　　　3D Benchmarks/Floating-Point Benchmarks

The most common type of 3D application today is 3D games. Benchmarks that measure processor, 3D, and floating-point performance include:

- 3D Winbench* 2000 Processor Test
- WinBench* 99–FPU WinMark*

2.4　　　　Internet Technology Benchmarks

Internet applications are evolving at a tremendous rate and include browser, 3D, and multimedia technologies. In attempting to evaluate processor Internet performance, PC users should consult the productivity, 3D, and multimedia benchmarks listed above. Additionally, some Java Internet technology benchmarks are:

System Level Benchmark:

- SYSmark* J

2.5　　　Evolving and Future Benchmarks

Benchmarks evolve as a direct response to the development of new technologies and the need to evaluate them objectively. As hardware and software technologies evolve, benchmarks must also evolve to capture new capabilities accurately.

The mobile Pentium III processor represents a major step in the evolution of computing potential. Currently available benchmarks show considerable gains across the Spectrum of Performance. Since applications that take full advantage of the mobile Pentium III processor are in development, many of the existing benchmarks do not fully test the processor's new capabilities.

Currently, the 3D Winbench* 2000 Processor Test and the MultimediaMark*99 benchmark take advantage of the capabilities of the mobile Pentium III processor. As existing benchmarks are updated to support the new capabilities, and as new benchmarks are introduced, Intel will update this Performance Brief.

3.0   The Mobile Pentium III Processor

The Intel mobile Pentium III processor offers new levels of performance and productivity for today's most demanding applications and operating systems. It incorporates advanced features to take full advantage of the Wired for Management enterprise architecture and the Personal Enterprise Computing environment that will drive business productivity to new heights in the new century.

In order to achieve near desktop performance, the Intel mobile Pentium III processor featuring Intel SpeedStep technology has two performance modes, Maximum Performance and Battery Optimized Performance. The Maximum Performance mode provides near desktop performance and runs at a higher frequency. The Battery Optimized Performance mode provides the best balance between performance and battery life and operates at a lower frequency. The user can do real-time dynamic switching between the modes. This occurs by switching the bus ratios, core operating voltage, and core processor speeds without resetting the system.

The mobile Pentium III processor introduces Streaming SIMD Extensions that include 70 new instructions for dramatically faster processing and improved output on existing and next-generation applications across the entire Spectrum of Performance. This includes advanced imaging, 3D streaming audio and video, Web access, speech recognition, new user interfaces, and other cutting-edge applications.

The mobile Pentium III processor is based on Intel's new 0.18-micron process that enables a higher level of integration while lowering both power consumption and heat dissipation. A 256-K full-speed Advanced Transfer Cache is included on the processor die itself for lower latency during cache accesses. Intelligent buffering of read/store data and a 256-bit wide cache line provide outstanding sustained concurrency and higher cache throughput, which enables higher performance. Although it contains 28.1 million transistors, the processor die is actually smaller than its predecessors are. The processor provides memory cacheability for up to 4 GB of addressable memory space. A self-reportable processor serial number gives security, authentication, and system management applications a powerful new tool for identifying individual systems.

The mobile Pentium III processor is available in BGA2, micro-PGA2, or mobile module connector 2 (MMC2) form factors for high-volume availability, improved handling protection, and compatibility with the high-performance processors of the future. Compatibility with the widely deployed 440BX AGPset platform also ensures compatibility with existing systems and a short qualification cycle for maximum return on investment.

The mobile Pentium III processor is backed by over 25 years of Intel experience in manufacturing high-quality, reliable microprocessors.

4.0 Mobile Pentium III Processor Product Feature Highlights

The mobile Pentium III processor is fully compatible with an entire library of PC software based on operating systems such as MS-DOS*, Windows* 3.1, Windows for Workgroups* 3.11, Windows* 98, Windows* 95, OS/2*, UnixWare*, SCO UNIX*, Windows* NT, Windows* 2000, OPENSTEP*, and Sun Solaris*. Architectural features of the mobile Pentium III processor include:

- Intel SpeedStep technology:

  The mobile Pentium III processor featuring Intel SpeedStep technology is offered at 850 MHz, 800 MHz, 750 MHz, 700 MHz, 650 MHz, 600 MHz, and low voltage 600 MHz. Highlights of this technology include:
  ⇒ Two performance modes - Maximum Performance mode for near desktop performance, and Battery Optimized Performance mode for lower power consumption and improved battery life.
  ⇒ Real-time dynamic switching between the two performance modes without resetting the system.

- Streaming SIMD Extensions:

  The Streaming SIMD Extensions consist of 70 new instructions, including single instruction multiple data floating-point, additional SIMD integer, and cacheability control instructions. Some of the technologies that benefit from the Streaming SIMD Extensions include advanced imaging, 3D, streaming audio and video, and speech recognition applications. The benefits include:
  ⇒ Higher resolution and higher quality image viewing and manipulation
  ⇒ High quality audio, MPEG2* video, and simultaneous MPEG2 encoding and decoding
  ⇒ Reduced CPU utilization for speech recognition, as well as higher accuracy and faster response times

- Intel Processor Serial Number:

  The processor serial number—the first of Intel's planned building blocks for PC security—serves as an electronic serial number for the processor and by extension, its system or user, enabling the system/user to be identified by networks and applications. The processor serial number will be used in applications that benefit from stronger forms of system and user identification, such as the following:
  ⇒ Applications using security capabilities: Managed access to new Internet content and services; electronic document exchange
  ⇒ Manageability applications: Asset management; remote system load and configuration

- Intel MMX™ Media Enhancement Technology:

  Intel MMX technology is designed as a set of 57 basic, general-purpose integer instructions and four data types that are easily applied to the needs of a wide range of multimedia and communications applications. Highlights of the technology include:
  ⇒ Single Instruction, Multiple Data (SIMD) technique
  ⇒ Eight 64-bit wide MMX technology registers

- Dynamic Execution Technology:
  ⇒ Multiple branch prediction: Predicts program execution through several branches, thereby accelerating the flow of work to the processor

⇒ Dataflow analysis: Creates an optimized, reordered schedule of instructions by analyzing data dependencies between instructions

⇒ Speculative execution: Carries out instructions speculatively and, based on this optimized schedule, ensures that the mobile processor's superscalar execution units remain busy, thereby boosting overall performance

- Testing and Performance Monitoring Features:

⇒ Built-In Self Test (BIST) provides single stuck-at fault coverage of the microcode and large logic arrays, as well as testing of the instruction cache, data cache, Translation Lookaside Buffers (TLBs), and ROMs.

⇒ IEEE 1149.1 Standard Test Access Port and Boundary Scan mechanism enables testing of the Pentium III processor and system connections through a standard interface.

⇒ Internal performance counters can be used for performance monitoring and event counting.

⇒ Incorporates an on-die diode that can be used to monitor the die temperature. A thermal sensor located on the motherboard can monitor the die temperature of the mobile Pentium III processor for thermal management purposes.

- Other significant features of the mobile Pentium III processor include:

⇒ High-performance Dual Independent Bus (DIB) architecture (system bus and cache bus) provides high bandwidth, performance, and scalability with future system technologies.

⇒ The system bus supports multiple outstanding transactions to increase bandwidth availability.

⇒ A 256-K integrated, unified, non-blocking, level-two (L2) cache improves performance by reducing the average memory access time and by providing fast access to recently used instructions and data. Performance is boosted even further through the Full Speed Advanced Transfer Cache. This L2 cache is integrated on the processor die to minimize latency during cache accesses. Intelligent buffering and a 256-bit cache bus provide superior concurrency and throughput. This processor also incorporates separate 16-K, level-one caches— one for instructions and one for data.

⇒ The mobile Pentium III processor supports memory cacheability for up to 4 GB of addressable memory space.

⇒ The processor is available with Error Correction Code (ECC) functionality on the level-two cache bus for applications where data intensity and reliability are essential.

⇒ A pipelined Floating-Point Unit (FPU) supports the 32-bit and 64-bit formats specified in IEEE standard 754 as well as an 80-bit format.

⇒ Parity-protected address/request and response system bus signals with a retry mechanism ensure high data integrity and reliability.

5.0   Intel 440BX AGPset Product Feature Highlights

The Intel 440BX AGPset is the first AGPset to optimize mobile Pentium III processor performance for 3D and video applications, offering a 100-MHz system bus, wider and deeper buffers system-wide, and SDRAM memory capabilities. The 440BX AGPset builds on the innovations of Intel's Advanced Graphics Port (AGP) and Quad Port Acceleration (QPA) to provide a proven, stable platform for consumer desktops, mainstream business desktops, mobile systems, and standard-volume workstations and servers.

By optimizing the performance of the mobile Pentium III processor's Dual Independent Bus (DIB) architecture, the 440BX AGPset fully supports the new generation of visual computing applications. The applications include: 3D and video applications for design; data visualization; Web content creation; education; gaming; and the emerging, human-centered operating systems that will transform the way computers are used in the future.

Countless corporations have already deployed the 440BX AGPset to support the mobile Pentium II processor on a 66-MHz system bus. The same chipset can also be configured to provide 100-MHz system bus performance to support the mobile Pentium III processor. The 440BX AGPset gives corporations an established platform that preserves legacy investments while easily qualifying for the higher-performing systems of the future. Features of the 440BX AGPset include:

- 100-MHz system bus/SDRAM support for optimum performance in platforms featuring the Pentium III processor with Dual Independent Bus (DIB) architecture, AGP technology, and 100-MHz SDRAM

- Intel Quad Port Acceleration (QPA), providing four-port concurrent arbitration of the processor bus, graphics bus, PCI bus, and SDRAM to deliver outstanding throughput for 3D graphics and other visual computing applications

- Intel graphics accelerator for best-of-class 3D, multimedia, and gaming platforms

- Enhanced power and thermal manageability, including full compliance with the PC98 power-management specification for minimal power consumption in all processing states

- Open page architecture, enabling multiple SDRAM pages for reduced latency and superior 3D performance

- Expanded data buffering for improved system performance and concurrency

- Compatibility with ATA/66 hard disk drives for increased spindle rates, higher densities, and disk caching enhancements

- Scalability and flexibility for preservation of existing platform investments

Businesses around the world have already qualified and proven the Intel 440BX AGPset as the platform of choice in countless desktop and mobile Pentium II processor-based systems. Now the same compatibility, stability, and reliability are available to support Intel's highest performing family of mobile processors. The mobile Pentium III processor combines with the 440BX AGPset to create a balanced system with all the performance and headroom that mainstream users need to maximize productivity today and for years to come.

6.0   Performance Summary

6.1   Productivity Benchmarks

6.1.1   SYSmark* 2000

SYSmark 2000 is a suite of application software and associated benchmark scripts developed by the Business Applications Performance Corporation (BAPCO), a non-profit consortium of PC OEMs, software vendors, semiconductor manufacturers, and industry publications. SYSmark 2000 is a tool that measures system performance on popular business-oriented applications in the Microsoft* Windows operating environment. SYSmark 2000 contains 12 application workloads that are divided into two categories: office productivity and Internet content creation.

SYSmark 2000 includes 32-bit benchmark scripts for the following categories and applications:

Office Productivity:

- Corel* CorelDRAW* 8

- Microsoft Excel* 97

- Dragon Systems* Naturally Speaking* 2.02

- Netscape* Communicator* 4.05

- Caere* OmniPage Pro* 8.0

- Corel Paradox* 8.0

- Microsoft PowerPoint* 97

- Microsoft Word* 97

Content Creation:

- MetaCreations* Bryce* 2

- Avid* Elastic Reality* 3.1

- Macromedia* Extreme3D * 2

- Adobe* Photoshop* 4.0.1

- Adobe Premiere* 4.2

- Xing Technology* XingMPEG* Encoder* 2.1

**Figure 2. Intel Mobile Pentium III Processor for SYSmark 2000 on Windows 98 Benchmark**
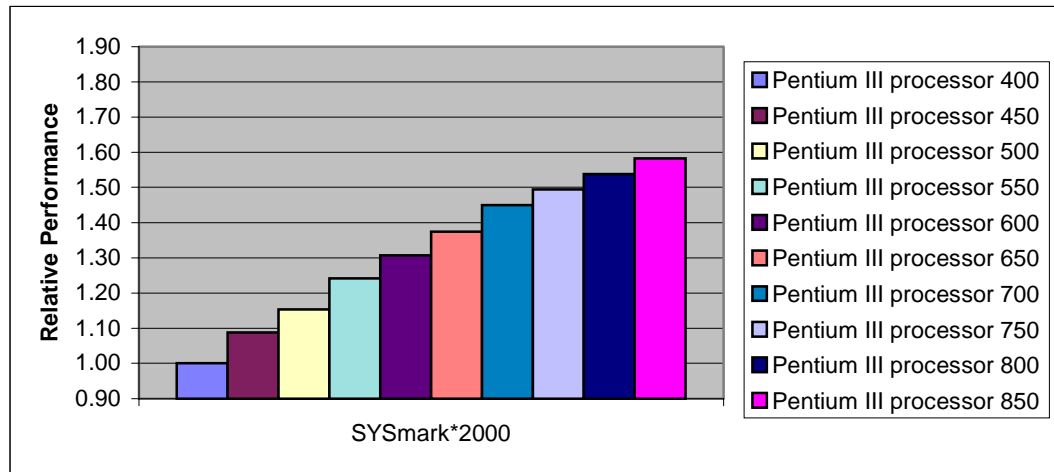
6.1.2   Winstone* 99

Winstone 99 is a system-level, application-based benchmark developed by Ziff-Davis. Winstone 99 measures a PC's overall performance when running Windows-based 32-bit applications on Windows 98 or Windows NT 4.0. It runs actual 32-bit business suites through a series of scripted activities and uses the time a PC takes to complete those activities to produce its performance scores.

Winstone 99 incorporates the following popular office software suites: Corel WordPerfect* Suite 8, Lotus* SmartSuite*, and Microsoft Office* 97. To mirror the typical usage patterns of today's PC users, the benchmark keeps multiple applications open within each suite and switches tasks between these applications and the Netscape Navigator Internet browser.

Figure 3. Intel Mobile Pentium III Processor Performance for Winstone 99 Benchmark
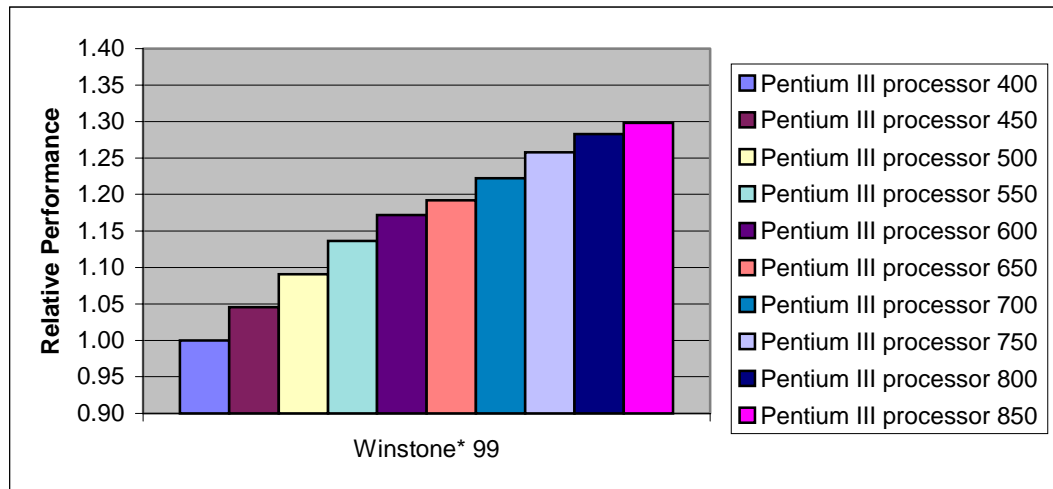


6.2   Multimedia Benchmarks

6.2.1   MultimediaMark* 99

MultimediaMark 99 is a benchmark application suite by Futuremark Corporation. It focuses on testing multimedia performance of a modern PC in a "real world" environment. The components of MultimediaMark 99 include MPEG-1 video encoding, MPEG-1 video playback, image processing, and audio effects.

Figure 4. Intel Mobile Pentium III Processor Performance for the MultimediaMark 99 Benchmark
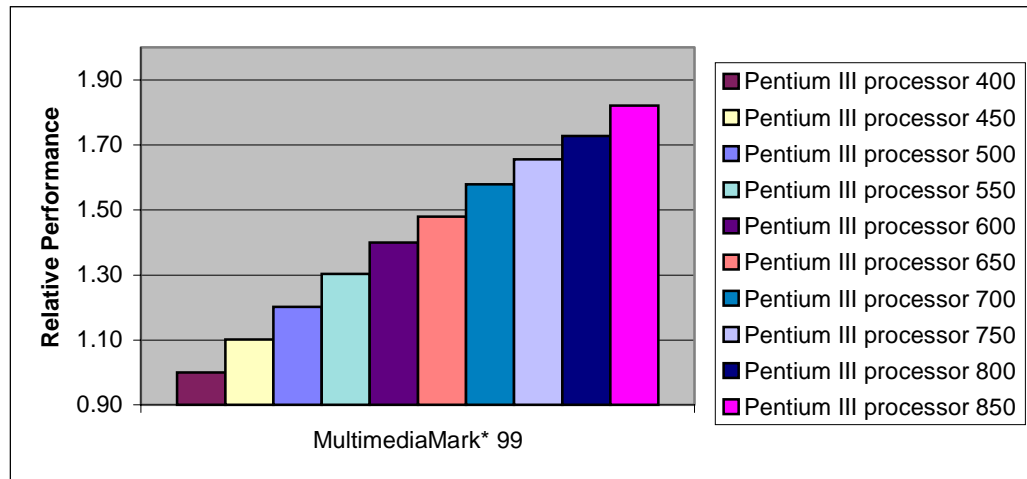
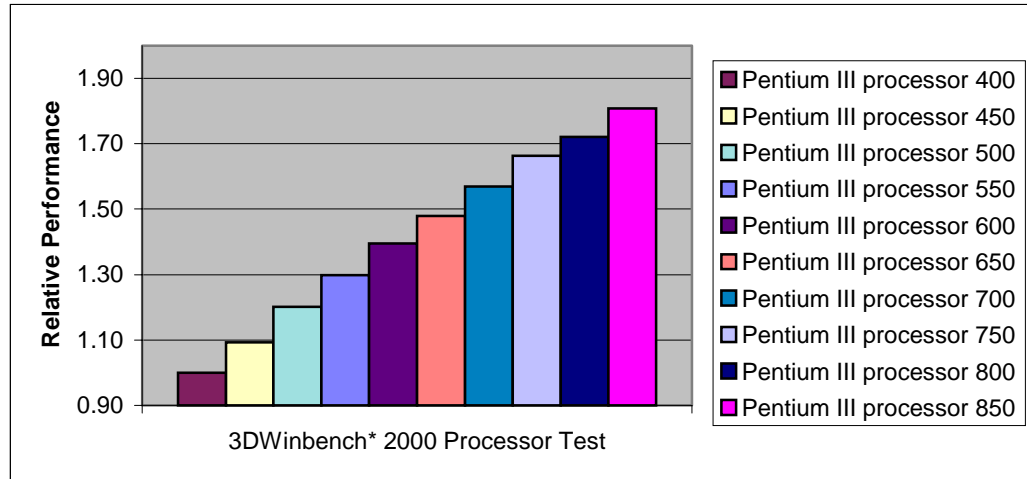
6.3   3D Benchmarks/Floating-Point Benchmarks

6.3.1   3D Winbench* 2000 Processor Test

3D Winbench* 2000 measures system-level 3D performance, including CPU and graphics subsystem performance. To understand the processor 3D performance, the benchmark suite includes the 3D WinBench 2000- Processor Test. This benchmark measures the CPU-intensive portion of the 3D graphics pipeline.

Figure 5. Intel Mobile Pentium III Processor Performance for the 3D Winbench 2000 Processor Test

6.3.2   WinBench* –FPU WinMark

The WinBench 99–FPU WinMark 99 benchmark measures the performance of the processor floating-point subsystem, which is used for such tasks as 3D graphics rendering and scientific calculations. This synthetic benchmark was developed by Ziff-Davis. The test consists of five algorithms: 3D graphics operations, fast Fourier transforms (FFT), calculation of planetary orbitals, calculation of areas of polygons, and Gauss-Jordan elimination of a coefficient matrix of linear equations. The benchmark reports a single score based on the weightings that Ziff-Davis has assigned to the component algorithms.

Figure 6. Intel Mobile Pentium III Processor Performance for the WinBench FPU WinMark
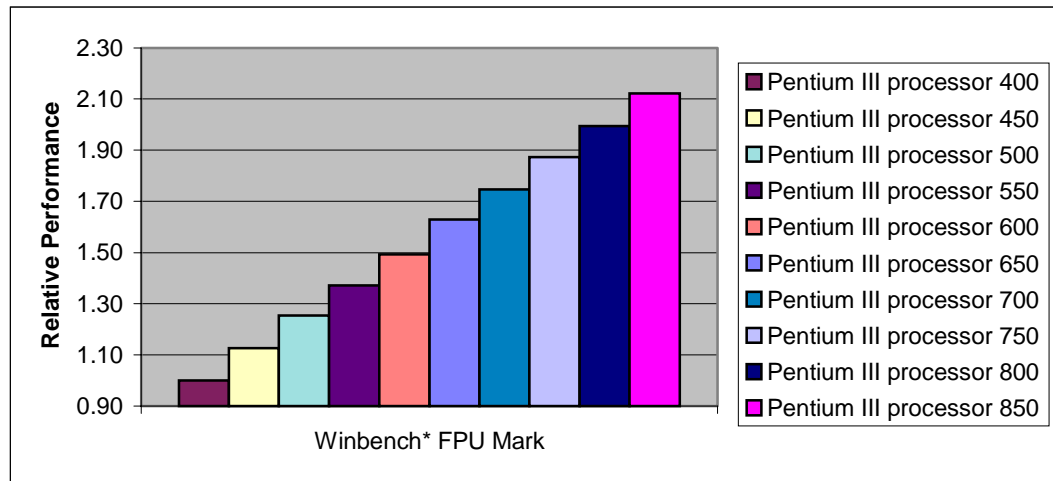
6.4   Internet Technology Benchmarks

6.4.1   SYSmark* J

SYSmark J is a Java benchmark suite designed and developed by the Business Applications Performance Corporation (BAPCO). It allows performance comparisons across platforms that support Java Development Kit Version 1.1 (JDK1.1). SYSmark J is a collection of four applications covering word processing, spreadsheet, image processing, and multimedia.

Figure 7. Intel Mobile Pentium III Processor Performance for the SYSmark J Benchmark
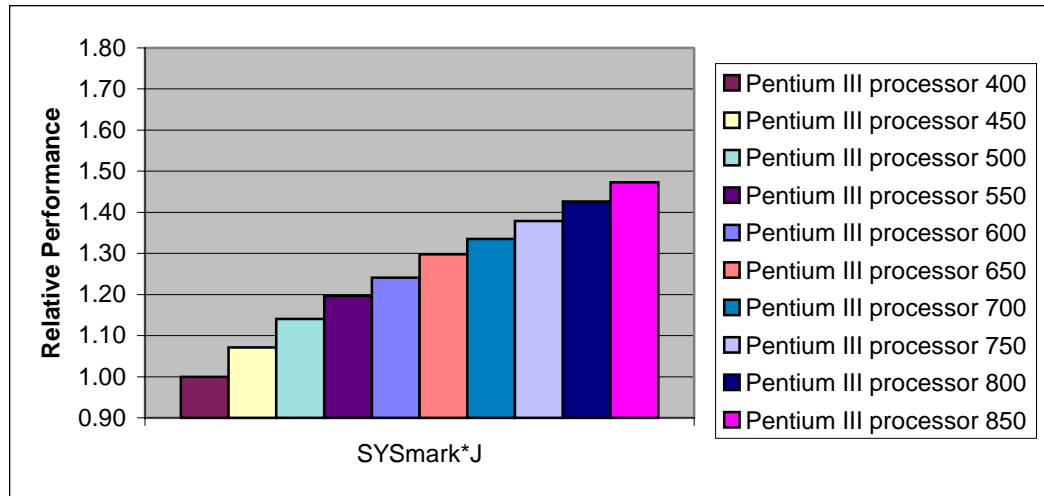
7.0   Summary

Table 1 summarizes productivity benchmark performance of the mobile Pentium III processor at speeds of 450 MHz and above, relative to that of the mobile Pentium III processor at 400 MHz. A higher score indicates better performance.

Table 1. Spectrum of Performance Benchmark Results—Productivity Benchmark

	SYSmark* 2000	Winstone* 99
Mobile Pentium III processor 400 MHz	1.00	1.00
Mobile Pentium III processor 450 MHz	1.09	1.05
Mobile Pentium III processor 500 MHz	1.15	1.09
Mobile Pentium III processor 550 MHz	1.24	1.14
Mobile Pentium III processor 600 MHz	1.31	1.17
Mobile Pentium III processor 650 MHz	1.37	1.19
Mobile Pentium III processor 700 MHz	1.45	1.22
Mobile Pentium III processor 750 MHz	1.49	1.26
Mobile Pentium III processor 800 MHz	1.54	1.28
Mobile Pentium III processor 850 MHz	1.58	1.30

Table 2 summarizes the multimedia benchmark performance of the mobile Pentium III processor at speeds of 450 MHz and above, relative to that of the mobile Pentium III processor at 400 MHz. A higher score indicates better performance.

Table 2. Spectrum of Performance Benchmark Results —Multimedia Benchmarks

	Multimediamark*99
Mobile Pentium III processor 400 MHz	1.00
Mobile Pentium III processor 450 MHz	1.10
Mobile Pentium III processor 500 MHz	1.20
Mobile Pentium III processor 550 MHz	1.30
Mobile Pentium III processor 600 MHz	1.40
Mobile Pentium III processor 650 MHz	1.48
Mobile Pentium III processor 700 MHz	1.58
Mobile Pentium III processor 750 MHz	1.66
Mobile Pentium III processor 800 MHz	1.73
Mobile Pentium III processor 850 MHz	1.82

Table 3 summarizes the 3D/floating-point benchmark performance of the mobile Pentium III processor at speeds of 450 MHz and above, relative to the mobile Pentium III processor at 400 MHz. A higher score indicates better performance.

Table 3. Spectrum of Performance Benchmark Results— 3D Benchmarks/Floating Point Benchmarks

	3DWinbench*2000 Processor Test	Winbench* FPU Winmark
Mobile Pentium III processor 400 MHz	1.00	1.00
Mobile Pentium III processor 450 MHz	1.09	1.13
Mobile Pentium III processor 500 MHz	1.20	1.25
Mobile Pentium III processor 550 MHz	1.30	1.37
Mobile Pentium III processor 600 MHz	1.40	1.49
Mobile Pentium III processor 650 MHz	1.48	1.63
Mobile Pentium III processor 700 MHz	1.57	1.75
Mobile Pentium III processor 750 MHz	1.66	1.87
Mobile Pentium III processor 800 MHz	1.72	2.00
Mobile Pentium III processor 850 MHz	1.81	2.12

Table 4 summarizes Internet benchmark performance of the Intel mobile Pentium III processor at speeds of 450 MHz and above, relative to that of the mobile Pentium III processor at 400 MHz. A higher score indicates better performance.

Table 4. Spectrum of Performance Benchmark Results—Internet Technology Benchmarks

	SYSmark*J
Mobile Pentium III processor 400 MHz	1.00
Mobile Pentium III processor 450 MHz	1.07
Mobile Pentium III processor 500 MHz	1.14
Mobile Pentium III processor 550 MHz	1.20
Mobile Pentium III processor 600 MHz	1.24
Mobile Pentium III processor 650 MHz	1.30
Mobile Pentium III processor 700 MHz	1.34
Mobile Pentium III processor 750 MHz	1.38
Mobile Pentium III processor 800 MHz	1.43
Mobile Pentium III processor 850 MHz	1.47

Appendix A—Test Configurations

Table 5. System Configuration Used in Benchmark Tests

Processor	Mobile Pentium III Processor at 400 MHz, 450 MHz, 500 MHz, 550 MHz, 600 MHz, 650 MHz, 700 MHz, and 750 MHz, 800 MHz, 850 MHz
OEM's System	Dell* Lattitude CPx with Intel 440BX AGPset
Processor System Bus Speed	100 MHz
Primary Cache	16-Kbyte (Instruction) 16-Kbyte (Data)
Secondary Cache	On-die 256 Kbytes with Advanced Transfer Cache
System Memory Size/Speed	128-MB SDRAM 100
Motherboard Chip Set	Intel 440BX
Hard Disk	IBM 4.8 GB*
Media	Toshiba CD XM-1902B 24X*
Operating System	DirectX version 7.00G, Windows 98 SE*
Sound	ESS Maestro-31*
Video Controller	ATI Rage Mobility-M1* AGP2x graphics controller