Sun Ultra™ 60 Workstation

Just the Facts

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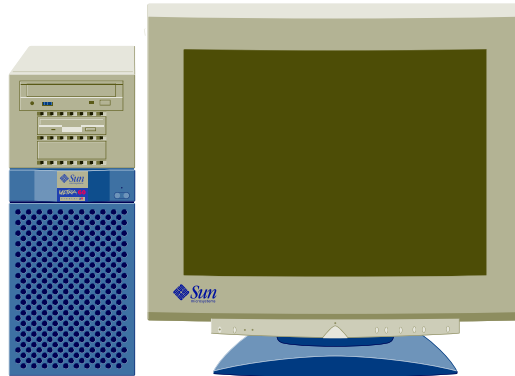
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Positioning

Introduction

Figure 1. Sun Ultra™ 60 system

Multiprocessing Power on the Desktop

The Sun Ultra™ 60 workstation brings multiprocessing power, industry-standard PCI I/O, and dual-UPA graphics capability to the desktop. This next-generation workstation uses the processing power of UltraSPARC™-II processors, Sun™ Creator3D and Sun Elite3D graphics technology, UltraSCSI disks, and the innovative high-performance peripheral component interconnect (PCI) I/O bus. With the minitower system enclosure, Sun Ultra 60 workstation provides all the modular and expandable features that users have grown to expect from Sun Workstation™ systems. Sun's commitment to high-performance computing means the Ultra 60 workstation delivers increasing levels of excellent performance and preserves 100 percent binary compatibility with application software.

Sun Ultra 60 Workstations

Sun Ultra 60 workstations are available with four different processor configurations. Models 1360 and 2360 were announced in April 1998. They use the 360-MHz processor with 4 MB of Level 2 cache. Model 1360 is configured with one processor, while Model 2360 comes equipped with two processors. Models 1450 and 2450 are the 450-MHz processor versions of the Ultra 60 workstation. Models 1360 and 1450 are easily upgraded to their dual-processor counterparts by adding a second processor.

All four systems include the highly integrated Sun Creator3D or Sun Elite3D graphics, which provide high performance and a comprehensive range of graphics functionality without the high cost of conventional "large, expensive, frame buffer through I/O bus" technology provided by the competition.

Ultra 60 workstations continue the Sun tradition of delivering balanced system design and innovation. The powerful Ultra port architecture (UPA), introduced on the original Ultra systems, continues in the Ultra 60 system with enhancements. The Ultra 60 workstation has dual UPA graphics slots to support up to two Sun Creator graphics or Sun Elite3D graphics-driven monitors and the UltraSCSI disk technology has doubled the disk I/O performance of Ultra 1 or Ultra 2 systems.

The Ultra 60 workstation continues Sun's drive to deliver industry-standard PCI I/O bus, enabling access to hundreds of expansion and networking options. Sun has added innovation to the Ultra 60 workstation PCI I/O bus with dual bus channels providing sustained high performance to the system's PCI slots. In addition, Sun has delivered the advanced 66-MHz PCI, which is capable of 200 MB per second throughput, ideal for high-performance networking requirements.

The Ultra 60 workstation is *not* just an Ultra system with PCI slots. All UltraComputing™ technologies have been scaled to higher performance; UltraSPARC-II processing power, 120-MHz UPA interconnect, and two channels of UltraSCSI for internal and/or external disks and peripherals. In addition, the Ultra 60 workstation uses the next generation of Sun Creator graphics accelerators along with the Sun Elite3D graphics products. It also uses the revolutionary and innovative, multiple channel PCI bus—with 66-MHz support.

Product Family Placement

The Ultra 60 workstation is the advanced member of the current desktop product family, which scales from the entry-level, Ultra 5 and mid-range Ultra 10, up to the two-way Ultra 60 workstation.

Ultra systems have several things in common, including:

- The UltraSPARC processor
- 100 percent binary compatible from the low end to the high end, including Sun's server family
- Scalable from the low-end uniprocessor systems to the 64-way Sun Enterprise™ 10000 (Starfire™) server
- Modular—easy-to-swap components
- Excellent price/performance in their class

Workstation	Target Users and Markets
Ultra 5 and Ultra 10	Designed as a low-cost desktop solution, the Ultra 5 and 10 systems appeal to customers looking for a low-priced system offering accelerated graphics, expandability, fast application performance, and investment protection. The Ultra 5 and 10 workstations are well suited for many different customers, from those who require low-cost imaging solutions to those who demand intensive graphics and expansion capabilities. Target markets include software development, financial, government, telecommunications, manufacturing, and education.
Ultra 2	Designed for the technical user who requires high performance and multiprocessing (MP) capability on the desktop. MP-ready and multithreaded applications will benefit greatly from the performance of the Sun Ultra 2 system. The target customer is the traditional "power desktop" user who has performance, expansion and SBus I/O requirements.
Ultra 60	The Ultra 60 workstation is a more advanced Ultra 2 workstation. Like the Ultra 2 system, the Ultra 60 workstation is designed for the technical user who requires high performance and multiprocessing capability. The Ultra 60 workstation also addresses the needs of graphics intensive users and continues to support and build upon the upgradability features to which Ultra 2 workstation users have grown accustomed. With the 450-MHz UltraSPARC-II processor with 4 MB of Level 2 cache, the Ultra 60 workstation is the absolute performance leader for Sun's workstation family. The target customer is the traditional "power desktop" user who has performance and expansion requirements that exceed the capabilities of the Ultra 5 and Ultra 10 systems. This includes both technical and commercial users who need the large number of applications and the functional capabilities of the Solaris™ Operating Environment, the high-performance of the UltraSPARC-II CPU, dual-headed graphics, and superior throughput.

Key Messages

Sun Ultra 60 workstation is the high-end member of the UltraSPARC processor-based workstation family. UltraComputing technology has evolved to new levels of performance and technology innovation.

- **Innovative minitower system design provides modularity for flexibility, maximum system growth, and expansion potential**
  - The Ultra 60 workstation offers the flexibility of starting with a single CPU and adding a second CPU later as compute needs grow
  - Memory capacity to 2 GB maximum (16 slots using existing 16-MB, 32-MB, 64-MB, or 128-MB DIMMs)
  - Supports 9.1-GB and 18.2-GB drive options (supports 1-inch or 1.6-inch high UltraSCSI disk drives); up to 36 GB of internal drive space
  - Two UPA graphics slots able to support two Sun Creator3D, or Sun Elite3D m3 graphics cards (in any combination), or one Sun Elite3D m6 and one Sun Creator3D, or Sun Elite3D m3 graphics card
  - Expanded front access capabilities: power switch, 5-inch removable media bay for options such as 32X CD-ROM or tape options. Optional front access floppy plus second 3.5-inch front access bay for options that can interface using the PCI slots such as PCMCIA adapters
  - High I/O expansion with four full-sized, industry-standard PCI bus slots

- **High-performance UltraSPARC-II CPU processor module**
  - 64-bit SPARC version 9 at 360 MHz or 450 MHz
  - 4 MB of second-level cache memory
  - 100 percent binary compatibility with current Solaris Operating Environment
  - Runs 32-bit applications unmodified from the earlier Solaris 2.3 and Solaris 2.4 Operating Environments
  - Easy-to-upgrade processor modular design offers customers easy performance upgrades to their existing 300-MHz and 360-MHz models

- **Exceptional throughput**
  - UPA provides a crossbar-oriented interconnection establishing a 144-bit wide, ECC-protected data path to the CPU
  - Clocked at up to 120 MHz, the UPA crossbar gives a peak throughput of 1.9 GB per second (models with 360-MHz processor)
  - Memory subsystem offers a 576-bit-wide memory path
  - Architecture allows memory to be installed in fours to take advantage of 576-bit-wide memory path
  - UltraSCSI is integrated on the motherboard, offering double the disk performance (40 MB per second) of the current Ultra 1 or Ultra 2 systems
  - A second UltraSCSI channel is available, allowing external devices to be connected to separately, further improving I/O throughput

- **One of the industry leaders for networking, connectivity, and I/O performance ratings**
  - 100 Mbps Fast Ethernet through twisted pair is a standard feature in all Ultra 60 workstations, but the system also maintains connectivity with 10 Mbps networking technology through an autosensing speed switch feature
  - Standard MII port connects to external transceivers, which provide connectivity to media other than the standard integrated 100/10BASE-T twisted pair

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- Advanced networking options include FDDI and additional Fast Ethernet ports through industry-standard PCI option cards
- Innovative multiple-channel industry standard PCI I/O bus provides sustained high throughput on all four full-sized PCI slots
- One of the industry's first 66-MHz PCI I/O slots capable of delivering 200 MB per second throughput ideal for high-performance networking requirements

- **Enhanced Sun Creator graphics series 3 provides comprehensive range of graphics functionality at low cost: 2-D, windowing, 24-bit true color graphics, and supporting both imaging and advanced 3-D graphics in one architecture**
  - Sun Creator graphics technology is enhanced, with up to 50 percent graphics performance improvement over series 1, plus high-resolution support for 24-inch wide-screen monitors (up to 1920 x 1200)
  - Four 8-bit color maps for dynamic colormap segment allocation within the 8-bit color overlay plane and for adjustable gamma correction; the provides greater access to colors even in 8-bit mode and gives the user the ability to color adjust (gamma correct) for optimal display quality

- **Support for high-power Sun Elite3D graphics family provides high-end graphics for a mid-range price**
  - Sun Elite3D m3 graphics is Sun's high-power, mid-range 3-D graphics option in the Elite Graphics product line, offering more than twice the 3-D performance of Sun Creator3D graphics
  - Sun Elite3D m6 graphics is Sun's high-power, high-end 3-D graphics option in the Elite Graphics product line, offering 4 to 5 times the 3-D performance of Sun Creator3D graphics

Sun Ultra 60 System Models

The Sun Ultra 60 workstation comes in four models that differ only in the installed processor module. All models support up to two UltraSPARC CPUs of like speed.

Sun Ultra 60	Model 1360	Model 2360	Model 1450	Model 2450
Processor speed	1 x 360 MHz (can upgrade to two processors)	2 x 360 MHz	1 x 450 MHz (can upgrade to two processors)	2 x 450 MHz
UPA speed	120 MHz	120 MHz	112.5 MHz	112.5 MHz
SPECint_95*	16.10	16.10	19.7	19.7
SPECfp_95*	23.50	29.50	27	32.7

* SPECint_95 and SPECfp_95 results using SPARCompiler™ version 5.0.

Availability

- Sun Ultra 60 workstation Model 1300 and Model 2300, Sun Creator3D graphics configurations began shipping February 1998. The last order date was August 4, 1999.
- Sun Ultra 60 workstation Model 1300 and Model 2300, Sun Elite3D graphics configurations began shipping March 1998.
- Sun Ultra 60 workstation Models 1360 and 2360, Sun Creator and Sun Elite3D graphics configurations began shipping April 1998.
- Sun Ultra 60 workstation Models 1450 and 2450 began shipping in May 1999.
- Sun Ultra 60 workstation Models began shipping with 18-GB, 10000-rpm internal drives in November 1999.

Target Users

The Ultra 60 workstation is a more advanced Ultra 2 workstation. Like the Ultra 2 workstation, the Ultra 60 workstation is designed for the technical user who requires high performance and multiprocessing (MP) capability. Ultra 60 workstation also addresses the needs of users with graphics-intensive applications and continues to support and build upon the upgradability features with which Ultra 2 system users have grown accustomed.

The target customer is the "power desktop" user who has performance and expansion requirements that exceed the capabilities of the Ultra 2 system. This includes both technical and commercial users who need the large number of applications and the functional capabilities of the Solaris Operating Environment, the high-performance of the UltraSPARC-II CPU, dual-headed graphics, and superior throughput.

Target Markets

Industry	Key Features to Highlight
Electronic Design (EDA) • Chip designers, board designers • System houses • Telco	• High-performance CPUs • High-memory capacity • Availability of applications
Financial • Stock and commodity traders • Banks	• High performance • Compact design • Multimedia capabilities
Mechanical Design (MCAD/MCAE) • Automotive • Aerospace • Defense industry • Mechanical equipment designers	• High-performance CPUs • High-end graphics performance and functionality standard • Availability of applications
Oil and Gas • 2-D, 3-D, and 4-D seismic analysis • Production engineering • Reservoir engineering	• High-performance CPUs • Dual Sun Creator graphics monitors • Multithreaded OpenGL® software • High-end performance and functionality for both graphics and imaging operations

Industry	Key Features to Highlight
Publishing and Imaging • Newspapers • Magazines • Image banks • Advertising agencies	• High-performance CPUs • High-end performance and functionality for both graphics and imaging operations • Dual Sun Creator graphics monitors
Research and Development • In-house development • Research institutions	• High computing performance • Feature-rich Solaris Operating Environment
Software Development (CASE) • ISVs • In-house development at large organizations	• High-performance Solaris Operating Environment • Availability of applications • Multithreaded application development
Visualization and Simulation • Scientific visualization • Technical simulation	• High-performance CPUs • High-end performance and functionality for both graphics and imaging operations • Dual Sun Creator graphics monitors

Selling Highlights

Alliances and Key Applications

Sun has worked closely with major software vendors to see that their applications are officially supported on the Sun Ultra™ 60 workstation are available. All major applications that are available can be found in our Sun Developer Connection℠ catalog of third-party solutions.

Target Market	ISV	Software Applications
Entertainment/ Animation/ Digital Creation	Adobe	PhotoShop
	ArSciMed	Kinema/Sim
	Electric Image	Electric Image
	Engineering Animation Inc.	Vislab
	Lightwork	Kinetix (rendering tool kit)
	NewTek	Lightwave 3D
	Nichimen	NWorld
	XaosTools	Pandemonium
EDA	Avant!/ISS	DRC/ERC product
	Avant!/Meta Software	HSpice
	Cadence Design	Vampire Dracula
	Compass Design	Pathfinder
	K2 Technologies	Mask Compose and Quick View
	Mentor Graphics	Mask Compose and Quick View Caliber ICVerify
	Mentor/Precedence	Checkmate
	Silvaco	Atlas Athena Spice
	SpeedSim	SpeedSim
	Systems Science	Vera
	Viewlogic/Vantage Analysis	SpeedWave MT
	Simplex	Thunder and Lightning Fire and Ice
	Silvaco	Virtual Wafer Fab Automation Tools
Health Care	Cemax	VIP 2.0
	Context Vision	Imaging processing for refining MR data
	Geovision	Vision
	ISG	Silohet
	Virtual Vision Software	

Target Market	ISV	Software Applications
MCAE	ANSYS, Inc.	ANSYS
	Computational Dynamics, Inc.	StarCD
	ESI	Pam-Crash
	EXA Corporation	Powerflow
	Fluent, Inc.	Fluent, Fluent UNS, Rampant, Nekton
	Fluid Dynamics, Inc. (FDI)	FIDAP
	Hibbitt, Karlsson & Sorensen, Inc. (HKS)	ABAQUS
	Livermore Software Technology Corporation (LSTC)	LSDyna 3D
	MacNeal-Schwendler (MSC)	PATRAN, NASTRAN
	MARC Analysis Research Corp	Mentat, MARC
Oil and Gas	AVS	AVS Express, Toolmaster, AVS5
	Cognesis	VoxelGeo
	GeoQuest	GeoViz, Charisma
	Landmark Graphics	ProMax, Seisworks, Strata Model, Earth Cube
	Shell Oil	VolumeViewer
Web Site	For general information see: http://www.sun.com/desktop	

Compatibility

The Ultra 60 workstation runs the Solaris™ 7 Operating Environment. It can also run 32-bit applications unmodified from the Solaris 2.3 and Solaris 2.6 Operating Environments making these systems compatible with previous systems and software.

UltraSPARC™-II Processor

The Sun Ultra™ 60 workstation is a shared-memory, multitasking system built around the UltraSPARC™-II microprocessor. The UltraSPARC-II processor is Sun's latest generation of the SPARC™ processor family and the second generation of 64-bit UltraSPARC chips. The Ultra 60 workstation can use up to two 300-MHz, 360-MHz, or 450-MHz UltraSPARC-II processors.

- Modules have the 64-bit SPARC V9 architecture
- Systems have up to 4 MB of Ecache per CPU—eight times the cache size of the Ultra 1 workstation
- As a member of the UltraSPARC family of CPUs, full binary compatibility is assured

PCI Technology

System I/O for the Ultra 60 workstation is provided by two industry-standard peripheral component interconnect (PCI) data buses. All PCI buses in the Ultra 60 workstation comply with the 2.1 revision of the PCI specification, released in March 1995.

- Sun leads the industry with PCI/66, which has twice the throughput of standard PCI
- Two independent PCI buses deliver outstanding I/O bandwidth, sustained throughput of up to 200 MB per second

Sun Creator3D Graphics, Series 3

Sun Creator graphics integrates high-performance graphics with 24-bit imaging, windowing, video playback and 2-D/3-D graphics with Sun's UltraSPARC-II processors. For accelerated imaging and video playback, Sun Creator is combined with the visual instruction set (VIS™ software), an extremely comprehensive set of imaging and graphics instructions built into the CPU.

Sun Creator graphics is designed as an integral part of the workstation system and is able to draw on system resources for functions traditionally built into the graphics board with specialized hardware. The result is that Sun Creator is very fast and cost effective.

Sun Creator3D graphics, series 3 is the latest generation of the Sun Creator graphics family of accelerators. It can accelerate and support diverse types of graphics needs ranging from 8-bit and 24-bit windowing to high-end 3-D graphics. Sun Creator3D provides fast, high-quality transformation and display of 3-D solid and wireframe objects.

Sun Creator 3D graphics, series 3 has four 8-bit color maps for better dynamic color map segment allocation to applications running in 8-bit and 24-bit color. This feature gives applications better access to private color map segments that do not interfere with other applications. Adjustable gamma correction, which gives the user the ability to adjust display color to best match individual preferences is also supported. Sun Creator3D, series 3 adds hardware acceleration of OpenGL® stencil planes. This results in increased application performance for many applications based on OpenGL technology.

Lastly, Sun Creator3D series 3 supports a 1920 x 1200 resolution with Sun's 24-inch monitors (in single-buffer mode). Typical uses for configurations with the 24-inch monitor are in prepress, publishing, imaging, and in other situations in which high-quality 2-D imaging or large amounts screen real estate are essential.

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Sun Elite3D Graphics

Sun Elite3D graphics represents a high-powered graphics subsystem for the 3-D graphics market that is complementary to the Sun Creator graphics product line. Sun Elite3D graphics retains the basic underlying architecture of Sun Creator graphics while maintaining full API layer compatibility and transparent acceleration of 3-D graphics APIs. Like the Sun Creator graphics, Sun Elite3D graphics incorporates the visual instruction set (VIS software). Sun Elite 3D graphics comes in two models: Sun Elite3D m3 graphics offers users twice the performance of Sun Creator3D graphics while Sun Elite3D m6 graphics can provide four to five times the performance of Sun Creator3D graphics.

Sun Elite 3D graphics provides very fast, high-quality transformation and display of 3-D solid and wireframe objects, and dramatically accelerates high-end functionality, such as double-buffering, triangle and quad rendering, and lighting and shading. At the same time, Sun Elite 3D graphics accelerates 2-D objects that meet X11 rules. Fast 8-bit and 24-bit window system and imaging performance are provided. Sun Elite 3D graphics systems provide 96-bit planes, including full 24-bit double-buffer planes required for smooth animation. A 28-bit Z-buffer is included to provides hardware assistance for hidden surface removal and dynamic rendering for 3-D objects.

Sun Elite 3D graphics systems utilize 3D-RAM technology. This technology is responsible for implementing fast, inexpensive 3-D frame buffers. In addition, Sun Elite 3D graphics has three or six (depending on the model) on-board floating-point processors that speed up floating-point-intensive operations such as transformations, clip tests, face determinations, and lighting.

Sun Elite 3D graphics is fully compatible with Sun Creator3D graphics accelerators, and does not compromise the windowing system, 2-D graphics, imaging, or video performance. Sun Elite 3D graphics simply adds significant performance gains for 3-D applications.

Enabling Technologies

Technology Overview—More Than Just a Fast Processor

Good performance through advanced applications typically demands excellent performance from more than one part of the system. Most often, an application consists of data fetching, computation, and presentation. Unless the system is designed to address all of these, it will always be limited by the weakest link in the chain.

The Sun Ultra™ 60 workstation is designed for balanced system performance, accelerating applications at every step. Faster I/O and networking, together with the UPA interconnect, allow fast data fetching. The UltraSPARC™ CPU provides supercomputing power, and moves data through the UPA at high speed. Tightly integrated Sun Creator and Sun Elite3D graphics provides high-end graphics functionality and performance for the Ultra 60 workstation's Sun Creator and Sun Elite3D graphics systems.
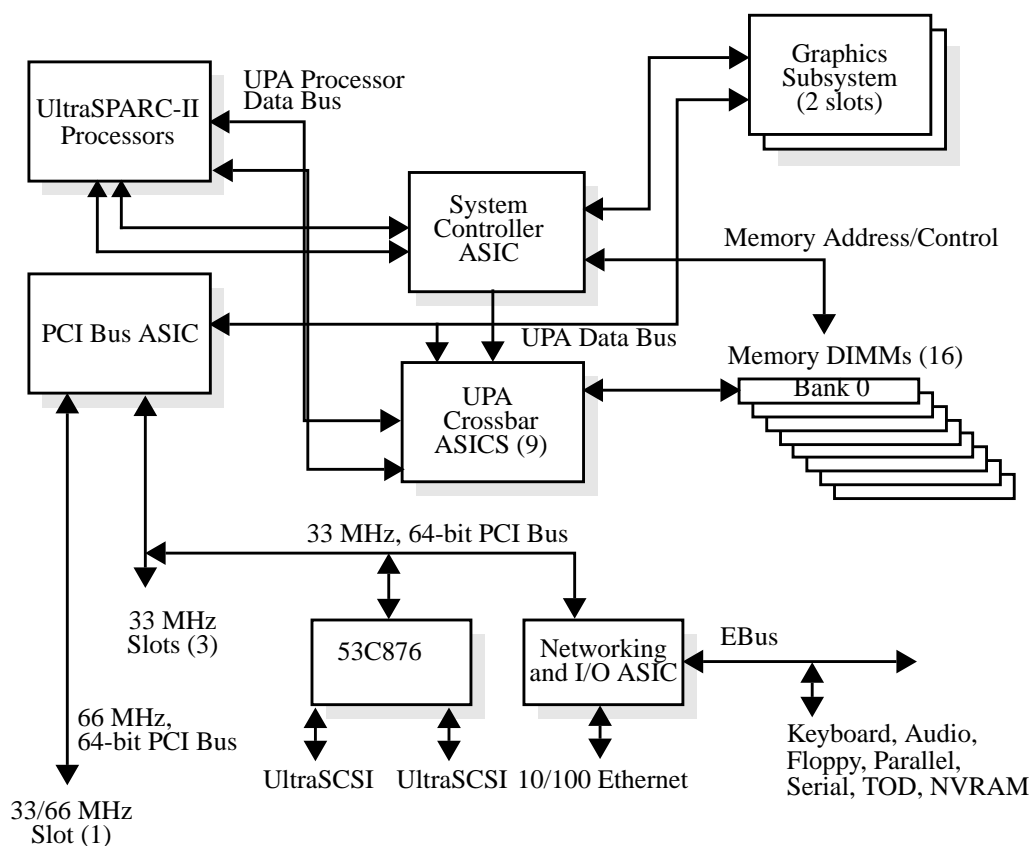
Figure 2. Architecture of the Ultra 60 system

The Sun Ultra 60 workstation has an integrated Ultra port architecture (UPA). This is based on a packet-switched, crossbar architecture. Sun is the one of the first manufacturers to provide such an architecture on the desktop. The Sun Ultra 60 workstation has nine buffered crossbar-switched processors that allow the memory and the graphics to interconnect. This architecture is the basis for high-powered computing and graphics.

Key Facts

- High performance uniprocessor and multiprocessor Sun workstation; uses the 450-MHz UltraSPARC-II processor
- High-end graphics functionality and performance at entry-level prices with Sun Creator3D and Sun Elite3D graphics
- Balanced system design
  - Very fast UPA at 120 MHz or 1.9-GB-per-second throughput.
  - Matching performance enhancement in I/O, networking, and memory access
  - Application performance without compromise

Technical Fact Summary

- Higher performance system bus provides fast access to memory and graphics
- Flexible hard disk expandability
  - Up to two internal UltraSCSI disks; either 9.1-GB or 18.2-GB disks
  - Up to 109.2 GB of total disk storage
- High-performance memory subsystem
  - Up to 2 GB using 16 x 128-MB DIMMs, installed in sets of four
  - Supports Ultra 1 and Ultra 2 workstation and SPARCstation™ 20 system DIMMs for compatibility and investment protection
- High-performance I/O
  - Two channels at 40-MB-per-second UltraSCSI, one internal, and one external
  - Innovative high-performance PCI I/O bus offering dual independent PCI buses, plus 66-MHz PCI support
- Designed for interactive media applications
  - Integrated visual instruction set (VIS™ software) in the UltraSPARC CPU
  - Advanced 24-bit accelerated Sun Creator3D graphics standard
  - 32X CD-ROM, photo-CD compatible
- Expansion to advanced networking
  - Fast Ethernet, 100BASE-T, autosensing, and autoswitching to 10BASE-T for backward compatibility
  - MII connector to Fast Ethernet for connection to other types of Ethernet transceivers and media
  - PCI networking options include Gigabit Ethernet, ATM, token ring, and FDDI
- System enclosure
  - Cost-effective minitower enclosure offering flexible expansion

UltraSPARC Processor

The Ultra 60 workstation is a high-performance, multiprocessing system built around the UltraSPARC-II microprocessor. The UltraSPARC-II processor is Sun's latest generation of the SPARC™ processor family and the second generation of 64-bit UltraSPARC chips. It utilizes the latest 0.35-micron technology (compared to the UltraSPARC-I CPU's 0.5-micron technology), which shrinks the die size to 149^2 mm (from 218^2 mm). This reduced die size is the key to UltraSPARC-II CPU's higher clock rates and increased

performance. This smaller die size also enables the UltraSPARC-II processor to operate at a core voltage of 2.5 volts, rather than UltraSPARC-I CPU's 3.3 volts. This lower voltage reduces power consumption and allows the chip to operate at higher frequencies without increasing total power requirements or heat dissipation—both major design issues in today's high performance systems.

The UltraSPARC-II processors used in the Ultra 60 workstation are individually mounted on 4-inch x 6-inch, field-installable module cards along with associated UPA data buffers and up to 4 MB of high-speed SRAM external cache memory. These modules are the same as those used in the Ultra 2 workstation. This modular design facilitates easy system processor upgrades (to next generation UltraSPARC processors), and system service.

Features	**Benefits**
• 450-MHz performance	• Fast application performance
• Integrated VIS instruction set software	• Ready for increased performance on multimedia and networking operations
• Multilevel trap handling	• Efficient process handling
• Utilizes the latest 0.35 micron technology, which greatly decreases the die size	• Results in a significant increase performance and a significant decrease in power consumption (due to a lower core voltage of 2.5 volts)
• CPU is mounted on field-installable module card with associated UPA data buffers and 4-MB of Ecache	• Facilitates easy system processor upgrades and system service

UPA System Bus

The Ultra 60 workstation processors, memory, and I/O subsystems are interconnected by the high-speed Ultra port architecture (UPA) crossbar datapath. This is an enhanced implementation of the same UPA design used in the Ultra 1 and Ultra 2 workstations. The CPU datapaths are 144-bits wide, with 128 bits for data and 16 bits for error correcting code (ECC). The UPA data path that support system I/O is 72 bits wide, with 64 bits for data and 8 bits for ECC. The memory interface supports a single 576-bit-wide datapath.

With 360-MHz CPU installed (Model 1360 or 2360), the UPA transfers data at 120 MHz (up to 1.6-GB-per-second throughput). CPU segments, which transfer 16 bytes of data in parallel every clock cycle, each have a maximum transfer rate of 1.9 GB per second. With the 450-MHz CPU installed (Models 1450 and 2450), the Ultra 60 workstation runs the UPA at 112.5 MHz (up to 1.8-GB-per-second throughput).

Features	**Benefits**
• Single 576-bit-wide, high-speed memory bus	• High-performance memory access
	• Flexibility in memory expansion options
• 120-MHz UPA	• Able to use advanced UltraSPARC-II processors

Memory

The Ultra 60 workstation supports up to 2 GB of 60-ns, 5-volt, dynamic RAM memory. Dual in-line memory modules (DIMMs) used by the Ultra 60 workstation are the same type as those used in the Ultra 1 and Ultra 2 workstations. Memory is organized into four banks of four DIMMs. DIMMs must be installed in sets of four identical DIMMs.

Feature	Benefit
• Uses the same type of memory as Ultra 1 and Ultra 2 workstations	• Protects customer's investment and enhances upgradability

Storage

Internal data storage for the Ultra 60 workstation is provided by up to two 18.2 GB, 10000-rpm, UltraSCSI disk drives (9.1-GB drives are supported). These 10000-rpm drives offer a peak data transfer rate of 40 MB per second, or twice the transfer rate of fast/wide SCSI controllers.

In addition to its internal and external high-speed fixed storage capabilities, the Ultra 60 workstation provides an optional 32X CD-ROM drive and a 1.44-MB, 3.5-inch, manual-eject floppy drive for software installation and system management.

Features	Benefits
• 40-MB-per-second UltraSCSI	• Fast access and retrieval of mass storage data
• 18.2-GB, 10000-rpm disk drives	• Flexibility in internal disk expansion and high internal capacity

The Ultra 60 workstation minitower accommodates front-access peripheral expansion through one 1.6-inch drive half-height 5.25-inch bay, and two 3.5-inch bays for a diskette drive, PCMCIA adapter, or other options.

Figure 3. Ultra 60 workstation chassis with access panel removed, provides full access to internal options

System I/O—High-Performance PCI Technology

System I/O for the Ultra 60 workstation is provided by two industry-standard peripheral component interconnect (PCI) data buses. Both PCI buses in Ultra 60 workstations comply with the 2.1 revision of the PCI specification, released in March 1995.

- PCI slot 1 operates at 33 MHz or 66 MHz and supports either a 32-bit or 64-bit, 3.3-volt or universal PCI card

- PCI slots 2 through 4 operate at 33 MHz and provide for 32- or 64-bit, 5-volt or universal PCI cards

Slots	Slot Width	Clock Rate	Card Input Voltages Supported
1	32 or 64 bits	33 or 66 MHz	3.3 volt or universal
2-4	32 or 64 bits	33 MHz only	5 volt or universal

In addition to the I/O capabilities available through PCI option cards, the Ultra 60 workstation provides the following I/O channels directly from the main system board:

- Two (1 internal/1 external) 40-MB UltraSCSI channels with an external 68-pin SCSI connector

- One external 10/100BASE-T autoselect Ethernet port (supports either a Cat-5 UTP, RJ45 connector, or 40-pin miniature "D" MII connection)

- Two external EIA-232D or EIA-423 serial ports via two DB25 connectors (support EIA-423 synchronous data rates from 50 baud to 384 Kbps, and asynchronous data rates from 50 baud to 460.8 Kbaud)

- One external 2-MB Centronics-compatible, bidirectional, EPP parallel port with one DB25 connector

- One external standard Sun keyboard/mouse port (mini DIN-8 connector)

Features

- One of the industry's first 66-MHz PCI with 200-MB-per-second bandwidth (sustained)

- Two independent PCI buses

- Two independent UltraSCSI buses

Benefits

- High performance I/O throughput

- Access to many third-party solutions

- High, sustained I/O throughput

- Higher performance throughput through the use of independent busses

SunPCi™ PC Coprocessor Card

The SunPCi™ card is a cost-effective hardware and software product that provides PC compatibility to customers who wish to run PC applications on Sun workstations using Solaris™ Operating Environment software. The SunPCi card brings together the ease of use of DOS and Microsoft Windows programs and the powerful features of the Solaris Operating Environment, giving users access to powerful workstation technology without sacrificing access to DOS and Microsoft Windows applications.

The SunPCi card is integrated with the workstation in which it is installed. It uses the workstation's keyboard, mouse, floppy drive, and Ethernet port as if they were its own, and it uses files from the Solaris file system to emulate C:\ and D:\ drives. If the VGA port on the card is not used for a second display, the video from the SunPCi card is routed to an X11 window on the workstation's monitor.

Other Solaris Operating Environment services are available to the SunPCi card. Any file system which is mounted on the hosting workstation, local or networked, including CD-ROMs, can be mapped to a network drive symbol on the PC. In addition, the SunPCi card can access printers connected to a Solaris network.

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Nearly any Solaris service for which there is a Microsoft Windows client can be used from the SunPCi card. The SunPCi card must be assigned its own IP address, and the SunPCi Solaris drivers select net traffic addressed to the card and pass it to the card. This is transparent to the SunPCi card.

Features	Benefits
• Full PC compatibility	• Runs Microsoft Windows NT, Windows 95, Windows 3.x, and DOS applications, whether off-the-shelf or developed in-house
• Solaris Operating Environment/PC interoperability	• Integrates Ultra workstations into heterogeneous enterprise environments
	• Increases productivity by allowing access to technical and productivity applications via the same monitor, keyboard, and mouse
	• Allows sharing of files, data, and cut/copy/paste functions between Solaris and PC environments
	• Uses Solaris Operating Environment resources and peripherals from within PC environment: Ethernet networking (file, print, etc.), Solaris file system, removable media (CD-ROM, floppy, etc.), shared monitor
	• Saves desktop real estate with all-in-one design
	• Reduces system management costs
• 400-MHz AMD K6-2 processor	• Provides power and performance to run demanding productivity and technical applications and get the job done in a hurry
	• Runs Microsoft Windows NT/95 and DOS applications at native, Pentium II-class speeds
• 64- to 256-MB RAM on-card	• Runs multiple PC applications without memory constraints
	• Provides dedicated memory for PC applications
	• Expandable to grow with your needs
• USB, parallel, and serial ports	• Standard ports to connect to devices new and old: keyboards, mice, multimedia devices, printers, etc.
• 24-bit graphics, monitor port	• Drives an optional second monitor dedicated to PC environment in 24-bit, 1600 x 1200 graphics
• SoundBlaster-compatible sound	• Audio performance for running multimedia PC applications
• Audio in/out ports	• Supports stereo speakers, microphone in
• PCI form factor	• PC coprocessor supports all of Sun's PCI-based Ultra workstations: Ultra 5, Ultra 10, Ultra 30, Ultra 60, and Ultra 450

PGX32™ Graphics

PGX32™ graphics is Sun's first high-resolution 8-bit and 24-bit color PCI graphics frame buffer option supporting all Sun PCI I/O-based workstations and workgroup servers. The PGX32 graphics frame buffer is targeted towards professionals requiring fast X Window system performance, displaying 24-bit and 8-bit graphics at full speed. With 8 MB of SGRAM, the PGX32 graphics frame buffer is capable of providing

full 24-bit hardware double buffering at resolutions up to 1152 x 900, 8+24-bit color up to 1280 x 1024 and support up to 1600 x 1200 in pseudo color (8-bit color) mode. PGX32 graphics supports the resolutions shown in the table below.

Display Resolution	Color Mode	Double Buffered	Vertical Refresh Rate (Hz)
640 x 480	8-bit, 24-bit, 8+24-bit	Yes	60/72/75/85
800 x 600	8-bit, 24-bit, 8+24-bit	Yes	60/72/75/85
1024 x 768	8-bit, 24-bit, 8+24-bit	Yes	60/70/75/77/85
1024 x 800	8-bit, 24-bit, 8+24-bit	Yes	85
1152 x 900	8-bit, 24-bit, 8+24-bit	Yes	60/66/70/75/76
1152 x 900	8-bit	Yes	60/66/70/75/76/85
1280 x 800	8-bit, 8+24-bit	Single Only	76
1280 x 1024	8-bit	Yes	60/67/75/76/85
1280 x 1024	24-bit, 8+24-bit	Single Only	60/67/75/76
1600 x 1000	8-bit	Yes	66/76
1600 x 1200	8-bit	Yes	60/65/66/70/75/76/80

The PGX32 graphics frame buffer supports all standard Sun video timings and also supports VESA timings for supporting PC type displays and flat panels. It is also capable of supporting Sun's 24-inch display @ 1600 x 1000.

The PGX32 graphics frame buffer can work in single or multiheaded configurations and can be set as the only frame buffer in the system, as the console or as the secondary frame buffer. Up to four PGX32 graphics frame buffers are supported in any system. The PGX32 graphics frame buffer supports all releases of Solaris 2.6 and the latest Solaris 7 Operating Environment release. The product has not been tested with all configurations with Solaris 2.5 Operating Environment.

Features	Benefits
• Simultaneous 8-bit and 24-bit	• Eliminates colormap flashing display visual support when running both 8-bit and 24-bit applications; allows legacy 8-bit applications to run while simultaneously running the latest 24-bit applications
• 24-bit true color video support	• Display the highest quality color on screen
• Support for high resolutions	• Ability to display more information with higher quality and image detail
• PCI 33-MHz format	• Allows usage in the widest variety of systems from the Ultra 5 workstation up to the Sun Enterprise™ 450 workgroup server
• 1280 x 1024 at 76-Hz resolution	• High-resolution display quality standard

Features

- Multiheaded (display) support; multiple frame buffers (with support for up to four PGX32 graphics frame buffers in one system)

- 8-bit overlay plane

Benefits

- For users who must do multiple tasks simultaneously, for example, command and control applications, design, and analysis for engineers

- Allows overlay of 8-bit windows on top of the 24-bit visuals without damaging the underlying visual, resulting in seamless integration and manipulation of windows

Sun Creator Graphics Series 3 Overview

Sun Creator graphics series 3 is the latest generation of the Sun Creator graphics family of accelerators. With one architecture it can accelerate and support diverse types of graphic needs ranging from 8-bit and 24-bit windowing to high-end 3-D graphics.

Sun Creator graphics is designed as an integral part of Sun Ultra workstations or Sun Enterprise servers and is, therefore, designed to take advantage of the UltraSPARC CPU performance increases to 300 MHz and beyond. The original generation of Sun Creator graphics has a single graphics/frame buffer clock for all on-board logic. This new generation has one clock for the internal graphics processing and another clock for the frame buffer. This design makes it possible to drive each part at its maximum speed.

Until May 1999, Sun Creator graphics was available in two configurations:

- The single-buffered configuration (known as Sun Creator) supports hardware acceleration of 2-D graphics.

- The double-buffered configuration (known as Sun Creator3D) is used for fast, high-quality transformation and display of 3-D solid and wireframe objects. It also provides support for high-resolution (1920 x 1200) monitors such as the Sun 24-inch, wide-screen display.

Only the double-buffered configuration (Sun Creator 3D) is now available.

Sun Creator3D graphics series 3 is available for most Ultra workstations (all except the Ultra 5 workstation) as well as the mid-range Sun Enterprise servers (Sun Enterprise 3500–6500 servers).

System Architecture

Sun Creator Graphics Models

The two models, Sun Creator and Sun Creator3D, are physically different boards. A Sun Creator board cannot be upgraded to a Sun Creator3D board by adding more 3D-RAM memory. An upgrade is performed by changing the graphics board.

Sun Creator (no longer available)	Sun Creator3D
• Full 2-D imaging and windowing acceleration	• Full 2-D imaging and windowing acceleration, plus full 3-D acceleration
• Suited for 2-D, windowing, and imaging applications including: CASE, color publishing, EDA, medical imaging, and general research	• Ideal for high-end 2-D, mid-range 3-D graphics, and solids in MCAD and MCAE, as well as high-end imaging and color publishing applications
• 24-bit true color, single-buffered	• 24-bit true color, double-buffered up to 1280 x 1024
	• 28-bit Z-buffer
• 8-bit overlay and visual planes	• 8-bit overlay and visual planes
• Stereo display up to 960 x 680 at 112 Hz non-interlaced	• Stereo display up to 960 x 680 at 112 Hz non-interlaced, double- and Z-buffered
• 5-MB 3D-RAM memory	• 15-MB 3D-RAM memory
• 1280 x 1024 at 76 Hz standard with programmable bootprom resolution	• 1280 x 1024 at 76 Hz standard with programmable bootprom resolution
• NTSC/PAL video timings	• NTSC/PAL video timings
• 64-bit DAC	• 128-bit DAC
	• High resolution 1920 x 1200 at 70 Hz (single buffered) supporting 24-inch wide screen display—series 2 and series 3

Key Messages

- **High-performance graphics**

  Sun Creator graphics performance is based upon the Sun Creator approach to designing graphics. In series 3, the Sun Creator graphics technology is enhanced, with up to 50 percent graphics performance improvement over series 1.

  – UltraSPARC CPU

  Sun Creator graphics relies on the power of the UltraSPARC CPU for floating point calculations, and on the visual instruction set (VIS™ software) to accelerate imaging-related operations. This eliminates the need for a dedicated graphics processor, and results in a significant cost advantage.

  – Ultra port architecture (UPA) high-speed interconnect for graphics

  UPA provides a high-speed, high-bandwidth interconnect between the CPU, Sun Creator graphics, and main memory. It raises overall graphics performance while maintaining a balanced throughput. Unlike the peripheral buses, such as SBus or PCI, the UPA interconnect ties Sun Creator graphics directly to the CPU and memory, and delivers greater bandwidth by orders of magnitude.

  UPA also allows Sun Creator3D to utilize main system memory for texturing, allowing large texture-mapping possibilities.

– Sun Creator-rendering ASIC (FBC2)

A completely new ASIC, FBC2 renders graphic primitives at very high speeds. FBC2 accelerates fills, scrolling, text, lines, and polygon rendering.

– 3D-RAM graphics memory

This new generation of the 3D-RAM breakthrough in graphic memory provides high-bandwidth and built-in acceleration for 3-D graphics.

- **Scalable performance**

The performance of Sun Creator graphics takes advantage of general system performance enhancements and will scale up with increases in CPU clock rate, making it unnecessary to upgrade graphics as new generations of CPUs become available.

- **More standard functionality**

All Sun Creator graphics products come standard with high resolution and 24-bit true color, as well as an 8-bit overlay plane. Sun Creator3D supports 24-bit double buffering and a 28-bit Z-buffer. In addition, stereo output support is built-in. Sun Creator graphics has established a new standard for workstation graphics functionality.

Sun Creator3D graphics series 2 and series 3 also add support for high-resolution monitors (up to 1920 x 1200) and hardware acceleration of color-space conversion during video playback.

Four 8-bit color maps for dynamic color-map segment allocation within the 8-bit color overlay plane and support for adjustable gamma correction give applications greater access to colors even in 8-bit mode and give the user the ability to color adjust (gamma correct) for optimal display quality.

- **Fully compatible with existing APIs**

Sun Creator graphics accelerates existing APIs, including OpenGL®, X11, XIL™, and XGL™ graphics libraries.

Sun Elite3D Graphics Overview

Sun Elite 3D graphics greatly accelerates the rendering of 3-D triangles, vectors, and texture maps over what is possible with Sun Creator or a raw CPU. It does this by adding specialized graphics floating-point units and more powerful pixel-drawing chips. It supports a 1280 x 1024 96-bit-deep frame buffer, configured the same as the double-buffered and Z-buffered Sun Creator3D. The 96-bit pixels support two 24-bit color buffers, an 8-bit pseudo-color overlay buffer and a 28-bit Z buffer, plus some miscellaneous control planes.

Sun microsystems®

UPA-Bus

64

AFB
Command

CM-Bus

Serial
Port

48

CF-Bus

| AFB Float 0 | AFB Float 1 | AFB Float 2 | AFB Float 3 | AFB Float 4 | AFB Float 5 |

FD-Bus

32

64

CDC-Bus

AFB Draw 0

AFB Draw 1

8

3DRAM 3DRAM 3DRAM
3DRAM 3DRAM 3DRAM

3DRAM 3DRAM 3DRAM
3DRAM 3DRAM 3DRAM

RAMDAC

Boot PROM

Video Output
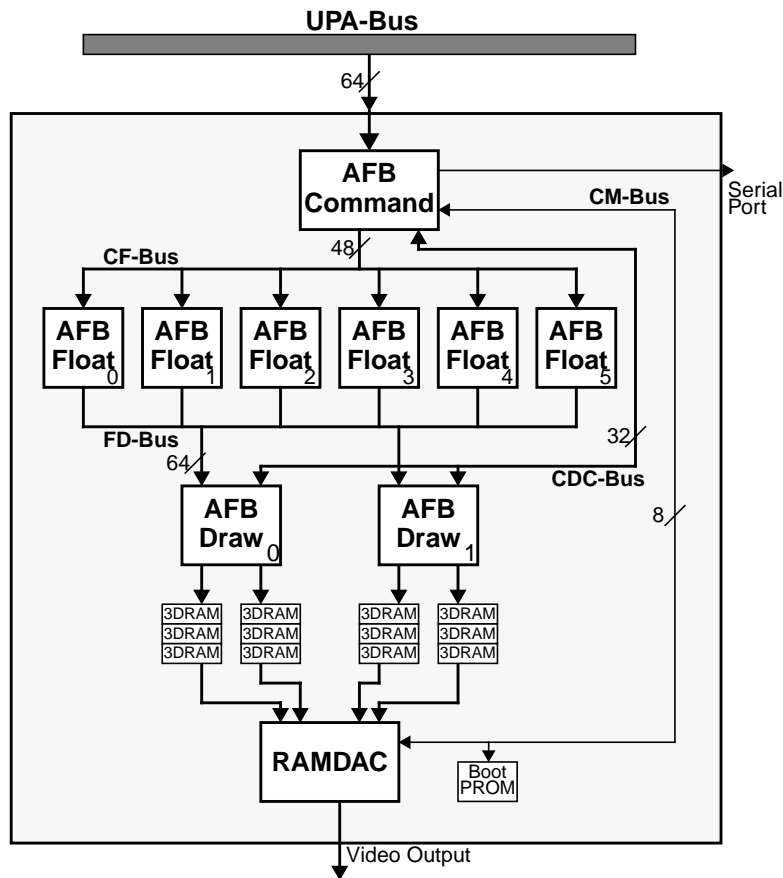
Figure 4. Sun Elite3D m6 graphics chip-level diagram

Sun Elite 3D graphics has a highly parallel and efficient graphics pipeline. The Sun Elite 3D graphics architecture uses a new generation of 3D-RAM chip. This chip speeds up a read/modify/write pixel access from 160 ns to 10 ns, changing all of the rules about graphics pipeline behavior.

AFB-Command, at the interface level, is a superset of the Sun Creator ASIC chip. The additional functionality supports rendering of model space geometry. The main change is to allow the most important bits to be packaged up into single-header words that can be passed down with the geometric data without stopping the pipeline. Additional functionality includes complete binary compatibility with the register set and functions of Sun Creator3D graphics and support for the OpenGL platform.

Given the technological changes brought on by 3D-RAM, the primary justification for the existence of a 3-D graphics accelerator is to deliver an order of magnitude more floating-point performance than a contemporary general purpose RISC CPU, at a price less than that of a single CPU and cache.

Sun Elite 3D Graphics Features and Benefits

Features	Benefits
• Integrated imaging	• Performs fast imaging and 3-D on unified frame buffer
• High-performance accelerated 24-bit double-buffered 3-D graphics	• Smooth animation and interactivity of 3-D graphics
• 28-bit Z-buffer	• Improves visual quality and depth accuracy
• 8-bit overlay plane	• Allows overlay of 8-bit windows on top of the 24-bit visuals without damaging the underlying visual; allows seamless integration and manipulation of windows
• Gouraud shading	• Allows smooth shading of solid geometry
• Alpha blending and screen-door transparency	• Simulates transparent materials such as glass
• Line and dot antialiasing	• Needed in MCAD and visualization for better visual quality
• Per-pixel depth cueing	• More accurate depth cueing or fog
• Per-pixel alpha interpolation	• Greater accuracy and image quality
• 4-bit stencil support with hardware acceleration of OpenGL platform stencil functions	• Provides greater performance
• Accelerated lighting	• More lights can be turned on for enhanced visual display without encountering large performance penalties
• Compressed geometric decompression	• Allows much more geometric data to be stored in the available memory, but also reduces bus bandwidth needs as well; for efficient geometry handling to enable network-centric graphics collaboration
• Four 8-bit color maps	• For dynamic colormap segment allocation when running 8-bit window systems should eliminate color flashing problems
• Adjustable gamma correction	• Allows users to gamma correct visuals for enhanced visual quality
• NTSC/PAL video timing support	• Supports frame buffer to video output
• Stereo video output (960 x 680 at 112 Hz) supported with 19- and 21-inch monitors	• With frame buffer, monitor, and window systems support for stereo, users can get more accurate representation of 3-D data
• 1280 x 1024 at 76-Hz resolution standard	• High-resolution display quality
• Dual-headed support (two Sun Elite3D m6 graphics frame buffers)	• For users who need to do multiple things simultaneously, such as command and control applications, 3-D, and video playback for animators, or design and analysis for engineers

System Architecture

Sun microsystems

Features

- OpenGL 1.1.2., XGL 3.0, XIL, X Windows, Java 3D™ software support

- Binary compatibility with Sun Creator graphics product family

Benefits

- A choice of APIs

- Interoperability with existing applications and users

Sun Ultra 60 Workstation Graphics Performance

Benchmarks	Ultra 60 360 MHz			Ultra 60 450 MHz		
	Sun Creator3D	Sun Elite3D m3	Sun Elite3D m6	Sun Creator3D	Sun Elite3D m3	Sun Elite3D m6
Xmark	33.0	31.9	31.9	35.4	37.8	39.2
2-D Vectors per Second	4.8M	3.9M	4.1M	5.0M	5.0M	5.0M
3-D Performance						
• 3-D vectors/second	3.7M	4.9M	8.8M	3.7M	4.9M	8.8M
• 3-D mesh/second	1.4M	3.0M	5.9M	1.3M	3.0M	5.9M
• 3-D quads/second	468K	1.3M	1.3M	468K	1.5M	1.3M
GPC PLB						
• PLBwire93	248	286	412	258	301	433
• PLBsurf93	368	496	658	414	519	680
OpenGL						
• ProCDRS-02	7.8	13.9	19.0	8.8	13.5	19.1
• DX-05	11.6	26.5	29.4	12.3	27.5	31.2
Standard Color Monitors Supported	17 inch, 19 inch, 21 inch, and 24 inch	17 inch, 19 inch, and 21 inch		17 inch, 19 inch, 21 inch, and 24 inch	17 inch, 19 inch, and 21 inch	

* Performance data as of September 1999. Performance data is subject ot change. Please see Sun's web site at `http://www.sun.com/desktop/` for the latest performance numbers.

* Configuration for timinig includes Solaris 7 Operating Environment and OpenGL 1.1.2 platform.

Metrics Defined

- 2-D vectors are 10 pixels long, X11 perf numbers

- 3-D vectors are 10 pixels long, depth cued, clip tested, perspective projection, solid line through OGL

- 3-D triangles are 25 pixel triangle mesh, one light source

- 3-D quads are 100 pixel, independent quadrilaterals, with one directional light source

- Both 3-D mesh and quads are Gouraud shaded, randomly oriented, transformed, clip tested, with perspective projection and Z-buffered through OGL

- Configuration with 24-inch monitor use Sun Creator3D graphics in high-resolution, single-buffer mode

- XIL numbers are in million pixels (megapixels per second) for a single-band image

System Architecture

Sun microsystems

Special Features

- Accelerated imaging and advanced 3-D graphics with Gouraud shading, line antialiasing, per-pixel depth cueing, subpixel addressing, transparency, stereo viewing with monitor
- Sun Creator graphics series 3 and Sun Elite3D graphics utilize a new connector for stereo viewing synchronization, a 7-pin mini-DIN style of connector (StereoGraphics Corporations sells a cable adapter for connecting the old and new styles of connectors. It can be ordered from them using the part number ESUN.)

Sun Ultra 60 Workstation Configuration

Product Highlights	Sun Ultra 60 Model 1360	Sun Ultra 60 Model 2360	Sun Ultra 60 Model 1450	Sun Ultra 60 Model 2450
Dimensions	45 cm x 19 cm x 49.8 cm (H x W x D) 17.7 inches x 7.5 inches x 19.6 inches			
Weight	23.6 kg (50 pounds)			
CPU and UPA				
• Architecture	UltraSPARC-II		UltraSPARC-II	
• Clock rate	360 MHz		450 MHz	
• Processor slots	2		2	
• Cache on chip	32 KB		32 KB	
• External cache	4 MB		4 MB	
• UPA speed	120 MHz		112.5 MHz	
Memory				
• Memory type	ECC			
• Number of slots	16			
• Capacity	64 MB to 2 GB			
• DRAM speed	60 ns			
• Bus width	576 bits			
• DIMM sizes	16, 32, 64, and 128 MB			
Storage				
• Maximum internal	Two internal disk capacity, up to 36.4 GB			
• Maximum total	218.4 GB			
I/O Interfaces				
• UltraSCSI	40 MB/sec. UltraSCSI (SCSI-3), 2 channels(1 internal, 1 external)			
• Serial ports	Two RS-232C/RS423 DB25			
• Parallel port	Centronics compatible (DB25)			
• PCI I/O bus	Four full-size PCI slots (version 2.1): Three at 33 MHz; one at 33 MHz or 66 MHz			
Networking Ports	TP Ethernet 10/100BASE-T or MII port			

System Architecture

Sun microsystems

Product Highlights	Sun Ultra 60 Model 1360	Sun Ultra 60 Model 2360	Sun Ultra 60 Model 1450	Sun Ultra 60 Model 2450
Backup and Distribution				
• Floppy		Optional 3.5-inch floppy		
• CD-ROM		SunCD™ 644-MB, SunCD 32X		
• Internal		Optional 12-GB to 24-GB DDS-3 4-mm; 14-GB 8-mm, up to two 9.1-,GB or 18.2-GB disks		
• External		9.1-GB to 18.2-GB Sun StorEdge™ UniPack system; 18.2-GB to 109.2-GB Sun StorEdge MultiPack system StorEdge A1000, D1000,A3500, A5000 arrays 4-GB to 8-GB SLR tape 20-GB to 40-GB, 8-mm 12-GB to 24-GB, 4-mm DDS-3 72-GB to 144-GB, 4-mm DDS-3 autoloader 20-GB to 40-GB DLT 4000, 35-GB to 70-GB DLT 7000 Sun StorEdge L400,L100, L1800, and L3500 tape libraries		

Sun Ultra 60 System Graphics Configuration

Product Highlights	Sun Ultra 60 Sun Creator3D	Sun Ultra 60 Sun Elite3D
Operating Environment	Solaris 2.5.1 Hardware: 11/97 Solaris 2.6 Hardware: 3/98 Solaris 7	
Monitors		
• 17-inch and 19-inch color		
• 21-inch color	1280 x 1024 at 76 Hz 1152 x 900 at 76 Hz and other programmable resolutions	1280 x 1024 at 76 Hz 1152 x 900 at 76 Hz and other programmable resolutions
• 24-inch wide-screen color	High-resolution support: 1920 x 1200 at 70 Hz* 1600 x 1000 at 76 or 66 Hz* 1440 x 900 at 76 Hz* 1280 x 800 at 76 Hz	N/A
Graphics		
• Slots	Two UPA graphics slots	Two UPA graphics slots
• Graphics supported in UPA slot	Sun Creator3D frame buffer	Sun Elite3D m3 frame buffer or Sun Elite3D m6 frame buffer†
• Color planes and visual capabilities	NTSC/PAL timing 24-bit plus 8-bit overlay Stereo 960 x 680 at 112 Hz	NTSC/PAL timing 24-bit plus 8-bit overlay Stereo 960 x 680 at 112 Hz
• Double buffer	8-bit/24-bit	24-bit
• Z-buffer	—/28-bit	28-bit
✔= Primary application * = Sun Creator3D graphics in single buffer mode † = only one Sun Elite3D m6 graphics frame buffer per Ultra 60 workstation		

Product Highlights	Sun Ultra 60 Sun Creator3D	Sun Ultra 60 Sun Elite3D
• Multimedia features	24-bit true color accelerated video playback	24-bit true color accelerated video playback
Graphics Market Positioning		
• Windowing and 2-D	✔	✔
• 3-D wireframe	✔	✔
• 24-bit and imaging	✔	✔
• 3-D solids	✔	✔
• Multimedia	✔	✔
✔= Primary application * = Sun Creator3D graphics in single buffer mode † = only one Sun Elite3D m6 graphics frame buffer per Ultra 60 workstation		

System Architecture

![Sun microsystems logo]

System Administration

Sun Ultra™ 60 workstations deliver the power and graphics needed by the customers who use heavy compute-intensive applications. Customers who run these compute-intensive applications require a system like the Solaris™ 7 Operating Environment that can provide highly reliable, available, fast and safe desktop computing environment. Built into Solaris 7 Operating Environment are systems management and security features that will help deliver the computing environment demanded by these customers. Sun also offers unbundled systems management products that will supplement the systems management features in the Solaris 7 Operating Environment. Together, the Solaris 7 Operating Environment management features and Sun's unbundled systems management products create one the most stable and available desktop computing environment in the industry.

Solstice AdminTools™ Software

Solstice AdminTools™ software is a set of GUI-based administration tools that have been shipping since the Solaris 2.2 Operating Environment release and can be used to provide local systems administration. Solstice AdminTools software can be used to manage user accounts, groups, hosts, printers, serial ports, and installation/removal of software.

SunVTS™ Software

The SunVTS™ system exerciser is a graphically oriented UNIX® application that permits the continuous exercising of system resources and internal and external peripheral equipment. Used to determine if the system is functioning properly, SunVTS software incorporates a multifunctional stress test of the system through operating-system-level calls, and allows the addition of new tests as they become available.

Solaris™ Web Start Software

Solaris™ Web Start software is an easy-to-use Java™ technology-based application that guides users through the installation of both the Solaris Operating Environment and copackaged application software with a single on-screen button. Its graphical user interface facilitates file system configuration. It also features built-in suite of on-line information answers questions about the product itself, the software it installs, and the hardware platform it supports.

Solstice Enterprise Agents™ Software

Solstice Enterprise Agents™ software allows the workstation to be managed from simple network management protocol (SNMP)-based system/network management tools. Solstice Enterprise Agents software is based on the new extensible agent technology or manager/subagent technology. The Manager agents receive and respond to SNMP or desktop management interface (DMI) requests. After retrieving the appropriate values from the respective subagents, responses are sent. The subagents manage information bases (MIBs or MIFs) designed for specific components and applications.

Solaris™ Desktop Extensions Software

Solaris™ Desktop Extensions software features ideal systems management tools for those non-UNIX platform users who want to quickly view processes and system resources. The process manager in Solaris Desktop Extensions software is a GUI-based tool that enables users to quickly identify, sort, suspend, and eliminate processes based on attributes such as CPU consumption and time elapsed.

Solaris Desktop Extensions software also features a GUI-based performance monitor, enabling users to quickly monitor some of the key system resources such as CPU, load, disk, page, context, job swaps, interrupts, packets, collisions, and errors.

ShowMe How™ Software: State-of-the-Art Installation and Maintenance Instruction

ShowMe How™ software is a documentation system that presents information in a highly understandable multimedia format. Installation and service tutorials as well as reference information provide users with comprehensive, easy-to-use instruction. ShowMe How software streamlines installation and maintenance to lower service costs and maximize system uptime. Some of the features of this tool are:

- Distributed on CD-ROM
- Movies of installation and replacement procedures played through ShowMe TV™ software packaged with application
- Photo sequences with narrated installation and replacement procedures
- Text-based instructions can be viewed on-line and printed, excerpted from standard Sun documentation
- Photos with active callouts link to more detailed photos and text-based reference information

Solaris Operating Environment

Sun workstations are supported by the Solaris 7 Operating Environment, one of the industry's leading enterprise operating environments. The Solaris 7 Operating Environment contains the base-level functionality required for all Sun Workstation™ systems. The Solaris 7 Operating Environment is a solid, scalable 32-bit and 64-bit Operating Environment. The Solaris 7 Operating Environment includes:

- A 32- and 64-bit kernel
- Standards-based networking with easy access to a wide range of computing environments and network technologies
- Support for both SPARC™ processor-based platforms and Intel platforms
- Integrated Java technology
- System administration support

The Solaris Operating Environment delivers a competitive advantage to businesses through networked computing, scalability, and multiarchitecture support. The Solaris Operating Environment provides an advanced, superior solution for all customer IT needs, both technical and business. With its strength in enterprise-class reliability, scalability, and performance, the Solaris Operating Environment is an industrial-grade solution with the quality and robustness required to deliver mission-critical computing.

Sun Ultra 60 systems are supported by Solaris 2.5.1 Hardware: 11/97, Solaris 2.6 Hardware: 3/98, and Solaris 7 Operating Environments.

Solaris Operating Environment Features and Benefits

Features	Benefits
• Mainframe-class reliability, availability, and serviceability	• Provides greater system stability and less system downtime by allowing customers to add, remove, and replace defective hardware without rebooting the system
• Higher performance	• A complete 64-bit computing environment provides greater computing capacity, precision, and performance
• Improved scalability	• The 64-bit kernel provides access to and capacity for more system resources; this allows more applications to be consolidated onto a single server, and enables systems to handle much larger problem sets
• Greater ease of use	• Web-based installation, text and voice notes, and graphical process manager make Solaris software easy to install and use
• Comprehensive global product	• Supports the euro currency symbol, complex text formats for Arabic, Thai, and Hebrew languages, and the development of multilingual applications
• 100 percent binary compatibility	• Software investment protection—all of today's Solaris Operating Environment-certified 32-bit applications continue to run on Solaris 7 Operating Environment without modification

Solaris 7 Operating Environment 11/99 New Features

A number of new features were added to the Solaris 7 Operating Environment in November 1999. They are:

- **Netscape™ application launcher**—enables users to easily access and launch Netscape files and associated Netscape applications such as Composer automatically. This new Netscape application launcher eliminates the need to run the entire Netscape environment, making access to Netscape applications simpler than ever.

- **PDASync (Personal Digital Assistant) support**—a Java technology-based application for professionals on the go. Enables users to easily synchronize their desktop calendar, mail, address book, and memos with their PDA.

- **X11R6.4 support**—a new enhanced version of XServer delivers key new features that increase user productivity and mobility. These are:

  – **Web-enabled X application**—access on any browser-based desktop. Provides access to corporate X applications for remote users through the Internet or intranet

  – **Xinerama support**—provides one logical screen image support that can be displayed across multiple monitors

  – **Color utilization policy (CUP) support**—minimizes color-map flashing

  – **XPrint extension**—provides a framework for X applications to render on non-display devices, such as printers and facsimile machines

  – **EnergyStar support**—built-in power management controls to conserve workstation power

  – **Developer toolkit**—includes new public APIs and documentation for Xinerama, XPrint, XKB, DPMS, and CUP extensions

System Management

Solaris 7 Operating Environment 5/99 New Features

PC Launcher 1.0 (SPARC only) was added to the Solaris 7 Operating Environment in May 1999. PC Launcher allows the SunPCi card to have seamless access and power to view, edit, and print many popular types of PC files or attachments instantly, by automatically launching the associated Microsoft Windows application and. By incorporating PC launcher into the Solaris CDE desktop, users can share attachments and files created by Microsoft Word, Excel, PowerPoint, Lotus 1-2-3, and AutoCAD applications.

Graphics Software Interfaces

Sun systems support all Solaris 2.5.1, Solaris 2.6, and Solaris 7 Operating Environment graphics and window system APIs, including OpenGL®, XGL™, XIL™, and Display PostScript™ APIs. A large number of Sun and third-party graphics APIs are also supported, including IRIS GL, OpenGL, GKS, HOOPS, Java 3D™, and PHIGS APIs. Industry-standard X-extension libraries, such as Xlib and PEXlib, are available and are accelerated via the XGL and XIL foundation graphics libraries.
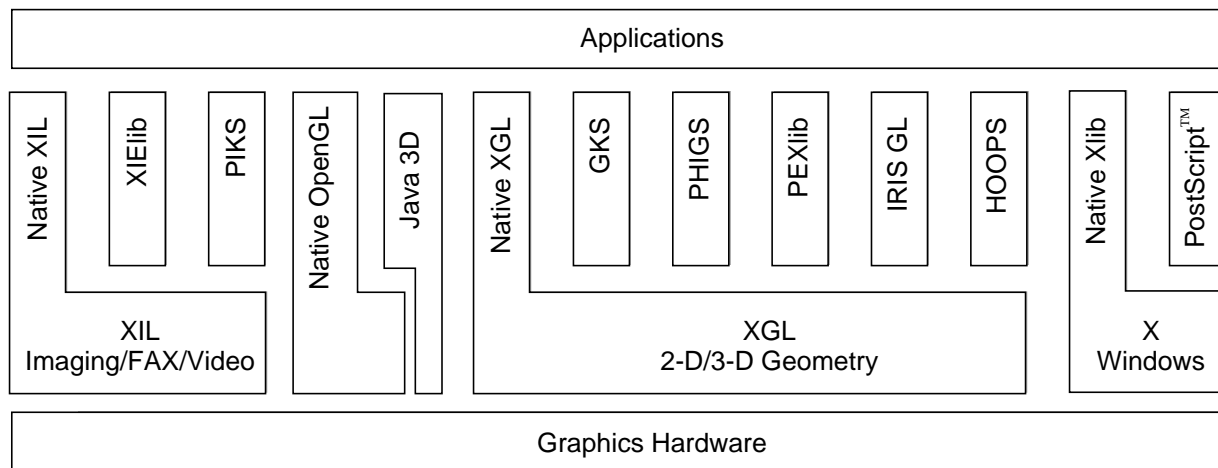
Figure 5. Graphics software interfaces

Solaris Operating Environment System Requirements

Disk Space	End user: 25 MB Developer: 40 MB (runtime binaries and header files)
Memory	64 MB minimum 128 MB or higher recommended for serious applications

Solaris Operating Environment Licensing and Usage

All Sun system and system-board products include a Solaris Operating Environment license. The type of Solaris license(s) shipped with each platform reflects the way in which that system is most commonly used. Additional Solaris licenses are available to allow increased usage of the software.

Ultra 60 workstations come with a Solaris Desktop license. This license is limited and does not provide several of the services provided by the Solaris Server license, such as:

- Allowing more than two users to be directly connected

- Providing database or compute services for more than two continuous users

- Providing swap-disk space for any other system

- Providing home-directory space for any other system

If a system shipped with a Solaris Desktop license will be used as a server (requires services listed above), the system must be upgraded to a Solaris Server license.

OpenGL 1.1.2 API for the Solaris Operating Environment

The OpenGL 1.1.2 API for the Solaris Operating Environment provides a complete solution for developing and deploying interactive 3-D applications across SPARC workstations. It enables mainstream, competitive 3-D graphics and visualization applications to be deployed on Sun's Ultra family of graphics workstations at a compelling price-to-performance ratio. The OpenGL API is an application programming interface that provides 2-D and 3-D graphics functions, including modeling, transformations, color, lighting, and smooth shading, as well as advanced features such as texture mapping, NURBS, fog, alpha blending, and motion blur. The OpenGL API works in both immediate and non-editable display-list graphics modes.

The OpenGL API is targeted at developers creating interactive 3-D applications for the enterprise, the intranet, and the Internet. These developers are affiliated with ISVs or VEUs in technical markets or in research labs. Potential users include those in computer-aided design and manufacturing, global information systems, simulation, industrial design and modeling, entertainment, biochemistry, and petroleum exploration market segments.

Widespread multivendor availability of the OpenGL API allows source-code portability of 3-D graphics clients. The OpenGL 1.1.2 API for the Solaris Operating Environment is a compliant implementation of the OpenGL 1.1 API from the OpenGL Architecture Review Board (ARB) and is, therefore, source-code compatible with other conformant the OpenGL API applications on the market. Most existing OpenGL applications just need to be recompiled in order to run with the OpenGL 1.1.2 API for the Solaris Operating Environment.

The OpenGL 1.1.2 API for the Solaris Operating Environment is available for the Sun Creator and Sun Elite3D graphics product families, where the OpenGL API functionality is accelerated in hardware. In addition, it is available on all the legacy SPARCstation™ systems equipped with SX, ZX, GX, GXplus, TurboGX™, TurboGXplus™, S24™, PGX™, or FSV graphics frame buffers, which is made possible through an optimized software-rendering pipeline.

The OpenGL 1.1.2 API for the Solaris Operating Environment provides the following features:

Features	Benefits
• 64-bit OpenGL libraries	• Allows OpenGL applications to take advantage of the full 64-bit addressing in Solaris 7 Operating Environment
• Occlusion culling test extension	• Allows applications to trivially reject occluded objects in a scene, resulting in big improvements in interactive rendering performance for visualization of large models
• Improvements in DPA rendering support	• Allows OpenGL rendering on Ultra 60 systems using the PGX or PGX24™ graphics frame buffers
• Constant texture data extension	• Reduces texture mapping memory utilization and loading time
• General performance improvements	• Offers better performance for all supported graphics cards; in particular, there has been some substantial performance gains for Sun Elite3D frame buffers; for some applications over 100 percent

Sun microsystems

OpenGL 1.1.2 API Technical Facts

OpenGL 1.1.2 API system requirements:

Platforms	Sun Elite3D, Sun Creator3D, Sun Creator, PGX, ZX, GX, TGX, SX graphics product families
• Operating environments supported	Solaris 2.5.1 Maintenance Update™ 3 Solaris 2.6 or higher Solaris 7
• Window system supported	CDE or OpenWindows™
Disk Space	
• For end-user run times	32 MB for 32-bit 55 MB for 64-bit
• For developers	
– Run time binaries and header files	44 MB for 32-bit 67 MB for 64-bit
– To build example files	54 MB for 32-bit 77 MB for 64-bit
Memory	64 MB minimum 128 MB or more recommended

Sun microsystems

The Sun Ultra™ systems use a marketing part number scheme that is designed to provide greater flexibility and expandability. This page explains how to read the part numbering scheme. "N" means "Not available" or "Not applicable."

A11-AAA1-1A-111AAC

System

Microprocessor family

Microprocessor speed

Ecache size

Number of microprocessors

Monitor

Frame buffer

Memory

Disk

"Non-standard" system
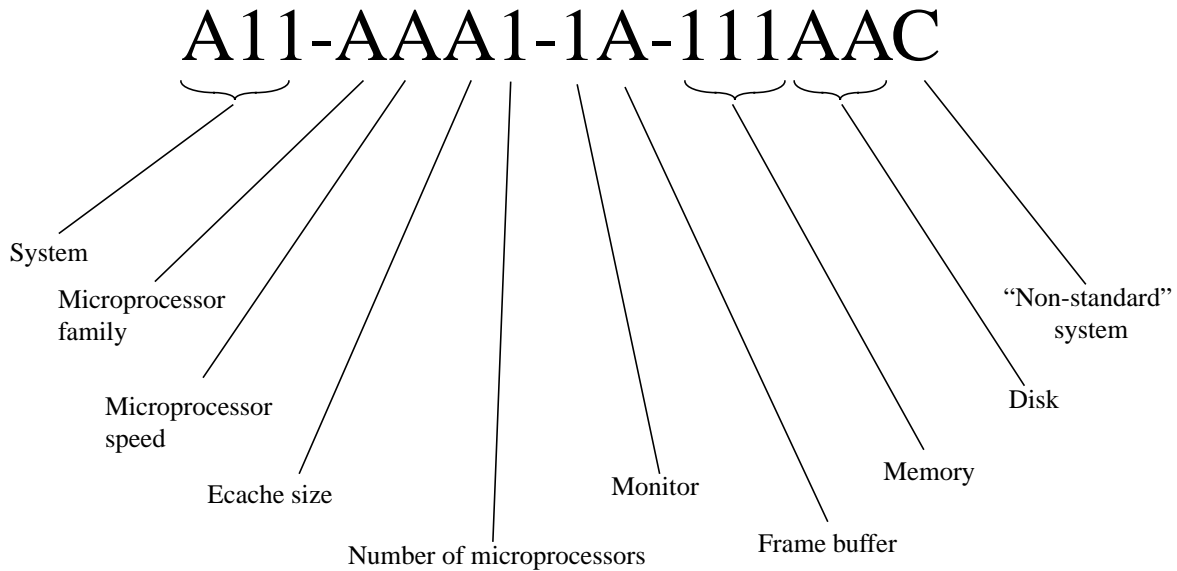
(Note: A = alpha character, 1 = numeric character, C = optional alpha or numeric character)

Model Key (Subset of Part Number Definitions)

System	Ecache Size	Memory
A23 = Sun Ultra 60 workstation	C = 2 MB	256 = 256 MB
	D = 4 MB	512 = 512 MB
Microprocessor Family		1024 = 1 GB
U = UltraSPARC™	**Monitor**	
	9 = No monitor configured	**Disk**
Microprocessor Speed		AH = 9.1 GB
G = UltraSPARC-II 360 MHz	**Frame Buffer**	AQ = 18.2 GB, 10000-rpm drive
L = UltraSPARC-II 450 MHz	L = Sun Creator3D	NN = Diskless
	M = Sun Elite3D m6	
	Q = Sun Elite3D m3	

Sun Ultra 60 Workstation Model 1360

Part Number	System
	One 360-MHz UltraSPARC-II processor with 4-MB Ecache and a 18.2-GB, 10000-rpm internal hard drive
A23-UGD1-9L-128AQ	128-MB DRAM, Sun Creator3D series 3 double-buffer graphics
A23-UGD1-9L-512AQ	512-MB DRAM, Sun Creator3D series 3 double-buffer graphics
A23-UGD1-9Q-256AQ	256-MB DRAM, Sun Elite3D m3 graphics
A23-UGD1-9Q-512AQ	512-MB DRAM, Sun Elite3D m3 graphics
A23-UGD1-9M-512AQ	512-MB DRAM, Sun Elite3D m6 graphics

Sun Ultra 60 Workstation Model 2360

Part Number	System
	Two 360-MHz UltraSPARC-II processors with 4-MB Ecache and a 18.2-GB, 10000-rpm internal hard drive
A23-UGD2-9L-256AQ	256-MB DRAM, Sun Creator3D series 3 double-buffer graphics
A23-UGD2-9L-512AQ	512-MB DRAM, Sun Creator3D series 3 double-buffer graphics
A23-UGD2-9Q-512AQ	512-MB DRAM, Sun Elite3D m3 graphics
A23-UGD2-9M-512AQ	512-MB DRAM, Sun Elite3D m6 graphics

Ordering Information

Sun Ultra 60 Workstation Model 1450

Part Number	System
	One 450-MHz UltraSPARC-II processor with 4-MB Ecache and a 18.2-GB, 10000-rpm internal hard drive
A23-ULD1-9L-256AQ	256-MB DRAM, Sun Creator3D series 3 double-buffer graphics
A23-ULD1-9L-512AQ	512-MB DRAM, Sun Creator3D series 3 double-buffer graphics
A23-ULD1-9Q-512AQ	512-MB DRAM, Sun Elite3D m3 graphics
A23-ULD1-9Q-1024AQ	1024-MB DRAM, Sun Elite3D m3 graphics
A23-ULD1-9M-512AQ	512-MB DRAM, Sun Elite3D m6 graphics

Sun Ultra 60 Workstation Model 2450

Part Number	System
	Two 450-MHz UltraSPARC-II processors with 4-MB Ecache and a 18.2-GB, 10000-rpm internal hard drive
A23-ULD2-9L-256AQ	256-MB DRAM, Sun Creator3D series 3 double-buffer graphics
A23-ULD2-9L-512AQ	512-MB DRAM, Sun Creator3D series 3 double-buffer graphics
A23-ULD2-9Q-512AQ	256-MB DRAM, Sun Elite3D m3 graphics
A23-ULD2-9M-512AQ	512-MB DRAM, Sun Elite3D m6 graphics

Ordering Information

Sun microsystems

Ordering Guidelines and Notes

- **Memory**
  - The Ultra 60 workstation supports 2 GB of main memory. The DIMMs are of the same type as those used in the SPARCstation™ 20, Ultra 1, and Ultra 2 systems. This architecture currently accepts 32-MB, 64-MB, or 128-MB memory modules.
  - The Ultra 60 workstation can accommodate up to 16 DIMM modules in increments of four. DIMM modules within each set *must* be of the same type. DIMM module sets of four may be mixed.

- **Graphics**
  - The Ultra 60 workstation has two UPA graphics slots that support *Sun Creator*, Sun Creator3D, Sun Elite3D m3, and Sun Elite3D m6 graphics accelerators. A customer can mix and match any of these accelerators within the Ultra 60 workstation with one exception: *only one Sun Elite3D m6 board can be supported by the Ultra 60 workstation with either a Sun Creator3D or Sun Elite3D m3 graphics adapter.*

- **Monitors**
  - Monitors are not included with any Ultra 60 systems.
  - A monitor must be purchased with an Ultra 60 workstation.
  - Only the Sun Creator3D graphics accelerator supports 1920 x 1200 resolution for 24-inch monitors. In addition, Sun Creator3D graphics provides single-buffered, *not* double-buffered support at this resolution. Single-buffering does not provide high-performance 3-D graphics imaging; therefore, 3-D intensive applications are not recommended with this configuration.

- **SCSI**
  - The internal SCSI host controller operates in Fast-20 (UltraSCSI) mode by default. Installation of non-FAST-20 devices, although allowed, will decrease overall SCSI performance.
  - The total combined SCSI cable length must not exceed three meters for fast/wide operation or 1.5 meters for Fast-20 (UltraSCSI) operation.
  - To achieve Fast-20 speeds on all devices on the bus, it is recommended that:
    - A maximum of two Sun StorEdge™ UniPack systems using Fast-20 cables be connected to the external connector.
    - All devices on the SCSI bus should be Fast-20 devices. (Non-Fast-20 devices may cause the internal devices to run at fast/wide speeds, but are supported.)

- **Keyboard**
  - Ultra 60 workstations come with Type-6 keyboards.
  - Type-4 keyboards are not supported on the Ultra 60 workstation. Order Type-5 keyboards, when applicable.

Sun microsystems

Options

Below is a comprehensive list of system expansion, networking, graphics, and multimedia options that are supported by Sun Ultra 60 systems. Refer to the Sun Price Book and configuration guides for currently available option listings, configuration notes, and ordering information. When no maximum number is listed, refer to ordering or configuration notes for that option.

Note: *Options listed in italics are supported by the Ultra 60 workstation, but are no longer available for purchase from Sun. These are listed only for reference purposes.*

Part Number	Option Description	Maximum Number Supported	Comments
Processors			
X1192A	UltraSPARC-II 360 MHz, 4-MB Level 2 cache	2	
X1195A	UltraSPARC-II 450 MHz, 4-MB Level 2 cache	2	
X1191A	*UltraSPARC-II 300 MHz, 2-MB Level 2 cache*	*2*	
Memory			These are all pairs of DIMM units
X7002A	64-MB, 60-ns DIMM memory expansion (2 x 32 MB)	8	
X7003A	128-MB, 60-ns DIMM memory expansion (2 x 64 MB)	8	
X7004A	256-MB, 60-ns DIMM memory expansion (2 x 128 MB)	8	
X7043A	128-MB, 60-ns DIMM memory expansion (2 x 64 MB	8	
X7001A	*32-MB, 60-ns DIMM memory expansion (2 x 16 MB)*	*8*	
Mass Storage— Internal			
X5229A	*9.1-GB, 7200-rpm fast/wide UltraSCSI disk, 1-inch high*	*2*	
X5232A	18.2-GB, 7200-rpm fast/wide UltraSCSI disk, 1.6-inch high	2	
X5234A	9.1-GB, 10000-rpm fast/wide UltraSCSI disk, 1-inch high	2	
X5237A	18.2-GB, 10000-rpm fast/wide UltraSCSI disk	2	
X6166A	SunCD™ 32X CD-ROM drive with cable (for FlexiPack)	1	
X6004A	3.5-inch, 1.44-MB manual-eject floppy drive (triple density)	1	
X6106A	4-GB to 8-GB SLR tape drive	1	
X6212A	7-GB to 14-GB, 8-mm tape drive	1	
X6282A	12-GB to 24-GB, 4-mm DDS-3 tape drive	1	
X5214A	4.2-GB, 7200-rpm fast/wide UltraSCSI disk	2	
X6203A	*14-GB, 8-mm tape drive*	*2*	
X6520A	*2.1-GB, 7200-rpm fast/wide UltraSCSI disk*	*2*	
X5251A	*9.1-GB, 7200-rpm fast/wide UltraSCSI disk*	*1*	
X6153A	*SunCD 4X CD-ROM*	*1*	
X6161A	*SunCD 12X CD-ROM drive with cable (for FlexiPack)*	*1*	
X6256A	*4-GB 4-mm DDS tape drive*	*1*	
X6203A	*14-GB 8-mm tape drive*	*1*	

Part Number	Option Description	Maximum Number Supported	Comments
Mass Storage— External			
X814A	*5.0-GB, 8-mm tape backup drive, desktop storage module*	*2*	
X827A	*20-GB, 4-mm tape autoloader, desktop storage module*	*2*	
X580A	*535-MB Fast SCSI-2 desktop disk pack*	*4*	
X545A	*1.05-GB Fast SCSI-2 desktop disk pack*	*4*	
X567A	*2.1-GB Fast SCSI-2 desktop disk pack*	*4*	
X737A	*2.1-GB Fast SCSI-2 desktop disk pack*	*4*	
X579A	*SunCD 2Plus™, desktop storage pack*	*2*	
X660A	*150-MB QIC tape drive, desktop storage pack*	*2*	
X822A	*5.0-GB, 4-mm tape drive, desktop storage pack*	*2*	
X834A	*10-GB, 8-mm backup tape drive, desktop storage module*	*2*	
X844A	*14.0-GB, 8-mm tape drive, desktop storage pack*	*2*	
Mass Storage— Sun StorEdge™ UniPack	*The following UniPack options come with a 68–68 pin SCSI cable:*		
Note:	*Order X3856A 68-pin to 68-pin SCSI cable with power cord for connecting a Sun StorEdge UniPack, FlexiPack, or MultiPack to Ultra 2, Ultra 30, Ultra 60, Ultra 450, Sun Enterprise™ 450, or Netra™ t systems*		
SG-XDSK010A-4G	4.2-GB, 7200-rpm UniPack	16	
SG-XDSK010A-9G	9.1-GB, 7200-rpm UniPack	16	
SG-XDSK010B-18G	18.2-GB, 7200-rpm UniPack	16	
X5101A	*1.05-GB, 7200-rpm fast/wide SCSI-2 disk UniPack*		
X5151A	*2.1-GB, 7200-rpm fast/wide SCSI-2 disk UniPack*		
X5209A	*4.2-GB, 7200-rpm fast/wide SCSI-2 disk UniPack*		
X5253A	*9.1-GB, 7200-rpm fast/wide SCSI-2 disk UniPack*		
SG-XTAPMLR-310A	25-GB to 50-GB MLR tape drive in a UniPack desktop enclosure	2	
SG-XTAPSLR-010A	4-GB to 8-GB SLR tape drive UniPack	2	
SG-XTAP4MM-011A	12-GB to 24-GB, 4-mm DDS-3 tape drive UniPack desktop enclosure	2	
SG-XTAP8MM-010A	7-GB to 14-GB, 8-mm drive in a UniPack desktop enclosure	2	
SG-XTAP8MM-011A	20-GB to 40-GB, 8-mm drive in a UniPack desktop enclosure	2	
X6101A	*2.5-GB QIC tape UniPack*	*1*	
X6208A	*14-GB, 8-mm tape UniPack*	*2*	
X6251A	*5-GB, 4-mm tape UniPack*	*2*	
X6261A	*4-GB to 8-GB, 4-mm DDS-2 drive*	*2*	
SG-XTAP-8MM-020A	*20-GB to 40-GB, 8-mm tape UniPack, desktop*	*2*	

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Part Number	Option Description	Maximum Number Supported	Comments
Mass Storage— Sun StorEdge UniPack (cont.)			
X6157A	SunCD 12X CD-ROM UniPack	1	
X6151A	*SunCD 4X CD-ROM UniPack*	*1*	
	The following UniPack options come with a 50–68 pin SCSI cable:		*NOTE*: 68-pin is required on the Ultra 60; these options supported if the correct cable is substituted
X5102A	*1.05-GB, 7200-rpm fast/wide SCSI-2 disk UniPack*	*4*	
X5152A	*2.1-GB, 7200-rpm fast/wide SCSI-2 disk UniPack*	*4*	
X5204A	*2.1-GB, 7200-rpm fast/wide SCSI-2 disk UniPack*	*4*	
X5213A	*4.2-GB, 7200-rpm fast/wide SCSI-2 disk UniPack*	*2*	
X5254A	*9.1-GB, 7200-rpm fast/wide SCSI-2 disk UniPack*	*2*	
X6152A	*SunCD 4X CD-ROM UniPack*	*1*	
X6158A	*SunCD 12X CD-ROM UniPack*	*2*	
X6102A	*2.5-GB QIC tape UniPack*	*2*	
X6202A	*14-GB, 8-mm tape UniPack*	*2*	
X6209A	*14-GB, 8-mm tape UniPack*	*2*	
X6252A	*5-GB, 4-mm tape UniPack*	*2*	
X6262A	*4-GB to 8-GB, 4-mm DDS-2 tape drive*	*2*	
X6281A	*12-GB to 24-GB, 4-mm DDS-3 tape drive*	*2*	
X6231A	*20-GB to 40-GB, 8-mm tape drive*	*2*	
Mass Storage— MultiDisk Pack			
X569A	*4.2-GB SCSI MultiDisk Pack (2 x 2.1-GB Fast SCSI-2 disk)*	*2*	
X570A	*8.4-GB SCSI MultiDisk Pack (4 x 2.1-GB Fast SCSI-2 disk)*	*1*	
X739A	*8.4-GB, 7200-rpm MultiDisk Pack (4 x 2.1-GB Fast SCSI-2 disk)*	*1*	
X748A	*8.4-GB SCSI MultiDisk Pack (2 x 4.2-GB Fast SCSI-2 disk)*	*2*	
X749A	*16.8-GB SCSI MultiDisk Pack (4 x 4.2-GB Fast SCSI-2 disk)*	*1*	
X771A	*2.1-GB SCSI MultiDisk Pack (2 x 1.05-GB)*	*2*	
X5211A	*8.4-GB (2 x 4.2 GB), 7200-rpm fast/wide SCSI-2 MultiPack*	*2*	
X5212A	*16.8-GB (4 x 4.2 GB), 5400-rpm fast/wide SCSI-2 MultiPack*	*1*	
X738A	*4.2-GB, 7200-rpm MultiDisk Pack (2 x 2.1 GB)*	*2*	

Ordering Information

Sun microsystems

Part Number	Option Description	Maximum Number Supported	Comments
Mass Storage— Sun StorEdge FlexiPack	*The following FlexiPack options come with a 68–68 pin SCSI cable:*		
SG-XTAP-DLT-020A	20-GB to 40-GB, DLT 4000 tape, desktop	2	
SG-XTAP-DLT-021A	35-GB to 70-GB, DLT 7000 tape, desktop	2	
SG-XTAP-4MM-021A	12-GB to 24-GB, 4-mm DDS-3 tape FlexiPack	2	
SG-XTAP-4MM-031A	72-GB to 144-GB, 4-mm DDS-3 tape FlexiPack, desktop autoloader	2	
SG-XTAP-8MM-020A	14-GB, 8-mm tape FlexiPack	2	
SG-XTAP-8MM-021A	20-GB to 40-GB, 8-mm tape FlexiPack, desktop	2	
SG-XTAP-SLR-020A	4-GB SLR tape FlexiPack	2	
SG-XTAP-MLR-320A	25-GB to 50-GB MLR drive FlexiPack, desktop	2	
SG-XTAP-8MM-011A	*7-GB to 14-GB, 8-mm tape FlexiPack, desktop*	*2*	
X6106A	4-GB to 8-GB SLR internal tape drive		
X6122A	25-GB MLR internal tape FlexiPack or Sun Enterprise server systems		
X6166A	32GB to 40-GB, 8-mm internal tape drive for FlexiPack		
X6212A	12-GB to 24-GB, 4-mm DDS-3 internal tape drive		
X6236A	20-GB to 40-GB, 8-mm internal tape for FlexiPack		
X6282A	12-GB, to 24 GB, 4-mm DDS-3 tape internal		
X6284A	*112-GB to 24-GB, 4-mm DDS-3 tape FlexiPack*	*2*	
X6264A	*4-GB to 8-GB, 4-mm DDS-3 tape FlexiPack*	*2*	
X6159A	*SunCD 12X CD-ROM FlexiPack*	*2*	
	The following FlexiPack options come with a 50–68 pin SCSI cable:		***NOTE**: 68-pin is required on the Ultra 60; these options are supported if the correct cable is substituted*
X6058A	*DLT 4000*	*2*	
X6061A	*DLT 7000*	*2*	
X6291A	*72-GB to 144-GB, 4-mm DDS-3 autoloader tape FlexiPack*	*2*	
X6285A	*12-GB to 24-GB, 4-mm DDS-3 tape FlexiPack*	*2*	
X6265A	*4-GB to 8-GB, 4-mm DDS-3 tape FlexiPack*	*2*	
X6233A	*20-GB to 40-GB, 8-mm tape FlexiPack*	*2*	
X6211A	*14-GB, 8-mm tape FlexiPack*	*2*	
X6150A	*SunCD 12X CD-ROM FlexiPack*	*2*	

Ordering Information

Part Number	Option Description	Maximum Number Supported	Comments
Mass Storage— Sun StorEdge MultiPack			
SG-XDSK020A-8G	8.4-GB (2 x 4.2-GB) 7200-rpm MultiPack	1	
SG-XDSK020A-18G	18.2-GB (2 x 9.1-GB) 7200-rpm MultiPack	1	
SG-XDSK020B-36G	36.4-GB (2 x 18.2-GB) 7200-rpm MultiPack	1	
SG-XDSK040A-16G	16.8-GB (4 x 4.2-GB) 7200-rpm MultiPack	1	
SG-XDSK040A-36G	36.4-GB (4 x 9.1-GB) 7200-rpm MultiPack	1	
SG-XDSK040B-72G	72.8-GB (4 x 18.2-GB) 7200-rpm MultiPack	1	
SG-XDSK060A-25G	25.2-GB (6 x 4.2-GB) 7200-rpm MultiPack	1	
SG-XDSK060A-54G	54.6-GB (6 x 9.1-GB) 7200-rpm MultiPack	1	
SG-XDSK060B-109G	109.2-GB (6 x 18.2-GB) 7200-rpm MultiPack	1	
SG-XLIBDLT1-280G	280-GB to 560-GB L280 tape autoloader (desktop)	1	
X5511A	*4.2-GB (2 x 2.1-GB), 7200-rpm fast/wide SCSI-2 MultiPack*	*1*	
X5512A	*12.6-GB (6 x 2.1-GB), 7200-rpm fast/wide SCSI-2 MultiPack*	*1*	
X5513A	*25.2-GB (12 x 2.1-GB), 7200-rpm fast/wide SCSI-2 MultiPack*	*1*	
X5514A	*8.4-GB (2 x 4.2-GB), 7200-rpm fast/wide SCSI-2 MultiPack*	*1*	
X5515A	*25.2-GB (6 x 4.2-GB), 7200-rpm fast/wide SCSI-2 MultiPack*	*1*	
X5516A	*50.4-GB (12 x 4.2-GB), 7200-rpm fast/wide SCSI-2 MultiPack*	*1*	
X5501A	*8.4-GB (2 x 4.2-GB), 7200-rpm fast/wide SCSI-2 MultiPack*	*1*	
X5502A	*16.8-GB (4 x 4.2-GB), 7200-rpm fast/wide SCSI-2 MultiPack*	*1*	
X5503A	*25.2-GB (6 x 4.2-GB), 7200-rpm fast/wide SCSI-2 MultiPack*	*1*	
X5504A	*18.2-GB (2 x 9.1-GB), 7200-rpm fast/wide SCSI-2 MultiPack*	*1*	
X5505A	*36.4-GB (4 x 9.1-GB), 7200-rpm fast/wide SCSI-2 MultiPack*	*1*	
X5506A	*54.6-GB (6 x 9.1-GB), 7200-rpm fast/wide SCSI-2 MultiPack*	*1*	
X6528A	*18.2-GB MultiPack (2 x 9.1-GB), 7200-rpm UltraSCSI*	*1*	
X6529A	*36.4-GB MultiPack (4 x 9.1-GB), 7200-rpm UltraSCSI*	*1*	

Part Number	Option Description	Maximum Number Supported	Comments
Sun StorEdge—Tape Libraries			
SG-XLIB8MMB-400G	400-GB to 800-GB 8-mm Sun StorEdge L400 tape library tower, 1 tape drive	1	
SG-XLIB8MM1-400G	400-GB to 800-GB 8-mm L400 tape library tower, 2 tape drives	1	
SG-XLIB8MMC-400G	400-GB to 800-GB 8-mm Sun StorEdge L1000 tape library rackmount, 2 tape drives	1	
SG-XLIBDLT1-1TB	L1000 tape library deskside, 1 DLT 7000 tape drive	1	
SG-XLIBDLT4-1TB	L1000 tape library deskside, 4 DLT 7000 tape drive	1	
SG-XLIBDLT1R-1TB	L1000 tape library rackmount, 1 DLT 7000 tape drive	1	
SG-XLIBDLT4R-1TB	L1000 tape library rackmount, 4 DLT 7000 tape drive	1	
X6227A	*140-GB L140, tower, one drive*	*1*	
SG-XLIB-8MM1-400G	*400-GB L400, tower, two drives, barcode*	*1*	
SG-XLIB-DLT1-280G	*Sun StorEdge L280 autoloader, desktop*	*1*	
X849A	*SPARCstorage™ Library Model 8/140, 140-GB, 8-mm stackable unit*	*1*	
X867A	*SPARCstorage Library Model 8/140, 140-GB, 8-mm, two drives and barcode reader, tower unit*	*1*	
X869X	*SPARCstorage Library Model 8/140, 140-GB, 8-mm, two drives and barcode reader, stackable unit*	*1*	
Sun StorEdge—Disk Arrays			
SG-XARY530A-91G	91-GB Sun StorEdge 5100 disk array (18-GB, 7200-rpm)	1	
SG-XARY530A-254G	254-GB Sun StorEdge 5100 disk array (18-GB, 7200-rpm)	1	
SG-XARY531A-254G	254-GB Sun StorEdge 5100 disk array (18-GB, 7200-rpm)	1	
SG-XARY533A-509.G	509-GB Sun StorEdge 5100 disk array (18-GB, 7200-rpm)	1	
SG-XARY533A-1528G	1.5-TB Sun StorEdge 5100 disk array (18-GB, 7200-rpm)	1	
SG-XARY520A-63G	63-GB Sun StorEdge 5200 disk array (9-GB, 10000-rpm)	1	
SG-XARY520A-200G	200-GB Sun StorEdge 5200 disk array (9-GB, 10000-rpm)	1	
SG-XARY521A-200G	200-GB Sun StorEdge 5200 disk array (9-GB, 10000-rpm)	1	
SG-XARY523A-400G	400-GB Sun StorEdge 5200 disk array (9-GB, 10000-rpm)	1	
SG-XARY523A-1200G	1.2-TB Sun StorEdge 5200 disk array (9-GB, 10000-rpm)	1	
Input Devices			
X180A	SunButtons™ 32-key function I/O device	1	
X190A	SunDials™ 8-dial interactive graphics I/O device for 3-D	1	

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Part Number	Option Description	Maximum Number Supported	Comments
PCI Expansion Cards			
X1032A	10/100BASE-T Ethernet with SunPCI™ UltraSCSI	4	
X1033A	10/100BASE-T Ethernet with MII PCI adapter	4	
X1034A	Sun Quad FastEthernet™ PCI Card (QFE)	1	
X1035A	SunFDDI™ single-attach PCI adapter (SAS/5.0)	3	
X1036A	SunFDDI dual-attach PCI adapter (DAS/5.0)	3	
X1039A	SunLink™ token ring interface/PCI adapter	2	
X1040A	High-speed serial interface PCI adapter (SunHSI™) (1 port)	3	Universal
X1041A	Serial asynchronous interface (SunSAI) PCI adapter	4	
X1066A	SunATM™/P-155MMF 3.0 PCI Bus adapter	2	
X1067A	SunATM/P-155UTP 3.0 PCI Bus adapter	2	
X1068A	SunATM/P-622MMF 3.0 PCI Bus adapter	1	
X1089A	SunVideo™ Plus video/audio capture	3	
X499A	PCI Multimedia Kit, SunVideo Plus, a PAL SunCamera™ II, Sun Microphone™ II, and documentation		
X1141A	Sun GigabitEthernet PCI adapter 2.0	1	
X6540A	Dual-channel, single-ended UltraSCSI controller	2	
X6541A	Dual-channel, differential UltraSCSI controller	3	
X1131A-64.2	SunPCi™ 400-MHz K6-2 co-processor card, 64-MB memory	1	
X1131A-64.1	*SunPCi 300-MHz K6-2 co-processor card, 64-MB memory*	*1*	
Graphics			
X3660A	PGX™ 8-bit color graphics PCI adapter frame buffer and cable	3	
X3668A	PGX32™ 8- and 24-bit color graphics PCI adapter frame buffer, CD, and cable	3	
X3670A	Sun Creator3D series 3, 24-bit color, double-buffered graphics accelerator, vertical board orientation, and cable	2	
X3664A	Sun Elite3D m3 graphics accelerator	2	
X3665A	Sun Elite3D m6 graphics accelerator	1	
X3662A	*Sun Creator series 3, single-buffered graphics*	*2*	
X3663A	*Sun Creator3D series 3, 24-bit color, double-buffered graphics accelerator, vertical board orientation, and cable*	*2*	
X3672A	*Sun Creator series 3, single-buffered graphics*	*2*	

Ordering Information

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Part Number	Option Description	Maximum Number Supported	Comments
Monitors			
X7103A	Entry-level 17-inch color monitor		
X328A	17-inch color monitor		
X7119A	19-inch color monitor		
X267A	20-inch color monitor		
X7121A	21-inch color monitor		
X7124A	Wide-screen 24-inch color monitor		
X7135A	19-inch flat screen color Trinitron monitor		
X7136A	21-inch flat screen color Trinitron monitor		
X7127A	18.1-inch flat panel LCD display		
X3872A	HD15-pin video output (for 17-inch and 19-inch monitors)		

Ordering Information

Sun microsystems

Upgrades

Sun upgrades offer customers superior investment protection for their existing Sun equipment.
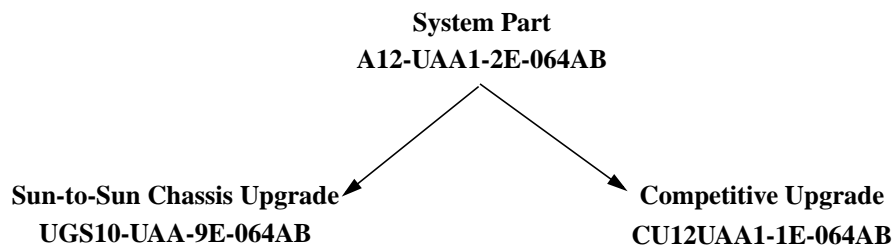
Key Messages

- Sun offers customers a variety of flexible upgrade paths to the most popular Sun systems

- Choose from chassis-only to full-system upgrades

- Sun upgrades allow as many components as possible to be carried forward, to protect the customer's hardware investment

- Existing investments in non-Sun hardware can be preserved by upgrading to Sun through competitive full-system upgrades

- SPARCstation 20 or Ultra workstation upgrades offer superior value by allowing the migration of memory to Sun Ultra 60 systems

Sun Ultra 60 Workstation Upgrade Paths

From	Receive	Return
Full system upgrade from Any SPARCstation or Ultra to Ultra 60 workstation	Complete Ultra 60 system	Complete SPARCstation or Ultra workstation
Competitive upgrade to Ultra 60 workstation	Complete Ultra 60 system	Complete competitive workstation

Marketing Upgrade Numbering Scheme

System Part
A12-UAA1-2E-064AB

Sun-to-Sun Chassis Upgrade
UGS10-UAA-9E-064AB

Competitive Upgrade
CU12UAA1-1E-064AB

- The differences between the upgrade and system part numbers lie in the first eight characters; the ten trailing characters carry the same interpretation as system parts.

- Sun-to-Sun upgrades begin with U or UG; competitive upgrades begin with CU.

- Sun-to-Sun upgrades show the "from" path system in the first three characters that follow the U or UG.

- Character representations following the "from" system have the same interpretation as system parts, but dashes may be removed from left to right, as necessary, to meet the maximum part number length of 18 characters.

Module Upgrades

Part Number	Description
UG-M300-M360-U60	Module upgrade from Ultra 60 workstation Model 300 to Model 360
UG-MXXX-M450	Module upgrade from SPARC or UltraSPARC processor to 450-MHz CPU

Upgrade to Sun Ultra 60 Workstation Model 1360

Part Number	Description
USS2-3UGD19L-128AQ	Chassis upgrade from any SLC™, ELC™, IPC™, 1/1+, SPARCclassic™, LX, IPX™, or SPARCstation 2 to Ultra 60 workstation, one 360-MHz UltraSPARC-II processor with 4-MB Ecache, Sun Creator3D series 3 double-buffered graphics, 128-MB DRAM, 18.2-GB internal hard drive, Solaris workstation license
UG14-3UGD19L-000AQ	Chassis upgrade from an Ultra 1 or Ultra 2 workstation to Ultra 60 workstation, one 360-MHz UltraSPARC-II processor with 4-MB Ecache, Sun Creator3D series 3 double-buffered graphics, memoryless, 18.2-GB internal hard drive, Solaris workstation license
UG14-3UGD19M-000AQ	Chassis upgrade from an Ultra 1 or Ultra 2 workstation to Ultra 60 workstation, one 360-MHz UltraSPARC-II processor with 4-MB Ecache, Sun Elite3D m6 graphics, memoryless, 18.2-GB internal hard drive, Solaris workstation license
UG14-3UGD19Q-128AQ	Chassis upgrade from an Ultra 1 or Ultra 2 workstation to Ultra 60 workstation, one 360-MHz UltraSPARC-II processor with 4-MB Ecache, Sun Elite3D m3 graphics, memoryless, 18.2-GB internal hard drive, 128-MB DRAM, Solaris workstation license
UG20-3UGD19L-128AQ	Chassis upgrade from a SPARCstation 10 or 20 to Ultra 60 workstation, one 360-MHz UltraSPARC-II processor with 4-MB Ecache, Sun Creator3D series 3 double-buffered graphics, 128-MB DRAM, 18.2-GB internal hard drive, Solaris workstation license
UG20-3UGD19Q-128AQ	Chassis upgrade from a SPARCstation 10 or 20 to Ultra 60 workstation, one 360-MHz UltraSPARC-II processor with 4-MB Ecache, Sun Elite3D m3 graphics, 128-MB DRAM, 18.2-GB internal hard drive, Solaris workstation license
UG20-3UGD19M-128AQ	Chassis upgrade from a SPARCstation 10 or 20 to Ultra 60 workstation, one 360-MHz UltraSPARC-II processor with 4-MB Ecache, Sun Elite3D m6 graphics, 128-MB DRAM, 18.2-GB internal hard drive, Solaris workstation license

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Upgrade to Sun Ultra 60 Workstation Model 1450

Part Number	Description
USS2-3ULD19L-256AQ	Chassis upgrade from any SLC, ELC, IPC, 1/1+, SPARCclassic, LX, IPX, or SPARCstation 2 to Ultra 60 workstation, one 450-MHz UltraSPARC-II processor with 4-MB Ecache, Sun Creator3D series 3 double-buffered graphics, 256-MB DRAM, 18.2-GB internal hard drive, Solaris workstation license
USS2-3ULD19Q-256AQ	Chassis upgrade from any SLC, ELC, IPC, 1/1+, SPARCclassic, LX, IPX, or SPARCstation 2 to Ultra 60 workstation, one 450-MHz UltraSPARC-II processor with 4-MB Ecache, Elister3D m3 graphics, 256-MB DRAM, 18.2-GB internal hard drive, Solaris workstation license
UG16-3ULD19L-000AQ	Chassis upgrade from an Ultra 1 or Ultra 2 workstation to Ultra 60 workstation, one 450-MHz UltraSPARC-II processor with 4-MB Ecache, Sun Creator3D series 3 double-buffered graphics, memoryless, 18.2-GB internal hard drive, Solaris workstation license
UG16-3ULD19Q-000AQ	Chassis upgrade from an Ultra 1 or Ultra 2 workstation to Ultra 60 workstation, one 450-MHz UltraSPARC-II processor with 4-MB Ecache, Sun Elite3D m3 graphics, memoryless, 18.2-GB internal hard drive, Solaris workstation license
UG16-3ULD19M-000AQ	Chassis upgrade from an Ultra 1 or Ultra 2 workstation to Ultra 60 workstation, one 450-MHz UltraSPARC-II processor with 4-MB Ecache, Sun Elite3D m6 graphics, memoryless, 18.2-GB internal hard drive, Solaris workstation license
UG20-3UGD19L-256AQ	Chassis upgrade from a SPARCstation 4, 5, 10 or 20 to Ultra 60 workstation, one 450-MHz UltraSPARC-II processor with 4-MB Ecache, Sun Creator3D series 3 double-buffered graphics, 256-MB DRAM, 18.2-GB internal hard drive, Solaris workstation license
UG20-3ULD19Q-256AQ	Chassis upgrade from a SPARCstation 4, 5, 10 or 20 to Ultra 60 workstation, one 450-MHz UltraSPARC-II processor with 4-MB Ecache, Sun Elite3D m3 graphics, 256-MB DRAM, 18.2-GB internal hard drive, Solaris workstation license
UG20-3ULD19Q-1024AQ	Chassis upgrade from a SPARCstation 4, 5, 10 or 20 to Ultra 60 workstation, one 450-MHz UltraSPARC-II processor with 4-MB Ecache, Sun Elite3D m3 graphics, 1024-MB DRAM, 18.2-GB internal hard drive, Solaris workstation license

Ordering Information

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UG20-3ULD19M-256AQ

Chassis upgrade from a SPARCstation 10 or 20 to Ultra 60 workstation, one 450-MHz UltraSPARC-II processor with 4-MB Ecache, Sun Elite3D m6 graphics, 256-MB DRAM, 18.2-GB internal hard drive, Solaris workstation license

UG20-3ULD19M-512AQ

Chassis upgrade from a SPARCstation 10 or 20 to Ultra 60 workstation, one 450-MHz UltraSPARC-II processor with 4-MB Ecache, Sun Elite3D m6 graphics, 512-MB DRAM, 18.2-GB internal hard drive, Solaris workstation license

Upgrade to Sun Ultra 60 Workstation Model 2450

Part Number	Description
USS2-3ULD29L-256AQ	Chassis upgrade from any SLC, ELC, IPC, 1/1+, SPARCclassic, LX, IPX, or SPARCstation 2 to Ultra 60 workstation, two 450-MHz UltraSPARC-II processors with 4-MB Ecache, Sun Creator3D series 3 double-buffered graphics, 256-MB DRAM, 18.2-GB internal hard drive, Solaris workstation license
UG16-3ULD29Q-000AQ	Chassis upgrade from an Ultra 1 or Ultra 2 workstation to Ultra 60 workstation, two 450-MHz UltraSPARC-II processors with 4-MB Ecache, Sun Elite3D m3 graphics, memoryless, 18.2-GB internal hard drive, Solaris workstation license
UG16-3ULD29M-000AQ	Chassis upgrade from an Ultra 1 or Ultra 2 workstation to Ultra 60 workstation, two 450-MHz UltraSPARC-II processors with 4-MB Ecache, Sun Elite3D m6 graphics, memoryless, 18.2-GB internal hard drive, Solaris workstation license
UG20-3ULD19M-512AQ	Chassis upgrade from a SPARCstation 10 or 20 to Ultra 60 workstation, two 450-MHz UltraSPARC-II processors with 4-MB Ecache, Sun Elite3D m6 graphics, 512-MB DRAM, 18.2-GB internal hard drive, Solaris workstation license

Ordering Information

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Competitive Upgrades to Sun Ultra 60 Workstation Model 1360

Part Number	Model 1360
CU-3UGD1-9L-256AQ	Upgrade from competitive system to Ultra 60 workstation, one 360-MHz UltraSPARC-II processor with 4-MB Ecache, Sun Creator3D series 3 double-buffer graphics, 256-MB DRAM, 18.2-GB internal hard drive, Solaris workstation license
CU-3UGD1-9Q-128AQ	Upgrade from competitive system to Ultra 60 workstation, one 360-MHz UltraSPARC-II processor with 4-MB Ecache, Sun Elite3D m3 graphics, 128-MB DRAM, 18.2-GB internal hard drive, Solaris workstation license
CU-3UGD1-9M-128AQ	Upgrade from competitive system to Ultra 60 workstation, one 360-MHz UltraSPARC-II processor with 4-MB Ecache, Sun Elite3D m6 graphics, 128-MB DRAM, 18.2-GB internal hard drive, Solaris workstation license

Competitive Upgrades to Sun Ultra 60 Workstation Model 1450

Part Number	Model 1360
CU-3ULD1-9L-256AQ	Upgrade from competitive system to Ultra 60 workstation, one 450-MHz UltraSPARC-II processor with 4-MB Ecache, Sun Creator3D series 3 double-buffer graphics, 256-MB DRAM, 18.2-GB internal hard drive, Solaris workstation license
CU-3ULD1-9Q-256AQ	Upgrade from competitive system to Ultra 60 workstation, one 450-MHz UltraSPARC-II processor with 4-MB Ecache, Sun Elite3D m6 graphics, 256-MB DRAM, 18.2-GB internal hard drive, Solaris workstation license
CU-3ULD1-9M-256AQ	Upgrade from competitive system to Ultra 60 workstation, one 450-MHz UltraSPARC-II processor with 4-MB Ecache, Sun Elite3D m6 graphics, 256-MB DRAM, 18.2-GB internal hard drive, Solaris workstation license

Competitive Upgrades to Sun Ultra 60 Workstation Model 2450

Part Number	Model 2360
CU-3ULD2-9L-256AQ	Upgrade from competitive system to Ultra 60 workstation, two 450-MHz UltraSPARC-II processors with 4-MB Ecache, Sun Creator3D series 3 double-buffer graphics, 256-MB DRAM, 18.2-GB internal hard drive, Solaris workstation license

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Upgrade Ordering Notes

- Memory migrates from Ultra 1 and Ultra 2 workstations; disks do not migrate
- 300-MHz modules from the Ultra 2 and Ultra 30 workstations will migrate
- Graphics cards from A12 and A14 do not migrate to the Ultra 60 workstation
- Monitors
    - Monitors are not included with any Ultra 60 system upgrades
    - Sun branded 17-inch and 20-inch monitors migrate from previous generation Sun systems
    - For some monitors, a video adapter may be required. Please order the correct adapter (example: a 21-inch color monitor with on-board 8-bit graphics requires X470A). Adapter choices are:
        - X3872A—HD15F to 13W3 video adapter
        - X470A—13W3F to HD15M video adapter (10-inch cable)
    - If a monitor is needed, order an X-option or refer to monitor upgrade section of price book
- Country kits
    - Type-4 keyboards are not supported on the Ultra 60 workstation
    - Type-5 keyboards can migrate to the Ultra 60 workstation

Service and Support

The SunSpectrum℠ program is an innovative and flexible service offering that allows customers to choose the level of service best suited to their needs—ranging from mission-critical support for maximum solution availability to backup assistance for self-support customers. The SunSpectrum program provides a simple pricing structure in which a single fee covers support for an entire system, including related hardware and peripherals, the Solaris™ Operating Environment software, and telephone support for Sun software packages. The majority of Sun's customers today take advantage of the SunSpectrum program, underscoring the value it represents. Customers should check with their local Sun Enterprise Services representative for program/feature variance and availability in their area.

FEATURE	SUNSPECTRUM PLATINUM℠ Mission-critical Support	SUNSPECTRUM GOLD℠ Business-critical Support	SUNSPECTRUM SILVER℠ Systems Support	SUNSPECTRUM BRONZE℠ Self Support
Systems Features				
Systems approach coverage	Yes	Yes	Yes	Yes
System availability guarantee	Customized	No	No	No
Account Support Features				
Service account management team	Yes	No	No	No
Local customer support management	No	Yes	No	No
Personal technical account support	Yes	Yes	Option	No
SunStart℠ installation service	Yes	No	No	No
Account support plan	Yes	Yes	No	No
Software release planning	Yes	No	No	No
On-site account reviews	Monthly	Semiannual	No	No
Skills assessment	Yes	No	No	No
Site activity log	Yes	Yes	No	No
Coverage / Response Time				
Standard telephone coverage hours	7 day/24 hour	7 day/24 hour	8 a.m.–8 p.m., Monday–Friday	8 a.m.–5 p.m., Monday–Friday
Standard on-site coverage hours	7 day/24 hour	8 a.m.–8 p.m., Monday–Friday	8 a.m.–5 p.m., Monday–Friday	N/A
7-day/24-hour telephone coverage	Yes	Yes	Option	Option
7-day/24-hour on-site coverage	Yes	Option	Option	N/A
7-day/12-hour on-site coverage	No	Option	No	No
5-day/24-hour on-site coverage	No	Option	No	No

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FEATURE	SUNSPECTRUM PLATINUM[SM] Mission-critical Support	SUNSPECTRUM GOLD[SM] Business-critical Support	SUNSPECTRUM SILVER[SM] Systems Support	SUNSPECTRUM BRONZE[SM] Self Support
Coverage / Response Time (cont.)				
Customer-defined priority setting	Yes	Yes	Yes	Option
• Urgent (phone/on-site)	Live transfer/ 2 hour	Live transfer/ 4 hour	Live transfer/ 4 hour	4 hour / N/A
• Serious (phone/on-site)	Live transfer/ 4 hour	2 hour/next day	2 hour/next day	4 hour / N/A
• Not critical (phone/on-site)	Live transfer/ customer convenience	4 hour/ customer convenience	4 hour/ customer convenience	4 hour / N/A
2-hour on-site response	Yes	Option	Option	N/A
Additional contacts	Option	Option	Option	Option
Premier Support Features				
Mission-critical support team	Yes	For urgent problems	No	No
Sun Vendor Integration Program (SunVIP[SM])	Yes	Yes	No	No
Software patch management assistance	Yes	No	No	No
Field change order (FCO) management assistance	Yes	No	No	No
Hardware Support Delivery				
Replacement hardware parts	On-site technician	On-site technician	On-site technician	Courier
Two day parts delivery	N/A	N/A	N/A	Yes
Overnight parts delivery	N/A	N/A	N/A	Option
Same-day parts delivery	Yes	Yes	Yes	Option
Remote Systems Diagnostics				
Remote dial-in analysis	Yes	Yes	Yes	Yes
Remote systems monitoring	Yes	Yes	No	No
Remote predictive failure reporting	Yes	Yes	No	No
Software Enhancements and Maintenance Releases				
Solaris enhancement releases	Yes	Yes	Yes	Yes
Patches and maintenance releases	Yes	Yes	Yes	Yes
Sun unbundled software enhancements	Option	Option	Option	Option
Internet and CD-ROM Support Tools				
SunSolve[SM] license	Yes	Yes	Yes	Yes
SunSolve EarlyNotifier[SM] Service	Yes	Yes	Yes	Yes

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SunClient℠ Support Program

Now there is a way to reduce hardware and software support costs for JavaStation™ network computers and the Ultra™ 5 and Ultra 10 workstations. The SunClient℠ support program is a suite of offerings that is separate, yet complementary to the SunSpectrum program. SunClient support provides:

- A choice for optimizing low-cost workstation support
- Flexibility to select only the services needed
- Administrative simplicity, saving time and money
- Access to world-class UNIX® networking experts

FEATURE	SunClient Maintenance	SunClient Central Maintenance	SunClient Software Tech Support Option*
Systems approach coverage	*	*	
Solaris and unbundled software technical support	—	—	*
9 a.m.–5 p.m., Monday–Friday telephone coverage	*	*	*
9 a.m.–5 p.m., Monday–Friday on-site coverage	*†‡	*‡	—
Response times (phone/onsite)	4 hour callback/next business day response	4 hour callback/second business day response	4 hour callback
Centralized on-site repair of multiple units	—	*	Not Applicable
Patches	Not Applicable	Not Applicable	*
SunSolve license	Not Applicable	Not Applicable	*
SunSolve EarlyNotifier Service	Not Applicable	Not Applicable	*
Software updates	Not Applicable	Not Applicable	Not Applicable

* Can only be sold as an option to SunClient Maintenance or SunClient Central Maintenance.

† Next business day on-site response requires that the request for service be received by 3:00 p.m. If the call is received after 3:00 p.m., service will be provided on the second business day.

‡ Customers located more than 50 miles from an authorized service provider or reseller will be charged an additional fee for service activity.

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Features and Benefits of the SunClient Program

Features	Benefits

Features

- Unbundled hardware and software support

- Next business day (SunClient Maintenance) or second business day (SunClient Central Maintenance) on-site response

- Single contract with choice of automatic warranty upgrade

- SunClient Central Maintenance

- Service delivery by Sun experts

Benefits

- *Flexibility*

  Select the type and amount of coverage needed for desktop systems, so service dollars are targeted where they are needed most.

- *Cost savings*

  Pay only for the support services needed.

- *Cost efficiency*

  Because Sun can more efficiently manage spare inventory and labor scheduling, the savings can be passed on to the customer.

- *Simplicity*

  One contract covers a predefined number of systems at one low price. New systems acquired can be upgraded to the SunClient service level.

- *Cost savings*

  Sun realizes an economy of scale by repairing multiple systems with one visit and leverages existing support infrastructures, so cost efficiency is maximized while duplication of effort is eliminated.

- *Consistency*

  Selected desktops can be deployed anywhere with assurance of cost-effective, quality service and support.

For more information, visit the SunClient support web site at:
`http://www.sun.com/service/support/sunclient`

Service and Support

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Glossary

24-bit color	The ability to render objects from a palette of 16.7 million colors. It is often referred to as true color and results in much more realistic shading of 3-D objects for enhanced image quality.
3D-RAM	Dual-ported video memory with graphics functionality built into the memory chip.
100BASE-T	*See* Fast Ethernet.
Antialiasing	A graphics technique that greatly enhances the quality of images by eliminating many of the inaccuracies ("jaggies") inherent to rendering on a raster display. Typically found only in high-end graphics systems.
DIMM	Dual inline memory module. A memory unit that can come in a variety of sizes, such as 16 MB, 32 MB, 64 MB, and 128 MB.
Fast Ethernet	IEEE standard for 100-Mb Ethernet. This technology supports a data transfer rate of 100 megabits per second over special grades of twisted-pair wiring.
MII	Media independent interface. Used for connecting external transceivers to Fast Ethernet.
ODBC	Open database connectivity.
OpenGL®	The de facto standard software interface for graphics hardware that allows programmers to create interactive 3-D applications. The OpenGL API provides a full-featured, network-transparent application programming interface.
PCI	Peripheral component interconnect. A industry standard for connecting peripherals such as disk drives, tapes drives, and other devices used in the PCs.
PLBwire93	The Picture Level Benchmark for wireframe performance. A benchmark standardized by the National Computer Graphics Associated GPC committee. The value represents the geometric mean performance on several commonly used 3-D wireframe operations.
PLBsurf93	The Picture Level Benchmark for 3-D surface performance. A benchmark standardize by the National Computer Graphics Associated GPC committee. The value represents the geometric mean performance on several commonly used 3-D surface operations.
UPA	Ultra™ port architecture. A high-speed, crossbar-oriented, packet-switched mother board interconnect.
V9	Version 9 of the SPARC™ definition.

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VIS™	Visual instruction set. The UltraSPARC™ processor implements a special instruction set that is primarily aimed at image and video processing. Some of the instructions allow the CPU to directly access and operate on image data with a high degree of parallelism. Other instructions provide facilities for formatting and moving data at very high rates of speed both within the CPU, and between the CPU and the other system components.
XGL™	A foundation geometry-oriented 2-D/3-D graphics library that provides high functionality and performance to geometry applications and application program interfaces (APIs).
XIL™	X imaging library. A foundation imaging-oriented graphics library providing high functionality and performance to imaging applications.

Glossary

Materials Abstract

All materials are available on SunWIN except where noted otherwise.

Collateral	Description	Purpose	Distribution	Token # or COMAC Order #
PowerPack				
– *Sun Ultra™ 60 Workstation: Just the Facts*	Reference Guide for Sun Ultra 60 Workstation	Training Sales Tool	SunWIN, Reseller Web	75244
– *Sun Ultra 60 Workstation Customer Presentation*	Presentation	Sales Tool	SunWIN, Reseller Web	75252
References				
– *Sun Intro—Ultra 60 Workstations, January 1998*	Introduction E-mail	Sales Tool	SunWIN, Reseller Web, E-mail	77896, 77897
– *Sun Intro—Ultra 60 Workstations, April 1998*	Introduction E-mail	Sales Tool	SunWIN, Reseller Web, E-mail	85164
– *Ultra 60 Architecture White Paper, April 1998*	White Paper	Training Sales Tool	SunWIN, Reseller Web	75264
– *Sun™ Elite3D: Just the Facts, 1/98*	Reference Guide for Sun Elite3D m6 Graphics	Training Sales Tool	SunWIN, Reseller Web	75245
– *SunVideo Plus™: Just the Facts, January 1998*	Reference Guide for Sun Video Plus	Training Sales Tool	SunWIN	75247
– *Sun Creator Graphics series 3: Just the Facts*	Reference Guide for Sun Creator Graphics, series 3	Training Sales Tool	SunWIN, Reseller Web	75246
– *Graphics Solution Guide*	Graphics Overview	Sales Tool	SunWIN	75271
Presentations				
– *Sun in EDA Customer Presentation*	Presentation	Sales Tool	SunWIN, Reseller Web	59078
– *Sun in MCAD/MCAE Customer Presentation*	Presentation	Sales Tool	SunWIN, Reseller Web	59074
– *Sun in Software Development Customer Presentation*	Presentation (with slide notes)	Sales Tool	SunWIN, Reseller Web	59375
– *Sun in Geotechnical Customer Presentation*	Presentation	Sales Tool	SunWIN, Reseller Web	60292
– *Sun in Digital Content Creation, Customer Presentation*	Presentation	Sales Tool	SunWIN	75241
– *Graphics Overview Presentation*	Presentation	Sales Tool	SunWIN, Reseller Web	75254

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Collateral	Description	Purpose	Distribution	Token # or COMAC Order #
Quick Reference Cards				
– *Quick Reference Card—Sun Workstation™ Product Line Overview*	Quick Reference Card	Sales Tool	SunWIN, Reseller Web, First Resort	10826
– *Quick Reference Card—Sun Workstation Graphics Products Overview*	Quick Reference Card	Sales Tool	SunWIN, Reseller Web, First Resort	24507
– *Quick Reference Card— Competitive Summary Workstations*	Quick Reference Card	Sales Tool	SunWIN, Reseller Web, First Resort	12259
– *Quick Reference Card— Upgrade Paths*	Quick Reference Card	Sales Tool	SunWIN, Reseller Web, First Resort	24513
External Web Sites				
– *General Information on Sun's Desktop Line*	`http://www.sun.com/desktop`			
– *Detailed Information on the Ultra 60 Workstation*	`http://www.sun.com/desktop/products/Ultra60`			

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