Creator Graphics (Series 3)

Just the Facts

Sun microsystems

Creator Graphics Positioning

Introduction

Creator Graphics series 3 is the latest generation of the 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.

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 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, Creator Graphics was available in two configurations:

- The single-buffered configuration (known as Creator) supported hardware acceleration of 2-D graphics.
- The double-buffered configuration (known as 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 (Creator 3D) is now available.

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

Creator Graphics Models

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

Creator (no longer available)	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

- up3.22 68.72 D 283.22 68.72 282.79 68.3 282.79 68.3 D 282.79 68.3 282.79 68.3 282.79 68.3 D 282.79 68.3 288.42 investment in SBus-based peripherals and applications
- Low-cost, multiprocessing-capable workstation for multiprocessing and multithreaded application environments
- Upgradeable CPU modules

Key Messages

- **High-performance graphics**

  Creator Graphics performance is based upon the Creator approach to designing graphics. In series 3, the Creator Graphics technology is enhanced, with

Ultra 60 Workstation with Creator3D Graphics

Ultra 60 workstations with Creator3D are, like the Ultra 2, targeted at the high-performance compute-intensive and moderately graphics-intensive segment of its target markets. These markets include MCAD/MCAE, oil and gas, simulation and visualization applications, and command and control. Customers in this group need as much performance as possible, including multiprocessing capabilities, high memory capacity, and I/O bandwidth.

Features include:

- Maximum CPU performance
- PCI-based expansion capability with dual PCI-bus interfaces, with one 66-MHz PCI slot
- Large memory footprint with up to 2 GB of memory
- Two UPA slots capable of supporting two high-performance Creator3D cards

Sun Enterprise™ 3500-6500 Servers with Creator3D Graphics

The Sun Enterprise™ server family with Creator3D graphics is targeted at strategic markets, including: manufacturing, government, education, health care, design automation, and earth sciences. The following sections describe how each server in the Sun Enterprise family has different characteristics and is therefore deployed in a different capacity within the target markets.

The target markets for the Sun Enterprise servers include:

- Design automation
- MCAE (sweet spot of 4 to 8 processors)
- High-end MCAD
- Visualization/simulation
- Cave/virtual portals
- Large screen displays for viewing
- Earth resources
- Oil and gas
- Education/training
- Aerospace
- Defense
- Digital content creation
- Real-time animation review
- Virtual prototyping
- Command and control
- R&D

Sun Enterprise 3500 Server with Creator3D Graphics

The Sun Enterprise 3500 server with Creator3D is targeted at users who have multiprocessor and memory footprint requirements as well as extremely demanding I/O needs. It is targeted at design and analysis customers who, for example, want to use a multiprocessing system to perform CAD design work while running an analysis application in the background.

The Sun Enterprise 3500 server is an affordable server with unprecedented power and reliability in its class. The Sun Enterprise 3500 server enables customers to deploy sophisticated technical applications with the kind of performance and reliability previously available only in very expensive large-scale systems.

The Sun Enterprise 3500 server is ideal for customers who need application servers with tremendous network throughput and processing power, in addition to high reliability, availability, and serviceability. The Sun Enterprise 3500 server is ideal for price-sensitive customers who need integrated storage or want the investment protection offered by an expandable family of servers. The Sun Enterprise 3500 server with Creator3D graphics can be used for running dedicated, compute-intensive and high-end graphics applications.

In its line of Sun High-Performance Computing (HPC) servers, Sun offers the Sun HPC 3500 server, which combines the Sun Enterprise 3500 server with Sun™ HPC software that allows the platform to scale in the most demanding technical and supercomputing environments.

Unique product features include:

- Low-cost server for multiprocessing and multithreaded application environments
- Multiple frame buffer support up to three Creator3D frame buffers with up to four CPUs, two Creator3D frame buffer with six CPUs or one Creator3D frame buffers with up to eight high-performance UltraSPARC™ CPUs
- Upgradeable CPU modules
- Integrated storage

Sun Enterprise 4500 Server with Creator3D Graphics

The Sun Enterprise 4500 server is a versatile server with exceptional value for companies requiring affordable servers with tremendous computational power, and the ability to scale system performance and capacity as their needs grow. The Sun Enterprise 4500 server with Creator3D is targeted at users who have multiprocessor and memory footprint requirements as well as extremely demanding I/O needs.

The Sun Enterprise 4500 server is ideal for customers who need an enterprise-wide application server with high reliability, availability, and serviceability. Typical Sun Enterprise 4500 server customers use their servers to provide access to large CAD databases, product data management systems, decision support applications, or visual simulation applications.

The Sun Enterprise 4500 server is recommended over the Sun Enterprise 3500 server if the customer's I/O and CPU growth requirements go beyond the capacity of the Sun Enterprise 3500 server.

Unique product features include:

- High-performance server for multiprocessing and multithreaded application environments
- Compact packaging
- Upgradeable CPU modules

Sun Enterprise 5500 Server with Creator3D Graphics

The Sun Enterprise 5500 server is a scalable and reliable data center server capable of running mission-critical applications. The Sun Enterprise 5500 server is ideal for customers who have mainframe-class system requirements. With features previously only in fault-tolerant and mainframe systems, the Sun Enterprise 5500 server has a comprehensive set of uptime features. The Sun Enterprise 5500 server is recommended over the 4500 server if the customer needs a rackmount system with integrated mass storage.

Unique product features include the following:

- Rackmountable
- Integrated mass storage

Sun Enterprise 6500 Server with Creator3D Graphics

The Sun Enterprise 6500 server is ideal for customers who need to build network computing applications of a size and scale that previously required mainframes or supercomputers. The customer receives the benefits of improved data access and flexibility even as data grows to multiple terabytes. The Sun Enterprise 6500 server offers more than twice the CPU, memory, and Creator3D Graphics expandability of the Sun Enterprise 5500 server. The Sun Enterprise 6500 server should be recommended when the Sun Enterprise 5500 does not offer enough expandability.

This product is targeted at users who need the high performance of Sun Enterprise server systems and who need CPU, memory, I/O, and other server support features.

Unique product features include the following:

- Most expandable, multiprocessing-capable graphics server for multiprocessing and multithreaded application environments
- Up to four Creator3D series 3 frame buffers are supported at this time
- Upgradeable CPU modules

Target Markets

Creator3D graphics addresses the high-performance graphics requirements of Sun's traditional technical workstation markets such as MCAD/MCAE, earth resources, medical, and R&D. Additionally, Creator3D allows expansion into new high-growth markets and areas such as digital content creation and visualization/ simulation. Visualization/simulation is being used more and more by companies who are turning to computers for complete digital mock-ups of products and to gain insight and understanding of very complex problems and data. These people need power to perform.

Users in these markets have an ever-increasing need to work with more information and data with shorter turnaround, shorter time frames, and shrinking budgets and resources. Within each of these markets, there is a class of users who always need more performance and scale their projects to the hardware they can afford.

New ISVs and applications have been ported to Sun within these markets that previously ran only on competitive systems from companies such as SGI and IBM, or even only on PCs. More applications are coming. See the partial list in the following *Selling Highlights* section.

Here are some of the target markets for Creator3D graphics and the key features in that market.

Market	Applications	Key Features
MCAD/MCAE	• High-end mechanical design • Styling and design • Visualization and simulation • Analysis	• High-performance 3-D graphics and CPUs • Visual quality • Key software availability • Multiple frame-buffer support • MP configurations for high application • Stereoscopic support
Earth Resources Oil and Gas Geo Engineering GIS	• Visual simulation, modeling and analysis • Leading number of third-party software applications	• Creator3D, high-performance frame buffers • Sun OpenGL® for Solaris™ 1.1.2 with Imaging Extensions • Multiprocessing • No-cost texture mapping • Ability to handle very large texture maps using main memory

Market	Applications	Key Features
Health Care	• Medical imaging and visualization • Surgical preplanning • Computer-assisted surgery	• Integrated 3-D and imaging • High-speed interconnect to main memory for very large texture and image capacity • High I/O bandwidth • Accelerated processing with MP and RIP capabilities • Stereoscopic support • Adjustable gamma correction • Multiple frame-buffer support
Digital Content Creation Entertainment	• Animation/modeling and layout • Film and broadcast media production • Corporate communications • Game development	• High-performance 3-D graphics • Visual quality • Multiple frame buffer support • Integrated imaging and video playback • High rendermark/cubic foot density • Cost
Visualization/ Simulation	• Education and training • Classified defense • VR applications • Increasing component of other technical markets • Insight, comprehension, understanding	• High-performance Creator3D graphics • Visual quality • Multiple frame-buffer support • High I/O bandwidth • MP capabilities • Texture mapping • Stereoscopic support • Peripheral support
General Science	• Visualization	• MP capabilities • High-performance 3-D graphics

Creator3D provides an opportunity to increase Sun's marketshare in its traditional markets while capturing new applications and market share in high-growth markets, such as digital content creation and visualization/simulation. Creator3D strengthens Sun's product offerings in current accounts and provides opportunities to displace seats from traditional competitors such as SGI. Spurred by high-growth of 3-D applications and the need to reduce cost and time-to-market and to increase worker productivity, the need for high performance 3-D graphics will continue to increase.

Installed-base opportunities include upgrades or replacement of SPARCstation™ systems and even Ultra 1 systems that are up for replacement after three years. Take note of pockets of competitive systems from SGI, DEC, IBM, and even HP, or whole departments. Expand into new applications, such as auto-styling, analysis through simulation of crash testing, flight simulation, design review theatres, and so on.

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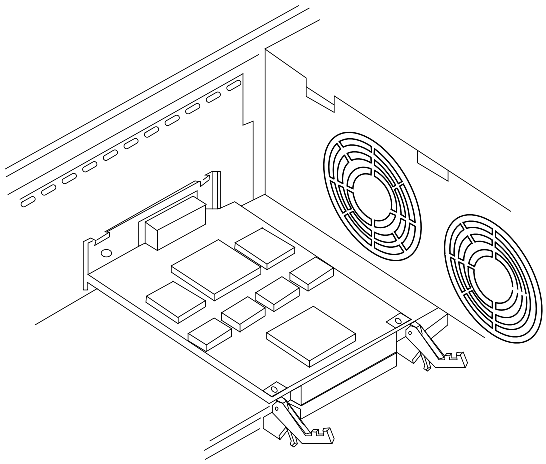
Key Third-party Applications

Target Market	ISV	Software Applications
MCAD/MCAE	Computervision	CADDS 5, Medusa
	Dassault	Catia, Catia Studio
	EDS/Unigraphics	Unigraphics
	Parametric Technology Corp	Pro Engineer, ProDesigner, TrueGrid
	SDRC	I-Deas Master series
	Technomatix	ROBCAD
	Altair	Hypermesh
	Mechanical Dynamics	ADAMS
	Matra Datavision	Euclid-IS, Prelude
	Marc Analysis	MARC
	MacNeal-Schwendler	NASTRAN, PATRAN III, Conceptstation
	Ansys	Ansys
	Tripos Inc.	Unify
	Bentley Systems	Microstation
Earth Resources Oil and Gas GIS	Advanced Visual Systems	AVS Express, Toolmaster, AVS5
	Cognesis	VoxelGeo
	GeoQuest	GeoViz, Charisma
	Landmark Graphics	ProMax, Seisworks, Strata Model, Earth Cube
	Geovision	Vision
	Shell Oil	VolumeViewer
	ERDAS	ER Mapper, ERDAS Imagine
	ESRI	ArcView, ARCInfo
	Paradyme Geophysical	
Health Care	Cemax	VIP 2.0
	Context Vision	Imaging processing for refining MR data
	ISG	Silohet
	Virtual Vision Software	C-MED
	Visualization Technologies	
	Sensible Technologies	PHANToM (haptic peripheral device)

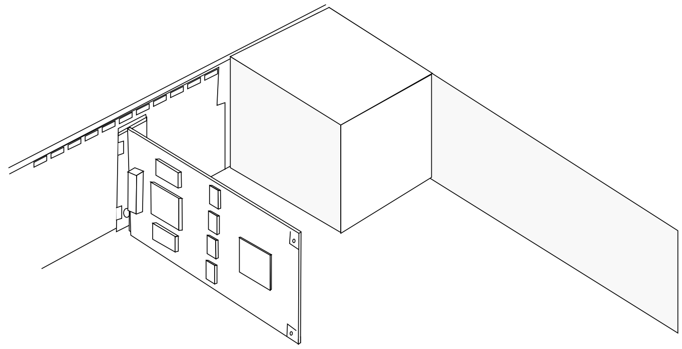
Target Market	ISV	Software Applications
Digital Content Creation Entertainment/ Animation	Adobe	Photoshop
	NewTek	Lightwave 3-D
	Electric Image	Electric Image
	Lightwork	Kinetix (rendering tool kit)
	Nichimen	NWorld
	XaosTools	Pandemonium
	ArSciMed	Kinema/Sim
	Mental Images	Mental Ray
	SoftImage	SoftImage 3-D
	Radiance Software International	Ez3d VRML Author Pro
	Apunix Computer Services	Apunix Openscan
	Engineering Animation Inc.	VisProducts
	Pixar	Renderman
Visualization/ Simulation	Advanced Visual Systems	AVS Express, Toolmaster AVS5
	Engineering Animation Inc.	VisProducts, VisMockUp, VisFly
	Sense8	WorldUp, Sense8 World Tool Kit
	Autometrics	Edge and Soft Plotter
	Division	dVise, dVise Flythru
	ArSciMed	Kinema/Sim
	Parametric Technology Corp	ProFlythrough
	Facet	Facet
	Template Graphics	OpenInventor
	Muse Technology	MuSE
	IBM	IBM Visualization Data Explorer
	Sensible Technologies	PHANToM (haptic peripheral device)
	US Department of Defense	Battlefield Visualization
	Fluent	Fluent, Rampant, Nekton
	Compuflow	Flotran
	Vital Images	Voxelmath
	Visual Numerics	PV Wave, Exponent Graphics
	Fluid Dynamics International	Fidep
	Woltham Research	Mathmatica
	SAS Institute	SAS
	Lockheed-Martin Federal Systems	Power Image
Molecular Biology	MSI Biodesign	Piograf, NMRgraf
	Biosym Technology	Discover, Insight II
	Molecular Simulations	CHARM, Quanta
	Genasys II	Genemap, Genacell

Compatibility

Creator Graphics series 3 is totally software-compatible with the previous versions of Creator Graphics on an API level. However, there are two physical orientations: vertical and horizontal. Boards in the vertical orientation are designed to fit in the Ultra™ 10, Ultra 30, and Ultra 60 workstations. The Ultra 2 workstation and the Sun Enterprise™ servers require the horizontal orientation. Figure 1 shows the orientation differences.



View of horizontal board



View of vertical board

Figure 1. Views of horizontal and vertical boards

Technology Overview

Graphics Memory Technology

Over the last decade, graphics has emerged as a very important element in the use of computing. Driven by the increasing sophistication of the applications and users, as well as by broad trends in hardware performance and cost reduction, graphics has become an integral part of technical computing today.

Despite these advances, most graphics subsystems are an afterthought. Their architecture, limited integration, and emphasis on performing specific subsets of graphics functionality reveal that they are designed without consideration of the overall system architecture.

According to a recent IDC study, Sun Microsystems is one of the established volume leaders in graphics UNIX® workstation shipments for most technical markets. From ECAD, MCAD, and GIS, to UNIX technology-based publishing and graphic arts, Sun™ workstations represent the largest single-vendor platform in use today.

Sun has gained leadership in these markets because of its single-minded focus on platform integration, working towards its intended goal of providing the best price/performance in workstation-class desktop solutions available. Sun's revolutionary Creator Graphics-based systems are based on the powerful Ultra workstation product line, one of the industry's most innovative system platforms available. Designed as part of the overall Ultra™ system architecture, Creator Graphics incorporates the best features of Sun's previous accelerators and frame buffers, at a fraction of the cost and with almost twice the performance.

The usual bottleneck for 3-D graphics hardware has been the rate at which pixels can be rendered into a frame buffer for Z-buffered rendering. Historically, the performance of hidden-surface-removal algorithms has been limited by the pixel fill rate of 2-D projections of 3-D primitives. Solutions to these limitations are dependent on an appropriate memory architecture.

Most common computer memory technologies present serious trade-offs when they are used for implementing high-speed, low-cost frame buffers for today's volume systems. Some of the most common memory architectures and implementations of frame buffer and general-purpose memory include:

- Dynamic RAM (DRAM)

  DRAM provides the best density and has the best-understood technology curve, but is generally too slow.
- Video RAM (VRAM)

  Dual-ported VRAM offers improved bandwidth over DRAM. However, over the past five years, VRAM performance has improved by only about 30 percent.
- Static RAM (SRAM)

  SRAM provides fast cycle times but is too expensive to implement economically in a desktop system.

Exotic architectures, such as massive DRAM interleaving, are also available, but they are not practical for cost-effective desktop systems.

Another problem with conventional memory architectures is the number of read-modify-write transactions that result from 3-D graphics applications. To maximize performance, read-modify-write operations should be avoided since they can take up to four times longer to complete than a pure write transaction.

Z-buffering, as required for 3-D hidden-surface removal, is the main operation that causes expensive read-modify-write transactions. The graphics application's Z-coordinate data must traverse the pins of the chip twice: once to read out the old Z value, and a second time to write the new Z value if a new value is selected. Additionally, window ID compares, stenciling, antialiasing, and blending operations can cause expensive read-modify-write transactions.

Working together, Sun Microsystems and Mitsubishi Electronics have created breakthrough technologies that allow implementation of fast, inexpensive 3-D graphics buffers which address many of the cost and performance issues. Mitsubishi developed a memory technology which incorporated DRAM and SRAM on a single chip, while Sun developed a new concept for high-performance 3-D frame buffer design. The result of this collaboration is known as 3D-RAM.

- **3D-RAM**

  3D-RAM integrates DRAM and SRAM cache on a single chip along with an on-chip arithmetic logic unit (ALU). Because the ALU was implemented directly on the 3D-RAM chip, Z-buffering and the read-modify-write cycle operations are performed completely inside the 3D-RAM.

  The result is a 10-megabit part that handles 3-D graphics ***ten times*** faster than conventional VRAM, at a lower system cost.

Texture Mapping

Sun's Ultra Creator3D graphics systems feature a highly integrated approach that connects powerful UltraSPARC™ processors with advanced Creator3D accelerator modules over a high-speed packet-switched memory interconnect known as the Ultra Port Architecture (UPA).

This innovative approach allows textures to be stored in general-purpose system memory where they are operated on by powerful multimedia instructions within the UltraSPARC CPU. Known as the visual instruction set (VIS™), these instructions provide key mathematical and multimedia instructions, many of which are used for texture-mapping operations.

This approach has key advantages for texture mapping.

- Low system cost

  Leveraging system memory for texture storage keeps system costs low since system memory represents a shared resource. When not in use for texture-mapping applications, memory is still usable for other applications.

- Large texture storage

  Extremely large textures can be accommodated in system memory since it represents a virtual address space. 3-D texture-mapping applications that use very large textures can be supported with no additional hardware costs.

- Scalable performance

  Because texture mapping is performed in the UltraSPARC processor, texture mapping can benefit from the stability gained by adding faster UltraSPARC processors.

- Other interesting texture mapping applications

  By locating textures in main memory, other interesting texture mapping applications are available, such as performing image processing functions on textures and using texture-mapped video rather than static images.

In recent years, advanced graphics technologies such as texture mapping have moved from specialized niche applications to general-purpose usage in broad consumer-oriented markets. Entertainment, animation, simulation, and even graphic arts have benefited from the low cost of texture-capable desktop systems. Together with advances in texture-mapping algorithms and low-cost devices, the sophistication and general-purpose application of texturing technology is enabling increased realism in rendering across virtually all segments of graphics use.

According to a recent IDC study, Sun Microsystems is the largest provider of UNIX graphics systems for 9 out of 13 technical market segments. Long heralded as a leader in platform and graphics device integration, Sun and its third parties provide the UNIX workstation industry's broadest of family solutions. Regardless of what level of performance or cost a customer requires, these solutions enable the effective use of texture-mapping technology and free the user to focus on results rather than on the intricacies of the application.

Particularly exciting is the use of texture mapping in extremely price-sensitive environments where the cost per seat is paramount. Sun's highly integrated, low-cost Creator3D graphics systems enable users to apply texturing to their data with a minimal impact on their budget.

Sun Microsystems' open-systems philosophy and wide support for third-party products and industry standards such as PHIGS and OpenGL® further broaden the choices for end users, thus enabling them to implement cross-platform-capable applications without compromising portability or performance.

Product Update

During the last several months, Sun has made changes to the Creator Graphic availability, packaging, and boards.

1. In November 1998, the product packaging has been changed so that X-options no longer contain extension cables that previously were copackaged with some of the graphics cards. The cables are available separately. Cables were removed from the following packages:

Part Number	**Board**
X3653A	Creator horizontal (FFB-SBH)
X3657A	Creator3D series 2 horizontal (FFB2-DBH)
X3661A	Creator3D series 3 horizontal (FFB2+DBH)
X3663A	Creator3D series 3 vertical (FFB2+DBV)

Cables, available separately, are listed below:

Part Number	**Cable**
F530-2020-01	Video extension cable (FRU, MALE/FEMALE)
F530-2154-01	Keyboard extension cable (FRU, KEYBOARD EX)
F180-1179-01	Extra power cord (PWR CD,18/3,5-15)

2. Also in November, the Creator3D series 3 graphics accelerators were updated with a new PROM to support additional monitor resolutions. They also provide better support for the Sun 21-inch display and support PC video standards. Additional resolutions added/updated include:

Resolutions	**Standard**
• 1600 x 1200 x 75 (new)	• VESA
• 1280 x 1024 x 85 (new)	• VESA
• 1280 x 1024 x 75 (new)	• VESA
• 1024 x 768 x 75 (updated)	• VESA

Resolutions	Standard
• 1024 x 768 x 60 (updated)	• VESA
• 800 x 600 x 75 (new)	• VESA
• 640 x 480 x 60 (updated)	• VESA

Note: *New PROM adds support for PC resolutions and updated support for separate sync*

3. In May 1999, the Creator models have been transitioned. In addition, all series 2 models have been transitioned. Only Creator3D series 3 is now available.

To reflect these, new marketing part numbers have been created and the older part numbers have been discontinued at the same time.

Pre November Part Number	Post November Part Number	Description	Status
3653A	3669A	CREATOR series 1 HORIZ	No longer available
X3653A	X3669A	CREATOR series 1 HORIZ	No longer available
3657A	3675A	CREATOR3D series 2 HORIZ	No longer available
X3657A	X3675A	CREATOR3D series 2 HORIZ	No longer available
3661A	3671A	CREATOR3D series 3 HORIZ	Available
X3661A	X3671A	CREATOR3D series 3 HORIZ	Available
C3661A	C3671A	CTO-CREATOR3D series 3 HORIZ	Available
X3662A	3672A	CREATOR series 3 VERT	No longer available
C3662A	C3672A	CTO-CREATOR series 3 VERT	No longer available
X3663A	X3670A	CREATOR3D series 3 VERT	Available
C3663A	C3670A	CTO-CREATOR3D series 3 VERT	Available

24-inch HDTV Color Display Monitor

The new Sun 24-inch, wide-screen, color monitor is a high-resolution Trinitron display with digital multiscan capabilities. The monitor features front-panel controls with on-screen display in two modes (normal and expert), Moire cancellation, VESA DDC interface, power management, tilt-swivel capabilities, 13W3 and HD15 connector capabilities, and a conductive AR film coating to minimize glare.

Supported Resolutions/Timings (16:10 aspect Ratio/Non-interlaced)	1920 x 1200 @ 70 Hz (maximum) 1600 x 1000 @ 66 Hz 1280 x 800 @ 76 Hz	1600 x 1000 @ 76 Hz 1440 x 900 @ 76 Hz
	Note: *The monitor is also capable of running any standard 4:3 aspect ratio resolution such as VGA, SVGA, 1152 x 900, 1280 x 1024, and so on. However, to fully utilize the wide-screen format, Sun recommends using one of the 16:10 resolutions listed above.*	
Picture Tube Size	24 inches diagonally	
Viewable Image Size	22.5 inches diagonally	
Dot Pitch	Variable 0.26 mm (center), 0.29 mm (corner)	
Deflection Frequency	Horizontal: 30 to 96 kHz Vertical: 50 to 160 Hz	

Enabling Technology

Input Connectors	13W3 captive cable connector HD15-pin video input interfaces (Front-panel switch allows users to select connector type)	
Front-panel Connectors	Brightness Size Geometry (pincushion, tilt, and so on) Moire cancellation Color temperature Reset	Contrast Center Convergence Beam landing DeGauss
AC Input Voltage/Current	100–240 volts, 50/60 Hz, 2.2–1.4 amps	
Power Consumption (Normal Operation)	200 watts maximum 170 watts typical	
Operating Temperature	10 to 35˚C	
Operating Humidity	10 to 80 percent (non-condensing)	
Altitude Range	Sea level to 3,048 meters (10,000 feet)	
Compliant Standards	UL 1950 TUV/GS CB Scheme EN 29241-3/ISO9241-3 PTB FCC Class B VCCI Class 2 TCO ’92	SCA C22.2, No. 950 EMKO-TSE (74-SEC) 207 ZH1/618 DHHS CE IC Class B MPR II EPA EnergyStar / NUTEK
Dimensions	580 x 500 x 548 mm (W/H/D)	
Weight	41 kg (90 pounds, 6 ounces) approximately	
Face Plate Treatment	Conductive AR film coating	

Creator Graphics Architecture

The Creator Graphics architecture is designed to solve two key issues in graphics design: bandwidth and performance. Since graphics-rendering performance is highly dependent on the system's bandwidth, heavy emphasis is placed on designing a system interconnect that can handle high-speed data traffic. It is also considered key to increase the speed at which graphics computation and display rendering are performed.

The architecture of Creator Graphics relies heavily on the use of a very high-speed conduit between the system's CPU, memory, and graphics subsystem. The Ultra™ port architecture (UPA) crossbar interconnect incorporates a high-speed, packet-switched design that provides the necessary bandwidth to the Creator Graphics module.

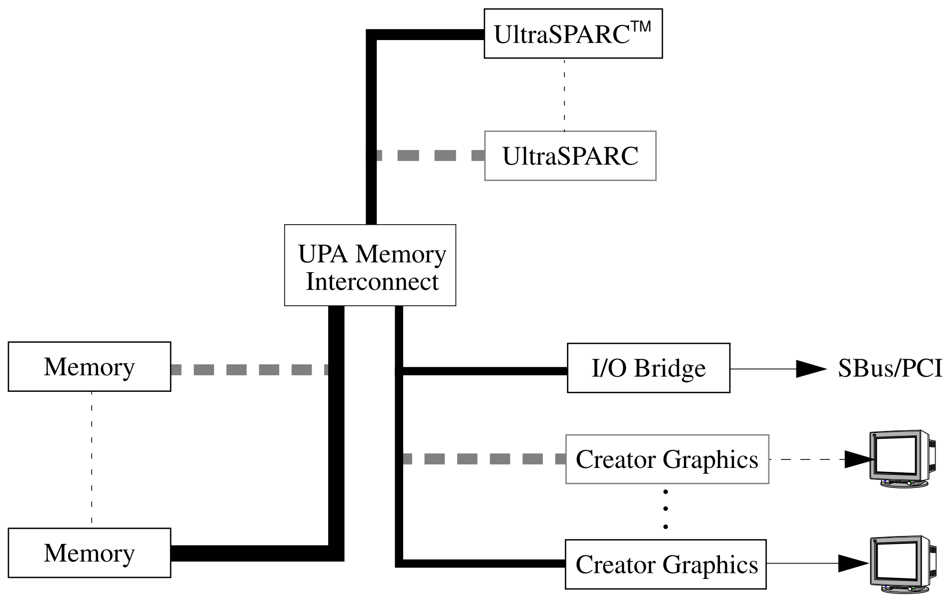


Figure 2. UPA architecture block diagram

The Creator Graphics module attaches directly to the UPA crossbar interconnect using a 64-bit interface. This direct connection is evidence of the importance of graphics in the overall design of Ultra systems. Creator and Creator3D share the same basic design. Creator3D differs in that it contains more 3D-RAM frame buffer memory to provide double-buffering and Z-buffering functionality.

Sun Graphics Accelerator Configurations

Parameter	TurboGXplus™	Creator3D series 3				
		Ultra 2	Ultra 10	Ultra 60 300 MHz	Ultra 60 360 MHz	Ultra 60 450 MHz
Resolution and Visual Capabilities	1024 x 768 @ 66 or 77 Hz 1152 x 900 @ 66 or 76 Hz 1280 x 1024 @ 67 or 76 Hz	**VESA Resolutions Supported:** 640 x 480 @60 Hz 800 x 600 @75 Hz 1024 x 768 @60 or 75 Hz 1280 x 1024 @60 or 75 Hz 1600 x 1200 @75 Hz **Composite (Sun) Resolutions Supported:** NTSC and PAL timings 1024 x 800 @56, 60, 72, or 84 Hz 1024 x 768 @60, 63, 70, or 77 Hz 1152 x 900 @ 66Hz or 76 Hz 1280 x 1024 @ 67 Hz or 76 Hz Stereo (960 x 680 @ 108 or 112 Hz) **24-inch Display (HDTV-style)[a] Resolutions Supported:** 1440 x 900 @ 76 Hz 1600 x 1000 @ 66 or 76 Hz 1600 x 1280 @ 76 Hz 1920 x 1080 @72 Hz 1920 x 1200 @70 Hz				
Color Planes	8-bit, 8-bit double buffer	24-bit; 8-bit overlay (24-bit double buffer)				
Z-buffer	—	28 bit				
Special Features	Accelerated text, windows; 2-D and 3-D vectors; double buffering; high resolutions	Accelerated imaging and advanced 3-D graphics with Gouraud shading, line anti-aliasing, per-pixel depth cueing, subpixel addressing, transparency, stereo viewing with monitor				
Monitors	17-inch and 20-inch color	17-inch[b], 19-inch[b], 21-inch, and 24-inch[a] color monitors				
Software Interfaces: OpenGL®, XGL™, XIL™, SunPHIGS™, PEXlib, Java 3D™						
Notes: a Single-buffered only b 13W3 to HD-15 Video adapter is required						

Software Interfaces

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

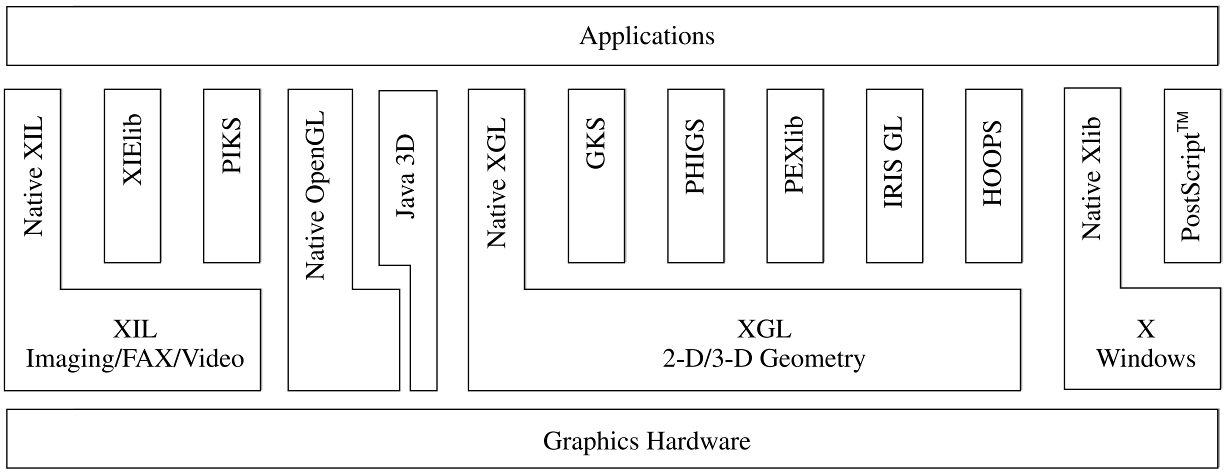


Figure 3. Graphics software interfaces

Because Creator Graphics platforms provide windowing, imaging, and geometry acceleration, they enhance the performance of all of the APIs mentioned above.

The OpenWindows™ and the Common Desktop Environment (CDE)

The OpenWindows™ environment is an MIT X Window System (X11 R6) compliant server. Applications that use the X protocol, running both locally or remotely, will receive acceleration from Creator Graphics. The industry-standard Display PostScript (DPS) environment is provided within OpenWindows to support on-screen rendering of documents and images written within Adobe® PostScript™ page description language. Many of the OpenWindows management functions have been optimized to take advantage of the Creator Graphics architecture, including rectangle fills, line rendering, text rendering, vertical scrolling, and raster operations.

The XIL Imaging and Video Library

The XIL library is a foundation-level imaging interface that provides the common functions required by many imaging and video applications. As a foundation software layer for imaging applications, the XIL library defines how imaging operations, such as display, image manipulations, compression, and decompression are carried out.

The XIL library contains three primary components: a programming interface specification for basic imaging functionality, a high-performance implementation of the specification, and a standard hardware interface specification, which enables third-party hardware developers to readily support the XIL library and applications built upon it.

The XGL Geometry Library

The XGL library is the Solaris foundation geometry library that provides the functionality and performance required by applications requiring geometry manipulation and display. The XGL library provides for the optimization of 2-D and 3-D rendering, including high-quality lighting and shading, and advanced primitives (such as NURBS and meshes, texture mapping, antialiasing, and transparency), and a flexible geometry pipeline. The XGL library includes sophisticated state-of-the-art features, such as dynamic tessellation of NURBS surfaces, as well as flexible pipelines for lighting and transformation.

Creator Graphics systems provide acceleration for many XGL functions:

- 2-D (3 x 2) and 3-D (4 x 4) transformations
- Geometry attributes (color, line type, fill pattern, textures, and so on)
- Lighting and shading (flat and Gouraud, as well as up to 32 light sources—positional, directional, spot, and ambient)
- Non-uniform rational B-splines (NURBS)
- Screen-door and alpha-blended transparency
- Antialiasing
- Linear and scaled depth cueing
- Texture mapping (2-D texturing of 3-D surfaces)

OpenGL Geometry Library

The OpenGL graphics application programming interface is an industry-standard, vendor-neutral software interface that operates independently of operating and window system platforms. Based upon its proprietary predecessor, GL, OpenGL provides a broad set of 2-D and 3-D graphics functions for modeling transformations, color, lighting, shading, and advanced features such as texture mapping.

The OpenGL Architecture Review Board is responsible for defining the characteristics and features of OpenGL, and for providing conformance testing, release approval, and specification definition. Like Sun's XGL graphics library, OpenGL is independent of any underlying window system, and display of rendered graphics occurs through either extensions to the graphics library or through direct window system calls.

Sun has provided OpenGL for Solaris: Ultra™ Creator3D Edition since July 1996, specifically for use on Creator3D Graphics systems. OpenGL 1.1.2 is now available and is highly accelerated by Creator3D and also supported on many other graphics cards, including Creator (single-buffer) cards.

Ordering Information

Creator Graphics Accelerator Options

Part Number	Description	Comments
Graphics Boards		
X3671A	Creator3D, series 3, 24-bit color, double-buffered graphics accelerator, horizontal board orientation	For Ultra™ 2 workstation and Sun Enterprise™ servers
X3670A	Creator3D, series 3, 24-bit color, double-buffered graphics accelerator, vertical board orientation	For Ultra 10, Ultra 30, and Ultra 60 workstations
Monitors		
X7103A	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	

Configuration Information

The following table shows the number of Creator Graphics accelerators and monitors supported by the different Ultra workstations and Sun Enterprise servers.

System	Maximum Number of Creator Frame Buffers	Board Orientation	Graphics Version	
			Creator	Creator3D
Ultra 1	1	Horizontal	series 1	series 2
Ultra 2	1	Horizontal	series 1	series 2, 3
Ultra 5	0	Not Available	Not Available	Not Available
Ultra 10	1	Vertical	series 3	series 3
Ultra 30	2	Vertical	series 3	series 3
Ultra 60	2	Vertical	series 3	series 3
Sun Enterprise 4000	4	Horizontal	N/A	series 2
Sun Enterprise 3500	3	Horizontal	N/A	series 2, 3
Sun Enterprise 4500	4	Horizontal	N/A	series 2, 3
Sun Enterprise 5500	4	Horizontal	N/A	series 2, 3
Sun Enterprise 6500	4	Horizontal	N/A	series 2, 3

Creator Graphics, series 2 and later, utilizes a new connector for stereo viewing synchronization, a 7-pin mini-DIN style of connector.

Note: *Stereographics sells a cable adapter for joining the old and new style of connectors. It can be ordered from them using the part number ESUN.*

Frame Buffers and Monitors

Monitors			17-inch Entry	19-inch Color	20-inch Color	21-inch Color	24-inch Color
Graphics Cards	**Horizontal/ Vertical**	**Order Number**	**X7103A**	**X7119A**	**X267A**	**X7121A**	**X7124A**
TurboGXplus™	H	X3655A		✔	✔	✔	
Creator3D, series 3	H	X3671A	✔	✔	✔	✔	✔
Creator3D, series 3	V	X3670A	✔	✔	✔	✔	✔
Video Connector Adapter, HD 15F-to-13W3M[a]		X3872A	✔	✔			
Notes: a Required for 13W3-based platforms, included in X7110A and X3660A							

Ordering Information

Creator Graphics Upgrades

Part Number	Description
UG-FFB-FFB3-DB-1-V	Upgrade from any Creator Graphics board to Creator3D series 3, 24-bit color, double-buffered graphics accelerator, vertical board orientation
UG-FFB-FFB3-DB-1-H	Upgrade from any Creator Graphics board to Creator3D series 3, 24-bit color, double-buffered graphics accelerator, horizontal board orientation
UG-FFB-AFB-M3-V	Upgrade from any Creator Graphics board to Elite3D m3, 24-bit color, double-buffered graphics accelerator, vertical board orientation and cable
UG-FFB-AFB-M6-V	Upgrade from any Creator Graphics board to Elite3D m6, 24-bit color, double-buffered graphics accelerator, vertical board orientation and cable
UG-FFB-AFB-M6-H	Upgrade from any Creator Graphics board to Elite3D m6, 24-bit color, double-buffered graphics accelerator, horizontal board orientation and cable

Service and Support

The SunSpectrum[SM] 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 that it represents. Customers should check with their local Sun Enterprise™ Services representatives for program and feature availability in their areas.

FEATURE	SUNSPECTRUM PLATINUM[SM] Mission-critical Support	SUNSPECTRUM GOLD[SM] Business-critical Support	SUNSPECTRUM SILVER[SM] Systems Support	SUNSPECTRUM BRONZE[SM] 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
Personal technical account support	Yes	Yes	No	No
Account support plan	Yes	Yes	No	No
Software release planning	Yes	No	No	No
On-site account reviews	Monthly	Semiannual	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	No
7-day/24-hour on-site coverage	Yes	Option	Option	N/A
Customer-defined priority setting	Yes	Yes	Yes	No
• 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
Additional contacts	Option	Option	Option	Option

FEATURE	SUNSPECTRUM PLATINUM℠ Mission-critical Support	SUNSPECTRUM GOLD℠ Business-critical Support	SUNSPECTRUM SILVER℠ Systems Support	SUNSPECTRUM BRONZE℠ Self Support
Enhanced Support Features				
Mission-critical support team	Yes	Yes	No	No
Sun Vendor Integration Program (SunVIP℠)	Yes	Yes	No	No
Software patch management assistance	Yes	No	No	No
Field change order (FCO) management assistance	Yes	No	No	No
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™ license	Yes	Yes	Yes	Yes
SunSolve EarlyNotifier℠ Service	Yes	Yes	Yes	Yes

SunClient℠

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 new suite of offerings that is separate, yet complementary to the SunSpectrum program. SunClient Support provides:

- A new 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	*	*	*
8 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	—	*	N/A
Patches	N/A	N/A	*
SunSolve license	N/A	N/A	*
SunSolve EarlyNotifier Service	N/A	N/A	*
Software Updates	N/A	N/A	N/A

* 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.

Features and Benefits of the SunClient Program

Features	Benefits
• Unbundled hardware and software support	• **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.
• Next business day (SunClient Maintenance) or second business day (SunClient Central Maintenance) on-site response	• **Cost efficiency** Because Sun can more efficiently manage spare inventory and labor scheduling, the savings can be passed on to the customer.
• Single contract with choice of automatic warranty upgrade	• **Simplicity** One contract covers a predefined number of systems at one low price. New systems acquired can be upgraded to the SunClient service level.
• SunClient Central Maintenance	• **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.
• Service delivery by Sun experts	• **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`

24-bit color	The ability to render objects using 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	A new architecture for 3-D frame buffers. A memory technology that incorporates DRAM and SRAM on a single chip along with an on-chip arithmetic logic unit.
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.
CDRS	A standardized benchmark for OpenGL®. Represents the mean performance of several commonly used 3-D graphics operations.
Depth-cueing	A technique that selectively varies image intensity to create an illusion of depth in a 3-D model. Accomplished in hardware through the use of a Z-buffer.
Double-buffering	Additional frame buffer memory that allows smooth continuous motion of objects moving on the screen. Two buffers: one for rendering and updating, the other for display.
DPS	Display PostScript™. PostScript™ imaging model used as a screen graphics library to display text, graphics, and images on a single page.
Dynamic tessellation NURBS	NURBS stands for non-uniform rational B-splines. NURBS is a curve-definition method based on B-splines that enable complex, high-quality curved surfaces. The fast, interactive creation of triangulated data from a NURBS surface. Dynamic tessellation permits a graphics application using NURBS to achieve high rates of rendering performance while maintaining acceptable display resolution. Texture mapping techniques can also be applied to the tessellated data.
FBC-2	Frame buffer controller, series 2. Performs the set-up, edge-interpolation, and span-interpolation functions in the 3-D graphics pipeline. It also performs pixel processing to accelerate high-end 3-D functionality, such as hidden-surface removal, smooth shading, transparency, and antialiasing.
Gouraud shading	A means of rendering images composed of many-faceted polygons, enabling smoothly shaded surfaces. Rhymes with Thoreau.
GRU	Graphics unit. A dedicated graphics unit as a part of the floating-point unit for operating directly on graphics data. The UltraSPARC™ processor incorporates a comprehensive set of graphics instructions that provide fast hardware support for 2-D and 3-D graphics, image manipulation and compression, and video and audio processing.

KCMS™	Kodak Color Management System™. A platform providing an independent means of maintaining correct color balance for digital color presentation. Provides WYSIWYG color representation between mediums.
OpenGL	The standard software interface for graphics hardware that allows programmers to create interactive 3-D applications. OpenGL provides a full-featured, network-transparent application programming interface.
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 standardized by the National Computer Graphics Associated GPC committee. The value represents the geometric mean performance on several commonly used 3-D surface operations.
RAMDAC	Converts digital data (in frame buffer memory) to the analog signals required to drive the CRT display.
Transparency	A method of rendering objects that provides the appearance of transparency. Common approaches include the use of mesh, through which a portion of the pixels are rendered, and blending, whereby background and objects pixels are blended together.
Texture mapping	A technique for enhancement of surface details on a geometric object without having to compute the geometry of those details. Texture mapping is accomplished by mapping a 2-D raster image to each individual 3-D facet of an object.
UPA	Ultra™ port architecture. A high-speed, crossbar-oriented, packet-switched motherboard interconnect.
VIS™	Visual instruction set. The UltraSPARC™ processor implements a special instruction set that is aimed primarily at image and video processing. Some of the instructions allow the CPU to access and operate on image data directly 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™	A foundation imaging-oriented graphics library providing high functionality and performance to imaging applications.
Z-buffering	Additional memory that allows for fast computation and rendering of the Z-dimension, or depth, of a 3-D solids object. Presence of a Z-buffer typically determines whether a graphics workstation is considered 3-D.

Materials Abstract

All materials are available on SunWIN except where noted otherwise.

Collateral	Description	Purpose	Distribution	Token # or COMAC Order #
Powerpack				
– *Creator Graphics Just the Facts*	Reference Document for Creator Graphics	Training Sales Tool	SunWIN, Reseller Web	70123
– *Creator Graphics3D series 3 Just the Facts*	Reference Document for Creator Graphics	Training Sales Tool	SunWIN, Reseller Web	75246
– *Sun Graphics Products Customer Presentation*	Presentation on Sun's Graphics Solutions Including Sun Elite3D Graphics; Slide Notes for Presentation	Sales Tool	SunWIN, Reseller Web	75254
Presentations				
– *Sun in EDA*	Market Presentation	Sales Tool	SunWIN	59078
– *Sun in MCAD/MCAE*	Market Presentation	Sales Tool	SunWIN	59074
– *Sun in Geotechnical*	Market Presentation	Sales Tool	SunWIN	60292
– *Sun in Digital Content Creation*	Market Presentation	Sales Tool	SunWIN	75241
References				
– *Sun Workstation Graphics Quick Reference Card*	Reference for All Graphics Products	Sales Tool	SunWIN, Reseller Web	24507
– *Creator Graphics Technology White Paper*	A Description of the Creator Graphics Architecture	Training	SunWIN, Reseller Web	49269
– *Advanced Texture Mapping*	A White Paper About Texture Mapping Techniques	Training	SunWIN	67281
Product Literature				
– *Graphics Solution Guide*	Graphics Overview	Sales Tool	SunWIN	75271
– *Graphics Overview*	Brochure	Sales Tool	SunWIN, Reseller Web COMAC	69376 BE604-3
Demos				
– *Technical Computing Solutions Launch Demo CD*	A CD with a Variety of Demonstration Applications	Sales Tool	COMAC	WE184-0
Web Sites				
– *General Product Information*	`http://www.sun.com`			
– *General Information on Creator3D Graphics*	`http://www.sun.com/desktop/products/Graphics/creator3d.html`			