Sun™ Expert3D Frame Buffer

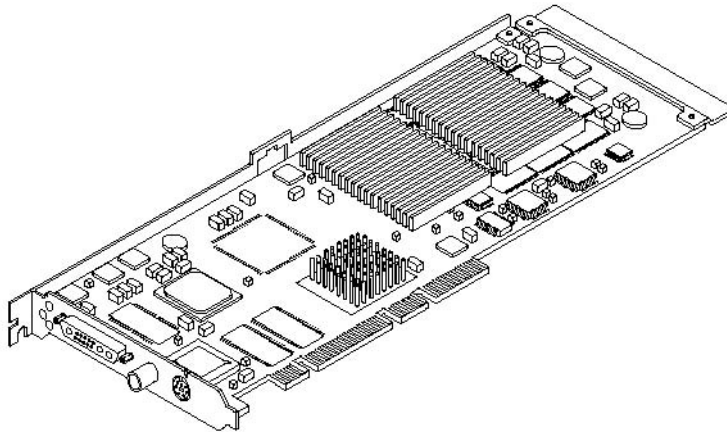# Just the Facts

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Figure 1. The Sun™ Expert3D Frame Buffer

The need for extremely high-end graphics support has continually increased over the last few years. Several industries now have a critical need to improve user productivity by providing better system interactivity, and therefore require 24-bit color graphics and accelerated 3-D graphics. Solids modeling requires very high compute power coupled with the ability to search large databases and access to large memory capacity for image storage. In addition, with the introduction of the 24-inch HDTV style of monitor customers now require full-featured support at the highest resolution for that monitor in order for it to be used with 3-D applications.

To provide support for these kinds of capabilities, Sun is introducing the Sun™ Expert3D frame buffer. The Sun Expert3D frame buffer is one of the fastest professional graphics frame buffers available in the market place. It provides an affordable, high-performance graphics solution for demanding 3-D graphics applications that specifically require hardware-based texture mapping acceleration. The Sun Expert3D frame buffer complements the reliability, high performance, and affordability of Sun workstations, providing an integrated solution for compute-intensive visualization applications.

The Sun Expert3D frame buffer offers state-of-art handling of color and gamma correction, and advanced 3-D functionality including hardware accelerated texture mapping with on-board texture memory. The Sun Expert3D frame buffer supports monitor refresh rates of up to 112 Hz and provides double-buffered/ Z-buffered support for 3-D graphics up to 1920 x 1200 with support for stereoscopic 3D up to 1280 x 1024 resolution.

The Sun Expert3D frame buffer is a 64-bit, 66/33-MHz PCI graphics board that includes 64 MB of frame buffer memory and 64 MB of texture memory. It provides the following advanced features:

- On-board texture mapping memory and acceleration
- Support for resolutions up to 2.5 megapixels (1920 x 1200, double-buffered/Z-buffered)
- Double-buffering and Z-buffering (3-D) support at the super high resolution of 1920 x 1200
- Stereo video mode support at 1280 x 1024
- Multi-display support (dual Sun Expert3D frame buffers in one system) with frame locking
- External video synchronization

The Sun Expert3D frame buffer provides Sun's most complete acceleration of the Sun™ OpenGL® for Solaris™ API to date, including 2-D and 3-D texture mapping, image processing, and support for the Sun OpenGL for Solaris 1.2.1 API. Platforms which can support the Sun Expert3D frame buffer include the Ultra™ 60 and Ultra 80 workstations.

Key Messages

Ultra 60 and Ultra 80 workstations configured with one or two Sun Expert3D frame buffers help make Sun competitive in the technical market place, particularly the oil and gas, GIS, and high-end MCAD markets, which is a key market segment for Sun's high-performance desktops.

The Sun Expert3D frame buffer addresses the texture mapping requirements of certain technical applications. This product is ideal for customers who demand the reliability of the Solaris™ Operating Environment and the high performance of the UltraSPARC™ processor-based workstations, for running 3-D applications.

Product Family Placement

The Sun Expert3D frame buffer is positioned as Sun's high-end graphics product offering for desktop workstation users requiring hardware accelerated texture mapping in all of Sun's technical markets. For users requiring high-performance geometry acceleration without texture mapping, Sun Elite3D graphics is the better option.

The Sun Expert3D frame buffer has similar geometry performance to Sun Elite3D m6 graphics, but its 64 MB of texture memory and hardware texture mapping provide up to ten times the performance of Sun Elite3D graphics in rendering 25-pixel, trilinear-textured, Z-buffered, and Gouraud-shaded triangles.

The 64 MB of frame buffer memory provides super high-resolution of 1920 x 1200, double-buffered displays and 1280 x 1024 stereo display.

	PGX32™	Sun Creator3D	Sun Elite3D m3	Sun Elite3D m6	Sun Expert3D
Bus	PCI	UPA	UPA	UPA	PCI (33 or 66 MHz, 64 bit)
Max 2-D resolution	1280 x 1024	1920 x 1200 (single buffered)	1280 x 1024	1280 x 1024	1920 x 1200
Max 3-D resolution	—	1280 x 1024	1280 x 1024	1280 x 1024	1920 x 1200
Stereo resolution	—	960 x 680 @ 122 Hz	960 x 680 @ 122 Hz	960 x 680 @ 122 Hz	1280 x 1024 @ 112 Hz
Memory type	SDRAM	3DRAM	3DRAM	3DRAM	SDRAM
Frame buffer memory	8 MB	15 MB	15 MB	15 MB	64 MB
On-board texture memory	—	System memory	16 x 16 texel cache	16 x 16 texel cache	64 MB of onboard memory
Geometry performance (tris/sec.)	—	1.4 M	3.0 M	5.9 M	5.5 M
Texture fill rate (pixs/sec.)	—	host bound	25–30 M	25–30 M	143 M
APIs supported (software interfaces)	OpenGL, XGL™, XIL™, Xlib, Java 3D™				OpenGL , Xlib, Java 3D™

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Key Features and Benefits

Features	Benefits
• On-board, dedicated, 64-MB texture-mapping memory	• Accelerates applications requiring texture maps, allowing for complex, true-color, 2-D and 3-D texture storage in applications requiring texture mapping
• On-board 64-MB frame buffer memory	• Provides support of 24-bit true color 2-D and 3-D up to 1920 x 1200 with a 16:10 aspect ratio supporting Sun's 24-inch display
• On-board 3-D geometry accelerator	• Accelerates 3-D geometry at up to 6M triangles/second with up to 3.2 GFLOPS (3.2 billion floating-point operations per second) of performance
• On-board rasterization engine	• Performs triangle setup, texture processing, and all the pixel operations involved in rasterization with a peak performance of 143 Mpixels/sec. (Trilinear) fill rate
• Supports double-buffering and Z-buffering at up to 1920 x 1200 resolution in 24-bit color	• Allows customers to use large-screen, super high-resolution monitors including Sun's 24-inch HDTV-style, wide-screen monitor to display 2-D and 3-D graphics data
• Supports stereoscopic video graphics at 1280 x 1024 resolution	• Allows customers to display 3-D data in stereoscopic video at higher resolutions, providing enhanced realism for immersive applications and environments
• Multi-display graphics framelock support	• Enables multiple graphics frame buffers to be used in a single system to render to multiple displays for maximum desktop real estate and resolutions
• Multi-display support (support of up to two Sun Expert3D boards in a single workstation)	• Allows users to run dual displays when two Sun Expert3D boards are installed and synched together for users who need to be able to do multiple things across multiple displays simultaneously, i.e., command and control applications, 3-D and video playback for animators, automotive design and analysis, and so on
• Hardware-accelerated, 3-D, volumetric texture support	• Supports and accelerates 3-D textures for volumetric rendering as opposed to 2-D textures, in which a 2-D image is "mapped onto" or "painted onto" the surface of a 3-D object and 3D volumetric textures define textures in three dimensions. True 3-D volumetric textures are conceptually composed of a large number of 2-D textures layered on top of each other to define a 3-D space (i.e., volume). These 3-D textures are currently used in areas including medical imaging and geographic information systems (GIS) applications, and they are expected to be required by future digital content creation applications.
• 32-bit Z-buffer	• Provides very high level of three-dimensional accuracy, eliminating anomalies such as the flickering of objects when moving around a 3-D image
• Hardware-accelerated trilinear MIP-mapped texturing	• Provides outstanding quality hardware-accelerated texture mapping for stunning visual realism within texture mapping application

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Features	Benefits
• 13W3 video output connector	• Provides a better video image quality on screen than standard PC HD-15 at higher resolutions displaying more defined and clearer images
• 64-bit accumulation buffer support	• Enhances the creation of special effects for digital media and visual simulation applications
• External video sync port supporting NTSC, PAL, TTL, LVTTL, and CMOS signals	• Allows the Sun Expert3D frame buffer to synchronize/lock onto an external video signal
• Hardware-based image processing	• Enables imaging acceleration to markets such as medical imaging, GIS, and other imaging intensive applications
• 10-bit gamma correction	• Provides an extra level of color correction compensation, providing more accurate color representation on a wider range of displays

Target Users

Sun Expert3D graphics falls within the traditional workstation and technical markets, and addresses graphics market requirements from the mid-range workstation to the superworkstation. It is targeted at users who need more 3-D and texture mapping performance to get their jobs done. These users are typically expensive resources, and companies need to make them more productive to meet the market demands for better quality, lower costs, and lower time-to-market.

Typical users include:

• Product design engineers and designers in MCAD/MCAE, who can benefit from working with whole subassemblies rather than individual parts, and who need to discover problems and issues at the design stage rather than in production.

• Petroleum engineers and professionals who work with large amounts of seismic data for drilling, exploration, and recovery purposes.

• Technical directors needing to animate and render characters and scenes in real-time in order to meet their production deadlines.

• Surgeons and medical professionals who need to capture, process and visualize tissue and internal structures for planning and diagnostics prior to surgery.

• People who need to be highly trained before getting into aircraft or handling hazardous equipment or materials.

No matter what the market or application area, the need to understand, simulate, and visualize complex problems and data is increasing as users rely more and more on computers as tools to gain insight and understanding, and improve accuracy, safety, and reliability.

Target Markets

Ultra 60 and Ultra 80 workstations with Sun Expert3D graphics are targeted at the high-performance compute- and graphics-intensive segment of its target markets. These markets include high-end 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.

Positioning

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Unique product 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 graphics frame buffers: one Sun Elite3D m6 graphics frame buffer and either a Sun Elite3D m3 or Creator3D frame buffer or two Sun Elite3D m3 graphics frame buffers

The Sun Expert3D frame buffer's advanced design is ideal for customers and ISVs who make heavy use of texture mapping in their 3-D applications, such as those in the oil and gas market (seismic data visualization), the GIS market (specially for terrain mapping), MCAD market (auto-styling applications), the DCC market, and the subset of the medical imaging market which uses 3-D techniques for analyzing patient data.

The Sun Expert3D frame buffer provides an affordable, high-performance graphics solution for demanding 2-D and 3-D graphics applications that specifically require hardware-based texture mapping acceleration. The Sun Expert3D frame buffer provides an opportunity to increase Sun's market share in its traditional markets while capturing new applications and market share in high-growth markets, such as digital content creation and visualization/simulation.

The Sun Expert3D frame buffer is targeted at the segments within Sun's traditional workstation markets requiring hardware-accelerated texture mapping, high-resolution 24-bit color, and 3-D acceleration. It is also able to address specific application requirements for applications so far only available on high-end SGI systems.

The three largest segments for Sun in terms of number of units are technical software engineering, electronic design automation (EDA), and mechanical design and analysis (MCAD/MCAE).

Below are the markets that Sun traditionally has been a key player in or has been strongly entering into with the Sun Creator and Sun Elite3D product lines. The Sun Expert3D frame buffer is a key complementing factor in these segments as the need for hardware-accelerated texture mapping continues to increase.

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 accelerated frame buffer support in the system • MP configurations • High-resolution stereoscopic support
Earth resources Oil and gas GEO engineering GIS	• Visual simulation, modeling, and analysis • Leading number of third-party software applications • Terrain mapping	• Sun Expert3D graphics, high-performance frame buffers • Sun OpenGL for Solaris API with imaging extensions • Multiprocessing • High-performance texture mapping
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 in the system

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Market	Applications	Key Features
Visualization/ simulation	• Education and training • Classified defense • VR applications • Increasing component of other technical markets • Insight, comprehension, and understanding	• High-performance Sun Expert3D graphics • Visual quality • Multiple frame buffer support in the system • MP capabilities • Accelerated texture mapping • Stereoscopic support • Peripheral support
General science	• Visualization	• MP capabilities • High-performance 3-D graphics
Health care	• Medical imaging and visualization • Surgical preplanning • Computer-assisted surgery	• Integrated 3-D and imaging • Accelerated processing with MP and RIP capabilities • Stereoscopic support • Adjustable gamma correction • Multi frame buffer support in the system • Accelerated texture mapping

Availability

General availability for the Sun Expert3D frame buffer for the Ultra 60 and Ultra 80 workstations is scheduled for April 4, 2000. Support for the Sun Enterprise™ 450 server and future Sun workstations is planned for later in the year.

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Selling Highlights

Market Value Proposition

The Sun™ Expert3D frame buffer systems provide an affordable, high-performance graphics solution for demanding 3-D graphics applications that specifically require hardware-based, texture-mapping acceleration. Affordable high-performance graphics allows users to work more efficiently, enabling greater productivity. Ultimately, it helps reduce the time required to complete tasks and makes better use of expensive resources by making them more productive. This new level of performance enables people to do things they could not do before. 3-D applications that use texture mapping are accelerated by this product.

The Sun Expert3D frame buffer supports the standard Sun™ OpenGL® for Solaris™ API and the Java 3D™ API. All existing applications using these APIs can run unmodified on the Sun Expert3D frame buffer. With respect to texture mapping, applications see an appreciable performance boost but the same level of geometry performance when compared to the Sun Elite3D graphics frame buffers.

Compatibility

The Sun Expert3D frame buffer requires a 64-bit PCI slot (either 66 or 33 MHz) slot and thus fits into the Ultra™ 60 and Ultra 80 systems with up to two Sun Expert3D boards per system.

Classification	Platform	Frame Buffer Configurations Supported			
		Sun Expert 3D	Sun Elilte3D	Sun Creator3D	PGX32™
Mid-range Dual-processor	Ultra 60 workstation	2	0	0	1
		1	1	0	1
		1	0	1	1
		0	1 m3/1 m6	1	1
		0	2 m3/1 m6	0	1
		0	0	2	1
High-end Quad-processor	Ultra 80 workstation	2	0	Not supported	1
		1	1		1
		0	2		1

Complementary to Sun's existing graphics product lines, the Sun Expert3D frame buffer's design goal is to maintain API-layer compatibility with Sun Elite3D and Sun Creator3D graphics while transparently accelerating the same set of 3-D graphics APIs to orders of magnitudes greater.

Sun Expert3D frame buffer is supported on Sun OpenGL for Solaris API version 1.1.2 and subsequent releases, and on X11R6 and subsequent versions. Note that the Java 3D API is internally using the Sun OpenGL for Solaris 1.1.2 API on the Sun platform.

On-board Texture Mapping

Texture mapping is the process of superimposing a 2-D texture or pattern over the surface of a 3-D graphical object. This is an efficient method for producing the appearance of texture, such as that of wood or stone, on a large surface area. An alternate type of texture mapping, 3-D or volumetric, involves creating a 3-D texture and projecting an object into that texture. The Sun™ Expert3D frame buffer accelerates the rendering of both 2-D and 3-D textures.

The texture mapping performance of the Sun Expert3D frame buffer is exceptional and can compete with the high-end texture mapping accelerators on the market. The price-performance point will be especially compelling for customers who need excellent animation and data visualization capabilities, such as those in the oil and gas industry.

The Sun Expert3D frame buffer also supports stereoscopic video output through a 7-pin DIN connector to carry sync signal to stereo LCD shutter glasses. This is the same as the Sun Elite3D graphics stereo connector, providing compatibility with customers' existing stereo glasses and emitters.
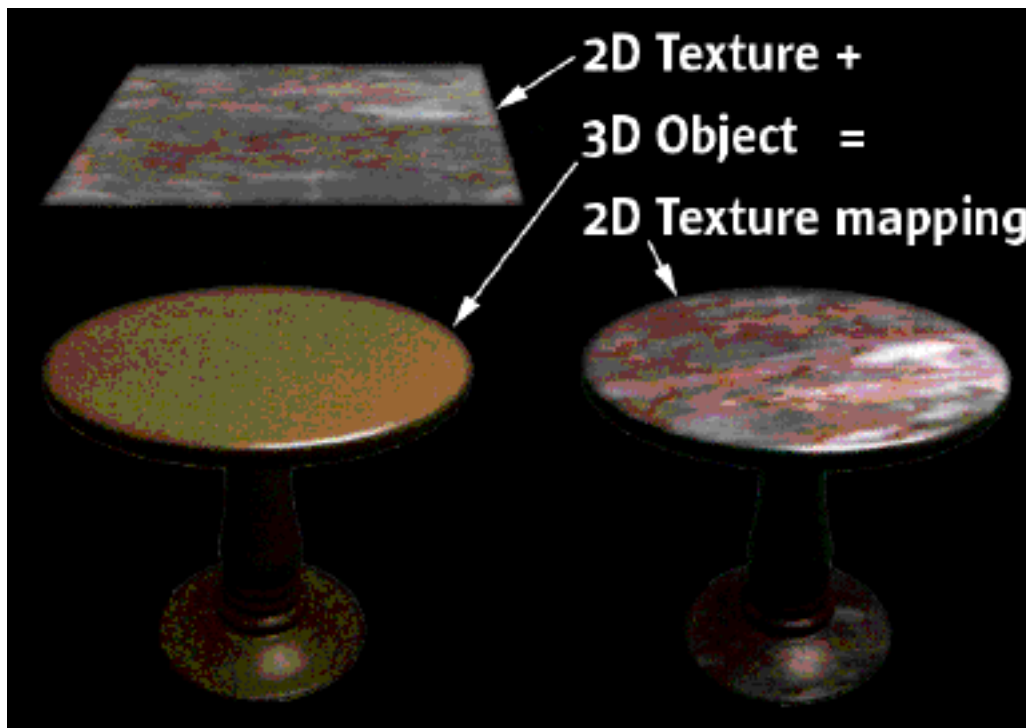
Multi-screen Rendering—Xinerama

In conjunction with the Xinerama X-window extension available in Solaris™ 7 Operating Environment (11/99 or later releases) and Sun™ OpenGL® for Solaris™ 1.2.1 API, users can now configure their systems to use multiple frame buffers as one large, super-high resolution, virtual display. Sun OpenGL for Solaris 1.2.1 API enables all OpenGL API-based applications to run virtually seamlessly in multi-screen Xinerama environment; developers no longer need to rewrite their 3-D applications to take advantage of multiple screens.

The Sun OpenGL for Solaris 1.2.1 API supports up to eight frame buffers (monitors) depending on the frame buffer and system capabilities. Sun Expert3D graphics users can take advantage of two monitors simultaneously at this time.
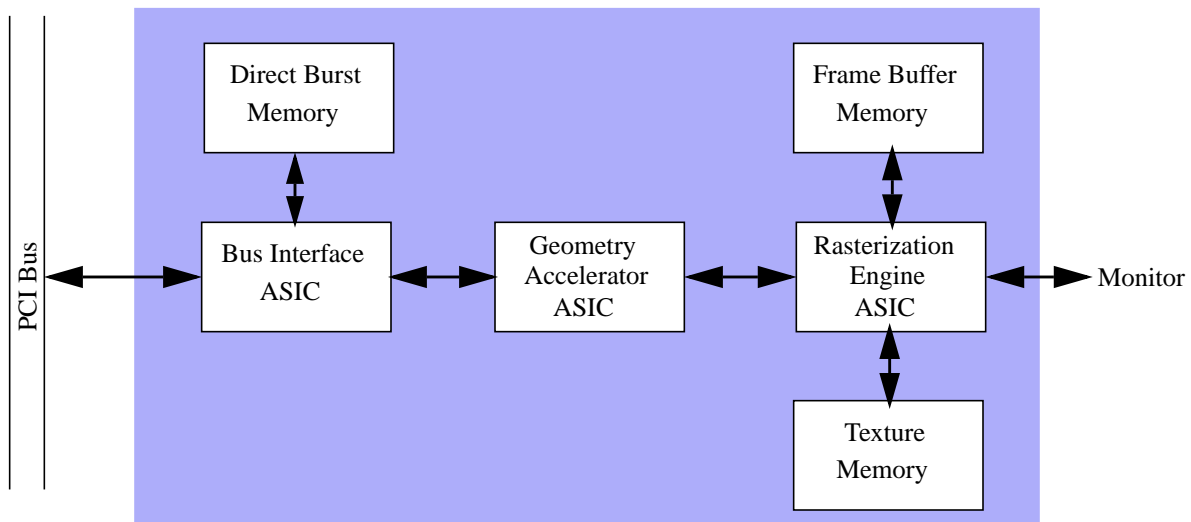
Overview

The Sun™ Expert3D frame buffer is based upon several core components. The major components in the Sun Expert3D frame buffer system are:

- The *bus interface ASIC* provides the host bus (64-bit PCI) interface for the graphics board. The ASIC provides an interface for supporting up to 64 MB of local request memory, which is referred to as direct burst memory. On the Sun Expert3D frame buffer, there are 8 MB of direct burst memory.

- The *geometry accelerator ASIC* performs transform, clipping, and lighting.
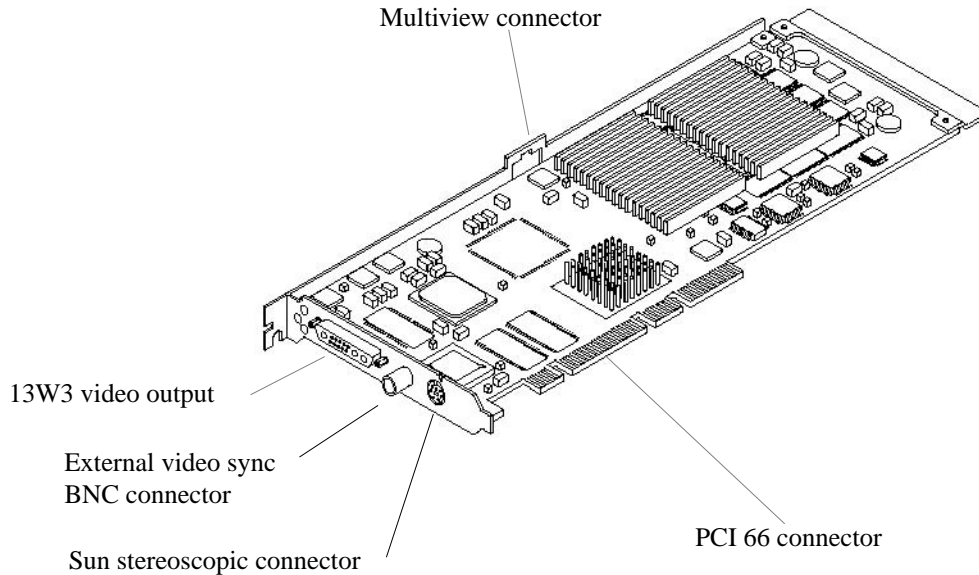
- The *rasterization engine ASIC* performs 2-D and 3-D rasterization, 2-D and 3-D texturing, pixel transfers, and fragment processing.

- The *texture memory* is 64 MB of SDRAM.

- There is 64 MB of *frame buffer memory*. This memory is integrated with the rasterization engine and provides a high-resolution 10-bit RGB analog video output at dot rates of up to 350 MHz.

Internal and External Interfaces

The Sun Expert3D frame buffer interfaces are summarized as follows:

- The Sun Expert3D frame buffer provides a 33- or 66-MHz, 64-bit PCI interface. The Sun Expert3D frame buffer board is a single full-length PCI board. Power requirements are ~50 Watts. 200-lfm airflow is required.

- The PCI 33- or 66-MHz/64-bit bus is the system interface. The bus interface ASIC communicates with the graphics engine via the Bus/CBus interfaces. The bus interface is a 64-bit TBus when interfacing to the geometry accelerator, a 32-bit CBus when interfacing directly to the rasterization ASIC and a 32-bit demultiplexed CBus.

- The 13W3 CRT video output provides separate RGB component analog video output to the computer display monitor. Composite and separate sync options are supported. A DDC link is provided for monitor query and control.

- The front lock input uses a 75-Ohm BNC male connector. A 75-Ohm coaxial cable terminated with a female BNC connector is used to connect this port and provide a periodic signal that the display system attempts to lock its vertical refresh rate to. The supported formats are

  – NTSC composite video

  – PAL composite video

  – TTL, LVTTL, or CMOS level compatible periodic signal (50 Hz–180 Hz) with a low or high pulse width of 100 ns (TBV)

  – Stereo connector is a 7-pin DIN connector standard. It provides connection to LCD shutter glasses emitter module or to other stereo shutter devices. It is the same as the Sun Elite3D graphics stereo connector.

Multiview connector

13W3 video output

External video sync
BNC connector

Sun stereoscopic connector

PCI 66 connector

System Architecture

Video Output Port Pinout

Pin	Signal
A1	Red analog video
A2	Green analog video
A3	Blue analog video
1	DDC SCL (serial clock)
2	DDC power (5.0V) (Fused, will supply up to 300mA, limited to 1.0A.)
3	No connection
4	Ground (DDC return)
5	Composite sync
6	DDC SDA (serial data)
7	Vertical sync
8	No connection
9	No connection
10	Ground (sync return)

Architectural Features

- 8-MB SDRAM display list memory cache
- 64-MB onboard texture memory with full-mipmapped, trilinear, interpolated texture processing
- 10-bit gamma correction
- Hardware cursor
- Stereoscopic viewing support—interlaced or frame sequential
- DDC monitor support
- Display power management signalling (DPMS)
- Synchronization of the video timing to an external timing source (frame lock)
- Two video lookup tables

Hardware Accelerated Features

- **Geometry acceleration with**

  - Model view matrix transformation of vertex and normal coordinates
  - Full lighting calculations (up to 24 lights)
  - Up to six user clip planes
  - Perspective transformation

  - Viewport transformation
  - View volume clipping
  - Local display list storage and processing

- **Accelerated 2-D operations**

  - 16- and 32-bit color depths

  - Block gets (screen to system copy)

- Area fills
- Block moves (screen to screen copy)
- Block puts (system to screen copy)
- Vectors (diamond rule compliant)

- **Accelerated Sun OpenGL for Solaris API operations**

  - Sun OpenGL for Solaris 1.2.1 API
  - Fogging (linear, exponential, exponential**2, user-defined)

  - Points (2-D, 3-D, wide)
  - Texture mapping (point, bilinear, trilinear, and multiple internal formats)

  - Vectors (2-D and 3-D lines and linestrips; wide, and stippled)
  - Stencil operations

  - Polygons (triangles, triangle strips, quads, quad strips, polygons, and point/line polygon mode)
  - Dithering

  - Antialiased points, vectors, and polygons
  - Rich set of blending operations

  - Image support (multiple formats, zoom, bilinear scaling, color matrix, and color tables)
  - Depth buffering (32-bit, integer and floating point depth formats)

  - Alpha operations
  - Hardware accumulation buffer operations

  - Scissoring
  - Hardware Pbuffer operations

  - Window clipping
  - Fast window clears

  - Masking
  - Fast window-mode double buffering

  - Double-buffered overlay
  - Frame-sequential stereo support

Note: *The first release of the Sun Expert3D frame buffer's software does not include multi-sampled antialiasing support, although it is a capability of the hardware and will be supported in a subsequent release.*

- **Support of Sun OpenGL for Solaris API extensions**

  - Imaging extensions (pixel buffer, color table, color matrix, convolution, etc.)
  - Texture extensions (edge clamp, border clamp, LOD clamp, generate mipmap)

  - Blend extensions (blend color, blend minmax, blend function separate, etc.)
  - Texture color table

  - Histogram
  - Post-texturing specular

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Texture Mapping Features

- Support for 64 MB of texture memory
- 2-D nearest/linear/mipmapped
- 3-D nearest/linear/mipmapped
- 1/2/4/8 bytes/texel
- 1/2/3/4 components/texel
- Texture scale and bias, texture lookup table
- Texture environment blending functions
- Stencil plane support
- Designed for efficient Sun OpenGL for Solaris API operation

Display Resolutions

Maximum display resolutions (maximum) for the Sun Expert3D frame buffer are listed in the table below.

Aspect Ratio	Mode: 192 bits/pixel (with 64-bit accumulation buffer)
4 x 3	1824 x 1368
5 x 4	1280 x 1024
16 x 9	1920 x 1080
16 x 10	1920 x 1200
4 x 3 Frame Sequential Stereo	1280 x 1024

Sun Expert3D frame buffer video timings/monitor screen resolutions (64-MB frame buffer), 13W3 output:

Display Resolution	Vertical Refresh Rate	Sync Standard	Aspect Ratio
1920 x 1200	70, 75 Hz	Sun	16:10
1920 x 1080	72 Hz	Sun	16:9
1792 x 1344	76 Hz	VESA	4:3
1600 x 1280	76 Hz	Sun	5:4
1600 x 1200	75 Hz	VESA	4:3
1600 x 1000	66, 76 Hz	Sun	16:10
1440 x 900	76 Hz	Sun	16:10
1280 x 800	76 Hz	Sun	16:10
1280 x 1024	60, 75, 85 Hz	VESA	5:4
1280 x 1024	67, 76 Hz	Sun	5:4
1280 x 1024	112 Hz	Sun-Stereo	5:4
1152 x 900	66, 76 Hz	Sun	5:4
1024 x 800	84 Hz	Sun	5:4
1024 x 768	75 Hz	VESA	4:3
1024 x 768	60, 70, 77 Hz	Sun	4:3
960 x 680	108, 112 Hz	Sun-Stereo	Sun-Stereo
768 x 575	50i Hz	PAL	PAL

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Display Resolution	Vertical Refresh Rate	Sync Standard	Aspect Ratio
640 x 480	60 Hz	VESA	4:3
640 x 480	60i Hz	NTSC	NTSC

Note: *All resolutions marked VESA use separate sync; the remainder use composite sync.*

The Sun Expert3D board supports full 24-bit 2-D And 3-D (double- and Z-buffered) at all resolutions.

Monitor Support

The Sun Expert3D frame buffer supports all of Sun's current displays including the following:

- 17-inch entry level color
- 19-inch color monitor
- 21-inch color monitor
- 24-inch color wide screen display
- 18-inch flat panel LCD display

Frame Buffer Bit Planes

Bit Plane Type	Number of Bits
Image front buffer	24
Image back buffer	24
Overlay front buffer	8
Overlay back buffer	8
Color mode control	2
Z-buffer	32
Mask	2
Double buffer control (image)	1
Double buffer control (overlay)	1
Alpha front buffer	8
Alpha back buffer	8
Stencil	8
Fast clear front buffer	1
Fast clear back buffer	1
Accumulation buffer	64

System Architecture

Sun Expert3D Frame Buffer Interfaces and Connectors

Video Outputs Supported	A primary video output stream (RGB component analog, up to 1920 x 1200 @ 75 Hz) to the main display via 13W3 connector on back panel.
13W3 Connector	The 13W3 provides CRT video output provides separate RGB component analog video output to the computer display monitor. Composite and separate sync options are supported. A DDC2B/EDID link is provided for monitor query and control.
Stereoscopic Connector	The Sun Expert3D frame buffer supports stereoscopic video output through a 7-pin DIN connector to carry sync signal to stereo LCD shutter glasses. This is the same interface as the Sun Elite3D stereo connector.
External Video Synchronization Input Connector	The video timing may be synchronized to an external timing source. This port uses a 75-Ohm BNC male connector. A 75-Ohm coaxial cable terminated with a female BNC connector is used to connected to this port and to provide a periodic signal to which the display system attempts to lock its vertical refresh rate. For optimal performance, the vertical refresh rate should be configured by the user to be an integer multiple of the frequency of the incoming signal. Supported formats are NTSC, PAL, TTL, LVTTL, or CMOS level compatible periodic signals (50 MHz–180 MHz) with a minimum low or high pulse width of 100 ns.
Multiview In/Out	Internal connector for frame rate locking multiple boards in a single system.

Provides workstation users a wide range of specialized features required by advanced high end technical applications.

- Professional workstation-class graphics features supported including:
  - Model view matrix transformation of vertex and normal coordinates
  - Texture matrix transformation of texture coordinates
  - Full lighting calculations with up to 24 light sources
  - Up to six user clip planes
  - Perspective transformation
  - Viewport transformation
  - View volume clipping
  - Points (2-D, 3-D, wide)
  - Vectors (2-D and 3-D lines and line strips; wide, stippled)
  - Polygons (triangles, triangle strips, quads, quad strips, polygons, point/line polygon mode)
  - Antialiased points, vectors, and polygons
  - Imaging support (multiple formats, zoom, bilinear scaling, color matrix, color tables)
  - Scissoring
  - Window clipping
  - Masking
  - Fogging (linear, exponential, exponential2, user-defined)
  - Texture mapping (point, bilinear, trilinear, and internal formats)
  - Stencil operations
  - Dithering

System Architecture

- Rich set of blending operations
- Fast window clears
- Fast window-mode double buffering
- Frame-sequential stereo support
- Extensive support of Sun OpenGL for Solaris API extensions
- Imaging extensions such as pixel buffer, color table, color matrix, and convolution
- Blend extensions such as blend color, blend minmax, and blend function separate
- Texture extensions (edge clamp, border clamp, LOD clamp, generate mipmap)
- Texture color table
- Post-texturing specular
- 10-bit gamma correction
- Hardware cursor
- Two video lookup tables

System Architecture

Requirements and Configuration

The Sun™ Expert3D frame buffer is configured in both the Ultra™ 60 and Ultra 80 workstations and is also offered as an X-option and C-option to support more than one Sun Expert3D frame buffer board in a system.

The Sun Expert3D frame buffer supports the Solaris™ 2.6 (HW3 or newer), 7 (8/99), and 8 (2/00 or newer) Operating Environments.

Below is the matrix of supported configurations:

System	Configured in system?	Available as an X-option?	Number Supported (up to)			
			Sun Expert3D	Sun Elite3D m6/m3	Sun Creator3D, Series 3	PGX32™
Ultra 80 workstation	yes	yes	2	0	0	1
			1	1	0	1
			0	2	0	1
Ultra 60 workstation	yes	yes	2	0	0	1
			1	1	0	1
			1	0	1	1
			0	1 m3 or 1 m6	1	1
			0	1 m6 or 2 m3	0	1
			0	0	2	1

The Sun Expert3D frame buffer is a full-size, single-slot, 64-bit/66-MHz PCI board and can plug into the dedicated 64-bit/66-MHz slot of the Ultra 60 or Ultra 80 workstations. The Sun Expert3D frame buffer can also plug into any of the 64-bit/33-MHz slots, but due to the slower bus, performance is lower. When installing this board, always install it into the 64-bit/66-MHz slot first, then into the 64-bit/33-MHz slot.

The Sun Expert3D frame buffer has both internal I/O ports for multidisplay capabilities and external I/O ports for external video synchronization and stereo capabilities.

The Sun Expert3D frame buffer has two internal I/O port connectors to support connecting up to two Sun Expert3D boards in an Ultra 80 or 60 system for video syncing (called Multiview). The Multiview In and Multiview Out connections on the board are accessible only inside the workstation chassis and are used for cable connections from one Sun Expert3D board to another.

The Sun Expert3D frame buffer has three external connections on the back of the frame buffer (exposed to outside of system when installed). A 13W3 video output connector for connecting to a Sun compatible monitor, a stereo video mode connector to connect to stereo glasses, and a BNC connector to connect an external video synchronization signal.

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Sun Expert3D Frame Buffer Window System Requirements

- OpenWindows™ 3.6 software or later
- CDE 1.2 or later
- Sun™ OpenGL® for Solaris™ 1.1.2 API or newer
- Configuration tools

    Command line device configuration tool (`fbconfig`) is provided with the Sun Expert3D frame buffer.

- Java 3D™ API

    The Java 3D API is implemented on the Sun OpenGL for Solaris API. It is accelerated on the Sun Expert3D frame buffer to the extent of Sun OpenGL for Solaris API acceleration.

Dimensions of the Sun Expert3D Frame Buffer

Board Height	3.875 in. (not including gold fingers)
Gold Finger Height	0.325 in.
Total Height	4.2 in.
Board Length	11.257 in. (does not include connector overhang/extender)
Weight	406 g
Power Requirements	50 Watts total power 11.1 A - 3.3V current 2.6 A - 5.0V current 0.05 A - 12.0V current

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System Management

Operating Environment

Sun™ Expert3D graphics is compatible with the Solaris™ 2.6 (HW3), 7 (8/99 or newer), and 8 Operating Environments.

Software Components

For customers and ISVs, Sun Expert3D graphics is software-compatible with current graphics products, allowing the use of the same code for window system and Sun™ OpenGL® for Solaris™ and Java 3D™ APIs. The hardware is designed to work efficiently with the Sun OpenGL for Solaris API. Compatibility with Sun's API libraries means that applications will only need to be qualified and tested. XGL™ and XIL™ are supported via X-rendering, which is not hardware accelerated.

Sun OpenGL for Solaris 1.2.1 API

The Sun OpenGL 1.2.1 for Solaris API for the Solaris Operating Environment provides a complete solution for developing and deploying interactive 3-D applications across SPARC™ processor-based workstations. It enables mainstream, industry-leading 3-D graphics and visualization applications to be deployed on Sun's Ultra™ workstations with Sun Creator3D, Sun Elite3D, and Sun Expert3D graphics at a compelling price-to-performance ratio. The Sun OpenGL for Solaris API is an application programming interface (API) 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 Sun OpenGL for Solaris API works in both immediate and non-editable display-list graphics modes.

The Sun OpenGL for Solaris 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 Sun OpenGL for Solaris API allows source-code portability of 3-D graphics clients. The Sun OpenGL for Solaris 1.2.1 API for the Solaris Operating Environment is an implementation of the OpenGL 1.2 API from the OpenGL Architecture Review Board (ARB) and is, therefore, source-code compatible with other OpenGL API-conformant applications on the market. Most existing OpenGL API applications need only to be recompiled in order to run with Sun OpenGL for Solaris 1.2.1 software.

The Sun OpenGL for Solaris1.2.1 API is available for the Sun Creator, Sun Elite3D, and Sun Expert3D graphics product families, where the Sun OpenGL for Solaris API functionality is accelerated in hardware. Sun Expert3D graphics support is also available for the Sun OpenGL for Solaris 1.1.2 and 1.2 API.

Sun OpenGL for Solaris 1.2.1 API Features and Benefits

Features	Function
• 64-bit Sun OpenGL for Solaris API libraries	• Allows Sun OpenGL for Solaris API applications to take advantage of the full 64-bit addressing in the Solaris 7 and Solaris 8 Operating Environment
• Occlusion culling test extension	• Enables applications to trivially reject occluded objects in a scene, resulting in big improvements in interactive rendering performance for visualization of large models
• Xinerama support	• See the Sun OpenGL for Solaris Performance and Implementation Guide for features

System Management

Ordering Information

The Sun™ Expert3D frame buffer is offered in a single configuration. The difference in part numbers is in factory-installed, field-installed, or configure-to-order options.

Part Number	Description
3678A	Sun Expert3D frame buffer 64/64: high-resolution DBZ 64-MB frame buffer, 64-MB texture memory, one 13W3 port high-resolution DBZ is 1920 x 1200, 128 or 192-bits/pixel, double buffered with Z. Configured in system.
X3678A	Sun Expert3D frame buffer 64/64: high-resolution DBZ 64-MB frame buffer, 64-MB texture memory, one 13W3 port high-resolution DBZ is 1920 x 1200, 128 or 192-bits/pixel, double buffered with Z.
C3678A	Sun Expert3D frame buffer 64/64: high-resolution DBZ 64-MB frame buffer, 64-MB texture memory, one 13W3 port high-resolution DBZ is 1920 x 1200, 128 or 192-bits/pixel, double buffered with Z. Configure to order (multiple boards).

The X-option price is expected to be US$3495 list price, category H.

For Sun or third party-displays with a HD15 connector, the Sun video adapter, part# X3872A is required to connect to the Sun Expert3D board's 13W3 based video out connector.

The Sun Expert3D frame buffer ships with the following:

- Sun Expert3D Installation CD
- Sun Expert3D Installation Guide
- Dual Sun Expert3D connection cable (for dual display support)
- Antistatic installation wristband

Upgrades

Sun Expert3D Frame Buffer Upgrades

Part Number	Description
UG-FFBV-3678A	Upgrade to Sun Expert3D 24-bit color, high-resolution, 2-D/3-D graphic accelerator with on-board texture mapping acceleration; supports PCI 64 bit/66 MHz or 64 bit/33 MHz. Customer returns Sun Creator3D graphics board. For Ultra™ 60 workstation only.
UG-AFBM3V-3678A	Upgrade to Sun Expert3D 24-bit color, high-resolution, 2-D/3-D graphic accelerator with on-board texture mapping acceleration; supports PCI 64 bit/66 MHz or 64 bit/33 MHz. Customer returns Sun Elite3D m3 graphics board For Ultra 60 and 80 workstations only.
UG-AFBM6V-3678A	Upgrade to Sun Expert3D 24-bit color, high-resolution, 2-D/3-D graphic accelerator with on-board texture mapping acceleration; supports PCI 64 bit/66 MHz or 64 bit/33 MHz. Customer returns Sun Elite3D m6 graphics board. For Ultra 60 and 80 workstations only.

Ordering Information

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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
Local customer support management	No	Yes	No	No
Personal technical account support	Yes	Yes	Option	No
SunStart^{SM} 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

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 Operating Environment 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

Service and Support

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Warranty

Currently Sun Enterprise Services does not offer individual warranties for X-option graphics products. By default the Sun Expert3D frame buffer warranty is determined by the product in which it is installed. For example, power desktops currently receive a "one year return to depot" warranty.

In most countries the commitment is to return a replacement part within 15 business days. Remote geographic areas and very low volume sales areas may commit to deliver a part to the customers country border within 15 business days.

Service and Support

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Glossary

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.
3-D texture mapping	See Texture mapping.
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.
Depth-cueing or fog	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.
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.
Gouraud shading	A means of rendering images composed of many-faceted polygons, enabling smoothly shaded surfaces. Rhymes with Thoreau.
Java 3D™	A new API based on the Java™ programming language. It is part of the Java Media Set for writing stand-alone, 3-D graphics applications or Web-based 3-D applets. Gives developers high-level constructs for creating and manipulating 3-D geometry and tools for constructing the structures used in rendering that geometry.
OpenGL®	The 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. See http://www.opengl.org for more information.
Pbuffer	Off-screen rendering without window obstructions.
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. An alternate type of texture mapping, 3-D or volumetric, involves creating a 3-D texture and projecting an object into that texture.
UPA	Ultra™ port architecture. A high-speed, crossbar-oriented, packet-switched motherboard interconnect.
Volumetric texture mapping	See Texture mapping.
XGL™	A 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 or depth-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.

Glossary

Materials Abstract

All materials are available on SunWIN except where noted otherwise.

Collateral	Description	Purpose	Distribution	Token # or COMAC Order #
References				
– *Sun™ Expert3D Frame Buffer Just the Facts*	Reference guide for the Sun Expert3D frame buffer (this document)	Training Sales Tool	SunWIN, Reseller Web	114214
– *Sun Creator Graphics3D series 3, Just the Facts*	Reference Document for Sun Creator3D Graphics	Training Sales Tool	SunWIN, Reseller Web	75246
– *Sun Elite3D Graphics: Just the Facts,*	Reference Guide for Sun Elite3D m6 Graphics	Training Sales Tool	SunWIN, Reseller Web	75245
– *Sun Ultra™ 60 Workstation: Just the Facts*	Reference Guide for Sun Ultra 60 Workstation	Training Sales Tool	SunWIN, Reseller Web	75244
– *Sun Ultra 80 Workstation: Just the Facts*	Reference Guide for Sun Ultra 80 Workstation	Training Sales Tool	SunWIN, Reseller Web	110090
– *Introduction to Texture Mapping White Paper*	Technical Brief	Training Sales Tool	SunWIN, Reseller Web	67281
Product Literature				
– *Sun Expert3D Data Sheet*	Data Sheet	Sales Tool	SunWIN COMAC	116159
– *Graphics Solution Guide*	Graphics Overview	Sales Tool	SunWIN	75271
– *Graphics Overview*	Brochure	Sales Tool	SunWIN, Reseller Web COMAC	BE508-2
– *Workstation Overview Brochure*	Quick Reference Card	Sales Tool	SunWIN, Reseller Web, COMAC	69376 BE604-3
Presentations				
– *Graphics Overview Presentation*	Presentation	Sales Tool	SunWIN, Reseller Web	75254, 75255
– *Sun in MCAD/MCAE*	Presentation	Sales Tool	SunWIN, Reseller Web	59074, 59263
– *Sun in Oil and Gas*	Presentation	Sales Tool	SunWIN, Reseller Web	60292, 60297
– *Sun in Digital Content Creation*	Presentation	Sales Tool	SunWIN, Reseller Web	75241, 75242

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Collateral *(cont.)*	Description	Purpose	Distribution	Token # or COMAC Order #
Quick Reference Cards				
– *Sun Workstation Graphics Products Overview*	Quick Reference Card	Sales Tool	SunWIN, Reseller Web, First Resort	24507
– *Sun Workstation Product Line Overview*	Quick Reference Card	Sales Tool	SunWIN, Reseller Web, First Resort	10826
– *Competitive Summary, Workstations*	Quick Reference Card	Sales Tool	SunWIN, Reseller Web, First Resort	12259
– *Upgrade Paths*	Quick Reference Card	Sales Tool	SunWIN, Reseller Web, First Resort	24513
– *Sun Graphics Specification Chart, 3/00*	Quick Reference Card	Sales Tool	SunWIN, Reseller Web, First Resort	95113
External Web Site				
– *General Information on Desktop Graphics*	`http://www.sun.com/desktop/products/Graphics/`			

Materials Abstract

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