SXRD™

SONY

KDS-R60XBR1 and KDS-R50XBR1: Technical Background

November 4th, 2005

Unleashing The Full Power of HD

As High Definition programming becomes more available and High Definition televisions continue to proliferate, it is increasingly obvious that not all HDTVs are created equal. Many televisions designated "High Definition" fall far short of the medium's full potential: 1920 pixels horizontal by 1080 pixels vertical.

Sony® has a legacy of technical excellence in television, in addition Sony is a global leader in High Definition broadcasting and digital cinematography equipment and Sony Pictures Entertainment is a force in HD television program production and digital motion pictures. No wonder Sony engineers are so passionate about creating home televisions that do justice to HD source material. We know exactly how High Definition looks in the studio and we believe viewers deserve that same experience at home. The result of this commitment is Sony's SXRD™ (Silicon Xtal Reflective Display) device.

Sony is now launching the company's third-generation SXRD device. With a display area of just 0.61 inches, this is the world's smallest microdisplay with full 1920 x1080 native resolution. The very first products to incorporate this technology are also the latest to carry the XBR® designation, a badge Sony has long awarded to our best televisions. Introducing the KDS-R60XBR1 Rear Projection TV with a gorgeous 60-inch screen and the 50-inch KDS-R50XBR1 Rear Projection TV (screen size measured diagonally).

Sony's third-generation SXRD device, key to the KDS-R60XBR1 and KDS-R50XBR1.

Contents

SXRD™ technology

The need for full HD resolution.

High Definition programming is becoming mainstream.

- As of July 2005, the National Association of Broadcasters reports that over 1,500 television stations in the US are broadcasting HD. And a healthy proportion of the broadcast television schedule is now presented in HD, including dramas, sitcoms, sports, specials and late night talk.

- The National Cable & Telecommunications Association has announced that 92 million US households are passed by HD cable service, while the list of HD cable channels now includes Cinemax HD, Comcast SportsNet HDTV, Discovery HD Theater, ESPN HD, ESPN2 HD, FSN HD, HBO HD, HDNet, HDNet Movies, INHD, INHD2, MSG Networks in HD, NBA TV, NFL Network HD, Outdoor Channel 2 HD, Showtime HD, Spice HD, STARZ! HDTV, The Movie Channel HD, TNT in HD, Universal HD and YES-HD.

- The DISH Network and DIRECTV satellite services provide an impressive range of HD programming, including over 100 NFL games in HD on DIRECTV.

- Consumers can now shoot their own home videos on HDV 1080i High Definition camcorders, play back prerecorded HD movies on D-VHS tapes and even record TV shows on HD personal video recorders.

- In Japan, Blu-ray™ Disc High Definition optical recorders have already reached the consumer market.

Despite all these programming riches, many video projectors that meet the Consumer Electronics Association's standard for "High Definition" actually cannot display every pixel of the majority of HD content, which is 1920 horizontal x 1080 vertical pixels. In these projectors, "down-conversion" or "down-scaling" circuits are required to reduce the resolution to fit on a panel that typically offers just 1280 x 720 pixels. This effectively discards pixels from the original 1920 x 1080 broadcast.

The Full Power of HD requires more. It requires a full 1920 x 1080 pixels, progressively scanned 60 times per second. In this way, all of the original pixels can be reproduced without any “downscaling.” To deliver this full HD experience Sony developed our proprietary SXRD microdisplay panel.

Just three types of microdisplays

In the United States, literally hundreds of fixed-pixel projector models are available from dozens of companies. But under the surface, almost every one of these projectors depends on just three types of microdisplays:

1. **H-LCD.** High Temperature Polysilicon Liquid Crystal Displays, a transmissive technology in which the light shines through the panel.

2. **DLP®**. Digital Light Processing displays, a reflective technology that uses a micro-mirror array.

3. **LCoS.** Liquid Crystal on Silicon panels, a category of reflective panels that includes the Direct drive Image Light Amplifier (D-ILA™) display.

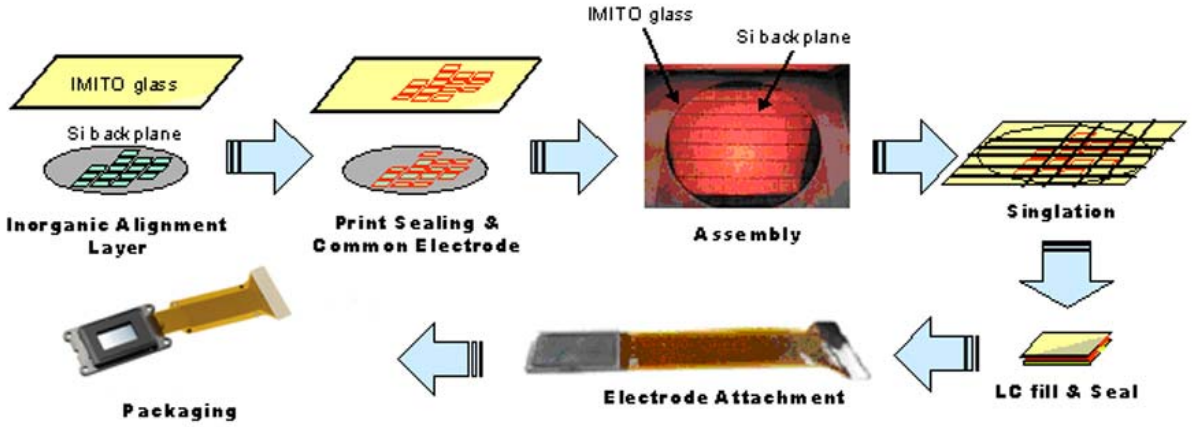
The birth of the SXRD™ microdisplay

From the outset, Sony was determined to create something fundamentally better. The challenge was to build a device with the highest pixel density and smallest possible inter-pixel spacing, along with world-class contrast, color stability and picture clarity. The answer was an all-new approach to reflective liquid crystal technology: the SXRD panel.

Photomicrograph of the SXRD panel silicon backplane in cross section.

SXRD chip production

Unlike conventional LCoS devices, which are notoriously difficult to manufacture, the SXRD device uses a production process that Sony has perfected in the company's own, dedicated manufacturing facilities. This has enabled Sony to bring SXRD technology smoothly into full production, while taking full advantage of its many benefits.



Sony assembles the IMITO glass and silicon backplane prior to cutting the wafer into individual chips (singlation). In this way, Sony achieves three key advantages: a narrow cell gap, a dust-free process and no LC gap spacers in the image area.

Sony produces the SXRD™ silicon backplane at our Kokubu Technology Center. The backplane uses a 0.35 micron process and an innovative drive circuit. The devices themselves are assembled at Sony's Kumamoto Technology Center. There, Sony affixes the Index Matching Indium-Tin-Oxide (IMITO) glass to the backplane before we cut the wafer into individual chips. This process minimizes the Liquid Crystal cell gap, minimizes dust and keeps LC gap spacers clear of the image area—all important considerations in picture quality.

The rapid evolution of SXRD technology

The very first product to incorporate SXRD technology was Sony's Qualia™ 004 custom installation front projector in early 2004. Critics were dazzled by its stable color, vivid contrast and full HD resolution: 1920 x 1080 pixels. Sony soon incorporated the same SXRD device into the Qualia 006 home theater rear projection television.

Sony's Qualia™ 004 custom installation projector was the first product to incorporate SXRD™ technology.

The Qualia 006 first brought SXRD technology into home theater rear projection television. (Shown with optional stand.)

A substantially larger device became the key to Sony's incredible "4K" professional projectors, the SRX-R110 and the SRX-R105. Designed for digital cinema, large

venues, command & control, museums and exhibits, these projectors offer a jaw-dropping 4096 x 2160 resolution.

The highly acclaimed SRX-R110 professional projector.

Now Sony debuts the company's third generation. At 0.61 inches diagonal, this is the world's smallest microdisplay with full 1920 x 1080 resolution. Thanks to this new device, Sony's KDS-R60XBR1 and KDS-R50XBR1 place SXRD™ technology within the reach of more consumers than ever before.

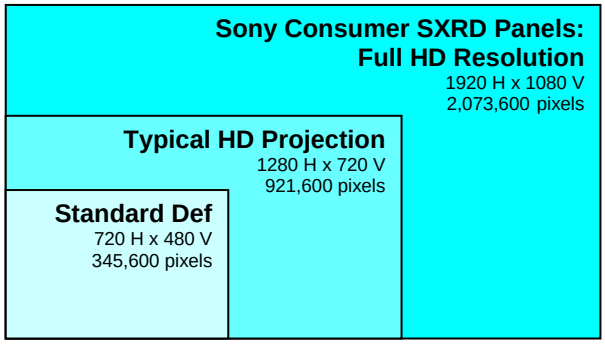
Sony's KDS-R60XBR1 home theater projection television brings SXRD technology within the reach of more consumers.

Generation	1st Generation	2nd Generation	3rd Generation
Application	Custom Installation, Home Theater	Digital Cinema, Large Venues, Command & Control, Museums and Exhibits	Home Theater
Products	Qualia™ 004 FPJ Qualia™ 006 RPJ	SRX-R110 SRX-R105	KDS-R60XBR1 KDS-R50XBR1
Size	0.78 inches diagonal	1.55 inches diagonal	0.61 inches diagonal
Resolution, HxV pixels	1920 x 1080	4096 x 2160	1920 x 1080
Reflectivity	65%	72%	74%
Device Contrast Ratio	> 3000:1	> 4000:1	5000:1
Pixel Pitch	9 µm	8.5 µm	7 µm
Inter-Pixel Spacing	0.35 µm	0.35 µm	0.35 µm

Sony's third-generation SXRD™ device is now the world's smallest microdisplay with full 1920 x 1080 native resolution

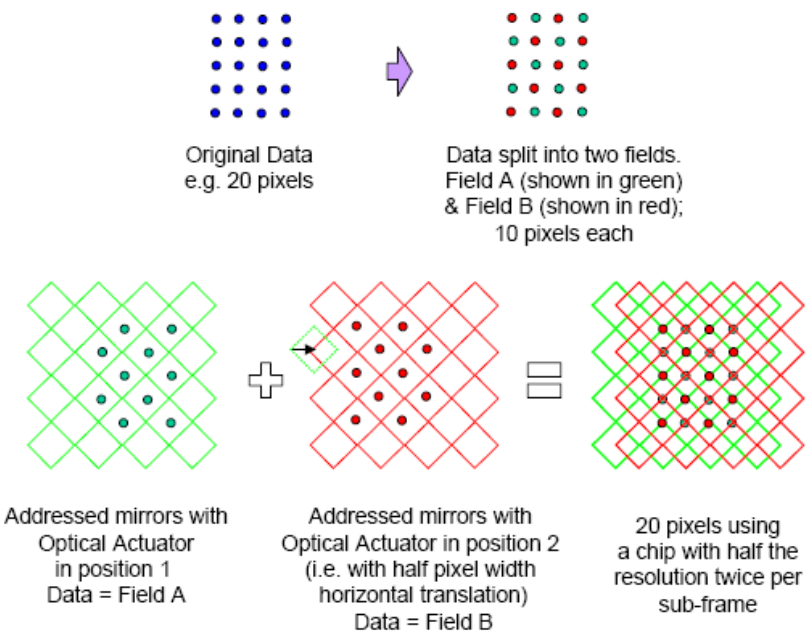
HD resolution... and Beyond

From the outset, Sony's very first SXRD products achieved full HD resolution (1920x1080) using a one-to-one relationship between the pixels on the microdisplay and the pixels on the screen.



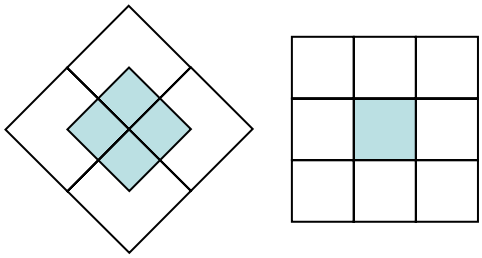
Compared to many microdisplays that are designated "High Definition," Sony SXRD devices for consumer television have more than twice as many pixels.

Originally, DLP chips also offered a one-to-one relationship between the pixels on the chip and the pixels on the screen. But in a move oddly reminiscent of interlace scanning, recent DLP projectors divide each display frame into two "subframes." A pivoting mirror outside the display panel called the "optical actuator" toggles the screen image back and forth. The system shows the pixels of the first subframe, then toggles to show the pixels of the second. This is a cost-reduction strategy because when the pixel count of the microdisplay is cut in half, the resulting chip is less expensive.



The DLP "optical actuator" system works to double the native resolution of the panel itself.

The optical actuator system also uses a different orientation for the microdisplay pixels. The first DLP chips used an "orthogonal" array of pixels, arranged in vertical columns and horizontal rows. The DLP panels used with optical actuators adopt a diamond or diagonal pixel array.



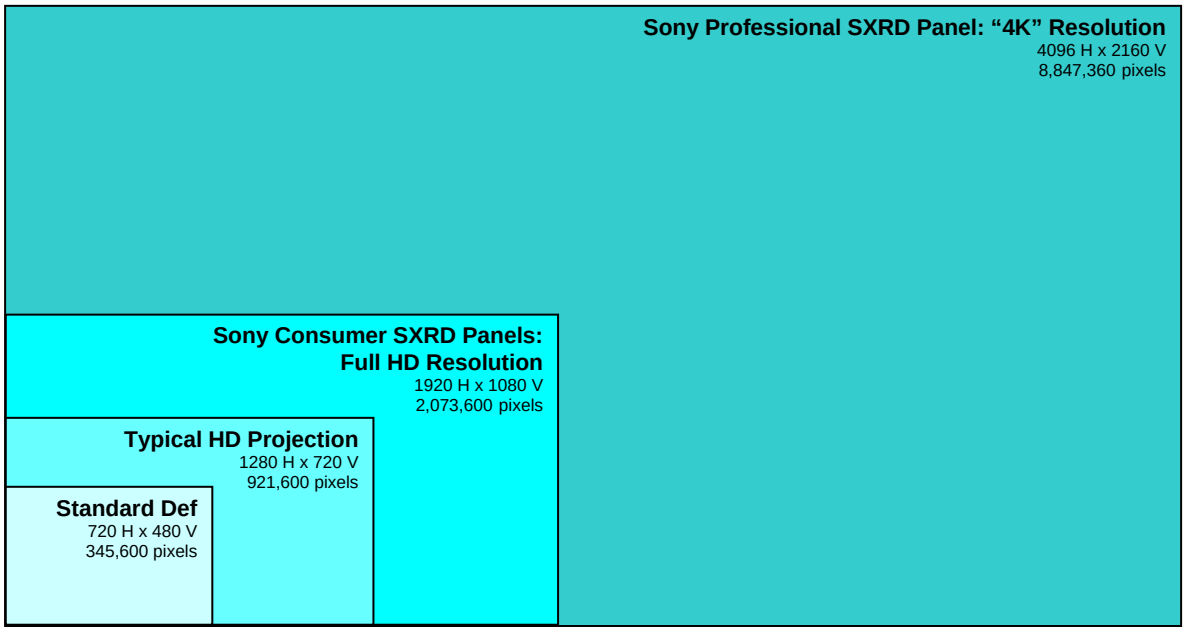
In the optical actuator system, a diagonal array pixel (left) shares its area with four adjacent pixels. An orthogonal array pixel (right) never shares its area.

Unlike either 1280 x 720 panels or optical actuator approaches, SXRD™ displays achieve full 1920 x 1080 native resolution, which show all the pixels, all the time. Sony can do what others can't thanks in part to the extremely fine "pitch" of the SXRD pixels. In Sony's latest SXRD panel, refinements to the drive circuit layout have enabled Sony to reduce the pixel pitch to just 7 micrometers, for comparison, a human hair is roughly 70 micrometers thick. This 7-micrometer pitch delivers 4.0 times the picture density of Sony's own H-LCD. The fine pitch enables Sony to put 2,073,600 pixels (1920 x 1080) on an integrated circuit chip with a surface just 0.61 inches diagonal. So 1080-line HD sources appear in their full glory.

As the pixels become smaller, the "pixel density" becomes greater. Higher pixel density is the key to providing a television with full High Definition and three microdisplays at a price where others offer just one chip.

More than 8 megapixels on an inch and a half of silicon, this is the professional version of Sony's SXRD™ device.

SXRD technology was designed from the outset to support multiple markets. So each SXRD silicon wafer can be easily sliced into large or small chips, in order to suit a variety of applications—from home theaters to the most demanding multiplex cinemas. For this purpose Sony created a giant 1.55-inch diagonal SXRD device for our professional "4K" projectors, bringing SXRD technology to the most stringent application in entertainment and information display.

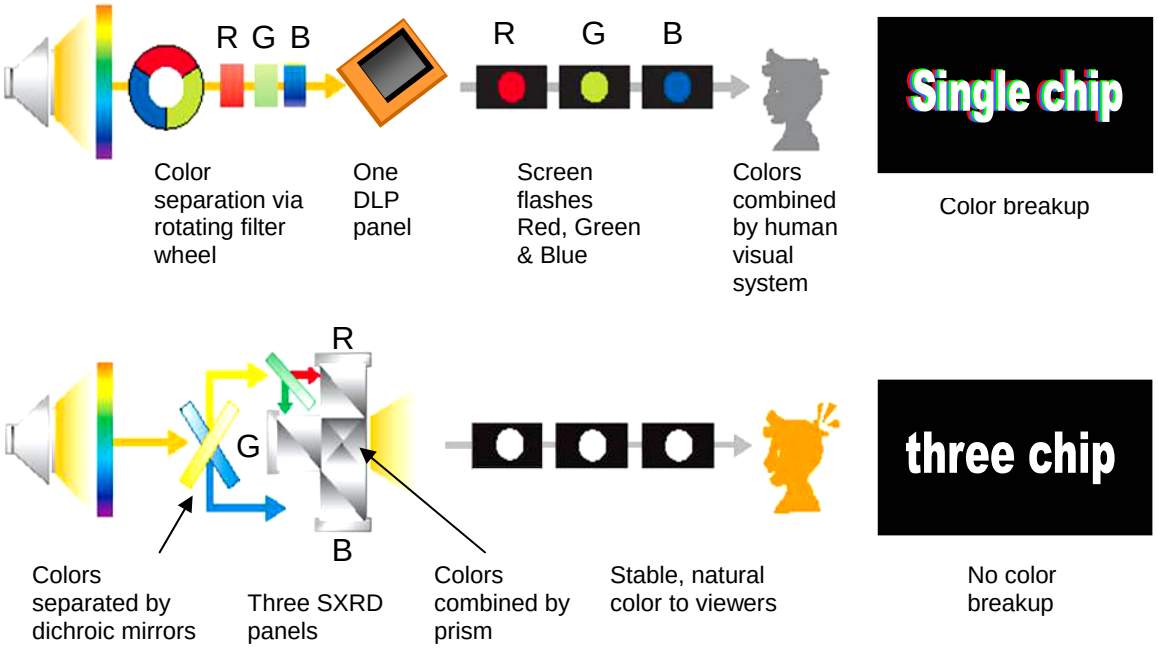


SXRD technology is also scalable. Our professional projectors achieve "4K" resolution—more than four times the pixels of full High Definition.

Stable, natural color

To further hold down cost, many DLP projectors use a single microdisplay. In a throwback to the mechanical color television proposals of the 1950s, color is separated by a rotating color wheel that is timed to coincide with a subframe for each color segment on the wheel, such as Red, Green and Blue. DLP color wheels now use as many as eight segments. Regardless of the number of segments, the single-chip DLP system can only flash one color at a time. In fact, the colors remain completely separate until they are combined by the human visual system.

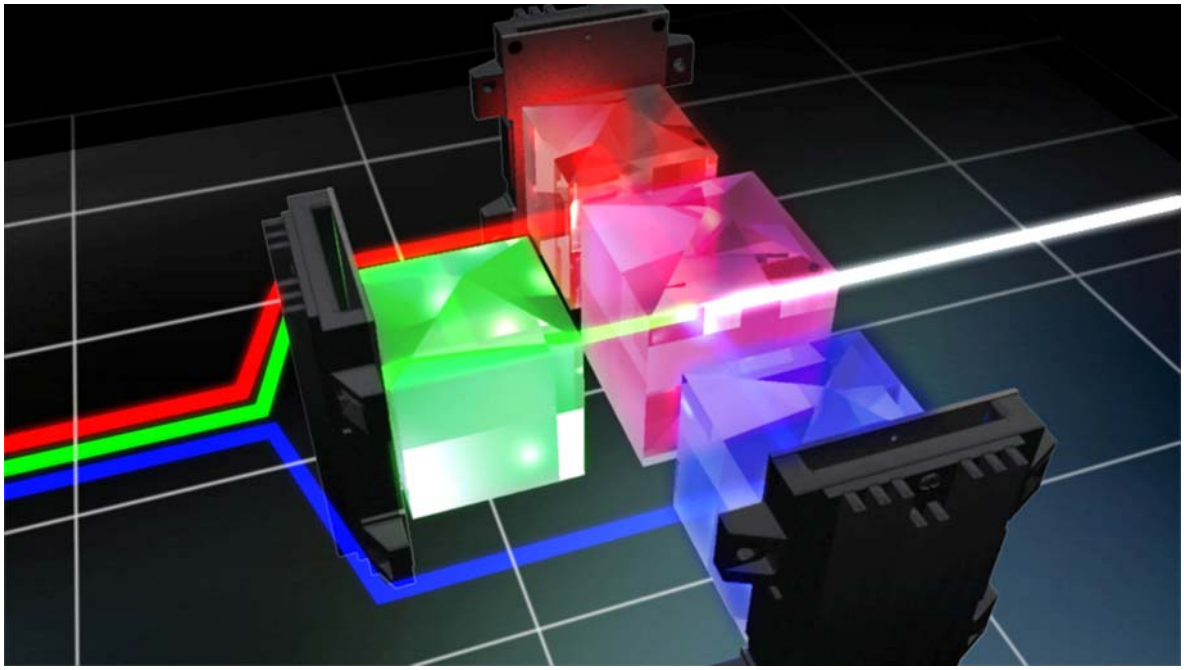
This single-chip system can generate adequate color under many viewing conditions. However, under certain highcontrast conditions, color breakup—rainbow flashes of the individual colors may be seen. This can occur when looking away from the screen or even blinking. Combining the requirements of the color wheel with those of the optical actuator, each video picture could be represented by as many as *sixteen* subframes (the eight color segments times the two optical actuator positions).



Projectors with a single DLP chip are subject to color breakup which may be visible or concern some viewers. SXRD projectors use a separate chip for Red, Green and Blue to display all the colors all the time. So color breakup is never a problem. (Sample illustration of color breakup with a high contrast image that may be visible to viewers.)

In designing SXRD™ projection systems, Sony® engineers wanted more. These Sony projectors use three SXRD chips, one each for Red, Green and Blue. In this way, SXRD projectors display *all the colors, on all the pixels, all the time.*

There are no "subframes," and no rainbow artifacts, ever. Thanks to Sony's three chip design, you get stable, consistent color under all viewing conditions, in addition to high optical efficiency. These benefits of three-chip architecture are so widely recognized that in high-end projectors, even DLP systems use three chips.

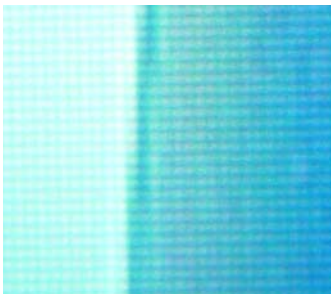


This conceptual view of the SXRD™ optical engine shows the filtered Red, Green and Blue light entering at left, the three SXRD devices and the combined light exiting the prism, at right.

Minimal screen-door effect

On all fixed-pixel displays, the pixels are separated by gaps that contain no picture information. To generate the effect of a seamless, continuous image, these gaps should be minimized. Unfortunately, High Temperature Polysilicon LCD’s require substantial gaps between pixels because the transistors must exist in the same plane as the pixel electrodes.

On the screen, large inter-pixel gaps can appear to have heavy black outlines. At close distances it can appear as if you are viewing the image through a screen door. You can always moderate this "screen door" effect by sitting further back from the television. But that tends to reduce the apparent resolution, defeating the whole reason people bring home High Definition in the first place.

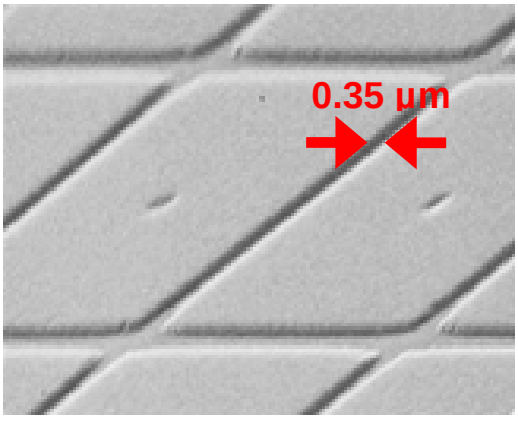


Typical H-LCD
1366 x 768 pixels
Fill Factor 50%

Sony SXRD
1920 x 1080 pixels
Fill Factor up to 92%

Close-up (approx 1") screen image of two projectors of the same screen size. Left: the screen door effect on a typical H-LCD projector. Right: the SXRD projector is better, thanks to its higher 1920 x 1080 native resolution and high fill factor.

While light *shines through* H-LCD devices, light *reflects from* the SXRD™ device. All the transistors are hidden in the silicon backplane behind the reflective surface. This arrangement enabled Sony to design inter-pixel gaps just 1/10 the width found in an H-LCD device. While the distance from the center of one SXRD pixel to the center of the next is as low as 7 micrometers, the inter-pixel gap is just 0.35 micrometers. This is one of *the world's smallest inter-pixel spacings*. This tight spacing means that over 90% of the SXRD device's surface is devoted to live image area. This is known as the fill factor of the device.



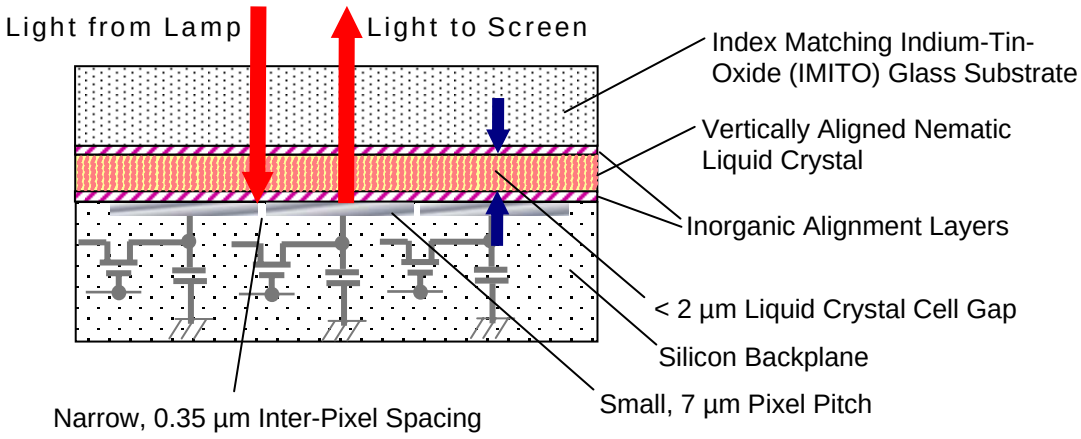
Photomicrograph of the SXRD device surface, showing the fill factor of over 90% and 0.35 micrometer inter-pixel gap.

The design of the silicon backplane not only controls screen door effect, but also contributes to superb uniformity and low crosstalk, minimizing any noise in the image.

High speed

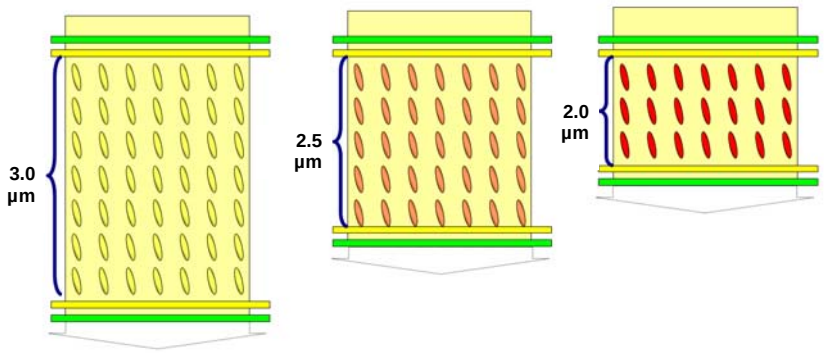
It is well known that CRTs exhibit very fast response to the dynamic changes in television pictures. So movement is rendered crisply and accurately. Unfortunately, Liquid Crystal Displays are typically not as fast. That's because the liquid crystals are viscous, with consistency more like honey than water. When the transistors command a pixel to change its state, the liquid crystal takes a few milliseconds to respond. In video, milliseconds are important. Typical 60 Hz interlaced material requires the projector to display a new scene every 16.7 milliseconds. Slow LCD response can blur fast motion, for example a race car zooming past a trackside camera.

Transmissive H-LCDs are not the only panels that use a liquid crystal layer. So does the SXRD™ device. But while light travels through the transmissive H-LCD only once, light passes through the SXRD liquid crystal twice, first coming in to strike the mirrored backplane and then reflecting out toward the screen undergoing a change in polarization depending on the applied voltage. Because the light passes through twice, the liquid crystal layer can be *half as thick*.



Conceptual drawing, not to scale, of Sony's 3rd-generation SXRD device in cross section. Light from the projection lamp enters through the glass substrate at the top, passes through the 2-micrometer Liquid Crystal layer, reflects off the mirrored surface of the Silicon backplane, and passes out through the Liquid Crystal, toward the screen.

Having an LC layer that's half as thick is a huge advantage because thinner layers mean fewer LC molecules to twist. And that means more power is available to twist each molecule, and thus a faster response time. In practice, response time varies as the square of the LC layer thickness. So reducing the layer thickness by 50% means the response time is cut by 75%.



A thinner Liquid Crystal layer (right) means fewer LC molecules to twist and more available power to twist each molecule. The result? Faster response.

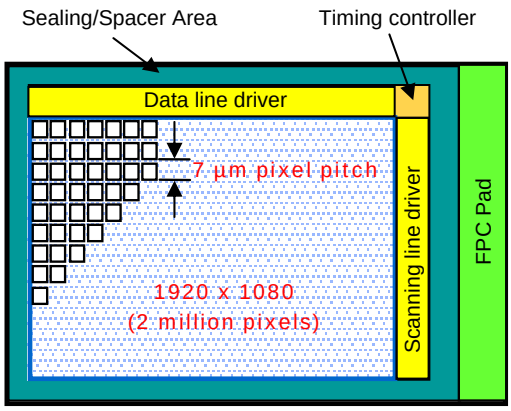
At less than 2 micrometers, the SXRD™ device's liquid crystal layer is not only thinner than with transmissive H-LCD; it's also thinner than with the typical LCoS device. The SXRD picture remains crisp and clear during fast action scenes such as those seen in sports like hockey, basketball, and auto racing The specified response is 2.5 milliseconds for the rise time (tr) and also 2.5 milliseconds for fall time (tf).

High contrast

Contrast, an essential requirement of any display system, is measured as the ratio between the brightest possible white and the darkest possible black. Sony's SXRD displays achieve superb contrast ratio, thanks to three distinct innovations.

- **Vertically Aligned Nematic (VAN) liquid crystal.** Many H-LCD projectors use Twisted Nematic (TN) liquid crystal, which displays white when no voltage is applied. Sony uses VAN liquid crystal optimized for the SXRD panel, which displays black when no voltage is applied.

- **Ultra-thin LC layer, less than 2 micrometers.** The contrast ratio is defined in part by the "dark level"—the darkest possible black that the panel can display. Lower dark levels are better. As with response time, the dark level varies as the square of the LC layer thickness. For this reason, Sony's ultra-thin LC layer—less than 2 micrometers—contributes directly to a higher contrast ratio.



Plan view, not to scale, of Sony's latest SXRD chip. By locating the Sealing/Spacer outside the active picture area, the SXRD design maintains maximum contrast.

- **Spacer-less design.** Many LCD panels require spacers in the image area to maintain a uniform cell gap. Unfortunately, these spacers interrupt the regularity of the nearby liquid crystal molecules, affecting contrast. The SXRD device incorporates a spacer/sealer around the periphery of the live display area. As a result, the image area is entirely free from spacers, and maintains maximum contrast. This process also maintains highly precise cell gap uniformity.

Thanks to these features and additional refinements to the SXRD™ device structure, the contrast ratio of Sony's third-generation SXRD device, when measured with a conoscope, is 5000:1—a substantial improvement over an H-LCD design.

Long life

Two thin sheets of material hold the liquid crystal in alignment. Typically this material is organic polyimide film. This generally works well but has less than optimal operating life in the stressful, high-heat environment of a video projector. Sony's inorganic thin film alignment layer not only maintains vertical liquid crystal alignment but also exhibits exceptional thermal stability. This substantially extends the operating life of the SXRD device.

In addition, H-LCD panels are squarely in the light transmission path, making them relatively difficult to cool. Because light reflects off the SXRD devices, their "dark" side is out of the light transmission path, allowing for much simpler and more effective cooling, prolonging the device life further still.

A new benchmark

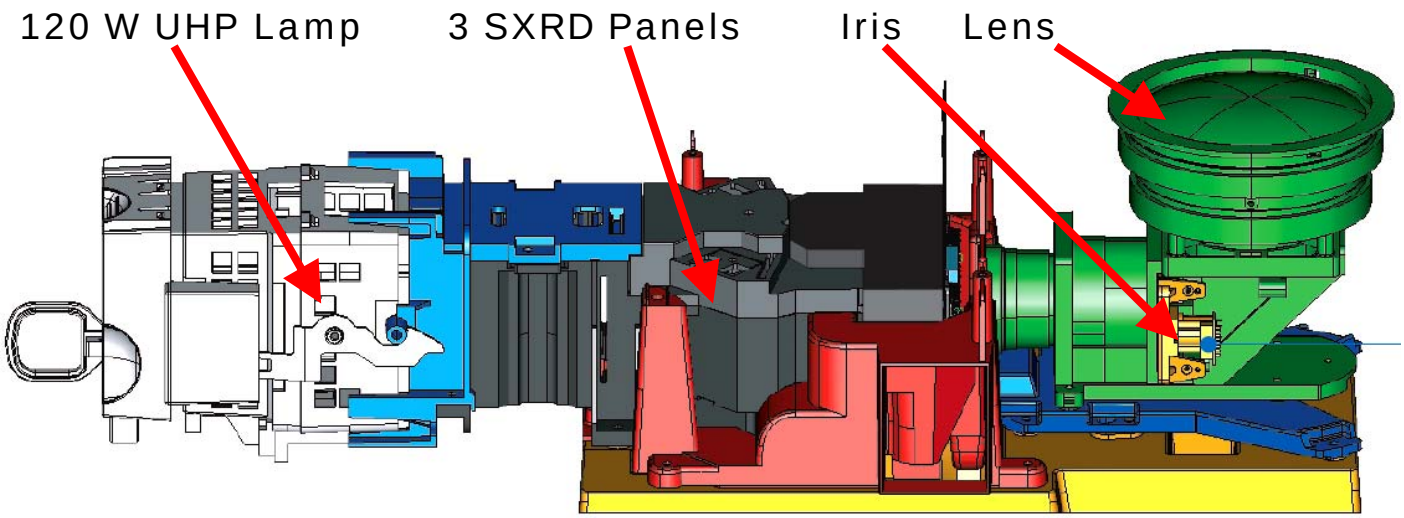
Hailed by critics, movie theater owners, demanding professionals, SXRD™ technology has helped establish Sony's latest video projectors as industry benchmarks. Sony is a leader in applications as varied as digital cinema, custom installation and home theater. SXRD displays are breaking new ground for the two most important parameters of picture quality: resolution and contrast ratio. The technology also achieves blistering response speed, long operating life and superb freedom from the screen door effect, while the three-chip design delivers exquisite, ultra-stable color. In this way, SXRD technology unleashes The Full Power of HD.

Picture Technologies

Creating a superior microdisplay is a momentous step toward creating a superior projection television. But the SXRD device itself is just the beginning. Sony® engineers set to work designing an optical engine, electronics, inputs and outputs that would do full justice to the 1920 x 1080 resolution of the SXRD chip.

Optical Engine with three SXRD™ chips

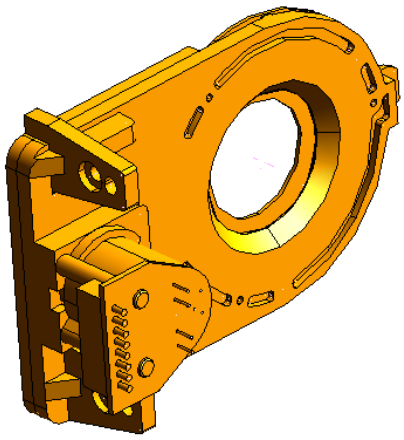
Sony builds the three SXRD chips into a subassembly called the Optical Engine. It starts with a 120 watt Ultra High Pressure (UHP) lamp, which features high output, high efficiency and stable performance over a long life. Light from the lamp passes through three dichroic mirrors that result in filtered Red, Green and Blue light for the three SXRD devices. To control unwanted color shading, Sony designed the three light paths to be of equal length. Reflected light from the three SXRD chips is combined into a single, integrated, full-color image by the prism. The result is a bright, high-resolution image with natural, balanced color.



The optical engine of the KDS-R60XBR1 and KDS-R50XBR1 is engineered to deliver the full precision of Sony's three SXRD chips.

Cinema Black Pro system

Just as the human iris constantly adjusts to overall light levels, a motor-driven iris in these televisions can make similar adjustments. As part of Sony's Cinema Black Pro system, this enhances the "dynamic" or scene-to-scene contrast ratio. The iris, positioned between the prism and the projection lens assembly, can be controlled by users in two distinct ways:

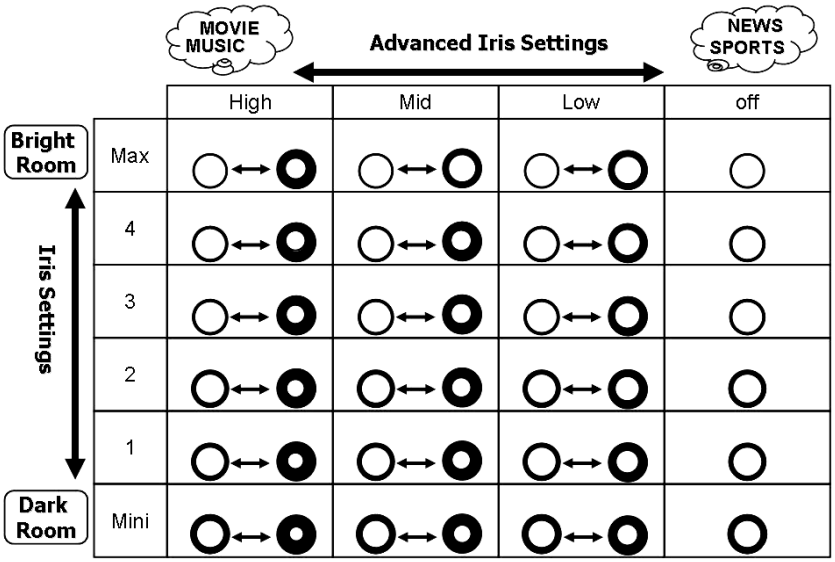


Sony's motorized iris plays a crucial role in increasing dynamic, scene-to-scene contrast.

- **The Iris setting** adjusts the television for ambient room lighting in six steps from minimum (dark room) to maximum (bright room). The television can save a separate Iris setting for each picture mode (such as Vivid, Standard or Pro) and each input.

- **The Advanced Iris setting** dynamically responds to the average brightness of video pictures. The iris closes down for dark scenes, enabling intense blacks and superb shadow detail. In the same way, the iris opens up for bright scenes, achieving outstanding brightness and beautiful highlight detail. This operation yields exceptional dynamic contrast ratio: up to 10,000:1*. Four Advanced Iris settings include High, Mid, Low and Off. Off is recommended for live programming such as News and Sports. High is ideal for highly dynamic material such as Movies.

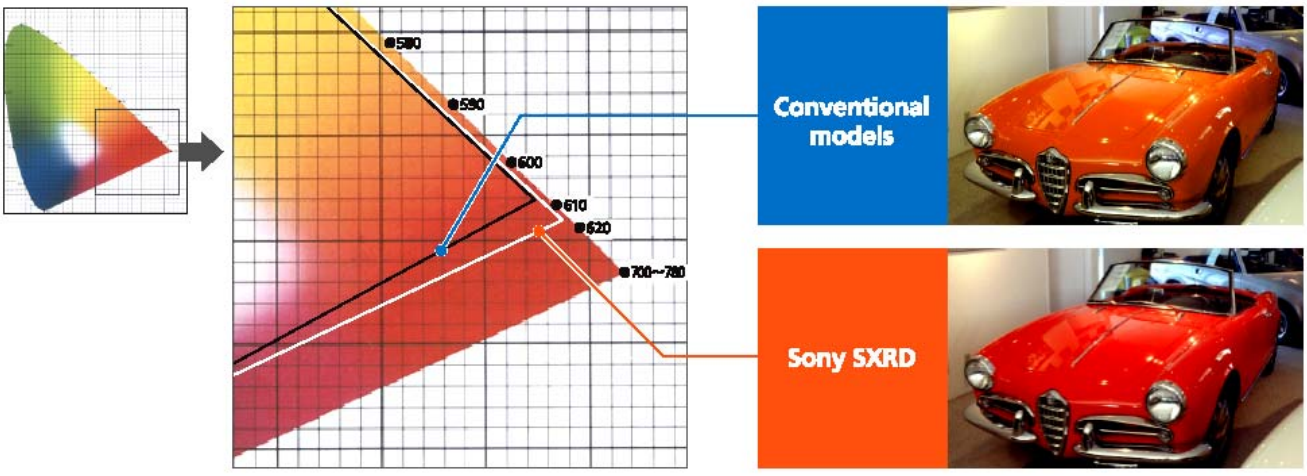
*The contrast ratio is measured based on the VESA standard with the "Advanced Iris" set to "High".



Sony delivers the right brightness and contrast for both the ambient room light (Iris) and the type of programming (Advanced Iris).

Improved Color Gamut

Additional refinements in the Optical Engine enable the KDS-R60XBR1 and R50XBR1 to reproduce more colors than previous Sony® projectors. Color reproduction requires a delicate balance of gamut (range of colors) versus brightness. By integrating Sony's optical filter technology, the highly efficient 120 watt UHP lamp and an advanced cooling system, Sony was able to extend the range of red tones while still maintaining superb screen brightness.

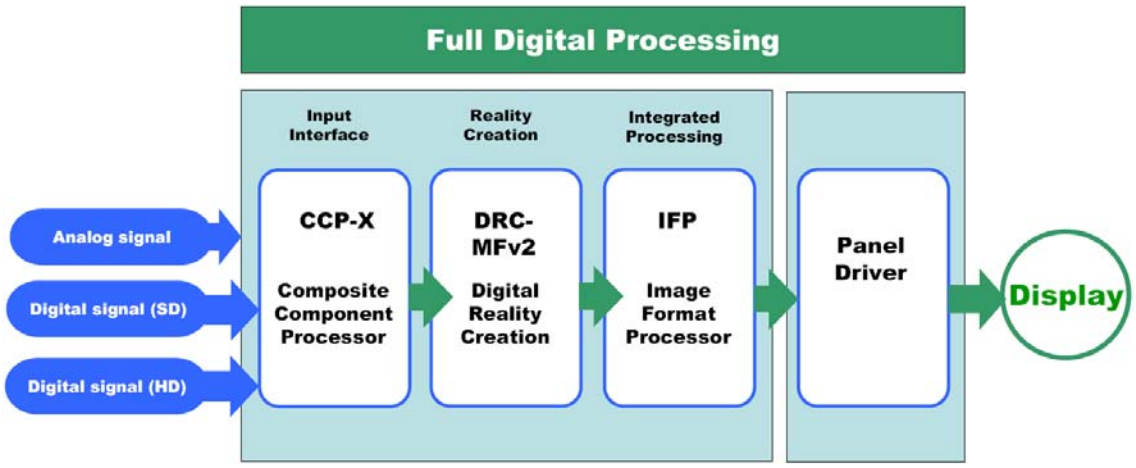


A close-up of the chromaticity chart shows that Sony's KDS-R60XBR1 and KDS-R50XBR1 can reproduce deeper, more satisfying red than previous Sony projectors.

WEGA Engine™ HD Processing

These televisions are designed to elicit maximum performance in an increasingly digital world. For this reason, they incorporate Sony's WEGA Engine HD signal processing, which accepts digital signals directly and immediately converts analog inputs to digital. This minimizes the analog-to-digital and digital-to-analog conversions, for exceptional picture quality and reduced video "noise." The system has four distinct stages.

- **Composite Component Processor (CCP-X)** enhances input signal-to-noise ratio by performing chroma decoding in the digital domain.
- **Sony's Digital Reality Creation®** (DRC™) Multi-function V2 system then prepares Standard Definition input signals for 1920 x 1080 HD display by mapping SD signals to their HD equivalents. The DRC Palette option lets you customize the level of detail (Reality) and smoothness (Clarity) to match the input signal quality, viewing conditions and personal preferences.
- **The Image Format Processor** includes a Digital Texture Enhancer function to optimize contrast by utilizing a wide dynamic range. An enhanced motion vector algorithm also reduces signal noise, while maintaining the overall level of sharpness.
- Finally, the **Panel Driver** converts the picture data to an analog signal optimized for the specific electrical requirements of the SXRD™ chips.



CineMotion® 3-2 reverse pull-down

Much of prime time television and most DVDs were originally shot on movie film at 24 frames per second or in 24-frame progressive digital High Definition (24p). These original frames can be broken into fields during TV transmission or DVD playback. If handled carelessly, progressive scan display of these fields can result in severe motion artifacts, with "feathering" or "combing" at the vertical edges of moving objects. To prevent this, the CineMotion circuit intelligently preserves the integrity of the original frames. You get smoother, more seamless pictures. It's an important advantage for movies, music videos and television series.

Audio

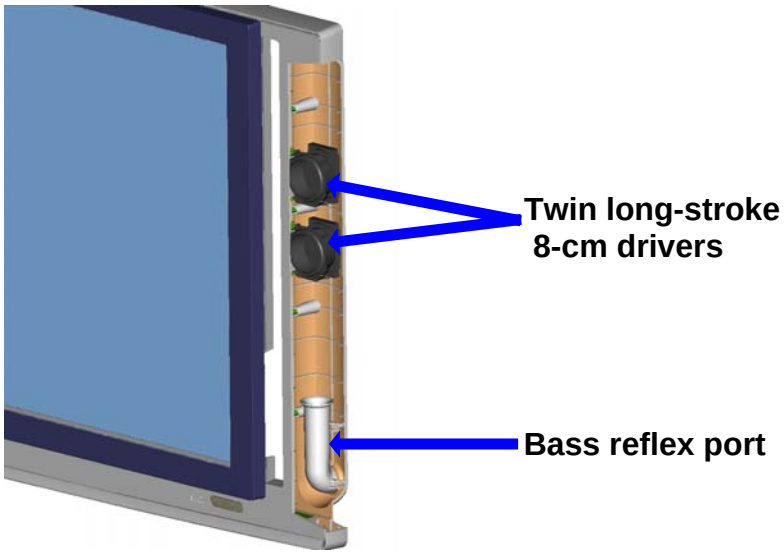
As fully integrated televisions, the KDS-R60XBR1 and R50XBR1 also include extensive facilities for on-board sound reproduction—in addition to sophisticated connections for outboard audio components.

S-Master® digital amplifier

The inside of a television is hardly the ideal environment for a high fidelity amplifier. Size and heat constraints impose severe practical limits. That's why Sony adopted the S-Master digital amplifier circuit we originally designed for high fidelity components. In addition to high output and low distortion, the amplifier is amazingly space efficient and generates very little heat. The result is impressive audio performance from an all-in-one television.

High fidelity speakers

Sony was determined to elicit high-output, low-distortion sound from elegantly thin speaker enclosures. In a classic high fidelity solution, Sony incorporates a pair of long-throw drivers operating in unison. This increases the ability of the speaker system to move air—without increasing the width of the enclosure. For even more extended bass, Sony adopted the bass reflex design, with a tuned port that vents at the bottom of the speaker cabinet.



High fidelity speaker design.

Dolby® Digital 2.0-channel decoding

Modern digital program material, including HDTV broadcasts and DVDs, offer Dolby® Digital sound tracks with rich dynamic range, low distortion and extended frequency response. The KDS-R60XBR1 and KDS-R50XBR1 include a built-in Dolby Digital decoder to reproduce these sound tracks through the built-in stereo speakers.

SRS® TruSurround® audio

DVDs and HDTV broadcasts include rich surround sound information, the effect of which can be lost without a full 5.1-channel speaker system. SRS TruSurround audio processing takes advantage of the psychoacoustics of head-related transfer functions to create the effect of surround sound even when you're only using the television's built-in stereo speakers.

Optical digital audio output

Sony provides an optical digital audio output to enable the HDTV signal's Dolby® Digital multi-channel audio to be decoded on an outboard A/V receiver, preamplifier or audio processor.

Inputs and Outputs

Sony® engineers have a passion for home theater audio and video components. So they're particularly alert to the latest opportunities and best practices in component interconnection. This expertise is clearly reflected in the KDS-R60XBR1 and KDS-R50XBR1, televisions that are destined to be the centerpieces of advanced home theater systems.

Digital Cable Ready Integrated HDTV

As you would expect, these new televisions have full, integrated High Definition TV (ATSC) tuning in addition to Standard Definition NTSC. The televisions are also Digital Cable Ready. A rear-panel CableCARD™ Slot enables cable subscribers to watch encrypted cable channels without the need for a separate cable box. (Requires subscription, activation and CableCARD module from your cable TV provider.)

Dual HDMI™ digital audio/video inputs

Two High-Definition Multimedia Interface (HDMI) inputs provide pristine digital-to-digital connections for HDMI-equipped audio/video components, such as a DVD player, A/V receiver, satellite receiver or cable box. The HDMI connections deliver uncompressed, High Definition or Standard Definition digital video plus digital audio together on a single cable. The HDMI specification enables source components and target components to communicate their signal-handling capabilities and automatically transfer signals at the highest resolution they have in common. The HDMI signal content is secured with HDCP technology.

Three i.LINK® DV/HDV interfaces

As the number one camcorder brand in the United States, Sony understands the entertainment value of home movies. And Sony appreciates the opportunity to connect High Definition digital camcorders to a High Definition digital television in the digital domain. That's why these televisions include three i.LINK interfaces that accommodate both Standard Definition DV camcorders and High Definition HDV 1080i camcorders and allow secure transfer of copyright-protected High Definition content between these devices and the television. (i.LINK® is a trademark of Sony used only to designate that a product contains an IEEE 1394 connector. All products with an i.LINK connector may not communicate with each other.)

D-sub 15-pin PC input

Personal computers are becoming an increasingly important source of digital entertainment, including digital pictures and video clips stored as MPG, AVI, or MOV files. For this reason, the KDS-R60XBR1 and KDS-R50XBR1 are designed to be used as computer displays, connected via the D-sub 15-pin input. The televisions accept a wide range of input signals, including VGA (640 x 480, 720 x 400), WVGA (854 x 480), SVGA (800 x 600), XGA (1024 x 768), WXGA (1280 x 720, 1280 x 768) and SXGA (1280 x 1024). You can enjoy PC sources in Normal mode, which displays the picture in its original size, at a one-to-one pixel relationship. Or you can expand the PC source using Full1 mode (full screen height) or Full 2 mode (full screen height and width).

Memory Stick PRO™ media slot

You can also pop the Memory Stick® or Memory Stick PRO™ media out of a compatible Sony® camera or camcorder and into the television's front panel slot, (please check our website for compatibility). This enables a host of capabilities:

- View photo (JPEG) and movie (MPEG1) files in a slide show or thumbnail index.
- Set customized slide show options, including transition and MP3 background audio.
- Pan, zoom and rotate photos.
- Select photos and set print quantities to be output when the Memory Stick media is inserted into a compatible photo printer.
- Protect (lock) or delete files on the Memory Stick media.

Other inputs

- **Analog component video inputs (Y/Pb/Pr)** let you connect High Definition or Standard Definition analog sources at extremely high quality.
- **S-Video inputs** support moderate resolution composite sources.
- **Composite video inputs** enable basic video connections.

Design

The KDS-R60XBR1 and KDS-R50XBR1 have a dramatic sculptural design. The flatness of the screen is emphasized with a dark gray bezel, while the loudspeakers occupy a silver frame that projects on wings to the left and right of the screen.

The televisions are also practical, with light weight and low power consumption relative to their screen size. To accommodate the widest range of rooms and viewing situations, these televisions are comparable in depth to popular 27-inch tube televisions (20-1/4" depth for the KDS-R60XBR1; 18-7/8" depth for the KDS-R50XBR1).

A final word

No technical paper, however detailed, can substitute for the actual experience of connecting a good High Definition source, sitting back and actually watching these televisions. With the exceptional quality of full 1920 x 1080 pixels, and with all the pixels and all the colors showing all the time, here are televisions that truly unleash The Full Power of HD.

SONY

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