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SPECIAL REPORT

In
Plane
Switching



Enhanced Super IPS
Next Generation Image Quality



LG.PHILIPS LCD



Technology You Can See!

EDITORIAL



Richard Barnes
Editor-in-Chief

Widespread consumer acceptance of LCD TV is today being driven not only by attractive pricing, but also by the increasing availability of full high definition (HD) broadcast TV and the upcoming launch of full HD optical disks (HD-DVD and Blu-Ray) and gaming platforms. This HD content will mean that the full high resolution (1920x1080, 2 megapixels) offered by widescreen LCD TVs will be a necessity rather than a luxury. To meet this growing market demand, LG.Philips LCD's Gen. 6 TFTLCD fab, "P6", came online last year making 32- and 37-inch panels, and their Gen. 7 fab, "P7", comes online in the first quarter of 2006 producing 42- and 47-inch panels. These advanced facilities provide better economies of scale to deliver higher volumes of large and wide full HDTV panels at attractive price points. Still, buyers sometimes hesitate when considering LCD TVs. Indeed two of the main issues LCD TVs have faced in the past have been related to viewing angles and contrast ratios. The introduction of LG.Philips LCD's Super In-Plane Switching (S-IPS) technology almost completely overcame the viewing angle problem, delivering a great image at almost any angle, with very little color shift. The opening of LG.Philips LCD's new Gen. 7 plant coincides with its development of "Enhanced Super IPS", meaning even better image quality in LCD TVs in the future. But what does this really mean in detail? In this Special Report, we look at what Enhanced S-IPS will bring to the customer... what value it will add to LCDs... and how manufacturers can bring real customer benefits through its use. Through interviews with leading figures within LG.Philips LCD and a leading analyst in the field, we aim to give you a clear overview of what this technology will bring to the fore.



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VIEW FROM THE INSIDE

Introduction – Bruce Berkoff



Bruce Berkoff
Executive
Vice President
Marketing

This is an exciting time for LG.Philips LCD and the TFT-LCD industry, as we are truly in a transitional phase. LG.Philips LCD began in 1995 as a supplier of notebook display modules, and later began to supply monitor panels for the IT industry.

Since this time, rapid technology development and market shifts have seen our recent focus shift toward the CE market, as ever-larger wide-format flat panel HDTVs have become a “must have” item.

LG.Philips LCD has a history of rising to market challenges and opportunities. We have developed the industry’s foremost portfolio of manufacturing facilities, including the world’s first Gen. 4 fab in Q3 ‘00, the world’s first Gen. 5 fab in Q1 ‘02, the world’s largest Gen. 6 fab in Q3 ‘04, and the world’s largest Gen. 7 factory to date, which comes online in Q1 ‘06. Our production technology strength has ensured our customers access to a full range of high-end products at large volumes and economies of scale for the notebook, monitor and flat TV markets.

Looking ahead, we expect the flat panel PC and TV markets to continue their growth trends as full HD content (2 megapixels at resolution of 1920x1080) becomes widely available and the importance of higher resolution displays increases.

We are prepared to meet demand for HD and full HD panels at a full range of standard wide-format TV sizes, including 20-, 23-, 26-, 32-, 37-, 42- and 47-inches. This selection is unrivalled by competing TV technologies such as PDP and rear-projection, neither of which can offer consumers HD and full HD resolutions at such a wide range of sizes. LCD also delivers low power, light weight, thin and attractive form factors and superior daytime viewing characteristics.

For years, LG.Philips LCD’s Super IPS, or “S-IPS”, wide viewing angle technology has delivered an unrivalled LCD viewing experience to end users. In this special report we are proud to introduce the next generation of this technology: Enhanced Super IPS. Enhanced S-IPS will take the viewing experience to the next level, and we hope that these pages will give you a clear picture of how LG.Philips LCD and this exciting new technology will enable a bright future for the flat panel market of tomorrow.

Interview – Eddie Yeo



Eddie Yeo
Executive Vice
President and Head
of Product
Development

Cleverdis: *How would you describe the philosophy of LG.Philips LCD when it comes to manufacturing LCD displays?*

Eddie Yeo: At LG.Philips LCD, we believe that a picture is worth a thousand words, and that flat panel displays are enabling rich and expressive images to be incorporated into ever more areas of our lives. Whether your display is a large and wide full high-definition TV, a set of high-resolution monitors or a wide-format notebook PC, it is important that viewers see the best looking image possible.

LG.Philips LCD has a long history of being on the cutting edge of the flat panel industry’s technical developments, introducing new products and technology to meet the needs of its superior customer base. Tell us about some of the benchmarks in LG.Philips LCD’s history of panel making...

In Q3 ‘97 we launched the world’s first 14.1-inch XGA notebook panel, in Q4 ‘01 we brought to market the world’s first 20-inch UXGA monitor panel and in Q4 ‘03 we launched the world’s first 42-inch wide XGA HDTV panel. This trend of product innovation is

something that our customers have come to expect and trust us to deliver.

We know you are particularly proud of one of your latest technological achievements - to be discussed in this report: Enhanced Super In-Plane Switching (Enhanced S-IPS). Tell us about this...

Enhanced S-IPS builds on our years of experience with industry-leading S-IPS wide viewing angle technology, providing an unrivalled TV viewing experience. This next generation of IPS technology will provide the widest viewing angle possible with the least color shift, even at off-axis angles. In addition, it builds on the strengths of S-IPS by delivering faster response times and significantly improved black levels and contrast ratios, especially when employed in concert with our dynamic contrast technology.

... So Enhanced S-IPS will help revolutionize the market?

Yes. We firmly believe that Enhanced S-IPS will deliver a viewing experience that is second to none in the flat panel market. Enhanced S-IPS will be the technology of choice whether people are looking for a 20- or a 47-inch wide HD or full HD TV to enjoy watching movies at home, or a 23-inch wide high resolution monitor for their graphic design needs.

LCD TECHNOLOGY & ENHANCED S-IPS

PRINCIPLE ADVANTAGES OF IPS

In-Plane Switching (IPS) is a liquid crystal switching technology that addresses the problems that affected early TFT-LCD panels many years ago, including limited viewing angles, color shift and slow response times. Thanks to the roll-out of successive generations of IPS technology, all of these issues are now largely in the past, and high-end LCD TVs that combine an IPS-based panel with premium set electronics truly deliver a superior viewing experience.

Wide viewing angle	178° (U/D, L/R, off-axis)
Smooth motion picture	< 5ms (gray-to-gray with ODC)
High brightness	400~600 nits
Natural color	> 72%
Long lifetime	> 50,000 hours
High contrast	1600:1 (with DCR)

THE EVOLUTION OF IPS

The original IPS technology was developed some years ago by engineers at Hitachi as a way to overcome the poor viewing angle characteristics of early TFT-LCD technology. The basic principle was to change the physical behavior of the liquid crystal layer by having the molecules move in parallel to the TFT and color filter layers rather than at oblique angles. This fundamental change significantly lessened light scattering, and thus improved the picture uniformity and color fidelity when viewed from wide angles.

Several years later, LG.Philips LCD introduced Super IPS (S-IPS), which built upon the strengths of IPS by employing an advanced "multi-domain" liquid crystal alignment. S-IPS set a new standard in premium LCD panels by further improving viewing angle to up to 178° (U/D, L/R), increasing color fidelity, achieving gray-to-gray (GtG) response times of under 8ms (when combined with over-driving circuitry (ODC)) and max dynamic contrast ratio (DCR) of 1200:1.

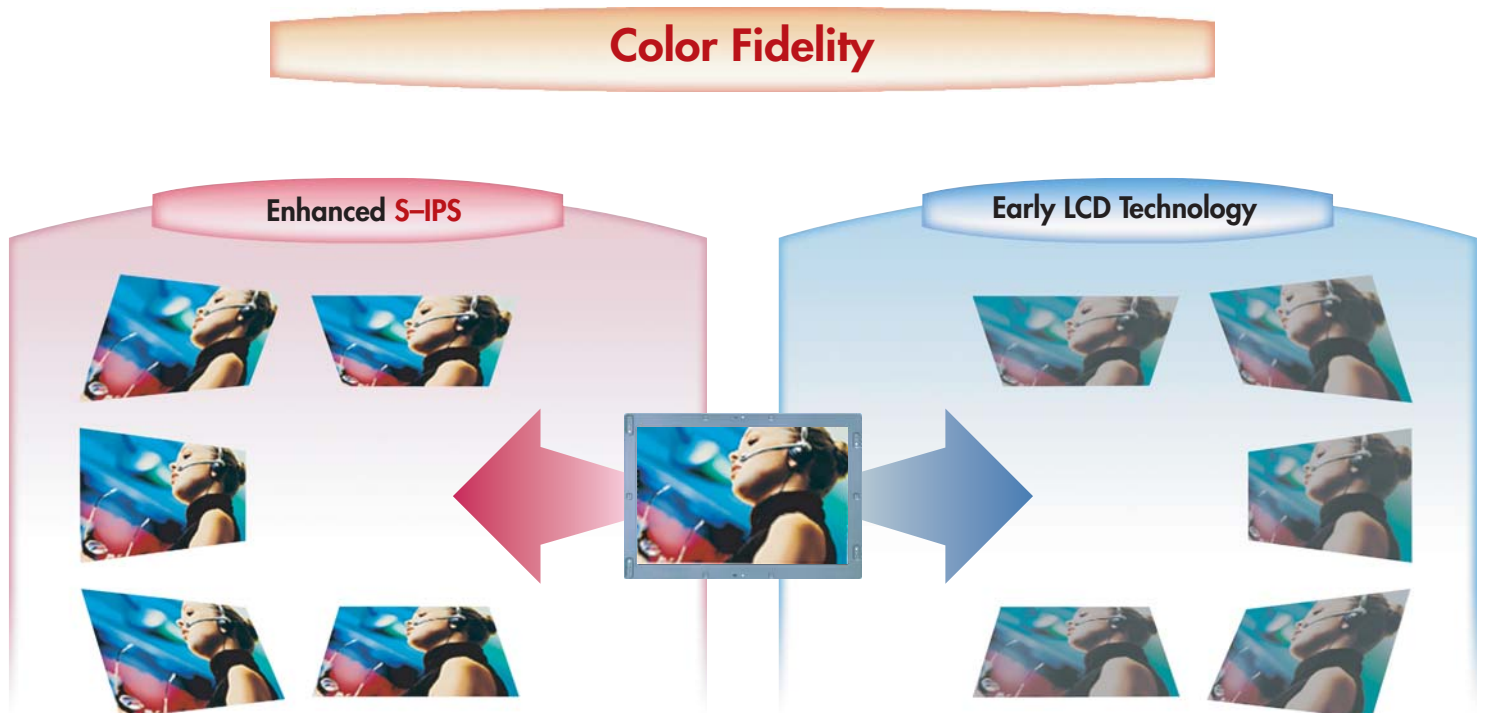
Enhanced Super IPS (Enhanced S-IPS) is the newest generation of IPS technology, and takes the LCD viewing experience to the next level. Enhanced S-IPS improves upon the previous generation by extending the viewing angle benefits to off-axis directions, specifically at 45° to the horizontal and vertical. In addition, Enhanced S-IPS achieves response times of under 5ms (with ODC) and a DCR of 1600:1.

REAL-LIFE PERFORMANCE BENEFITS

While it is easy to compare flat panels based on a wide array of specifications, it can be more difficult to understand how these measurements impact the real-life experience of viewing the panel. However, Enhanced S-IPS is a technology that affects the basic viewing experience in a clearly visible way.

WIDE VIEWING ANGLE

Enhanced S-IPS builds on S-IPS technology by providing the same 178° viewing angle from above and below and to the sides, and



greatly improves the off-axis viewing experience by delivering crisp images with minimal color shift, even when viewed from off-axis angles such as 45°.

Enhanced Super IPS truly delivers a great viewing experience from virtually any angle.

RESPONSE TIME

In theory, an LCD needs to have a pixel switching response time of less than 16.7 milliseconds in order to display standard NTSC video material without flicker.

However, even at these switching speeds, LCDs can still suffer from motion blur or smearing when displaying fast motion video due to the eye's visual perception. In order to help tackle this problem, Enhanced S-IPS delivers effective response times of less than 5ms gray-to-gray (GtG) when combined with overdrive circuitry (ODC). When an Enhanced S-IPS panel is put together with high-quality front-end electronics and technology such as scanning backlights or data insertion (DI), motion blur can be reduced to the point where it is almost undetectable.

CONTRAST RATIO

Similarly, Enhanced S-IPS enables ambient dynamic contrast ratios of up to 1600:1. This is a significant achievement, as it ensures that LCD panels can reproduce bright, vivid colors on the screen, without sacrificing deep black colors.

THE BOTTOM LINE

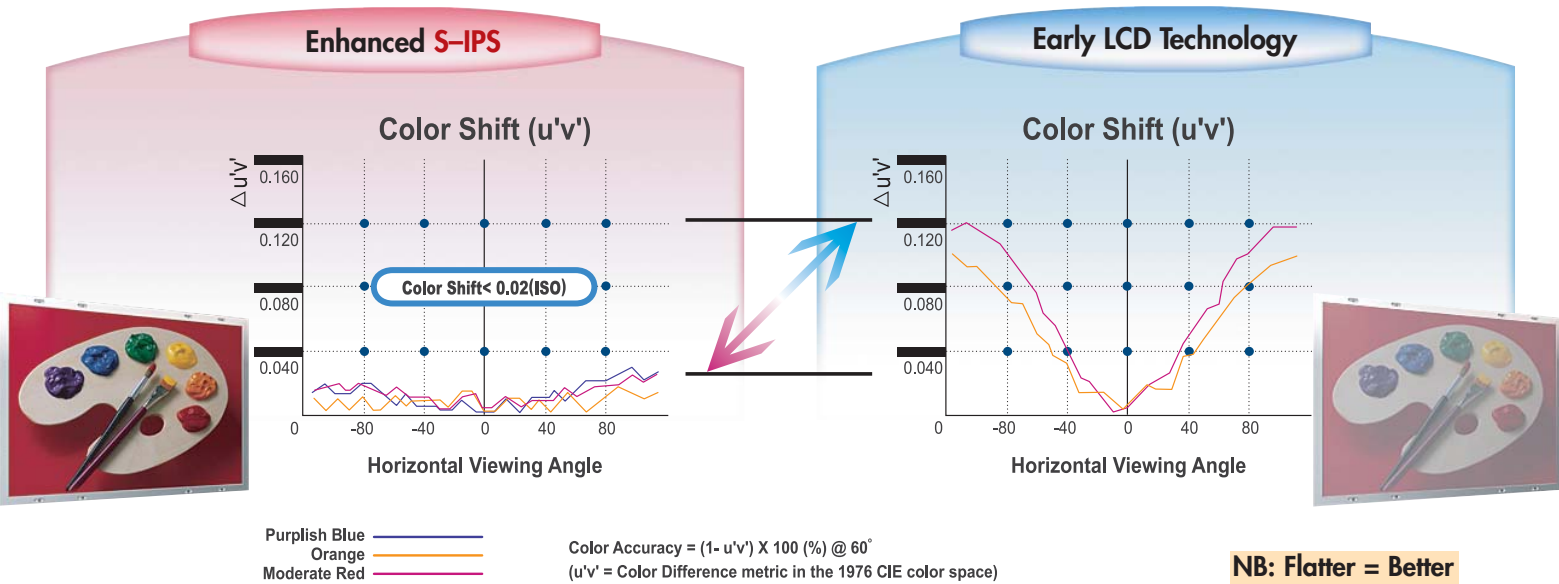
As the era of full HD (1920x1080 or 2 megapixels) content dawns, it is becoming increasingly easy for average consumers to achieve a true cinema experience in the comfort of their homes. When a TFT-LCD panel that implements LG.Philips LCD's Enhanced S-IPS technology is combined with quality front-end electronics, it will be possible to produce flat panel TVs with crisp, clean pictures and little or no motion blurring. While there are competing LCD and flat panel solutions in the market today, consumers should not allow themselves to be swayed by spec sheet numbers measured in unrealistic viewing conditions. Instead, consumers should judge displays based on actual viewing with real full HD content.

"Advancements of Enhanced S-IPS"

IPS	S-IPS	Enhanced S-IPS "The best solution for HDTV"
25 ms (On/Off)	8 ms (GtG*)	Response Time* < 5 ms (GtG)
20 ms	16 ms	MPRT < 12 ms ▶ < 8 ms
*170°/170°/160°	178°/178°/160°	Viewing Angle 178°/178°/178°
1.0 nit	0.4 nit	Black Level < 0.3 nit
500:1	1200:1**	Contrast Ratio > 1600:1 ▶ > 2000:1**

* Horizontal / Vertical / Diagonal
** GtG = gray-to-gray
+ With Over Driving Circuitry (ODC)
++ Dynamic Contrast Ratio

Color Accuracy: Enhanced S-IPS – 98%



FULL HD REVOLUTION



LC420WU1: 42-inch full HD widescreen LCD panel sets the industry standard size and resolution

FULL HD BECOMES A REALITY

1920x1080 (full HD) is now within the reach of TV buyers – the ultimate in “future proof”. While it’s possible to find 720p compatible HD panels in a broad selection of LCD TVs nowadays, what really adds value is the ability to offer true 1080p resolution, or “full HD”, for larger displays. HD video content is increasingly available in the form of broadcast TV, high resolution digital photos, HD gaming consoles and the newest version of HD optical discs (HD DVD and BluRay). Some industry organizations (i.e. the European Broadcast Union) are pushing for future standards to be based on 1080p. The integration of LG.Philips LCD’s full HD panels in new generation TV sets will add exceptional value, not only in the manner in which they are able to render images today, but also through the fact that they will be fully compliant with tomorrow’s forecast standards.

MULTIMEDIA CENTERPIECE

An LCD TV is the perfect centerpiece for the high definition digital lifestyle, serving as a multimedia display hub. Full HD resolution is fast becoming a necessity rather than a premium feature, and no other flat panel solution can offer the full HD, 2 megapixel, viewing experience in such a wide range of sizes as a TFT-LCD. LG.Philips LCD is at the forefront of the full HD revolution, offering a full line-up of industry standard LCD TV sizes in HD (1366x768) resolution: 23-, 26-, 32-, 37- and 42-inches. In addition, LG.Philips LCD offers premium full HD (1920x1080) panels at standard sizes of 42- and 47-inches. With the first quarter 2006 launch of the world’s largest Gen. 7 fab in Paju, South Korea, LG.Philips LCD delivers full HD panels at 42- and 47-inches in the large volumes necessary to allow for affordable consumer set prices. A full HD LCD display (1920x1080, 2 megapixels) makes a perfect multimedia hub for full HD content.



HD broadcasting is increasingly available, with most stations offering 1080i content



Next generation gaming platforms will offer widescreen full HD graphics



Both high definition DVD formats support full HD



Media center PCs for web surfing, video and photos, and gaming



Digital photos have average resolutions of 5 megapixels



An LCD TV is the Perfect HD Multimedia Centerpiece

Super IPS Certified Environmentally Friendly

LG.Philips LCD is the first TFT-LCD manufacturer to receive the Swedish Environmental Management Council’s (SEMC) Environmental Product Declaration (EPD) certification.

LG.Philips LCD’s TFT-LCD panels consume low energy, emit little electromagnetic interference and are lead-free. Super IPS products are compliant with European RoHS (Restriction of Hazardous Substances) environmental standards, a first for LCD TVs.



THE ANALYST'S POINT OF VIEW



Paul Semenza
Vice President,
Display and
Consumer Research
iSuppli Corporation

Cleverdis: What is iSuppli's current view on the TFT-LCD market? In particular, how do you see the TV market developing over the coming years?

Paul Semenza: iSuppli sees a bright future for the LCD TV market, with set shipments expected to reach over 60 million units by 2008, more than three times the figure for 2005.

However, this impressive growth in unit shipments does not tell the whole story: as the number of sets increases, the average diagonal size shipped is also climbing. For example, in 2004 the average diagonal

screen size of an LCD TV was about 23-inches, but we expect this to reach the 30-inch level in early 2006.

These trends are working together to greatly raise the area of large TFT-LCD panels shipped, from just under 20 million square meters in 2005 to over 41 million by 2008, a positive for TFT-LCD panel manufacturers such as LG.Philips LCD. This is also of great benefit to consumers, who are being offered large and high-quality flat panel televisions at increasingly more attractive set prices.

There is a lot of talk about oversupply in the market these days. What is iSuppli's opinion of how potential oversupply will impact market leaders such as LG.Philips LCD?

After being in fairly close balance for most of 2005, iSuppli believes that the LCD industry will enter a period of oversupply in the first half of 2006, and that some panel makers could suffer. However, we expect that the market will tighten dramatically in the second half, as falling prices – particularly in large TV panels – drive more consumers toward TFT-LCD.

In your opinion, has LCD TV technology overcome the technological challenges that it faced in its early days, including limited viewing angle? Is it safe to say that LCD will be the future of the TV market?

Over the past few years, TFT-LCD producers have managed to simultaneously lower the cost, improve the performance, and increase the screen size of LCD TV panels. These three key factors are behind the rapid penetration of LCD into the television market, from 5 percent in 2004 to what we expect to be nearly 40 percent by 2009. Large investments in manufacturing capacity, along with technology developments enabling wide viewing angle, fast switching time, and rich colors have been responsible for this growth. LG.Philips LCD has been on the leading edge on both the manufacturing and technology fronts.

CONCLUSION



Gérard Lefebvre
Founder & President
Cleverdis

After having massively invested in order to make it to the top in technical terms, LG.Philips LCD (LPL) has also understood the importance of communicating not only with OEM customers, but also with end clients about "What's Inside" (i.e. Intel Inside, Powered by NVIDIA etc.), because the panel is the "heart" of the TV screen, just like the processor is at the heart of the computer.

This, to us, is a sign of maturity that corresponds perfectly with LG.Philips LCD's current state of industrial development and their stature as market leader.

Indeed, in the past few years, LG.Philips LCD has transformed its global strength in the production of monitors and notebooks into a leadership role in the mainstream 26-, 32- and 37-inch LCD TV panel market, as these are major growth areas for LCD TVs. Proof of this strength comes in the opening of LG.Philips LCD's "P7" facility in Paju (South Korea) – in the early part of 2006, with a design production capacity of 90,000 input sheets per month – earlier than previously estimated, coinciding with

increasing demand for LCD TVs and larger and wider PC monitors. The expansion will give LG.Philips LCD the world's largest LCD production facility, costing over \$5 billion to set up, with targeted annual sales in the billions upon completion.

Toward the same goals, the company announced that it had signed an Investment Agreement with the government of Poland to build a back-end module production plant in Wroclaw (a city in Southern Poland), making LG.Philips LCD the first global LCD industry player to commence such production in Europe. All this production capacity would not be necessary without an end product beyond reproach, and to this end we have been more than interested to note the exceptional work put in by the company's R&D department in developing LCD panels whose image quality and performance levels have been even further enhanced, meaning consumer electronics (CE) companies integrating these panels into flat TVs will be able to use the new Enhanced S-IPS technology as a solid selling point in the ever more competitive TV market. The introduction of Enhanced S-IPS will thus no doubt assist the industry in general to grow and flourish, and will help further alleviate any consumer concerns about LCD image quality, and usher in a new era of ever better HDTVs.

A beautiful picture from every seat in the house!

LG.Philips LCD provides a full line up of large & wide LCD TV modules with S-IPS!



LG.Philips LCD Milestones

- World's #1 LCD monitor module supplier in '00-'03*
- World's #1 15" and above LCD notebook PC module supplier by units in '02-'04**
- World's #1 large-area TFT-LCD supplier by input area for '02 & '03, and #1 by unit shipments & revenue for '03* **
- World's first 4th generation LCD factory in '00, world's first & third 5th generation LCD factories in '02 & '03 and world's largest 6th generation factory in '04
- First to develop and mass produce 14.1"XGA, 17.1"WXGA+, 18.1"SXGA, 20.1"VGA, 20.1"UXGA, 22"WXGA, 23"WUXGA, 30"WQXGA+ and 42"WXGA LCD modules
- Highest rated in DisplaySearch's Customer Satisfaction Award in '02, '03, '04 and '05***

★ According to DisplaySearch, various publications

* Quarterly Large-Area TFT-LCD Shipment Report of Q2'02-Q3'04 †

** Quarterly TFT-LCD Supply/Demand and Capital Spending Report of Q2'02-Q3'04

*** Annual Customer Satisfaction Reports for 2002, 2003, 2004 and 2005

† The latest DisplaySearch numbers were from the Q1'05 report

★ 2-time winner ; SID Display of the Year Award 2003 & 2004



20.1" UNGA display with Copper Bus Technology 55" Full HDTV, the world's largest shipping LCD for TVs

★ 4-time winner ; DisplaySearch Customer Satisfaction Award 2002-2005



DisplaySearch March 2002 DisplaySearch April 2003 DisplaySearch March 2004 DisplaySearch May 2005

