LCD TV – GETTING BIGGER, GETTER BETTER GETTER TOUGHER

Flat panel displays like LCD and plasma are quite becoming the norm for the next TV to be purchased for the house or the office. While it is often touted that these latest technologies boasted larger screen sizes and more impressive picture quality, many TV makers still struggle with the fact that such flat-panel displays require sophisticated picture processing and some experience to let these panels perform at their optimum levels.

Introduction

Navigating through the TV with a remote control appears simple and nothing complex, especially to the average consumer since consumers do not have to reboot their TVs or download new drivers. Because TVs remain so simple to use, TV manufacturers do not often get sufficient credit for their underlying technological achievements. Nevertheless, TV manufacturers are constantly required to meet more and more demanding market challenges, forcing them to rethink their design and manufacturing strategies.

The challenges for any TV makers today include the technology shifts and new markets requirements. With the demand for flat panel TVs being evident, even in the most price-sensitive markets, TV makers must be able to offer the latest and the best to capture the markets. New motion-blur removal and film de-judder technologies re-defined picture quality standards while new transmission standards (DVB-T, ATSC, ISDB-T, DMB-T/H) imposed mandate on new forms of terrestrial TV broadcast; adding to the complexity of an already sophisticated product.

Adopting New Picture Enhancement Technologies

Despite the attractiveness of the LCD TV, it is actually the characteristics of liquid crystal that leads to motion blur. In a moving object scene, the liquid crystal causes a mismatch between what the human brain expects to see and what the eye actually sees.

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This mismatch occurs at any panel response time, even if the response time is 0 m/s, because the pixel distance between what the brain expects and what the eye perceives causes a loss in perceived sharpness in the moving objects, even though the individual frames displayed may be perfect. The human brain is deceived and motion blur results from this perception.

In addition, video images are usually transmitted in interlaced format and each field contains only the even or the odd lines of the picture. Modern flat panel displays like LCD TVs show progressive-scan images only. Since pixels on LCD panels are illuminated digitally, they are set to a specific intensity, and these pixels hold this value until the value is changed again. The “hold time” is the duration that a pixel is being lit, and this determines the sharpness on the LCD with the image becoming sharper as the “hold time” gets shorter. The “hold time” also influences the image in terms of edge sharpness for all time-variant picture material containing motion. It is also the “hold time” in the conventional LCD TV that causes motion blurring and film judder.

Apart from the limitation on the liquid crystal itself, movie content also plays a part in film judder on tradition LCD TV. This is because films are shot, edited and mastered at 24 frames per second while movies are viewed on a LCD TV screens at 50 or 60 frames per second.

Today’s film mode detectors, inverse 3:2/2:2 pull-down and motion-adaptive de-interlaced technology covert the frame rate by simply repeating frames. This causes an irritating start-stop motion representation on all TV display types known as film judder.

With all the limitations circling the LCD TV, getting the best picture from these panels requires the very best upstream electronics. Motion compensation together with frame rate conversion technology are required to eliminate the motion blur and film judder.

Currently, new ICs available removes motion blur from standard- and high-definition content by doubling the picture frame rate to 100 or 120 hertz. Micronas ICs increases

the frame rate to the desired display frame rate by calculating and adding new picture frames in between the original film pictures that represent the real object positions at shooting time. Doubling the frame rate ensures the sharpest edges on moving objects and clearest definition on structures and textures of panned and zoomed backgrounds.

In addition, Micronas motion vector algorithms generate new frames to achieve improved picture performance which is superior to more costly and less sophisticated methods such as backlight scanning or black field insertion. Both backlight scanning and black field insertion are more expensive as they require faster and stronger backlight lamps and do not generate the same level of picture as compared to the Micronas motion vector algorithms. Micronas motion vector algorithms offer excellent reproduction of moving images, including precise reproduction of clean lines and edges, regardless of the original source material format. In addition, they also neutralizes shutter effects, generates more unique frames per second from film sources, and offers one of the best de-interlacing performances of any method developed so far. LCD TVs using Micronas ICs combine the benefits of LCDs with the motion quality of CRTs, resulting in superior picture quality.

With newer and better panel displaying 1080-line images in a progressive scan at 90, 100, or even 120 frames per second, TV makers must select electronics that can correctly de-interlace the picture. Scaling, sharpening, contrast-enhancement and picture interpolation are then left to the experience of the TV engineer to remove motion blurring or 'judder' and ensure a pleasant picture quality.

Addressing the Digital TV markets

While integrated Digital Televisions (IDTVs) are among the most complex and sophisticated digital devices, consumer expects nothing less than how they would operate their traditional analogue TVs. Digital broadcast standards like DVB-T, ATSC, ISDB-T, DMB-T/H require new designs, from antenna input all the way through to the display and loudspeaker outputs. The display must deal with multiple picture formats,

like high definition content, may be 720 horizontal lines, scanned progressively, or 1080 lines, scanned in an interlaced pattern or progressively.

Manufacturers must meet fragmented, regional broadcast requirements all over the world. Analogue TV in itself is complex with different video (PAL, SECAM, NTSC) and audio (A2, NICAM, BTSC) systems varying from country to country. Digital TV adds ATSC, DVB-T, ISDB-T and DMB-T/H requirements, with no single world standard for digital television having emerged.

ATSC is used in North America, Mexico, and Korea, and allows a range of country-specific options. Variations of DVB-T are used in several regions and countries in the world, and contain a framework of specification parameters and optional extensions, with plenty of room for country-specific variations. Governments, providers, and system integrators select broadcast options (transmission modes), network implementation (single versus multi-frequency network), and receiver performance and functions.

As a result, in Europe alone each country has its own DVB-T adaptation; documented in country-specific requirements or guidelines. The D-book standard emerged in the UK; Nordig TV profile applies to the Nordic countries. The European Information, Communications & Consumer Electronics Technology Industry Association (EICTA) developed the E-book[1]. Many countries then subsequently developed local versions based on the E-book, but added country-specific requirements.

The broadcaster can vary transmission parameters according to the desired reception condition. This in turn is affected by the landscape: from flat country-side without obstacles, to cities, to areas with mountains which are causing signal echoes which can disturb the quality of reception. Reception conditions are also affected by whether DVB-T must support in-house antennas versus rooftop-antenna reception.

Another variable is the choice of Single Frequency Networks (SFN) versus Multi Frequency Networks (MFN). An MFN is a network implementation which broadcasts the same program content at exactly the same RF-frequency from multiple transmitters

in an area. The goal is that any receiver is within range of at least one transmitter, but it means that most receiver get the same signal via more than one signal path. This is called Multi-Path. Sometimes the multiple signals cancel each other out. The design of the receiver must therefore accommodate this difficulty.[2]

Many countries permit, or require, certain data services such as EPG (Electronic Program Guide), Digital Text, MHEG5 or Off-Air Download service (Software Upgrade Service). Data for these services are embedded in the Program Specific Information (PSI) portion of the MPEG Transport Stream, and the exact definition and usage differs from country to country. This can result in incorrect implementations of channel tables and other applications.

Building a TV platform that can be sold in multiple markets is more difficult than ever, due to the proliferation of standards. The IDTV must be able to receive standard and high-definition digital signals. The IDTV must also be backward compatible and accept analogue legacy input signals from standard-definition and high definition DVD players and other equipment. Therefore, TV makers with plans to succeed the global trend must have reliable and experience partners in addressing the fragmented markets. Micronas believes in providing better solution with faster customer service and field test support, therefore its R&D and application centres for ATSC and DVB-T are located in the regions where these signals are transmitted. This is to ensure that all customers working with Micronas are assured of a reliable solution in the market.

Preparing for the future

The modern TV is a software system. DSPs perform many of the key functions once handled by analogue components. As a result, every functional block in a TV must integrate with the software of other blocks, as well as the electrical and signal requirements. End-to-end system design is no longer a luxury but a necessity.

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[1] Officially known as the “Baseline Digital Terrestrial TV Receiver Specification”.
[2] There are other sources of multi-path as well; MFN is only one.

While reference designs offered by IC vendors serve the purpose in allowing one to evaluate the IC capabilities, these reference designs are not fully integrated into a final system, especially from an application software point of view. In general, these designs have not been optimized over the range of normal production variations, nor have they been qualified in real-life field conditions; and as a result, they are just not production-ready.

Only a complete system design, developed by experienced TV engineers, will be competitive in the marketplace. Such designs are cost-effective to manufacture, certified in the required markets, and field tested to ensure real-world performance.

The highly-complex world of TV design means that a TV manufacturer needs a partner who not only offer advanced technologies, leading-edge architectures, and a strong roadmap, but also the specialized knowledge and experience in country-specific requirements, market conditions and actual broadcast signal conditions in the field.

Micronas has long recognized the need for world-standard TV platform families, and has historically designed chip sets which allow TV makers to market standardized platforms world wide, with a minimum of production variants. Micronas, as a market leader in innovative global TV system solutions, leverages its expertise into new markets emerging through the digitization of audio and video content. It offers a whole portfolio of system solutions, addressing every design as an end-to-end system design. This system approach was established together with its subsidiary IKONVERGENZ, with the aim to support its customers at an even higher level. IKONVERGENZ offers TV makers rapid market entry with production-ready manufacturable-designs that are field-tested and market-proven. Its partnership with Micronas means that customers of both receive the advantages of thorough system design and ICs which are designed from the outset to fit into top-quality, cost-effective systems. TV manufacturers only have to decide to choose from the ready-designs from IKONVERGENZ or develop its own TV platform using a variety of tested IC solutions from Micronas.

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