

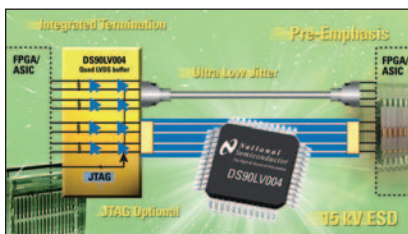
ANALOG | edgeSM



DESIGN | *idea:* Enabling HDTV Capabilities ▶▶▶

Featured Products

World's First Four-Channel LVDS Buffer with Configurable Pre-emphasis



The DS90LV004 extends cable and backplane driving distances, boosts weak FPGA and ASIC LVDS signals, improves signal quality over lossy interconnects,

and has 15 kV ESD protection from off board ESD strikes.

This device is a four channel LVDS buffer and repeater that operates up to 1.5 Gbps over the entire supply voltage and temperature operating range. High-speed data paths and flow-through pin out minimize internal device jitter and simplify board layout. In addition, the configurable pre-emphasis feature overcomes ISI jitter effects from lossy backplanes and cables.

The differential inputs accept LVDS and Bus LVDS signals such as those on National's 10-, 16-, and 18-bit Bus LVDS SerDes, as well as CML and LVPECL. The differential inputs are internally terminated with a 100Ω resistor to improve performance and minimize board space. The repeater function is especially useful for boosting signals for longer distance transmission over lossy cables and backplanes.

Features

- 1.5 Gbps data rate per channel
- Configurable pre-emphasis drives lossy backplanes and cables
- LVDS/CML/LVPECL compatible input, LVDS output
- On-chip 100Ω input termination
- 15 kV ESD protection
- Single 3.3V supply
- Industrial -40 to +85°C temperature range
- See SCAN90004 for JTAG-enabled version

The DS90LV004 is ideal for buffering LVDS signals in office imaging systems, video systems, medical imaging, telecom, datacom, industrial, and automotive applications. The DS90LV004 is available in TQFP-48 packaging.

www.national.com/pf/DS/DS90LV004.html

Industry's First High-Definition Video (YP_BP_R) to RGBHV (VGA) Video Decoder IC

The LMH1251 is a YP_BP_R to RGBHV decoder with an integrated wideband 2:1 analog video switch. The device accepts one set of YP_BP_R inputs and one set of RGB/HSync/VSync inputs. Based on the input selected, the output will be either a decoded TV or buffered PC video signal. The LMH1251 is capable of driving and/or processing 480i, 480p, 1080i, 1080p, XGA, SXGA, and UXGA video formats, which makes it an ideal solution for enhancing value in applications ranging from LCD monitors and set-top boxes to professional video equipment. Format conversion is done in the analog domain to preserve signal integrity and maintain picture clarity.

Features

- YP_BP_R to RGBHV conversion within 1% accuracy
- YP_BP_R path: 70 MHz -3 dB Bandwidth
- RGB path: 400 MHz -3 dB Bandwidth
- Supports PC video display resolutions up to UXGA (1600 x 1200 @ 75 Hz)
- Sync separator and processor
- Smart video format detection for 480i, 480p, 720p, 1080i, and 1080p
- Power save mode
- Integrated 2:1 mux



The LMH1251 is ideal for use in TFT LCD monitors, set-top boxes, and projectors, video format conversion systems, video editing and broadcast equipment. The LMH1251 is available in a TSSOP-24 package.

www.national.com/pf/LM/LMH1251.html

Enabling HDTV Capabilities in Today's Systems

High Definition TV (HDTV) is now more prolific than ever. With a tremendously distinguishable difference in picture quality from traditional NTSC video, there is good reason why HDTV has been receiving high acclaim from videophiles as well as lay consumers. Today, the adoption of HDTV by the broadcast industry is on the incline as the percentage of worldwide TV service operators rapidly increases the offering of HD programming. Even video game console makers have joined the High Definition Video movement in recent years.

Now, taking a closer look at HDTV in terms of scanning format and active video lines per frame, "720p" and "1080i" are both designated as HD. 720p has 720 active lines per frame which are scanned progressively and 1080i has 1080 active lines per frame which are scanned in the interlaced mode. Another format, called Enhanced Definition (EDTV) or SDTV, is an alternative to HD. EDTV is not true High Definition per se, but an alternative video format under the 480p standard. EDTV is quite arguably the next best

thing to HDTV and offers the standard 480 active video lines; however, the scanning format is progressive. This makes for a significant step forward in image quality.

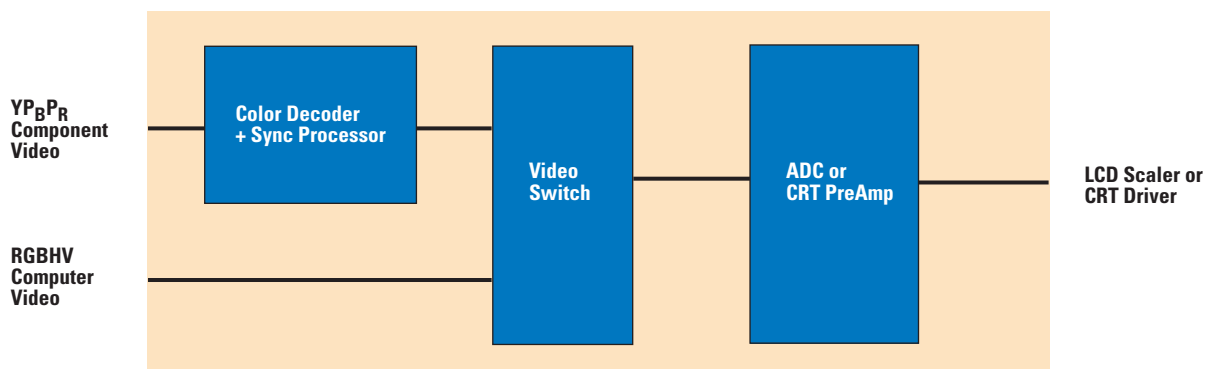
In order to utilize the advantages of EDTV and HDTV, a few things are necessary:

- Video transmission via the YP_BP_R component standard: composite video cabling is only appropriate for NTSC video, and although S-video may be sufficiently acceptable for EDTV, HDTV should strictly use YP_BP_R components.
- A video source that is capable of outputting such signals: for example, only a Progressive Scan DVD player is able to provide video in the 480p format, which in fact is the native resolution of DVDs.
- A television or display monitor that is capable of handling such signals as inputs: most of the standard analog TVs do not have the line rate capability to display any format beyond 480 Interlaced. A progressive scan TV set such as an EDTV or HDTV is thus required.

Due to these requirements, EDTV and HDTV sets are clearly more expensive than the common interlaced TV. However, if the timing capabilities of the display monitor are the impediment, there is an alternative for viewers to still enjoy progressive scan or HD video content. Computer graphics displays such as LCD and CRT monitors are certainly capable of handling the timing requirements of such signals. PC monitors are essentially HD display sets, though there is one caveat – they employ the RGBHV video standard rather than the YP_BP_R video standard.

In the YP_BP_R color space, color information is determined by two separate chrominance signals (P_B and P_R), which are also a function of a third signal, the luminance signal. Horizontal and Vertical Sync are then compositely embedded onto this luminance signal. In the computer graphics video color space, color is defined by primary Red, Green, and Blue components, and Horizontal and Vertical Syncs are separated into two individual signals. The components of the YP_BP_R and RGB color spaces are related by a matrix algebraic relationship, with the

Figure 1: System Block Diagram



coefficients of the matrices varying from format to format, i.e. SDTV, HDTV, etc. Thus, the components of the $Y_P B_P R$ can be decoded into RGB accordingly. Such processing along with sync separation will effectively provide a complete $Y_P B_P R$ to RGBHV conversion which enables progressive scan DVDs, HD video, or video game consoles to directly drive PC display monitors.

Although there are quite a few ways to convert $Y_P B_P R$ to RGBHV, key considerations for implementation are cost, color space decoding precision, sync processing performance, and minimal impact to system architecture. The two solutions on the market today are a discrete design or integration into a very high-priced digital video processor. Both of these solutions compromise color decoding quality and system cost effectiveness. Carrying out the conversion discretely is cumbersome, requiring a number of devices and board space. Depending on the desired color accuracy, the discrete design can pose an additional challenge for design engineers. On the other hand, highly integrated digital video processors that may include the $Y_P B_P R$ to RGBHV conversion are bundled with an excess of functions and features which makes them very cost inefficient. Ideally, a single monolithic IC that would increase quality and reduce cost over these existing $Y_P B_P R$ to RGBHV solutions is desired. Further, this single-chip solution should be a direct drop into the signal path, easing system design and accelerating time-to-market. A simple block diagram of a possible system architecture is shown in *Figure 1*.

Featuring this type of conversion capability at the analog front end of PC monitors can be an excellent way to add total system value, as supporting $Y_P B_P R$ component inputs ultimately results in an "HD Ready" display set. Moreover, this addition aligns well with the ongoing trend of integrating multimedia

functionality to desktop PCs and displays, and could quite possibly provide a second wind for CRT monitors.

National Semiconductor's LMH1251 offers an effective monolithic solution for analog $Y_P B_P R$ to RGBHV conversion with superior performance and video quality.

It provides a high performance video multiplexer, which accepts either PC graphics video (RGBHV) or SD/HD video ($Y_P B_P R$). This integration of a high bandwidth video switch with a color space dematrixer and sync processor lends itself well for display system architectures, which provides the end user with instant flexibility for viewing HDTV content or PC graphics video at their desktop or projector screen. A simplified block diagram of the LMH1251 is shown in *Figure 2*.

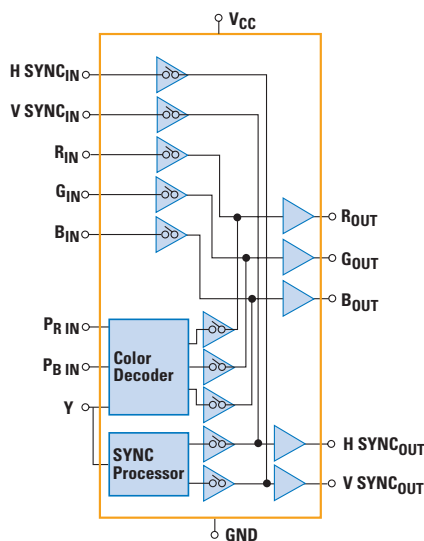
The high precision analog color decoding within the LMH1251 is carried out in full compliance with the linear equations specified in the EIA/CEA-770.2-C standard for analog component SDTV and the EIA/CEA-770.3-C for analog component HDTV. The highly advanced integrated sync processor is

also compatible with the horizontal and vertical timing specifications of these standards. Furthermore, it is fully compatible with Macrovision Corporation's copyright protective sync scheme that is embedded on many DVD movie titles.

A key feature of the LMH1251 device is its capability to automatically detect the incoming component video format. Based on this detection of whether the input is SDTV (480i/480p) or HDTV (720p/1080i), it will then make the decision to apply the appropriate color decoding equation and sync processing scheme. It also provides a status output, specifying the format information, which can be useful to the system MCU. A power save mode feature is included as well, significantly reducing the chip's power consumption during energy save modes, which are common in display systems.

To support high-end PC graphics video input sources as well, the LMH1251 includes a wideband, unity gain RGB video path. With the heightening of PC desktop resolutions that are commonly in use today, the LMH1251 is designed to easily handle modes of up to UXGA (1600x1200), making it ideal for a broad range of display monitors. ■

Figure 2: Simplified LMH1251 Block Diagram



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Featured Products

Wideband Video Op Amps; Single, Single with Shutdown, and Quad



The LMH6714/20/22 series combine National's VIP10™ high speed complementary bipolar process with National's current feedback topology to produce a very high-speed op amp. These devices offer exceptional performance with a flat gain response of 0.1 dB to 120MHz, a 70 mA continuous output current, and 0.01% and 0.01° differential gain and phase errors for NTSC and PAL video signals. These devices have excellent distortion and bandwidth specifications with low power consumption.

Features

- 400 MHz ($A_v = +2V/V$, $V_{OUT} = 500 \text{ mV}_{pp}$) -3 dB BW
- 250 MHz ($A_v = +2V/V$, $V_{OUT} = 2 \text{ V}_{pp}$) -3 dB BW
- Low power: 5.6 mA/channel
- -70 HD2/-85 HD3 at 5 MHz, 2 V_{pp}
- 1800 V/ μs slew rate
- Unity gain stable
- Shutdown (LMH6720)
- Low shutdown current: 500 μA (LMH6720)

The LMH6714/20/22 series is ideal for various high-speed applications including video distribution and switching, professional video systems, and wideband active filters. The LMH6714 is available in a SOIC-8 and SOT23-5 package. The LMH6720 is available in a SOIC-8 and SOT23-6 package. The LMH6722 is available in an SOIC-14 package.

www.national.com/pf/LM/LMH6714.html

www.national.com/pf/LM/LMH6720.html

www.national.com/pf/LM/LMH6722.html

Single/Dual, High-Performance, Low-Power, 8-Bit, 1.5 GSPS (3 GSPS DES mode) A/D Converter

The ADC08D1500 is the industry's lowest power, best performing, dual 8-bit 1.5 GSPS analog-to-digital converter. It digitizes two signals to 8-bit resolution at sampling rates up to 1.7 GSPS or one signal at sampling rates up to 3.4 GSPS. Consuming a typical 1.85W at 3 GSPS from a single 1.9V supply, this device is guaranteed to have no missing codes over the full operating temperature range. The ADC081500 is the single converter conversion of the ADC08D1500.

The unique folding and interpolating architecture, fully differential comparator design, innovative design of the internal sample-and-hold amplifier, and the self-calibration scheme enable a very flat response of all dynamic parameters beyond Nyquist.



Features

- 7.3 Effective number of bits (ENOB) at Nyquist, 1.5 GSPS (typ.)
- Bit error rate 10^{-18} (typ.)
- Interleave mode on the ADC08D1500 for up to 3.4 GSPS sampling
- Choice of SDR or DDR output clocking
- Multiple ADC synchronization capability
- Serial interface for extended control
- Fine adjustment of input full-scale range and offset
- Single +1.9V ($\pm 0.1V$) operation
- ADC08D1500 Consumes only 1.85W while running at 3 GSPS
- ADC081500 Consumes only 1.2W while running at 1.5 GSPS

The ADC08D1500 and the ADC081500 are well suited for a variety of applications including direct RF down conversion, digital oscilloscopes, satellite set-top boxes, communications systems, and test instrumentation. These converters operate over the Industrial ($-40^\circ\text{C} \leq T_A \leq +85^\circ\text{C}$) temperature range and are available in a LQFP-128 package.

www.national.com/pf/DC/ADC081500.html

www.national.com/pf/DC/ADC08D1500.html