

Design Migration from the LM1881 to the LMH1980

National Semiconductor
Application Note 1681
Alan Ocampo
August 2007



Introduction

The LMH1980 is a SD/HD/PC video sync separator intended to replace the LM1881 sync separator in consumer, security and surveillance, and industrial video applications where high-definition compatibility is needed. This application note discusses the LMH1980's advantages over the LM1881 and considerations for designing the LMH1980 into current LM1881 sockets. In broadcast and professional video systems where timing jitter is a critical system parameter, another sync separator, the LMH1981, offers the best jitter performance while supporting all SD & HD analog video standards.

Advantages of the LMH1980

The LMH1980 offers several advantages over the LM1881, including:

- Lower operating supply of 3.3V
- Wide temperature range of -40°C to $+85^{\circ}\text{C}$
- Auto-detection of the input video format using a fixed-value resistor biasing architecture
- Support for HD tri-level sync separation
- HSync output and HD Detect Flag output
- Smaller package

Improved Operating Range

The LM1881 required a supply voltage from 5V to 12V, whereas the LMH1980 operates with a supply voltage as low as 3.3V. This allows the LMH1980 to be used in applications where a lower supply voltage between 3.3V to 5V is available. Additionally, the improved operating temperature range makes it better suited for applications where reliability is needed at cold temperatures as low as -40°C .

Video Auto-Detection and Formats

The LMH1980 accepts an analog video input with either bi-level sync or tri-level sync and automatically detects the video format, thus eliminating the need for external R_{SET} adjustment required by the older LM1881 to support different line rates. Only a fixed 10 k Ω 1% external resistor is needed to sustain the internal biasing architecture of the LMH1980, which adapts to the input line rate without physical or electrical intervention. The outputs are accurate after a sufficient start-up time is met, typically within one to two fields of video.

The LMH1980 supports sync separation for analog CVBS, Y (luma) from Y/C and $Y_{\text{B}}P_{\text{R}}$, and G (Sync on Green) from GBR/RGsb, as specified in the following video standards.

- Composite Video (CVBS) and S-Video (Y/C)
—SMPTE 170M (NTSC), ITU-R BT.470 (PAL)

- Component Video ($Y_{\text{B}}P_{\text{R}}$ /GBR)
—SDTV: SMPTE 125M, SMPTE 267M, ITU-R BT.601 (480I, 576I)
—EDTV: ITU-R BT.1358 (480P, 576P)
—HDTV: SMPTE 296M (720P), SMPTE 274M (1080I/P), SMPTE RP 211 (1080PsF)
- PC Graphics (RGsB)
—VESA Monitor Timing Standards and Guidelines
Version 1.0, Revision 0.8
- Non-Standard Video
—Composite NTSC & PAL (or Component 480I & 576I) without vertical serration and equalization pulses

Additional Outputs

The LMH1980 provides a true Horizontal Sync signal (HSync), which was not available in the LM1881. Unlike the Composite Sync signal of the LM1881, the HSync signal can be directly input to a PLL to generate a synchronous line-locked clock without the complication of managing double frequency serration pulses in the vertical interval (e.g.: PLL coast mode).

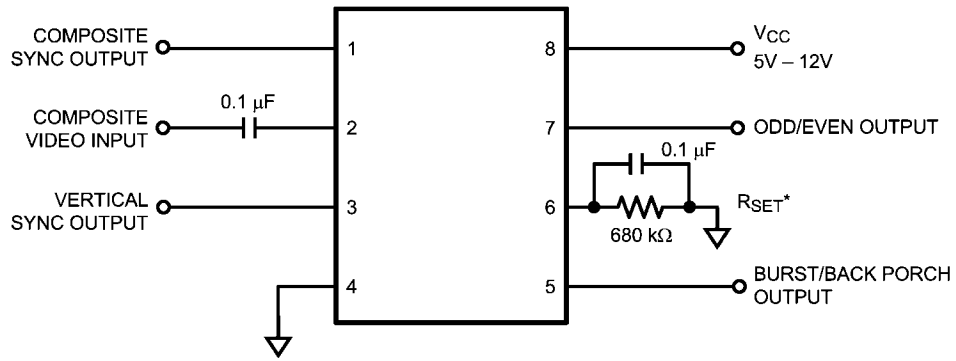
The LMH1980 also features an HD Detect Flag which outputs a logic low signal when a valid HD video input with tri-level sync is detected; otherwise, it outputs logic high. This can be useful in multiple format applications where the external chroma low-pass filter needs to be disabled when an HD video signal is applied; otherwise, the chroma filter can distort the HD tri-level sync pulses, which may lead to increased output propagation delay and jitter. An implementation of a switch-controlled chroma filter is shown and described in the LMH1980 datasheet.

Package & PCB Considerations

The LMH1980 is offered in a space-saving 10-lead MSOP, which reduces the area needed on the PCB. Because of the smaller package and additional outputs of the LMH1980, it is not a drop-in replacement for the LM1881, and the circuit schematic and PCB layout need to be slightly modified. As a comparison, the typical application circuit schematics are shown for the LM1881 and the LMH1980 in *Figure 1* and *Figure 2*, respectively.

Although omitted from the LM1881 circuit, the LMH1980 circuit shows the recommended supply bypass capacitors, chroma (RC low-pass) filter components, and output protection resistors.

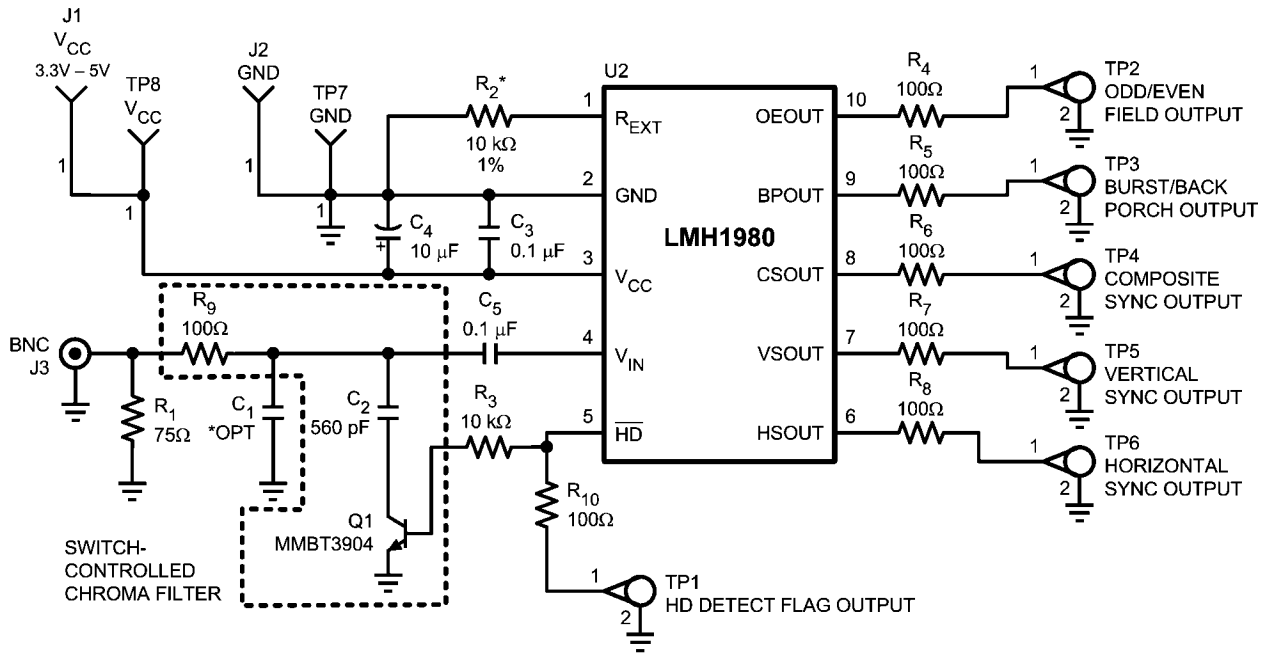
Please refer to the PCB Layout Considerations section in the LMH1980 datasheet and application note AN-1618 for more information about component placement and trace routing.



*R_{SET} VALUE NEEDS TO BE CHANGED TO SUPPORT OTHER VIDEO LINE RATES

30029901

FIGURE 1. LM1881 Typical Application Circuit with R_{SET} = 680 kΩ for Composite Video



*R₂ VALUE IS FIXED AT 10 kΩ 1% FOR ALL SUPPORTED VIDEO LINE RATES

30029902

FIGURE 2. LMH1880 Typical Application Circuit with Switch-Controlled Chroma Filter

Notes

AN-1681

Notes

THE CONTENTS OF THIS DOCUMENT ARE PROVIDED IN CONNECTION WITH NATIONAL SEMICONDUCTOR CORPORATION ("NATIONAL") PRODUCTS. NATIONAL MAKES NO REPRESENTATIONS OR WARRANTIES WITH RESPECT TO THE ACCURACY OR COMPLETENESS OF THE CONTENTS OF THIS PUBLICATION AND RESERVES THE RIGHT TO MAKE CHANGES TO SPECIFICATIONS AND PRODUCT DESCRIPTIONS AT ANY TIME WITHOUT NOTICE. NO LICENSE, WHETHER EXPRESS, IMPLIED, ARISING BY ESTOPPEL OR OTHERWISE, TO ANY INTELLECTUAL PROPERTY RIGHTS IS GRANTED BY THIS DOCUMENT.

TESTING AND OTHER QUALITY CONTROLS ARE USED TO THE EXTENT NATIONAL DEEMS NECESSARY TO SUPPORT NATIONAL'S PRODUCT WARRANTY. EXCEPT WHERE MANDATED BY GOVERNMENT REQUIREMENTS, TESTING OF ALL PARAMETERS OF EACH PRODUCT IS NOT NECESSARILY PERFORMED. NATIONAL ASSUMES NO LIABILITY FOR APPLICATIONS ASSISTANCE OR BUYER PRODUCT DESIGN. BUYERS ARE RESPONSIBLE FOR THEIR PRODUCTS AND APPLICATIONS USING NATIONAL COMPONENTS. PRIOR TO USING OR DISTRIBUTING ANY PRODUCTS THAT INCLUDE NATIONAL COMPONENTS, BUYERS SHOULD PROVIDE ADEQUATE DESIGN, TESTING AND OPERATING SAFEGUARDS.

EXCEPT AS PROVIDED IN NATIONAL'S TERMS AND CONDITIONS OF SALE FOR SUCH PRODUCTS, NATIONAL ASSUMES NO LIABILITY WHATSOEVER, AND NATIONAL DISCLAIMS ANY EXPRESS OR IMPLIED WARRANTY RELATING TO THE SALE AND/OR USE OF NATIONAL PRODUCTS INCLUDING LIABILITY OR WARRANTIES RELATING TO FITNESS FOR A PARTICULAR PURPOSE, MERCHANTABILITY, OR INFRINGEMENT OF ANY PATENT, COPYRIGHT OR OTHER INTELLECTUAL PROPERTY RIGHT.

LIFE SUPPORT POLICY

NATIONAL'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS PRIOR WRITTEN APPROVAL OF THE CHIEF EXECUTIVE OFFICER AND GENERAL COUNSEL OF NATIONAL SEMICONDUCTOR CORPORATION. As used herein:

Life support devices or systems are devices which (a) are intended for surgical implant into the body, or (b) support or sustain life and whose failure to perform when properly used in accordance with instructions for use provided in the labeling can be reasonably expected to result in a significant injury to the user. A critical component is any component in a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system or to affect its safety or effectiveness.

National Semiconductor and the National Semiconductor logo are registered trademarks of National Semiconductor Corporation. All other brand or product names may be trademarks or registered trademarks of their respective holders.

Copyright© 2007 National Semiconductor Corporation

For the most current product information visit us at www.national.com



National Semiconductor Americas Customer Support Center
 Email: new.feedback@nsc.com
 Tel: 1-800-272-9959

National Semiconductor Europe Customer Support Center
 Fax: +49 (0) 180-530-85-86
 Email: europe.support@nsc.com
 Deutsch Tel: +49 (0) 69 9508 6208
 English Tel: +49 (0) 870 24 0 2171
 Français Tel: +33 (0) 1 41 91 8790

National Semiconductor Asia Pacific Customer Support Center
 Email: ap.support@nsc.com

National Semiconductor Japan Customer Support Center
 Fax: 81-3-5639-7507
 Email: jpn.feedback@nsc.com
 Tel: 81-3-5639-7560