

Overview

The increasing number of A/V sources (VCR, DVD, set top box, etc.) in a typical home entertainment system presents the need for a simple way to select the desired source. Add-on mechanical switches available today are bulky, and prone to contact wear resulting in degraded performance over time. Solid state analog switches solve this problem, but passive switching of AC coupling capacitors in audio sources can produce an annoying thump as they are charged and discharged during the make or break action of the switch. This application note describes how to use the Intersil EL4342, fixed gain of 1, and ISL59446, fixed gain of 2 Triple 4:1 MUX amps to design simple audio-video source selection multiplexers that provide excellent performance while greatly reducing the annoying effects due to audio switching transients.

Circuit Description

The basic A/V multiplexer shown in Figure 1 uses the 4:1 Triple Video MUX amp to select any 1 of 4 external audio-video sources consisting of a composite video signal and stereo L-R audio channels. The circuit uses Channel A to select the 1 of 4 composite video sources, and channels B and C to select the stereo left and right audio channels. Channel select logic inputs S0 and S1 are binary coded and perform the input source selection according to the table in Figure 1. The HIZ logic input disables all 3 channels by placing their outputs into a high impedance state which disconnects the audio sources, and places the composite video output at the 0VDC black level. This feature is useful if externally controlled blanking is desired during channel switching. This HIZ disable function can also be used to expand the number of A/V input sources from 4 to higher multiples by enabling additional A/V MUX amps to share the same output channels.

Operating the circuit from dual $\pm 5V$ supplies enables the video input and output to be DC coupled so that the composite video DC and sync levels are preserved at the output.

Choosing MUX Amp Gain

The EL4342 and ISL59446 are pin to pin replacement parts. The only difference is in their internal gain settings. The EL4342 has an internally set gain of 1, and the ISL59446 has an internally set gain of 2. The choice of gain depends on the video channel input and output requirements. If the composite video inputs and output display are in close proximity to the MUX amp, input terminating resistors R1A through R4A can be large so that the overall video channel gain is preserved at 0dB. In this case, the EL4342 with a gain of 1 would be a suitable choice. If the application

requires 75 Ω back-terminated cable driving at the output, or the input, the ISL59446 with its internal gain of 2 may be the better choice. In the latter case, the higher gain of 2 would also appear in the audio channels, which might require a simple voltage divider at the audio outputs to maintain the correct audio levels.

Adding capacitive coupling (C1b, c through C4b, c) to the audio input isolates the amplifier from unwanted DC that may be present in the audio source. Resistors R1b, c through R4b, c set the desired input impedance and form the input high pass filter. A 4.7 μF capacitor and a 10k resistor produce a 20Hz, -3dB cutoff frequency.

The usual approach of using AC coupling in this way has the drawback that low impedance mechanical or solid state switches produce an audible thump, as they charge and discharge the AC coupling capacitors during channel to channel switching. The high impedance input buffers in the MUX amp solve this problem by maintaining a constant impedance on the coupling capacitance during switching.

Video performance is exceptional owing to the 500MHz -3dB bandwidth and 60MHz 0.1dB gain-flatness of the MUX amps. The high video performance also benefits audio performance resulting in a very flat (± 0.02 dB) frequency response from DC to well beyond 80kHz. The audio frequency response is tailored by the input and output R-C filters. THD+N vs. amplitude measured on an Audio Precision series 2500 over the 20Hz to 20kHz frequency range is less than 0.015% from 1Vrms down to 100mVrms, increasing to 0.1% down to 4mVrms.

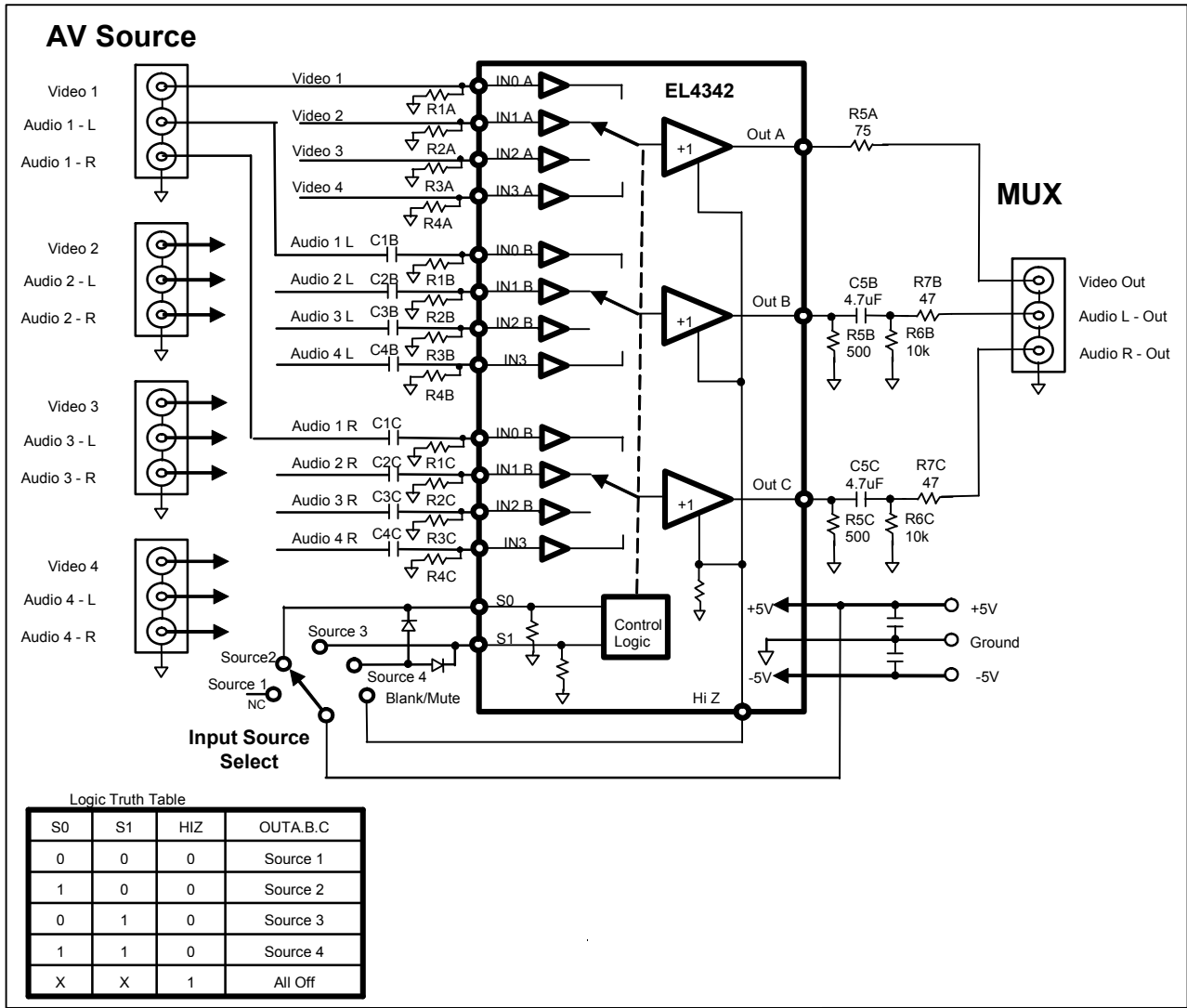


FIGURE 1. BASIC A/V MUX

Notice

1. Descriptions of circuits, software and other related information in this document are provided only to illustrate the operation of semiconductor products and application examples. You are fully responsible for the incorporation or any other use of the circuits, software, and information in the design of your product or system. Renesas Electronics disclaims any and all liability for any losses and damages incurred by you or third parties arising from the use of these circuits, software, or information.
 2. Renesas Electronics hereby expressly disclaims any warranties against and liability for infringement or any other claims involving patents, copyrights, or other intellectual property rights of third parties, by or arising from the use of Renesas Electronics products or technical information described in this document, including but not limited to, the product data, drawings, charts, programs, algorithms, and application examples.
 3. No license, express, implied or otherwise, is granted hereby under any patents, copyrights or other intellectual property rights of Renesas Electronics or others.
 4. You shall not alter, modify, copy, or reverse engineer any Renesas Electronics product, whether in whole or in part. Renesas Electronics disclaims any and all liability for any losses or damages incurred by you or third parties arising from such alteration, modification, copying or reverse engineering.
 5. Renesas Electronics products are classified according to the following two quality grades: "Standard" and "High Quality". The intended applications for each Renesas Electronics product depends on the product's quality grade, as indicated below.
"Standard": Computers; office equipment; communications equipment; test and measurement equipment; audio and visual equipment; home electronic appliances; machine tools; personal electronic equipment; industrial robots; etc.
"High Quality": Transportation equipment (automobiles, trains, ships, etc.); traffic control (traffic lights); large-scale communication equipment; key financial terminal systems; safety control equipment; etc.
Unless expressly designated as a high reliability product or a product for harsh environments in a Renesas Electronics data sheet or other Renesas Electronics document, Renesas Electronics products are not intended or authorized for use in products or systems that may pose a direct threat to human life or bodily injury (artificial life support devices or systems; surgical implantations; etc.), or may cause serious property damage (space system; undersea repeaters; nuclear power control systems; aircraft control systems; key plant systems; military equipment; etc.). Renesas Electronics disclaims any and all liability for any damages or losses incurred by you or any third parties arising from the use of any Renesas Electronics product that is inconsistent with any Renesas Electronics data sheet, user's manual or other Renesas Electronics document.
 6. When using Renesas Electronics products, refer to the latest product information (data sheets, user's manuals, application notes, "General Notes for Handling and Using Semiconductor Devices" in the reliability handbook, etc.), and ensure that usage conditions are within the ranges specified by Renesas Electronics with respect to maximum ratings, operating power supply voltage range, heat dissipation characteristics, installation, etc. Renesas Electronics disclaims any and all liability for any malfunctions, failure or accident arising out of the use of Renesas Electronics products outside of such specified ranges.
 7. Although Renesas Electronics endeavors to improve the quality and reliability of Renesas Electronics products, semiconductor products have specific characteristics, such as the occurrence of failure at a certain rate and malfunctions under certain use conditions. Unless designated as a high reliability product or a product for harsh environments in a Renesas Electronics data sheet or other Renesas Electronics document, Renesas Electronics products are not subject to radiation resistance design. You are responsible for implementing safety measures to guard against the possibility of bodily injury, injury or damage caused by fire, and/or danger to the public in the event of a failure or malfunction of Renesas Electronics products, such as safety design for hardware and software, including but not limited to redundancy, fire control and malfunction prevention, appropriate treatment for aging degradation or any other appropriate measures. Because the evaluation of microcomputer software alone is very difficult and impractical, you are responsible for evaluating the safety of the final products or systems manufactured by you.
 8. Please contact a Renesas Electronics sales office for details as to environmental matters such as the environmental compatibility of each Renesas Electronics product. You are responsible for carefully and sufficiently investigating applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive, and using Renesas Electronics products in compliance with all these applicable laws and regulations. Renesas Electronics disclaims any and all liability for damages or losses occurring as a result of your noncompliance with applicable laws and regulations.
 9. Renesas Electronics products and technologies shall not be used for or incorporated into any products or systems whose manufacture, use, or sale is prohibited under any applicable domestic or foreign laws or regulations. You shall comply with any applicable export control laws and regulations promulgated and administered by the governments of any countries asserting jurisdiction over the parties or transactions.
 10. It is the responsibility of the buyer or distributor of Renesas Electronics products, or any other party who distributes, disposes of, or otherwise sells or transfers the product to a third party, to notify such third party in advance of the contents and conditions set forth in this document.
 11. This document shall not be reprinted, reproduced or duplicated in any form, in whole or in part, without prior written consent of Renesas Electronics.
 12. Please contact a Renesas Electronics sales office if you have any questions regarding the information contained in this document or Renesas Electronics products.
- (Note 1) "Renesas Electronics" as used in this document means Renesas Electronics Corporation and also includes its directly or indirectly controlled subsidiaries.
(Note 2) "Renesas Electronics product(s)" means any product developed or manufactured by or for Renesas Electronics.

(Rev.4.0-1 November 2017)



SALES OFFICES

Renesas Electronics Corporation

<http://www.renesas.com>

Refer to "<http://www.renesas.com/>" for the latest and detailed information.

Renesas Electronics America Inc.
1001 Murphy Ranch Road, Milpitas, CA 95035, U.S.A.
Tel: +1-408-432-8888, Fax: +1-408-434-5351

Renesas Electronics Canada Limited
9251 Yonge Street, Suite 8309 Richmond Hill, Ontario Canada L4C 9T3
Tel: +1-905-237-2004

Renesas Electronics Europe Limited
Dukes Meadow, Millboard Road, Bourne End, Buckinghamshire, SL8 5FH, U.K
Tel: +44-1628-651-700, Fax: +44-1628-651-804

Renesas Electronics Europe GmbH
Arcadiastrasse 10, 40472 Düsseldorf, Germany
Tel: +49-211-6503-0, Fax: +49-211-6503-1327

Renesas Electronics (China) Co., Ltd.
Room 1709 Quantum Plaza, No.27 ZhichunLu, Haidian District, Beijing, 100191 P. R. China
Tel: +86-10-8235-1155, Fax: +86-10-8235-7679

Renesas Electronics (Shanghai) Co., Ltd.
Unit 301, Tower A, Central Towers, 555 Langao Road, Putuo District, Shanghai, 200333 P. R. China
Tel: +86-21-2226-0888, Fax: +86-21-2226-0999

Renesas Electronics Hong Kong Limited
Unit 1601-1611, 16/F., Tower 2, Grand Century Place, 193 Prince Edward Road West, Mongkok, Kowloon, Hong Kong
Tel: +852-2265-6688, Fax: +852-2886-9022

Renesas Electronics Taiwan Co., Ltd.
13F, No. 363, Fu Shing North Road, Taipei 10543, Taiwan
Tel: +886-2-8175-9600, Fax: +886-2-8175-9670

Renesas Electronics Singapore Pte. Ltd.
80 Bendemeer Road, Unit #06-02 Hyflux Innovation Centre, Singapore 339949
Tel: +65-6213-0200, Fax: +65-6213-0300

Renesas Electronics Malaysia Sdn.Bhd.
Unit 1207, Block B, Menara Amcorp, Amcorp Trade Centre, No. 18, Jln Persiaran Barat, 46050 Petaling Jaya, Selangor Darul Ehsan, Malaysia
Tel: +60-3-7955-9390, Fax: +60-3-7955-9510

Renesas Electronics India Pvt. Ltd.
No.777C, 100 Feet Road, HAL 2nd Stage, Indiranagar, Bangalore 560 038, India
Tel: +91-80-67208700, Fax: +91-80-67208777

Renesas Electronics Korea Co., Ltd.
17F, KAMCO Yangjae Tower, 262, Gangnam-daero, Gangnam-gu, Seoul, 06265 Korea
Tel: +82-2-558-3737, Fax: +82-2-558-5338