

Keywords: HDTV, reconstruction, video filter, DVD video, high definition, reconstruction, antialiasing, ypbpr, TV, display, filters, EIA770-3, SMPTE, output, active, op amp, progressive scan, dvd Aug 28, 2003

APPLICATION NOTE 2383

Active HDTV Reconstruction Filter Lowers Cost and Improves Performance

In order to preserve the quality of HDTV and progressive DVD video, a bank of three (RGB/YPbPr), 5-pole reconstruction filters are used to set the 30MHz bandwidth and to provide the >40dB selectivity required by EIA770-3.

In order to preserve the quality of HDTV and progressive DVD video, a bank of three (RGB/YPbPr), 5-pole reconstruction filters are used to set the 30MHz bandwidth and to provide the >40dB selectivity required by EIA770-3.

Historically these filters have been passive L-C types. Because of the steep selectivity of the filter, they require group-delay compensation. They also require gain to drive the back-terminated output and isolate the filter and DAC from the load. Because of the difficulty, custom parts, and tuning required, L-C filters used for these applications are usually purchased at significant cost, which is further burdened by the cost of buffering.

The active-reconstruction filter shown is a lower cost alternative. It uses R-C components, and provides a 30MHz bandwidth with >40dB rejection at 74.25MHz, as well as group-delay compensation and buffering using a single [MAX4383](#) quad op amp. The improved tolerance of capacitors (1% to 2%) vs. inductors (5% to 10%) removes the need for production tuning, although initial component selection is required to account for the parasitic components of the PCB. The circuit shown uses dual supplies, but the [MAX4383](#) can use a single supply with appropriate biasing.

The filter itself is a Rauch, or multiple-feedback realization of a 5-pole, modified Butterworth characteristic using one first-order +6dB gain stage and two 2nd-order unity-gain stages. The final stage is a first -order group-delay compensator, which drives the back-terminated 75 Ω load to an overall unity gain. There are three sensitive points in the circuit: R14, which controls the real pole, C1 and C4, which control the high-frequency poles, and C5, which sets the GD compensation.

R16 and a connector are provided at the input, in place of the DAC load, for measurement purposes. The DAC load resistance is typically 35 Ω to 40 Ω , on which the values of R14 and R16 are based. In some MPEG decoders, this may be as high as 150 Ω to 160 Ω . To accommodate different DAC load resistors, adjust the value of the R14, C6 product accordingly. The values of C1 and C4 are small with respect to the PCB•fs parasitic capacity, and reflect a two-sided PCB on FR-4 with 1/2oz, 3/16in-thick copper with a ground plane around the op-amp pins. C5 adjusts the GD compensation. In laying out this circuit, it is best to adjust the values of C1 and C4 for bandwidth before adjusting C5 for GD-variation compensation. A fully configured PCB is available.

Schematic of Filter

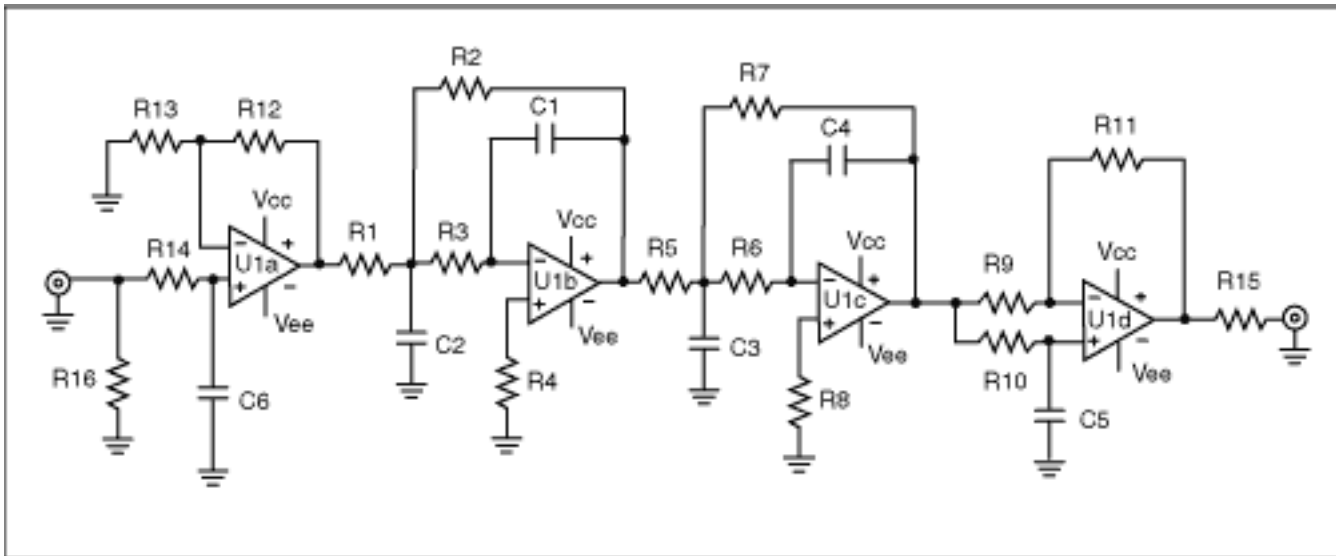


Figure 1. A 5-Pole active filter for HDTV and progressive DVD-reconstruction applications.

Component List

Designation	Qty.	Description
C1, C4	1	3.3pF, 50V COG, $\pm 0.25\text{pF}$ ceramic capacitor (0603)TDK C1608COG1H3R3CT
C2	1	68pF, 50V G0G, 5% ceramic capacitor (0603)Murata GRM11885C1H680J or TDK C1608C0G1H680JT
C3	1	27pF, 50 COG, 5% ceramic capacitor (0603)Murata GRM1885C1H270J or TDK C1608C0G1H270JT
C5	1	33pF, 50V COG, 5% ceramic capacitor (0603)Taiyo Yuden UMK107CG330JZ or TDK C1608C0G1H330JT
C6	1	100pF, 50V COG, 5% ceramic capacitor (0603)Murata GRM1885C1H101JTDK C1608C0G1H101JT
C7, C9	2	10 μF , 6.3V X5R, 20% ceramic capacitor (0805)Taiyo Yuden JMK212BJ106MG or TDK C2012X5R0J106M
C8, C10	2	0.1 μF , 25V X7R, 10% ceramic capacitor (0603)TDK C1608X7R1E104K
R1, R2, R4, R5, R7-R13	11	210 Ω , 1% resistor (0805)
R3	1	100 Ω , 1% resistor (0805)
R6	1	121 Ω , 1% resistor (0805)
R14, R15, R16	3	75 Ω , 1% resistor (0805)
R17	0	Not installed, resistor (0805)
U1	1	MAX4383EUP (14-pin TSSOP)
INPUT, OUTPUT	2	BNC connectors
None	1	MAX4383 PC board

Typical Applications Circuit

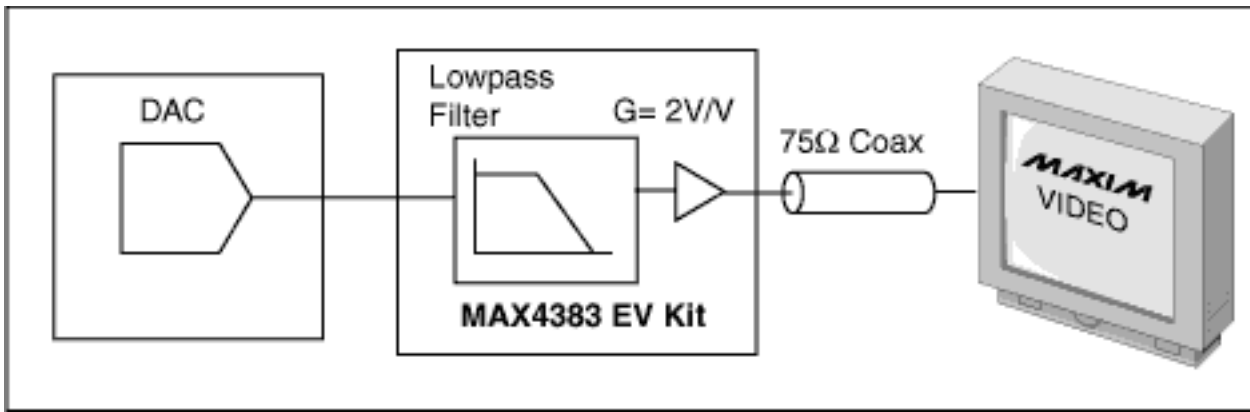


Figure 2.

Gain vs. Frequency

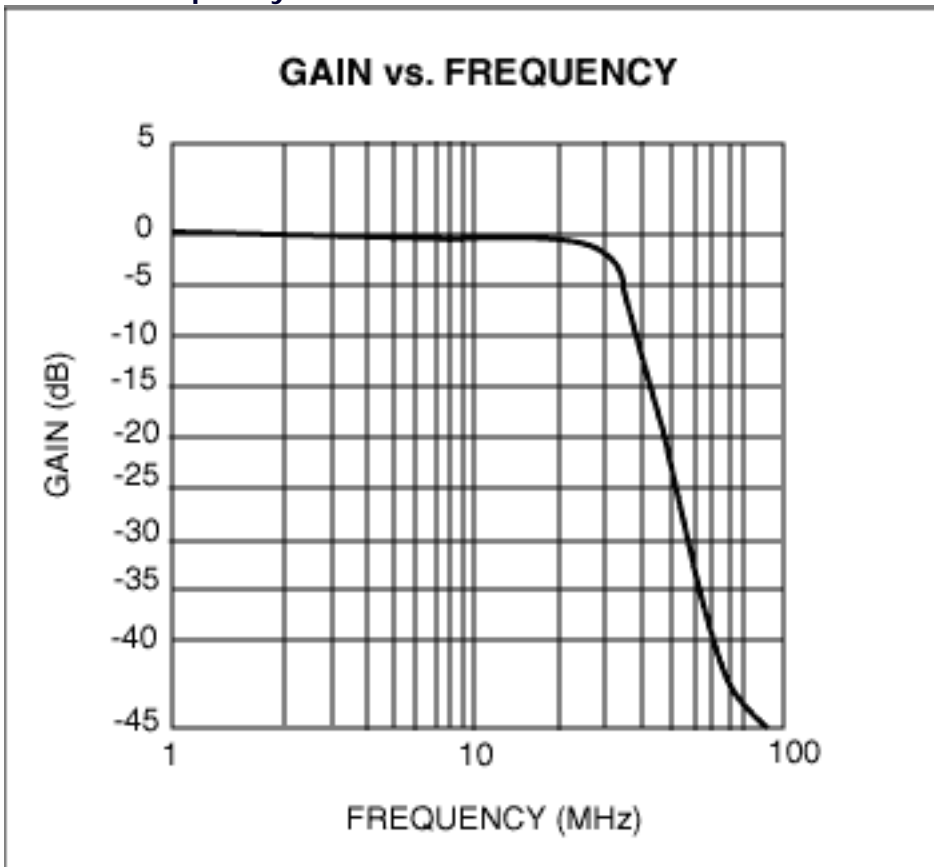


Figure 3.

1. MAX4383 EV kit

Application Note 2383: <http://www.maxim-ic.com/an2383>

More Information

For technical questions and support: <http://www.maxim-ic.com/support>

For samples: <http://www.maxim-ic.com/samples>

Other questions and comments: <http://www.maxim-ic.com/contact>

Related Parts

MAX4383: [QuickView](#) -- [Full \(PDF\) Data Sheet](#) -- [Free Samples](#)

MAX4383EVkit: [QuickView](#) -- [Full \(PDF\) Data Sheet](#)

AN2383, AN 2383, APP2383, Appnote2383, Appnote 2383
Copyright © 2005 by Maxim Integrated Products
Additional legal notices: <http://www.maxim-ic.com/legal>