

APPLICATION NOTE

**ADV7174/79 Video Encoder Evaluation Board Module
(EVAL-ADV7174/79 EBM)**



EVAL-ADV7174/79EBM Application Note Rev.0		Video Group Limerick	
21 st Oct 2002	Analog Devices B.V. PRELIMINARY	1 of 22	



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1.0 Introduction and Quickstart

ADV7174/79 Digital Video Decoder Evaluation board (EVAL-ADV7174/79-EBM)

Introduction

This application note is intended to provide application support for the Analog Devices EVAL-ADV7174/79EBM board. It contains a description of the hardware, on board jumpers, switch settings and interpretation of LED's. The Digital Video Encoder converts a digital video input signal into an analog output signal. Using the board with the evaluation software and a personal computer enables access to all features and settings of the devices. It handles the I²C compatible bus via an RJ11 adapter.

Evaluation Kit

Each ADV7174/79EBM evaluation kit consists of the following:

- An ADV7174/79 modular evaluation board
- ADV7174/79 Evaluation software, EVAL-ADV7174/79SW
- RJ11 cable and parallel port adapter.
- 7.5V – 9V DC 2 Amp power supply module
- RS232 download cable
- Evaluation Board Application note, EVAL-ADV7174/79EBM
- Digital Video De-serializer module
- Power bridge cable

The following optional extras are also available:

- ADV7185 Decoder EBM
- ADV7183 Decoder EBM

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Quick-start guide

To set the ADV7174/79EBM into a single channel CVBS output on DAC B and to have a Y/C output via DAC's A, C and the S-video connector please follow the instructions listed below,

Initial Configuration:

Set on board Jumpers as follows:

Serial Input Module: J1 out, J2 Lo, J3 3.3V, J4 in, J5 out, J6 in, J7 in, J8 in, J9 in, J10 B.

Encoder: J1 in.

Set Switch pack one as follows

Switch Pack 1:	SW1 = Off	=	PAL set
	SW2 = Off	=	DAC B – CVBS, DAC A – Luma, DAC C - Chroma
	SW3 = Off	=	Don't care
	SW4 = Off	=	Don't care
	SW5 = Off	=	Internal Colour Bars Disabled
	SW6 = Off	=	Macrovision disabled*
	SW7 = Off	=	Reserved
	SW8 = Off	=	Reserved

Note: `Open` on the switch pack denotes the `Off` position.

* Only available on the ADV7174

- Interconnect the two kit modules at P1 connector on the encoder board and P2 connector on the decoder board.
- Input a digital CVBS signal to BNC P1 connector on the Deserializer board.
- Connect up a display device to phono output P2, DAC B output on the encoder module for CVBS operation.
- For Y/C operation, connect The S-Video output on the encoder to the display device, or alternately connect DAC A corresponding to Y and DAC C corresponding to C to the display device.
- Connect power to the encoder module at P5.
- Connect bridge power cable between P6 on the deserializer board and P4 on the encoder board.
- NB: First implement a reset on the encoder module by pressing S1 followed by a reset on the deserializer module (S2).
- The CVBS signal input will now be decoded by the on board deserializer and then encoded by the encoder and output at P2, DAC B.

2.0 Functional Description

The Eval-ADV7174/79EBM consists of 2 modular printed circuit boards designed for the demonstration of the ADV7174/79 video encoder. The kit can also be extended with the ADV7185 EBM/ADV7183 EBM video decoder board. The decoder and encoder can be operated `back to back` or independently. The board modules within the kit have been designed to be `plug and play` compatible with present and future evaluation board modules from ADI. The board has been designed to make accurate and detailed device evaluation efficient and fast. The inclusion of an on board microconverter, all DC power regulation and a digital video deserializer make this possible.

2.1 Description Overview

The EVAL-ADV7174/79EBM is controlled by the Deserializer board, which houses the Analog Devices ADUC812 microconverter. The ADuC provides an I^2C compatible bus controller that communicates with the ADV7174/79 and an RJ11 interface that communicates with the host PC. This allows the modules to be used standalone without the need for external control. Optionally the ADuC can be bypassed and the boards be controlled over a PC and the ADV7174/79 Evaluation Software.

The EVAL-ADV7174/79EBM accepts CCIR656 8-bit parallel YCrCb digital video in PAL or NTSC mode on the 96-pin connector. The ADV7174/79 converts the digital video into its analog equivalent in CVBS, Y/C, RGB or component YUV format. The analog output is accessed at the 3 phono connectors and an S-Video connector for Y/C format.

At power-up/reset the ADV7174/79 is initialised by the microcode program located in the ADUC812 microconverter, P-4 on the deserialiser board allows the user to download new program code provided that J5 is set accordingly, see further for details.

To experiment with the programmable features of the Encoder an I^2C compatible interface is available (P-5). This allows standard communication between the evaluation board and a personal computer. Windows compatible application software is available to provide user interface for performing register-level and high-level control of the video encoder.

2.1.1 Board-Level Description

The board level block diagram of the EVAL-ADV7174/79EBM is shown in figure 2-1, the primary features of the boards are:

ADV7174/79 EBM:

- Analog Devices ADV7174/79 video encoder.
- Buffered Output Filters using AD8061.
- Phono and S-Video outputs.

Deserializer:

- Analog Devices ADUC812 microconverter.
- RJ11 interface for communication with standard PC parallel port.
- I^2C compatible bus interface.
- On board DC power regulation.
- D-type RS232 programming connector for the microconverter.
- Genum GS7005 deserializer.
- 8-way DIL switch for preset configuration.

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Figure 2.1 Board Level Block Diagram

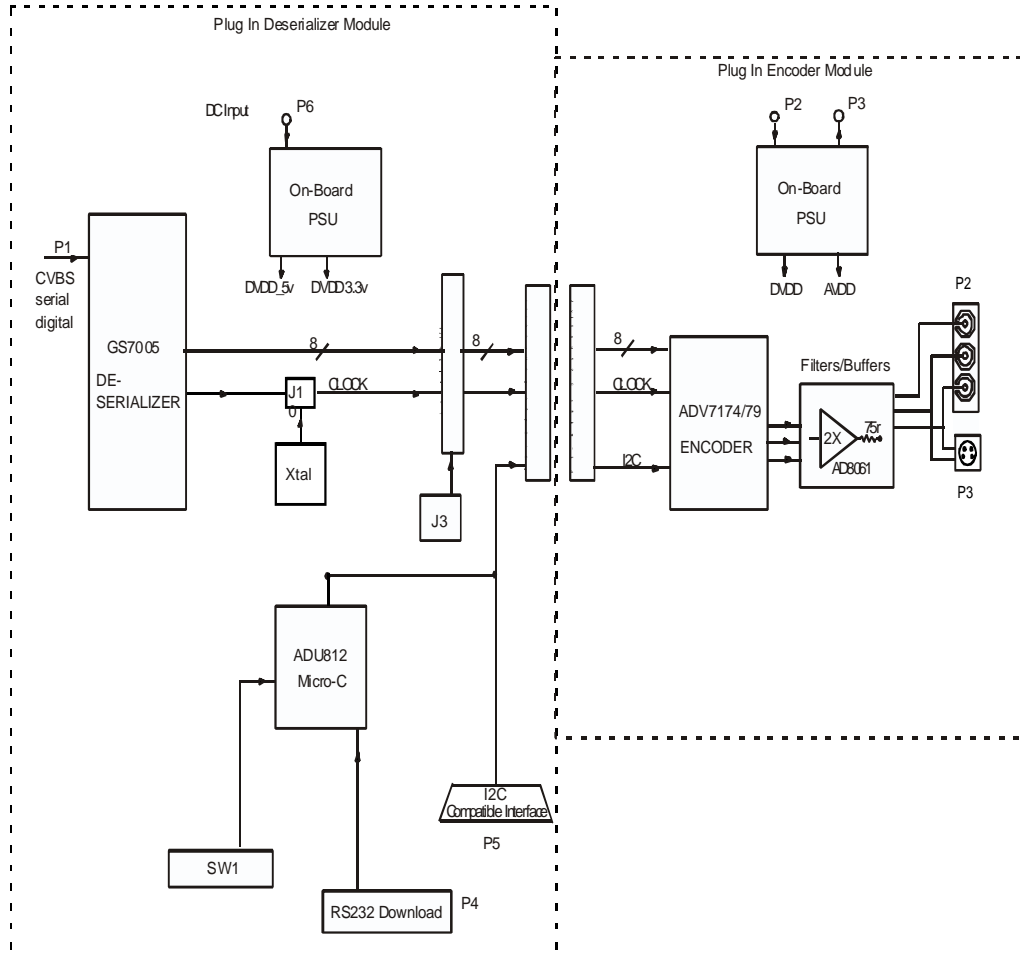


Table 2-1 EVAL-ADV7174/79EBM selectable output options via PC software

Option	DACA	DACB	DACC
1	CVBS	CVBS	C
2	Y	CVBS	C
3	CVBS	CVBS	C
4	Y	CVBS	C
5	CVBS	B	R
6	G	B	R
7	CVBS	U	V
8	Y	U	V
9	C	CVBS	C
10	Y	CVBS	C
11	C	CVBS	C
12	Y	CVBS	C
13	C	B	R
14	G	B	R
15	C	U	V
16	Y	U	V

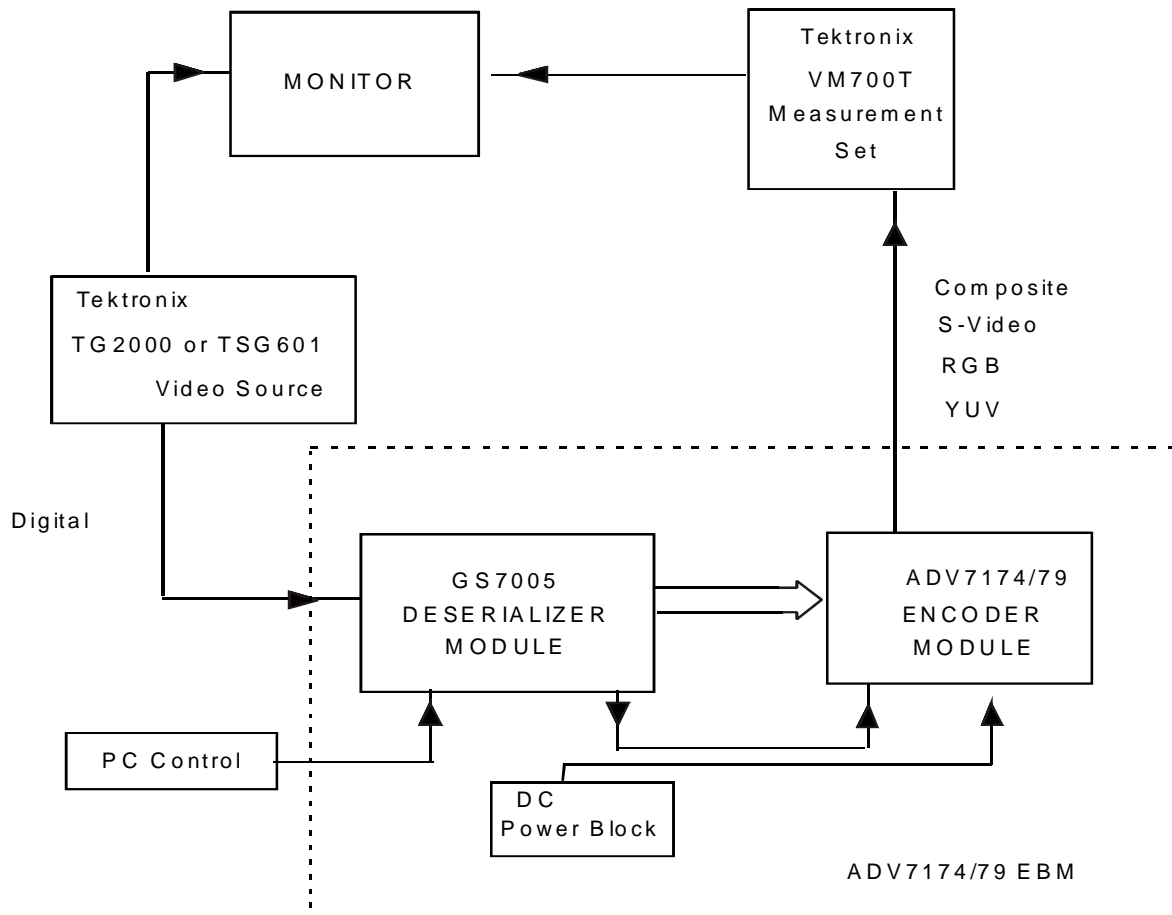
- CVBS: Composite Video Baseband Signal
- Y: Luminance Component Signal (For YUV or Y/C Mode)
- C: Chrominance Signal (For Y/C Mode)
- U: Chrominance Component Signal (For YUV Mode)
- V: Chrominance Component Signal (For YUV Mode)
- R: Red Component Video (For RGB Mode)
- G: Green Component Video (For RGB Mode)
- B: Blue Component Video (For RGB Mode)

2.1.2 System-Level Description

A system-level block diagram incorporating the EVAL-ADV7174/79EBM is shown on figure 2-2. Typical commercially available test equipment is also shown. The primary features of this configuration, which is used for system evaluation, are:

- Video source to the EVAL-ADV7174/79EBM is provided by the Deserializer module
- Device registers can be manipulated through the RJ11 port, using a PC and the appropriate evaluation software.
- Device performance can be measured with a video analyser.
- Device performance can be viewed and /or compared with the source video.
- Features on other compatible modules such as the ADV7170/71/72/73 encoder can also be evaluated with this configuration.

Figure 2-2. System-Level Block Diagram

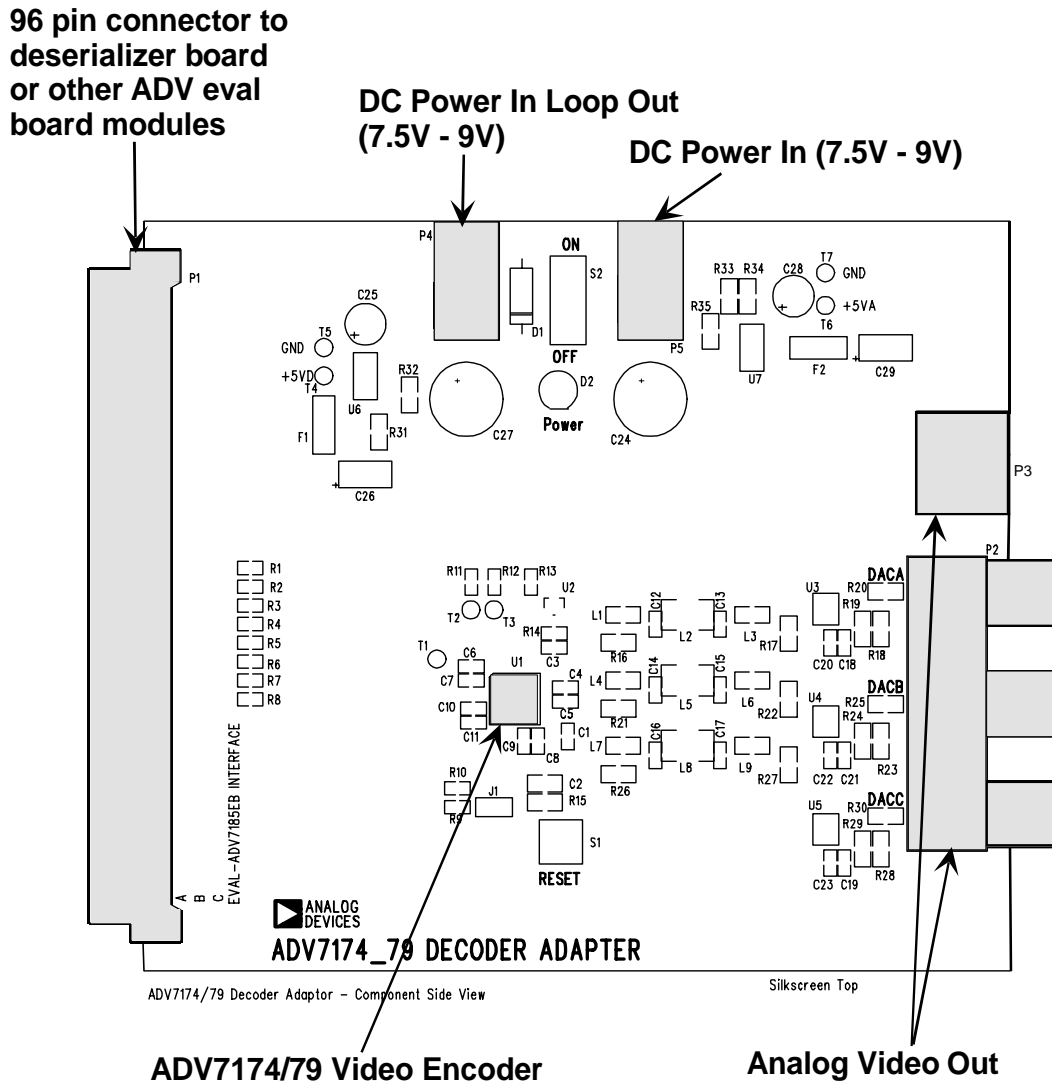


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3.0 Hardware Configuration

Figure 3-1a shows the EVAL-ADV7174/79EBM decoder module board layout with the location and orientation of jumpers, switches and connectors.

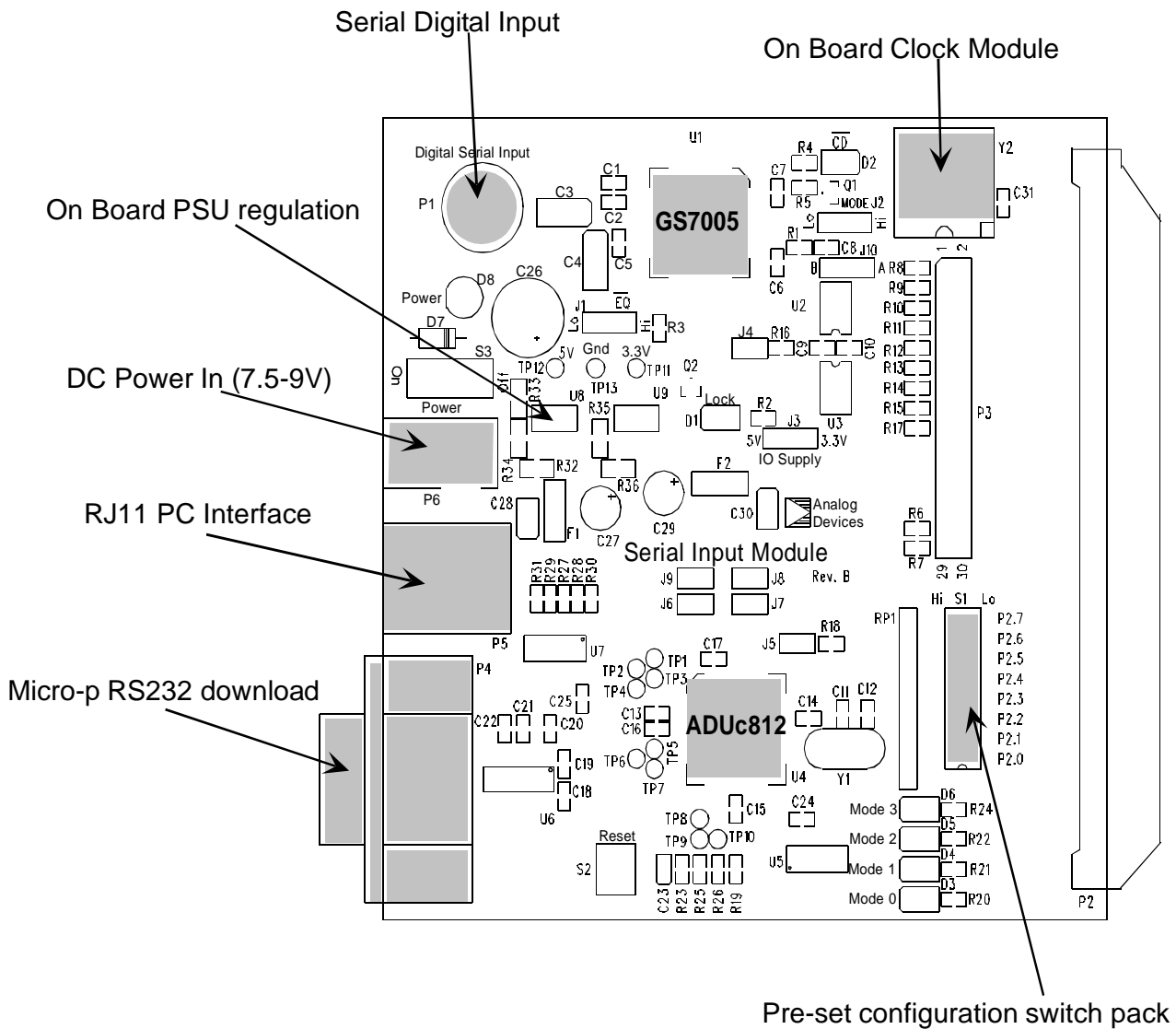
Figure 3-1a. EVAL-ADV7174/79EBM Decoder Module Board Layout



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Figure 3-1b. Deserializer EBM Layout

Figure 3-1b shows the Deserializer EBM encoder module board layout with the location and orientation of jumpers, switches and connectors.



3.1.1 Jumper Settings

The EVAL-ADV7174/79EBM jumper settings are shown in Table 3-1

Table 3-1 EVAL-ADV7174/79EBM Jumper Definitions

Encoder Module

Jumper(s)	Valid Jumper Positions.	Silkscreen Marking	Description
J1			Sets up the ALSB address for the ADV7174/79 J1 inserted MPU address = 54h J1 removed MPU address = D4h

Deserializer Module

J1	J1A J1B	EQ/	J1A enables cable equalisation J1B disables cable equalisation
J2	J2A J2B	MODE	J2A enables NRZI and SMPTE decoding of the digital serial input J2B disables NRZI and SMPTE decoding of the digital serial input
J3	J3A J3B		J3A OE/ of U3, U2 levelshifter are connected to 5V. J3B OE/ of U3, U2 levelshifter are connected to 3.3V.
J4			J4 inserted connects OE/ of U3, U2 levelshifter to ground. J4 removed connects OE/ according to J3 settings
J5			PSEN of Adu connected to ground. Removal of this jumper will cause the Adu to download new code after a board reset. If no code is available the Adu memory will be erased.
J6			Removal of this jumper disconnects SCLK signals coming from the Adu from the SCLK net on the board.
J7			Removal of this jumper disconnects SDA signals coming from the Adu from the SDA net on the board.
J8			Removal of this jumper disconnects SDA coming from the P2 connector from the SDA net on the board.
J9			Removal of this jumper disconnects SCLK coming from the P2 connector from the SCLK net on the board.
J10	J10A J10B	Clock	J10A enables the on-board oscillator to clock the encoder. J10B enables the clock from the SDI input to clock the encoder.

3.1.2 Interpretation of on Board LED`s

Table 3-2 describes how to interpret the state of the on board light-emitting diodes.

Table 3-2. Definition of LED status.

Encoder Module:

LED No.	Silkscreen Marking	Colour	Description / Condition
D2			LED is illuminated if DC power present.

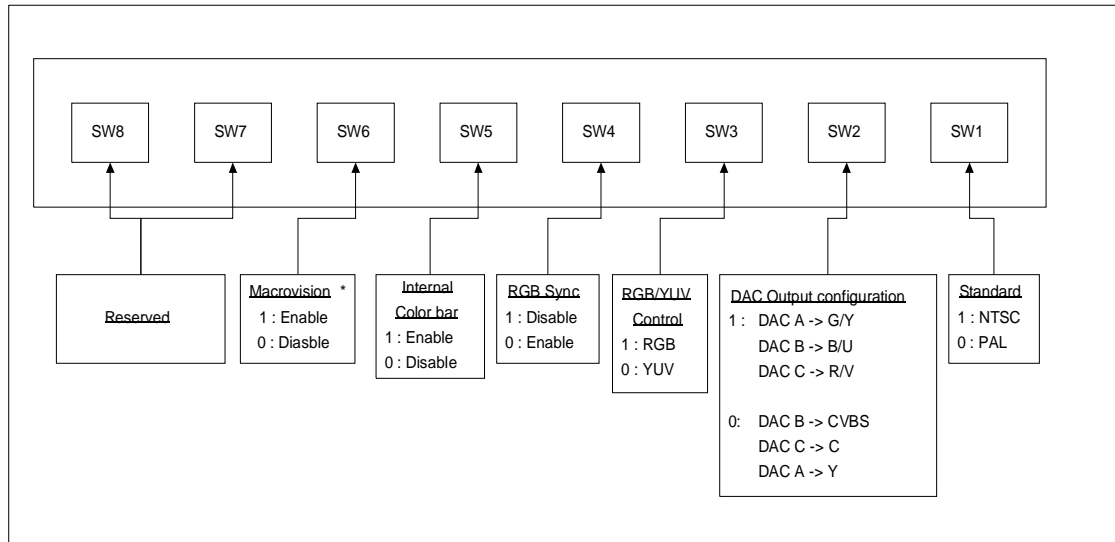
Deserializer Module:

LED No.	Silkscreen Marking	Colour	Description / Condition
D1	LOCK		LED illuminated when the GS7005 Deserializer has acquired lock with the incoming digital video
D2	CD/		LED illuminated when no input carrier present on the incoming digital serial video signal
D3			Reserved
D4			Reserved
D5			Reserved
D6			Reserved
D8			LED is illuminated if DC power is present

3.1.3 Switch Settings

Table 3-3 shows the valid DIP switch settings for the EVAL-ADV7174/79EBM. The 8-way DIP switch is used by the microconverter to determine, at power-up/reset, what the default settings are used.

Table 3-3 SW2 DIL switch pack settings



* Only available on the ADV7174

3.1.4 Power Supply Requirements

To enable robust and easy evaluation of the EVAL-ADV7174/79EBM the various power supplies have been designed in to the evaluation boards. Externally, the only power required is one single supply, which is recommended to be rated at 7V to 9V and have a minimum supply current of 1.6 amps. Both modules can be supplied independently, or daisy-chain linked. Table 3-4 lists the different supply rails and the voltage on each.

Table 3-4 On board Power Supply Requirements

Test Point	Supply ID	Voltage	Description
TP11	DVDD_3v	+3.3V	Digital +3.3V Supply
TP12	DVDD_5v	+5V	Digital +5V supply
TP6	AVDD	+5V	Encoder Analog +5V supply
TP4	DVDD	+5V	Encoder Digital +5V supply

4.0 SCHEMATICS

This chapter presents the schematic information and diagrams for the EVAL-ADV7174/79EBM evaluation board

4.1 Schematic Information

This chapter provides schematic diagrams and additional related information.

4.1.1 EVAL-ADV7174/79EBM Video Encoder

The ADV7174/79 is an integrated Digital Video Encoder that converts digital ITU-R BT656 4:2:2 Component Video Data (8,16 bit) into a standard analog baseband television signal compatible with NTSC, PAL B/D/G/H/I, PAL N& PAL-60. In addition to the composite output signal, there is the facility to output S-VHS Y/C Video, RGB Video and YUV Video. The analog video is output over phono connector P2.

4.1.2 On board level shifters

The on-board level shifter IC's (74lv244) ensure that the output pixel bus and control signals are compatible with encoder devices that have a 3.3V I/O supply. When operating at 3.3V, the level shifters are 5V tolerant in that they can accept up to a 5V input but their output high value will be 3.3V. The supply voltage to the level shifter will determine the max output voltage hence the voltage level of the encoder board output data is programmable. This can be set via jumper J3.

4.1.3 ADUC812 Microconverter

The ADUC812 microconverter controls the on board I^2C and executes the microcode program. The primary functions of the microcode program are:

- Power-up/reset initialisation of video chipset into a particular video mode.
- Download of EVAL-ADV7174/79EBM microcode. This can be done directly via P4 on the decoder board, the RS232 download port.
- Operation of the Evaluation board independent of the PC evaluation software.
- Reads the status register of the decoder and will illuminate the appropriate status LED, see Table 3-2.

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4.1.4 PC interface

The PC interface provides two-way buffering between the EVAL-AD7174/79EBM and the control PC. I^2C signals are fed to and from the PC parallel port via RJ11 connector P5.

4.1.5 Encoder Module On Board power supply regulation

The board module has a total of two supply rails. Externally, the only power required is one single supply, which is recommended to be rated at 7V to 9V and have a minimum supply current of 1.6 amps. Table 3-4 lists the different supply rails, the voltage on each and the current drawn on default power up.

4.1.6 Encoder Module output filters/buffers

Outputs from the encoder DAC's are fed through the SD low pass, anti-aliasing reconstruction filters before going to the output buffers. The AD7174/79EBM encoder module uses AD8061 buffers, which provide a 2X buffered output and operate from a single rail DC supply. Note, these outputs should be terminated with a 75 ohm impedance. These outputs can be configured to supply standard definition CVBS and S-Video (Y/C) or RGB/YUV outputs at the output phono connector (P2).

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Figure 4.2.1 ADV7174/79 EBM - Video Encoder

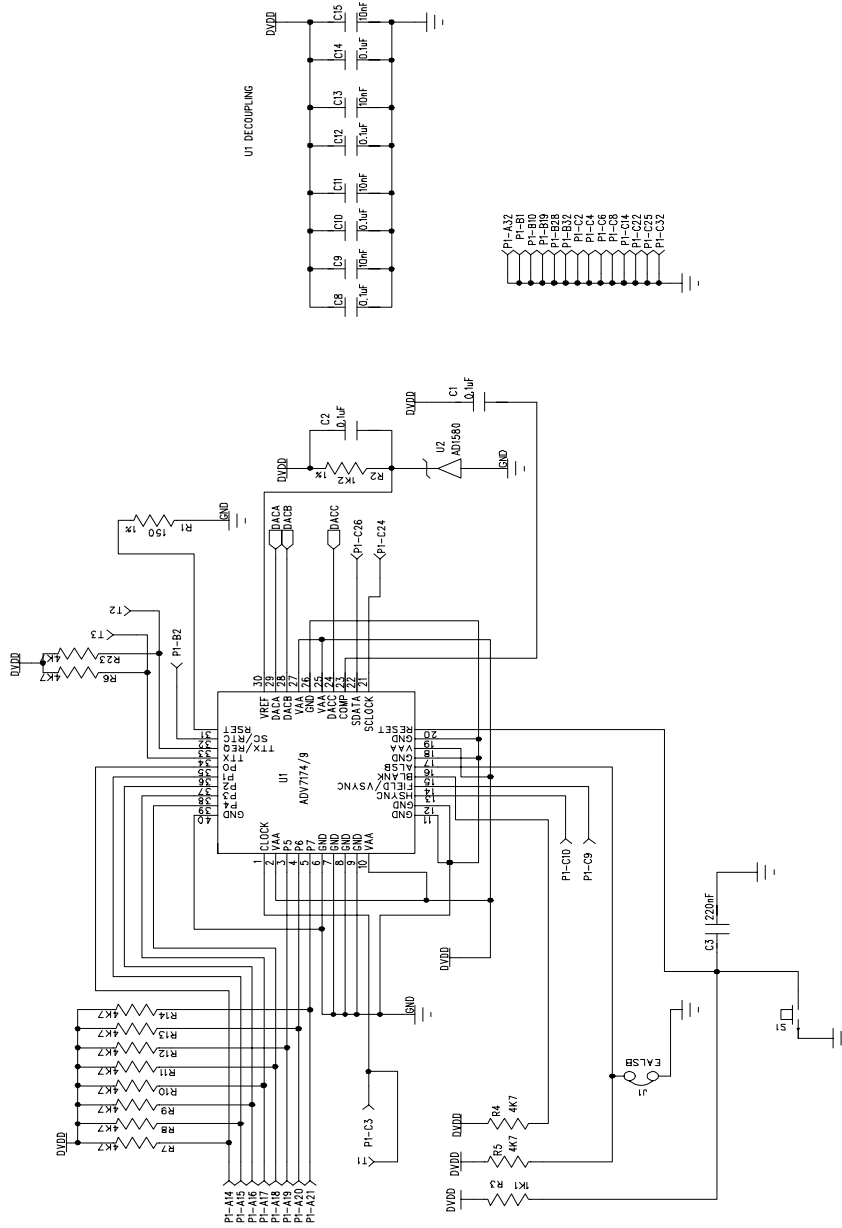


Figure 4.2.2 ADV7174/79 EBM - Filter Section

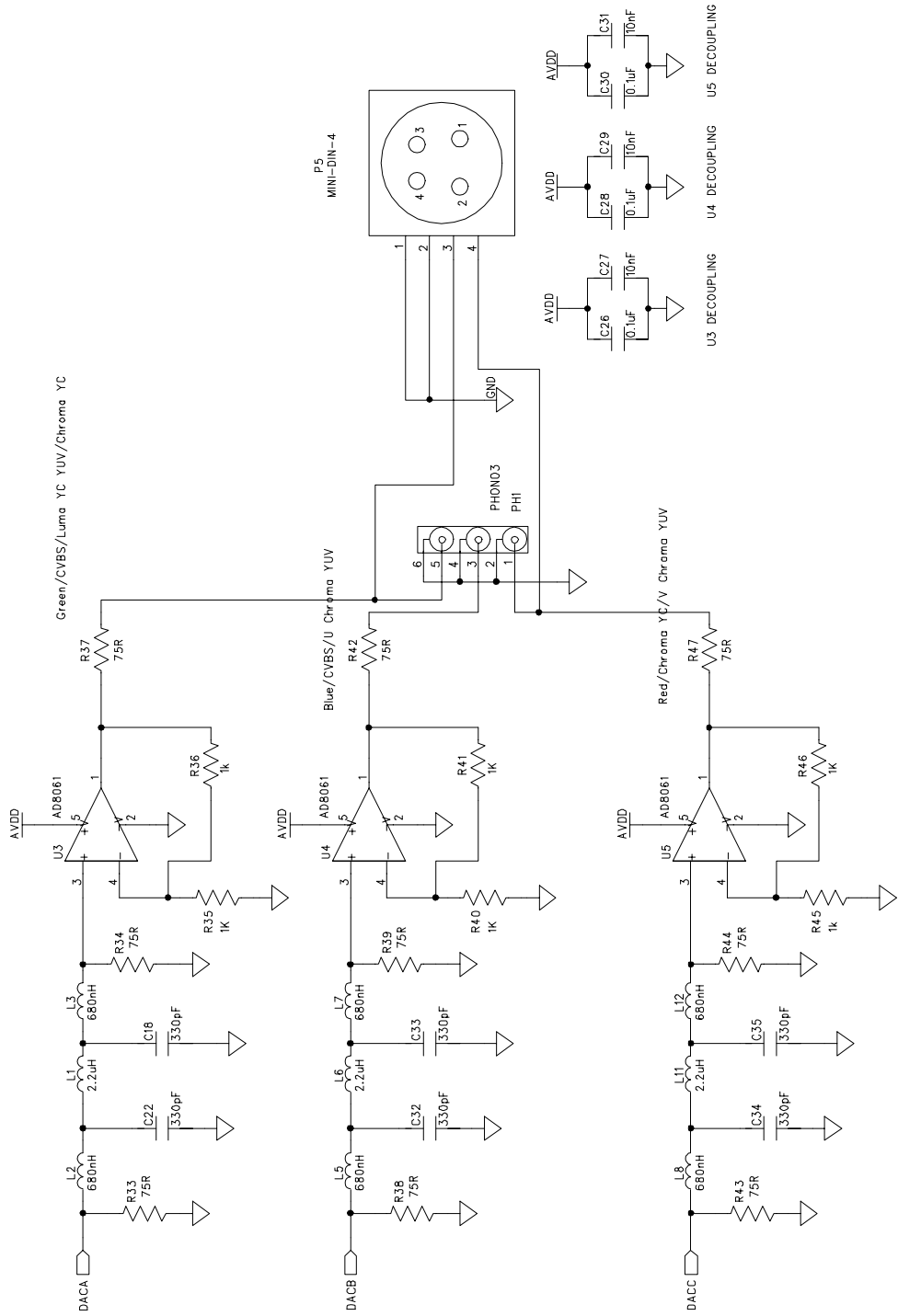
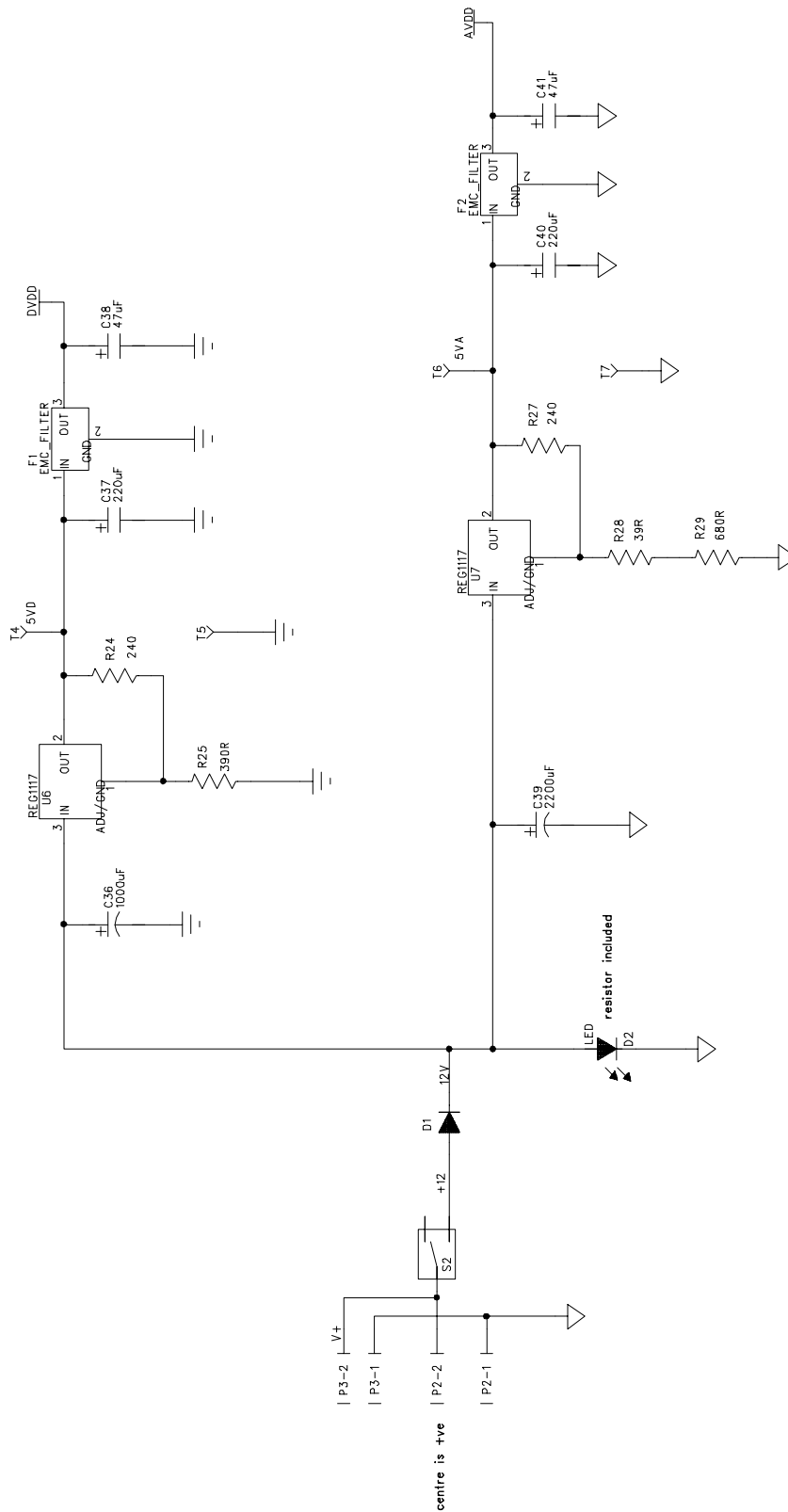


Figure 4.2.3 ADV7174/79 EBM – Power Section



4.3 *PCB layout with Analog and Digital signal processing*

When designing the EVAL-ADV7174/79-EBM the following important design considerations were used and should be considered when implementing PCB layout with Analog and Digital signal processing.

- Use separate ground planes for analog and digital supply, use one layer for both planes and ensure that there is no overlapping.
- Use separate supply planes for analog and digital, ensure that the analog supply does not overlap the digital ground and visa versa.
- Try to keep digital signals away from analog areas of the board.
- Avoid long tracks for both analog and digital signals.
- Place decoupling capacitors (22nF to 100nF) close to the power pins of all the on board ICs.

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5.0 Relevant Information

5.1 Microcode Download

The Evaluation Board can be operated with either the Micro-Code or the Evaluation Software.

Micro-Code Download:

1. Connect the 9-pin D-type connector that is supplied with the kit between the evaluation board - P4 and a free serial com port on the PC.
2. Install the Micro-converter download program on the PC. This can be done by running `setup.exe` in the `microcode` folder on the ADV7174/79EBM evaluation CD.
3. Insert jumper J5, apply power to the evaluation board and implement a reset by pressing S2. This action will clear any code from the micro-converter.
4. On the main windows task bar select, START..PROGRAMS...AduC....WSD. The Windows Software Download program should open and if communication between the evaluation board and PC is OK, the message `Resetting AduC812 OK` will be displayed.
5. Click on download and select the hex file you wish to load into the micro-controller. The evaluation board hex file can be found the `MIRCOCODE` folder. Once you select the file download will start automatically. When the file has downloaded, `OK` will be displayed.
6. Remove the jumper J5 and reset the board using S2. Your code has now downloaded.

Fig 5.0 EVAL-ADV7174/79EBM I²c compatible interface wiring diagrams

