Advantiv EVAL-ADV7850 Video Evaluation Board

FEATURES
4 HDMI inputs, 1 HDMI output
1 VGA input, 1 component input
1 CVBS input, 1 headphone output
1 audio DAC output, 1 audio ADC input
PC communication via RS-232 or USB interface

SOFTWARE NEEDED
Windows OS for controlling the board via AVES application
RS-232 software for updating the firmware of the board (if desired or necessary)

GENERAL DESCRIPTION
The Advantiv® EVAL-ADV7850 video evaluation board (AVEB) is a low cost solution for evaluating the performance of the ADV7850 HDMI transceiver.

The evaluation board contains a Blackfin® ADSP-BF524 processor for system control. The evaluation board includes software (firmware) that provides a serial command interface to control the various features and functions of the board.

PHOTOGRAPH OF EVALUATION BOARD

Figure 1. Advantiv EVAL-ADV7850 Video Evaluation Board with Factory Jumper Settings
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# Revision History

7/12—Revision 0: Initial Version
TERMINOLOGY

Source
A source outputs digital audio/video over a DVI/HDMI, component, VGA, or CVBS interface. This can be a DVD/Blu-ray player, set-top box, game console, or any other device with these outputs.

Sink
A sink accepts video through a DVI/HDMI interface. In the context of this user guide, sink nearly always refers to a display with DVI/HDMI input.

Repeater
With respect to this evaluation board, a repeater refers to the software that runs on the ADSP-BF524 and implements the link between a source and sink.
EVALUATION BOARD HARDWARE

EVALUATION BOARD USAGE

The evaluation board can be connected as shown in Figure 2. An HDCP license is required to purchase this board.

The RS-232 command line interface operates at a 115,200 baud rate with eight data bits, no parity bit, one stop bit, and no flow control. Typing `help` via RS-232 lists the commands that can be used to control the board, as well as the version of firmware and the build date.

The repeater software starts upon power-up, allowing an HDMI sink to receive content from an HDMI/HDCP source soon after it is connected.

There are three main ways to control the board:

- Commands via RS-232
- Repeater software via RS-232
- Advantiv video evaluation software (AVES)

Commands via RS-232

This mode uses the RS-232 command line interface. The ADSP-BF524 powers up to a known reset state and then outputs a prompt. At this point, commands can be entered. Typing `help` shows a list of available commands. Using the appropriate commands, the user can read/write registers in the ADV7850. All registers are at their reset values.

It is possible to stop the repeater software in this mode by issuing a `stoprep` command via the RS-232. To restart the repeater software issue a `startrep` command via the RS-232.

Repeater Software via RS-232

This mode uses the RS-232 command line interface to control the repeater software and to direct reads and writes to the ADV7850 registers. The repeater software outputs messages via RS-232 as events, such as encryption, formats, sink, or source changes, occur. Registers can still be read/written from the command line, but anything that is written to a register can be overwritten by the repeater software if it is running.

In this mode, there are additional commands from the repeater itself. All repeater commands are in the `rep xxx` format, where `xxx` is the repeater command. Issue a `rep help` command to view a list of the available repeater commands. These commands provide information about the state of the repeater, source, and sink.

AVES

AVES is a Windows*-based application that runs on a PC and allows the user to read/write registers in the ADV7850. The software also displays the individual bit fields for each register and allows the user to modify these individual bit fields. The software supports RS-232, USB, and I²C (using the Total Phase Aardvark I²C/SPI host adapter). Information about the video evaluation board is located on the EVAL-ADV7850 page on EngineerZone at ez.analog.com/docs/DOC-2152.

Additional information about the software is located at ez.analog.com/docs/DOC-1789. The latest version of the software can also be downloaded from this Web page.
HEADERS

This evaluation board has multiple 0.1 inch headers that connect to the digital audio/video signals (as well as some control signals). This provides users with easy access and maximum flexibility when evaluating devices.

Table 1 to Table 5 provide details about the physical arrangement on the board and may be useful when probing these signals.

### Table 1. J11 Off-Board I2S

<table>
<thead>
<tr>
<th>Pin</th>
<th>Function</th>
<th>Pin</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3.3 V</td>
<td>2</td>
<td>3.3 V</td>
</tr>
<tr>
<td>3</td>
<td>GND</td>
<td>4</td>
<td>HA_AP4</td>
</tr>
<tr>
<td>5</td>
<td>GND</td>
<td>6</td>
<td>HA_AP5</td>
</tr>
<tr>
<td>7</td>
<td>HA_AP0</td>
<td>8</td>
<td>HA_SCLK</td>
</tr>
<tr>
<td>9</td>
<td>HA_AP1</td>
<td>10</td>
<td>HA_MCLKOUT</td>
</tr>
<tr>
<td>11</td>
<td>HA_AP2</td>
<td>12</td>
<td>GND</td>
</tr>
<tr>
<td>13</td>
<td>HA_AP3</td>
<td>14</td>
<td>GND</td>
</tr>
<tr>
<td>15</td>
<td>GND</td>
<td>16</td>
<td>AC_MCLK</td>
</tr>
<tr>
<td>17</td>
<td>AC_SDI</td>
<td>18</td>
<td>AC_LRCLK</td>
</tr>
<tr>
<td>19</td>
<td>AC_SCLK</td>
<td>20</td>
<td>SPDIF_IN</td>
</tr>
<tr>
<td>21</td>
<td>NC</td>
<td>22</td>
<td>GND</td>
</tr>
<tr>
<td>23</td>
<td>SCL</td>
<td>24</td>
<td>SDA</td>
</tr>
<tr>
<td>25</td>
<td>GND</td>
<td>26</td>
<td>GND</td>
</tr>
</tbody>
</table>

### Table 2. JP1, JP2, JP3

<table>
<thead>
<tr>
<th>Pins Shorted</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>JP1-1, JP1-2</td>
<td>DDC_5V to EDID PROM</td>
</tr>
<tr>
<td>JP2-1, JP2-2</td>
<td>DDC_SCL to EDID PROM</td>
</tr>
<tr>
<td>JP3-1, JP3-2</td>
<td>DDC_SDA to EDID PROM</td>
</tr>
<tr>
<td>JP1-2, JP1-3</td>
<td>Board 3.3V to EDID PROM</td>
</tr>
<tr>
<td>JP2-2, JP2-3</td>
<td>Board SCL to EDID PROM</td>
</tr>
<tr>
<td>JP3-2, JP3-3</td>
<td>Board SDA to EDID PROM</td>
</tr>
</tbody>
</table>

### Table 3. J12 TTX

<table>
<thead>
<tr>
<th>Pin</th>
<th>Function</th>
<th>Pin</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>HA_AP3</td>
<td>2</td>
<td>GND</td>
</tr>
<tr>
<td>3</td>
<td>TTX_SCLK</td>
<td>4</td>
<td>GND</td>
</tr>
<tr>
<td>5</td>
<td>TTX_MOSI</td>
<td>6</td>
<td>GND</td>
</tr>
<tr>
<td>7</td>
<td>TTX_MISO</td>
<td>8</td>
<td>GND</td>
</tr>
<tr>
<td>9</td>
<td>TTX_CSBI1</td>
<td>10</td>
<td>GND</td>
</tr>
</tbody>
</table>

### Table 4. J14 Resets/Interrupts

<table>
<thead>
<tr>
<th>Pin</th>
<th>Function</th>
<th>Pin</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>RESET_BUTTONn</td>
<td>2</td>
<td>GND</td>
</tr>
<tr>
<td>3</td>
<td>BF524_RESETn</td>
<td>4</td>
<td>GND</td>
</tr>
<tr>
<td>5</td>
<td>ADV7850_RESETn</td>
<td>6</td>
<td>GND</td>
</tr>
<tr>
<td>7</td>
<td>ADV7850_INT1</td>
<td>8</td>
<td>GND</td>
</tr>
<tr>
<td>9</td>
<td>ADV7850INT2</td>
<td>10</td>
<td>GND</td>
</tr>
</tbody>
</table>

### Table 5. J10 General-Purpose Input/Output

<table>
<thead>
<tr>
<th>Pin</th>
<th>Function</th>
<th>Pin</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>GPIO_PF0</td>
<td>2</td>
<td>GND</td>
</tr>
<tr>
<td>3</td>
<td>GPIO_PF1</td>
<td>4</td>
<td>GND</td>
</tr>
<tr>
<td>5</td>
<td>GPIO_PF2</td>
<td>6</td>
<td>GND</td>
</tr>
<tr>
<td>7</td>
<td>GPIO_PF3</td>
<td>8</td>
<td>GND</td>
</tr>
<tr>
<td>9</td>
<td>GPIO_PF4</td>
<td>10</td>
<td>GND</td>
</tr>
</tbody>
</table>

### AUDIO CODEC FUNCTIONALITY

The audio codec requires an external MCLK. Insert the desired clock signal into J11–16 with CMOS-compliant amplitudes. Reference the Hardware Manual Paragraph 11.3 in DOC-2152 for nominal frequencies.
EVALUATION BOARD SOFTWARE

UPGRADING THE FIRMWARE

The software (firmware) on the evaluation board can be upgraded using the standard Blackfin development tools.

- VisualDSP++ 5.0 Update 8
- JTAG debugger for Blackfin processors (HPUSB-ICE or ICE-100B) connected to the JTAG connector (J7)

Using these tools, you can connect the evaluation board to the ADSP-BF524 processor, run a script, and program the SPI flash memory device (U10).

Most evaluation boards for Blackfin processors are shipped with the Das U-Boot boot loader firmware, and you can upgrade the firmware using only an RS-232 cable and software. If you see the following output after resetting the board or applying power, your evaluation board has U-Boot:

U-Boot 2010.06 (ADI-2010R1-RC2) (Jan 12 2011 - 15:53:34)

CPU: ADSP bf524-0.2 (Detected Rev: 0.2)  
(spi flash boot)
Board: ADI Advantiv™ Video Evaluation Board
Support: http://ez.analog.com
Clock: VCO: 300 MHz, Core: 300 MHz, System: 100 MHz
RAM: 8 MiB
SF: Detected M25P80 with page size 256, total 1 MiB
In: serial
Out: serial
Err: serial
KGDB: [on serial] ready
Hit any key to stop autoboot:

If your evaluation board has U-Boot, you can use the following steps to upgrade the application firmware of your board (if you determine that this is necessary). These instructions assume that you are using the latest version of Tera Term for Windows (which is free to download and use), but any RS-232 software with YMODEM upload capability should also work.

1. After you see the hit any key to stop autoboot prompt, press a key during the countdown. You should then see a prompt, `bfin >`.
2. At the prompt, type the following command:
   `sf probe 0:1`
   You should see the following:
   SF: Detected M25P80 with page size 256, total 1 MiB
   1024 KiB M25P80 at 0:1 is now current device
   `bfin>`
3. At the prompt, type the following command:
   `loady`
   You should see the following output:
   `## Ready for binary (ymodem) download to 0x00100000 at 115200 bps...`
   `C`
4. In Tera Term, under File, click Transfer and then YMODEM, and select Send...
5. Select the application firmware (for example, EVALADV7850_v1p0_app.bin) and click Open.
6. You should see the YMODEM send dialog box progress quickly from 0% to 100%. If the software stalls at Packet 1 or Packet 2 for a few seconds, you may need to cancel and retry. It is possible that you may need to repeat Step 3 through Step 5 a few times to accomplish the transfer. After the transfer is complete, you should see the following:
   CCxyzModem - CRC mode, 0(SOH)/215(STX)/0(CAN) packets, 5 retries
   `## Total Size = 0x000357fc = 219132 Bytes`
   `bfin>`
7. At the prompt, type the following command to erase the application area of the SPI flash memory:
   `sf erase 0x60000 0xa0000`
   You should then see the following output:
   `bfin>
8. At the prompt, type the following command to program the application area of the SPI flash memory:
   `sf write $(loadaddr) 0x60000 $(filesize)`
   You should then see the following output:
   `bfin>`
9. At this point, if you reset your board and allow the countdown to complete, U-Boot should launch the application firmware that was just programmed.
EVALUATION BOARD BLOCK DIAGRAM AND ARTWORK

Figure 2. Block Diagram of the EVAL-ADV7850 (for the Evaluation Board Schematics, see DOC-2151)

Figure 3. Assembly Drawing (Top Side) of the EVAL-ADV7850
## BILL OF MATERIALS

Table 6. Evaluation Board Hardware Components

<table>
<thead>
<tr>
<th>Reference Designator</th>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>D1</td>
<td>Tx HPD</td>
<td>Hot plug detect signal of the HDMI transmitter. Indicates status of respective HDMI HPD.</td>
</tr>
<tr>
<td>D10, D11, D12, D13</td>
<td>Rx HPD</td>
<td>Hot plug detect signal of the HDMI receiver. Indicates status of respective HDMI HPD.</td>
</tr>
<tr>
<td>D2</td>
<td>VGA of 5 V</td>
<td>Indicator of 5 V variable gain amplifier connection.</td>
</tr>
<tr>
<td>D3</td>
<td>1.8 V</td>
<td>Indicator of 1.8 V power supply.</td>
</tr>
<tr>
<td>D4</td>
<td>5 V</td>
<td>Indicator of 5 V power supply.</td>
</tr>
<tr>
<td>D5</td>
<td>LED</td>
<td>Read indicator. Illuminates when iC data is read from the board.</td>
</tr>
<tr>
<td>D6</td>
<td>LED</td>
<td>Write indicator. Illuminates when iC data is written to the board.</td>
</tr>
<tr>
<td>D7</td>
<td>LED</td>
<td>General indicators. Undefined at present.</td>
</tr>
<tr>
<td>D8</td>
<td>Repeater</td>
<td>Repeater indicator. Indicates when repeater is active.</td>
</tr>
<tr>
<td>D9</td>
<td>Heartbeat</td>
<td>Heartbeat LED. Blinks at ~0.5 Hz rate when code is running.</td>
</tr>
<tr>
<td>J1</td>
<td>Component input</td>
<td>RCA component input.</td>
</tr>
<tr>
<td>J10</td>
<td>GPIO</td>
<td>General-purpose input/output.</td>
</tr>
<tr>
<td>J11</td>
<td>I²S header</td>
<td>I²C digital audio header.</td>
</tr>
<tr>
<td>J12</td>
<td>VBI data processor header</td>
<td>TTX connection.</td>
</tr>
<tr>
<td>J13</td>
<td>Audio codec mux input</td>
<td>RCA stereo audio mux input.</td>
</tr>
<tr>
<td>J14</td>
<td>Chip reset/external interrupt header</td>
<td>Reset and interrupt header for external connection and monitoring.</td>
</tr>
<tr>
<td>J16</td>
<td>Audio codec mux output</td>
<td>RCA stereo jack input.</td>
</tr>
<tr>
<td>J2</td>
<td>HDMI output</td>
<td>This is the only video output connector.</td>
</tr>
<tr>
<td>J17, J18, J19, J20</td>
<td>HDMI inputs</td>
<td>J20 is HDMI Port A, J19 is HDMI Port B, J18 is HDMI Port C, J17 is HDMI Port D.</td>
</tr>
<tr>
<td>J3</td>
<td>VGA input</td>
<td>VGA input.</td>
</tr>
<tr>
<td>J4</td>
<td>Power</td>
<td>Power input 5 V, 2.5 A</td>
</tr>
<tr>
<td>J5</td>
<td>CVBS input</td>
<td>CVBS input.</td>
</tr>
<tr>
<td>J6</td>
<td>HPOUT</td>
<td>3.5 mm stereo jack output.</td>
</tr>
<tr>
<td>J7</td>
<td>SPI header</td>
<td>SPI header, Aardvark compliant.</td>
</tr>
<tr>
<td>J8</td>
<td>I²C header</td>
<td>I²C header, Aardvark compliant.</td>
</tr>
<tr>
<td>J9</td>
<td>DAC output</td>
<td>Stereo audio DAC output.</td>
</tr>
<tr>
<td>JP1, JP2, JP3</td>
<td>EDID jumpers</td>
<td>Jumper headers for directly connecting EDID EPROM to either Port D or I²C bus.</td>
</tr>
<tr>
<td>P1</td>
<td>RS-232 port</td>
<td>RS-232 interface to the computer (for user control and debug output).</td>
</tr>
<tr>
<td>P2</td>
<td>USB port</td>
<td>This USB port can be used instead of RS-232 if the computer in use does not have the RS-232 interface.</td>
</tr>
<tr>
<td>SW1</td>
<td>Power switch</td>
<td>Momentary power-down switch. Emulates unplugging and plugging in the power supply.</td>
</tr>
<tr>
<td>SW2</td>
<td>Reset switch</td>
<td>Switch that resets the ADSP-BF524.</td>
</tr>
</tbody>
</table>
## RELATED LINKS

<table>
<thead>
<tr>
<th>Resource</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADV7850</td>
<td>Product Page, ADV7850 Complete AV Front End</td>
</tr>
<tr>
<td>ADSP-BF524</td>
<td>Product Page, ADSP-BF524 Low Power Blackfin Processor with Advanced Peripherals and Low Standby Power</td>
</tr>
<tr>
<td>DOC-2152</td>
<td>ADV7850 Design Support Files</td>
</tr>
<tr>
<td>DOC-2151</td>
<td>Advantiv EVAL-ADV7850EBZ Video Evaluation Board</td>
</tr>
<tr>
<td>DOC-1789</td>
<td>Advantiv Video Evaluation Software</td>
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I2C refers to a communications protocol originally developed by Philips Semiconductors (now NXP Semiconductors).