ANALOG DEVICES

ADV7180/ADV7181C
Calibrating for Manual Chroma Gain

CHROMA GAIN BACKGROUND

The ADV7180/ADV7181C chroma gain is purely digital and is implemented using a digital multiplier which has the advantage of making the chroma gain independent of process and temperature. The chroma gain is adjusted either automatically by an Automatic Gain Control (AGC) or manually.

CHROMA AGC

The Chroma AGC can operate in two different modes. In one mode it follows the Luma AGC which means it is based on horizontal sync depth. In the other mode it monitors changes in the color burst amplitude and adjusts the gain accordingly.

The input sync depth and color burst amplitude range for which the Chroma AGC will compensate for is shown in the following table. Also shown in the table is the value of the **Chroma Gain Control Register CMG[11:0]** at these voltages. The AGC does not apply any more gain/attenuation outside of these voltages.

Part	Standard	Minimum Sync Depth		Maximum Sync Depth*	
		Input Sync Depth	CMG[11:0] Readback (decimal)	Input Sync Depth	CMG[11:0] Readback (decimal)
ADV7180: 64 and 40 lead models	NTSC M	94 mV	1772	404 mV	567
	PAL B/G	94 mV	1900	424 mV	579
ADV7180: 32 and 48 lead models	NTSC M	94 mV	1772	404 mV	541
	PAL B/G	94 mV	1900	424 mV	552
ADV7181C	NTSC M	65 mV	1772	404 mV	420
	PAL B/G	70 mV	1710	424 mV	430

*Limited by maximum sync depth of source used. ADV7180/ADV7181C can support larger sync depths.

Part	Standard	Minimum Color Burst		Maximum Color Burst**	
		Color Burst Amplitude	CMG[11:0] Readback (decimal)	Color Burst Amplitude	CMG[11:0] Readback (decimal)
ADV7180: 64 and 40 lead models	NTSC M	59 mV	4095	404 mV	625
	PAL B/G	60 mV	4095	600 mV	424
ADV7180: 32 and 48 lead models	NTSC M	59 mV	4095	404 mV	628
	PAL B/G	64 mV	4095	600 mV	426
ADV7181C	NTSC M	48 mV	4095	404 mV	500
	PAL B/G	50 mV	4095	600 mV	344

**Limited by maximum color burst amplitude of source used. ADV7180/ADV7181C can support larger color burst amplitudes.

PROGRAMMING THE MANUAL CHROMA GAIN

Two I²C writes are required to program a manual gain.

1. Disable the AGC: Write 00 to the **AGC Mode Control Register CAGC[1:0]** (Address 0x2C).
2. Write the desired gain: Write the desired value in hex to the **Chroma Gain Control Register CMG[11:0]** (Address 0x2D/0x2E) where bits [3:0] of 0x2D are the MSBs [11:8] and bits [7:0] of register 0x2E are the LSBs [7:0].

Since the relationship between the **Chroma Gain Control Register CMG[11:0]** and the resulting chroma gain is uncertain, the ADV7180/ADV7181C must be calibrated in order to find out this relationship, as described in the following section.

CALIBRATING IN ORDER TO APPLY A MEANINGFUL MANUAL CHROMA GAIN

Brief Description

Calibrate by applying a standard CVBS signal at the input to the Video System and note the chroma level. Then measure the chroma level of the CVBS signal at the output and manually adjust the **Chroma Gain Control Register CMG[11:0]** until they are equal. This value in the **Chroma Gain Control Register CMG[11:0]** gives a gain of 1 and it is called the Chroma Calibration Factor. Note that only decimal values between 0 to 4095 are allowed to be written to the **Chroma Gain Control Register CMG[11:0]** (that is, 0x00 to 0xFFF) . The following formula is used to calculate the chroma gain.

$$Chroma\ Gain = \frac{CMG[11:0]_{decimal}}{Chroma\ Calibration\ Factor}$$

Note: CMG[11:0] is a decimal number between 0 and 4095

For the ADV7180 evaluation boards the Chroma Calibration Factor tends to be in the range of 830 to 880 (decimal). For the ADV7181C evaluation boards the Chroma Calibration Factor tends to be in the range of 700 to 725 (decimal). The Chroma Calibration Factor has to be calculated separately for PAL and NTSC.

Detailed Description

These steps describe how to calculate the Chroma Calibration Factor for an ADV7180/ADV7181C evaluation board. **Note**: If the video source is PAL, the ColorBars 100/0/75/0 test pattern should be used. If the video source is NTSC, the SMPTE Bard test pattern should be used.

1. Connect a CVBS video source directly to a Tektronix VM700 Video Measurement Test Set.
    a. Ensure VM700 is terminated with a 75 Ω resistor.
2. On the VM700, press *Measure* and then select *ColorBar -> Menu ->Reference -> Store (1) reference.*

    This stores the chroma gain information of the CBVS input.

3. Disconnect the CVBS video source from the VM700 and connect it to the CVBS input of the ADV7180/ADV7181C evaluation board.
4. Program the ADV7180/ADV7181C with the latest ADI recommended script.
5. Program the encoder on the ADV7180/ADV7181C evaluation board to output in CVBS mode.
    a. ADV7180 evaluation board: Device 3, Address 0x82, bit [1] set to 1.
    b. ADV7181C evaluation board: Device 3, Address 0x82, bits [2:1] set to 0b'10.
6. Connect the CVBS output of the ADV7180/ADV7181C evaluation board into the VM700.
7. On the VM700, press *Measure* and then select *ColorBar -> Menu -> Relative to Ref -> Use (1) Reference.*

    This allows comparison between the output of the ADV7180/ADV7181C evaluation board and the previously stored data.

8. Turn off the Chroma AGC of the ADV7180/ADV7181C, and manually change the **Chroma Gain Control Register CMG[11:0]** of the ADV7180/ADV7181C until the chroma level on the VM700 matches the reference stored in step 2. This value, in decimal, is the Chroma Calibration Factor.

Note:

The ADV7180 evaluation boards have a 36Ω/39Ω resistor divider on all the analog inputs in order to keep the video signal within the ADC range. To calculate the Chroma Calibration Factor without the resistor divider, repeat the previous steps but in step 2 measure the CVBS signal at the pin of the part.

REVISION HISTORY

02/14 – Rev. A: Format updated
12/10 – Rev. 0: Initial version

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