Group 41

TSIU03 - Final Presentation

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Johan Levinsson, Oscar Petersson, Erik Peyronson

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Introduction

Audio signal processing

Signal level indicator

Our own flavor:

- Background image
- Graphic scales for L/R input/output channels
- Class-D amplifier

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UI

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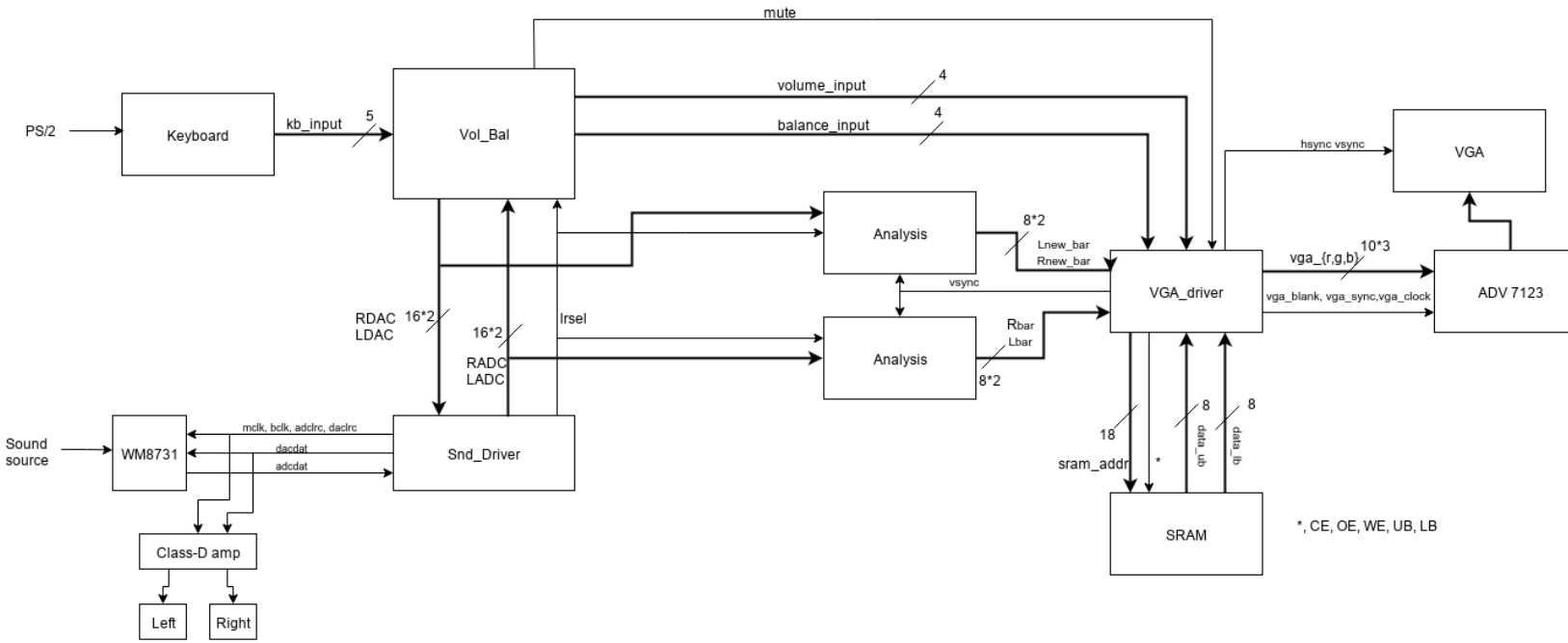
Overview



Keyboard, Vol_Bal, Snd_Driver, Analysis, VGA_Driver

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Keyboard Decoding

Scan Code Detection

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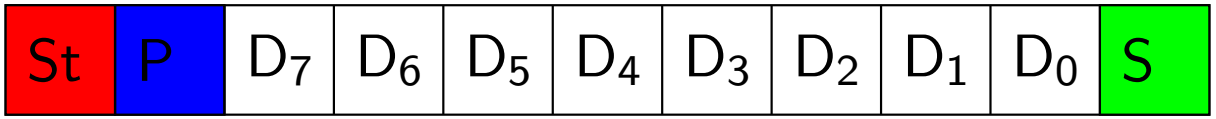
Scan Code Detection



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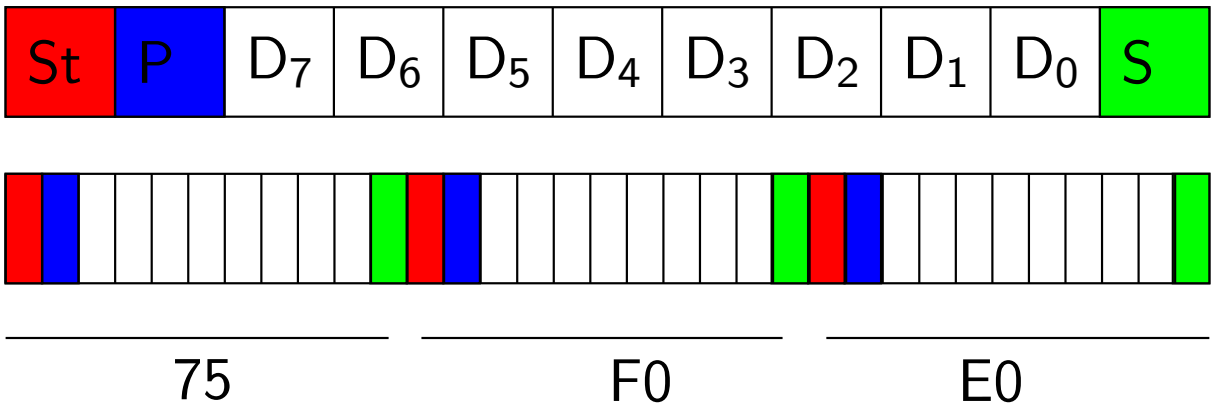

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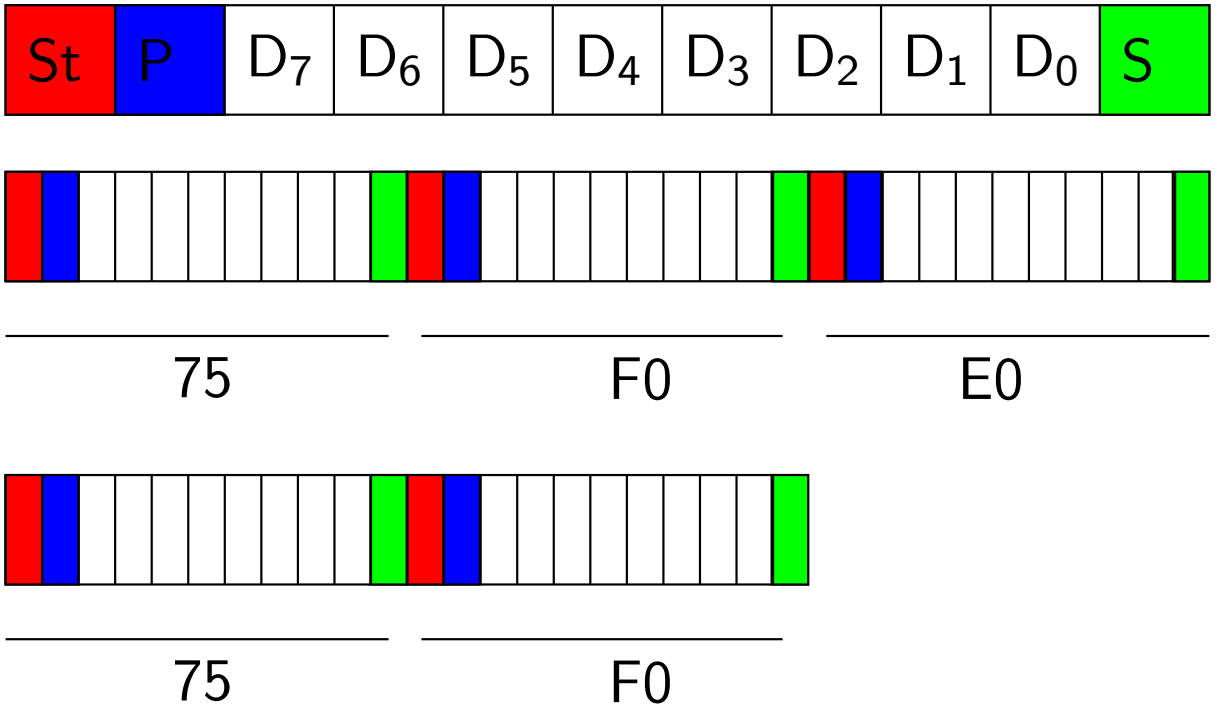

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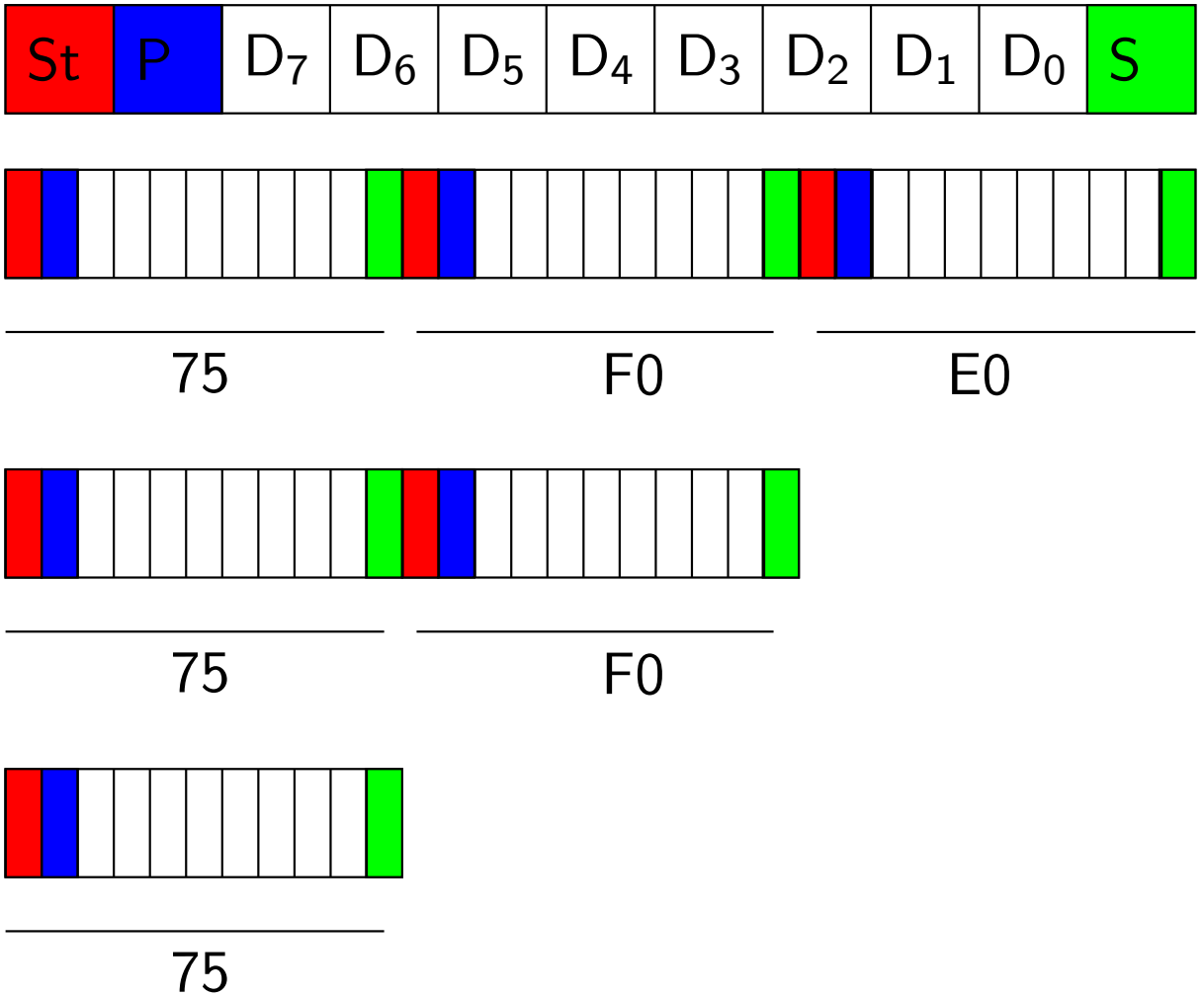

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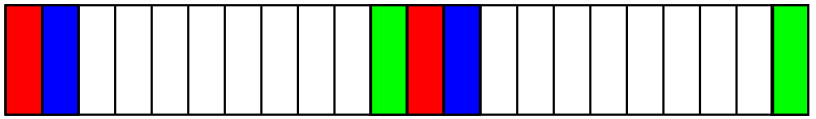

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75 F0 BREAKSET

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Keyboard Decoding

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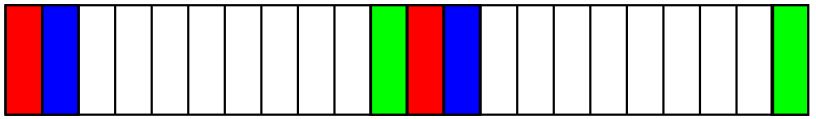

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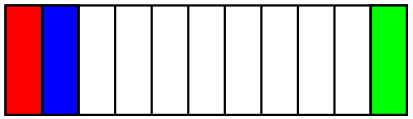

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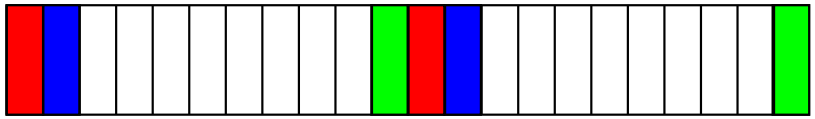
Keyboard Decoding

Scan Code Detection



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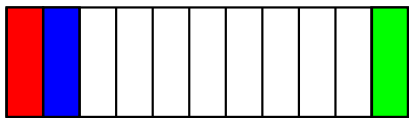

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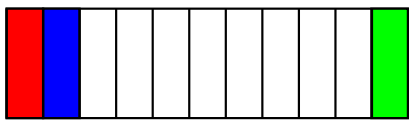

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NN BREAKSET

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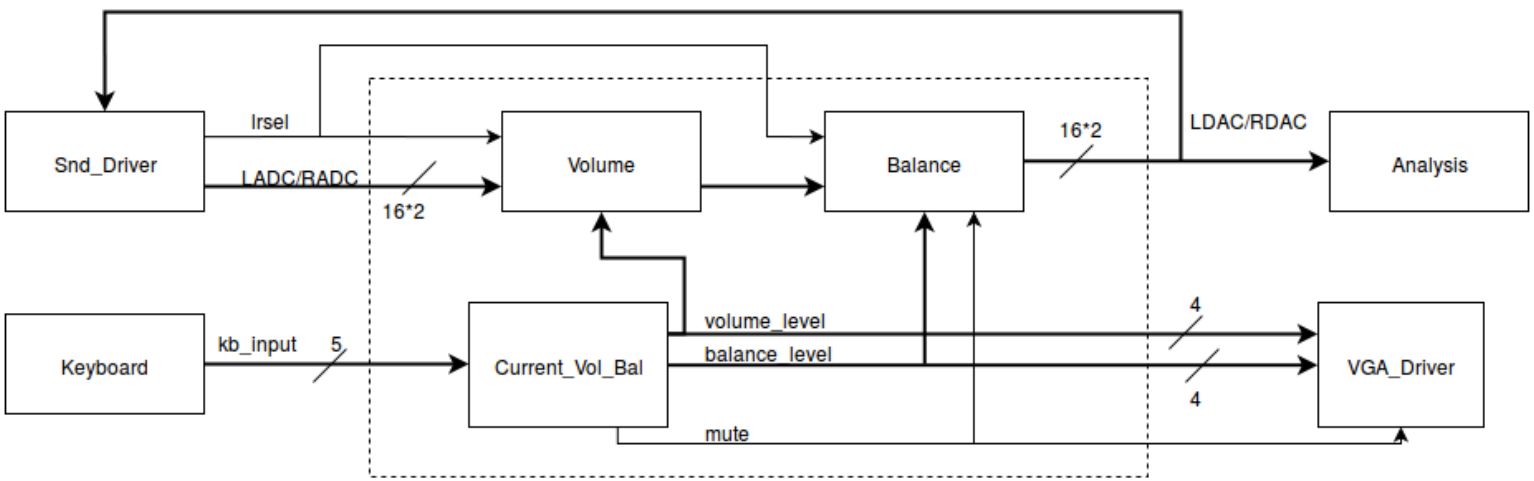
Volume and Balance adjustment

Audio signal adjustment

Storage of system levels



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Volume and Balance adjustment

Current_Vol_Bal

Volume: 0 to 10

Balance: -8 to 8

Legality example:

`i_volume`:	1	0	1	0		(10 - lowest volume)
`kb_input`:	0	0	1	0	0	(lower volume)
`i_kb_input`:	0	0	0	0	0	(result: do nothing)

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Volume and Balance adjustment

Volume_Adjustment

Logarithmic scaling

$$A_{adj} = A_{in} \cdot (1/\sqrt{2})^n$$

Output range: -30 to 0 dB

Implemented using a state machine

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Volume and Balance adjustment

Balance_Adjustment

Linear scaling

$$A_{l\_out} = \frac{8 - m}{8} \cdot A_{l\_adj} \quad , \; A_{l\_out} = A_{l\_adj} \; for \; m < 0$$

$$A_{r\_out} = \frac{8 - |m|}{8} \cdot A_{r\_adj} \quad , \; A_{r\_out} = A_{r\_adj} \; for \; m > 0$$

Controlled by `volume_done` and `lrsel`.

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Analysis

Analyzes incoming samples, low-pass filtering them.

Output in form of a natural number, which determines the height of the bars.

Updates in sync with vsync.

Both left & right channel separately.

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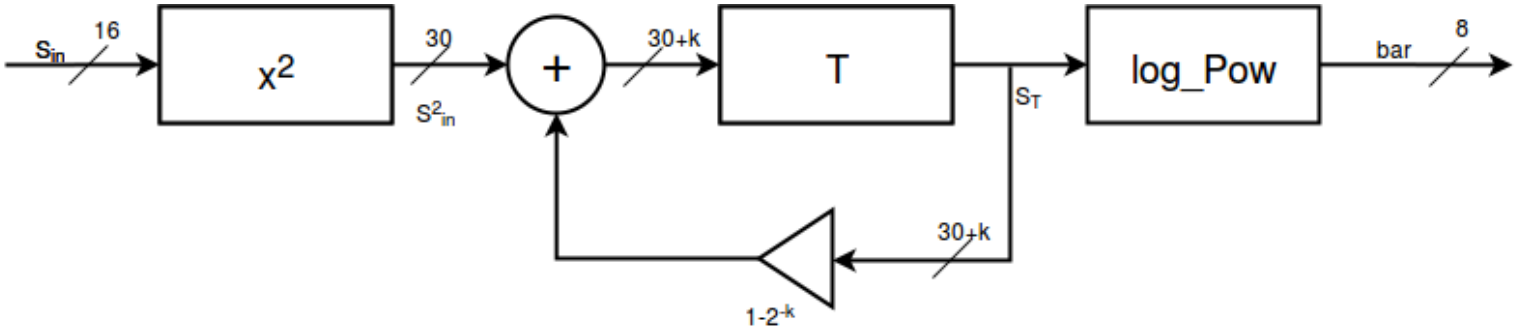
Analysis



The low-pass filter. k is chosen by the approximation

$$\frac{1}{10}\ \mathrm{s} = 2^k \cdot \frac{1}{48800} \Rightarrow 2^k = 4880 \approx 2^{12} \Rightarrow k = 12$$

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VGA_driver

Intro

Based on Laboration 3.

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VGA_driver

Intro

Based on Laboration 3.

Two new submodules.

- bar_tender.
- bar_mixer.

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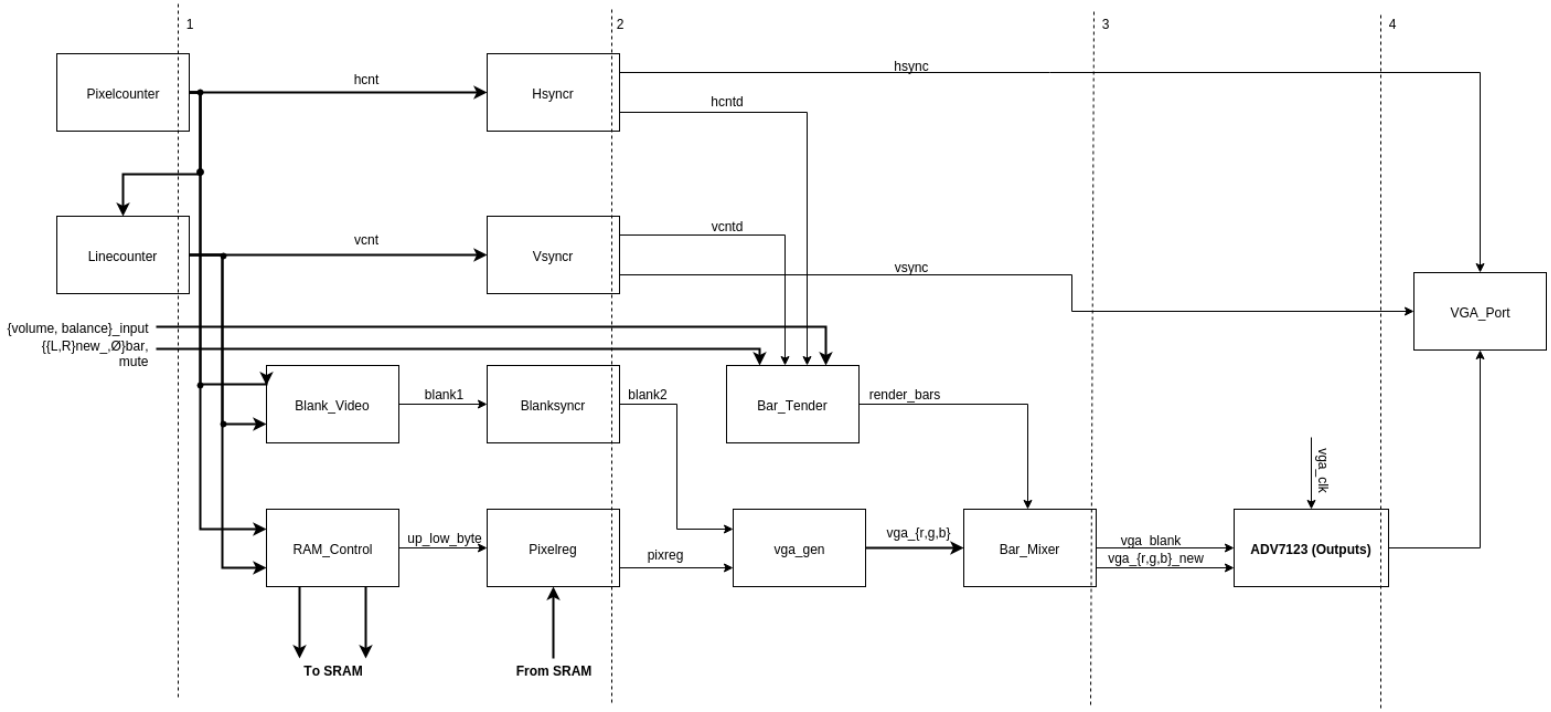
VGA_driver

Vga_driver overview



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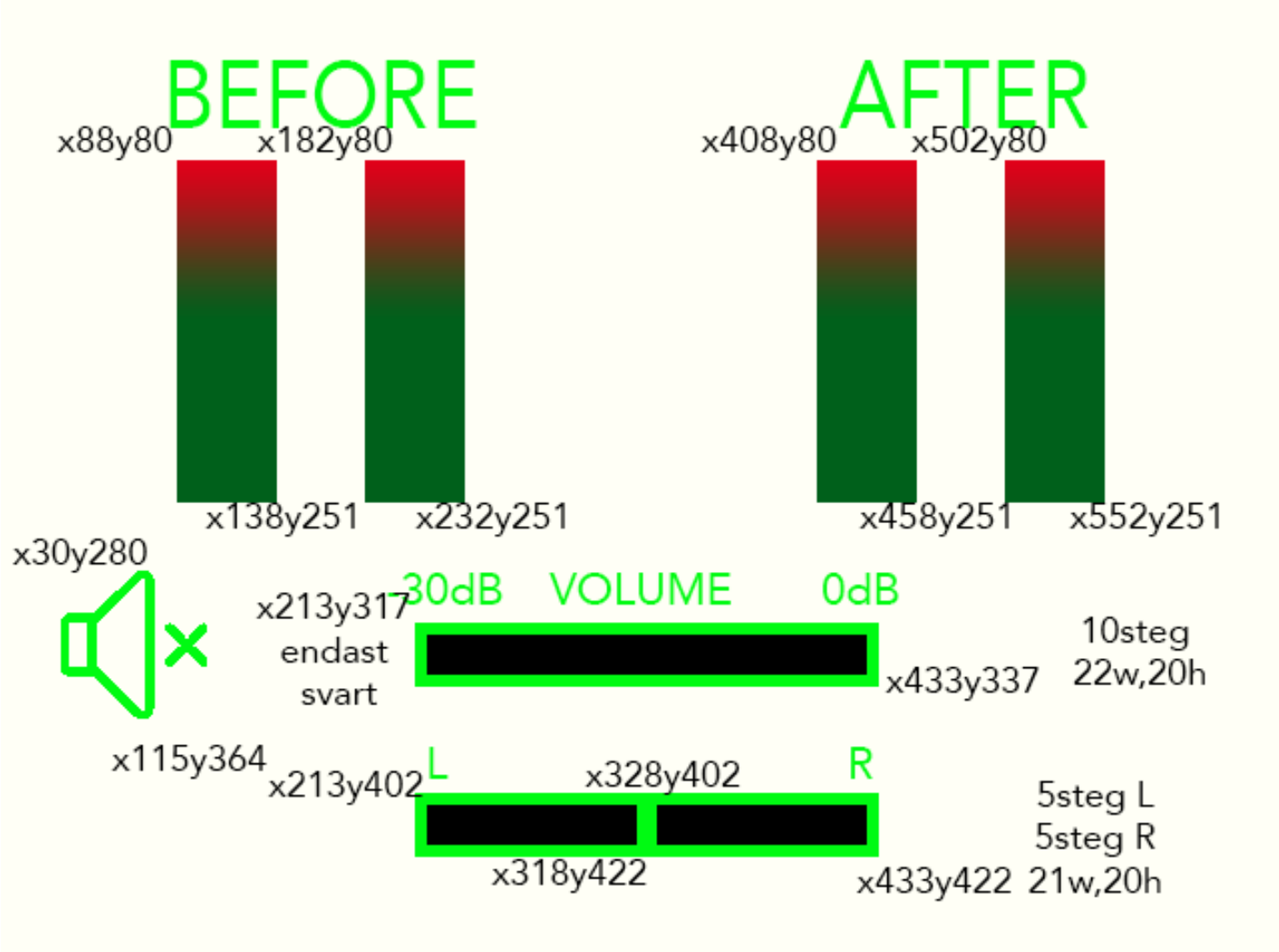
VGA_driver

Concept UI



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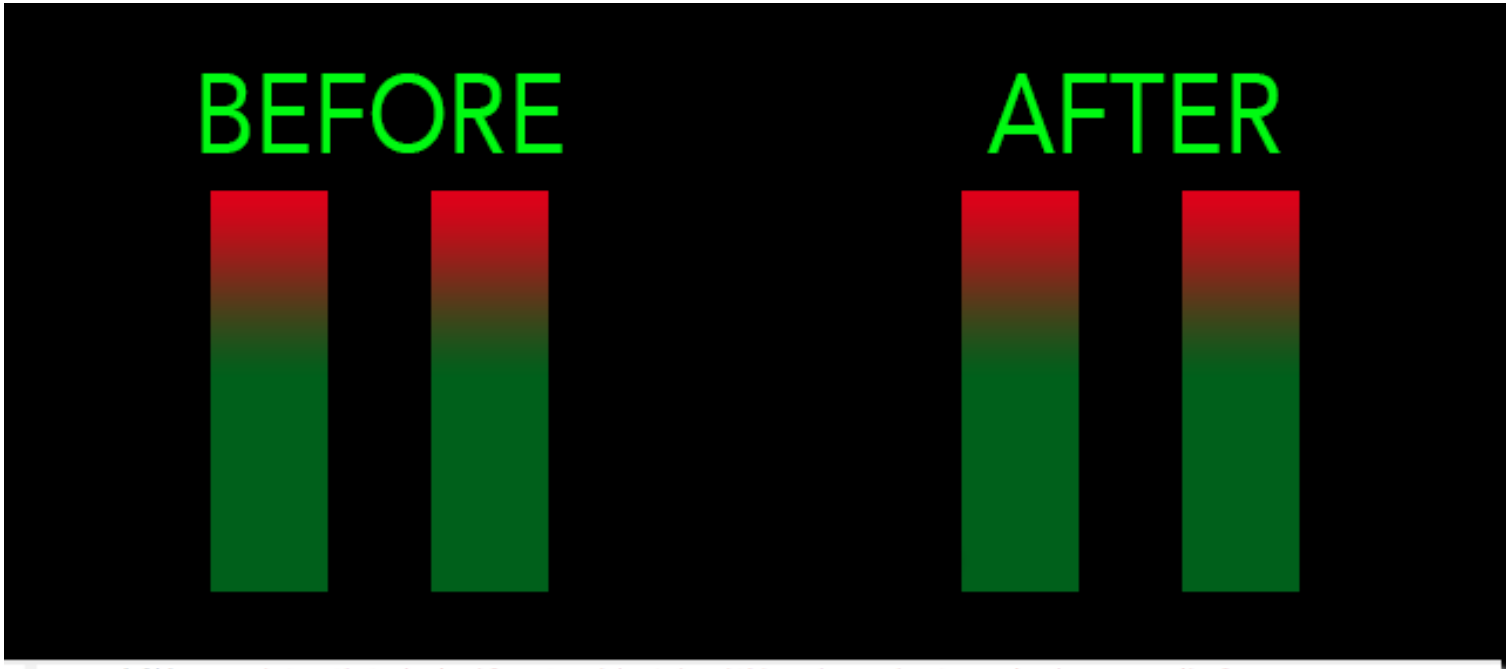
Bar_tender




```
process(clk) -- Register that checks if vcnt and hcnt is within a bar and sets render bars accordingly
begin
  if(rising_edge(clk)) then
    render_barsi <= '0';
    render_peaki <= '0';

    -- Left bar
    if((hcnt >= l_bar_x) and (hcnt < (l_bar_x + bar_width)) ) then -- X boundries
      if(vcnt >= l_bar_y and vcnt <= l_bar_y + 171 - L_bar) then    -- Y boundries
        if(vcnt >= l_bar_y + 171 - max_peak_l - peak_thickness and vcnt <= l_bar_y + 17171 - max_peak_l) then -- Peak_level
          render_peaki <= '1';  --Inside peak level indicator
        else
          render_barsi <= '1';  --Inside bar
        end if;
      end if;
    end if;
  end if;
end process;
```

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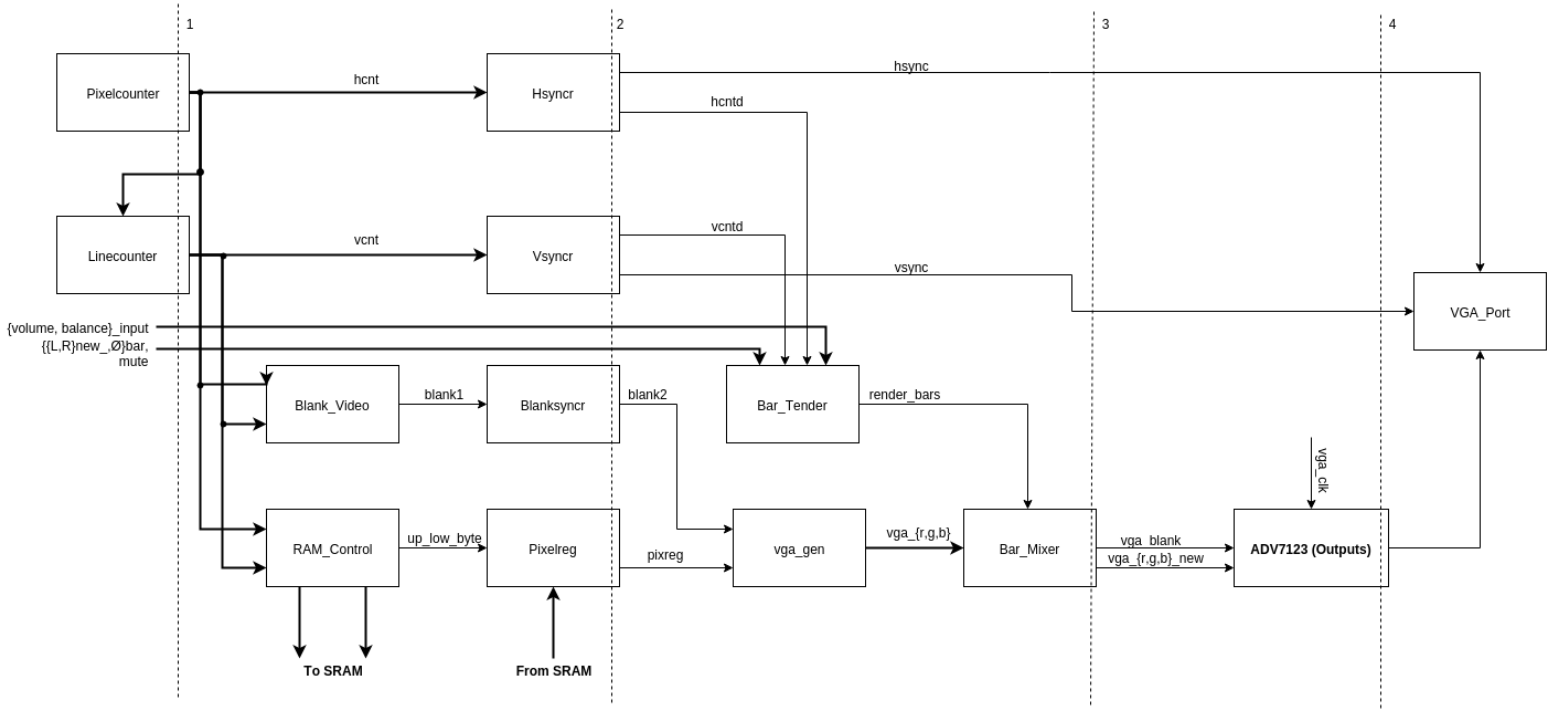
VGA_driver

Vga_driver overview



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VGA_driver

Bar_mixer

```
1  architecture rtl of bar_mixer is
2  begin
3  process(render_bars, render_peak)
4  begin
5    if(render_bars = '1') then
6      vga_r_new <= (others => '0');
7      vga_b_new <= (others => '0');
8      vga_g_new <= (others => '0');
9    elsif (render_peak = '1') then
10     vga_r_new <= (others => '1');
11     vga_g_new <= (others => '1');
12     vga_b_new <= (others => '1');
13   else
14     vga_r_new <= vga_r;
15     vga_g_new <= vga_g;
16     vga_b_new <= vga_b;
17   end if;
18 end process;
```