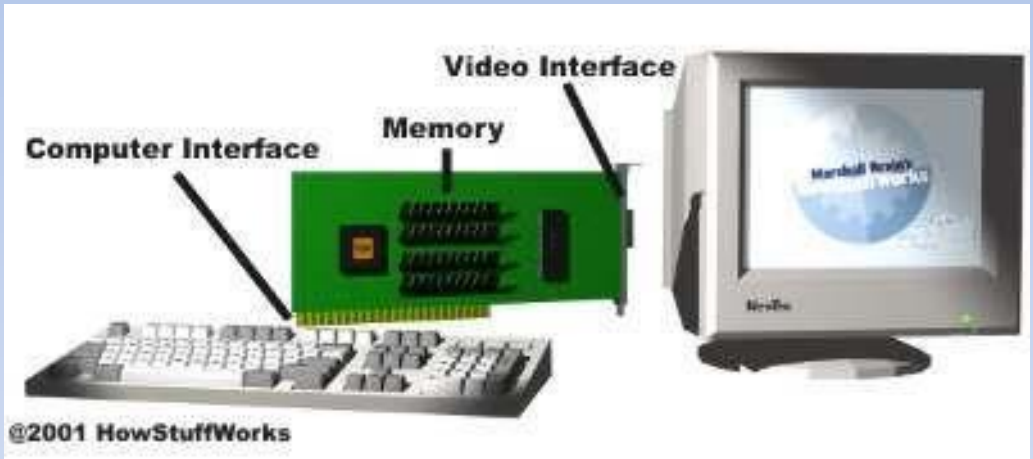
VHDL programmering för inbyggda system

Välkommen

VGA = Video Grafics Array



More to read:
http://en.wikipedia.org/wiki/Video_Graphics_Array
DE2_115_user_manual

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Standard VGA

Video Graphics Array (**VGA**) was first marketed in 1987 by IBM. Since then it has been a well established standard, used in many applications .

Standard VGA graphics modes are

640×480 in 16 colors

640×350 in 16 colors

320×200 in 16 colors

320×200 in 256 colors (Mode 13h)

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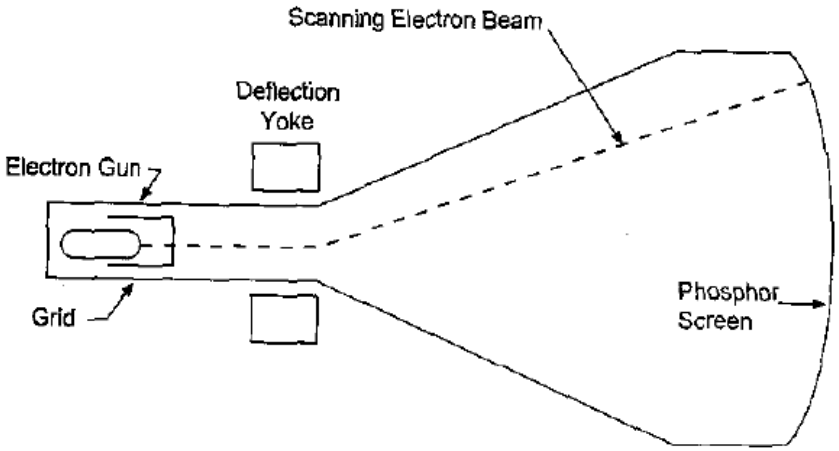
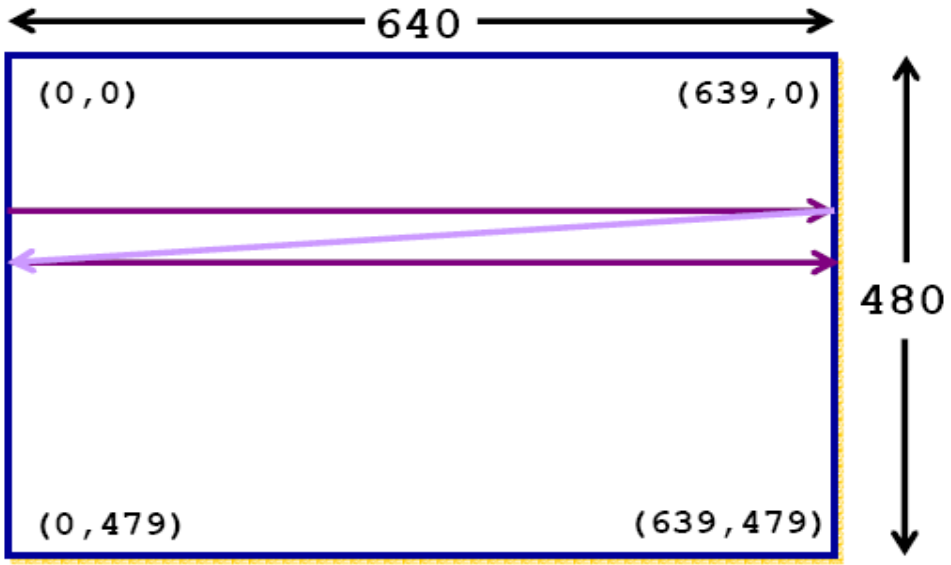
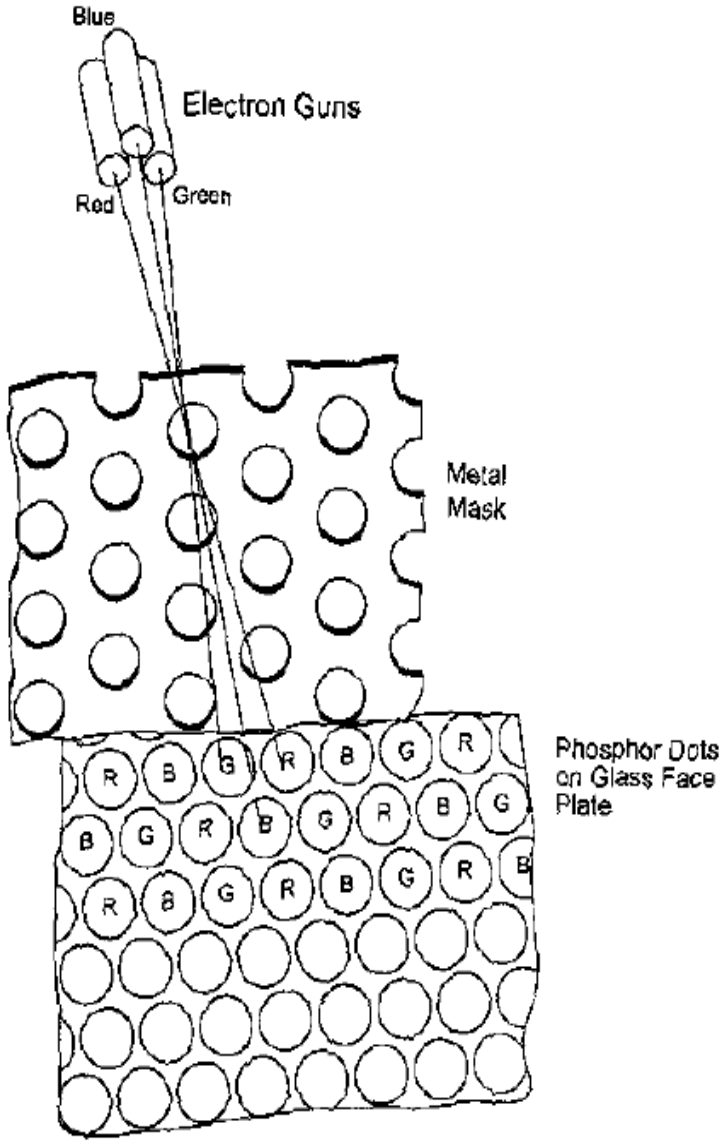
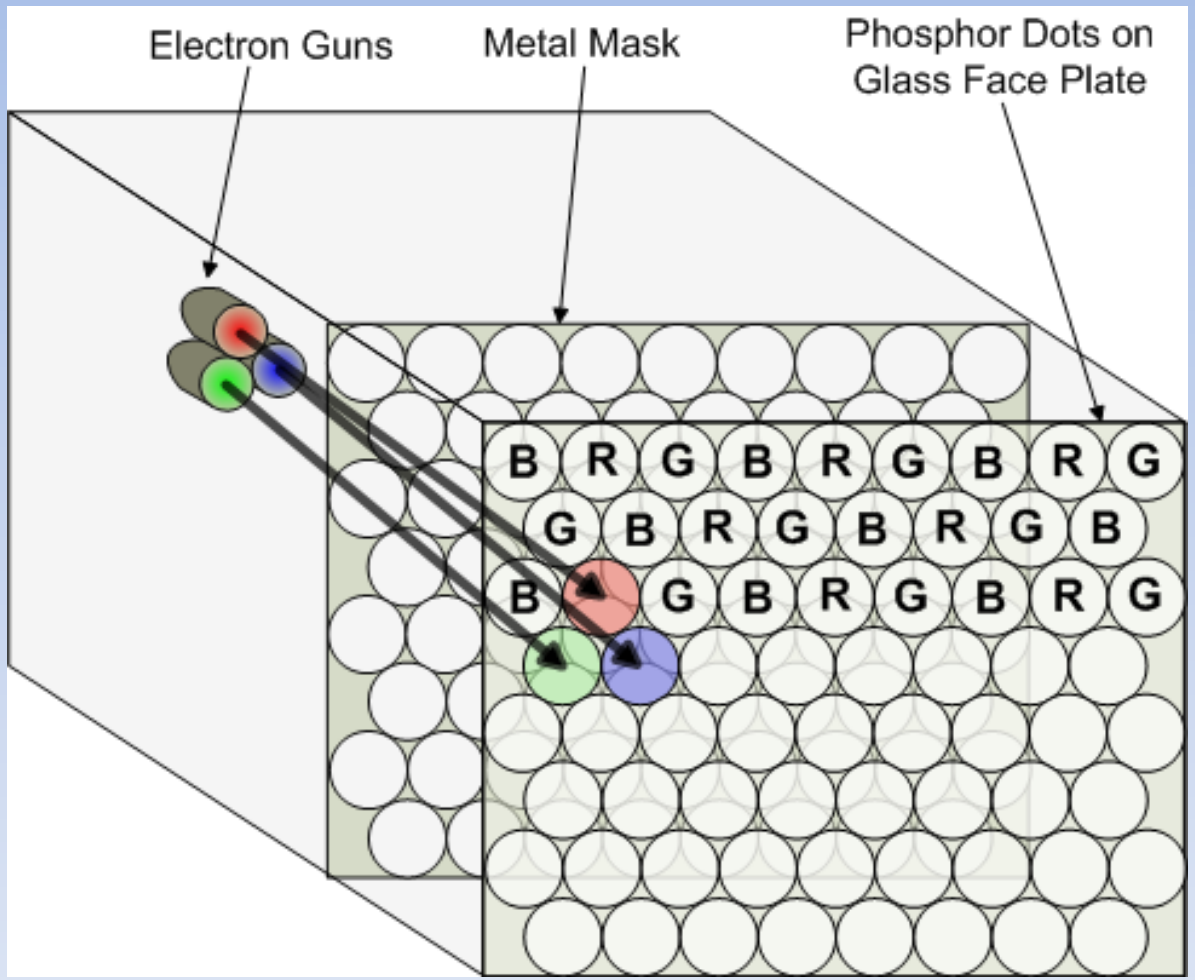
History





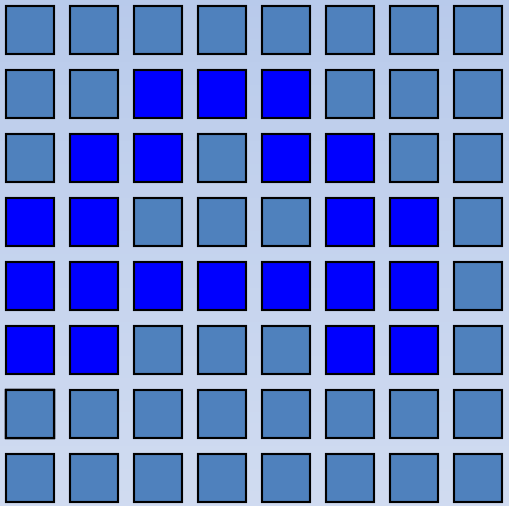


VGA signal production



A character-glyph example

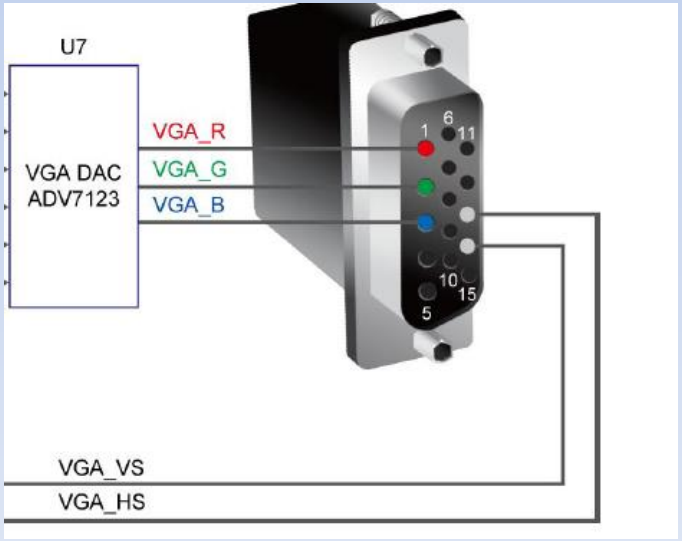
- Here's a sample 8x8 character glyph ('A'):



This glyph can be represented as an array of 8 bytes:
0x00, 0x38, 0x6C, 0xC6, 0xFE, 0xC6, 0x00, 0x00

VGA signals

- 5 signals
  - 2 signals for synchronization of VGA monitor
    - Vertical Sync
    - Horizontal sync
  - 3 signals for color information (can be a vector)
    - Red
    - Green
    - Blue



RGB (Red, Green & Blue) values

	Red	Green	Blue	Color
0	0	0	0	Black
1	0	0	1	Blue
2	0	1	0	Green
3	0	1	1	Cyan
4	1	0	0	Red
5	1	0	1	Magenta
6	1	1	0	Yellow
7	1	1	1	White

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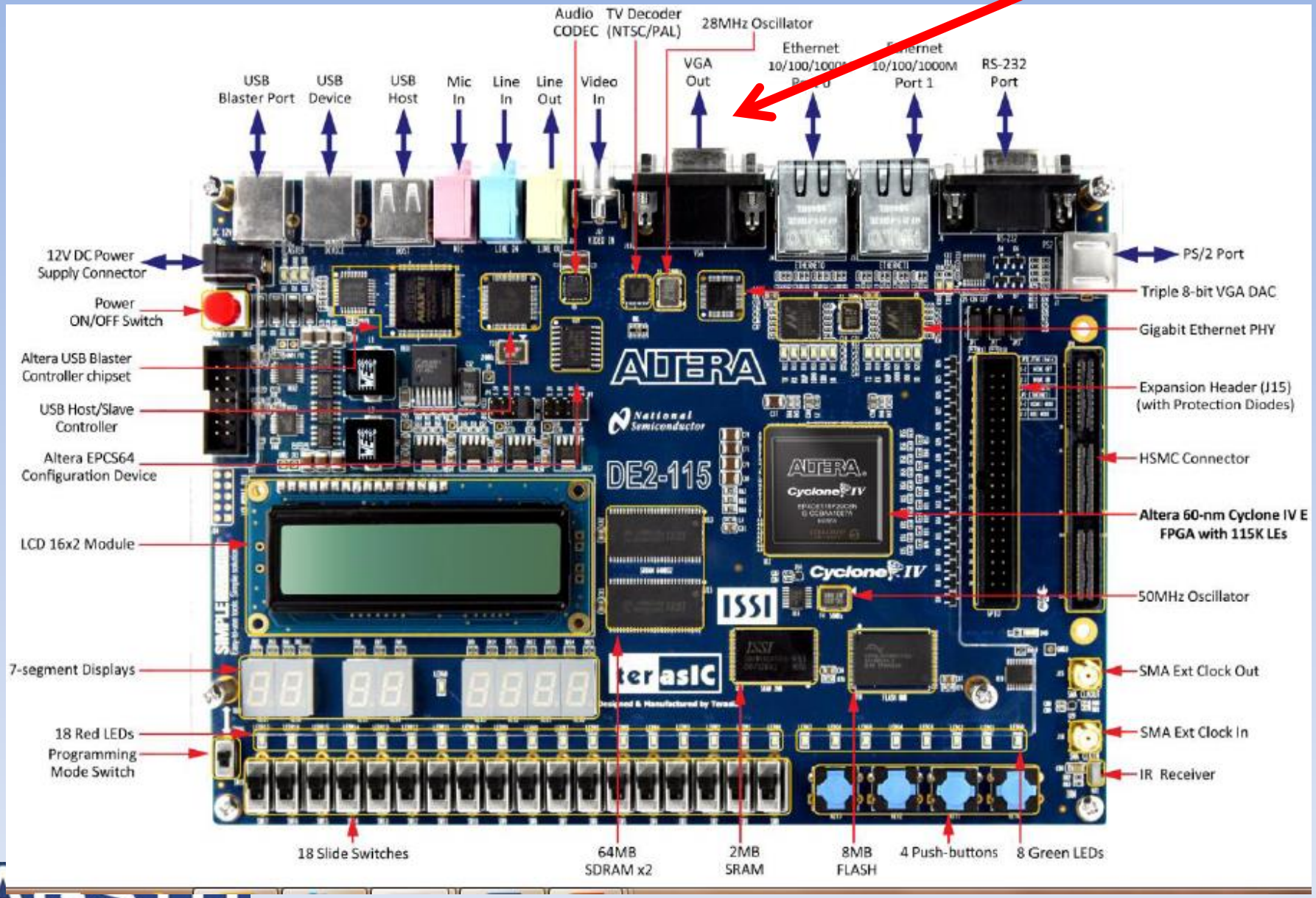
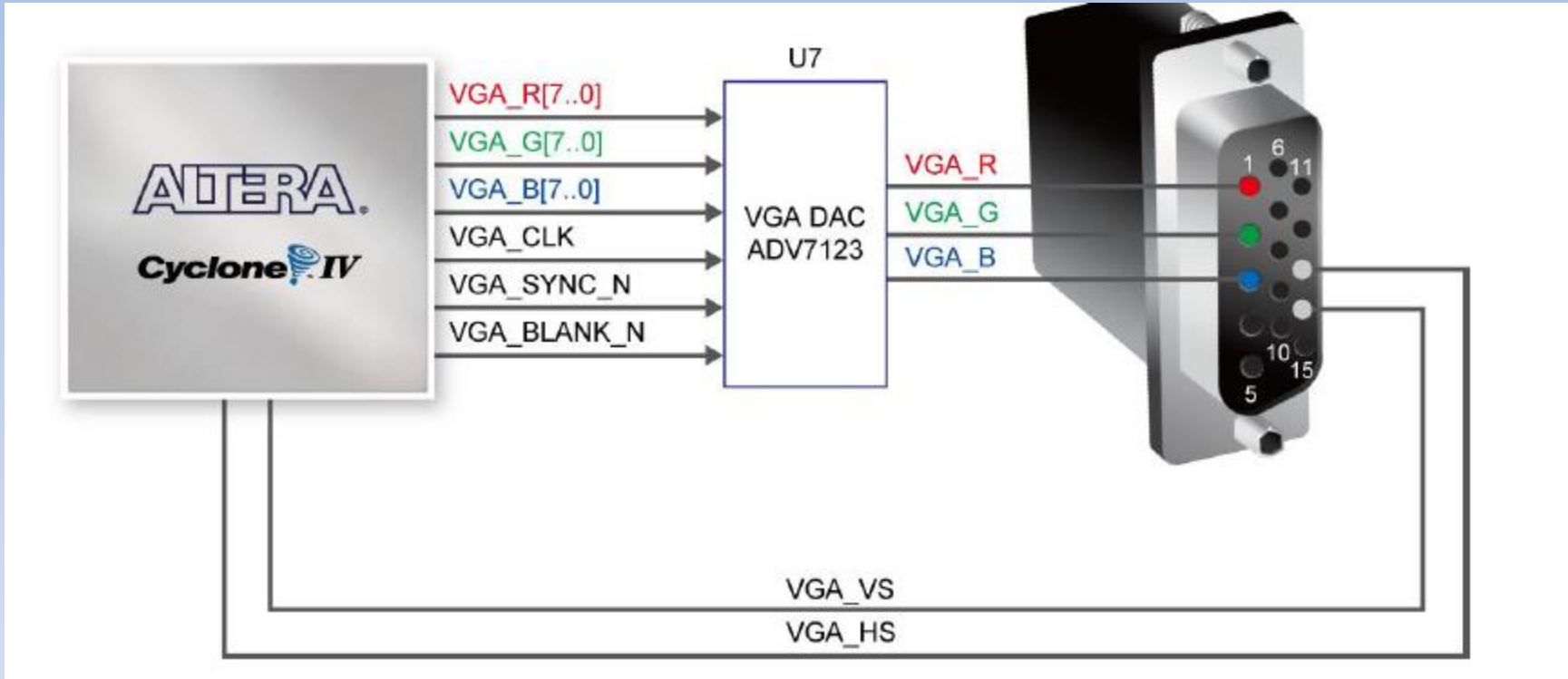
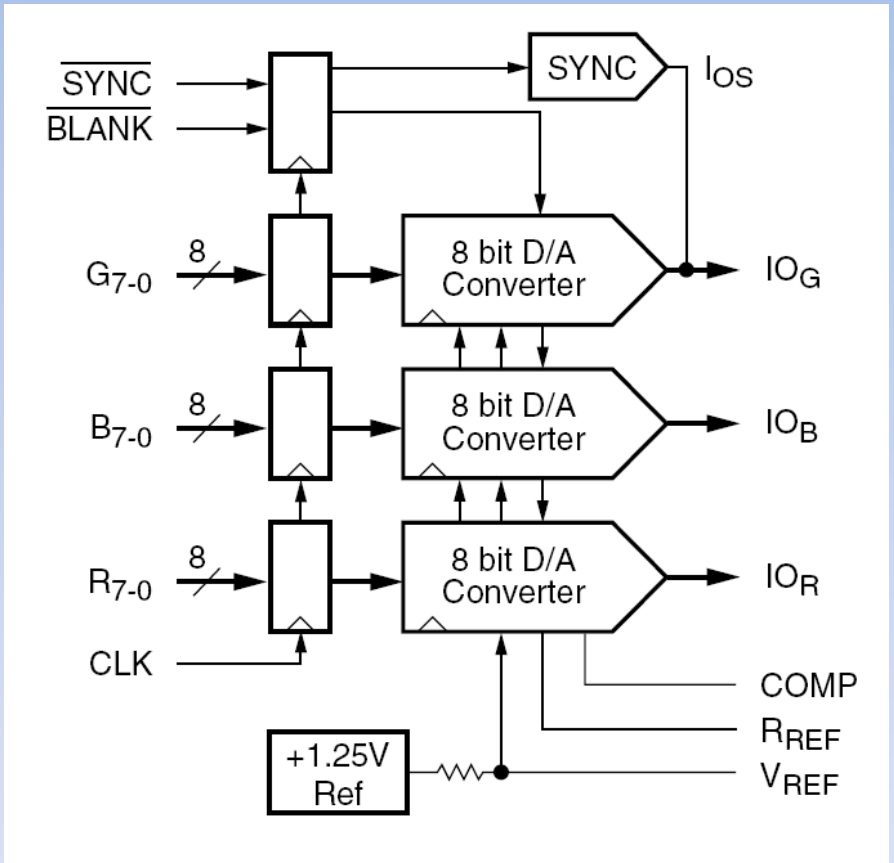


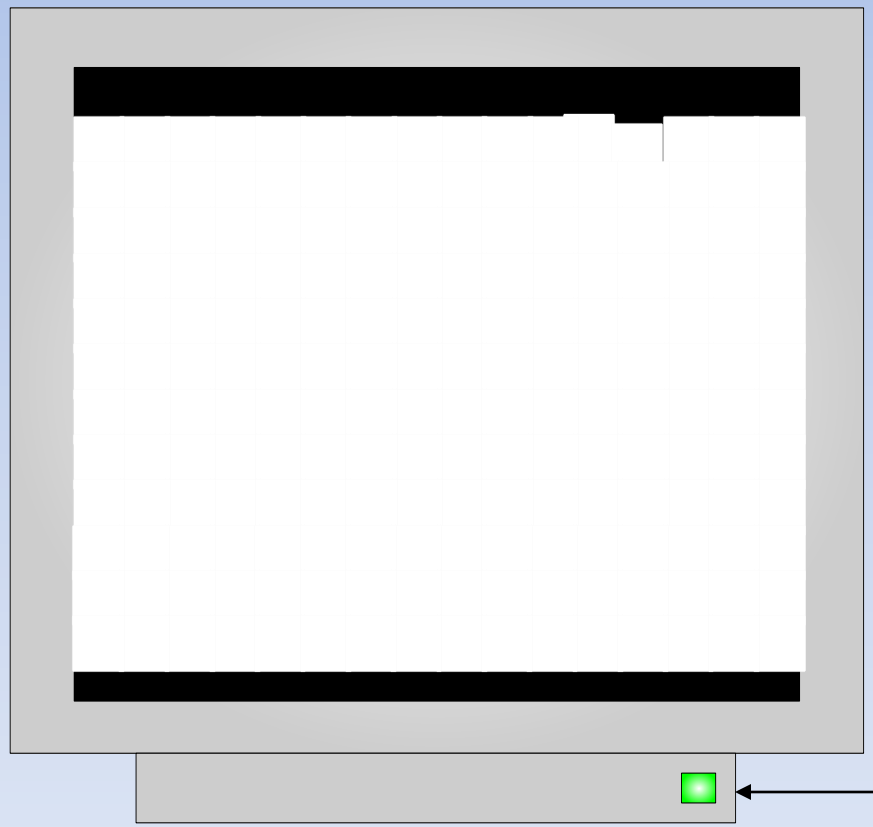
Overview



VGA DAC blockschema

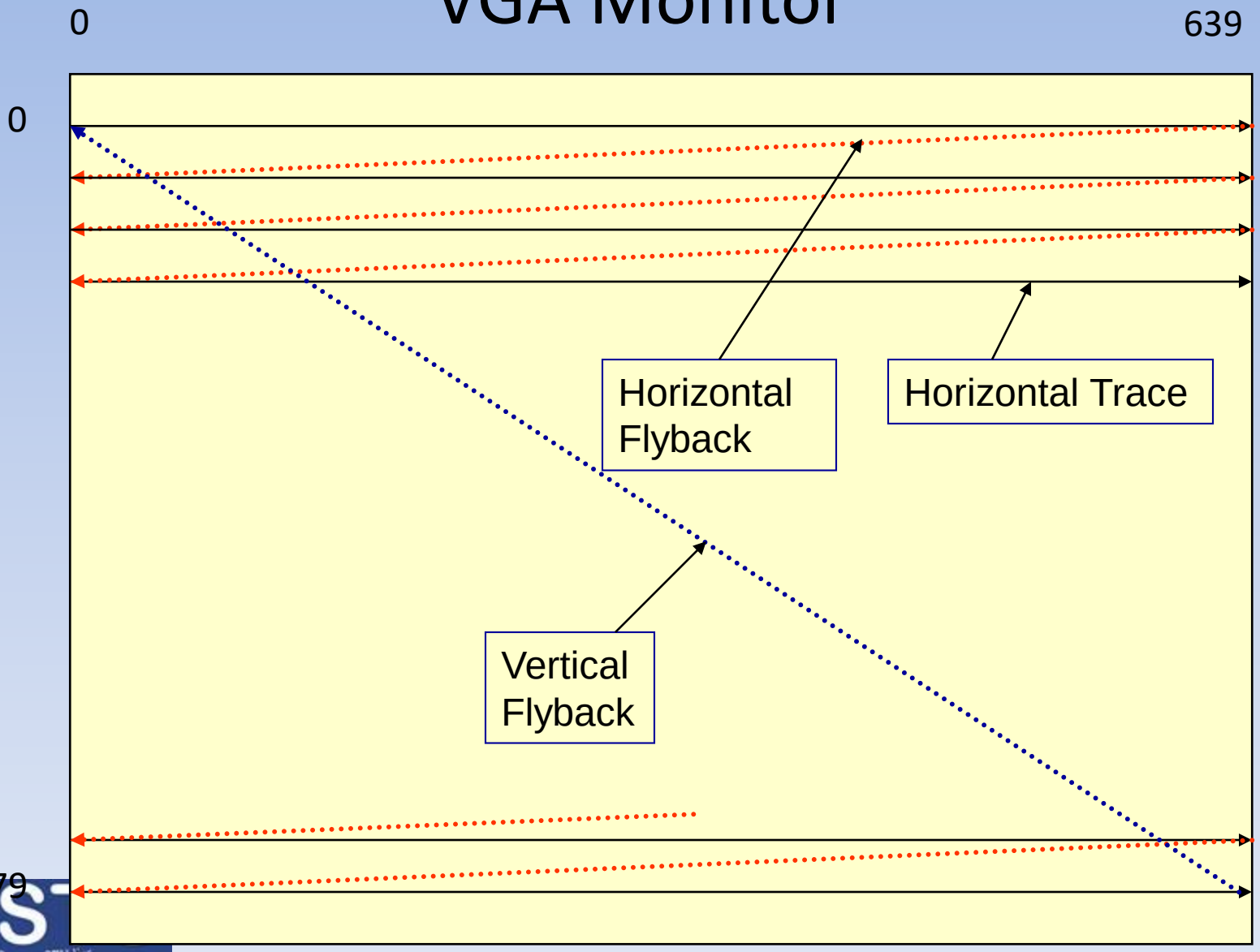


Drawing of a Frame

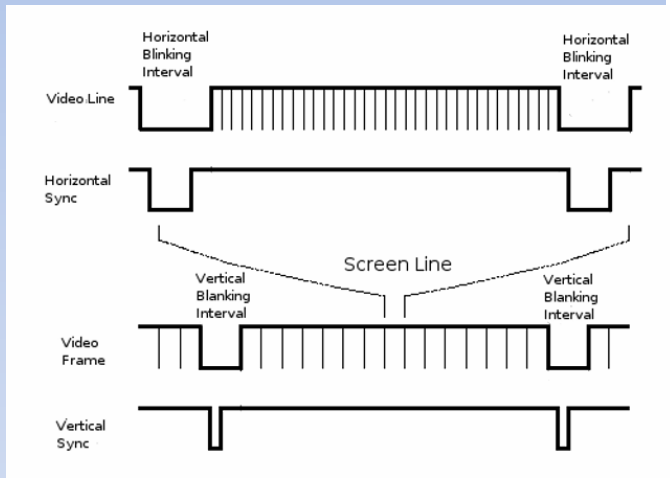


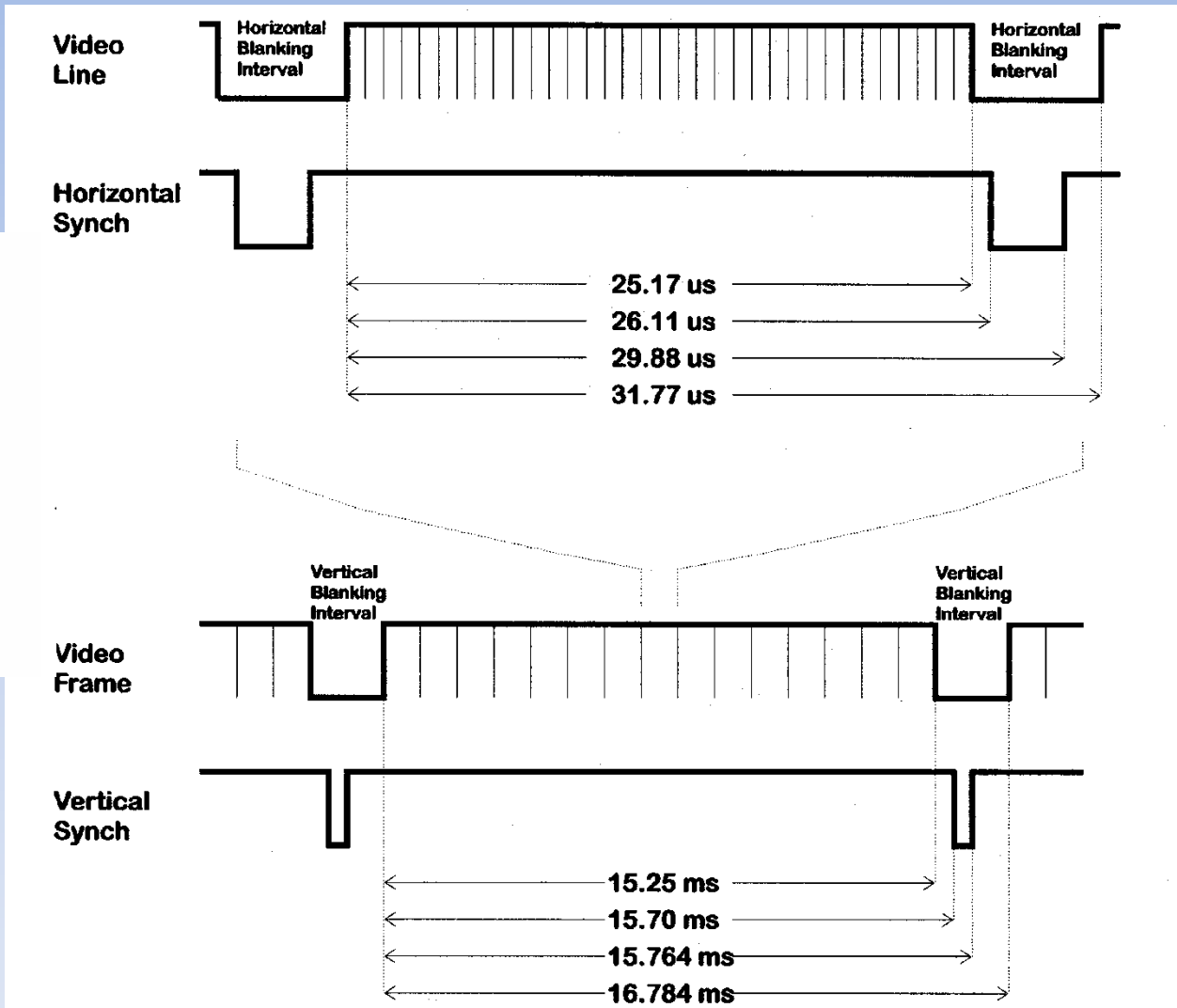
SYNC fungerar

VGA Monitor



VGA Timing





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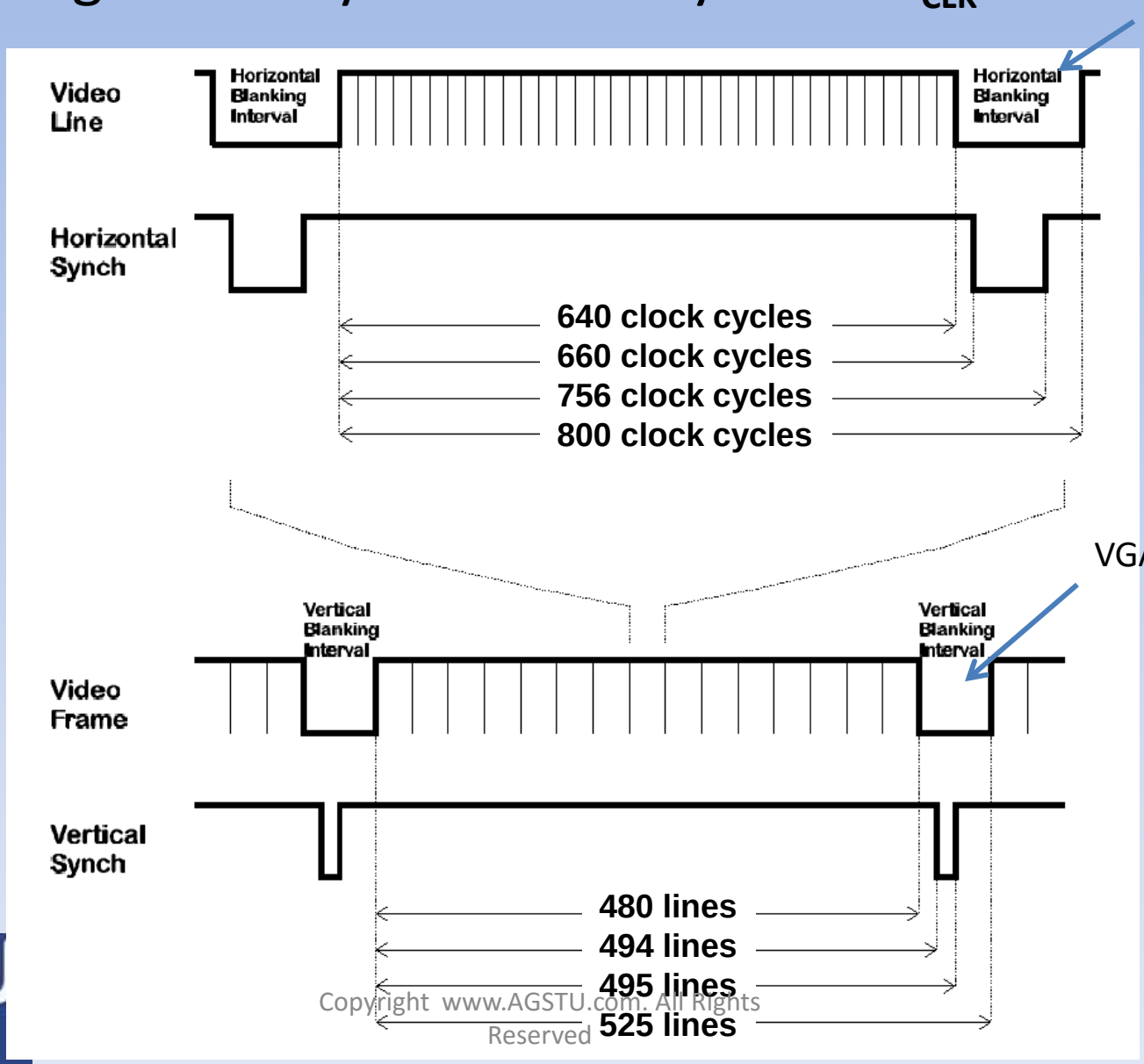
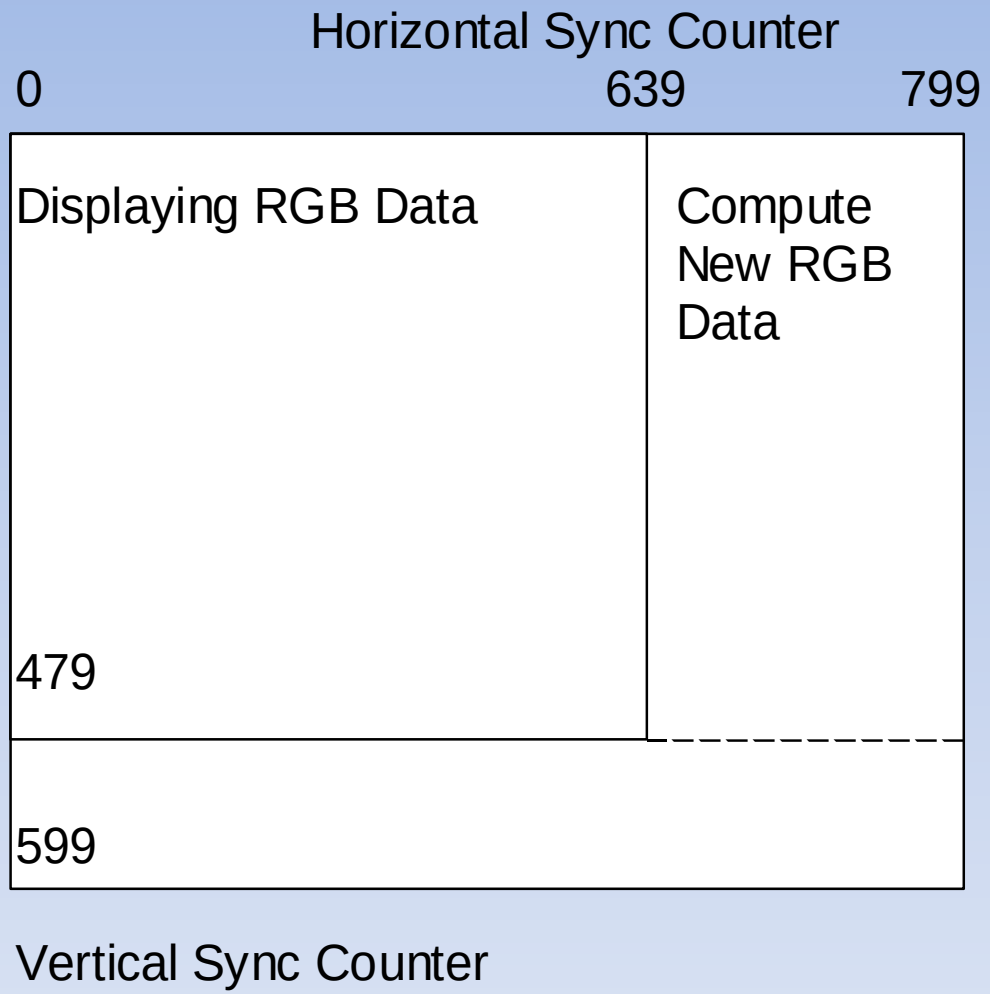
VGA Control Signal Timing (Protocol)

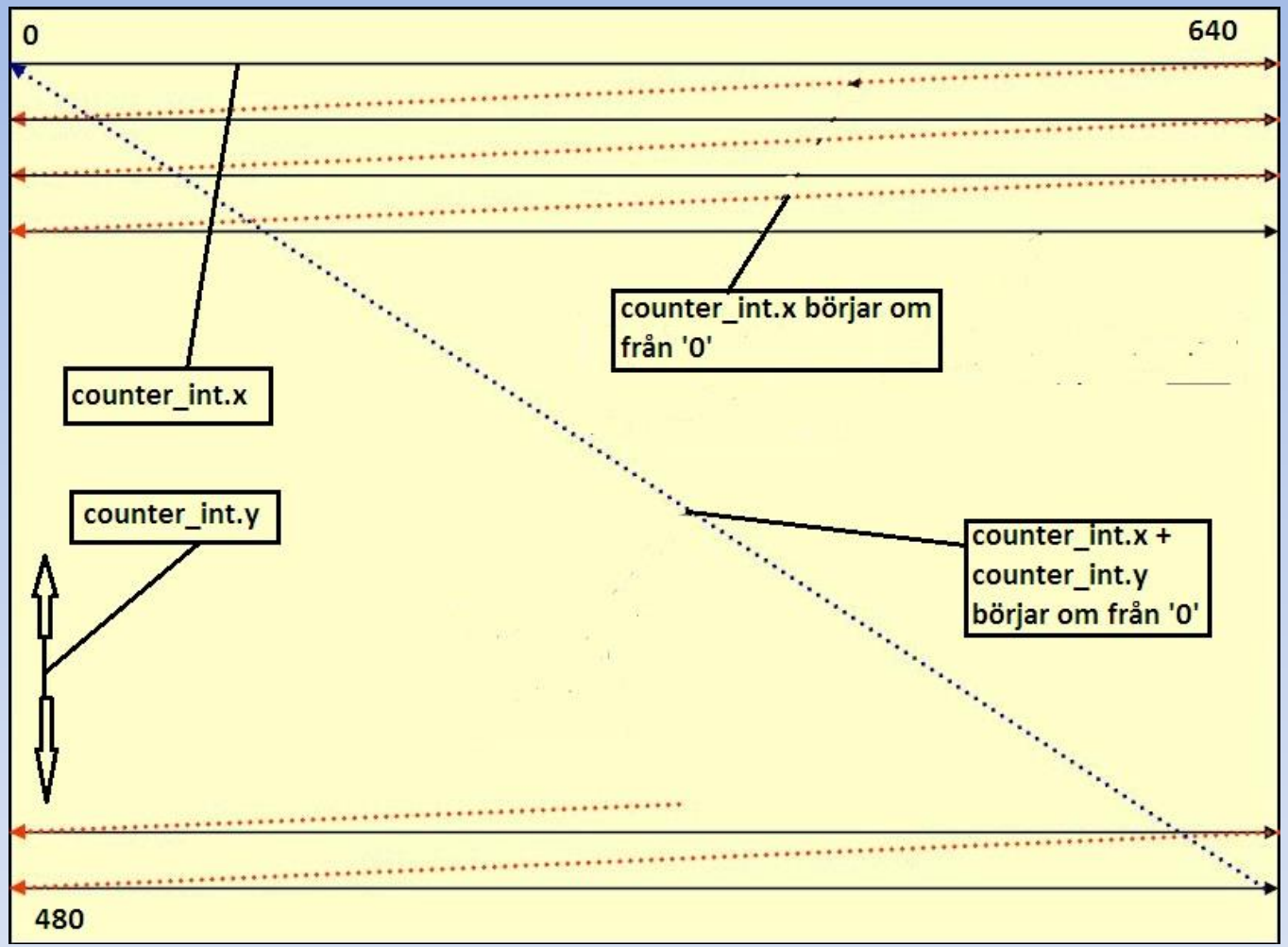
VGA Image - 640 by 480 Pixel Layout **for f_{CLK} = 25 MHz**



Display and computer data



X and Y Counter



Översikt

640pixel bred och 480 linjer hög. Synlig del av bilden. Under denna del är R,G och B aktiva och skapar tillsammans färgen på pixlarna. HS och VS är ”1” dvs. höga.	20 pixlar	96 pixlar	44 pixlar
14 linjer. Den här delen av bilden kallas ”front porch”. Här är R,G och B inaktiva alltså ”0”. HS och VS är fortfarande ”1”.			
1 linje. I den här delen är HS och VS låga eller ”0”. R, G och B är ”0”.			
30 linjer. Den här delen av bilden kallas ”back porch”. Här är R,G och B inaktiva alltså ”0”. HS och VS är ”1”.			

VGA entity exempel

```
library ieee;
use ieee.std_logic_1164.all;
use ieee.std_logic_unsigned.all;

entity VGA is
port(     reset_n, CLOCK_50                    : in std_logic;
-- till VGA enheten
          VGA_HS, VGA_VS, VGA_CLK                    : out std_logic;
          VGA_BLANK_N, VGA_SYNC_N                    : out std_logic;
          VGA_B, VGA_G, VGA_R : out std_logic_vector(7 downto 0);
-- För att testa på kortet
          KEY : IN std_logic_vector(2 downto 0));
end VGA;
```

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Skriv kommentarer först

-- Clock out RGB Pixel Row Data Horizontal Sync--

-- --____________________--------

-- 0   639   659   755   799

-- 480 Horizontal Sync (pixel rows) Vertical Sync--

-- --______________----------

-- 0   480   493-494   524

-- Repetera gärna teori_5b pulsgenerering

- [More to read:](http://en.wikipedia.org/wiki/Video_Graphics_Array)
- http://en.wikipedia.org/wiki/Video_Graphics_Array
- DE2_115_user_manual

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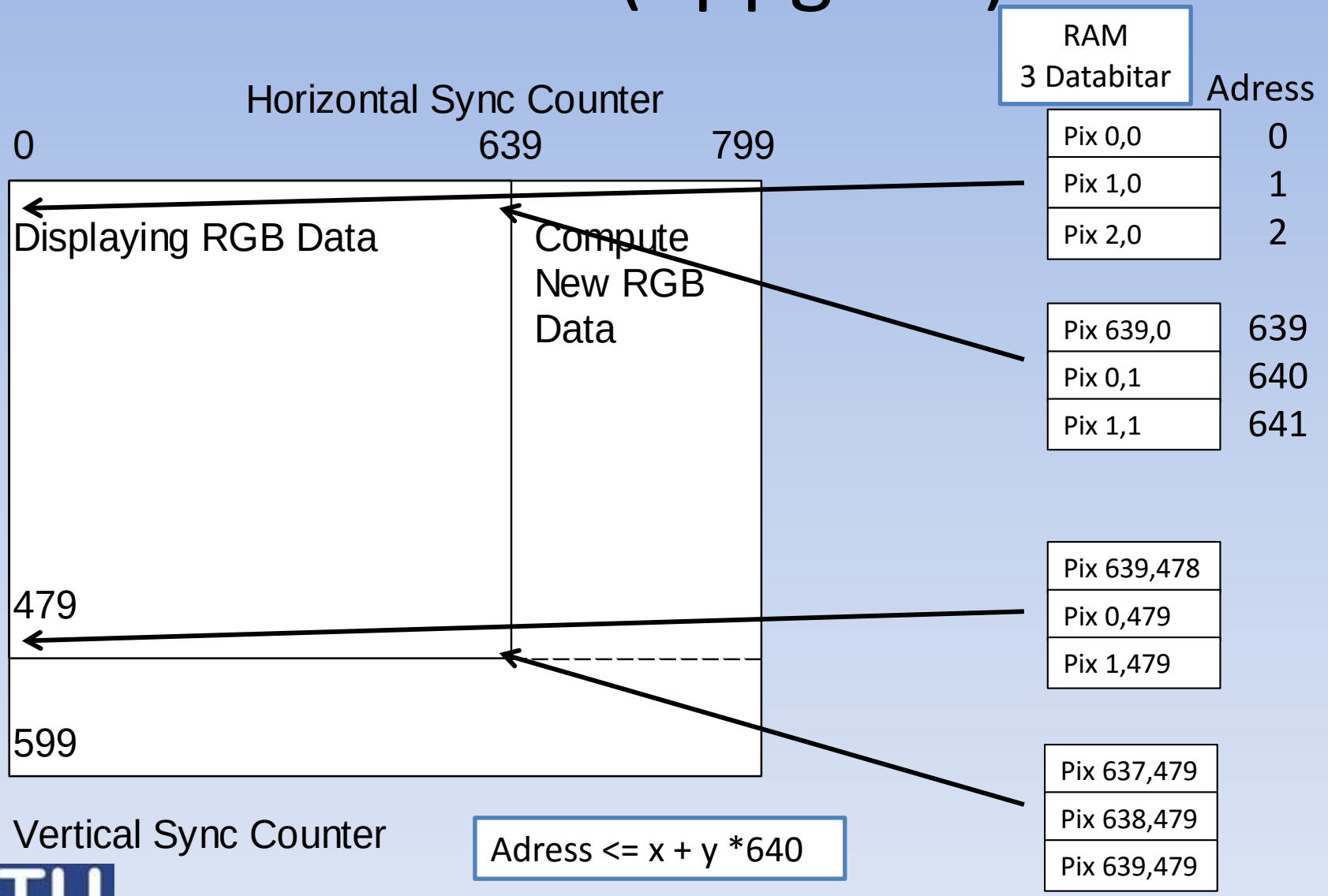
Grafikminne (uppgift 9)



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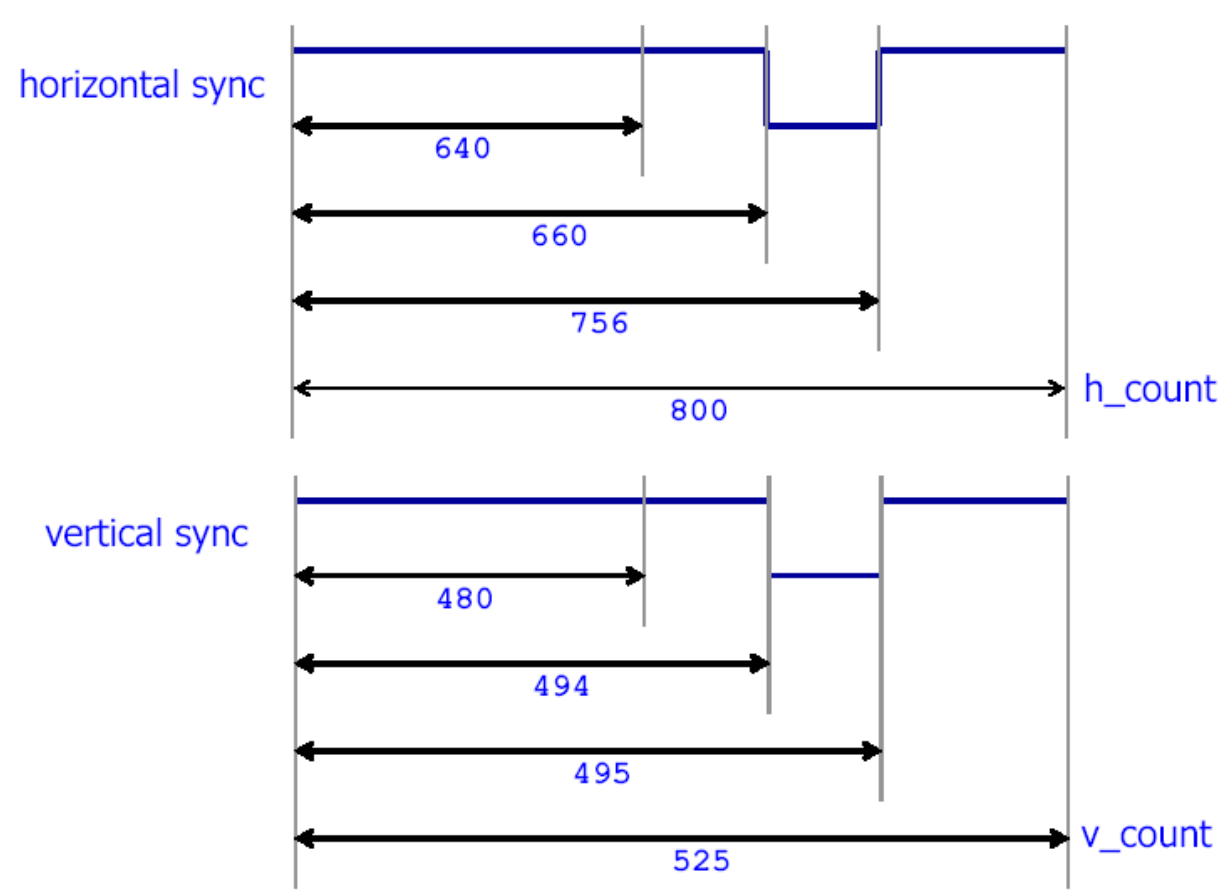
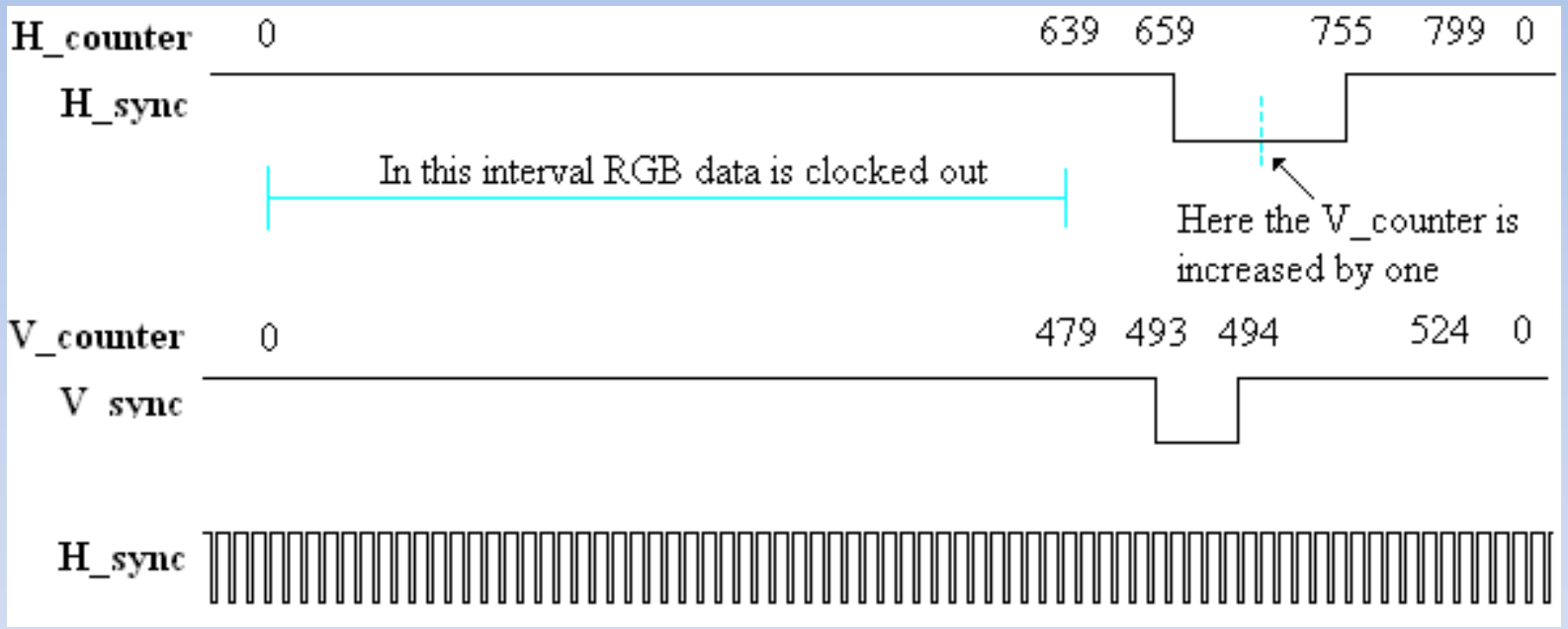
Timing

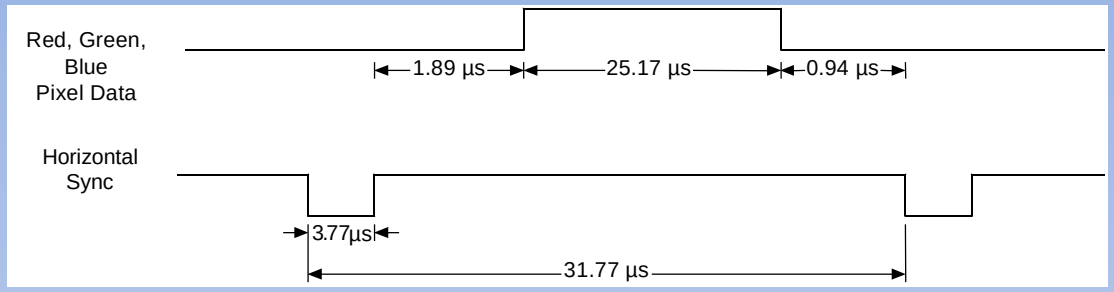


VGA Synchronization



Timing_2

Horizontal



Vertical