TEORIA VGA

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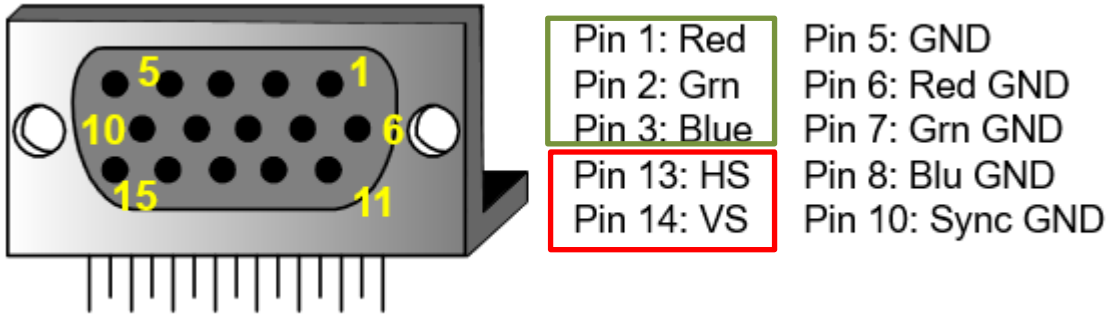
GICS

PADRÃO VGA

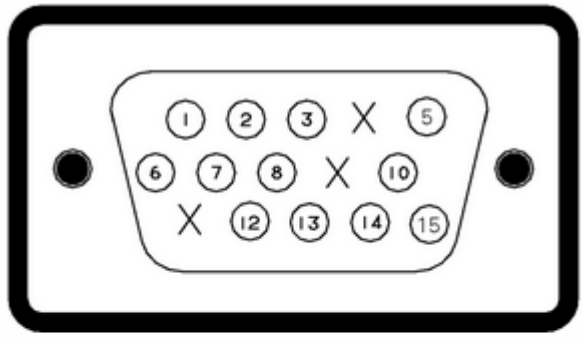
- Criado em 1987;
- Atualmente especificação da VESA;
- Resolução 640x480 pixels;
- Tela com proporção => 4:3 (L:A).



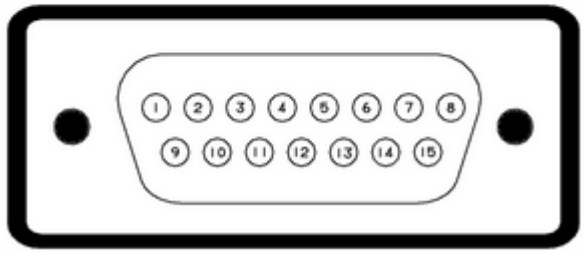
Fonte: [1]

Figure 1. VGA connector.

CONECTOR VGA



PC connector (DB15)



Macintosh connector

Fonte: [2]

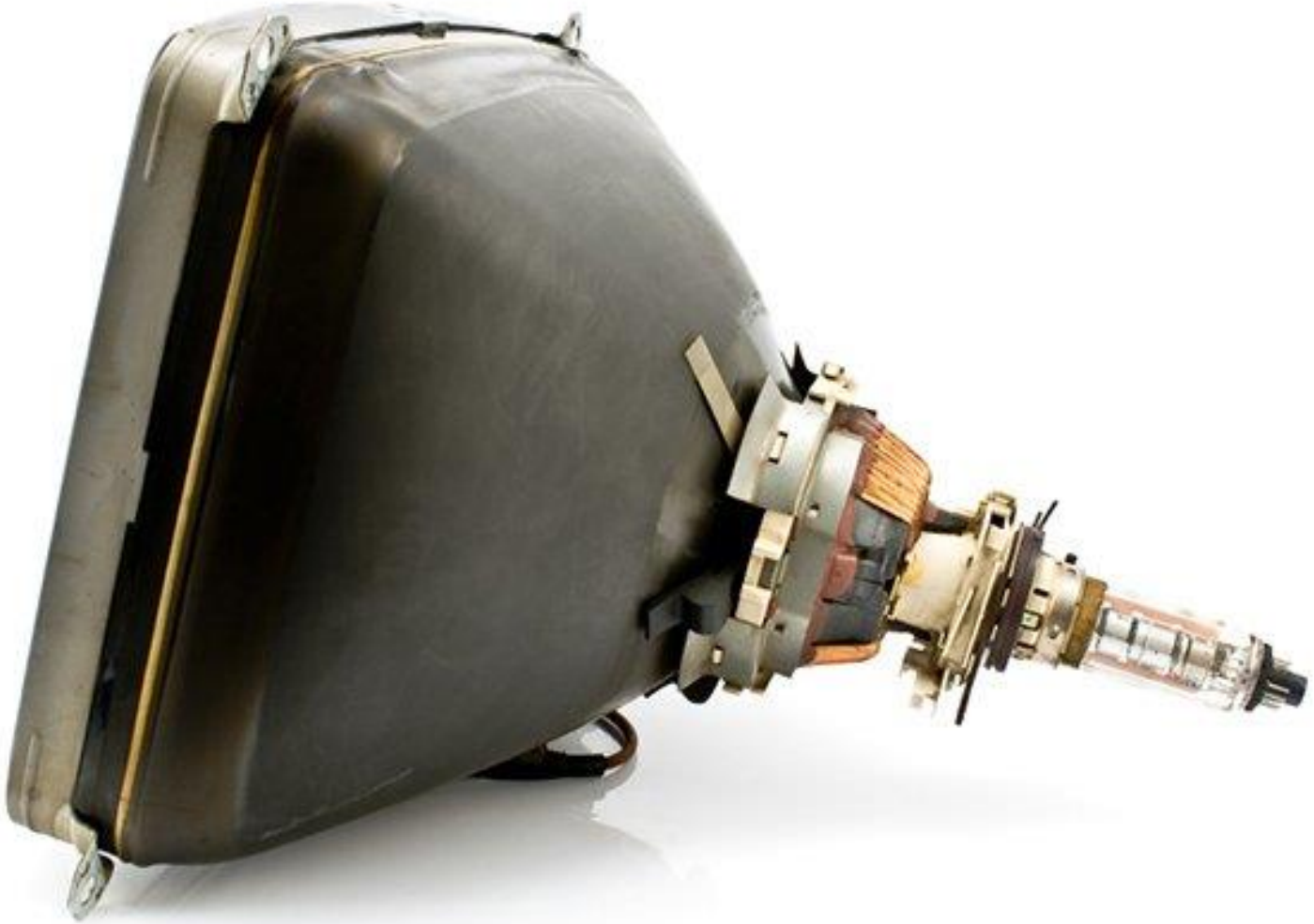
Pinout. "NC" means "No Connect"

Pin	PC (DB15 connector)	Macintosh
01	Red	
02	Green	Ref
03	Blue	H/V-Sync (not separate sync)
04	NC	Sense 0
05	DDC Return	Green
06	GND-R	GND-G
07	GND-G	Sense 1
08	GND-B	Reserved
09	NC	Blue
10	GND-Sync/Self Raster	Sense 2
11	NC	GND
12	DDC Data	V-Sync
13	H-Sync	GND-B
14	V-Sync	GND
15	DDC Clock	H-Sync

Fonte: [2]

DDC Data: usado para o monitor informar ao adaptador de vídeo quais são as resoluções disponíveis.

PRINCÍPIO DE FUNCIONAMENTO CRT

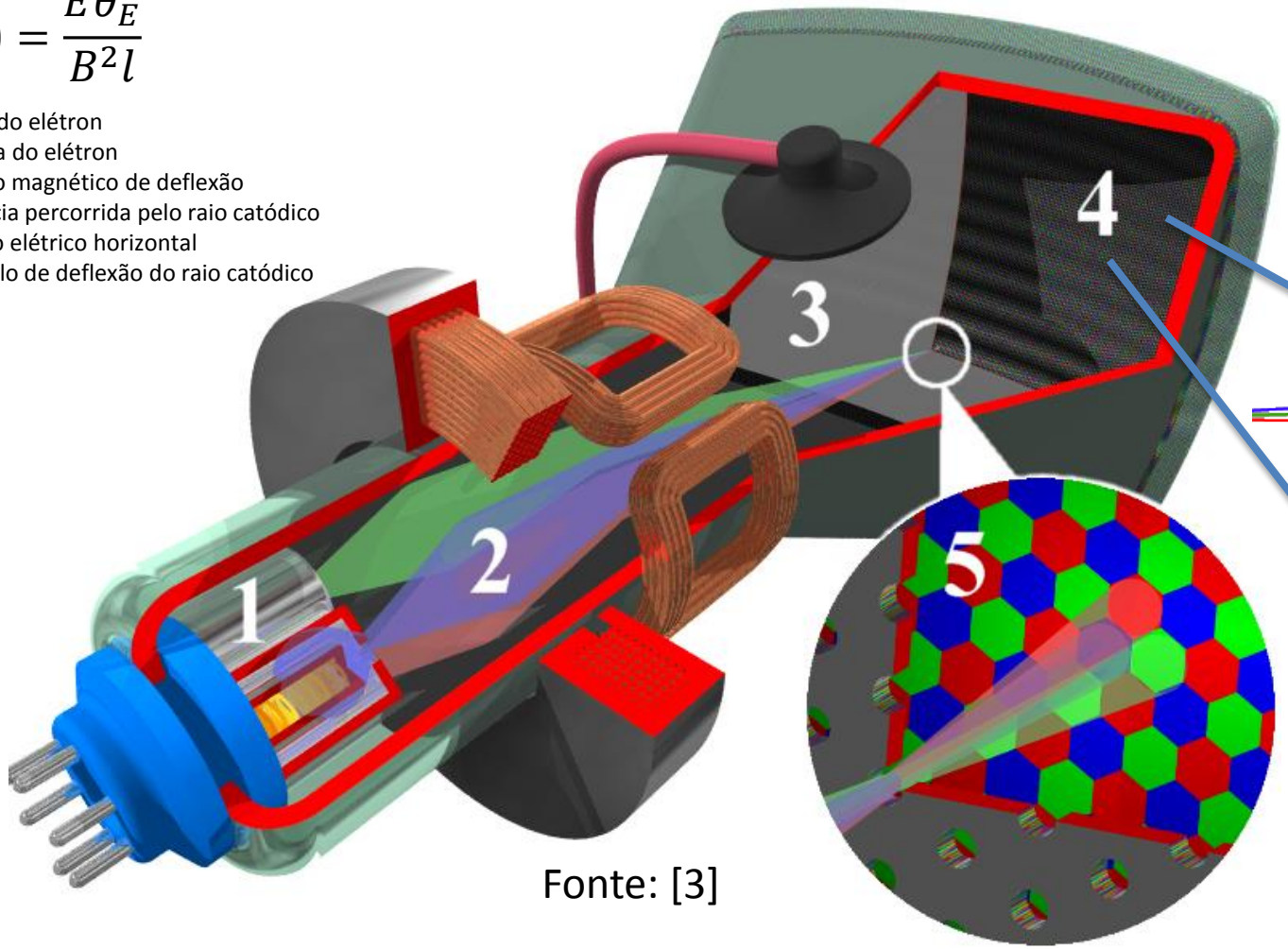


Fonte: [4]

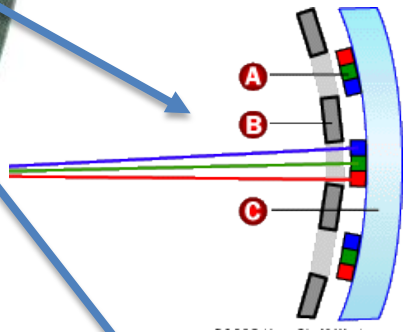
PRINCÍPIO DE FUNCIONAMENTO CRT

$$\left(\frac{e}{m}\right) = \frac{E\theta_E}{B^2 l}$$

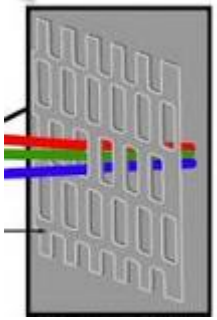
e = carga do elétron
m = massa do elétron
B = campo magnético de deflexão
l = distância percorrida pelo raio catódico
E = campo elétrico horizontal
θ_E = angulo de deflexão do raio catódico



Fonte: [3]

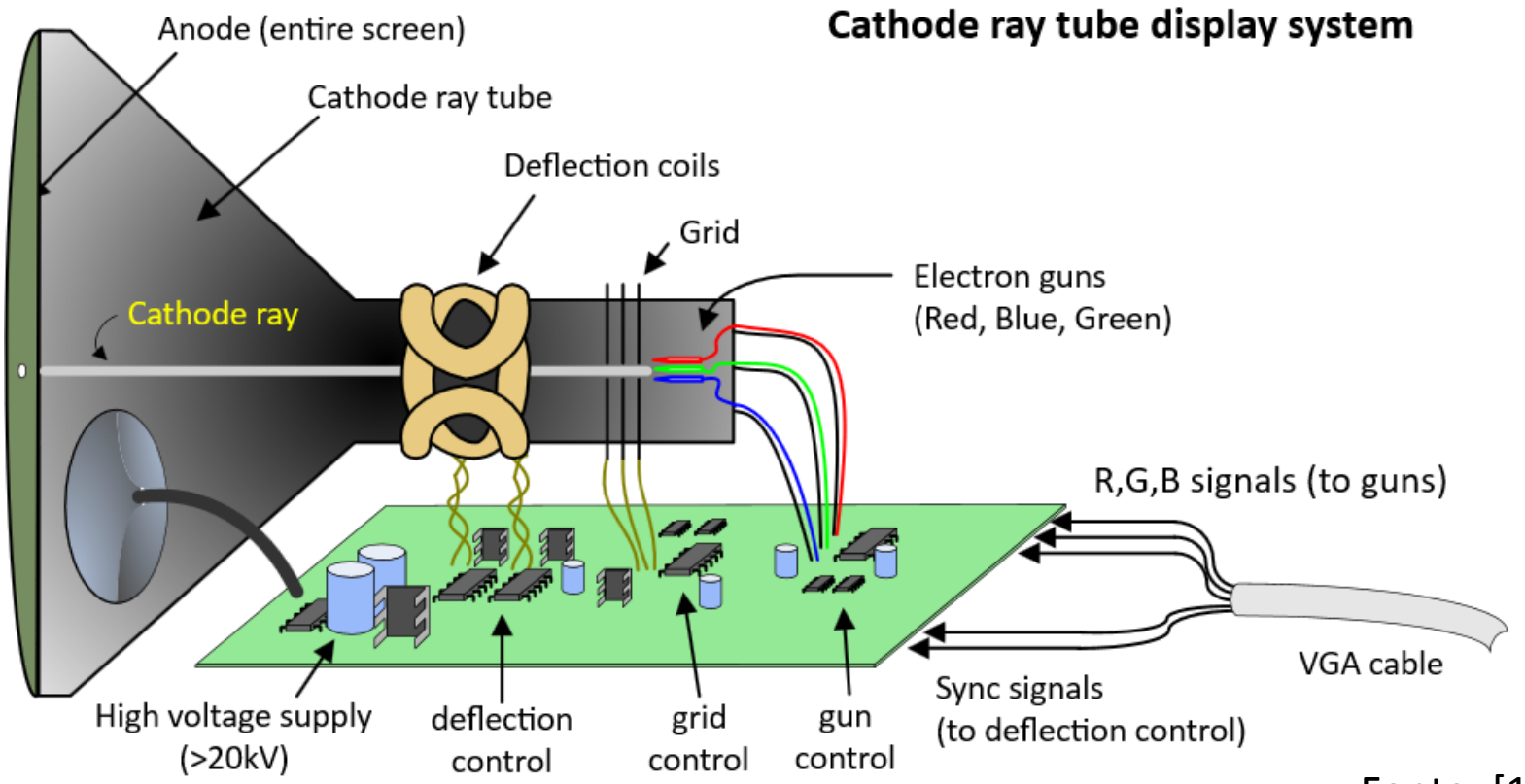


Fonte: [4]



Fonte: [7]

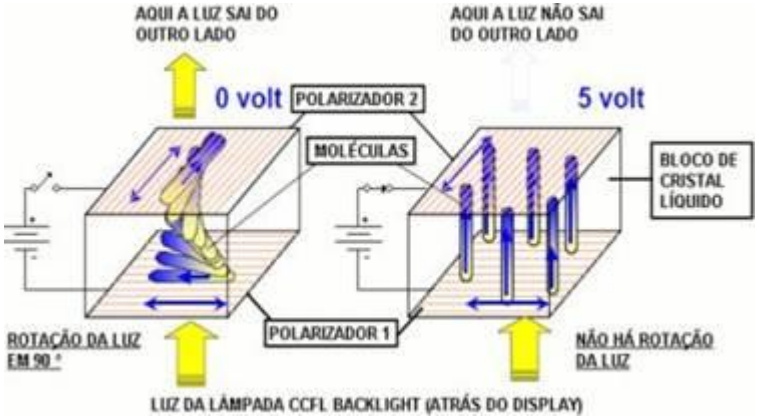
PRINCÍPIO DE FUNCIONAMENTO CRT



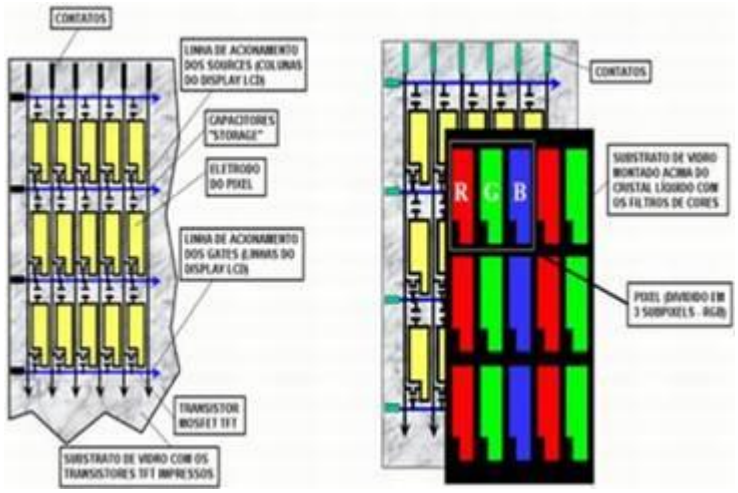
Fonte: [1]

GICS

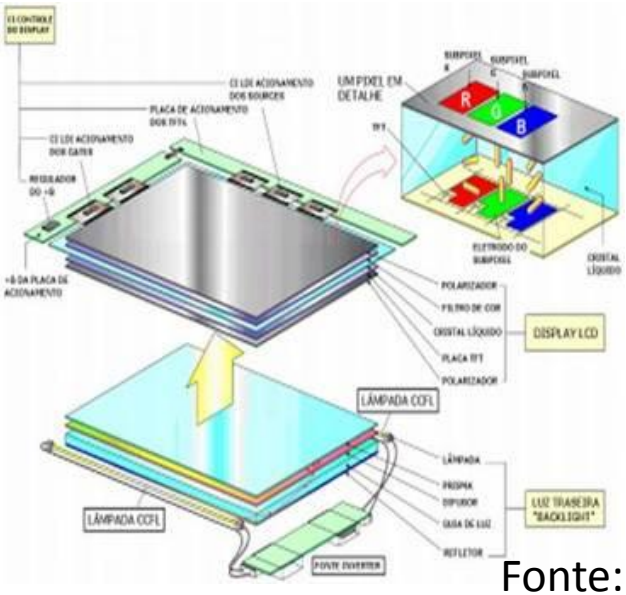
PRINCÍPIO DE FUNCIONAMENTO LCD



Fonte: [4]

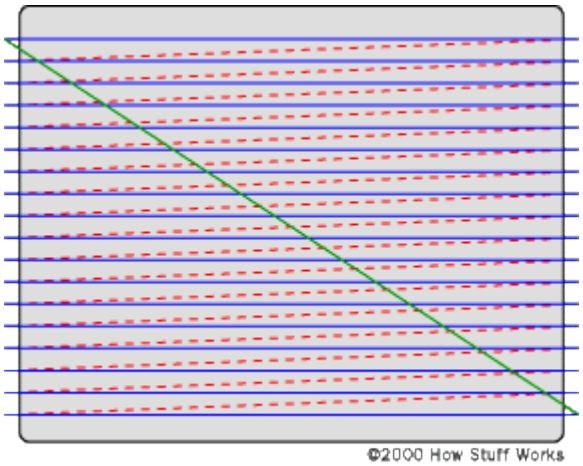


Fonte: [4]

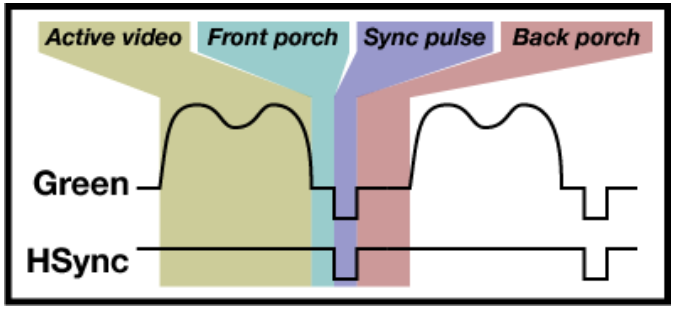


Fonte: [4]

SINAL VGA – VARREDURA DE TELA



Fonte: [4]



Fonte: [6]

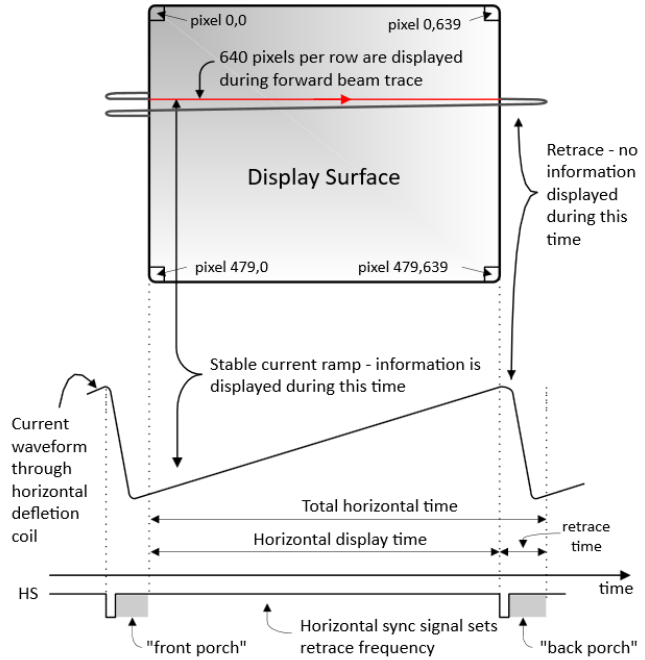
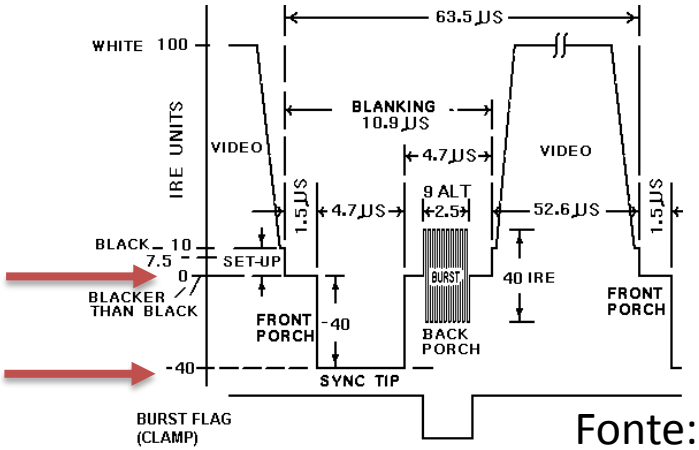


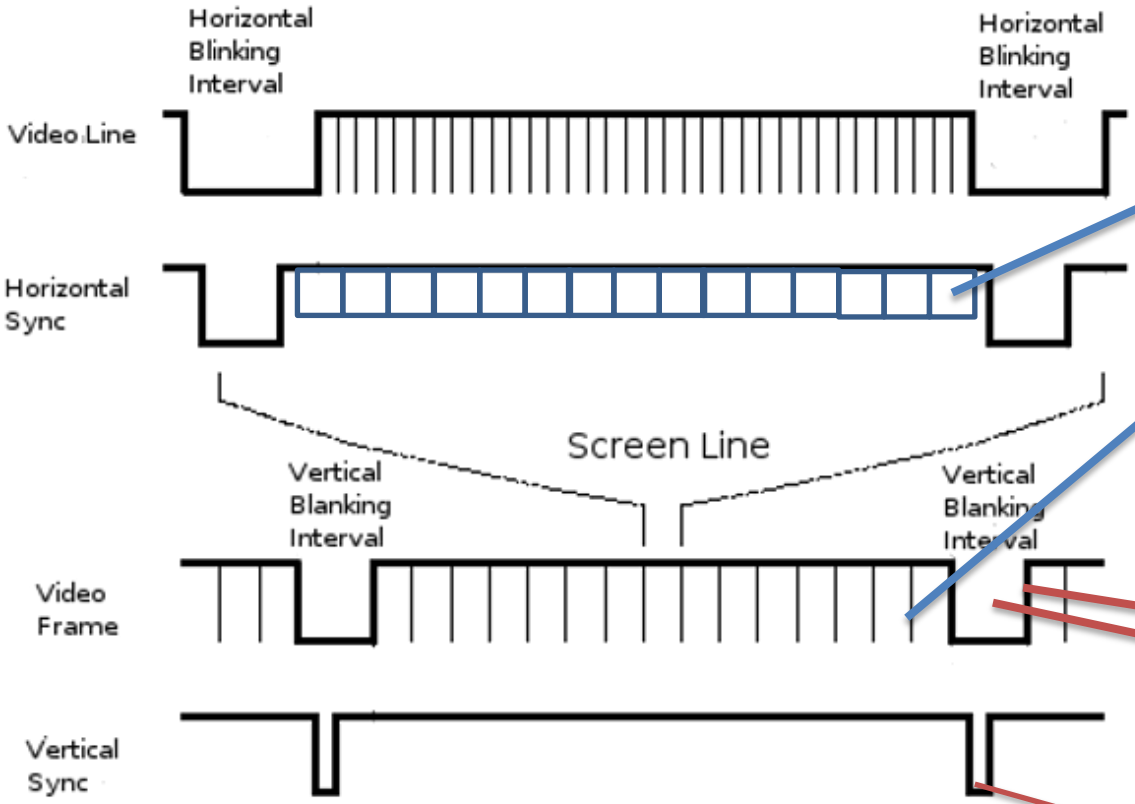
Figure 3. VGA horizontal synchronization.

Fonte: [1]

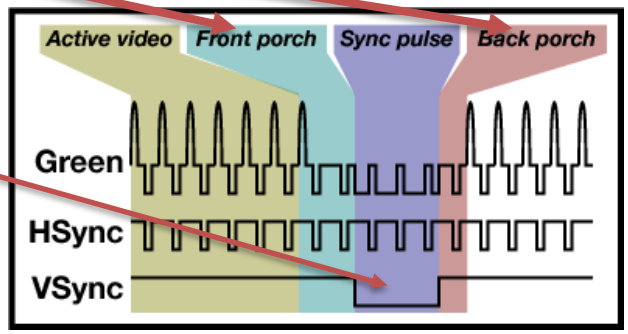


Fonte: [8]

SINAL VGA – VARREDURA DE TELA



Fonte: [2]



Fonte: [6]

SINAL VGA - CONTROLLER

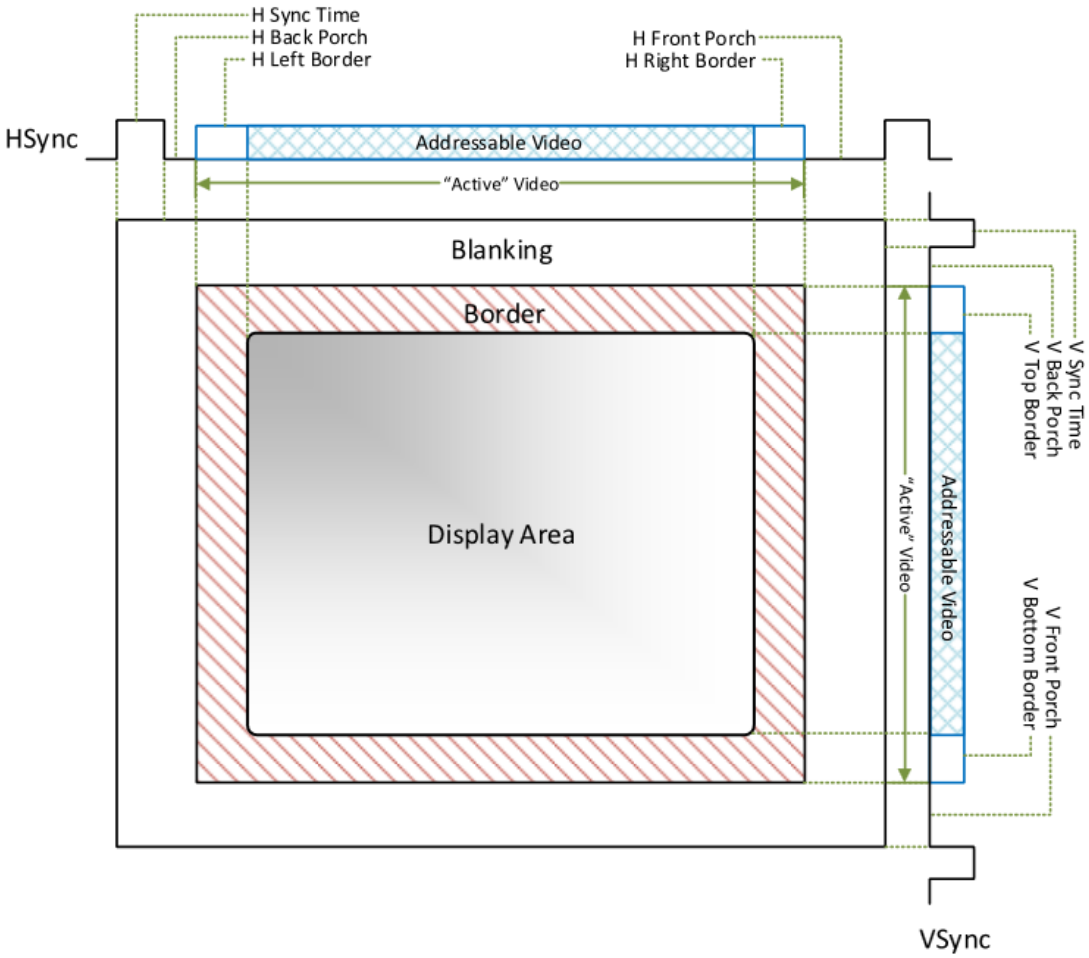


Figure 4. VGA timing specification.

Fonte: [1]

SINAL VGA - CONTROLLER

VGA 640 x 480 – Frame Rate: 60 Hz

Description	Notation	Time	Width/Freq
Pixel Clock	t_{clk}	39.7 ns (± 0.5%)	25.175MHz
Hor Sync Time	t_{hs}	3.813 µs	96 Pixels
Hor Back Porch	t_{hbp}	1.907 µs	48 Pixels
Hor Front Porch	t_{hfp}	0.636 µs	16 Pixels
Hor Addr Video Time	t_{haddr}	25.422 µs	640 Pixels
Hor L/R Border	t_{hbd}	0 µs	0 Pixels
V Sync Time	t_{vs}	0.064 ms	2 Lines
V Back Porch	t_{vbp}	1.048 ms	33 Lines
V Front Porch	t_{vfp}	0.318 ms	10 Lines
V Addr Video Time	t_{vaddr}	15.253 ms	480 Lines

Fonte: [1]

SINAL VGA

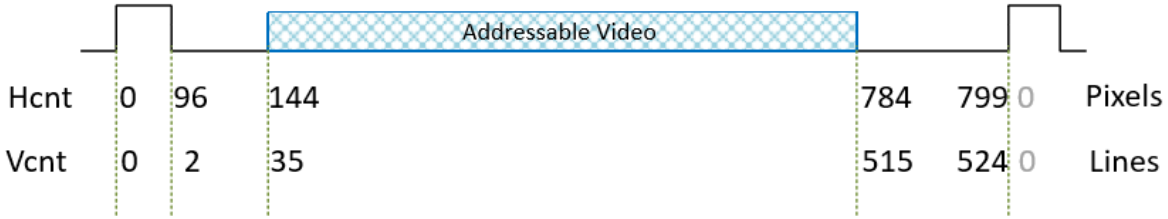
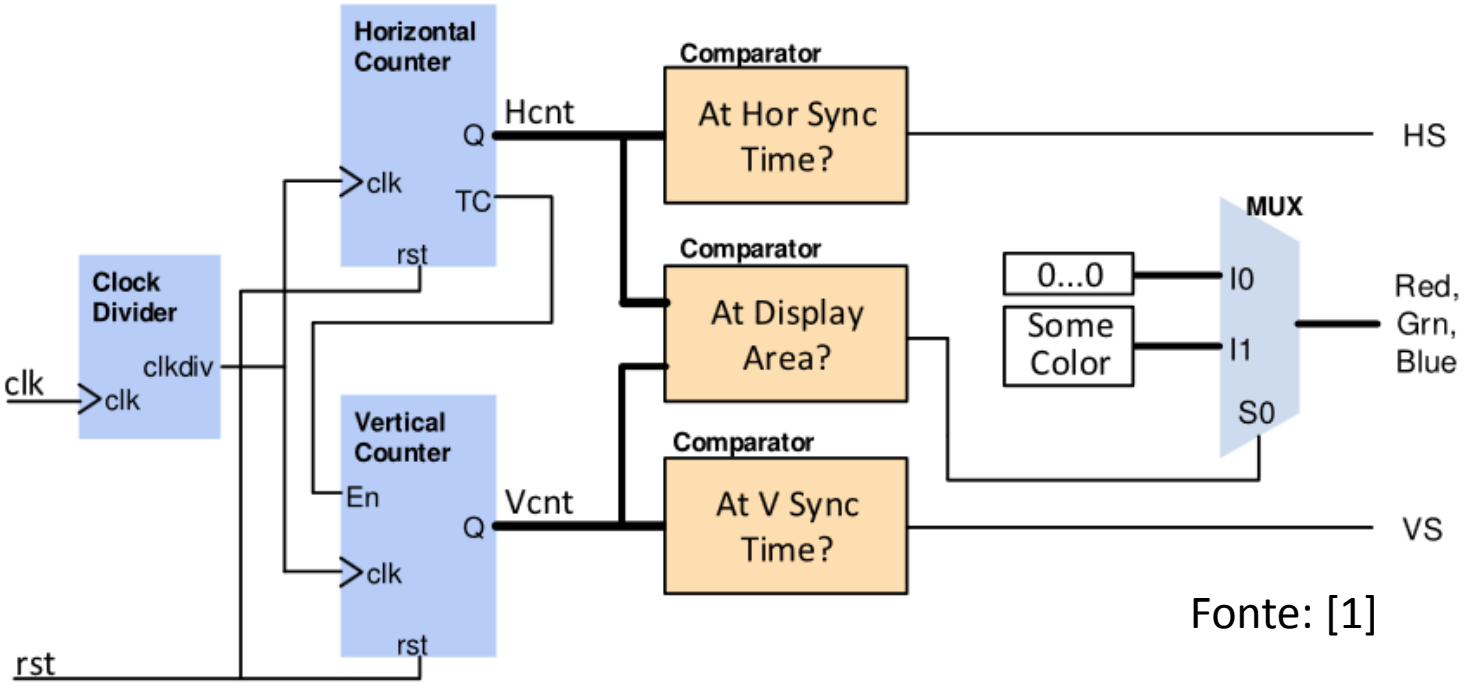


Figure 5. HS and VS generation based on counter values.

Fonte: [1]



Fonte: [1]

Figure 6. VGA Controller Reference Block Diagram

Nexys2 – VGA Controller

- 8-bits, 256 cores;
- Compatível com os 75 ohms do monitor;
- RGB Range:
  - 0V (fully off)
  - 0.7V (fully on)

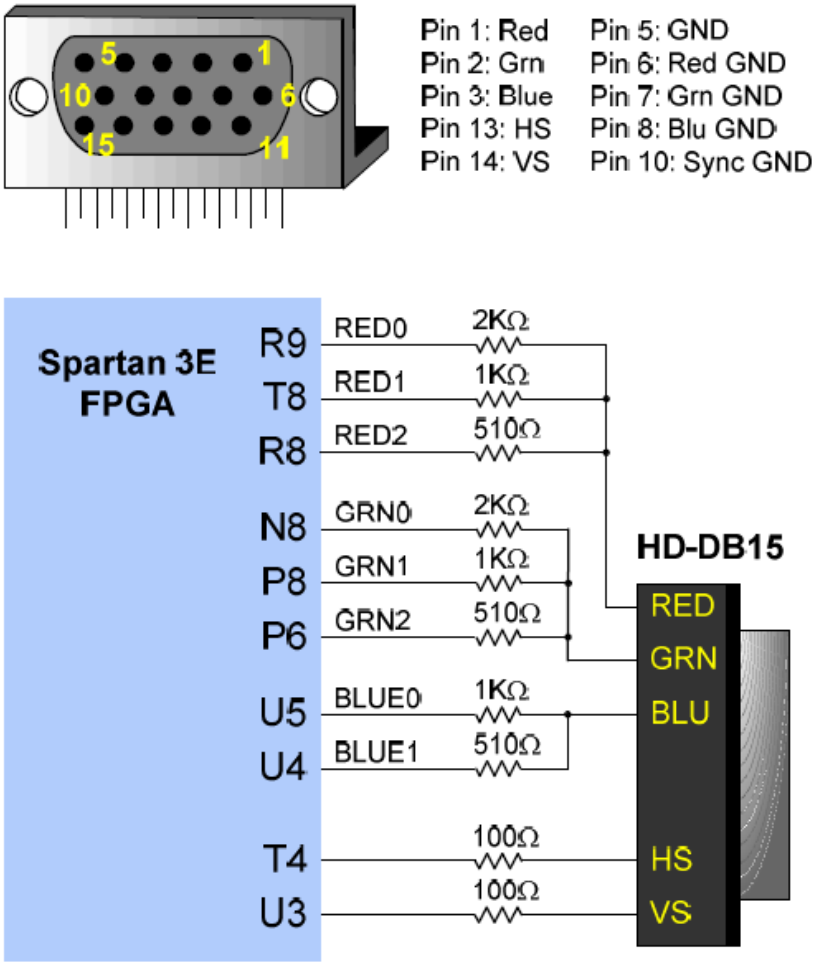


Figure 16: VGA pin definitions and Nexys2 circuit

VGA TIMINGS

Format	Pixel Clock (MHz)	Horizontal (in Pixels)				Vertical (in Lines)			
		Active Video	Front Porch	Sync Pulse	Back Porch	Active Video	Front Porch	Sync Pulse	Back Porch
640x480, 60Hz	25.175	640	16	96	48	480	11	2	31
640x480, 72Hz	31.500	640	24	40	128	480	9	3	28
640x480, 75Hz	31.500	640	16	96	48	480	11	2	32
640x480, 85Hz	36.000	640	32	48	112	480	1	3	25
800x600, 56Hz	38.100	800	32	128	128	600	1	4	14
800x600, 60Hz	40.000	800	40	128	88	600	1	4	23
800x600, 72Hz	50.000	800	56	120	64	600	37	6	23
800x600, 75Hz	49.500	800	16	80	160	600	1	2	21
800x600, 85Hz	56.250	800	32	64	152	600	1	3	27
1024x768, 60Hz	65.000	1024	24	136	160	768	3	6	29
1024x768, 70Hz	75.000	1024	24	136	144	768	3	6	29
1024x768, 75Hz	78.750	1024	16	96	176	768	1	3	28
1024x768, 85Hz	94.500	1024	48	96	208	768	1	3	36

Source: Rick Ballantyne, Xilinx Inc.

Fonte: [6]

REFERÊNCIAS

[1] - https://learn.digilentinc.com/Documents/269

[2] - http://javiervalcarce.eu/html/vga-signal-format-timming-specs-en.html

[3] - https://sites.google.com/site/mistermaia/artigos-trabalhos/fisica-monitor-de-tubo-de-raios-catodicos-cristal-liquido-e-plasma

[4] - http://zipanuncios.com.br/ads/compro-vidro-crt-de-tubo-e-monitor/

[5] - Digilent Nexys2 Board Reference Manual

[6] - http://web.mit.edu/6.111/www/s2004/NEWKIT/vga.shtml

[7]- http://principaisfisicos.blogspot.com.br/2010/10/como-funciona-uma-televisao.html

[8] - http://electronics.stackexchange.com/questions/201011/what-is-front-porch-and-back-porch-of-a-video-signal-in-crt-display