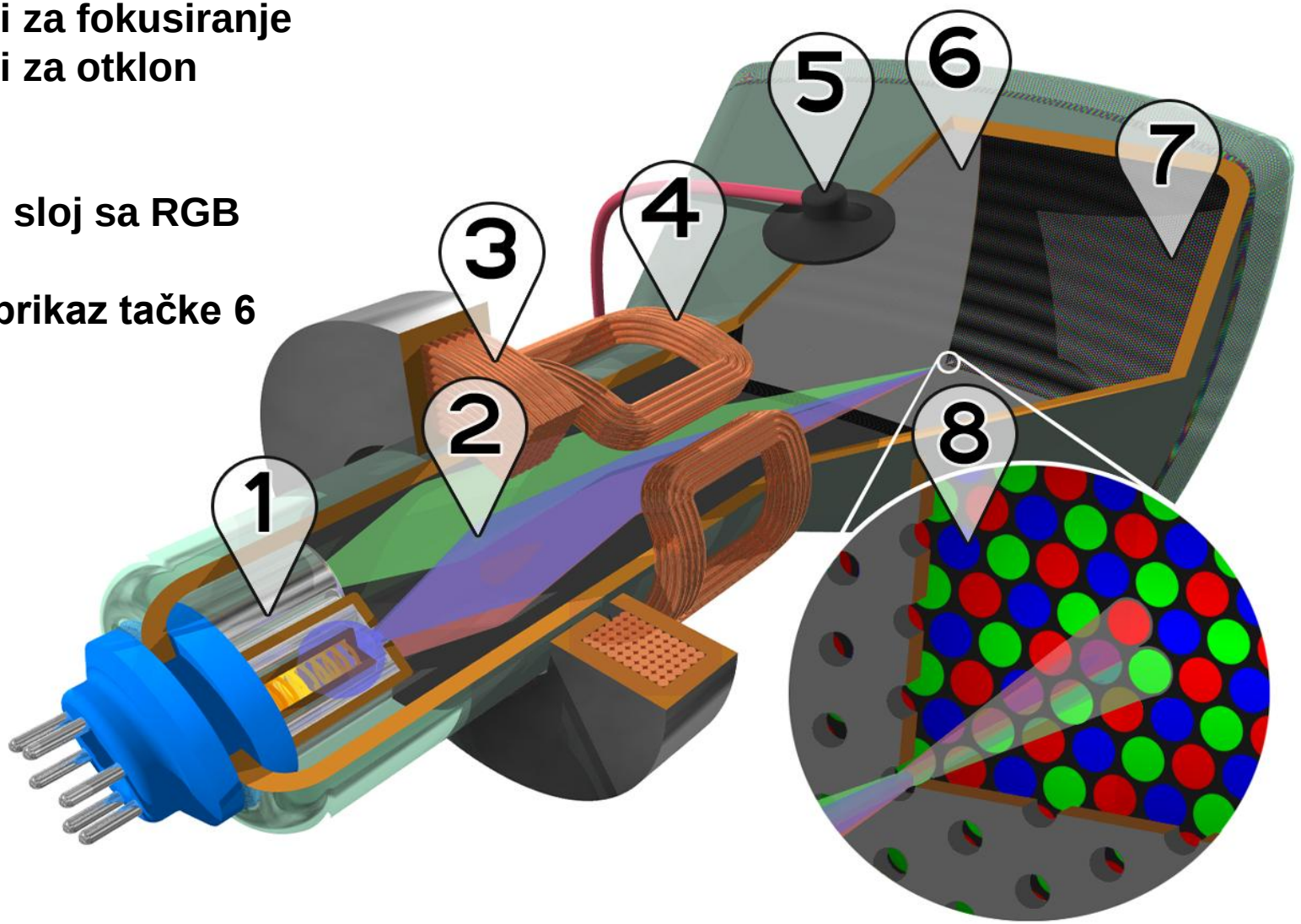
VGA

Video Graphics Array

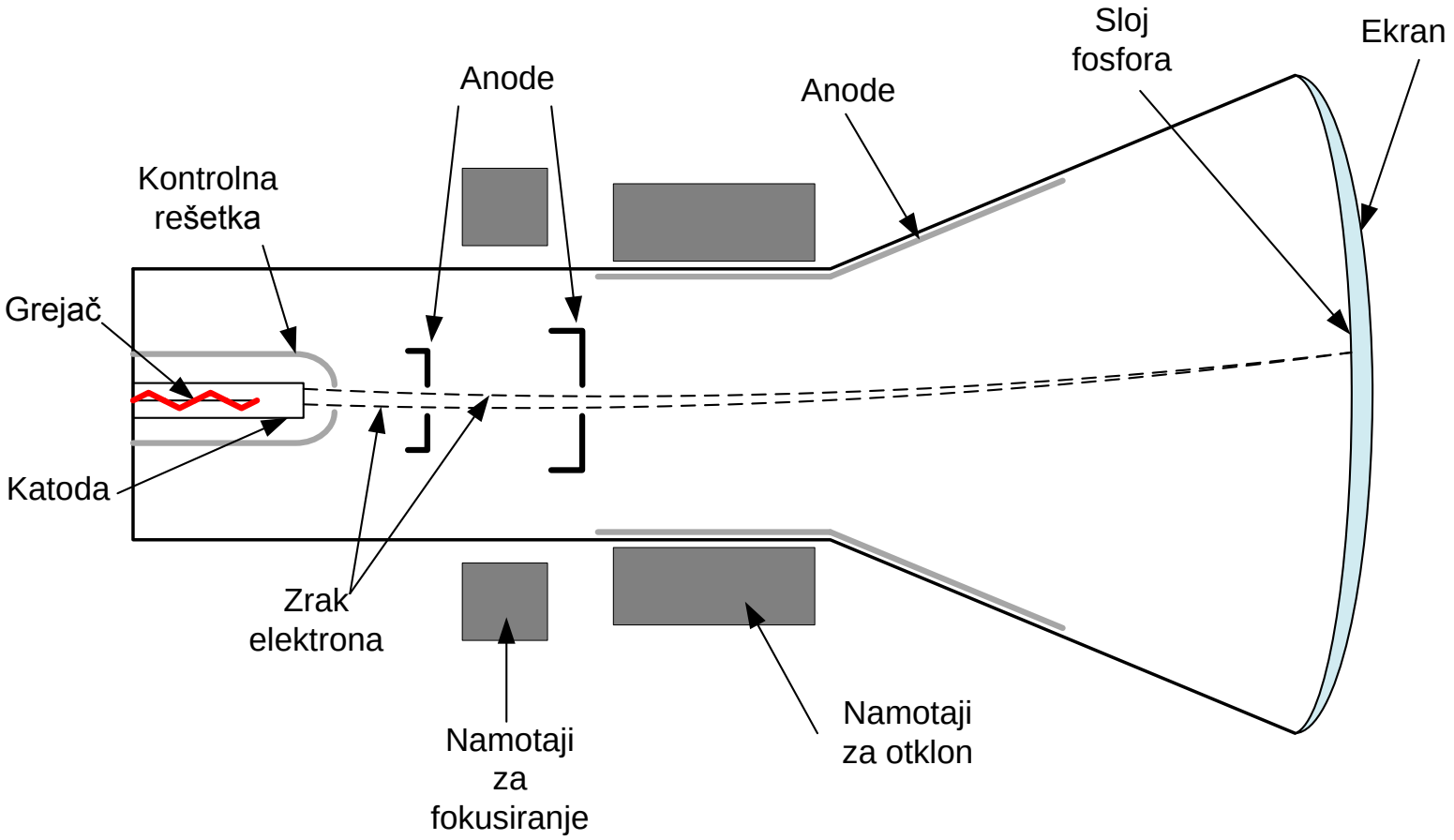
Računarski monitori

Ekran sa katodnom cevi

1. **Tri elektronska topa**
2. **Zraci elektrona**
3. **Namotaji za fokusiranje**
4. **Namotaji za otklon**
5. **Anoda**
6. **Maska**
7. **Fosforni sloj sa RGB zonama**
8. **Uvećan prikaz tačke 6**



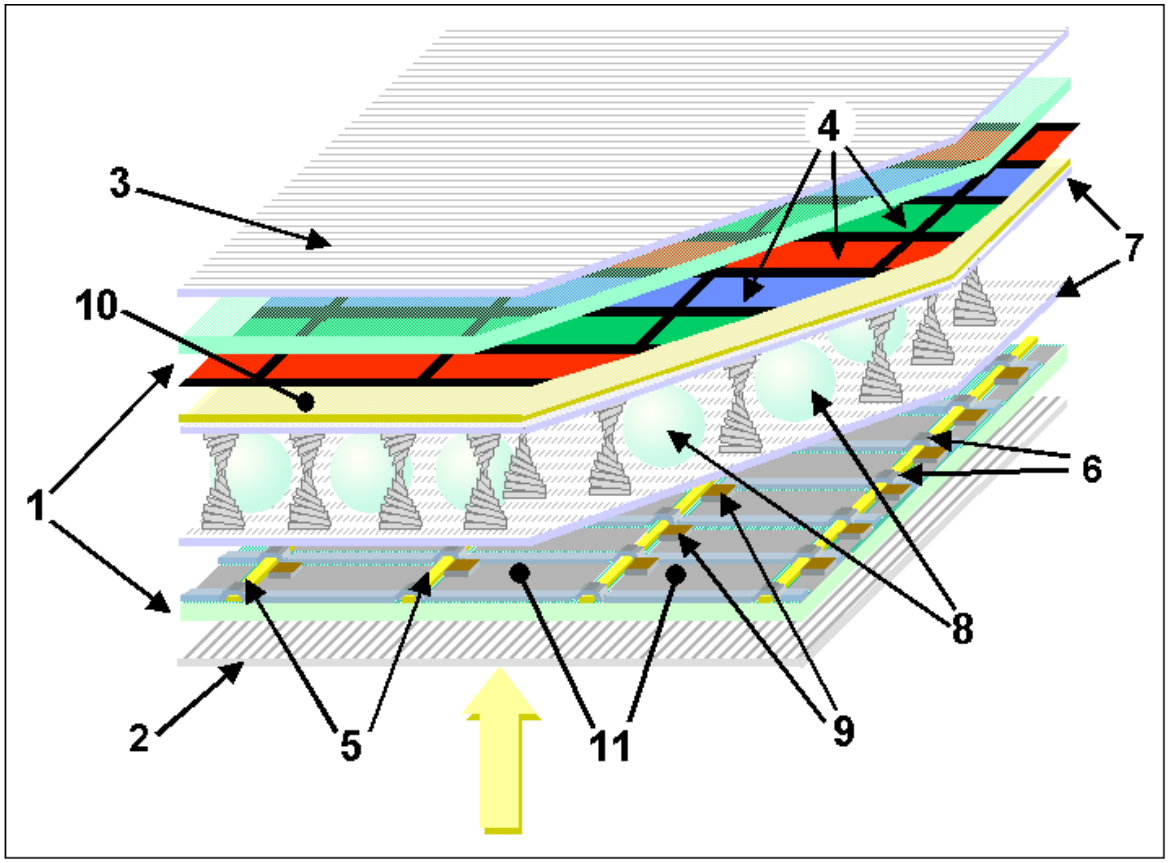
Ekran sa katodnom cevi



TFT LCD ekran – princip rada

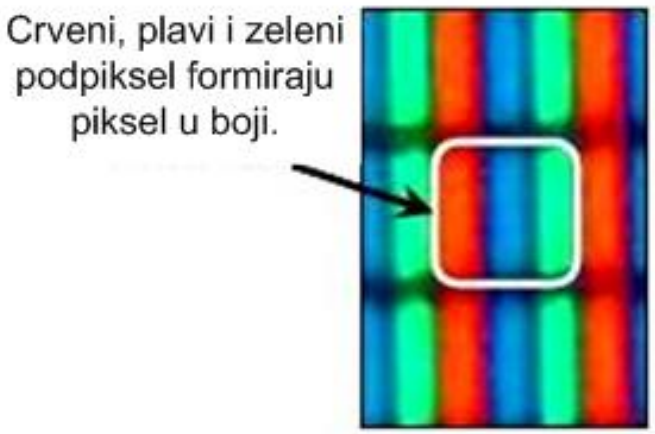
- TFT – Thin Film Transistor
- LCD - Liquid Crystal Display

1: staklene ploče
2&3: polarizatori
4: RGB maska boja
5&6: komandne linije
7: sloj polimera
8: distanceri
9: tranzistori
10&11: elektrode

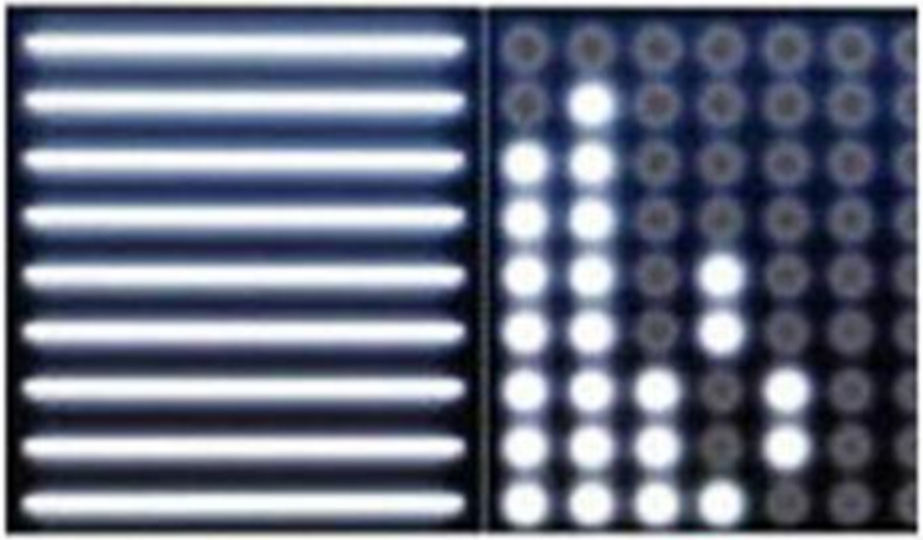


TFT LCD ekran

- Struktura piksela



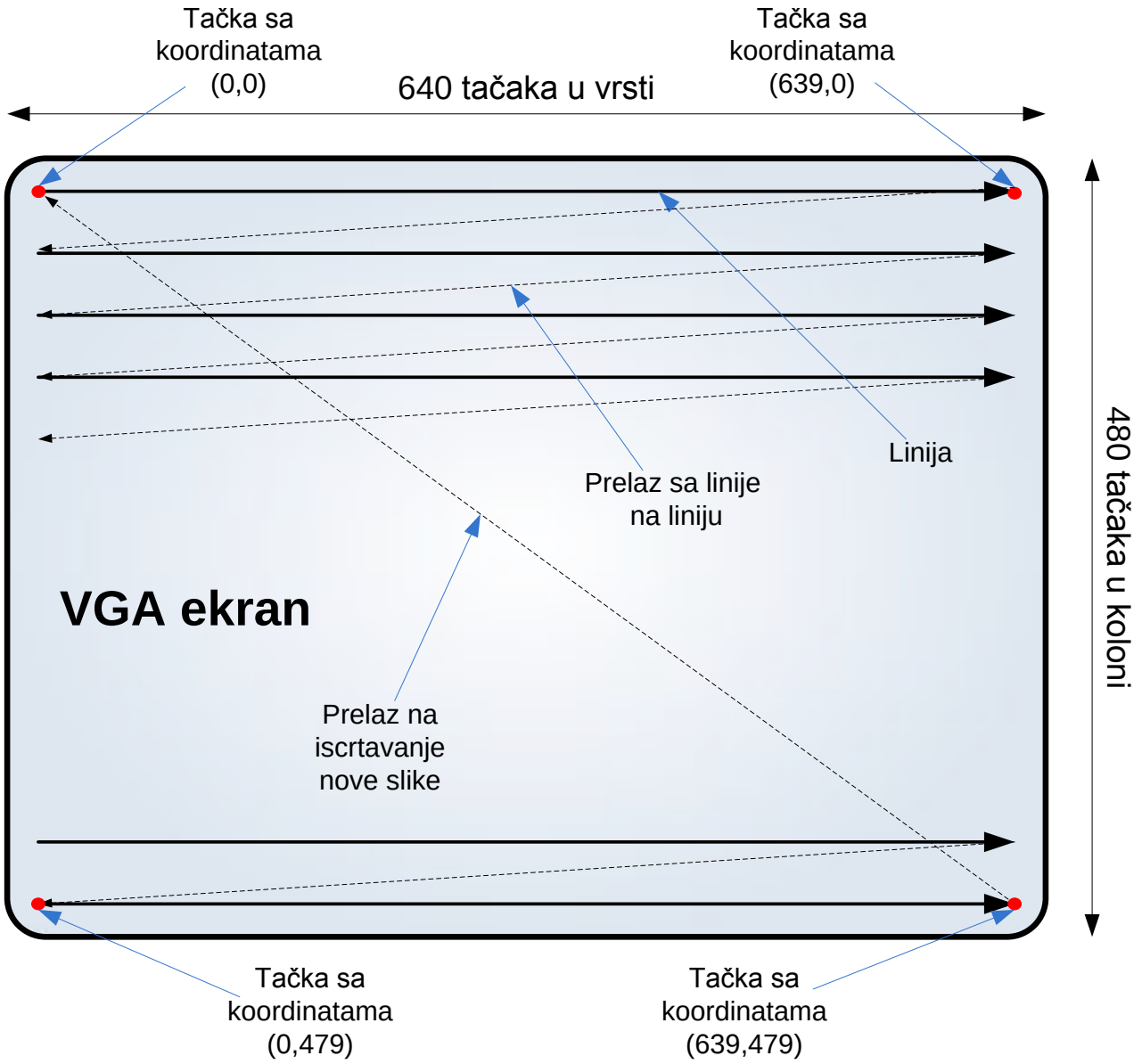
Pozadinsko osvetljenje



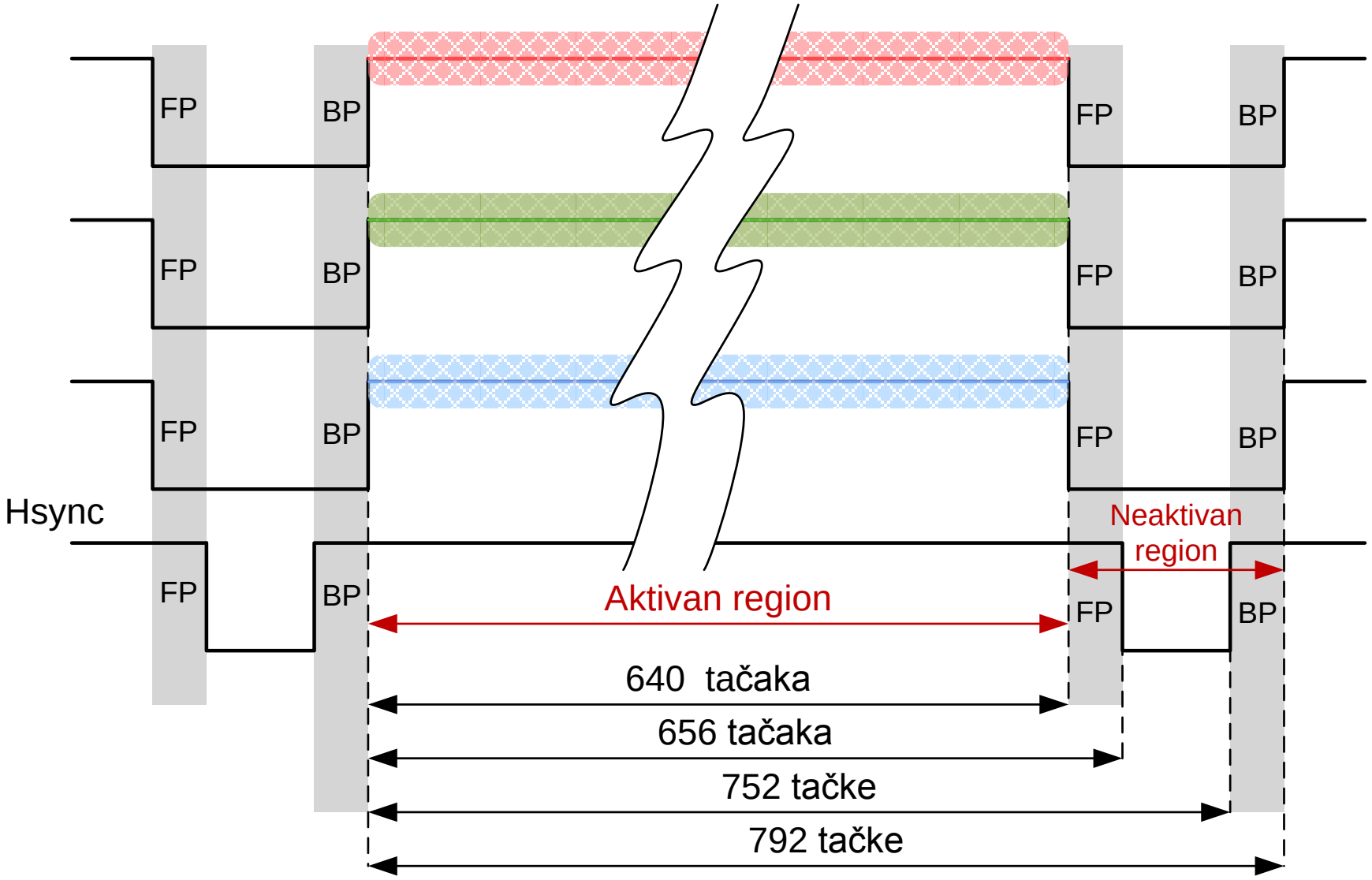
CCFL
Isključivo globalno zatamnjivanje

LED
Moguće lokalno zatamnjivanje

VGA sprega - iscrtavanje slika na ekranu



Linija


FP
BP
FP
BP
FP
BP
FP
BP
FP
BP
FP
BP
FP
BP
Hsync
Neaktivan region
Aktivan region
640 tačaka
656 tačaka
752 tačke
792 tačke

Ekran

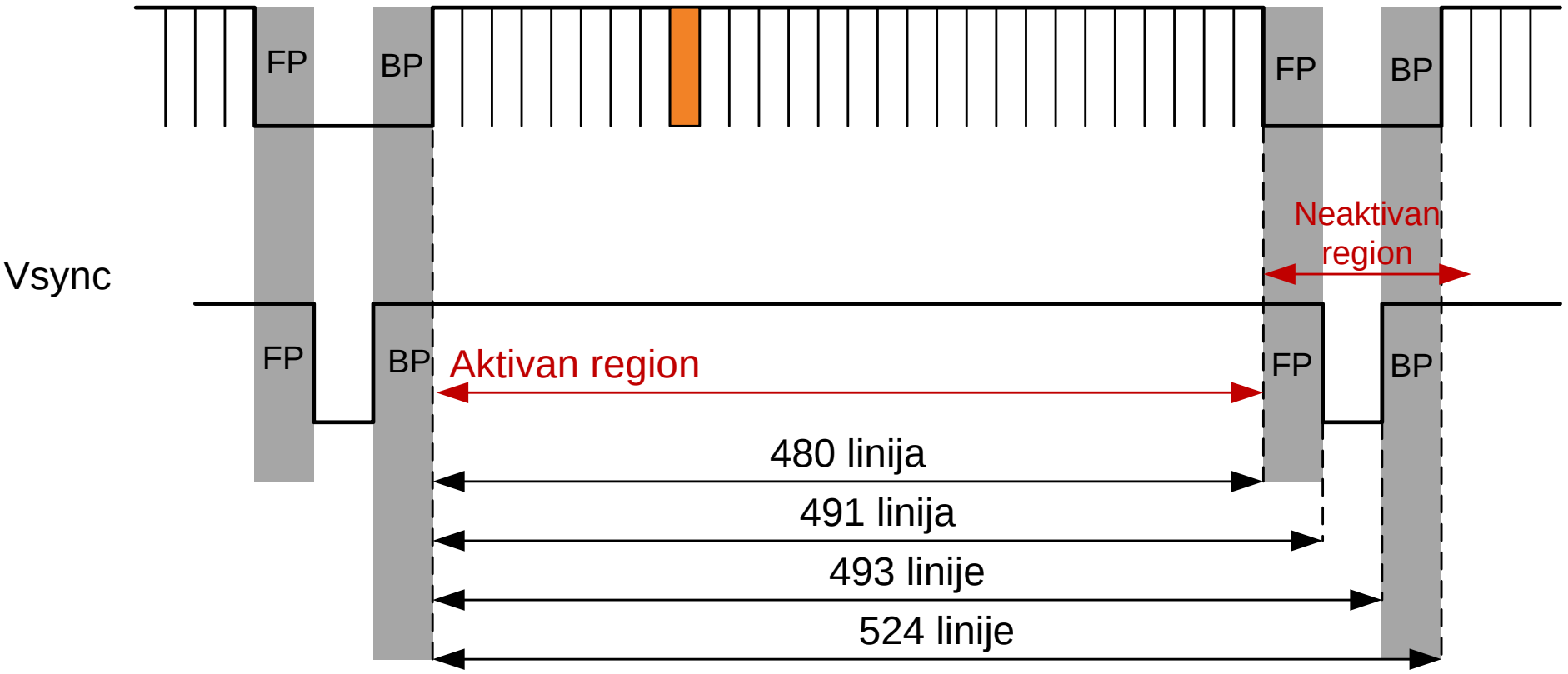

FP
BP
FP
BP
Vsync
Neaktivan region
FP
BP
Aktivan region
FP
BP
480 linija
491 linija
493 linije
524 linije

Tabela parametara za sve podržane rezolucije

Rezolucija	Frekvencija takta [MHz]	frekvencija horizontalne sinhronizacije [kHz]	frekvencija vertikalne sinhronizacije [Hz]	ukupan broj tačaka po horizontali	ukupan broj tačaka po vertikali	vrednost parametra resolution _type
64x48	**25.17**	**-**	**-**	**-**	**-**	**0**
640x480	**25.17**	**31.46**	**60.04**	**800**	**524**	**1**
800x600	**50**	**48.08**	**72.19**	**1040**	**666**	**2**
1024x768	**75**	**56.48**	**70.07**	**1328**	**806**	**3**
1152x864	**108**	**67.5**	**75**	**1600**	**900**	**4**
1280x1024	**108**	**63.98**	**60.02**	**1688**	**1066**	**5**

VGA – IF GENERATE

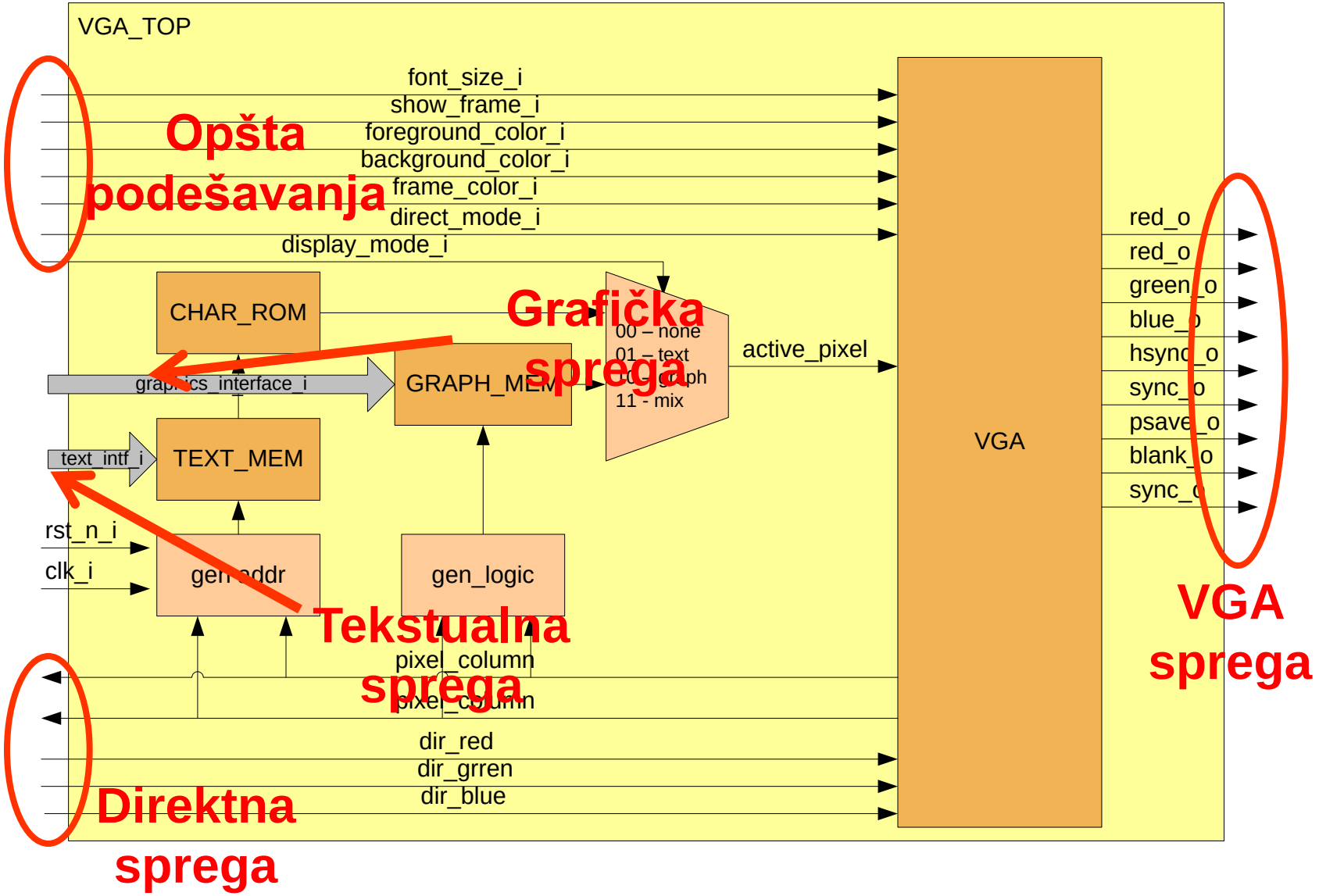
```
res_0: IF ( resolution_type = 0 ) GENERATE

          dcm25_i:dcm25MHz PORT MAP(
                                    CLKIN_IN        => clk_i        ,
                                    RST_IN          => rst_s        ,
                                    CLKFX_OUT       => clk_s        ,
                                    CLKIN_IBUFG_OUT => open         ,
                                    CLK0_OUT        => open         ,
                                    LOCKED_OUT      => locked_s
                                   );
       END GENERATE res_0;

res_1: IF ( resolution_type = 1 ) GENERATE

          dcm50_i:dcm50MHz PORT MAP(
                                    CLKIN_IN        => clk_i        ,
                                    RST_IN          => rst_s        ,
                                    CLKFX_OUT       => clk_s        ,
                                    CLKIN_IBUFG_OUT => open         ,
                                    CLK0_OUT        => open         ,
                                    LOCKED_OUT      => locked_s
                                   );
       END GENERATE res_1;
```

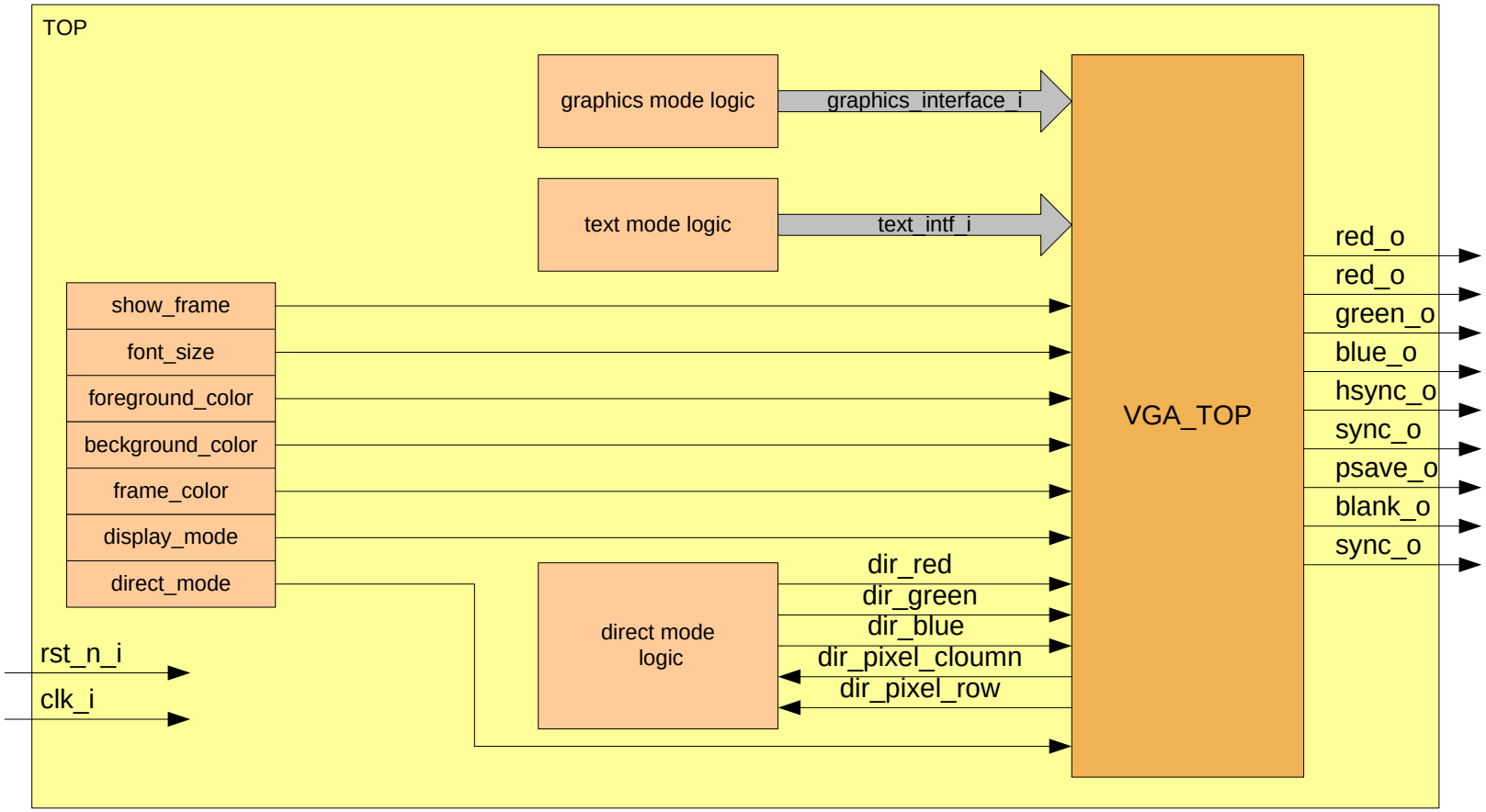
Struktura VGA modula



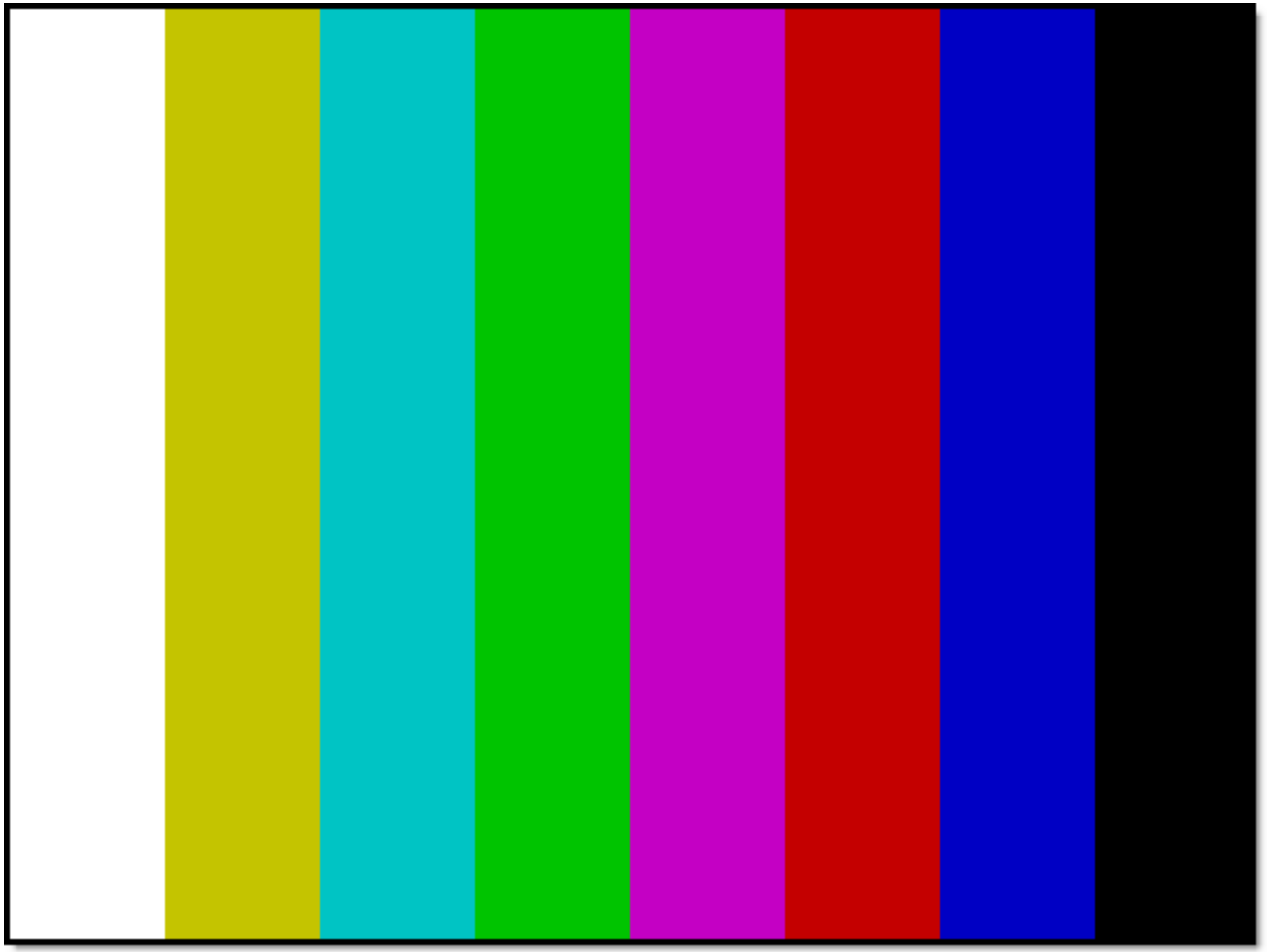
Boje

- Svaka boja je predstavljena sa 8 bita odnosno 24 bita po pikselu
- U direktnom režimu je moguće iskoristiti sve kombinacije boja
- Tekstaulni i grafički režim
  - samo dve boje
  - Jedan bit po boji

Struktura sistema

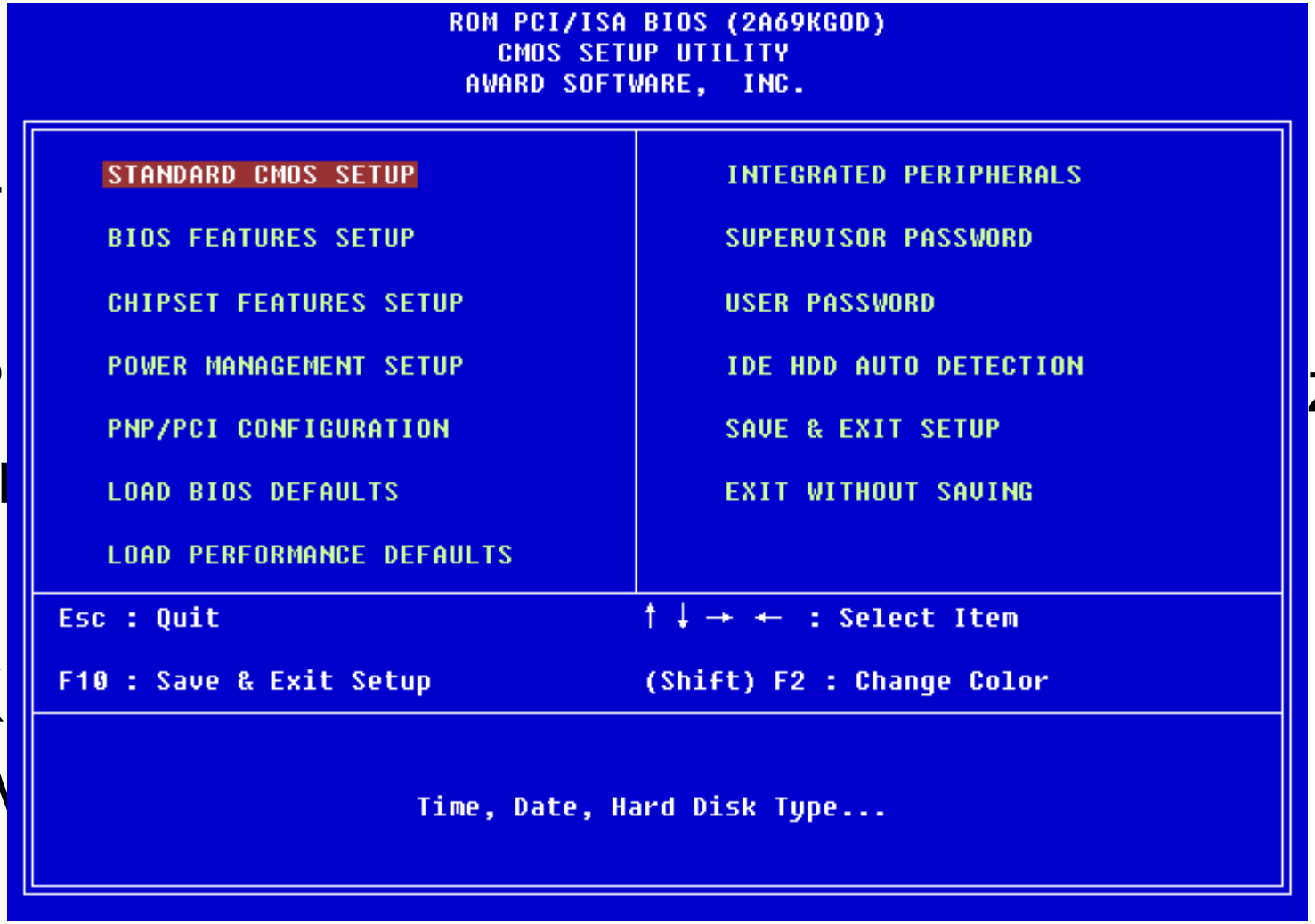


1. Color bar



2-3.Tekstualni režim rada

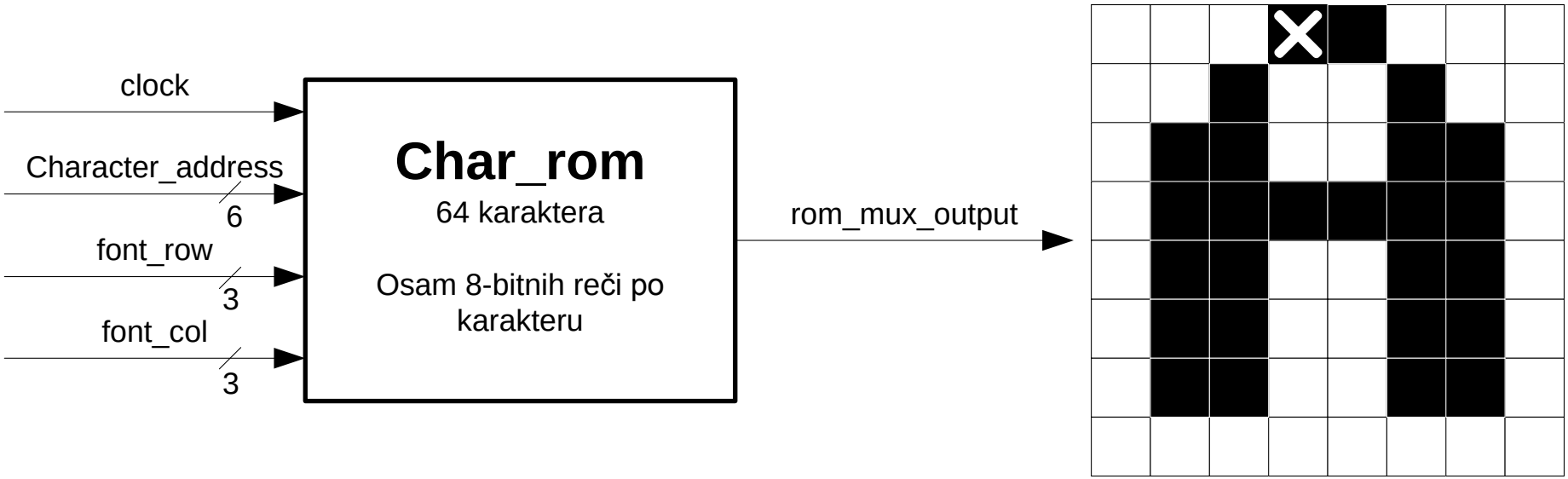
- E
- P z
  pr
- K
  sv



CHAR ROM

- ROM memorija koja sadrži definiciju 64 karaktera
- Dimenzije karaktera su 8x8 piksela
- 8 osmobitnih reči po karakteru
- Detaljna objašnjenja definisanja sadržaja txt_rom-a i samog txt_rom-a se nalaze u praktikumu u poglavljima 3.2 i 3.3.

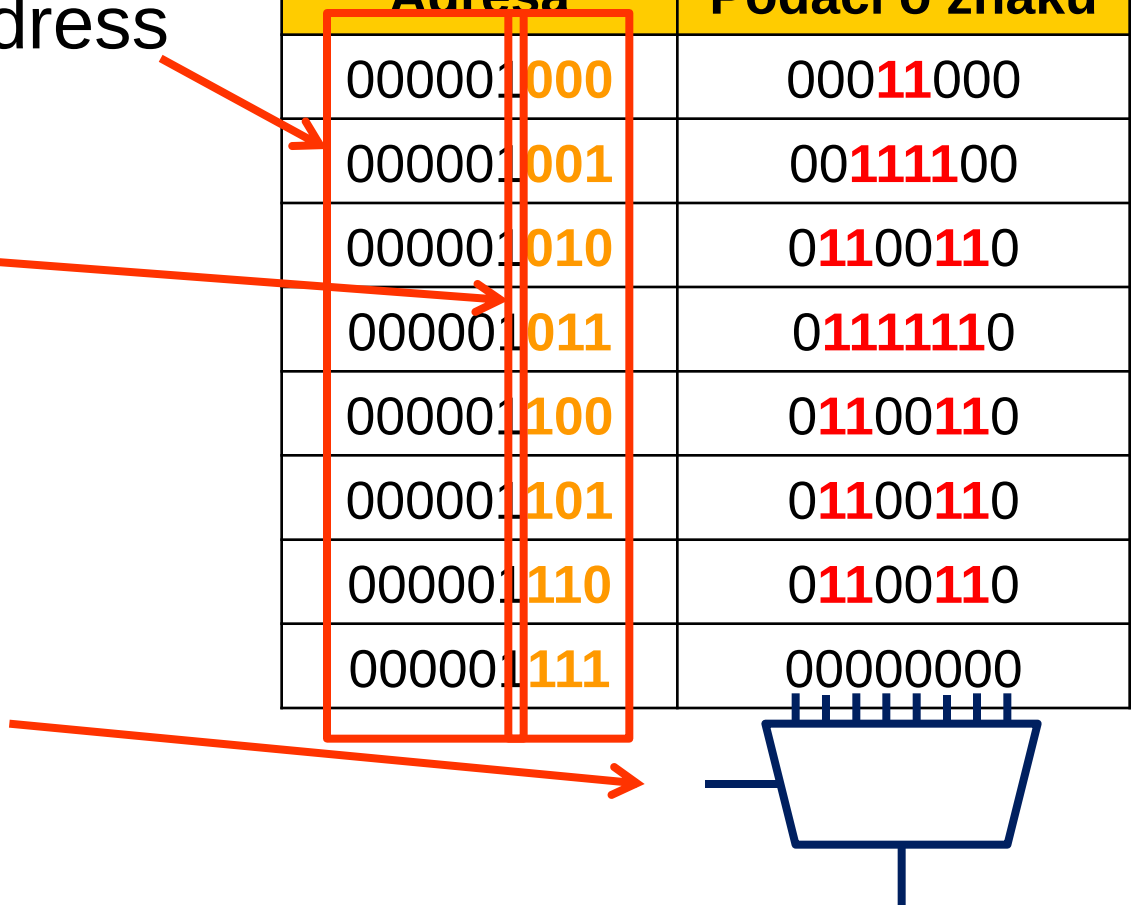
CHAR ROM


clock
Character_address
6
font_row
3
font_col
3
Char_rom
64 karaktera
Osam 8-bitnih reči po karakteru
rom_mux_output

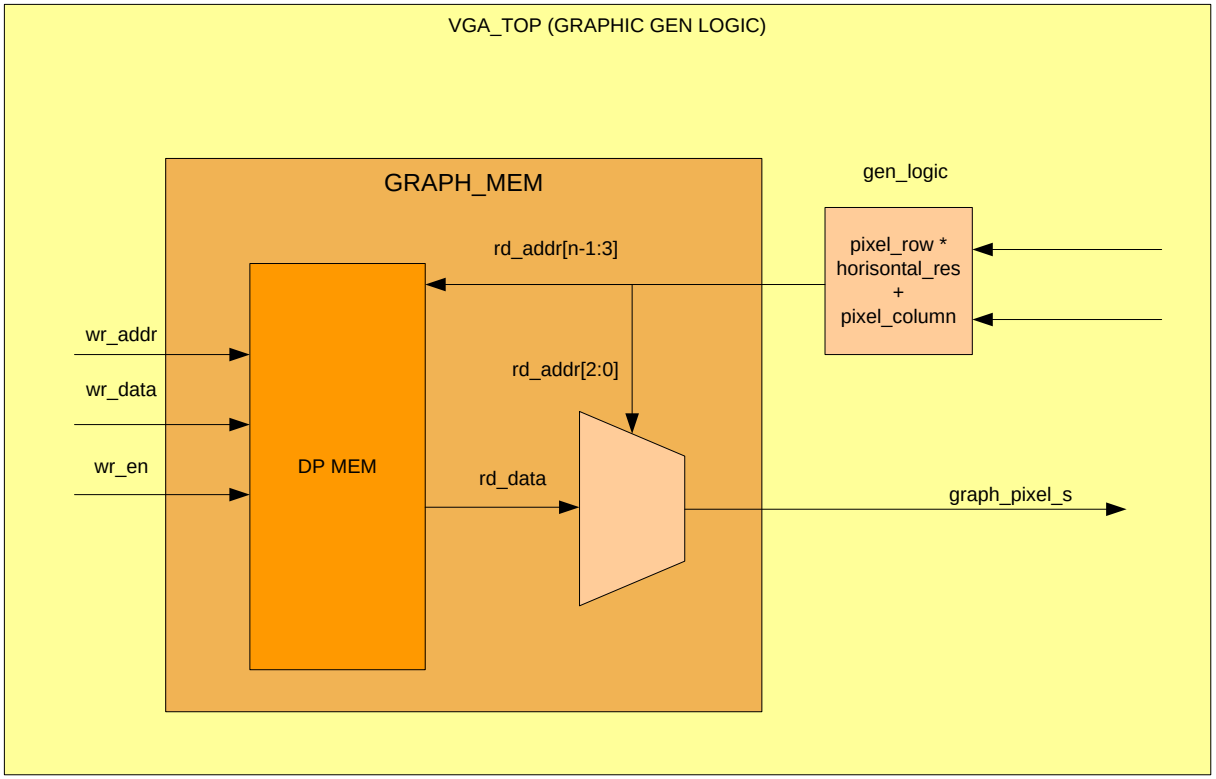
Adresiranje CHAR ROM-a

- Character address
- Font_row
- Font_column

Adresa	Podaci o znaku
00000**1000**	000**11**000
00000**1001**	00**1111**00
00000**1010**	0**11**00**11**0
00000**1011**	0**1111111**0
00000**1100**	0**11**00**11**0
00000**1101**	0**11**00**11**0
00000**1110**	0**11**00**11**0
00000**1111**	00000000



4-5. Grafički režim rada



Literatura

- Praktikum!
- Aldec Evita VHDL tutorial

Kraj

- Pitanja