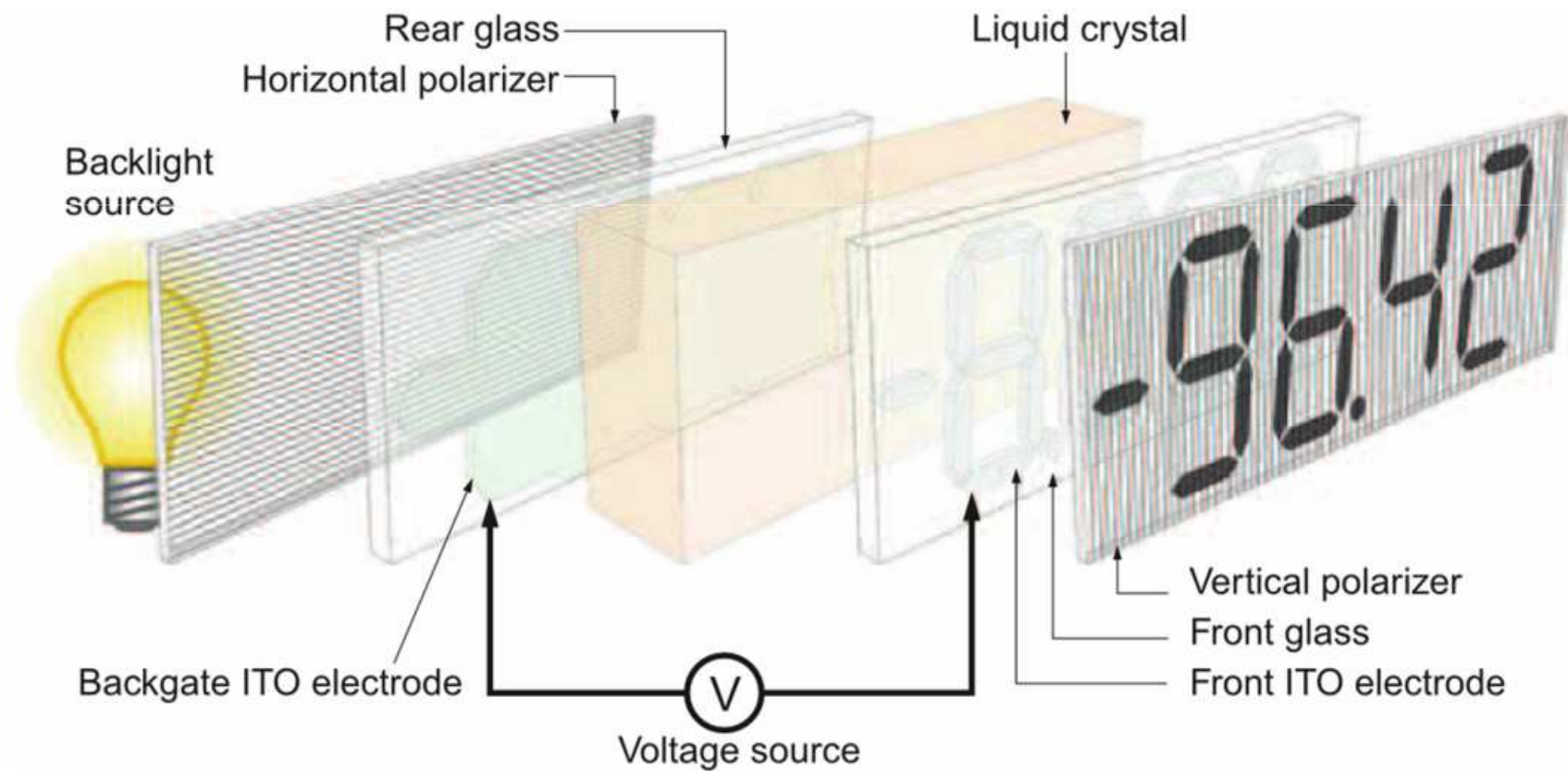


Povezivanje sa LCD displejima

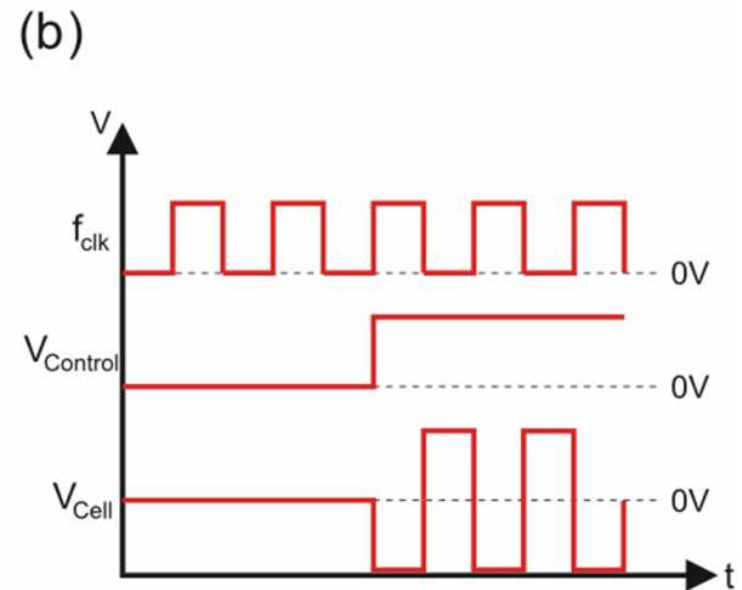
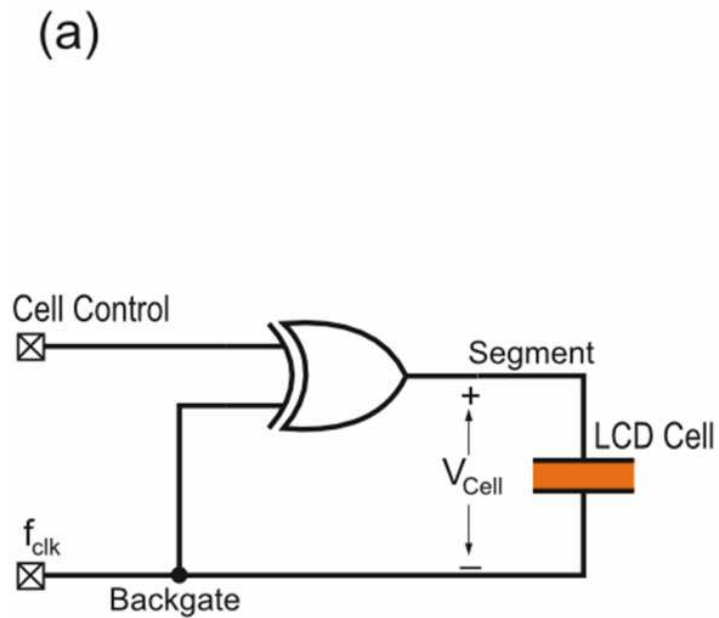


Struktura LCD-a



Drajversko kolo

- Problem sa DC naponom i rešenje:



Načini upravljanja LCDo

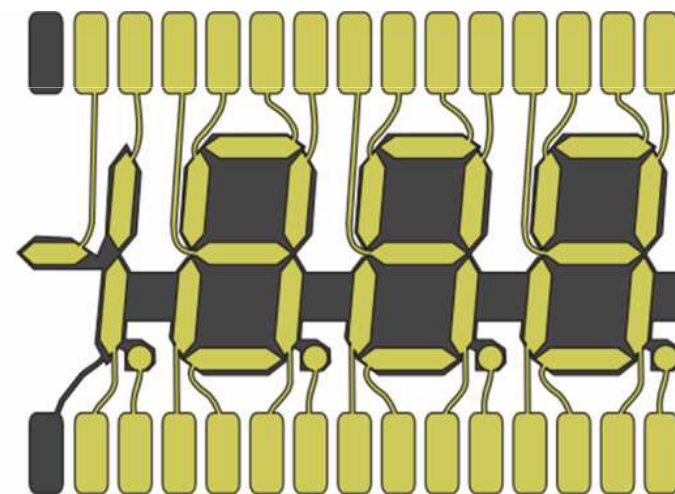
- Direktno
- Multipleksirano
- Aktivnom matricom

Direktno

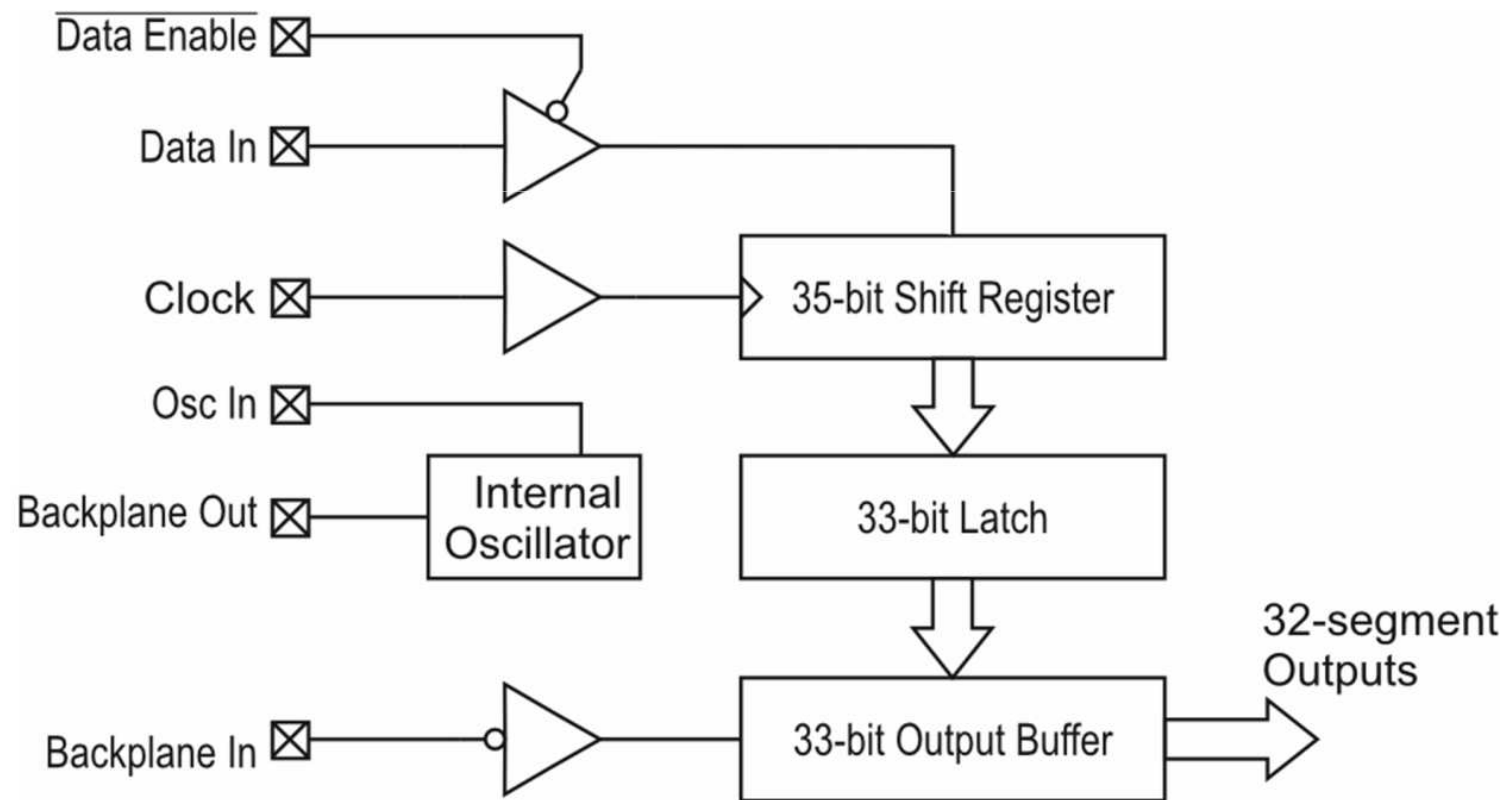
(a)



(b)



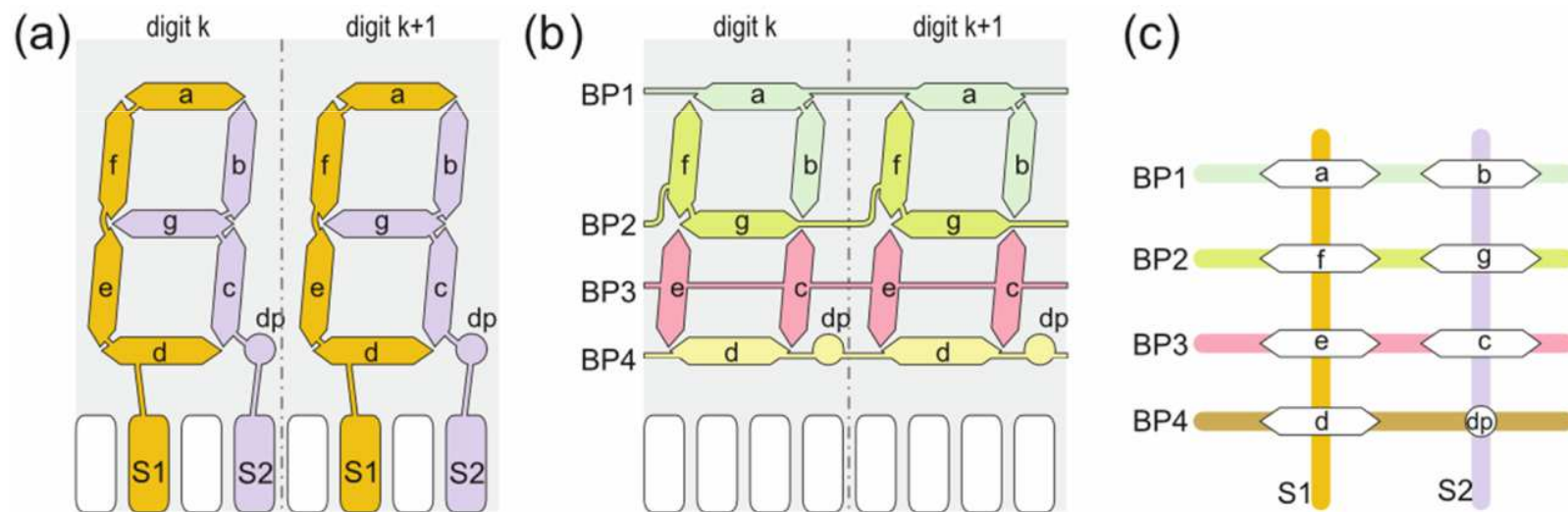
Blok diagram MM5452 direktnog drajvera



Multipleksno

- Matrična struktura (segmenti-kolone, pozadina(BPx)-redovi)
- Nereagovanje na vršnu vrednost ili maksimalnu već na RMS AC vrednost radi kontrole kontrasta
- Uslov za aktivaciju segmenta $|V_{BPi} - V_{Sj}| \geq |V_{Ton}|$
- Uslov za deaktivaciju segmenta $|V_{BPi} - V_{Sj}| \leq |V_{Toff}|$

Matričná struktúra

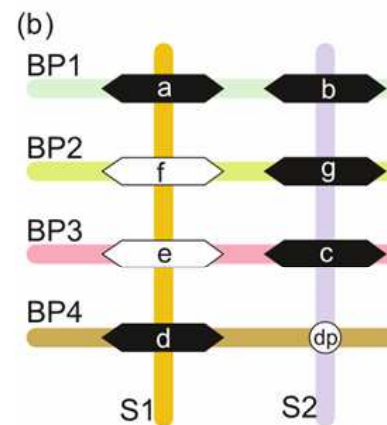
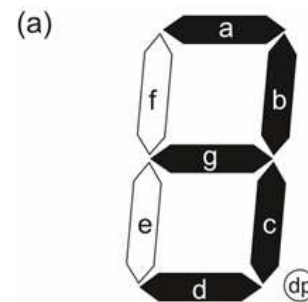


Redukcija broja pinova

- Za npr. 3.5 cifarni LCD je potrebno 11 umesto 28 pinova koliko je potrebno za direktno upravljanje

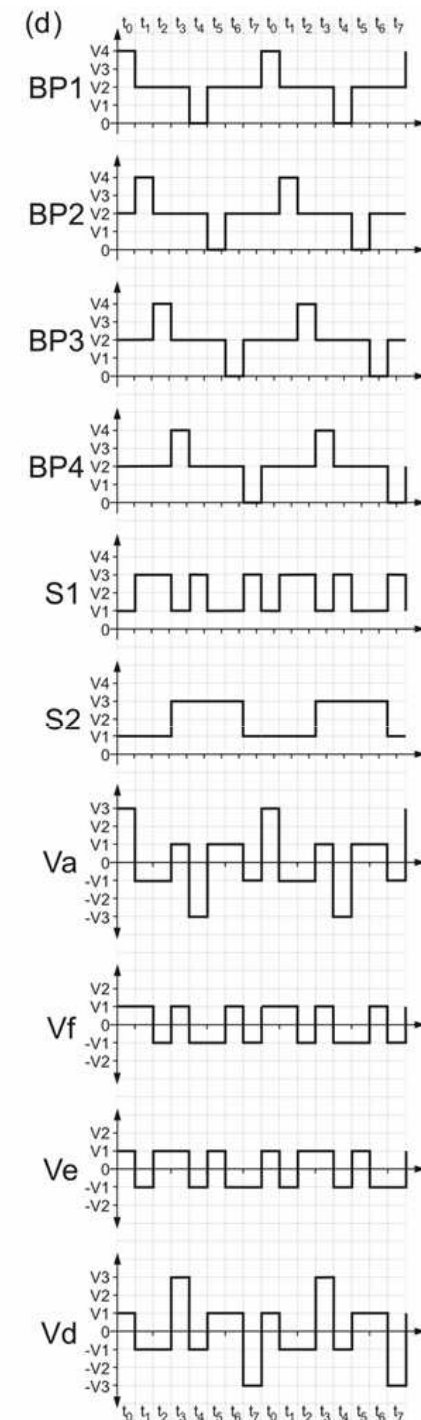
Dodatna objašnjenja:

- 4 naponska nivoa BP_a
- 2 impulsa (prvo +, pa -)
- Konačni napon segmenta se dobija kao razlika BP i S
- Frejm traje 2x4=8
- 1 znači max, 0 znači min, - znači neki analogni napon

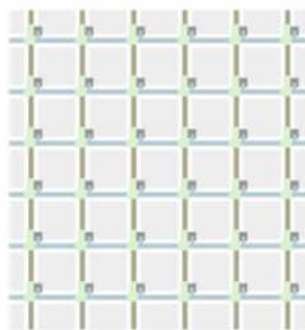


(c)

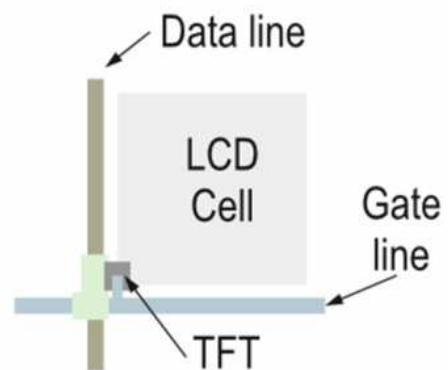
	t_0	t_1	t_2	t_3	t_4	t_5	t_6	t_7
BP1	1	-	-	-	0	-	-	-
BP2	-	1	-	-	-	0	-	-
BP3	-	-	1	-	-	-	0	-
BP4	-	-	-	1	-	-	-	0
S1	0	1	1	0	1	0	0	1
S2	0	0	0	1	1	1	1	0



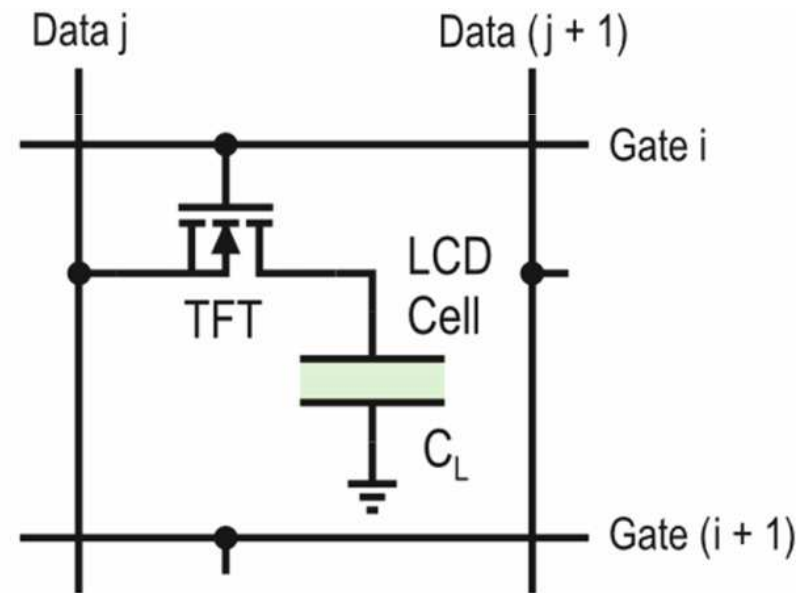
Aktivna matrica



(a)

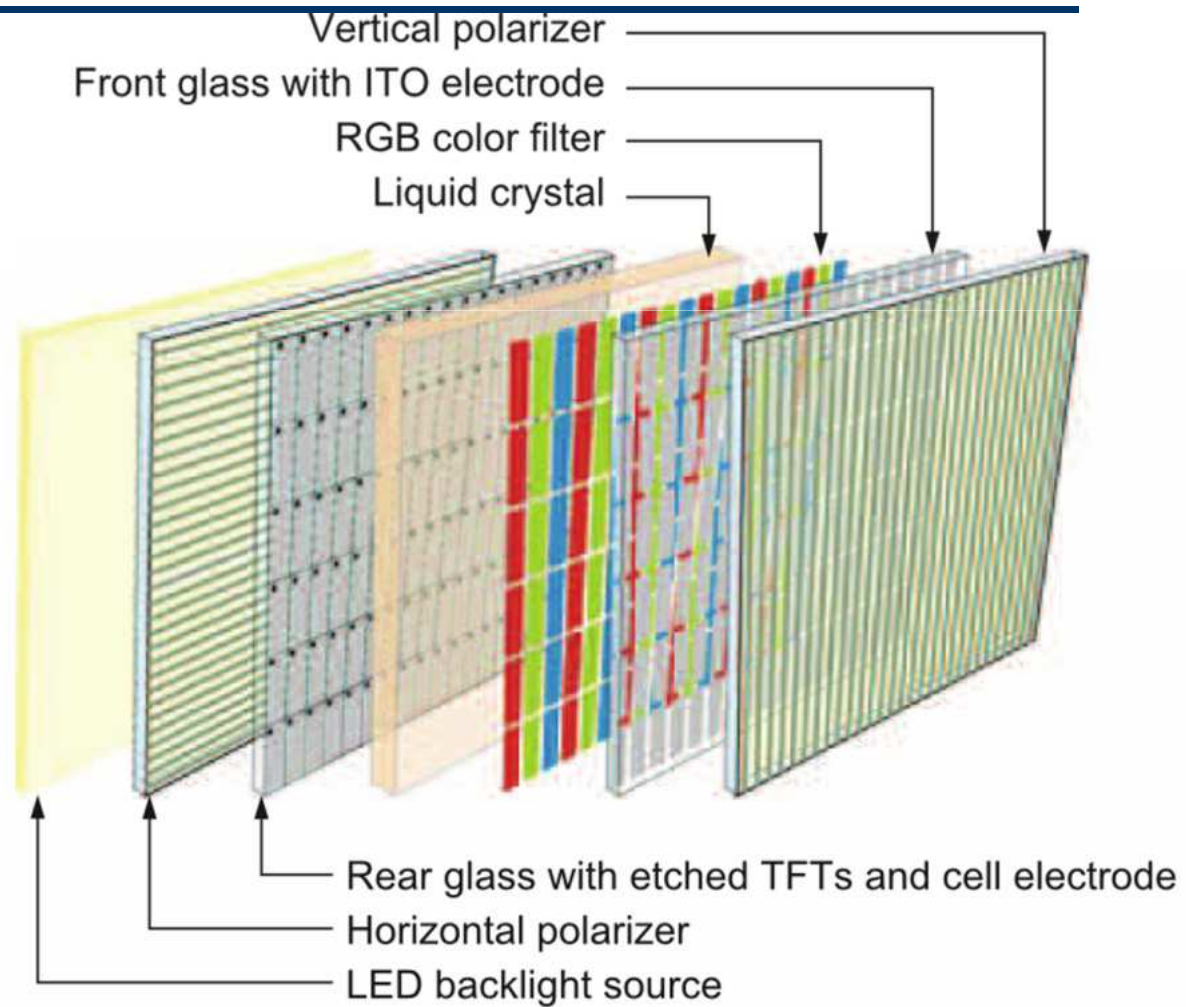


(b)



(c)

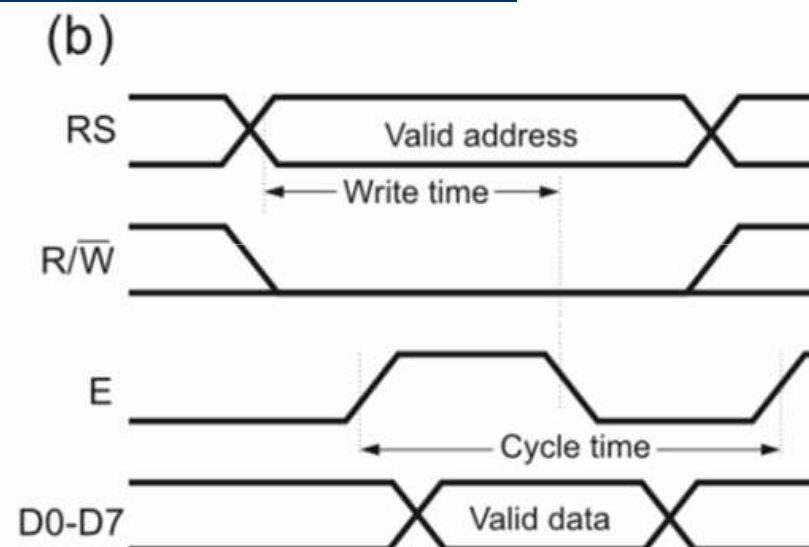
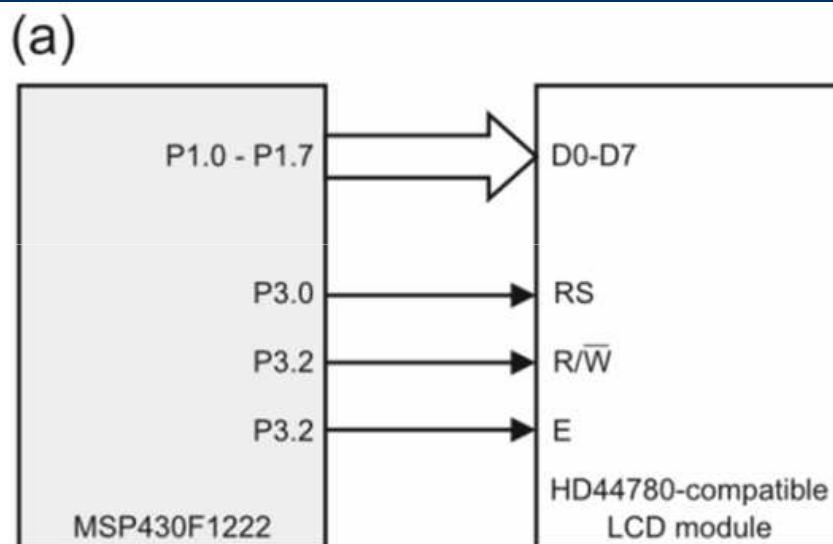
TFT LCD



2x16 alfanumerički LCD (Hitachi HD44780U)



Povezivanje LCDA preko portova mikrokontrolera – paralelno



Signal	Type	Description
<i>RS</i>	Control	Command/Data: '0' = Command, '1' = Data
<i>R/W</i>	Control	Read/Write line: '0' = Write, '1' = Read
<i>E</i>	Control	Enable strobe
<i>D0 – D7</i>	Data	Bidirectional data lines

Primer inicijalizacione sekvence

1. A warm-up delay of 40 ms or more after power-up.
2. Specify whether an 8-bit (default) or 4-bit protocol will be used.
3. Another delay, this time of at least 4.1 ms.
4. Resend the command in line 2 two more times.
5. A function set command specifying the number of lines and character set.
6. Three commands in sequence, issuing a display off, a clear, and set entry mode.

Serijsko povezivanje LCDova

- UART
- SPI
- I2C