

Fizičko projektovanje

Sadržaj:

1. Osnovni CMOS proces
2. Pravila projektovanja
- 3. Potpuno projektovanje po narudžbini**
4. Delimično projektovanje po narudžbini

3. Potpuno projektovanje po narudžbini

Sadržaj:

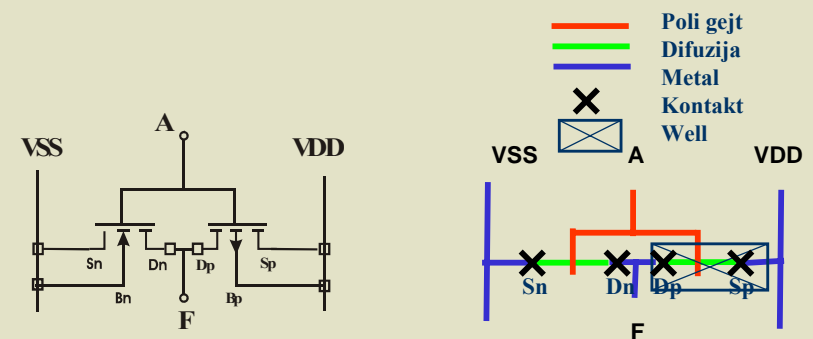
- 3.1 Ocena uspešnosti projekta
- 3.2 Projektovanje statičkih logičkih kola
- 3.3 Simboličko projektovanje**
- 3.4 Projektovanje veza
- 3.5 Uzroci otkaza

3.3 Simboličko projektovanje

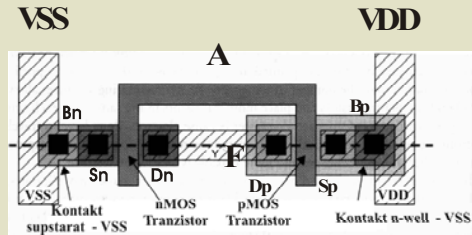
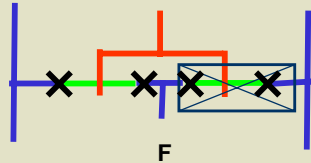
Kako najlakše iz električne šeme preći na lejaut?

- Električna šema već sadrži
 - tranzistore
 - veze
- Tranzistor zameniti simbolom u kome figurišu elementi sadržani u lejautu (difuzija, gejt, metali, orijentacija,...)
 - Stick dijagram

3.3 Simboličko projektovanje



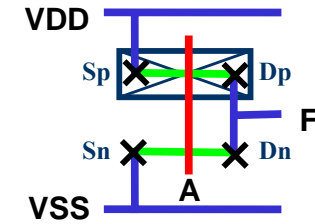
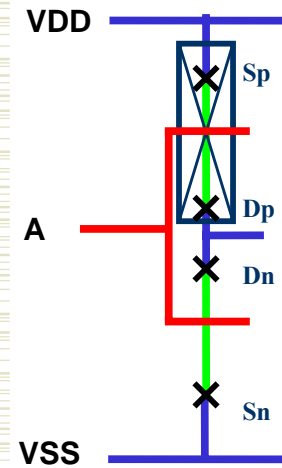
3.3 Simboličko projektovanje



LEDA - Laboratory for Electronic Design Automation
<http://leda.elfak.ni.ac.yu/>



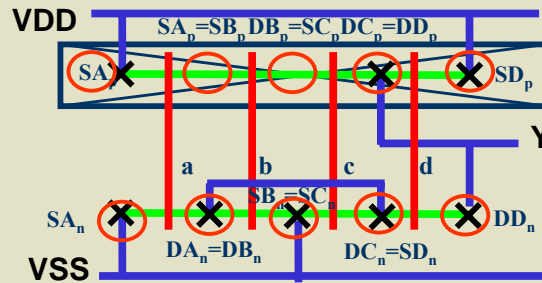
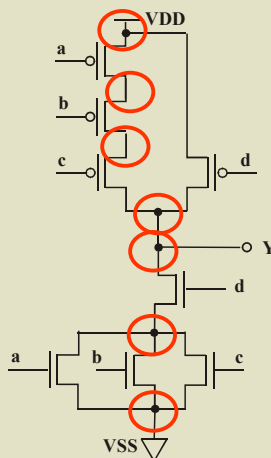
3.3 Simboličko projektovanje



LEDA - Laboratory for Electronic Design Automation
<http://leda.elfak.ni.ac.yu/>



3.3 Simboličko projektovanje

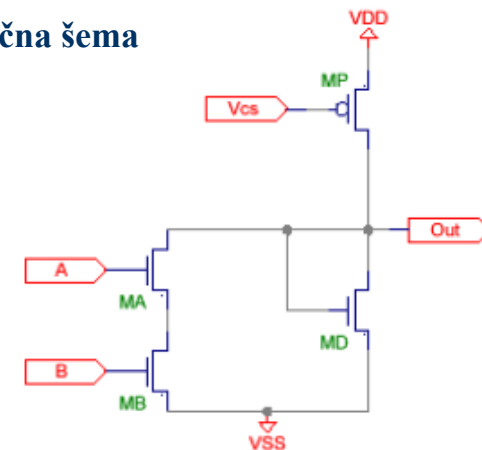


LEDA - Laboratory for Electronic Design Automation
<http://leda.elfak.ni.ac.yu/>



3.3 Simboličko projektovanje

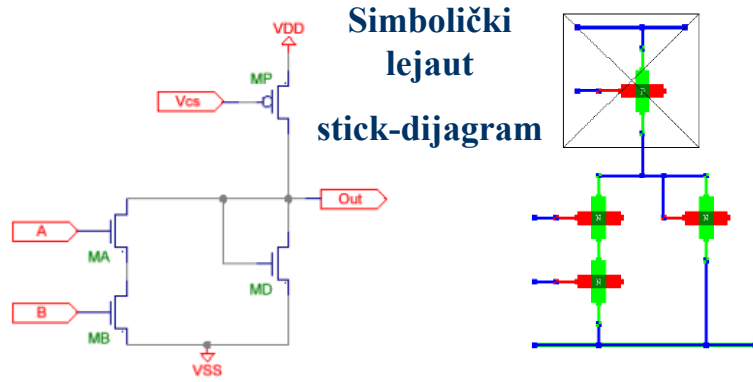
Električna šema



LEDA - Laboratory for Electronic Design Automation
<http://leda.elfak.ni.ac.yu/>



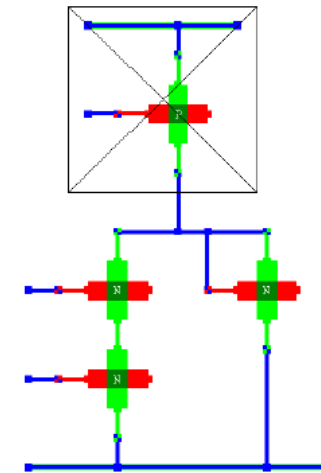
3.3 Simboličko projektovanje



LEDA - Laboratory for Electronic Design Automation
<http://leda.elfak.ni.ac.yu/>



3.3 Simboličko projektovanje

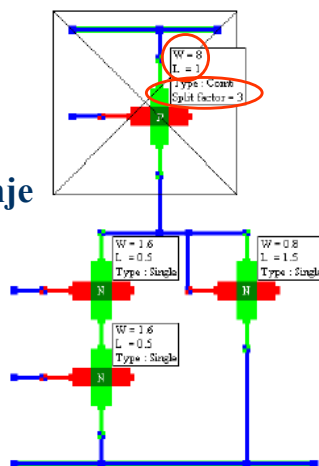


LEDA - Laboratory for Electronic Design Automation
<http://leda.elfak.ni.ac.yu/>



3.3 Simboličko projektovanje

Dimenzionisanje tranzistora

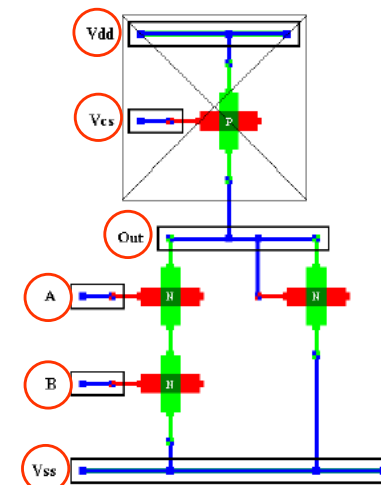


LEDA - Laboratory for Electronic Design Automation
<http://leda.elfak.ni.ac.yu/>



3.3 Simboličko projektovanje

Definisanje čvorova

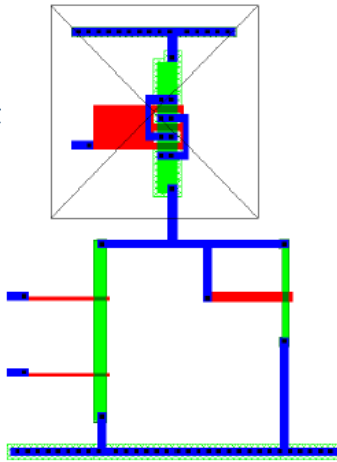


LEDA - Laboratory for Electronic Design Automation
<http://leda.elfak.ni.ac.yu/>



3.3 Simboličko projektovanje

Prelazak na fizički ležaut



LEDA - Labr
<http://leda.elfak.ni.ac.yu/>



3.3 Simboličko projektovanje

Kompakcija po širini

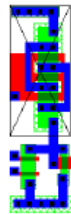


LEDA - Laboratory for Electronic I
<http://leda.elfak.ni.ac.yu/>



3.3 Simboličko projektovanje

Kompakcija po visini

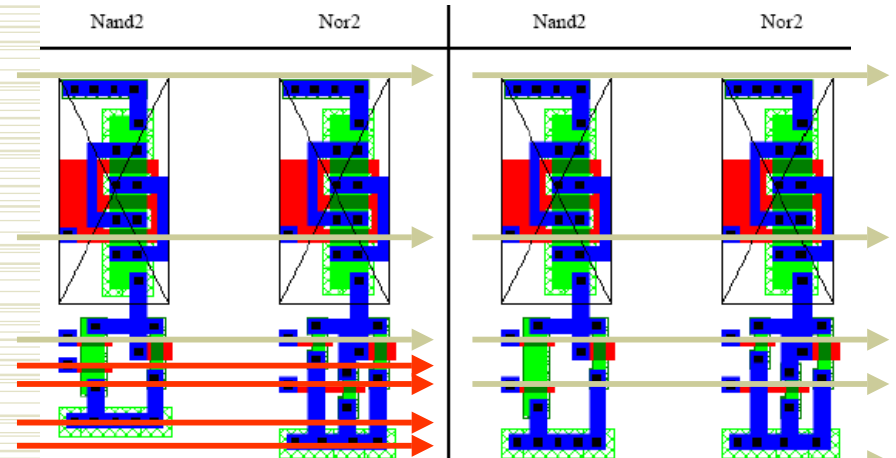


LEDA - Laboratory for Electronic Design Automation
<http://leda.elfak.ni.ac.yu/>



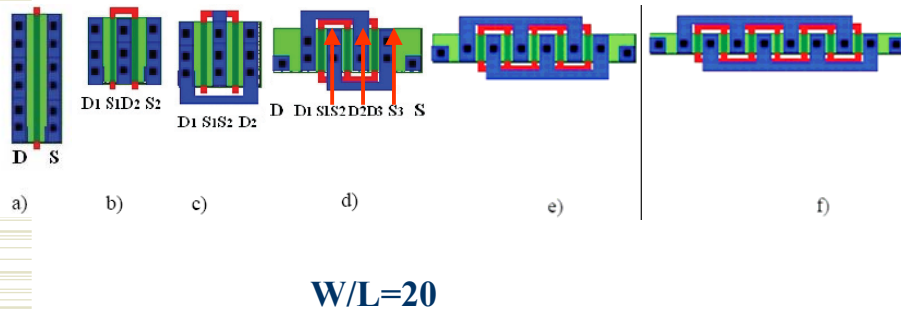
3.3 Simboličko projektovanje

Standardizovanje dimenzija ćelija



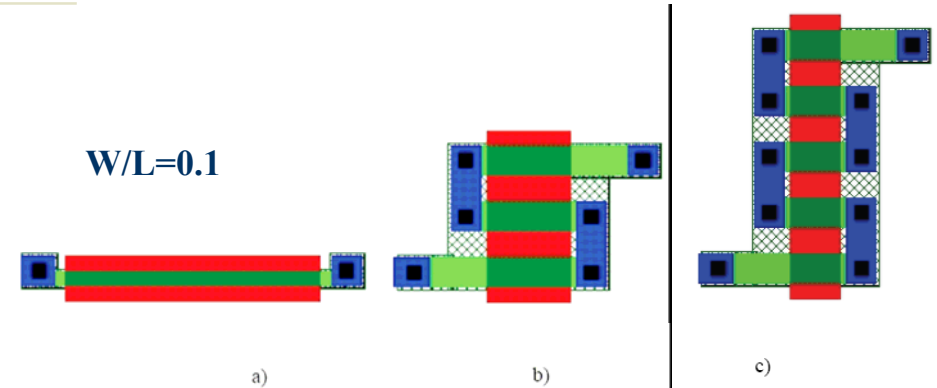
3.3 Simboličko projektovanje

Realizacija širokih tranzistora $W \gg L$



3.3 Simboličko projektovanje

Realizacija dugih tranzistora $L \gg W$ ($W/L=0.1$)



3.3 Simboličko projektovanje

Kako proceniti dimenzije ćelija pre nego što se nacрта kompletan ležaut?

Treba se podsetiti pravila projektovanja:

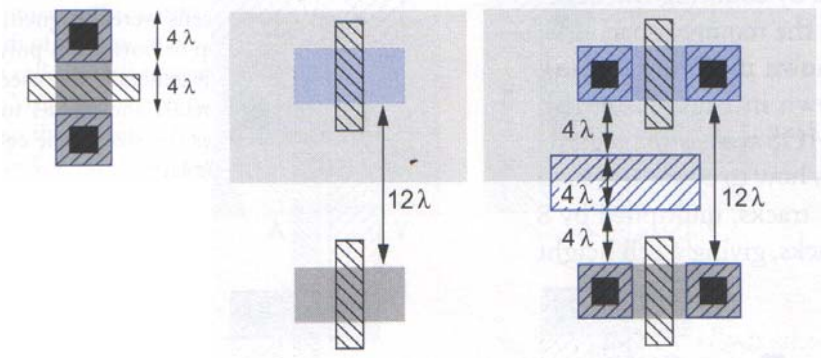
Miminalna širina metala i razmak između je po 4λ

Isto važi za difuziju



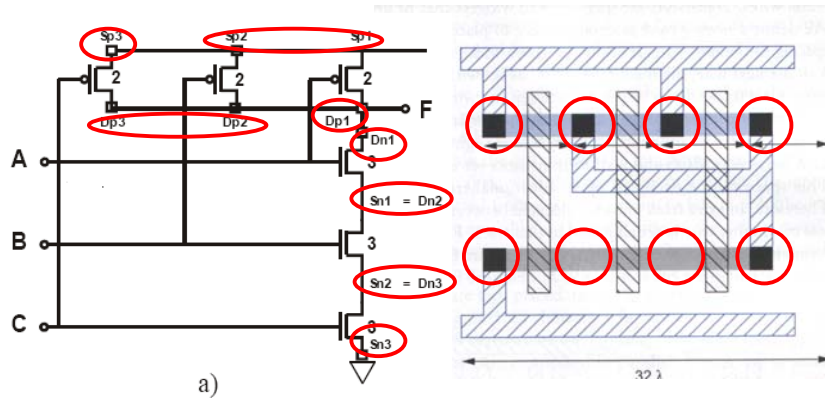
3.3 Simboličko projektovanje

Tranzistor minimalno zauzima



3.3 Simboličko projektovanje

NAND3



LEDA - Laboratory for Electronic Design Automation
<http://leda.elfak.ni.ac.yu/>



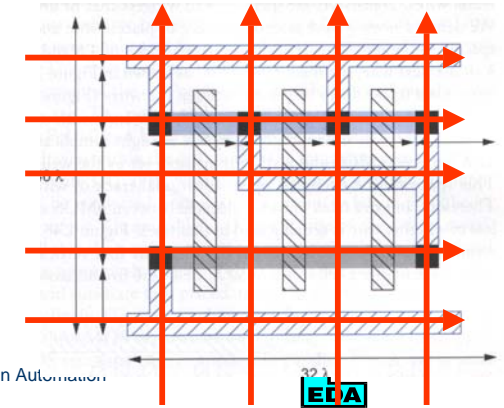
3.3 Simboličko projektovanje

Dovoljno je uočiti broj metalnih traka i/ili traka difuzije i pomnožiti ih sa 8λ

NAND3

visina $5 \times 8 = 40\lambda$

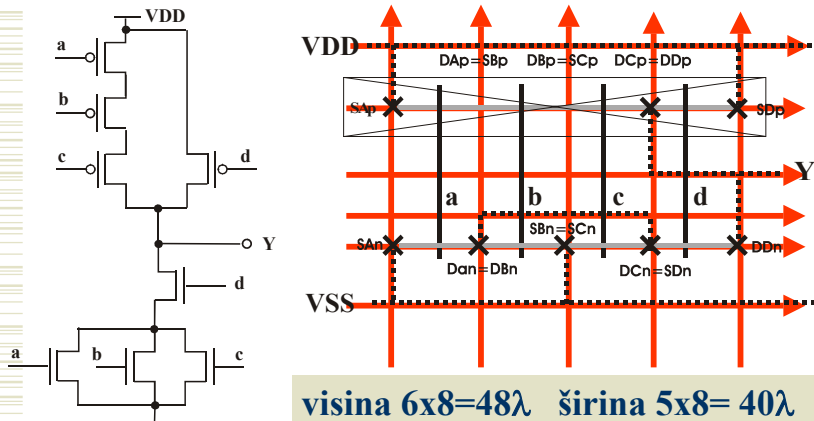
širina $4 \times 8 = 32\lambda$



LEDA - Laboratory for Electronic Design Automation
<http://leda.elfak.ni.ac.yu/>



3.3 Simboličko projektovanje



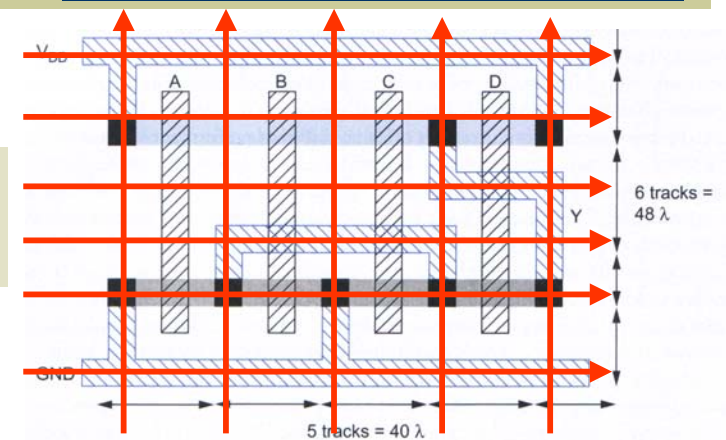
LEDA - Laboratory for Electronic Design Automation
<http://leda.elfak.ni.ac.yu/>



3.3 Simboličko projektovanje

visina
 $6 \times 8 =$
 $= 48\lambda$

širina $5 \times 8 = 40\lambda$



LEDA - Laboratory for Electronic Design Automation
<http://leda.elfak.ni.ac.yu/>



3.3 Simboličko projektovanje

Završna faza generisanja ćelija jeste eksportovanje u CIF (ili GDSII) format

Ove formate prepoznaju standardni editori lejaute

(**IC Station** iz Mentor Graphics alata i

Virtuoso iz Cadence alata)