

INDUSTRIJSKA ELEKTRONIKA

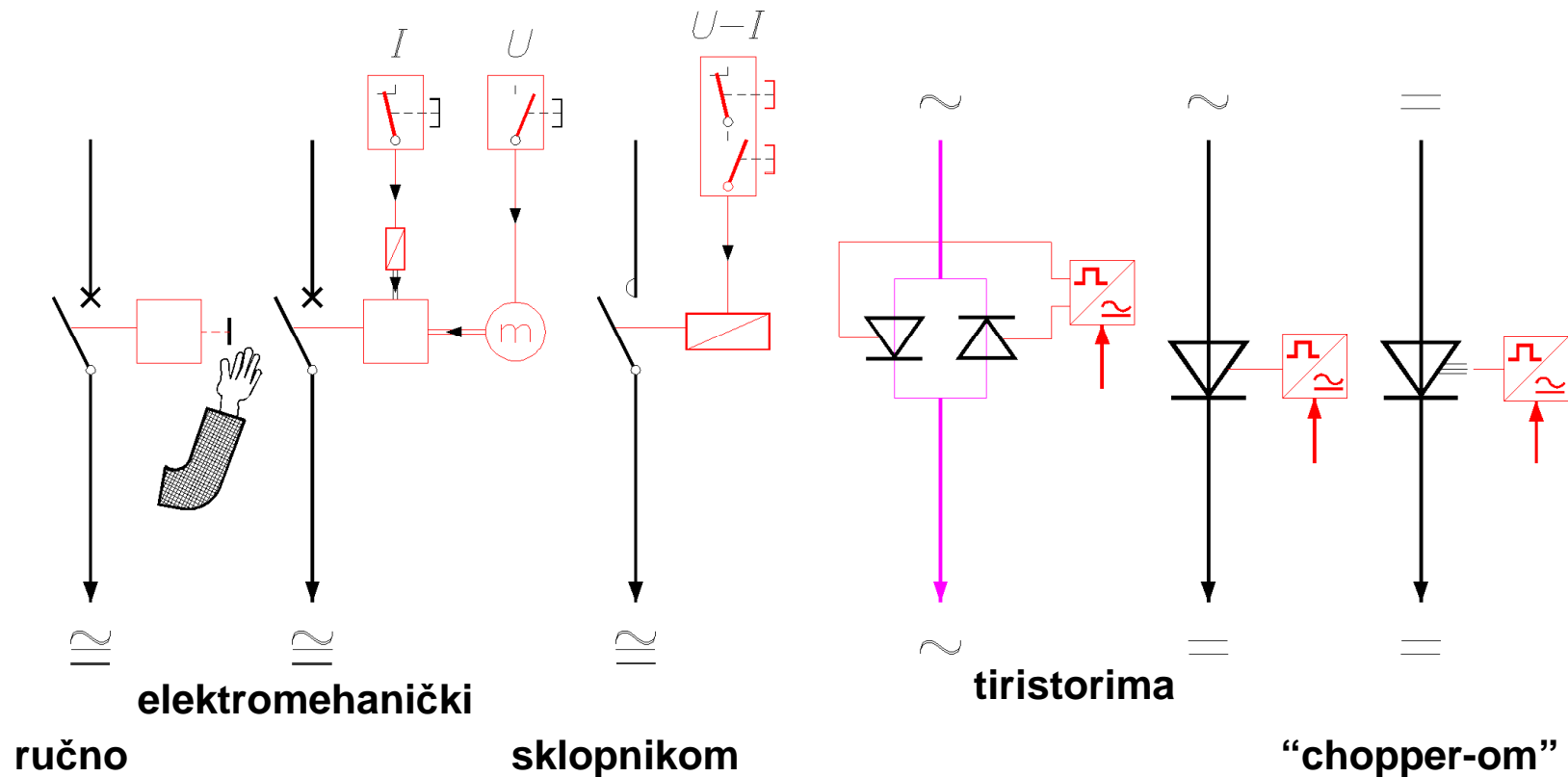
obuhvaća elektroničku tehnologiju za automatizaciju tehnoloških procesa

MEHANIZACIJA, UPRAVLJANJE, REGULACIJA, AUTOMATIZACIJA

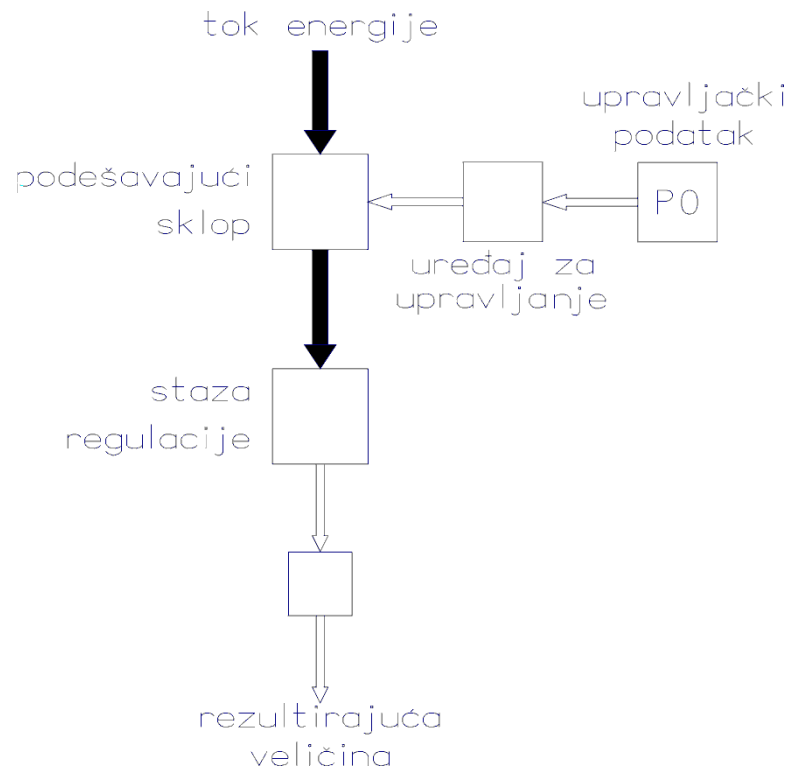
Mehanizacija - preduvjet upravljanja procesima

Upravljanje - ne postoji povratna veza (utjecaj rezultata upavljanja na upravljanje procesom)

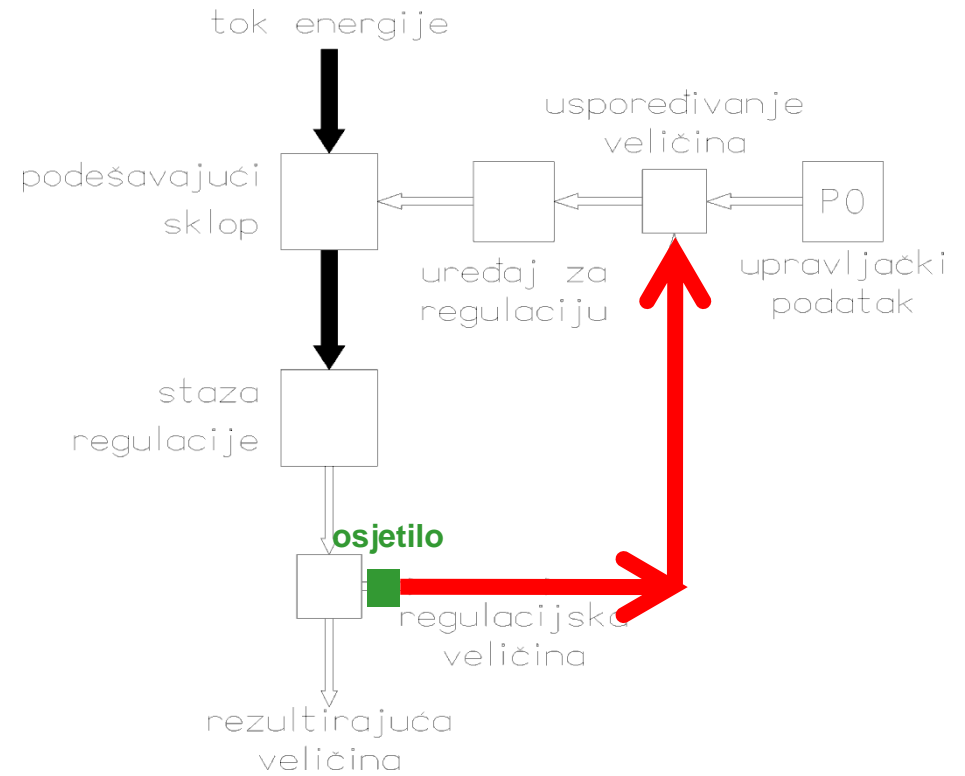
upravljanje tokom energije



upravljanje

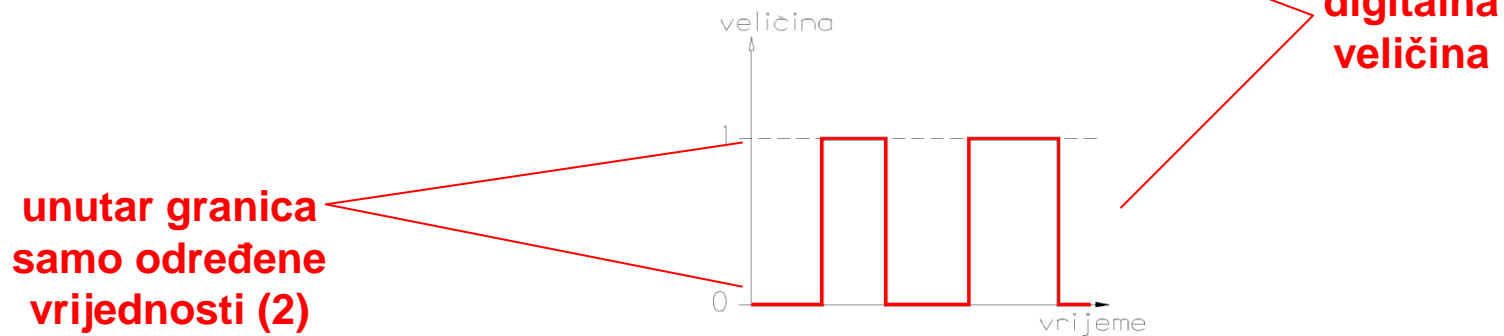
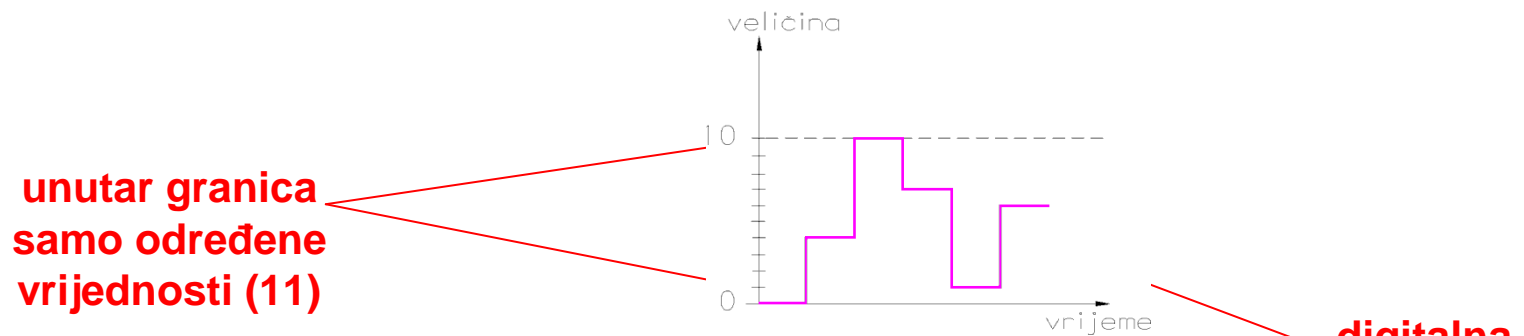
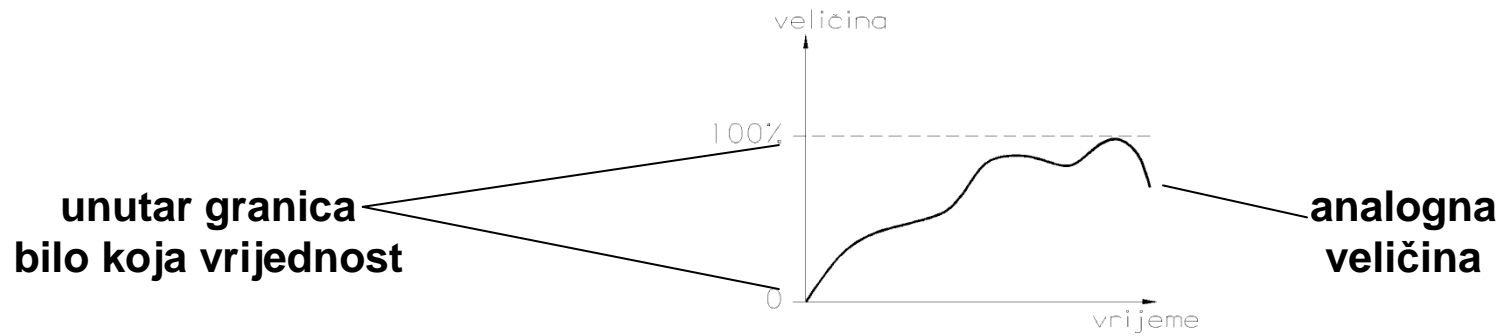


regulacija



POJMOVI ELEKTRONIČKOG UPRAVLJANJA, REGULACIJE I AUTOMATIZACIJE

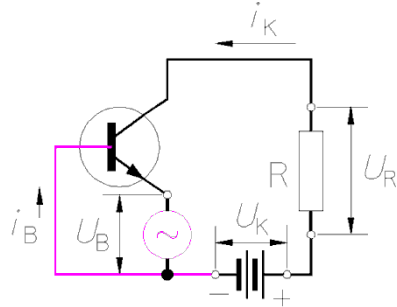
Anlogne i digitalne veličine



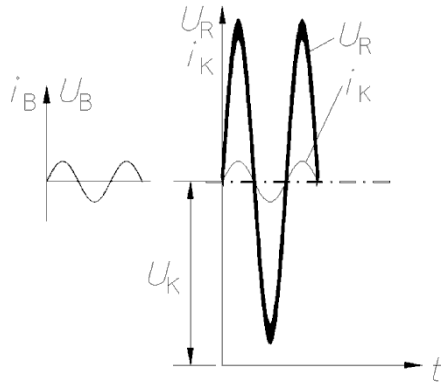
Pojačanje signala

Pojačala

napona



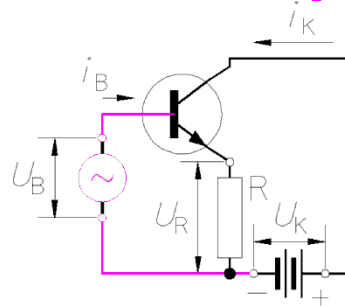
zajednička baza



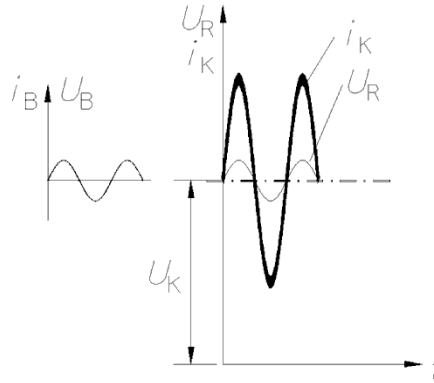
$$\frac{i_K}{i_B} \approx 1 \quad \frac{U_R}{U_B} \geq 400$$

što veći otpori

struje



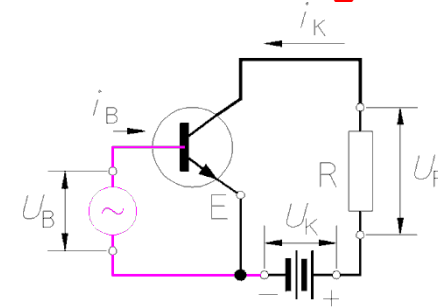
zajednički kolektor



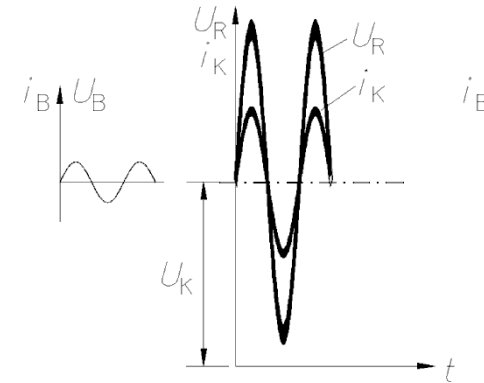
$$\frac{i_K}{i_B} \geq 35 \quad \frac{U_R}{U_B} \approx 1$$

što manji otpori

snage



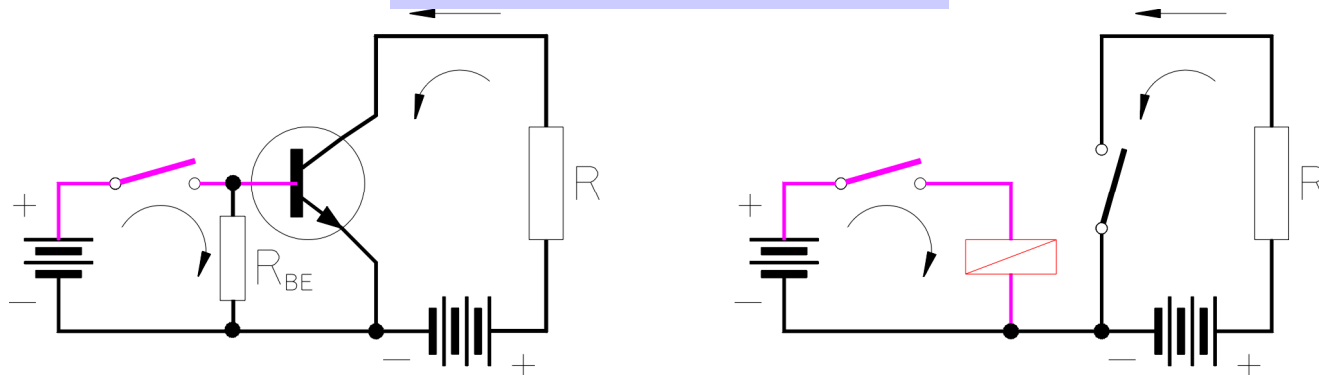
zajednički emiter



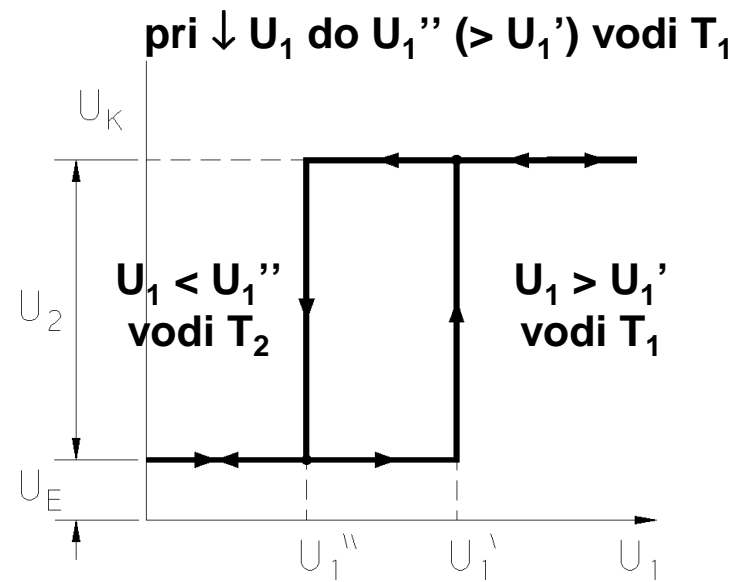
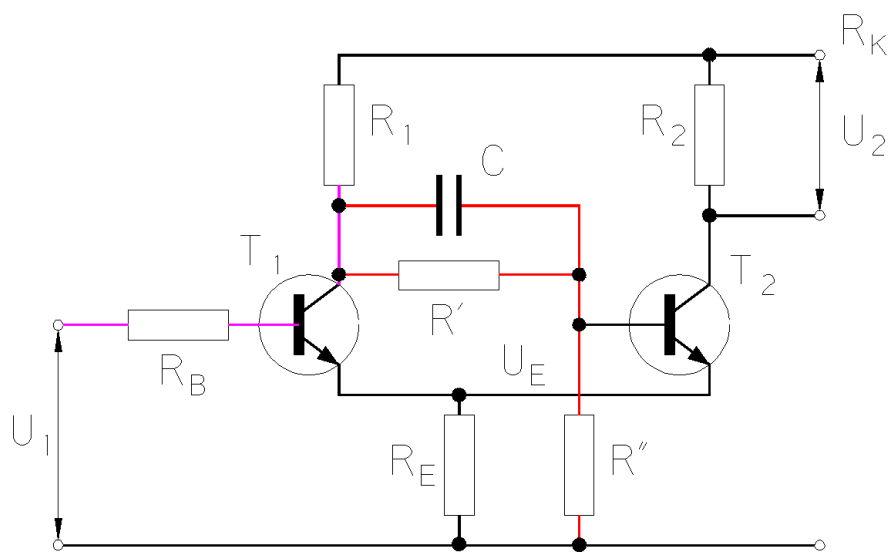
$$\frac{i_K}{i_B} \geq 35 \quad \frac{U_R}{U_B} \geq 300$$

otpori usklađeni za prijenos max. snage

Tranzistor kao sklopka



Tranzistorski okidački sklop



pri $\uparrow U_1$ do $U_1'' (< U_1')$ vodi T_2

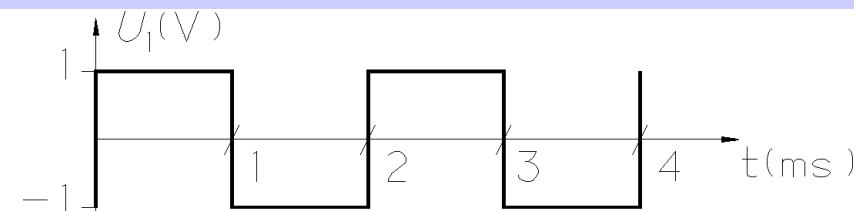
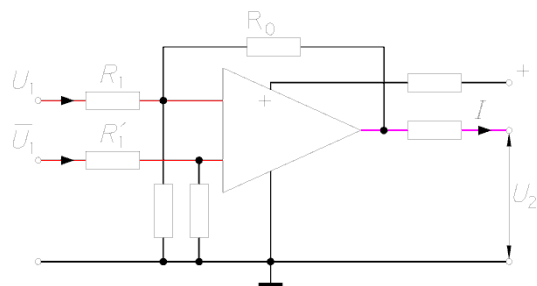
pri $\downarrow U_1$ do $U_1'' (> U_1')$ vodi T_1

generiranje jednoznačnih signala 0 i 1

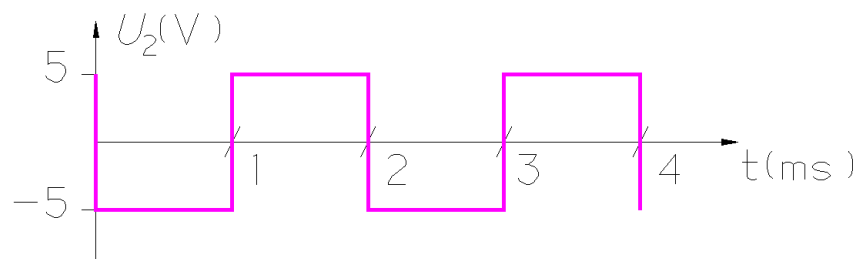
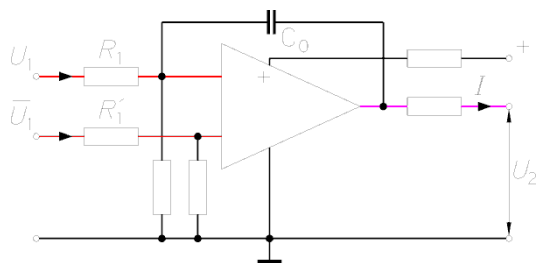
Operacijska pojačala

Oblikovanje signala operacijskim pojačalima

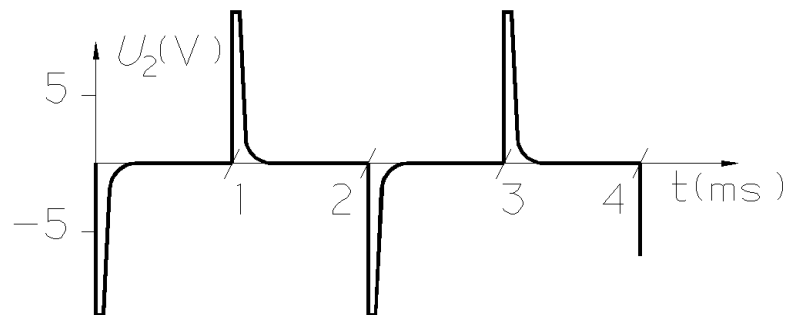
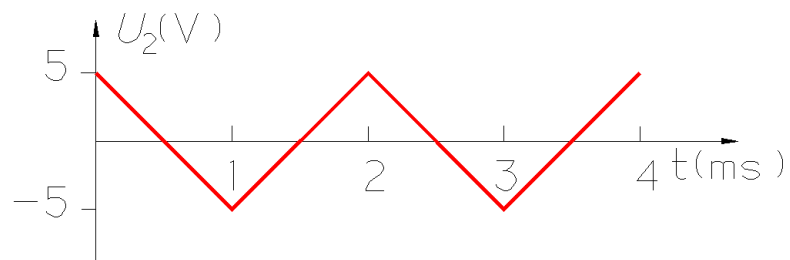
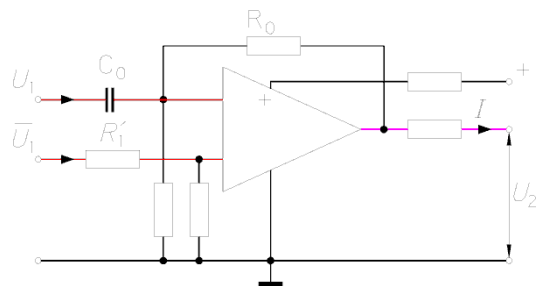
invertiranje



integriranje

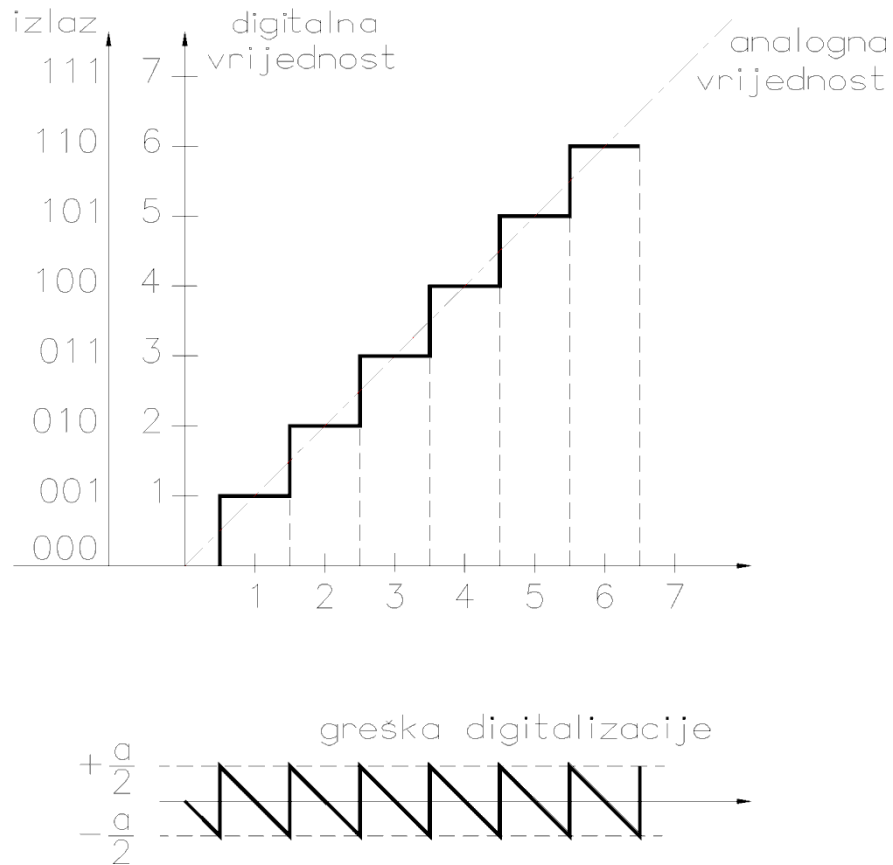


deriviranje

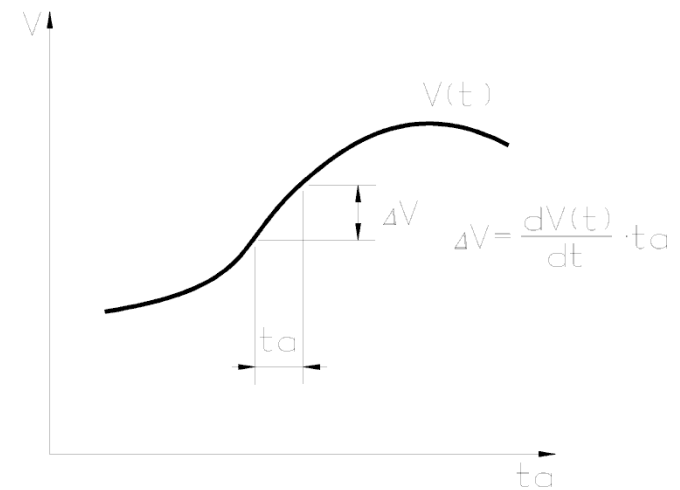


Digitaliziranje analogne veličine

kodirana, digitalna i analogna vrijednost

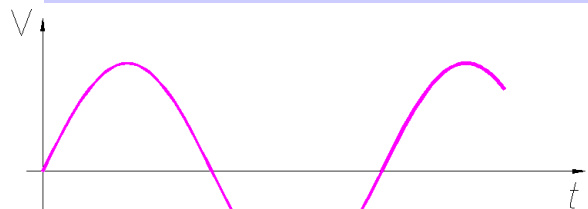


utjecaj vremena uzorkovanja (t_a) na preciznost digitalizacija (ΔV)

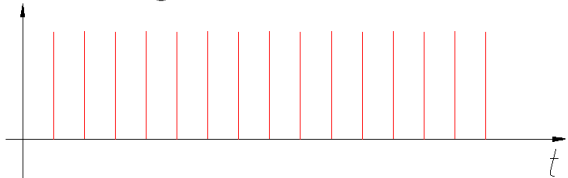


**pogreška se smanjuje smanjenjem "a"
(finijom podjelom - većim brojem znamenaka)**

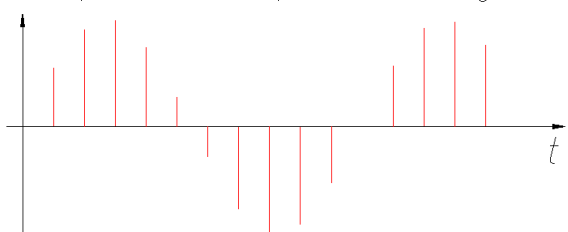
Digitaliziranje sinusne veličine



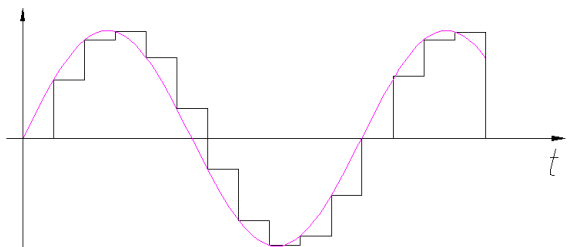
analogna veličina "a"



impulsi za preuzimanje "a"

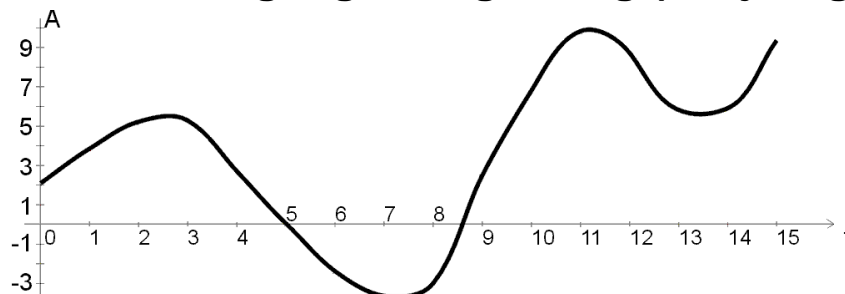


impulsi modulirani sa "a" vrijednošću

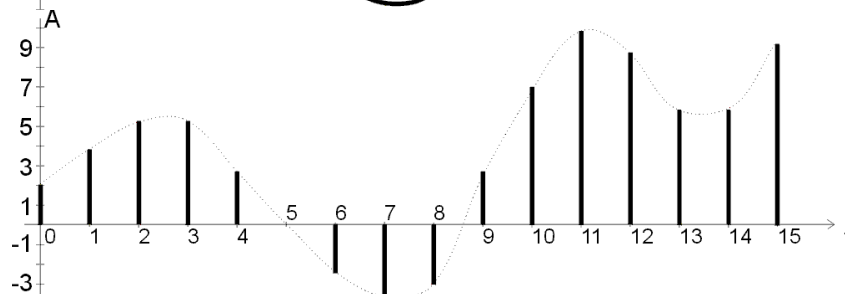


stepenovana analogna veličina za kodiranje

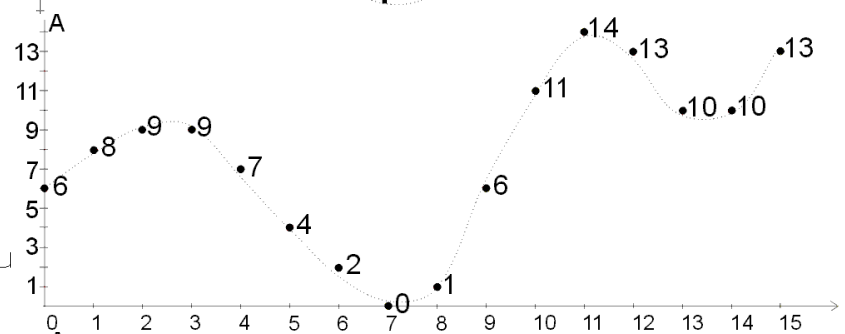
od analognog do digitalnog (serijskog) signala



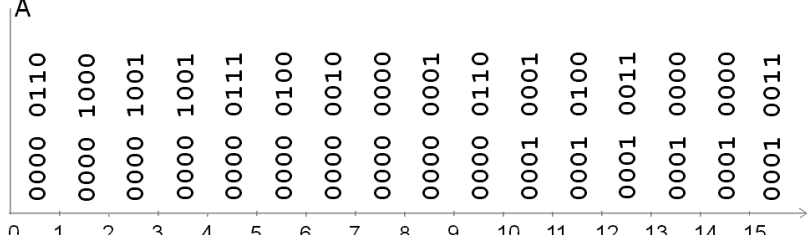
analogni signal



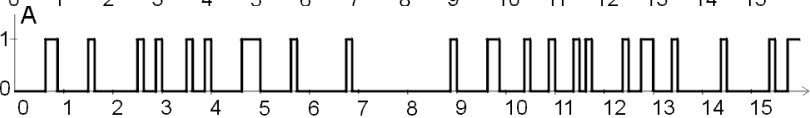
uzorkovani signal



kvantizirani signal

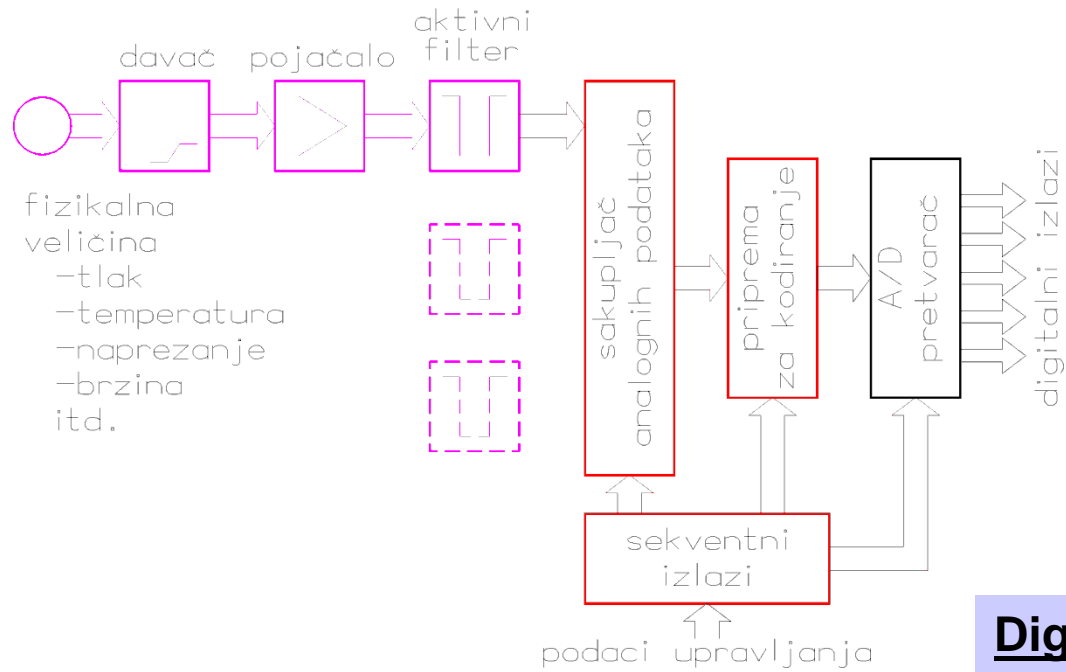


kodirani signal

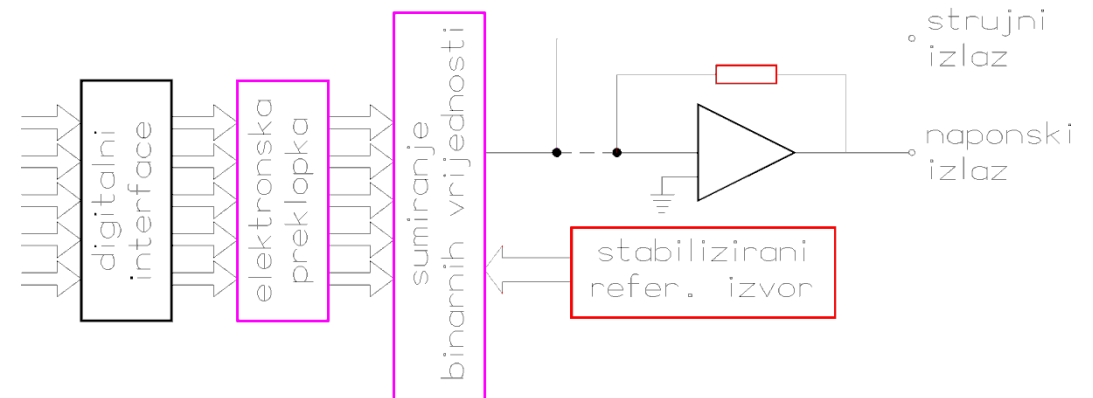


digitalni signal

Analogno - digitalni (AD) pretvornici

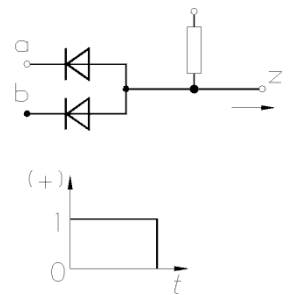
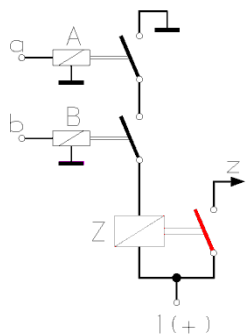


Digitalo - analogni (DA) pretvornici



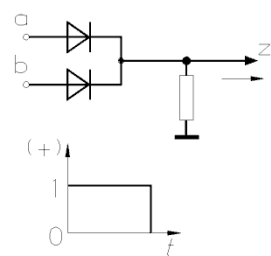
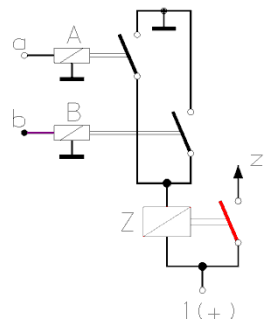
LOGIČKA OBRADA PODATAKA

Osnovne logičke jedinice



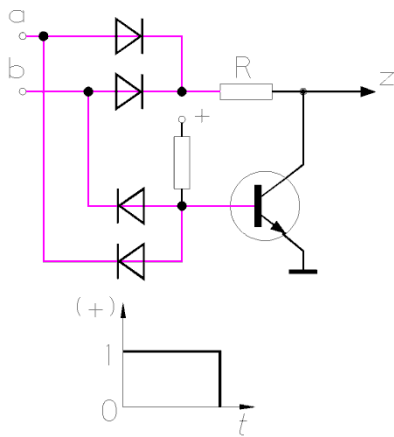
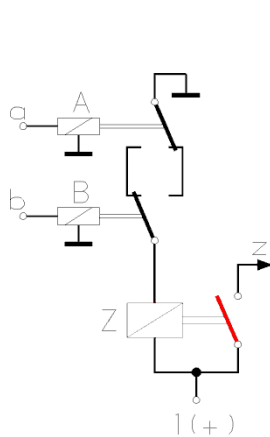
a	b	z
0	0	0
1	0	0
0	1	0
1	1	1

oznaka: "1" (AND)
 $z = a \cdot b$



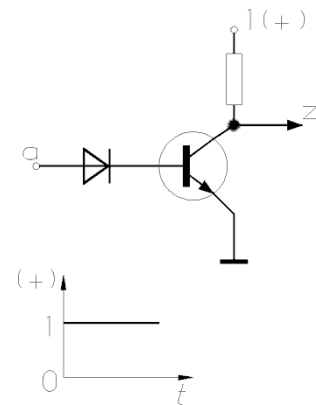
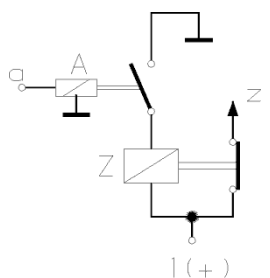
a	b	z
0	0	0
1	0	1
0	1	1
1	1	1

oznaka: "1|1" (OR)
 $z = a + b$



a	b	z
0	0	0
0	1	1
1	0	1
1	1	0

oznaka: isključivo 1|1
 $z = a\bar{b} + \bar{a}b$

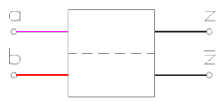


a	z
0	1
1	0

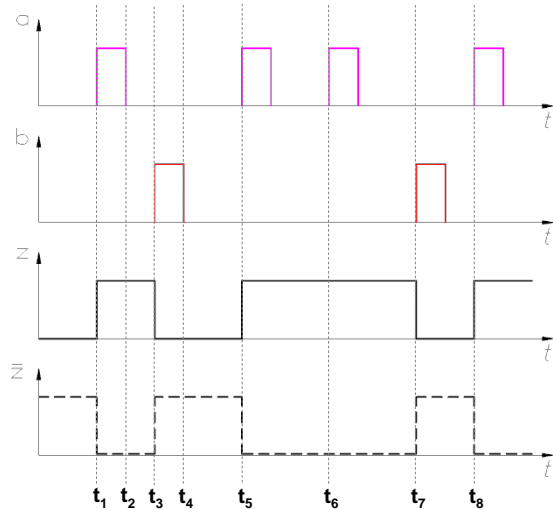
oznaka: "NE" (NO)
 $z = \bar{a}$

Logičke jedinice s memorijom

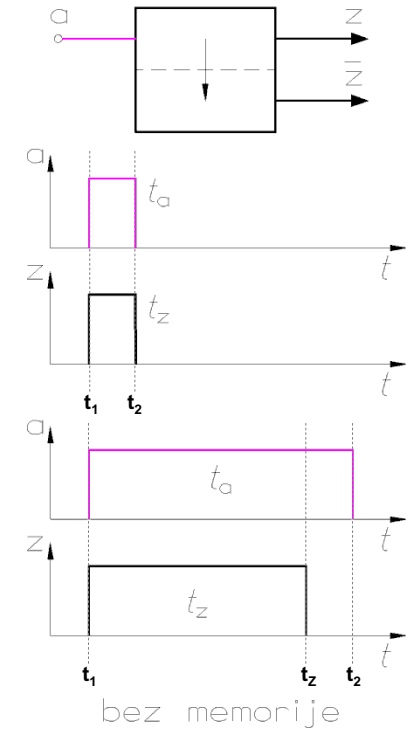
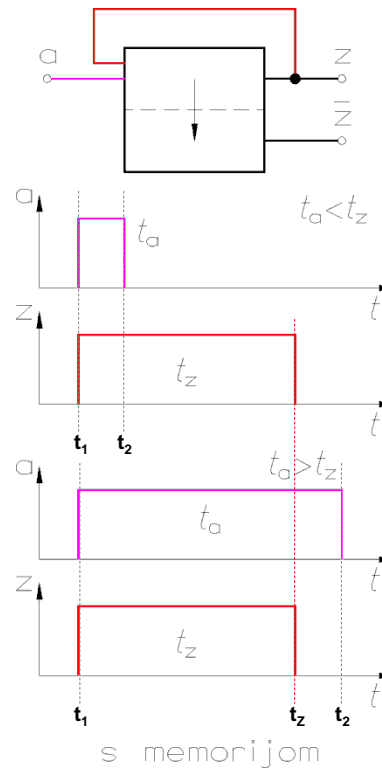
jedinice s pamćenjem



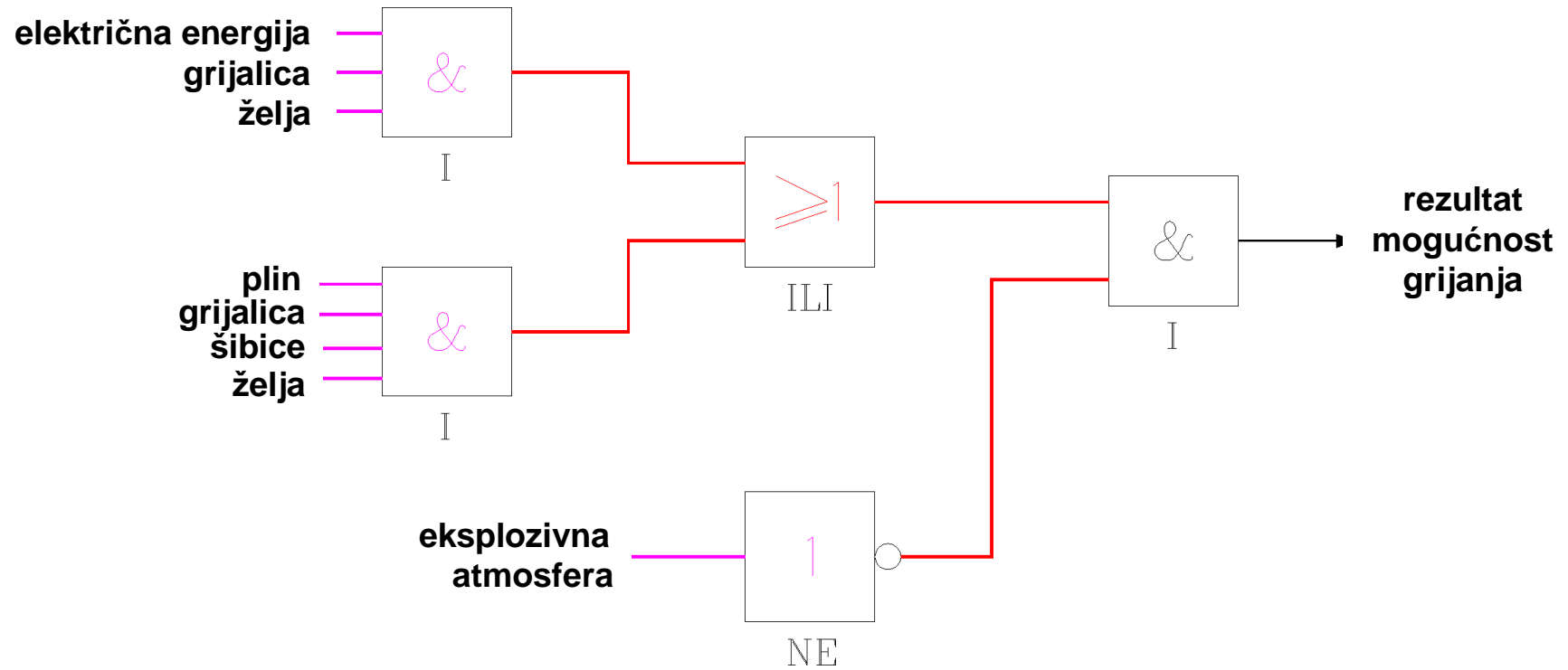
a	b	z	\bar{z}
0	0	0	1
1	0	1	0
0	1	0	1
0	0	0	1



jedinica za prijenos zapamćenog signala



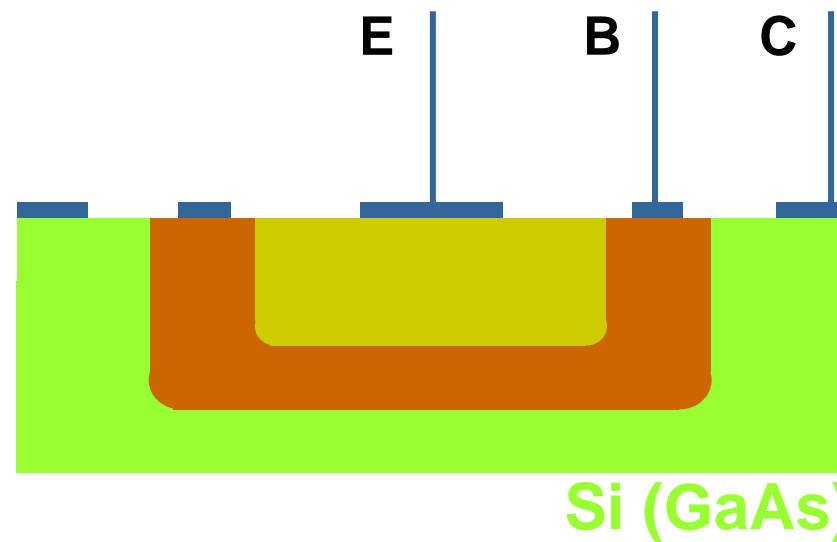
Logička obrada procesa primjenom osnovnih logičkih jedinica



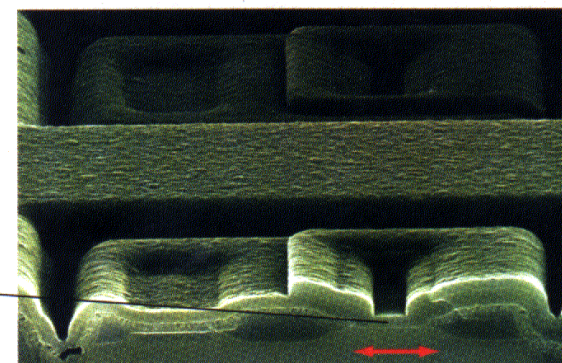
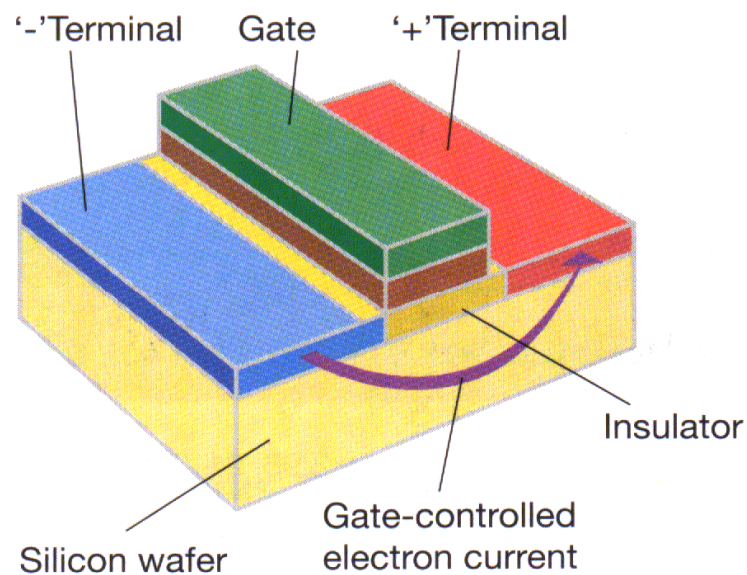
MIKROELEKTRONIKA - INTEGRIRANI LOGIČKI SKLOPOVI

- monolitni
- hibridni

Monolitni

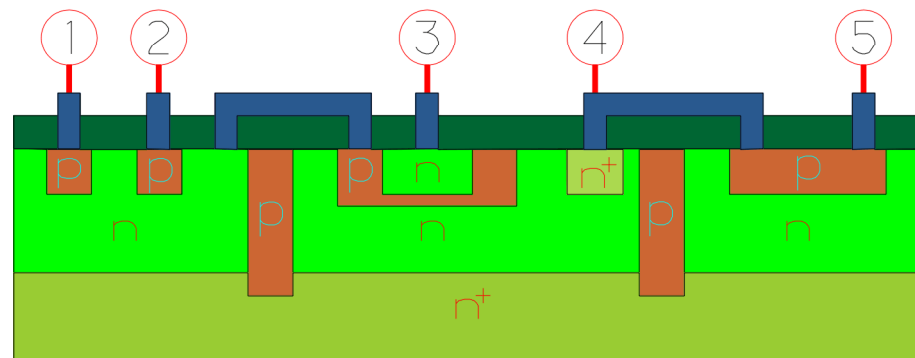
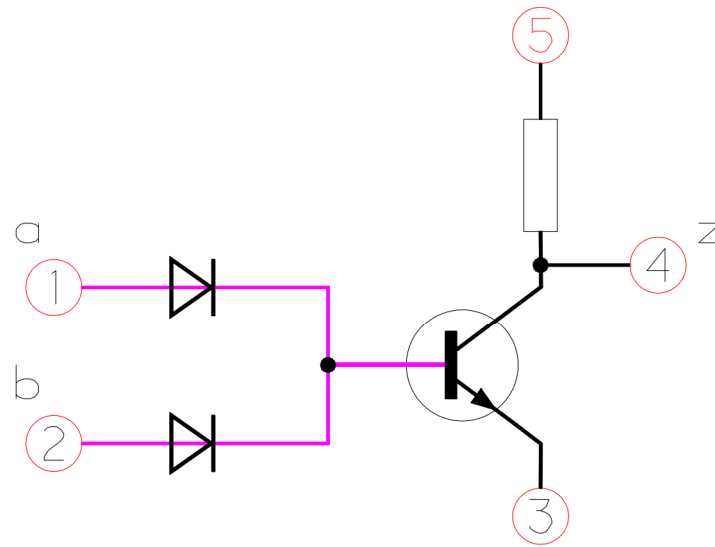


fotolitografski
postupak
kod bipolarne
tehnologije

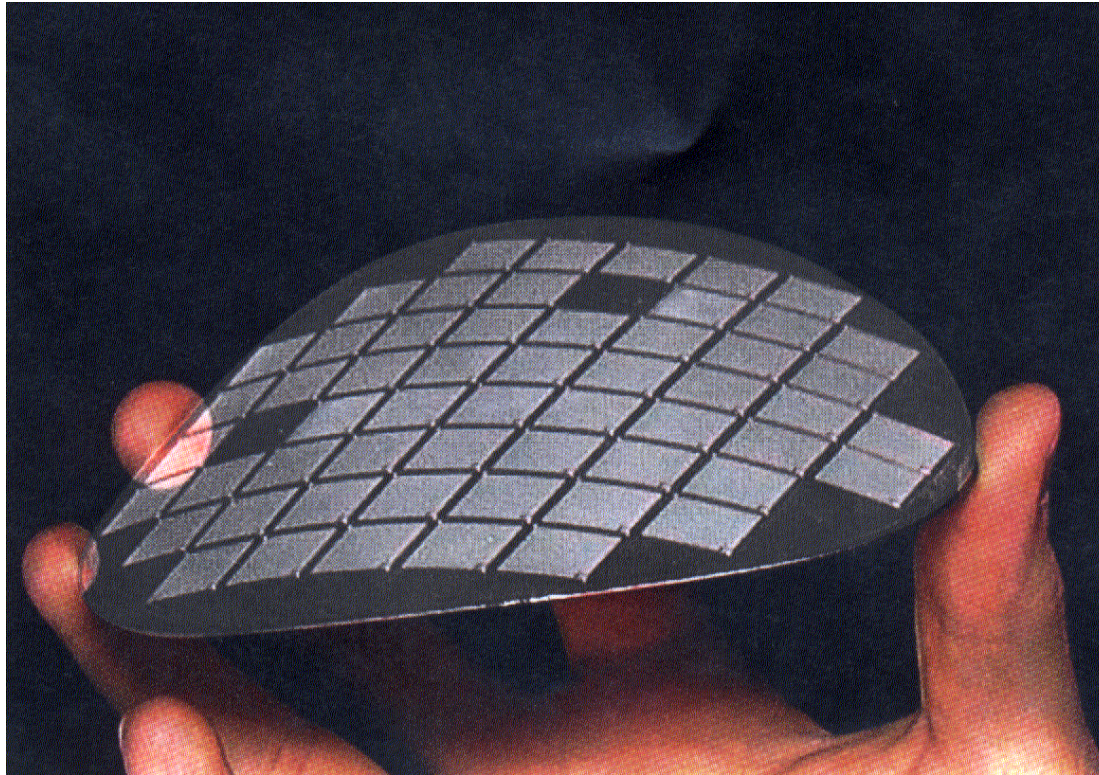


0.25 μm

Izvedba NOR sklopa u bipolarnoj tehnologiji monolitnih integriranih sklopova



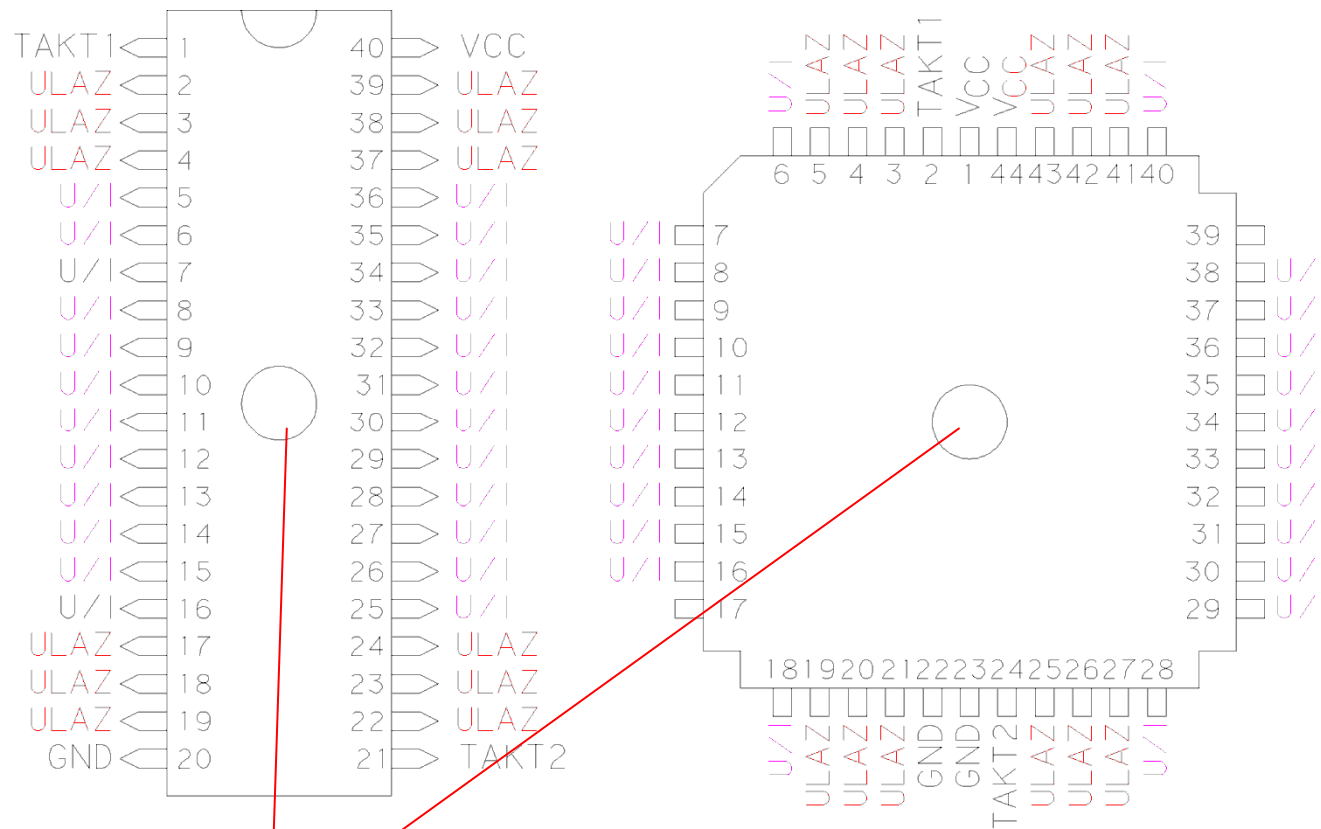
Si wafer debljine 125 μ m na kojem je više od 10.000.000 tranzistora



- danas procesori 0,13 (0,045) -mikronska tehnologija (>77 milijuna tranzistora)
- takt >3 GHz
- optimizacija po potrošnji energije sustavske sabirnice i dijelova superbrze memorije (dijelovi memorije se isključuju kad nisu u uporabi)

Programibilni integrirani sklop

Izvedba i raspored izvoda programabilnih integriranih sklopova

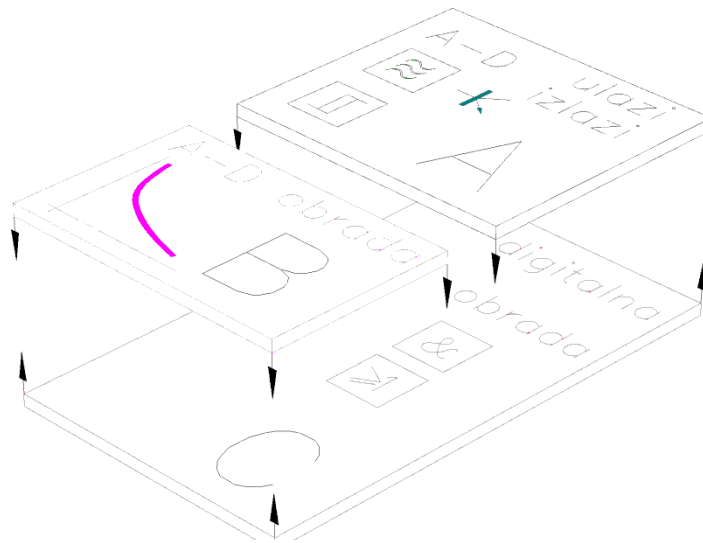


otvor za brisanje programa UV svjetlom

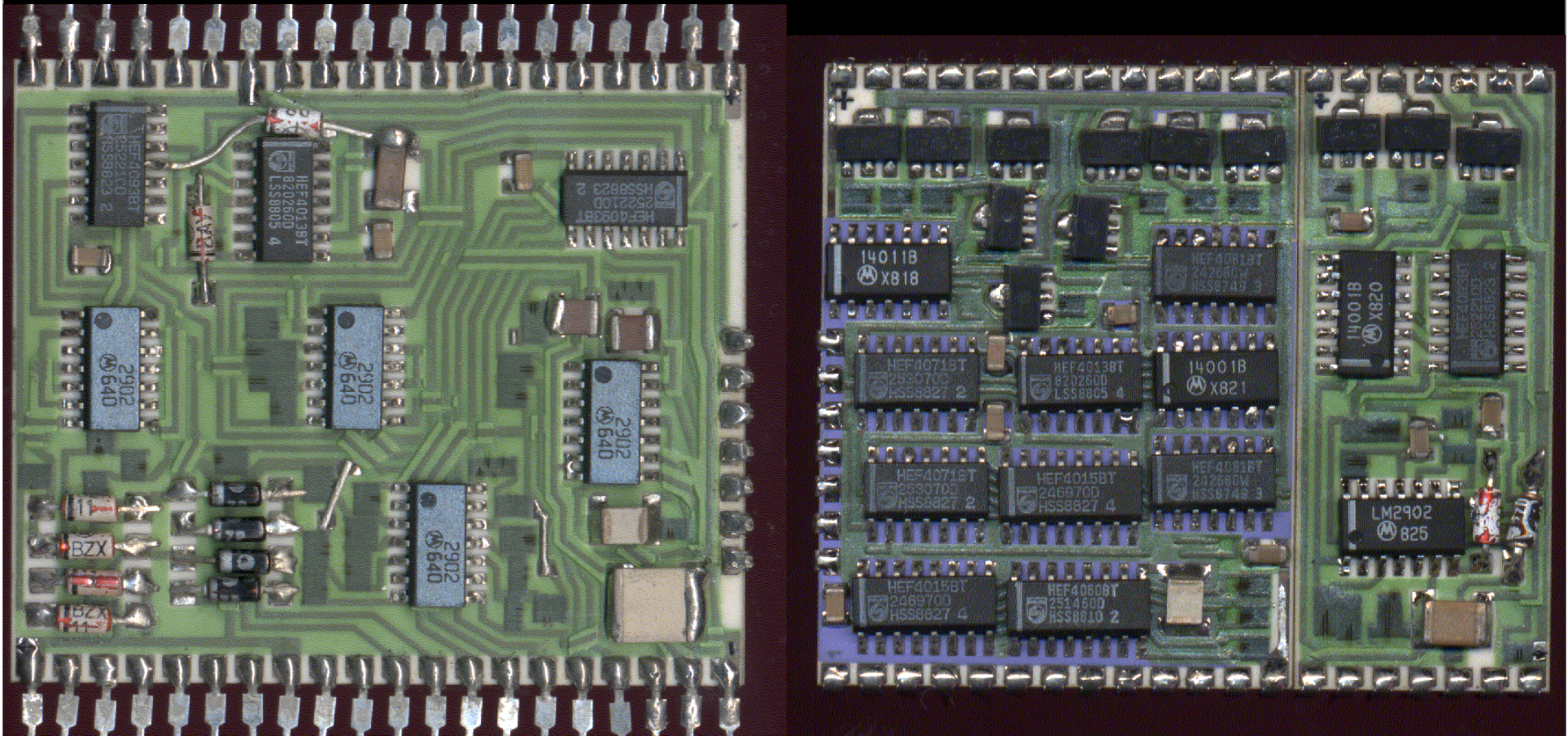
Hibridni integrirani sklopovi

- keramička podloga
- višeslojni sitotisak
- posebne paste
- lasersko ugađanje
- monolitni sklopovi
- SMA tehnologija

podjela na blokove (nezavisne cjeline)



dvostrana izvedba jedne cjeline



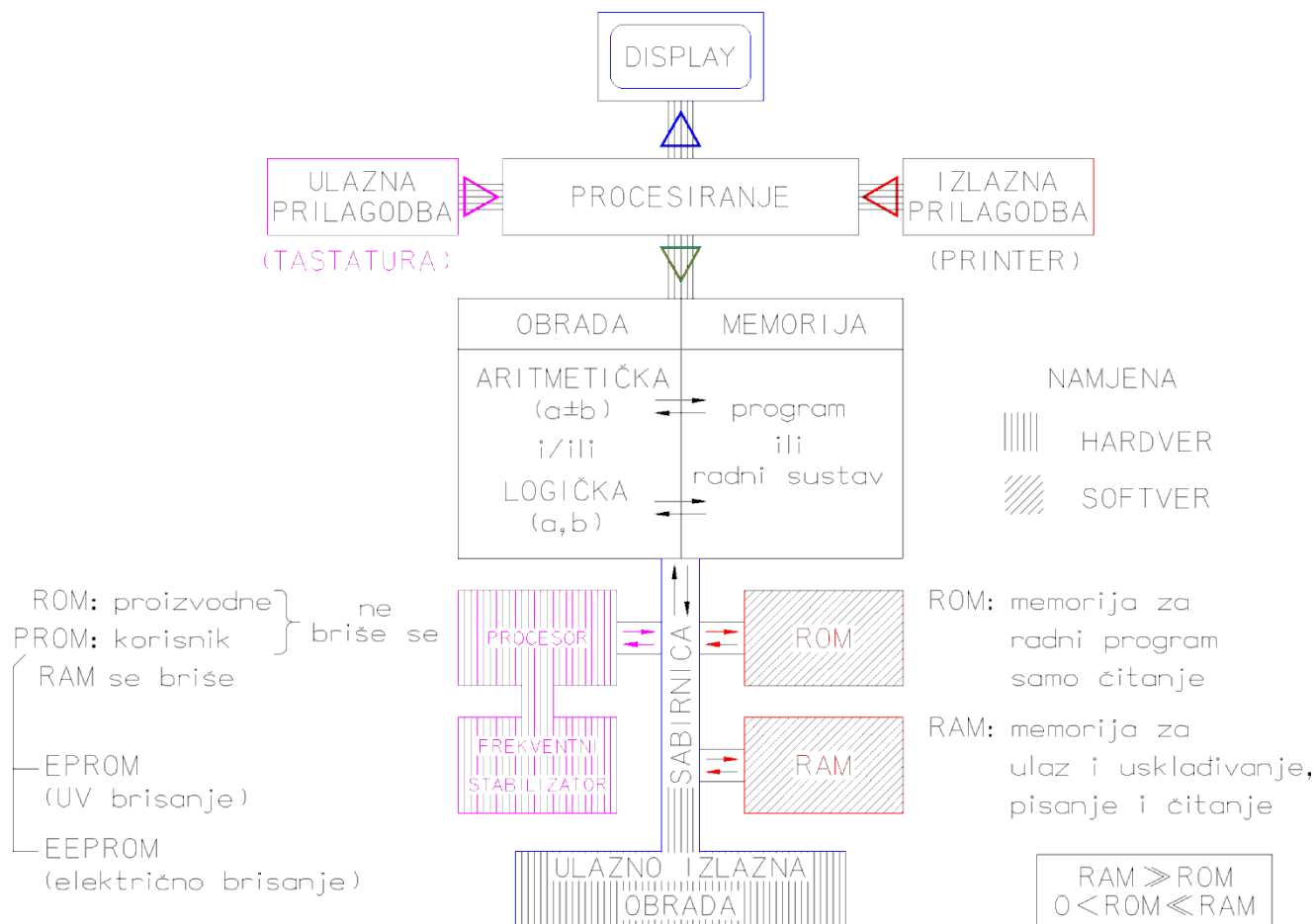
RAČUNALA U AUTOMATIZACIJI

1939. funkcionalni protutip računala - vakuumske cijevi - John Atanasoff

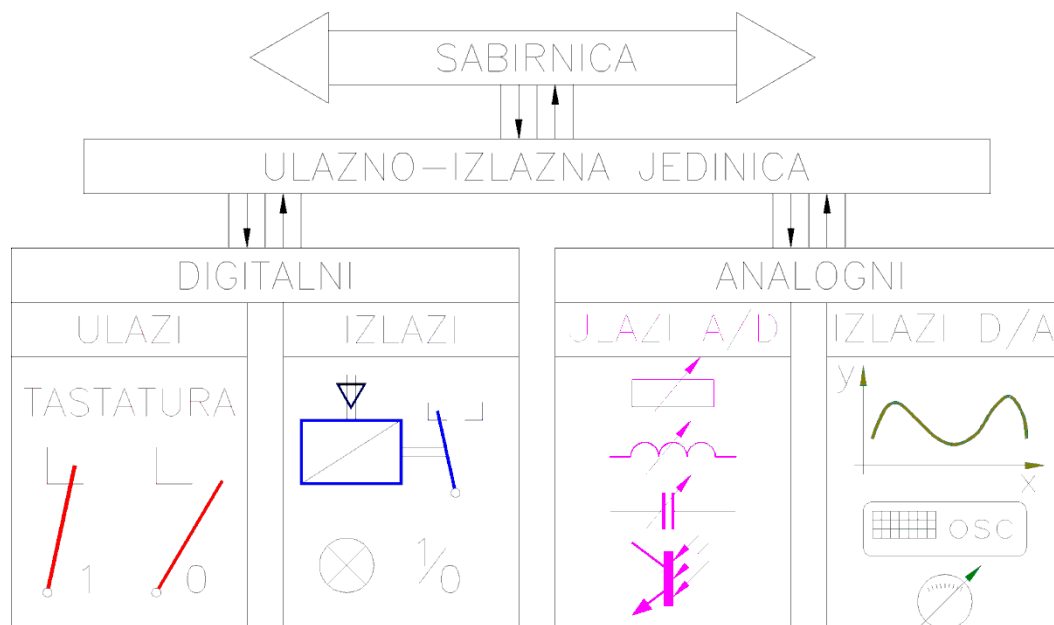
1943. prosinac - COLOSSUS - London - 1500 vakuukmskih cijevi - dekodiranje ENIGME

1945. ENIAC - Iowa State College – 18 000 vakuumskih cij. - Von Neuman - programiranje

Mikroprocesorski sustav



sučelja mikroprocesorskog sustava



Mikroprocesor u upravljanju tehnološkim procesom

