

# INDUSTRIJSKA ELEKTRONIKA

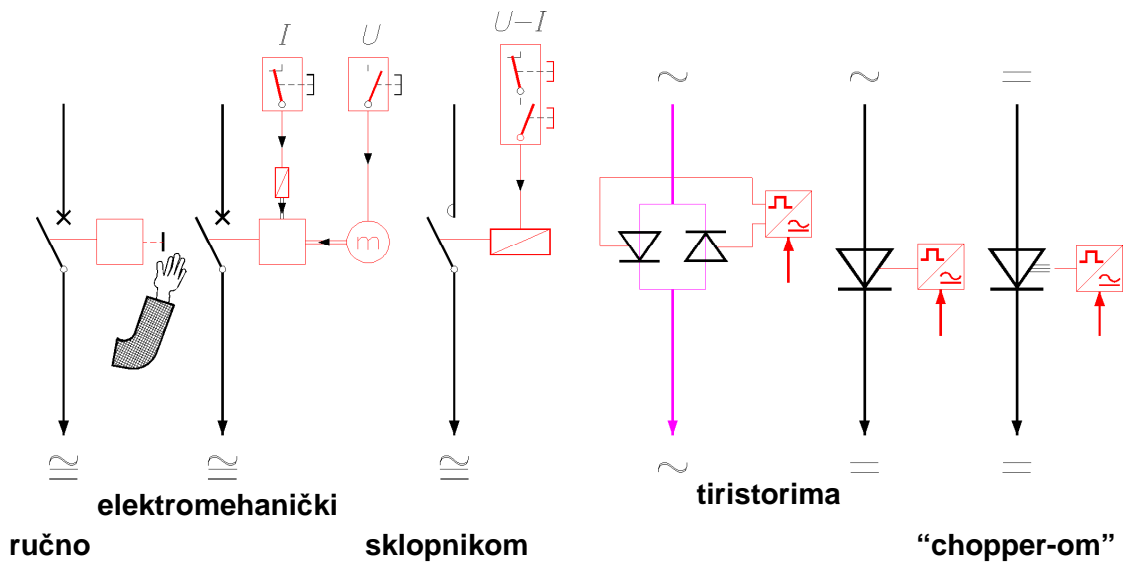
obuhvaća elektroničku tehnologiju za automatizaciju tehnoloških procesa

## MEHANIZACIJA, UPRAVLJANJE, REGULACIJA, AUTOMATIZACIJA

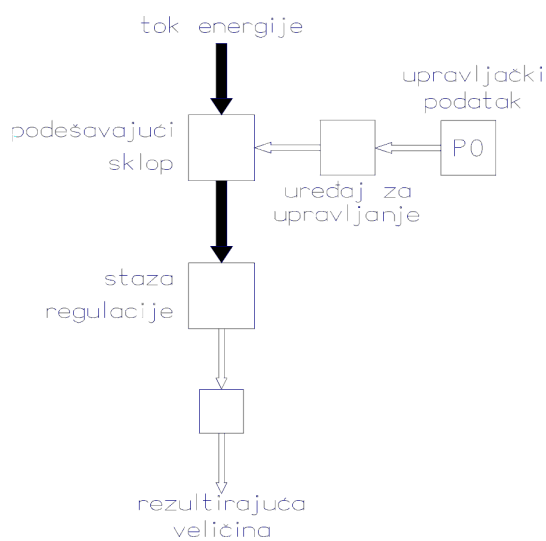
Mehanizacija - preduvjet upravljanja procesima

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

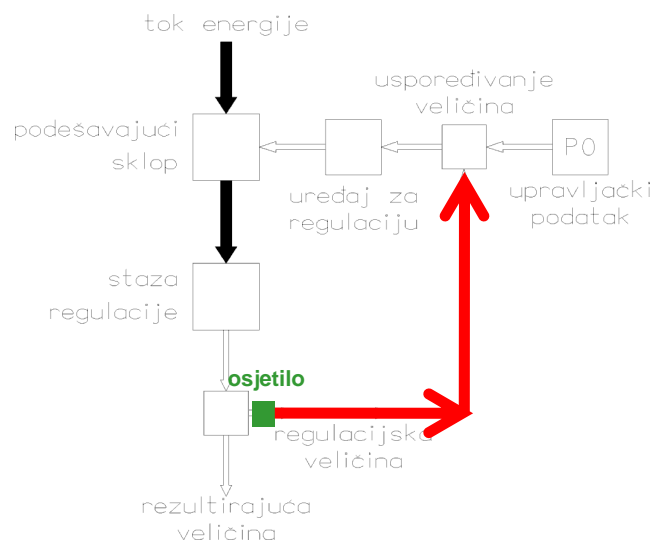
upravljanje tokom energije



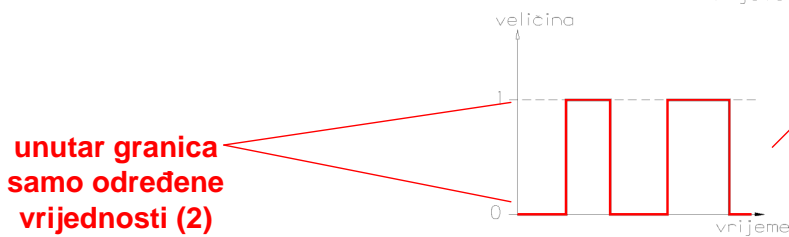
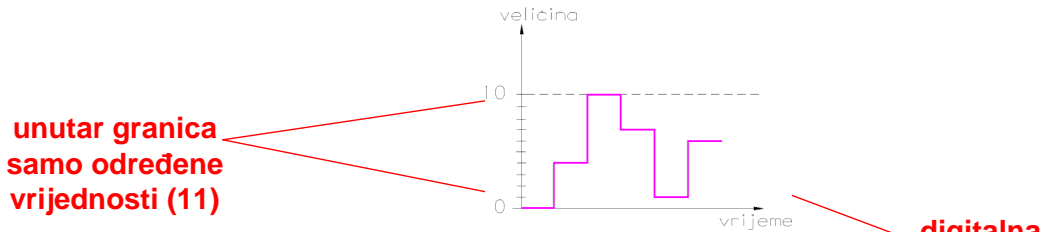
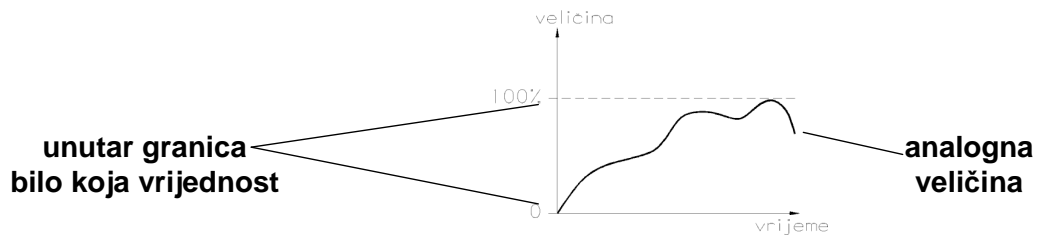
### upravljanje



### regulacija

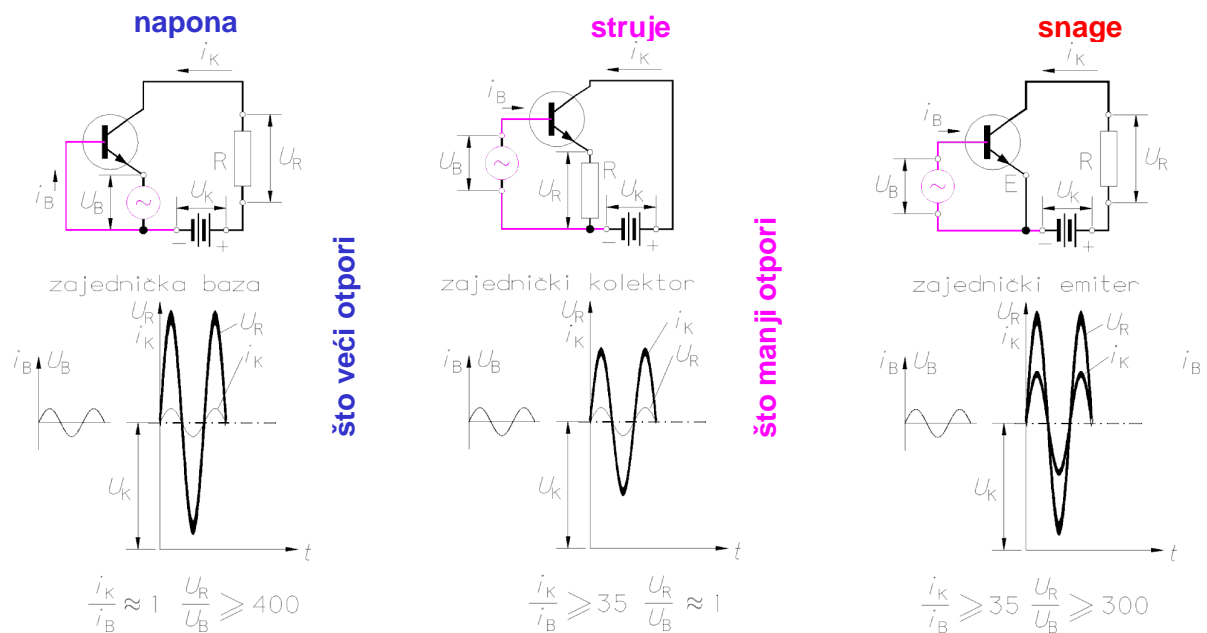


**Analogne i digitalne veličine**



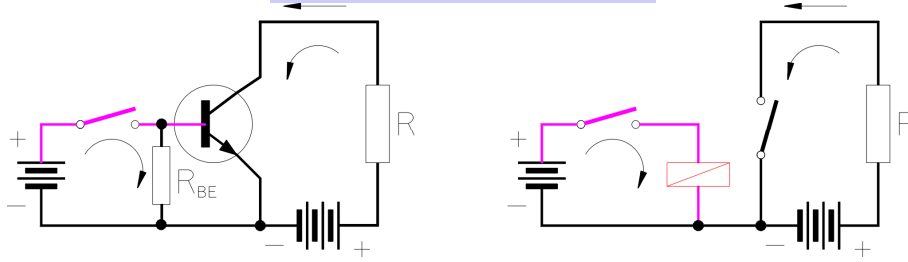
**Pojačanje signala**

**Pojačala**

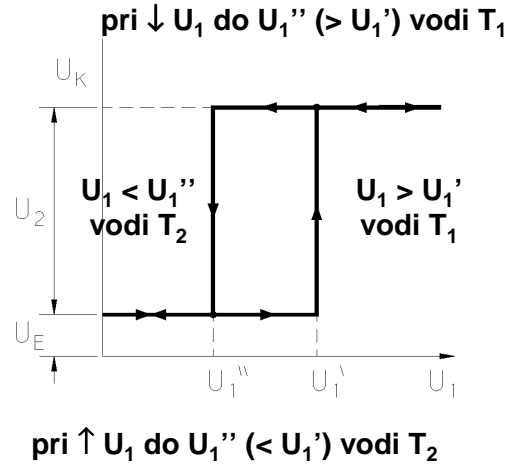
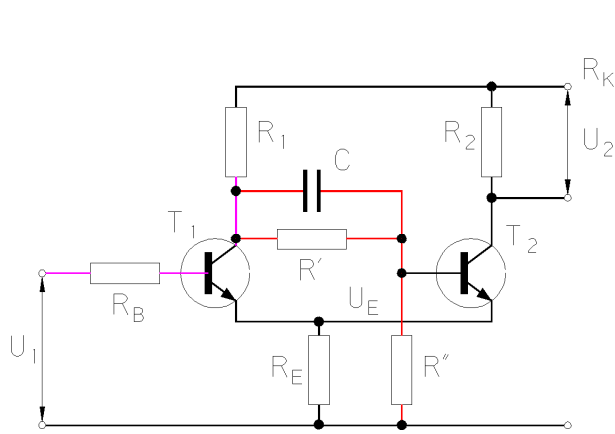


otpori usklađeni za prijenos max. snage

### Tranzistor kao sklopka



### Tranzistorski okidački sklop

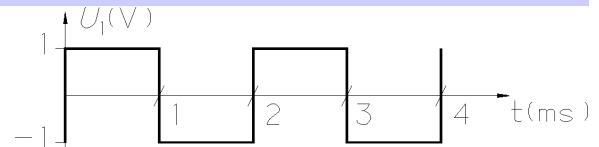
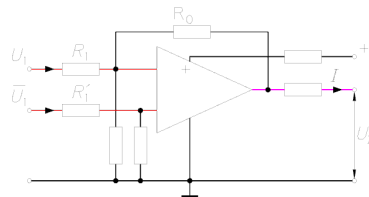


generiranje jednoznačnih signala 0 i 1

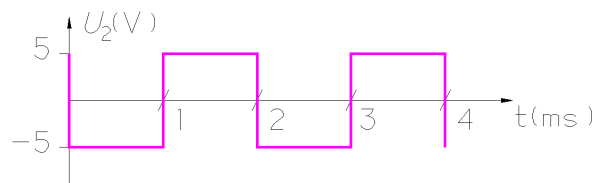
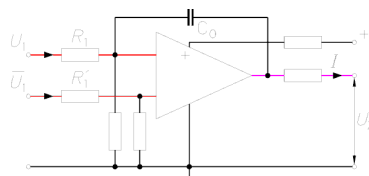
### Operacijska pojačala

### Oblikovanje signala operacijskim pojačalima

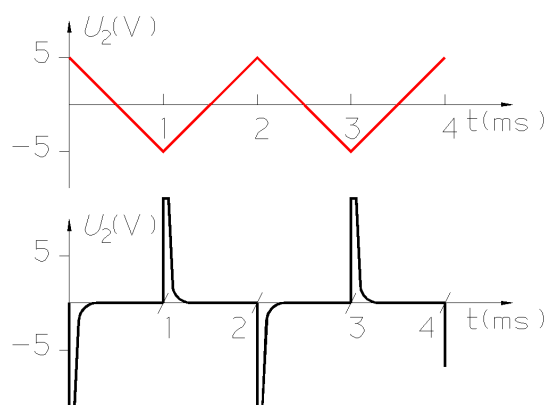
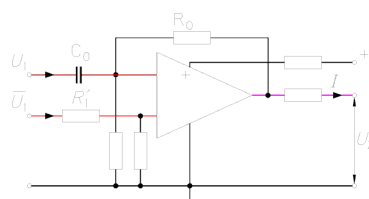
invertiranje



integriranje

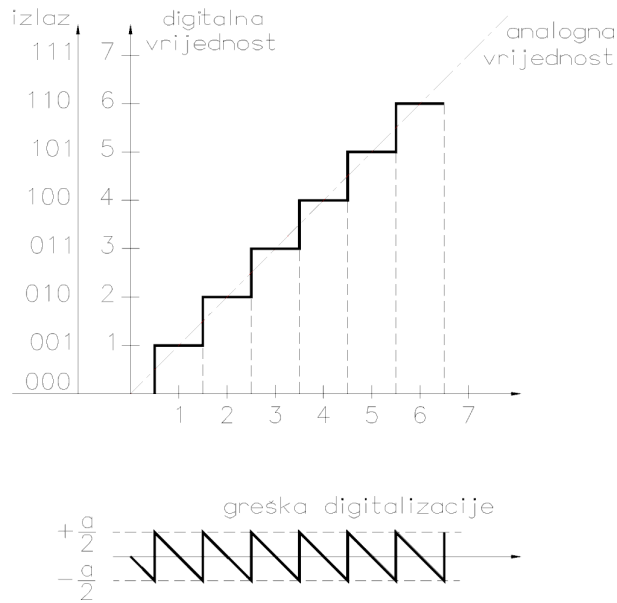


deriviranje

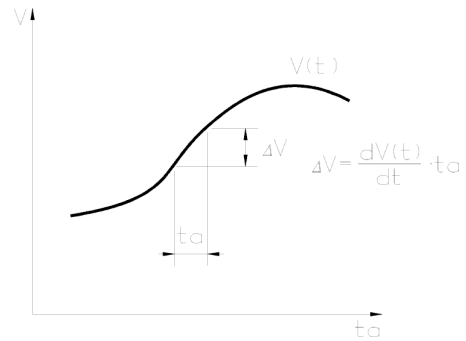


# Digitaliziranje analogne veličine

## kodirana, digitalna i analogna vrijednost

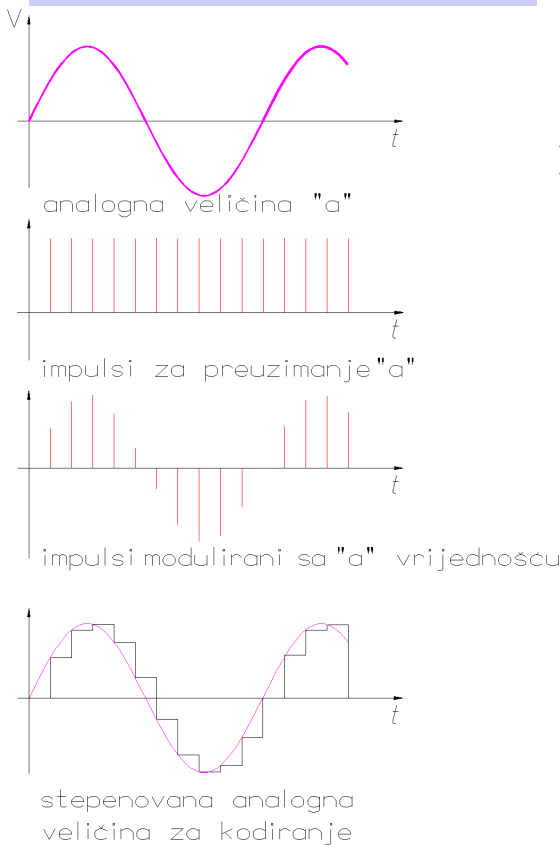


## utjecaj vremena uzorkovanja ( $t_a$ ) na preciznost digitalizacije ( $\Delta V$ )

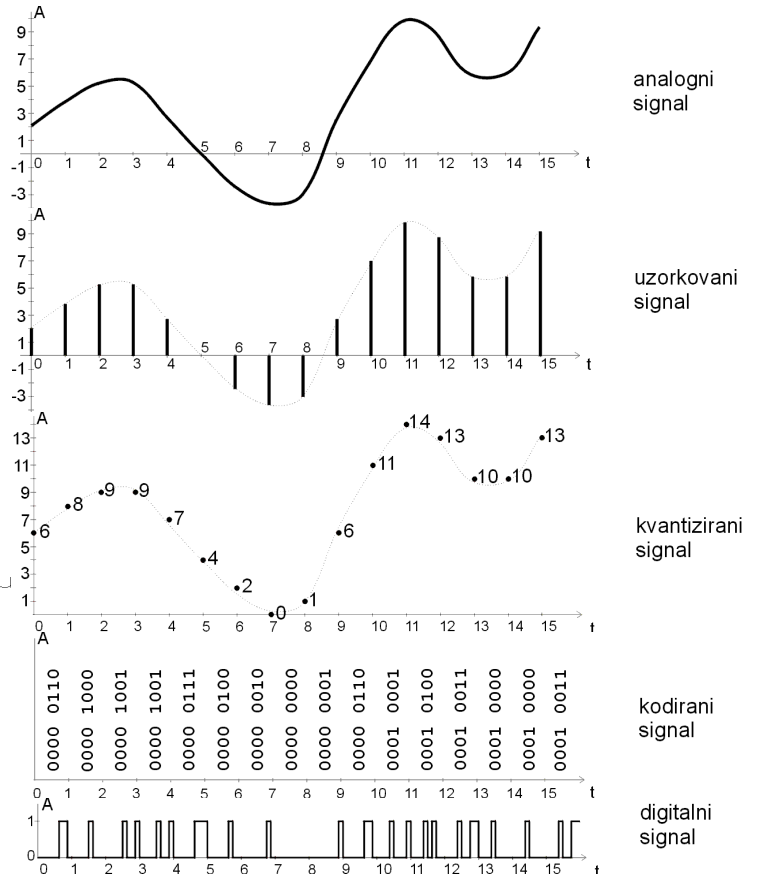


**pogreška se smanjuje smanjenjem "a"  
(finijom podjelom - većim brojem znamenaka)**

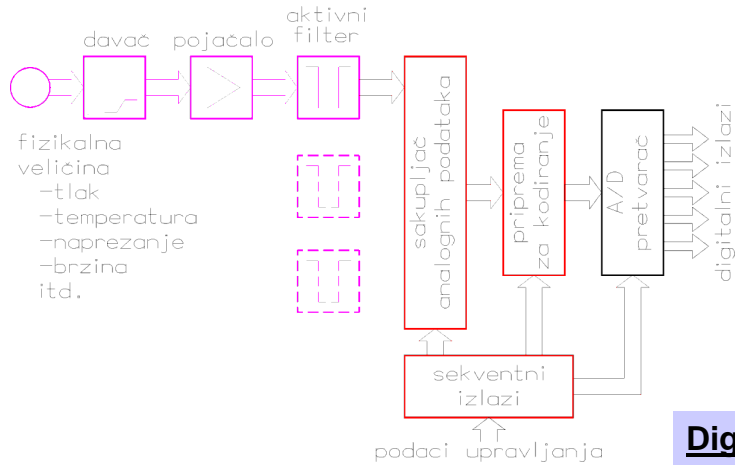
## Digitaliziranje sinusne veličine



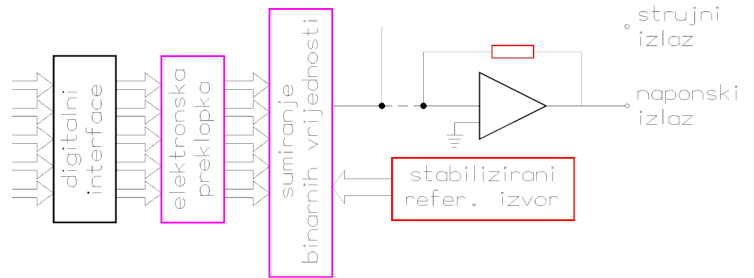
## od analognog do digitalnog (serijskog) signala



# Analogno - digitalni (AD) pretvornici

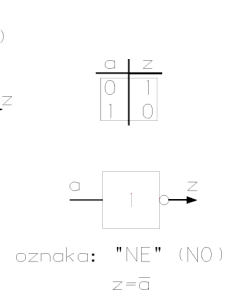
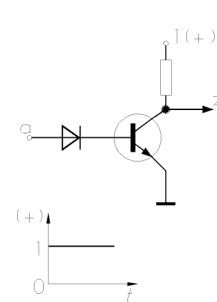
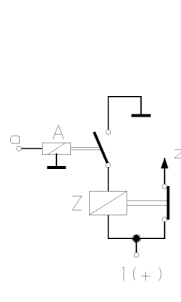
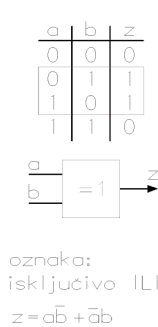
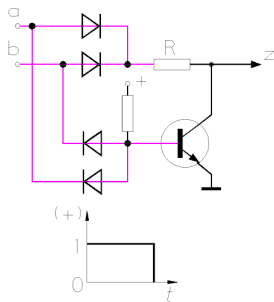
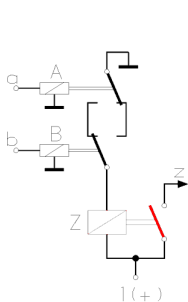
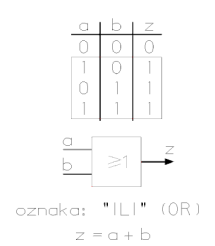
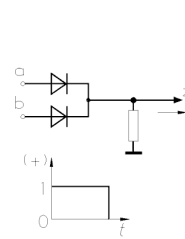
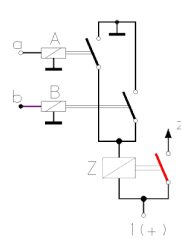
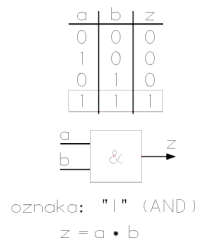
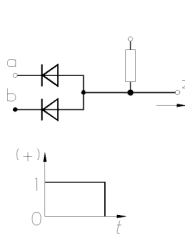
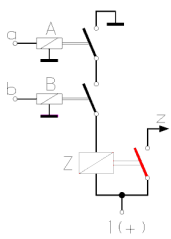


# Digitano - analogni (DA) pretvornici

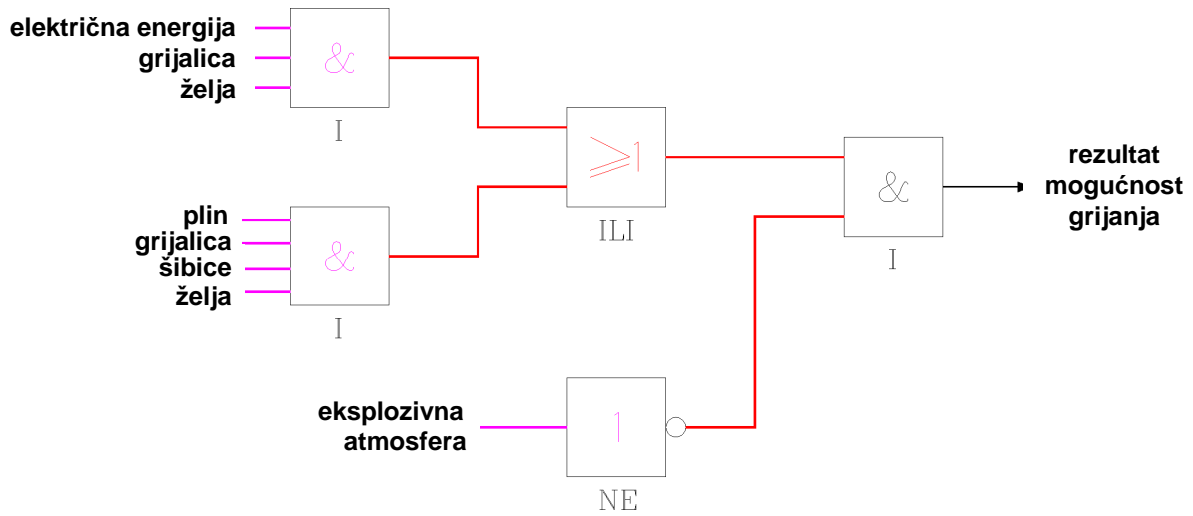


# LOGIČKA OBRADA PODATAKA

## Osnovne logičke jedinice

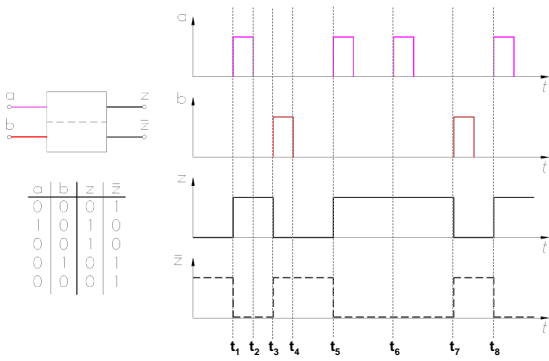


## Logička obrada procesa primjenom osnovnih logičkih jedinica

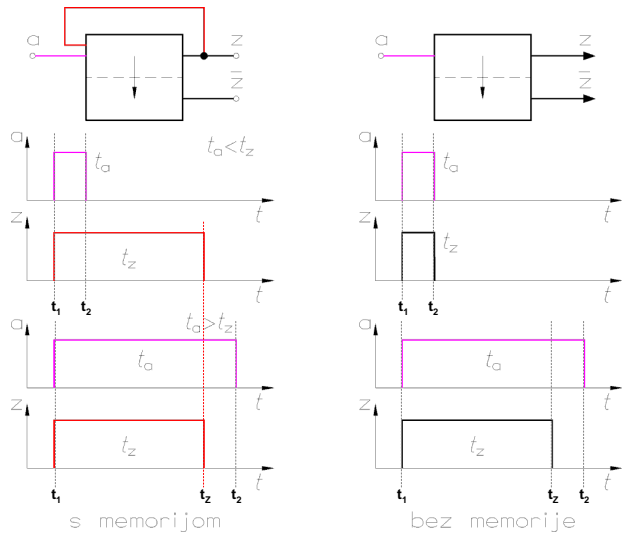


## Logičke jedinice s memorijom

### jedinice s pamćenjem



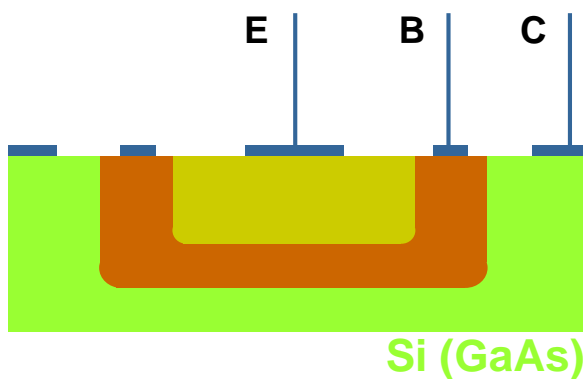
### jedinica za prijenos zapamćenog signala



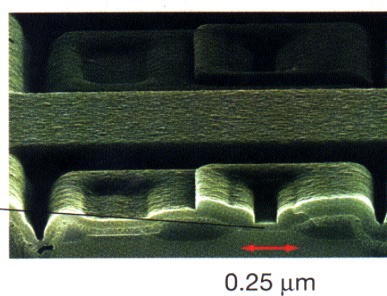
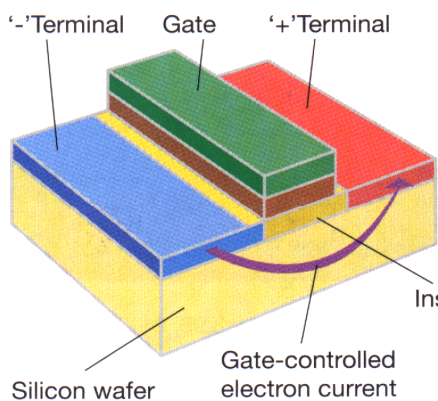
# MIKROELEKTRONIKA - INTEGRIRANI LOGIČKI SKLOPOVI

- monolitni
- hibridni

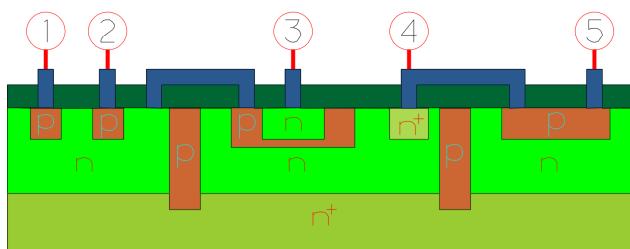
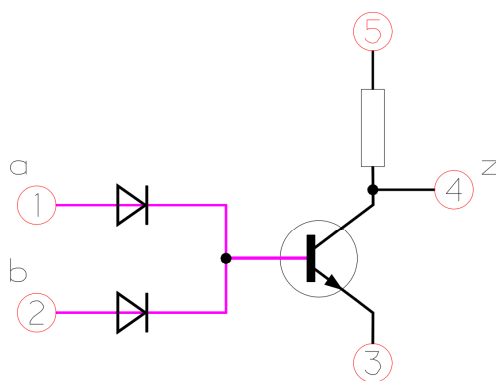
## Monolitni



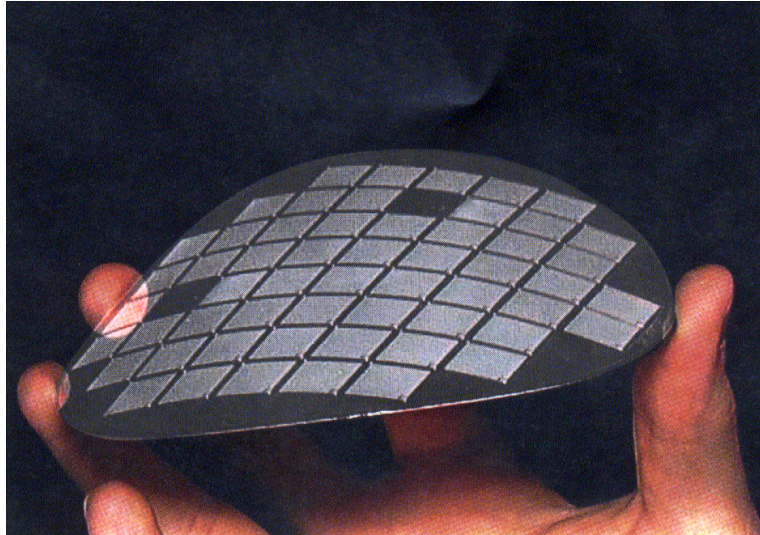
fotolitografski postupak kod bipolarne tehnologije



## Izvedba NOR sklopa u bipolarnoj tehnologiji monolitnih integriranih sklopova



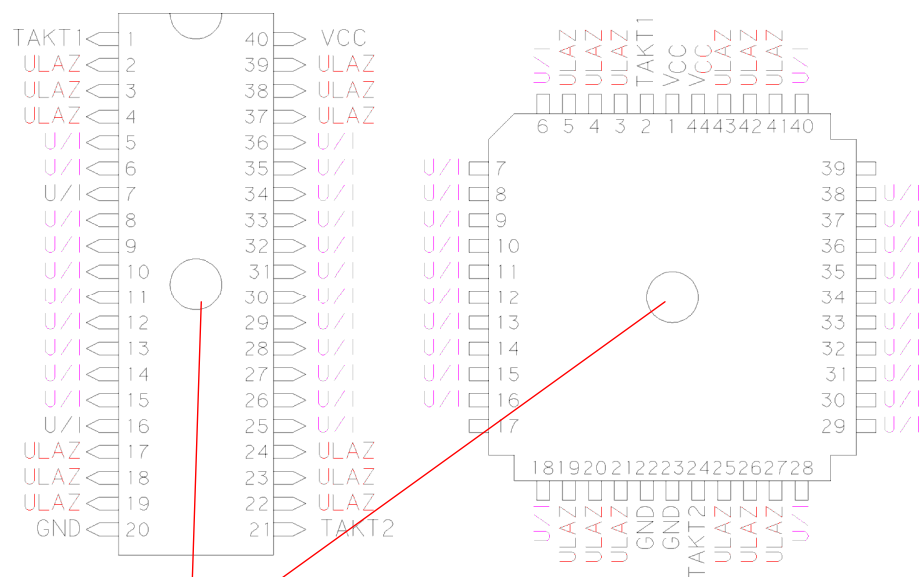
Si wafer debljine 125 $\mu$ m na kojem je više od 10.000.000 tranzistora



- 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



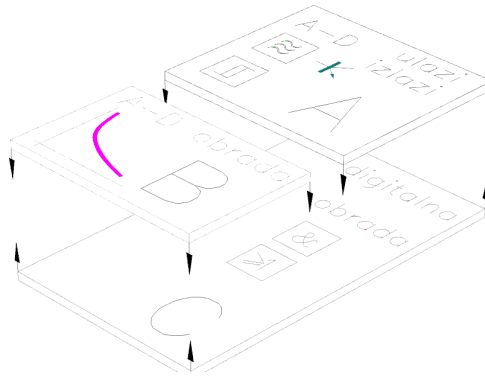
otvor za brisanje programa UV svjetlom



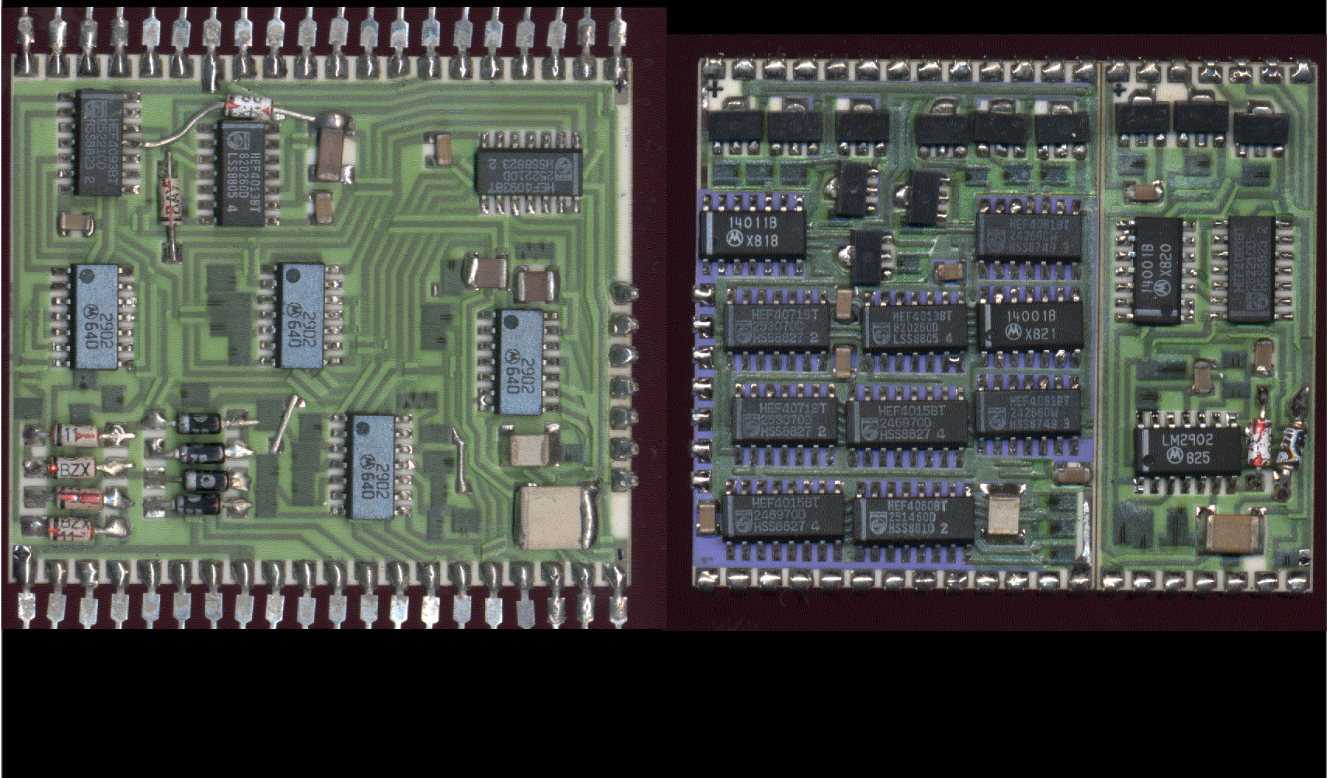
## Hibridni integrirani sklopovi

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

podjela na blokove (nezavisne cjeline)



dvostrana izvedba jedne cjeline



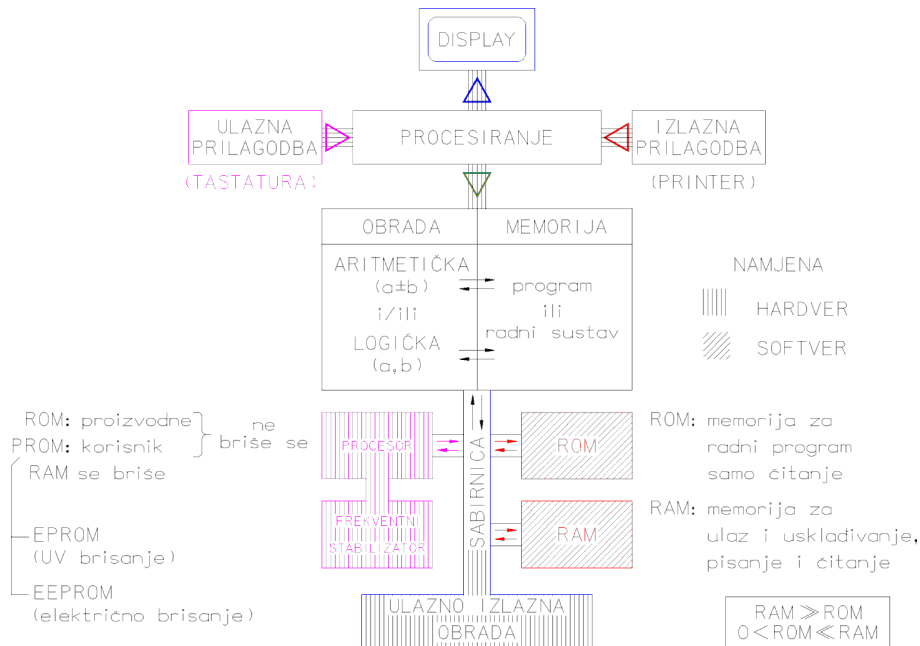
# RAČUNALA U AUTOMATIZACIJI

1939. funkcionalni protutip računala - vakuumske cijevi - John Atanasoff

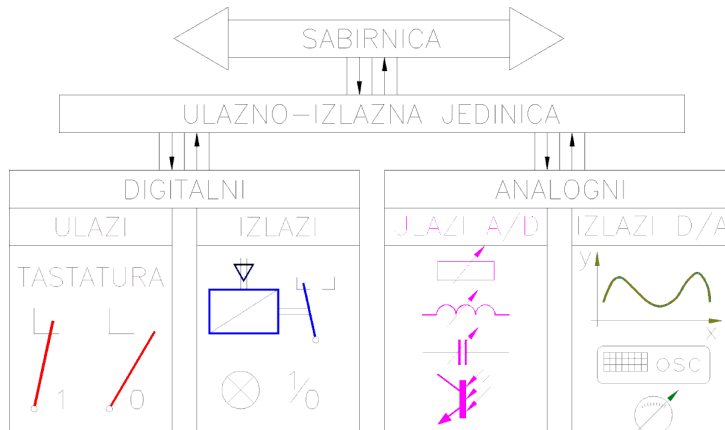
1943. prosinac - COLOSSUS - London - 1500 vakuukmskih cijevi - dekodiranje ENIGME

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

## Mikroprocesorski sustav



## sučelja mikroprocesorskog sustava



## Mikroprocesor u upravljanju tehnološkim procesom

