

DIGITALNA LOGIKA

BISTABILI

Karakteristike bistabila i vrste

Bistabili-memorijski elementi

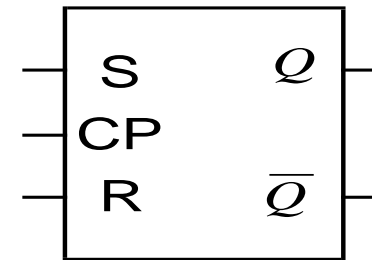
Ima dva stabilna stanja

Pamti "0" ili "1"

Vrste-prema ulazima za okidanje(promjenu stanja):

-SR; JK; D; T

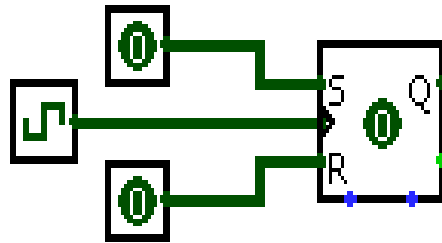
Upravljivi bistabili –sa CP ulazom—Sinkroni rad



Rad SR bistabila i tablica stanja

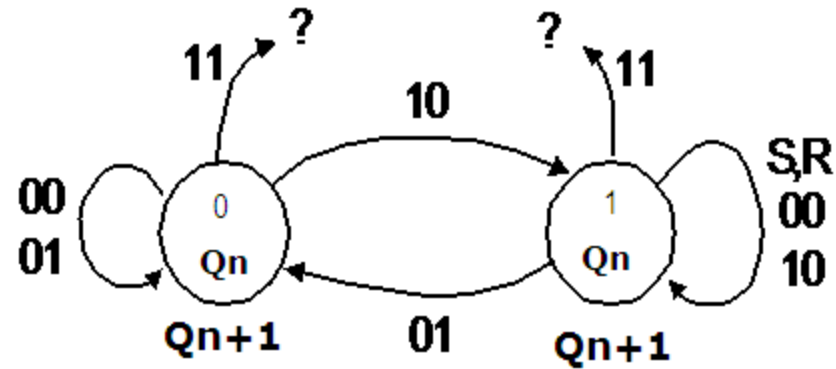
sažeta
tablica

S	R	Q_{n+1}
0	0	Q_n
0	1	0
1	0	1
1	1	X



Q_n	S	R	Q_{n+1}
0	0	0	0
0	0	1	0
0	1	0	1
0	1	1	?, X
1	0	0	1
1	0	1	0
1	1	0	1
1	1	1	?, X

Dijagram stanja SR bistabila



		SR			
		00	01	11	10
Q _n	0			X	1
	1	1		X	1

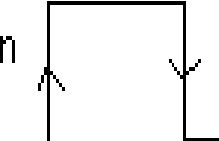
$$Q_{n+1} = S + \bar{R} \cdot Q_n$$

Q _n	S	R	Q _{n+1}
0	0	0	0
0	0	1	0
0	1	0	1
0	1	1	?, X
1	0	0	1
1	0	1	0
1	1	0	1
1	1	1	?, X

Bridom okidani SR bistabil

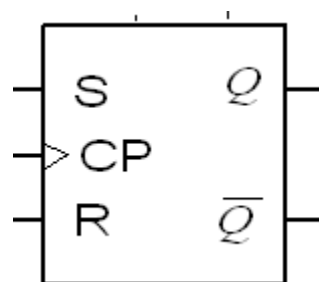
- Stanje na izlazu mijenja se na prednji ili zadnji brid Cp impulsa u skladu sa stanjem sinkronih ulaza (SR,JK;D,T)

Pozitivan
brid

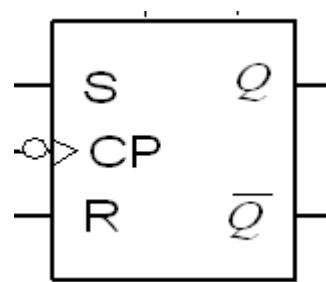


Negativan brid

CP	S	R	Q_{n+1}
$\downarrow \uparrow$	0	0	Q_n
$\downarrow \uparrow$	0	1	0
$\downarrow \uparrow$	1	0	1
$\downarrow \uparrow$	1	1	X



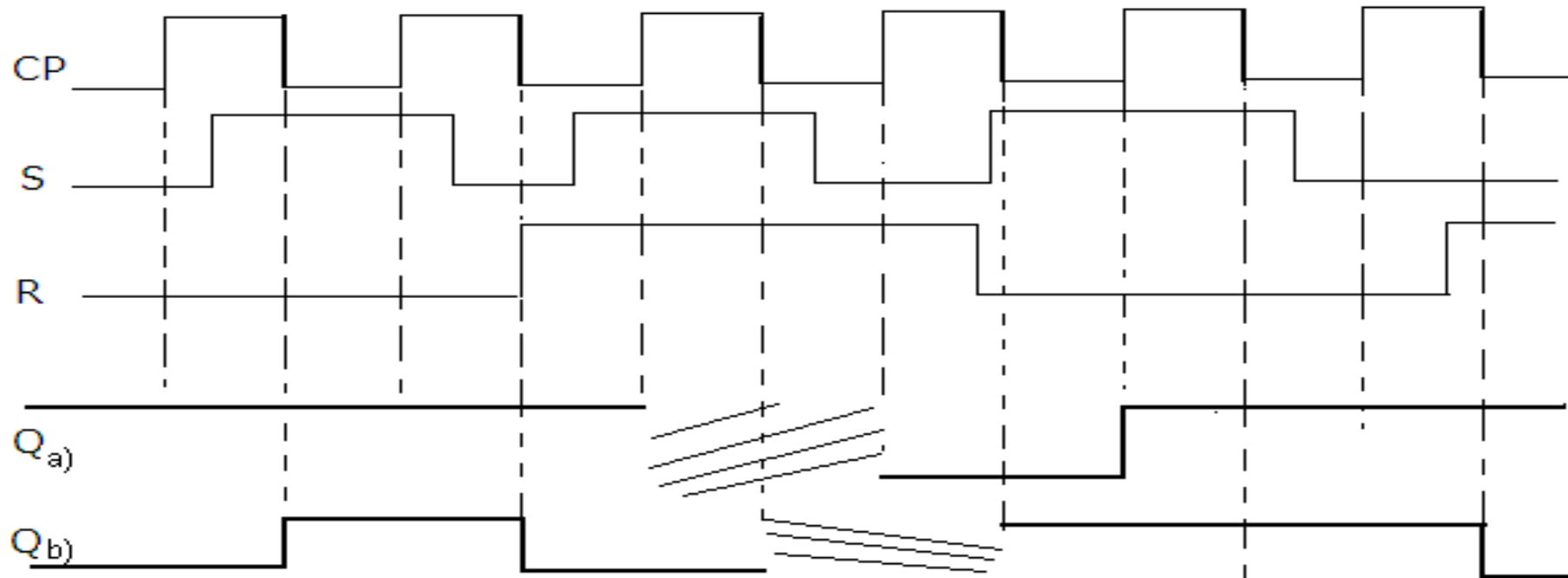
a)



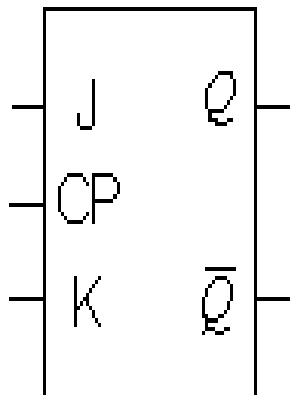
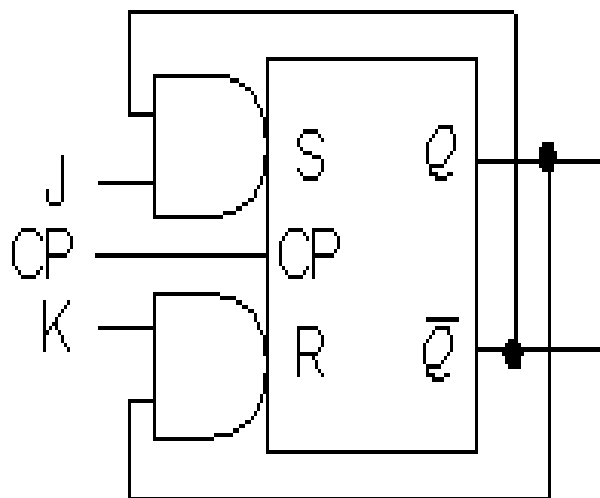
b)

Za zadane vremenske signale odrediti promjene na izlazu bridom okidanog bistabila

- a) $Q_n=1$ (na pozitivan brid) b) $Q_n=0$ (na negativan brid)



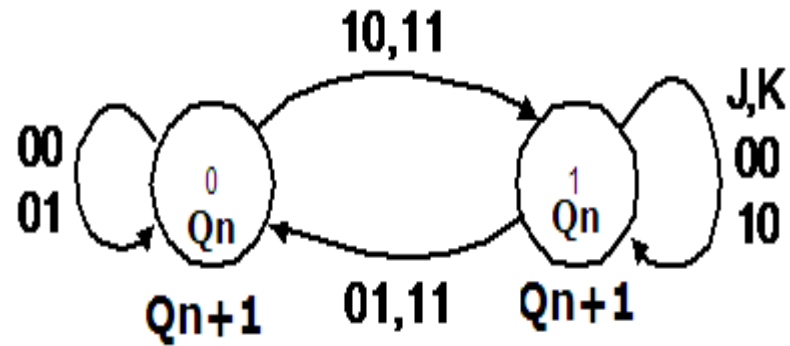
Realizirati JK bistabil pomoću SR bistabila i napisati tablicu stanja



Q_n	J	K	Q_{n+1}
0	0	0	0
0	0	1	0
0	1	0	1
0	1	1	1
1	0	0	1
1	0	1	0
1	1	0	1
1	1	1	0

J	K	Q_{n+1}
0	0	Q_n
0	1	0
1	0	1
1	1	$\overline{Q_n}$

Dijagram stanja JK bistabila

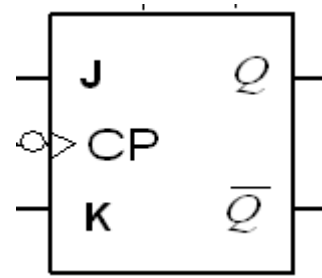
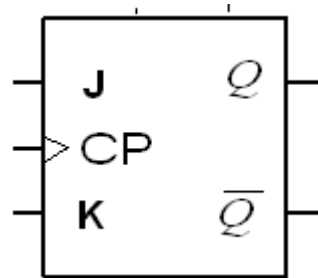


		JK			
		00	01	11	10
Q_n	0			1	1
	1	1			1

$$Q_{n+1} = J \cdot \bar{Q}_n + \bar{K} \cdot Q_n$$

Q_n	J	K	Q_{n+1}
0	0	0	0
0	0	1	0
0	1	0	1
0	1	1	1
1	0	0	1
1	0	1	0
1	1	0	1
1	1	1	0

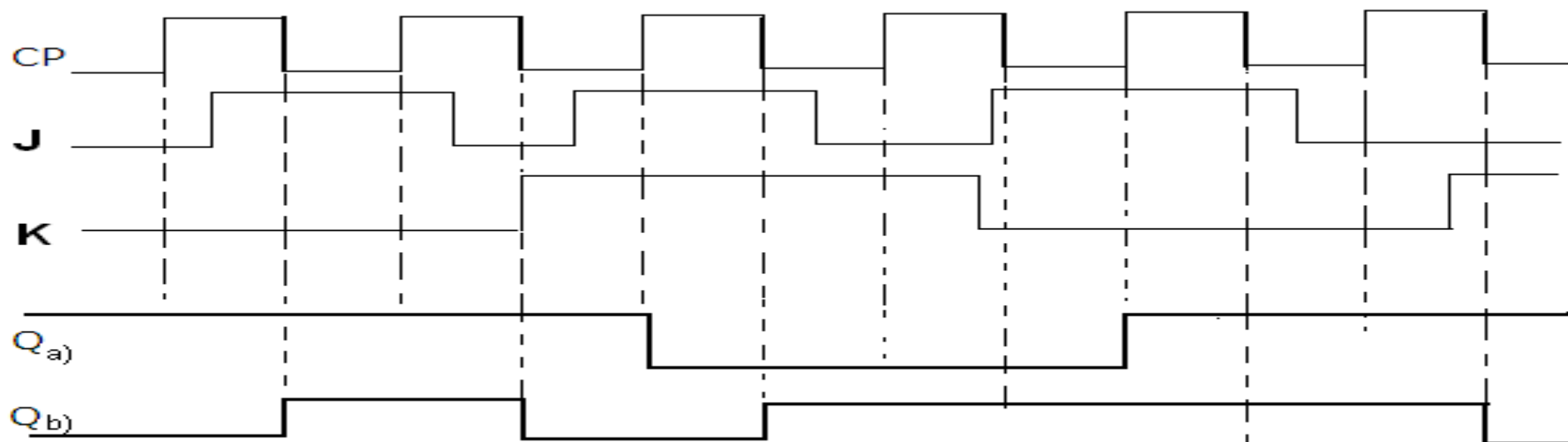
Bridom okidani JK bistabil



CP	J	K	Q_{n+1}
$\downarrow \uparrow$	0	0	Q_n
$\downarrow \uparrow$	0	1	0
$\downarrow \uparrow$	1	0	1
$\downarrow \uparrow$	1	1	$\overline{Q_n}$

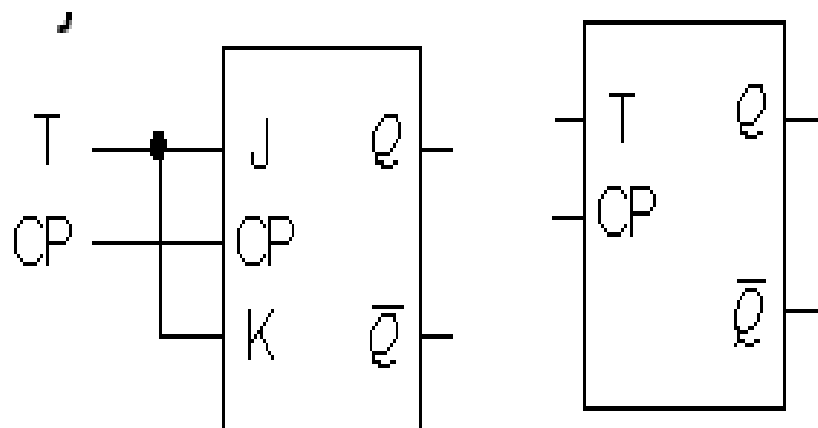
Za zadane vremenske signale odrediti promjene na izlazu bridom okidanog bistabila

a) $Q_n=1$ b) $Q_n=0$



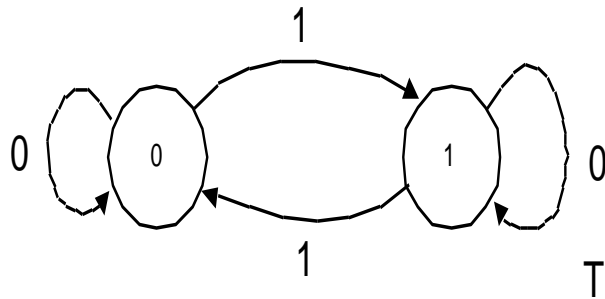
T bistabil –simbol i tablica stanja

tablica stanja:



Q_n	T	Q_{n+1}
0	0	0
0	1	1
1	0	1
1	1	0

Dijagram stanja T bistabila



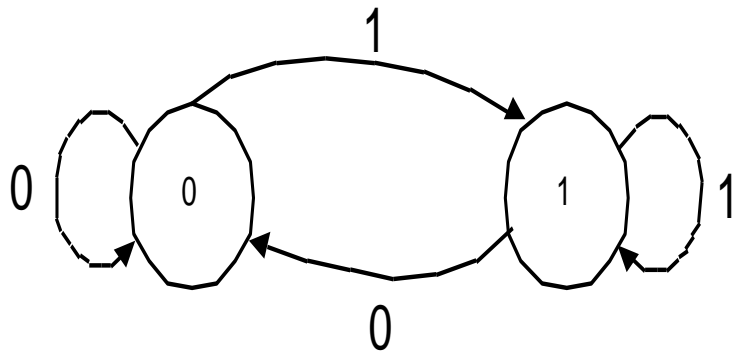
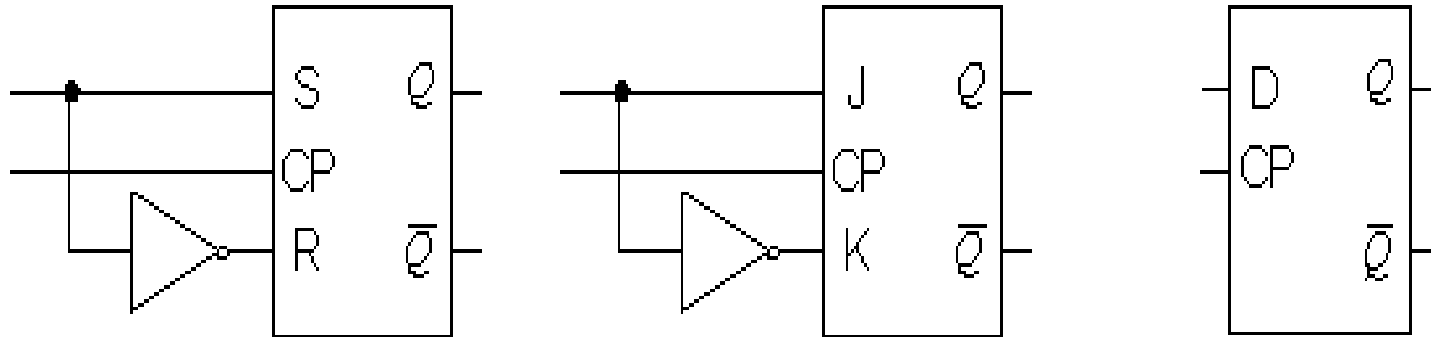
Q_n	Q_{n+1}	T
0	0	0
0	1	1
1	0	1
1	1	0

T	Q_{n+1}
0	Q_n
1	$\overline{Q_n}$

T	0	1
Q_n		
0		1
1	1	

$$Q_{n+1} = T \cdot \overline{Q_n} + \overline{T} \cdot Q_n$$

D bistabil- simbol i tablica stanja

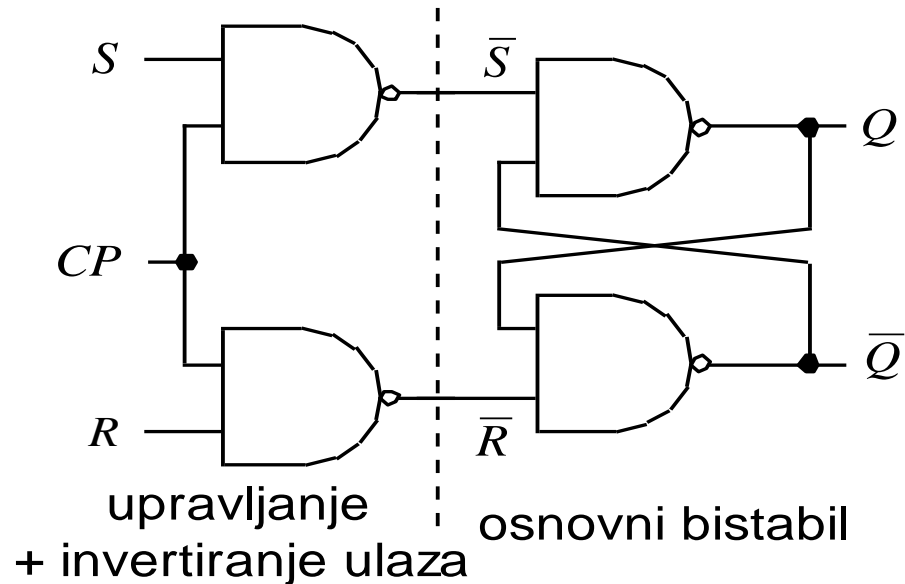


	D	
	0	1
Q _n 0		1
1		1

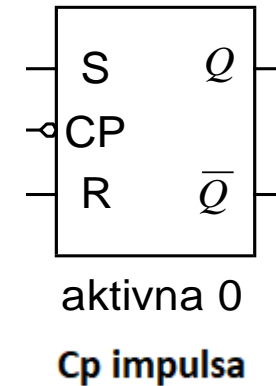
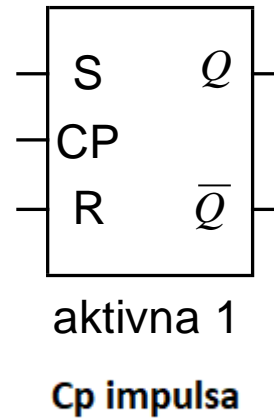
Q _n	D	Q _{n+1}
0	0	0
0	1	1
1	0	0
1	1	1

$$Q_{n+1} = D_n$$

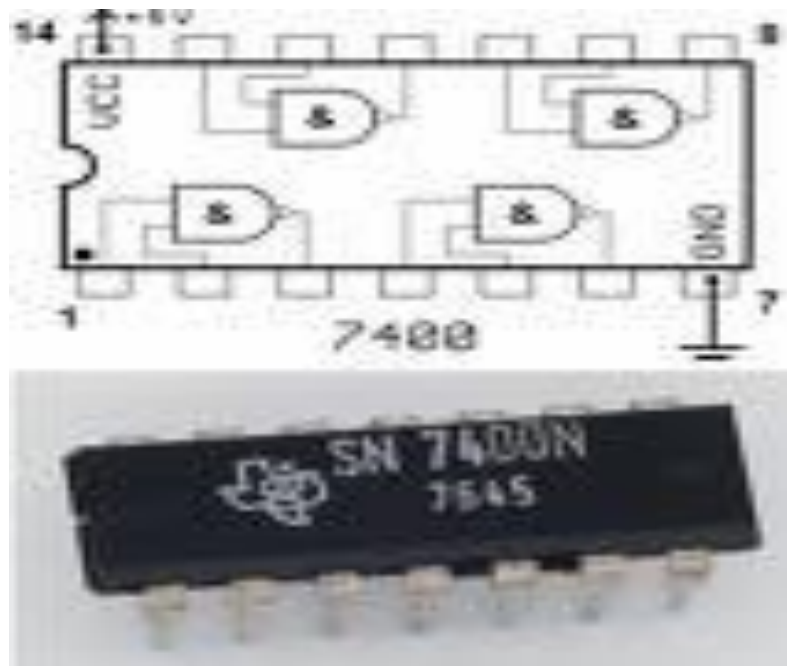
Sinkroni bistabil- okidan Cp impulsima



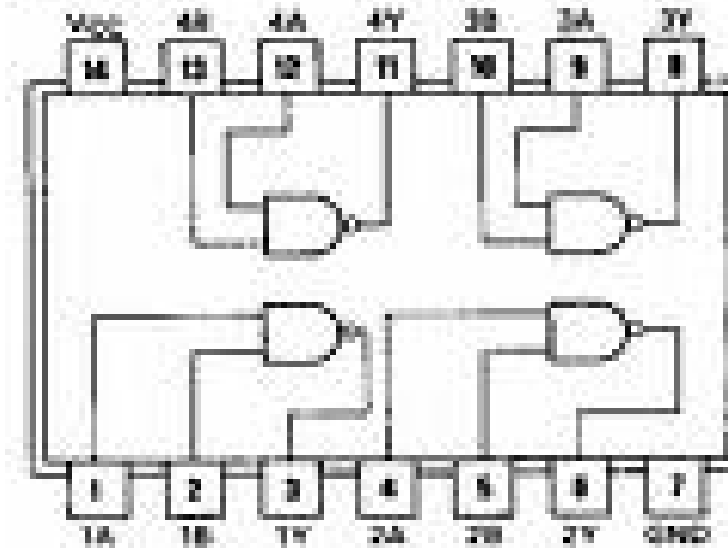
logička shema
upravljivog bistabila-
izvedba sa NI logičkim
sklopovima



Sinkroni bistabil izveden pomoću 7400

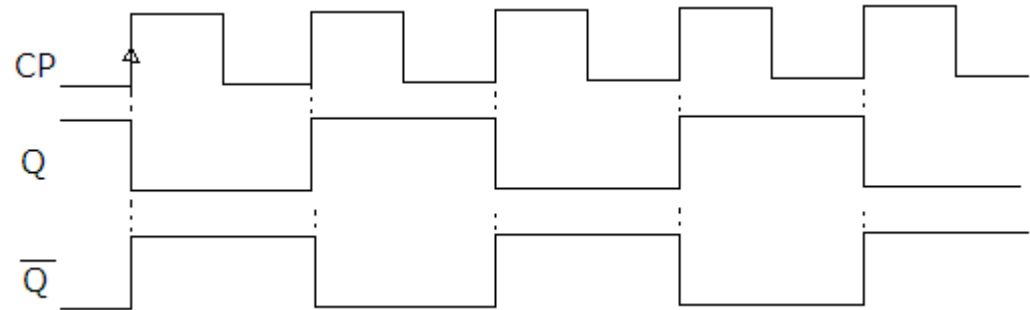
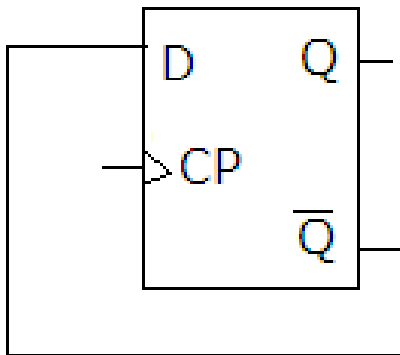


7400



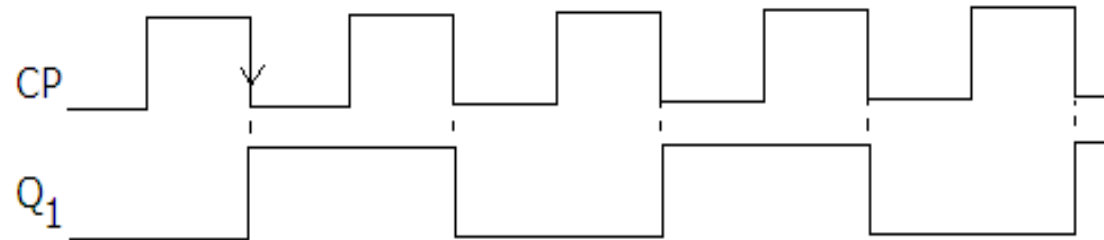
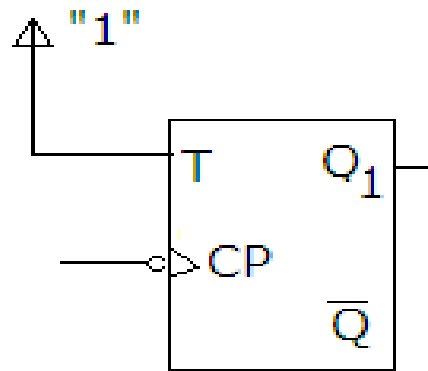
Odrediti frekvenciju izlaznog signala tako spojenog bistabila, ako je početno stanje bistabila $Q_n=1$, a frekvencija CP impulsa je 10kHz.

- $f_{CP}=10\text{kHz}$ $f_Q=f_{CP}/2=5\text{kHz}$



Odrediti frekvenciju izlaznog signala tako spojenog bistabila, ako je početno stanje bistabila $Q_n=0$, a frekvencija CP impulsa je 10kHz.

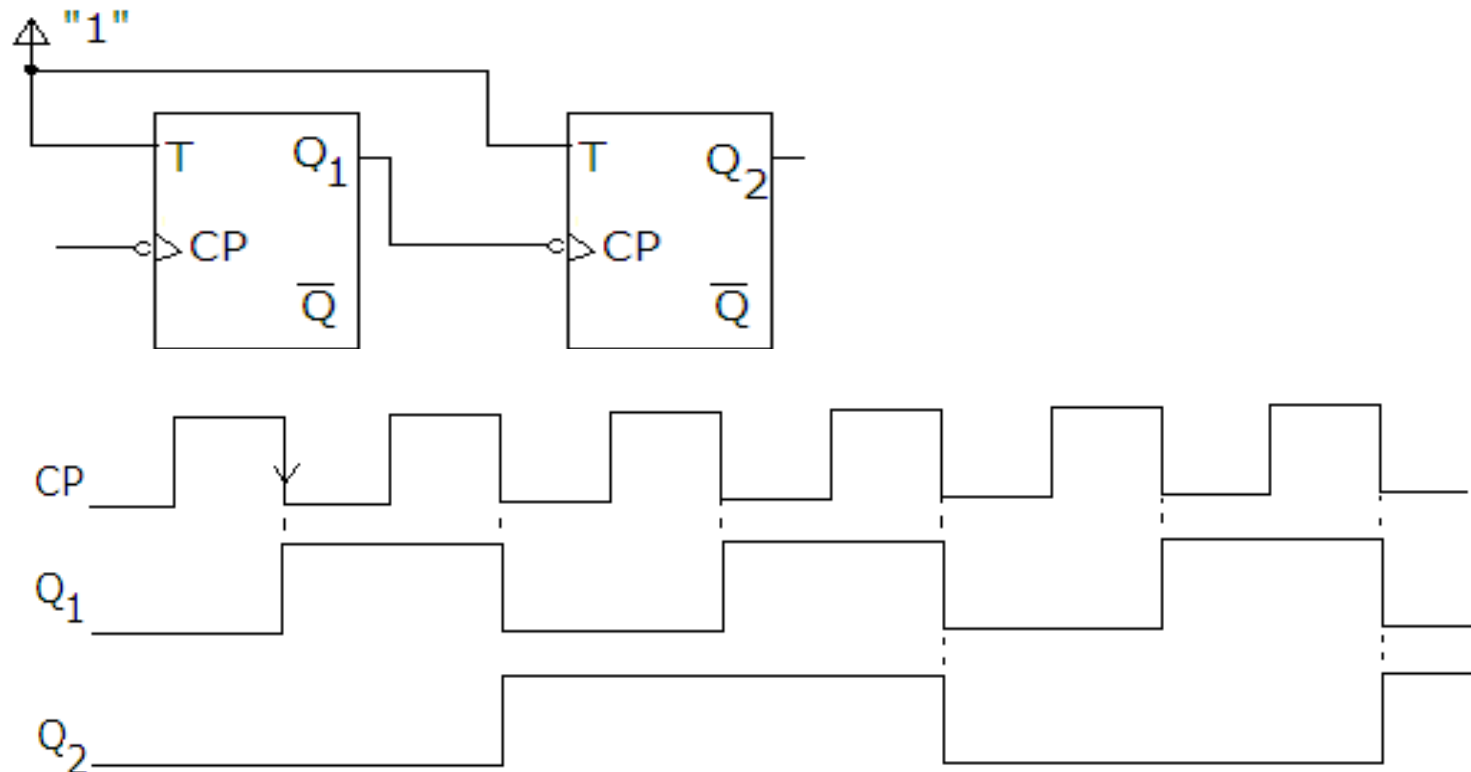
• $f_{CP}=10\text{kHz}$ $f_{Q1}=f_{CP} / 2=5\text{kHz}$



Odrediti frekvenciju izlaznog signala tako spojenih bistabila, ako su početna stanja bistabila $Q_n=0$, a frekvencija CP impulsa je 10kHz

- $f_{CP}=10\text{kHz}$ $f_{Q1}=f_{CP}/2=5\text{kHz}$

- $f_{Q2}=f_{CP}/4=2,5\text{kHz}$



Pomoću D bistabila i logičkih sklopova realizirati T bistabil

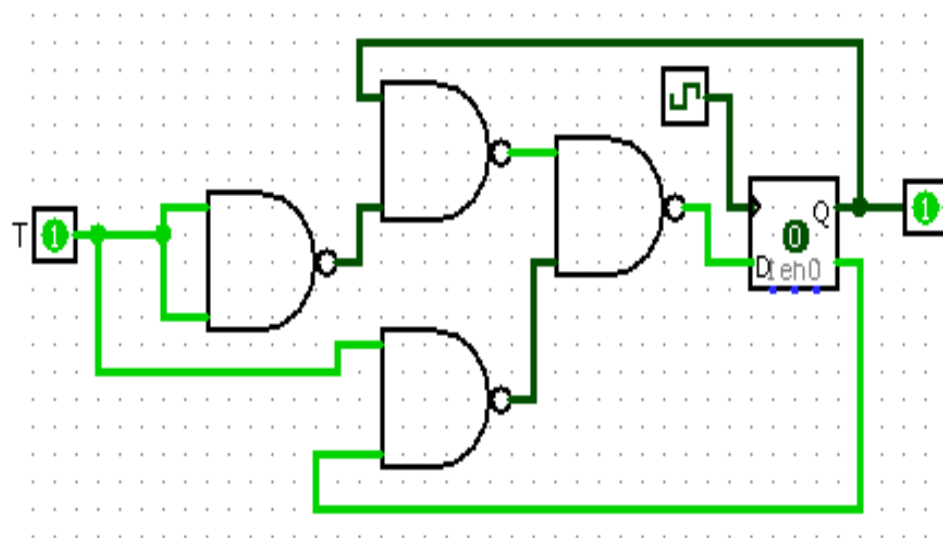
tablica stanja:

Q_n	T	Q_{n+1}	D
0	0	0	0
0	1	1	1
1	0	1	1
1	1	0	0

$$Q_{n+1} = D$$

$$D = \overline{T}Q_n + T\overline{Q}_n$$

$$D = \overline{\overline{\overline{T}Q_n} * \overline{\overline{T}Q_n}}$$

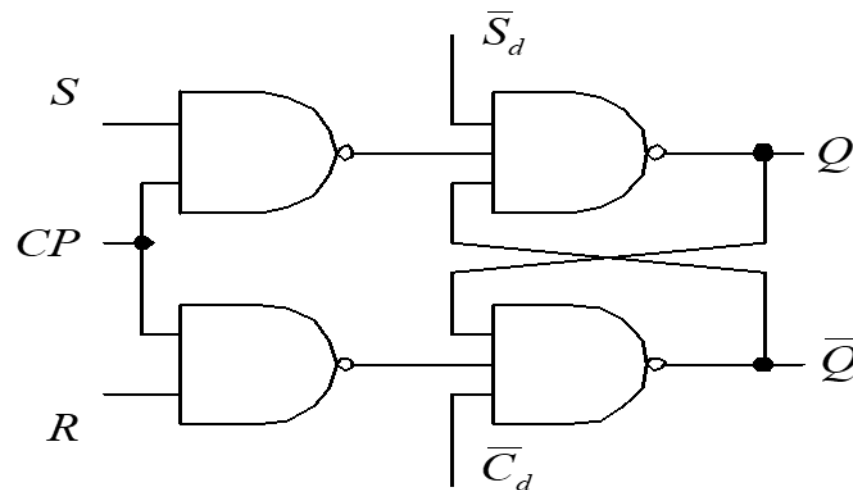
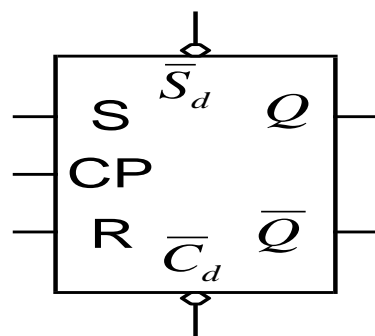


Rad bistabila: sinkroni-asinkroni

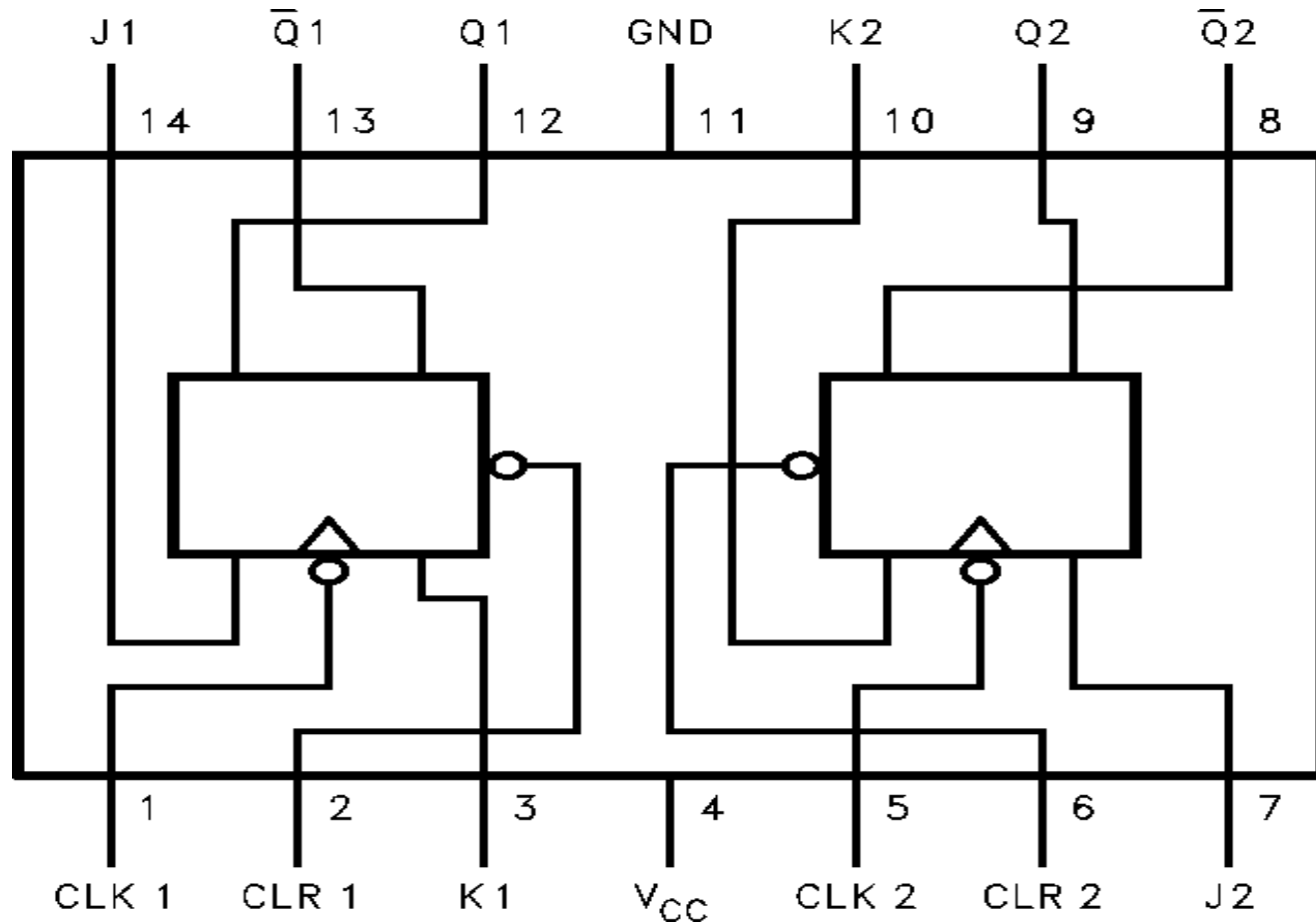
- Sinkroni rad bistabila- promjena stanja događa se preko ulaza SR, JK, D, T u skladu sa C_p impulsima
- Asinkroni rad bistabila-preko ulaza S_d (PR) ili C_d (CLR)
- Prioritet tih ulaza nad sinkronim

Bistabili sa asinkronim ulazima

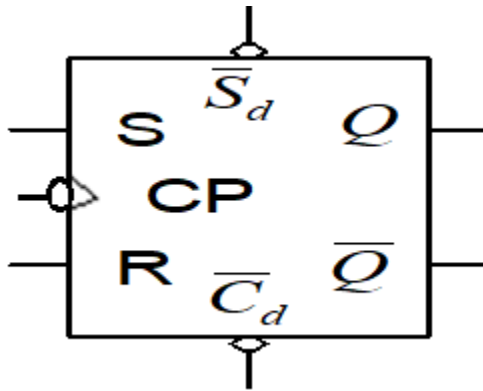
- Preko asinkronih ulaza postavljamo bistabile u određeno stanje bez obzira na stanja sinkronih ulaza (SR; JK; D; T) i C_p impulsa
- Sa S_d (PR) $Q=1$
- Sa C_d (CLR) $Q=0$
- S_d i C_d aktivni u nuli
- (oznaka kružića)



7473 - Dual Master-Slave J-K Flip-Flops with Clear and Complementary Outputs

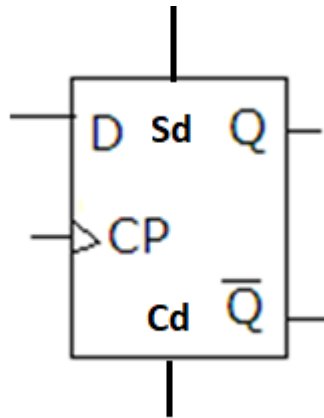


Primjer 1: Za zadani bistabil napisati tablicu stanja i analizirati rad



CP	S _d	C _d	S	R	Q _{n+1}	
↓	1	1	0	0	Q _n	
↓	1	1	0	1	0	sinkroni rad
↓	1	1	1	0	1	
↓	1	1	1	1	X	
X	0	1	X	X	1	asinkroni rad
X	1	0	X	X	0	

Primjer 2: Za zadani bistabil napisati tablicu stanja i analizirati rad



CP	Sd	Cd	D	Q_{n+1}	
0	0	0	X	Q_n	
↑	0	0	0	0	sinkroni rad
↑	0	0	1	1	
X	0	1	X	0	asinkroni rad
X	1	0	X	1	