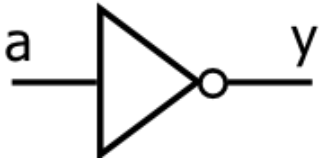
Boolova logična vrata

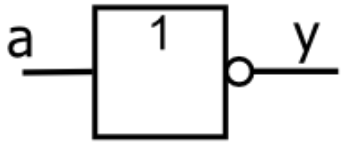
- Logične funkcije nad binarnimi vrednostmi: 0 in 1
- Najbolj preprost gradnik je negator
  - en vhodni in en izhodni signal
  - izhod ima invertirano (negirano) vrednost glede na vhod

y = NOT (a)

značilen simbol:

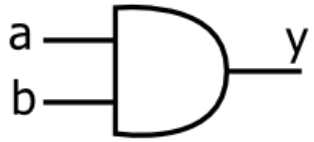
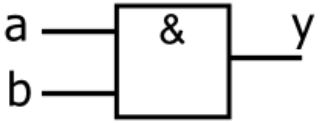
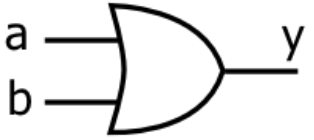
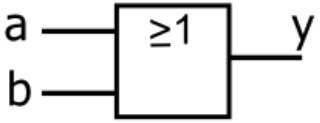
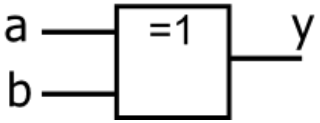


IEEE simbol:



a	y
0	1
1	0

Logična vrata z dvema vhodoma

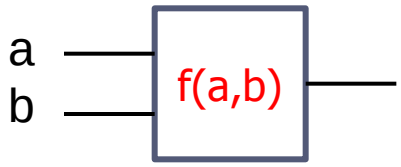
operacija	grafični simbol		pravilnostna tabela
y = a AND b	značilen:		
	IEEE:		
y = a OR b	značilen:		
	IEEE:		
y = a XOR b	značilen:		
	IEEE:		

a b | y
0 0 | 0
0 1 | 0
1 0 | 0
1 1 | 1

a b | y
0 0 | 0
0 1 | 1
1 0 | 1
1 1 | 1

a b | y
0 0 | 0
0 1 | 1
1 0 | 1
1 1 | 0

Boolove funkcije z dvema vhodoma



a	b	16 možnih funkcij															
0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
0	1	0	0	0	0	1	1	1	1	0	0	0	0	1	1	1	1
1	0	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1
1	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1

a AND b

a XOR b

a OR b

NOT(a OR b)

a = b

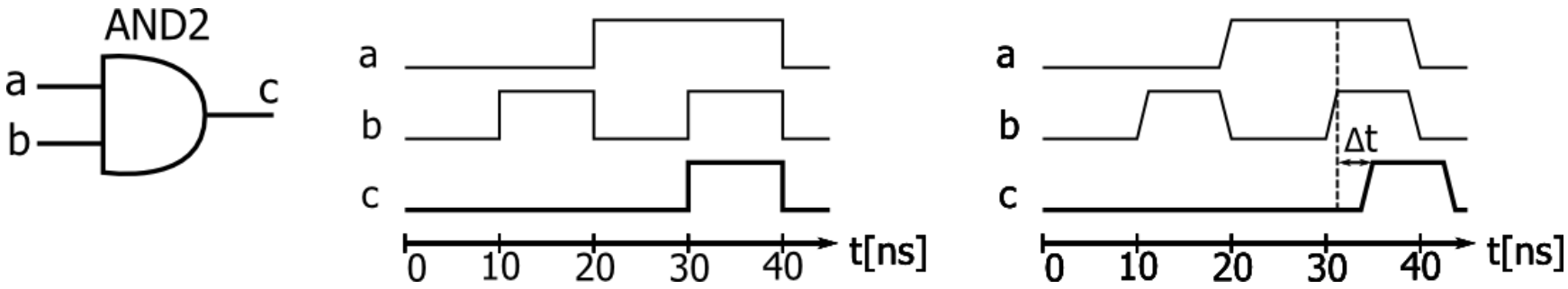
NOT b

NOT a

NOT (a AND b)

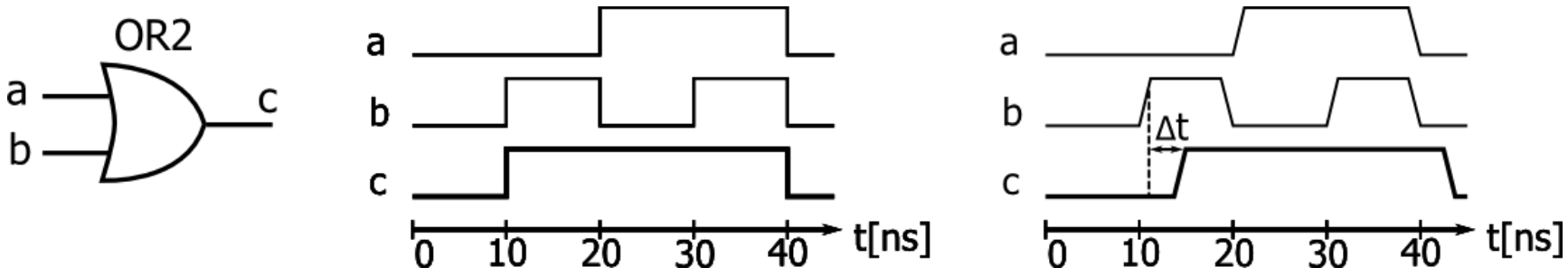
Časovni diagram logičnih vrat AND

- Simulacijski (idealni) in realni časovni diagram



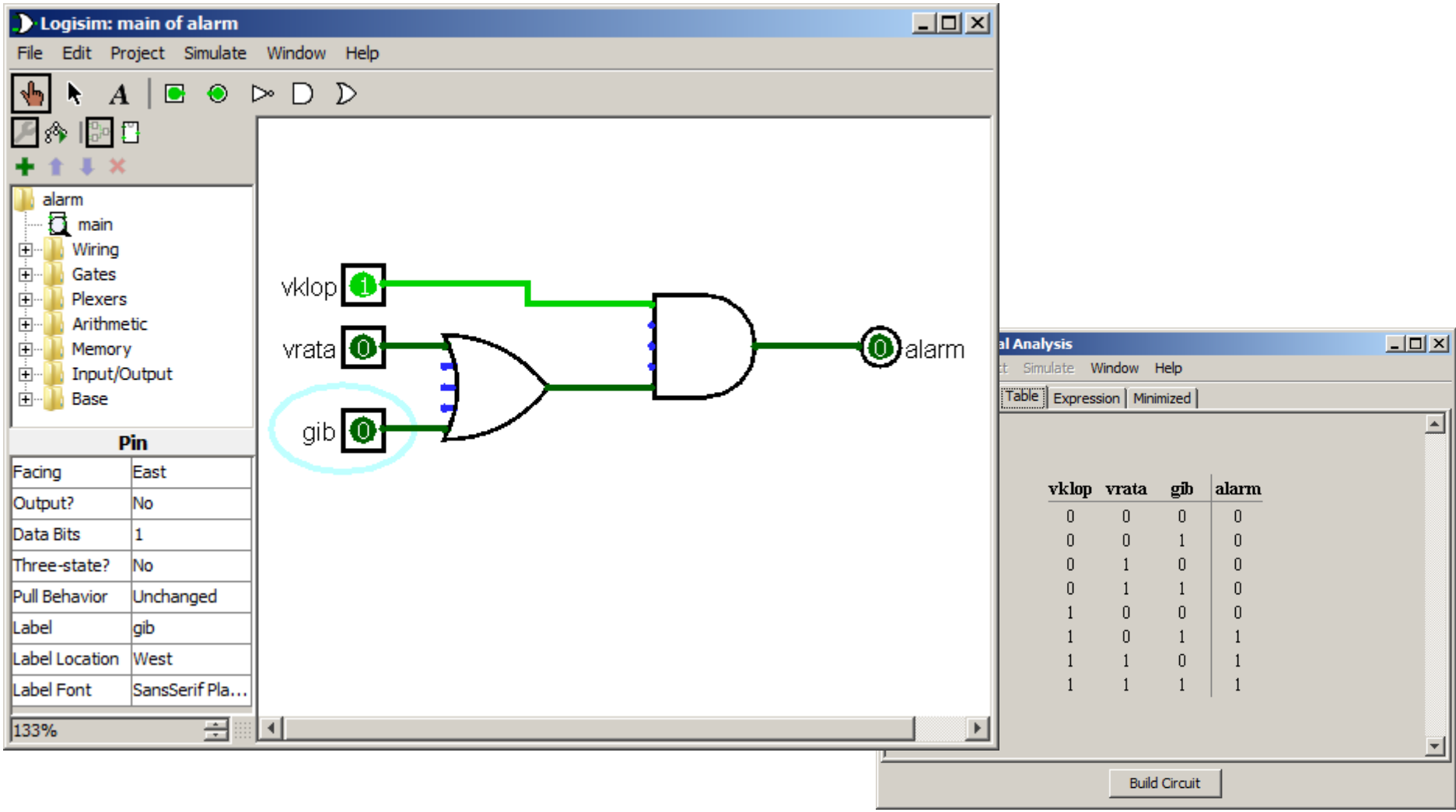
Časovni diagram logičnih vrat OR

- Simulacijski (idealni) in realni časovni diagram



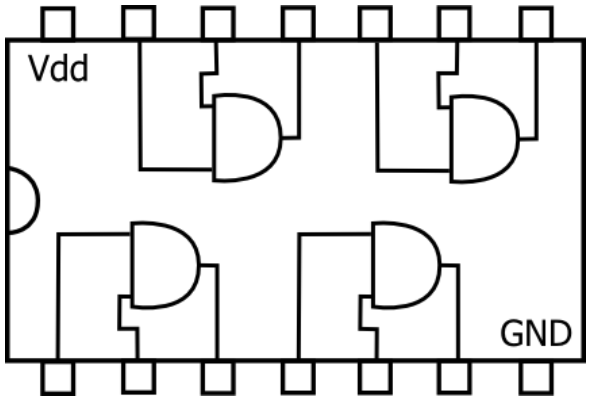
Simulator logičnih vezij

- Risanje in simulacija vezja v orodju Logisim



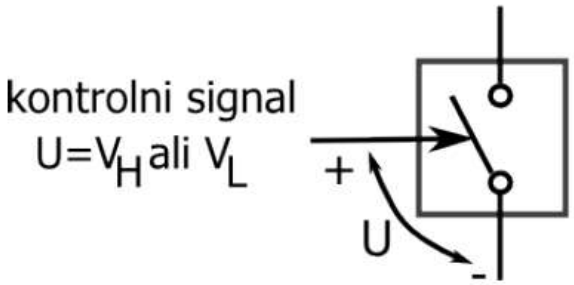
Izdelava logičnih vrat

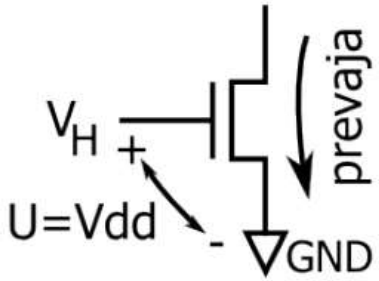
- Integrirana vezja s posameznimi vrati iz družine 74nnn
  - npr. 7408 vsebuje 4 logična vrata AND

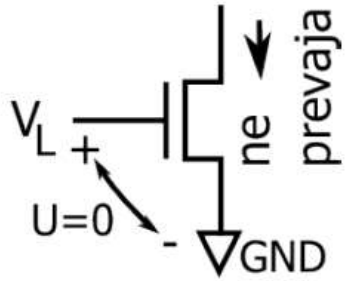


Elektronska stikala

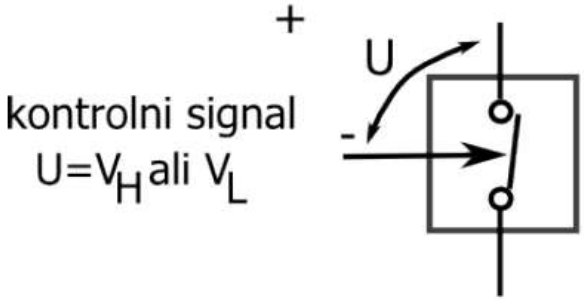
a) elektronsko stikalo: nMOS

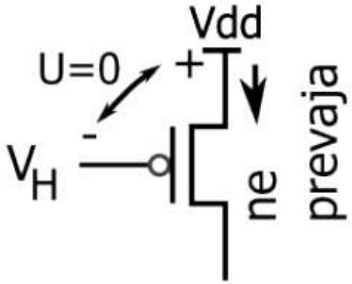


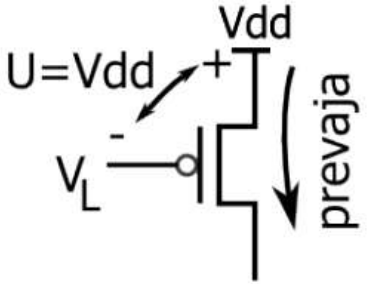




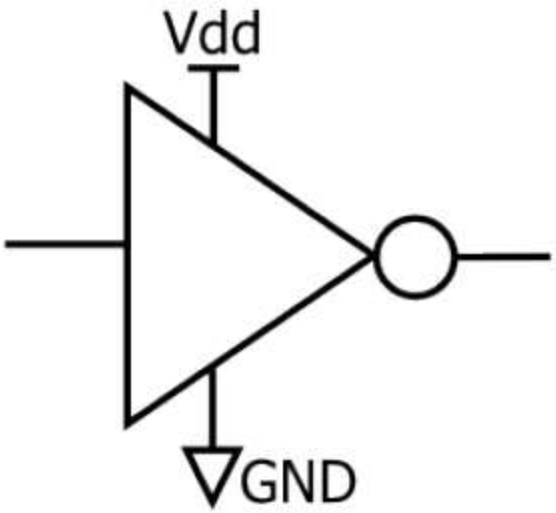
b) elektronsko stikalo: pMOS

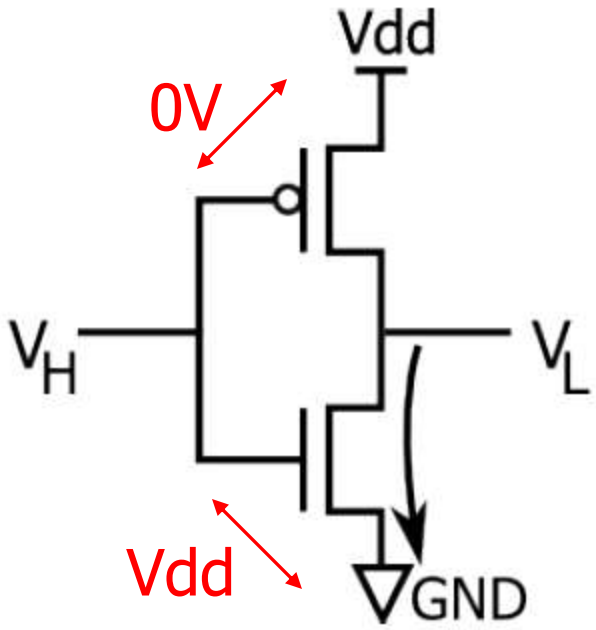




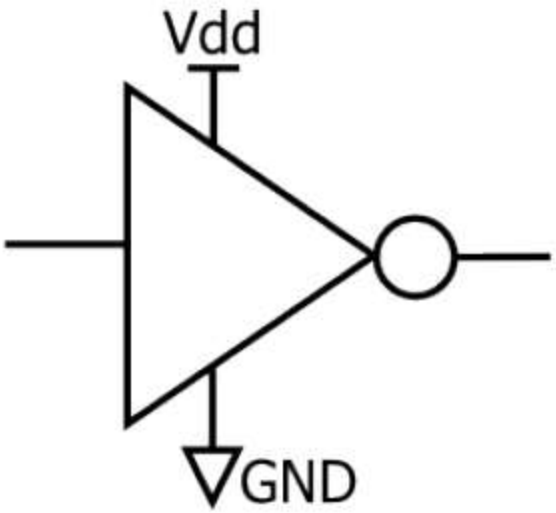


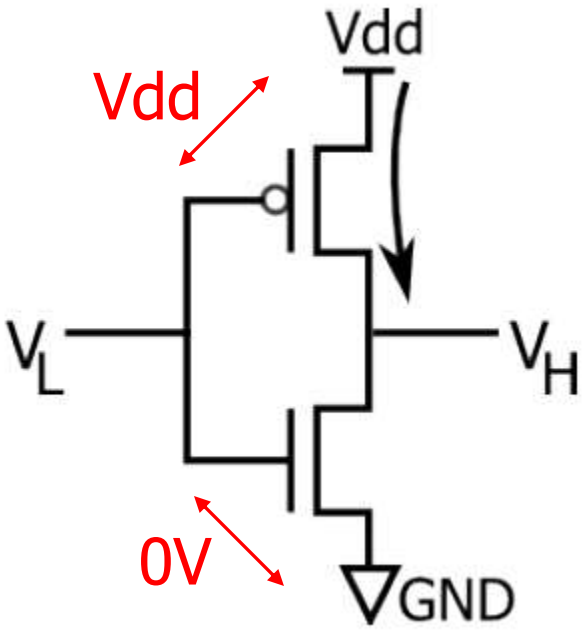
Negator v izvedbi CMOS





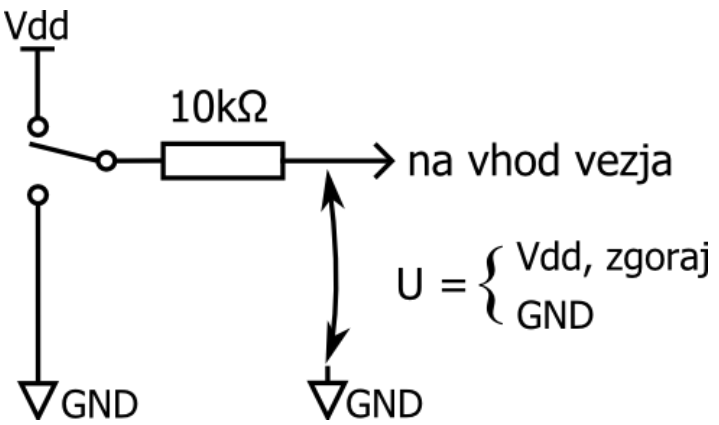
Negator v izvedbi CMOS





Signali v integriranih vezjih

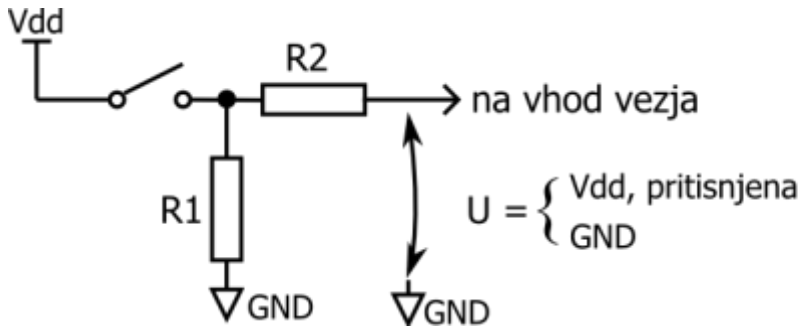
- Priključki na programirljivih vezjih so običajno dvosmerni
  - ko oblikujemo vezje, določimo ali je vhod ali izhod
- Kadar je priključek vhod ima zelo veliko upornost
- Kadar je izhod pa ima majhno notranjo upornost proti Vdd ali GND
  - poskrbeti moramo, da vežemo izhoda na Vdd ali GND, ker bi naredili kratek stik
- Primer: vezava preklopnega stikala
  - v serijo vežemo zaščitni upor



Vezava tipke

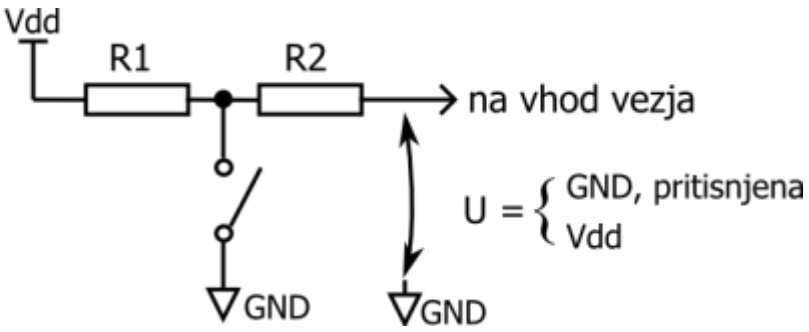
- Potrebujemo predupor R1, ki določa logično stanje ko je tipka spuščena in zaščitni upor R2 (vrednosti nekaj kΩ)

Pozitivna logika



- na vhod vezja '1' ko je tipka pritisnjena

Negativna logika

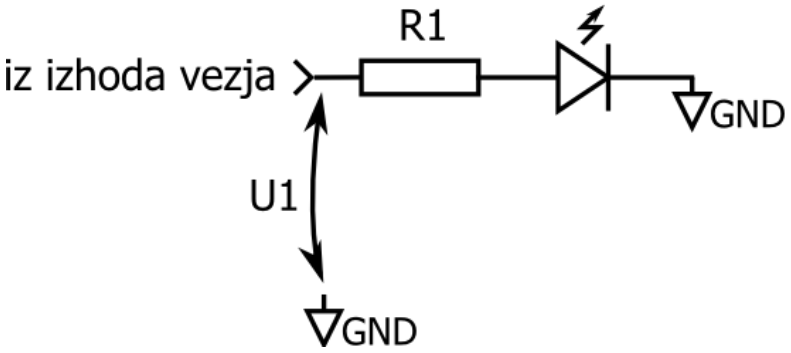


- na vhod vezja '0' ko je tipka pritisnjena

Vezava svetleče diode - LED

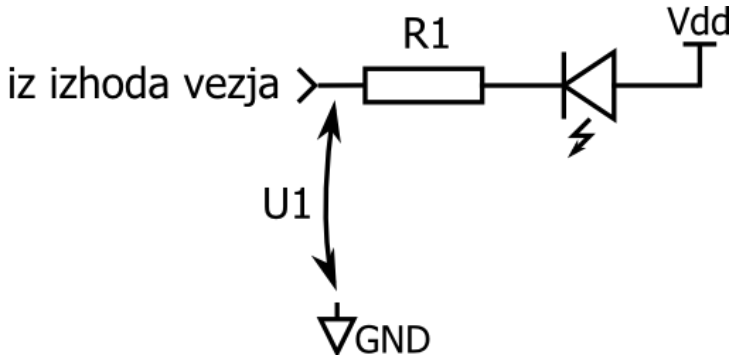
- Potrebujemo predupor R1 za omejitev toka skozi LED
  - npr. za 3.3mA LED izračunamo (3.3V-2V) / 3.3mA = 390Ω

Pozitivna logika



- LED sveti, ko je na izhodu vezja '1'

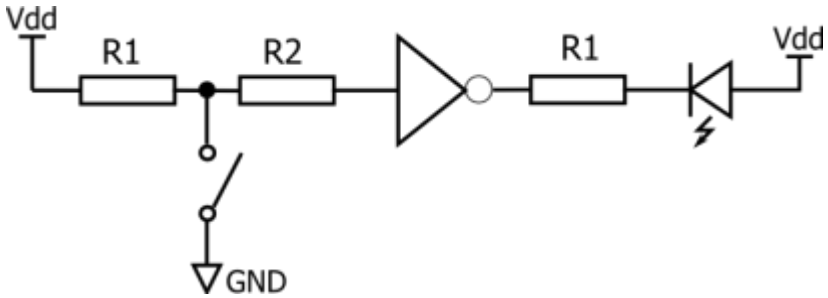
Negativna logika



- LED sveti, ko je na izhodu vezja '0'

Kdaj bo LED prižgana?

Ko bo tipka razklenjena.



Ne glede na tipko!