1)

**Doğruluk tablosu değerlerine göre Source ve Drain uçları değişmektedir! Kodlarda bu uçlar belirtildi. Bu soruda transistör numaraları yukarıdaki gibidir.**

M6 ve M3 transistörlerinin bağlanış şeklinden dolayı B girişinden girilen değere göre çeşitli çıktı durumları elde ediliyor. B girişinden 0 veya 1 verdiğimizde source-drain-bulk uçları değişiyor ve bu sayede 4 farklı durum elde ediliyor.

**A=0 ve B=0 için;**

.MODEL MOSN NMOS LEVEL=2 LD=0.15U TOX=200.0E-10

+ NSUB=5.36726E+15 VTO=0.743469 KP=8.00059E-05 GAMMA=0.543

+ PHI=0.6 U0=655.881 UEXP=0.157282 UCRIT=31443.8

+ DELTA=2.39824 VMAX=55260.9 XJ=0.25U LAMBDA=0.0367072

+ NFS=1E+12 NEFF=1.001 NSS=1E+11 TPG=1.0 RSH=70.00

+ CGDO=4.3E-10 CGSO=4.3E-10 CJ=0.0003 MJ=0.6585

+ CJSW=8.0E-10 MJSW=0.2402 PB=0.58

.MODEL MOSP PMOS LEVEL=2 LD=0.15U TOX=200.0E-10

+ NSUB=4.3318E+15 VTO=-0.738861 KP=2.70E-05 GAMMA=0.58

+ PHI=0.6 U0=261.977 UEXP=0.323932 UCRIT=65719.8

+ DELTA=1.79192 VMAX=25694 XJ=0.25U LAMBDA=0.0612279

+ NFS=1E+12 NEFF=1.001 NSS=1E+11 TPG=-1.0 RSH=120.6

+ CGDO=4.3E-10 CGSO=4.3E-10 CJ=0.0005 MJ=0.5052

+ CJSW=1.349E-10 MJSW=0.2417 PB=0.64

\*  **D G S B**

M1 3 2 0 0 MOSN W=1.8u L=1.2u

M2 3 4 5 5 MOSN W=1.8u L=1.2u

M3 5 3 4 4 MOSN W=1.8u L=1.2u

M4 3 2 1 1 MOSP W=3.6u L=1.2u

M5 2 4 5 5 MOSP W=3.6u L=1.2u

M6 4 2 5 5 MOSP W=3.6u L=1.2u

vdd 1 0 5V

v2 2 0 0v

v4 4 0 0v

\*Vin1 2 0 pulse(0V 5V 0 0ns 0ns 100ns 200ns)

\*Vin2 4 0 pulse(0V 5V 0 0ns 0ns 200ns 400ns)

.control

tran 0.05n 500n

plot v(2) v(4) v(5)

.endc

.end

**A=0 ve B=1 için;**

.MODEL MOSN NMOS LEVEL=2 LD=0.15U TOX=200.0E-10

+ NSUB=5.36726E+15 VTO=0.743469 KP=8.00059E-05 GAMMA=0.543

+ PHI=0.6 U0=655.881 UEXP=0.157282 UCRIT=31443.8

+ DELTA=2.39824 VMAX=55260.9 XJ=0.25U LAMBDA=0.0367072

+ NFS=1E+12 NEFF=1.001 NSS=1E+11 TPG=1.0 RSH=70.00

+ CGDO=4.3E-10 CGSO=4.3E-10 CJ=0.0003 MJ=0.6585

+ CJSW=8.0E-10 MJSW=0.2402 PB=0.58

.MODEL MOSP PMOS LEVEL=2 LD=0.15U TOX=200.0E-10

+ NSUB=4.3318E+15 VTO=-0.738861 KP=2.70E-05 GAMMA=0.58

+ PHI=0.6 U0=261.977 UEXP=0.323932 UCRIT=65719.8

+ DELTA=1.79192 VMAX=25694 XJ=0.25U LAMBDA=0.0612279

+ NFS=1E+12 NEFF=1.001 NSS=1E+11 TPG=-1.0 RSH=120.6

+ CGDO=4.3E-10 CGSO=4.3E-10 CJ=0.0005 MJ=0.5052

+ CJSW=1.349E-10 MJSW=0.2417 PB=0.64

**\* D G S B**

M1 3 2 0 0 MOSN W=1.8u L=1.2u

M2 3 4 5 5 MOSN W=1.8u L=1.2u

M3 4 3 5 5 MOSN W=1.8u L=1.2u

M4 3 2 1 1 MOSP W=3.6u L=1.2u

M5 2 4 5 5 MOSP W=3.6u L=1.2u

M6 5 2 4 4 MOSP W=3.6u L=1.2u

vdd 1 0 5V

v2 2 0 0v

v4 4 0 5v

\*Vin1 2 0 pulse(0V 5V 0 0ns 0ns 100ns 200ns)

\*Vin2 4 0 pulse(0V 5V 0 0ns 0ns 200ns 400ns)

.control

tran 0.05n 500n

plot v(2) v(4) v(5)+0.1

.endc

.end

**A=1 ve B=0 için;**

.MODEL MOSN NMOS LEVEL=2 LD=0.15U TOX=200.0E-10

+ NSUB=5.36726E+15 VTO=0.743469 KP=8.00059E-05 GAMMA=0.543

+ PHI=0.6 U0=655.881 UEXP=0.157282 UCRIT=31443.8

+ DELTA=2.39824 VMAX=55260.9 XJ=0.25U LAMBDA=0.0367072

+ NFS=1E+12 NEFF=1.001 NSS=1E+11 TPG=1.0 RSH=70.00

+ CGDO=4.3E-10 CGSO=4.3E-10 CJ=0.0003 MJ=0.6585

+ CJSW=8.0E-10 MJSW=0.2402 PB=0.58

.MODEL MOSP PMOS LEVEL=2 LD=0.15U TOX=200.0E-10

+ NSUB=4.3318E+15 VTO=-0.738861 KP=2.70E-05 GAMMA=0.58

+ PHI=0.6 U0=261.977 UEXP=0.323932 UCRIT=65719.8

+ DELTA=1.79192 VMAX=25694 XJ=0.25U LAMBDA=0.0612279

+ NFS=1E+12 NEFF=1.001 NSS=1E+11 TPG=-1.0 RSH=120.6

+ CGDO=4.3E-10 CGSO=4.3E-10 CJ=0.0005 MJ=0.5052

+ CJSW=1.349E-10 MJSW=0.2417 PB=0.64

**\* D G S B**

M1 3 2 0 0 MOSN W=1.8u L=1.2u

M2 5 4 3 3 MOSN W=1.8u L=1.2u

M3 5 3 4 4 MOSN W=1.8u L=1.2u

M4 3 2 1 1 MOSP W=3.6u L=1.2u

M5 2 4 5 5 MOSP W=3.6u L=1.2u

M6 4 2 5 5 MOSP W=3.6u L=1.2u

vdd 1 0 5V

v2 2 0 5v

v4 4 0 0v

\*Vin1 2 0 pulse(0V 5V 0 0ns 0ns 100ns 200ns)

\*Vin2 4 0 pulse(0V 5V 0 0ns 0ns 200ns 400ns)

.control

tran 0.05n 500n

plot v(2) v(4) v(5)+0.1

.endc

.end

**A=1 ve B=1 için;**

.MODEL MOSN NMOS LEVEL=2 LD=0.15U TOX=200.0E-10

+ NSUB=5.36726E+15 VTO=0.743469 KP=8.00059E-05 GAMMA=0.543

+ PHI=0.6 U0=655.881 UEXP=0.157282 UCRIT=31443.8

+ DELTA=2.39824 VMAX=55260.9 XJ=0.25U LAMBDA=0.0367072

+ NFS=1E+12 NEFF=1.001 NSS=1E+11 TPG=1.0 RSH=70.00

+ CGDO=4.3E-10 CGSO=4.3E-10 CJ=0.0003 MJ=0.6585

+ CJSW=8.0E-10 MJSW=0.2402 PB=0.58

.MODEL MOSP PMOS LEVEL=2 LD=0.15U TOX=200.0E-10

+ NSUB=4.3318E+15 VTO=-0.738861 KP=2.70E-05 GAMMA=0.58

+ PHI=0.6 U0=261.977 UEXP=0.323932 UCRIT=65719.8

+ DELTA=1.79192 VMAX=25694 XJ=0.25U LAMBDA=0.0612279

+ NFS=1E+12 NEFF=1.001 NSS=1E+11 TPG=-1.0 RSH=120.6

+ CGDO=4.3E-10 CGSO=4.3E-10 CJ=0.0005 MJ=0.5052

+ CJSW=1.349E-10 MJSW=0.2417 PB=0.64

\* D G S B

M1 3 2 0 0 MOSN W=1.8u L=1.2u

M2 3 4 5 5 MOSN W=1.8u L=1.2u

M3 4 3 5 5 MOSN W=1.8u L=1.2u

M4 3 2 1 1 MOSP W=3.6u L=1.2u

M5 5 4 2 2 MOSP W=3.6u L=1.2u

M6 5 2 4 4 MOSP W=3.6u L=1.2u

vdd 1 0 5V

v2 2 0 5v

v4 4 0 5v

\*Vin1 2 0 pulse(0V 5V 0 0ns 0ns 100ns 200ns)

\*Vin2 4 0 pulse(0V 5V 0 0ns 0ns 200ns 400ns)

.control

tran 0.05n 500n

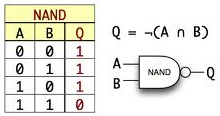
plot v(2)+0.1 v(4)

plot v(5)

.endc

.end

2)



.MODEL MOSN NMOS LEVEL=2 LD=0.15U TOX=200.0E-10

+ NSUB=5.36726E+15 VTO=0.743469 KP=8.00059E-05 GAMMA=0.543

+ PHI=0.6 U0=655.881 UEXP=0.157282 UCRIT=31443.8

+ DELTA=2.39824 VMAX=55260.9 XJ=0.25U LAMBDA=0.0367072

+ NFS=1E+12 NEFF=1.001 NSS=1E+11 TPG=1.0 RSH=70.00

+ CGDO=4.3E-10 CGSO=4.3E-10 CJ=0.0003 MJ=0.6585

+ CJSW=8.0E-10 MJSW=0.2402 PB=0.58

.MODEL MOSP PMOS LEVEL=2 LD=0.15U TOX=200.0E-10

+ NSUB=4.3318E+15 VTO=-0.738861 KP=2.70E-05 GAMMA=0.58

+ PHI=0.6 U0=261.977 UEXP=0.323932 UCRIT=65719.8

+ DELTA=1.79192 VMAX=25694 XJ=0.25U LAMBDA=0.0612279

+ NFS=1E+12 NEFF=1.001 NSS=1E+11 TPG=-1.0 RSH=120.6

+ CGDO=4.3E-10 CGSO=4.3E-10 CJ=0.0005 MJ=0.5052

+ CJSW=1.349E-10 MJSW=0.2417 PB=0.64

M1 2 5 3 3 MOSN W=1.8u L=1.2u

M2 3 4 0 0 MOSN W=1.8u L=1.2u

M3 2 4 1 1 MOSP W=5.4u L=1.2u

M4 2 5 1 1 MOSP W=5.4u L=1.2u

vdd 1 0 5V

Vin 4 0 pulse(5V 0V 0 1ns 1ns 100ns 200ns)

Vin1 5 0 pulse(5V 0V 0 1ns 1ns 200ns 400ns)

c1 5 0 1fF

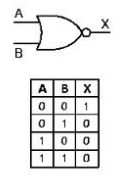
.control

tran 0.05n 200n

plot v(2) v(4)+0.1 v(5)+0.2

.endc

.end

3)

.MODEL MOSN NMOS LEVEL=2 LD=0.15U TOX=200.0E-10

+ NSUB=5.36726E+15 VTO=0.743469 KP=8.00059E-05 GAMMA=0.543

+ PHI=0.6 U0=655.881 UEXP=0.157282 UCRIT=31443.8

+ DELTA=2.39824 VMAX=55260.9 XJ=0.25U LAMBDA=0.0367072

+ NFS=1E+12 NEFF=1.001 NSS=1E+11 TPG=1.0 RSH=70.00

+ CGDO=4.3E-10 CGSO=4.3E-10 CJ=0.0003 MJ=0.6585

+ CJSW=8.0E-10 MJSW=0.2402 PB=0.58

.MODEL MOSP PMOS LEVEL=2 LD=0.15U TOX=200.0E-10

+ NSUB=4.3318E+15 VTO=-0.738861 KP=2.70E-05 GAMMA=0.58

+ PHI=0.6 U0=261.977 UEXP=0.323932 UCRIT=65719.8

+ DELTA=1.79192 VMAX=25694 XJ=0.25U LAMBDA=0.0612279

+ NFS=1E+12 NEFF=1.001 NSS=1E+11 TPG=-1.0 RSH=120.6

+ CGDO=4.3E-10 CGSO=4.3E-10 CJ=0.0005 MJ=0.5052

+ CJSW=1.349E-10 MJSW=0.2417 PB=0.64

M1 5 2 0 0 MOSN W=1.8u L=1.2u

M2 5 4 0 0 MOSN W=1.8u L=1.2u

M3 3 2 1 1 MOSP W=5.4u L=1.2u

M4 5 4 3 3 MOSP W=5.4u L=1.2u

vdd 1 0 5V

Vin 2 0 pulse(5V 0V 0 1ns 1ns 100ns 200ns)

Vin1 4 0 pulse(5v 0V 0 1ns 1ns 200ns 400ns)

c1 5 0 1fF

.control

tran 0.05n 400n

plot v(5) v(2)+0.1 v(4)+0.2

.endc

.end