

Figure 6-1

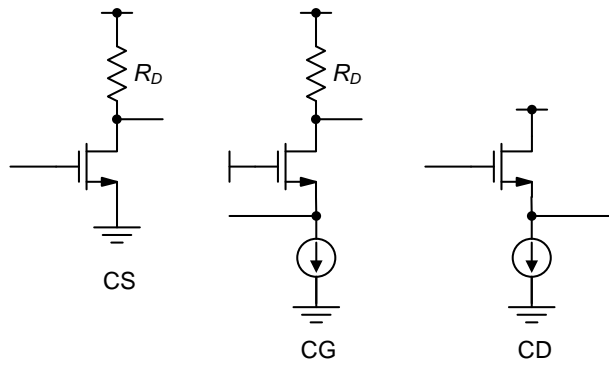


Figure 6-2

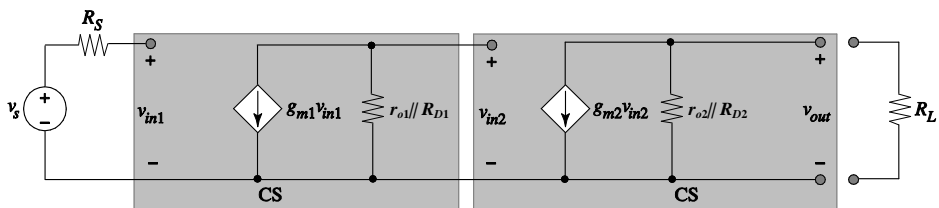


Figure 6-3

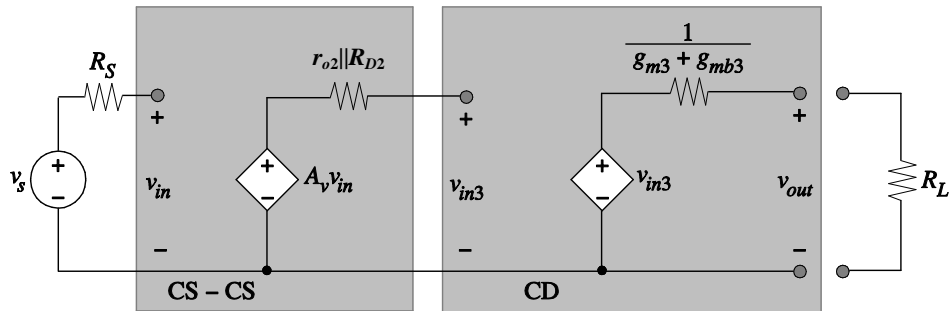


Figure 6-4

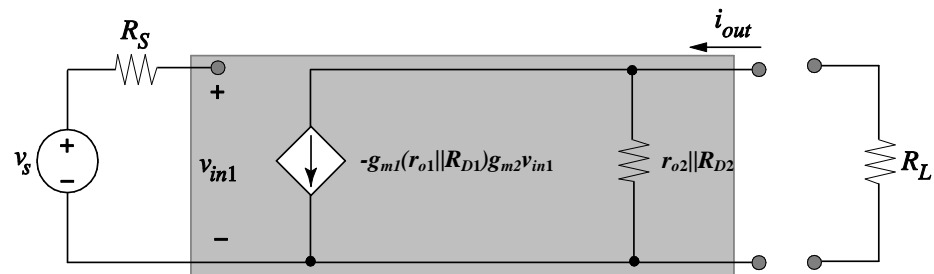


Figure 6-5

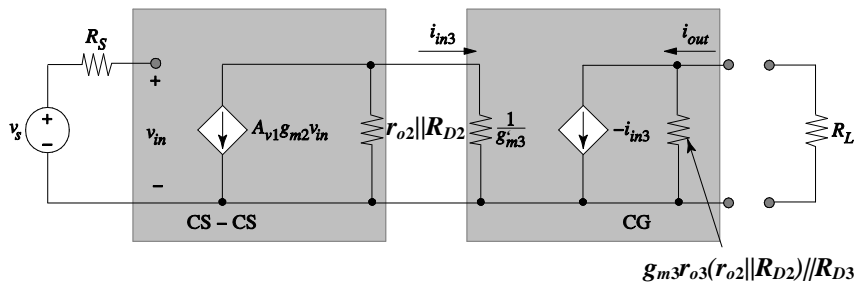


Figure Ex6-1A

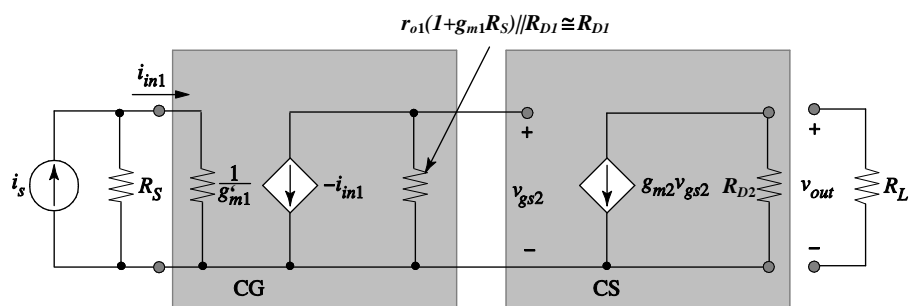


Figure Ex6-1B

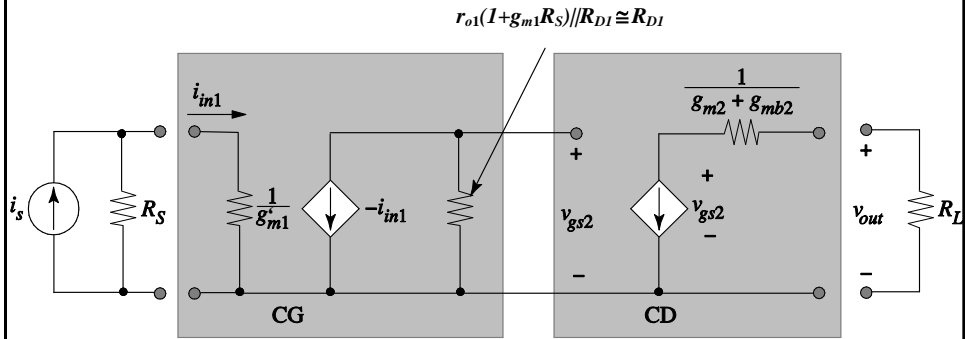


Figure 6-6

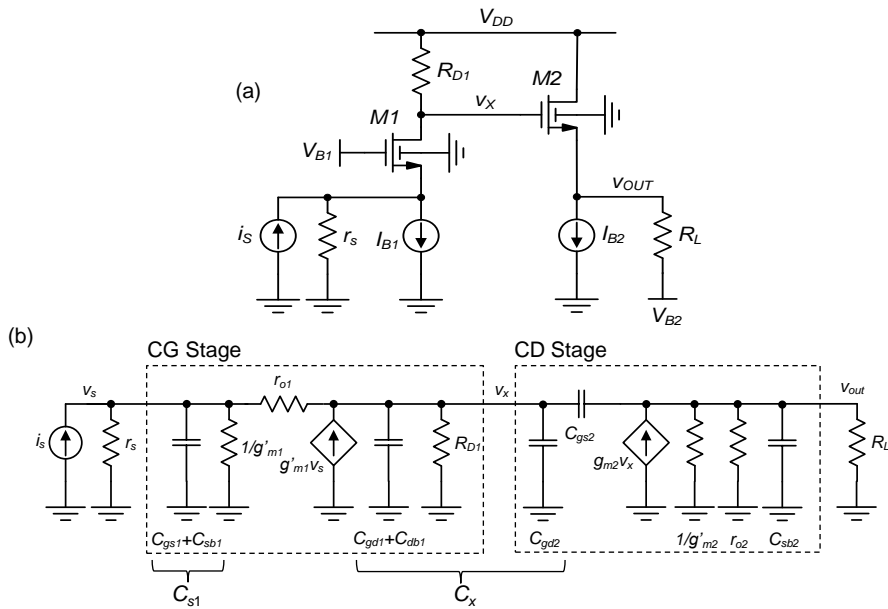
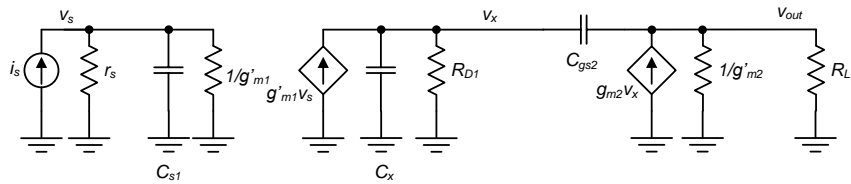
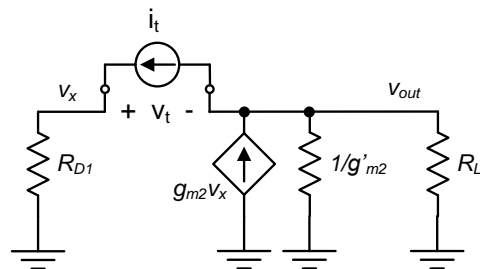


Figure 6-7



Example 6-2 Solution



Example 6-3 Solution

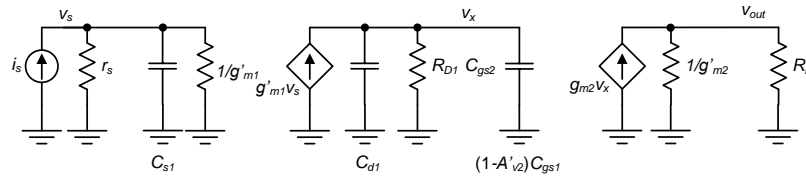


Figure 6-8

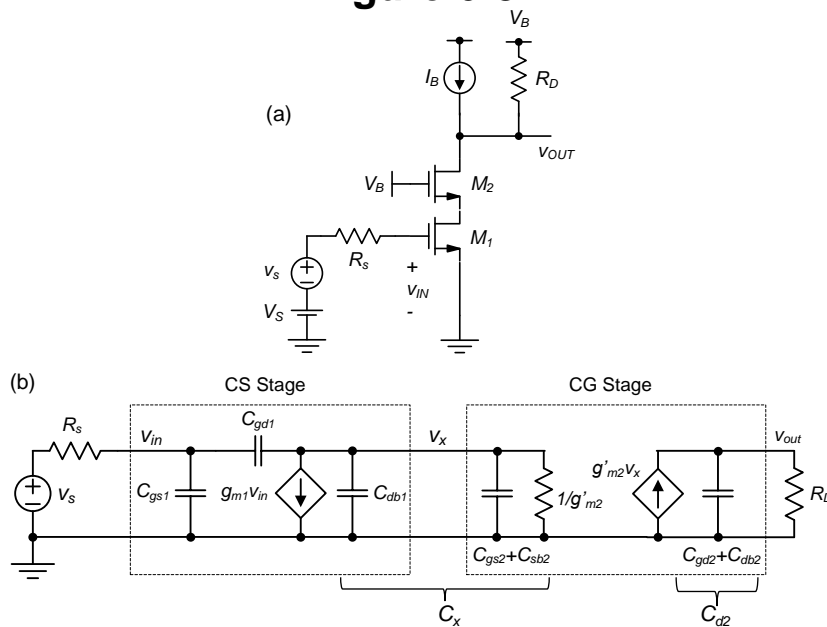


Figure Ex6-3

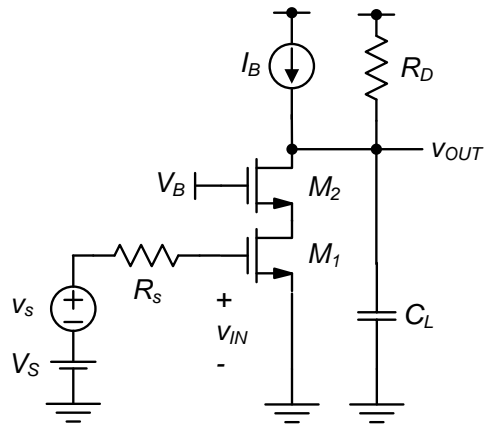


Figure 6-9

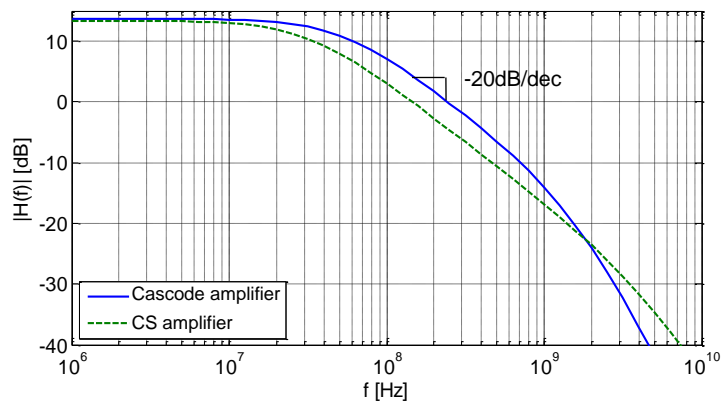


Figure 6-10

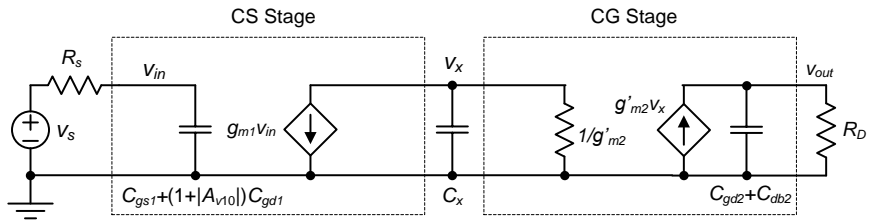


Figure 6-11

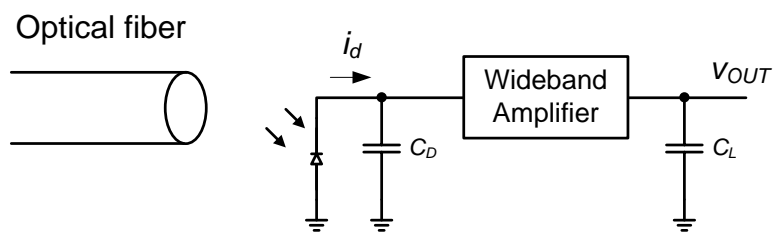


Figure 6-12

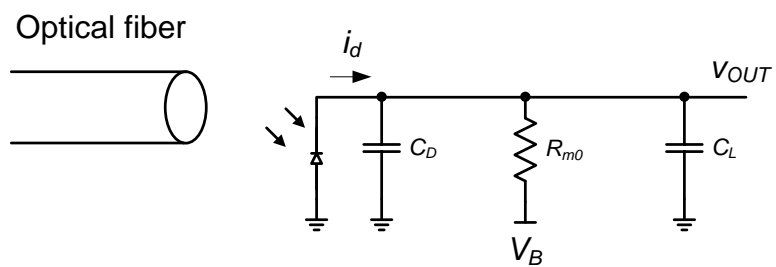


Figure 6-13

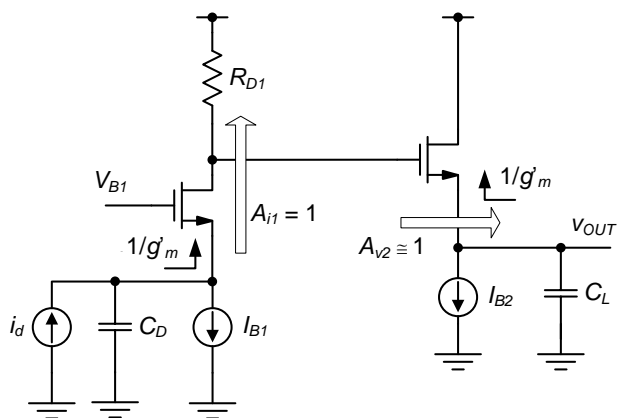


Figure 6-14

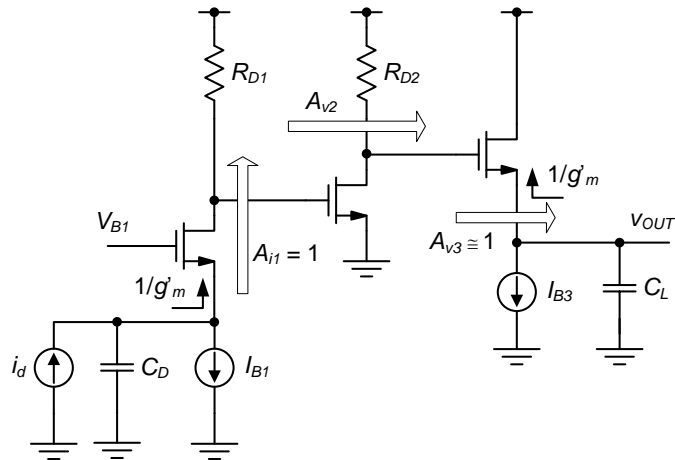


Figure 6-15

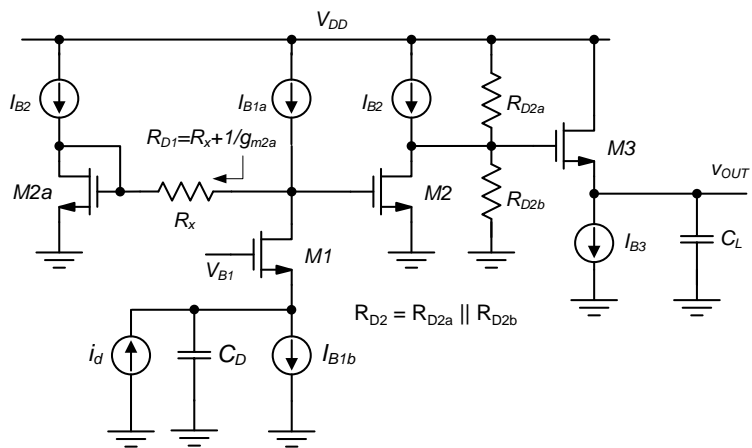


Figure 6-16

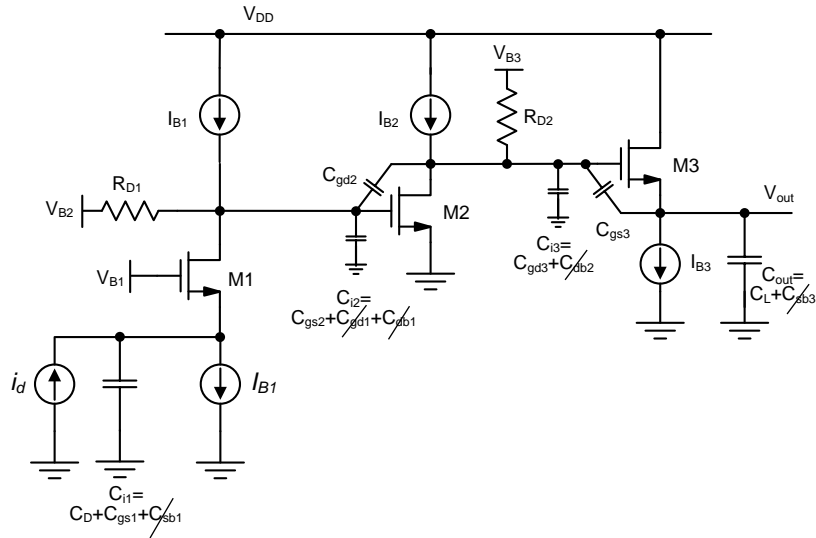


Figure 6-17

```
% Design script for three-stage transresistance amplifier

% Process technology parameters
kp_n = 50e-6;
Cox = 2.3e-3;
mu_n = kp_n/Cox;
Cov = 0.5e-9;
gmb_gm = 0.2;

% Design specifications
Rm = 2e3;
CD = 5e-12;
CL = 10e-12;
IDtot = 3e-3;

% Design choices
VOV1 = 0.3;
VOV2 = 0.3;
VOV3 = 0.3;
L1 = 1e-6;
L2 = 1e-6;
L3 = 1e-6;

% optimization parameters
ID1_IDtot = 0.25;
ID3_IDtot = 0.25;
Av20 = 10;

% Compute drain currents
ID1 = IDtot*ID1_IDtot;
ID3 = IDtot*ID3_IDtot;
ID2 = IDtot - ID1 - ID3;

% Calculations for M1
gm1 = 2*ID1/VOV1;
W1 = 2*ID1/(kp_n/L1*VOV1^2);
Cgs1 = 2/3*W1*L1*Cox + W1*Cov;
tau_in = (Cgs1+CD)/(gm1*(1+gmb_gm));

% Calculations for M3
gm3 = 2*ID3/VOV3;
W3 = 2*ID3/(kp_n/L3*VOV3^2);
Cgs3 = 2/3*W3*L3*Cox + W3*Cov;
Cgd3 = W3*Cov;
Av30 = 1-gmb_gm;
tau_out = (CL+Cgs3)/(gm3*(1+gmb_gm));

% Calculations for M2
gm2 = 2*ID2/VOV2;
W2 = 2*ID2/(kp_n/L2*VOV2^2);
Cgs2 = 2/3*W2*L2*Cox + W2*Cov;
Cgd2 = W2*Cov;
RD1 = Rm/Av20/Av30;
RD2 = Av20/gm2;
tau_core = RD1*(Cgs2 + (1+Av20)*Cgd2) + RD2*(Cgd3+(1-Av30)*Cgs3);

% Total time constant and bandwidth estimate
tau_tot = tau_in + tau_core + tau_out;
f3dB = 1/(2*pi*tau_tot);
```

Figure 6-18

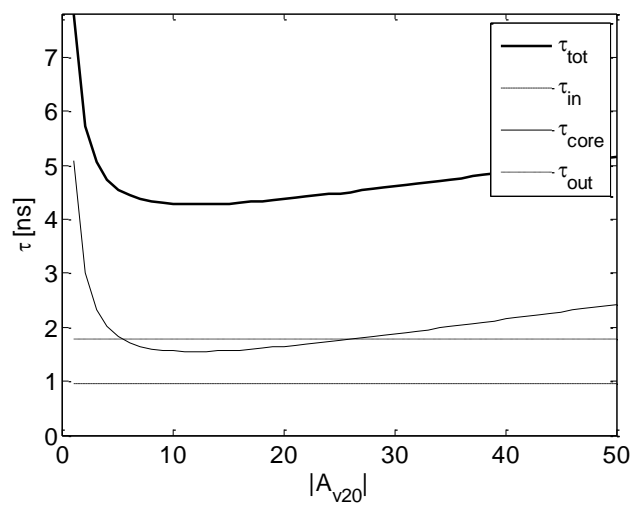


Figure P6-3

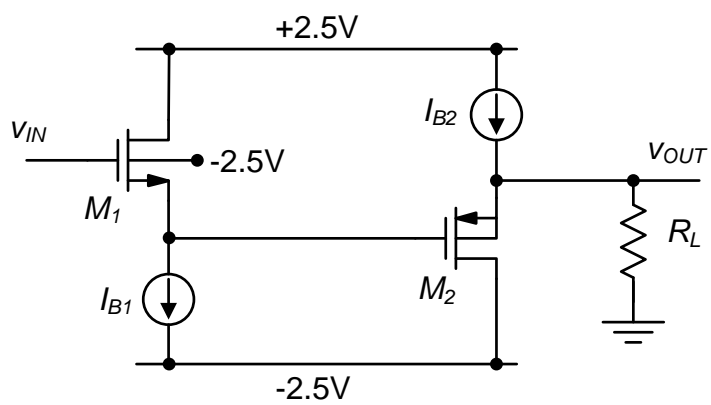
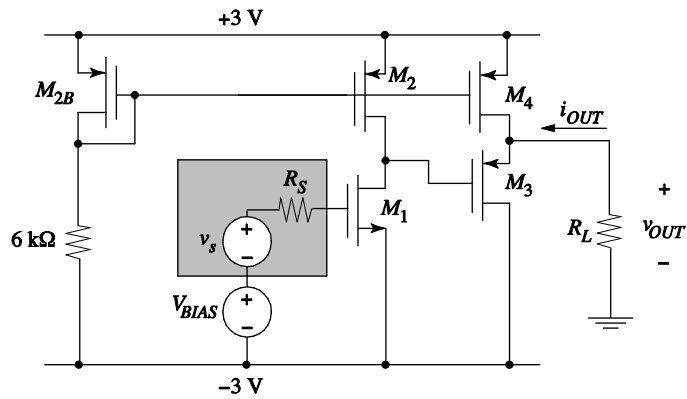
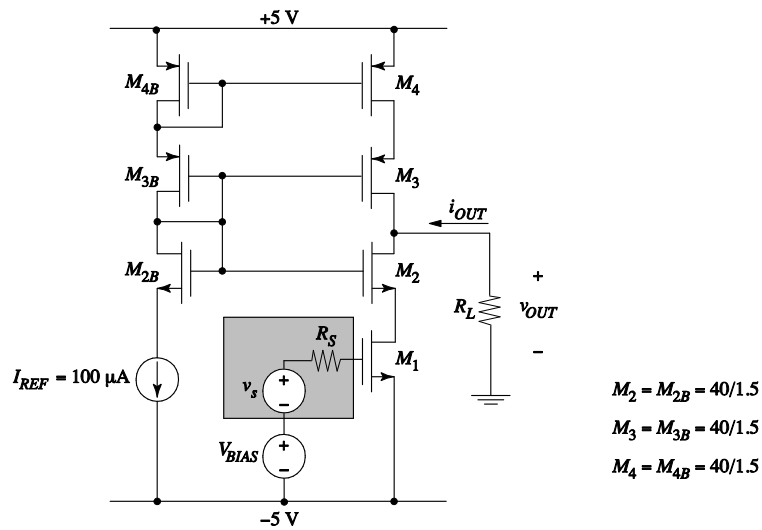


Figure P6-5



Howe & Sodini, Fig. P9-17

Figure P6-6



Howe & Sodini, Fig. P9-20

Figure P6-7

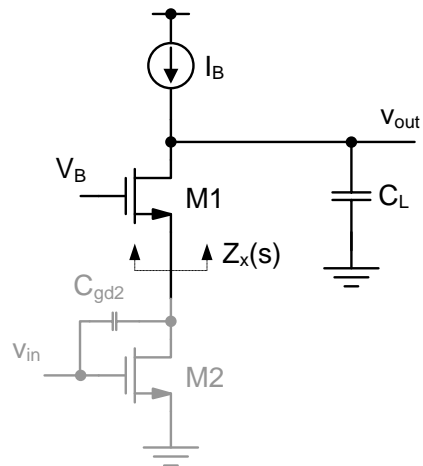


Figure P6-8

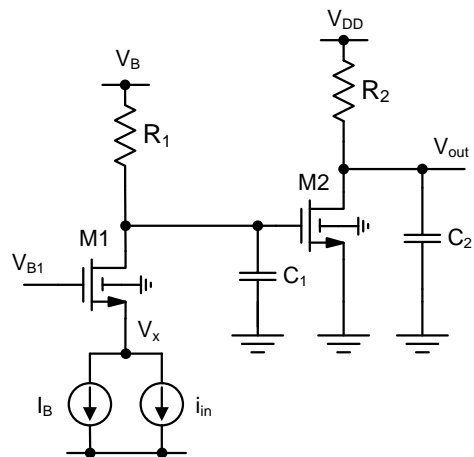


Figure P6-9

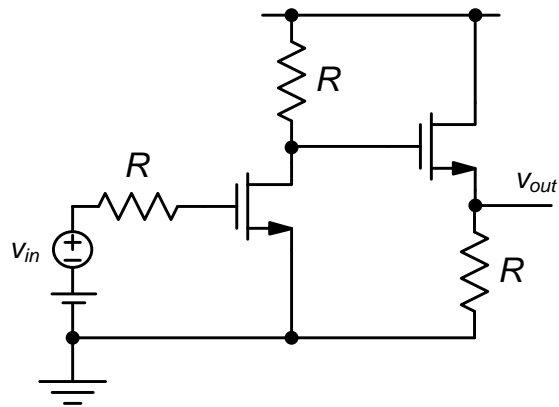


Figure P6-12

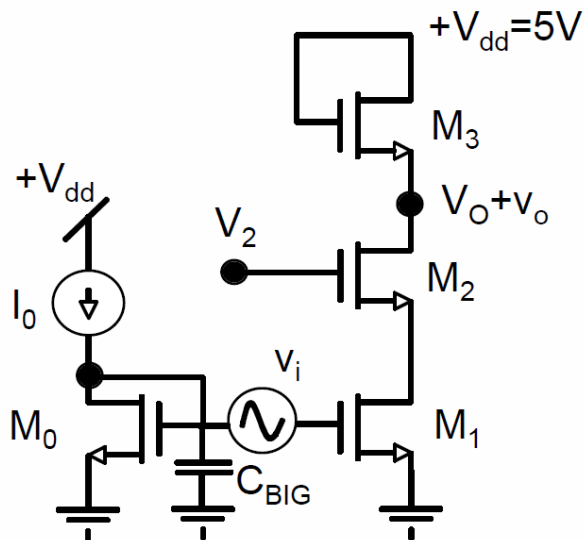


Figure P6-13

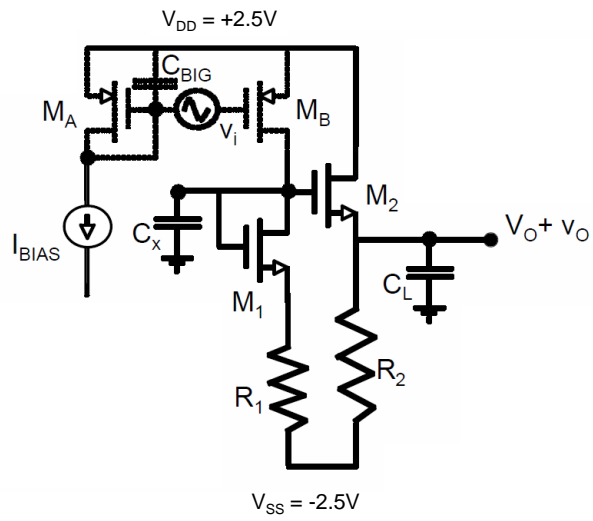


Figure P6-14

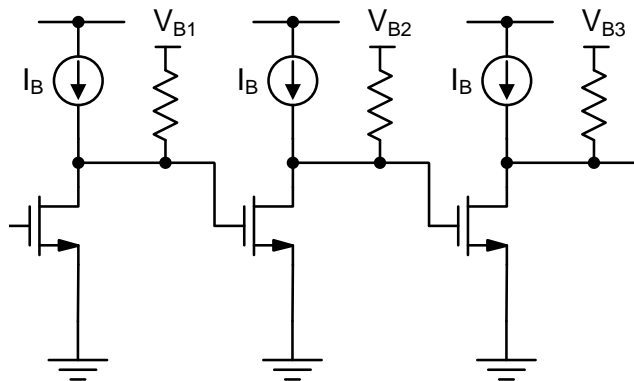


Figure P6-15

