SHEET-2

N -33MM, P -33MM

Parameters:

Vdd=1.8v

Gain=60.1DB

PM= 41.1

BW= 1.34MHz

Power= 24.9uW

Current= 13.8uA

CMRR=93.8DB

PSRR=104.6DB

SR=3V/uS

C_L =342.7KPf

V_{th} (nmos)=0.33v – 0.34v

V_{th} (pmos)=0.43v

$\mu_n cox=345uA/V^2$

$\mu_p cox=55uA/V^2$

Calculation:

SR= $\frac{I}{Cc}$

I_5=SR*Cc

I_5=0.1p x 3V/uS

=0.3uA

VDS5=VGS5-VTH

=Vdd-Vbias-Vth

=1.8-1.246-0.43

Vds5=0.124V

i) $\left(\frac{W}{L}\right)_5 = \frac{2*I_5}{□pcox\ (vds5)^2} = \frac{2(0.3u)}{55u*(0.124)^2} = 0.709$

Practical : $\frac{240n}{340n} = 0.705$

Theoritical: W5=244n L5=344n

ii) $W_{GB} = \frac{gm1}{c_c}$

$Gm_1 = W_{GB} * C_c = (0.1p)(20M) = 2u$ mho

$\left(\frac{W}{L}\right)_1 = \frac{gm1^2}{2kpI1} = \frac{(2u)^2}{2*55u*0.15u} = 0.24$

Practical : $\frac{240n}{1u} = 0.24$

Theoritical: $\frac{240n}{1u} = 0.24$ W1=240n L1=1u

(iii) $\left(\frac{W}{L}\right)_1 = \left(\frac{W}{L}\right)_2 = 0.24$

W_2=240n

L_2=1□

(iv) $\left(\frac{W}{L}\right)_3 = \frac{2*i3}{unCox\ [Vds3]^2} = \frac{2\times0.15u}{345u\times0.035^2} = 0.709$ $V_{ds3} = V_{gs3} - V_{ss}$

$= v_{dd} - V_{bias\_0} = 1.8-1.765 = 0.035$

w_3=244n ; L_3=344n

(v) $\left(\frac{W}{L}\right)_3 = \left(\frac{W}{L}\right)_4$=0.709

$V_{ds3}=V_{ds6}$

(vi) $g_{m6}=\frac{gm2}{\tan\left(\frac{90-PM}{2}\right)}=\frac{2u}{\tan\left(\frac{90-41.1}{2}\right)}$=4.39u

$\left(\frac{W}{L}\right)_6=\frac{Gm6}{unCox\ [Vds6]^2}=\frac{4.39u}{345u*0.035^2}$=0.363

W_6=180n

L_6=500n

(vii) $I_6=\frac{\left(\frac{W}{L}\right)_6}{\left(\frac{W}{L}\right)_3}*I_3=\frac{0.036}{0.709}*0.15u$=0.07uA

$I_6=I_7$

$\left(\frac{W}{L}\right)_7=\frac{I_7}{I_5}*\left(\frac{W}{L}\right)_5$.

$\left(\frac{W}{L}\right)_7=\frac{0.07u}{0.3u}*0.709$=0.165

W_7=100n

L_7=590n

(viii) $\left(\frac{W}{L}\right)_{10}=\frac{2*I_{10}}{upcox\ (Vgs10-Vth)^2}$.

Assume I_{10}=1u; $\left(\frac{W}{L}\right)_{10}=\frac{2*1u}{55u(0.19)^2}$=1Vds10= Vgs10-$V_{th}$ = 1.8-Vbias-0.43 = 1.8-1.18-0.43=0.19

W_{10}=340n

L_{10}=340n

(ix) $\left(\frac{W}{L}\right)_9 = \left(\frac{W}{L}\right)_{10}$ =1

W_9=340n ; L_9=340n

(x)R_0= $\sqrt{\frac{1}{2Kp\left(\frac{W}{L}\right)_8 I_8}}$

Let R_o=390kΩ , I_8=1u

$\left(\frac{W}{L}\right)_8 = \frac{1}{2kp\,R_o{}^2 I_8}$=0.059

W_8=239n , L_8=4u

TABLE:

Simualted Results :

	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10
W	240n	240n	240n	240n	240n	240n	240n	240n	280n	340n
L	1u	1u	340n	340n	340n	340n	500n	4u	500n	340n

Theoritical values :

	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10
W	240n	240n	244n	244n	244n	230n	180n	100n	340n	340n
L	1u	1u	344n	344n	344n	6.5u	500n	590n	340n	340n