IC CAD Project

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Contents

1	The	oretical Design	2
2	Sch	ematic	3
3	Sim	ulation Results	13
	3.1	TT	13
		$3.1.1 -40^{\circ}$	13
		$3.1.2 120^{\circ} \dots \dots \dots \dots \dots \dots \dots \dots \dots $	17
	3.2	FF	20
		$3.2.1 -40^{\circ}$	20
		$3.2.2 27^{\circ} \dots \dots$	23
		$3.2.3 120^{\circ} \dots \dots \dots \dots \dots \dots \dots \dots \dots $	26
	3.3	SS	29
		$3.3.1 -40^{\circ}$	29
		$3.3.2 27^{\circ} \dots \dots$	32
		$3.3.3 120^{\circ} \dots \dots \dots \dots \dots \dots \dots \dots \dots $	35
	3.4	Final Results	38
4	Lay	out	38
5	Para	asitics	43
	5.1	R Only	45
	5.2	RC	48
	5.3	RLC	51
6	Fina	al Comparison	54

1 Theoretical Design

There are 3 criteria that determine the design of the amplifier. First is the central frequency, which is the frequency of the LC tank:

$$f = \frac{1}{2\pi\sqrt{LC}} = 8 \,\text{GHz} \implies LC = 3.95 \times 10^{-22}$$

As the inductor values are limited due to the design rules, I first checked to see what values are available and then chose the capacitor accordingly:

$$L = 1.44 \, \text{nH}$$
 , $C = 274 \, \text{fF}$

Then I used the fractional bandwidth to find the quality factor of the LC tank:

$$\frac{f_C}{\Delta f} = Q = 10 = \frac{R_p}{L\omega} \Rightarrow R_p = 10L\omega = 725\,\Omega$$

Then, I find the transconductance of the transistors by ignoring the output resistance of the transistor compared to the parallel resistance of the tank and assuming the capacitor to be ideal:

$$A_v = 25 \, \text{dB} = 17.78 = R_p g_m \Rightarrow g_m = 23.4 \, \text{mS}$$

Then, using ADS, I plotted the g_m versus the drain current of an NMOS transistor with $W=50\,\mu m$, as seen in figure 1 and as the current for this width would be too much, I increased the width as well to reach $W=90\,\mu m$ and a current of 2.16 mA. The size of the tail transistor is chosen to be twice that of the input transistors and the size of the current mirror transistor is one-tenth of the tail transistor.

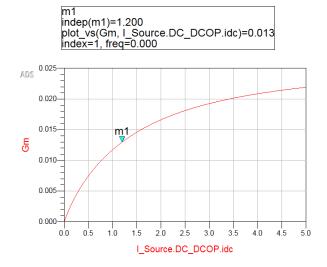


Figure 1: g_m vs. I_D

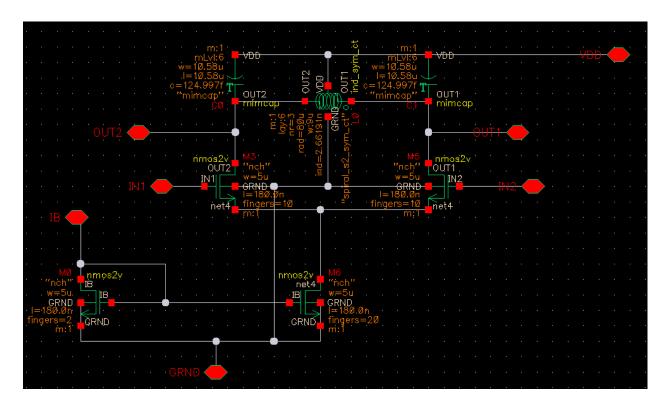


Figure 2: The final schematics

	Width (um)	Length (nm)	Fingers
Input transistors (M3 & M5)	5	180	10
Tail transistor (M6)	5	180	20
Current mirror transistor (M0)	5	180	2

Table 1: The transistor specification

2 Schematic

After some trial and error, the circuit in fig. 2 was reached that satisfies all but one of the requirements. I created a symbol from the schematic and used it for further testing.

I used two test benches to test the properties of my design: one for the AC analysis to find the gain and bandwidth, and another for the PSS analysis to show the linearity requirements (fig. 3).

The analysis specifications for the AC analysis (fig. 4), the compression point analysis (fig. 82), the IPn analysis (fig. 6), and the noise analysis (fig. 7) are shown below. The analysis results, including the operating points of the transistors from a DC analysis, are shown in the following figures and in table 4.

	Radius (um)	Number of turns	Width (um)	Inductnce (nH)
Inductor (L0)	80	3	9	2.661

Table 2: Inductor specifications

	Width (um)	Length (um)	Capacitance (fF)
Capacitors (C0 & C1)	10.58	10.58	124.997

Table 3: Capacitor specifications

8.378
25.891
1.153
-4.359
4.668
2.071

Table 4: The circuit properties at normal temperature

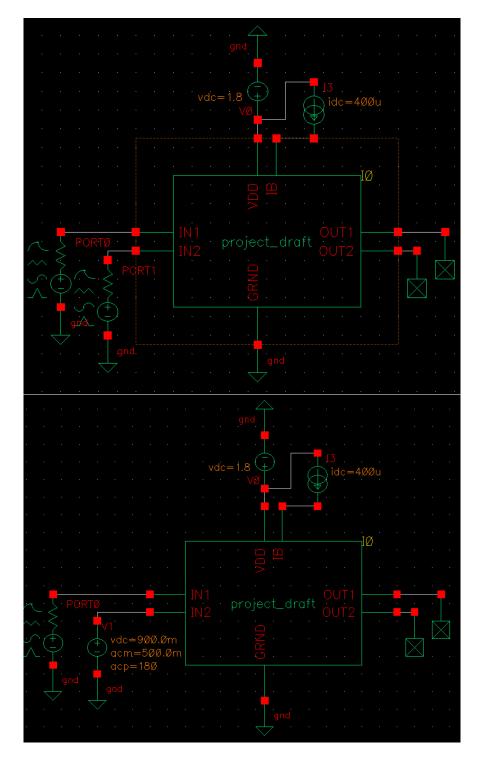


Figure 3: The test benches

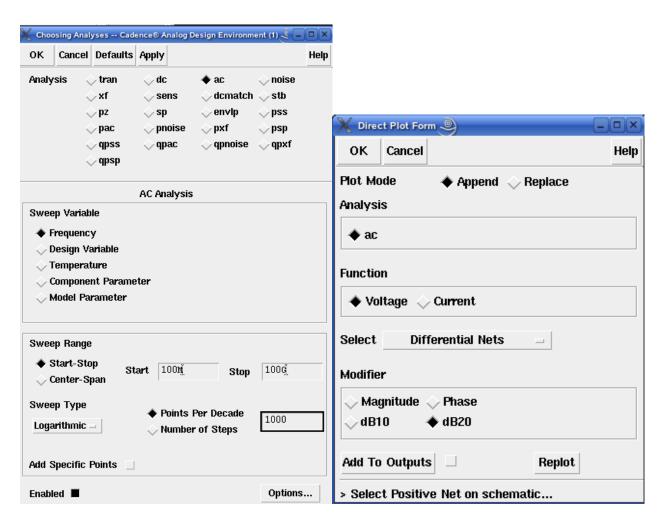


Figure 4: AC analysis setup

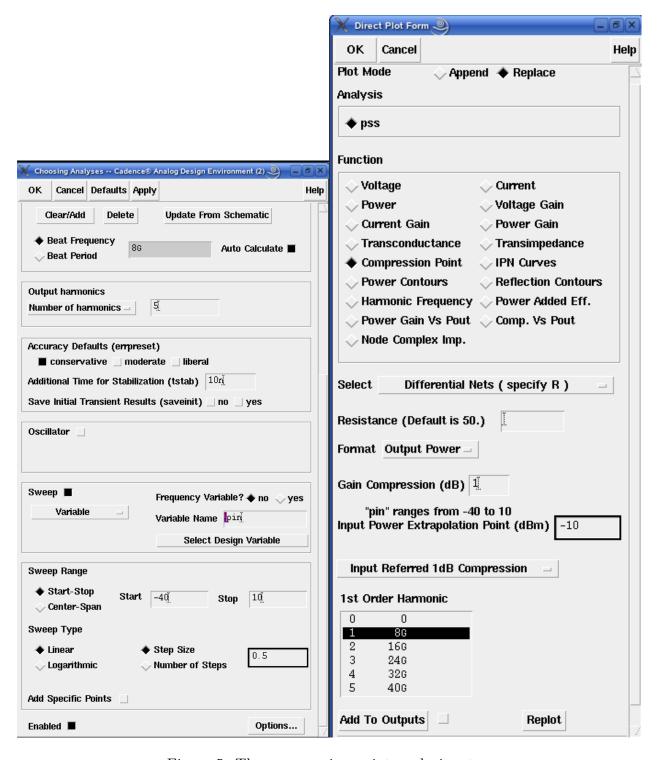


Figure 5: The compression point analysis setup

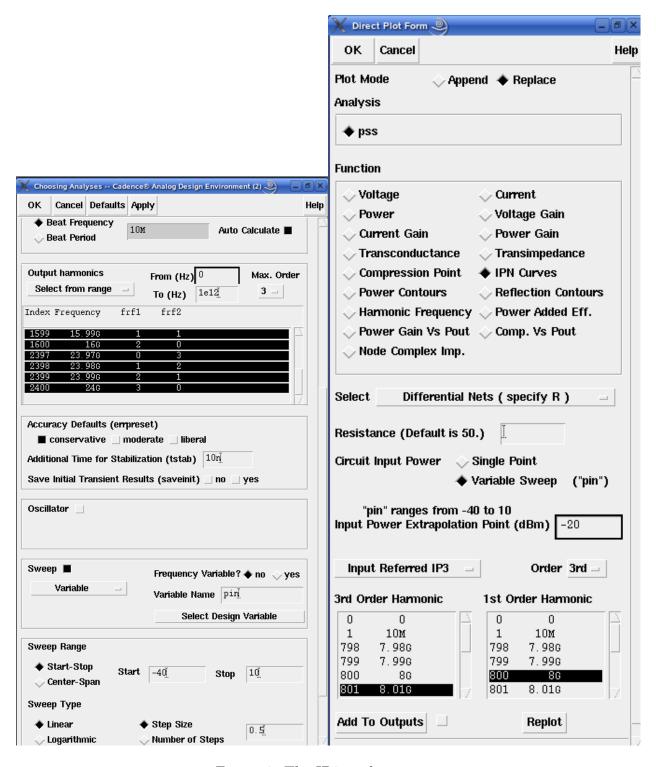


Figure 6: The IP3 analysis setup

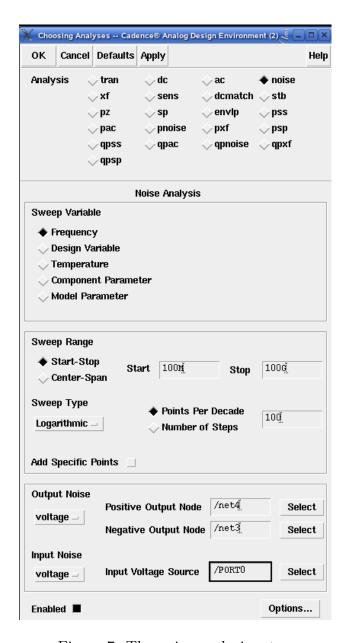


Figure 7: The noise analysis setup

signal	OP("IO.M3" "??")		
	450,450	signal betaeff	OP("IO.M5" "??") 152.169m
betaeff cbb	152.169m 14.1671f	cbb	152.169m 14.1671f
cbd	43.9535a	cbd	43.9535a
cbg	-9.88887f	cbg	-9. 88887f
cbs	-4.32222f	cbs cdb	-4. 32222f -6. 92121a
cdb cdd	-6.92121a 18.3155f	cdd	-6. 92121a 18. 3155f
cdg	-18.3449f	cdq	-18.3449f
cds	36.2751a	cds	36.2751a
cgb	-7.43434f	cgb	-7.43434f
cgd	-17.8413f	cgd	-17. 8413f 86. 9657f
cgs cgs	86.9657f -61.6901f	cgg cqs	-61.6901f
cjd	18.8953f	cjd	18.8953f
cjs	25.7643f	cjs	25. 7643f
csb	-6.72587f	csb	-6.72587f
csd	-518. 225a -58. 7319f	csd csg	-518.225a -58.7319f
css	65.976f	css	65.976f
gds	661.066u	gds	661.066u
gm.	17. 2657m	gm _.	17. 2657m
gmbs	2.85131m 8.11562	gmbs qmoverid	2.85131m 8.11562
gmoverid ibulk	-81.416p	ibulk	-81.416p
id	2.12746m	id	2.12746m
ids	2.12746m	ids	2.12746m
is	-2.12746т 1.83323т	is	-2.12746m
pwr region	1. 65323m 2	pwr region	1.83323m 2
reversed	0	reversed	0
ron	405.035	ron	405.035
type	0	type	0
vbs vds	-928.966m 861.696m	vbs vds	-928.966m 861.696m
vdsat	136.884m	vdsat	136.884m
vgs	871.034m	vgs	871.034m
vth	717.844m	vth	717.844m
signal	OP("IO.M6" "??")	signal	OP("IO.MO" "??")
betaeff	317.012m	betaeff	31. 6968m
cbb cbd	38. 6198f 33. 5063a	cbb cbd	3. 86565f 2. 13252a
cbg	-21.7144f	cbq	-2.16887f
cbs	-16.9389f	cbs	-1.69891f
cdb	-19.6438a	cdb	-4.09178a
cdd	36. 6262f	cdd cdq	3.66618f -3.67487f
odg ods	-36.675f 68.4437a	cds	12. 7847a
cgb	-15.5338f	cgb	-1.53488f
cgd	-36.413f	cgd	-3.64246f
cgg	175.336f	cgg	17. 5322f
cgs cjd	-123.389f 44.7061f	cgs cjd	-12.3549f 4.78904f
cja cjs	67. 0198f	cjs	10.5896f
csb	-23.0663f	csb	-2.32668f
csd	-246.725a	csd	-25.8479a
csg css	-116.946f 140.259f	csg	-11.6885f 14.041f
css gds	931. 349u	qds	14. 0411 106. 196u
gm	34.5142m	gm	3.31249m
gmbs	9.73182m	gmbs	943. 709u
gmoverid	8.1116	gmoverid	8.28122 -54.9841f
ibulk id	-807.071p 4.25492m	ibulk id	-54.9841f 400u
ids	4. 25492m	ids	400u
is	-4.25492m	is	-400u
pwr	3.95268m	pwr	268. 082u
region	2 0	region reversed	2 0
reversed	218.327	reversed	1. 67551K
ron			
ron type	0	type	0
type vbs	0 0	vbs	0
type vbs vds	0 0 928.966m	vbs vds	0 670. 205m
type vbs vds vdsat	0 0 928.966m 128.391m	vbs vds vdsat	0 670.205m 128.065m
type vbs vds	0 0 928.966m	vbs vds	0 670. 205m

Figure 8: The DC operating points of all transistors

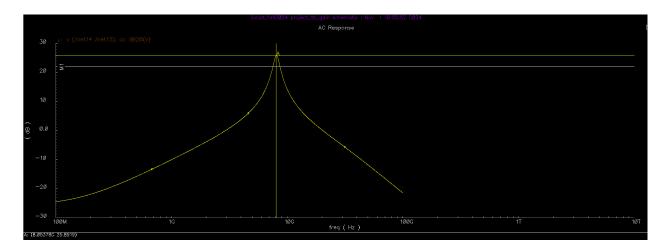


Figure 9: The gain plot

```
Curve name map:
-----

Curvel - v (/net14 /net13); ac dB20(V)

Curve table:
-----

Y value Curve1

M1 22 7.5353501876
8.68876848746
```

Figure 10: The bandwidth, using a horizontal marker

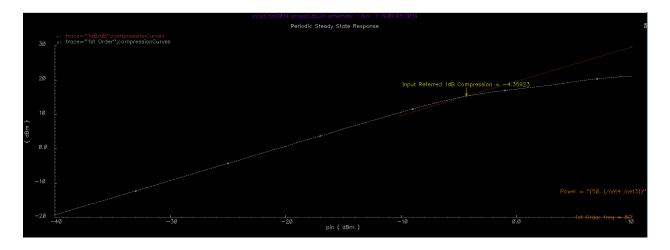


Figure 11: The 1dB compression point

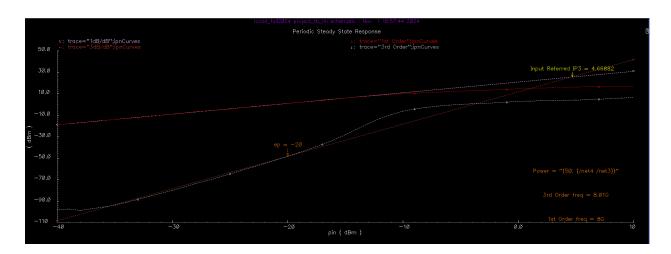


Figure 12: The IIP3 plot

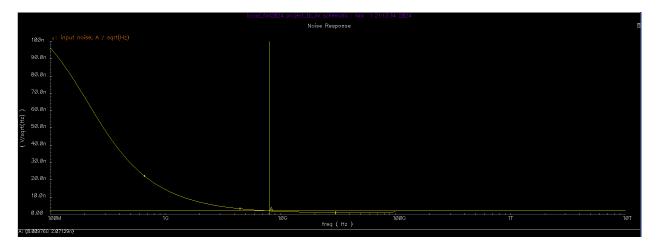


Figure 13: The input-referred noise plot

3 Simulation Results

The results for the TT corner at 27 degrees were shown in the last section. Here we will investigate every property at the TT, FF, and SS corners for temperatures of -40, 27, and 120 degrees.

3.1 TT

To change the temperature, I used $\tt Analog\ Environment > Setup > Temperature...$ and set the temperature to the desired value

3.1.1 -40°

The analysis results are shown in the following figures and in table 5.

8.380
27.543
1.463
-6.004
-3.563
1.964

Table 5: The circuit properties at -40°

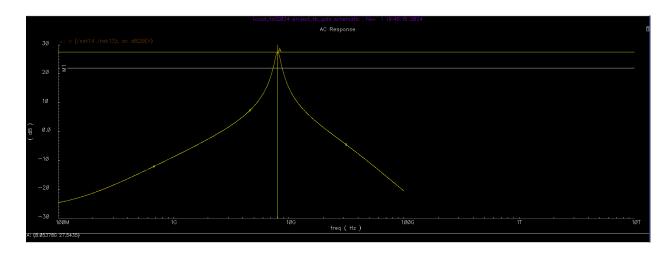


Figure 14: The gain plot

```
Curve name map:
------

Curvel - v (/net14 /net13); ac dB20(V)

Curve table:
------

Y value Curve1

M1 22 7.32760367136
8.79093909836
```

Figure 15: The bandwidth, using a horizontal marker

oi mal	OB / "TI	1 w2" "22"\			
signal	0P ("I	J.M3" "??")	signal	ΠΡ ("T	0.M5" "??")
betaeff	242	242m	betaeff		. 242m
cbb		1908f	cbb	14	. 1908f
cbd		6383a	cbd		. 6383a
cbg	-9	92328f	cbg		. 92328f
cbs		31217f	cbs		. 31217f
cdb		20222a	cdb cdd		. 20222a . 3122f
cdd		3122f 3417f	cdq		.3417f
cdg cds		7046a	cds		. 7046a
cgb		63889f	cgb		. 63889f
cgd		8395f	cgd	-17	. 8395f
cgg		1894f	cgg		. 1894f
cgs		711f	cgs		. 711f
cjd		5658f	cjd		.5658f .1196f
cjs csb		1196f 54572f	cjs csb		.54572f
csd		278a	csd		. 278a
csg		9244f	csg		. 9244f
css	65	9874f	css		. 9874f
gds		295u	gds		. 295u
gon		2802m	gm		. 2802m
gmbs		25439m	gmbs		.25439m .52891
gmoverid ibulk		52891 905p	gmoverid ibulk		. 905p
id		12829m	id		. 12829m
ids		12829m	ids		. 12829m
is	-2	12829m	is	-2	. 12829m
pwr		85108m	pwr		.85108m
region	2		region	2	
reversed ron	0 408	663	reversed ron	0 408	. 663
type	400	000	type	400	
vbs	-922	95m	vbs		. 95m
vds		751m	vds		. 751m
vdsat		865m	vdsat		.865m
vgs		05m	vgs		. 05m
vth		956m	vth		. 956m
signal		. M6" "??")		OP ("I	0.MO" "??")
betaeff	502.	727m	betaeff	50	. 2666m
betaeff cbb	502. 38.	727m 5993f	betaeff cbb	50 3	. 2666m . 86327f
betaeff cbb cbd	502. 38. 34.	727m	betaeff cbb cbd	50 3 2	. 2666m
betaeff cbb cbd cbg cbs	502. 38. 34. -21. -16.	727m 5993f 8265a 7699f 8643f	betaeff cbb	50 3 2 -2 -1	.2666m .86327f .66512a .17479f .69114f
betaeff cbb cbd cbg cbs cdb	502. 38. 34. -21. -16. -18.	727m 5993f 8265a 7699f 8643f 6126a	betaeff cbb cbd cbg cbs cdb	50 3 2 -2 -1 -3	.2666m .86327f .66512a .17479f .69114f .60428a
betaeff cbb cbd cbg cbs cdb cdb	502. 38. 34. -21. -16. -18. 36.	727m 5993f 8265a 7699f 8643f 6126a 6217f	betaeff cbb cbd cbg cbs cdb cdb	50 3 2 -2 -1 -3 3	.2666m .86327f .66512a .17479f .69114f .60428a .66456f
betaeff cbb cbd cbg cbs cdb cdd cdd	502. 38. 34. -21. -16. -18. 36.	727m 5993f 8265a 7699f 8643f 6126a 6217f 6725F	betaeff cbb cbd cbg cbs cdb cdb cdd cdd	50 3 2 -2 -1 -3 3 -3	.2666m .86327f .66512a .17479f .69114f .60428a .66456f .67337f
betaeff cbb cbd cbg cbs cdb cdd cdd cdg	502. 38. 34. -21. -16. -18. 36. -36. 69.	727m 5993f 8265a 7699f 8643f 6126a 6217f 6725f 372a	betaeff cbb ccbd cbg cbs cdb cdd cdd cdd cdg	50 3 2 -2 -1 -3 3 -3 12	.2666m .86327f .66512a .17479f .69114f .60428a .66486f .67337f .4195a
betaeff cbb cbd cbg cbs cds cdb cdd cdg cdg cds	502. 38. 34. -21. -16. -18. 36. -36. 69. -15.	727m 5993f 8265a 7699f 8643f 6126a 6217f 6725f 372a 844f	betaeff cbb cbd cbg cbs cdb cdb cdb cdb cdc	50 3 2 -2 -1 -3 3 -3 12 -1	.2666m .86327f .66512a .17479f .69114f .60428a .66456f .67337f .4195a .56734f
betaeff cbb cbd cbg cbs cdb cdb cdb cdd cdg cds cdg	502. 38. 34. -21. -16. -18. 36. -36. 69.	727m 5993f 8265a 7699f 8643f 6126a 6217f 6725f 372a 844f 41f	betaeff cbb cbd cbg cbs cdb cdb cdd cdg cds cds cdg	50 3 2 -2 -1 -3 3 -3 12 -1 -3	.2666m .86327f .66512a .17479f .69114f .60428a .66486f .67337f .4195a
betaeff cbb cbd cbg cbs cdb cdd cdg cds cds cgs cgs	502. 38. 34. -21. -16. -18. 36. -36. 69. -15. -36. 175.	727m 5993f 8265a 7699f 8643f 6126a 6217f 6725f 372a 844f 41f 77f 516f	betaeff cbb cbd cbg cbs cdb cdd cdg cds ccgs cgb	50 3 2 -2 -1 -3 3 12 -1 -3 17 -12	.2666m .86327f .66512a .17479f .69114f .60428a .66456f .67337f .4195a .56734f .64178f .5747f .3656f
betaeff cbb cbd cbg cbs cdb cdd cdg cds cgs cgs cgd cgg	502. 38. 34. -21. -16. -18. 36. -36. -99. -15. -36. 175. -123. 43.	727m 5993f 8265a 7699f 8643f 6126a 6217f 6725f 372a 844f 41f 77f 516f 6466f	betaeff cbb cbd cbg cbs cdb cdb cdd cdg cds cgs cgb	50 3 2 -2 -1 -3 3 -3 12 -1 -3 17 -12 4	.2666m .86327f .66512a .17479f .69114f .60428a .66456f .67337f .4195a .56734f .64178f .5747f .3656f .63356f
betaeff cbb cbd cbg cbs cdb cdd cdd cdg cds cgs cgb cgd	502. 38. 34211618. 3636. 691536. 175123. 43. 63.	727m 5993f 8265a 7699f 8643f 6126a 6217f 6725f 372a 844f 41f 77f 516f 6466f	betaeff cbb cbd cbg cbs cdb cdd cdg cdg cdg cgs cgb cgd	50 3 2 -2 -1 -3 3 -3 12 -1 -3 17 -12 4	.2666m .86327f .66512a .17479f .69114f .60428a .66456f .67337f .4195a .56734f .64178f .5747f .3656f .63356f
betaeff cbb cbd cbg cbs cdb cdd cdg cds cgs cgs cgd cgg	502. 38. 34211618. 3636. 691536. 175123. 43. 6322.	727m 5993f 8265a 7699f 8643f 6126a 6217f 6725f 372a 844f 41f 77f 516f 6466f 3565f	betaeff cbb cbd cbg cbs cdb cdd cdg cds cgs cgb cgd cgg cgg cgg cjd cjs csb	50 3 2 -2 -1 -3 3 -3 12 -1 -3 17 -12 4 10 -2	.2666m .86327f .66512a .17479f .69114f .60428a .66456f .67337f .4195a .56734f .64178f .5747f .3656f .63356f .0055f
betaeff cbb cbd cbg cbs cdb cdd cdg cds cgg cgd cgd cgg cgs cjd cjs	502. 38. 34211636. 691536. 175123. 43. 6322246.	727m 5993f 8265a 7699f 8643f 6126a 6217f 6725f 372a 844f 41f 77f 516f 6466f 3565f 7367f	betaeff cbb cbd cbg cbs cdb cdd cdg cds cgs cgs cjd cjs csb	50 3 2 -2 -1 -3 3 12 -1 -1 -17 -12 4 10 -2 -25	.2666m .86327f .66512a .17479f .69114f .60428a .66456f .67337f .4195a .56734f .64178f .5747f .3656f .63356f .0055f .29232f
betaeff cbb cbd cbg cbs cdb cdd cdg cds cgs cgs cgs cgs cgs cjs css	502. 38. 34211618. 3636. 6915123. 43. 6322246.	727m 5993f 8265a 7699f 8643f 6126a 6217f 6725f 372a 844f 41f 77f 516f 6466f 3365f 7367f 562a	betaeff cbb cbd cbg cbs cdb cdd cdg cdg cds cgb cgd cgd cgc cgc cgc cgc cgc cgc cgc cgc	50 3 2 -2 -1 -3 3 12 -1 -3 7 -12 4 10 -2 -25 -11	.2666m .86327f .66512a .17479f .69114f .60428a .66456f .67337f .4195a .56734f .64178f .5747f .3656f .63356f .0055f .29232f .4395a
betaeff cbb cbd cbg cbs cdb cdd cdg cds cgg cgd cgd cgg cgs cjd cjs	502. 38. 34211618. 363636. 175123. 4322246117. 140.	727m 5993f 8265a 7699f 8643f 6126a 6217f 6725f 372a 844f 41f 77f 516f 6466f 3565f 7367f	betaeff cbb cbd cbg cbs cdb cdd cdg cds cgs cgs cjd cjs csb	50 3 2 -2 -1 -3 12 -1 -3 17 -12 4 10 -2 -25 -11	.2666m .86327f .66512a .17479f .69114f .60428a .66456f .67337f .4195a .56734f .64178f .5747f .3656f .63356f .0055f .29232f
betaeff cbb cbd cbg cbs cdb cdd cdg cds cgs cgs cgd cgg cgs cjs csb csb csb csb	502. 38. 34211618. 3636691536. 175123. 43. 6322246117. 140. 1. 40.	727m 5993f 8265a 7699f 8643f 6126a 6217f 6725f 372a 844f 41f 77f 516f 6466f 3365f 7367f 562a 328f 311f 03179m 1873m	betaeff cbb cbd cbg cbs cdb cdd cdg cds cgs cgs cgc cgs cjs csb csd csd cgs	50 3 2 -2 -1 -3 3 -3 12 -1 -1 -3 17 -12 4 10 -2 -25 -11 141	.2666m .86327f .66512a .17479f .69114f .60428a .66456f .67337f .4195a .56734f .64178f .5747f .3656f .63356f .0055f .29232f .4395a .7265f .0443f .438u .87347m
betaeff cbb cbd cbg cbs cdb cdd cdg cds cgs cgd cgs cjd cjs csb csd csd csg gd gm gmbs	502. 38. 34211618. 36363515123. 43. 6322246117. 140. 11.	727m 5293f 8265a 7699f 8643f 6126a 6217f 6725f 372a 844f 41f 77f 516f 6466f 3565f 7367f 552a 328f 331f 03179m 1873m	betaeff cbb cbd cbg cbs cdb cdd cdg cds cgs cgd cgs cjd cjs csb csd csd cgb cgs cjm cgs cmb csd csd cgb cgm cgm cgm cgm	50 3 2 -2 -1 -3 3 12 -1 -3 17 -12 4 10 -2 -25 -11 14 111 3	.2666m .86327f .66512a .17479f .69114f .69114f .60428a .66456f .67337f .4195a .56734f .64178f .5747f .3656f .63356f .0055f .29232f .4395a .7265f .0443f .438u .87347m
betaeff cbb cbd cbg ccbs cdb cdd cdg cds cgb cgg cgs cgs cjd cjs csb csb csd csg gmb sgmbs gmbs gmoverid	502. 38. 34211618. 3636. 175123. 4322246117. 140. 11. 9.	727m 5993f 8265a 7699f 8643f 6126a 6217f 6725f 372a 844f 41f 77f 516f 6466f 3565f 7367f 552a 328f 311f 03179m 1873m 1817m	hetaeff cbb cbd cbg ccbs cdb cdd cdd cdg cds cgb cgd cgg cgs cgi cji cji cji cji csb csb csb csd csg gm gmy gms gmnoverid	50 3 3 2 2 -2 2 -2 1 -1 1 -3 3 1 2 2 -1 1 -3 1 7 -1 2 4 4 1 1 1 1 1 1 1 1 1 1 9	.2666m .86327f .66512a .17479f .69114f .60428a .66456f .67337f .4195a .56734f .64178f .5747f .3656f .63356f .0055f .29232f .4395a .7265f .0443f .4395a .7265f
betaeff cbb cbd cbg cbs cdb cdd cdg cds cgs cgs cgs cgs cjs csb csb csd csg gmsyerid ibulk	502. 38. 34211636. 691536. 175123. 43226117. 140. 11. 40. 11. 91.	727m 5993f 8265a 7699f 8643f 6126a 6217f 6725f 372a 844f 41f 77f 516f 6466f 3365f 7367f 562a 328f 311f 03179m 18173m 18173m 18173m	betaeff cbb cbd cbg cbs cdb cdd cdg cds cgs cgs cgc cgs cjd css csb csd csg	50 3 3 2 2 -2 -1 -3 3 3 12 -1 -3 17 -12 -2 -25 -11 14 111 3 1 19 9 -269	.2666m .86327f .66512a .17479f .69114f .60428a .66456f .67337f .4195a .56734f .64178f .5747f .3656f .63356f .0055f .29232f .4395a .7265f .0443f .4394a .4394a .4394a .4394a .4394a .4394a .666866
betaeff cbb cbd cbg cbs cdb cdd cdg cds cgs cgs cgs cjs css csd csg csg gm gmbs gmoverid id	502. 38. 34211618. 3636. 175123. 4322246117. 140. 1. 40. 11. 91.	727m 5993f 8265a 7699f 8643F 6126a 6217f 6725F 372a 844f 41f 77f 516f 6466f 33655 7367f 552a 328f 331f 03179m 1873m 1817m 44125 26856n	betaeff cbb cbd cbg cbs cdb cdd cdg cds cgs cgd cgg cgs cjd cjs csb csd csg csg gm gmbs gmoverid id	50 3 3 2 2 -22 -1 -3 3 3 12 2 -1 -3 17 -12 4 10 -2 -25 -11 4 111 3 1 1 9 -269 4000	.2666m .86327f .66512a .17479f .69114f .60128a .66456f .67337f .4195a .56734f .64178f .5747f .3656f .63356f .0055f .29232f .4395a .7265f .0443f .438u .87347m .08818m .68368
betaeff cbb cbd cbg ccbs cdb cdd cdg cds cgb cgg cgs cgc cgs cjd cjs csb csb csd csg gs gm gms gmbs gmoverid idd ids	502. 38. 34211618. 3636. 6915123. 43. 6322246117. 140. 11. 40. 11. 91. 4.	727m 5993f 8265a 7699f 82643f 6126a 6217f 6725f 372a 844f 41f 77f 516f 6466f 3565f 7367f 5562a 328f 311f 03179m 1873m 1817m 44125 268556n 25657m	betaeff cbb cbd cbg ccbs cdb cdd cdd cdg cds cgb cgb cgc cgc cgc cgc cgc cgc cgc cgc	50 3 3 2 2 -22 -11 -3 3 12 -11 -3 17 -12 4 4 100 -2 -25 -11 144 1111 9 9 400 400 400 400 400 60 60 60 60 60 60 60 60 60 60 60 60 6	.2666m .86327f .66512a .17479f .69114f .60428a .66456f .67337f .4195a .56734f .64178f .5747f .3656f .63356f .0055f .29232f .4395a .7265f .0443f .4395a .7265f .0443f .438u .87347m .08818m .68368 .671f u
betaeff cbb cbd cbg cbs cdb cdd cdg cds cgs cgs cgs cjs css csd csg csg gm gmbs gmoverid id	502. 38. 34211618. 3636. 6915123. 4322246117. 140. 11. 91. 4. 44.	727m 5993f 8265a 7699f 8643F 6126a 6217f 6725F 372a 844f 41f 77f 516f 6466f 33655 7367f 552a 328f 331f 03179m 1873m 1817m 44125 26856n	betaeff cbb cbd cbg cbs cdb cdd cdg cds cgs cgd cgg cgs cjd cjs csb csd csg csg gm gmbs gmoverid id	50 3 3 2 2 2 -1 1 -3 3 3 12 2 -1 1 -1 2 4 4 100 -2 2 -25 -11 1 11 3 1 1 9 400 400 -400 -400 -400 -400 -400 -400	.2666m .86327f .66512a .17479f .69114f .60428a .66456f .67337f .4195a .56734f .64178f .5747f .3656f .63356f .0055f .29232f .4395a .7265f .0443f .4395a .7265f .0443f .438u .87347m .08818m .68368 .671f u
betaeff cbb cbd cbd ccbs cdb cdd cdd cdg cds cgb cgd cgg cgs cjid cjid csd csd csg gmoverid id id ids is pwr Fegion	502. 38. 3421163636. 6915123. 432221101111111111	727m 5993f 8265a 7699f 8643f 6126a 6217f 6725f 372a 844f 41f 77f 516f 6466f 3565f 3287 3287 311f 03179m 1877m 1817m 44125 226855fm 225657m	betaeff cbb cbd cbg ccbs cdb cdd cdd cdg cds cgb cgg cgs cgs cjd cjs csb csb csd csg gmoverid ibulk id ids is pwr	50 3 2 2 -2 -1 -3 3 -3 12 2 -1 -1 -3 17 -12 4 100 -2 2 25 -11 14 400 4000 4000 272 2	.2666m .86327f .66512a .17479f .69114f .60428a .66456f .67337f .4195a .56734f .4195a .56734f .64178f .5747f .3656f .63356f .0055f .29232f .4395a .7265f .0443f .4395a .7265f .0443f .438u .87347m .08818m .68368 .671f u
betaeff cbb cbd cbd cbs cdb cdd cdg cds cgs cgs cgd cgs cjd css csb csd csg gds gm gmbe gmoverid ibulk id ids is pwr reqion	502. 38. 3421161836366915123. 4322246. 11111114432. 0	727m 5993f 8265a 7699f 8643f 6126a 6217f 6725f 372a 844f 41f 77f 516f 6466f 33655 7367f 562a 328f 311f 03179m 1873m 1817m 44125 26855m 22657m 226657m	betaeff cbb cbb cbd cbg cbs cdb cdd cdg cds cgs cgs cgs cjs csb csd csg gds gg gm gmbs gmoverid ids is pwr requion reversed	50 3 2 2 -2 -1 1 -3 3 12 1 -1 1 -3 17 -12 4 4 100 -2 -25 -11 1 14 111 1 1 9 400 -400 272 2 2 2 0 0 0	.2666m .86327f .66512a .17479f .69114f .60428a .66456f .67337f .4195a .56734f .64178f .57747f .3656f .63356f .0055f .29232f .4395a .7265f .0443f .439u .87347m .08818m .68368 .671f u
betaeff cbb cbd cbd cbg cbs cdb cdd cdg cds cgs cgs cgs cjd cjs csb csd csg css gds gm gmbs gmoverid ibulk id ids is pwr Fectors	502. 38. 34211618. 36366915123. 432224611711444320216.	727m 5993f 8265a 7699f 8643f 6126a 6217f 6725f 372a 844f 41f 77f 516f 6466f 33655 7367f 562a 328f 311f 03179m 1873m 1817m 44125 26855m 22657m 226657m	betaeff cbb cbb cbd cbg cbs cdb cdd cdg cds cgs cgs cgd cgs cjd cjs csb csd csp css gds gm gm gmbs gmoverid ibulk id ids is pwr Ferion reversed ron	500 33 22 -22 -11 -33 312 -11 -33 177 -122 -255 -111 111 33 11 9400 4000 4200 272 272 272 272 272 272 -400 -11 -4000 -272 -4000 -11 -40000 -11	.2666m .86327f .66512a .17479f .69114f .60128a .66456f .67337f .4195a .56734f .64178f .5747f .3656f .63356f .0055f .29232f .4395a .7265f .0443f .438u .87347m .08818m .68368 .671f u u u u .853u
betaeff cbb cbd cbd cbg ccbs cdb cdd cdd cdg cds cgb cgc cgs cjd cjs csb csb csb csd csg ds disp disp moverid ibulk id ids is pwr region reversed ron type	502. 38. 34211636363635175123. 4322246401140114011401140114011401140114011401140114011401140101010101010101	727m 5993f 8265a 7699f 8643f 6126a 6217f 6725f 372a 844f 41f 77f 516f 6466f 33655 7367f 562a 328f 311f 03179m 1873m 1817m 44125 26855m 22657m 226657m	betaeff cbb cbd cbg ccbs cdb cdd cdd cdg cds cgb cgg cgs cjd cjj csb csb csd csg gmoverid ibulk id id ids is pwr Tegion reversed ron type	500 322 -22-11 -333122 -11-33177 -122-25 -1111311113 1199-2699 4000-4000-2722 2722-2000 2722-200	.2666m .86327f .66512a .17479f .69114f .60428a .66456f .67337f .4195a .56734f .64178f .5747f .3656f .63356f .0055f .29232f .4395a .7265f .0443f .4395a .7265f .0443f .438u .87347m .08818m .68368 .671f u
betaeff cbb cbd cbd cbg cbs cdb cdd cdg cds cgs cgs cgd cgs cjd cjs csb csd csg css gm gmbs gmoverid ids ids ids is pwr requeror	502. 38. 342116183636371512322246. 11. 914. 4. 44. 320212020202020202020	727m 5993f 8265a 7699f 8643f 6126a 6217f 6725f 372a 844f 41f 77f 516f 6466f 3565f 7367f 562a 328f 311f 03179m 1873m 1817m 44125 228557m 225657m 225657m 225657m	betaeff cbb cbb cbd cbg cbs cdb cdd cdg cds cgb cgd cgg cgs cjb csb csb csb csb csb csb csb csb csb cs	500 33 22 -22 -11 -3 3 312 -11 -3 77 -122 4 4 100 -22 -25 400 4000 272 22 20 0 0 0 0 0 0 0 0 0 0 0 0 0	.2666m .86327f .66512a .17479f .69114f .60428a .66456f .67337f .4195a .56734f .64178f .5747f .3656f .63356f .0055f .29232f .4395a .7255f .0443f .438u .87347m .08818m .68368 .671f u
betaeff cbb cbd cbd cbg ccbs cdb cdd cdd cdg cds cgb cgc cgs cjd cjs csb csb csb csd csg ds disp disp moverid ibulk id ids is pwr region reversed ron type	502. 38. 34211618363669151234322246117110144432222222222	727m 5993f 8265a 7699f 8643f 6126a 6217f 6725f 372a 844f 41f 77f 516f 6466f 3565f 7367f 562a 328f 311f 03179m 1873m 1817m 44125 228557m 225657m 225657m 225657m	betaeff cbb cbb cbd cbg ccbs cdb cdd cdd cdg cds cgb cgg cgs cjd cjb csb csb csb csb csb csb csb csb csb cs	500 33 22 -22 -11 -33 33 12 12 -11 -33 12 12 14 10 12 12 14 10 12 12 12 12 12 12 12 12 12 12 12 12 12	.2666m .86327f .66512a .17479f .69114f .60428a .66456f .67337f .4195a .56734f .64178f .5747f .3656f .63356f .0055f .29232f .4395a .7265f .0443f .4395a .7265f .0443f .438u .87347m .08818m .68368 .671f u
betaeff cbb cbd cbd cbg cbs cdb cdd cdg cds cgs cgs cgd cgs cjd css csb csd csd csg css csb csd csd csg css csc csc csc csc csc csc csc csc	502. 38. 342116183636371512322246. 111111144322226666666666	727m 5993f 8265a 7699f 82643f 6126a 6217f 6725f 372a 844f 41f 77f 516f 6466f 3565f 7367f 562a 328f 311f 03179m 1873m 1817m 44125 26855n 22657m 226657m 226657m 226657m 226657m 226657m	betaeff cbb cbb cbd cbg cbs cdb cdd cdg cds cgb cgd cgg cgs cjb csb csd csb csb csd gb csb csb csb csb csb csc csg css gma gmb gmoverid ibulk id	500 33 22 -22 -11 -3 3 3 12 -11 -3 17 -12 2 4 100 -22 -25 -400 4000 4000 272 20 0 0 0 682 977 682	.2666m .86327f .66512a .17479f .69114f .60428a .66456f .67337f .4195a .56734f .64178f .5747f .3656f .63356f .0055f .29232f .4395a .7255f .0443f .439u .87347m .08818m .68368 .671f u u .853u
betaeff cbb cbd cbd cbg ccbs cdb cdd cdd cdg cds cgb cgg cgs cji cji cjs csb csb csd csg gmb gmoverid ibulk id ids is pwr region reversed ron type vbs vds	502. 38. 342116183636371512322246. 111111144322226666666666	727m 5993f 8265a 7699f 82643f 6126a 6217f 6725f 372a 844f 41f 77f 516f 6466f 3565f 7367f 5562a 328f 3311f 03179m 1873m 1817m 44125 26856n 25657m 25657m 25657m 226657m 226657m	betaeff cbb cbb cbd cbg ccbs cdb cdd cdd cdg cds cgb cgg cgs cjd cjs csb csb csd csg gmoverid ibulk id id ids is pwr reversed ron type vbs vds	500 33 22 -22 -11 -3 3 3 12 -11 -3 17 -12 2 4 100 -22 -25 -400 4000 4000 272 20 0 0 0 682 977 682	.2666m .86327f .66512a .17479f .60114f .60428a .66456f .67337f .4195a .56734f .4195a .56734f .64178f .5747f .3656f .63356f .0055f .29232f .4395a .7265f .0443f .4395a .7265f .0443f .438u .87347m .08818m .68368 .671f u u .853u

Figure 16: The DC operating points of all transistors

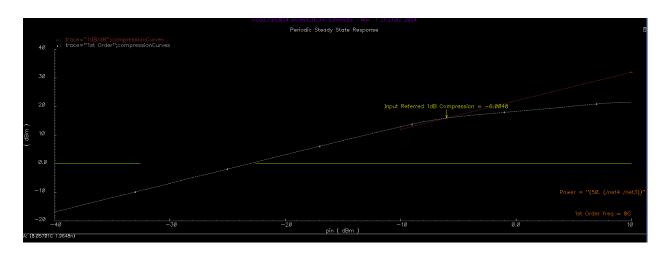


Figure 17: The 1dB compression point

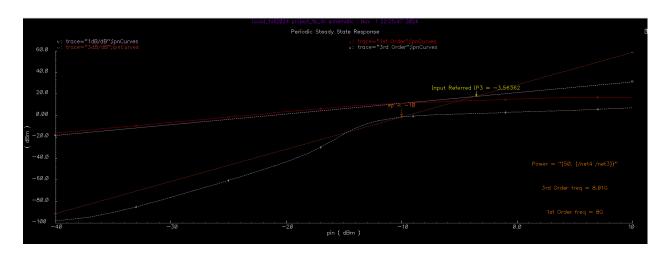


Figure 18: The IIP3 plot

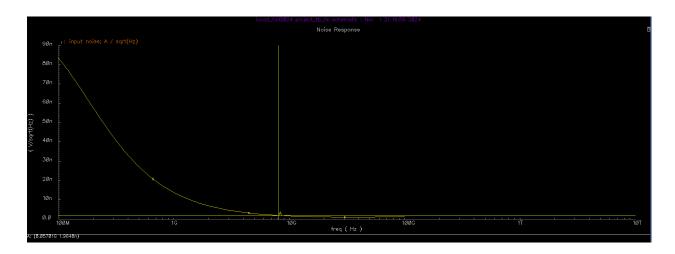


Figure 19: The input-referred noise

$3.1.2 120^{\circ}$

The analysis results are shown in the following figures and in table 6.

Power comsumption (mW)	8.377
Gain (@ 8GHz, dB)	23.792
Bandwidth (GHz)	0.794
1dB compression point (dBm)	-2.411
3rd input intercept point (dBm)	1.201
Input-referred noise (@ 8GHz, $\frac{nV}{\sqrt{Hz}}$)	2.232

Table 6: The circuit properties at 120°

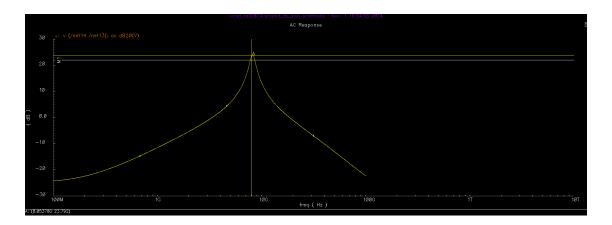


Figure 20: The gain plot

```
Curve name map:
------

Curve1 - v (/net14 /net13); ac dB20(V)

Curve table:
------

Y value Curve1

M1 22 7.79737479286
8.59133209546
```

Figure 21: The bandwidth, using a horizontal marker

	/	_	
signal	OP("IO.M3" "??")	signal	OP("IO.M5" "??")
	04 5000	betaeff	91.5292m
betaeff	91.5292m	cbb	14.146f
cbb cbd	14.146f 42.3969a	cbd	42.3969a
cbg	-9.85569f	cbg	-9.85569f
cbs	-4.33269f	cbs	-4. 33269f
cdb	-8.0975a	cdb	-8. 0975a
cdd	18.3215f	cdd	18. 3215f
cdg	-18.3501f	cdg	-18.3501f
cds	36.6926a	cds	36. 6926a -7. 12538f
cgb	-7.12538f	cgb cgd	-7.125361 -17.8442f
cgd	-17.8442f	cgg	86. 8266f
cgg	86.8266f	cgs	-61.857f
cgs	-61.857f	cjd	18.9894f
cjd	18.9894f	cjs	26. 2519f
cjs	26.2519f	cšb	-7.01251f
csb csd	-7.01251f	csd	-519.709a
	-519.709a -58.6208f	csg	-58.6208f
csg	66.153f	css	66. 153f
gds	607.104u	gds	607. 104u
gm.	14.4773m	gm,	14.4773m
qmbs	2.48576m	gmbs	2. 48576m
gmoverid	6.80461	gmoverid	6.80461
ibulk	-58.0854p	ibulk	-58.0854p
id	2.12758m	id ids	2. 12758m 2. 12758m
ids	2.12758m	is	2.12756m -2.12758m
is	-2.12758m	pwr	-2.12758m 1.82051m
pwr	1.82051m	region	2
region	2	reversed	0
reversed	0 402.181	ron	402.181
ron	0	type	0
type vbs	-932.155m	vbs	-932.155m
vds	855.671m	vds	855.671m
vdsat	184.233m	vdsat	184.233m
vgs	867.845m	vgs	867.845m
vth		vth	665.475m
vth	665.475m	vth signal	665.475m OP("IO.MO" "??")
vth signal	665.475m OP("IO.M6" "??")		
vth signal betaeff	665.475m OP("IO.M6" "??") 192.116m	signal betaeff cbb	OP("IO.MO" "??") 19.2085m 3.86662f
with signal betaeff cbb	665.475m OP("IO.M6" "??") 192.116m 38.6256f	signal betaeff cbb cbd	OP("IO.MO" "??") 19.2085m 3.86662f 1.13849a
with signal betaeff cbb cbd	665.475m OP("IO.M6" "??") 192.116m 38.6256f 30.9686a	sigmal betaeff cbb cbd cbg	OP("IO.MO" "??") 19.2085m 3.86662f 1.13849a -2.16114f
vth signal betaeff cbb cbd cbg	665.475m OP("IO.M6" "??") 192.116m 38.6256f 30.9686a -21.6434f	signal betaeff cbb cbd cbg cbs	OP("IO.MO" "??") 19.2085m 3.86662f 1.13849a -2.16114f -1.70662f
vth signal betaeff cbb cbd cbg cbs cdb	665.475m OP("IO.M6" "??") 192.116m 38.6256f 30.9686a	signal betaeff cbb cbd cbg cbs cdb	OP("IO.MO" "??") 19.2085m 3.86662f 1.13849a -2.16114f -1.70662f -4.88385a
vth signal betaeff cbb cbd cbd cbg cbs	665.475m OP("IO.M6" "??") 192.116m 38.6256f 30.9686a -21.6434f -17.0132f	sigmal betaeff cbb cbd cbg cbs cdb	OP("IO.MO" "??") 19.2085m 3.86662f 1.13849a -2.16114f -1.70662f -4.88385a 3.66917f
vth signal betaeff cbb ccbd ccbd ccbc cdc cdc cdc cdd cdd	665.475m OP("IO.M6" "??") 192.116m 38.6256f 30.9686a -21.6434f -17.0132f -21.7294a 36.6344f -36.6808f	signal betaeff cbb cbd cbg cbs cdb	OP("IO.MO" "??") 19.2085m 3.86662f 1.13849a -2.16114f -1.70662f -4.88385a 3.66917f -3.67732f
vth signal betæeff cbb cbd cbg cbs cdb cdd cdg cdd	665.475m OP("IO.M6" "??") 192.116m 38.6256f 30.9686a -21.6434f -17.0132f -21.7294a 36.6344f -36.6808f 68.0822a	signal betaeff cbb cbd cbg cbs cdb cdb cdb	OP("IO.MO" "??") 19.2085m 3.86662f 1.13849a -2.16114f -1.70662f -4.88385a 3.66917f -3.67732f 13.0342a
vth signal betaeff cbb cbd cbg cbs cdb cdb cdb cdb	665.475m OP("IO.M6" "??") 192.116m 38.6256f 30.9686a -21.6434f -17.0132f -21.7294a 36.6344f -36.6808f 68.0822a -14.9857f	sigmal betaeff cbb cbd cbg cbs cdb cdd cdd cdd	OP("IO.MO" "??") 19.2085m 3.86662f 1.13849a -2.16114f -1.70662f -4.88385a 3.66917f -3.67732f
wth signal betaeff cbb cbd cbg cbs cdb cdc cdc cdc cdg cdg cdg	665.475m OP("IO.M6" "??") 192.116m 38.6256f 30.9686a -21.6434f -17.0132f -21.7294a 36.6344f -36.6808f 68.0822a -14.9857f -36.4168f	signal betaeff cbb cbd cbg cbs cdb cdd cdg cdg	OP("IO.MO" "??") 19.2085m 3.86662f 1.13849a -2.16114f -1.70662f -4.88385a 3.66917f -3.67732f 13.0342a -1.4788f
vth signal betæeff cbb cbd cbg cbs cdb cdc cdc cdc cdc cdc cdg cds cdc cgc	665.475m OP("IO.M6" "??") 192.116m 38.6256f 30.9686a -21.6434f -17.0132f -21.7294a 36.6344f -36.6808f 68.0822a -14.9857f -36.4168f 175.092f	sigmal betaeff cbb cbd cbg cbs cdb cdd cdd cdd	OP("IO.MO" "??") 19.2085m 3.86662f 1.13849a -2.16114f -1.70662f -4.88385a 3.66917f -3.67732f 13.0342a -1.4788f -3.64354f 17.5093f -12.387f
vth signal betaeff cbb cbd cbg cbs cdb cdd cdg cds cgg cgs	665.475m OP("IO.M6" "??") 192.116m 38.6256f 30.9686a -21.6434f -17.0132f -21.7294a 36.6344f -36.6808f 68.0822a -14.9857f -36.4168f 175.092f -123.689f	sigmal betaeff cbb cbd cbg cbs cdb cdd cdg cdg cds cgg cgg cgg	OP("IO.MO" "??") 19.2085m 3.86662f 1.13849a -2.16114f -1.70662f -4.88385a 3.66917f -3.67732f 13.0342a -1.4788f -3.64354f 17.5093f -12.387f 4.92393f
with signal betaeff cbb cbd cbg cbs cdb cdd cdg cdg cdg cdg cgg cgg	665.475m OP("IO.M6" "??") 192.116m 38.6256f 30.9686a -21.6434f -17.0132f -21.7294a 36.6344f -36.6808f 68.0822a -14.9857f -36.4168f 175.092f -123.689f 45.4452f	sigmal betaeff cbb cbd cbg cbs cdb cdd cdg cds cdg cds cgg cgd	OP("IO.MO" "??") 19.2085m 3.86662f 1.13849a -2.16114f -1.70662f -4.88385a 3.66917f -3.67732f 13.0342a -1.4788f -3.64354f 17.5093f -12.387f 4.92393f 11.4005f
vth signal betæeff cbb cbd cbg cds cds cdg cdg cgg cgg cgg cgg	665.475m OP("IO.M6" "??") 192.116m 38.6256f 30.9686a -21.6434f -17.0132f -21.7294a 36.6344f -36.6808f 68.0822a -14.9857f -36.4168f 175.092f -123.689f 45.4452f 72.1042f	sigmal betaeff cbb cbd cbg cbs cdb cdd cdg cdg cds cgb cgd cgd cgg cgs cjd cjs csb	OP("IO.MO" "??") 19.2085m 3.86662f 1.13849a -2.16114f -1.70662f -4.88385a 3.66917f -3.67732f 13.0342a -1.4788f -3.64354f 17.5093f -12.387f 4.92393f 11.4005f -2.38294f
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vth signal betaeff cbb cbd cbd cbg cds cdb cdg cds cgb cgd cgs cgd cgg cgs cgs csb csb csb cid cid id id id ids is pwr region reversed ron type vbs vds vdsat	065.475m OP ("IO.M6" "??") 192.116m 38.6256f 30.9686a -21.6434f -17.0132f -21.7294a 36.6344f -36.6808f 68.0822a -14.9857f -36.4168f 175.092f -123.689f 45.4452f 72.1042f -23.6182f -248.636a -116.767f 140.634f 858.923u 29.2912m 8.3889m 6.8837 -395.319p 4.25515m 4.25515m -4.25515m -4.25515m 3.96646m 22 0 019.065 0 932.155m 171.831m	signal betaeff cbb cbd cbg cbs cdb cdd cdg cds cgc cgc cgc cgc cgc cgs cjd cjs csb csd csq csg css gds gm gmbs gmoverid ibulk id ids is pwr seqion reversed ron type vbs vds	OP("IO.MO" "??") 19.2085m 3.86662f 1.13849a -2.16114f -1.70662f -4.88385a 3.66917f -3.67732f 13.0342a -1.4788f -3.64354f 17.5093f -12.387f 4.92393f 11.4005f -2.38294f -26.7638a -11.6708f 14.0805f 105.018u 2.79422m 809.068u 6.98554 -3.33425p 400u 400u -400u -660.259m 171.446m
vth signal betaeff cbb cbd cbd cbs cdb cdd cds cdg cds cgg cgd cgg cjs cjb csb csd csg cji cjs csb csd csg cjs csb csd csg csc csb csd csg csc csc csc csc csc csc csc csc csc	065.475m OP("IO.M6" "??") 192.116m 38.6256f 30.9686a -21.6434f -17.0132f -21.7294a 36.6344f -36.6808f 68.0822a -14.9857f -36.4168f 175.092f -123.689f 45.4452f 72.1042f -23.6182f -248.636a -116.767f 140.634f 858.923u 29.2912m 8.38898m 6.8837 -395.319p 4.25515m 4.25515m 4.25515m 3.96646m 22 0 0 932.155m 171.831m 660.259m	signal betaeff cbb cbd cbg cbs cdb cdd cdg cds cgb cgd cgg cgs cjd cjs csb csd csg csp csb csd csg csp css csb csd csg css css css css css css css css css	OP("IO.MO" "??") 19.2085m 3.86662f 1.13849a -2.16114f -1.70662f -4.88385a 3.66917f -3.67732f 13.0342a -1.4788f -3.64354f 17.5093f -12.387f 4.92393f 11.4005f -2.38294f -26.7638a -11.6708f 14.0805f 105.018u 2.79422m 809.068u 6.98554 -3.33425p 400u 400u -400u 264.104u 26 0 660.259m
vth signal betaeff cbb cbd cbd cbg cds cdb cdg cds cgb cgd cgs cgd cgg cgs cgs csb csb csb cid cid id id id ids is pwr region reversed ron type vbs vds vdsat	065.475m OP ("IO.M6" "??") 192.116m 38.6256f 30.9686a -21.6434f -17.0132f -21.7294a 36.6344f -36.6808f 68.0822a -14.9857f -36.4168f 175.092f -123.689f 45.4452f 72.1042f -23.6182f -248.636a -116.767f 140.634f 858.923u 29.2912m 8.3889m 6.8837 -395.319p 4.25515m 4.25515m -4.25515m -4.25515m 3.96646m 22 0 019.065 0 932.155m 171.831m	signal betaeff cbb cbd cbg cbs cdb cdd cdg cds cgs cgd cgg cgs cjd cjs csb csd csg gs sp csb csd csg csp csc csg csc csc	OP("IO.MO" "??") 19.2085m 3.86662f 1.13849a -2.16114f -1.70662f -4.88385a 3.66917f -3.67132f 13.0342a -1.4788f -3.64354f 17.5093f -12.387f 4.92393f 11.4005f -2.38294f -26.7638a -11.6708f 14.0805f 105.018u 2.79422m 809.068u 6.98554 -3.33425p 400u 400u -400u 264.104u 2 0 1.65065K 0 0 0 660.259m 171.446m 660.259m

Figure 22: The DC operating points of all transistors

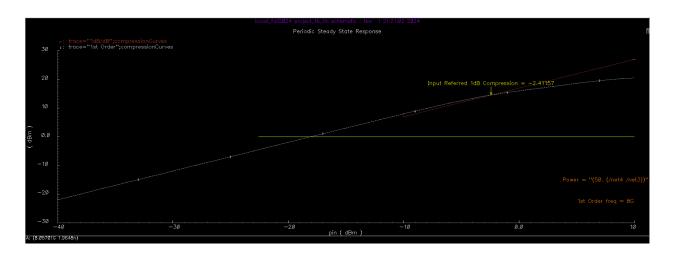


Figure 23: The 1dB compression point

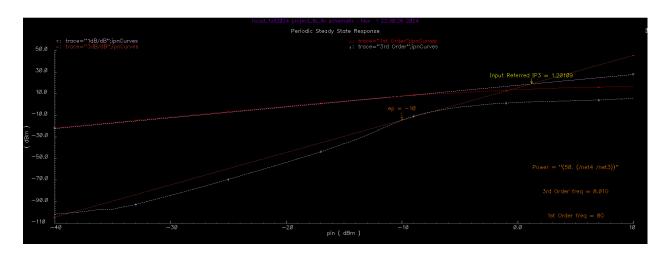


Figure 24: The IIP3 plot

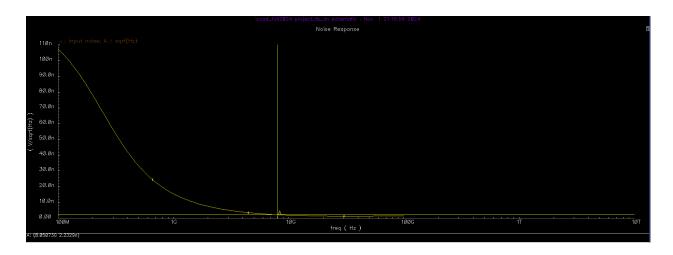


Figure 25: The input-referred noise

3.2 FF

To change the corner, I use Analog Environment > Setup > Model Libraries... and changed the corner of the transistor model, the MIM capacitor model, and the M model to FF.

$3.2.1 -40^{\circ}$

The analysis results are shown in the following figures and in table 7.

Power comsumption (mW)	9.003
Gain (@ 8GHz, dB)	26.227
Bandwidth (GHz)	1.651
1dB compression point (dBm)	-1.160
3rd input intercept point (dBm)	-1.343
Input-referred noise (@ 8GHz, $\frac{nV}{\sqrt{Hz}}$)	1.906

Table 7: The circuit properties at -40°

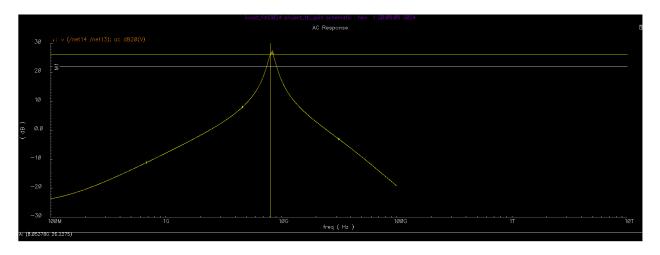


Figure 26: The gain plot

```
Curve name map:
------

Curvel - v (/net14 /net13); ac dB20(V)

Curve table:
-----

Y value Curve1

M1 22 7.47276040116
9.12362341286
```

Figure 27: The bandwidth, using a horizontal marker

	OD (#70 MO# #00#)		
signal	OP("IO.M3" "??")	signal	OP("IO.M5" "??")
betaeff	296.209m	betaeff	296.209m
cbb	13.5948f	cbb	13.5948f
cbd	74. 2728a	cbd	74.2728a -9.73662f
cbg	-9.73662f	cbg cbs	-3. 93243f
cbs	-3.93243f	cdb	-5. 46399a
cdb	-5. 46399a	cdd	19. 2678f
cdd	19. 2678f	cdg	-19.3033f
cdg cds	-19.3033f 41.0278a	cds	41.0278a
cgb	-8.94875f	cgb	-8.94875f
cgd	-18.4637f	cgd	-18.4637f
cgg	87.8978f	cgg	87.8978f -60.4853f
cgs	-60.4853f	cgs cjd	-60.46531 17.6426f
cjd	17.6426f	cjs	23. 4238f
cjs	23. 4238f	csb	-4.64056f
csb	-4. 64056f -878. 33a	csd	-878.33a
csd csg	-58.8578f	csg	-58.8578f
css	64.3767f	css	64. 3767f
gds	1.06472m	gds 	1.06472m
gm.	22.5571m	gnu gnubs	22.5571m 2.58625m
gmbs	2.58625m	gmos gmoverid	9. 79913
gmoverid	9.79913	ibulk	-31.8792p
ibulk id	-31.8792p	id	2.30194m
ids	2.30194m 2.30194m	ids	2.30194m
is	-2.30194m	is	-2.30194m
pwr	1.79943m	pwr	1.79943m
region	2	region reversed	2 0
reversed	0	ron	339.582
ron	339. 582	type	0
type vbs	0 -1.01041	vbs	-1.01041
vds	781.699m	vds	781.699m
vdsat	97.5725m	vdsat	97.5725m
vgs	789.593m	vgs vth	789.593m 672.873m
vth	672.873m	VCII	072. 073JIL
signal	OP("IO.M6" "??")	signal	OP("IO.MO" "??")
betaeff	OP("IO.M6" "??") 599.564m	betaeff	59.9246m
betaeff cbb	OP("IO.M6" "??") 599.564m 37.3854f	betaeff cbb	59.9246m 3.7413f
betaeff cbb cbd	OP("IO.M6" "??") 599.564m 37.3854f 138.422a	betaeff cbb cbd	59.9246m 3.7413f 12.5666a
betaeff cbb cbd cbg	OP("IO.M6" "??") 599.564m 37.3854f 138.422a -21.4588f	betaeff cbb cbd cbg	59.9246m 3.7413f 12.5666a -2.142f
betaeff cbb cbd	OP("IO.M6" "??") 599.564m 37.3854f 138.422a	betaeff cbb cbd	59.9246m 3.7413f 12.5666a
betaeff cbb cbd cbg cbs cdb	OP("10.M6" "??") 599.564m 37.3854f 138.422a -21.4588f -16.065f -12.7015a 38.5232f	betaeff cbb cbd cbg cbs cdb cdd	59.9246m 3.7413f 12.5666a -2.142f -1.61187f -3.7166a 3.85589f
betaeff cbb cbd cbg cbs cdb cdb cdd cdg	OP("IO.M6" "??") 599.564m 37.3854f 138.422a -21.4588f -16.065f -12.7015a 38.5232f -38.5654f	betaeff cbb cbd cbg cbs cdb cdd cdg	59.9246m 3.7413f 12.5666a -2.142f -1.61187f -3.7166a 3.85589f -3.86641f
betaeff cbb cbd cbg cbs cdb cdd cdd cdd cdg	OP("10.M6" "??") 599.564m 37.3854f 138.422a -21.4588f -16.065f -12.7015a 38.5232f -38.5654f 54.9211a	betaeff cbb cbd cbg cbs cdb cdb cdd cdd	59, 9246m 3, 7413f 12, 5666a -2, 142f -1, 61187f -3, 7166a 3, 85589f -3, 86641f 14, 2358a
betaeff cbb cbd cbg cbs cdb cdd cdd cdg cds cdg	OP("10.M6" "??") 599.564m 37.3854f 138.422a -21.4588f -16.065f -12.7015a 38.5232f -38.5654f 54.9211a -18.2607f	betaeff cbb cbd cbg cbs cdb cdd cdg cdg	59.9246m 3.7413f 12.5666a -2.142f -1.61187f -3.7166a 3.85589f -3.86641f 14.2358a -1.79898f
betaeff cbb cbd cbg cbs cdb cdd cdd cdg cds	OP ("10.M6" "??") 599.564m 37.3854f 138.422a -21.4588f -16.065f -12.7015a 38.5232f -38.5654f 54.9211a -18.2607f -37.8065f	betaeff cbb cbd cbg cbs cdb cdd cdg cdc	59.9246m 3.7413f 12.5666a -2.142f -1.61187f -3.7166a 3.85589f -3.86641f 14.2358a -1.79898f -3.78204f
betaeff cbb cbd cbg cbs cdb cdd cdd cdg cds cdg cds cgg	OP("10.M6" "??") 599.564m 37.3854f 138.422a -21.4588f -16.065f -12.7015a 38.5232f -38.5654f 54.9211a -18.2607f	betaeff cbb cbd cbg cbs cdb cdd cdg cdg	59.9246m 3.7413f 12.5666a -2.142f -1.61187f -3.7166a 3.85589f -3.86641f 14.2358a -1.79898f
betaeff cbb cbd cbg cbs cdb cdd cdd cdg cds	OP ("10.M6" "??") 599.564m 37.3854f 138.422a -21.4588f -16.065f -12.7015a 38.5232f -38.5654f 54.9211a -18.2607f -37.8065f 177.183f -121.116f 40.669f	betaeff cbb cbd cbg cbs cdb cdd cdg cds cdg cds	59.9246m 3.7413f 12.5666a -2.142f -1.61187f -3.7166a 3.85589f -3.86641f 14.2358a -1.79898f -3.78204f 17.6933f -12.1123f 4.48669f
betaeff cbb cbd cbg cbs cdb cdd cdg cds cgs cgs cgs cjs	OP ("10.M6" "??") 599.564m 37.3854f 138.422a -21.4588f -16.065f -12.7015a 38.5232f -38.5654f 54.9211a -18.2607f -37.8065f 177.183f -121.116f 40.669f 60.212f	betaeff cbb cbd cbg cbs cdb cdd cdg cds cgg cgs cgs	59, 9246m 3, 7413f 12, 5666a -2, 142f -1, 61187f -3, 7166a 3, 85589f -3, 86641f 14, 2358a -1, 79898f -3, 78204f 17, 6933f -12, 1123f 4, 40669f 9, 50755f
betaeff cbb cbd cbg cbs cdb cdd cdg cds cgs cgs cjd cjs csb	OP("10.M6" "??") 599.564m 37.3854f 138.422a -21.4588f -16.065f -12.7015a 38.5232f -38.5654f 54.9211a -18.2607f -37.8065f 177.183f -121.116f 40.669f 60.212f -19.112f	betaeff cbb cbd cbg cbs cdb cdd cdg cds cgg cgd cgd cgd cgd cgd csg	59, 9246m 3, 7413f 12, 5666a -2, 142f -1, 61187f -3, 7166a 3, 85589f -3, 86641f 14, 2358a -1, 79898f -3, 78204f 17, 6933f -12, 1123f 4, 48669f 9, 50755f -1, 93861f
betaeff cbb cbd cbg cbs cdb cdd cdg cds cgg cgd cgg cjs cjd cjs csb	OP ("10.M6" "??") 599.564m 37.3854f 138.422a -21.4588f -16.065f -12.7015a 38.5232f -38.5654f 54.9211a -18.2607f -37.8065f 177.183f -121.116f 40.669f 60.212f -19.112f -855.108a	hetaeff cbb cbd cbg cbs cdb cdd cdg cds cgg cds cgd cgg cgg cgs cjd cjs	59.9246m 3.7413f 12.5666a -2.142f -1.61187f -3.7166a 3.85589f -3.86641f 14.2358a -1.79898f -3.78204f 17.6933f -12.1123f 4.48669f 9.50755f -1.93861f -86.4134a
betaeff cbb cbd cbg cbs cdb cdd cdg cds cgs cgs cgs cjs css csb	OP ("10.M6" "??") 599.564m 37.3854f 138.422a -21.4588f -16.065f -12.7015a 38.5232f -38.5654f 54.9211a -18.2607f -37.8065f 177.183f -121.116f 40.669f 60.212f -19.112f -855.108a -117.159f	betaeff cbb cbd cbg cbs cdb cdd cdg cds cgb cgd cgg cgs cjs csb	59, 9246m 3, 7413f 12, 5666a -2, 142f -1, 61187f -3, 7166a 3, 85589f -3, 86641f 14, 2358a -1, 79898f -3, 78204f 17, 6933f -12, 1123f 4, 40669f 9, 50755f -1, 93861f -86, 4134a -11, 6849f
betaeff cbb cbd cbg cbs cdb cdd cdg cds cgs cgd cgg cjd cjs csb csd csg csb csd	OP ("10.M6" "??") 599.564m 37.3854f 138.422a -21.4588f -16.065f -12.7015a 38.5232f -38.5654f 54.9211a -18.2607f -37.8065f 177.183f -121.116f 40.669f 60.212f -19.112f -855.108a	betaeff cbb cbd cbg cbs cdb cdd cdg cds cgg cgs cgd cgs cjd cjd cjs csb csd csd csd	59, 9246m 3, 7413f 12, 5666a -2, 142f -1, 61187f -3, 7166a 3, 85589f -3, 86641f 14, 2358a -1, 79898f -3, 78204f 17, 6933f -12, 1123f 4, 48669f 9, 50755f -1, 93861f -86, 4134a -11, 6849f 13, 7099f
betaeff cbb cbd cbg cbs cdb cdd cdg cds cgs cgs cgs cjs css csb csd csg css	OP ("10.M6" "??") 599.564m 37.3854f 138.422a -21.4588f -16.065f -12.7015a 38.5232f -38.5654f 54.9211a -18.2607f -37.8065f 177.183f -121.116f 40.669f 60.212f -19.112f -855.108a -117.159f 137.126f 1.49664m 44.9198m	betaeff cbb cbd cbg cbs cdb cdd cdg cds cgb cgd cgg cgs cjs csb	59, 9246m 3, 7413f 12, 5666a -2, 142f -1, 61187f -3, 7166a 3, 85589f -3, 86641f 14, 2358a -1, 79898f -3, 78204f 17, 6933f -12, 1123f 4, 48669f 9, 50755f -1, 93861f -86, 4134a -11, 6849f 13, 7099f 158, 543u 4, 16144m
betaeff cbb cbd cbg cbs cdb cdd cdg cds cgs cgd cgs cjd cjs csb csd csg cgs gmm	OP ("IO.M6" "??") 599.564m 37.3854f 138.422a -21.4588f -16.065f -12.7015a 38.5232f -38.5654f 54.9211a -18.2607f -37.8065f 177.183f -121.116f 40.669f 60.212f -19.112f -855.108a -117.159f 137.126f 1.49664m 44.9198m 10.6772m	betaeff cbb cbd cbg cbs cdb cdd cdg cds cgg cgs cgd cgs cjd cjd cjs csb csd csd csd csd csd	59, 9246m 3, 7413f 12, 5666a -2, 142f -1, 61187f -3, 7166a 3, 85589f -3, 86641f 14, 2358a -1, 79898f -3, 78204f 17, 6933f -12, 1123f 4, 48669f 9, 50755f -1, 93861f -86, 4134a -11, 6849f 13, 7099f 158, 543u 4, 16144m 1, 00925m
betaeff cbb cbd cbg cbs cdb cdd cdg cds cgg cgs cgs cjd cjd cjs csd csd csd cgg ggs ggs ggs ggs ggs ggs ggs ggs ggs	OP ("10.M6" "??") 599.564m 37.3854f 138.422a -21.4588f -16.065f -12.7015a 38.5232f -38.5654f 54.9211a -18.2607f -37.8065f 177.183f -121.116f 40.669f 60.212f -19.112f -855.108a -117.159f 137.126f 1.49664m 44.9198m 10.6772m 9.75693	betaeff cbb cbd cbd cbg cbs cdb cdd cdg cds cgs cgd cgs cjd cjs csb csd csg csg cys cjd cjs cma cma cma cma cma cma	59, 9246m 3, 7413f 12, 5666a -2, 142f -1, 61187f -3, 7166a 3, 85589f -3, 86641f 14, 2358a -1, 79898f -3, 78204f 17, 6933f -12, 1123f 4, 48669f 9, 50755f -1, 93861f -86, 4134a -11, 6849f 13, 7099f 158, 543u 4, 16144m 1, 00925m 10, 4036
betaeff cbb cbd cbg cbs cdb cdd cdg cds cgs cgs cgs cjs css csb csd csg gms gmbs gmoverid ibulk	OP ("10.M6" "??") 599.564m 37.3854f 138.422a -21.4588f -16.065f -12.7015a 38.5232f -38.5654f 54.9211a -18.2607f -37.8065f 177.183f -121.116f 40.669f 60.212f -19.112f -855.108a -117.159f 137.126f 1.49664m 44.9198m 10.6772m 9.75693 -6.37072n	betaeff cbb cbd cbg cbs cdb cdd cdg cds cgs cgd cgs cjd cjs csb csd csg gm gmbs gmoverid ibulk	59, 9246m 3, 7413f 12, 5666a -2, 142f -1, 61187f -3, 7166a 3, 85589f -3, 86641f 14, 2358a -1, 79898f -3, 78204f 17, 6933f -12, 1123f 4, 48669f 9, 50755f -1, 93861f -86, 4134a -11, 6849f 13, 7099f 158, 543u 4, 16144m 1, 00925m 10, 4036 -24, 6915f
betaeff cbb cbd cbg cds cdd cdg cds cgs cgd cgs cjd cjs csb csd csg gm gmbs gmoverid ibulk id	OP ("IO.M6" "??") 599.564m 37.3854f 138.422a -21.4588f -16.065f -12.7015a 38.5232f -38.5654f 54.9211a -18.2607f -37.8065f 177.183f -121.116f 40.669f 60.212f -19.112f -855.106a -117.159f 137.126f 1.49664m 44.9198m 10.6772m 9.75693 -6.37072n 4.60389m	betaeff cbb cbd cbg cbs cdb cdd cdg cds cgb cgd cgg cgs cjd cjd cjs csb csd csd csd gm gmbs gmoverid ibulk	59, 9246m 3, 7413f 12, 5666a -2, 142f -1, 61187f -3, 7166a 3, 85589f -3, 86641f 14, 2358a -1, 79898f -3, 78204f 17, 6933f -12, 1123f 4, 49669f 9, 50755f -1, 93861f -86, 4134a -11, 6849f 13, 7099f 158, 543u 4, 16144m 1, 00925m 10, 4036 -24, 6915f 400u
betaeff cbb cbd cbg cbs cdb cdd cdg cds cgs cgs cgs cjs css csb csd csg gms gmbs gmoverid ibulk	OP ("10.M6" "??") 599.564m 37.3854f 138.422a -21.4588f -16.065f -12.7015a 38.5232f -38.5654f 54.9211a -18.2607f -37.8065f 177.183f -121.116f 40.669f 60.212f -19.112f -855.108a -117.159f 137.126f 1.49664m 44.9198m 10.6772m 9.75693 -6.37072n	betaeff cbb cbd cbg cbs cdb cdd cdg cds cgs cgd cgs cjd cjs csb csd csg gm gmbs gmoverid ibulk	59, 9246m 3, 7413f 12, 5666a -2, 142f -1, 61187f -3, 7166a 3, 85589f -3, 86641f 14, 2358a -1, 79898f -3, 78204f 17, 6933f -12, 1123f 4, 48669f 9, 50755f -1, 93861f -86, 4134a -11, 6849f 13, 7099f 158, 543u 4, 16144m 1, 00925m 10, 4036 -24, 6915f
betaeff cbb cbd cbg cbs cdb cdd cdg cds cgb cgg cgs cgs cgb csb csb csd csg csb csb csd csd csd cid cid cid cid cid cid cid cid cid ci	OP ("10.M6" "??") 599.564m 37.3854f 138.422a -21.4588f -16.065f -12.7015a 38.5232f -38.5654f 54.9211a -18.2607f -37.8055f 177.183f -121.116f 40.669f 60.212f -19.112f -855.108a -117.159f 137.126f 1.49664m 44.9198m 10.6772m 9.75693 -6.37072n 4.60389m 4.60389m	betaeff cbb cbd cbd cbg cbs cdb cdd cdg cds cgs cgb cgd cgg cgs cjd cjs csb csd csg css gds gm gmbs gmoverid ibulk ids	59, 9246m 3, 7413f 12, 5666a -2, 142f -1, 61187f -3, 7166a 3, 85589f -3, 86641f 14, 2358a -1, 79898f -3, 78204f 17, 6933f -12, 1123f 4, 48669f 9, 50755f -1, 93861f -86, 4134a -11, 6849f 13, 7099f 158, 543u 4, 16144m 1, 00925m 10, 4036 -24, 6915f 400u 400u
betaeff cbb cbd cbg cbs cdb cdd cdg cds cgb cgd cgg cgs cjb csb csb csd csg gmb gmoverid id id ids is pwr	OP ("IO.M6" "??") 599.564m 37.3854f 138.422a -21.4588f -16.065f -12.7015a 38.5232f -38.5654f 54.9211a -18.2607f -37.8055f 177.183f -121.116f 40.669f 60.212f -19.112f -855.108a -117.159f 137.126f 1.49664m 44.9198m 10.6772m 9.75693 -6.37072n 4.60389m 4.60389m 4.60388m -4.60388m -4.60388m	betaeff cbb cbd cbg cbs cdb cdd cdg cds cgg cgs cjd cjs csb csd csg csg gds gm gmbs gmoverid ibulk id ids is pwr	59, 9246m 3, 7413f 12, 5666a -2, 142f -1, 61187f -3, 7166a 3, 85589f -3, 86641f 14, 2358a -1, 79898f -3, 78204f 17, 6933f -12, 1123f 4, 48669f 9, 50755f -1, 93861f -86, 4134a -11, 6849f 13, 7099f 158, 543u 4, 16144m 1, 00925m 10, 4036 -24, 6915f 400u 400u -400u -400u
betaeff cbb cbd cbg cbs cdb cdd cdg cds cgb cgd cgg cgs cjb csb csd csg css csb csd csb csd csb csd csb csd csc csc csc csc csc csc csc csc csc	OP ("IO.M6" "??") 599.564m 37.3854f 138.422a -21.4588f -16.065f -12.7015a 38.5232f -38.5654f 54.9211a -18.2607f -37.8065f 177.183f -121.116f 40.669f 60.212f -19.112f -855.108a -117.159f 137.126f 1.49664m 44.9198m 10.6772m 9.75693 -6.37072n 4.60389m 4.60388m -4.60388m -4.60388m -4.60388m	betaeff cbb cbd cbg cbs cdb cdd cdg cds cgc cgs cjd cjs csb csd csg csg gm gmbs gmoverid ibulk id ids is pwr region reversed	59, 9246m 3, 7413f 12, 5666a -2, 142f -1, 61187f -3, 7166a 3, 85589f -3, 86641f 14, 2358a -1, 79899f -3, 78204f 17, 6933f -12, 1123f 4, 48669f 9, 50755f -1, 93861f -86, 4134a -11, 6849f 13, 7099f 158, 543u 4, 16144m 1, 00925m 10, 4036 -24, 6915f 400u 400u -400u
betaeff cbb cbd cbg cbs cdd cdg cds cgs cgd cgs cjd css css csd csg gms gmbs gmoverid id ids is pwr reversed ron	OP ("IO.M6" "??") 599.564m 37.3854f 138.422a -21.4588f -16.065f -12.7015a 38.5232f -38.5654f 54.9211a -18.2607f -37.8055f 177.183f -121.116f 40.669f 60.212f -19.112f -855.108a -117.159f 137.126f 1.49664m 44.9198m 10.6772m 9.75693 -6.37072n 4.60389m 4.60388m -4.60388m -4.60388m -4.60388m -4.60388m -4.60388m -4.60388m -4.60388m -4.60388m -4.60388m	betaeff cbb cbd cbg cbs cdb cdd cdg cds cgg cgs cjd cjs csb csd csg gds gm gmbs gmoverid ibulk ids is pwr	59, 9246m 3, 7413f 12, 5666a -2, 142f -1, 61187f -3, 7166a 3, 85589f -3, 86641f 14, 2358a -1, 79898f -3, 78204f 17, 6933f -12, 1123f 4, 48669f 9, 50755f -1, 93861f -86, 4134a -11, 6849f 13, 7099f 158, 543u 4, 16144m 1, 00925m 10, 4036 -24, 6915f 400u 400u 4400u 4400u 4400u 4400u 545, 523u 2 0 1, 53452K
betaeff cbb cbd cbd cbg cbs cdb cdd cdg cds cgb cgd cgg cgs cji csb csb csd csg gmb gmb gmoverid id id ids is pwr region reversed ropb	OP ("IO.M6" "??") 599.564m 37.3854f 138.422a -21.4588f -16.065f -12.7015a 38.5232f -38.5654f 54.9211a -18.2607f -37.8055f 177.183f -121.116f 40.669f 60.212f -19.112f -855.108a -117.159f 137.126f 1.49664m 44.9198m 10.6772m 9.75693 -6.37072n 4.60389m 4.60388m -4.60388m	betaeff cbb cbd cbg cbs cdb cdd cdg cds cgb cgd cgs cjb cjd cjs csb csd csg csg css did did did did did ids is pwr	59, 9246m 3, 7413f 12, 5666a -2, 142f -1, 61187f -3, 7166a 3, 85589f -3, 86641f 14, 2358a -1, 79898f -3, 78204f 17, 6933f -12, 1123f 4, 48669f 9, 50755f -1, 93861f -86, 4134a -11, 6849f 13, 7099f 158, 543u 4, 16144m 1, 00925m 10, 4036 -24, 6915f 400u 400u -400u 245, 523u 2 0 0 1, 53452K 0
betaeff cbb cbd cbd cbg cbs cdd cdd cdg cds cgd cgd cgs cjd cjs csb csd csg gas gmoverid ibulk id ids is pwr reversed ron type tybe	OP ("IO.M6" "??") 599.564m 37.3854f 138.422a -21.4588f -16.065f -12.7015a 38.5232f -38.5654f 54.9211a -18.2607f -37.8065f 177.183f -121.116f 40.669f 60.212f -19.112f -855.108a -117.159f 137.126f 1.49664m 44.9198m 10.6772m 9.75693 -6.37072n 4.60389m 4.60388m -4.60388m	betaeff cbb cbd cbg cbs cdb cdd cdg cds cgc cgc cgc cgc cgs cjd cjs csb csd csg css gds gm gmbs gmoverid ibulk id ids is pwr segion reversed ron type	59, 9246m 3, 7413f 12, 5666a -2, 142f -1, 61187f -3, 7166a 3, 85589f -3, 86641f 14, 2358a -1, 79899f -3, 78204f 17, 6933f -12, 1123f 4, 48669f 9, 50755f -1, 93861f -86, 4134a -11, 6849f 13, 7099f 158, 543u 4, 16144m 1, 00925m 10, 4036 -24, 6915f 400u 400u -400u
betaeff cbb cbd cbd cbg cbs cdb cdd cdg cds cgb cgd cgg cgs cji csb csb csd csg gmb gmb gmoverid id id ids is pwr region reversed ropb	OP ("IO.M6" "??") 599.564m 37.3854f 138.422a -21.4588f -16.065f -12.7015a 38.5232f -38.5654f 54.9211a -18.2607f -37.8055f 177.183f -121.116f 40.669f 60.212f -19.112f -855.108a -117.159f 137.126f 1.49664m 44.9198m 10.6772m 9.75693 -6.37072n 4.60389m 4.60388m -4.60388m	betaeff cbb cbd cbg cbs cdb cdd cdg cds cgg cgs cjd cjs csb csd csg gds gm gmbs gmoverid ibulk id ids is pwr region reversed ron type vbs	59, 9246m 3, 7413f 12, 5666a -2, 142f -1, 61187f -3, 7166a 3, 85589f -3, 86641f 14, 2358a -1, 79898f -3, 78204f 17, 6933f -12, 1123f 4, 48669f 9, 50755f -1, 93861f -86, 4134a -11, 6849f 13, 7099f 158, 543u 4, 16144m 1, 00925m 10, 4036 -24, 6915f 400u 400u -400u 245, 523u 2 0 0 1, 53452K 0
betaeff cbb cbd cbg cbs cdd cdg cds cgd cgs cgd cgs cjd css csb csd csg gms gmbs gmoverid ibulk id ids is pwr reversed ron type vbs vds	OP ("IO.M6" "??") 599.564m 37.3854f 138.422a -21.4588f -16.065f -12.7015a 38.5232f -38.5654f 54.9211a -18.2607f -37.8055f 177.183f -121.116f 40.669f 60.212f -19.112f -855.108a -117.159f 137.126f 1.49664m 44.9198m 10.6772m 9.75693 -6.37072n 4.60388m -4.60388m -4.60388m -4.60388m -4.6518m 20 019.468 0	betaeff cbb cbd cbg cbs cdb cdd cdg cds cgc cgc cgc cgc cgs cjd cjs csb csd csg css gds gm gmbs gmoverid ibulk id ids is pwr segion reversed ron type	59, 9246m 3, 7413f 12, 5666a -2, 142f -1, 61187f -3, 7166a 3, 85589f -3, 86641f 14, 2358a -1, 79898f -3, 78204f 17, 6933f -12, 1123f 4, 48669f 9, 50755f -1, 93861f -86, 4134a -11, 6849f 13, 7099f 158, 543u 4, 16144m 1, 00925m 10, 4036 -24, 6915f 400u 400u -400u -400 0 -513, 807m
betaeff cbb cbd cbd cbg cbs cdd cdd cdg cds cgb cgd cgg cgs cjd cjb csb csd csb csd csb csd cijb cijb csb csd csc csc csc csc csc csc csc csc csc	OP ("IO.M6" "??") 599.564m 37.3854f 138.422a -21.4588f -16.065f -12.7015a 38.5232f -38.5654f 54.9211a -18.2607f -37.8055f 177.183f -121.116f 40.669f 60.212f -19.112f -855.108a -117.159f 137.126f 1.49664m 44.9198m 10.6772m 9.75693 -6.37072n 4.60389m 4.60389m 4.60388m -4.60388m	betaeff cbb cbd cbg cbs cdb cdd cdg cds cgb cgd cgs cjd cjs csb csd csg css gds gm gmbs gmoverid ibulk id ids is pwr reversed ron type vbs vds	59, 9246m 3, 7413f 12, 5666a -2, 142f -1, 61187f -3, 7166a 3, 85589f -3, 86641f 14, 2358a -1, 79898f -3, 78204f 17, 6933f -12, 1123f 4, 48669f 9, 50755f -1, 93861f -86, 4134a -11, 6849f 13, 7099f 158, 543u 4, 16144m 1, 00925m 10, 4036 -24, 6915f 400u 400u -400u 245, 523u 2 0 0 1, 53452K 0 0 613, 807m 89, 8858m

Figure 28: The DC operating points of all transistors

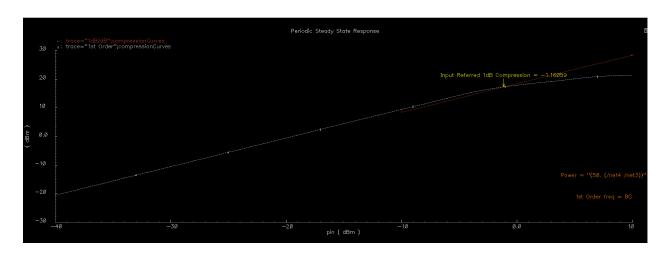


Figure 29: The 1dB compression point

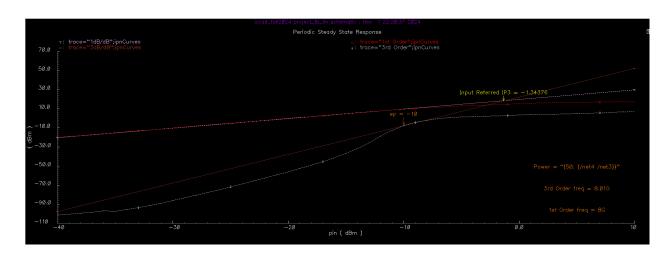


Figure 30: The IIP3 plot

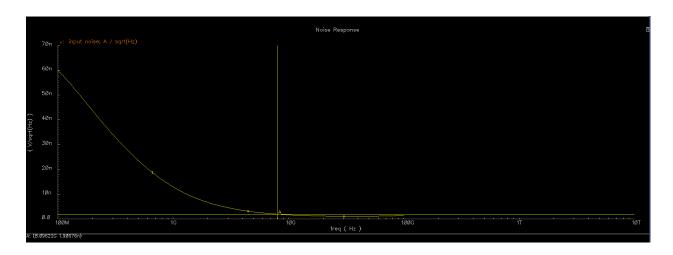


Figure 31: The input-referred noise

$3.2.2 27^{\circ}$

The analysis results are shown in the following figures and in table 8.

11.152
24.509
1.308
-0.485
1.647
2.017

Table 8: The circuit properties at 27°

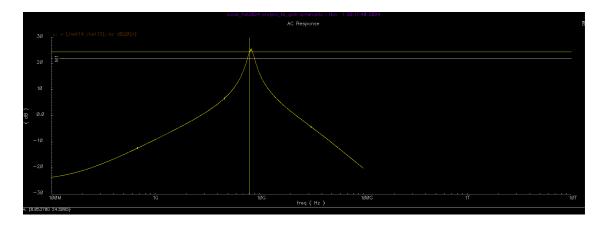


Figure 32: The gain plot

```
Curve name map:
------
Curve1 - v (/net14 /net13); ac dB20(V)

Curve table:
------
Y value Curve1

M1 22 7.70525799416
9.01324564366
```

Figure 33: The bandwidth, using a horizontal marker

- 2 1	OD (UT)) MOH HOOH)		
signal	OP ("I).M3" "??")	signal	OP("IO.M5" "??")
betaeff	100	563m	betaeff	186.563m
cbb		5678f	cbb	13.5678f
cbd		4129a	cbd	73.4129a
cbg		69971f	cpd	-9.69971f
cbs	-3.	94148f	cbs cdb	-3.94148f
cdb		20723a	cdd	-6.20723a 19.2721f
cdd		2721f	cdq	-19, 3076f
cdg		3076f	cds	41. 7524a
cds cgb		7524a 745f	cqb	-8.745f
cgd		4676f	cgd	-18.4676f
cgg		646f	cgg	87. 646f
cgs		4335f	cgs	-60.4335f
cjd		9556f	cjd	17. 9556f 23. 9886f
cjs		9886f	cjs csb	-4. 81657f
csb	-4. -877.	81657f	csd	-877.94a
csd csg		94a 6387f	csq	-58. 6387f
css		3332f	css	64. 3332f
qds		23u	gds	961. 23u
gm		3505m	gm.	19.3505m
gmbs		30229m	gmbs	2. 30229m
gmoverid		4507	gmoverid ibulk	8. 4507 -10. 4167p
ibulk id		4167p 28981m	id	2. 28981m
ids		28981m	ids	2. 28981m
is		28981m	is	-2.28981m
pwr		76689m	pwr	1.76689m
region	2		region	2
reversed	0	004	reversed ron	0 336. 984
ron	336. 0	984	type	0
type vbs		01832	vbs	-1.01832
vds		631m	vds	771.631m
vdsat		22m	vdsat	128.22m
vgs		681m	vgs	781.681m
vth				
vai	030.	645m	vth	636.645m
			signal	OP("IO.MO" "??")
signal betaeff	OP("I	645л). М6" "??") 944л	signal betaeff	OP("IO.MO" "??") 37.9693m
signal betaeff cbb	OP("I0 379. 37.	0.M6" "??") 944m 4108f	signal betaeff cbb	OP("IO.MO" "??") 37.9693m 3.74405f
signal betaeff cbb cbd	OP("I0 379. 37. 138.	D.M6" "??") 944m 4108f 226a	signal betaeff cbb cbd	OP("IO.MO" "??") 37.9693m 3.74405f 11.9352a
signal betaeff cbb cbd cbg	OP("I0 379. 37. 138. -21.	D. M6" "??") 944m 4108f 226a 4053f	signal betaeff cbb cbd cbg	OP("IO.MO" "??") 37.9693m 3.74405f 11.9352a -2.13637f
signal betaeff cbb cbd cbg cbs	OP ("IC 379. 37. 138. -21. -16.	D.M6" "??") 944m 4108f 226a 4053f 1437f	signal betaeff cbb cbd cbg cbs cdb	OP("IO.MO" "??") 37.9593m 3.74405f 11.9352a -2.13637f -1.61962f -4.28416a
signal betaeff cbb cbd cbg cbs cdb	OP ("IC 379: 37: 138: -21: -16: -13:	D.M6" "??") 944m 4108f 226a 4053f 1437f 2658a	signal betaeff cbb cbd cbg cbs cdb	OP("IO.MO" "??") 37.9693m 3.74405f 11.9352a -2.13637f -1.61962f -4.28416a 3.85793f
signal betaeff cbb cbd cbg cbs	OP ("I0 379 37, 138, -21, -16, -13, 38,	D.M6" "??") 944m 4108f 226a 4053f 1437f	signal betaeff cbb cbd cbg cbs cdb cdd cdd	OP("IO.MO" "??") 37.9693m 3.74405f 11.9352a -2.13637f -1.61962f -4.28416a 3.85793f -3.8684f
signal betaeff cbb cbd cbg cbs cdb cdd cdg cdg	0P ("I0 379, 37, 138, -21, -16, -13, 38, -38, 53,	D.M6" "??") 944m 4108f 226a 4053f 1437f 2658a 526f 5667f 945a	signal betaeff cbb cbd cbg cbs cdb cdd cdd cdg cds	OP("IO.MO" "??") 37.9693m 3.74405f 11.9352a -2.13637f -1.61962f -4.28416a 3.85793f -3.8684f 14.7553a
signal betaeff cbb cbd cbg cbs cdb cdb cdd cdg cds	0P ("I0 379 37, 138, -21, -16, -13, 38, -38, 53, -17,	D. M6" "??") 944m 4108f 226a 4053f 1437f 2658a 526f 5667f 945a	signal betaeff cbb cbd cbg cbs cdb cdb cdd ccdb ccdb	OP("IO.MO" "??") 37.9693m 3.74405f 11.9352a -2.13637f -1.61962f -4.28416a 3.85793f -3.8684f 14.7553a -1.76685f
signal betaeff cbb cbd cbg cbs cdb cdd cdd cdg cds cds	0P("I0" 379 377 1388 -211 -166 -133 388 -388 533 -177 -37 37 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9	D. M6" "??") 944m 4108f 226a 4053f 1437f 2558a 526f 5667f 945a 9458	signal betaeff cbb cbd cbg cbs cdb cdd cdg cds cdg	OP("IO.MO" "??") 37.9693m 3.74405f 11.9352a -2.13637f -1.61962f -4.28416a 3.85793f -3.8684f 14.7553a -1.76685f -3.78326f
signal betaeff cbb cbd cbg cbs cdb cdd cdg cdg cds	OP ("II 379 37, 138 -21, -16, -13, 38, -38, -38, -37, -37,	D.M6" "??") 944m 4108f 226a 4053f 1437f 2658a 526f 5667f 945a 9558f 8134f	signal betaeff cbb cbd cbg cbs cdb cdb cdd ccdb ccdb	OP("IO.MO" "??") 37.9693m 3.74405f 11.9352a -2.13637f -1.61962f -4.28416a 3.85793f -3.8684f 14.7553a -1.76685f
signal betaeff cbb cbd cbd cdb cdb cdb cdb cdb cdc cdc	OP ("II 379 37, 138 -21, -16, -13, 38, -38, -38, -37, -37, 176, -120,	D. M6" "??") 944m 4108f 226a 4053f 1437f 2658a 526f 5667f 945a 9658f 8134f 708f	signal betaeff cbb ccd ccd cdd cdd cdg cds cgb cgd cgd cgg	OP("IO.MO" "??") 37.9693m 3.74405f 11.9352a -2.13637f -1.61962f -4.28416a 3.85793f -3.8684f 14.7553a -1.76685f -3.78326f 17.6502f -12.1001f 4.64854f
signal betaeff cbb cbd cbg cbs cdb cdd cdg cds cgg cgg cgg	OP("I(379, 37, 1388, -21, -16, -13, 38, -38, -38, -37, -37, 176, -120, 41,	D.M6" "??") 944m 4108f 226a 4053f 1437f 2658a 526f 5667f 945a 9558f 8134f	signal betaeff cbb cbd cbg cbs cdb cdd cdg cds cgg cgs cgg	OP("IO.MO" "??") 37.9693m 3.74405f 11.9352a -2.13637f -1.61962f -4.28416a 3.85793f -3.8684f 14.7553a -1.76685f -3.78326f 17.6502f -12.1001f 4.64854f 10.0626f
signal betaeff cbb cbd cbd cdb cdb cdb cdb cdb cdc cdc	OP ("II 379, 37, 138, -21, -16, -13, 38, -38, -17, -37, 176, -120, 41, 63, -19,	D. M6" "??") 944m 4108f 226a 4053f 1437f 2658a 526f 5667f 945a 945a 9958f 8134f 708f 929f 5902f 6931f 4318f	signal betaeff cbb cbd cbg cds cdb cdd cdg cds cgs cgd cgg cgg cjd cjs csb	OP("IO.MO" "??") 37.9693m 3.74405f 11.9352a -2.13637f -1.61962f -4.28416a 3.85793f -3.8684f 14.7553a -1.76685f -3.78326f 17.6502f -12.1001f 4.64854f 10.0626f -1.97292f
signal betaeff cbb cbd cbg cbs cdb cdd cdg cds cgb cgb cgd cgc cgc cgc cgc cgs cjc cgc cgs	OP ("II 379 37, 138, -21, -16, -13, 38, -38, 53, -17, -37, 176, -120, 41, 63, -19, -850, -	D.M6" "??") 944m 4108f 226a 4053f 1437f 2658a 526f 5667f 945a 9558f 8134f 708f 929f 5902f 6931f 4318f 809a	signal betaeff cbb ccbd ccbg cdcd cdg cds cgc cgc cgc cgs cjd cjs csb	OP("IO.MO" "??") 37.9693m 3.74405f 11.9352a -2.13637f -1.61962f -4.28416a 3.85793f -3.8684f 14.7553a -1.76685f -3.78326f 17.6502f -12.1001f 4.64854f 10.0626f -1.97292f -86.6068a
signal betaeff cbb cbd cbd cdb cdb cdc cdc cds cds cgc cgc cgc cgc cgc cgc cgc cgc cgc cg	OP ("II" 379 37 37 138 -21 -16 -13 38 -38 53 -17 -37 176 -120 41 63 -19 -850 -116 .	D. M6" "??") 944m 4108f 226a 4053f 1437f 2658a 526f 5667f 945a 9658f 8134f 708f 929f 5902f 6931f 4318f 809a 736f	signal betaeff cbb cbd cbg cbs cdb cdd cdg cds cgg cgs cgd cgg cgs csb csb csd	OP("IO.MO" "??") 37.9693m 3.74405f 11.9352a -2.13637f -1.61962f -4.28416a 3.85793f -3.8684f 14.7553a -1.76685f -3.78326f 17.6502f -12.1001f 4.64854f 10.0626f -1.97292f -86.6068a -11.6455f
signal betaeff cbb cbd cbd cdb cdb cdb cdc cdc cdc cdc	OP("II 379 37. 138 -21. -16. -13. 38. -38. -37. 176. -120. 41. 63. -19. -850. -116.	D. M6" "??") 944m 4108f 226a 4053f 1437f 2658a 526f 5667f 945a 9658f 8134f 708f 929f 5902f 6931f 4318f 809a 736f 018f	signal betaeff cbb cbd cbg cds cdb cdd cdg cds cgs cgd cgg cgs cjd cjs csb csd csd	OP ("IO. MO" "??") 37. 9693m 3. 74405f 11. 9352a -2. 13637f -1. 61962f -4. 28416a 3. 85793f -3. 8684f 14. 7553a -1. 76685f -3. 78326f 17. 6502f -12. 1001f 4. 64854f 10. 0626f -1. 97292f -86. 6068a -11. 6455f 13. 705f
sigmal betaeff cbb cbd cbg cbs cdb cdd cdg cds cgc cgc cgc cgc cgs cjd cjs csb csd csd csg csd csd	OP("II 379) 37, 138, -21, -16, -13, 38, -38, -38, -17, -37, 176, -120, 41, 63, -19, -850, -116, 137,	D.M6" "??") 944m 4108f 226a 4053f 1437f 2658a 526f 5667f 945a 9558f 8134f 708f 929f 5902f 6931f 4318f 809a 736f 018f 32492m	signal betaeff cbb cbd cbg cbs cdb cdd cdg cds cgg cgs cgd cgg cgs csb csb csd	OP("IO.MO" "??") 37.9693m 3.74405f 11.9352a -2.13637f -1.61962f -4.28416a 3.85793f -3.8684f 14.7553a -1.76685f -3.78326f 17.6502f -12.1001f 4.64854f 10.0626f -1.97292f -86.6068a -11.6455f 13.705f 149.662u 3.57699m
signal betaeff cbb cbd cbd ccd cdb cdd cds cgs cgs cgd cgs cjd cjs csb csd csg cgs	OP("II 379 37. 138. -21. -16. -13. 38. -38. -53. -17. -37. 176. -120. 41. 63. -19. -850. -116. 137.	D. M6" "??") 944m 4108f 226a 4053f 1437f 2658a 526f 5667f 945a 9658f 8134f 708f 929f 5902f 6931f 4318f 809a 736f 018f 32492m 8077m	signal betaeff cbb cbd cbg ccdb cdb ccdc ccds ccgc cgc cgc cgc cgc cgc cgc cgc cgc c	OP ("IO. MO" "??") 37. 9693m 3. 74405f 11. 9352a -2. 13637f -1. 61962f -4. 28416a 3. 85793f -3. 8684f 14. 7553a -1. 76685f -3. 78326f 17. 6502f -12. 1001f 4. 64854f 10. 0626f -1. 97292f -86. 6068a -11. 6455f 13. 705f 149. 662u 3. 57699m 882. 509u
sigmal betaeff cbb cbd cbg cbs cdb cdd cdg cds cgc cgc cgc cgc cgs cjd cjs csb csd csd csg csd csd	OP("II 379 37 138 -211 -166 -133 38 53 -17 -37 1766 -120 411 63 -19 -850 -116 137 13 8 9	D.M6" "??") 944m 4108f 226a 4053f 1437f 2658a 526f 5667f 945a 9558f 8134f 708f 929f 5902f 6931f 4318f 809a 736f 018f 32492m	signal betaeff cbb cbd cbd cbg cbs cdb cdd cdg cds cgb cgc cgc cgc cgc cgc cgc cgc cgc cgc	OP("IO.MO" "??") 37.9693m 3.74405f 11.9352a -2.13637f -1.61962f -4.28416a 3.85793f -3.8684f 14.7553a -1.76685f -3.78326f 17.6502f -12.1001f 4.64854f 10.0626f -1.97292f -86.6068a -11.6455f 13.705f 149.662u 3.57699m 882.509u 8.94249
signal betaeff cbb cbd cbd cdb cdb cdb cdb cdc cdc cdc	OP("II 379 377 1388 -211 -166 -133 3838 53 -177 -377 1766 -120 41 633 -199 -850 -1166 1377 1 388 9 8	D. M6" "??") 944m 4108f 226a 4053f 1437f 2658a 526f 5667f 945a 945a 9958f 8134f 708f 929f 5902f 6931f 4318f 809a 736f 018f 32492m 8077m 37579m	signal betaeff cbb cbd cbg cbs cdb cdd cdg cds cgs cgs cgs cjd cjs csb csd csb csd gm gmbs gmoverid ibulk	OP("IO.MO" "??") 37.9693m 3.74405f 11.9352a -2.13637f -1.61962f -4.28416a 3.85793f -3.8684f 14.7553a -1.76685f -3.78326f 17.6502f -12.1001f 4.64854f 10.0626f -1.97292f -86.6068a -1.16455f 13.705f 149.662u 3.575699m 882.509u 8.94249 -3.43465f
signal betaeff cbb cbd cbd ccd cdb cdd cdg cds cgs cgd cgs cjd cjs csb csd csg csb csd csd csg csb csd csg csb csd csg csb csd	OP ("II" 379 379 377 1388 -211 -166 -133 3838 533 -177 -377 1766 -1200 411 633 8944 44 44	D. M6" "??") 944m 4108f 226a 4053f 1437f 2658a 526f 5667f 945a 9658f 8134f 708f 929f 5902f 6931f 4318f 809a 736f 018f 32492m 8077m 37579m 47401 68637n 57963m	signal betaeff cbb cbd cbg ccdb cdb ccdc ccds ccgc cgc cgc cgc cgc cgc cgc cgc cgc c	OP ("IO. MO" "??") 37. 9693m 3. 74405f 11. 9352a -2. 13637f -1. 61962f -4. 28416a 3. 85793f -3. 8684f 14. 7553a -1. 76685f -3. 78326f 17. 6502f -12. 1001f 4. 64854f 10. 0626f -1. 97292f -86. 6068a -11. 6455f 13. 705f 149. 662u 3. 57699m 882. 509u 8. 94249 -3. 43465f 400u
signal betaeff cbb cbd cbd cbg cds cdd cdg cds cgb cgc cgs cjc cgs cjs csb csd csg csd csg csd csg csd csd csg cid	0P ("II" 379 377 379 377 1388 -211 -166 -133 38 38 53 37 176 -120 411 63 39 98 8 -4 4 4 4 4 4	0.M6" "??") 944m 4108f 226a 4053f 1437f 2658a 526f 5667f 945a 99588f 8134f 708f 929f 5902f 6931f 4318f 809a 736f 018f 32492m 8077m 37579m 47401 686377a 57963m 579663m 579663m	signal betaeff cbb cbd cbd cbg cbs cdb cdd cdg cds cgb cgg cgs cgs cjd cjd cjd cjs csb csb csd csg csb csb csd csg csb csd cid id id ids	OP("IO.MO" "??") 37.9693m 3.74405f 11.9352a -2.13637f -1.61962f -4.28416a 3.85793f -3.8684f 14.7553a -1.76685f -3.78326f 17.6502f -12.1001f 4.64854f 10.0626f -1.97292f -86.6068a -11.6455f 13.705f 149.662u 3.57699m 882.509u 8.94249 -3.43465f 400u
signal betaeff cbb cbd cbd cdb cdb cdd cdg cds cgs cgd cgs cjd cjs csb csd csg cys cjd cjs csb csd csg csg css csb csd cdc cdc cit cit cit id ids iis	0P ("II" 379) 379 379 379 379 379 379 379 379 379 379	0. M6" "??") 944m 4108f 226a 4053f 1437f 2658a 526f 5667f 945a 9658f 8134f 708f 929f 5902f 6931f 4318f 809a 736f 018f 32492m 8077m 37579m 47401 66637n 57963m 57962m 57962m	signal betaeff cbb cbd cbg cbs cdb cdd cdg cds cgg cgs cgg cgs cjd cjs csb csd csg csp csb csd csp csb csd csp csb csd csd cijs cijs csb csd csd csg css csd csd cijs csb csd csd cijs csi csi csi csi csi csi csi csi csi cs	OP ("IO. MO" "??") 37. 9693m 3. 74405f 11. 9352a -2. 13637f -1. 61962f -4. 28416a 3. 85793f -3. 8684f 14. 7553a -1. 76685f -3. 78326f 17. 6502f -12. 1001f 4. 64854f 10. 0626f -1. 97292f -86. 6068a -11. 6455f 13. 705f 149. 662u 3. 57699m 882. 509u 8. 94249 -3. 43465f 400u
signal betaeff cbb cbd cbd ccd cdb cdd cdg cds cgs cgd cgs cjd cjs csb csd csg gm gm gm gm gm sgm cym sgm cym sgm cym sgm sgm cym tid ids is pwr	0P ("II" 379 377 377 1388 379 377 1388 388 388 388 388 388 388 397 377 377 1766 379 379 379 379 379 379 379 379 379 379	0. M6" "??") 944m 4108f 226a 4053f 1437f 2658a 526f 5667f 945a 9658f 8134f 708f 929f 5902f 6931f 4318f 809a 736f 018f 32492m 8077m 37579m 47401 668637n 57962m 57962m 57962m 66352m	signal betaeff cbb cbd cbd cbg cbs cdb cdd cdg cds cgb cgg cgs cgs cjd cjd cjd cjs csb csb csd csg csb csb csd csg csb csd cid id id ids	OP("IO.MO" "??") 37.9693m 3.74405f 11.9352a -2.13637f -1.61962f -4.28416a 3.85793f -3.8684f 14.7553a -1.76685f -3.78326f 17.6502f -12.1001f 4.64854f 10.0626f -1.97292f -86.6068a -11.6455f 13.705f 149.662u 3.57699m 882.509u 8.94249 -3.43465f 400u 400u -400u
signal betaeff cbb cbd cbd cdb cdb cdd cdc cds cgb cgd cgs cjb csb csb csb csb csb csb csb csb csb cs	0P("II") 379 379 379 1388 -211 -166 -133 -388 -388 -387 -17 -17 -37 -166 -120 -116 -137 -118 -380 -116 -137 -14 -4 -4 -4 -4 -4 -4 -4 -4 -4 -4 -4 -4 -4	9. M6" "??") 944m 4108f 226a 4053f 1437f 2658a 526f 5667f 945a 9658f 8134f 708f 929f 5902f 6931f 4318f 809a 736f 018f 018f 372492m 8077m 37579m 47401 68637n 57963m 57962m 57962m 57962m	signal betaeff cbb cbd cbd ccd cdc cdc cdc cds cgd cgd cgs cjd cjs csb csd csg cjs cjs cib csd csg cjs cib csd cdi cdg cfi cjs csb csd csg css csg css csg css csg css csg css csg css csc csg css csc csg css csc csg css csc csc	OP("IO.MO" "??") 37.9693m 3.74405f 11.9352a -2.13637f -1.61962f -4.28416a 3.85793f -3.8684f 14.7553a -1.76685f -3.78326f 17.6502f -12.1001f 4.64854f 10.0626f -1.97292f -86.6068a -11.6455f 13.705f 149.662u 3.57699m 882.509u 8.94249 -3.43465f 400u 400u -400u 239.671u
signal betaeff cbb cbd cbd ccd cdb cdd cdg cds cgs cgd cgs cjd cjs csb csd csg gm gm gm gm gm sgm cym sgm cym sgm cym sgm sgm cym tid ids is pwr	0P ("II" 379 379 379 379 379 379 379 379 379 379	9. M6" "??") 944m 4108f 226a 4053f 1437f 2658a 526f 5667f 945a 9658f 8134f 708f 929f 5902f 6931f 4318f 809a 736f 018f 018f 372492m 8077m 37579m 47401 68637n 57963m 57962m 57962m 57962m	signal betaeff cbb cbd cbg cbs cdb cdd cdg cds cgd cgd cgs cjd cjs csb csd csg cys cjd cji cibilk id ids is pwr reversed ron	OP ("IO. MO" "??") 37. 9693m 3. 74405f 11. 9352a -2. 13637f -1. 61962f -4. 28416a 3. 85793f -3. 8684f 14. 7553a -1. 76685f -3. 78326f 17. 6502f -12. 1001f 4. 64854f 10. 0626f -1. 97292f -86. 6068a -1. 1. 6455f 13. 705f 149. 662u 3. 57699m 882. 509u 8. 94249 -3. 43465f 400u 400u -400u 239. 671u 22 0 1. 49794K
signal betaeff cbb cbd cbd cdb cdb cdd cdd cdg cds cgd cgd cgs cjd cjd cjs csb csd csg gg gg gs gm gmb gmoverid ibulk id ids is pwr region reversed	0P ("II" 379) 379 379 379 379 379 379 379 379 379 379	0. M6" "??") 944m 4108f 226a 4053f 1437f 2658a 526f 5667f 945a 9658f 8134f 708f 929f 5902f 6931f 4318f 809a 736f 018f 32492m 80077m 37579m 47401 668637n 57963m 57962m 57962m 57962m 66352m	signal betaeff cbb cbd cbg cbs cdd cdd cdd cdg cgs cgs cgc cgs cjd cjb csd csd csg gms gmb gmb gmb gmb gmoverid ibulk id ids is pwr reversed ron reversed	OP("IO.MO" "??") 37.9693m 3.74405f 11.9352a -2.13637f -1.61962f -4.28416a 3.85793f -3.8684f 14.7553a -1.76685f -3.78326f 17.6502f -12.1001f 4.64854f 10.0626f -1.97292f -86.6068a -11.6455f 13.705f 149.662u 3.57699m 882.509u 8.94249 -3.43465f 400u 400u -400u 239.671u 2 0 1.49794K
signal betaeff cbb cbd cbd ccd cdb cdd cdg cds cgd cgd cgs cjd cjs csb csd csd csg cys cjd cijs cijs csb csd csd csg css csb csd csc csc csc csc csc csc csc csc csc	0P ("II" 379, 379, 379, 379, 379, 379, 379, 379,	9. M6" "??") 944m 4108f 226a 4053f 1437f 2558a 526f 5667f 945a 9658f 8134f 708f 929f 5902f 6931f 4318f 809a 736f 018f 32492m 8007m 37579m 47401 66837n 57963m 57962m 57962m 66352m	signal betaeff cbb cbd cbd ccd cdc cdb cdd cdg cds cgb cgd cgc cgs cjd cjs csb csd csg css csb csd cijs csb csd csg css csp csc csg css csc csc	OP("IO.MO" "??") 37.9693m 3.74405f 11.9352a -2.13637f -1.61962f -4.28416a 3.85793f -3.8684f 14.7553a -1.76685f -3.78326f 17.6502f -12.1001f 4.64854f 10.0626f -1.97292f -86.6068a -11.6455f 13.705f 149.662u 3.57699m 882.509u 8.94249 -3.43465f 400u 400u -400u 239.671u 22 0 1.49794K 0
signal betaeff cbb ccbd ccbd ccbd cdd cdd cdg cds cgb cgd cgs cjd cjs csb csd csg csb csd csg csb csd csg csb csd csp csb csd csg cron csp csc csb csd csg csb csd csg csc csc csc csc csc csc csc csc csc	0P ("II" 379 379 377 1388 379 379 379 379 379 379 379 379 379 379	0. M6" "??") 944m 4108f 226a 4053f 1437f 2658a 526f 5667f 945a 9658f 8134f 708f 929f 5902f 6931f 4318f 809a 736f 018f 32492m 8077m 37579m 47401 66637n 57962m 57962m 57962m 566352m	signal betaeff cbb cbd cbg cbs cdb cdd cdg cds cgs cgd cgs cjd cjs csb csd csg gm gmbs gmoverid ibulk id ids is pwr reversed ron type vbs vds	OP ("IO.MO" "??") 37.9693m 3.74405f 11.9352a -2.13637f -1.61962f -4.28416a 3.85793f 3.8684f 14.7553a -1.76685f -3.78326f 17.6502f -12.1001f 4.64854f 10.0626f -1.97292f -86.6068a -11.6455f 13.705f 149.662u 3.57699m 882.505u 8.94249 -3.43465f 400u -400u 239.671u 2 0 1.49794K 0 0 599.178m
signal betaeff cbb cbd cbd ccd cdb cdd cdg cds cgd cgg cgs cjd cjs csb csd csg csg cys csb csd csb csd csp cry cry css csb csd csc csc csc csc csc csc csc csc csc	0P ("II" 379) 379 379 379 379 379 379 379 379 379 379	0. M6" "??") 944m 4108f 226a 4053f 1437f 2658a 526f 5667f 945a 9658f 8134f 708f 929f 5902f 6931f 4318f 809a 736f 018f 32492m 8077m 37579m 47401 68637n 57963m 57962m 57962m 57962m 56552m	signal betaeff cbb cbd cbd ccd cdc cdb cdd cdg cds cgb cgd cgc cgs cjd cjs csb csd csg css csb csd cijs csb csd csg css csp csc csg css csc csc	OP("IO.MO" "??") 37.9693m 3.74405f 11.9352a -2.13637f -1.61962f -4.28416a 3.85793f -3.8684f 14.7553a -1.76685f -3.78326f 17.6502f -12.1001f 4.64854f 10.0626f -1.97292f -86.6068a -11.6455f 13.705f 149.662u 3.57699m 882.509u 8.94249 -3.43465f 400u 400u -400u 239.671u 22 0 1.49794K 0
signal betaeff cbb cbd cbd cbd cdb cdb cdd cdg cds cgb cgd cgs cjd cjs csb csd csp cscb csd cscb cscb	0P ("II" 379, 379, 379, 379, 379, 379, 379, 379,	0. M6" "??") 944m 4108f 226a 4053f 1437f 2658a 526f 5667f 945a 9658f 8134f 708f 929f 5902f 6931f 4318f 809a 736f 018f 32492m 8077m 37579m 47401 66637n 57962m 57962m 57962m 566352m	signal betaeff cbb cbd cbg cbs cdd cdd cdd cdg cgs cgs cjd cjs csb csb csd csg gms gmb gmb gmb gmoverid ibulk id ids is pwr reversed ron reversed ron type vbs vds	OP("IO.MO" "??") 37.9693m 3.74405f 11.9352a -2.13637f -1.61962f -4.28416a 3.85793f -3.8684f 14.7553a -1.76685f -3.78326f 17.6502f -12.1001f 4.64854f 10.0626f -1.97292f -86.6068a -11.6455f 13.705f 149.662u 3.57699m 882.509u 8.94249 -3.43465f 400u 400u -400u 239.671u 2 0 1.49794K 0 0 599.178m 117.835m

Figure 34: The DC operating points of all transistors

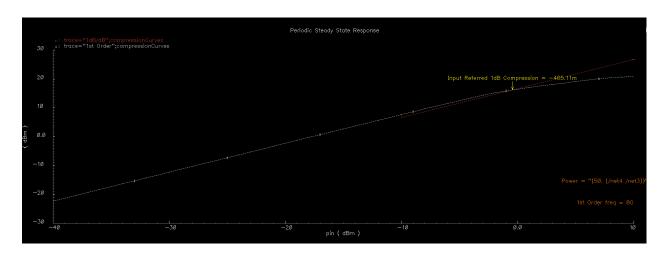


Figure 35: The 1dB compression point

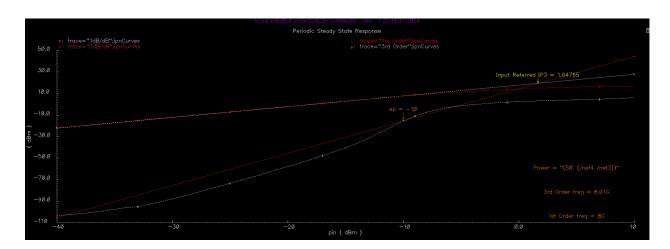


Figure 36: The IIP3 plot

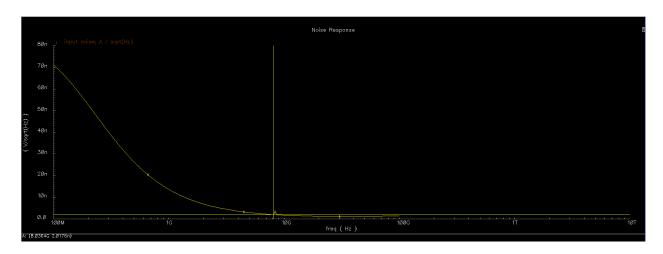


Figure 37: The input-referred noise

$3.2.3 \quad 120^{\circ}$

The analysis results are shown in the following figures and in table 9.

10.839
22.223
0.877
0.425
4.604
2.196

Table 9: The circuit properties at 120°

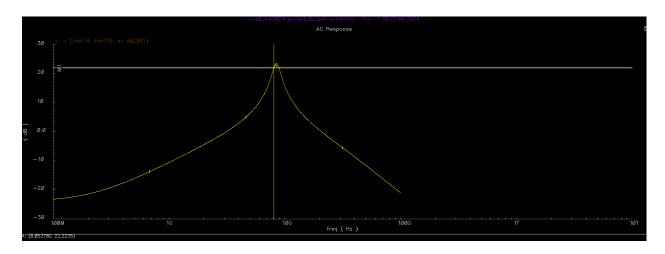


Figure 38: The gain plot

Figure 39: The bandwidth, using a horizontal marker

chain	signal	OP("IO.M3" "??")	_	
cabb 13 546 cbb 13 546 cbb 13 546 cbb 12 546 cbb 12 546 cbb 14 1 2005 cbb 17 54762 cbb 1	betreff	100 024**		
child 71, 2006a che 71, 2006a che 72, 2006a che 73, 2006a che 74, 2006a che 75, 2772b che 77, 2006 che 75, 2772b che 75, 2006 che 75, 2006 che 75, 2772b che 75, 2006 ch				
chag				
Description Company Description Desc	cbq			-0 66999f
ceb	cbs	-3.94903f		
10 10 10 10 10 10 10 10	cdb			
cds 42,1859a cds 42,1859a cdp -8,41856ff cpb -0,41856f cdp -17,4851f cpd -10,4721f cdp -18,4721f cpd -10,4721f cdp -9,5847f cpg -0,5847f cdp -18,3316f cpd 11,8016f cdp -18,3316f cpd 18,0316f cdp -18,0316f cpd 18,0316f cdp -18,0077f cpd -88,8077f csq -58,5077f cpd -88,8077f csq -58,5077f cpd -88,8077f csq -6,4015f cpd -78,807f csq -6,4015f cpd -78,807f csq -6,4015f cpd -78,807f csq -6,4015f cpd -78,907f csq -6,4015f cpd -78,907f csq -7,0435f cpd -78,907f csq -7,0435f cpd -78,907f	cdd			
cyb -9. 41826f cyb -8. 41826f cyd -18. 4721f cyd -19. 4721f cyd -1			cdg	
1-0. 1-21 1-22				
999 97.48516 egg 97.48516 egg -60.59476 egg -60.59476 114.39846 egg -60.59476 eab -5.114246 egg -50.59476 eab -5.114246 egg -50.59476 eab -5.114246 egg -50.59476 eab -6.59476 egg -60.59476 eab -5.114246 egg -50.59476 ead -879.621a ead -879.621a eag -68.60776 eag -68.607776 eag -68.60776 eag -68.607776 eag -68.60776 eag -68.60777 eag -69.6077777 eag -69.60777777 eag -69.607777777 eag -69.6077777777777777777777777777777777777				
egs				
gid 18.0316f cgld 18.0316f cgl				
23 24 3894f	cjd			
cab -5.11424f cod -570 521a	cjs	24.3894f		
ord 8-79 621a -50 5015	csb			
cas 64,5015f gds 977,515tu gds 977,515tu gm 16,152tm gm 17,152tm g	csd			
gds 677, 515u gds 677, 515u gm 16 15c1u gm 17 15c2u gm 16 15c1u gm 17 15c2u gm 17 15c2u gm 17 15c2u gm 18 15c2u gm			csg	
gm				
gmbb 2.043m gmbs 2.043m gmbs 2.043m gmbs 2.043m gmbs 2.043m gmbs 4.0495 gmoverid 7.08495 gmoverid 7.08495 moverid 7.08495 ibulk 7.3,4329 ibul				
gaoverid 7.0495 gaoverid 7.0495 jane jane jane jane jane jane jane jane				
ibulk	qmoverid			
ad 2.8119m	ibulk			
ids 2,28119m ids 2,28119m ids 2,28119m is -2.28119m pur 1,73975m pur 1,	id	2.28119m		
is -2.28119m prr 1.73975m prr 1	ids			
reversed 0 reversed 160	is			
reversed 0 reversed 0 reversed 0 reversed 0 ron 334, 321 ron 334, 321 ron 34,	pwr		pwr	1.73975m
ron 334 321				
type 0 type 0 vbs -1.02407 vbs -1.02407 vds 762.65m vds 175.566m vds 175.566m vds 175.568m vgs 775.931m vgs 775.931m vth 581.81m vgs 775.931m signal OP(*10.M6************************************				
wbs -1.02407 wbs -1.02407 vds 762.55m vds 762.25m vdsat 175.568m vds 762.25m vds 775.931m vgs 775.931m vth 581.81m vth 581.81m signal OP(**DM6**********************************				
vds 762, 65m vds 752, 65m vds 175, 56m vds 175, 591m vds 175, 931m vdh 581, 81m signal OP (*10, M6* "??") signal OP (*10, M0* "??") betaeff 224, 421m betaeff 22, 4236m bcb 37, 4259f cbb 3, 74599f bd 13, 7389a cbd 10, 5741a bcb -21, 2313f cbg -2, 12786f bcb -16, 2319f cbb -1, 62869f cbb -16, 2319f cbb -1, 62869f cbb -18, 2319f cbb -1, 62869f cbd -18, 3314f cdd -3, 382a cdd 38, 5314f cdd -3, 88217f cdd 38, 5314f cdd -3, 88217f cdd -3, 3856 cd -1, 10758f cdd -3, 3816 cd -1, 10758f cdd -3, 78197f cgd -2, 1358f </td <td></td> <td></td> <td></td> <td></td>				
vdsat 175, 568m vdsat 175, 568m vgs 775, 931m vgs 775, 931m vth 581,81m vth 581,81m signal OP (*10,N6* "??*) signal OP (*10,N6* "??*) betaeff 224,425m betaeff 22,423m bbb 37,4258f cbb 3,74398f cbd 13,3393 cbd 10,5741a cbd -2,3316 cbg -2,12786f cbd -1,62869f cbg -2,12786f cbd -1,4531a cbg -2,12786f cbd -1,4531f cbg -2,12786f cbd -1,4531a cbg -2,12786f cbd -1,5314f cbg -3,8231f cbd -1,5314f cbg -3,8231f cbd -3,3346a cbg -3,8231f cbd -3,3346a cbg -1,7405f cpg -1,7405f cpg -1,7075f cpg -1,405f cpg	vds			
vgs 775, 931m vgs 775, 931m vth 581, 81m vth 581, 81m signal OP (*10.M6" *??") signal OP (*10.M6" *??") betaeff 224, 425m 224, 425m cbb 37, 4598f cbb 37,4598f cbb 37,4598f cbb 37,4598f cbd 10,5784a cbb 37,4598f cbb -1,6289f cbf -2,1786af cbb -1,6289f cbf -1,5289f cbb -1,6289f cbf -1,5289f cbb -1,4831a cbf -1,5289f cbd -1,4839f cbf -1,5289f cbd -1,4859f cbf -1,5289f cbd -3,3745f cbf cbf -3,7821f cbd -3,3346a cbf -1,70788f cpg -17,485f cpg -1,70788f cpg -1,21,195f cpg -1,70788f cpg -1,21,195f cpg	vdsat			
wth 581.81m vfh 581.81m signal OP(*T0.M6* "??") signal OP(*T0.M0* "??") betaeff 224.421m betaeff 22.4256m bbb 37.4859f cbb 3.74598f cbd 119.7389a cbd 10.5741a cby -21.3313f cbg -2.12786f cbs -16.2869f cbs -1.62869f cdb -34.5331a cdb -5.31382a cdd 38.514f cdd 3.86217f cdg -38.5702f cdg -3.87201f cds 53.3346a cds 15.1577a cpd -17.4056f cgb -1.70758f cpd -17.4056f cgb -1.70758f cpg 176.418f cgg 176.284f cpg -12.139f cgg -12.1388f cjd 42.1710f cjd 4.80636f cjd 68.885f cjd -8.94 -9.0308f css 13.7371f	v gs			
betaeff cbb 37.4258f cbb 37.4258f cbb 37.4258f cbd 137.389a cbd 137.389a cbd 15.53146 cbb -16.2319f cbb -17.40516 cdd -38.5702f cdd -48.5702f	vth	581.81m		
betaeff cbb	signal	OP("IO.M6" "??")	sional	OP("IO.MO" "??")
cbd 137,389a cbd 10,5741a cbs -16,2319f cbg -2,12786f cbs -1,62869f cbb -1,62869f cbd -14,5331a cdb -5,31382a cdd 38,5702f cdd -3,87201f cds 53,3346a cds 15,1577a cgb -17,4056f cgb -1,70788f cgd -3,8197f cgd -3,7885 cgg 176,418f cgg -1,70788f cgg 176,418f cgg -17,6284f cgg -12,1358f cgs -12,1358f cjd 42,1719f cgs -12,1358f cjd 4,80636f cjs -12,1358f cjd 4,80636f cjs -2,03308f csb -2,03308f csb -2,03308f csd -37,7428a csb -2,03308f csg 11,6285f csg -11,6285f css 13,7494f css 13,7494f gds 1,17693m gds 146,29u gmbs 8,11994m gmbs 7,49315 cbid 4,56239m id 400u cis -4,56237m id 400u	betaeff			
cbg -21. 3313f cbg -2. 12786f cbb -16. 2319f cbs -1. 62869f cdd 38. 5314f cdd 3. 85217f cdg -38. 5702f cdg -3. 87201f cds 53. 3346a cds 15. 1577a cgb -17. 4056f cgb -1. 7078f cgg -37. 8197f cgd -3. 785f cgg 176. 418f cgg 17. 6284f cgg -121. 193f cgs -12. 1358f cjd 42. 1718f cjd 4. 80636f cjs 68. 8885f cjs 10. 891f csb -20. 0057f csb -2. 03308f csb -20. 0057f csb -2. 03308f csc 137. 371f csb -9. 03428 css 137. 371f css 13. 7494f gds 1. 17683m gds 146. 29u gmbs 9. 1809 398 2. 9926m gmbs 1. 19374 gmoverid <td>cbb</td> <td></td> <td></td> <td></td>	cbb			
obs -16.2319f obb -14.5231a odd -38.5702f cdg -38.5702f cdg -38.7021f cds 53.3346a cgb -17.4056f cgd -37.8197f cgg 176.418f cgg -17.6224f cgg -12.1358f cjd 42.1718f cjd 43.80536f cjd 48.80536f cjd 48.80536f cjd 48.80536f cjd 48.90536f cjd 48.90546 csg -11.6285f csg -11.6285f csg 19.16285f csg 19.16285f <t< td=""><td></td><td></td><td></td><td></td></t<>				
odd -14,5331a cdb -5,31382a odd 38,5314f cdd 3,85217f odg -38,5702f cdg -3,87201f ods 15,1577a cgb -1,70758f ogd -37,8197f cgd -3,785f ogg 176,6418f cgg 17,6284f cgs -12,1398f cgs -12,1358f cgs -12,1358f cgs -12,1358f cjd 4,8636f cjs 10,991f csb -20,0057f csb -2,03308f csd -84,179a csd -87,7428a csg -116,516f csg -11,6285f css 13,7391f css 13,7494f gds 1,17683m gds 146,29u gmbs 8,11994m gmbs 75,8335u gmoverid 7,19374 gmoverid 7,49815 bibulk -2,65439n id 400u ide 4,56237m id 400u				
odd 38 5314f cdd 3.85217f odg -38 5702f cdg -3.87201f cgb -17.4056f cgb -1.70788f cgd -37.8197f cgd -3.785f cgg 176.418f cgg 17.6284f cgs -121.193f cgs -12.1598f cjd 42.1718f cjd 4.80636f cjs 10.891f csb -2.03308f csb -20.0057f csb -2.03308f csd -849.179a csd -87.7428a csg -116.516f csg -11.6285f css 137.371f css 13.7494f gds 1.17683m gds 146.29u gmbs 8.11994m gmbs 758.335u gmoverid 7.19374 gmoverid 7.49815 ibulk -2.65439n id 400u id 4.56237m is -400u pyr 4.56237m is -400u reversed 0 0 0 vbs 0<				
cdg -38,5702F cdg -3,87201F cds 53,3346a cds 15,1577a cpb -17,4056f cpb -1,70758F cpd -37,8197f cpd -3,785f cpg 176,6418f cpg 17,6224F cps -121,193f cps -12,1358f cpd 42,1718f cps -12,1358f cpid 42,1718f cps -12,0308f cps -20,0057f cps 10,891f cps -20,0308f -20,0308f cpd -849,179a cpd -20,03308f cps -116,516f cpg -11,6225f cps -13,7371f cpg -20,03308f cps -11,6285f cpg -11,6225f cps -13,744f cpg 14,294 gds 14,294 cpg 29,9926m gmbs 8,11994m gmbs 78,335u gmoverid 7,19374 cps 7,49815 ibulk -2,55439n id 400u ids 4,56237m id 400u ipp 2 -400u ceversed 0 -400u cepton 224,46				
cds 53, 3346a cds 15, 1577a cgb -17, 4056f cgb -1, 70758f cgd -37, 8197f cgd -3, 785f cgs -12, 1358f cgs -12, 1358f cjd 42, 1718f cjd 4, 80636f cjs 68, 8855f cjs 10, 891f csb -20, 0057f csb -2, 03308f csd -849, 179a csd -87, 7428a csg -116, 516f csg -11, 6285f css 137, 371f css 13, 7494f gds 1, 17683m gds 146, 29u gm 2, 99926m gmbs 8, 11994m gmbs 75, 8, 335u gmoverid 7, 19374 gmoverid 7, 49815 ibulk -2, 65439n ibulk -6, 56707p id 4, 56237m id 400u ids 4, 56237m id 400u pwr 4, 56237m id 400u pwr 4, 67219m pwr 233, 704u reversed 0 ron 1, 46055K type 0 vbs 0 vds 584, 259m vds 584, 259m <td></td> <td></td> <td></td> <td></td>				
cgb -17 4056f cgd -37 8197f cgg 176 418f cgs -121 193f cjd 42 1718f cjd 48 885f cjs 10 891f csb -20 .0057f csd -84 179a csg -116 516f css 13 737f css 13 7494f gds 146 29u gm 2 99926m gmbs 8 11994m gmoverid 7 .19374 gmoverid 7 .49815 ibulk -2.65439n id 4.56237m ids 4.00u ids 4.56237m id 400u is -4.56237m id 4.00u is -4.56237m id 4.00u is -4.00u pwr 233.704u reversed 0 cron 224.46 type 0 vbs 0 vds 584.259m vds 584.259m	cds			
cgd -37.8197f cgd -3.785f cgg 176.418f cgg 17.6284f cgs -12.193f cgs -12.1358f cjd 42.1718f cjd 4.80636f cjs 68.8885f cjs 10.891f csb -20.0057f csb -2.03308f cscd -849.179a csd -87.7428a csg -11.6285f csg -11.6285f css 13.7494f gds 146.29u gm 32.8205m gm 2.99926m gmbs 75.835U gmbs 758.335U gmoverid 7.19374 gmoverid 7.48815 ibulk -2.65439n ibulk -6.56707p id 4.56237m ids 400u ids 4.56237m ids 400u ins -4.56237m ids 400u ins -4.56237m pwr 233.704u reversed 0 0 0 reversed 0 0 0 reversed 0 0 0 vbs 0 0 0 vbs 0 0 0 reversed 0 0 </td <td>cgb</td> <td></td> <td></td> <td></td>	cgb			
cgg 176.418f cgg 17.6284f cgs -121.193f cgs -12.1358f cjd 42.1718f cjd 4.80636f cjs 68.8885f cjs 10.891f csb -20.0057f csb -2.03308f csd -849.179a csd -87.7428a csg -11.6285f css 137.371f css 137.371f css 13.7494f gds 1.16285m gs 2.9926m gmbs 8.11994m gmbs 75.8355u gmoverid 7.19374 gmoverid 7.49815 ibulk -2.65439n ibulk -6.56707p id 4.56237m id 400u is -4.00c 4.67219m pwr 233.704u reversed 0 ron 1.46065k type 0 vbs 0 vbs 0 vbs 0 vds 584.259m vds 584.259m	cgd			
cjd 42.1718f cjd 4.80636f cjs 10.891f csb -2.03308f csd -849.179a csd -87.7428a csg -116.516f csg -11.6285f css 137.371f css 13.7494f gds 1.17683m gds 146.29u gm 2.8205m gm 2.99926m gmbs 8.11994m gmoverid 7.83515 gmoverid 7.19374 gmoverid 7.49815 ibulk -2.65439n ibulk -6.56707p id 4.56238m id 400u ids 4.00u 400u is -4.0237m is -400u pwr 4.56237m is -400u pwr 4.56237m is -400u pwr 233.704u region 2 reversed 0 0 0 ron 1.46065K 10 type 0 0 0 vds 584.259m vds 584.259m <td>cgg</td> <td></td> <td>cgg</td> <td></td>	cgg		cgg	
cjs 68.8885f cjs 10.891f csb -20.0057f csb -2.0308f csd -849.179a csd -87.7428a csg -11.6285f csg -11.6285f css 13.7494f gds 146.29u gm 32.8205m gm 2.99926m gmbs 8.11994m gmbs 758.335u gnoverid 7.19374 gmoverid 7.49815 ibulk -2.65439n ibulk -6.56707p id 4.56237m id 400u is -4.56237m is -400u pwr 4.56237m is -400u pwr 4.67219m pwr 233.704u reversed 0 0 reversed 0 0 vbs 0 0	cgs			
csb -20.0057f csb -2.0308f csd -849.179a csd -87.7428a csg -116.516f csg -11.6285f css 137.371f css 13.7494f gds 146.29u gds 146.29u gm 32.8205m gm 2.99926m gmbs 758.335u gmoverid 7.49815 ibulk -2.65439n ibulk -6.56707p id 4.00u 4.56237m id 400u ids 4.56237m id 400u is -4.56237m is -400u is -4.56237m is -400u reversed 0 reversed 0 reversed 0 reversed 0 ron 1.46065K type 0 vbs 0 vds 584.259m vds 584.259m vds 584.259m vds 584.259m	cjd			
csd -849.179a csd -87.7428a csg -116.516f csg -11.6285f css 13.7371f css 13.7494f gds 146.29u gm 2.99926m gmbs 8.11994m gmbs 758.335u gmoverid 7.19374 gmoverid 7.49815 ibulk -2.65439n ibulk -6.56707p id 4.56238m id 400u ids 4.00u 4.66237m is -400u is -4.00u -4.66237m is -400u pwr 4.67219m pwr 233.704u region 2 reversed 0 ron 1.46065K type 0 vbs 0 vbs 0 vds 584.259m vds 584.259m vds 584.259m				
csg -116.516f csg -11.6285f css 137.7371f css 13.7494f gds 1.17683m gds 146.29u gm 32.8205m gm 2.99926m gmbs 758.335u 39u gmoverid 7.19374 gmoverid 7.49815 ibulk -2.65439n ibulk -6.56707p id 4.56237m id 400u is -4.56237m is -400u is -4.56237m is -400u pwr 4.67219m pwr 233.704u region 2 2 reversed 0 0 ron 224.46 ron 1.46065K type 0 vbs 0 vbs 0 vbs 0 vds 584.259m vds 584.259m vds 584.259m vds 584.259m				
137.371f				
gds 1.17683m gds 146.29u gm 32.8205m gm 2.99926m gmbs 8.11994m gmbs 758.335u gmoverid 7.19374 gmoverid 7.49815 ibulk -2.65439n ibulk -6.56707p id 4.56237m id 400u is -4.000u -4.56237m is -400u pwr 4.67219m pwr 233.704u region 2 reversed 0 reversed 0 ron 1.46065K type 0 vbs 0 vbs 0 vds 584.259m vds 584.259m vds 584.259m				
gm 32.8205m gmb 32.8205m gm 2.99926m gmbs gmbs 758.335u gm	qds			
gmbs 8.11994m gmbs 758.335u gmoverid 7.19374 gmoverid 7.49815 ibulk -2.65439n ibulk -6.56707p id 400u ids 400u is -4.56237m is -400u is -4.56237m is -400u pwr 4.67219m pwr 233.704u reversed 0 2 reversed 0 reversed 0 ron 1.46065K type 0 vbs 0 vbs 0 vbs 0 vds 1.02407 vds 584.259m vds 584.259m vds 160.488m vgs 584.259m vds 200.0000	gm.		gm	2.99926m
Section Sect	gmbs	8.11994m		
id 4.56238m id 400u description ids 4.56237m ids 400u description ids 4.56237m ids 400u description is -4.56237m is -4.00u description 2 descr	gmoverid			
ids 400u is -4.56237m is -400u per 4.67219m pwr 233.704u region 2 reversed 0 reversed 0 ron 224.46 ron 1.46065K type 0 vbs 0 vbs 0 vbs 0 vds 1.02407 vds 584.259m vgs 584.259m	ibulk			-6.56707p
is -400u per 4.56237m per 233.704u region 2 reversed 0 ron 224.46 ron 224.46 ron 1.4605K type 0 vbs 0 vbs 0 vds 1.02407 vds 584.259m vdsat 162.72m vgs 584.259m vgs 584.259m	id			
pwr 233.704u region 2 reversed 0 ron 224.46 type 0 vbs 0 vds 0 vds 584.259m vgs 584.259m vgs 584.259m				
region 2 reversed 0 reversed 0 ron 1.46065K type 0 vbs 0 vds 0 vds 584.259m vdsat 160.488m vgs 584.259m				
reversed 0 reversed 0 ron 224.46 ron 1.46065K type 0 vbs 0 vds 1.02407 vds 584.259m vdsat 162.72m vgs 584.259m vgs 584.259m				
ron 224.46 ron 1.46065K type 0 vbs 0 vbs 0 vds 1.02407 vds 584.259m vdsat 162.72m vdsat 160.488m vgs 584.259m				0
type 0 vbs 0 vds 1.02407 vds 584.259m vdsat 160.488m vgs 584.259m vgs 584.259m	ron		ron	
vbs 0 vds 1.02407 vds 584.259m vdsat 162.72m vdsat 160.488m vgs 584.259m vgs 584.259m	type			
vdsat 162.72m vdsat 160.488m vgs 584.259m vgs 584.259m	vbs	0		
vgs 584, 259m vgs 584, 259m	vds			
*go 504. 255m	vdsat			
vth 391, 182m	vgs			
	vth	391.182m	* CII	yo im

Figure 40: The DC operating points of all transistors

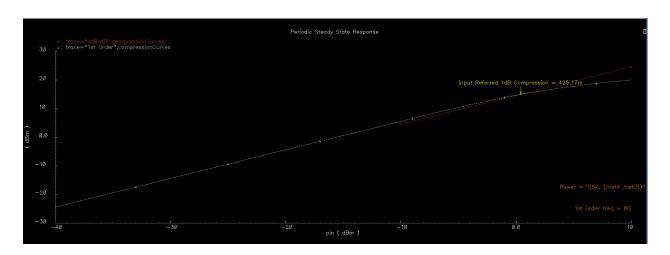


Figure 41: The 1dB compression point

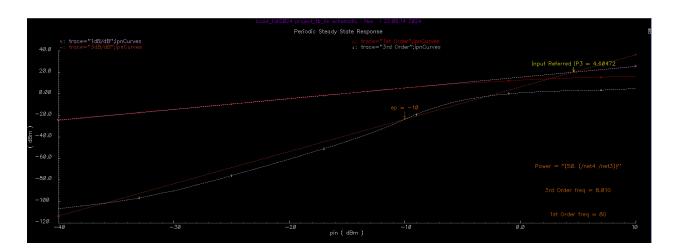


Figure 42: The IIP3 plot

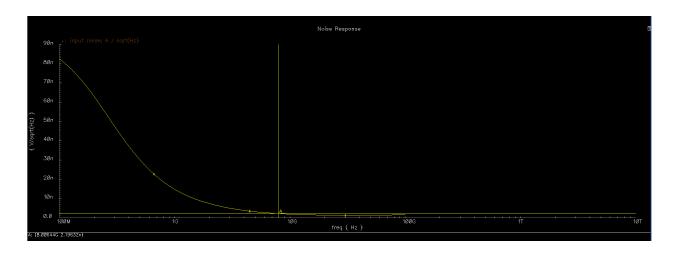


Figure 43: The input-referred noise

3.3 SS

3.3.1 -40°

The analysis results are shown in the following figures and in table 10.

Power comsumption (mW)	8.380
Gain (@ 8GHz, dB)	26.467
Bandwidth (GHz)	1.253
1dB compression point (dBm)	-7.744
3rd input intercept point (dBm)	-1.449
Input-referred noise (@ 8GHz, $\frac{nV}{\sqrt{Hz}}$)	1.992

Table 10: The circuit properties at -40°

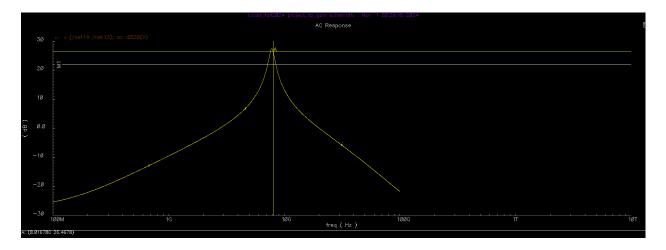


Figure 44: The gain plot

```
Curve name map:
------

Curvel - v (/net14 /net13); ac dB20(V)

Curve table:
------

Y value Curve1

M1 22 7.2057388196
8.46395820426
```

Figure 45: The bandwidth, using a horizontal marker

	signal	OP("IO.M3" "??")		
	signai	OP(10.M3 ??)	signal	OP("IO.M5" "??")
Seb	betaeff	197.696m	betaeff	
chg				
case	cbd	42.1271a		
cmb				
call				
cdg				
cols				
cop				
ord				
cog				
Corp. Corp				86.5989f
Section				
Section Sect	cjd			
cad				
csg				
Case				
gds				
10				
gmbs				
gnoverid 9,0127 gnoverid 9,0127 ibulk -743,113p ibulk -743,13p i				3.78907m
ibulk		9.0127		
ide 2 04813m ide 2	ibulk	-743.113p		
is = -2.04813a pvr 1.94287a pvr				
Porc				
Cartifold Serversed O				
reversed 0				
ron				
type 0 type -944.37m vbs -944.37m vds 948.506m vds 948.506m vds 948.506m vds 948.506m vds 112.706m vds 112.706m vds 112.706m vds 112.706m vds 112.706m vds 122.507m vds 125.563m vds 125.563m vds 125.563m vds 126.543m vds 127.707m vds 126.543m vds 127.707m vds 127.707m vds 127.543m vds 127.707m				
vbb -944. 37m vbb -944. 37m vda 948. 50Ga vda 948. 50Ga vdsat 112. 70Ga vdast 112. 70Ga vdb 955. 53m vga 955. 53m vth 822. 617a vth 822. 617a signal OP (*10. Mb* **72*) signal OP (*10. Mb* **72*) betaeff 419. 572a betaeff 41. 9548a obb 38. 98f obb 3. 99119F obd 3. 1189a obd 2. 73265a obd -2. 20532f obd 2. 73265a obs -1. 18759f obd 2. 73265a obs -1. 18759f obd -2. 20532f obs -1. 79156f odd -3. 35153a odd 3. 3733f odd -3. 34215f ods 2.271a odg -3. 47215f ods 11. 3222a odg -1. 34224f odg -1. 34224f odg -1. 4856f odg -1. 4857				
videat				-844.37m
vgs 955,63a vgs 955,63a vbth 822,617m vbth 822,617m signal OP("10.M6" "??") signal OP("10.M0" "??") betaeff 419,573m betaeff 419,548m bbb 39,898f cbb 3,99118f cbd 3,99118f cbb 2,73266a cbd 2,73266a cbd 2,73266a cbd 2,20532f cbd 2,73266a cbd -1,78503f cbd -1,78789f cbd -1,78503f cbd -1,78789f cbd -3,78153a cdb -1,78789f cbd 34,7303f cdb -3,78153a cbd 34,7303f cdd 3,47418f cbd 34,7318f cdg -1,34224f cpd -1,34224f cpd -3,48183f cpg -1,34224f cpd -3,48224f cpg 17,4557f cpg -1,26703f cpg 17,4557f cpg	vds	948.606m		
vth	vdsat			
signal 0P(*10.86***??**) betaeff 419.572m betaeff 419.572m bebb 39.898f cbb 39.898f cbb 39.898f cbc 31.1189a cbc 31.1189a cbc 31.1189a cbc 32.2029f cbc 32.20229f				
betaeff 419.572m betaeff 41.9548m betaeff chb 38.89ef chb 38.99ef chb 38.99ef chb 38.99ef chd 31.1189a cbd 2.73265a cdd 3.7415f cdd 3.7425f cdd 3.74			wth	822.617m
abb 39,898f abb 3,99118f bd 31,1189a abd 2,73265a cbp -22,0729f abg -2,20632f cbb -17,863f abg -2,20632f cdb -26,9635a abs -1,78759f cdd 34,7415f add 3,47415f cdd 3,47415f add 3,47415f cds 88,2271a add 11,2322a cdb -13,411f ads 11,2322a cdb -34,5187f add -1,34524f cgd -3,45224f add -1,4667f cgg 174,573f agg 174,667f cgg -1,26,643f agg 174,867f cgg -1,26,637f agg 174,867f cjd 4,78364f agg 10,5031f csb -26,439f agg -10,5031f csb -24,499a agg -11,7886f css 144,411f agg -11,7886f <td>signal</td> <td></td> <td>signal</td> <td>OP("IO.MO" "??")</td>	signal		signal	OP("IO.MO" "??")
cbd 31.1189a cbd 2.73265a cbg -22.0729f cbg -2.20632F cbs -17.8563f cbs -1.78759F cdd 34.7303f cdb -3.55153a cdd 34.7316f cdd 3.47415F cds 88.2271a cdg -3.46183f cgb -13.4111f cgb -1.33424f cgd -3.45187f cgd -3.45224f cgg 17.4567f cgg -1.74567f cgg 17.4567f cgg -17.6567f cgg -17.7657f cgg -17.6567f cgg -17.7657f cgg -17.6567f cgg -17.7656f cgg -17.7666f csb -26.4599f csb -2.65339f csd -24.6488a csg -11.7686f csg -17.709f csg -11.7686f css 14.4466f gs 99.2742u gmb 1.16473a gmb				
obg -22 0729f obg -2 20632f obs -17 8853f obs -1 78759f odd -3 55153a odd -3 55153a odd 3 47415f odd 3 47415f ods 88 2271a odd 11 2322a ogb -13 4111f ogd -3 45224f ogd -3 45224f ogd -3 45224f ogd -3 45224f ogd -3 45224f ogg 17 457f ogd -3 45224f ogg 17 4567f ogd -3 45224f ogg -12 6703f ogd -3 45224f ogg -12 6703f ogd -12 6703f ogd -4 47854f ogd -12 6703f ojd 46 6724f ogd -18 6736f osb -26 4899f ogb -2 65339f osd -24 599a ogd -17 7686f osg -11 7686f ogd 9 2742u ogd 9 2742u ogd 9 2742u				
cbs -17 8563f cbb -26 9635a cdb -3.55153a cdd 34 7303f cdg -3.48183f cds 88 2271a cgb -13 48181f cgc -13 4111f cgd -3.45224f cgg 174 573f cgg 174 573f cgg 174 4567f cgs -12.6703f cjd 46 6724f cjd 47.8364f cjd 48.7384f csd -24.679a csd -24.6539f csd -24.6488a csg -11.709f csd -3.44.4466f gds 99.2742u gm 36.5177a gm gmbs 11.5939m gmbs gmbs 11.4573m gm gmbs 1.14673m gm gmbrail 4.99626m id <				
cdb -26, 9635a cdb -3, 55153a cdd 34, 7303f cdd 3, 47415f cds 88, 2271a cds 11, 2322a cgb -13, 4111f cgb -1, 3424f cgd -3, 45224f cgd -3, 45224f cgg 17, 4567f cgg 17, 4567f cgs -12, 603f cgs -12, 6703f cjd 46, 6724f cgg -17, 4567f cjs 66, 4984f cjd -2, 6703f csd -24, 5489f csb -2, 55339f csd -24, 5488a csg -11, 709f csd -24, 5488a csg -11, 7686f css 14, 4466f csg -1, 5786f css 14, 4466f csg -1, 15786f css 14, 4466f csg -1, 1573a css 14, 573a csg -1, 1573a </td <td></td> <td>-17 9563f</td> <td></td> <td></td>		-17 9563f		
cdd 34.7303f cdd 3.47415f cdg -34.7916f cdg -3.48183f cds 88.2271a cds 11.2322a cpb -13.4111f cpb -1.33424f cpd -34.5187f cpd -3.45224f cpg 174.573f cpd -3.45224f cpg 174.573f cpd -12.6703f cpj -12.642f cpd -4.7636f cpj -12.6703f -12.6703f cpj -17.703f cpd -10.5031f csb -26.5539f cpd -2.55339f csd -242.799a cpd -24.6488a csg -11.709f cpd -24.6488a csg -11.7686f cpd cpd css 14.441f cpd cpd -27.420 cpk gb 99.2742u cpd 3.60001m cpk 99.2742u cpd 3.60001m cpd cpk 4.9626m cpd cpd -1.58585p id 4.09626m cpd <t< td=""><td></td><td></td><td></td><td></td></t<>				
odg -34,7916f odg -3,48183f ods 88,2271a ods 11,2322a oph -13,4111f oph -3,45224f ogd -3,45224f ogd -3,45224f ogg 174,573f ogg 17,4567f ogs -126,643f ogs -12,6703f ojd 46,6724f ojd 4,78364f ojs 10,5031f osb -26,4599f osb -26,4599f osb -2,6438a osg -117,709f osg -11,7686f oss 14,441f oss 14,4466f gds 956,886u gds 99,2742u gm 36,5177m gms 3,60001m gmbs 11,5939m gmbs 1,14673m gmbs 11,5939m gmbs 1,14673m gmoverid 8,9149 gmoverid 9,00004 ibulk -2,09626m id 4,000u ids 4,09626m id 4,000u ids 4,09626m id 4,000u ipyr 3,4876m yer 29 reversed 0 vbs 0 vbs 0 vbs 0 <	cdd			
cds 88, 2271a cgb -13, 3411f cgd -34, 5187f cgg 174, 573f cgs -12, 6703f cjd 46, 6724f cjd 47, 8364f cjd 47, 4868 cjd 47, 4868 cjd 47, 4168	cdg			
cgb -13.4111f cgb -1.3424f cgd -3.45187f cgd -3.45224f cgg 174.573f cgg 17.4567f cgs -126.643f cg -12.6703f cjd 46.6724f cjd 4.78364f cjs 66.4984f cjs 10.5031f csb -26.4599f csb -2.55339f csd -242.799a csd -26.4688a csg -117.709f csg -11.7686f css 14.441f csg -11.7686f css 14.446f gds 99.2742u gm 3.60001m gmbs 1.1673m gmbs 11.5939m gmbs 1.14673m gmoverid 8.9149 gmoverid 9.00004 ibiblk -209.643p ibilk -1.58585p id 4.09626m id 400u is -4.09626m id 400u pvr 298.167u 2 reversed 0 0 0 reversed 0 0 0 vbs 0 0 0 vbs 0 0 0 vds 745.418m vds	cds	88.2271a		
cgd -34.5187F cgd -3.4524F cgg 174.573F cgg 17.4567F cgs -126.643F cgs -12.6703F cjd 46.6724F cjd 4.78364F cjs 10.5031F csb -26.4599F csb -26.4599F csb -2.65339F csd -24.6488a csg -11.709F csg -11.709F csg -11.7686F css 14.4411F cs 14.466F gds 95.886u gds 99.2742u gm 36.5177m gm 3.60001m gmbs 11.5939m gmbs 1.14673m gmoverid 8.9149 gmoverid 9.0004 ibulk -29.643p ibulk -1.58585p id 4.09626m id 400u ids 4.09626m id 400u is -4.09626m id 400u is -4.000 ymr 3.45876m pwr 298.167u reversed 0 0 0 ron 1.86354K ybs 0 vbs 0 vbs 0 vbs 0 vds 745.418m	cgb			
126.643f	cgd			-3.45224f
cjd 46.6724f cls 66.4984f cls 10.5031f csb -26.4599f csd -242.799a csd -242.799a csd -242.799a csg -117.709f css 14.441f css 14.411f css 14.466f gds 956.886u gds 99.2742u gm 36.5177m gm 36.5177m gmbs 11.5939m gmbs 11.5939m gmbs 11.5939m gmoverid 8.9149 gmoverid 8.9149 gmoverid 8.9149 gmoverid 9.00004 ibulk -1.58585p id 4.09626m id 400u is -4.09626m id 400u is -4.09626m is -4.0962	cgg		cgg	
cjs 66.4984f csb -26.4599f csd -242.799a csd -242.799a csg -117.709f css 11.7686f css 14.4.411f css 14.466f gds 956.886u gm 36.5177m gm 3.60001m gmbs 11.5939m gmoverid 8.9149 gmoverid 8.9149 gmoverid 4.09626m id 400u is -4.09626m is -				
csb -26.4599f csb -2.65339f csd -24.6488a -24.6488a csg -117.709f csg -11.7686f css 144.411f css 14.4466f gds 956.886u gds 99.2742u gm 3.60001m gm 3.60001m gmbs 1.15939m gmbs 1.14673m gmoverid 8.9149 gmoverid 9.00004 ibulk -2.95.645p ibulk -1.58985p id 4.09626m id 400u is -4.09626m id 400u is -4.09626m is -400u pwr 3.45876m pwr 298.167u reversed 0 reversed 0 ron 206.132 ron 1.86354K type 0 vbs 0 vbs 0 vbs 0 vds 844.37m vds 745.418m vds 745.418m vds 745.418m				
csd -242.799a csd -24.6488a csg -117.709f csg -11.7686f css 144.411f css 14.4466f gds 95.886u gds 99.2742u gm 36.5177m gm 3.60001m gmbs 11.5939m gmoverid 9.00004 gmoverid 8.9149 gmoverid 9.00004 ibulk -209.643p ibulk -1.58585p id 4.09626m id 400u ids 4.09626m id 400u is -4.09626m is -400u pwr 3.45876m pwr 298.167u reversed 0 reversed 0 ron 2 reversed 0 vbs 0 vbs 0 vds 844.37m vds 745.418m vds 745.418m vds 745.418m				
Casg	csd			
css 144.411f css 14.4466f gds 956.886u gds 99.2742u gm 36.5177m gm 3.60001m gmbs 1.15939m gmbs 1.14673m gmoverid 9.00004 ibulk -209.643p ibulk -1.58585p id 4.09626m id 400u is -4.09626m id 400u is -4.09626m is -400u pwr 3.45876m pwr 298.167u reversed 0 reversed 0 ron 206.132 ron 1.86354K type 0 type 0 vbs 0 vbs 0 vds 844.37m vds 745.418m vds 745.418m vds 745.418m	csg			
gds 956.886u gds 99.2742u gm 36.5177m gm 3.60001m gmbs 11.5939m gmoverid 9.00004 ibulk -209.643p ibulk -1.58585p id 4.09626m id 400u ids 4.09626m ids 400u is -4.09626m is -400u pwr 3.45876m pwr 298.167u reversed 0 ron 1.86354K type 0 type 0 vbs 0 vbs 0 vds 844.37m vds 745.418m vds 745.418m vds 745.418m	css	144.411f		
gm 36.5177m gm 3.60001m gmbs 11.5939m gmbs 1.14673m gmoverid 8.9149 gmoverid 9.00004 ibulk -1.58585p id 4.09626m id 4000 ids 4.09626m ids 4000 ids -4.09626m ids 4000 ids -4.09626m igs -4000 pwr 3.45876m pwr 298.1670 region 2 reversed 0 ron 206.132 ron 1.86354K type 0 type 0 type 0 type 0 vbs 0 vds 844.37m vds 745.418m vds 745.418m vgs 745.418m	gds	956.886u		
gmbs 11.5939m gmbs 1.14673m gmoverid 8.9149 gmoverid 9.00004 ibulk -209.643p ibulk -1.58585p id 4.09626m id 400u ids 4.09626m id 400u ids -4.09626m ids 400u ids -4.09626m is -400u pwr 3.45876m pwr 298.167u	gan			
ibulk -209.643p ibulk -1.58585p id 4.09626m id 400u ids 4.09626m ids 400u is -4.09626m is -400u pwr 298.167u region 2 reversed 0 reversed 0 ron 206.132 ron 1.86354K type 0 type 0 vbs 0 vbs 0 vds 844.37m vds 745.418m vds 745.418m vds 745.418m vgs 745.418m vgs 745.418m	gnubs		gmbs	1.14673m
id 4.09626m id 400u ids 4.09626m ids 400u is -4.09626m is -400u pwr 3.45876m pwr 298.167u region 2 reversed 0 reversed 0 ron 206.132 ron 1.86354K type 0 type 0 vbs 0 type 0 vds 844.37m vds 745.418m vds 745.418m vgs 745.418m				
ids 4.09626m ids 400u is -4.09625m is -400u pwr 3.45876m pwr 298.167u region 2 reversed 0 ron 206.132 ron 1.86354K type 0 vbs 0 vds 44.37m vds 745.418m vds 106.461m vds 745.418m				
is -4.09626m is -400u pvr 3.45876m pwr 298.167u region 2 reversed 0 reversed 0 ron 206.132 ron 1.86354K type 0 type 0 vbs 0 vbs 0 vds 844.37m vds 745.418m vds 106.461m vds 745.418m vgs 745.418m				
pvr 3.45876m pvr 298.167u region 2 reversed 0 2 ron 206.132 ron 1.86354K type 0 type 0 vbs 0 vbs 0 vds 844.37m vds 745.418m vds 745.418m vds 106.351m vgs 745.418m vgs 745.418m				
region 2 reversed 0 ron 206.132 type 0 vbs 0 vds 0 vds 745.418m vgs 745.418m vgs 745.418m				
reversed 0 reversed				
ron 206.132 ron 1.86354K type 0 type 0 vbs 0 vbs 0 vds 844.37m vds 745.418m vgs 745.418m vgs 745.418m	reversed			
type 0 vbs 0 vds 844.37m vds 745.418m vdsat 106.461m vgs 745.418m vgs 745.418m	ron			
vbs 0 vbs 0 vds 844.37m vds 745.418m vdsat 106.461m vdsat 106.351m vgs 745.418m vgs 745.418m	type			
vds 844.37m vds 745.418m vdsat 106.461m vdsat 106.351m vgs 745.418m vgs 745.418m	vbs			0
vgs 745.418m vgs 745.418m				
11 (40.40)				
vth 610.476m				
			Vth	01U.4/6M

Figure 46: The DC operating points of all transistors

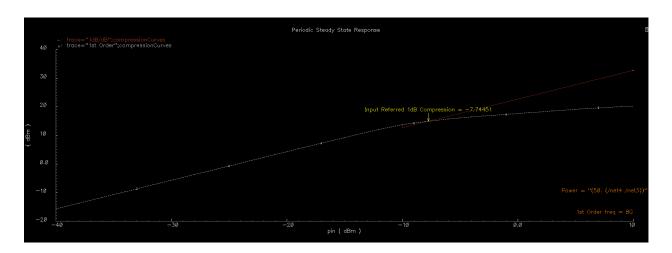


Figure 47: The 1dB compression point

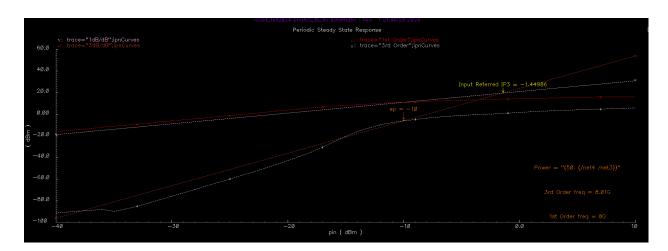


Figure 48: The IIP3 plot

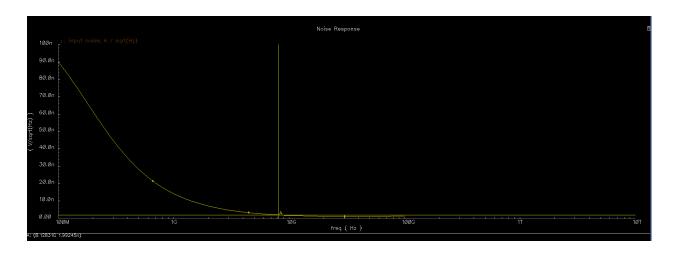


Figure 49: The input-referred noise

$3.3.2 27^{\circ}$

The analysis results are shown in the following figures and in table 11.

8.1
25.154
0.966
-6.582
-0.507
2.1

Table 11: The circuit properties at 27°

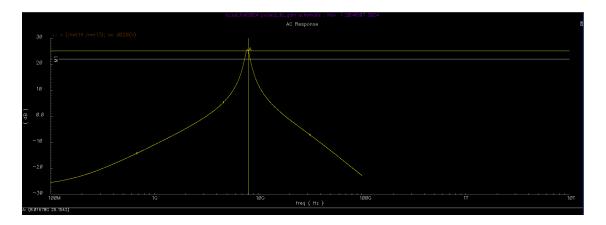


Figure 50: The gain plot

```
Curve name map:
------
Curve1 - v (/net14 /net13); ac dB20(V)

Curve table:
------
Y value Curve1

M1 22 7.39779910146
8.36375637386
```

Figure 51: The bandwidth, using a horizontal marker

signal	OP("IO.M3" "??")			
_		signal betaeff	OP("IO.M5" "??")	
betaeff	124.059m	cbb	124.059m 14.7976f	
cbb	14.7976f	cbd	41.5613a	
cbd cbq	41.5613a -10.0796f	cbg	-10.0796f	
cbs	-4.75961f	cbs	-4.75961f	
cdb	-7.53739a	cdb	-7.53739a 17.36416	
cdd	17.3641f	cdd cdq	17.3641f -17.3895f	
cdg	-17. 3895f	cds	32.9475a	
cds cgb	32.9475a -6.10544f	cgb	-6.10544f	
cgd	-16. 9367f	cgd	-16. 9367f	
cgg	86.3856f	cgg	86.3856f -63.3434f	
cgs	-63. 3434f	cgs cjd	-63.3434f 19.8356f	
cjd	19.8356f	cjs	27.5767f	
cjs csb	27.5767f -8.68466f	csb	-8.68466f	
csd	-468.969a	csd	-468.969a	
csg	-58.9165f	csg	-58.9165f 68.0701f	
css	68.0701f	css qds	558. 068u	
gds	558.068u 15.6063m	gm	15.6063m	
gm qmbs	3.28377m	gmbs	3.28377m	
gmoverid	7.61092	gmoverid	7. 61092	
ibulk	-346.864p	ibulk	-346. 864p	
id	2.05051m	id ids	2.05051m 2.05051m	
ids is	2.05051m -2.05051m	is	-2.05051m	
pwr	1.93353m	pwr	1.93353m	
region	2	region	2	
reversed	0	reversed	0	
ron	459.861 0	ron type	459.861 0	
type vbs	-848.051m	vbs	-848.051m	
vds	942. 949m	vds	942.949m	
vdsat	148.54m	vdsat	148.54m	
vgs	951.949m	vgs	951. 949m 784. 505m	
vth	784.505m	vth		
signal	OP("IO.M6" "??")	signal betaeff	OP ("IO. MO" "??")	
Signai			26.3624m	
betaeff	263.641m			
betaeff cbb	263.641m 39.9134f	cbb cbd	3.99294f	
betaeff cbb cbd	263.641m 39.9134f 28.8332a	cbb cbd cbg	3.99294f 2.2936a -2.20006f	
betaeff cbb cbd cbg	263.641m 39.9134f 28.8332a -22.0124f	cbb cbd cbg cbs	3.99294f 2.2936a -2.20006f -1.79518f	
betaeff cbb cbd	263.641m 39.9134f 28.8332a -22.0124f -17.9298f	cbb cbd cbg cbs cdb	3.99294f 2.2936a -2.20006f -1.79518f -3.98256a	
betaeff cbb cbd cbg cbs cdb	263.641m 39.9134f 28.832a -22.0124f -17.9298f -28.8943a 34.7377f	obb obd obg obs odb odd	3.99294f 2.2936a -2.20006f -1.79518f -3.98256a 3.47551f	
betaeff cbb cbd cbg cbs cdb cdb cdd cdd	263.641m 39.9134f 28.8332a -22.0124f -17.9298f -28.8943a 34.7377f -34.7965f	cbb cbd cbg cbs cdb	3.99294f 2.2936a -2.20006f -1.79518f -3.98256a	
betaeff cbb cbd cbg cbs cdb cdd cdd cdd	263.641m 39.9134f 28.8332a -22.0124f -17.9298f -28.8943a 34.7377f -34.7965f 87.6078a	cbb cbd cbg cbs cdb cdd cdg cds	3.99294f 2.2936a -2.20006f -1.79518f -3.98256a 3.47551f -3.48302f 11.4904a -1.3013f	
betzeff cbb cbd cbg cbs cdb cdd cdd cdg cdg	263.641m 39.9134f 28.8332a -22.0124f -17.9298f -28.8943a 34.7377f -34.7965f 87.6078a -13.0911f	cbb cbd cbg cbs cdb cdd cdg cds cgb	3.99294f 2.2936a -2.20006f -1.79518f -3.98256a 3.47551f -3.48302f 11.4904a -1.3013f -3.45283f	
betaeff cbb cbd cbg cbs cdb cdd cdg cdg cdg cdg	263.641m 39.9134f 28.8332a -22.0124f -17.9298f -28.8943a 34.7377f -34.7965f 87.6078a -13.0911f -34.5226f 174.149f	cbb cbd cbg cbs cdb cdd cdg cds cgb cgd	3.99294f 2.2936a -2.20006f -1.79518f -3.98256a 3.47551f -3.48302f 11.4904a -1.3013f -3.45283f 17.4146f	
betaeff cbb cbd cbg cbs cdb cdd cdg cds cgs cgs	263.641m 39.9134f 28.8332a -22.0124f -17.9298f -28.8943a 34.7377f -34.7965f 87.6078a -13.0911f -34.5226f 174.149f -126.535f	cbb cbd cbg cbs cdb cdd cdg cds cgb	3.99294f 2.2936a -2.20006f -1.79518f -3.98256a 3.47551f -3.48302f 11.4904a -1.3013f -3.45283f	
betaeff cbb cbd cbg cbs cdb cdd cdg cds cgg cgs	263.641m 39.9134f 28.8332a -22.0124f -17.9298f -28.8943a 34.7377f -34.7955f 87.6078a -13.0911f -34.5226f 174.149f -126.535f 47.8885f	cbb cbd cbg cbs cdb cdd cdg cds cgg cgg cgs cjd	3.99294f 2.2936a -2.20006f -1.79518f -3.98256a 3.47551f -3.48302f 11.4904a -1.3013f -3.45283f 17.4146f -12.6605f 4.93308f 11.1164f	
betaeff cbb cbd cbg cbs cdb cdd cdg cds cgg cgs cgd cgg	263.641m 39.9134f 28.8332a -22.0124f -17.9298f -28.8943a 34.7377f -34.7965f 87.6078a -13.0911f -34.5226f 174.149f -126.535f 47.8885f 70.3437f	cbb cbd cbd cbs cdb cdd cdg cds cgb cgd cgg cgs cjd cjs	3.99294f 2.2936a -2.20006f -1.79518f -3.98256a 3.47551f -3.48302f 11.4904a -1.3013f -3.45283f 17.4146f -12.6605f 4.93308f 11.1164f -2.68766f	
betaeff cbb cbd cbg cbs cdb cdd cdg cds cgg cgs	263 .641m 39 .9134f 28 .8332a -22 .0124f -17 .9298f -28 .8943a 34 .7377f -34 .7955f 87 .6078a -13 .0911f -34 .5226f 174 .149f -126 .535f 47 .8885f 70 .3437f -26 .7934f -244 .017a	cbb cbd cbd cbg cbs cdb cdd cdg cds cgg cgg cgg cgg cgg cjd cjs cob cod	3.99294f 2.2936a -2.20006f -1.79518f -3.98256a 3.47551f -3.48302f 11.4904a -1.3013f -3.45283f 17.4146f -12.6605f 4.93308f 11.1164f -2.68766f -24.978a	
betaeff cbb cbd cbg cbs cdb cdd cdg cds cgs cgs cgs cgs cjs cjs csb csb	263.641m 39.9134f 28.8332a -22.0124f -17.9298f -28.8943a 34.7377f -34.7965f 87.6078a -13.0911f -34.5226f 174.149f -126.535f 47.8885f 70.3437f -26.7934f -244.017a -117.34f	cbb cbd cbd cbs cdb cdd cdg cds cgb cgd cgg cgs cjd cjs	3.99294f 2.2936a -2.20006f -1.79518f -3.98256a 3.47551f -3.48302f 11.4904a -1.3013f -3.45283f 17.4146f -12.6605f 4.93308f 11.1164f -2.68766f	
betaeff cbb cbd cbg cbs cdb cdd cdg cds cgs cgb cgd cgg cgs cjd cjs csb csd csg	263.641m 39.9134f 28.8332a -22.0124f -17.9298f -28.8943a 34.7377f -34.7965f 87.6078a -13.0911f -34.5226f 174.149f -126.535f 47.8885f 70.3437f -26.7934f -244.017a -117.34f 144.377f	cbb cbd cbd cbg cbs cdb cdd cdg cds cgg cgs cgd cjs cjd cjs csd csg csd csg	3.99294f 2.2936a -2.20006f -1.79518f -3.98256a 3.47551f -3.48302f 11.4904a -1.3013f -3.45283f 17.4146f -12.6605f 4.93308f 11.1164f -2.88766f -24.978a -11.7316f 14.4442f 93.9219u	
hetaeff cbh cbd cbg cbs cdb cdd cdg cds cgb cgd cgg cgs cgs cjb cjid cjid cjid csd csd csd csd csd	263.641m 39.9134f 28.8332a -22.0124f -17.9298f -28.8943a 34.7377f -34.7955f 87.6078a -13.0911f -34.5226f 174.149f -126.535f 47.8885f 70.3437f -26.7934f -244.017a -117.34f 144.377f 881.033u	obb obd obd obg obs odb odd odg ods ogp ogg ogg ogg ogs ojd ogg osb osd osg osd ogg	3.99294f 2.2936a -2.20006f -1.79518f -3.98256a 3.47551f -3.48302f 11.4904a -1.3013f -3.45283f 17.4146f -12.6605f 4.93308f 11.1164f -2.88766f -24.978a -11.7316f 14.4442f 93.9219u 3.06245m	
betaeff cbb cbd cbg cbs cdb cdd cdg cds cgs cgs cjd cjs csb csd csd csg css	263.641m 39.9134f 28.8332a -22.0124f -17.9298f -28.8943a 34.7377f -34.7965f 87.6078a -13.0911f -34.5226f 174.149f -126.535f 47.8885f 70.3437f -26.7934f -244.017a -117.34f 144.377f	cbb cbd cbd cbg cbs cdb cdd cdg cds cgp cgs cjd cjs csb csd csg csd csg gds gm gmbs	3.99294f 2.2936a -2.20006f -1.79518f -3.98256a 3.47551f -3.48302f 11.4904a -1.3013f -3.45283f 17.4146f -12.6605f 4.93308f 11.1164f -2.68766f -24.978a -11.7316f 14.4442f 93.9219u 3.06245m 987.33u	
betaeff cbb cbb cbg cbs cdb cdd cdg cds cgb cgg cgs cgs cjid cjid cjs csb csd csg gg gg gs gs gs gs gs gs gs gs	263.641m 39.9134f 28.8332a -22.0124f -17.9298f -28.8943a 34.7377f -34.7965f 87.6078a -13.0911f -34.5226f 174.149f -126.535f 47.8885f 70.3437f -26.7934f -244.017a -117.34f 144.377f 881.033u 31.1495m 10.0051m 7.59554	cbb cbd cbd cbg cbs cdb cdd cdg cds cgg cgs cgd cgs cjd cjs csd csg css	3.99294f 2.2936a -2.20006f -1.79518f -3.98256a 3.47551f -3.48302f 11.4904a -1.3013f -3.45283f 17.4146f -12.6605f 4.93308f 11.1164f -2.88766f -24.978a -11.7316f 14.4442f 93.9219u 3.06245m 987.33u 7.65613	
betaeff cbb cbd cbg cbs cdb cdd cdg cds cgs cgs cgg cgs cjd css csb csd csg gds gm gmbs gmoverid ibulk	263.641m 39.9134f 28.8332a -22.0124f -17.9298f -28.8943a 34.7377f -34.7965f 87.6078a -13.0911f -34.5226f 174.149f -126.535f 47.8885f 70.3437f -26.7934f -244.017a -117.34f 144.377f 881.033u 31.1495m 10.0051m 7.59554 -105.87p	cbb cbd cbd cbg cbs cdb cdd cdg cds cgp cgs cjd cjs csb csd csg csd csg gds gm gmbs	3.99294f 2.2936a -2.20006f -1.79518f -3.98256a 3.47551f -3.48302f 11.4904a -1.3013f -3.45283f 17.4146f -12.6605f 4.93308f 11.1164f -2.68766f -24.978a -11.7316f 14.4442f 93.9219u 3.06245m 987.33u 7.65613 -425.191f 4000u	
betaeff cbb cbd cbg cdb cdd cdg cds cgb cgd cgg cgs cgi cjs csb csd csg csg gm gmb gmoverid id	263 .641m 39 .9134f 28 .8332a -22 .0124f -17. 9298f -28 .8943a 34 .7377f -34 .7965f 87 .6078a -13 .0911f -34 .5226f 174 .149f -126 .535f 47 .8885f 70 .3437f -26 .7934f -244 .017a -117 .34f 144 .377f 881 .033u 31 .1495m 10 .0051m 7 .59554 -105 .87p 4 .10102m	cbb cbd cbd cbg cbs cdb cdd cdg cds cgg cgs cjd cjs csb csd csg csg gm gms gmb gmoverid ibulk id	3.99294f 2.2936a -2.20006f -1.79518f -3.98256a 3.47551f -3.48302f 11.4904a -1.3013f -3.45283f 17.4146f -12.6605f 4.93308f 11.1164f -2.68766f -24.978a -11.7316f 14.4442f 93.9219u 3.06245m 987.33u 7.65613 -425.191f 400u 400u	
betaeff cbb cbd cbg cbs cdb cdd cdg cds cgs cgs cgc cgs cjd cjs csb csd csg	263.641m 39.9134f 28.8332a -22.0124f -17.9298f -28.8943a 34.7377f -34.7965f 87.6078a -13.0911f -34.5226f 174.149f -126.535f 47.8885f 70.3437f -26.7934f -244.017a -117.34f 144.377f 881.033u 31.1495m 10.0051m 7.59554 -105.87p	cbb cbd cbd cbg cbs cdb cdd cdg cds cgp cgs cgd cgs cjd cjs csb csd csg csd csg gm gmbs gmoverid ibulk id ids	3.99294f 2.2936a -2.20006f -1.79518f -3.98256a 3.47551f -3.48302f 11.4904a -1.3013f -3.45283f 17.4146f -12.6605f 4.93308f 11.1164f -2.68766f -24.978a -11.7316f 14.4442f 93.9219u 3.06245m 987.33u 7.55613 -425.191f 400u 400u -4000u	
betaeff cbb cbd cbg ccbs cdb cdd cdg cds cgb cgd cgg cgs cgs cgd cgg cgs cgb csb csd csg gmb gmbe gmoverid id ids ids	263 .641m 39 .9134f 28 .8332a -22 .0124f -17 .9298f -28 .8943a 34 .7377f -34 .7965f 87 .6078a -13 .0911f -34 .5226f 174 .149f -126 .535f 47 .8885f 70 .3437f -26 .7934f -244 .017a -117 .34f 144 .377f 881 .033u 31 .1495m 10 .0051m 7 .59554 -105 .87p 4 .10102m 4 .10102m -4 .10102m -4 .10102m -4 .10102m -3 .47788m	cbb cbd cbd cbg cbs cdb cdd cdg cds cgg cgs cjd cjs csb csd csg css gds gm gmbs gmoverid ibulk ids is pwr	3.99294f 2.2936a -2.20006f -1.79518f -3.98256a 3.47551f -3.48302f 11.4904a -1.3013f -3.45283f 17.4146f -12.6605f 4.93308f 11.1164f -2.68766f -24.978a -11.7316f 14.4442f 93.9219u 3.06245m 987.33u 7.65613 -425.191f 400u 400u -400u 294.688u	
betaeff cbb cbd cbd ccbs cdb cdd cdg cds cgb cgc cgs cjd cgs cjb csb csb csd csg gmobs gmoverid idd ids ids jwr region	263.641m 39.9134f 28.8332a -22.0124f -17.9298f -28.8943a 34.7377f -34.7965f 87.6078a -13.0911f -34.5226f 174.149f -126.535f 47.8885f 70.3437f -26.7934f -244.017a -117.34f 144.377f 881.033u 31.1495m 10.0051m 7.59554 -105.87p 4.10102m 4.10102m 4.10102m -4.10102m	cbb cbd cbd cbg cbs cdb cdd cdg cds cgp cgs cgd cgs cjd cjs csb csd csg csd csg gm gmbs gmoverid ibulk id ids	3.99294f 2.2936a -2.20006f -1.79518f -3.98256a 3.47551f -3.48302f 11.4904a -1.3013f -3.45283f 17.4146f -12.6605f 4.93308f 11.1164f -2.68766f -24.978a -11.7316f 14.4442f 93.9219u 3.06245m 987.33u 7.55613 -425.191f 400u 400u -4000u	
betaeff cbb cbd cbd cbg cbs cdb cdd cdg cds cgb cgd cgg cgs cjb csb csb csc cgg cgs csb csb csd csb csd csb csd csc csc csc csc csc csc csc csc csc	263.641m 39.9134f 28.8332a -22.0124f -17.9298f -28.8943a 34.7377f -34.7965f 87.6078a -13.0911f -34.5226f 174.149f -126.535f 47.8885f 70.3437f -26.7934f -244.017a -117.34f 144.377f 881.033u 31.1495m 10.0051m 7.59554 -105.87p 4.10102m -4.10102m -4.10102m -4.10102m -3.47788m 22	cbb cbd cbd cbg cbs cdb cdd cdg cds cgg cgs cjd cjs csb csd csg css gds gm gmbs gmoverid ibulk id ids is pwr region reversed ron	3.99294f 2.2936a -2.20006f -1.79518f -3.98256a 3.47551f -3.48302f 11.4904a -1.3013f -3.45283f 17.4146f -12.6605f 4.93308f 11.1164f -2.68766f -24.978a -11.7316f 14.4442f 93.9219u 3.06245m 987.33u 7.65613 -425.191f 400u 400u 294.688u 2 0 1.8418K	
betaeff cbb cbb cbc cbs cdb cdc cdc cdc cdc cdc cdc cgd cgd cgc cgc	263.641m 39.9134f 28.8332a -22.0124f -17.9298f -28.8943a 34.7377f -34.7965f 87.6078a -13.0911f -34.5226f 174.149f -126.535f 47.8885f 70.3437f -26.7934f -244.017a -117.34f 144.377f 881.033u 31.1495m 10.0051m 7.59554 -105.87p 4.10102m 4.10102m 4.10102m -4.10102m	cbb cbd cbd cbg cbs cdb cdd cdg cds cgg cgg cgs cjd cjs csb csd csg gs gm gmbs gmoverid ibulk id ids is pwr region reversed ron type	3.99294f 2.2936a -2.20006f -1.79518f -3.98256a 3.47551f -3.48302f 11.4904a -1.3013f -3.45283f 17.4146f -12.6605f 4.93308f 11.1164f -2.68766f -24.978a -11.7316f 14.4442f 93.9219u 3.06245m 987.33u 7.55613 -425.191f 400u 400u -400u 294.688u 2 0 1.8418K 0	
betaeff cbb cbd cbd cbg cbs cdb cdd cdg cds cgb cgd cgg cgs cjb csb csb csc cgg cgs csb csb csd csb csd csb csd csc csc csc csc csc csc csc csc csc	263.641m 39.9134f 28.8332a -22.0124f -17.9298f -28.8943a 34.7377f -34.7965f 87.6078a -13.0911f -34.5226f 174.149f -126.535f 47.8885f 70.3437f -26.7934f -244.017a -117.34f 144.377f 881.033u 31.1495m 10.0051m 7.59554 -105.87p 4.10102m 4.10102m 4.10102m -4.10102m 3.47788m 2 0 206.79 0	cbb cbd cbd cbg cbs cdb cdd cdg cds cgg cgg cgg cjd cjs csb csd csg gm gmbs gmoverid ibulk id ids is pwr region reversed ron type	3.99294f 2.2936a -2.20006f -1.79518f -3.98256a 3.47551f -3.48302f 11.4904a -1.3013f -3.45283f 17.4146f -12.6605f 4.93308f 11.1164f -2.68766f -24.978a -11.7316f 14.4442f 93.9219u 3.06245m 987.33u 7.65613 -425.191f 400u 400u -400u 294.688u 2 0 1.8418K 0	
betaeff cbb cbb cbd cbg ccbs cdb cdd cdd cdg cds cgb cgc cgs cgs csb csb csb csb cid cijs csb csb csb csb csb csc csc csc csc cs	263.641m 39.9134f 28.8332a -22.0124f -17.9298f -28.8943a 34.7377f -34.7955f 87.6078a -13.0911f -34.5226f 174.149f -126.535f 47.8885f 70.3437f -26.7934f -244.017a -117.34f 144.377f 881.033u 31.1495m 10.0051m 7.59554 -105.87p 4.10102m 4.10102m 4.10102m -4.10102m	cbb cbd cbd cbg cbs cdb cdd cdg cds cgg cgs cjd cjs csb csd csg css gds gm gmbs gmoverid ibulk id ids is pwr region reversed ron type vbs	3.99294f 2.2936a -2.20006f -1.79518f -3.98256a 3.47551f -3.48302f 11.4904a -1.3013f -3.45283f 17.4146f -12.6605f 4.93308f 11.1164f -2.68766f -24.978a -11.7316f 14.4442f 93.9219u 3.06245m 987.33u 7.65613 -425.191f 400u 400u 294.688u 2 0 1.8418K 0 0 736.72m	
betaeff cbb cbb cbd cbg ccbs cdb cdd cdg cds cgb cgc cgs cjd cjj csb csb csd csg gmoverid ibulk id ids is pwr region reversed ron type vbs vds	263.641m 39.9134f 28.8332a -22.0124f -17.9298f -28.8943a 34.7377f -34.7965f 87.6078a -13.0911f -34.5226f 174.149f -126.535f 47.8885f 70.3437f -26.7934f -244.017a -117.34f 144.377f 881.033u 31.1495m 10.0051m 7.59554 -105.87p 4.10102m 4.10102m 4.10102m 4.10102m 4.10102m -4.10102m	cbb cbd cbd cbg cbs cdb cdd cdg cds cgg cgg cgg cjd cjs csb csd csg gm gmbs gmoverid ibulk id ids is pwr region reversed ron type	3.99294f 2.2936a -2.20006f -1.79518f -3.98256a 3.47551f -3.48302f 11.4904a -1.3013f -3.45283f 17.4146f -12.6605f 4.93308f 11.1164f -2.68766f -24.978a -11.7316f 14.4442f 93.9219u 3.06245m 987.33u 7.65613 -425.191f 400u 400u -400u 294.688u 2 0 1.8418K 0	
betaeff cbb cbb cbd cbg ccbs cdb cdd cdg cds cgg cgs cgs csb csd csg css gm sgmbs gmoverid ibulk id ids is pwr region reversed ron type vbs	263.641m 39.9134f 28.8332a -22.0124f -17.9298f -28.8943a 34.7377f -34.7955f 87.6078a -13.0911f -34.5226f 174.149f -126.535f 47.8885f 70.3437f -26.7934f -244.017a -117.34f 144.377f 881.033u 31.1495m 10.0051m 7.59554 -105.87p 4.10102m 4.10102m 4.10102m -4.10102m	cbb cbd cbg cbs cdb cdd cdg cds cgg cds cgg cgg cgg cjs cjd cjs csb csd csg gm gmbs gmoverid ibulk id ids is pwr region reversed ron type vbs vds	3.99294f 2.2936a -2.20006f -1.79518f -3.98256a 3.47551f -3.48302f 11.4904a -1.3013f -3.45283f 17.4146f -12.6605f 4.93308f 11.1164f -2.88766f -24.978a -11.7316f 14.4442f 93.9219u 3.06245m 987.33u 7.55613 -425.191f 400u 400u -400u 294.688u 2 0 1.8418K 0 0 736.72m 139.687m	

Figure 52: The DC operating points of all transistors

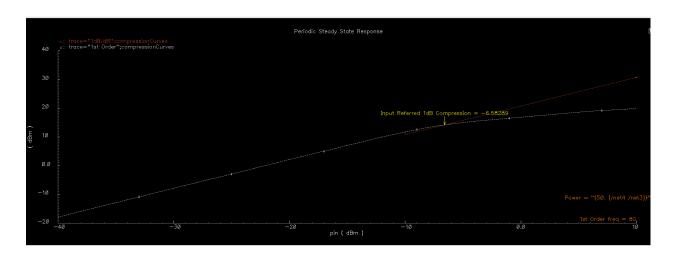


Figure 53: The 1dB compression point

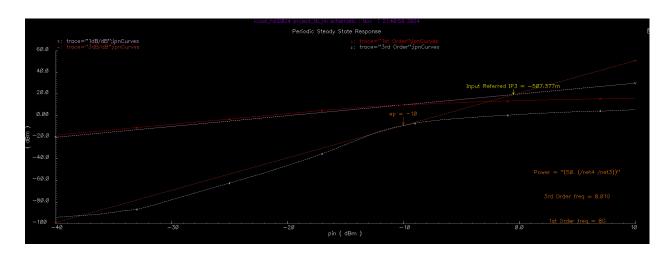


Figure 54: The IIP3 plot

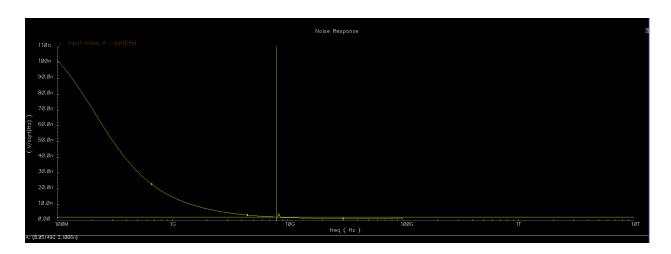


Figure 55: The input-referred noise

$3.3.3 120^{\circ}$

The analysis results are shown in the following figures and in table 12.

Power comsumption (mW)	8.931
Gain (@ 8GHz, dB)	23.48
Bandwidth (GHz)	0.611
1dB compression point (dBm)	-5.041
3rd input intercept point (dBm)	0.928
Input-referred noise (@ 8GHz, $\frac{nV}{\sqrt{Hz}}$)	2.27

Table 12: The circuit properties at 120°

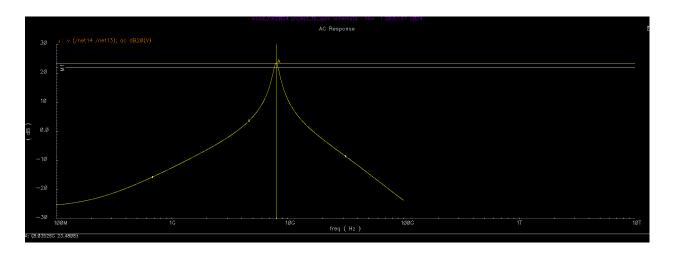


Figure 56: The gain plot

```
Curve name map:
------

Curve1 - v (/net14 /net13); ac dB20(V)

Curve table:
------

Y value Curve1

M1 22 7.64864177246
8.25935705446
```

Figure 57: The bandwidth, using a horizontal marker

	OD (#70 M2# #00#)			
signal	OP("IO.M3" "??")			
betaeff	74 5026-	signal	OP("IO.M5" "??")	
cbb	74.5036m 14.7846f	betaeff	74.5036m	
cbd	40. 283a	cbb cbd	14. 7846f 40. 283a	
cbg	-10.0476f	cbg	-10.0476f	
cbs	-4.77728f	cbs	-4.77728f	
cdb	-8.68012a	cdb	-8.68012a	
cdd	17.3691f	cdd	17.3691f	
cdg	-17.3937f	cdg	-17.3937f	
cds cgb	33. 3042a -5. 79479f	cds	33. 3042a	
cgd	-16.9404f	cgb	-5. 79479f	
cgg	86.2364f	cgd cgg	-16.9404f 86.2364f	
cgs	-63.5013f	cgs	-63.5013f	
cjd	19.9348f	cjd	19.9348f	
cjs	28.1734f	cjs	28.1734f	
csb csd	-8.98111f -468.984a	csb	-8. 98111f	
csq	-58.7951f	csd	-468.984a	
css	68. 2452f	csg	-58.7951f 68.2452f	
qds	508.763u	css gds	508. 763u	
gm	12.9803m	dur an	12.9803m	
gmbs	2.81979m	gnubs	2.81979m	
gmoverid	6.32868	gmoverid	6. 32868	
ibulk id	-149.653p 2.05103m	ibulk	-149.653p	
ids	2.05103m 2.05103m	id	2.05103m	
is	-2.05103m	ids is	2.05103m	
pwr	1.92771m	pwr	-2.05103m 1.92771m	
region	2	region	2	
reversed	0	reversed	0	
ron	458. 245 0	ron	458. 245	
type vbs	-848.391m	type	0	
vds	939.874m	vbs	-848.391m	
vdsat	199.783m	vds vdsat	939.874m 199.783m	
vgs	951.609m	vgs	951.609m	
vth	730.581m	vth	730.581m	
		signal	OP("I0.MO" "??")	
signal	OP("IO.M6" "??")	betaeff	15.8955m	
betaeff cbb	158.966m 39.9093f	cpp	3.99271f	
cbd	24.4056a	cbd	1.49771a	
cbg	-21.9388f	cbg	-2.19241f	
cbs				
	-17.9949f	cbs cdb	-1.80179f -4.66498a	
cdb	-32.7215a	cdb cdd	-4.66498a	
cdb cdd	-32.7215a 34.7516f	cdb		
cdb cdd cdg	-32, 7215a 34, 7516f -34, 8067f	cdb cdd cdg cds	-4. 66498a 3. 47794f -3. 48492f 11. 6367a	
cdb cdd cdg cds	-32. 7215a 34. 7516f -34. 8067f 87. 8147a	edb edd edg eds egb	-4.66498a 3.47794f -3.48492f 11.6367a -1.24424f	
cdb cdd cdg cds cgb	-32.7215a 34.7516f -34.8067f 87.8147a -12.5259f	cdb cdd cdg cds cgb cgd	-4.66498a 3.47794f -3.46492f 11.6367a -1.24424f -3.45374f	
cdb cdd cdg cds cgb cgd	-32. 7215a 34. 7516f -34. 8067f 87. 8147a	edb edd edg eds egb egd egg	-4.66498a 3.47794f -3.46492f 11.6367a -1.24424f -3.45374f 17.3892f	
cdb cdd cdg cds cgb cgd cgg cgg	-32.7215a 34.7516f -34.8067f 87.8147a -12.5259f -34.5282f 173.888f -126.834f	cdb cdd cdg cds cgb cgd cgg cgs	-4.66498a 3.47794f -3.48492f 11.6367a -1.24424f -3.45374f 17.3892f -12.6912f	
odb odd ods ogb ogd ogg ogs ojd	-32, 7215a 34, 7516f -34, 8067f 87, 8147a -12, 5259f -34, 5282f 173, 888f -126, 834f 48, 8158f	edb edd edg eds egb egd egg	-4.66498a 3.47794f -3.46492f 11.6367a -1.24424f -3.45374f 17.3892f	
cdb cdd cdg cds cgb cgd cgg cgg cgs cjid	-32. 7215a 34. 7516f -34. 8067f 87. 8147a -12. 5259f -34. 5282f 173. 888f -126. 834f 48. 8158f 75. 6808f	edb edd edg eds egb egd egg egs ejd	-4.66498a 3.47794f -3.48492f 11.6367a -1.24424f -3.45374f 17.3892f -12.6912f 5.05299f 11.9676f -2.7438f	
cdb cdd cds cds cgb cgd cgg cgg cgs cjd cjs csb	-32.7215a 34.7516f -34.8067f 87.8147a -12.5259f -34.5282f 173.888f -126.834f 48.8158f 75.6808f -27.3507f	cdb cdd cdg cds cgb cgd cgg cjs cjd cjs	-4.66498a 3.47794f -3.46492f 11.6367a -1.24424f -3.45374f 17.3892f -12.6912f 5.05299f 11.9676f -2.7438f -25.7023a	
cdb cdd cds cds cgb cgd cgg cgs cjd cjs cjs csb	-32, 7215a 34, 7516f -34, 8067f 87, 8147a -12, 5259f -34, 5282f 173, 888f -126, 834f 48, 8158f 75, 6808f -27, 3507f -247, 774a	cdb cdd cdg cds cgb cgd cgs cjd cjs csb csd	-4.66498a 3.47794f -3.48492f 11.6367a -1.24424f -3.45374f 17.3892f -12.6912f 5.05299f 11.9676f -2.7438f -25.7023a -11.7119f	
cdb cdd cds cds cgb cgd cgg cgg cgs cjd cjs csb	-32.7215a 34.7516f -34.8067f 87.8147a -12.5259f -34.5282f 173.888f -126.834f 48.8158f 75.6808f -27.3507f	cdb cdd cdg cds cgb cgd cgg cgs cjd cjs csb csd csg csg	-4.66498a 3.47794f -3.46492f 11.6367a -1.24424f -3.45374f 17.3892f -12.6912f 5.05299f 11.9676f -2.7438f -25.7023a -11.7119f 14.4814f	
cdb cdd cds cds cgb cgg cgs cjs cjs csb csd	-32, 7215a 34, 7516f -34, 8067f 87, 8147a -12, 5259f -34, 5282f 173, 888f -126, 834f 48, 8158f 75, 6808f -27, 3507f -247, 774a -117, 143f 144, 741f 835, 106u	cdb cdd cdg cds cgb cgd cgg cgs cjd cjs csb csd csg	-4.66498a 3.47794f -3.46492f 11.6367a -1.24424f -3.45374f 17.3892f -12.6912f 5.05299f 11.9676f -2.7438f -25.7023a -11.7119f 14.4814f 91.8474u	
cdb cdd cds cds cgb cgg cgs cjs cjs csb csd csg ggs	-32. 7215a 34. 7516f -34. 8067f 87. 8147a -12. 5259f -34. 5282f 173. 888f -126. 834f 48. 8158f 75. 6808f -27. 3507f -247. 774a -117. 143f 144. 741f 835. 106u 26. 1982m	cdb cdd cdg cds cgb cgd cgg cgs cjd cjs csb csd csg	-4.66498a 3.47794f -3.48492f 11.6367a -1.24424f -3.45374f 17.3892f -12.6912f 5.05299f 11.9676f -2.7438f -25.7023a -11.7119f 14.4814f 91.8474u 2.56833m	
cdb cdd cds cds cgb cgg cgs cjd cjs csb csd csq csg gds gds gm gmbs	-32.7215a 34.7515a 34.7516 -34.8067f 87.8147a -12.5259f -34.5282f 173.888f -126.834f 48.8158f 75.6808f -27.3507f -247.774a -117.143f 144.741f 835.106u 26.1982m 8.51202m	cdb cdd cdg cds cgb cgd cgg cgs cjd cjs csb csd csg	-4.66498a 3.47794f -3.46492f 11.6367a -1.24424f -3.45374f 17.3892f -12.6912f 5.05299f 11.9676f -2.7438f -25.7023a -11.7119f 14.4814f 91.8474u	
cdb cdd cdg cds cgb cgg cgg cgs cjd cjs csb csd csg gg gmb gmbs gmoverid	-32. 7215a 34. 7516f -34. 8067f 87. 8147a -12. 5259f -34. 5282f 173. 888f -126. 834f 48. 8158f 75. 6808f -27. 3507f -247. 774a -117. 143f 144. 741f 835. 106u 26. 1982m 8. 51202m 6. 3866	cdb cdd cdg cds cgb cgd cgg cgs cjd cjs csb csd csg csg	-4.66498a 3.47794f -3.48492f 11.6367a -1.24424f -3.45374f 17.3892f -12.6912f 5.05299f 11.9676f -2.7438f -25.7023a -11.7119f 14.4814f 91.8474u 2.56833m 837.812u 6.42082 -3.39178p	
cdb cdd cdg cds cgb cgg cgs cjs cjs csb csd csg gs gs gs gs tss gm gmbs gmnoverid ibulk	-32. 7215a 34. 7516f -34. 8067f 87. 8147a -12. 5259f -34. 5282f 173. 888f -126. 834f -48. 8158f 75. 6808f -27. 3507f -247. 774a -117. 143f 144. 741f 835. 106u 26. 1982m 8. 51202m 6. 3866 -64. 8883p	cdb cdd cdg cds cgb cgd cgg cgs cjd cjs csb csd csg csg csd csd csg csg csd csd csg chait	-4.66498a 3.47794f -3.46492f 11.6367a -1.24424f -3.45374f 17.3892f -12.6912f 5.05299f 11.9676f -2.7438f -25.7023a -11.7119f 14.4814f 91.8474u 2.56833m 837.812u 6.42082 -3.39178p 400u	
cdb cdd cds cds cgb cgg cgs cjd cjs csb csd csg gds gms gmbs gmoverid iid	-32. 7215a 34. 7516f -34. 8067f 87. 8147a -12. 5259f -34. 5282f 173. 888f -126. 834f 48. 8158f 75. 6808f -27. 3507f -247. 774a -117. 143f 144. 741f 835. 106u 26. 1982m 8. 51202m 6. 3866 -64. 8883p 4. 10206m	cdb cdd cdg cds cgb cgd cgg cgs cjd cjs csb csd csg csd csg csd csg csd csg csc csd csg css gds gm. gmbs gmoverid ibulk id	-4.66498a 3.47794f -3.46492f 11.6367a -1.24424f -3.45374f 17.3892f -12.6912f 5.05299f 11.9676f -2.7438f -25.7023a -11.7119f 14.4814f 91.8474u 2.56833m 837.812u 6.42082 -3.39178p 400u 400u	
cdb cdd cdg cds cgb cgg cgs cjd cjs csb csd csg css gds gm gmbs gmoverid id ids	-32. 7215a 34.7516f -34.8067f 87.8147a -12.5259f -34.5282f 173.888f -126.834f 48.8158f 75.6808f -27.3507f -247.774a -117.143f 144.741f 835.106u 26.1982m 8.51202m 6.3866 -64.8883p 4.10206m 4.10206m	cdb cdd cdg cds cgb cgd cgg cgs cjd cjs csb csd csg gms gmbs gmoverid ibulk id ids is	-4.66498a 3.47794f -3.48492f 11.6367a -1.24424f -3.45374f 17.3892f -12.6912f 5.05299f 11.9676f -2.7438f -25.7023a -11.7119f 14.4814f 91.8474u 2.56833m 837.812u 6.42082 -3.39178p 400u 400u -400u	
cdb cdd cds cds cgb cgg cgs cjd cjs csb csd csg gds gms gmbs gmoverid iid	-32. 7215a 34. 7516f -34. 8067f 87. 8147a -12. 5259f -34. 5282f 173. 888f -126. 834f 48. 8158f 75. 6808f -27. 3507f -247. 774a -117. 143f 144. 741f 835. 106u 26. 1982m 8. 51202m 6. 3866 -64. 8883p 4. 10206m	cdb cdd cdg cds cgb cgd cgg cgs cjd cjs csb csd csg gds gms gmbs gmoverid ibulk id ids is pwr	-4.66498a 3.47794f -3.46492f 11.6367a -1.24424f -3.45374f 17.3892f -12.6912f 5.05299f 11.9676f -2.7438f -25.7023a -11.7119f 14.4814f 91.8474u 2.56833m 837.812u 6.42082 -3.39178p 400u 400u -400u 292.611u	
cdb cdd cdg cds cgb cgg cgs cjd cjs csb csd csg gs gmb gmbs gmoverid id ids is pur	-32. 7215a 34.7516f -34.8067f 87.8147a -12.5259f -34.5282f 173.888f -126.834f 48.8158f 75.6808f -27.3507f -247.774a -117.143f 144.741f 835.106u 26.1982m 8.51202m 6.3866 -64.8883p 4.10206m 4.10206m -4.10206m -4.10206m -3.48015m	cdb cdd cdg cds cgb cgd cgg cgs cjd cjs csb csd csg gs gs gs ds gm gmbs gmoverid ibulk id ids is pwr	-4.66498a 3.47794f -3.46492f 11.6367a -1.24424f -3.45374f 17.3892f -12.6912f 5.05299f 11.9676f -2.7438f -25.7023a -11.7119f 14.4814f 91.8474u 2.56833m 837.812u 6.42082 -3.39178p 400u 400u -400u 292.611u	
cdb cdd cdg cds cgb cgg cgs cjs csb csd csg gds gmbs gmoverid ids is pwr region reversed	-32. 7215a 34. 7516f -34. 8067f 87. 8147a -12. 5259f -34. 5282f 173. 888f -126. 834f -48. 8158f 75. 6808f -27. 3507f -247. 774a -117. 143f 144. 741f 835. 105u 26. 1982m 8. 51202m 6. 3866 -64. 8883p 4. 10206m 4. 10206m -4. 10206m 3. 48015m	cdb cdd cdg cds cgb cgd cgg cgs cjd cjs csb csd csg gs csd csg csd csg css gds gm gmbs gmoverid ibulk id ids is pwr	-4.66498a 3.47794f -3.48492f 11.6367a -1.24424f -3.45374f 17.3892f -12.6912f -5.05299f 11.9676f -2.7438f -25.7023a -11.7119f 14.4814f 91.8474u 2.56833m 837.812u 6.42082 -3.39178p 400u 400u -400u 292.611u 2	
cdb cdd cds cds cgd cgg cgg cjd cjs csd csg csd csg gm gmbs gmbs gmoverid ibulk id ids is pwr region record	-32. 7215a 34. 7516f -34. 8067f 87. 8147a -12. 5259f -34. 5282f 173. 888f -126. 834f 48. 8158f 75. 6808f -27. 3507f -247. 774a -117. 143f 144. 741f 835. 106u 26. 1992m 8. 51202m 6. 3866 -64. 8883p 4. 10206m 4. 10206m -4. 10206m -4. 10206m -3. 48015m 20 206. 821	cdb cdd cdg cds cgb cgd cgg cgs cjd cjs csb csd csg gs gs gs ds gm gmbs gmoverid ibulk id ids is pwr	-4.66498a 3.47794f -3.46492f 11.6367a -1.24424f -3.45374f 17.3892f -12.6912f 5.05299f 11.9676f -2.7438f -25.7023a -11.7119f 14.4814f 91.8474u 2.56833m 837.812u 6.42082 -3.39178p 400u 400u -400u 292.611u	
cdb cdd cdg cds cgb cgg cgs cjd cjs csb cscd csg gds gm gmbs gmoverid id id ids is pwr Fegion reversed rron type	-32. 7215a 34. 7516f -34. 8067f 87. 8147a -12. 5259f -34. 5282f 173. 888f -126. 834f 48. 8158f 75. 6808f -27. 3507f -247. 774a -117. 143f 144. 741f 835. 106u 26. 1982m 8. 51202m 6. 3866 -64. 8883p 4. 10206m 4. 10206m -4. 10206m -4. 10206m 3. 48015m 20 206. 821 0	cdb cdd cdg cds cgb cgd cgg cgs cjd cjs csb csd csg gds gm gmbs gmoverid ibulk id ids is pwr reversed ron type	-4.66498a 3.47794f -3.48492f 11.6367a -1.24424f -3.45374f 17.3892f -12.6912f -5.05299f 11.9676f -2.7438f -25.7023a -11.7119f 14.4814f 91.8474u 2.56833m 837.812u 6.42082 -3.39178p 400u 400u -400u 292.611u 20 0 1.82882K 0	
cdb cdd cdg cds cgb cgg cgs cjs csb csd csg gds gmbs gmoverid ibulk id ids is pwr recyion reversed ron type	-32. 7215a 34. 7516f -34. 8067f 87. 8147a -12. 5259f -34. 5282f 173. 888f -126. 834f -48. 8158f 75. 6808f -27. 3507f -247. 774a -117. 143f 144. 741f 835. 106u 26. 1982m 8. 51202m 6. 3866 -64. 8883p 4. 10206m 4. 10206m -4. 10206m -4. 10206m 3. 48015m 20 00 00	cdb cdd cdg cds cgb cgd cgg cgs cjd cjs csb csd csg css gds gm gmbs gmoverid ibulk id ids is pwr Tegion reversed ron type vbs	-4.66498a 3.47794f -3.46492f 11.6367a -1.24424f -3.45374f 17.3892f -12.6912f 5.05299f 11.9676f -2.7438f -25.7023a -11.7119f 14.4814f 91.8474u 2.56833m 837.812u 6.42082 -3.39178p 400u 400u -400u 292.611u 20 1.82882K 0 0 731.528m	
cdb cdd cds cds cgd cgg cgs cjd cjs csd csg css gds gm gmbs gmoverid ibulk id ids is pwr Fegion reversed ron type vbs	-32. 7215a 34. 7516f -34. 8067f 87. 8147a -12. 5259f -34. 5282f 173. 888f -126. 834f 48. 8158f 75. 6808f -27. 3507f -247. 774a -117. 143f 144. 741f 835. 106u 26. 1982m 8. 51202m 6. 3866 -64. 8883p 4. 10206m 4. 10206m -4. 10206m -4. 10206m 3. 48015m 20 206. 821 0	cdb cdd cdg cds cgb cgd cgg cgs cjd cjs csb csd csg csg css gds gm gmbs gmoverid ibulk id ids is pwr reversed ron type vbs vds	-4.66498a 3.47794f -3.40492f 11.6367a -1.24424f -3.45374f 17.3892f -12.6912f 5.05299f 11.9676f -2.7438f -25.7023a -11.7119f 14.4814f 91.8474u 2.56833m 837.812u 6.42082 -3.39178p 400u 400u -400u 292.611u 2 0 1.82882K 0 0 731.528m 187.176m	
cdb cdd cdg cds cgb cgg cgs cjs csb csd csg gds gmbs gmoverid ibulk id ids is pwr recyion reversed ron type	-32. 7215a 34. 7516f 34. 8067f 87. 8147a -12. 5259f -34. 5282f 173. 888f -126. 834f 48. 8158f 75. 6808f -27. 3507f -247. 774a -117. 143f 144. 741f 835. 106u 26. 1982m 8. 51202m 6. 3866 -64. 8883p 4. 10206m 4. 10206m 4. 10206m -4. 10206m 3. 48015m 20 00 848. 391m 187. 336m 731. 526m	cdb cdd cdg cds cgb cgd cgg cgs cjd cjs csb csd csg gms gmbs gmoverid ibulk id ids is pwr region reversed ron type vbs vds vdsat vgs	-4.66498a 3.47794f -3.48492f 11.6367a -1.24424f -3.48574f 17.3892f -12.6912f -5.05299f 11.9676f -2.7438f -25.7023a -11.7119f 14.4814f 91.8474u 2.56833m 837.812u 6.42082 -3.39178p 400u 400u -400u 292.611u 2 0 1.82882K 0 0 731.528m 187.176m 731.528m	
cdb cdd cdg cds cgb cgg cgs cgc cgs csb csb cscd csg gds gm gmbs gmoverid id id id ids is pwr reversed rron type vbs vds	-32. 7215a 34. 7516f -34. 8067f 87. 8147a -12. 5259f -34. 5282f 173. 888f -126. 834f 48. 8158f 75. 6808f -27. 3507f -247. 774a -117. 143f 144. 741f 835. 106u 26. 1982m 8. 51202m 6. 3866 -64. 8883p 4. 10206m 4. 10206m -4. 10206m	cdb cdd cdg cds cgb cgd cgg cgs cjd cjs csb csd csg csg css gds gm gmbs gmoverid ibulk id ids is pwr reversed ron type vbs vds	-4.66498a 3.47794f -3.40492f 11.6367a -1.24424f -3.45374f 17.3892f -12.6912f 5.05299f 11.9676f -2.7438f -25.7023a -11.7119f 14.4814f 91.8474u 2.56833m 837.812u 6.42082 -3.39178p 400u 400u -400u 292.611u 2 0 1.82882K 0 0 731.528m 187.176m	

Figure 58: The DC operating points of all transistors

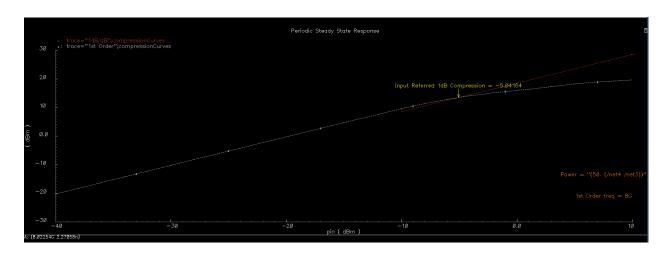


Figure 59: The 1dB compression point

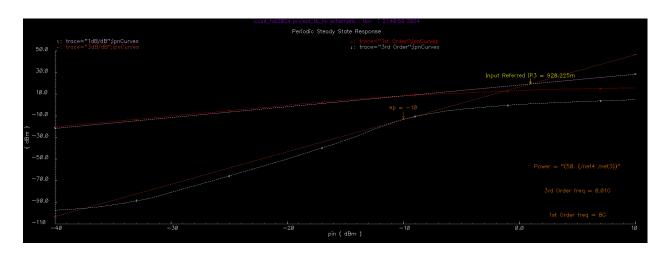


Figure 60: The IIP3 plot

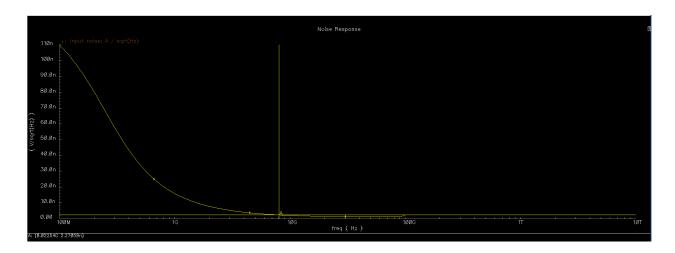


Figure 61: The input-referred noise

3.4 Final Results

	TT (-40)	TT (27)	TT (120)	FF (-40)	FF(27)	FF (120)	SS (-40)	SS(27)	SS(120)
Power comsumption (mW)	8.380	8.378	8.377	9.003	11.152	10.839	8.380	8.1	8.931
Gain (@ 8GHz, dB)	27.543	25.891	23.792	26.227	24.509	22.223	26.467	25.154	23.48
Bandwidth (GHz)	1.463	1.153	0.794	1.651	1.308	0.877	1.253	0.966	0.611
1dB compression point (dBm)	-6.004	-4.359	-2.411	-1.160	-0.485	0.425	-7.744	-6.582	-5.041
3rd input intercept point (dBm)	-3.563	4.668	1.201	-1.343	1.647	4.604	-1.449	-0.507	0.928
Input-referred noise (@ 8GHz, $\frac{nV}{\sqrt{Hz}}$)	1.964	2.071	2.232	1.906	2.017	2.196	1.992	2.1	2.27

Table 13: The circuit properties at all corners and temperatures

4 Layout

The first step was to lay the floor plan by putting down every element. As the amplifier is differential, keeping the design as symmetric as possible is important, so I put the components in a symmetric pattern, as shown in fig. 62. Then, I made the connections as short and sparse

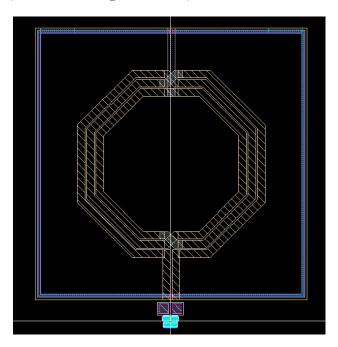


Figure 62: The floor plan

as possible. The following figures show every connection starting from the bottom of the circuit and moving to the top.

The bias transistors are shown in fig.63. The bulks are connected to the sources of both transistors which are connected on M1 and then brought to M2 to jump over the gate of the tail transistor and connected to the ground pin, GRND. The gates are also connected on both top and bottom, the two sides are connected to each other, and the bias current pin, IB. The drain of the current mirror transistor is directly connected to the top connection of the gate and the drains of the tail transistor are brought to M2 with VIAs and connected to the sources of the input transistors, as shown in fig. 64.

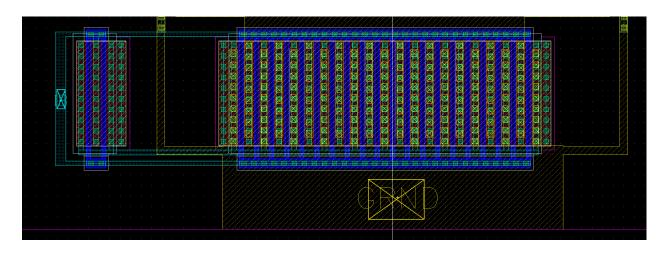


Figure 63: The bias circuit

The bulk connections of the input transistor are visible on both sides but detached from the sources. The bulk connection closer to the middle of both transistors is brought to M3 with VIAs to jump over the source connection, and then it is brought back to M2 to connect with the bulk connections on the outer edge and the GRND pin.

The gate connections of each transistor are connected on the outer edge and the input pins, IN1 and IN2, are placed there on M1. The drains of each transistor are connected and then brought to M6 with VIAs to connect to the top layer of the capacitors, as shown in fig. 65.

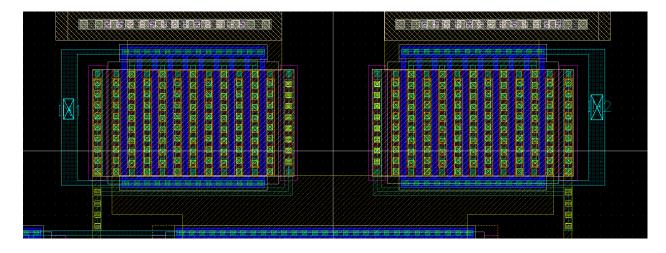


Figure 64: The input transistors

The top layer of the capacitors connects directly to the PLUS and MINUS terminals of the inductor and the output pins, OUT1 and OUT2, are placed on their connection. The bottom layer is dragged to the sides of the inductor and brought down to M4 with VIAs to connect to the center tap of the inductor, as shown in fig. 66. Fig. 67 shows the complete layout, while fig. 68 and fig. 69 show the results of the DRC and LVS runs.

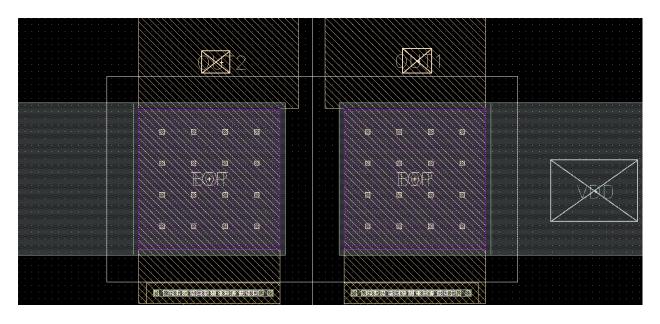


Figure 65: The capacitors

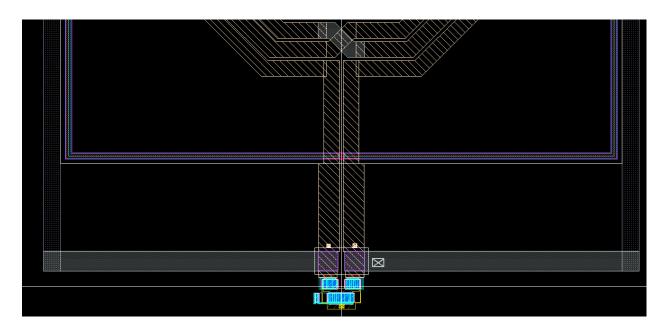


Figure 66: Overview of the capacitor connections

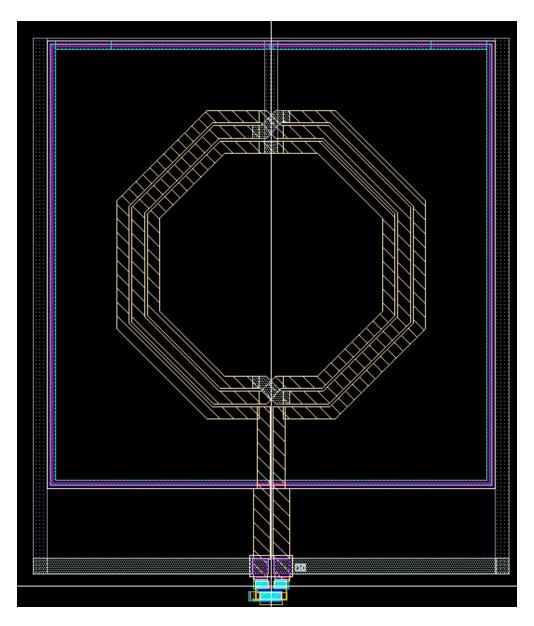


Figure 67: The layout

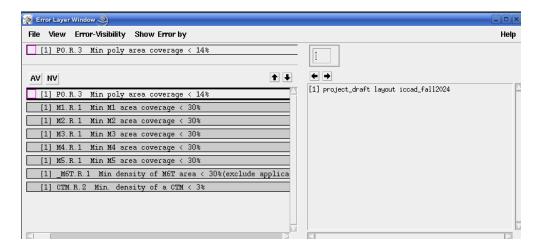


Figure 68: The DRC results

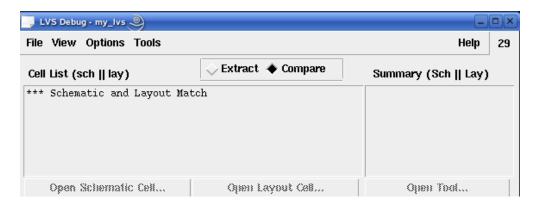


Figure 69: The LVS results

5 Parasitics

I ran the RCX three times: for R only, RC, and RLC. The settings each time were similar and only the name of the file and the extracted parameters in the Extraction tab were changed, a sample of which is shown in fig. 70. Also, fig. 71 shows a view of the RC parasitic file, zoomed in on the tail transistor to show the parasitics.

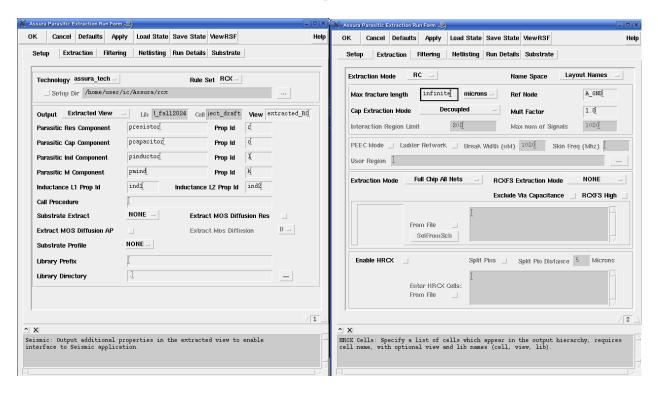


Figure 70: The RCX setup

Then, I made a config cell view of my test benches and ran the same analyses as the first section, for the TT corner at 27 degrees, the results of which are shown in the following subsections. The results for the AC and noise plots are drawn on the schematic results for ease of comparison, with the yellow line as the results from the parasitic view. Also, fig. 72 shows the hierarchy editor view of one of the test benches.

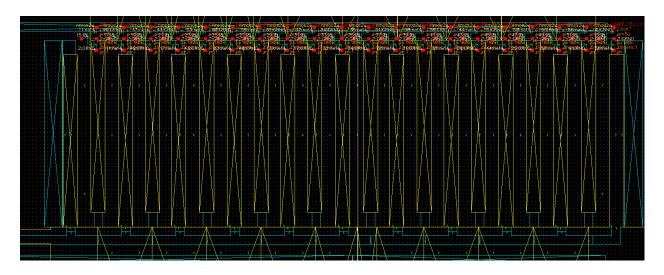


Figure 71: The parasitics

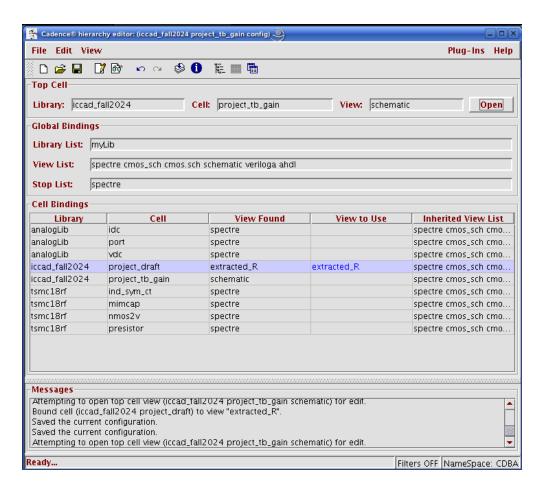


Figure 72: Hierarchy editor

5.1 R Only

The analysis results are shown in the following figures and in table 14. I could not run the PSS analysis to find IP3 because the error shown in fig. 77 occurred.

Power comsumption (mW)	8.368
Gain (@ 8GHz, dB)	22.821
Bandwidth (GHz)	0.63
1dB compression point (dBm)	-5.348
3rd input intercept point (dBm)	_
Input-referred noise (@ 8GHz, $\frac{nV}{\sqrt{Hz}}$)	1.992

Table 14: The circuit properties for the R-only parasitic view

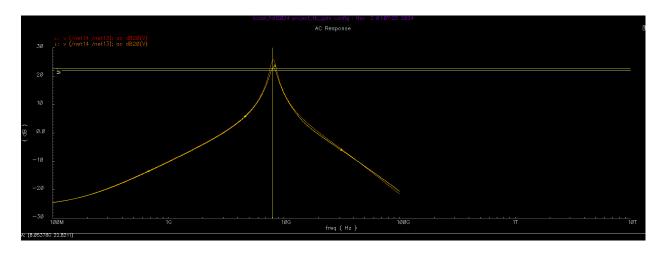


Figure 73: The gain plot

```
Curve name map:
-----

Curve2 - v (/net14 /net13); ac dB20(V)

Curve1 - v (/net14 /net13); ac dB20(V)

Curve table:
------

Y value Curve2 Curve1

M1 22 7.81347143636 7.5353501876
8.44380199726 8.68876848746
```

Figure 74: The bandwidth, using a horizontal marker

signal	OP("VO" "??")
i	-4.64941m
pwr	-8.36894m
v	1.8

Figure 75: The DC operating point of the supply voltage

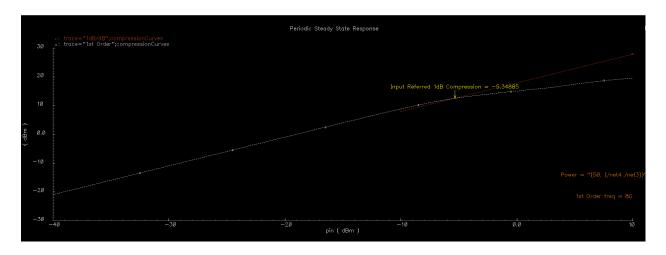


Figure 76: The 1dB compression point

```
Simulating 'input.scs' on linux at 1:57:03 AM, Sat Nov 2, 2024.

Compiling ahdlcmi module library.

Failed to compile ahdlcmi module library, see input.ahdlcmi/ahdlcmi.ou details

Could not open ahdlcmi module library input.ahdlcmi/obj/Linux2.6.11.4-
smp+gcc/optimize/libinput.so
    input.ahdlcmi/obj/Linux2.6.11.4-20a-smp+gcc/optimize/libinput.
    carnot open shared object file: No such file or directory

Could not open ahdlcmi module library input.ahdlcmi/obj/Linux2.6.11.4-
smp+gcc/optimize/libinput.so
    input.ahdlcmi/obj/Linux2.6.11.4-20a-smp+gcc/optimize/libinput.
    carnot open shared object file: No such file or directory

Could not open ahdlcmi module library input.ahdlcmi/obj/Linux2.6.11.4-
smp+gcc/optimize/libinput.so
    input.ahdlcmi/obj/Linux2.6.11.4-20a-smp+gcc/optimize/libinput.
    carnot open shared object file: No such file or directory

Could not open ahdlcmi module library input.ahdlcmi/obj/Linux2.6.11.4-
smp+gcc/optimize/libinput.so
    input.ahdlcmi/obj/Linux2.6.11.4-20a-smp+gcc/optimize/libinput.
    carnot open shared object file: No such file or directory

Could not open ahdlcmi module library input.ahdlcmi/obj/Linux2.6.11.4-
    smp+gcc/optimize/libinput.so
    input.ahdlcmi/obj/Linux2.6.11.4-20a-smp+gcc/optimize/libinput.
    carnot open shared object file: No such file or directory

Could not open ahdlcmi module library input.ahdlcmi/obj/Linux2.6.11.4-
    smp+gcc/optimize/libinput.so
    input.ahdlcmi/obj/Linux2.6.11.4-20a-smp+gcc/optimize/libinput.
    carnot open shared object file: No such file or directory

Could not open ahdlcmi module library input.ahdlcmi/obj/Linux2.6.11.4-
    smp+gcc/optimize/libinput.so
    input.ahdlcmi/obj/Linux2.6.11.4-20a-smp+gcc/optimize/libinput.so
    input.ahdlcmi/obj/Linux2.6.11.4-20a-smp+gcc/optimize/libinput.so
    input.ahdlcmi/obj/Linux2.6.11.4-20a-smp+gcc/optimize/libinput.so
    input.ahdlcmi/obj/Linux2.6.11.4-20a-smp+gcc/optimize/libinput.so
    input.ahdlcmi/obj/Linux2.6.11.4-20a-smp+gcc/optimize/libinput.so
    input.ahdlcmi/obj/Linux2.
```

Figure 77: The error shown after running PSS analysis for IIP3

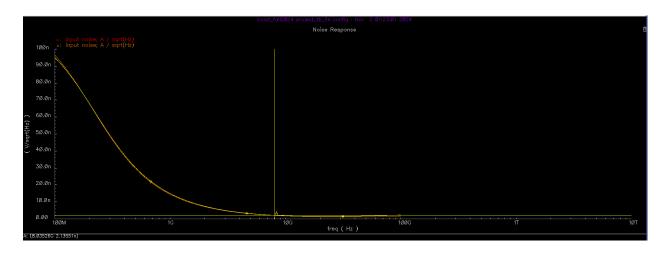


Figure 78: The input-referred noise

5.2 RC

The analysis results are shown in the following figures and in table 15. Again, I encountered the same error when running PSS for IP3.

Power comsumption (mW)	8.368
Gain (@ 8GHz, dB)	22.989
Bandwidth (GHz)	0.697
1dB compression point (dBm)	-8.001
3rd input intercept point (dBm)	_
Input-referred noise (@ 8GHz, $\frac{nV}{\sqrt{Hz}}$)	1.86

Table 15: The circuit properties for the RC parasitic view

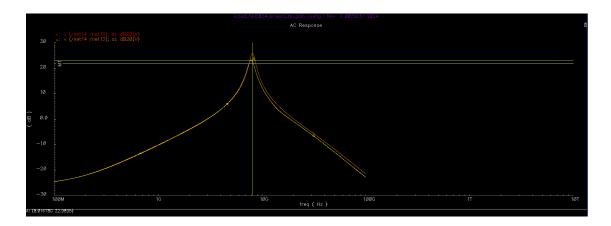


Figure 79: The gain plot

Figure 80: The bandwidth, using a horizontal marker

signal	OP("VO" "??")
i	-4.64941m
pwr	-8.36894m
v	1.8

Figure 81: The DC operating point of the supply voltage

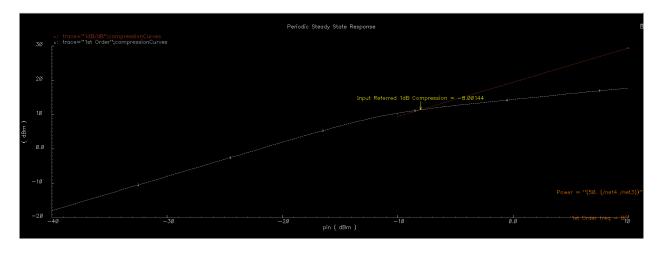


Figure 82: The 1dB compression point

```
Simulating 'input.scs' on linux at 1:59:28 AM, Sat Nov 2, 2024.

Compiling ahdlcmi module library.

Pailed to compile ahdlcmi module library, see input.ahdlcmi/ahdlcmi ou details

Could not open ahdlcmi module library input.ahdlcmi/obj/Linux2.6.11.4-
smp+gcc/optimize/libinput.so
input.ahdlcmi/obj/Linux2.6.11.4-20a-smp+gcc/optimize/libinput.
carnot open shared object file: No such file or directory

Could not open ahdlcmi module library input.ahdlcmi/obj/Linux2.6.11.4-
smp+gcc/optimize/libinput.so
input.ahdlcmi/obj/Linux2.6.11.4-20a-smp+gcc/optimize/libinput.
carnot open shared object file: No such file or directory

Could not open ahdlcmi module library input.ahdlcmi/obj/Linux2.6.11.4-
smp+gcc/optimize/libinput.so
input.ahdlcmi/obj/Linux2.6.11.4-20a-smp+gcc/optimize/libinput.
carnot open shared object file: No such file or directory

Could not open ahdlcmi module library input.ahdlcmi/obj/Linux2.6.11.4-
smp+gcc/optimize/libinput.so
input.ahdlcmi/obj/Linux2.6.11.4-20a-smp+gcc/optimize/libinput.
carnot open shared object file: No such file or directory

Could not open ahdlcmi module library input.ahdlcmi/obj/Linux2.6.11.4-
smp+gcc/optimize/libinput.so
input.ahdlcmi/obj/Linux2.6.11.4-20a-smp+gcc/optimize/libinput.
carnot open shared object file: No such file or directory

Could not open ahdlcmi module library input.ahdlcmi/obj/Linux2.6.11.4-
smp+gcc/optimize/libinput.so
input.ahdlcmi/obj/Linux2.6.11.4-20a-smp+gcc/optimize/libinput.
carnot open shared object file: No such file or directory

Could not open ahdlcmi module library input.ahdlcmi/obj/Linux2.6.11.4-
smp+gcc/optimize/libinput.so
input.ahdlcmi/obj/Linux2.6.11.4-20a-smp+gcc/optimize/libinput.
carnot open ahdlcmi module library input.ahdlcmi/obj/Linux2.6.11.4-
smp+gcc/optimize/libinput.so
input.ahdlcmi/obj/Linux2.6.11.4-20a-smp+gcc/optimize/libinput.
carnot open ahdlcmi module library input.ahdlcmi/obj/Linux2.6.11.4-
smp+gcc/optimize/libinput.so
input.ahdlcmi/obj/Linux2.6.11.4-20a-smp+gcc/optimize/libinput.
carnot open ahdlcmi module library input.ahdlcmi/ob
```

Figure 83: The error shown after running PSS analysis for IIP3

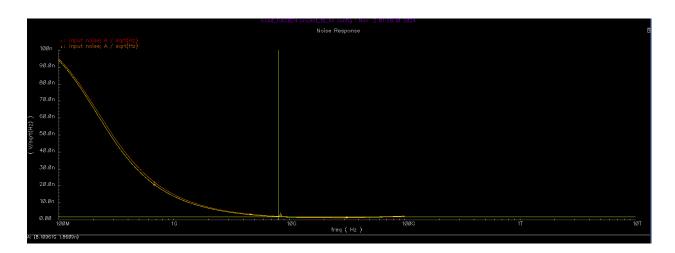


Figure 84: The input-referred noise

5.3 RLC

The analysis results are shown in the following figures and in table 16. Once again, I could not determine the IP3 due to the same error as the last ones.

Power comsumption (mW)	8.368
Gain (@ 8GHz, dB)	22.989
Bandwidth (GHz)	0.611
1dB compression point (dBm)	-8.001
3rd input intercept point (dBm)	_
Input-referred noise (@ 8GHz, $\frac{nV}{\sqrt{Hz}}$)	1.86

Table 16: The circuit properties for the RLC parasitic view

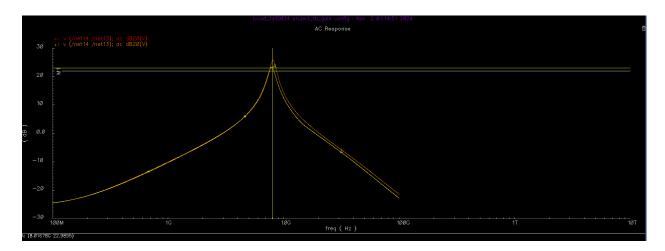


Figure 85: The gain plot

Figure 86: The bandwidth, using a horizontal marker

signal	OP("VO" "??")
i	-4.64941m
pwr	-8.36894m
v	1.8

Figure 87: The DC operating point of the supply voltage $\,$

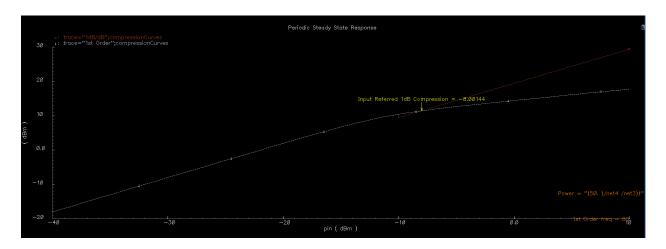


Figure 88: The 1dB compression point

```
Simulating `input.scs' on linux at 2:04:00 AM, Sat Nov 2, 2024.

Compiling ahdlcmi module library.

Failed to compile ahdlcmi module library, see input.ahdlcmi/ahdlcmi.ou details

Could not open ahdlcmi module library input.ahdlcmi/obj/Linux2.6.11.4-
smp+gcc/optimize/libinput.so input.ahdlcmi/obj/Linux2.6.11.4-20a-smp+gcc/optimize/libinput.
cannot open shared object file: No such file or directory

Could not open ahdlcmi module library input.ahdlcmi/obj/Linux2.6.11.4-
smp+gcc/optimize/libinput.so input.ahdlcmi/obj/Linux2.6.11.4-20a-smp+gcc/optimize/libinput.
cannot open shared object file: No such file or directory

Could not open ahdlcmi module library input.ahdlcmi/obj/Linux2.6.11.4-
smp+gcc/optimize/libinput.so input.ahdlcmi/obj/Linux2.6.11.4-20a-smp+gcc/optimize/libinput.
cannot open shared object file: No such file or directory

Could not open ahdlcmi module library input.ahdlcmi/obj/Linux2.6.11.4-
smp+gcc/optimize/libinput.so input.ahdlcmi/obj/Linux2.6.11.4-
smp+gc/optimize/libinput.so input.ahdlcmi/obj/Linux2.6.11.4-
smp+gcc/optimize/libinput.so input.ahdlcmi/obj/Linux2.6.11.4-
smp+gcc/optimize/libinput.so input.ahdlcmi/obj/Linux2.6.11.4-
smp+gcc/optimi
```

Figure 89: The error shown after running PSS analysis for IIP3

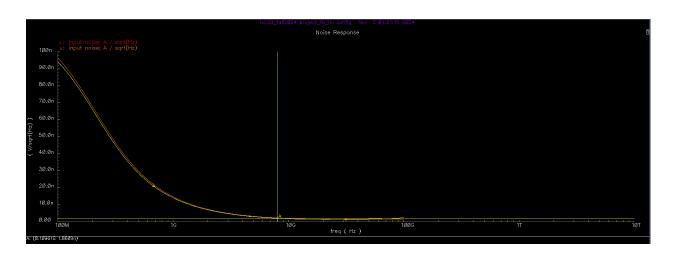


Figure 90: The input-referred noise

6 Final Comparison

The following table compares all the simulation results gathered from this project.

	TT (-40)	TT (27)	TT (120)	FF (-40)	FF (27)	FF (120)	SS (-40)	SS (27)	SS (120)	R	RC	RLC
Power (mW)	8.380	8.378	8.377	9.003	11.152	10.839	8.380	8.1	8.931	8.368	8.368	8.368
Frequency (GHz)	8.058	8.111	8.194	8.297	8.359	8.458	7.834	7.88	7.953	8.128	7.862	7.862
Gain (@ 8GHz, dB)	27.543	25.891	23.792	26.227	24.509	22.223	26.467	25.154	23.48	22.821	22.989	22.989
Bandwidth (GHz)	1.463	1.153	0.794	1.651	1.308	0.877	1.253	0.966	0.611	0.63	0.697	0.611
P_{1dB} (dBm)	-6.004	-4.359	-2.411	-1.160	-0.485	0.425	-7.744	-6.582	-5.041	-5.348	-8.001	-8.001
IIP3(dBm)	-3.563	4.668	1.201	-1.343	1.647	4.604	-1.449	-0.507	0.928	-	-	-
noise (@ 8GHz, $\frac{nV}{\sqrt{Hz}}$)	1.964	2.071	2.232	1.906	2.017	2.196	1.992	2.1	2.27	1.992	1.86	1.86

Table 17: The circuit properties at all corners and temperatures