Anexo I - *Script* para OCEAN

```
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
;;  Script para OCEAN                ;;
;;  Extraccion de bits aleatorios  ;;
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;

ocnWaveformTool( 'wavescan )
simulator( 'spectre )
design(  "../Sim/TRNG/spectre/schematic/netlist/netlist")
resultsDir( "../Sim/TRNG/spectre/schematic" )
modelFile(
'("/programs/cadence/DESIGN_KITS/ams_v3.80/spectre/c35/soac/cmos53.scs"
"cmostm")
'("/programs/cadence/DESIGN_KITS/ams_v3.80/spectre/c35/soac/res.scs"
"restm")
'("/programs/cadence/DESIGN_KITS/ams_v3.80/spectre/c35/soac/cap.scs"
"captm")
'("/programs/cadence/DESIGN_KITS/ams_v3.80/spectre/c35/soac/bip.scs"
"biptm")
'("/programs/cadence/DESIGN_KITS/ams_v3.80/spectre/c35/soac/ind.scs"
"indtm")
'("/programs/cadence/DESIGN_KITS/ams_v3.80/spectre/c35/soac/esddiode.scs"
"esddiodetm")
)
definitionFile(
"/programs/cadence/DESIGN_KITS/ams_v3.80/spectre/c35/soac/C35B4C0.scs"
)
;analysis('dc ?saveOppoint t  )
```

```
p = outfile("rng_bits.out" "a")

TSAMP = 3.2e-6
TSTOP = 320e-6

Nbits = int(TSTOP/TSAMP)

saveOption( 'save "selected" )
save( 'v "/OUTFINAL" )
temp( 27 )

FILEINI = "spectre1.fc"
FILEEND = "spectre2.fc"
for(j 1 200
analysis('tran ?stop TSTOP  ?tranNoise "Transient Noise"  ?noisefmax "2G"
?noisefmin "0.1"  ?noiseseed "1"  ?noisescale ""  ?noisetmin ""
?noiseupdate ""  ?noiseonoff ""  ?noiseinst ""  ?readic FILEINI
?writefinal FILEEND  )

run()
selectResult( 'tran )
OUT = v("/OUTFINAL" ?result 'tran)

for(i 1 Nbits
SAMPi = value(OUT (i-0.5)*TSAMP)

BITi = if(SAMPi > 1.5 1 0)
fprintf(p "%d\n" BITi)
)
drain(p)
aux = FILEINI
FILEINI = FILEEND
FILEEND = aux
```

```
)
close(p)
```

Anexo II - *Layout* elaborado en CADENCE

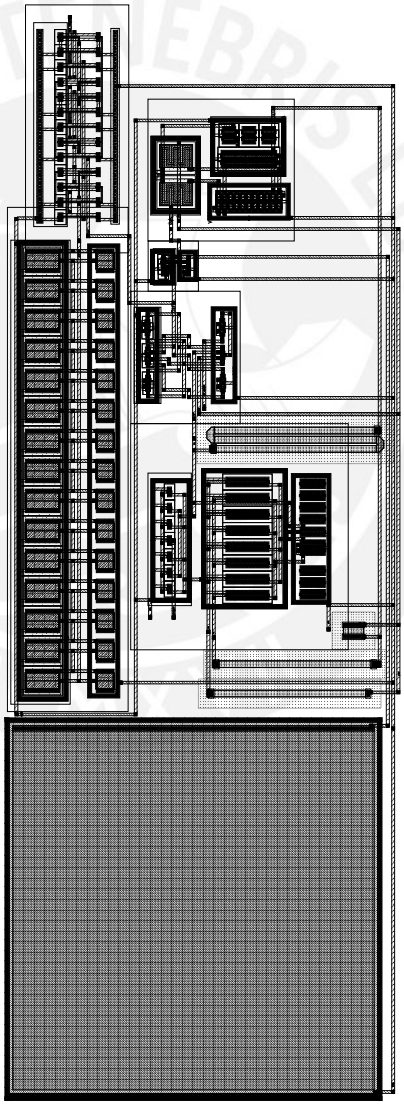

Figura 4.6: *Layout* del circuito completo.

Anexo III - Esquemáticos elaborados en CADENCE

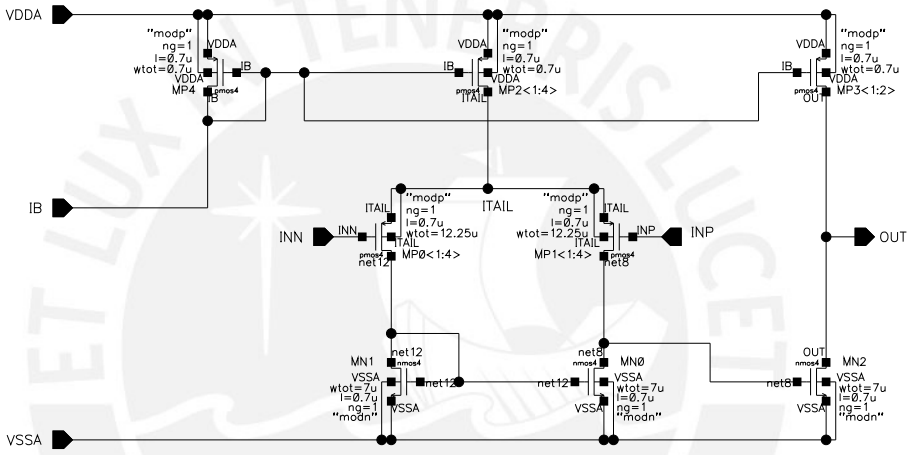

Figura 4.7: Esquemático del OPAMP.

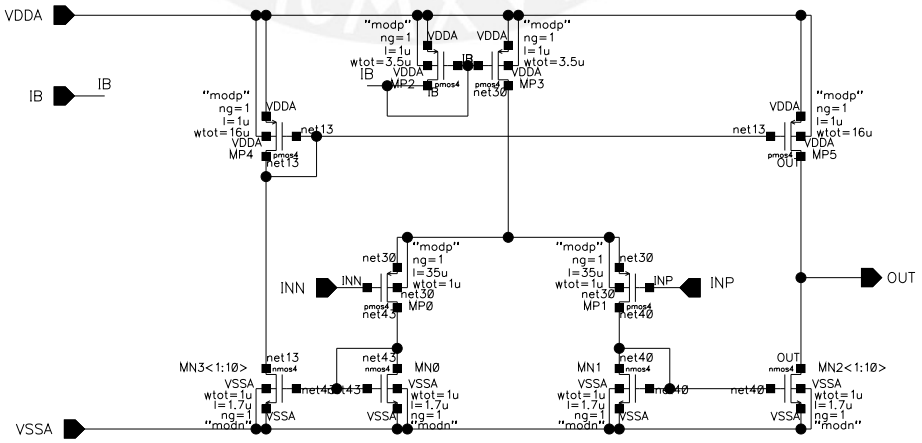

Figura 4.8: Esquemático del OTA.

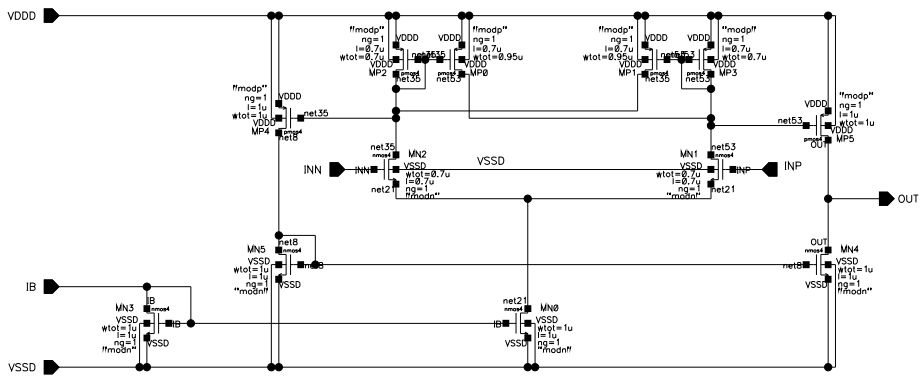

Figura 4.9: Esquemático del comparador.

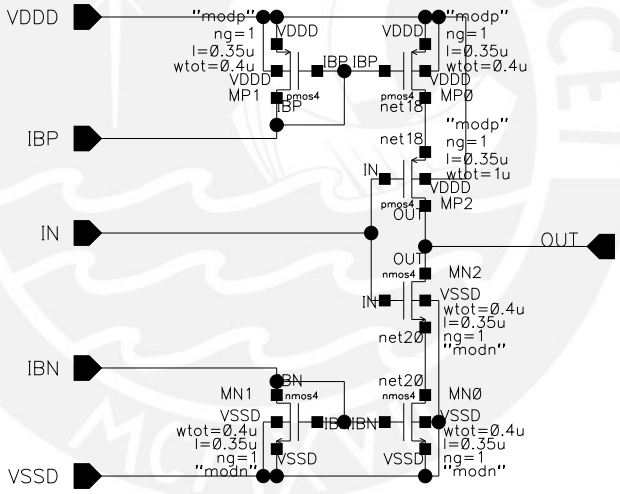

Figura 4.10: Esquemático del *charge pump*.

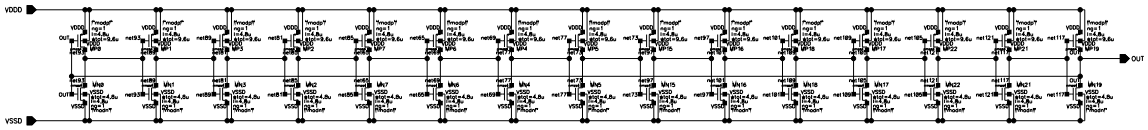

Figura 4.11: Esquemático del oscilador rápido.

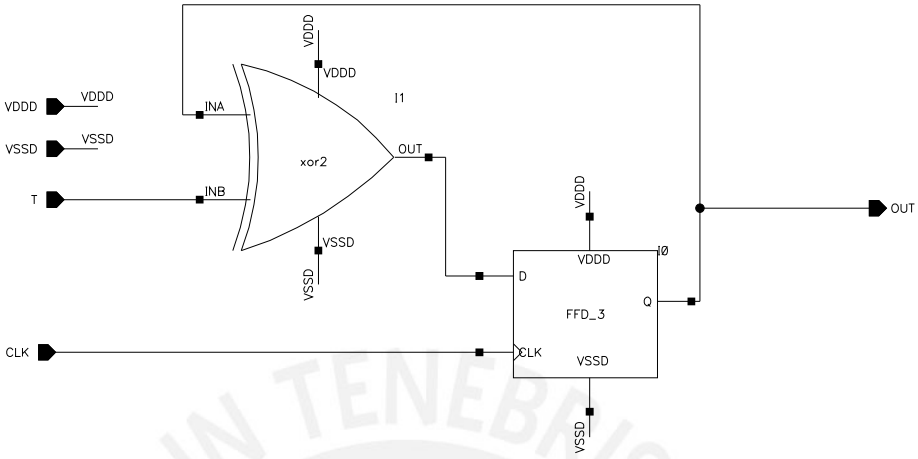

Figura 4.12: Esquemático del FF-T.

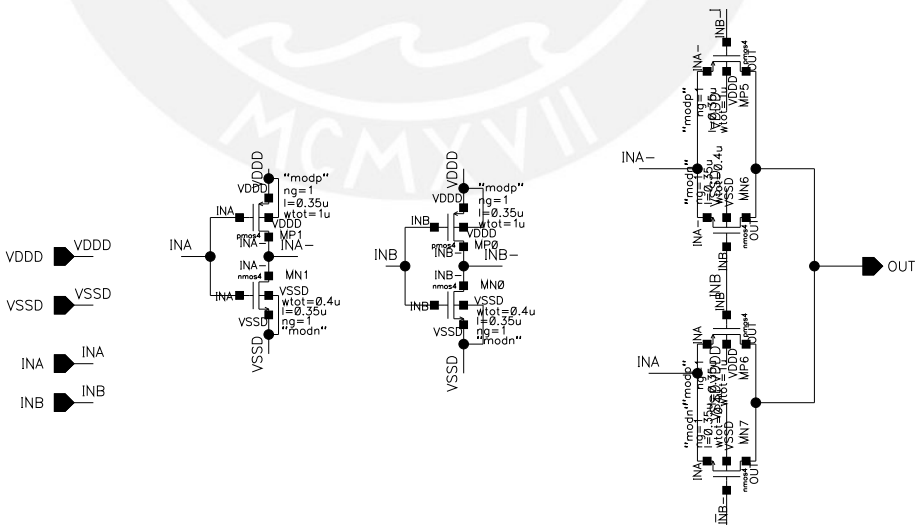

Figura 4.13: Esquemático de la compuerta XOR.

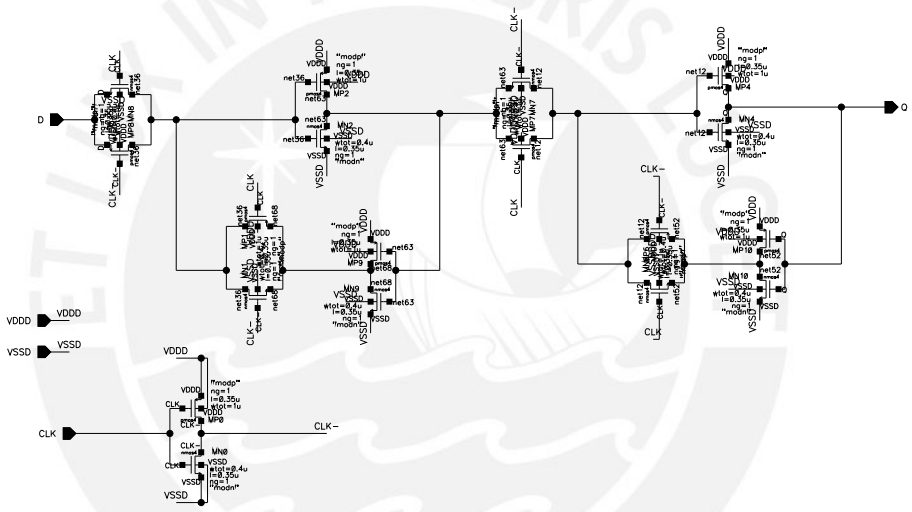

Figura 4.14: Esquemático del FF-D.

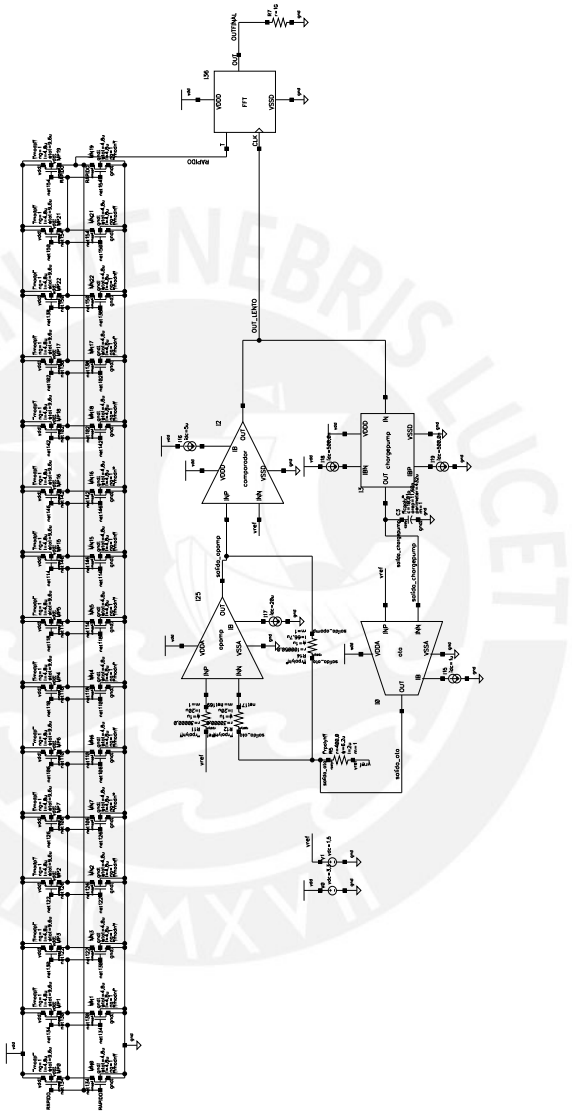

Figura 4.15: Esquemático del circuito completo.

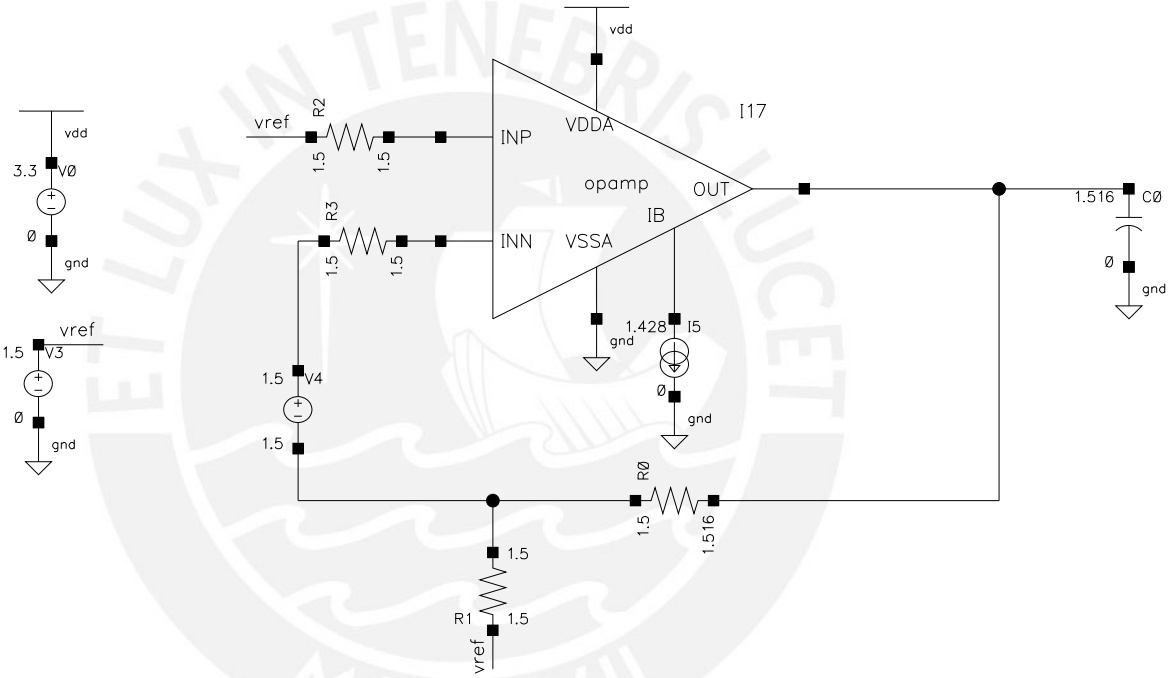

Figura 4.16: *Testbench* utilizado para medir la respuesta en frecuencia del OPAMP.