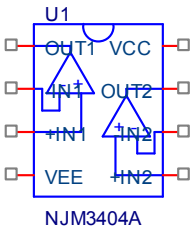
Device Modeling Report

COMPONENTS:MOSFET: OPERATIONAL AMPLIFIER
PART NUMBER:NJM3404A
MANUFACTURER: NEW JAPAN RADIO CO.,LTD

Bee Technologies Inc.

Spice Model

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*$
* PART NUMBER:NJM3404A
* MANUFACTURER: NEW JAPAN RADIO
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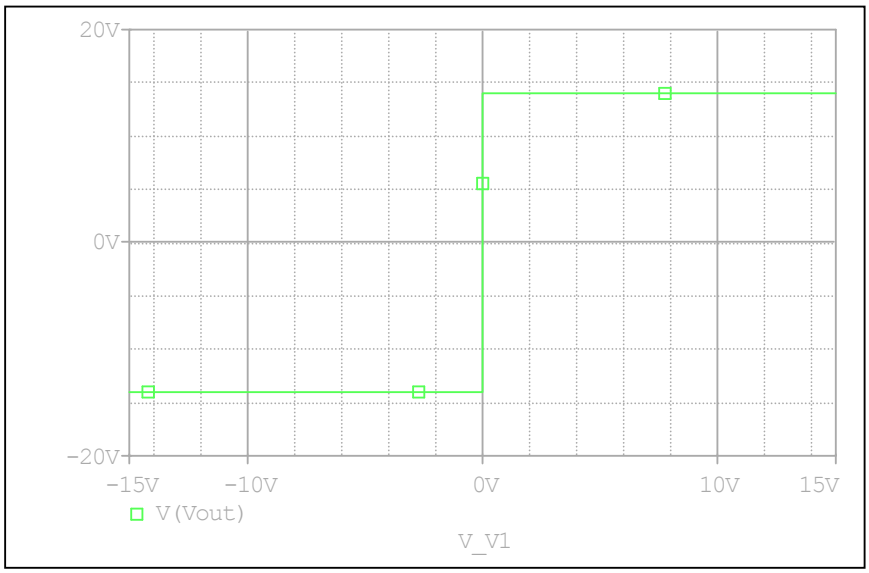
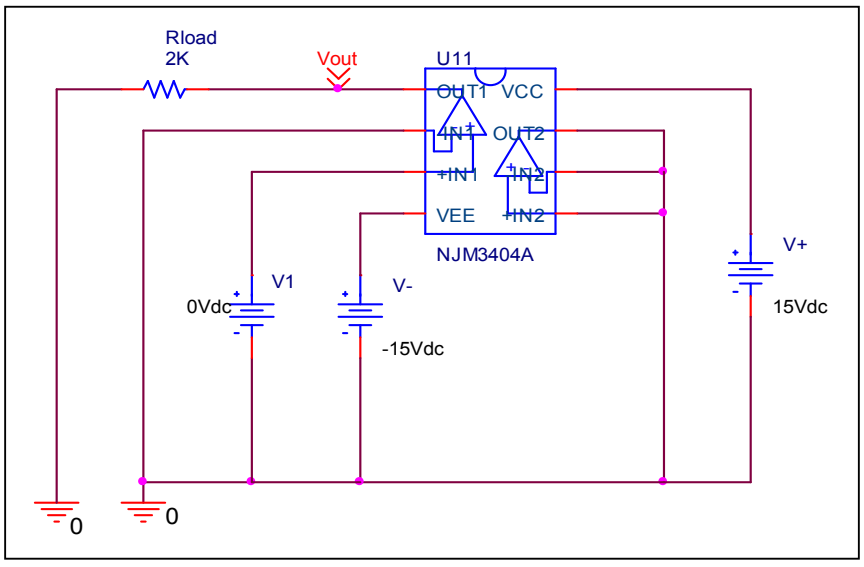
.Subckt NJM3404A OUT1 -IN1 +IN1 VEE +IN2 -IN2 OUT2 VCC
X_U1     +IN1 -IN1 VCC VEE OUT1 NJM3404A_SUB
X_U2     +IN2 -IN2 VCC VEE OUT2 NJM3404A_SUB
.ends  NJM3404A
.subckt NJM3404A_SUB 1 2 3 4 5
  c1   11 12 9.5263E-12
  c2    6  7 33.000E-12
  dc    5 53 dy
  de   54  5 dy
  dlp  90 91 dx
  dln  92 90 dx
  dp    4  3 dx
  egnd 99  0 poly(2) (3,0) (4,0) 0 .5 .5
  fb    7 99 poly(5) vb vc ve vlp vln 0 14.301E6 -1E3 1E3 14E6 -14E6
  ga    6  0 11 12 260.13E-6
  gcm   0  6 10 99 8.8626E-9
  iee   3 10 dc 39.741E-6
  hlim 90  0 vlim 1K
  q1   11  2 13 qx1
  q2   12  1 14 qx2
  r2    6  9 100.00E3
  rc1   4 11 3.8443E3
  rc2   4 12 3.8443E3
  re1  13 10 2.0981E3
  re2  14 10 2.0981E3
  ree  10 99 5.0326E6
  ro1   8  5 50
  ro2   7 99 25
  rp    3  4 1.8043E3
  vb    9  0 dc 0
  vc    3 53 dc 1.8080
  ve   54  4 dc 1.8080
  vlim  7  8 dc 0
  vlp  91  0 dc 29.500
  vln   0 92 dc 29.500
.model dx D(Is=800.00E-18)
.model dy D(Is=800.00E-18 Rs=1m Cjo=10p)
.model qx1 PNP(Is=800.00E-18 Bf=267.80)
.model qx2 PNP(Is=864.3162E-18 Bf=296.92)
.ends
*$
```

Output Voltage Swing

Simulation result



Evaluation circuit

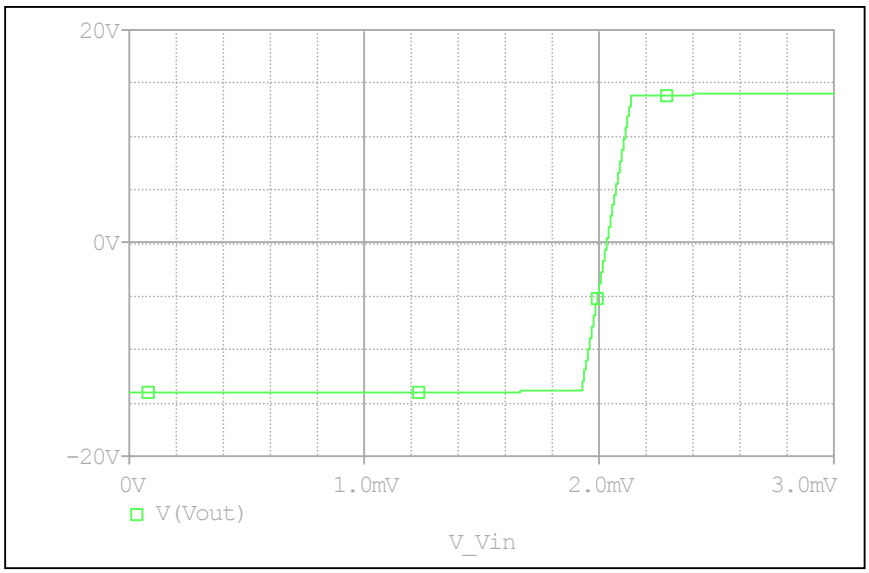


Comparison table

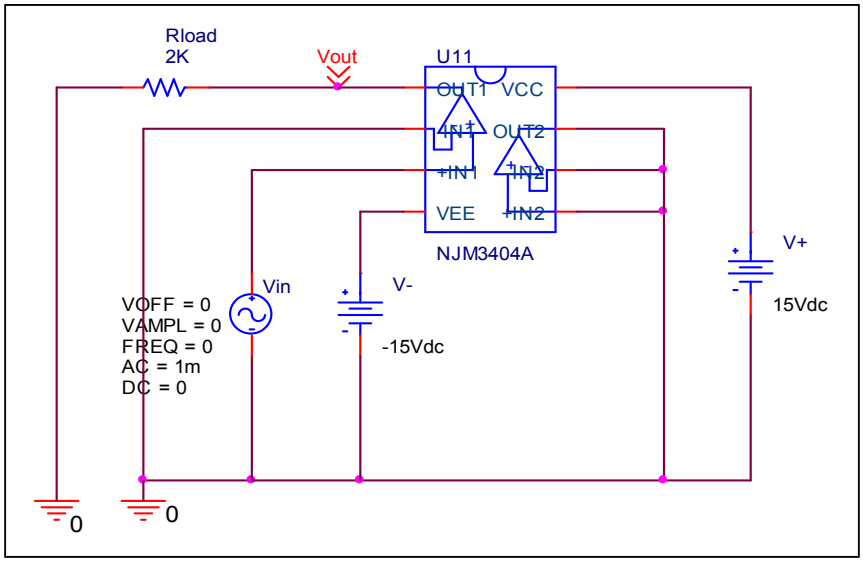
Output Voltage Swing	Measurement	Simulation	%Error
+Vout(V)	+14	+13.994	-0.043
-Vout(V)	-14	-13.994	-0.043

Input Offset Voltage

Simulation result



Evaluation circuit

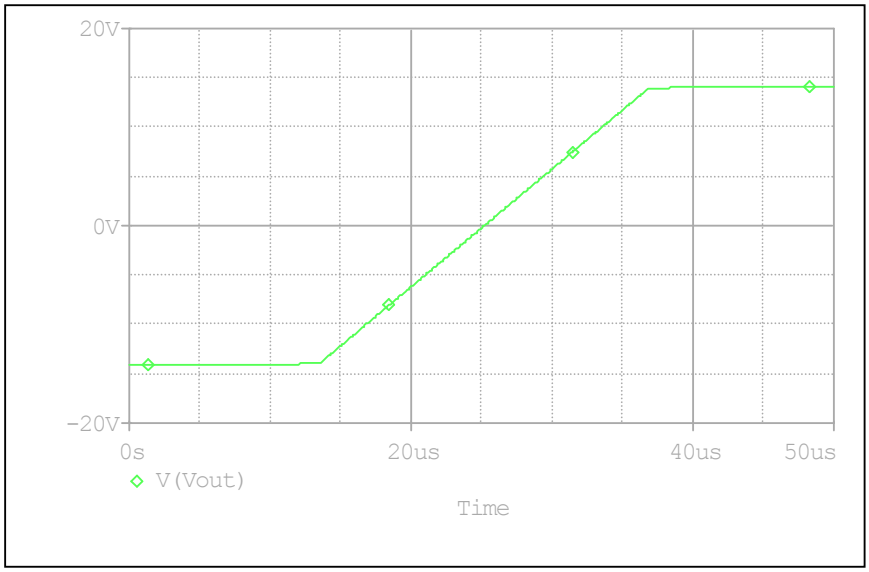


Comparison table

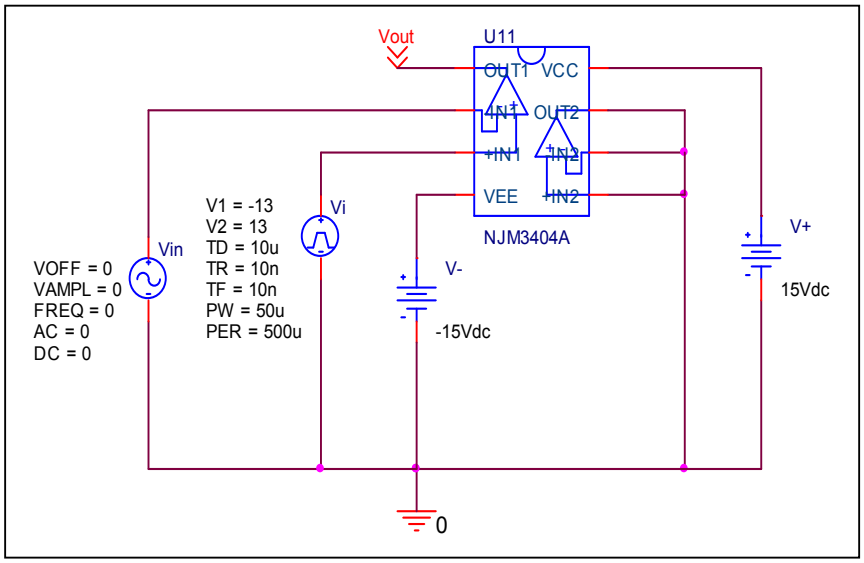
	Measurement	Simulation	%Error
Vos (mV)	2	2.0352	1.76

Slew Rate

Simulation result



Evaluation circuit

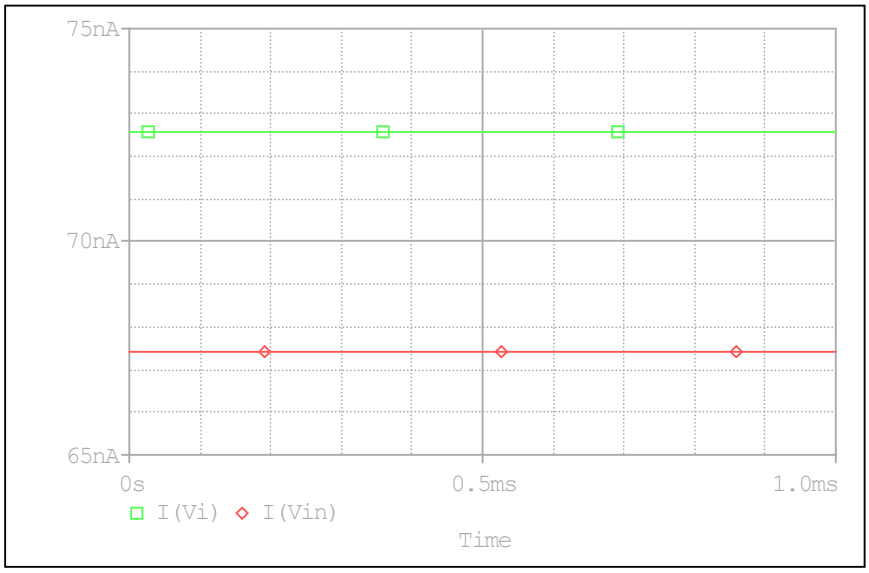


Comparison table

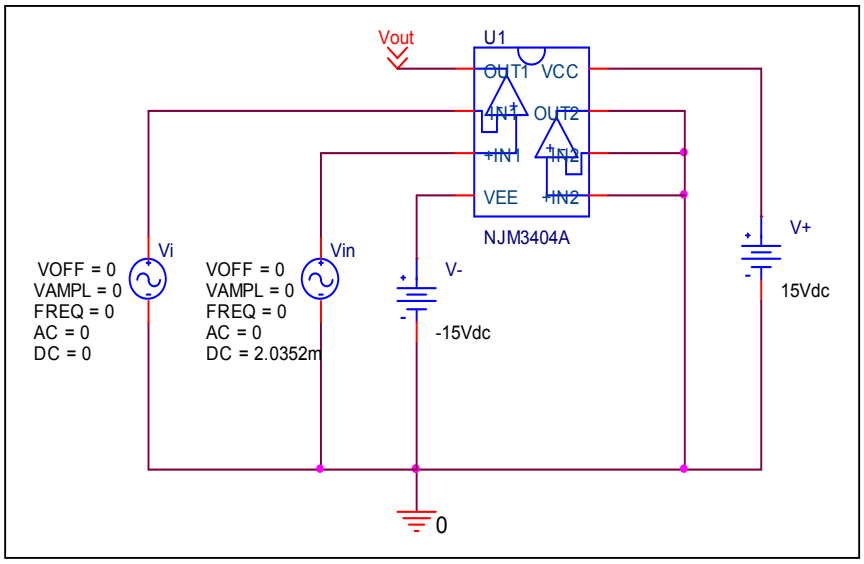
	Measurement	Simulation	%Error
Slew Rate(v/us)	1.2	1.195	-0.417

Input current

Simulation result



Evaluation circuit

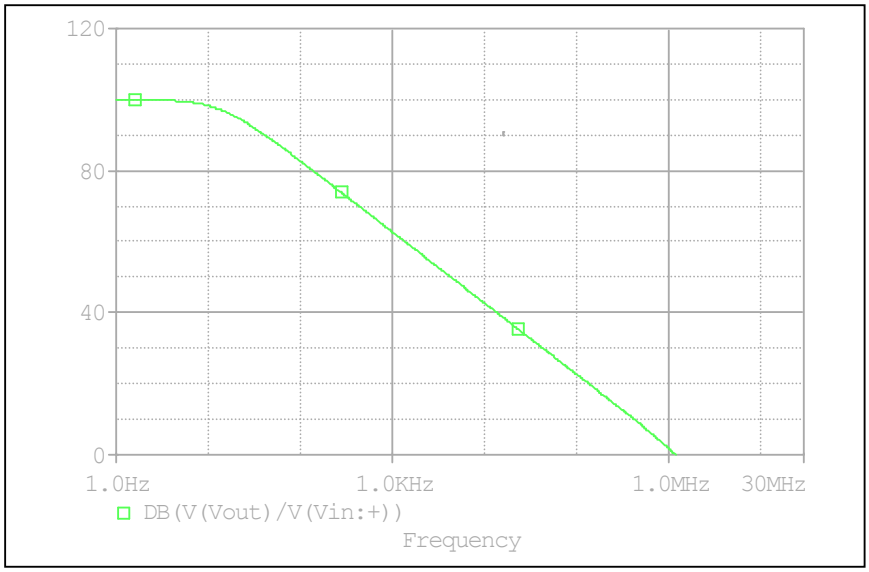


Comparison table

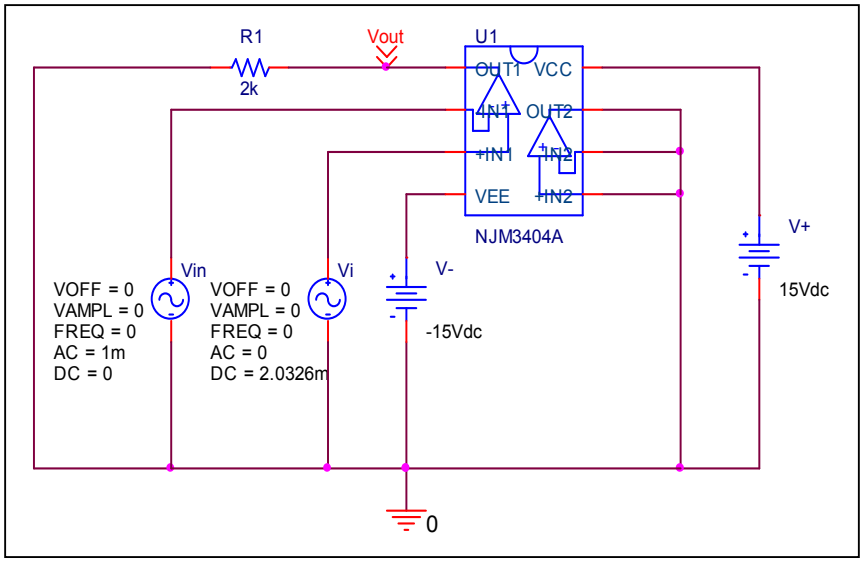
	Measurement	Simulation	%Error
Ib (nA)	70	70.010	0.014
Ibos (nA)	5	5.1327	2.654

Open Loop Voltage Gain vs. Frequency

Simulation result



Evaluation circuit

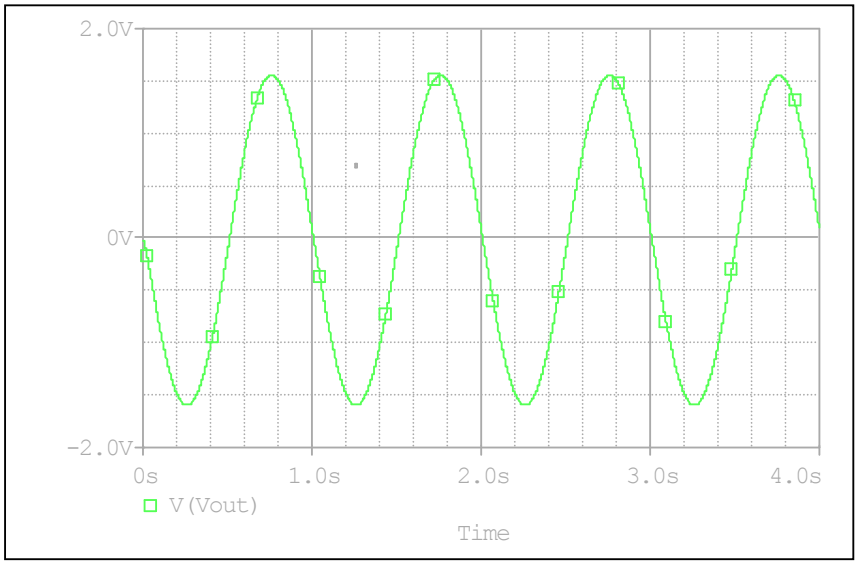


Comparison table

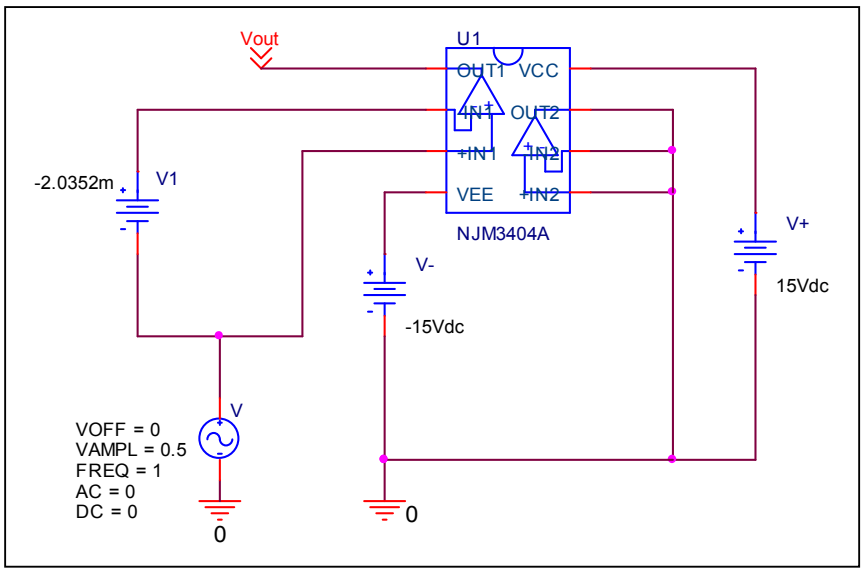
	Measurement	Simulation	%Error
f-0dB(MHz)	1.2	1.2046	0.383
Av-dc	100	100.053	0.053

Common-Mode Rejection Voltage gain

Simulation result



Evaluation circuit



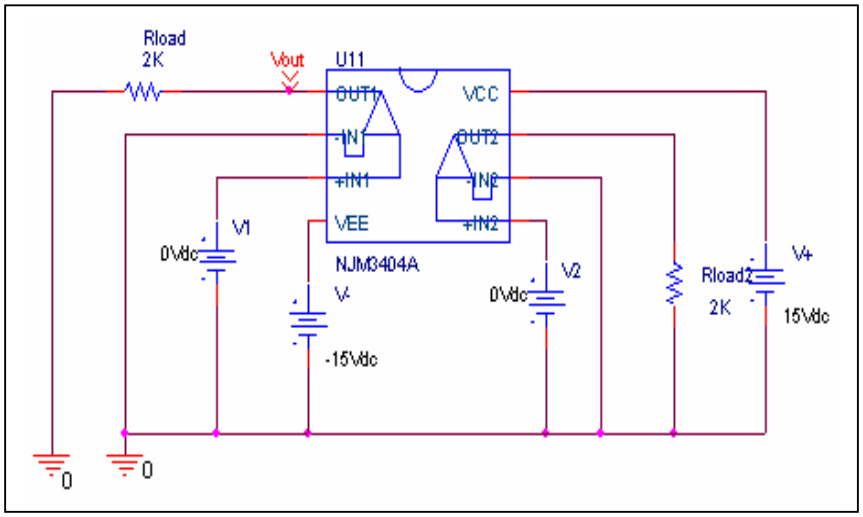
CMRR=20*LOG(100612.05/3.1545) = 90.074dB

Comparison table

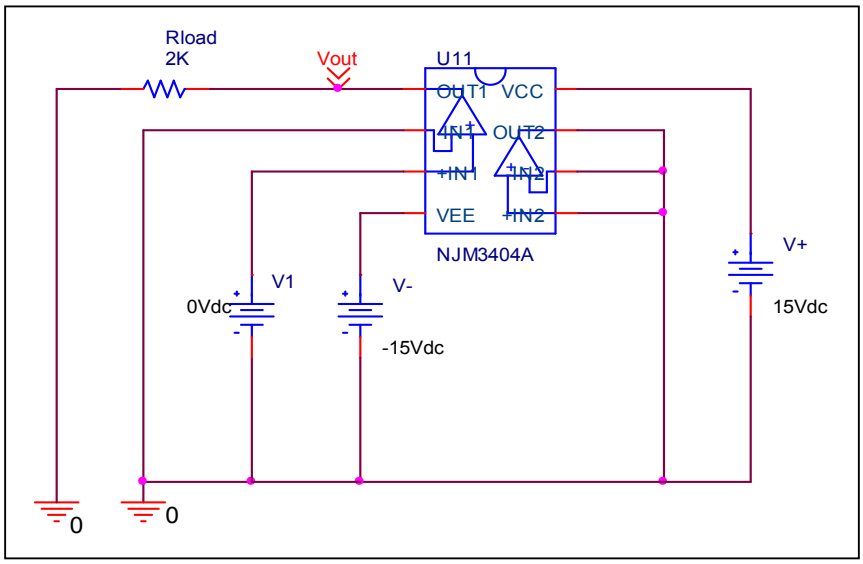
	Measurement	Simulation	%Error
CMRR(dB)	90	90.074	0.082

Remark Output Voltage Swing

Before

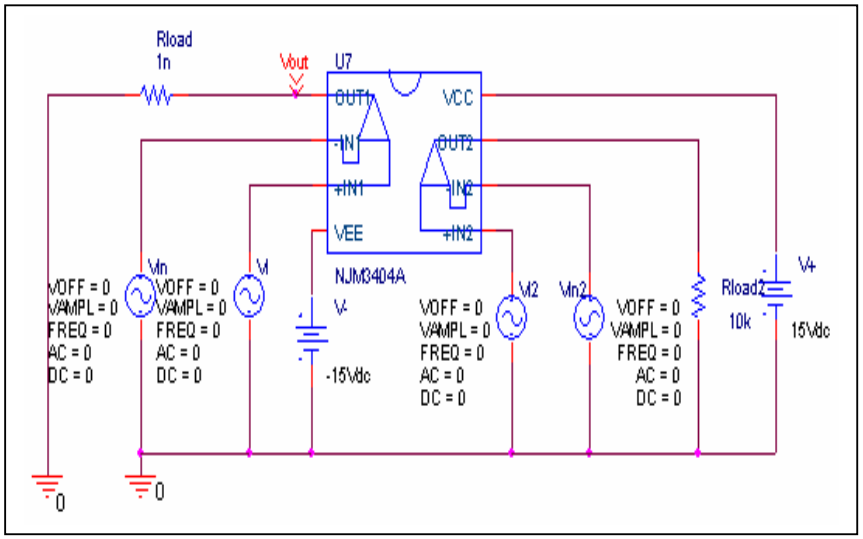


After

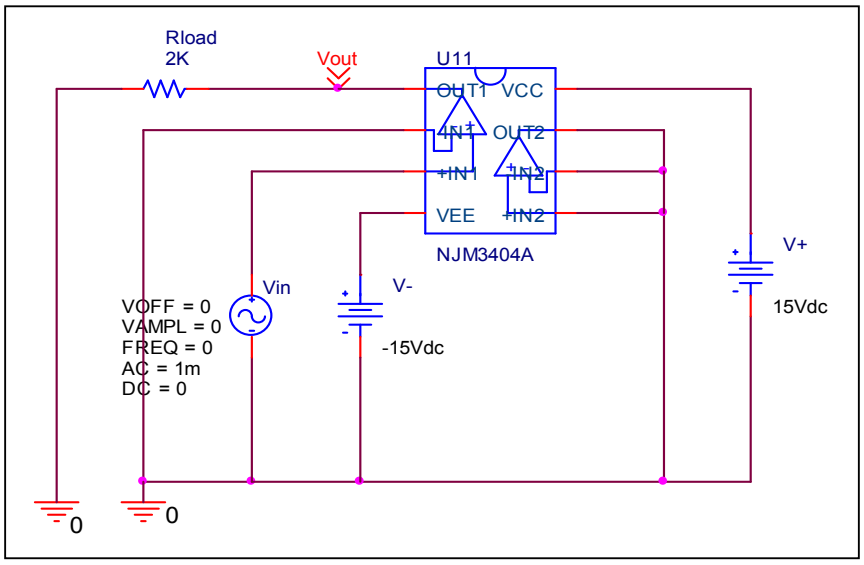


Remark Input Offset Voltage

Before

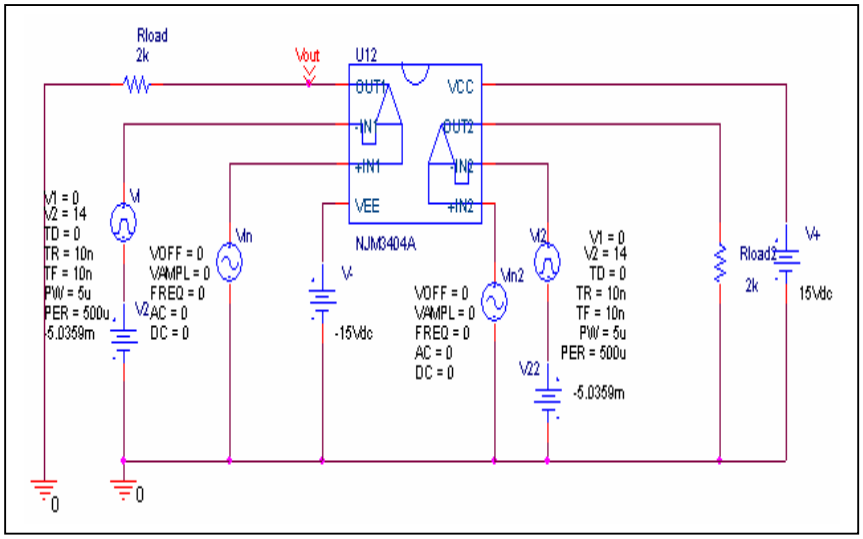


After

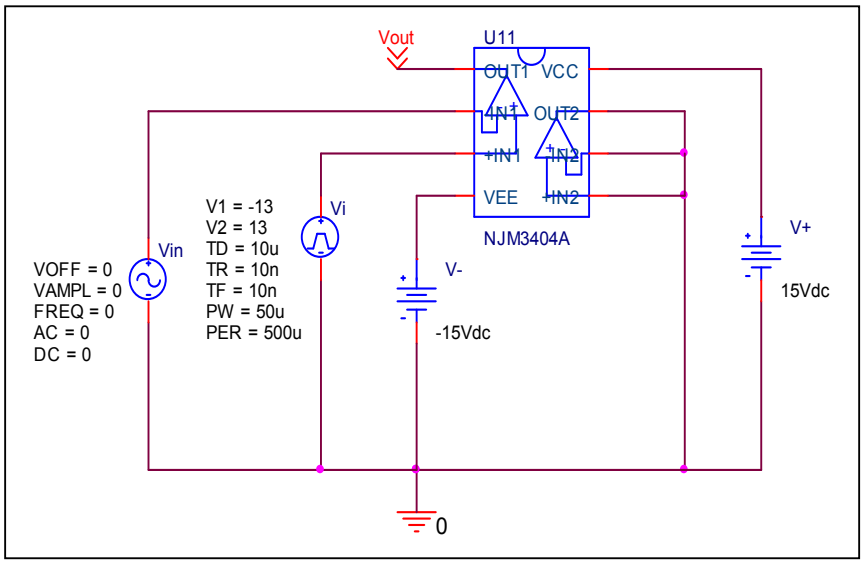


Remark Slew Rate

Before

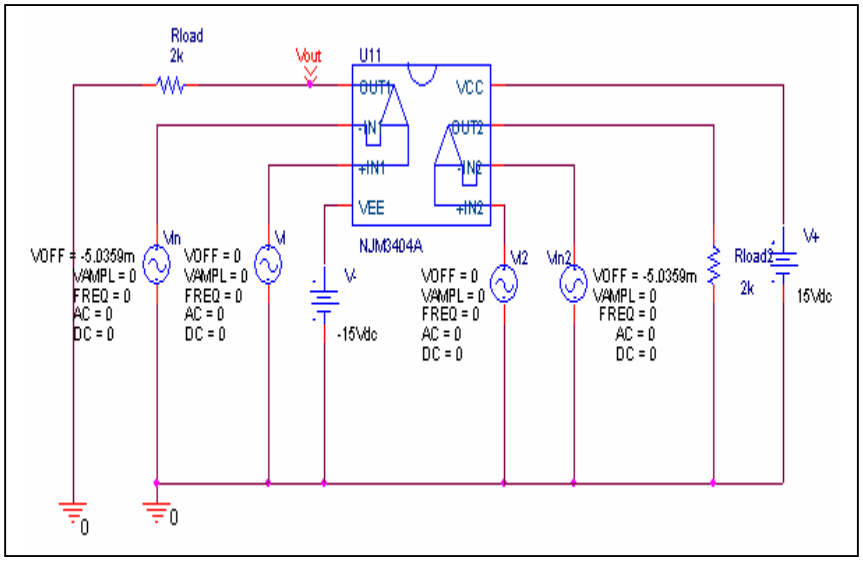


After

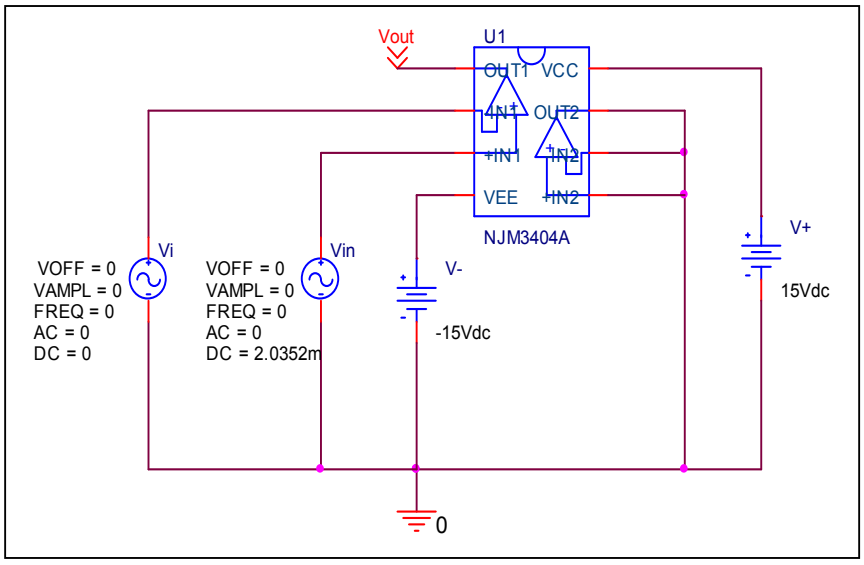


Remark Input current

Before

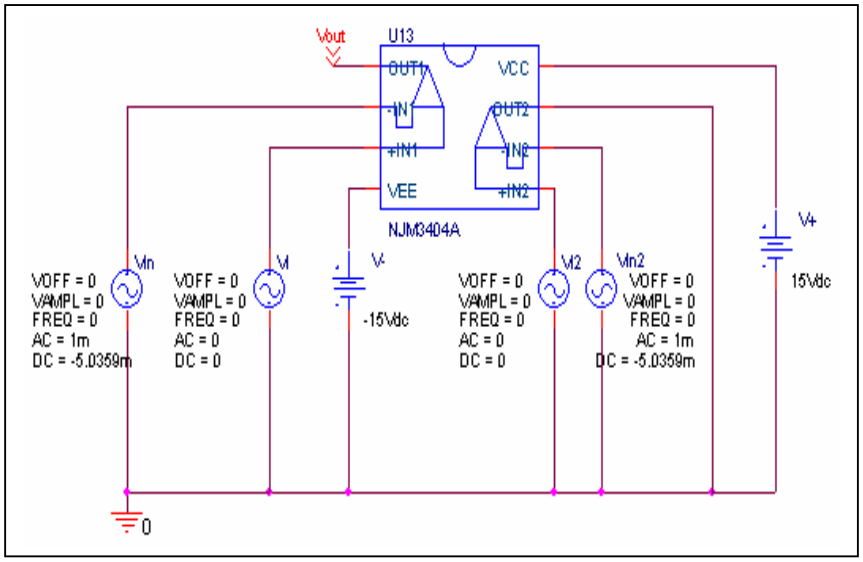


After

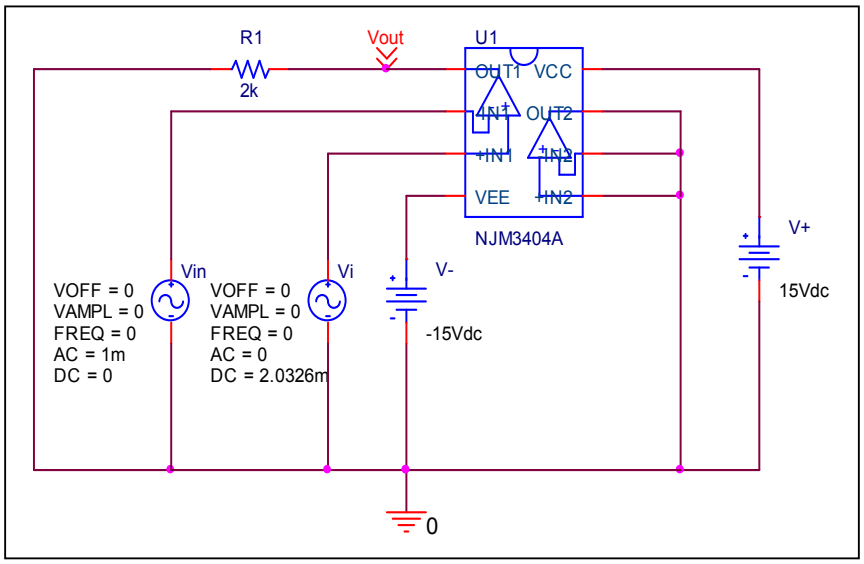


Remark Open Loop Voltage Gain vs. Frequency

Before

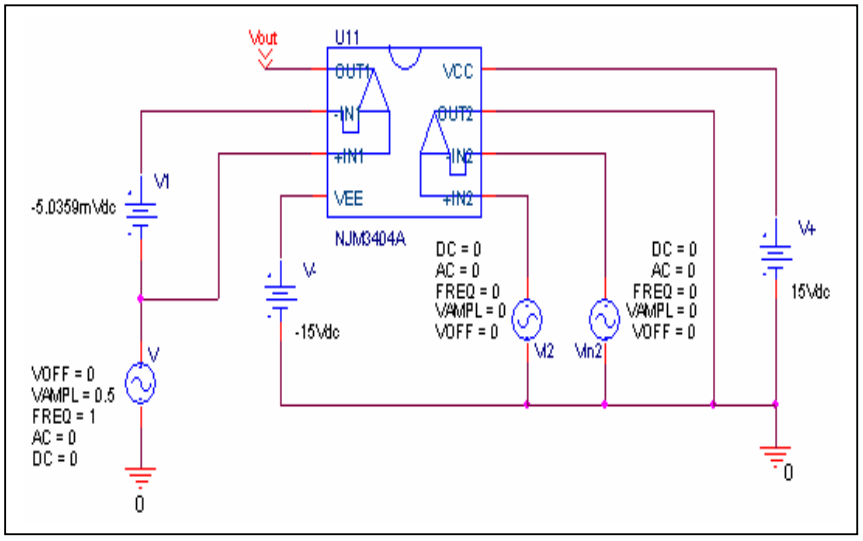


After



Remark Common-Mode Rejection Voltage gain

Before



After