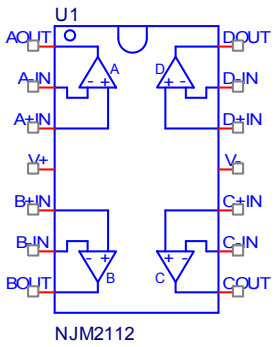
Device Modeling Report

COMPONENTS: OPERATIONAL AMPLIFIER
PART NUMBER:NJM2112
MANUFACTURER: NEW JAPAN RADIO CO.,LTD

Bee Technologies Inc.

Spice Model




```
*$
* PART NUMBER:NJM2112
* MANUFACTURER: NEW JAPAN RADIO
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.Subckt NJM2112 OUT1 -IN1 +IN1 V+ +IN2 -IN2 OUT2 OUT3 -IN3 +IN3 V-
+ +IN4 -IN4 OUT4
X_U1     +IN1 -IN1 V+ V- OUT1 NJM2112_S
X_U2     +IN2 -IN2 V+ V- OUT2 NJM2112_S
X_U3     +IN3 -IN3 V+ V- OUT3 NJM2112_S
X_U4     +IN4 -IN4 V+ V- OUT4 NJM2112_S
.ends  NJM2112
.subckt NJM2112_S  1 2 3 4 5
  c1   11 12 8.6603E-12
  c2    6  7 29.500E-12
  cee  10 99 1.0000E-30
  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 0 187.00E3 -1E3 1E3 190E3 -190E3
  ga    6  0 11 12 2.4968E-3
  gcm   0  6 10 99 431.78E-9
  iee   3 10 dc 99.202E-6
  hlim 90  0 vlim 1K
  q1   11  2 13 qx1
  q2   12  1 14 qx2
  r2    6  9 100.00E3
  rc1   4 11 400.52
  rc2   4 12 400.52
  re1  13 10 1
  re2  14 10 1
  ree  10 99 2.0161E6
  ro1   8  5 50
  ro2   7 99 25
  rp    3  4 125.31
  vb    9  0 dc 0
  vc    3 53 dc 1.0309
```
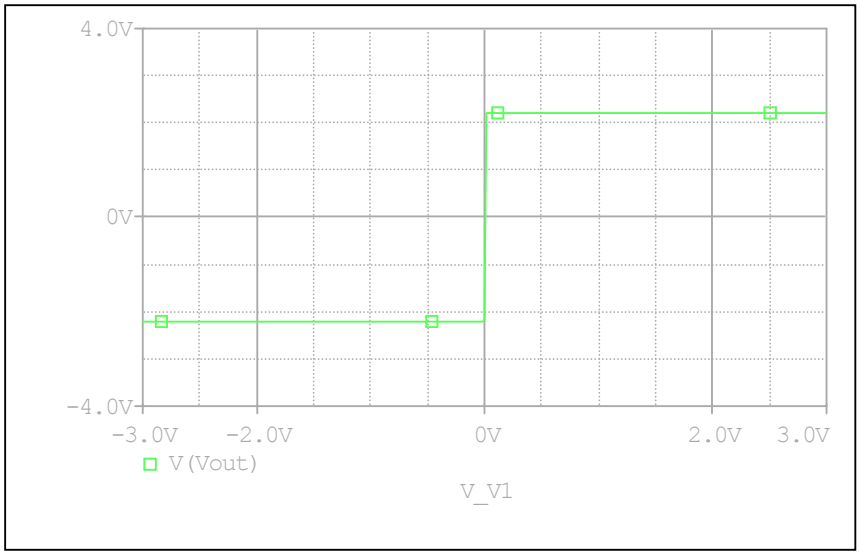
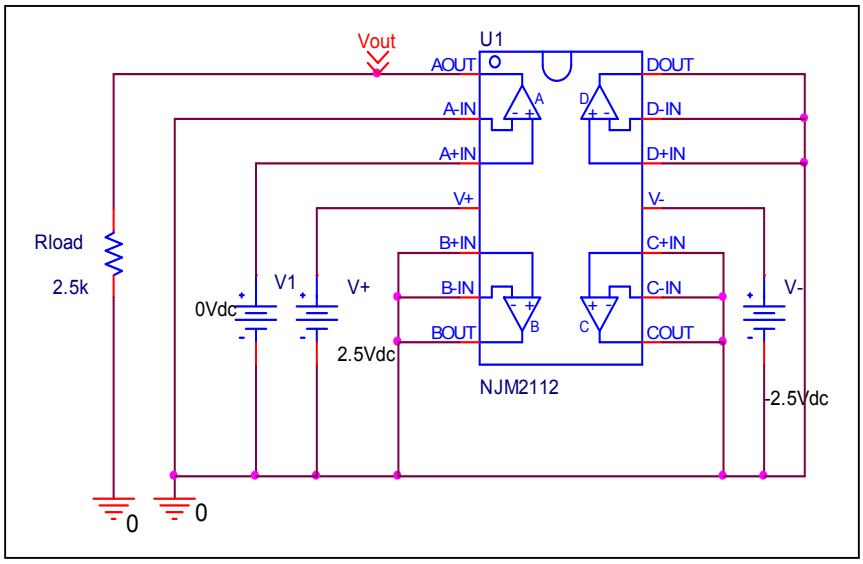

```
  ve   54  4 dc 1.0309
  vlim  7  8 dc 0
  vlp  91  0 dc 1.5000
  vln   0 92 dc 1.5000
.model dx D(Is=800.00E-18)
.model dy D(Is=800.00E-18 Rs=1m Cjo=10p)
.model qx1 PNP(Is=800.00E-18 Bf=463.27)
.model qx2 PNP(Is=828.3277E-18 Bf=520.23)
.ends
*$
```

Output Voltage Swing

Simulation result



Evaluation circuit

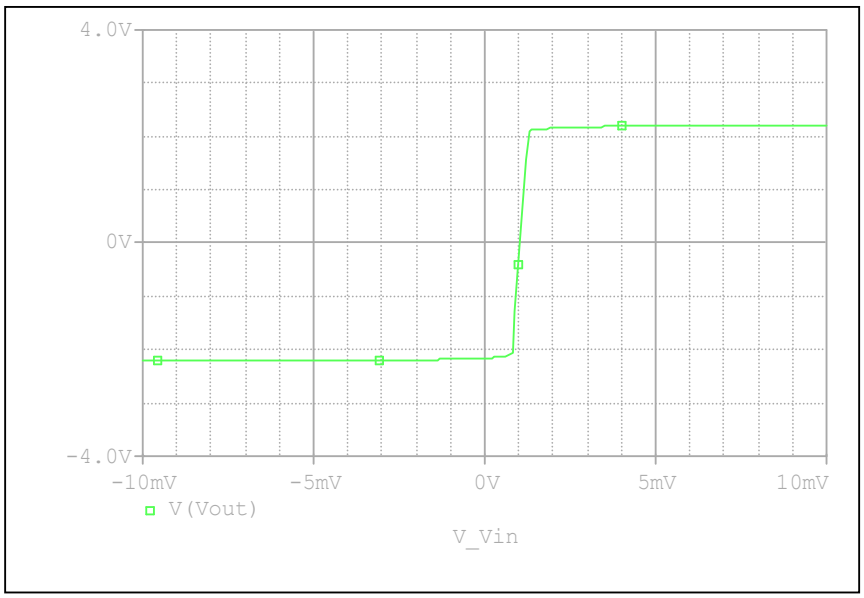


Comparison table

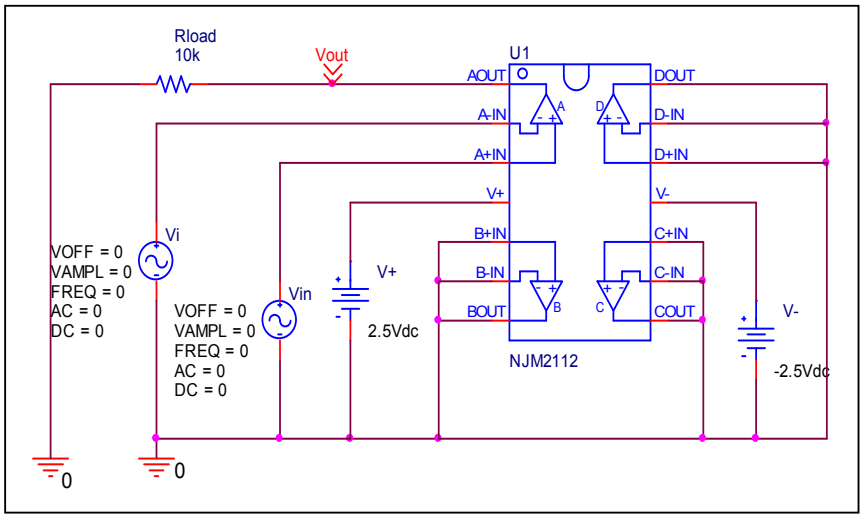
Output Voltage Swing	Measurement	Simulation	%Error
V+	+2.2	+2.1959	-0.186
V-	-2.2	-2.1959	-0.186

Input Offset Voltage

Simulation result



Evaluation circuit

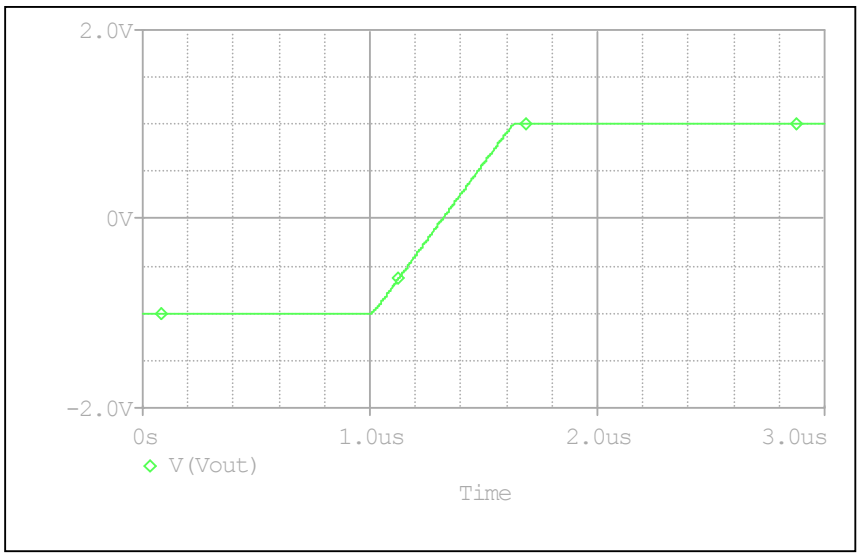


Comparison table

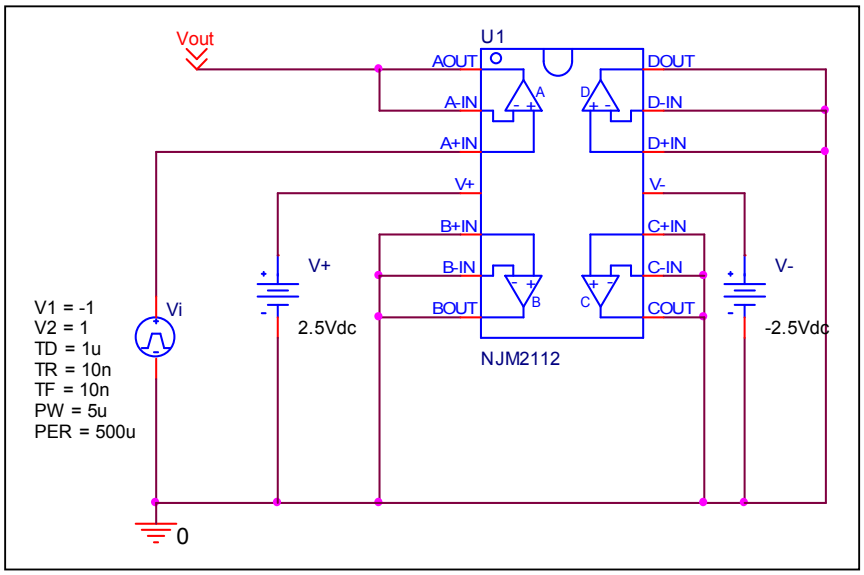
	Measurement	Simulation	%Error
Vos (mV)	1	1.0458	4.58

Slew Rate

Simulation result



Evaluation circu

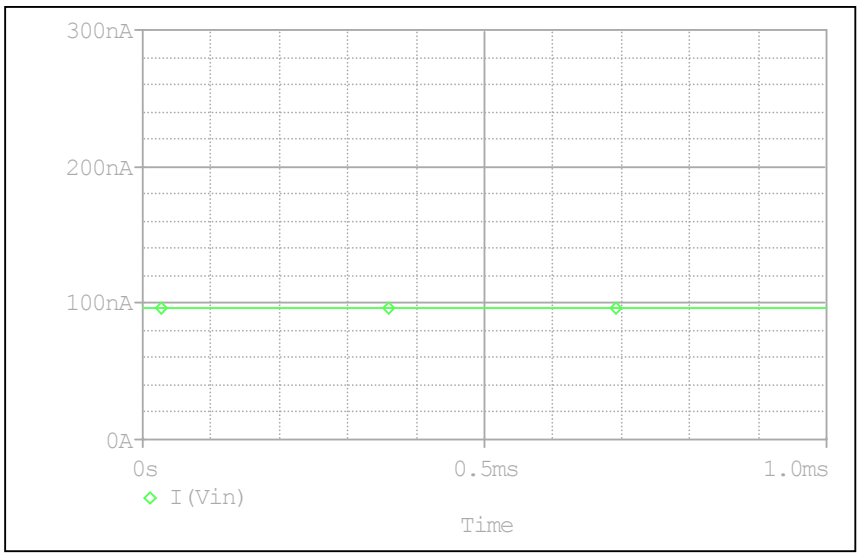


Comparison table

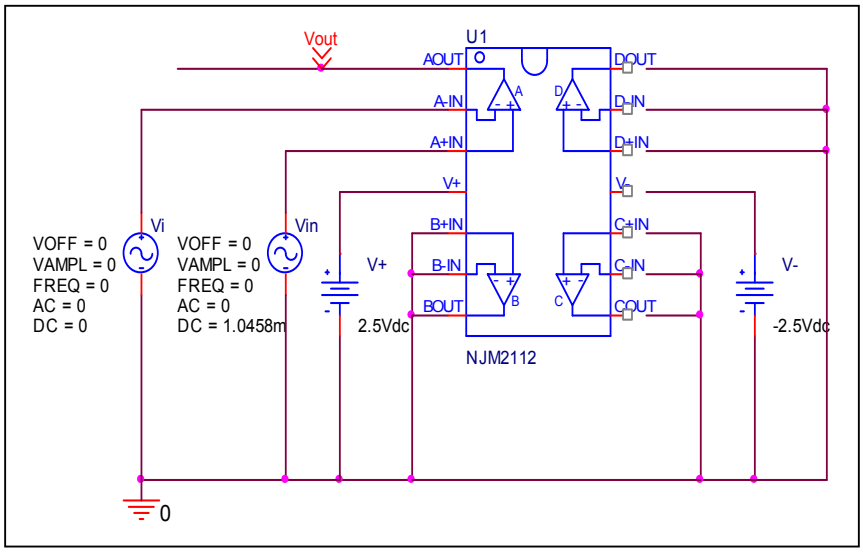
	Measurement	Simulation	%Error
Slew Rate(v/us)	3.2	3.286	2.688

Input current

Simulation result



Evaluation circuit

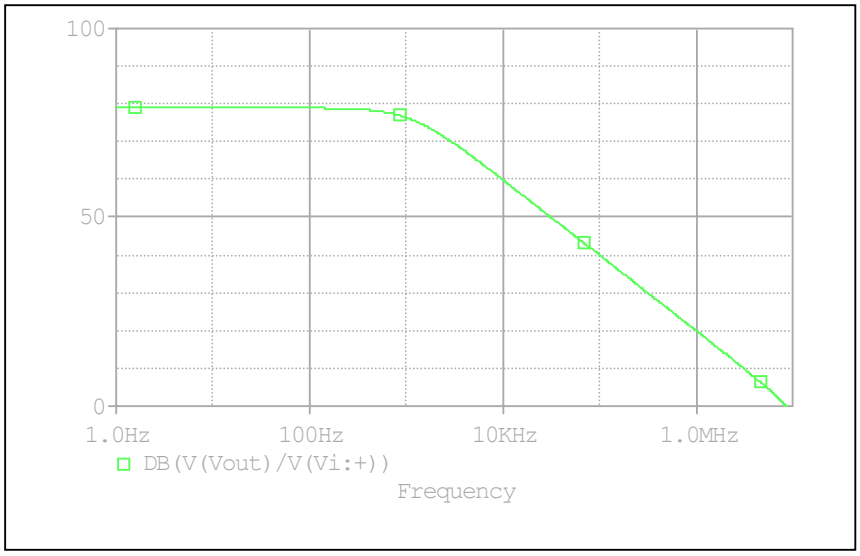


Comparison table

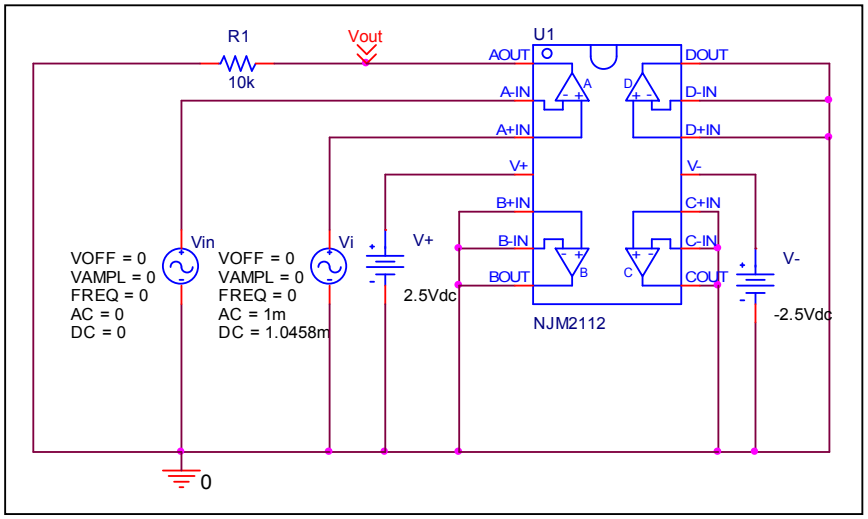
	Measurement	Simulation	%Error
Ib(nA)	100	96.489	-3.511

Open Loop Voltage Gain vs. Frequency

Simulation result



Evaluation circuit

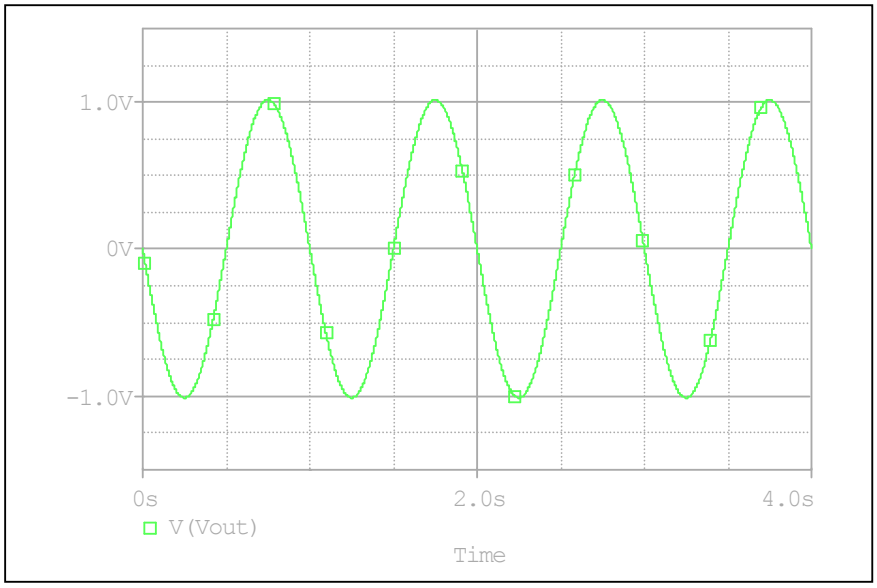


Comparison table

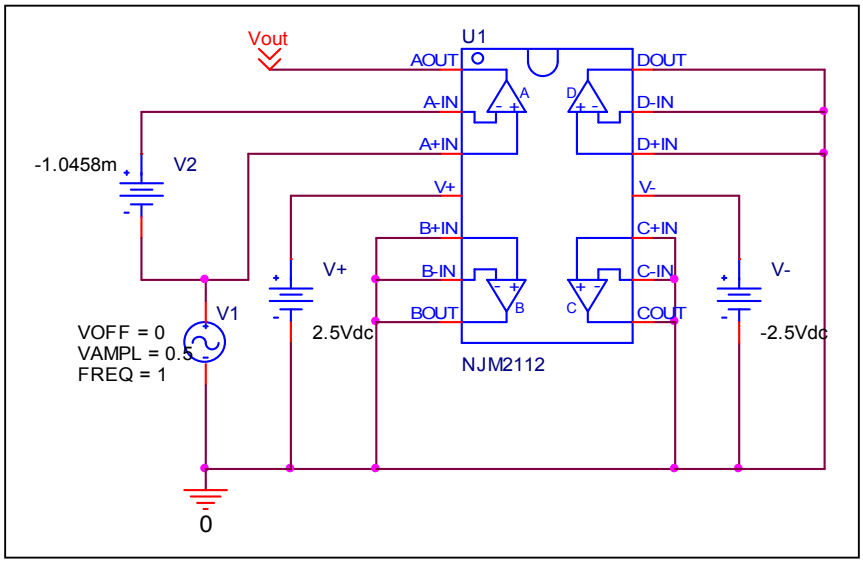
	Measurement	Simulation	%Error
f-0dB(MHz)	9	8.6837	-3.514
Av-dc	80	78.924	-1.345

Common-Mode Rejection Voltage gain

Simulation result



Evaluation circuit



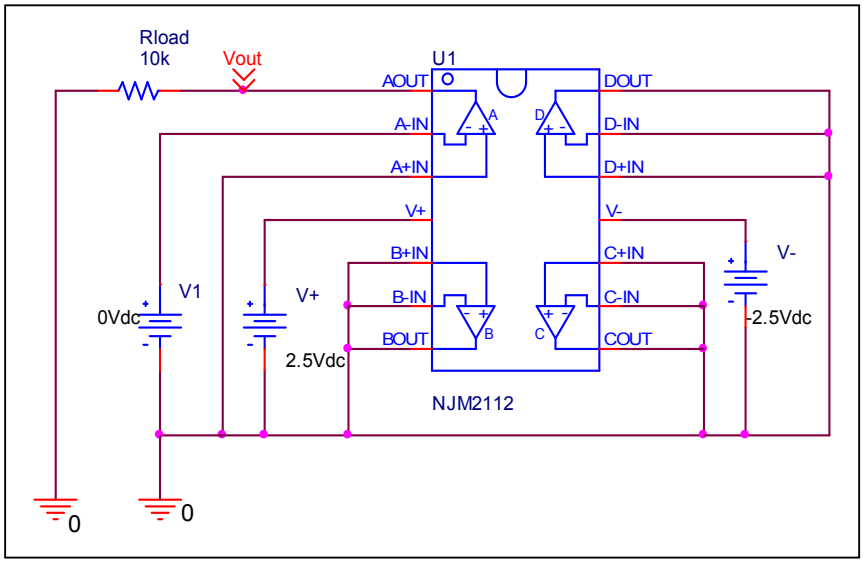
CMRR=20*LOG(8834.867/2.0248) = 72.796 dB

Comparison table

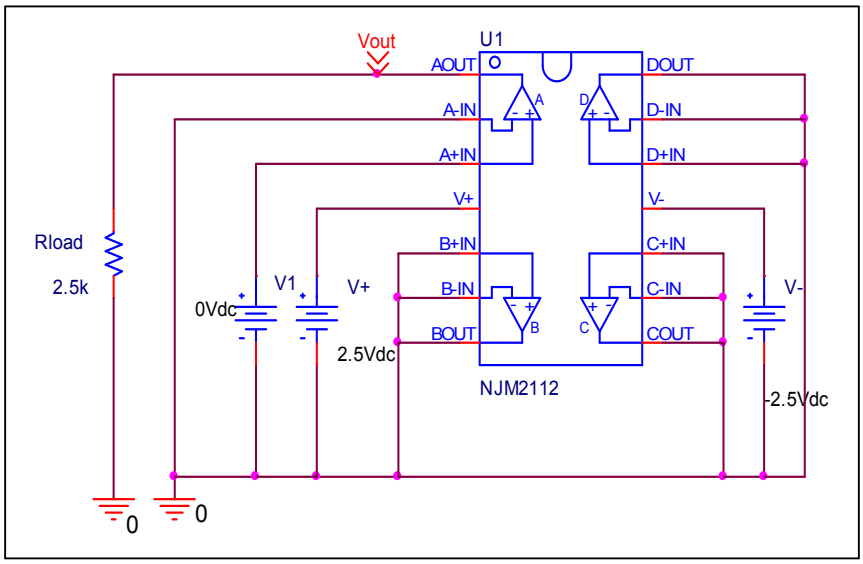
	Measurement	Simulation	%Error
CMRR(dB)	74	72.796	-1.627

Remark Output Voltage Swing

Before

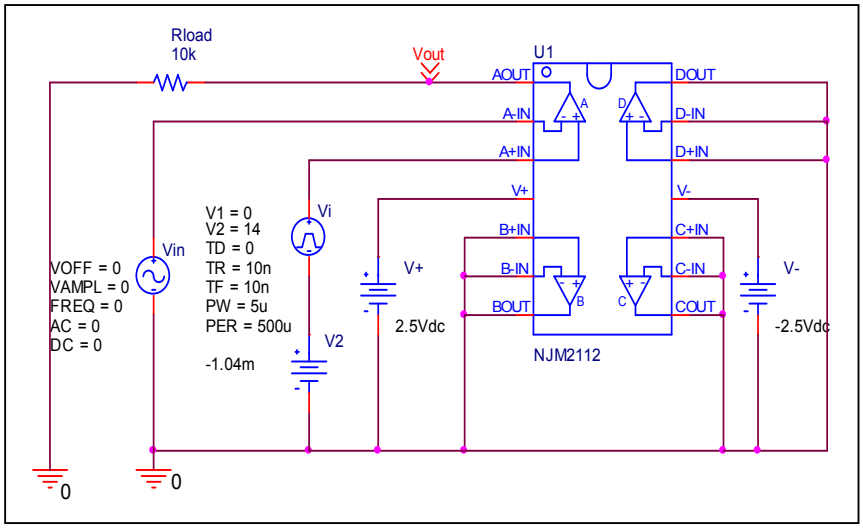


After

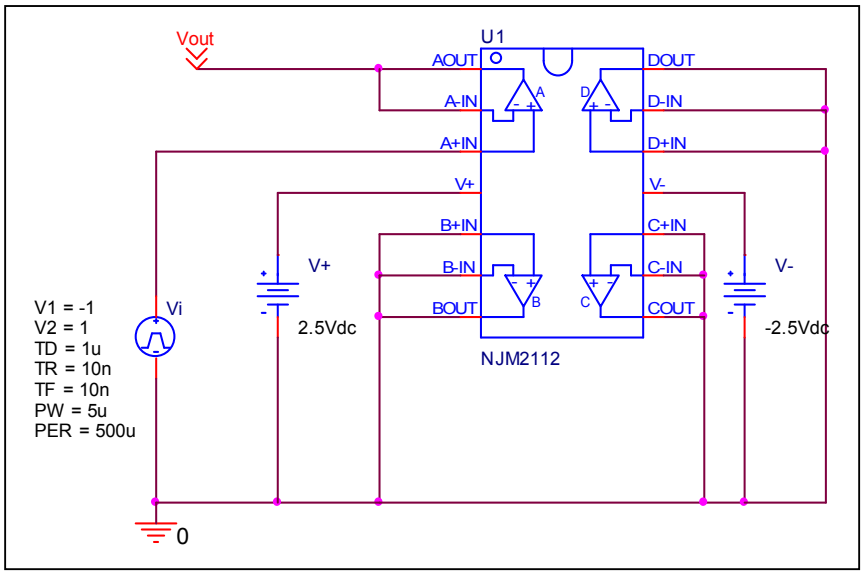


Remark Slew Rate

Before

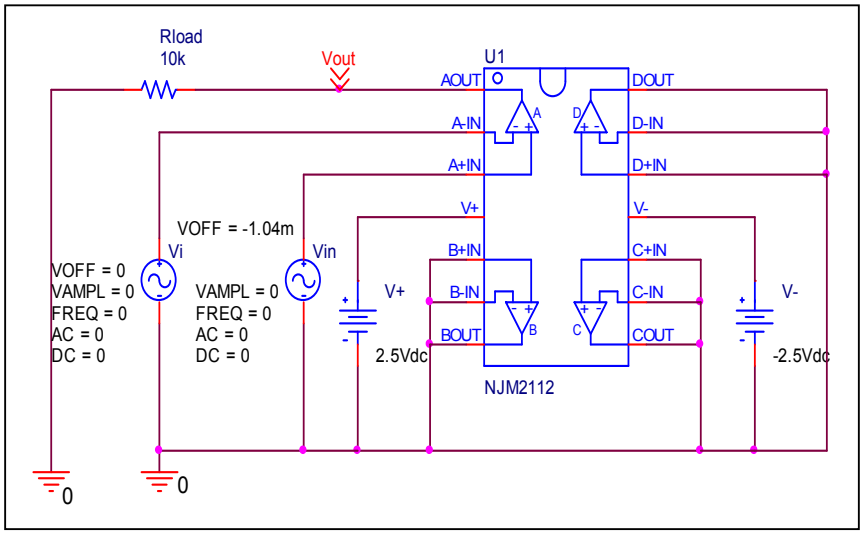


After

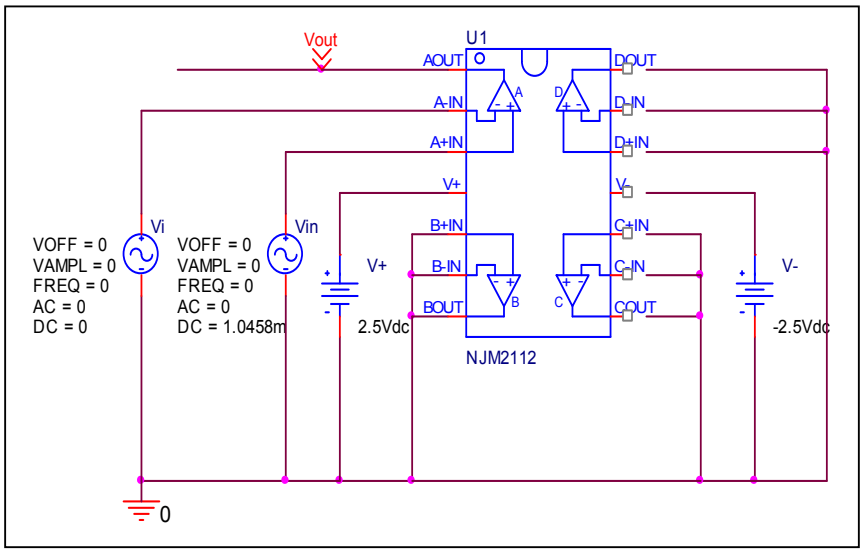


Remark Input current

Before

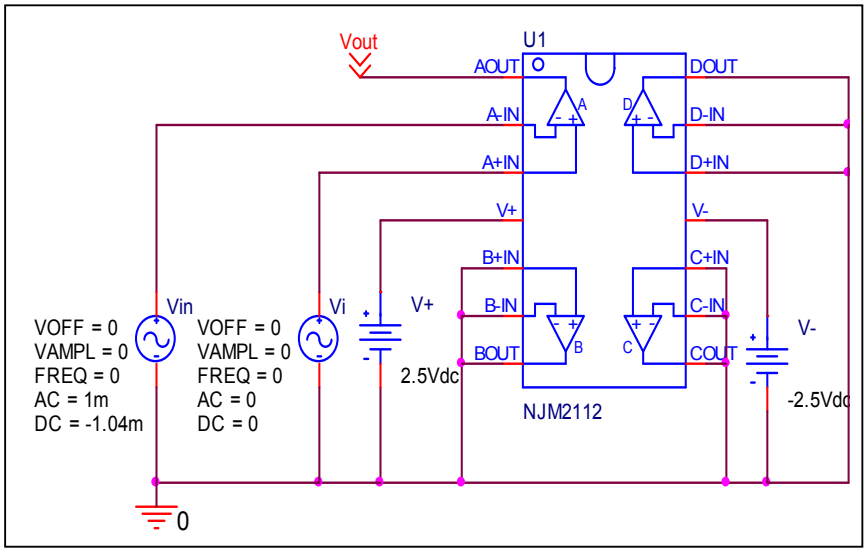


After

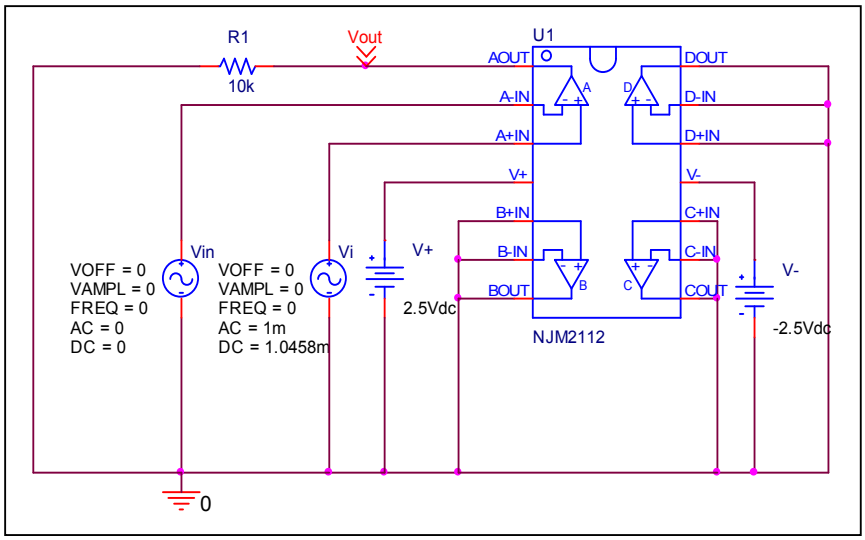


Remark Open Loop Voltage Gain vs. Frequency

Before

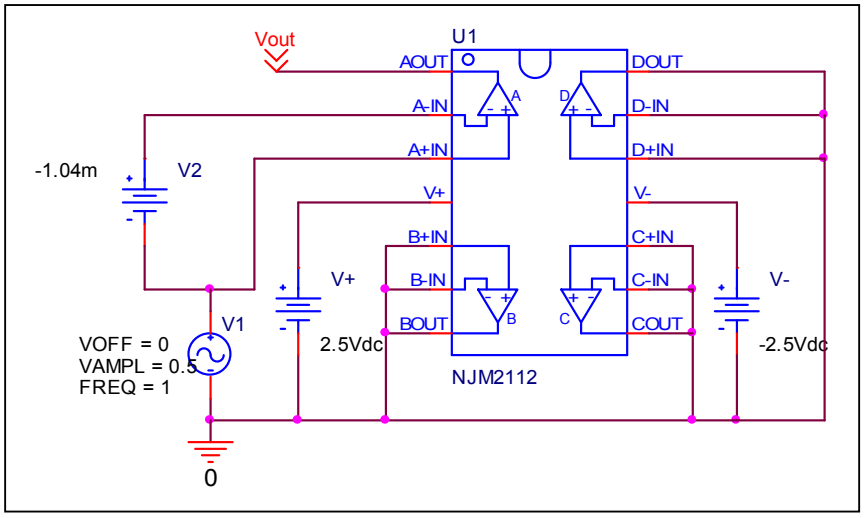


After



Remark Common-Mode Rejection Voltage gain

Before



After