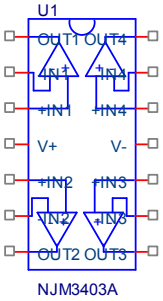
Device Modeling Report

COMPONENTS:MOSFET: OPERATIONAL AMPLIFIER
PART NUMBER:NJM3403A
MANUFACTURER: NEW JAPAN RADIO CO.,LTD

Bee Technologies Inc.

Spice Model

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*$
* PART NUMBER:NJM3403A
* MANUFACTURER: NEW JAPAN RADIO
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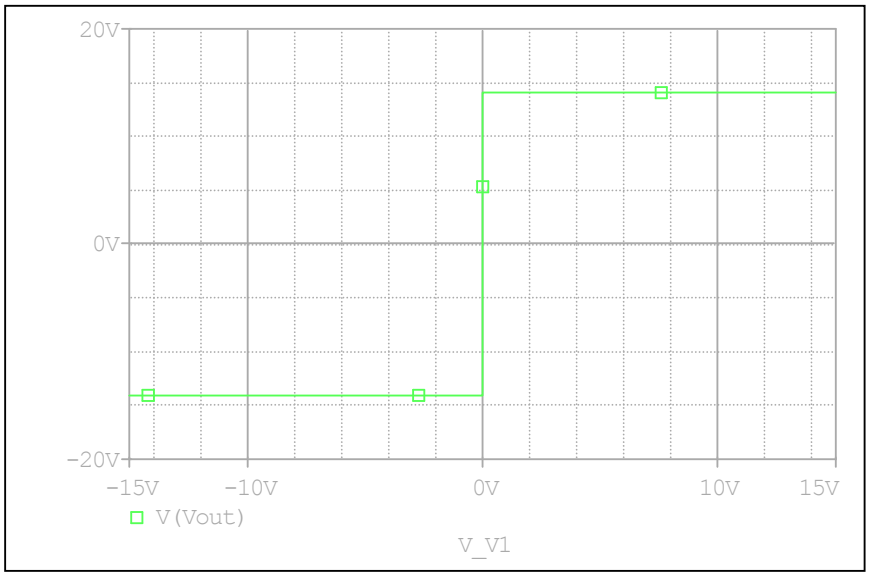
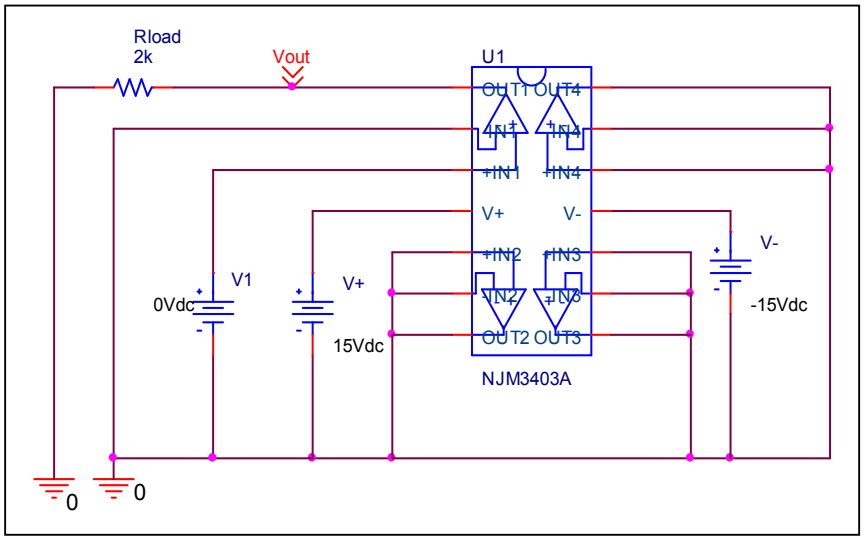
.Subckt NJM3403A OUT1 -IN1 +IN1 V+ +IN2 -IN2 OUT2 OUT3 -IN3 +IN3 V-
+ +IN4 -IN4 OUT4
X_U1     +IN1 -IN1 V+ V- OUT1 NJM3403A_SUB
X_U2     +IN2 -IN2 V+ V- OUT2 NJM3403A_SUB
X_U3     +IN3 -IN3 V+ V- OUT3 NJM3403A_SUB
X_U4     +IN4 -IN4 V+ V- OUT4 NJM3403A_SUB
.ends  NJM3403A
.subckt NJM3403A_SUB 1 2 3 4 5
  c1   11 12 8.6603E-12
  c2    6  7 30.000E-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 15.388E6 -1E3 1E3 15E6 -15E6
  ga    6  0 11 12 259.94E-6
  gcm   0  6 10 99 8.2198E-9
  iee   3 10 dc 36.591E-6
  hlim 90  0 vlim 1K
  q1   11  2 13 qx1
  q2   12  1 14 qx2
  r2    6  9 100.00E3
  rc1   4 11 3.8471E3
  rc2   4 12 3.8471E3
  re1  13 10 2.4186E3
  re2  14 10 2.4186E3
  ree  10 99 5.4658E6
  ro1   8  5 50
  ro2   7 99 25
  rp    3  4 1.8040E3
  vb    9  0 dc 0
  vc    3 53 dc 1.8037
  ve   54  4 dc 1.8037
  vlim  7  8 dc 0
  vlp  91  0 dc 25
  vln   0 92 dc 25
.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=249.66)
.model qx2 PNP(Is=864.3162E-18 Bf=268.01)
.ends
*$
```

Output Voltage Swing

Simulation result



Evaluation circuit

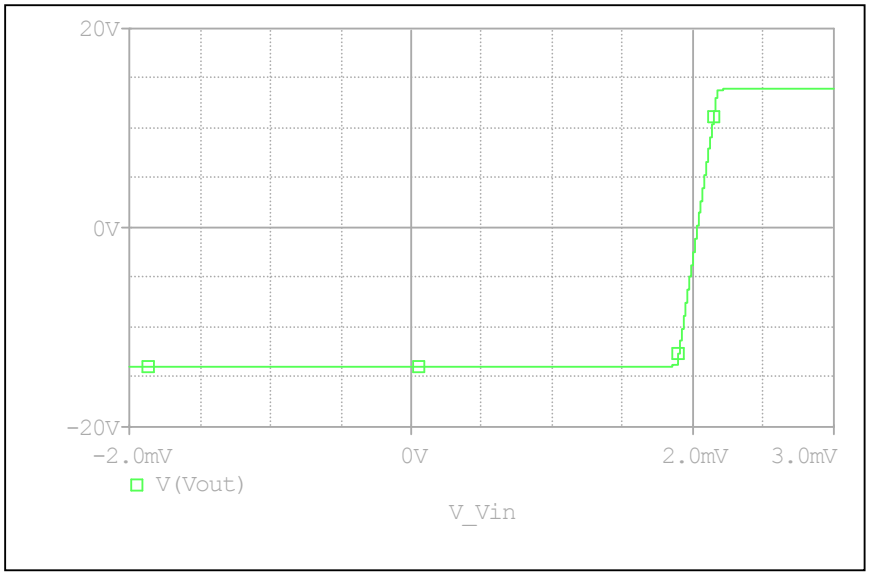


Comparison table

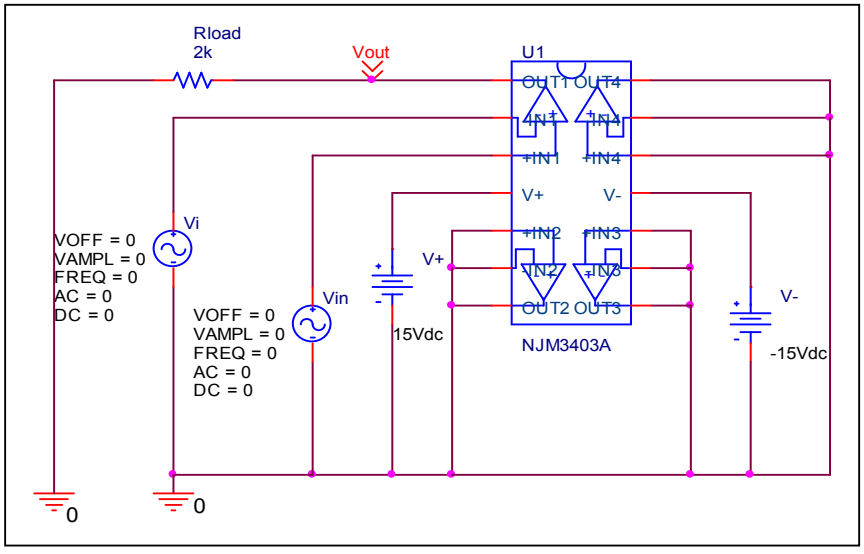
	Measurement	Simulation	%Error
+Vout(V)	+14	13.992	-0.057
-Vout(V)	-14	-13.992	-0.057

Input Offset Voltage

Simulation result



Evaluation circuit

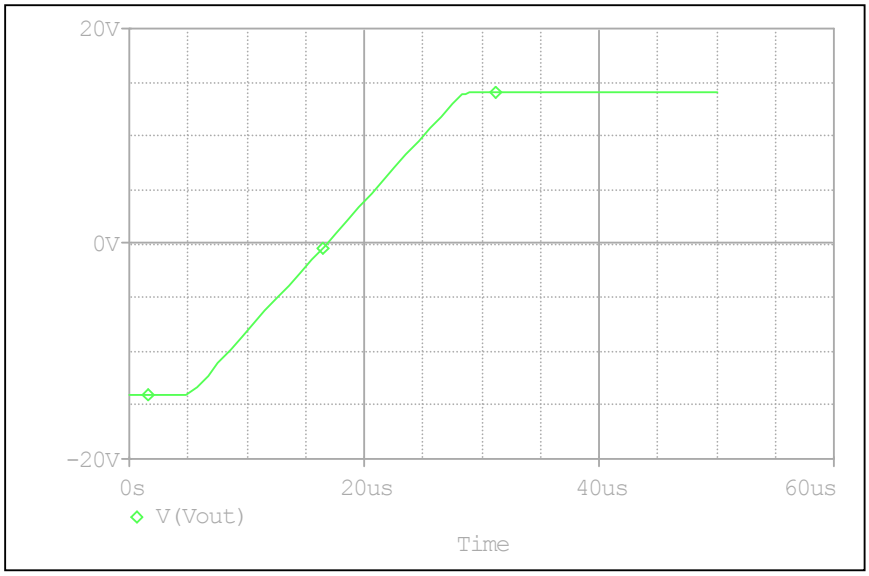


Comparison table

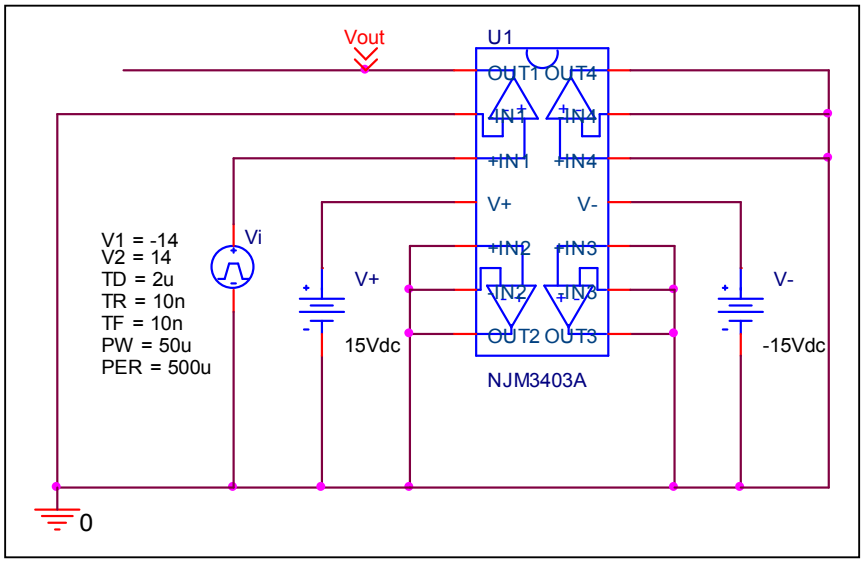
	Measurement	Simulation	%Error
Vos (mV)	2	2.0327	1.635

Slew Rate

Simulation result



Evaluation circuit

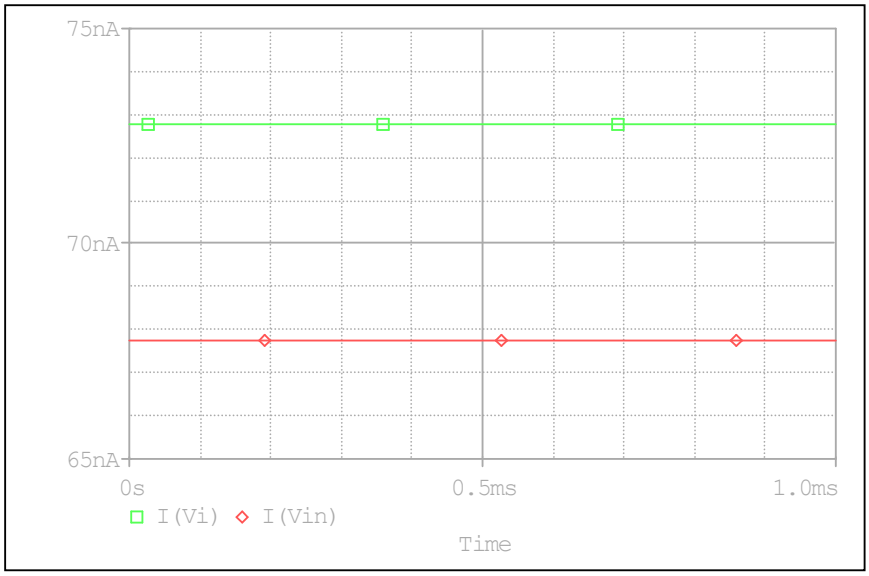


Comparison table

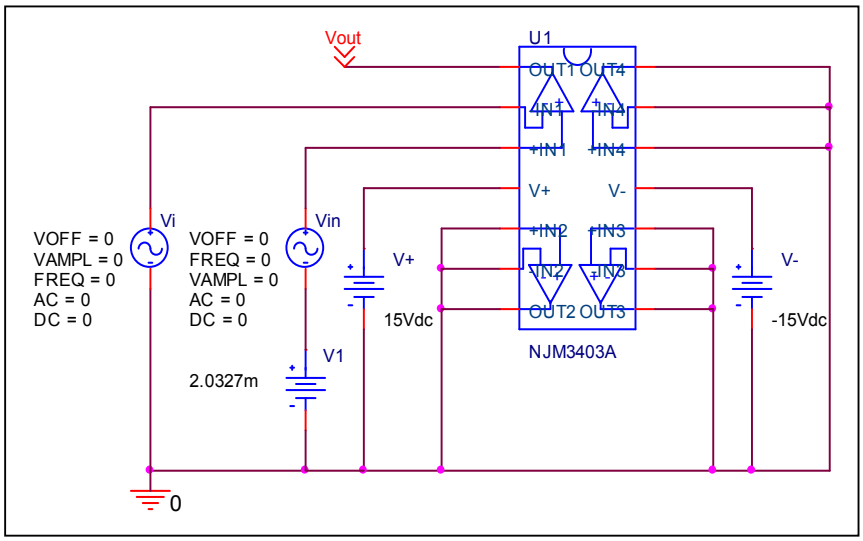
	Measurement	Simulation	%Error
Slew Rate(v/us)	1.2	1.21	0.833

Input current

Simulation result



Evaluation circuit

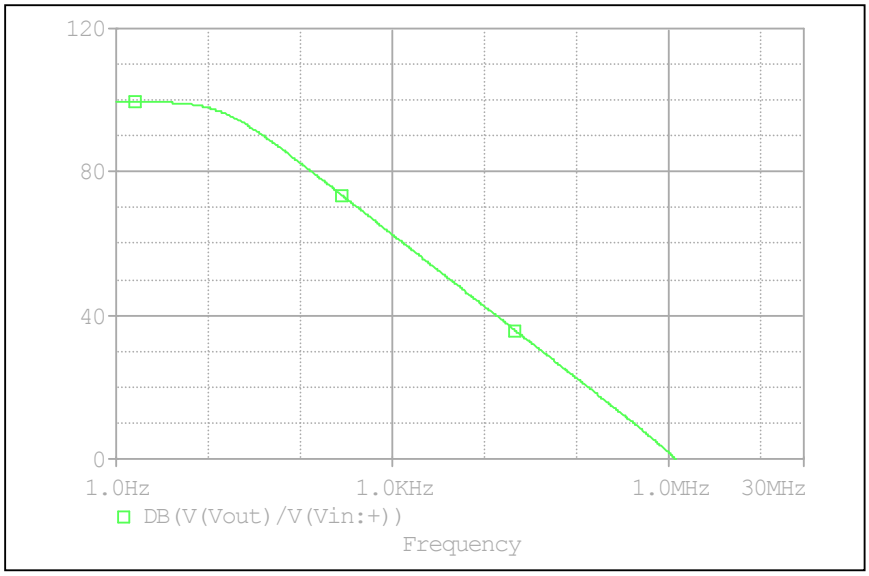


Comparison table

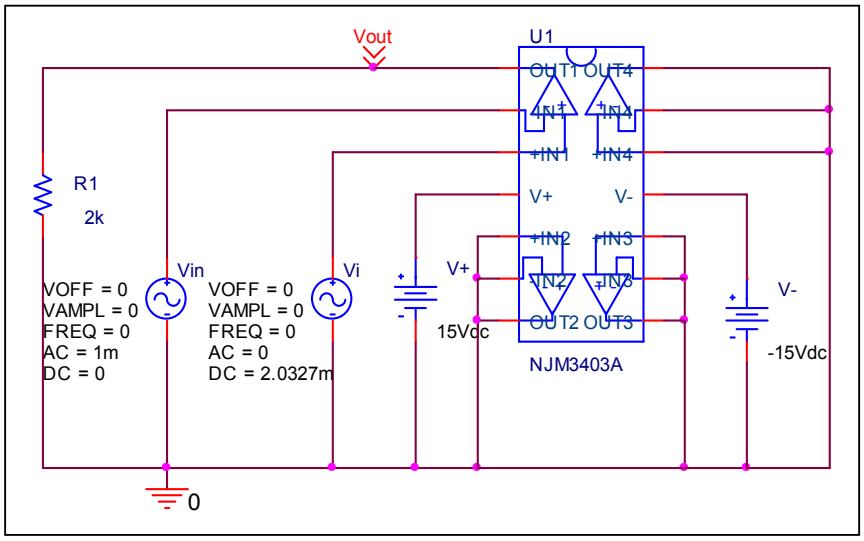
	Measurement	Simulation	%Error
Ib (nA)	70	70.253	0.361
Ibos (nA)	5	5.0023	0.046

Open Loop Voltage Gain vs. Frequency

Simulation result



Evaluation circuit

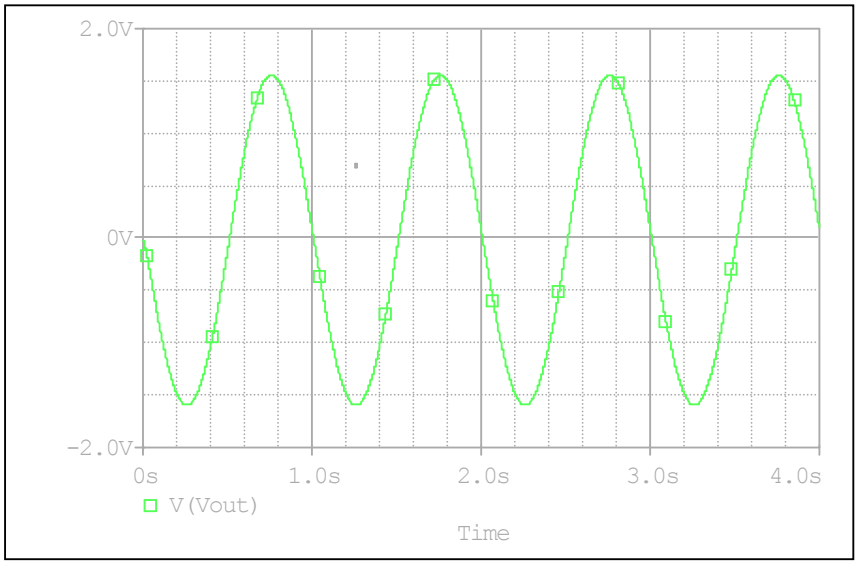


Comparison table

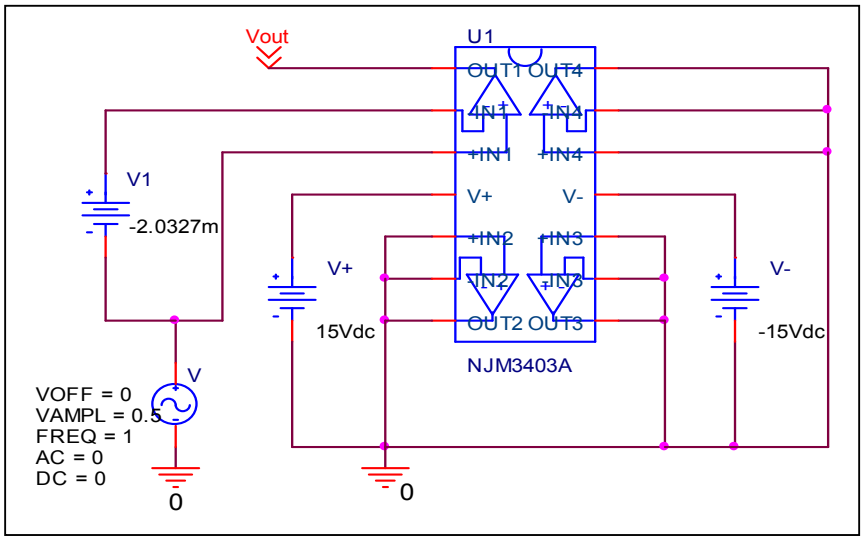
	Measurement	Simulation	%Error
f-0dB(MHz)	1.2	1.2005	0.042
Av-dc(dB)	100	99.647	-0.353

Common-Mode Rejection Voltage gain

Simulation result



Evaluation circuit



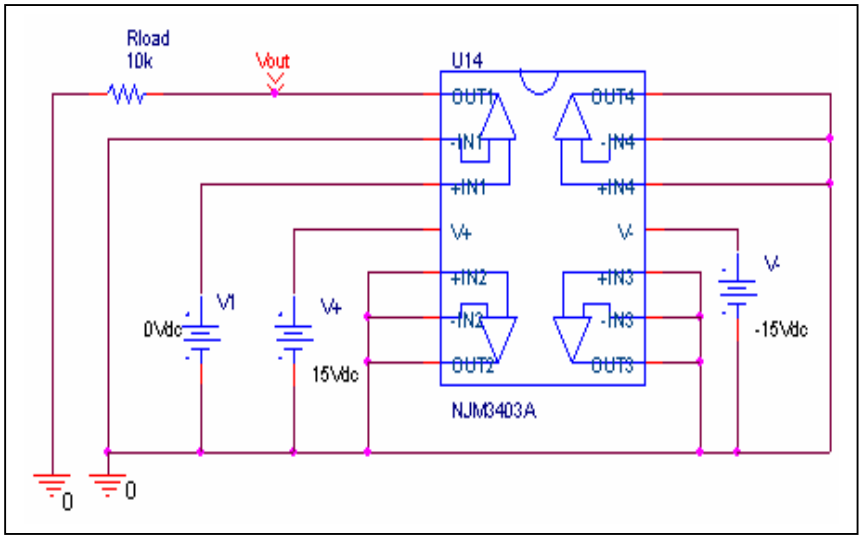
CMRR=20*LOG(96017.413/3.1506) = 89.679 dB

Comparison table

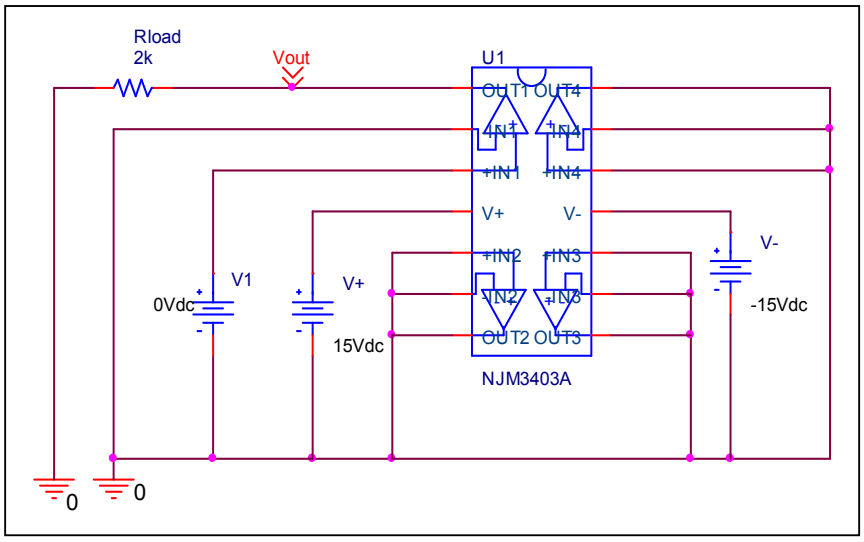
	Measurement	Simulation	%Error
CMRR(dB)	90	89.679	-0.357

Remark Output Voltage Swing

Before

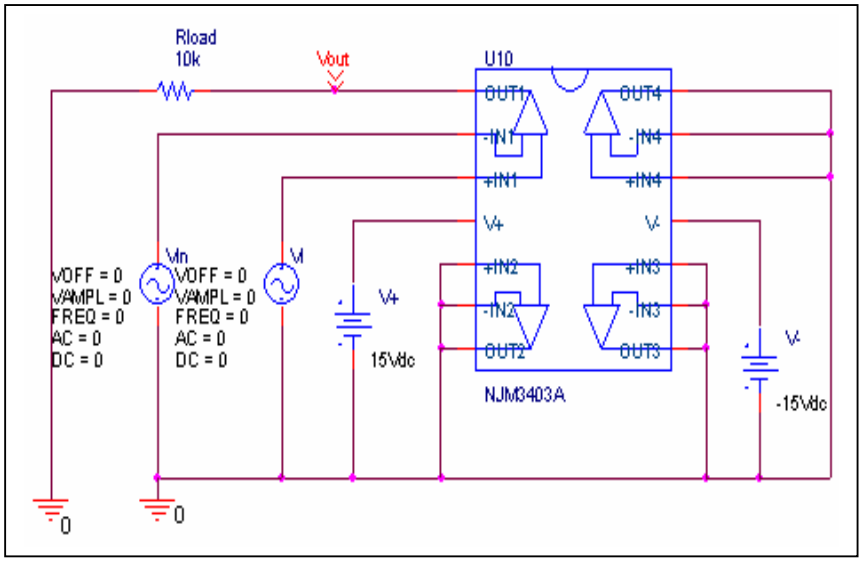


After

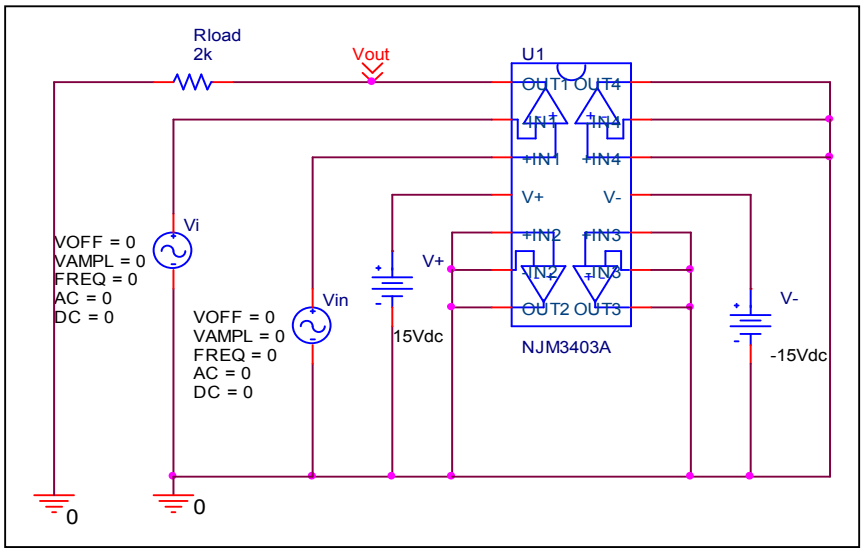


Remark Input Offset Voltage

Before

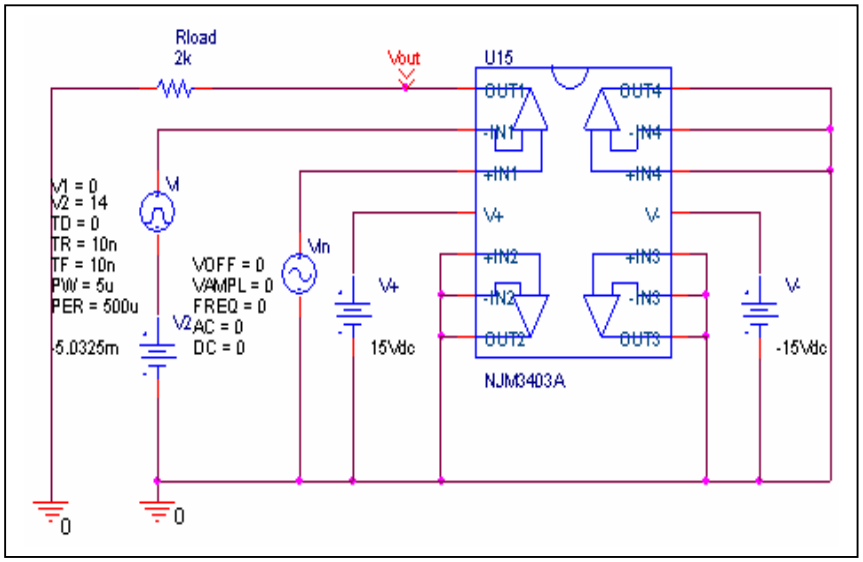


After

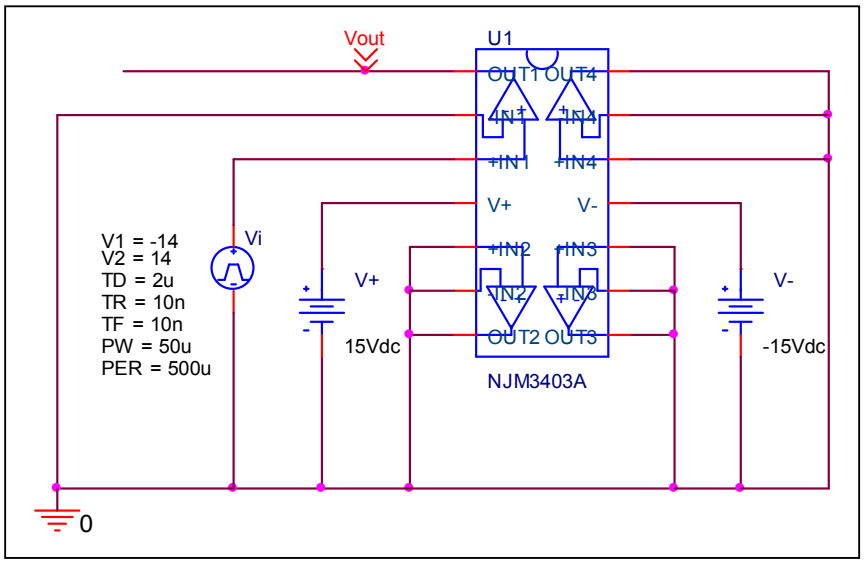


Remark Slew Rate

Before

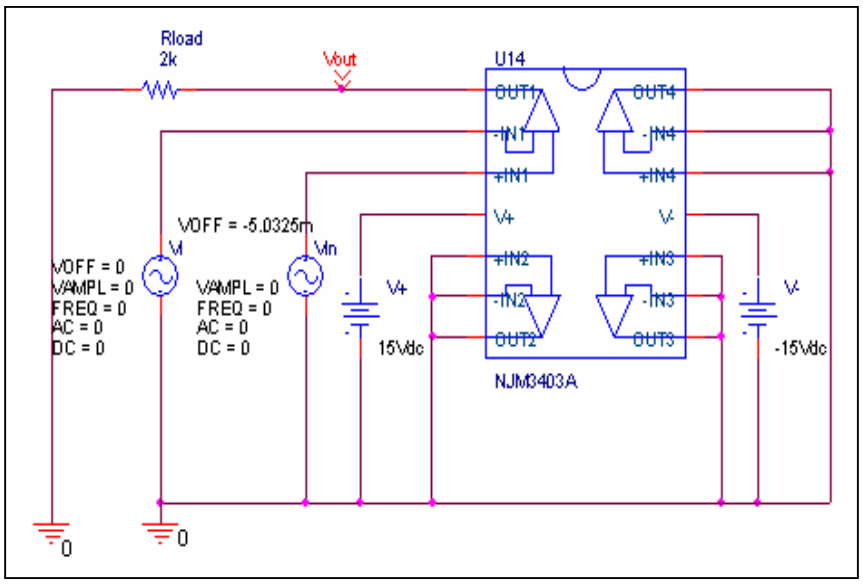


After

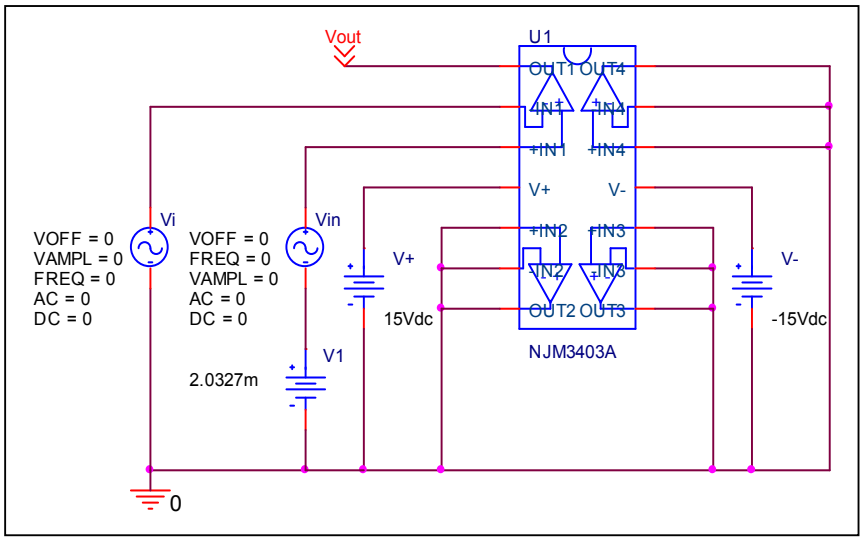


Remark Input current

Before

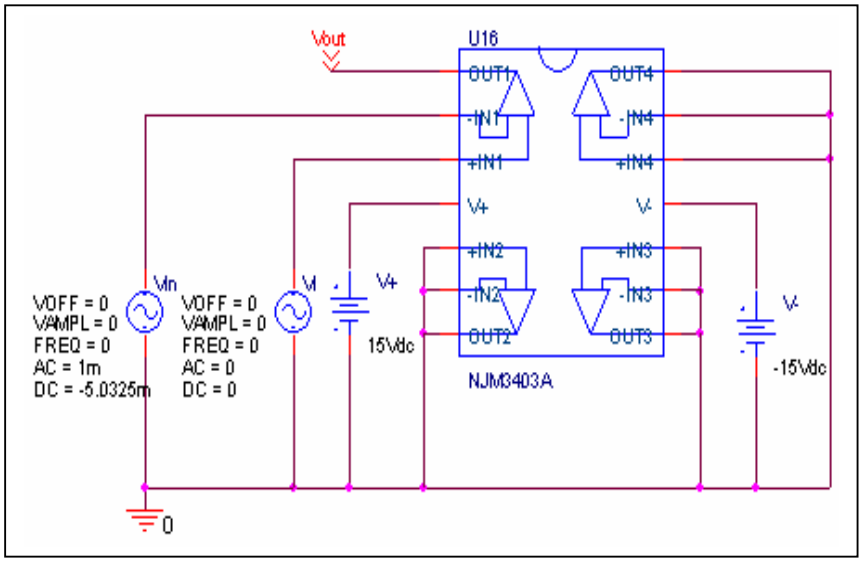


After

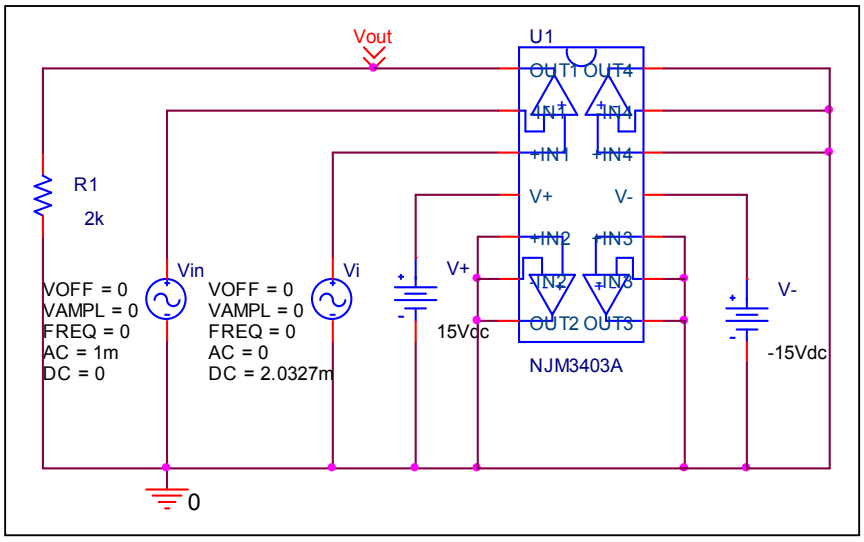


Remark Open Loop Voltage Gain vs. Frequency

Before

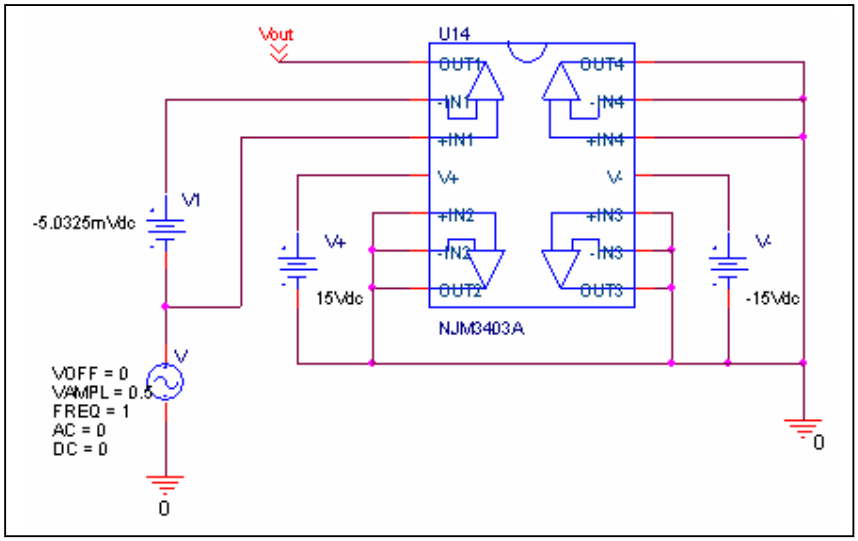


After



Remark Common-Mode Rejection Voltage gain

Before



After