

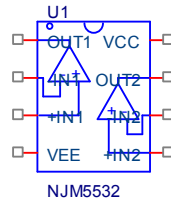
Device Modeling Report

COMPONENTS: OPERATIONAL AMPLIFIER
PART NUMBER: NJM5532
MANUFACTURER: NEW JAPAN RADIO CO.,LTD



Bee Technologies Inc.

Spice Model



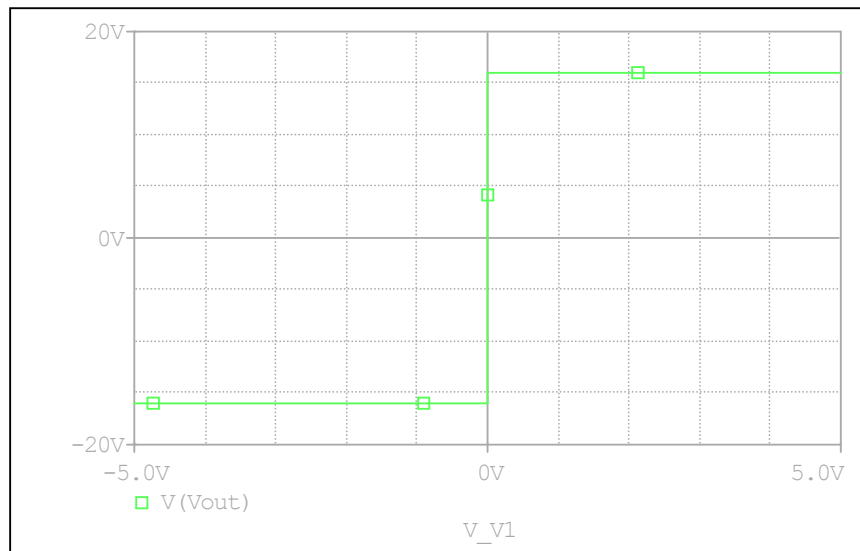
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*$
* PART NUMBER:NJM5532
* MANUFACTURER: NEW JAPAN RADIO
* All Rights Reserved Copyright (c) Bee Technologies Inc. 2007
.SUBCKT NJM5532 OUT1 -IN1 +IN1 VEE +IN2 -IN2 OUT2 VCC
X_U1  +IN1 -IN1 VCC VEE OUT1 NJM5532_SUB
X_U2  +IN2 -IN2 VCC VEE OUT2 NJM5532_SUB
.ENDS NJM5532
.SUBCKT NJM5532_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 0 945.77E3 -1E3 1E3 950E3 -950E3
GA 6 0 11 12 2.3854E-3
GCM 0 6 10 99 21.298E-9
IEE 10 4 DC 230.95E-6
HLIM 90 0 Vlim 1K
Q1 11 2 13 QX1
Q2 12 1 14 QX2
R2 6 9 100.00E3
RC1 3 11 419.21
RC2 3 12 419.21
RE1 13 10 194.51
RE2 14 10 194.51
REE 10 99 865.98E3
RO1 8 5 50
RO2 7 99 25
RP 3 4 2.6358E3
VB 9 0 DC 0
VC 3 53 DC 2.7845
VE 54 4 DC 2.7845
Vlim 7 8 DC 0
VLP 91 0 DC 38
VLN 0 92 DC 38
.MODEL DX D(Is=800.00E-18)
.MODEL DY D(Is=800.00E-18 Rs=1m Cjo=10p)
.MODEL QX1 NPN(Is=800.00E-18 Bf=557.42)
.MODEL QX2 NPN(Is=815.3794E-18 Bf=592.06)
.ENDS
*$

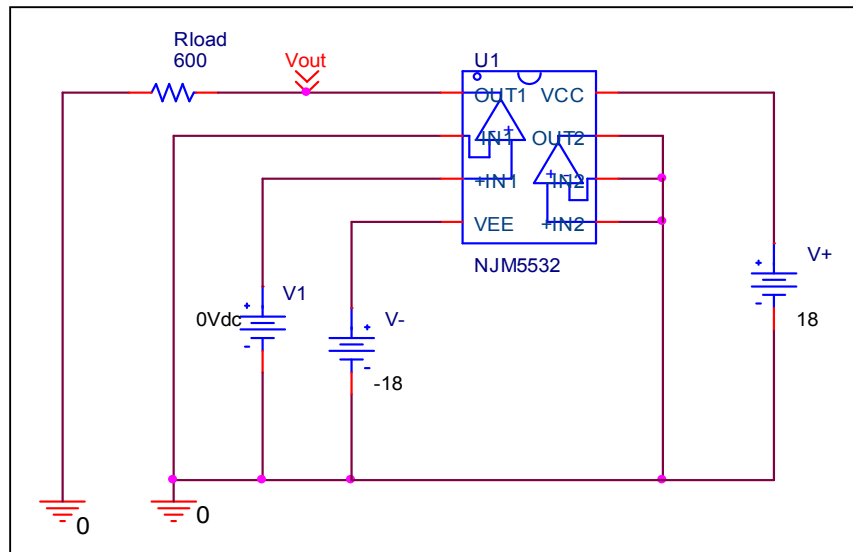
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Output Voltage Swing

Simulation result



Evaluation circuit

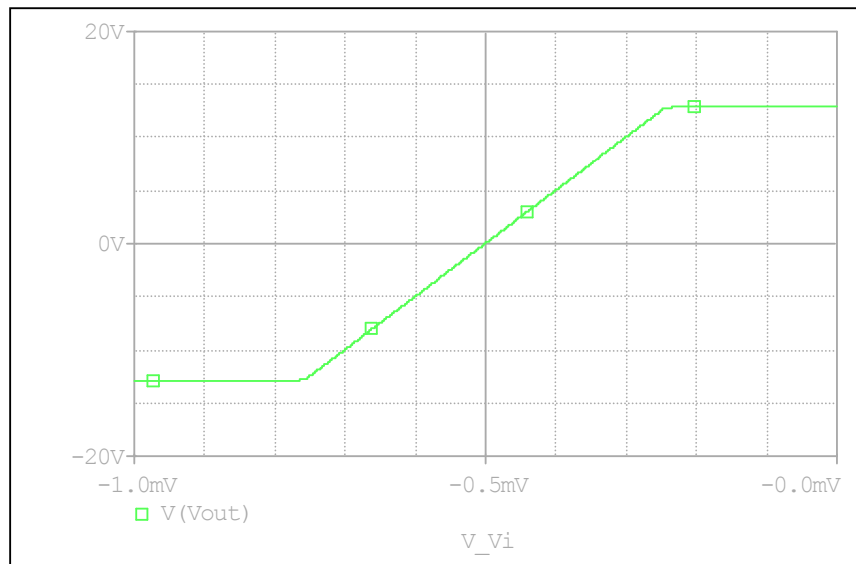


Comparison table

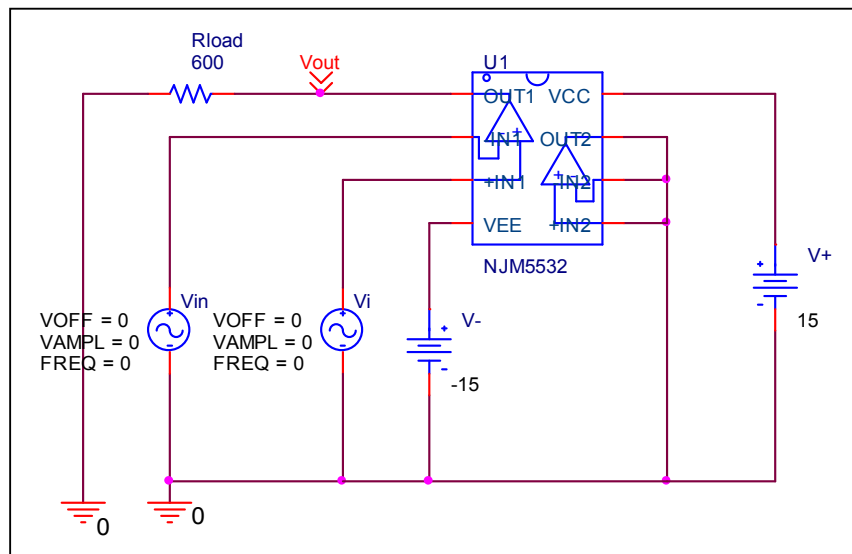
Output Voltage Swing	Measurement	Simulation	%Error
+Vout(V)	+16	+16	0
-Vout(V)	-16	-16	0

Input Offset Voltage

Simulation result



Evaluation circuit

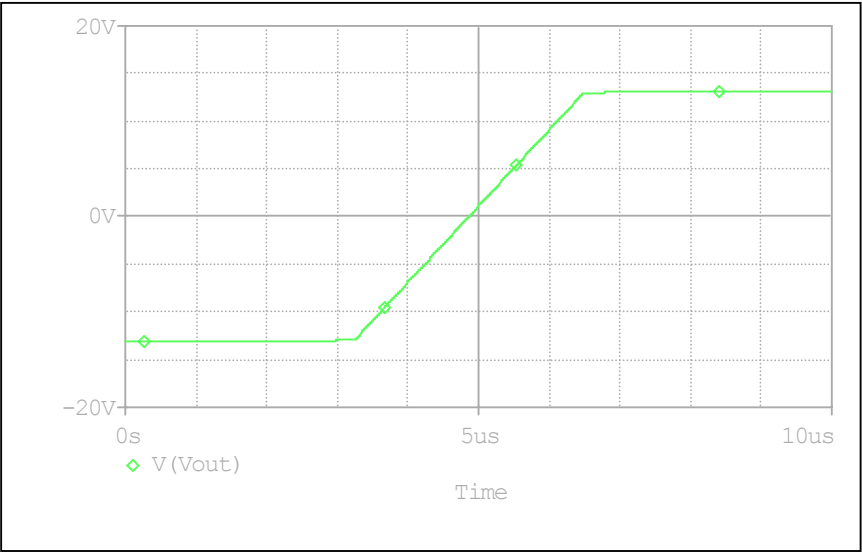


Comparison table

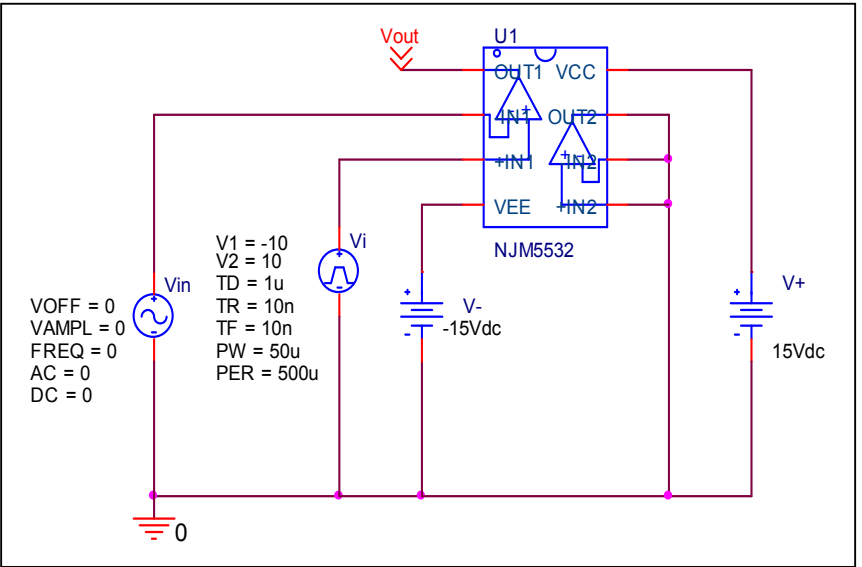
	Measurement	Simulation	%Error
Vos (mV)	0.5	0.501	0.2

Slew Rate

Simulation result



Evaluation circuit

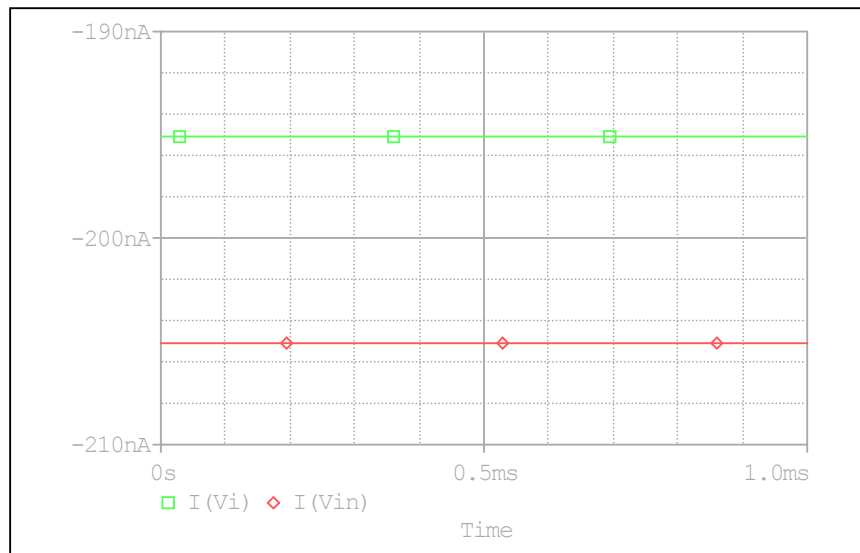


Comparison table

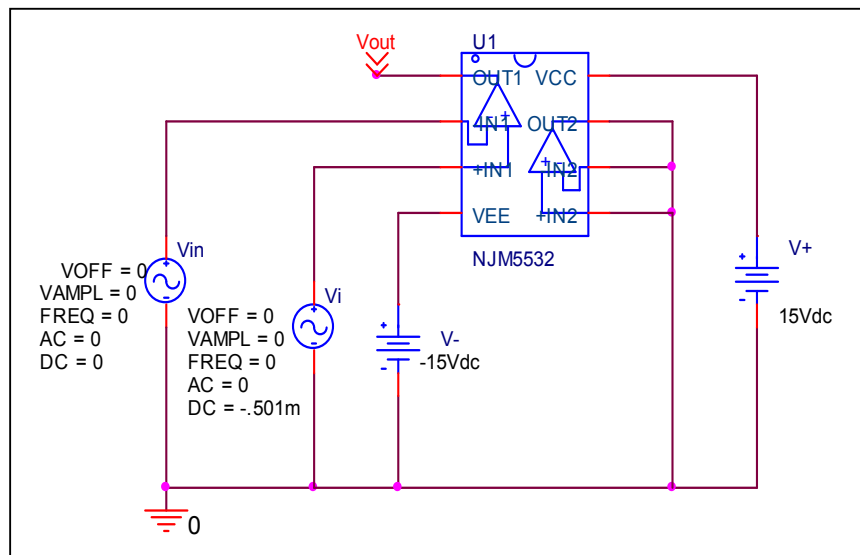
	Measurement	Simulation	%Error
Slew Rate(v/us)	8	7.999	-0.013

Input current

Simulation result



Evaluation circuit

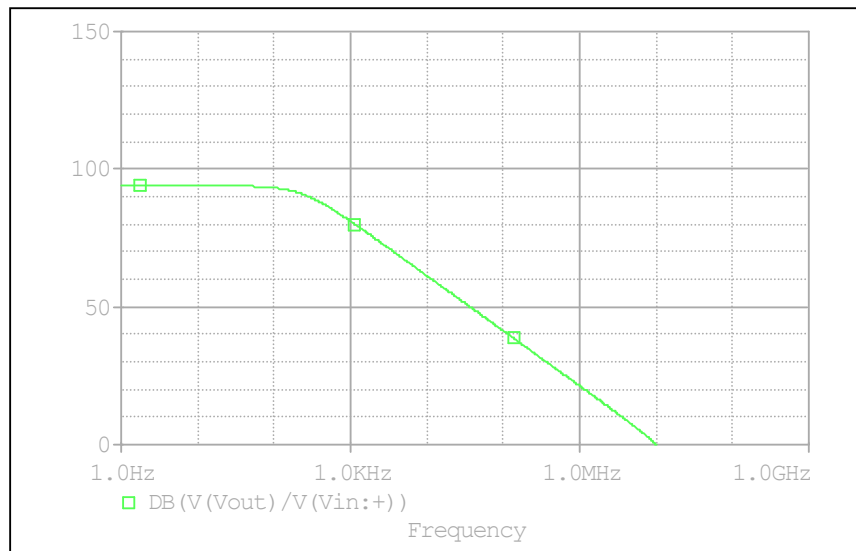


Comparison table

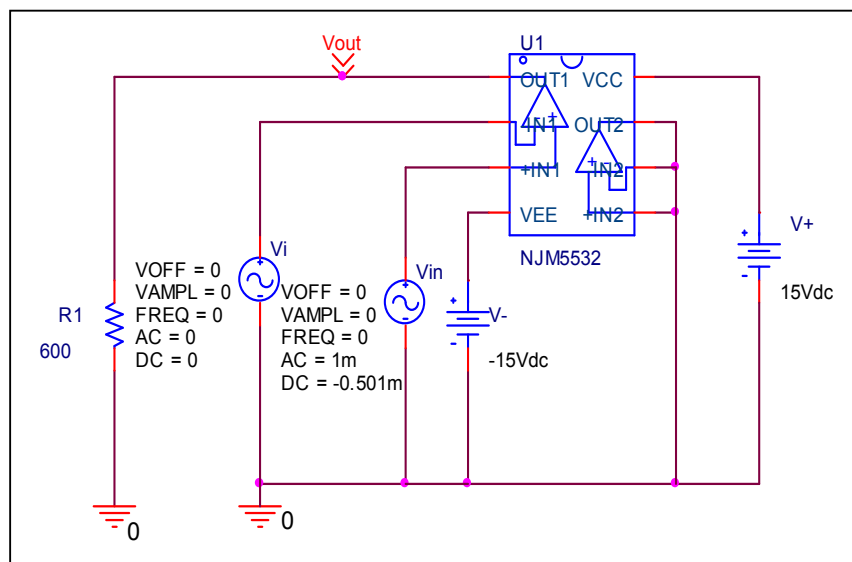
	Measurement	Simulation	%Error
I_b (nA)	200	200.015	0.007
I_{bos} (nA)	10	10.006	0.060

Open Loop Voltage Gain

Simulation result



Evaluation circuit

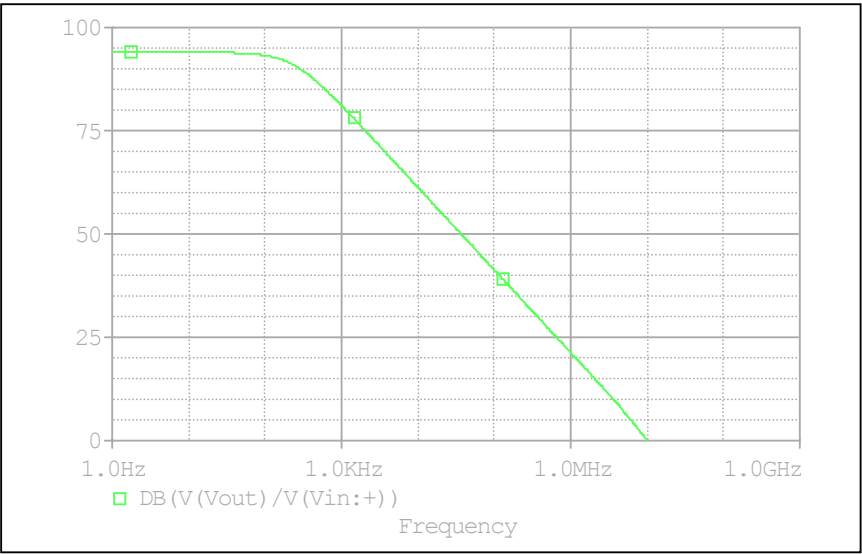


Comparison table

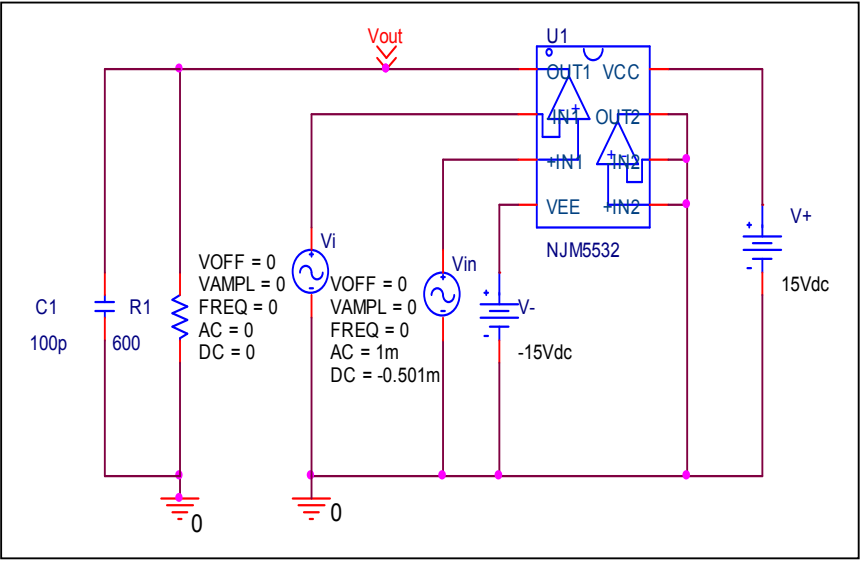
	Measurement	Simulation	%Error
Av-dc	94	93.987	-0.014

Gain Bandwidth

Simulation result



Evaluation circuit

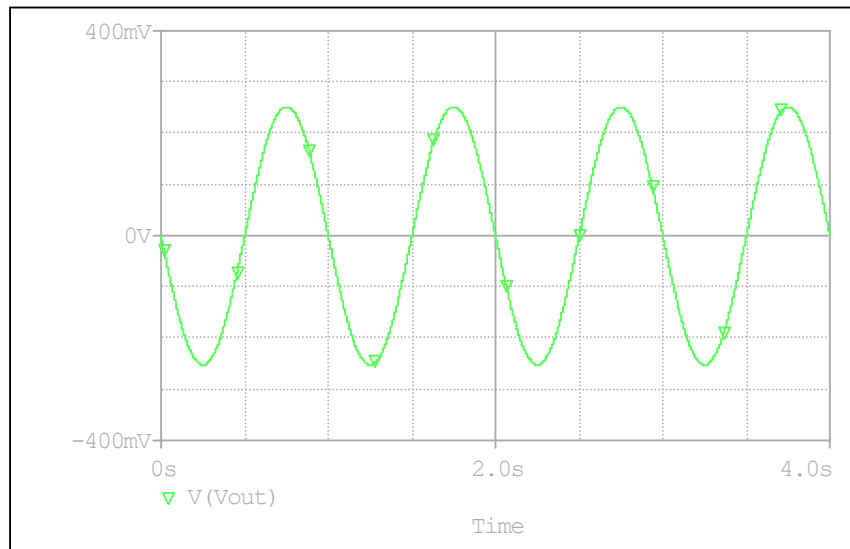


Comparison table $C_L = 100\text{pF}$, $R_L = 600\ \Omega$

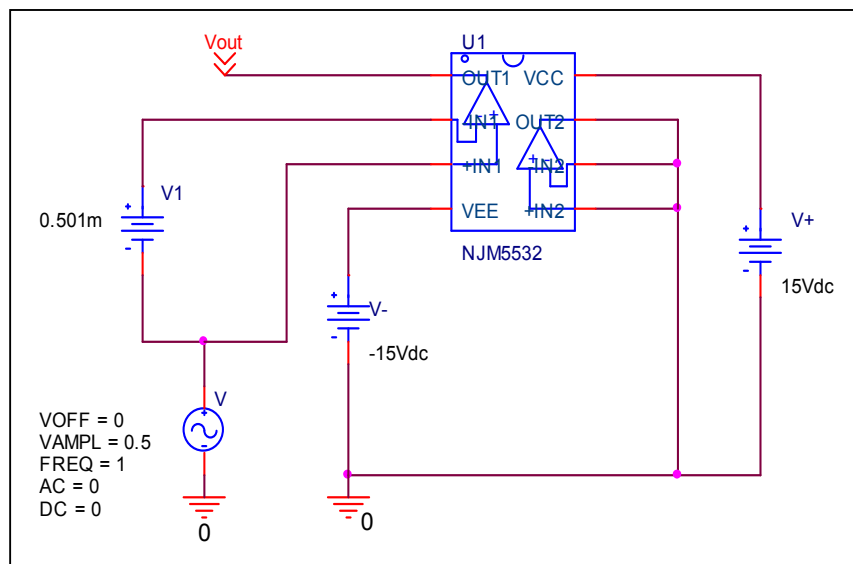
	Measurement	Simulation	%Error
f-0dB(MHz)	10	9.998	-0.02

Common-Mode Rejection Voltage gain

Simulation result



Evaluation circuit



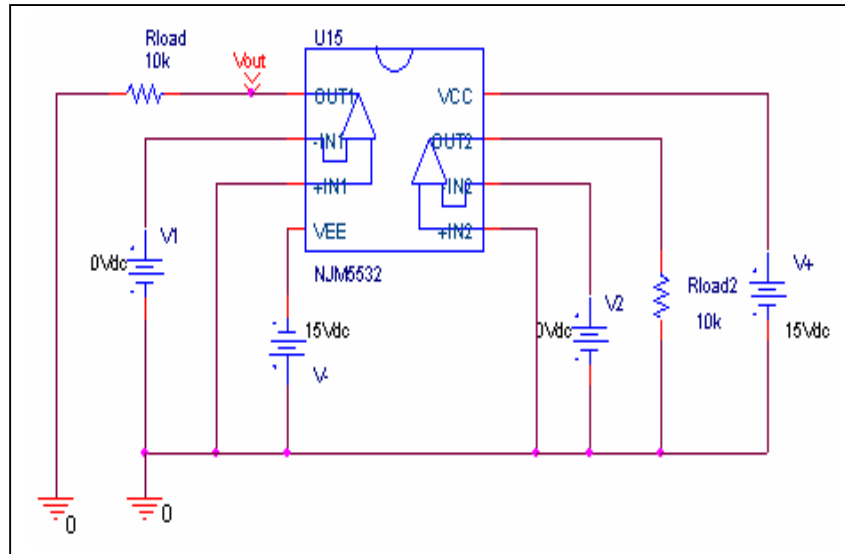
$$\text{CMRR} = 20 \cdot \log\left(\frac{50043.768}{0.503716}\right) = 99.943 \text{ dB}$$

Comparison table

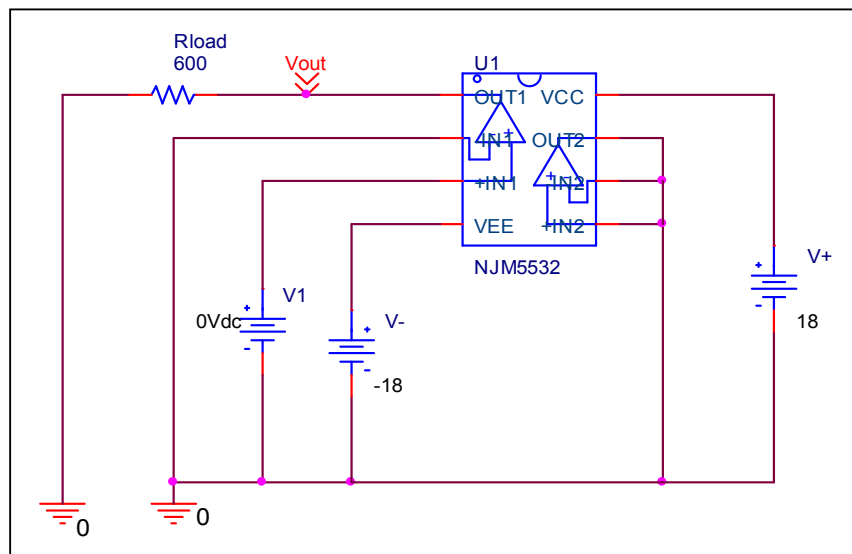
	Measurement	Simulation	%Error
CMRR(dB)	100	99.943	-0.057

Remark Output Voltage Swing

Before

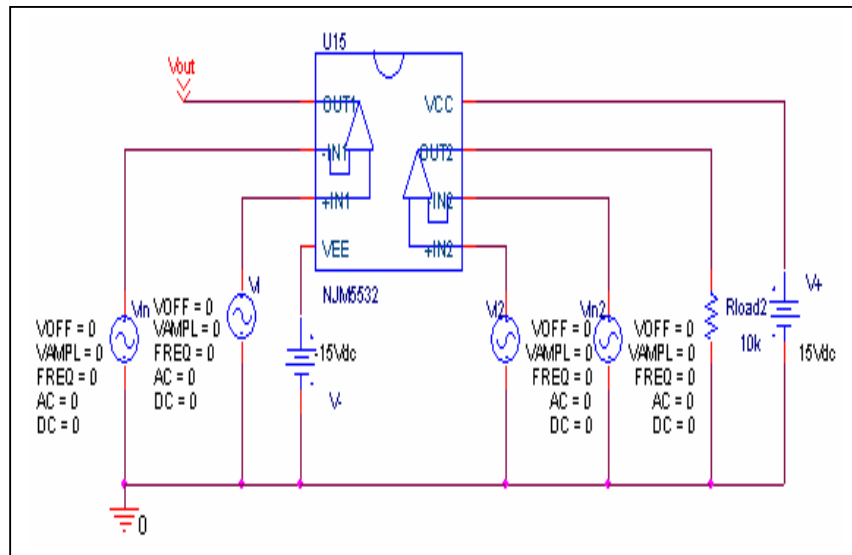


After

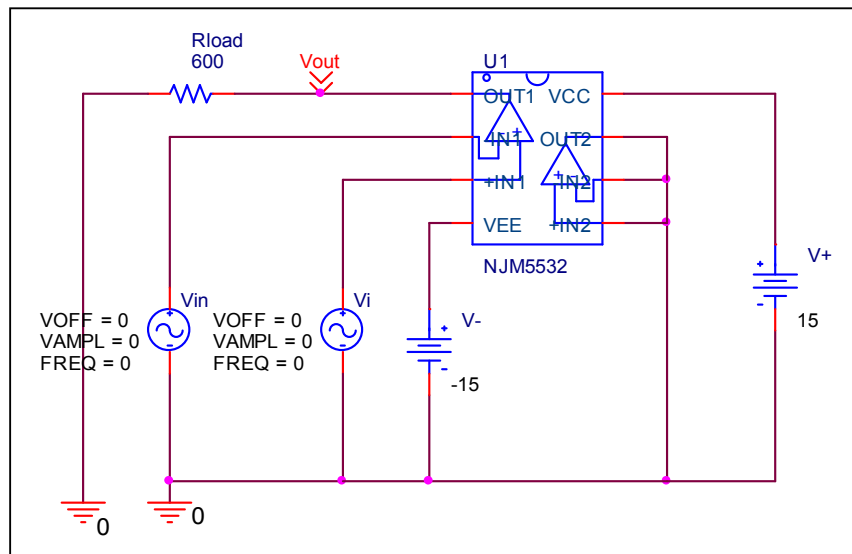


Remark Input Offset Voltage

Before

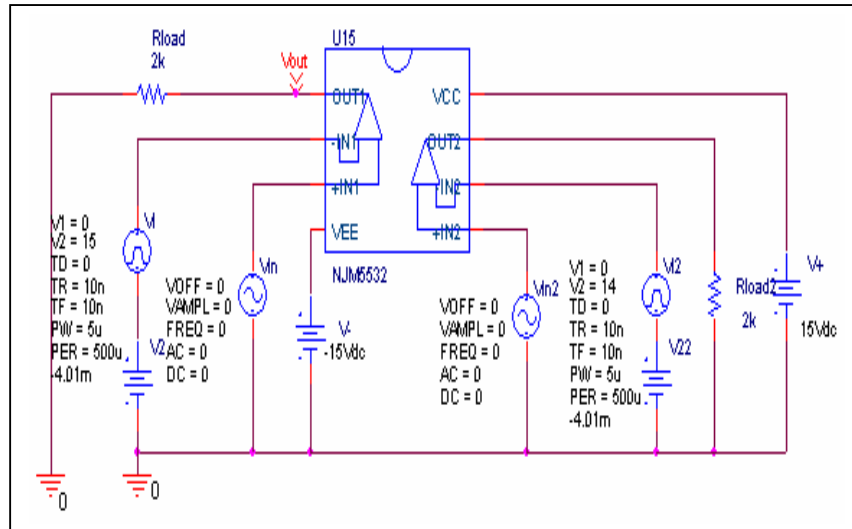


After

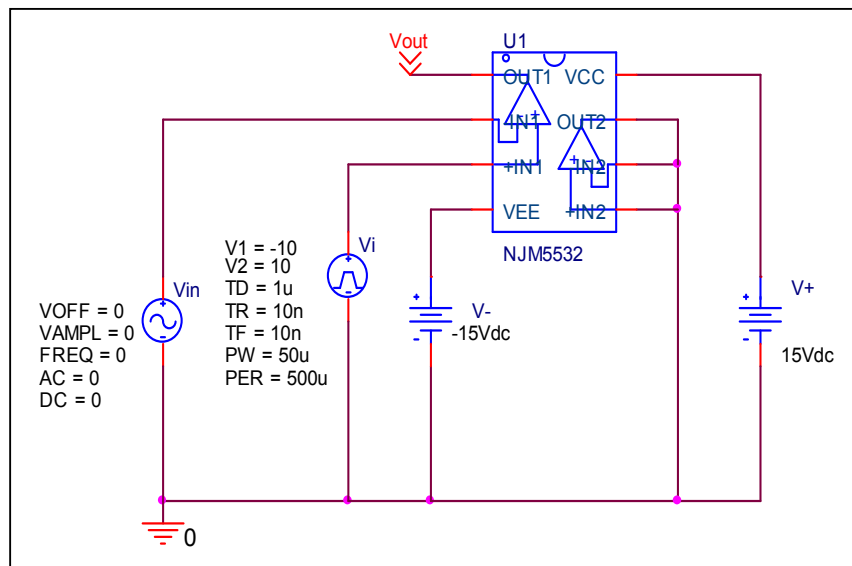


Remark Slew Rate

Before

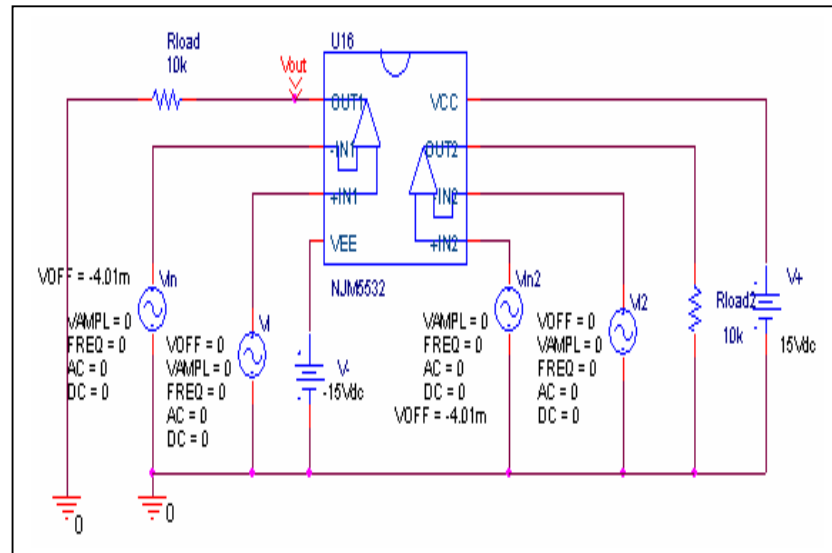


After

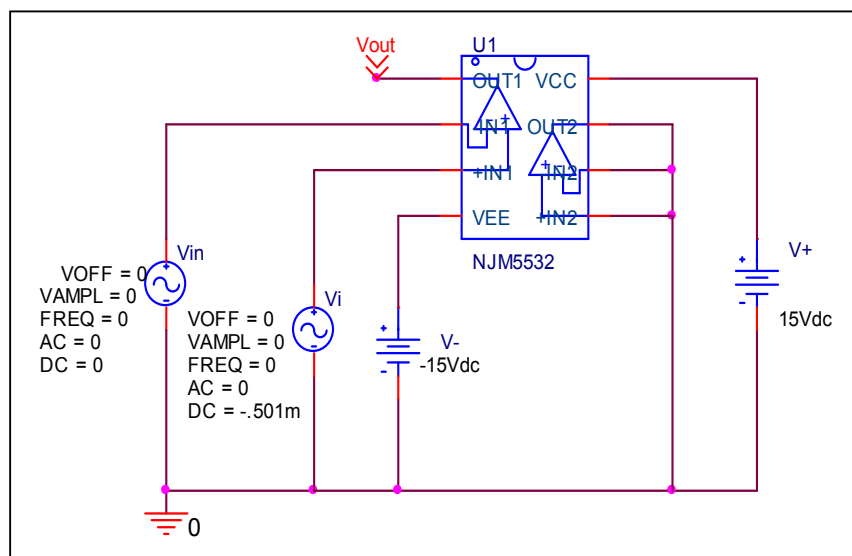


Remark Input current

Before

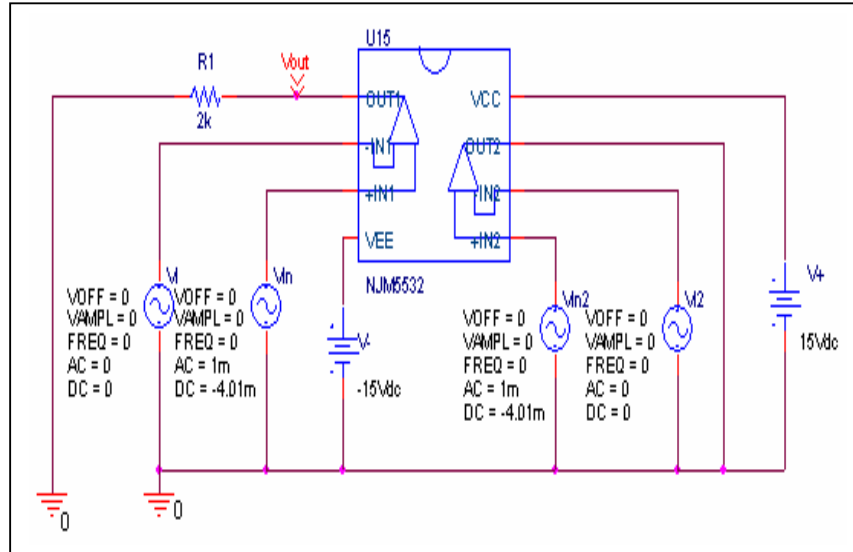


After

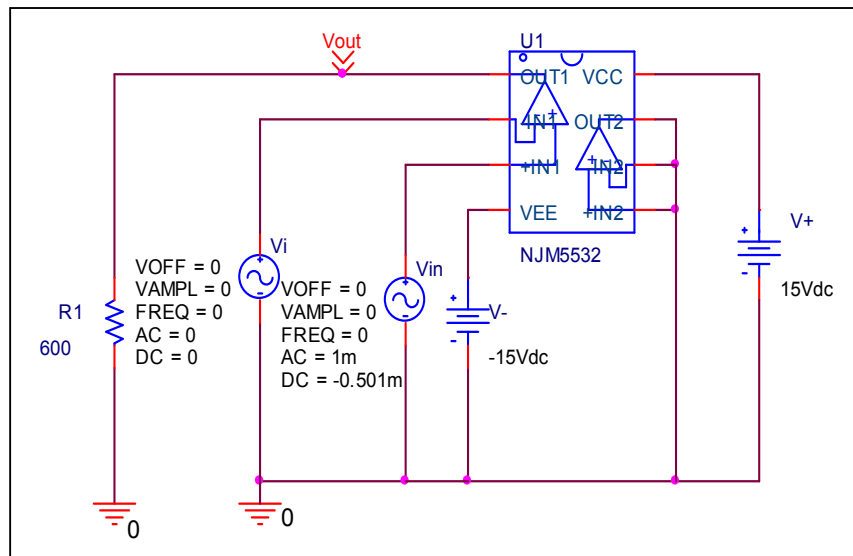


Remark Open Loop Voltage Gain

Before

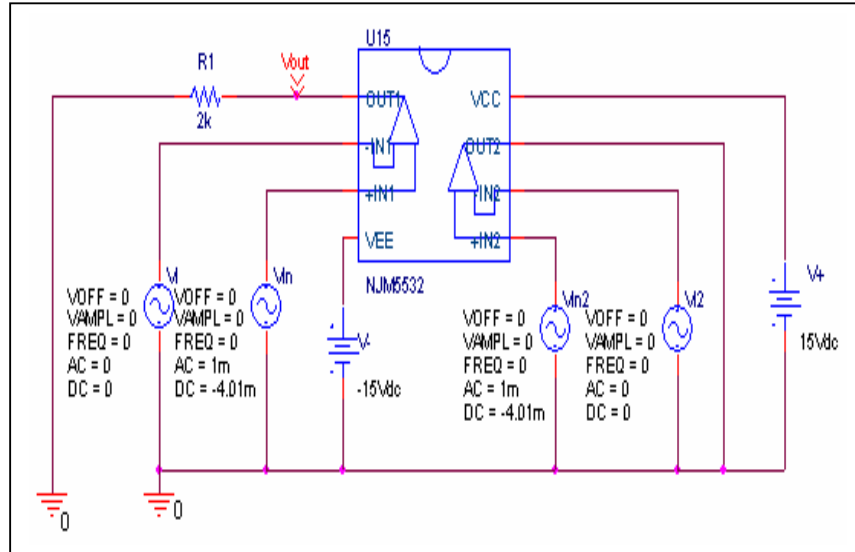


After



Remark Gain Bandwidth

Before



After

