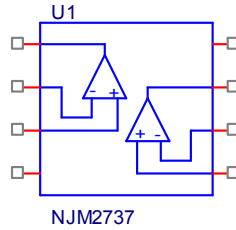# Device Modeling Report

COMPONENTS:MOSFET: OPERATIONAL AMPLIFIER
PART NUMBER:NJM2737
MANUFACTURER: NEW JAPAN RADIO CO.,LTD

Bee Technologies Inc.

# Spice Model

U1

NJM2737

```
*$
* PART NUMBER: NJM2737
* MANUFACTURER: NEW JAPAN RADIO
* All Rights Reserved Copyright (c) Bee Technologies Inc. 2007
.Subckt NJM2737 OUT1 -IN1 +IN1 V- +IN2 -IN2 OUT2 V+
X_U1    +IN1 -IN1 V+ V- OUT1 NJM2737_ME
X_U2    +IN2 -IN2 V+ V- OUT2 NJM2737_ME
.ends  NJM2737
.subckt NJM2737_ME 1 2 3 4 5
 c1   11 12 100.00E-15
 c2    6  7 21.1E-12
 cee  10 99 3.600E-9
 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 1.7153E6 -1E3 1E3 1E6 -1E6
 ga    6  0 11 12 414.69E-6
 gcm   0  6 10 99 131.14E-9
 iee   3 10 dc 22.298E-6
 hlim 90  0 vlim 1K
 q1   11  2 13 qx1
 q2   12  1 14 qx2
 r2    6  9 100.00E3
 rc1   4 11 2.4114E3
 rc2   4 12 2.4114E3
 re1  13 10 48.532
 re2  14 10 48.532
 ree  10 99 8.9694E6
 ro1   8  5 50
 ro2   7 99 25
 rp    3  4 50.011
 vb    9  0 dc 0
 vc    3 53 dc .945
 ve   54  4 dc .948
 vlim  7  8 dc 0
 vlp  91  0 dc 20
 vln   0 92 dc 20
.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=53.087)
.model qx2 PNP(Is=851.0500E-18 Bf=57.850)
.ends
*$
```
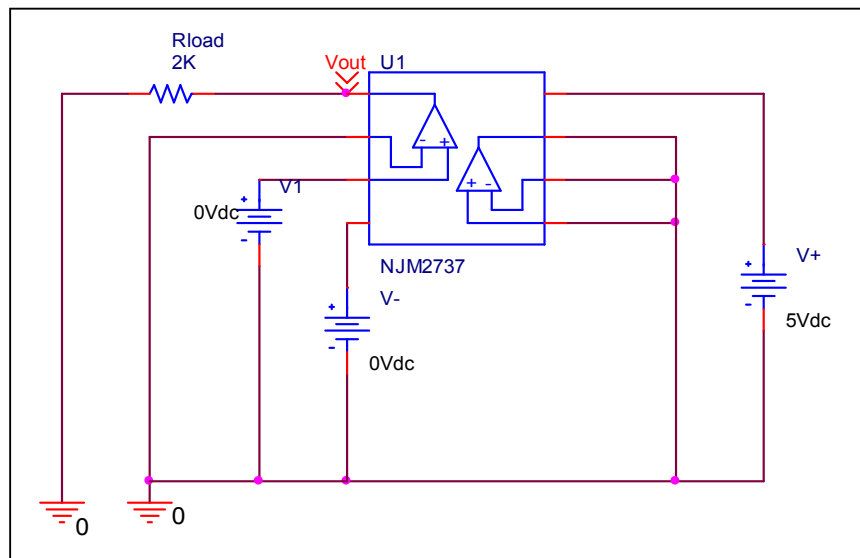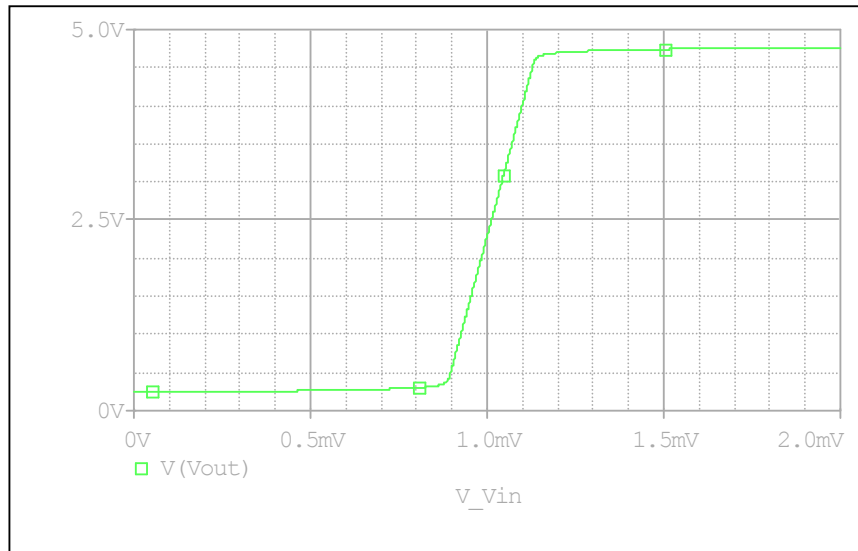
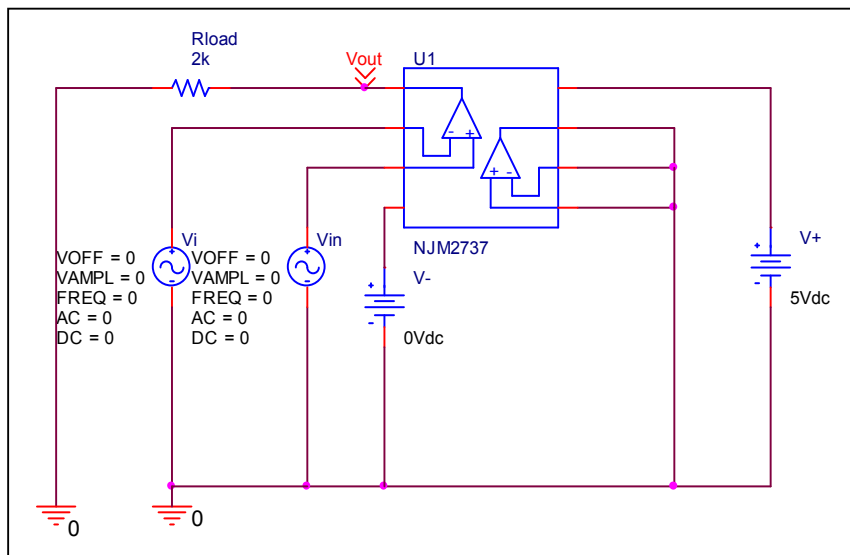# Output Voltage Swing
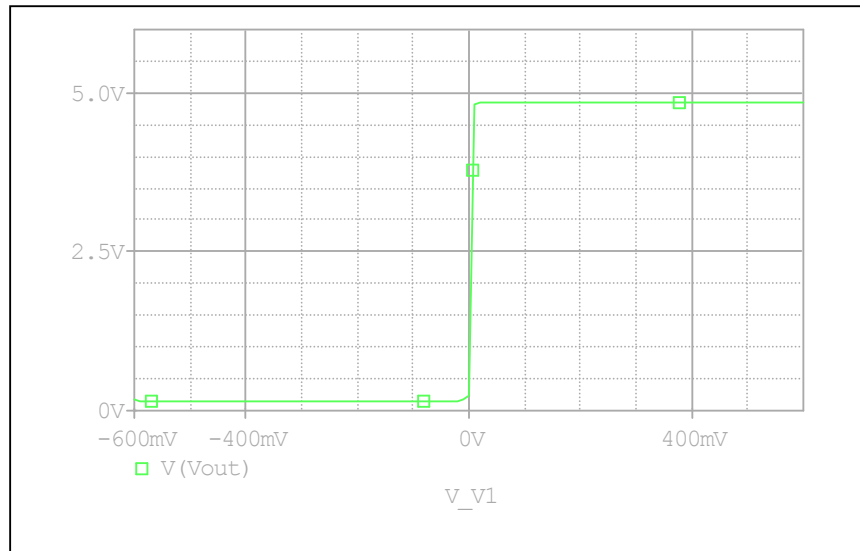
Evaluation circuit

Comparison table

Output Voltage Swing	Measurement	Simulation	%Error
V$_{OH}$ (V)	4.85	4.8504	0.008
V$_{OL}$ (V)	0.15	0.1492	-0.533

Input Offset Voltage

	Measurement	Simulation	%Error
Vos (mV)	1	1.012	1.2

Slew Rate
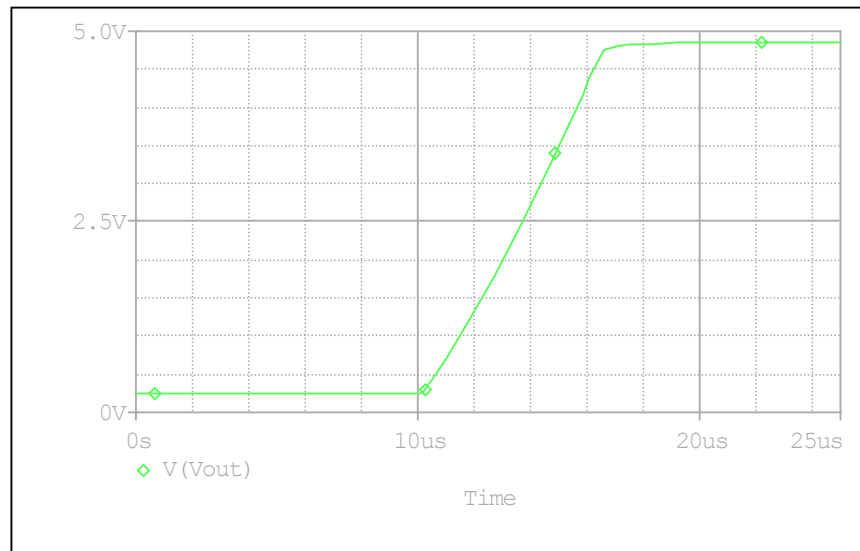
Evaluation circuit

Comparison table

	Measurement	Simulation	%Error
Slew Rate(v/us)	0.7	0.702	0.289

Input current
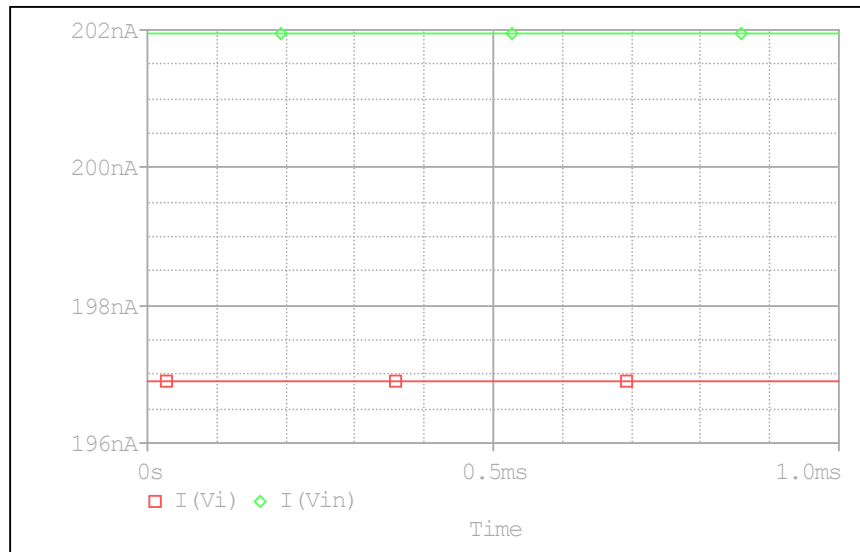
Evaluation circuit

Comparison table

	Measurement	Simulation	%Error
Ib (nA)	200.000	199.416	-0.292
Ibos (nA)	5.000	5.0469	0.938

Open Loop Voltage Gain vs. Frequency

Simulation result
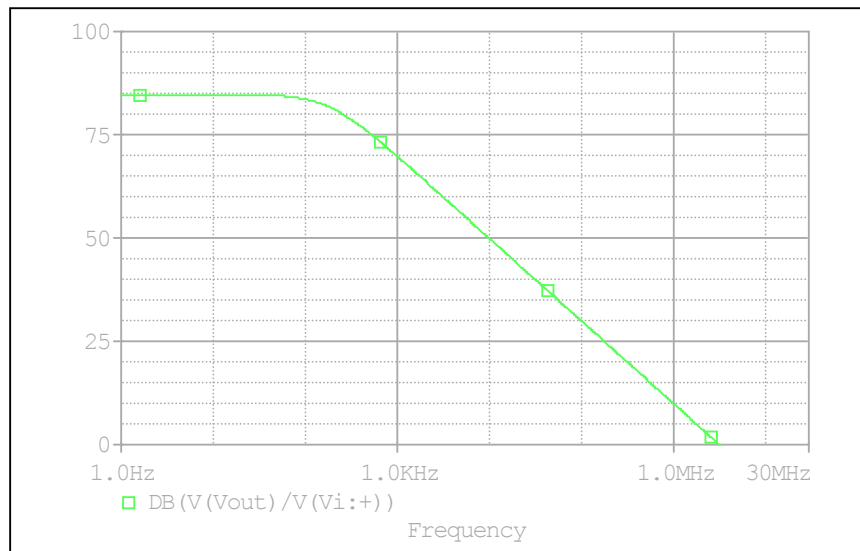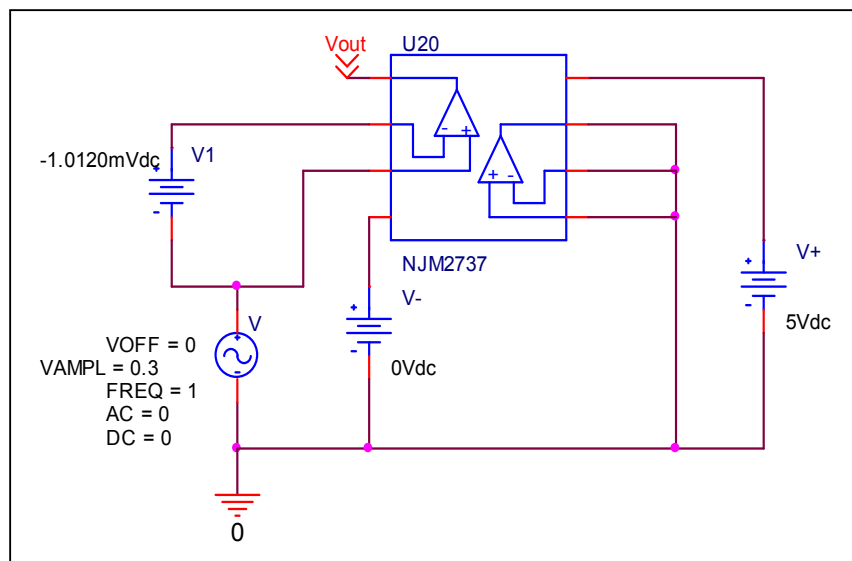

Evaluation circuit
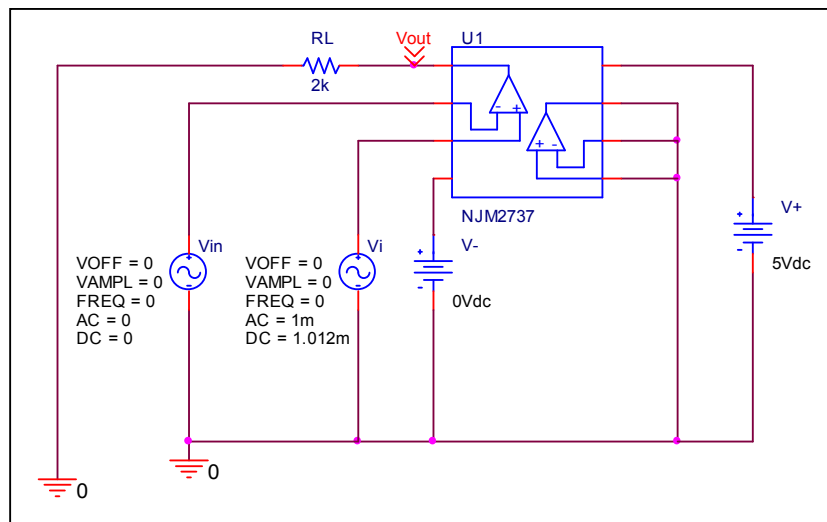
Comparison table

	Measurement	Simulation	%Error
f-0dB(MHz)	3.100	3.1046	0.148
Av-dc(dB)	85.000	84.759	-0.284

Common-Mode Rejection Voltage gain
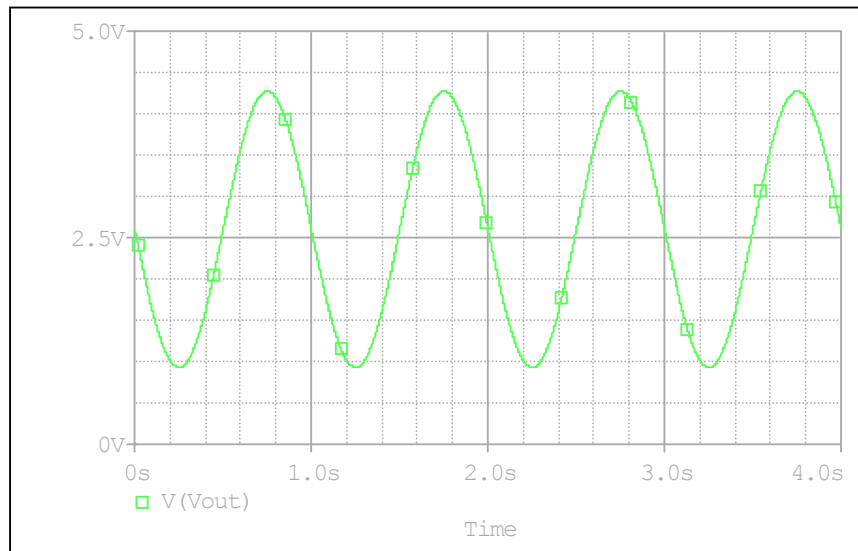
Evaluation circuit

CMRR=20*LOG(17098.185/(3.3436/0.6)) = 69.737 dB

Comparison table

	Measurement	Simulation	%Error
CMRR(dB)	70	69.737	-0.376

Remark Output Voltage Swing

Before
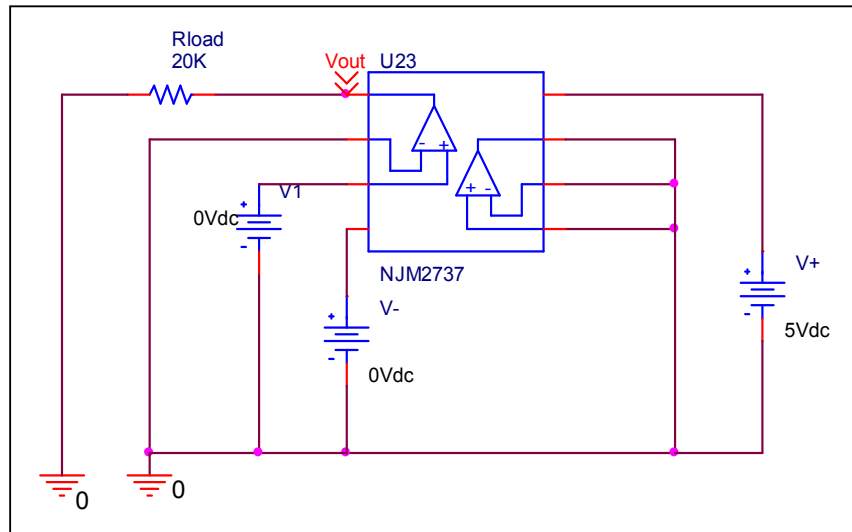
After
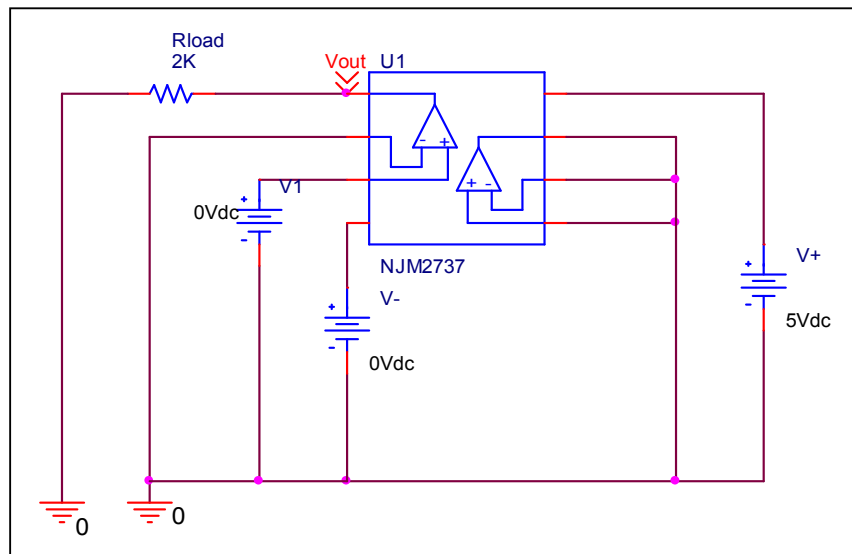
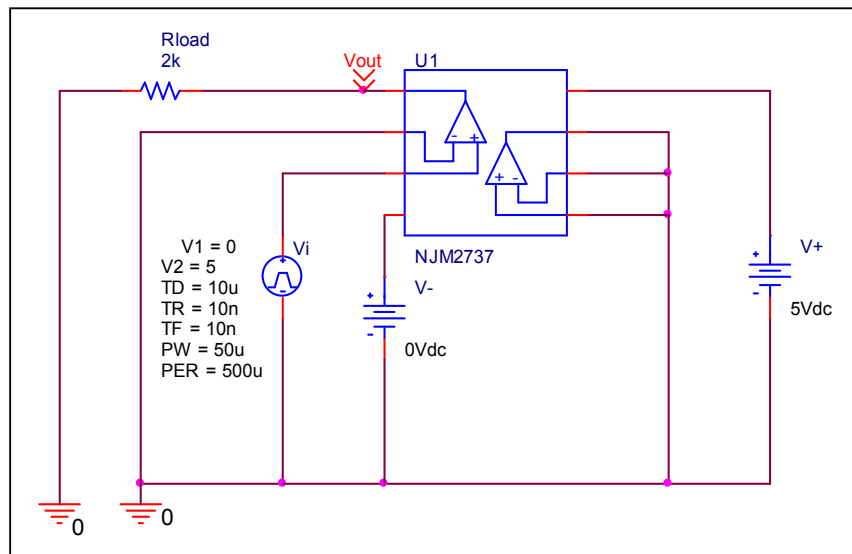# Remark Input Offset Voltage

Before
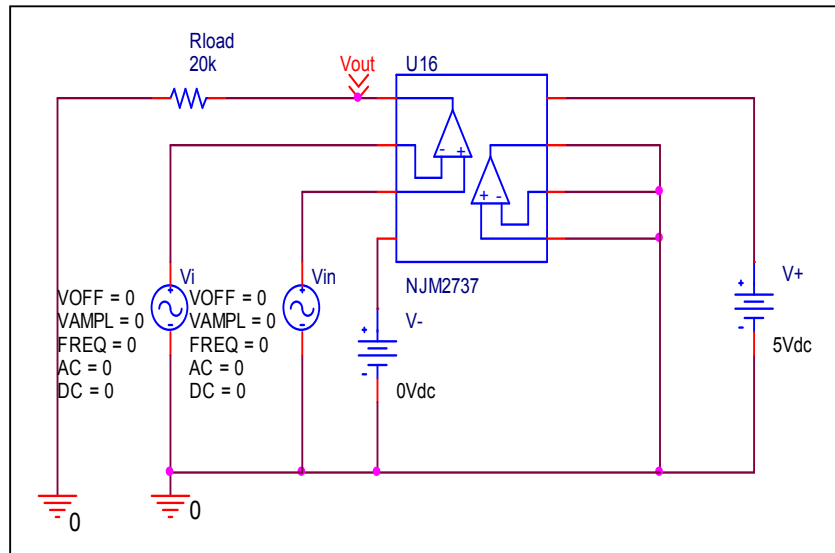
After
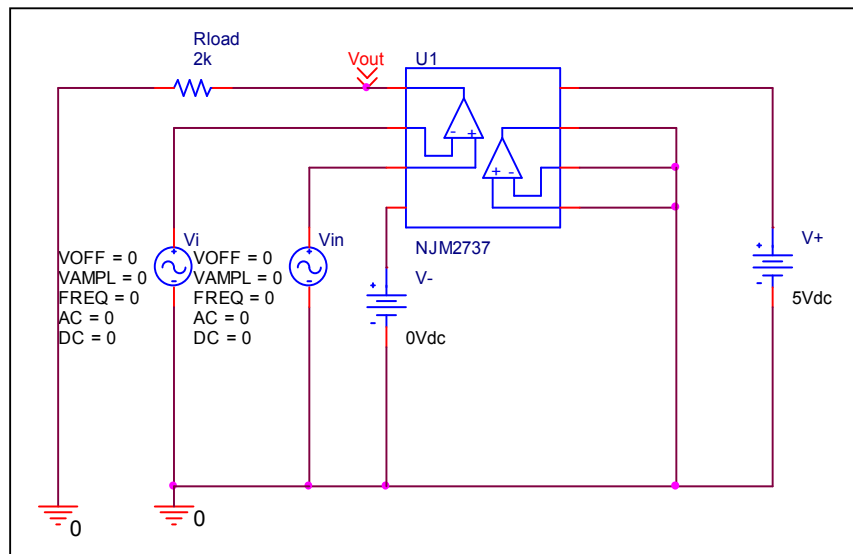
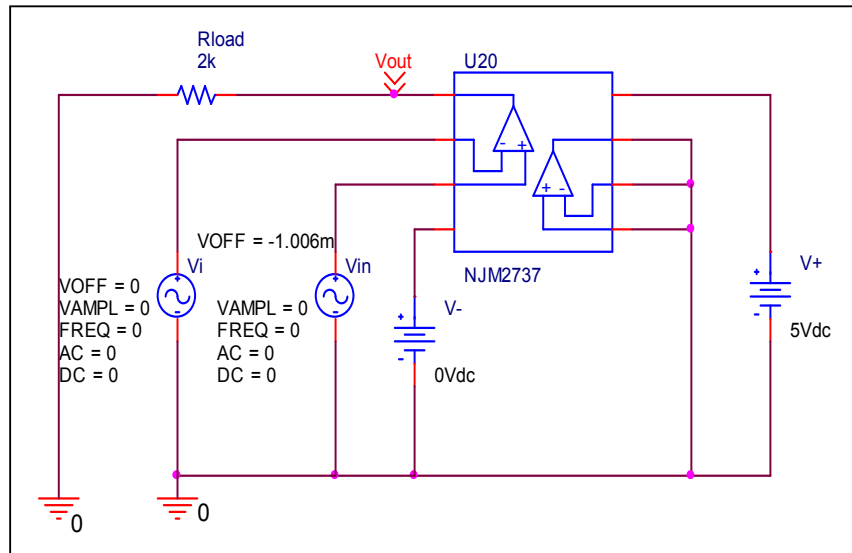## Remark Slew Rate

Before
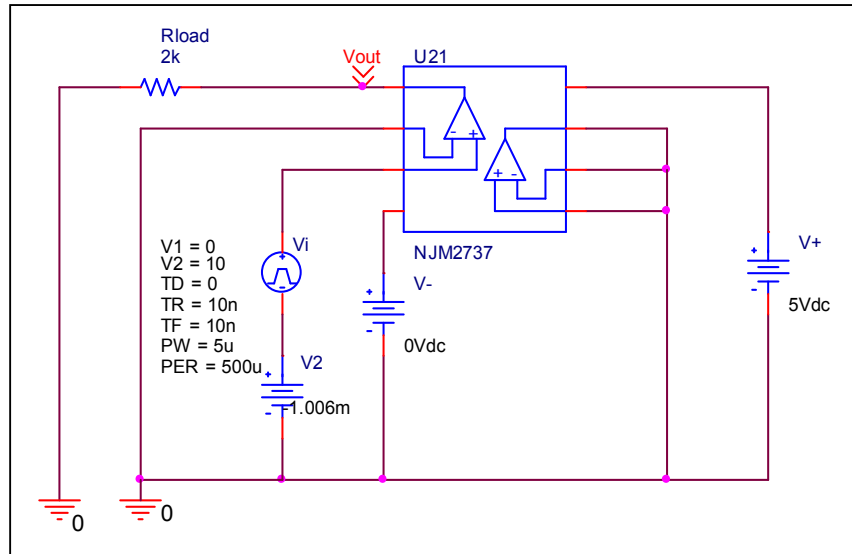
After

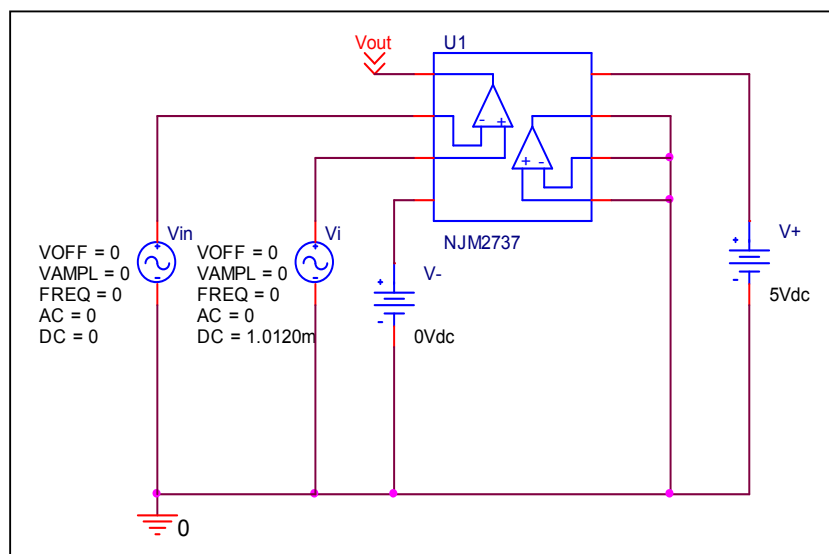# Remark Input current

Before

After

Remark Open Loop Voltage Gain vs. Frequency

Before

RL
2k

Vout

U22

NJM2737

V-

V+

5Vdc

0Vdc

Vin
VOFF = 0
VAMPL = 0
FREQ = 0
AC = 1m
DC = -1.006m

Vi
VOFF = 0
VAMPL = 0
FREQ = 0
AC = 0
DC = 0

0

0

After

RL
2k

Vout

U1

NJM2737

V-

V+

5Vdc

0Vdc

Vin
VOFF = 0
VAMPL = 0
FREQ = 0
AC = 0
DC = 0

Vi
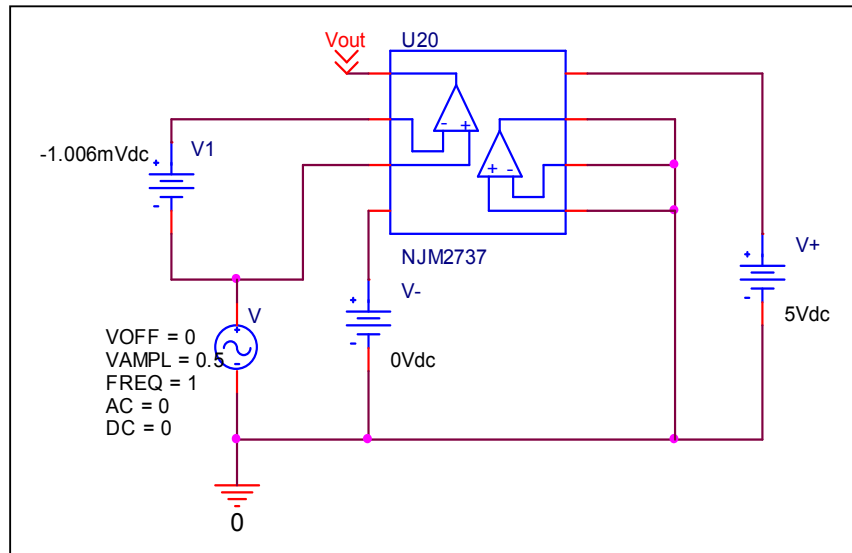VOFF = 0
VAMPL = 0
FREQ = 0
AC = 1m
DC = 1.012m

0

0
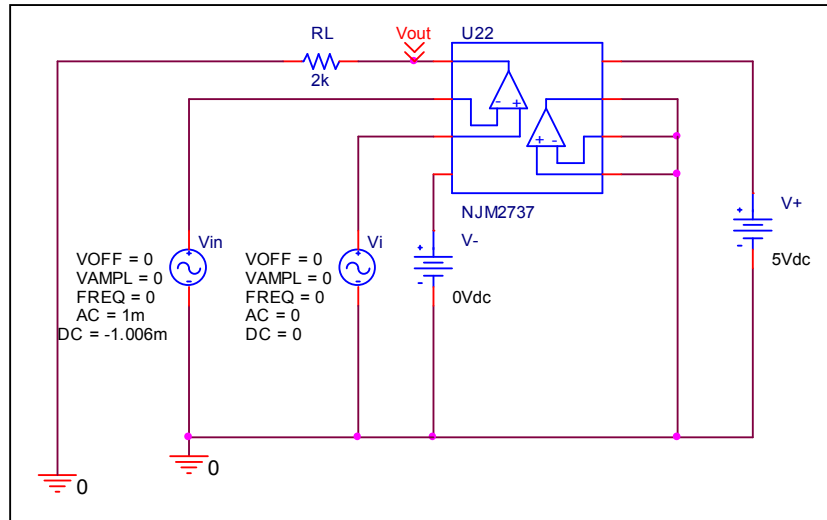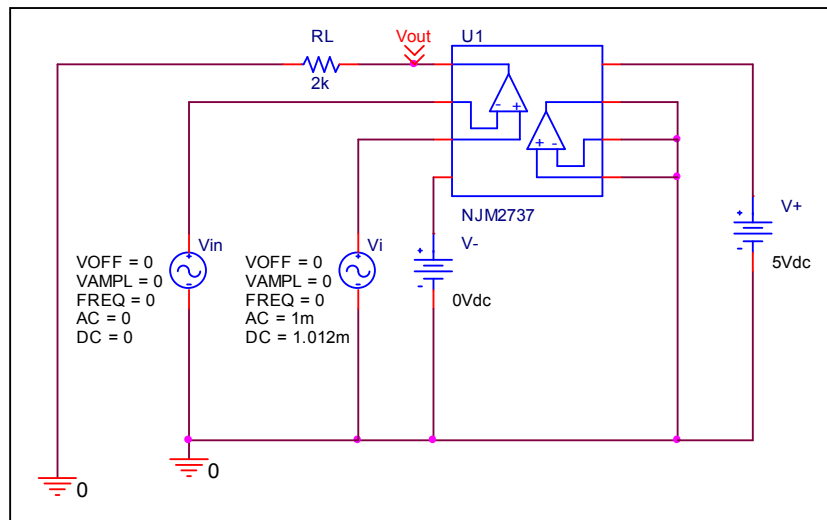
Remark Common-Mode Rejection Voltage gain

Before

After