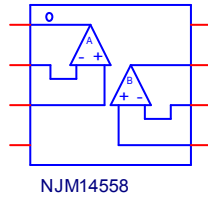# Device Modeling Report

COMPONENTS: OPERATIONAL AMPLIFIER
PART NUMBER:NJM14558
MANUFACTURER: NEW JAPAN RADIO CO.,LTD

**Bee Technologies Inc.**

SPice Model

NJM14558

```
*$
* PART NUMBER: NJM14558
* MANUFACTURER: NEW JAPAN RADIO
* All Rights Reserved Copyright (C) Bee Technologies Inc. 2007
.Subckt NJM14558 OUT1 -IN1 +IN1 V- +IN2 -IN2 OUT2 V+
X_U1    +IN1 -IN1 V+ V- OUT1 NJM14558_ME
X_U2    +IN2 -IN2 V+ V- OUT2 NJM14558_ME
.ends  NJM14558
.subckt NJM14558_ME 1 2 3 4 5
  c1   11 12 7.5056E-12
  c2    6  7 26.000E-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 4.2440E6 -1E3 1E3 4E6 -4E6
  ga    6  0 11 12 959.48E-6
  gcm   0  6 10 99 30.341E-9
  iee   3 10 dc 66.141E-6
  hlim 90  0 vlim 1K
  q1   11  2 13 qx1
  q2   12  1 14 qx2
  r2    6  9 100.00E3
  rc1   4 11 1.0610E3
  rc2   4 12 1.0610E3
  re1  13 10 276.68
  re2  14 10 276.68
  ree  10 99 3.0238E6
  ro1   8  5 50
  ro2   7 99 25
  rp    3  4 200.26
  vb    9  0 dc 0
  vc    3 53 dc 1.7384
  ve   54  4 dc 2.2384
  vlim  7  8 dc 0
  vlp  91  0 dc 2.1500
  vln   0 92 dc 2.1500
.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=445.64)
.model qx2 PNP(Is=898.3900E-18 Bf=492.91)
.ends
*$
```
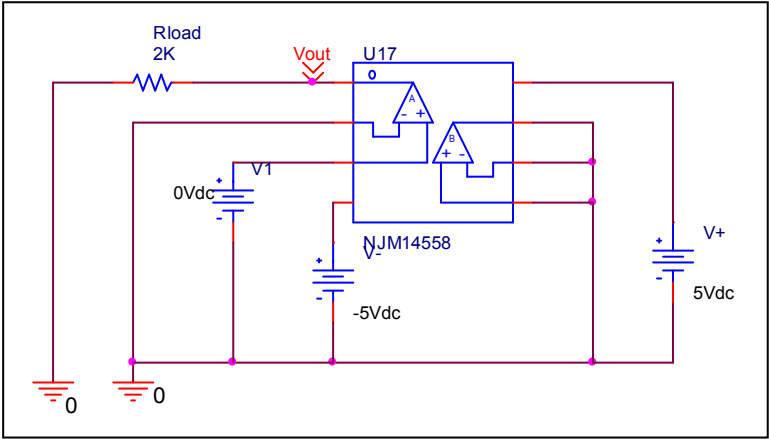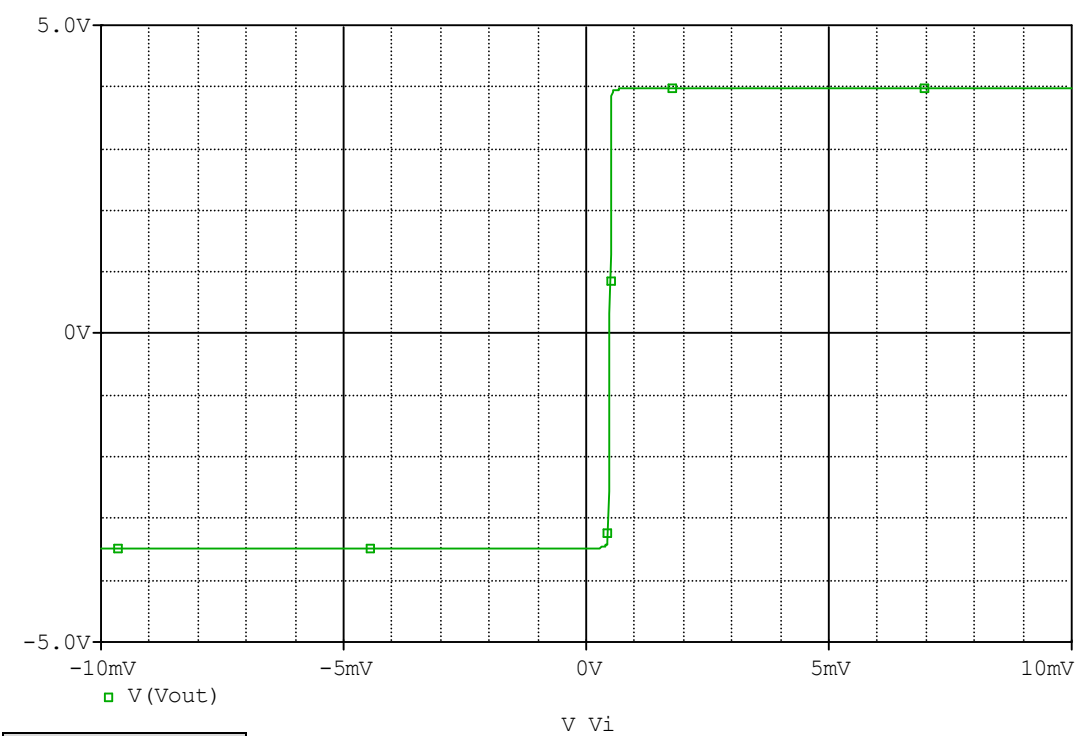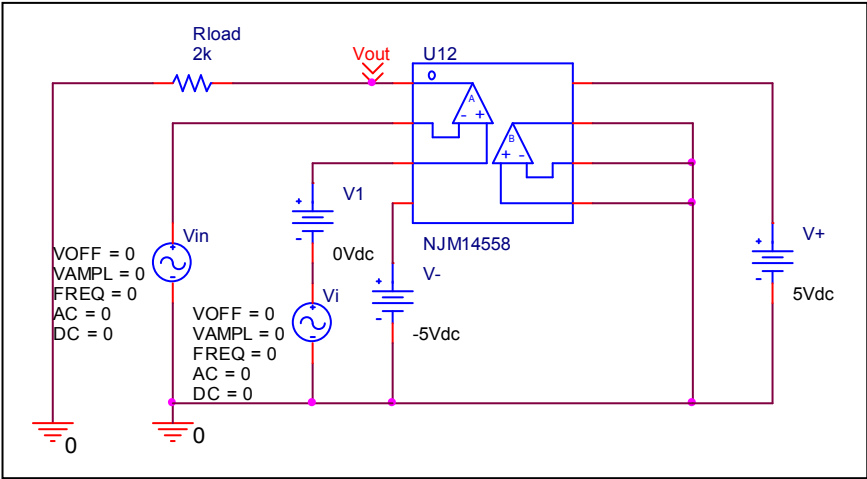
Output Voltage Swing

V(Vout)

V_V1
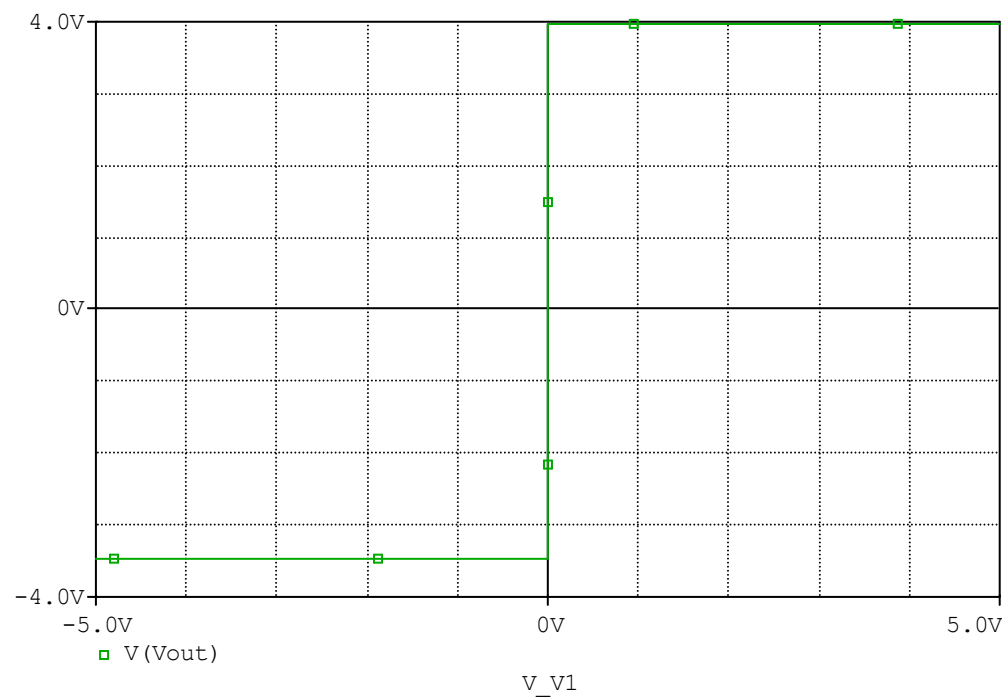
Evaluation circuit

Output Voltage Swing	Measurement	Simulation	%Error
+Vout(V)	4.000	3.976	-0.600
-Vout(V)	3.500	3.483	-0.486

Input Offset Voltage

V(Vout)

V_Vi

Evaluation circuit

Vos(mV)	Measurement	Simulation	Error
	0.5	0.5	0

Slew Rate

◇ V(Vout)

Time
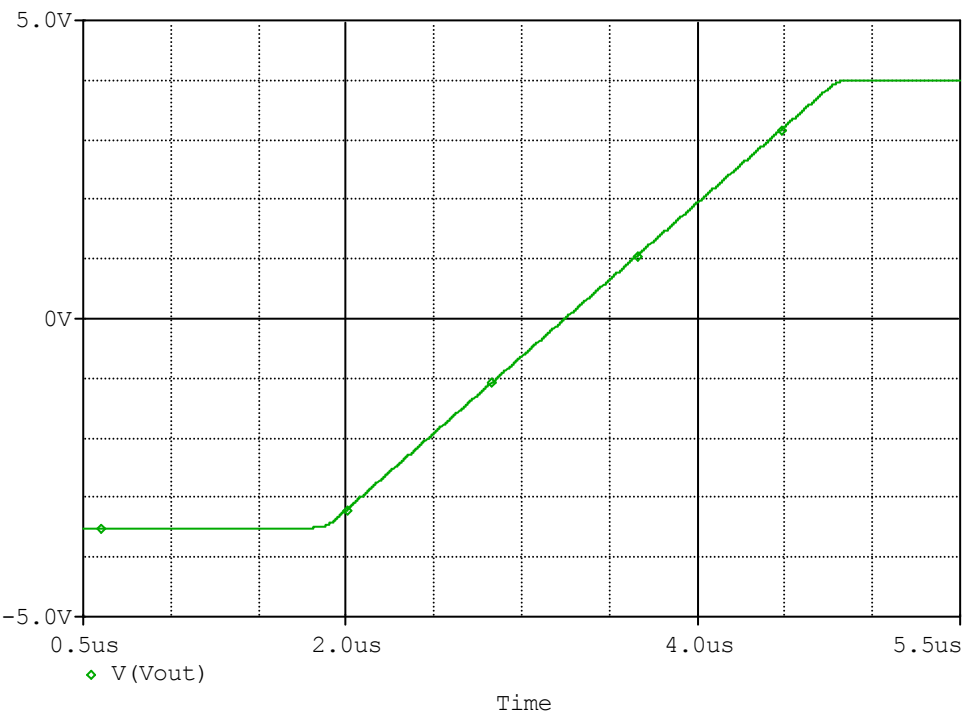
Evaluation circuit
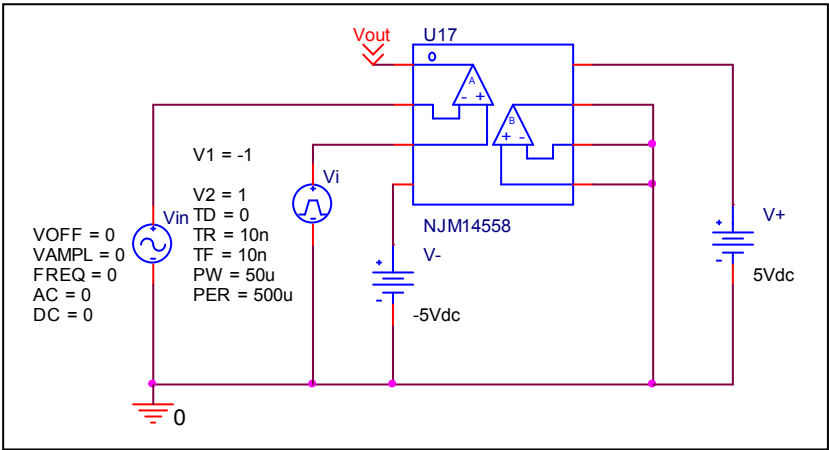
Slew Rate(v/us)	Measurement	Simulation	%Error
	2.500	2.507	0.280

Input current

□ I(Vi)   ◇ I(Vin)

Time
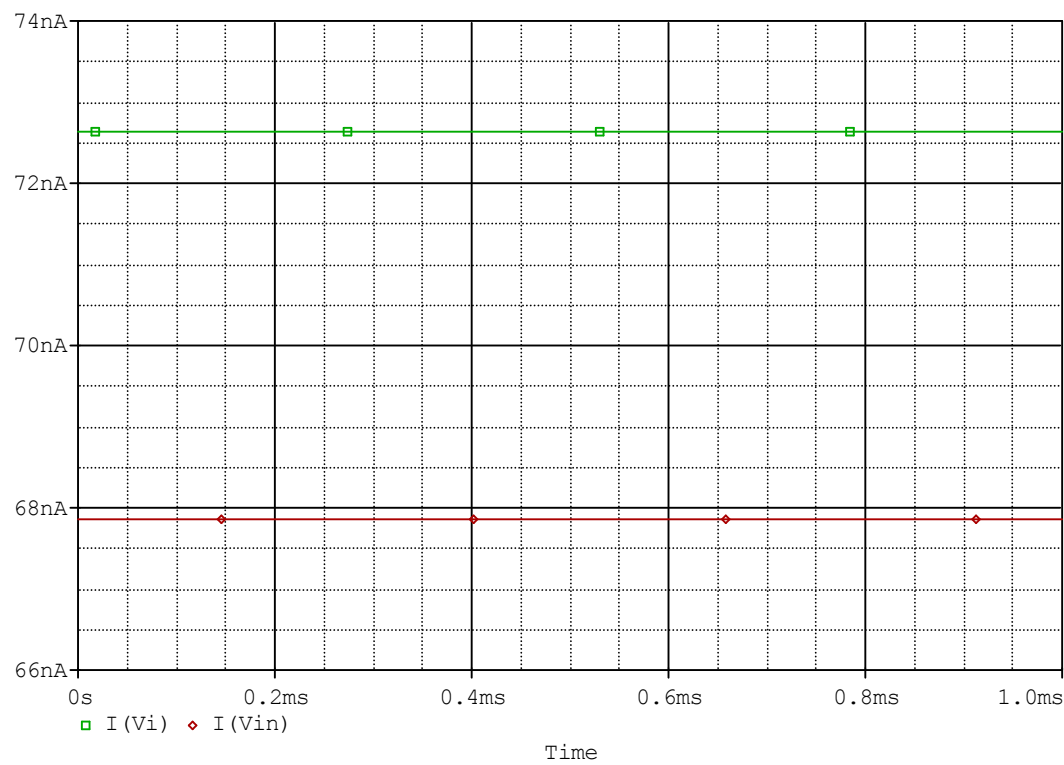
Evaluation circuit
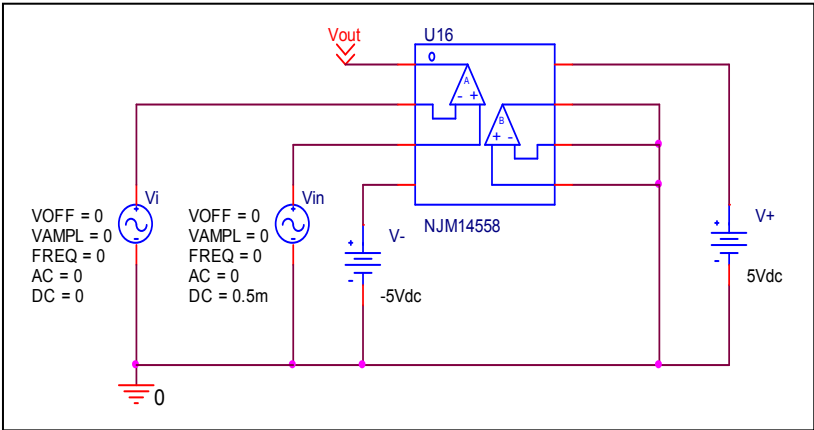
	Measurement	Simulation	%Error
Ib(nA)	70.000	70.2	0.286
Ibos(nA)	5.000	4.79	-4.200

Open Loop Voltage Gain vs. Frequency

Simulation result

□ DB(V(Vout)/V(Vin:+))

Frequency
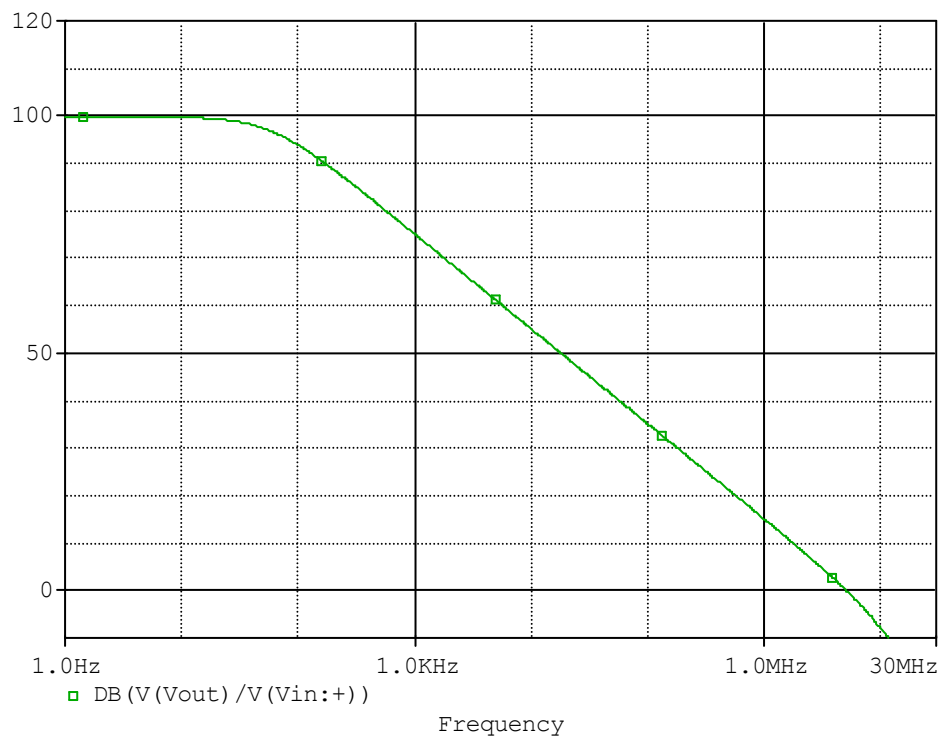
Evaluation circuit
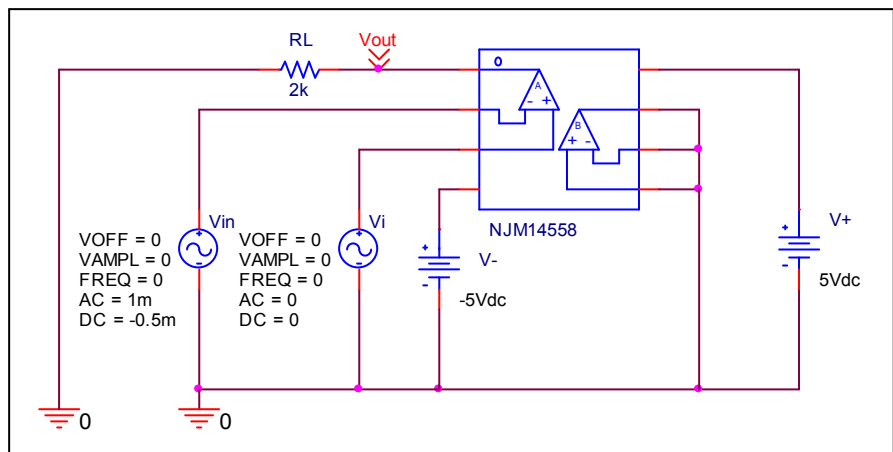
	Measurement	Simulation	%Error
f-0dB(MHz)	5.000	5.047	0.940
Av-dc(dB)	100.000	99.813	-0.187

Common-Mode Rejection Voltage gain

Simulation result

□ V(Vout)

Time
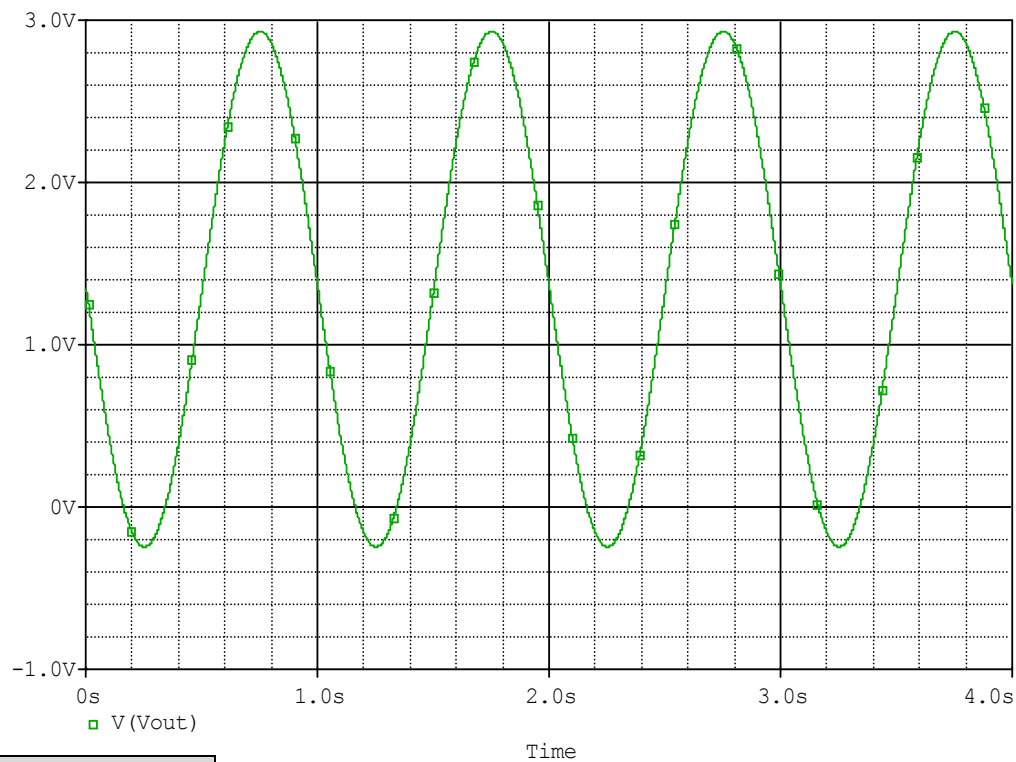
Evaluation circuit
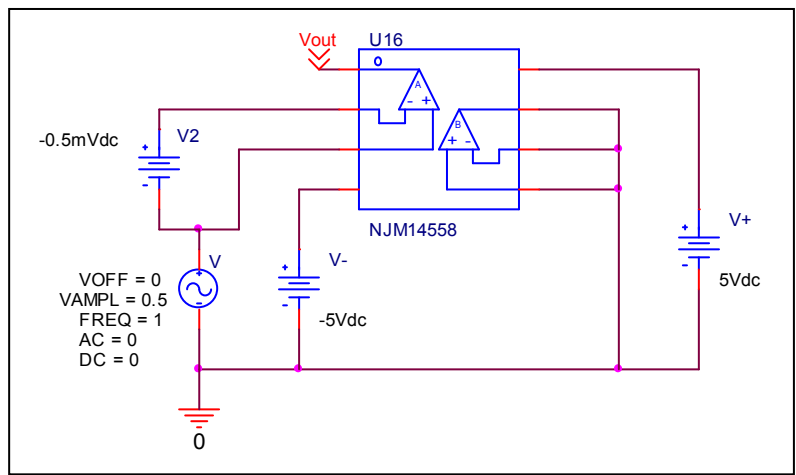
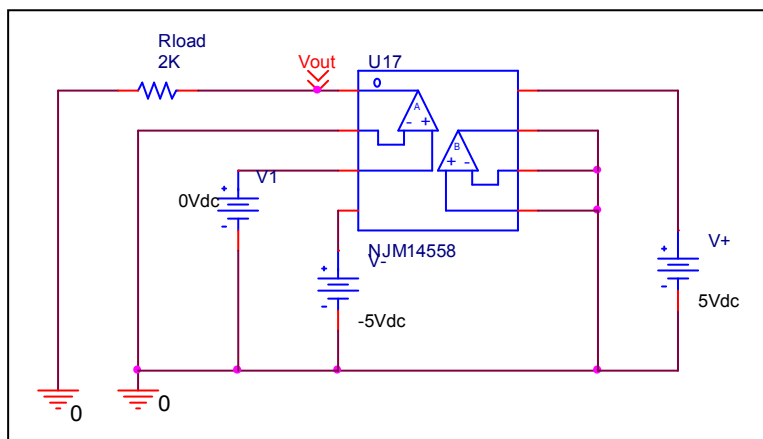Common Mode Reject Ratio=100115/3.224=31053

	Measurement	Simulation	%Error
CMRR	90.000	89.800	-0.222

Remark   Output Voltage Swing

Before
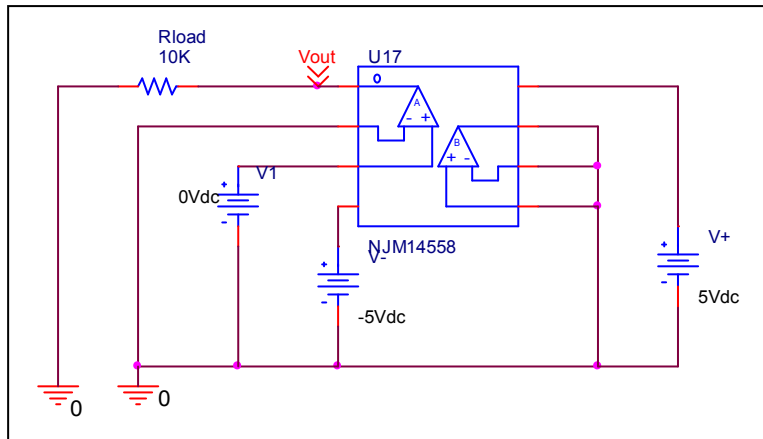
After

Remark   Input Offset Voltage

Before

Rload
10k

Vout

U12

o

A

B

NJM14558

V-

V+

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

Vin

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

Vi

-5Vdc

5Vdc

0

0

After

Rload
2k

Vout

U12

o

A

B

NJM14558

V1

0Vdc

V-

V+

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

Vin

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

Vi

-5Vdc

5Vdc

0

0

Remark   Slew Rate

Before

Rload
2k

Vout

U17

V1 = 0
V2 = 10
TD = 0
TR = 10n
TF = 10n
PW = 5u
PER = 500u

Vi

Vin

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

V2

NJM14558

V-

-5Vdc

V+

5Vdc

-3.0224m

0   0

After

Vout

U17

V1 = -1

V2 = 1
TD = 0
TR = 10n
TF = 10n
PW = 50u
PER = 500u

Vi

Vin

VOFF = 0
VAMPL = 0
FREQ = 0
AC = 0
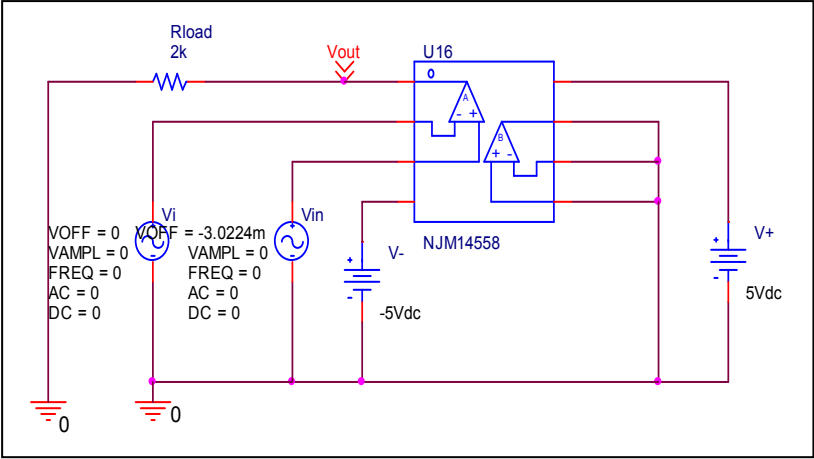DC = 0
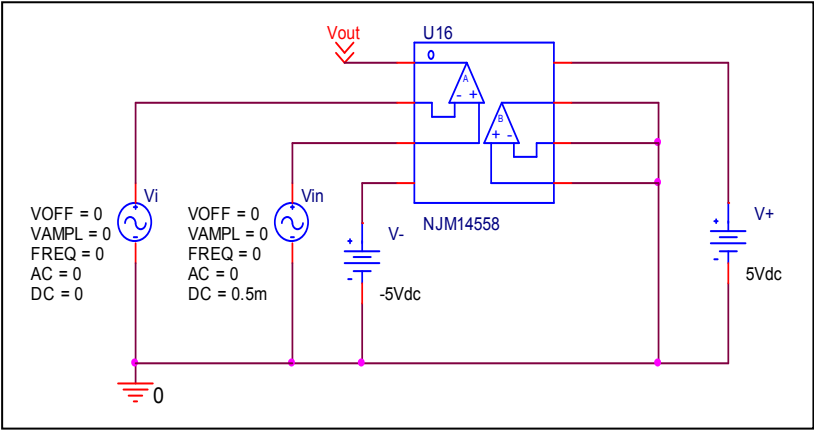
NJM14558

V-

-5Vdc

V+

5Vdc
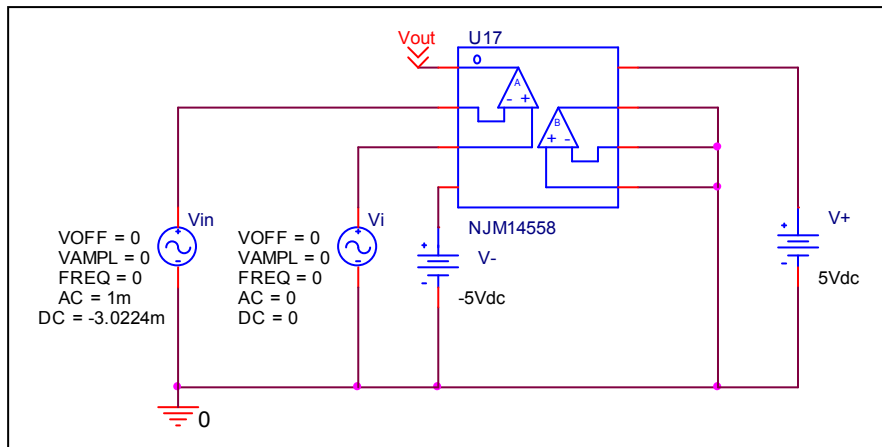
0

Remark   Input current

Before

After

Remark   Open Loop Voltage Gain vs. Frequency

Before

After

Remark   Common-Mode Rejection Voltage gain

Before

Vout

U16

-3.0224mVdc   V2

NJM14558

VOFF = 0
VAMPL = 0.5
FREQ = 1
AC = 0
DC = 0

V

V-

-5Vdc

V+

5Vdc

0

After

Vout

U16

-0.5mVdc   V2

NJM14558

VOFF = 0
VAMPL = 0.5
FREQ = 1
AC = 0
DC = 0

V

V-

-5Vdc

V+

5Vdc

0