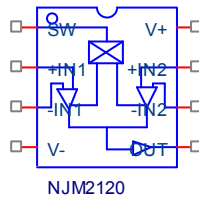# Device Modeling Report

COMPONENTS: OPERATIONAL AMPLIFIER
PART NUMBER:NJM2120
MANUFACTURER: NEW JAPAN RADIO CO.,LTD

Bee Technologies Inc.

Spice Model

NJM2120

```
*$
*PART NUMBER: NJM2120
*MANUFACTURER: NEW JAPAN RADIO
*OPAMP WITH SWITCH
*The NJM2120 is a dual operational amplifier of 2-INPUT
*and 1=OUTPUT with analog switch.This model including analog
*switch model.
*All Rights Reserved Copyright (c) Bee Technologies Inc. 2005
.Subckt NJM2120 SW -IN1 +IN1 V- +IN2 -IN2 OUT V+
X_U1     +IN1 -IN1 V+1 V- OUT1 NJM2120_S
X_U2     +IN2 -IN2 V+2 V- OUT2 NJM2120_S
R_RCC       V+ VCC 1m
R_RCC2      Vcc 0  100MEG
R_R38       V+1 0  1MEG
S_S6        out2 VCH2 N08350 0 _S6
RS_S6       N08350 0 1G
.MODEL      _S6 VSWITCH Roff=1e6 Ron=1.0 Voff=0.0V Von=1.0V
S_S5        out1 VCH1 N08350 0 _S5
RS_S5       N08350 0 1G
.MODEL      _S5 VSWITCH Roff=1e6 Ron=1.0 Voff=1.0V Von=0.0V
R_R33       0 SW  100MEG
R_R39       VCH1 0  1.4k
E_E2        N08350 0 VALUE { IF(V(SW)>V(Vcc)-0.7,0,1) }
R_R40       VCH2 0  1.4k
S_S3        V+ V+2 N08350 0 _S3
RS_S3       N08350 0 1G
.MODEL      _S3 VSWITCH Roff=100e6 Ron=1.0 Voff=0.0V Von=1.0V
R_R5        N08350 0  1MEG
E_ABM2      OUT 0 VALUE { ( V(vch1)+V(vch2) ) /1.0  }
S_S4        V+ V+1 N08350 0 _S4
RS_S4       N08350 0 1G
.MODEL      _S4 VSWITCH Roff=100e6 Ron=1.0 Voff=1 Von=0
R_R37       V+2 0  1MEG
.ends njm2120
```

```
.subckt njm2120_S  1 2 3 4 5
 c1   11 12 3.6603E-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 2.8673E6 -1E3 1E3 2E6 -2E6
 ga    6  0 11 12 1.3229E-3
 gcm   0  6 10 99 126.29E-9
 iee   3 10 dc 66.258E-6
 hlim 90  0 vlim 1K
 q1   11  2 13 qx1
 q2   12  1 14 qx2
 r2    6  9 100.00E3
 rc1   4 11 791.82
 rc2   4 12 791.82
 re1  13 10 8.0258
 re2  14 10 8.0258
 ree  10 99 3.0185E6
 ro1   8  5 50
 ro2   7 99 25
 rp    3  4 1.8072E3
 vb    9  0 dc 0
 vc    3 53 dc 1.7979
 ve   54  4 dc 1.7979
 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=184.36)
.model qx2 PNP(Is=823.2200E-18 Bf=417.72)
.ends
*$
```
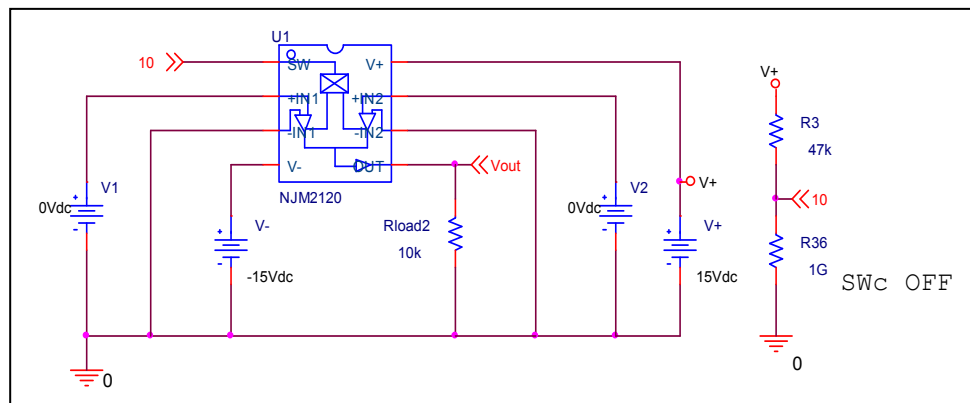
Output Voltage Swing (CH1)
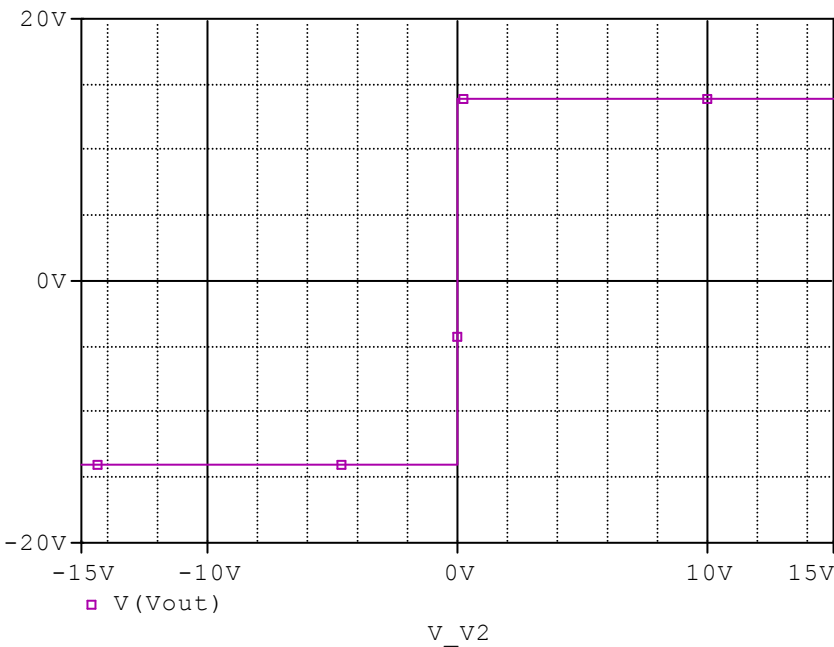
Simulation result
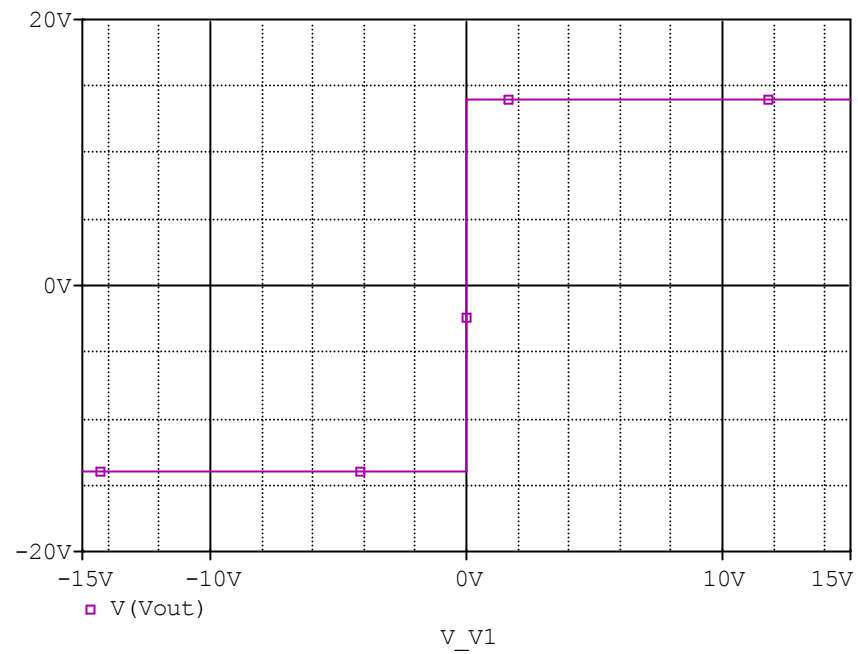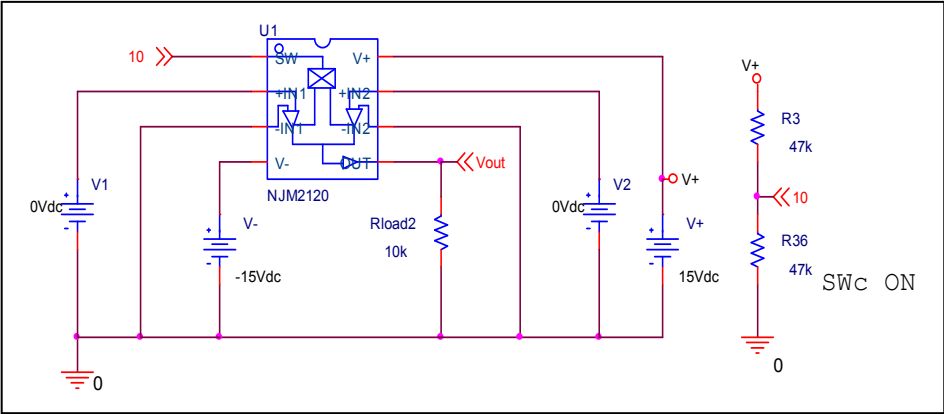

Evaluation circuit

Comparison table

Output Voltage Swing	Data sheet	Simulation	%Error
VOM	+/-14	+/-14	0

Output Voltage Swing (CH2)

Evaluation circuit

Comparison table

Output Voltage Swing	Data sheet	Simulation	%Error
VOM	+/-14	+/-14	0

Input Offset Voltage

Simulation result

- □ V(Vout)

V_Vin
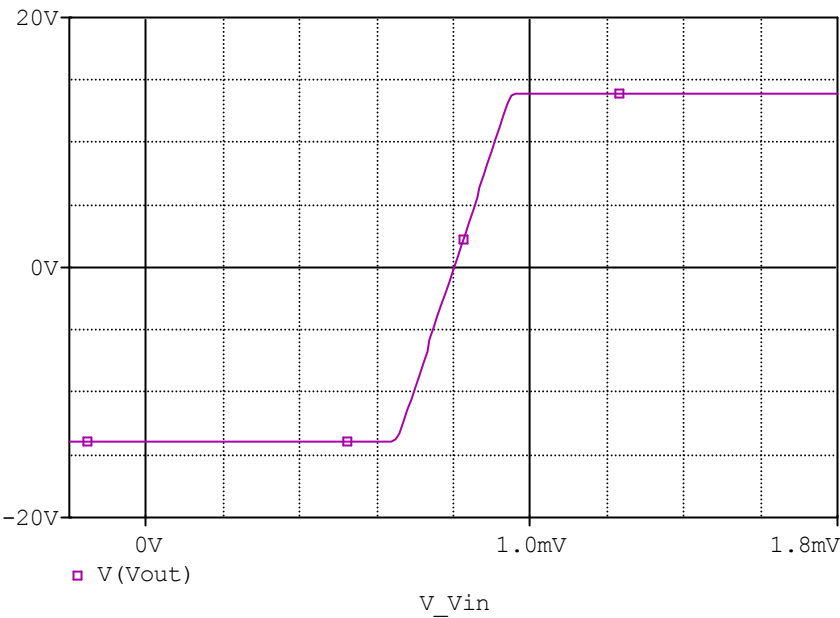
Evaluation circuit
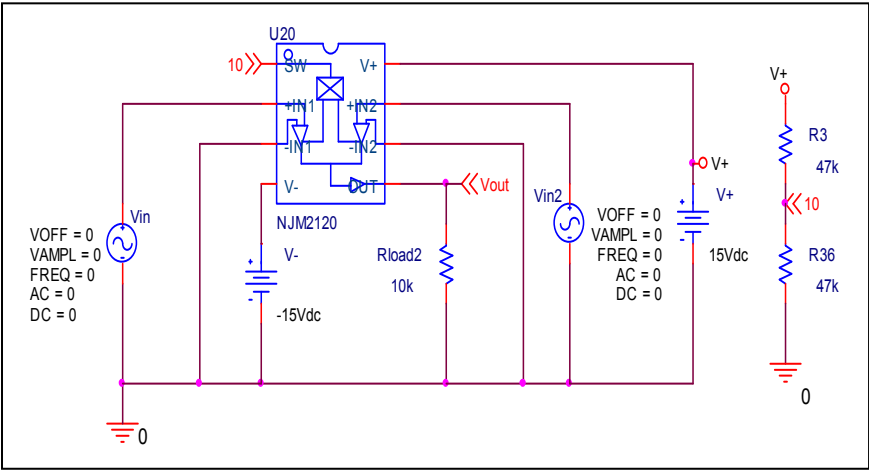
Comparison table

Vio	Measurement		Simulation		Error	
	0.8	mV	0.801	mV	0.125	%

Slew Rate

Simulation result
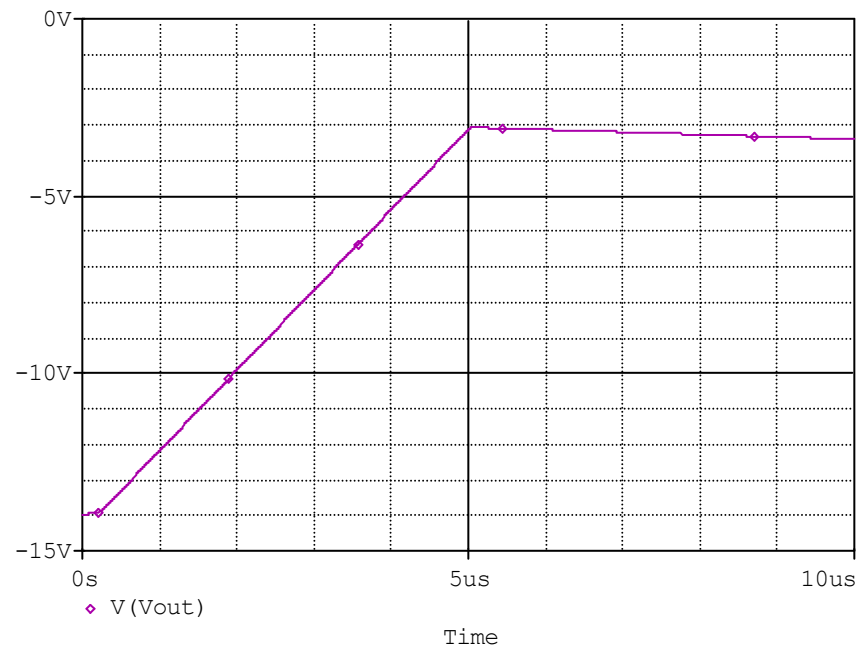
Evaluation circuit
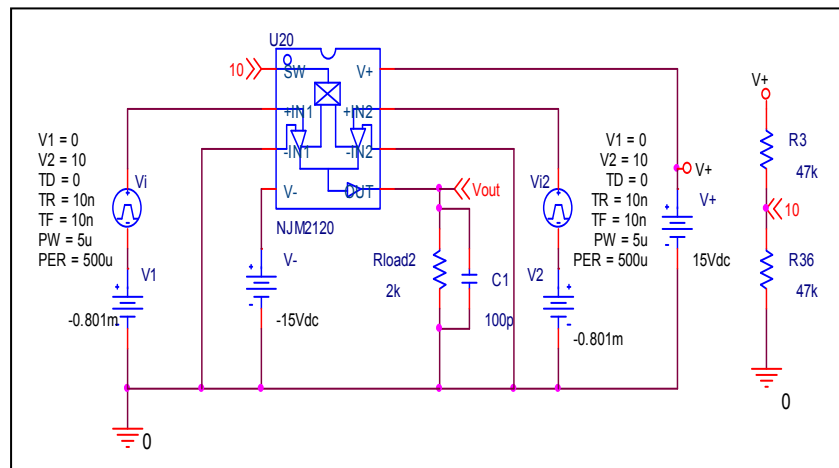
Comparison table

Slew Rate(v/us)	Data sheet	Simulation	%Error
	2.2	2.26	2.72

Input current

300nA

200nA

100nA

0A

0s   0.5ms   1.0ms

◇ I(Vin2)

Time
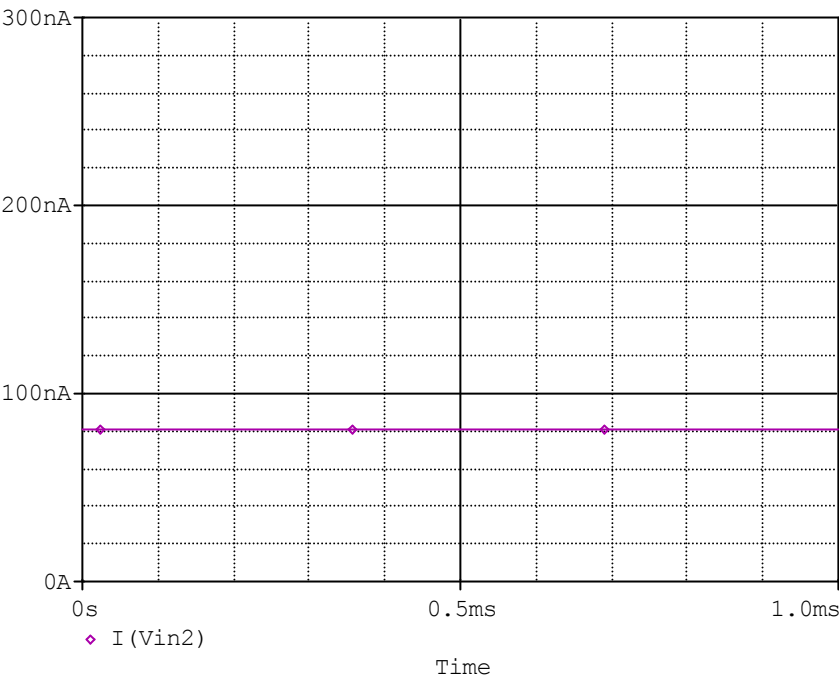
Evaluation circuit
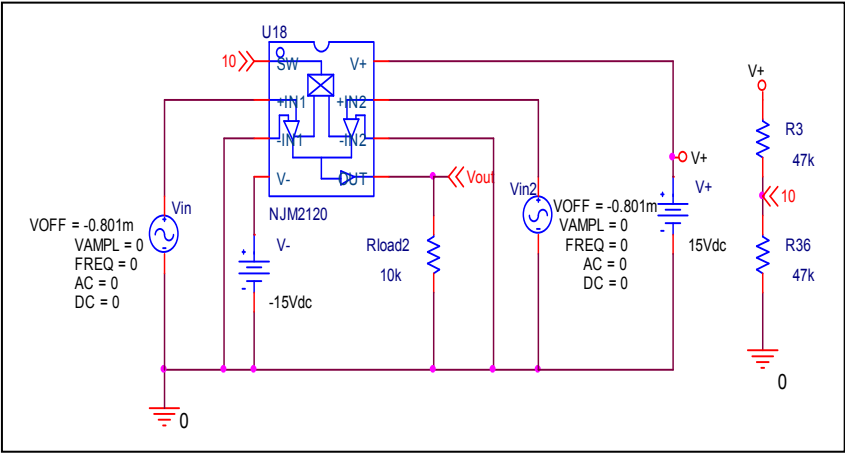
Comparison table

	Data sheet	Simulation	%Error
Ib(nA)	80	81.061	1.326

Open Loop Voltage Gain vs. Frequency

Simulation result
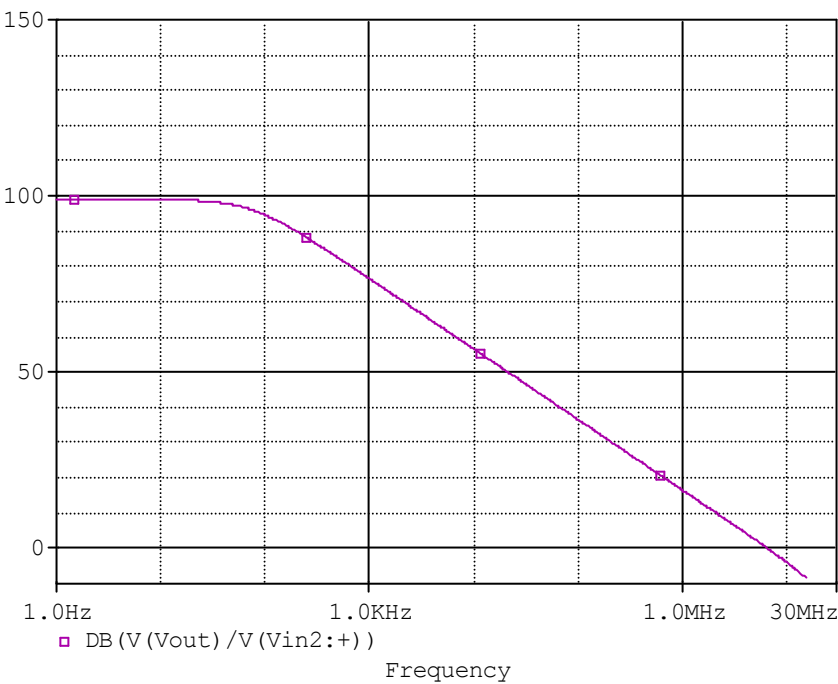
Evaluation circuit
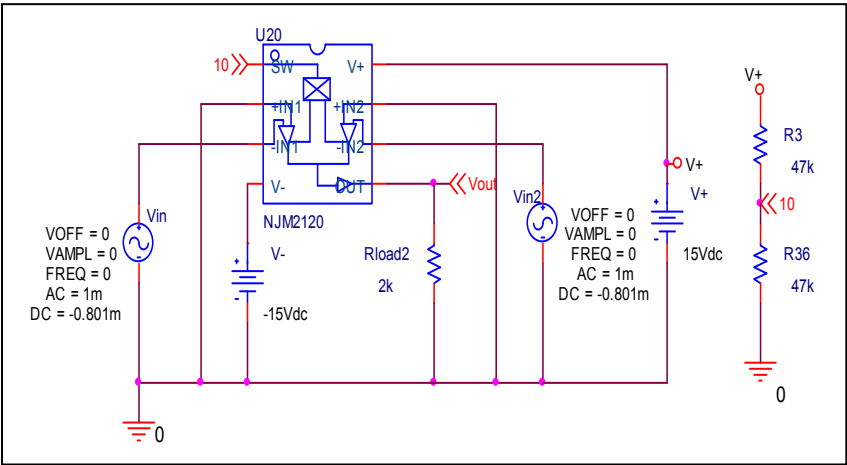
Comparison table

	Data sheet	Simulation	%Error
f-0dB(MHz)	7	6.76	-3.428
Av-dc	100	99.35	-0.65

Shock Noise Simulation   Reference

Simulation result

V(OUT)

Time

Evaluation circuit