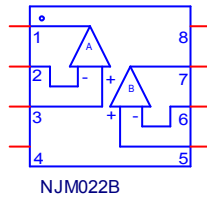# Device Modeling Report

COMPONENTS: OPERATIONAL AMPLIFIER
PART NUMBER:NJM022B
MANUFACTURER: NEW JAPAN RADIO CO.,LTD

**Bee Technologies Inc.**

SPice Model

NJM022B

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*$
* PART NUMBER: NJM022B
* MANUFACTURER: NEW JAPAN RADIO
* All Rights Reserved Copyright (c) Bee Technologies Inc. 2006
.Subckt NJM022B OUT1 -IN1 +IN1 VEE +IN2 -IN2 OUT2 VCC
X_U1     +IN1 -IN1 VCC VEE OUT1 NJM022B_ME
X_U2     +IN2 -IN2 VCC VEE OUT2 NJM022B_ME
.ends  NJM022B
.subckt NJM022B_ME  1 2 3 4 5
 c1   11 12 7.7942E-12
 c2    6  7 27.000E-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 4.6352E6 -1E3 1E3 4E6 -4E6
 ga    6  0 11 12 192.93E-6
 gcm   0  6 10 99 4.8461E-9
 iee   3 10 dc 30.041E-6
 hlim 90  0 vlim 1K
 q1   11  2 13 qx1
 q2   12  1 14 qx2
 r2    6  9 100.00E3
 rc1   4 11 4.6132E3
 rc2   4 12 4.6132E3
 re1  13 10 2.8850E3
 re2  14 10 2.8850E3
 ree  10 99 6.6576E6
 ro1   8  5 50
 ro2   7 99 25
 rp    3  4 1.8032E3
 vb    9  0 dc 0
 vc    3 53 dc 2.7979
 ve   54  4 dc 2.7979
 vlim  7  8 dc 0
 vlp  91  0 dc 7.5000
 vln   0 92 dc 7.5000
.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=698.16)
.model qx2 PNP(Is=970.6100E-18 Bf=768.64)
.ends
*$
```
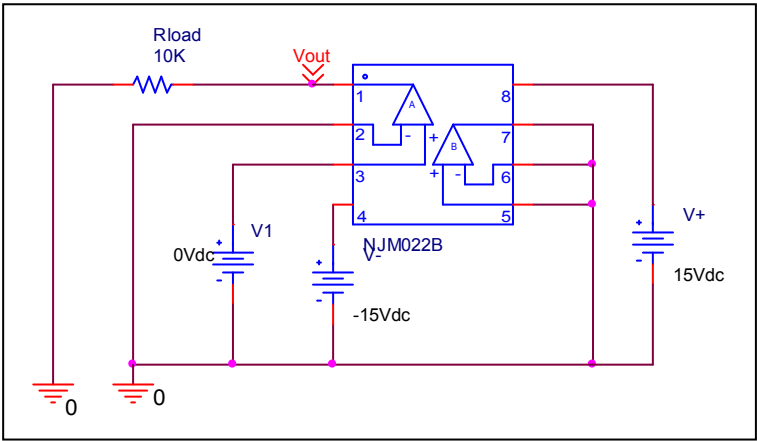
Output Voltage Swing

V(Vout)

V_V1
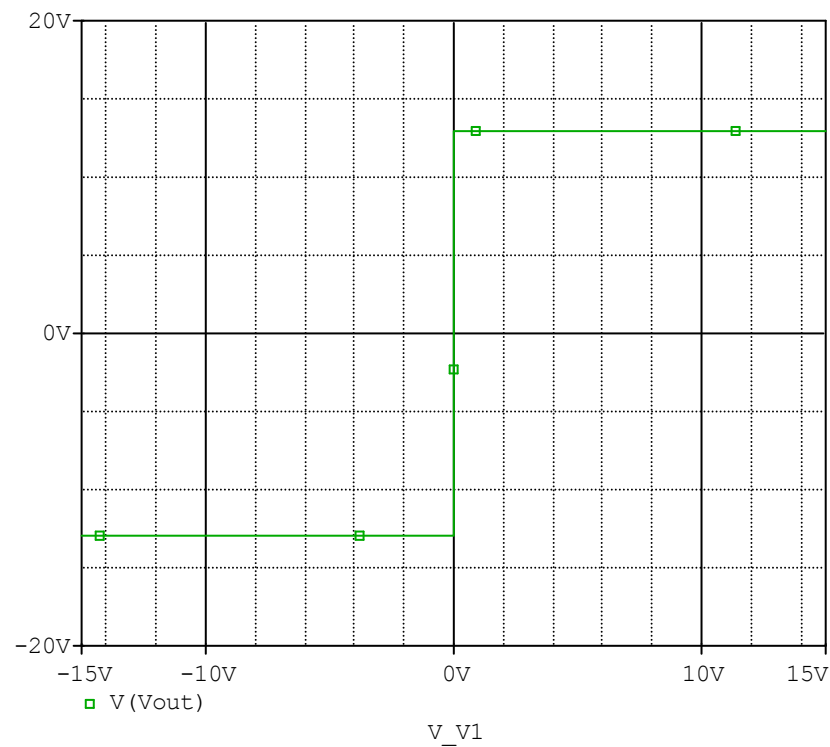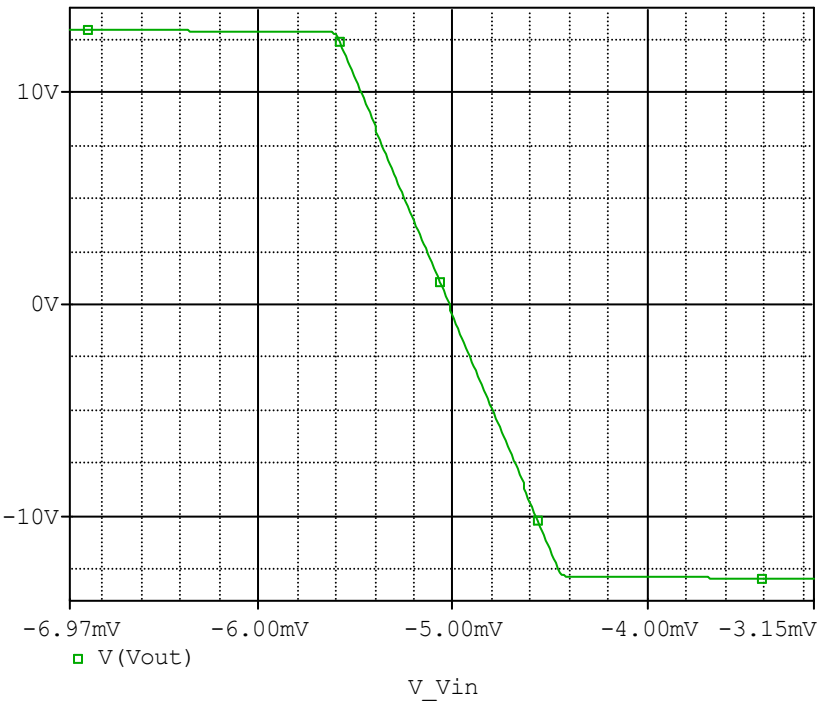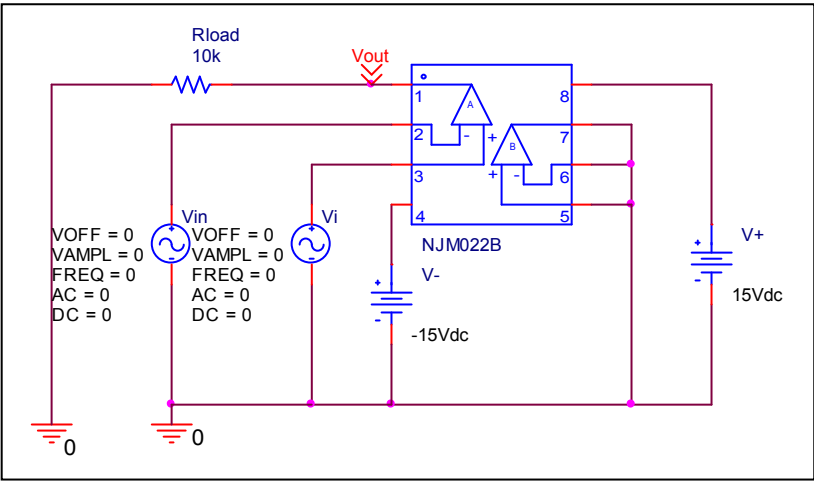
Evaluation circuit

Output Voltage Swing	Data sheet	Simulation	%Error
+Vout(V)	+13.000	+12.972	0.215
-Vout(V)	-13.000	-12.972	0.215

Input Offset Voltage

V(Vout)

V_Vin

Vos	Measurement		Simulation		Error	
	5.000	mV	5.021	mV	0.438	%

Slew Rate

Simulation result
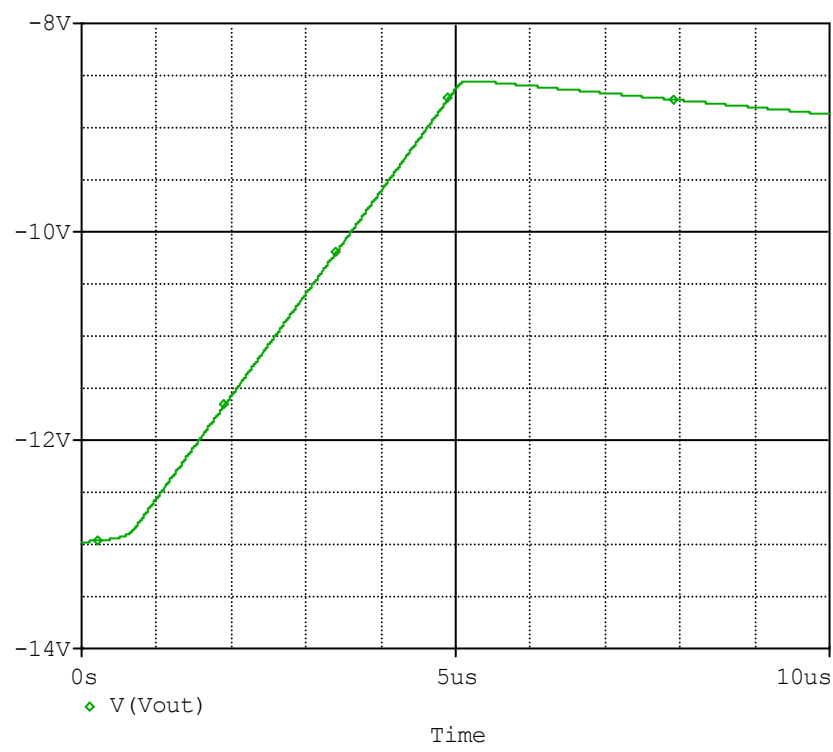
Evaluation circuit
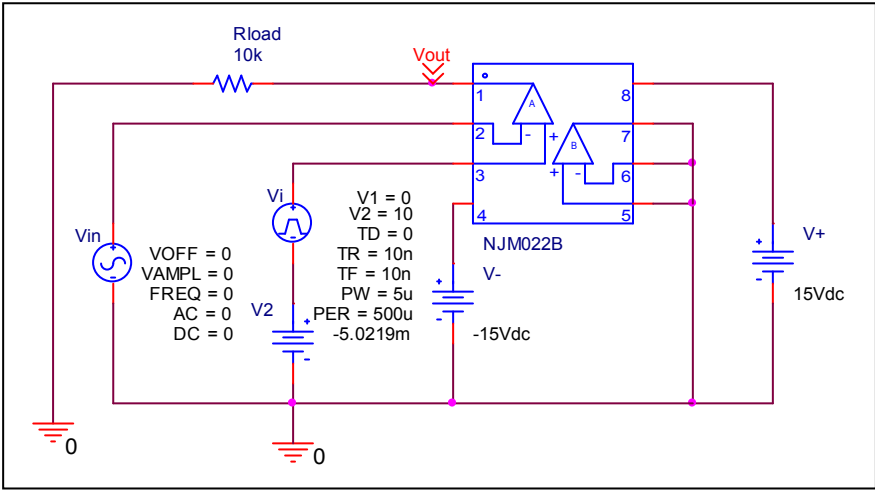
Slew Rate(v/us)	Data sheet	Simulation	%Error
	1.000	0.979	2.100

Input current
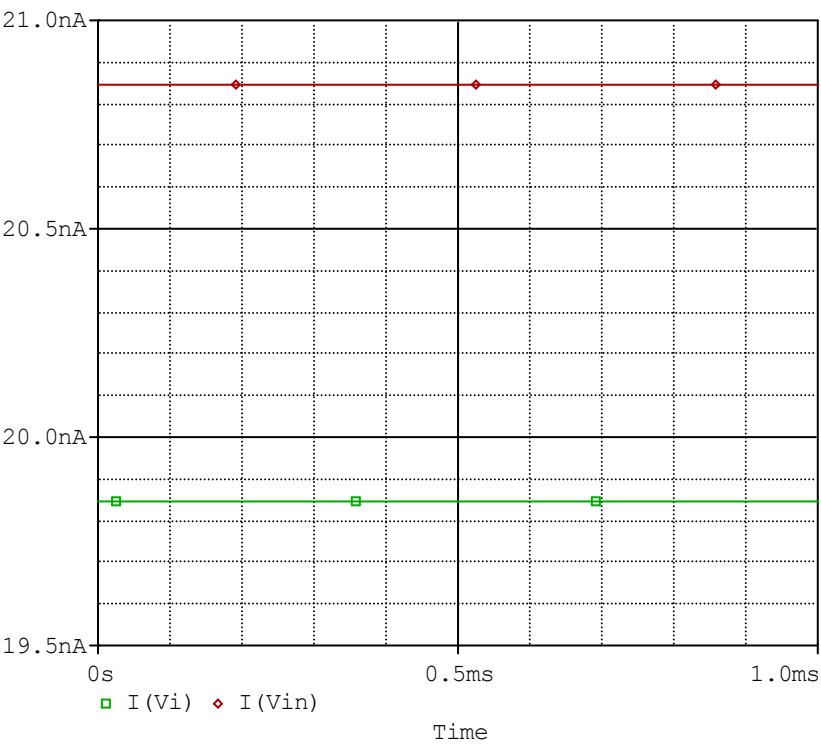
Evaluation circuit
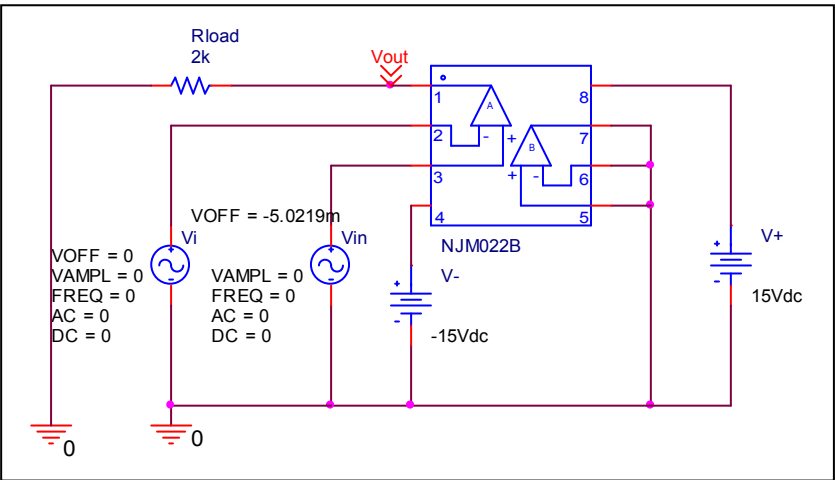
	Data sheet	Simulation	%Error
Ib(nA)	20.000	20.340	1.700
Ibos(nA)	1.000	1.001	0.100

Open Loop Voltage Gain vs. Frequency

□ DB(V(Vout)/V(Vin:+))

Frequency
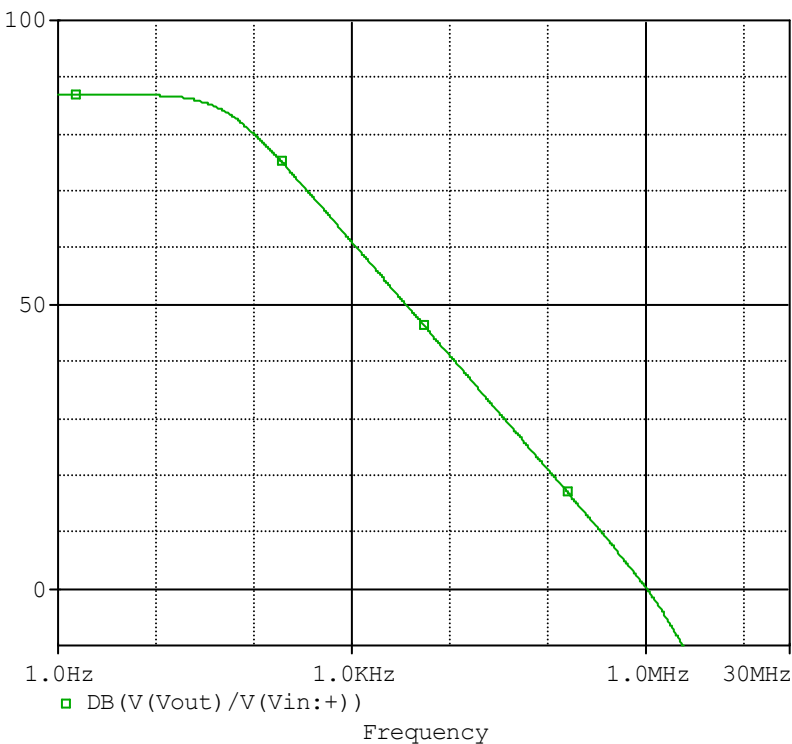
Evaluation circuit
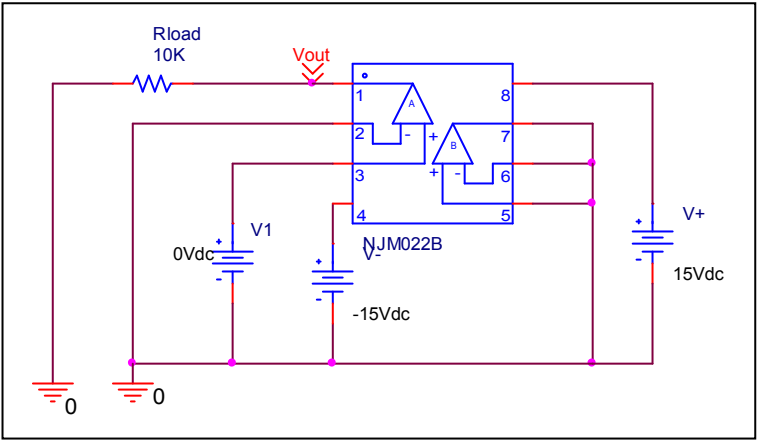
	Data sheet	Simulation	%Error
f-0dB(MHz)	1.000	1.050	5.000
Av-dc	88.000	88.079	0.089

Common-Mode Rejection Voltage gain

□ V(Vout)

Time
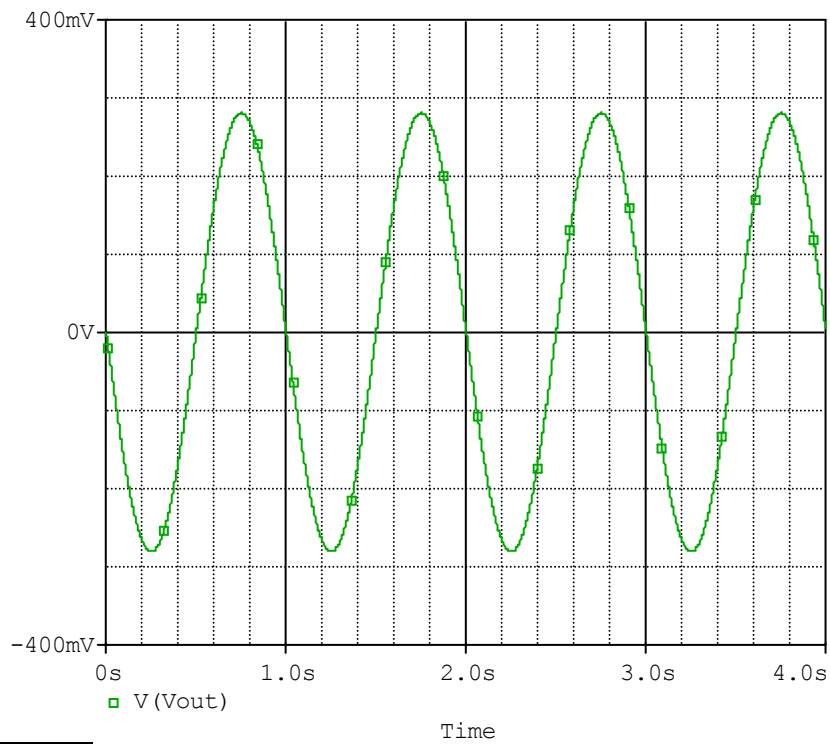
Evaluation circuit

Common Mode Reject Ratio=25348/0.561=45183.600

CMRR(dB)	Data sheet	Simulation	%Error
	92.000	93.099	1.194