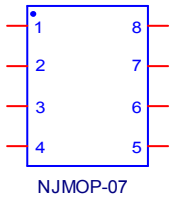
Device Modeling Report

COMPONENTS: OPERATIONAL AMPLIFIER
PART NUMBER:NJMOP-07
MANUFACTURER: NEW JAPAN RADIO CO.,LTD

Bee Technologies Inc.

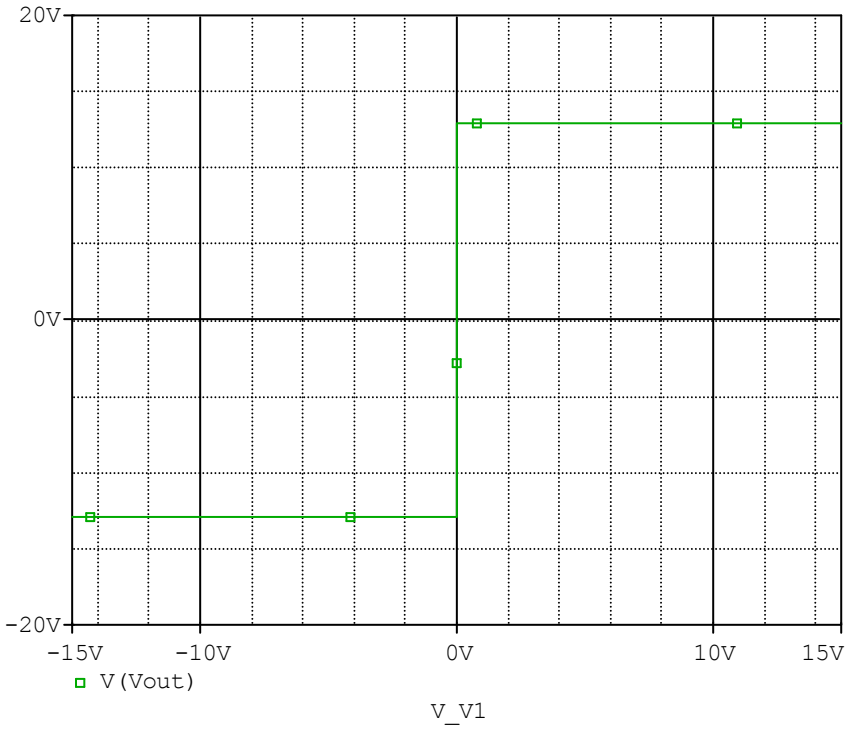
SPice Model



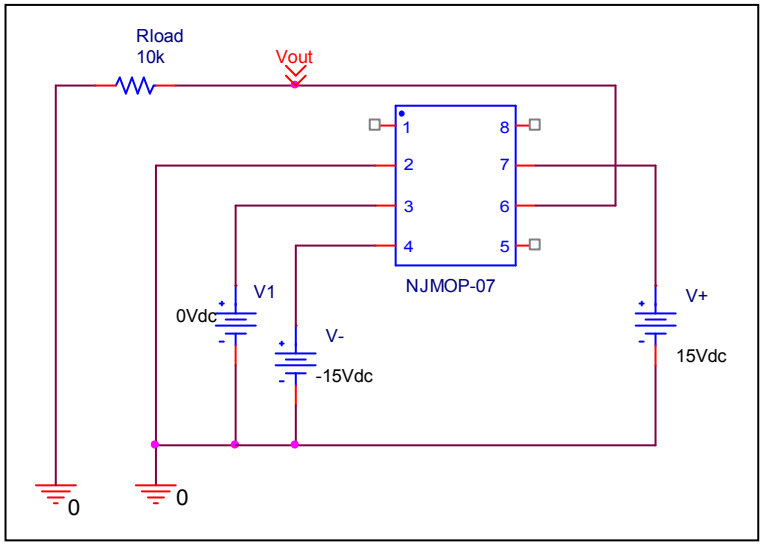

```
*$
* PART NUMBER: NJMOP-07
* MANUFACTURER: NEW JAPAN RADIO
* All Rights Reserved Copyright (C) Bee Technologies Inc. 2006
.Subckt NJMOP-07 -IN +iN V- OUT V+
X_U1     +IN -IN V+ V- OUT NJMOP-07_ME
.ends  NJMOP-07
.subckt NJMOP-07_ME 1 2 3 4 5
  c1   11 12 9.9593E-12
  c2    6  7 34.500E-12
  dc    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 0 168.96E6 -1E3 1E3 170E6 -170E6
  ga    6  0 11 12 119.25E-6
  gcm   0  6 10 99 119.25E-12
  iee   3 10 dc 5.1037E-6
  hlim 90  0 vlim 1K
  q1   11  2 13 qx1
  q2   12  1 14 qx2
  r2    6  9 100.00E3
  rc1   4 11 10.610E3
  rc2   4 12 10.610E3
  re1  13 10 467.19
  re2  14 10 467.19
  ree  10 99 39.188E6
  ro1   8  5 50
  ro2   7 99 25
  rp    3  4 1.8006E3
  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 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=1.1376E3)
.model qx2 PNP(Is=804.6500E-18 Bf=1.7977E3)
.ends
*$
```

Output Voltage Swing

Simulation result



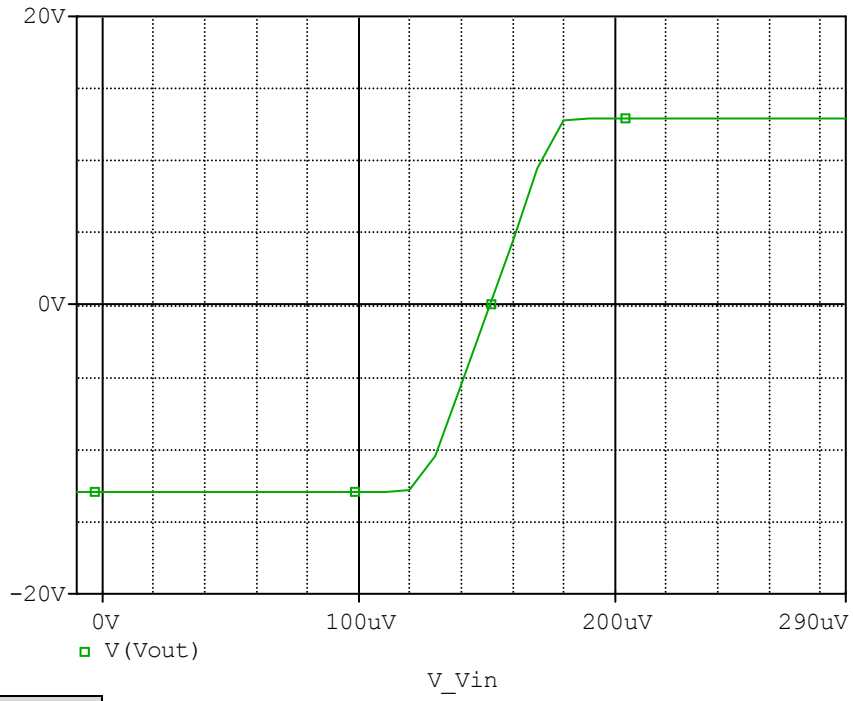
Evaluation circuit



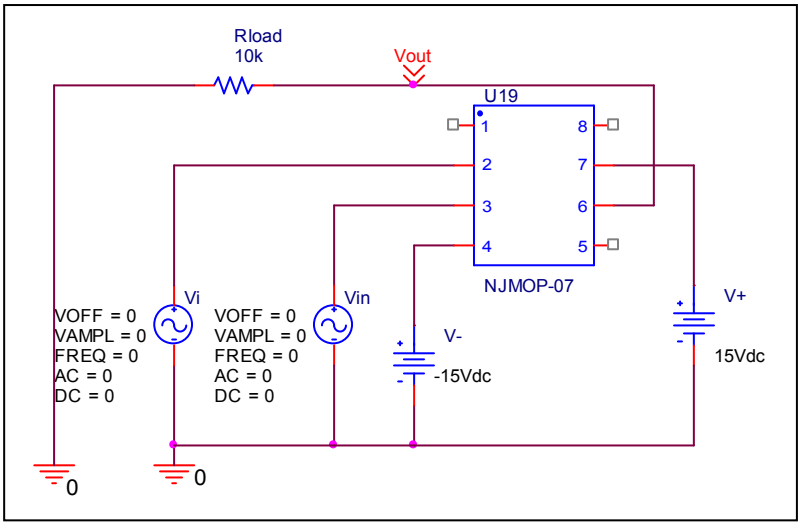
Output Voltage Swing	Data sheet	Simulation	%Error
+Vout(V)	13.000	12.932	-0.523
-Vout(V)	13.000	12.932	-0.523

Input Offset Voltage

Simulation result



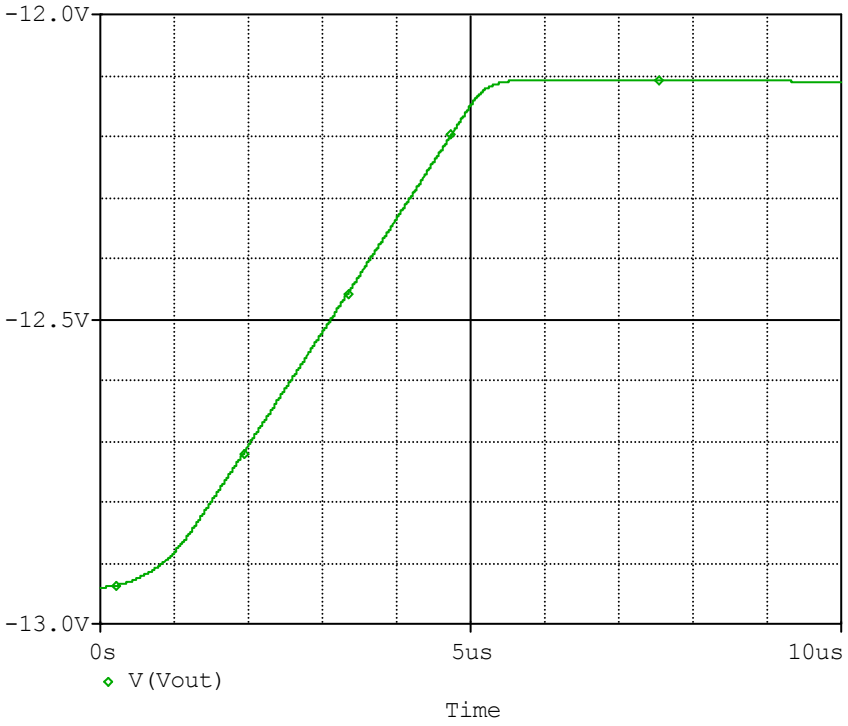
Evaluation circuit



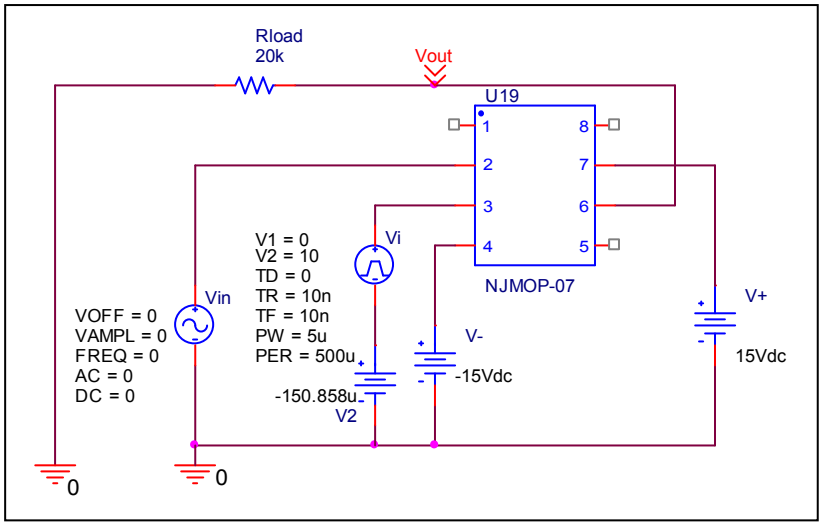
Vos	Measurement		Simulation		Error	
	150.000	uV	150.858	uV	0.572	%

Slew Rate

Simulation result



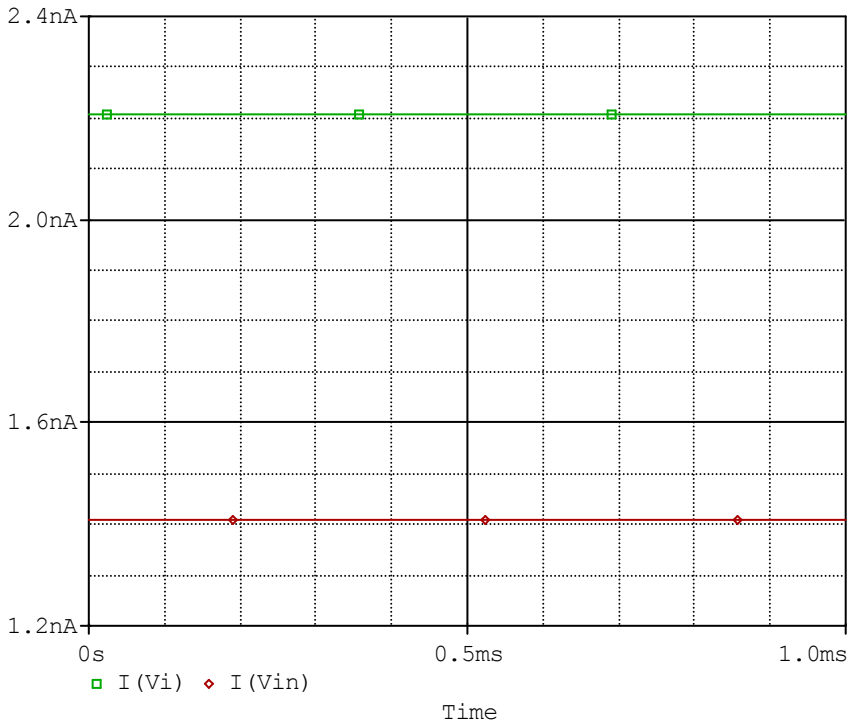
Evaluation circuit



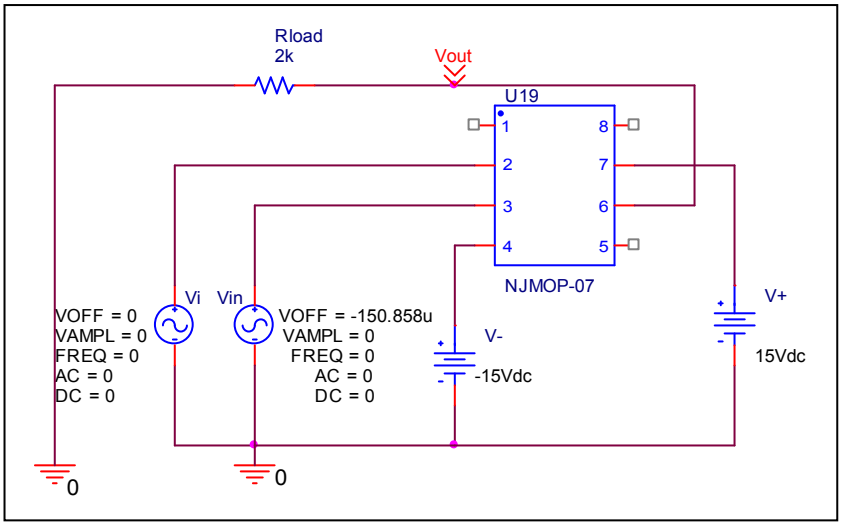
Slew Rate(v/us)	Data sheet	Simulation	%Error
	0.170	0.175	2.900

Input current

Simulation result



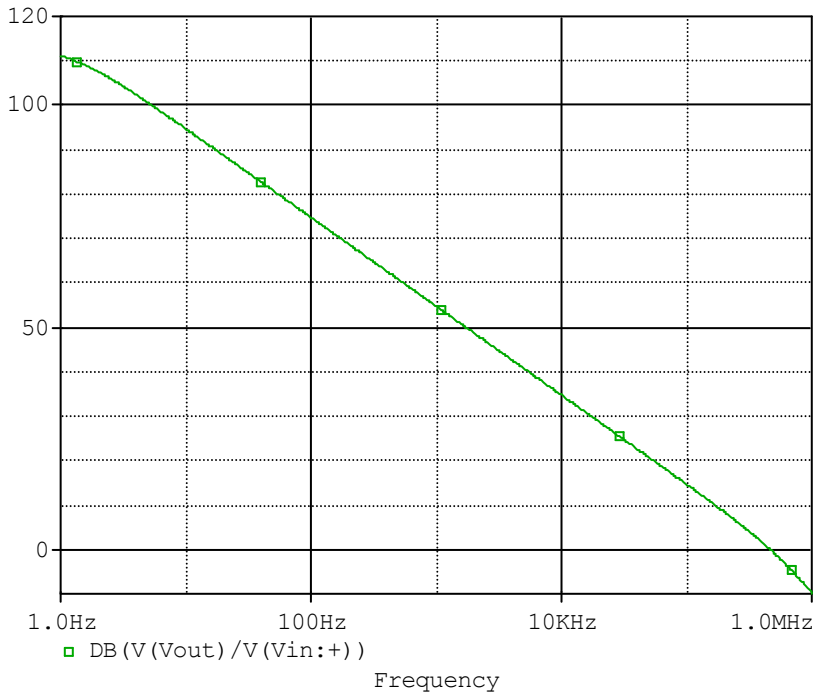
Evaluation circuit



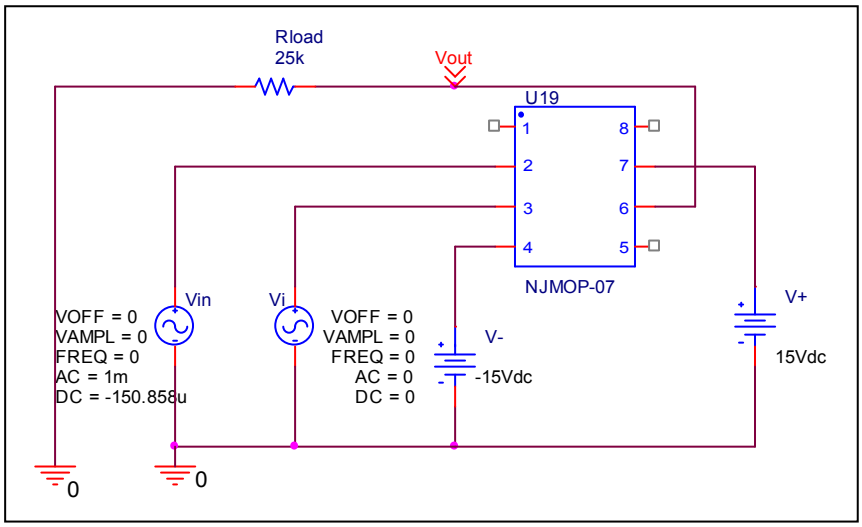
	Data sheet	Simulation	%Error
Ib(pA)	0.800	0.800	0.000
Ibos(nA)	1.800	1.805	0.277

Open Loop Voltage Gain vs. Frequency

Simulation result



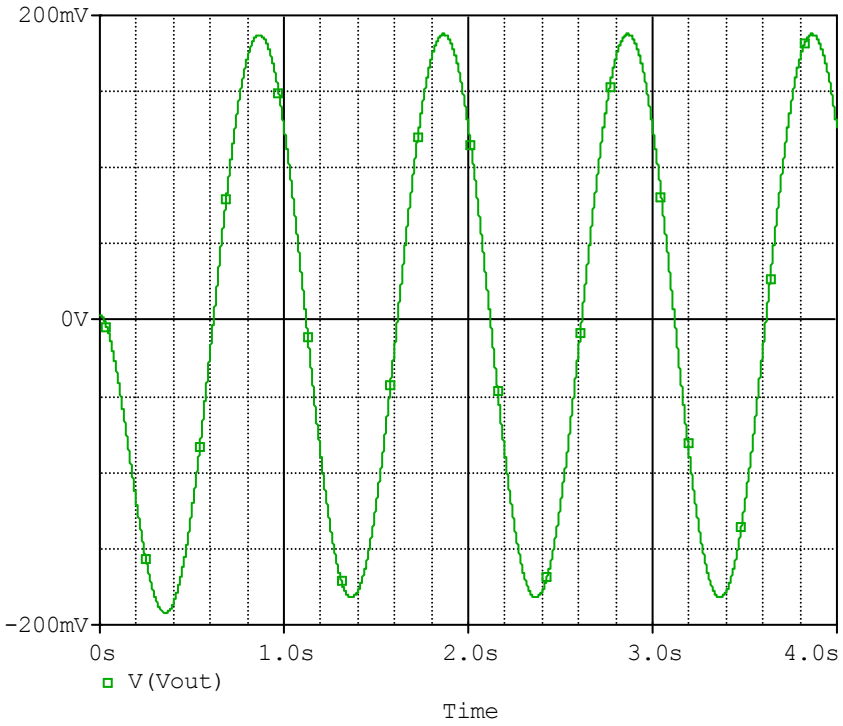
Evaluation circuit



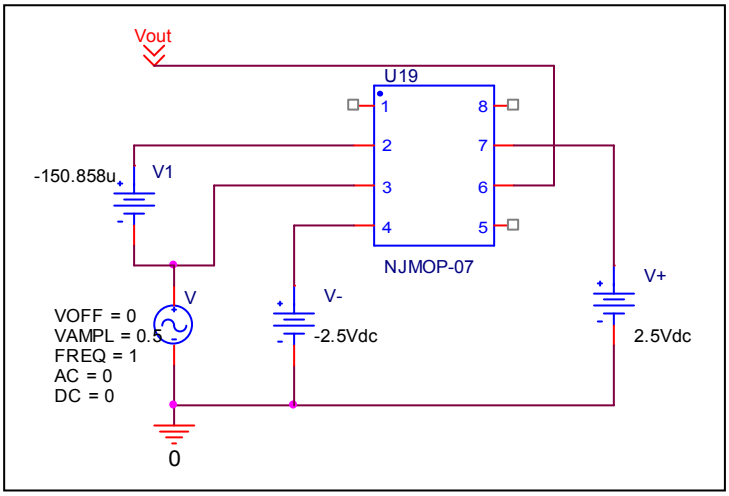
	Data sheet	Simulation	%Error
f-0dB(MHz)	0.500	0.476	-4.800
Av-dc(dB)	112.000	111.300	-0.625

Common-Mode Rejection Voltage gain

Simulation result



Evaluation circuit



Common Mode Reject Ratio=367282/0.379=969081.7

CMRR(dB)	Data sheet	Simulation	%Error
	120.000	119.700	-0.250