

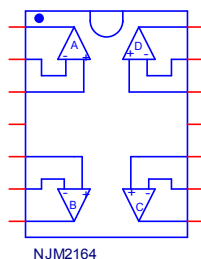
Device Modeling Report

COMPONENTS: OPERATIONAL AMPLIFIER
PART NUMBER: NJM2164
MANUFACTURER: NEW JAPAN RADIO CO., LTD



Bee Technologies Inc.

Spice Model



NJM2164

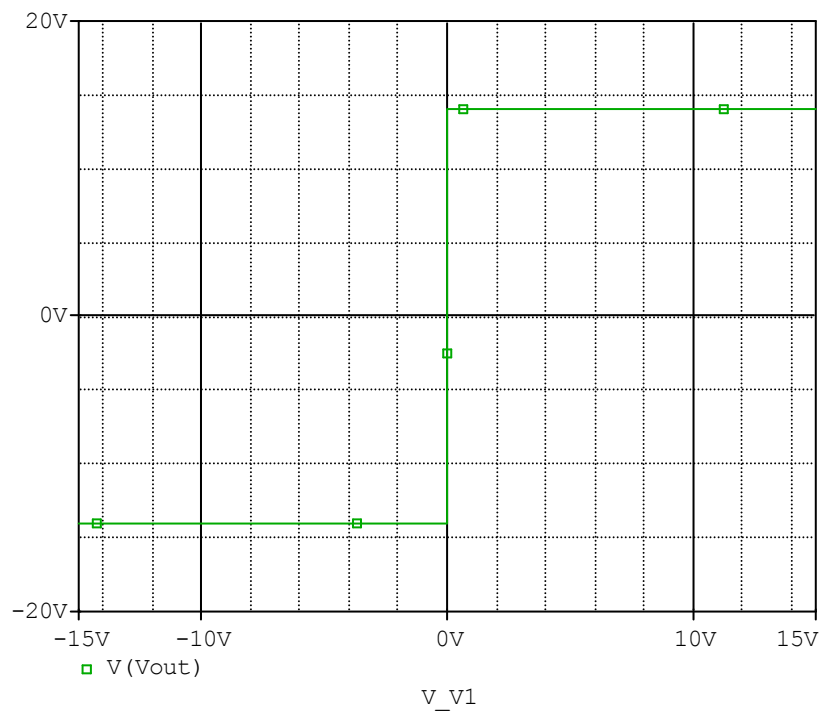
```

*$
* PART NUMBER: NJM2164
* MANUFACTURER: NEW JAPAN RADIO
* All Rights Reserved Copyright (c) Bee Technologies Inc. 2006
.Subckt NJM2164 OUT1 -IN1 +IN1 V+ +IN2 -IN2 OUT2 OUT3 -IN3 +IN3 V-
+ +IN4 -IN4 OUT4
X_U1  +IN1 -IN1 V+ V- OUT1 NJM2164_ME
X_U2  +IN2 -IN2 V+ V- OUT2 NJM2164_ME
X_U3  +IN3 -IN3 V+ V- OUT3 NJM2164_ME
X_U4  +IN4 -IN4 V+ V- OUT4 NJM2164_ME
.ends  NJM2164
.subckt NJM2164_ME 1 2 3 4 5
c1  11 12 2.5981E-12
c2  6 7 9.0000E-12
css 10 99 1.0000E-30
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
fb  7 99 poly(5) vb vc ve vlp vln 0 2.1221E6 -1E3 1E3 2E6 -2E6
ga  6 0 11 12 158.50E-6
gcm 0 6 10 99 5.0122E-9
iss 3 10 dc 106.00E-6
hlim 90 0 vlim 1K
j1  11 2 10 jx1
j2  12 1 10 jx2
r2  6 9 100.00E3
rd1 4 11 5.3052E3
rd2 4 12 5.3052E3
ro1 8 5 50
ro2 7 99 25
rp  3 4 1.8000E3
rss 10 99 1.8868E6
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 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 jx1 Pjf(Is=242.50E-12 Beta=237.00E-6 Vto=-.9925)
.model jx2 Pjf(Is=142.50E-12 Beta=237.00E-6 Vto=-1.007500)
.ends
*$

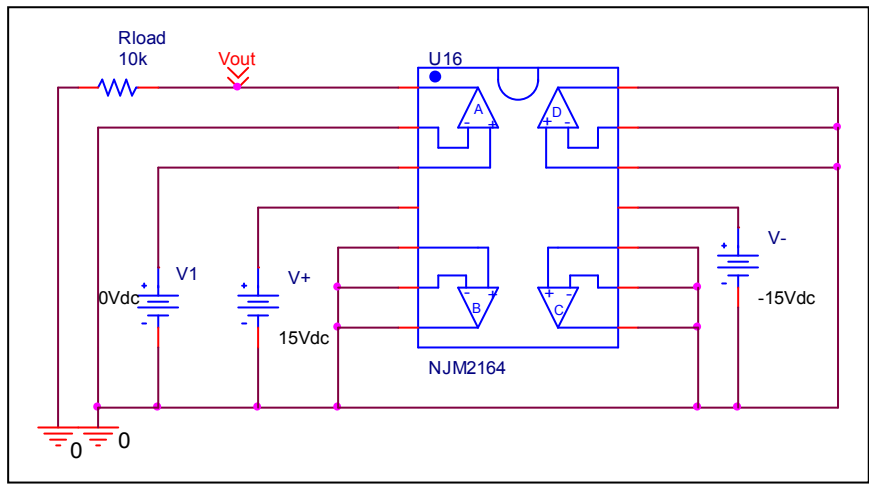
```

Output Voltage Swing

Simulation result



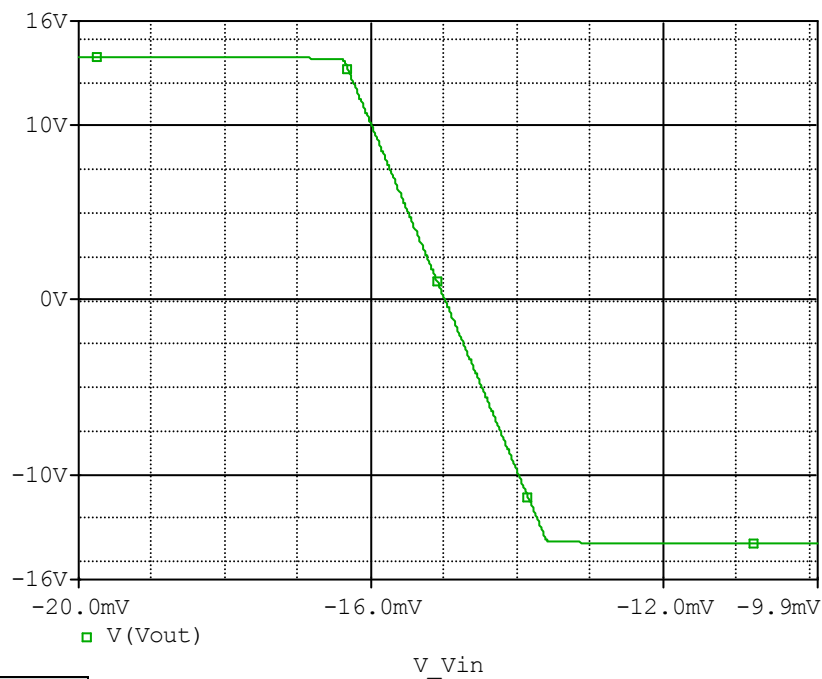
Evaluation circuit



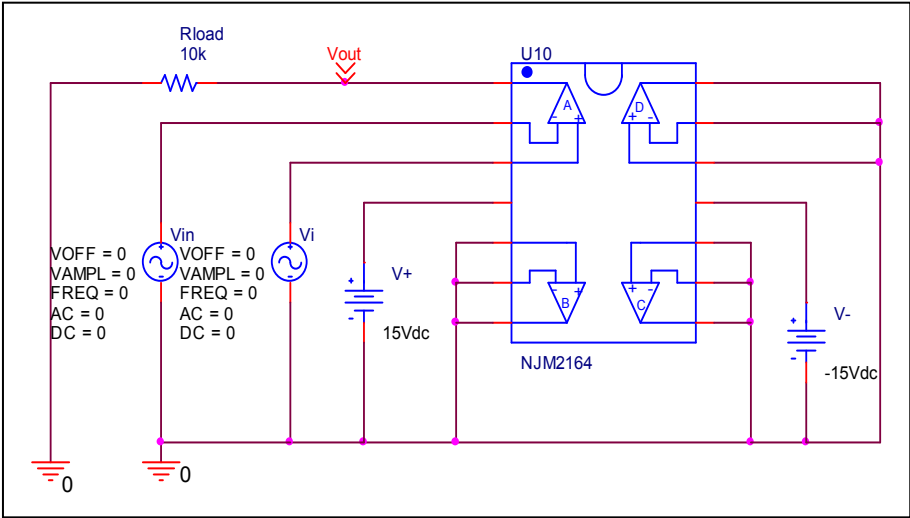
Output Voltage Swing	Data sheet	Simulation	%Error
+Vout(V)	+14.000	+13.972	0.200
-Vout(V)	-14.000	-13.972	0.200

Input Offset Voltage

Simulation result



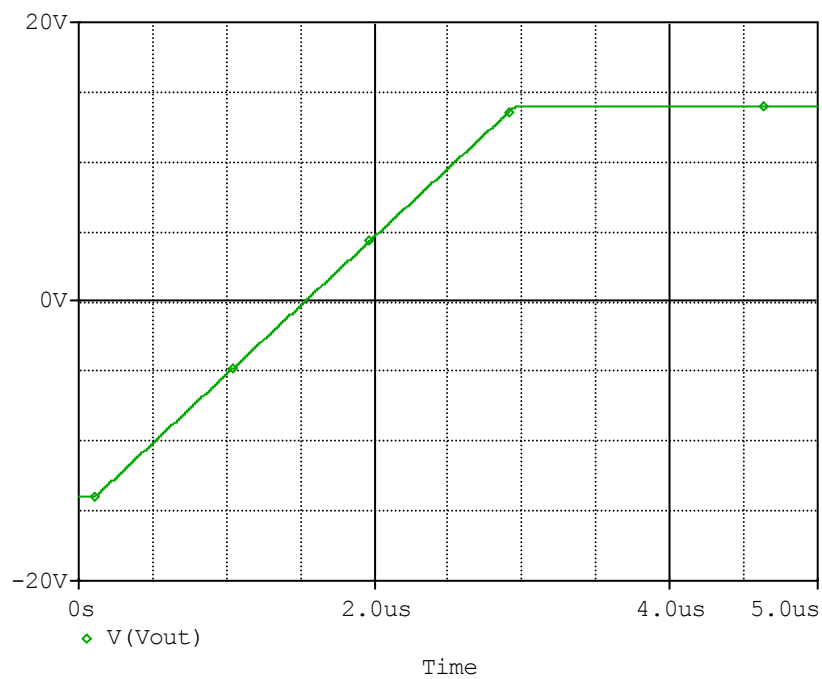
Evaluation circuit



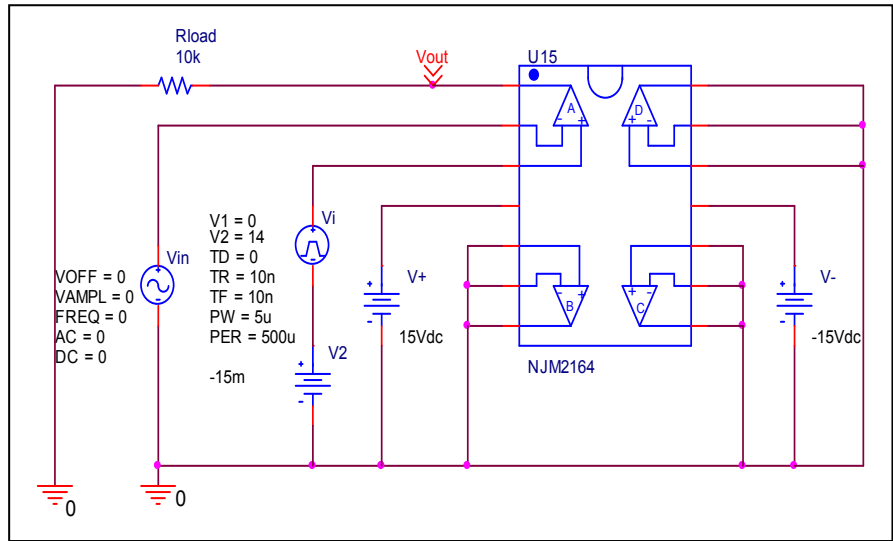
Vos	Measurement		Simulation		Error	
	15.000	mV	15.000	mV	0.000	%

Slew Rate

Simulation result



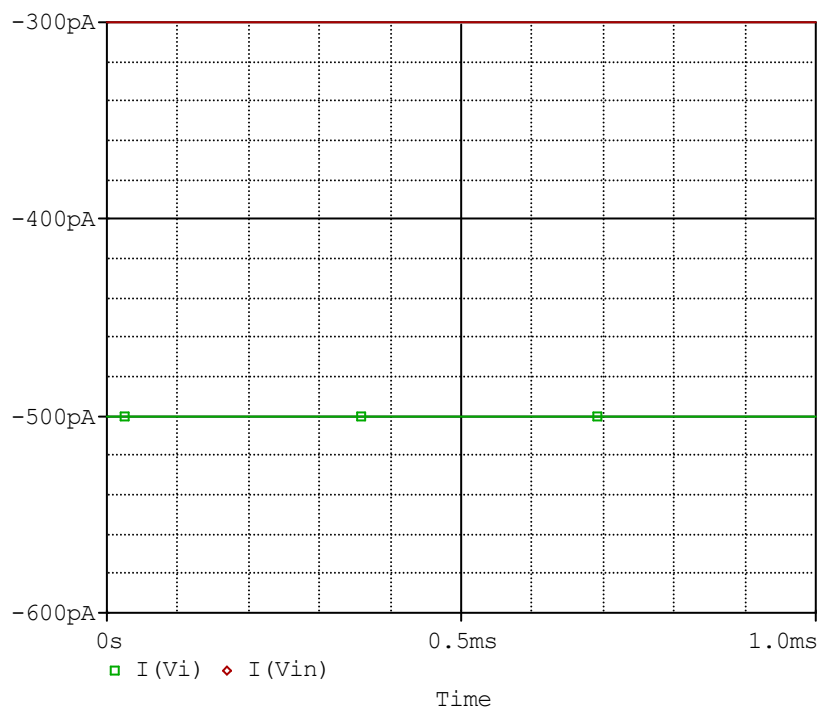
Evaluation circuit



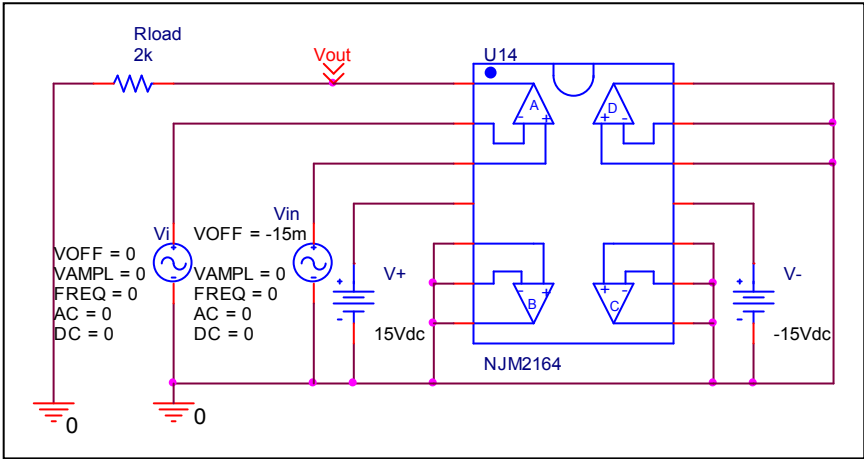
Slew Rate(v/us)	Data sheet	Simulation	%Error
	10.000	9.850	1.500

Input current

Simulation result



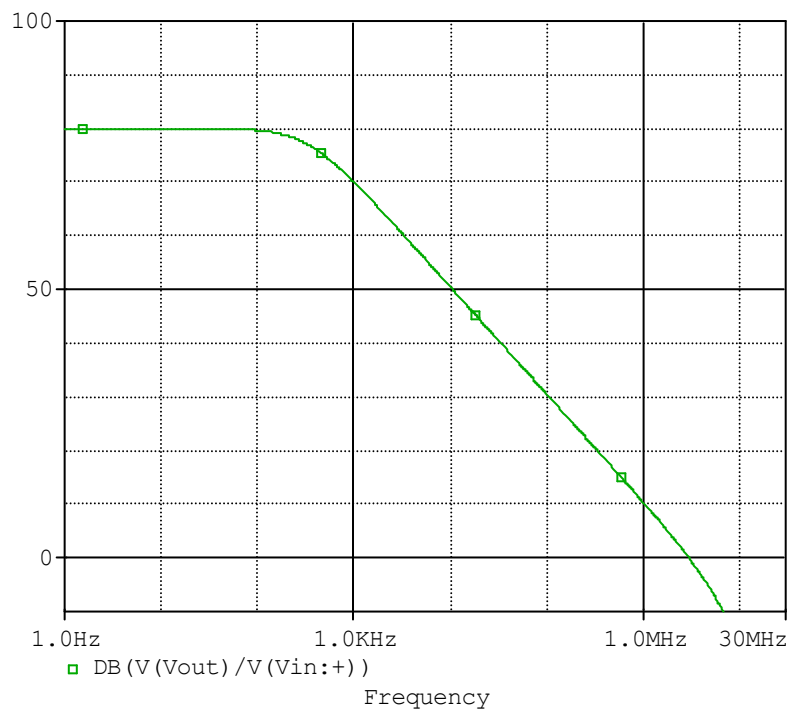
Evaluation circuit



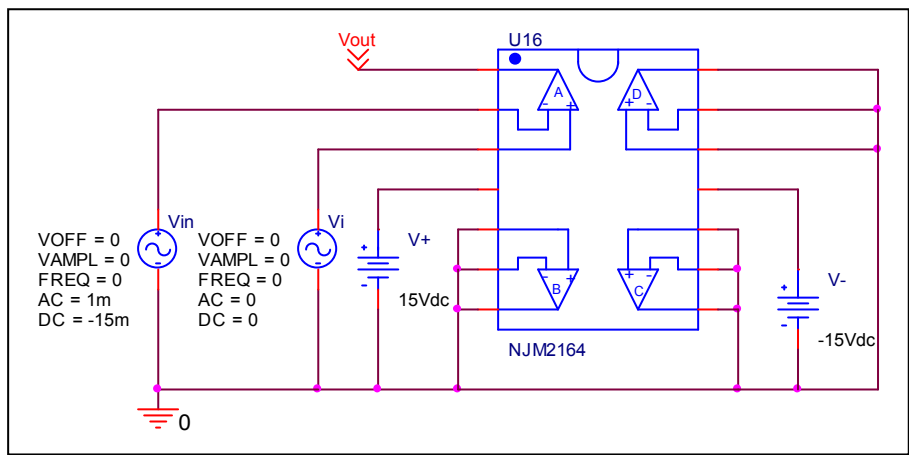
	Data sheet	Simulation	%Error
Ib(pA)	400.000	400.000	0.000
Ibos(pA)	200.000	200.000	0.000

Open Loop Voltage Gain vs. Frequency

Simulation result



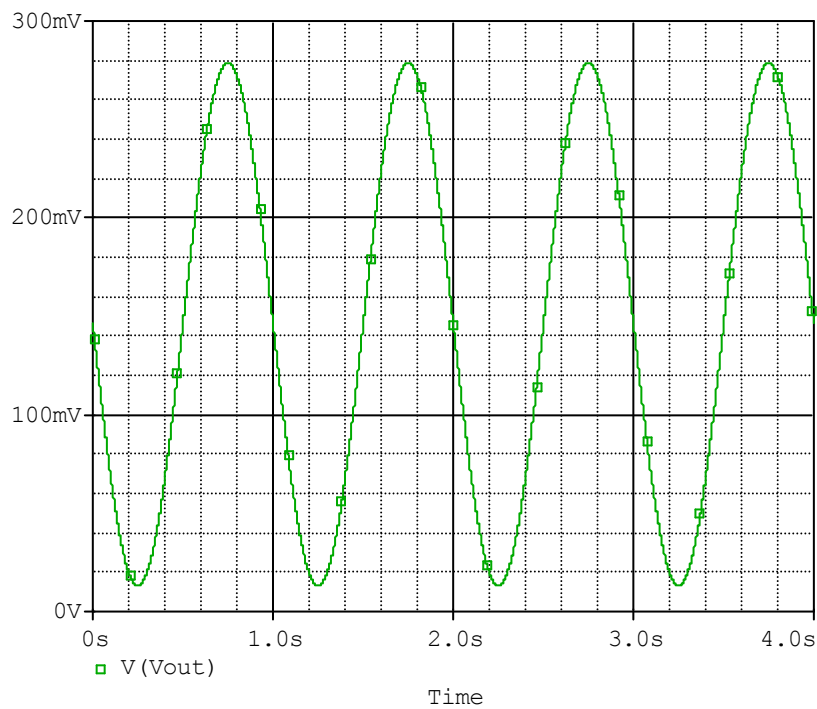
Evaluation circuit



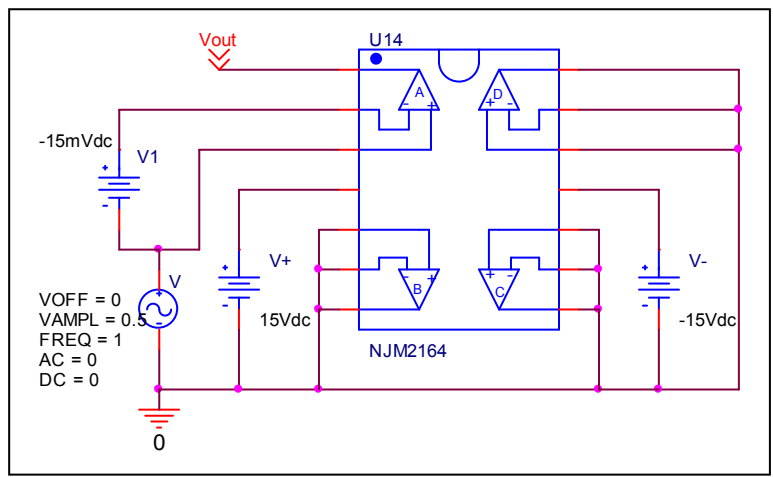
	Data sheet	Simulation	%Error
f-0dB(MHz)	3.000	2.950	1.667
Av-dc	80.000	79.950	0.062

Common-Mode Rejection Voltage gain

Simulation result



Evaluation circuit



Common Mode Reject Ratio= $9942/0.265=37516.981$

CMRR	Data sheet	Simulation	%Error
	90.000	91.484	1.648