

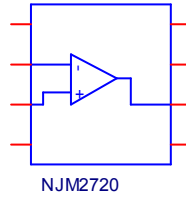
# Device Modeling Report

COMPONENTS: OPERATIONAL AMPLIFIER  
PART NUMBER: NJM2720  
MANUFACTURER: NEW JAPAN RADIO CO., LTD



**Bee Technologies Inc.**

## Spice Model



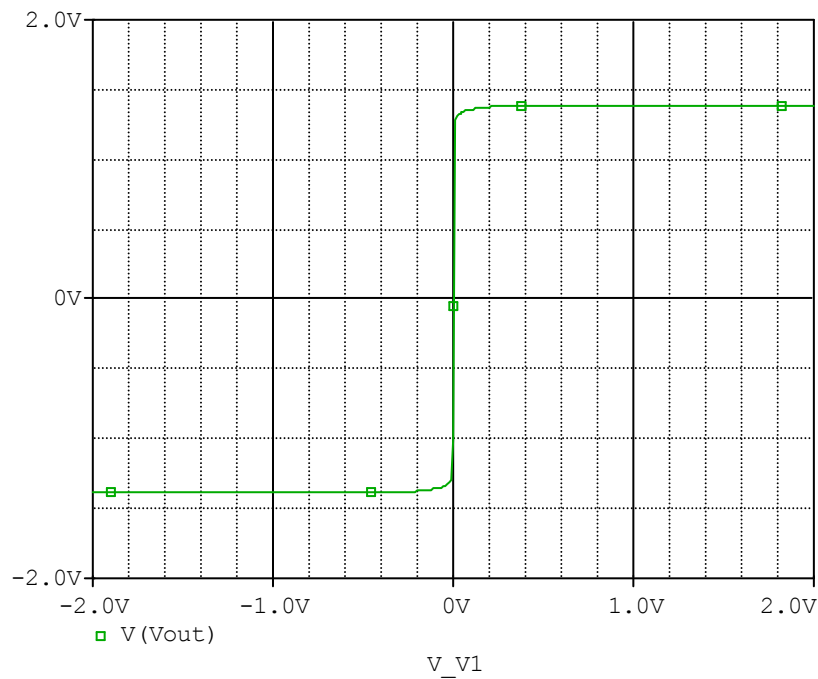
```

*$
* PART NUMBER:NJM2720
* MANUFACTURER: NEW JAPAN RADIO
* All Rights Reserved Copyright (c) Bee Technologies Inc. 2006
.Subckt NJM2720 OUT IN- IN+ V+ V-
X_U1  IN+ IN- V+ V- OUT NJM2720_ME
.ends NJM2720
.subckt NJM2720_ME 1 2 3 4 5
c1  11 12 8.6603E-12
c2  6 7 37.000E-15
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 1.7684E3 -1E3 1E3 1E3 -1E3
ga  6 0 11 12 22.619E-3
gcm 0 6 10 99 2.2619E-6
iee 3 10 dc 13.515E-3
hlim 90 0 vlim 1K
q1  11 2 13 qx1
q2  12 1 14 qx2
r2  6 9 100.00E3
rc1 4 11 44.210
rc2 4 12 44.210
re1 13 10 40.333
re2 14 10 40.333
ree 10 99 14.798E3
ro1 8 5 50
ro2 7 99 25
rp  3 4 137.74
vb  9 0 dc 0
vc  3 53 dc 1.8979
ve  54 4 dc 1.8979
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=894.22)
.model qx2 PNP(Is=844.8200E-18 Bf=905.86)
.ends
*$

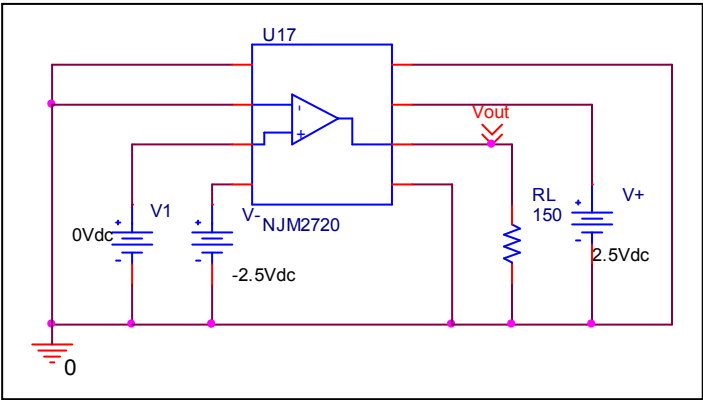
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# Output Voltage Swing

Simulation result



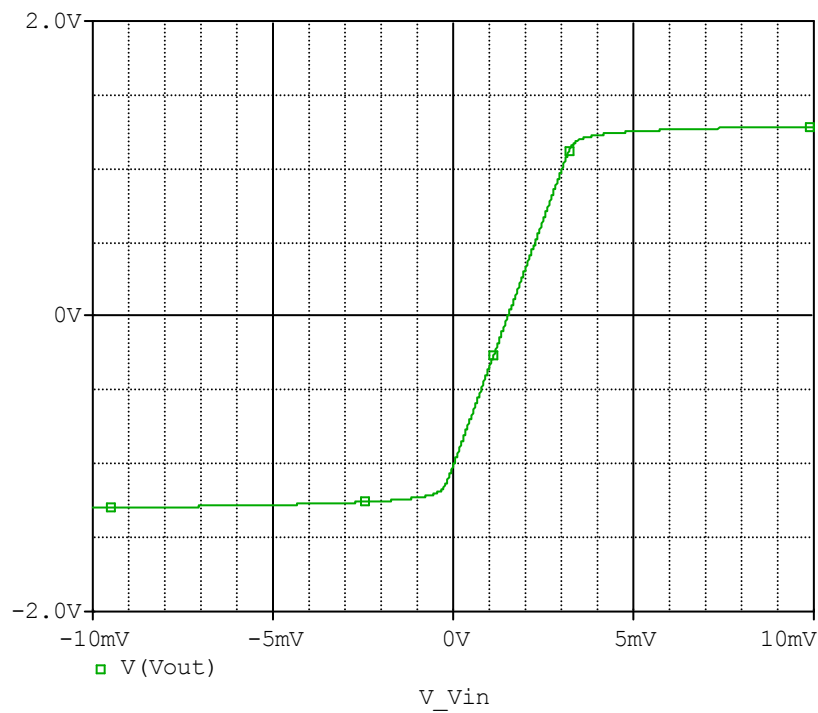
Evaluation circuit



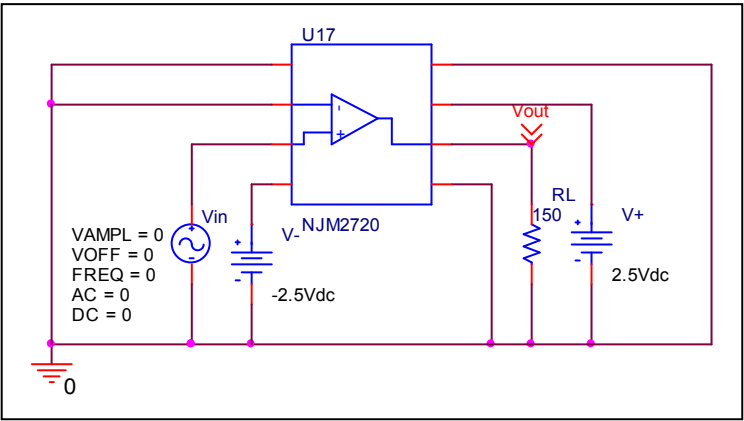
Output Voltage Swing	Data sheet	Simulation	%Error
+Vout(V)	1.400	1.385	-1.071
-Vout(V)	-1.400	-1.385	-1.071

# Input Offset Voltage

## Simulation result



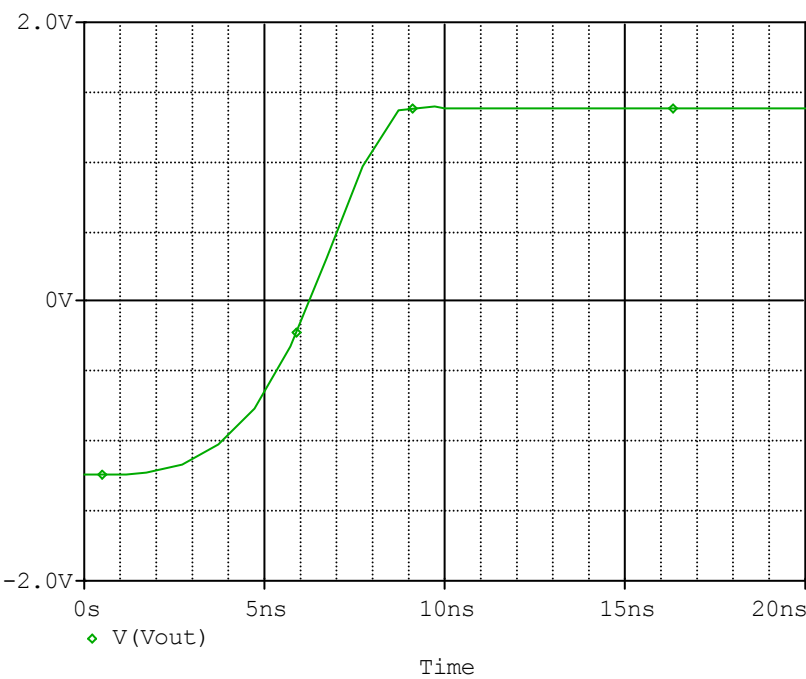
## Evaluation circuit



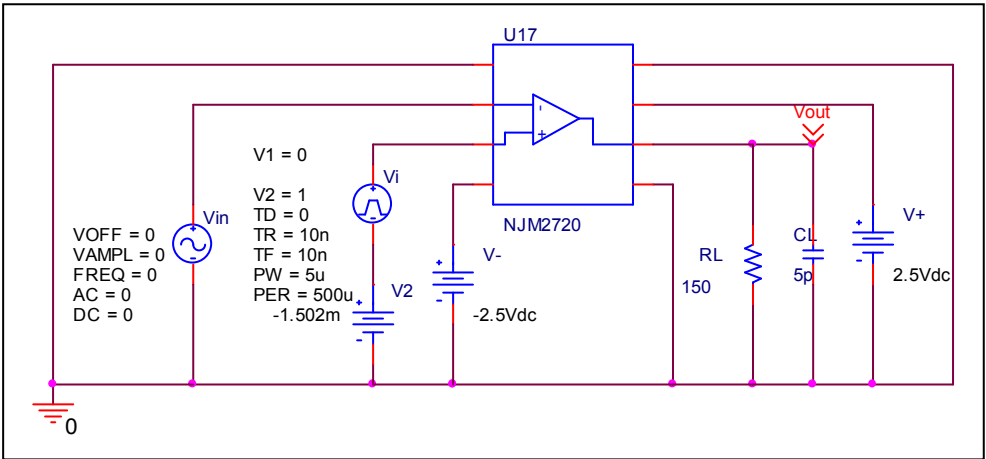
Vos	Measurement		Simulation		Error	
	1.500	mV	1.502	mV	0.133	%

# Slew Rate

## Simulation result



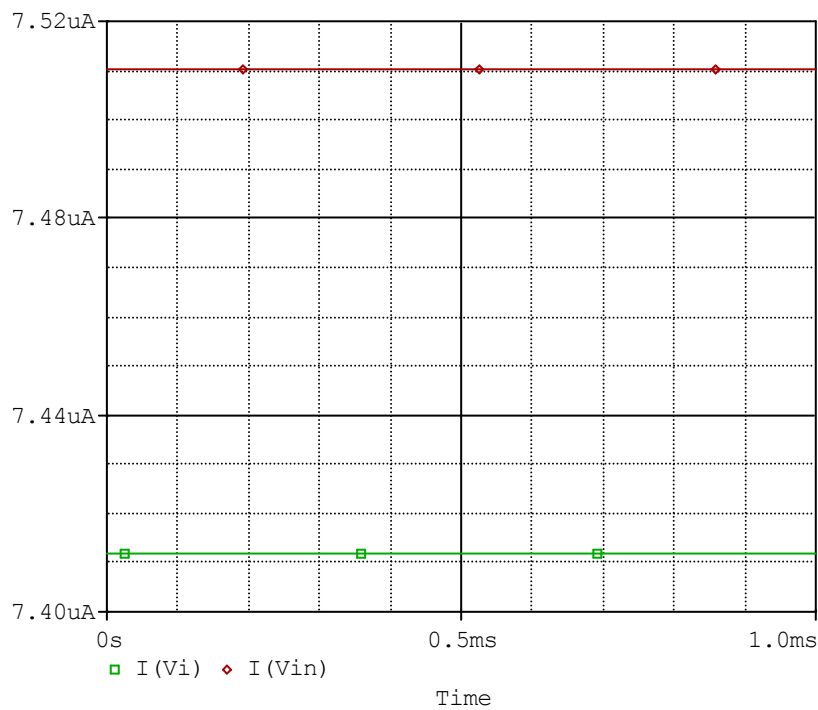
## Evaluation circuit



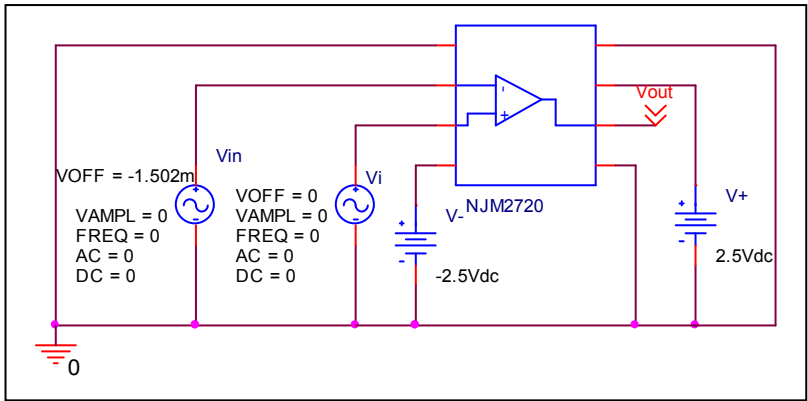
Slew Rate(v/us)	Data sheet	Simulation	%Error
	240.000	244.000	1.667

# Input current

## Simulation result



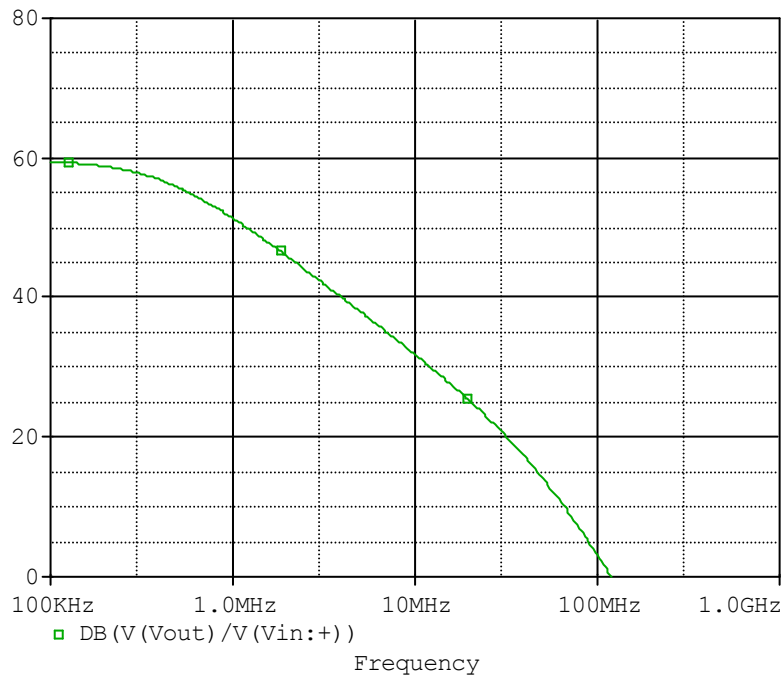
## Evaluation circuit



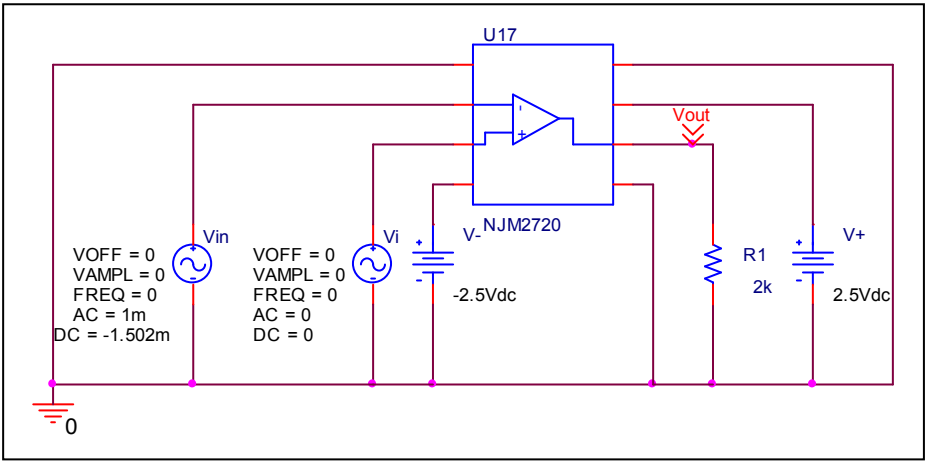
	Data sheet	Simulation	%Error
Ib(uA)	7.500	7.460	-0.533
Ibos(uA)	0.100	0.098	-2.000

# Open Loop Voltage Gain vs. Frequency

Simulation result



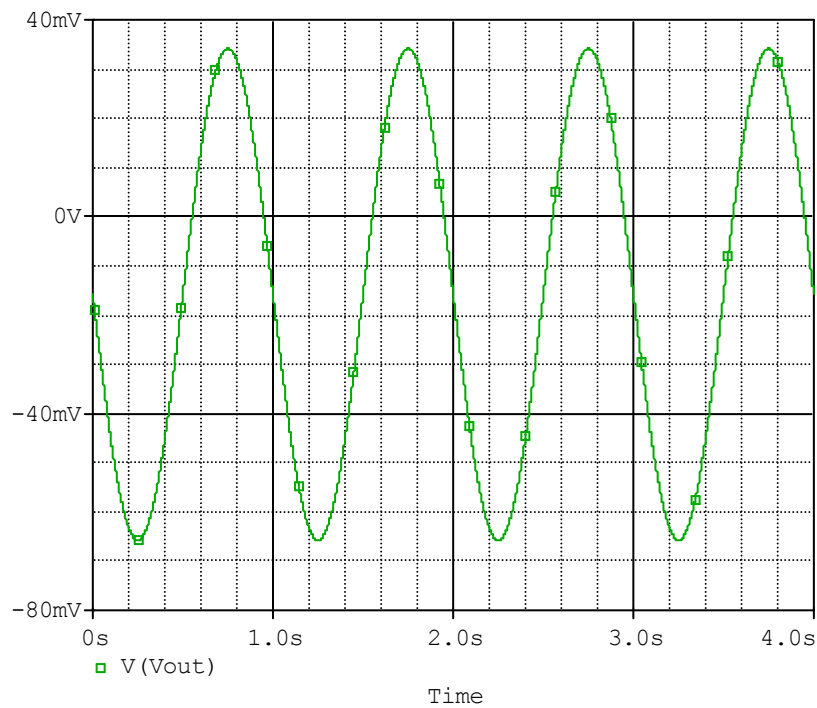
Evaluation circuit



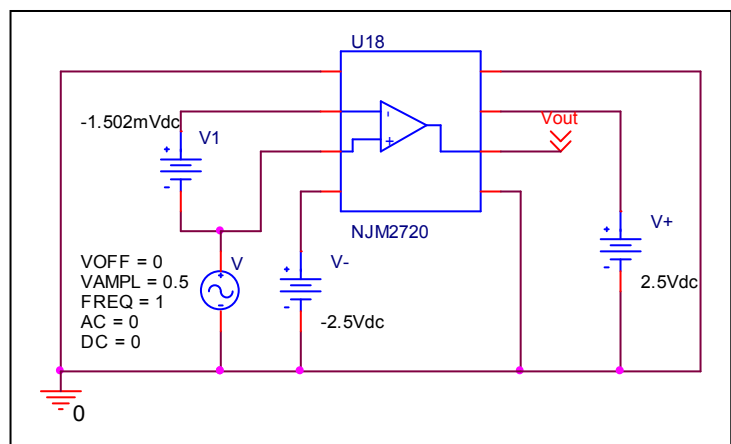
	Data sheet	Simulation	%Error
f-0dB(MHz)	120.000	118.677	-1.102
Av-dc	60.000	59.355	-1.075

# Common-Mode Rejection Voltage gain

## Simulation result



## Evaluation circuit



Common Mode Reject Ratio= $928.431/0.099=9378.098$

CMRR	Data sheet	Simulation	%Error
	80.000	79.442	-0.698