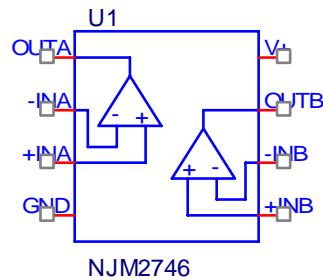# Device Modeling Report

COMPONENTS : OPERATIONAL AMPLIFIER
PART NUMBER : NJM2746
MANUFACTURER: NEW JAPAN RADIO

Bee Technologies Inc.

SPICE MODEL

U1
OUTA
-INA
+INA
GND
V+
OUTB
-INB
+INB
NJM2746

```
*$
*PART NUMBER: NJM2746
*MANUFACTURER: NEW JAPAN RADIO
*OPAMP
*All Rights Reserved Copyright (c) Bee Technologies Inc. 2005
.subckt njm2746 OUTA -INA +INA GND +INB -INB OUTB V+
X_U1 +INA -INA V+ GND OUTA njm2746_s
X_U2 +INB -INB V+ GND OUTB njm2746_s
.ends njm2746
.subckt njm2746_s   1 2 3 4 5
   c1     11 12 7.9386E-12
   c2      6   7 27.500E-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 0 373.25E3 -1E3 1E3 370E3 -370E3
   ga      6   0 11 12 1.9038E-3
   gcm     0   6 10 99 321.43E-9
   iee     3 10 dc 99.200E-6
   hlim 90    0 vlim 1K
   q1     11   2 13 qx1
   q2     12   1 14 qx2
   r2      6   9 100.00E3
   rc1     4 11 525.26
   rc2     4 12 525.26
   re1    13 10 2.7495
   re2    14 10 2.7495
   ree    10 99 2.0161E6
   ro1     8   5 50
   ro2     7 99 25
   rp      3   4 83.471
```
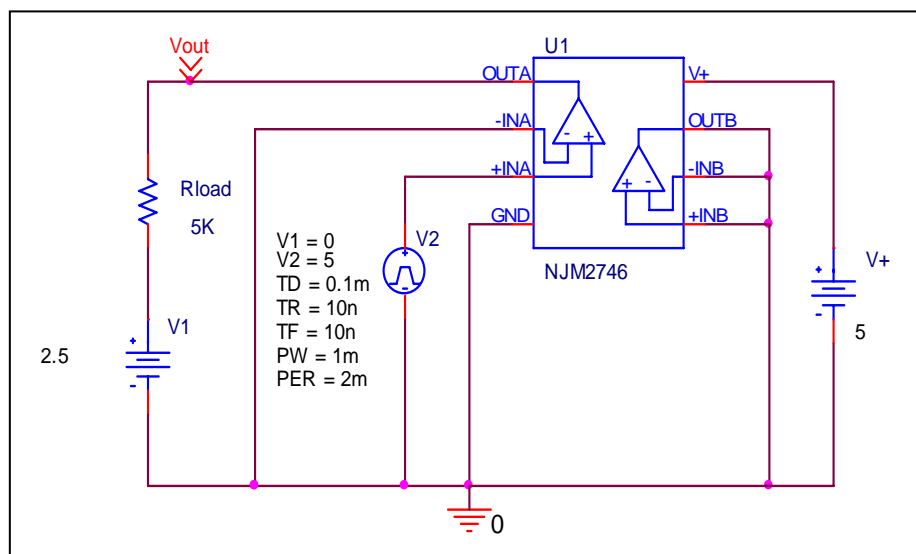
```
   vb      9    0 dc 0
   vc      3 53 dc .89791
   ve     54    4 dc .8085
   vlim   7    8 dc 0
   vlp   91    0 dc 20
   vln     0 92 dc 20
.model dx D(Is=800.00E-18)
.model dy D(Is=800.00E-18 Rs=1m Cjo=10p)
.model qx1 PNP(Is=800.00E-18 Bf=494.75)
.model qx2 PNP(Is=842.2140E-18 Bf=495.25)
.ends njm2746_s
*$
```

Output Voltage Swing
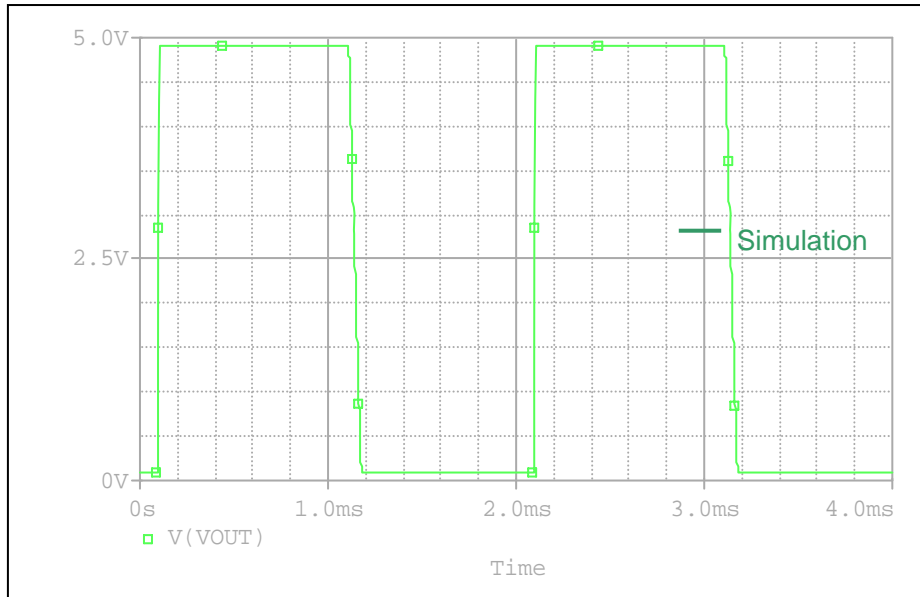
Evaluation circuit

Comparison Table
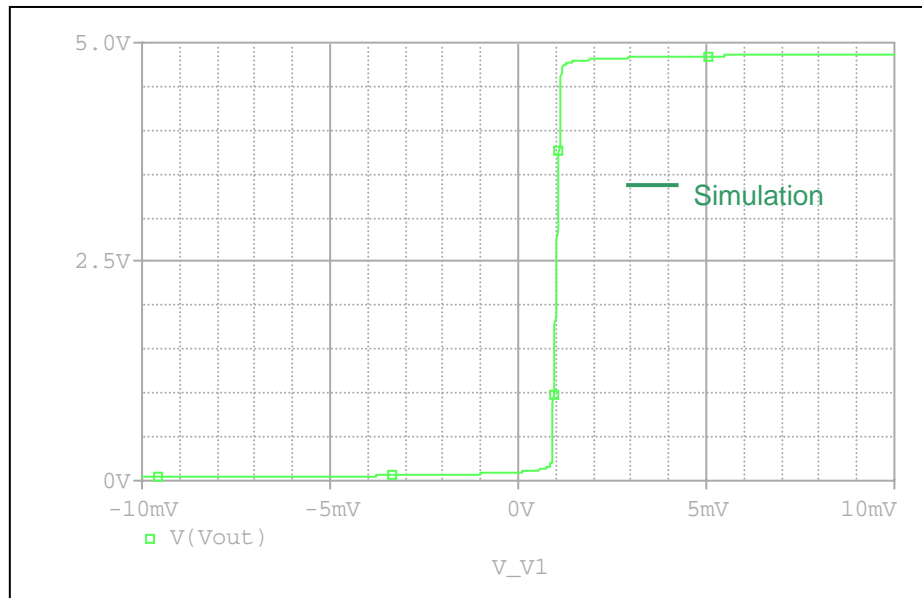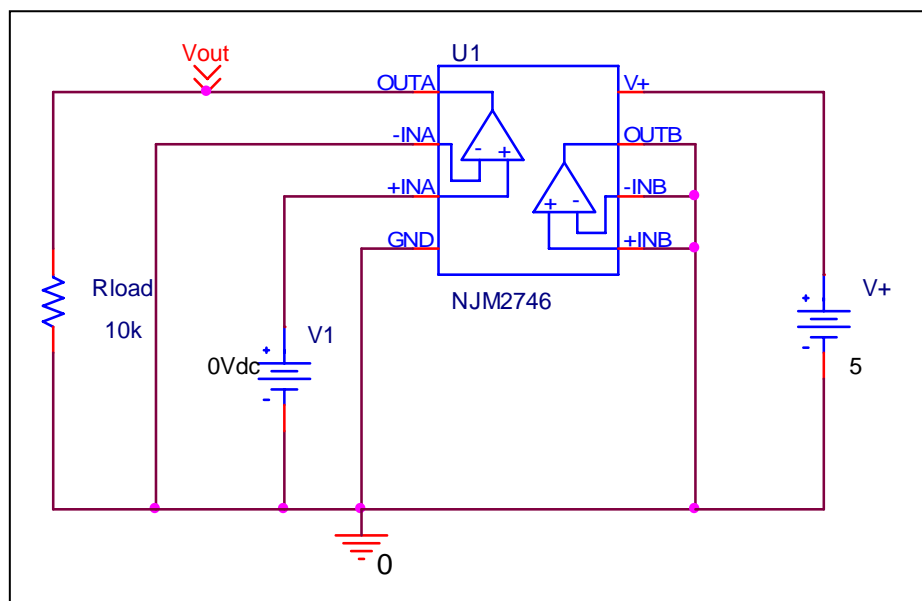
R_L = 5 kΩ to 2.5 V	Measurement	Simulation	%Error
V_{OH} (V)	4.9	4.9002	0.004
V_{OL} (V)	0.1	0.099967	-0.033

Input Offset Voltage

Input offset Voltage	Measurement	Simulation	%Error
V_{OS} (mV)	1	1.0178	1.780

Open loop Voltage Gain
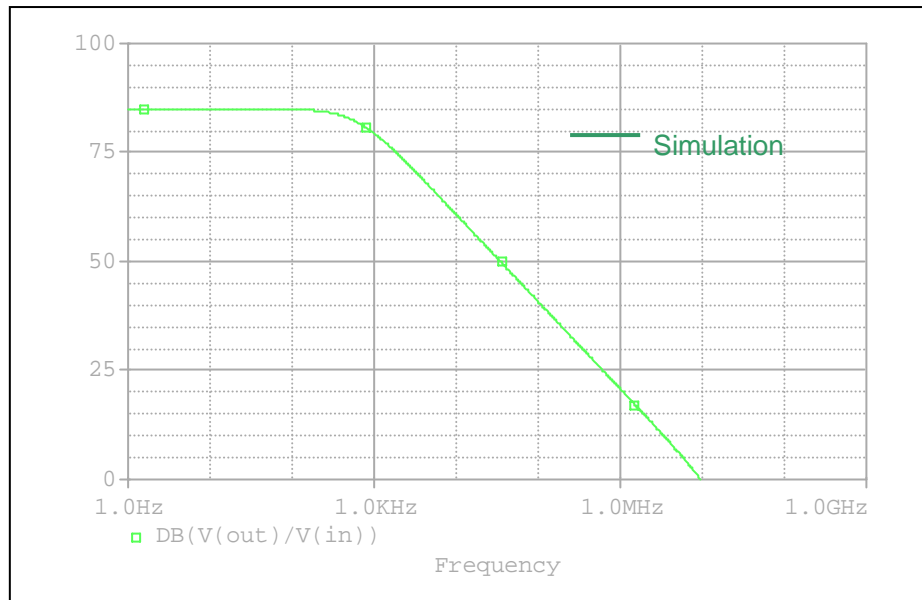
Evaluation Circuit
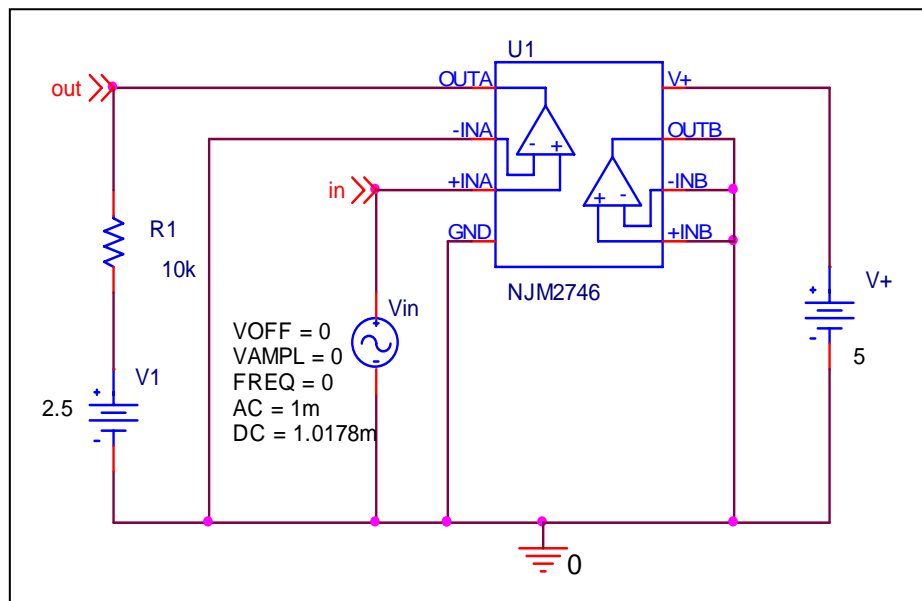
Comparison Table

	Measurement	Simulation	% Error
Av (dB)	85	85.005	0.006

Input Current
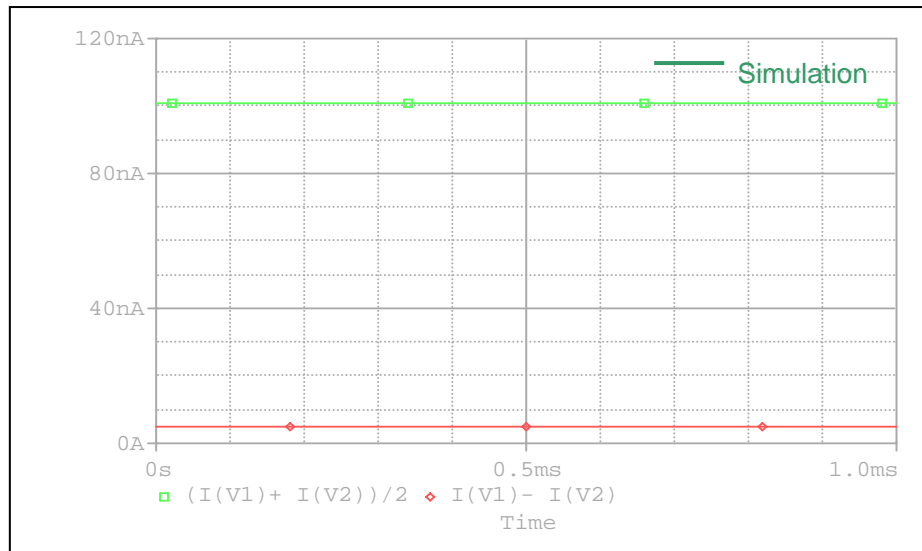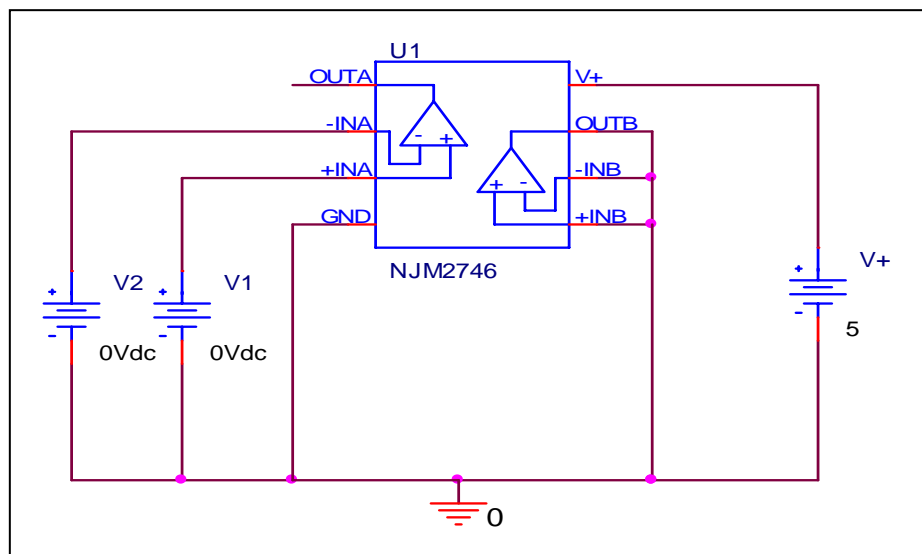
Input Current	Measurement	Simulation	% Error
I_b (nA)	100	100.928	0.928
I_{bos} (nA)	5	5.0595	1.190

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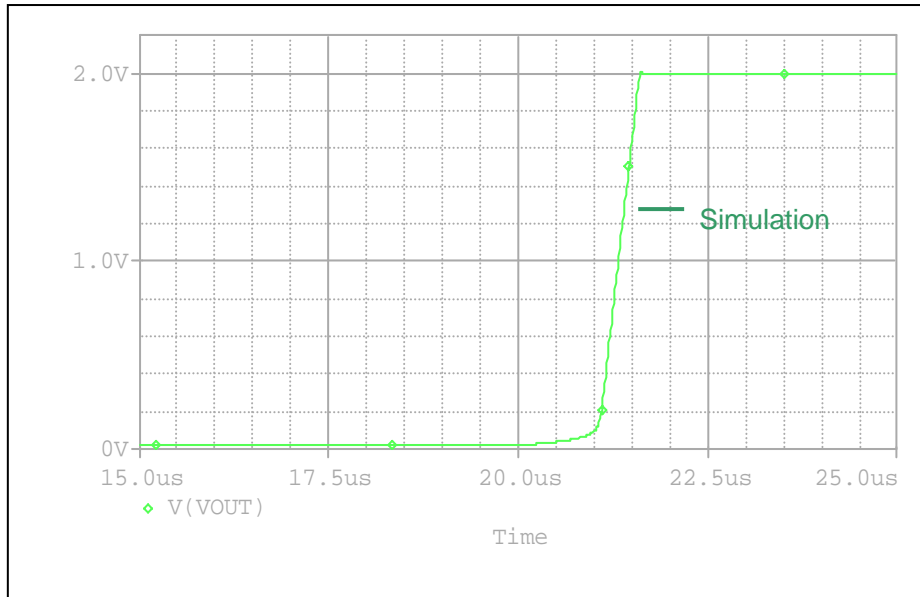
Slew Rate

Evaluation Circuit
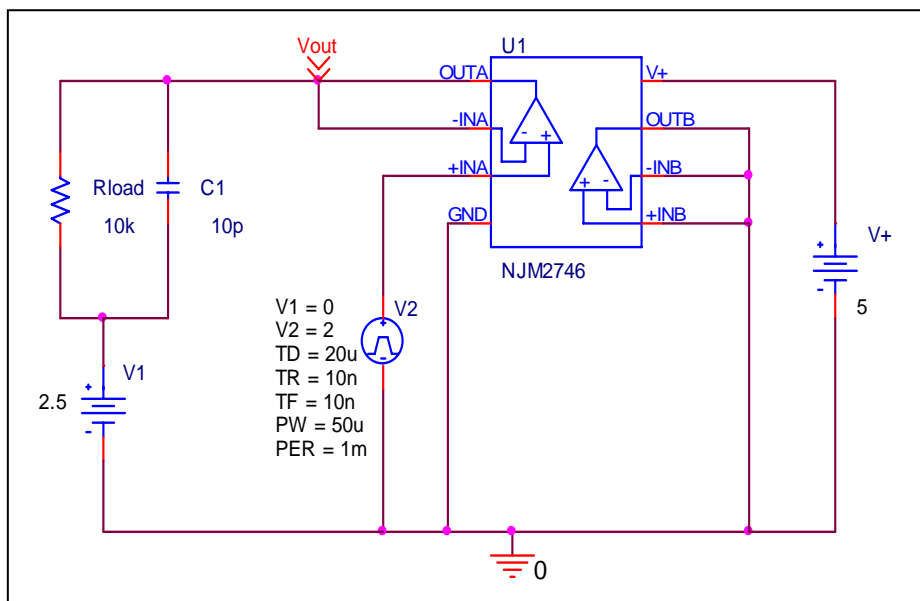
Comparison Table

Slew Rate	Measurement	Simulation	%Error
SR (V/us)	3.5	3.575	2.143

Common-Mode Rejection Ratio

CMRR **=** **AV/ACM**
= **17793/(3.153/1)**

	Measurement	Simulation	% Error
CMRR (dB)	75	75.031	0.041