

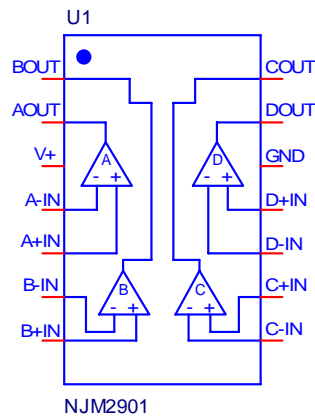
Device Modeling Report

COMPONENTS:VOLTAGE COMPARATOR
PART NUMBER:NJM2901
MANUFACTURER:NEW JAPN RADIO



Bee Technologies Inc.

Spice Model



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*$
*PART NUMBER: NJM2901
*MANUFACTURER: New Japan Radio
*BJT COMPARATOR
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.subckt njm2901 BOUTPUT AOUTPUT V+ A-INPUT A+INPUT B-INPUT
+ B+INPUT C-INPUT C+INPUT D-INPUT D+INPUT GND DOUTPUT COUTPUT
X_U1 A+INPUT A-INPUT V+ GND AOUTPUT njm2901_s
X_U2 B+INPUT B-INPUT V+ GND BOUTPUT njm2901_s
X_U3 C+INPUT C-INPUT V+ GND COUTPUT njm2901_s
X_U4 D+INPUT D-INPUT V+ GND DOUTPUT njm2901_s
.ends njm2901
*$
.subckt njm2901_s In+ li- V+ V- O/P
f1      9  V+ v1 1
iee     V+ 7 dc 100.0E-6
vi1     21 In+ dc 0.75
vi2     22 li- dc 0.749
q1      9 21 7 qin1
q2      8 22 7 qin2
q3      9 8  V- qmo
q4      8 8  V- qmi
.model qin1 PNP(Is=800.0E-18 Bf=1.78000E3)
.model qin2 PNP(Is=800.0E-18 Bf=2.2620E3)
.model qmi NPN(Is=897.20E-18 Bf=1002)

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.model qmo NPN(Is=800.0E-18 Bf=1000 Cjc=1E-15 Tr=55E-8)
e1  10  V-  9  V-  1
re1  101 V- 35
v1   10 11 dc 60m
q5   O/P 11 101 qoc
.model qoc NPN(Is=800.0E-18 Bf=7.3E3 Cjc=1E-15 Tf=0.49E-8 Tr=43.250E-8)
dp   V- V+ dx
rp   V+ V- 71.53
.model dx  D(Is=800.0E-18)
.ends njm2901_s
*$
```

BJT MODEL

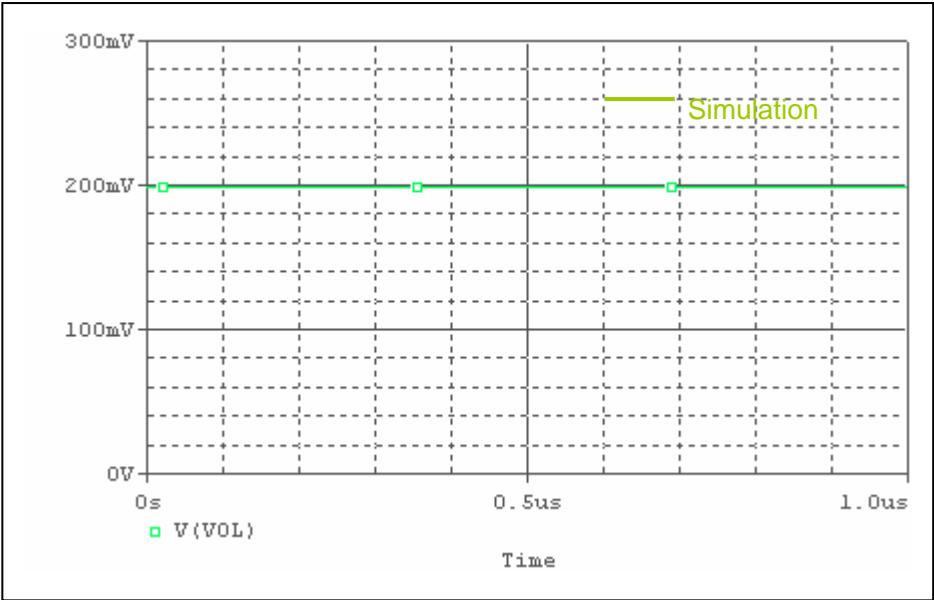
Pspice model parameter	Model description
IS	Saturation Current
BF	Ideal Maximum Forward Beta
CJC	Zero-bias Collector-Base Junction Capacitance
TF	Forward Transit Time
TR	Reverse Transit Time

DIODE MODEL

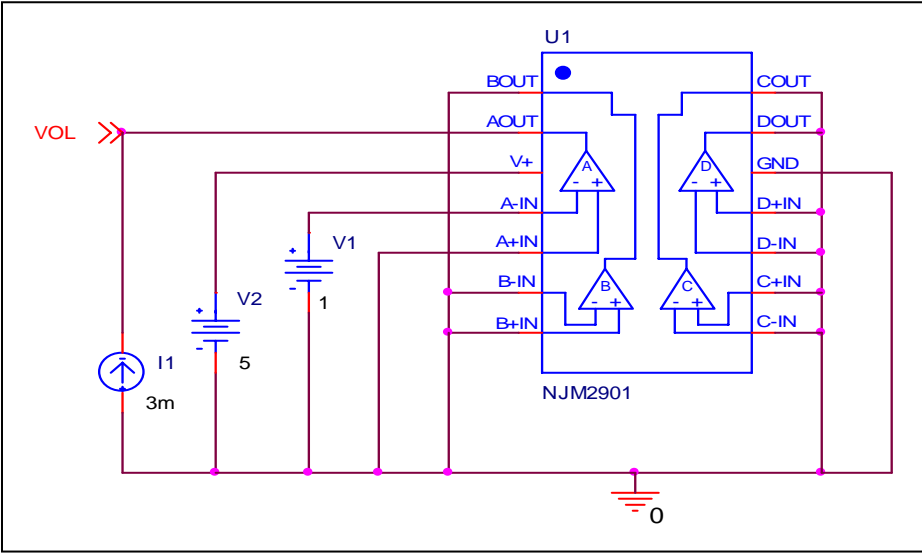
Pspice model parameter	Model description
IS	Saturation Current
RS	Series Resistance

Output Low Voltage

Simulation result



Evaluation Circuit

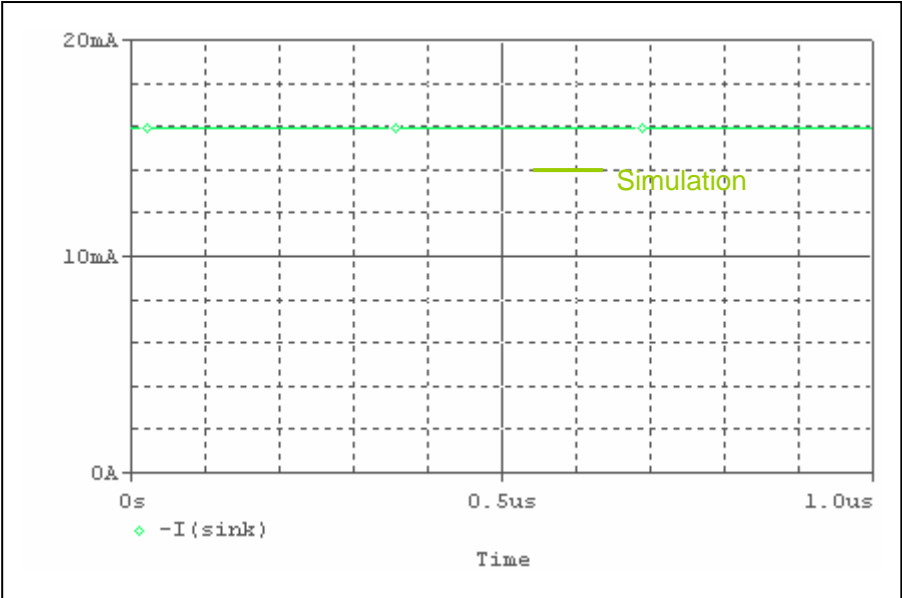


Comparison Table

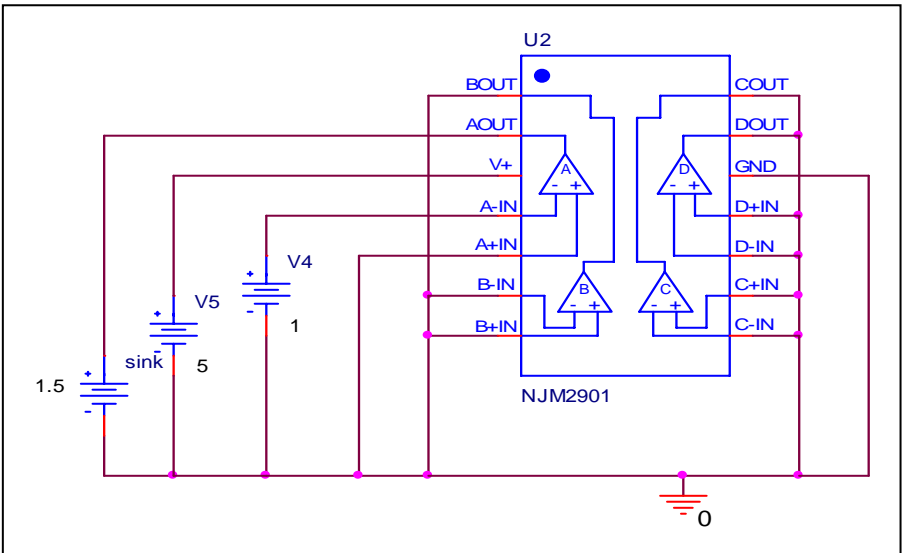
$I_{\text{sink}} = 3\text{mA}$	Measurement	Simulation	%Error
$V_{\text{ol}} \text{ (mV)}$	200	198.257	-0.8715

Sink Current

Simulation result



Evaluation Circuit

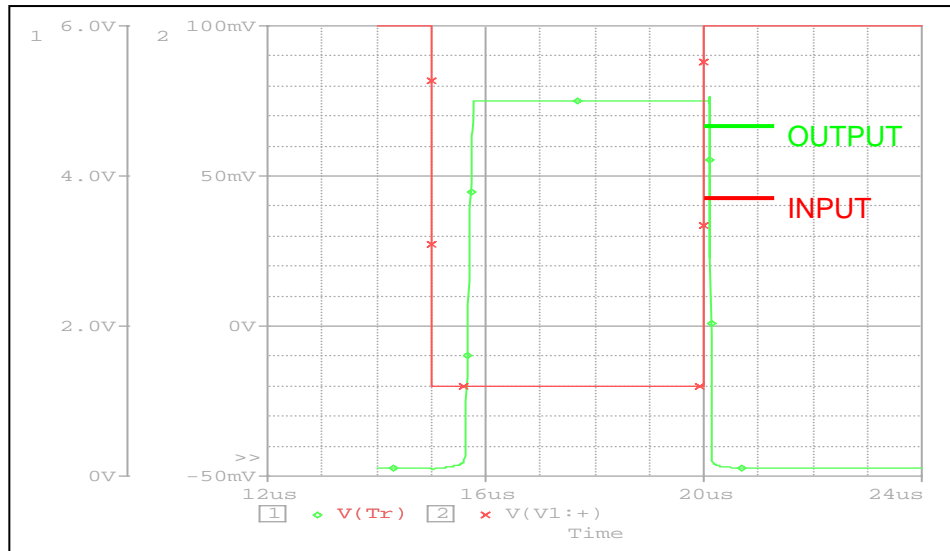


Comparison Table

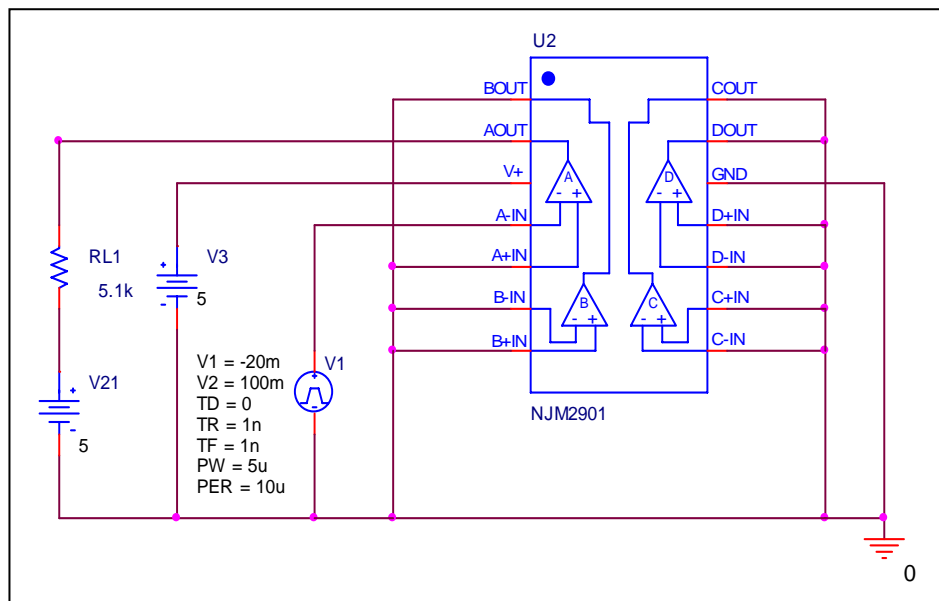
$V_{ol} = 1.5\text{ V}$	Measurement	Simulation	%Error
$I_{sink} \text{ (mA)}$	16	15.947	-0.3313

Response time (Rise time and Transition time)

Simulation result



Evaluation Circuit

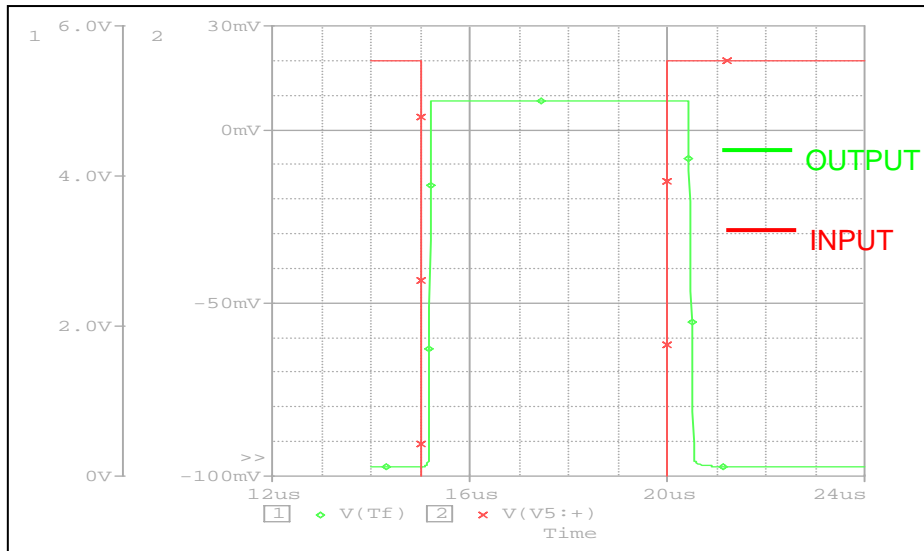


Comparison Table

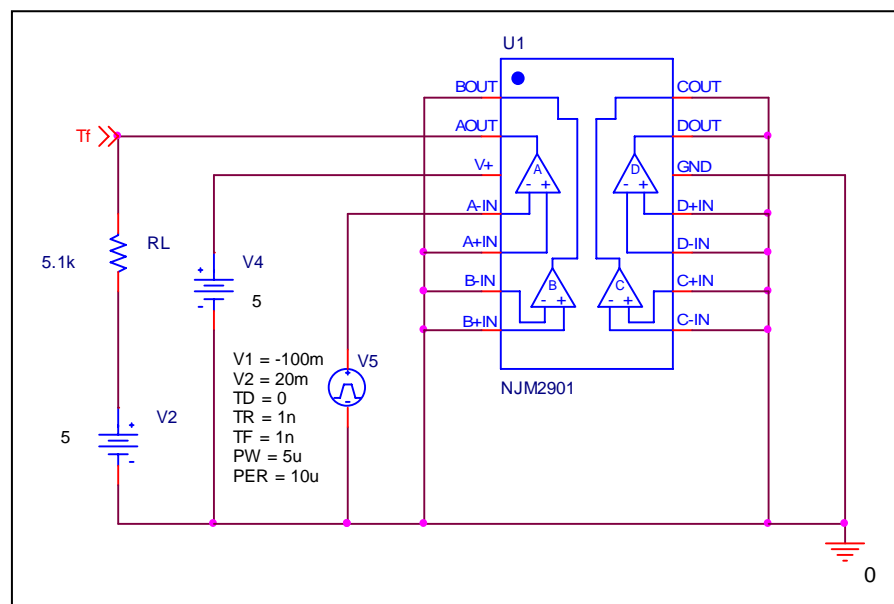
	Measurement	Simulation	% Error
Rising delay time (us)	0.63	0.629410	-0.094
Transition time (us)	0.12	0.123361	2.801

Response time (Falling time)

Simulation result



Evaluation Circuit

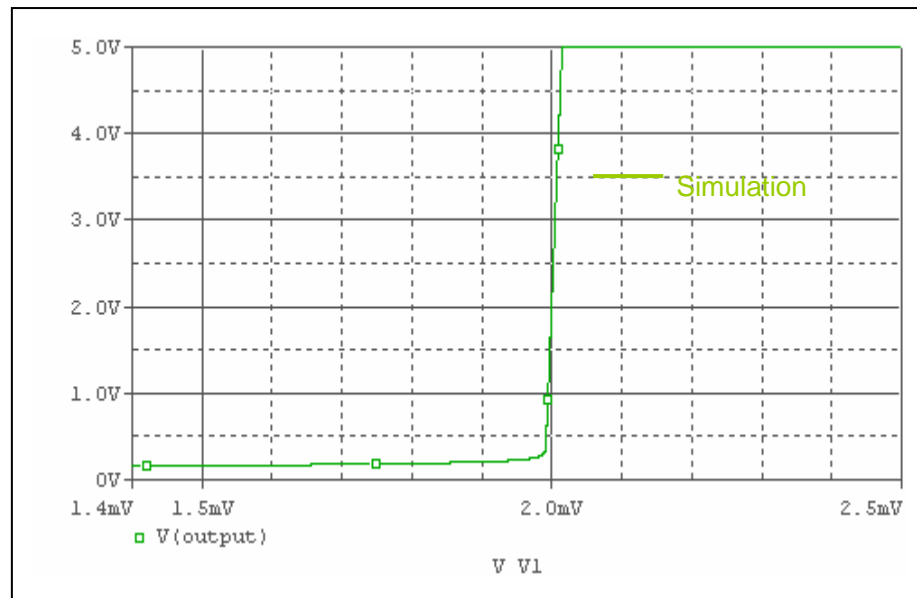


Comparison Table

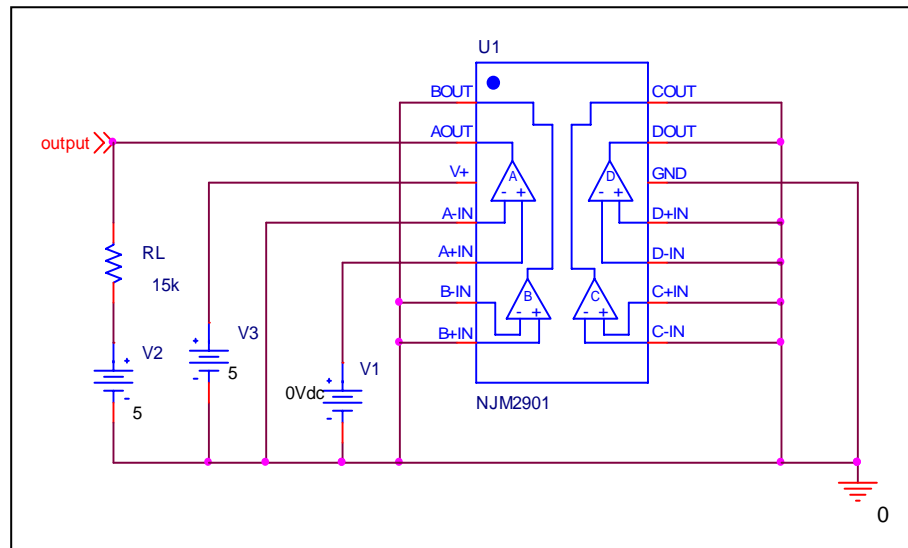
	Measurement	Simulation	% Error
Falling delay time (us)	0.43	0.431389	0.323

Input Offset Voltage Characteristics

Simulation result



Evaluation Circuit

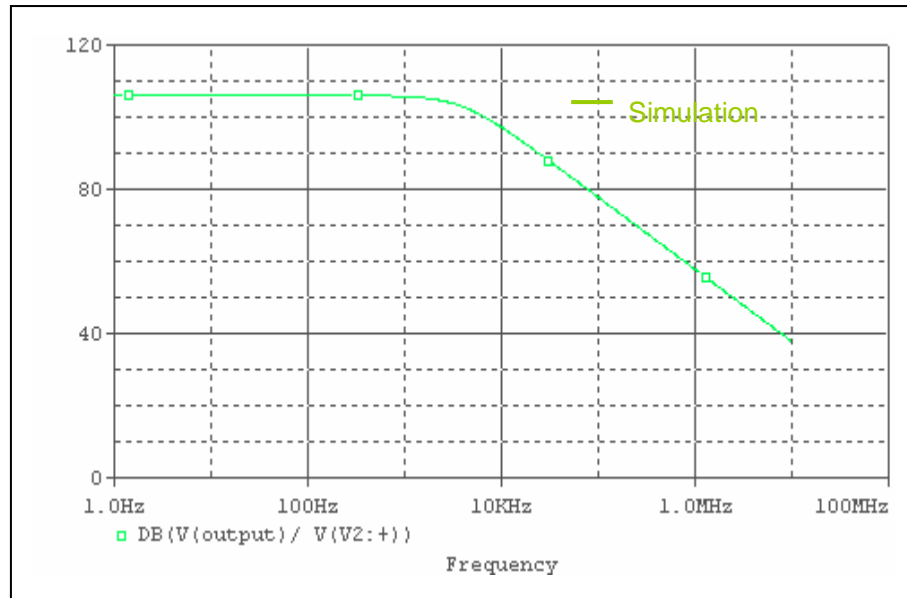


Comparison Table

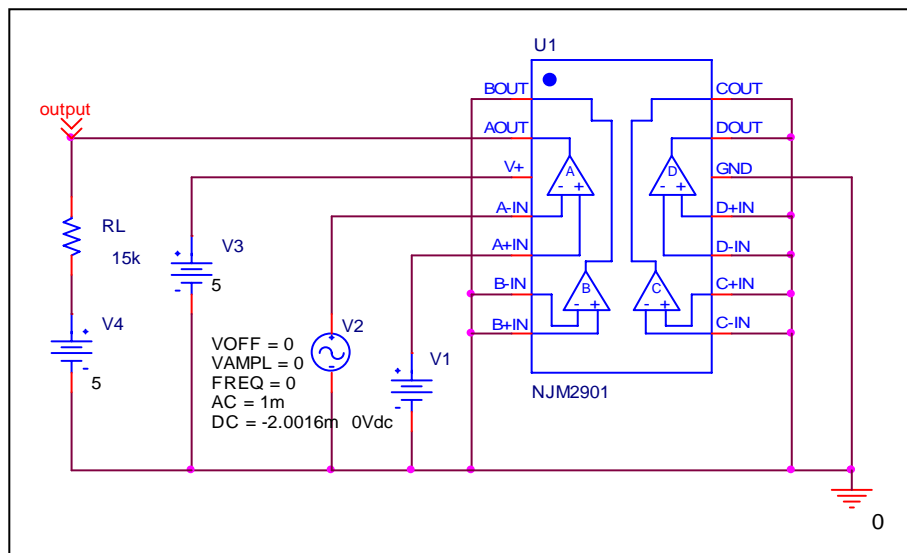
	Measurement	Simulation	%Error
$V_{io}(mV)$	2	2.0016	0.0800

Av Characteristics

Simulation result



Evaluation Circuit

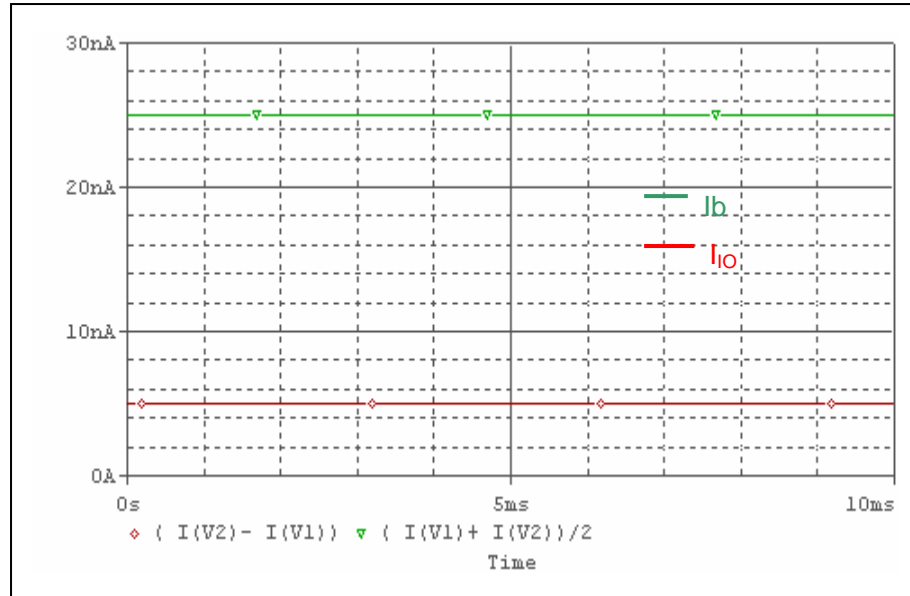


Comparison Table

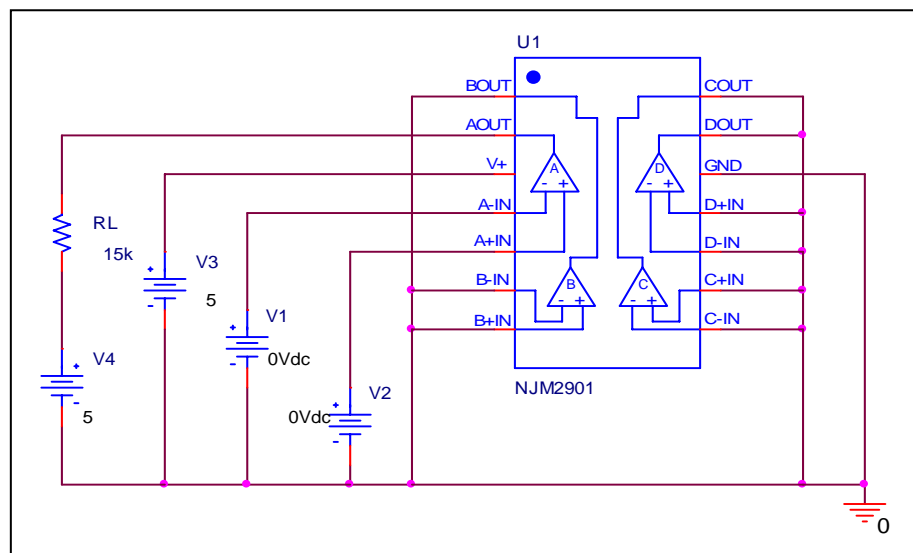
$R_L = 15k\Omega$	Measurement	Simulation	%Error
A_v (dB)	106	105.988	-0.011

Input Bias Current Characteristics

Simulation result



Evaluation Circuit



Comparison Table

	Measurement	Simulation	% Error
I _b (nA)	25	25.027	0.1080
I _{IO} (nA)	5	5.0130	0.2600