

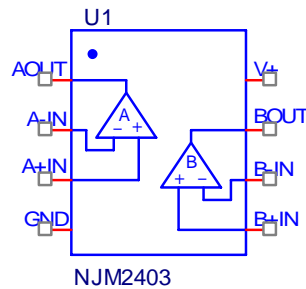
Device Modeling Report

COMPONENTS : VOLTAGE COMPARATOR
PART NUMBER : NJM2403
MANUFACTURER : NEW JAPAN RADIO



Bee Technologies Inc.

SPICE MODEL



```

*$
*PART NUMBER: NJM2403
*MANUFACTURER: NEW JAPAN RADIO
*BJT COMPARATOR
*All Rights Reserved Copyright (c) Bee Technologies Inc. 2004
.subckt njm2403 AOUT A-IN A+IN GND B+IN B-IN BOUT V+
X_U1 A+IN A-IN V+ GND AOUT njm2403_s
X_U2 B+IN B-IN V+ GND BOUT njm2403_s
.ends njm2403
.subckt njm2403_s In+ li- V+ V- O/P
f1 9 V+ v1 0.1
iee V+ 7 dc 100.0E-6
vi1 21 In+ dc 0.545
vi2 22 li- dc 0.5548
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=116.72 )
.model qin2 PNP(Is=800.0E-18 Bf=89.49 )
.model qmi NPN(Is=800.0E-18 Bf=1002 )
.model qmo NPN(Is=800.0E-18 Bf=1000 Cjc=1E-11 Tr=3.28E-8)
e1 10 V- 9 V- 1.2437
re1 101 V- 8
v1 10 11 dc 0.537
q5 O/P 11 101 qoc
.model qoc NPN(Is=800.0E-18 Bf=2.7E4 Cjc=1E-15 Tf=2.2E-8 Tr=30.4E-8)
dp V- V+ dx
rp V+ V- 83.47
.model dx D(Is=800.0E-18)
.ends njm2403_s
*$

```

BJT MODEL

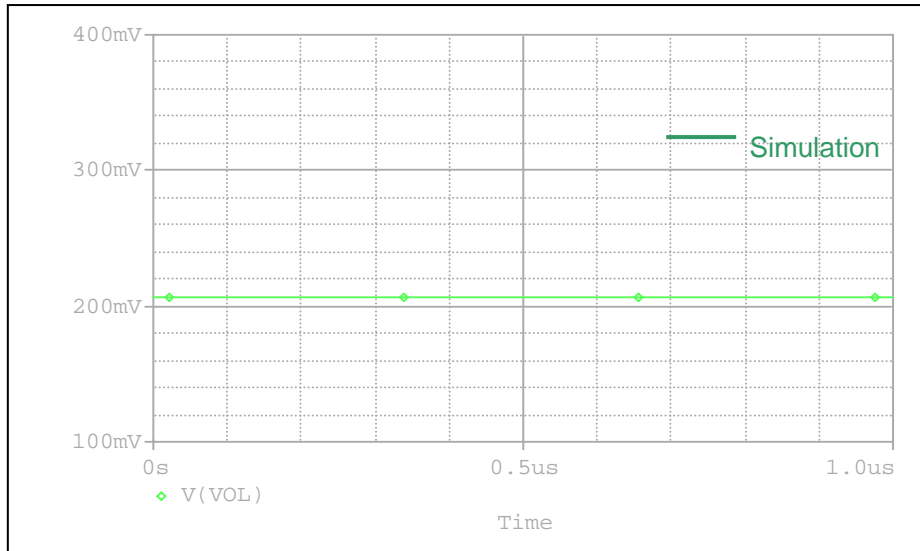
Pspice model parameter	Model description
IS	Saturation Current
BF	Ideal Maximum Forward Beta
CJC	Zero-bias Collector-Base Junction Capacitance
TF	Forward Transit Time
TR	Reverse Transit Time

DIODE MODEL

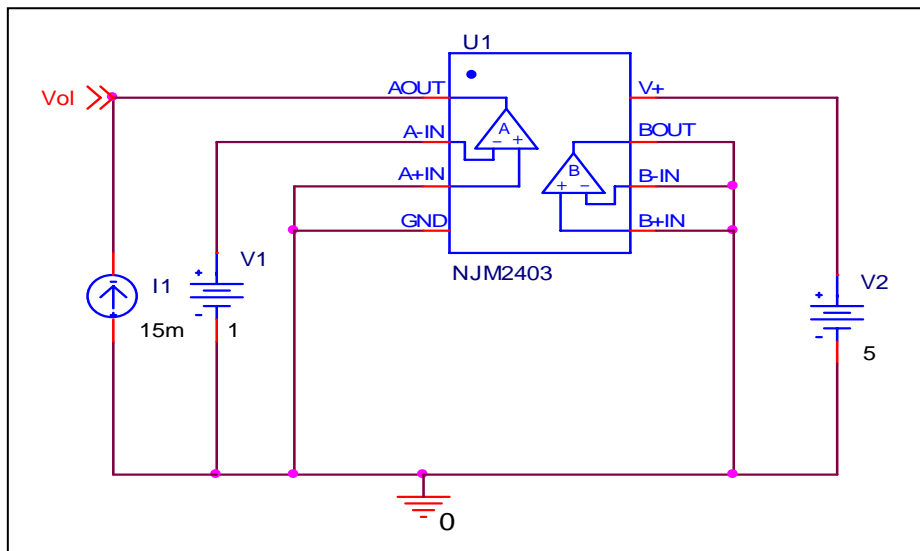
Pspice model parameter	Model description
IS	Saturation Current
RS	Series Resistance

Output Saturation Voltage

Simulation result



Evaluation Circuit

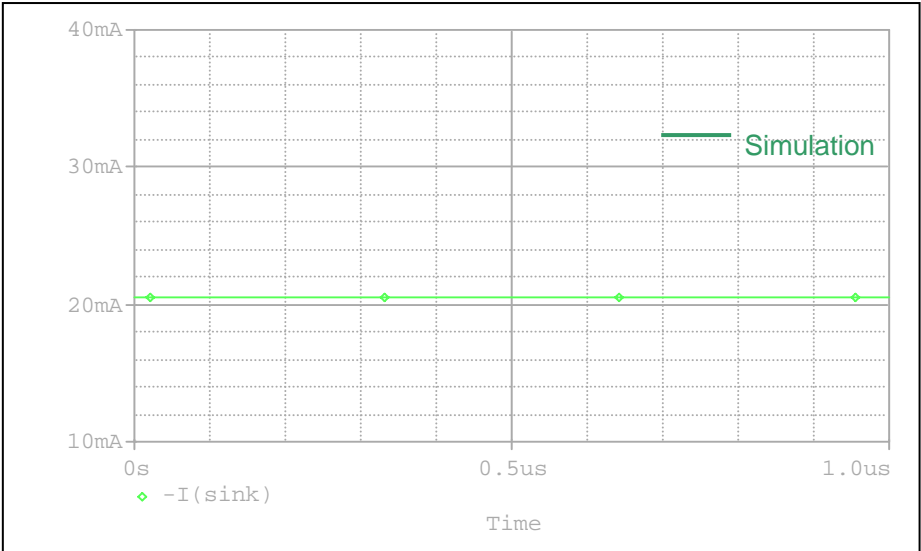


Comparison Table

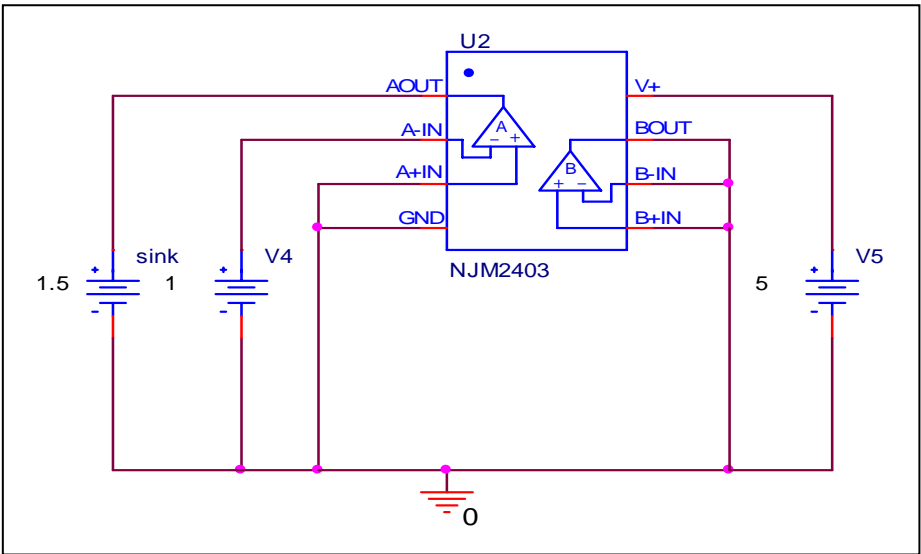
$I_{\text{sink}} = 15\text{mA}$	Measurement	Simulation	%Error
$V_{\text{SAT}} \text{ (mV)}$	200	206.333	3.167

Sink Current

Simulation result



Evaluation Circuit

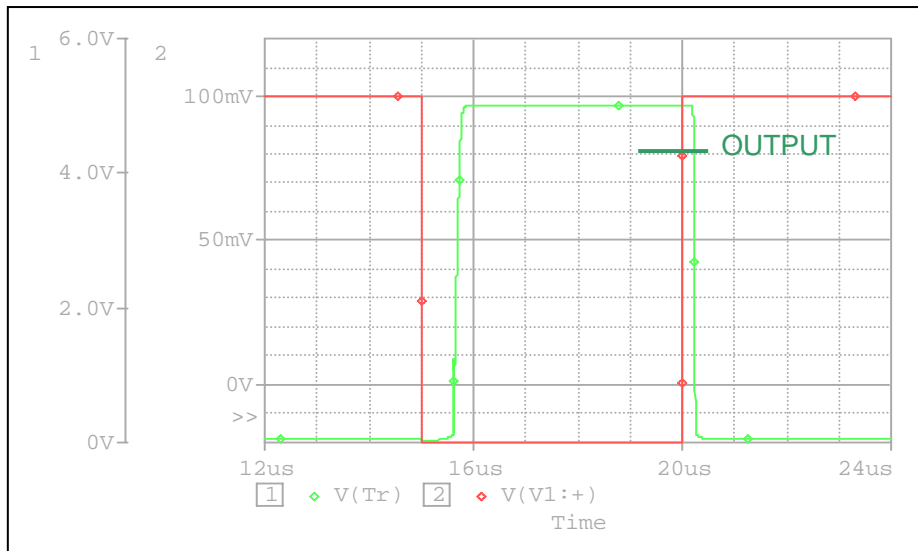


Comparison Table

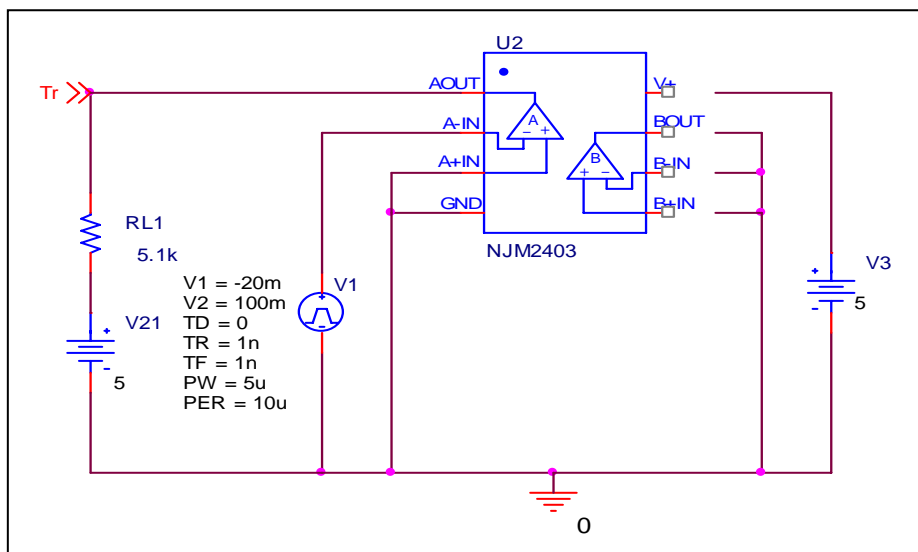
$V_{ol} = 1.5 \text{ V}$	Measurement	Simulation	%Error
$I_{\text{sink}} \text{ (mA)}$	20	20.459	2.295

Response time (Rise time and Transition time)

Simulation result



Evaluation Circuit

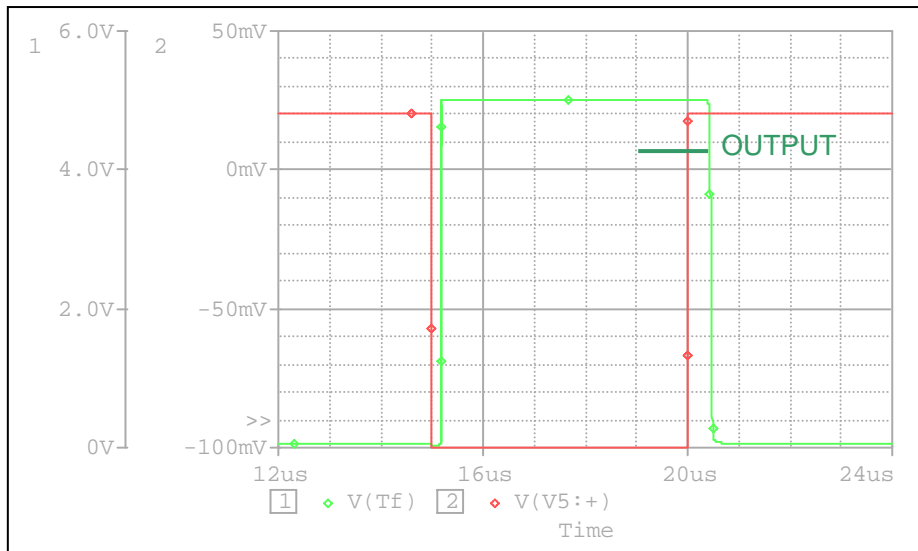


Comparison Table

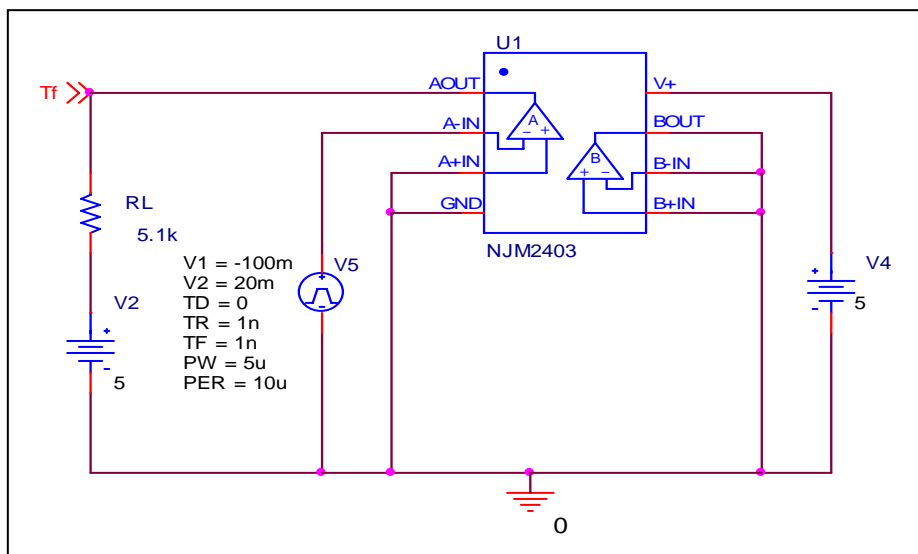
	Measurement	Simulation	% Error
Rising delay time (us)	0.63	0.632803	0.445
Transition time (us)	0.12	0.119944	-0.047

Response time (Falling time)

Simulation result



Evaluation Circuit

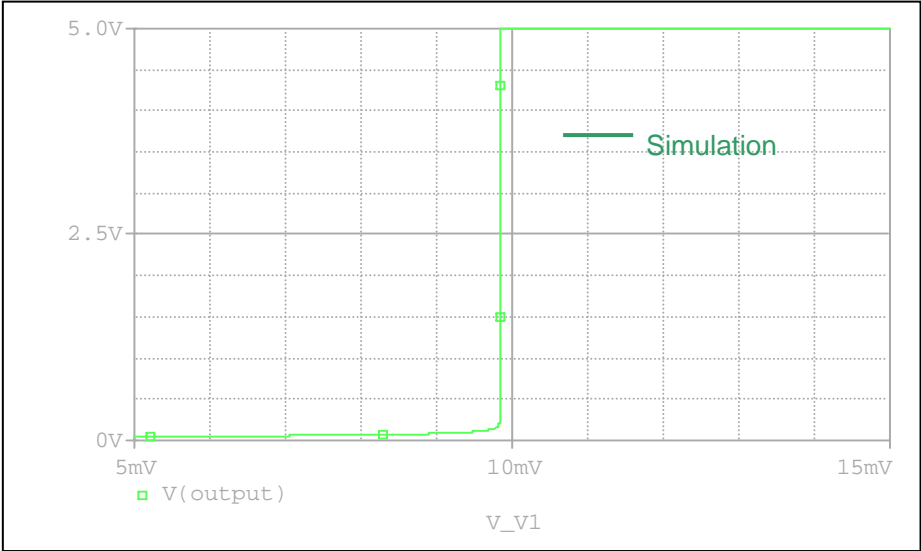


Comparison Table

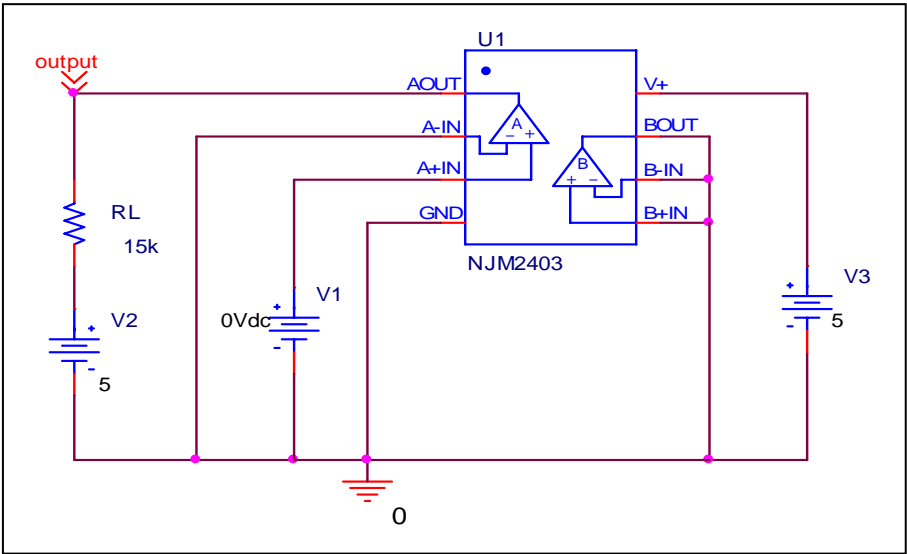
	Measurement	Simulation	% Error
Falling delay time (us)	0.43	0.430188	0.044

Input Offset Voltage Characteristics

Simulation result



Evaluation Circuit

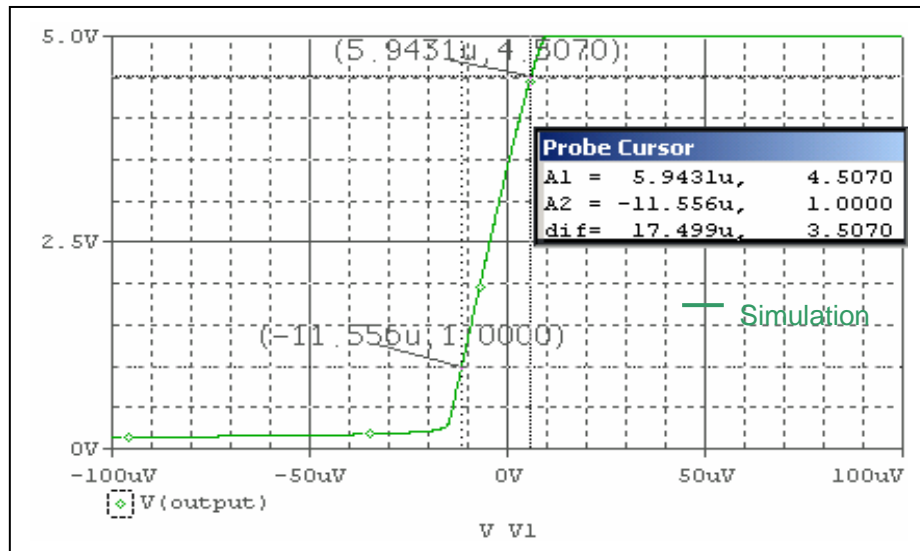


Comparison Table

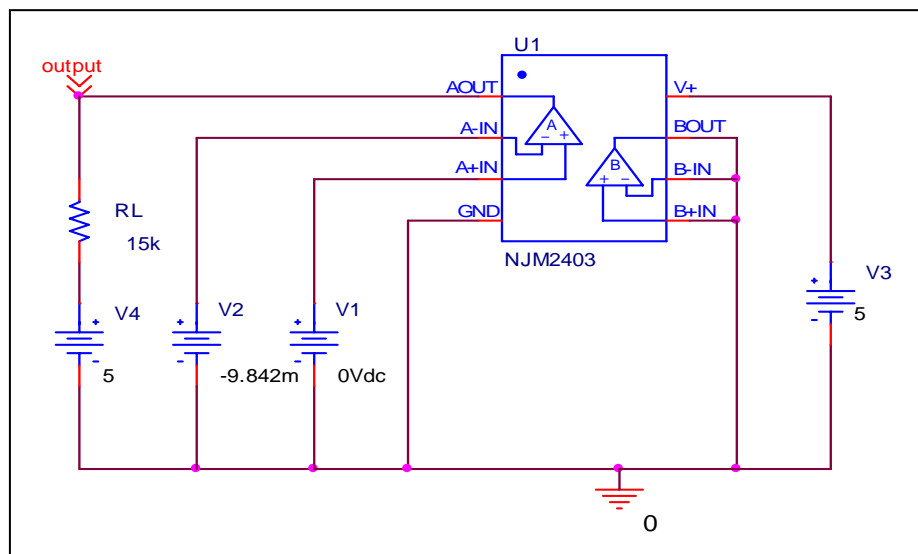
	Measurement	Simulation	%Error
$V_{io}(\text{mV})$	10	9.842	-1.580

Av Characteristics

Simulation result



Evaluation Circuit



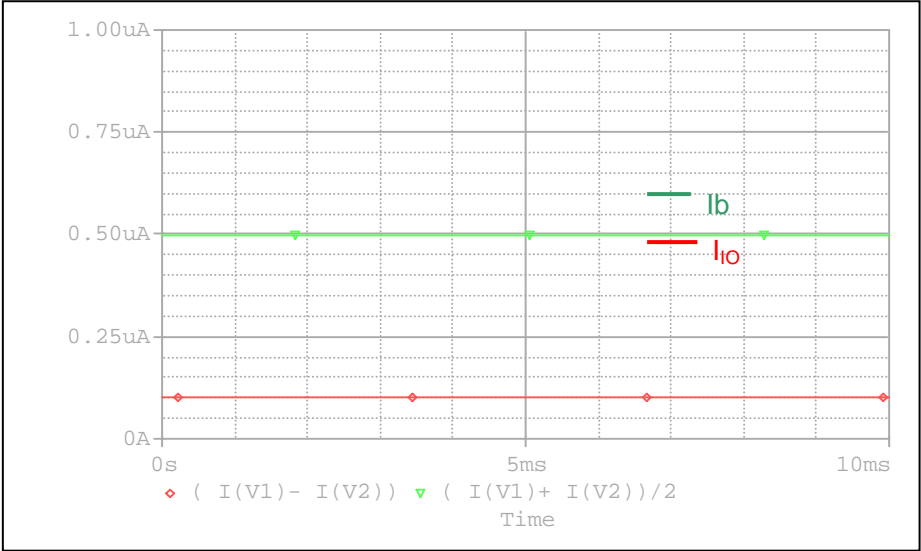
$$A_v = 3.5070 / 17.499u$$

Comparison Table

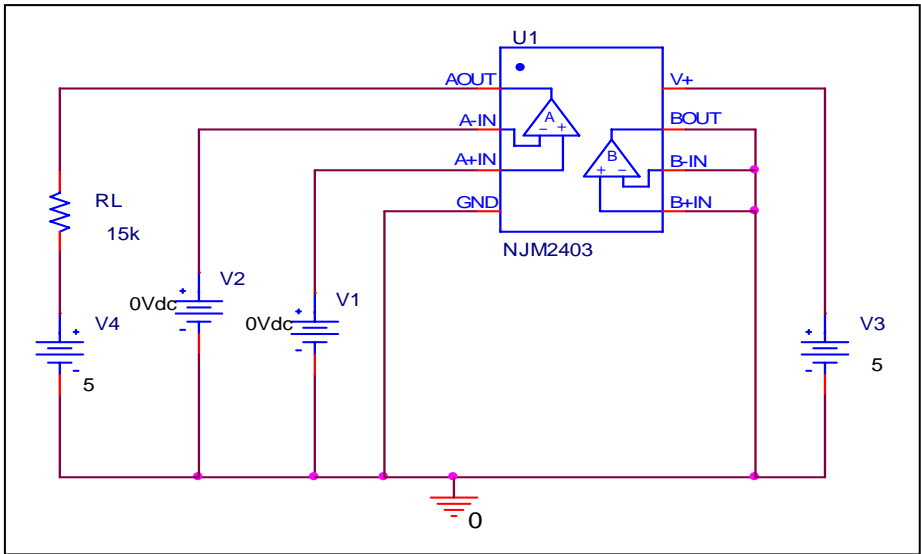
$R_L = 15k\Omega$	Measurement	Simulation	%Error
A_v (V/mV)	200	200.411	0.206

Input Bias Current Characteristics

Simulation result



Evaluation Circuit



Comparison Table

	Measurement	Simulation	% Error
Ib (nA)	500	499.852	-0.030
Iio (nA)	100	99.714	-0.286