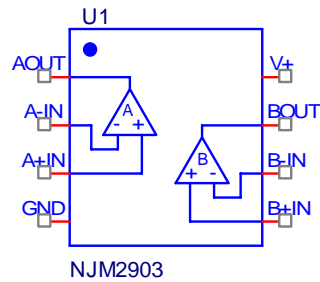# Device Modeling Report

COMPONENTS:VOLTAGE COMPARATOR
PART NUMBER:NJM2903
MANUFACTURER:NEW JAPN RADIO

Bee Technologies

Bee Technologies Inc.

Spice Model

NJM2903

```
*$
*PART NUMBER: NJM2903
*MANUFACTURER: New Japan Radio
*BJT COMPARATOR
*All Rights Reserved Copyright (c) Bee Technologies Inc. 2005
.subckt njm2903 AOUTPUT A-INPUT A+INPUT GND
+ B+INPUT B-INPUT BOUTPUT    V+
X_U1 A+INPUT A-INPUT V+ GND AOUTPUT njm2903_s
X_U2 B+INPUT B-INPUT V+ GND BOUTPUT njm2903_s
.ends njm2903
*$
.subckt njm2903_s In+ Ii- V+ V- O/P
f1       9    V+ v1 1
iee     V+ 7 dc 100.0E-6
vi1      21 In+ dc 0.74506
vi2      22 Ii- dc 0.752
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=.210200E3)
.model qin2 PNP(Is=800.0E-18 Bf=0.19500E3)
.model qmi NPN(Is=800.0E-18 Bf=1002)
.model qmo NPN(Is=800.0E-18 Bf=1000 Cjc=1E-15 Tr=57.8E-8)
```

```
e1      10   V-   9   V-   1
re1     101 V- 35
v1      10 11 dc 428m
q5      O/P 11 101 qoc
.model qoc NPN(Is=800.0E-18 Bf=7.3E3 Cjc=1E-15 Tf=0.365E-8 Tr=38.50E-8)
dp      V- V+ dx
rp      V+ V- 71.53
.model dx    D(Is=800.0E-18)
.ends njm2903_s
*$
```
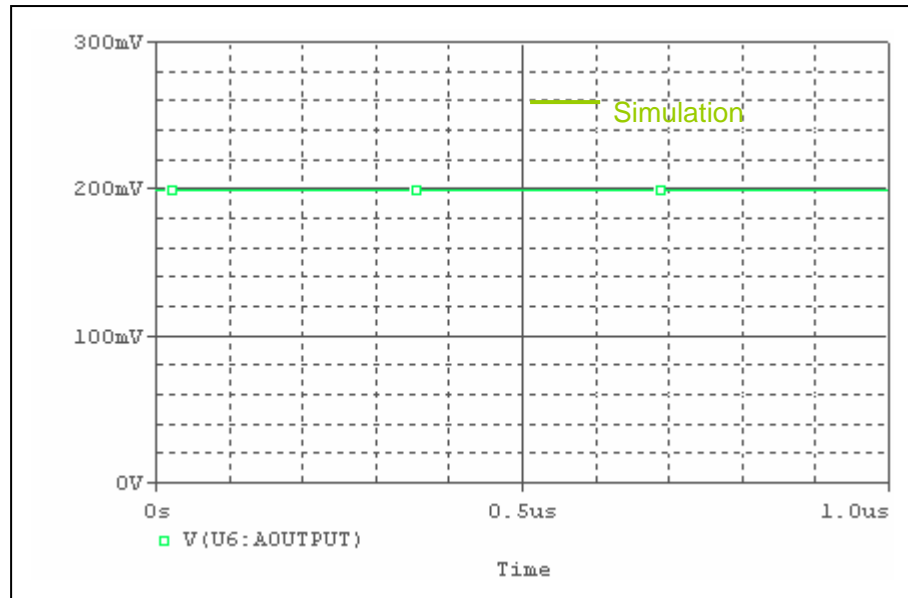
BJT MODEL

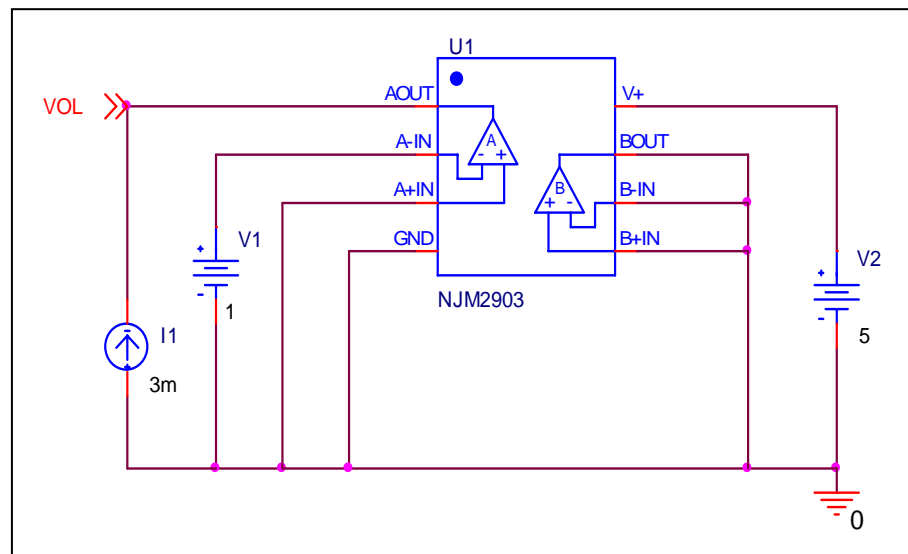| Pspice model parameter	Model description
IS	Saturation Current
BF	Ideal Maximum Forward Beta
CJC	Zero-bias Collector-Base Junction Capacitance
TF	Forward Transit Time
TR	Reverse Transit Time

DIODE MODEL

Pspice model parameter	Model description
IS	Saturation Current
RS	Series Resistance

Output Low Voltage

Evaluation Circuit

Comparison Table

I$_{sink}$ = 3mA	Measurement	Simulation	%Error
V$_{ol}$ (mV)	200	198.557	-0.7215

Sink Current
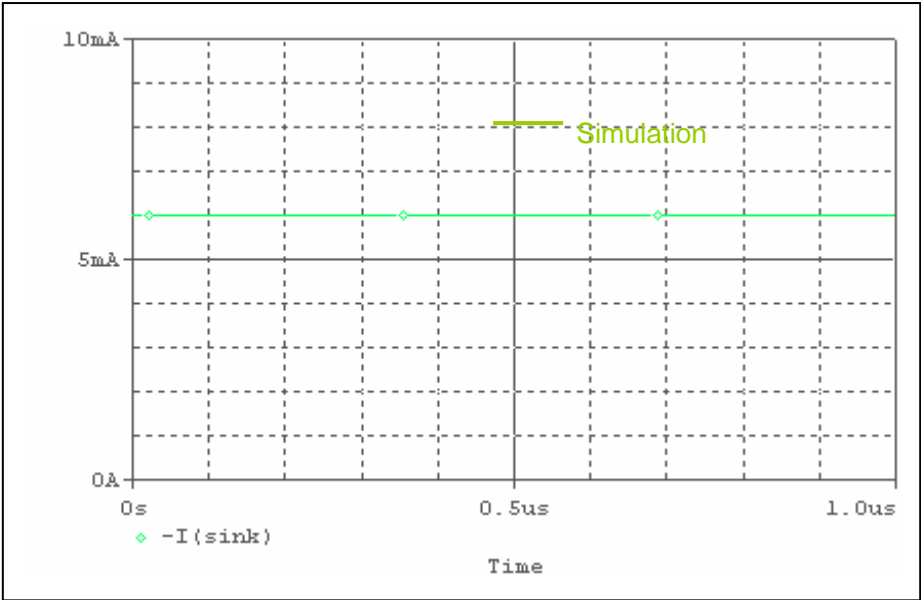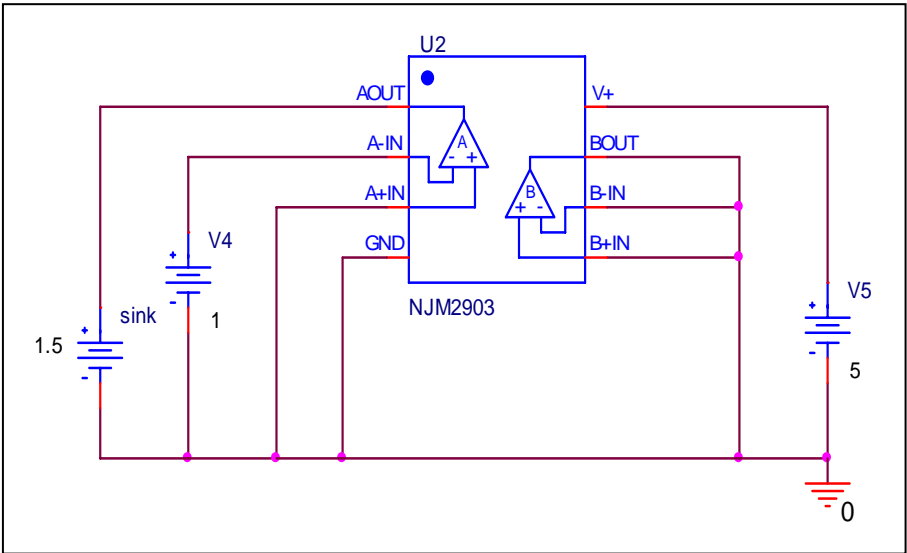
V_{ol} = 1.5 V	Measurement	Simulation	%Error
I_{sink} (mA)	6	6.0172	0.2867

Response time (Rise time and Transition time)

Simulation result
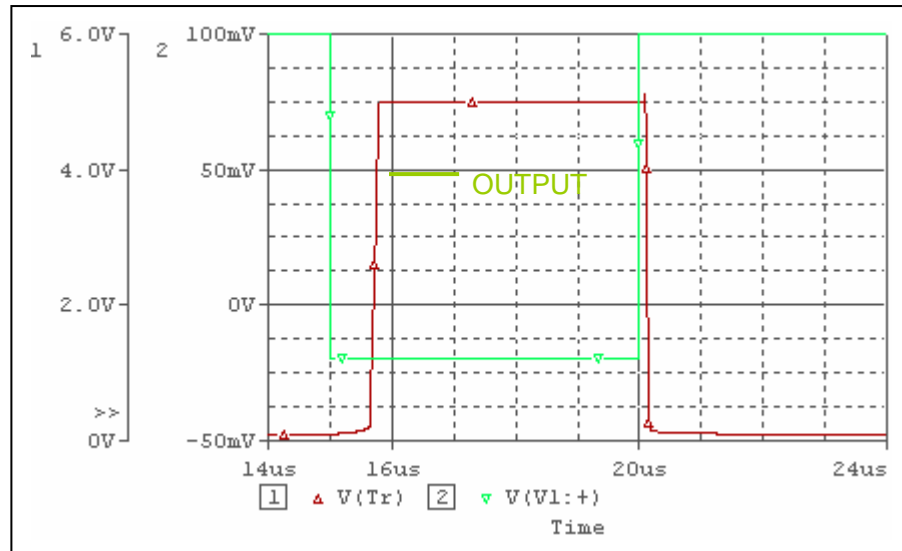
Evaluation Circuit
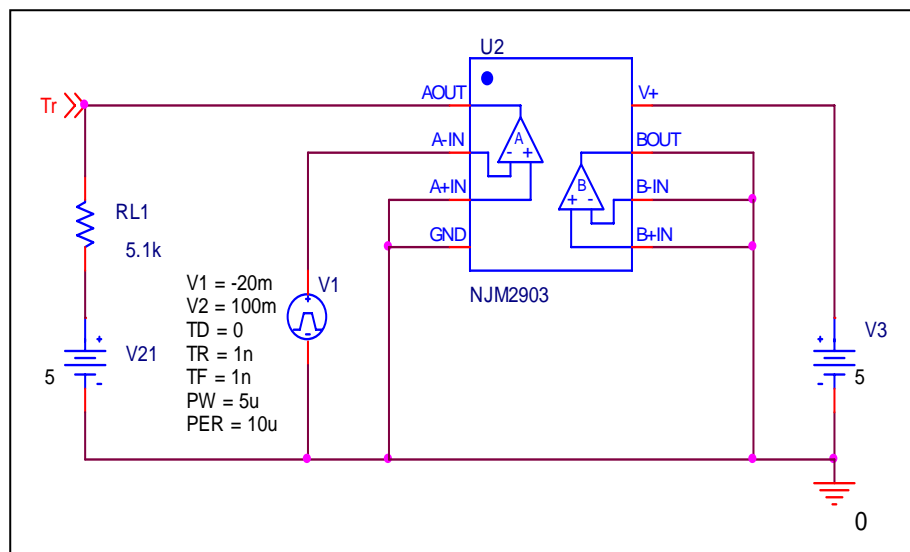
Comparison Table

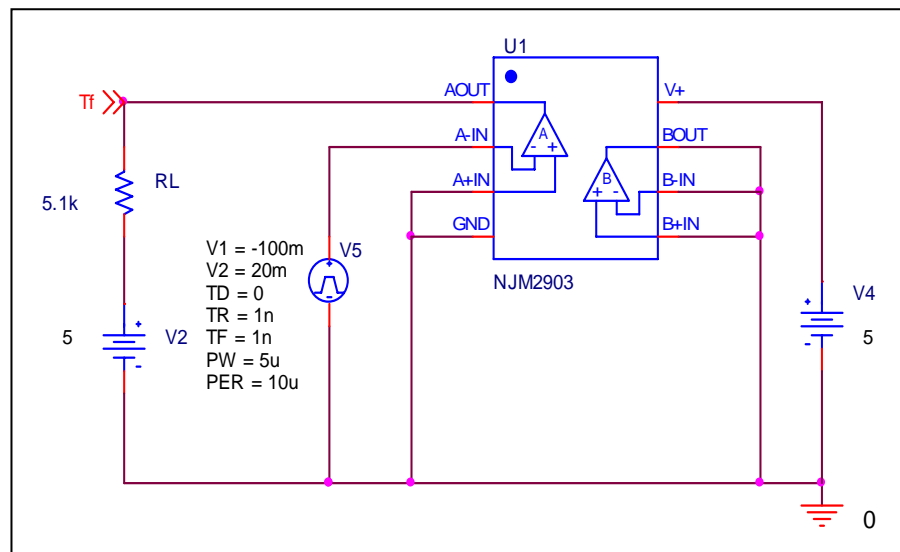|	Measurement	Simulation	% Error
Rising delay time (us)	0.63	0.628491	-0.2395
Transition time (us)	0.12	0.124967	4.1392

Response time (Falling time)
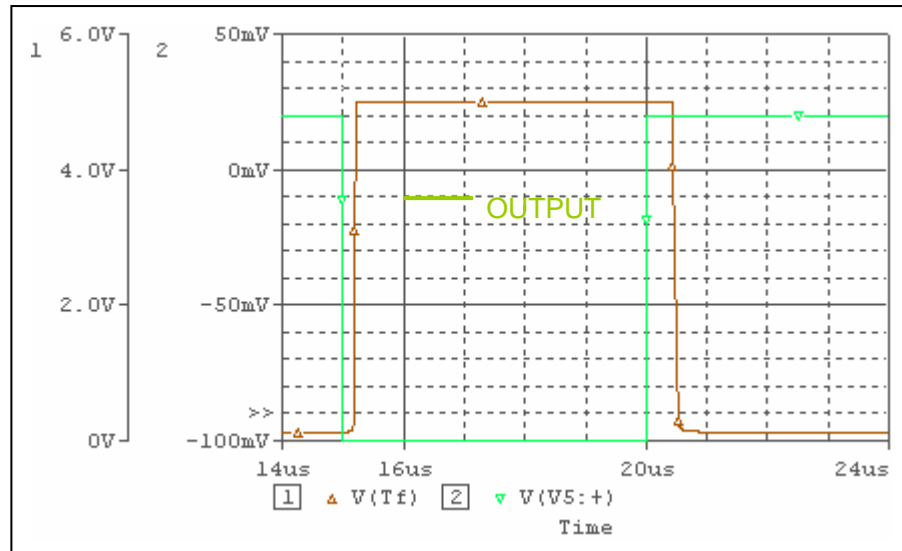
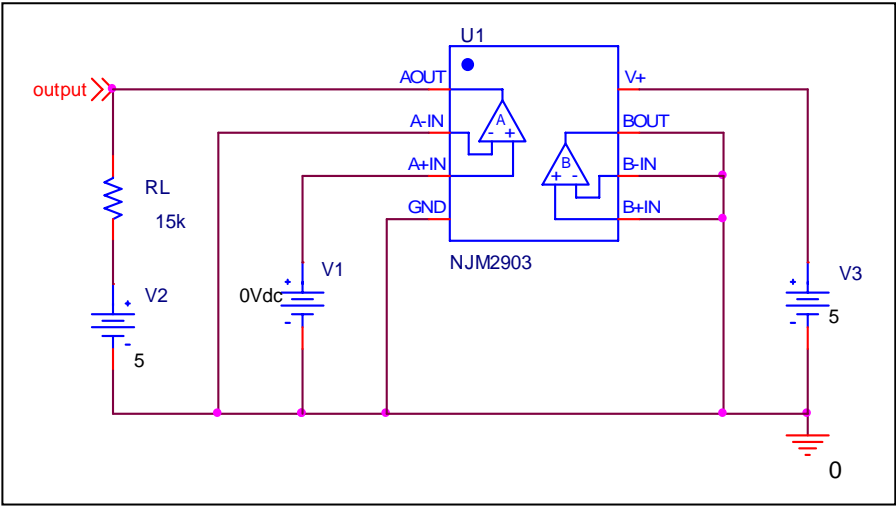|	Measurement	Simulation	% Error
Falling delay time (us)	0.43	0.429501	-0.1160

Input Offset Voltage Characteristics
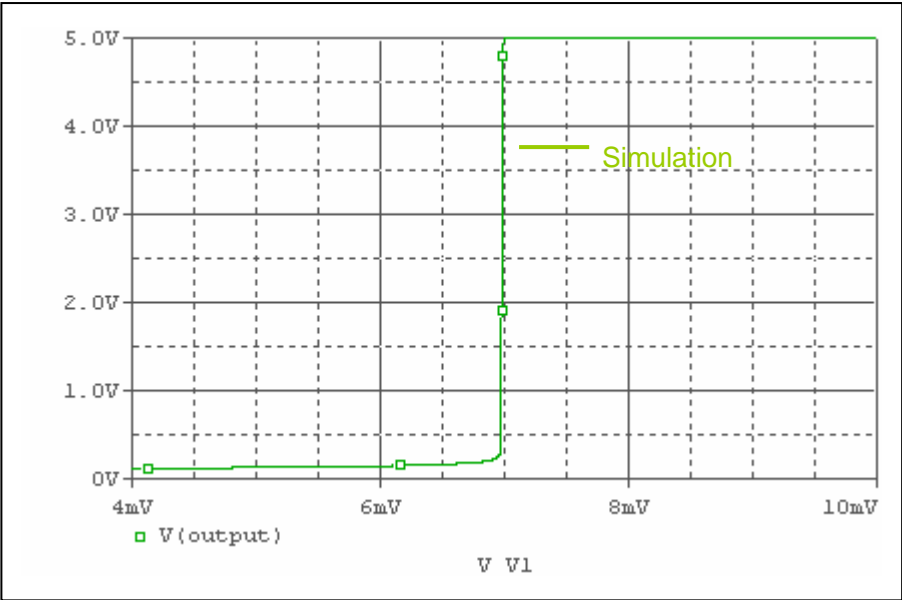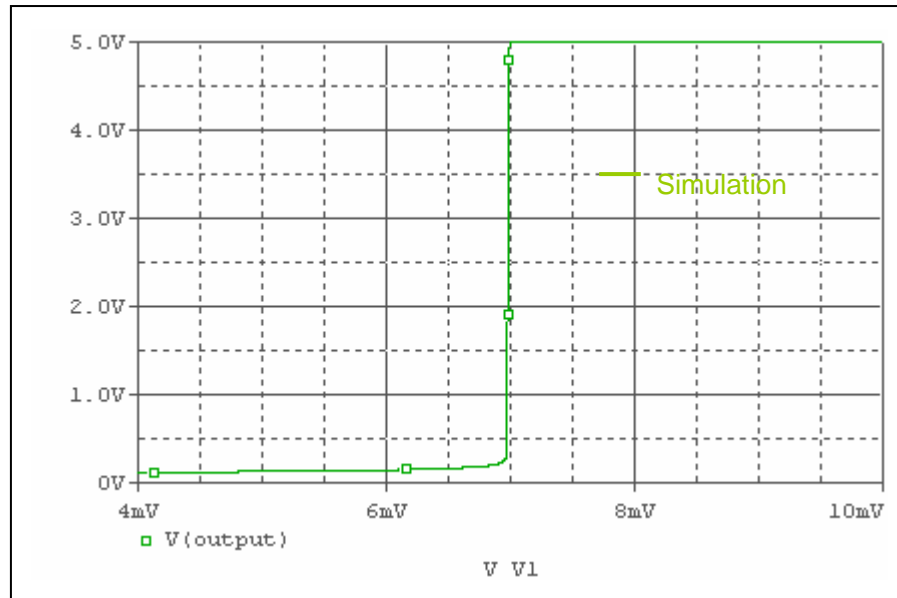
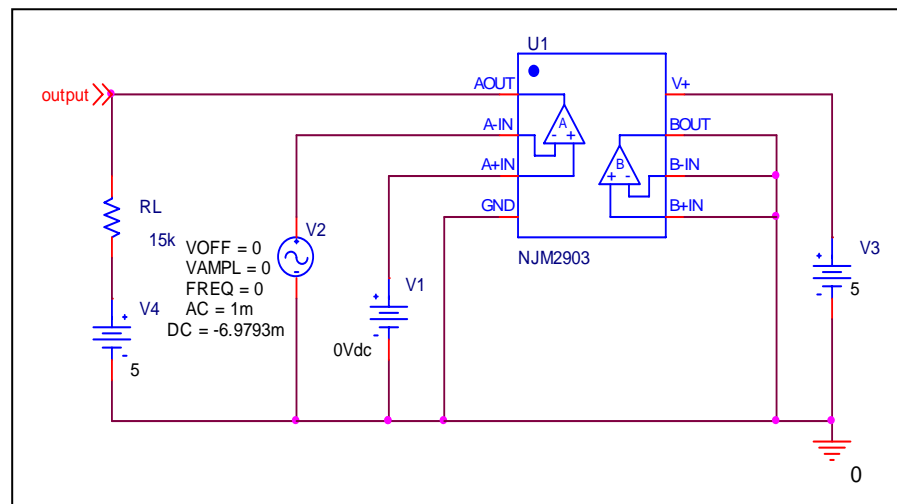Simulation result

Evaluation Circuit

Comparison Table

	Measurement	Simulation	%Error
V_{io}(mV)	7	6.9793	-0.2957

Av Characteristics

Simulation result

Evaluation Circuit

Comparison Table

R_L = 15kΩ	Measurement	Simulation	%Error
Av (dB)	106	105.599	-0.3783

Input Bias Current Characteristics

$$(I(V1)- I(V2)) \quad \triangledown \quad (I(V1)+ I(V2))/2$$
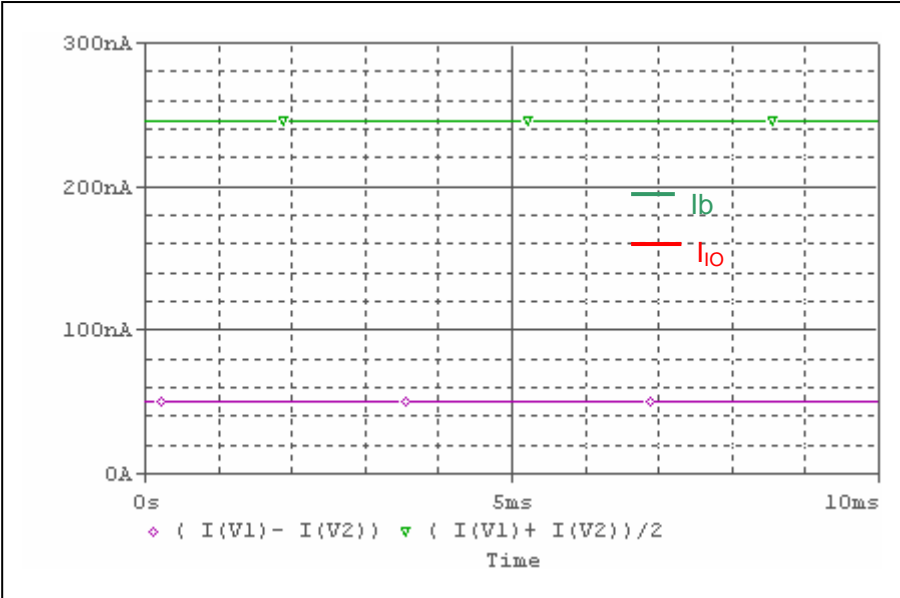
Evaluation Circuit
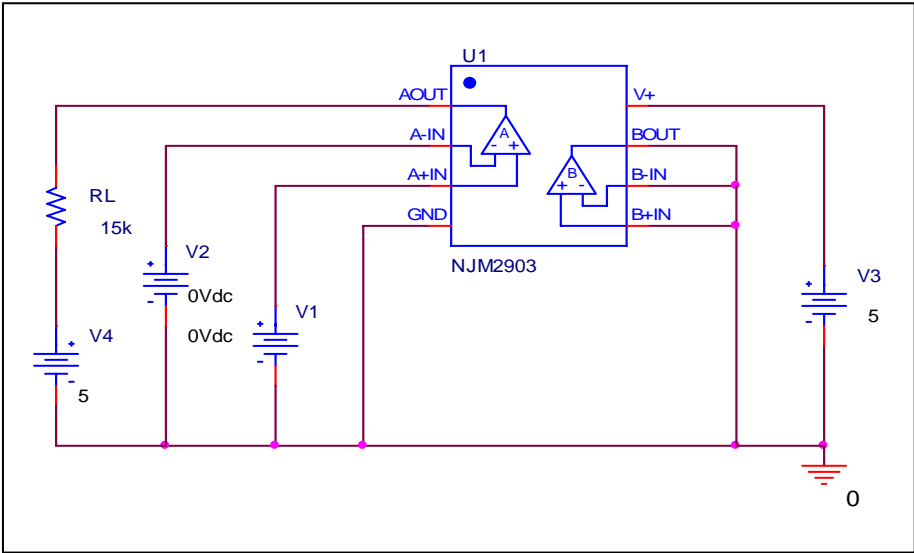
Comparison Table

	Measurement	Simulation	% Error
Ib (nA)	50	49.804	-0.3920
I_{IO} (nA)	250	246.035	-1.5860