

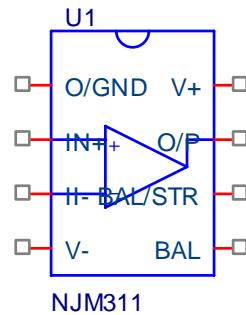
Device Modeling Report

COMPONENTS : VOLTAGE COMPARATOR
PART NUMBER : NJM311
MANUFACTURER : NEW JAPAN RADIO



Bee Technologies Inc.

SPICE MODEL



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*$
*PART NUMBER: NJM311
*MANUFACTURER: NEW JAPAN RADIO
*BJT COMPARATOR
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.subckt njm311 In+ li- V+ V- O/P O/GND
f1      9  V+ v1 1
iee     V+ 7 dc 100.0E-6
vi1     21 In+ dc 0.001
vi2     22 li- dc 0.00302
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=503)
.model qin2 PNP(Is=800.0E-18 Bf=494)
.model qmi NPN(Is=800.0E-18 Bf=1002)
.model qmo NPN(Is=800.0E-18 Bf=1000 Cjc=1E-15 Tr=120.3E-9)
e1      10 O/GND 9 V- 1
v1      10 11 dc 0
q5      O/P 11 O/GND qoc
.model qoc NPN(Is=800.0E-18 Bf=103.5E3 Cjc=1E-15 Tf=10.3E-11
+ Tr=37.7E-9 RE=11)
dp      V- V+ dx
rp      V+ V- 2.590E3
.model dx D(Is=800.0E-18)
.ends njm311
*$

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BJT MODEL

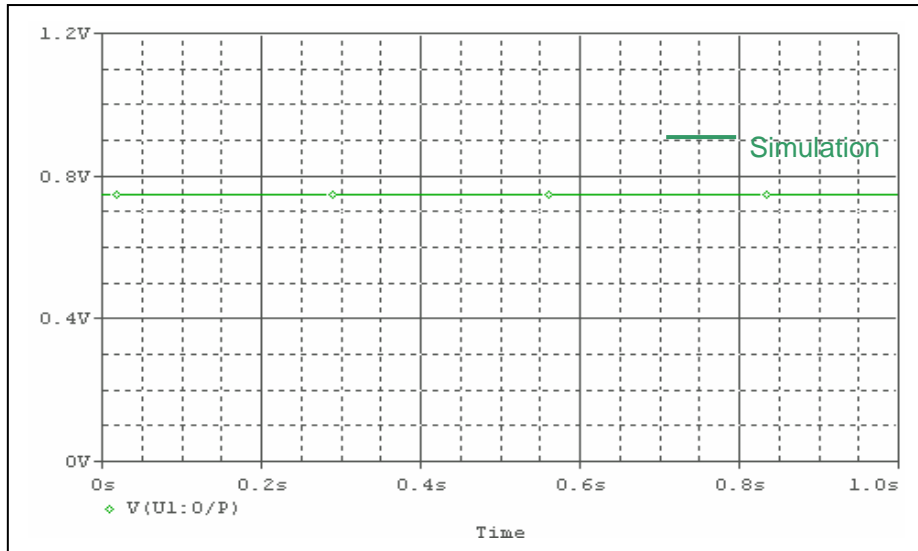
Pspice model parameter	Model description
IS	Saturation Current
BF	Ideal Maximum Forward Beta
CJC	Zero-bias Collector-Base Junction Capacitance
TF	Forward Transit Time
TR	Reverse Transit Time

DIODE MODEL

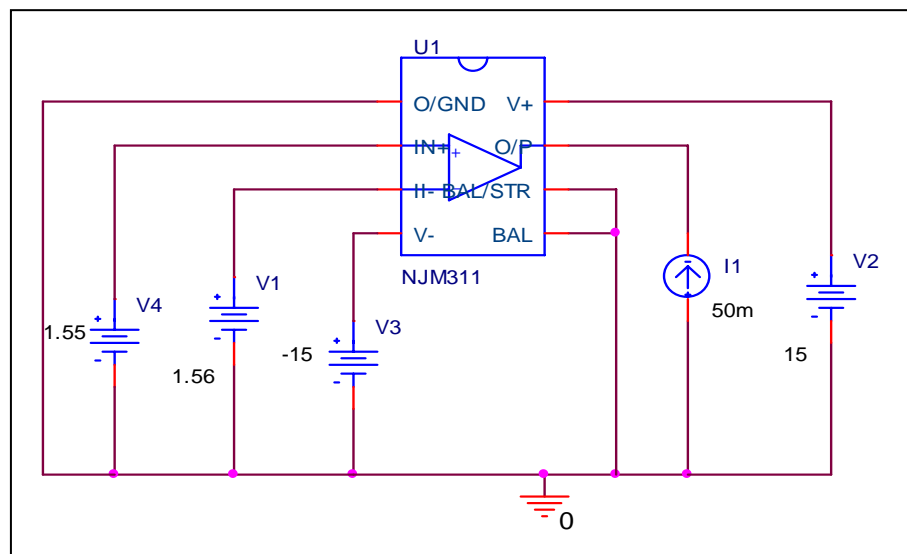
Pspice model parameter	Model description
IS	Saturation Current
RS	Series Resistance

Output Low Voltage

Simulation result



Evaluation Circuit

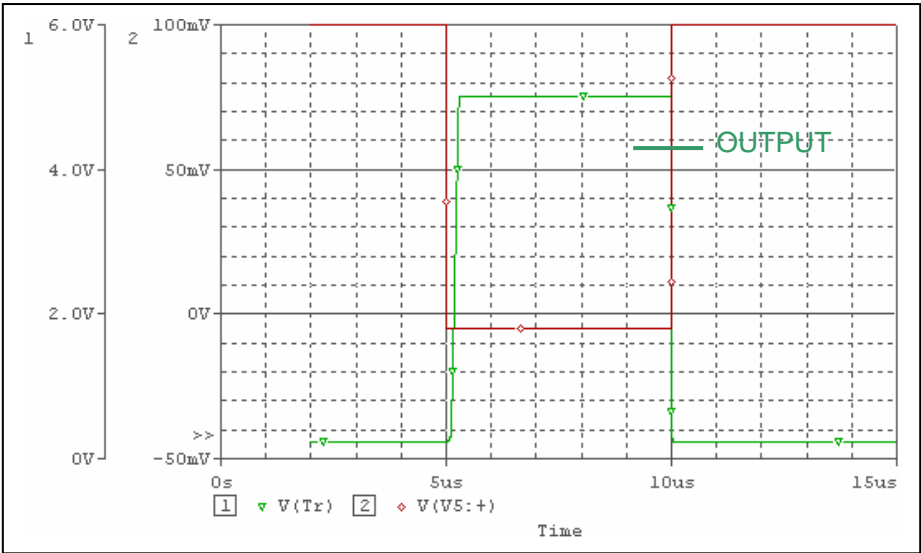


Comparison Table

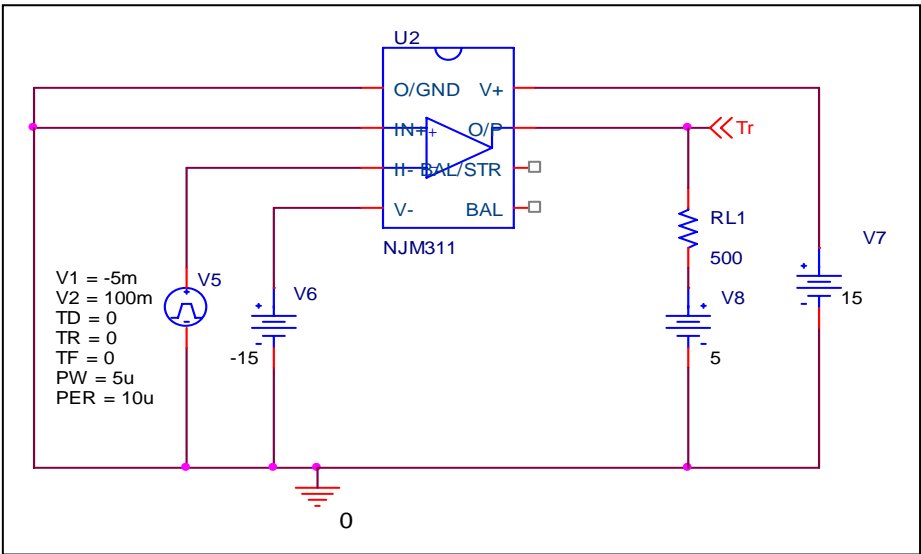
$I_o = 50\text{mA}$	Measurement	Simulation	%Error
$V_{ol} \text{ (V)}$	0.75	0.749735	-0.035

Response time

Simulation result



Evaluation Circuit

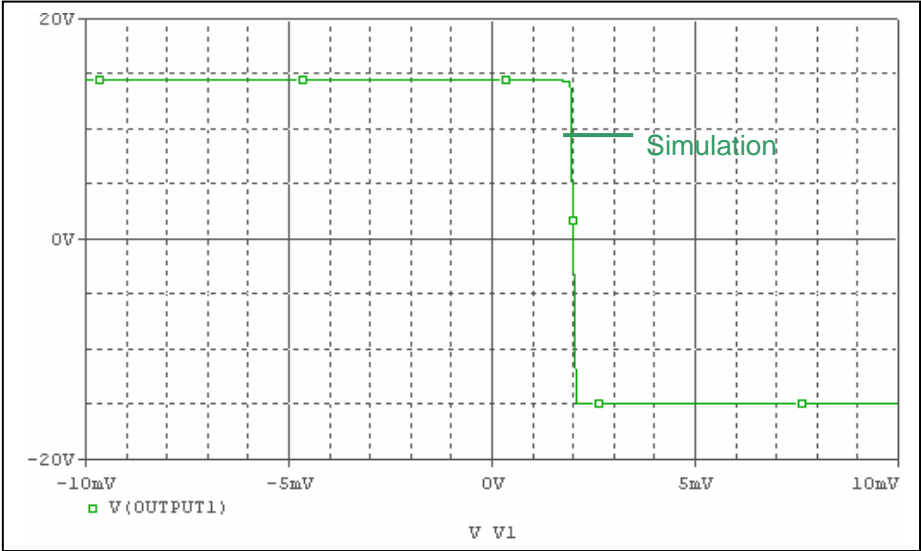


Comparison Table

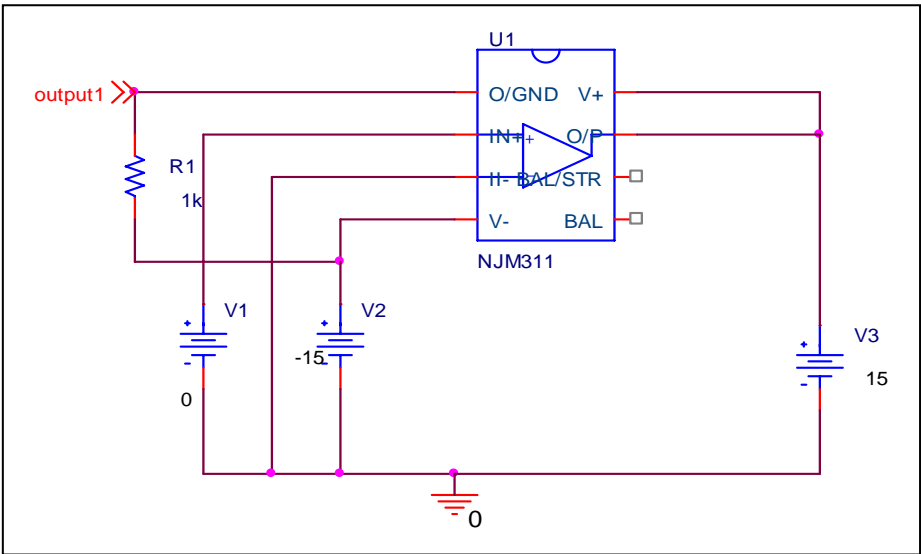
	Measurement	Simulation	% Error
Response time (ns)	200	193.370	-3.315

Input Offset Voltage Characteristics

Simulation result



Evaluation Circuit

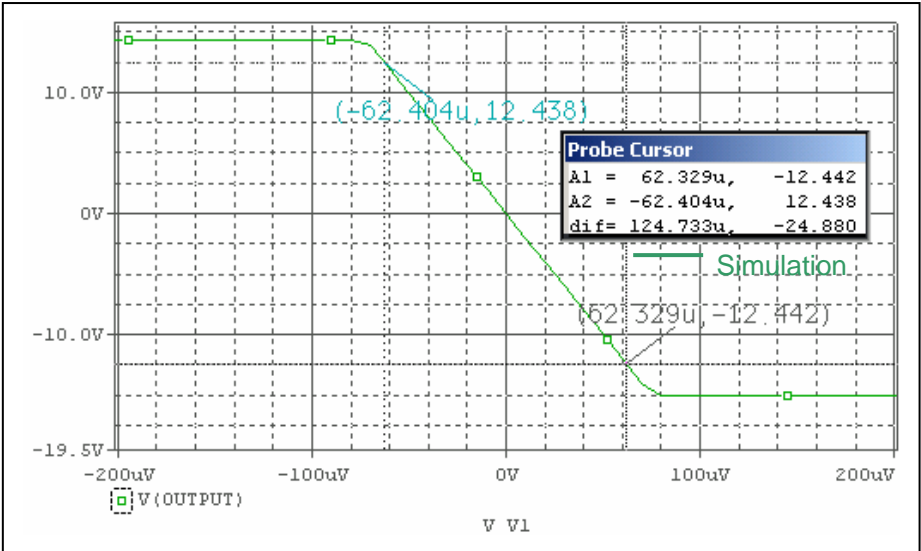


Comparison Table

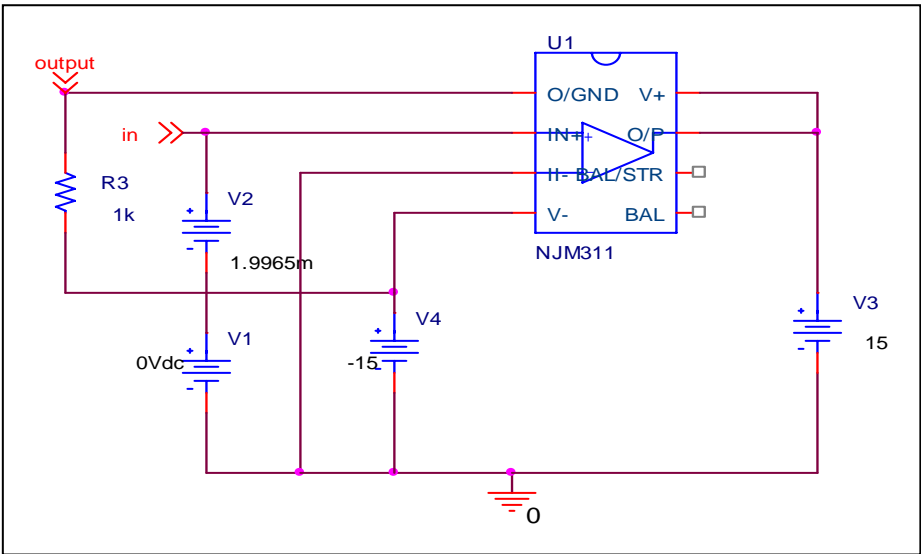
	Measurement	Simulation	%Error
$V_{io}(mV)$	2	1.9965	-0.175

Av Characteristics

Simulation result



Evaluation Circuit



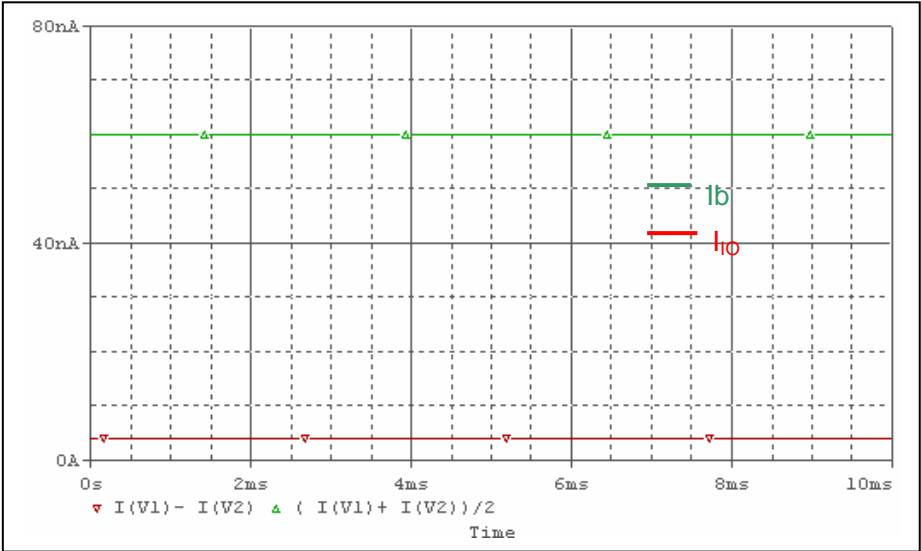
$$A_v = 20 \cdot \text{LOG}(24.880/124.733\text{u}) \quad \text{dB}$$

Comparison Table

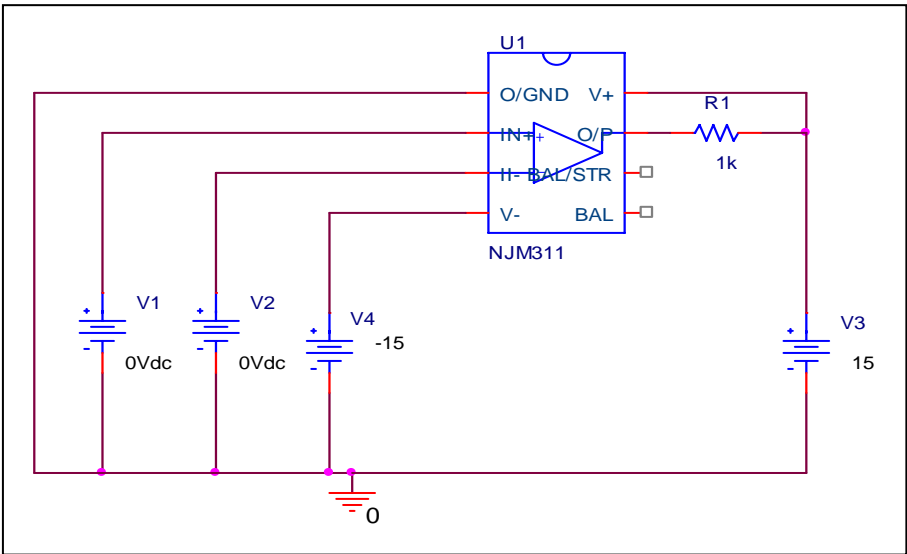
$R_L = 1\text{k}\Omega$	Measurement	Simulation	%Error
A_v (dB)	106	106	0

Input Bias Current Characteristics

Simulation result



Evaluation Circuit



Comparison Table

	Measurement	Simulation	% Error
I_b (nA)	100	100.059	0.059
I_{io} (nA)	6	6.0075	0.125