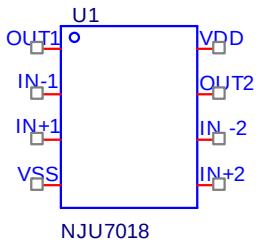
Device Modeling Report

COMPONENTS : OPERATIONAL AMPLIFIER (CMOS)
PART NUMBER : NJU7018
MANUFACTURER : NEW JAPAN RADIO

Bee Technologies Inc.

Spice Model

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*$
*PART NUMBER: NJU7018
*MANUFACTURER: NEW JAPAN RADIO
*CMOS OPAMP
*All Rights Reserved Copyright (c) Bee Technologies Inc. 2006
.SUBCKT nju7018 OUT1 -IN1 +IN1 VSS +IN2 -IN2 OUT2 VDD
X_U1 +IN1 -IN1 VDD    VSS OUT1 nju7018_s
X_U2 +IN2 -IN2 VDD    VSS OUT2 nju7018_s
.ENDS nju7018
.SUBCKT nju7018_s     IN+ IN- V+ V- OUT
m1 3 IN- 6 V- nix l=6u w=25u
m2 4 7 6 V- nix l=6u w=25u
m3 8 IN- 5 5 pix l=6u w=23.15u
m4 9 7 5 5 pix l=6u w=25u
eos 7 IN+ poly(1) 25 98 1e-3 0.451
iin1 IN+ 98 1.25p
iin2 IN- 98 1.25p
ios IN- IN+ 0.5p
i1 V+ 5 50u
i2 6 V- 50u
r1 V+ 3 4.833k
r2 V+ 4 4.833k
r3 8 V- 4.833k
r4 9 V- 4.833k
d3 5 V+ dx
d4 V- 6 dx
eref 98 0 poly(2) V+ 0 V- 0 0 0.75 0.75
g1 98 21 poly(2) 4 3 9 8 0 145u 145u
rg 21 98 18.078e6
cc 21 OUT 20p
d1 21 22 dx
d2 23 21 dx
v1 V+ 22 1.237
v2 23 V- 1.237
ecm 24 98 poly(2) IN+ 98 IN- 98 0 0.5 0.5
```

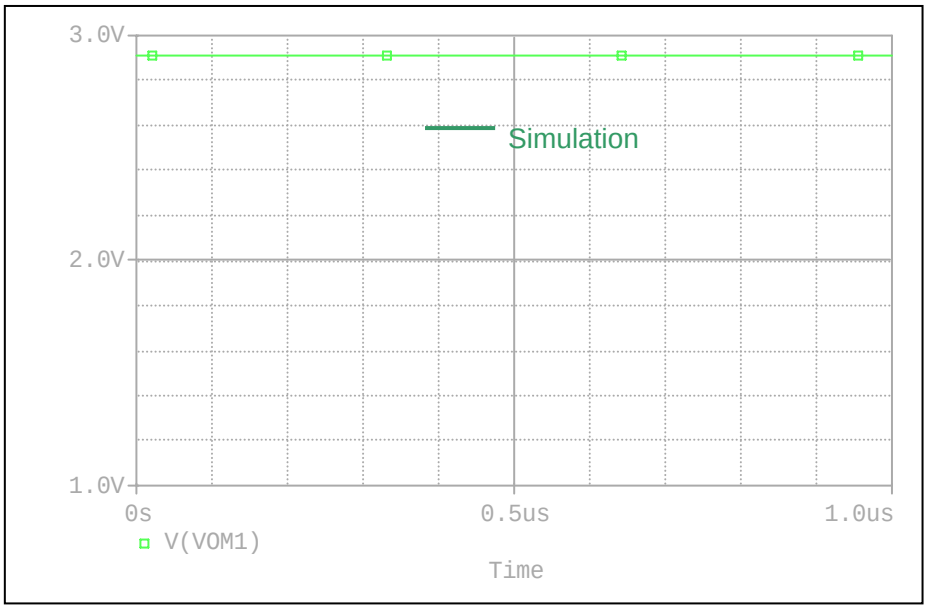
```
r5 24 25 1e6
r6 25 98 1.3k
c1 24 25 0.75p
isy V+ V- 450.4u
gsy V+ V- poly(1) V+ V- -3.334e-4 6.667e-5
ep V+ 39 poly(1) 98 21 0.8925 1
en 38 V- poly(1) 21 98 0.8925 1
m15 OUT 39 V+ V+ pox l=1.5u w=9u
m16 OUT 38 V- V- nox l=1.5u w=33u
c15 OUT 39 1p
c16 OUT 38 1p
.model dx d(rs=1 cjo=0.1p)
.model nix nmos( vto=.75 kp=205.5u rd=1 rs=1
+ rg=1 rb=1 cgso=4e-9 cgdo=4e-9 cgbo=16.667e-9
+ cbs=7e-12 cbd=7e-12)
.model nox nmos( vto=0.48 kp=195u rd=1.5 rs=1.5
+ rg=1 rb=1 cgso=66.667e-12 cgdo=66.667e-12
+ cgbo=125e-9 cbs=2.34e-13 cbd=2.34e-13)
.model pix pmos( vto=-0.75 kp=205.5u rd=1 rs=1
+ rg=1 rb=1 cgso=4e-9 cgdo=4e-9 cgbo=16.667e-9
+ cbs=2.34e-13 cbd=2.34e-13)
.model pox pmos( vto=-0.75 kp=195u rd=.5 rs=.5
+ rg=1 rb=1 cgso=66.667e-12 cgdo=66.667e-12
+ cgbo=125e-9 cbs=15.38e-11 cbd=15.38e-11)
.ends nju7018_s
*$
```

MOSFET MODEL

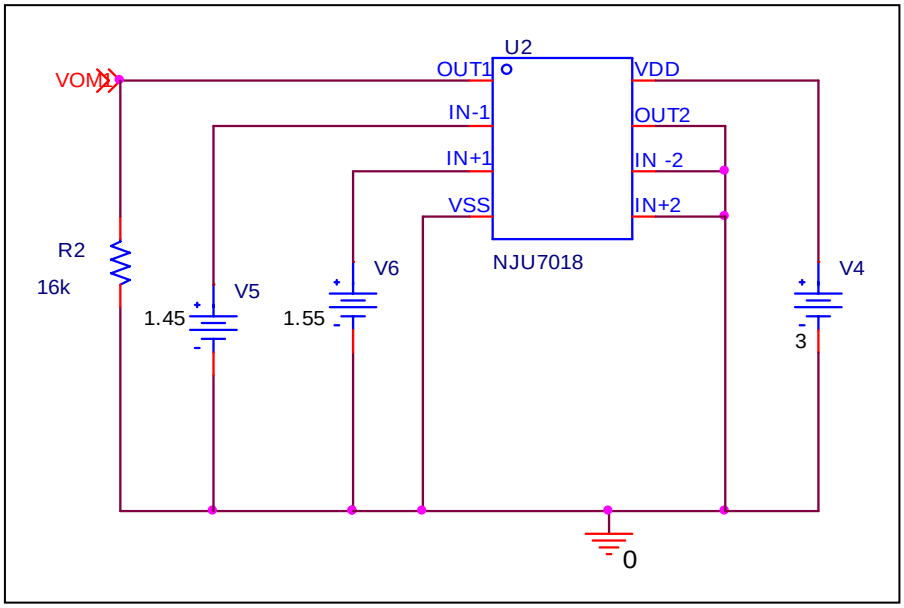
Pspice model parameter	Model description
LEVEL	
L	Channel Length
W	Channel Width
KP	Transconductance
RS	Source Ohmic Resistance
RD	Ohmic Drain Resistance
VTO	Zero-bias Threshold Voltage
RDS	Drain-Source Shunt Resistance
TOX	Gate Oxide Thickness
CGSO	Zero-bias Gate-Source Capacitance
CGDO	Zero-bias Gate-Drain Capacitance
CBD	Zero-bias Bulk-Drain Junction Capacitance
MJ	Bulk Junction Grading Coefficient
PB	Bulk Junction Potential
FC	Bulk Junction Forward-bias Capacitance Coefficient
RG	Gate Ohmic Resistance
IS	Bulk Junction Saturation Current
N	Bulk Junction Emission Coefficient
RB	Bulk Series Resistance
PHI	Surface Inversion Potential
GAMMA	Body-effect Parameter
DELTA	Width effect on Threshold Voltage
ETA	Static Feedback on Threshold Voltage
THETA	Modility Modulation
KAPPA	Saturation Field Factor
VMAX	Maximum Drift Velocity of Carriers
XJ	Metallurgical Junction Depth
UO	Surface Mobility

Output Voltage Swing (V_{OM1})

Simulation result



Evaluation Circuit

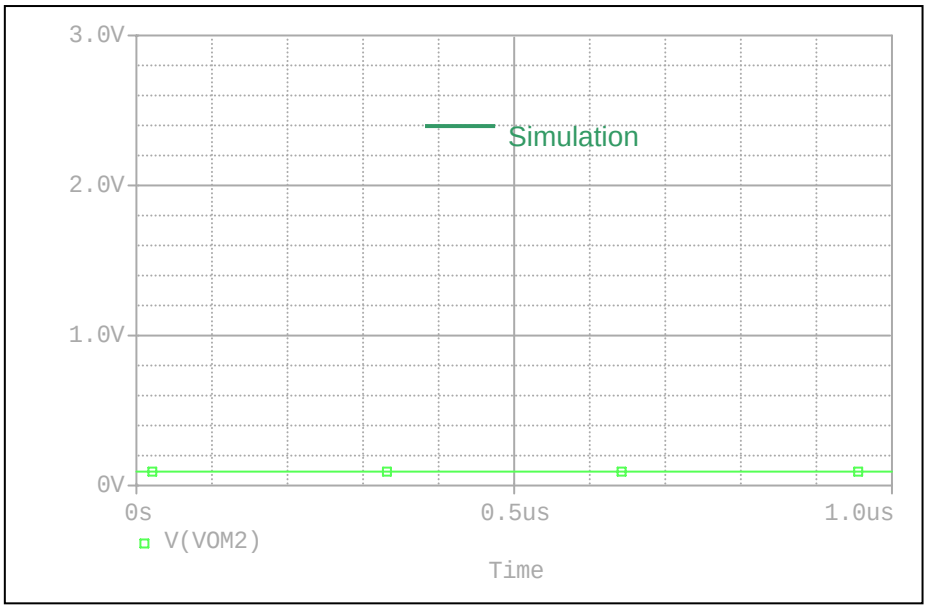


Comparison Table

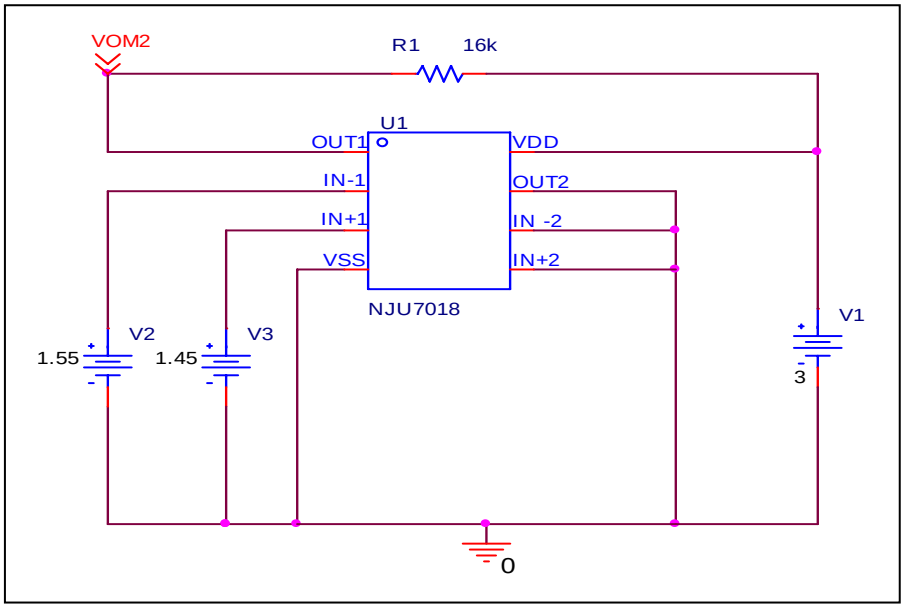
R_L=16 kΩ	Measurement	Simulation	%Error
V_{OM1} (V)	2.9	2.9069	0.238

Output Voltage Swing (V_{OM2})

Simulation result



Evaluation Circuit

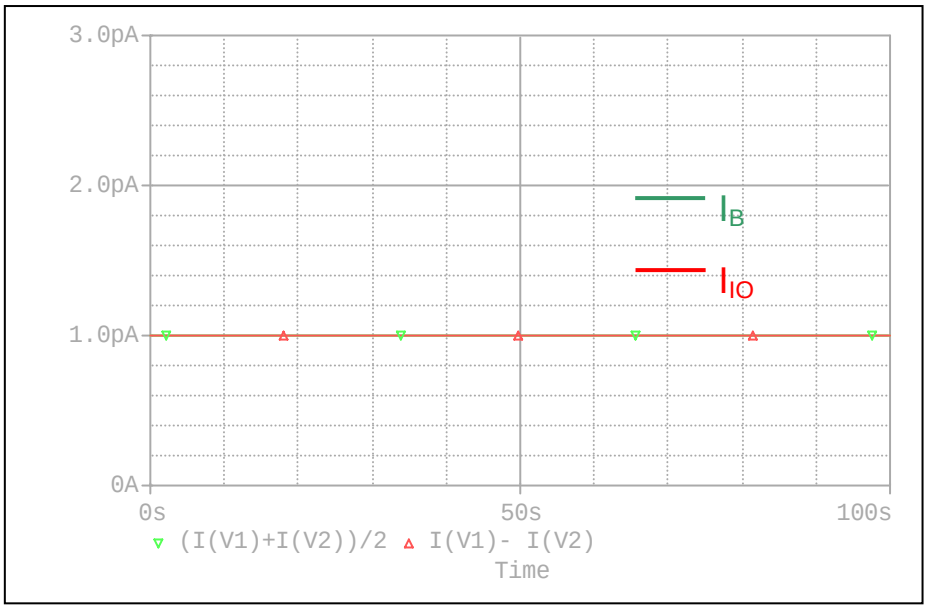


Comparison Table

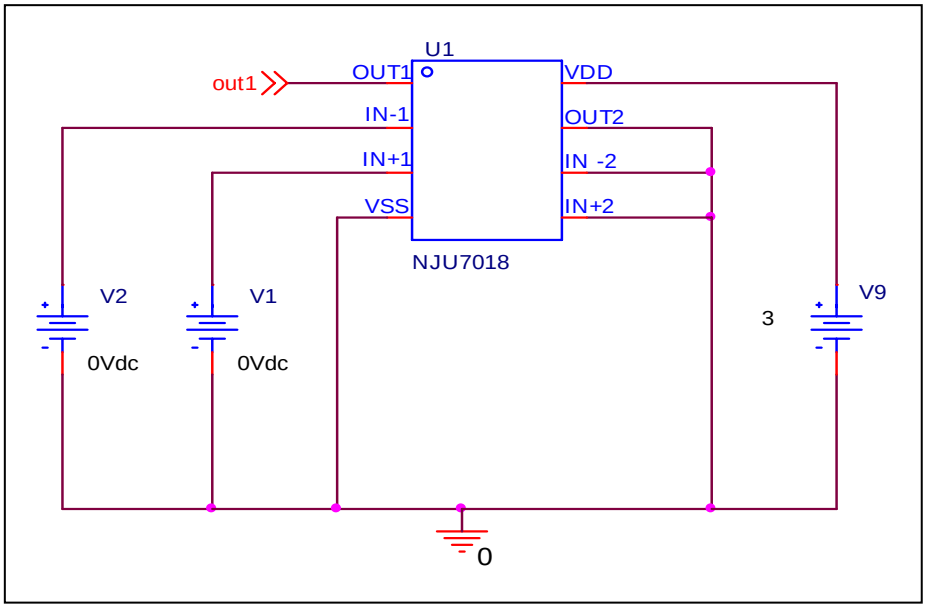
R_L=16 kΩ	Measurement	Simulation	%Error
V_{OM2} (V)	0.1	0.097928	-2.072

Input Current

Simulation result



Evaluation Circuit

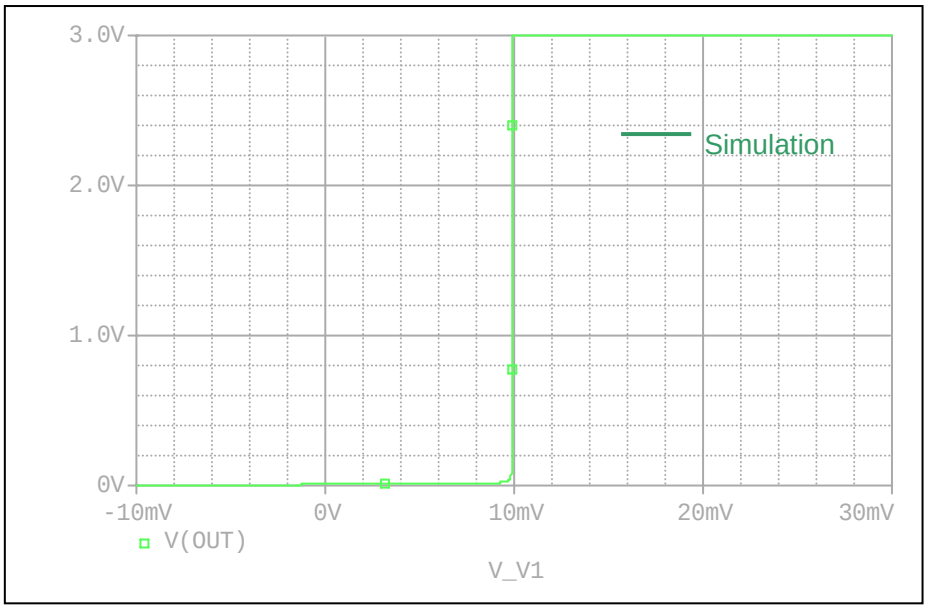


Comparison Table

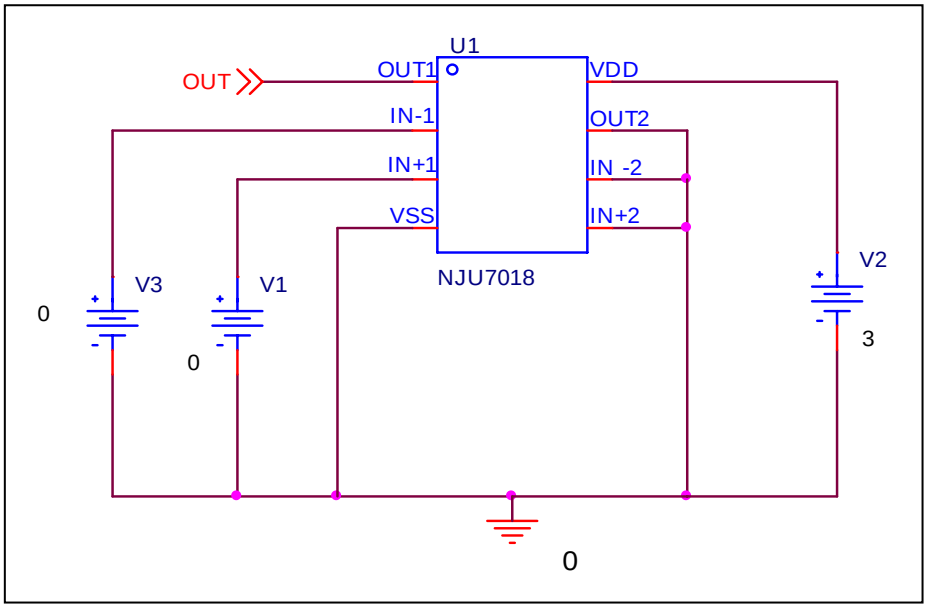
	Measurement	Simulation	% Error
I_b (pA)	1	1	0
I_{IO} (pA)	1	1	0

Input Offset Voltage

Simulation result



Evaluation Circuit

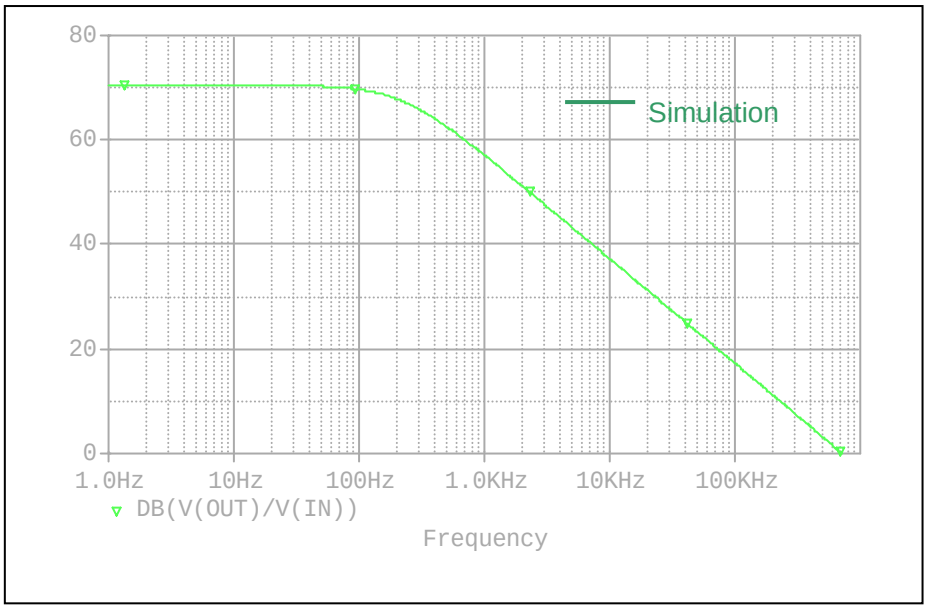


Comparison Table

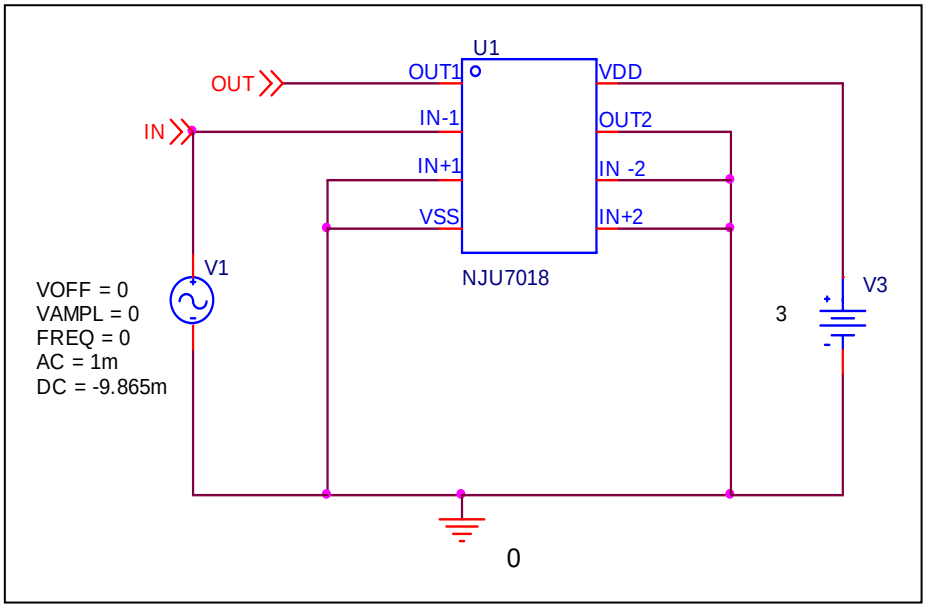
	Measurement	Simulation	%Error
V_{OS} (mV)	10	9.865	-1.350

Open loop Voltage Gain

Simulation result



Evaluation Circuit

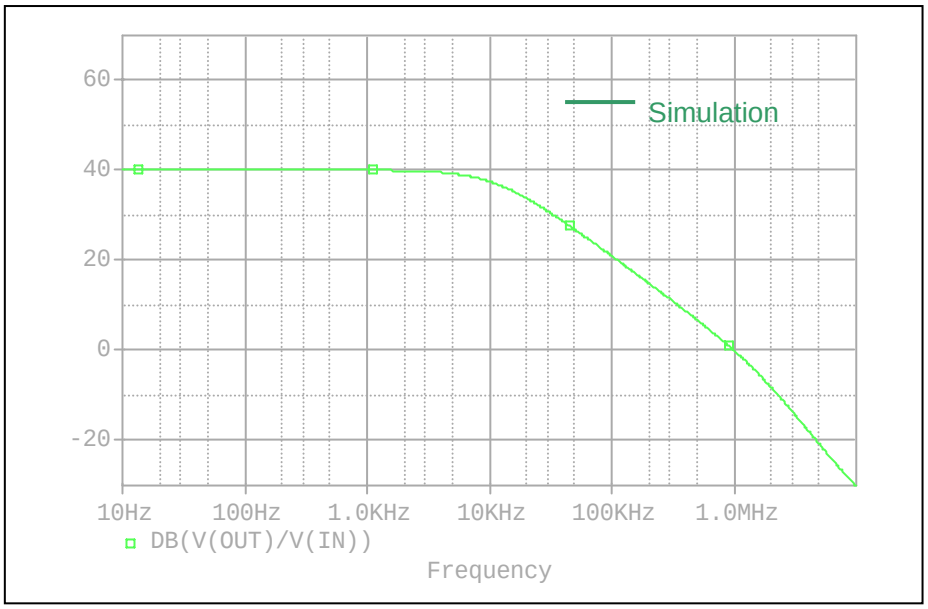


Comparison Table

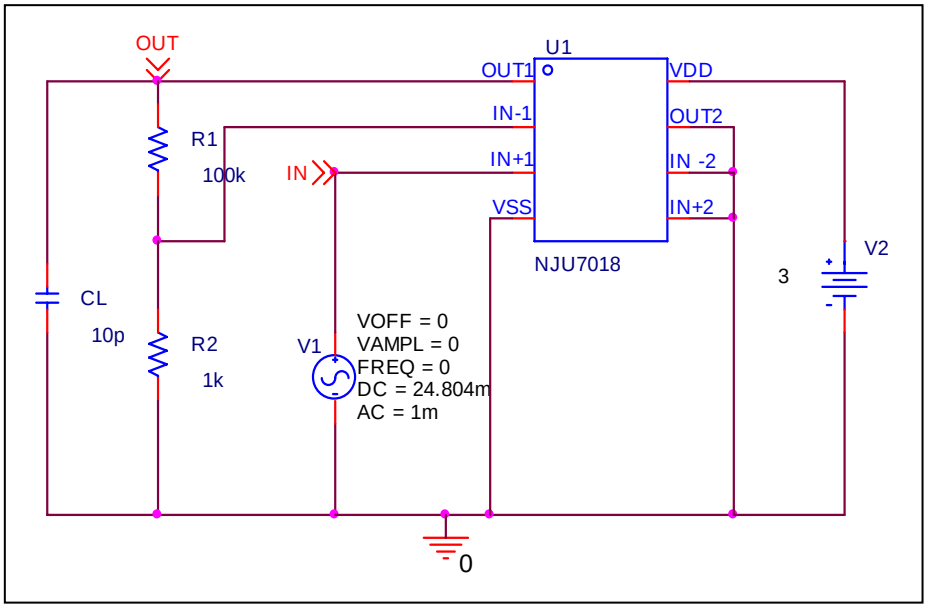
	Measurement	Simulation	%Error
Av (dB)	70	70.479	0.684

Unity Gain Frequency

Simulation result



Evaluation Circuit

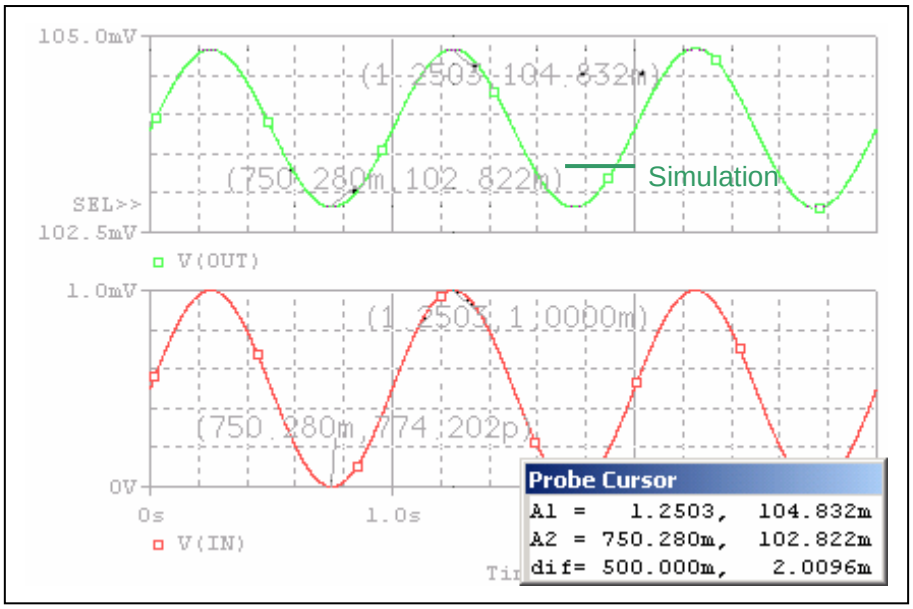


Comparison Table

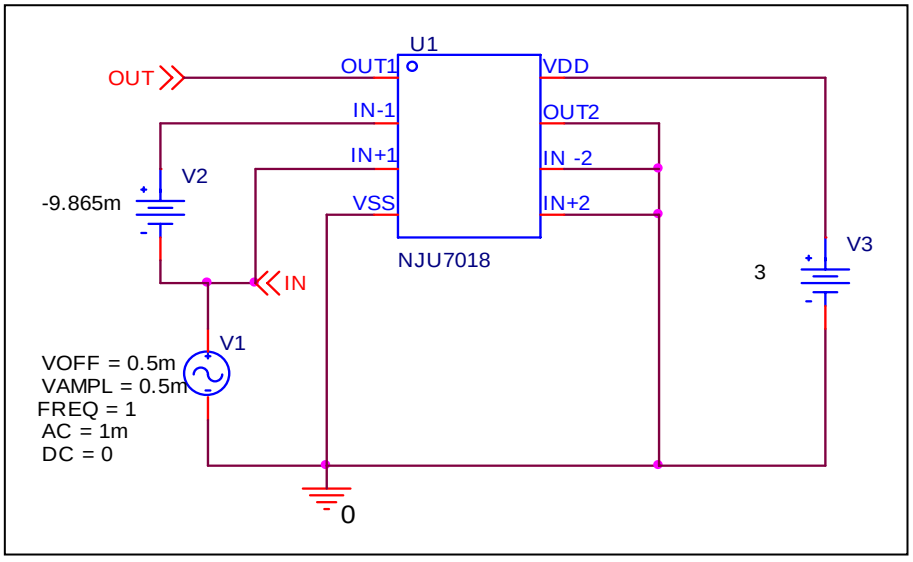
A_V=40dB,C_L=10pF	Measurement	Simulation	%Error
Ft (MHz)	1	1.003	0.3

Common-Mode Rejection Ratio

Simulation result



Evaluation Circuit



CMRR = AV/ACM

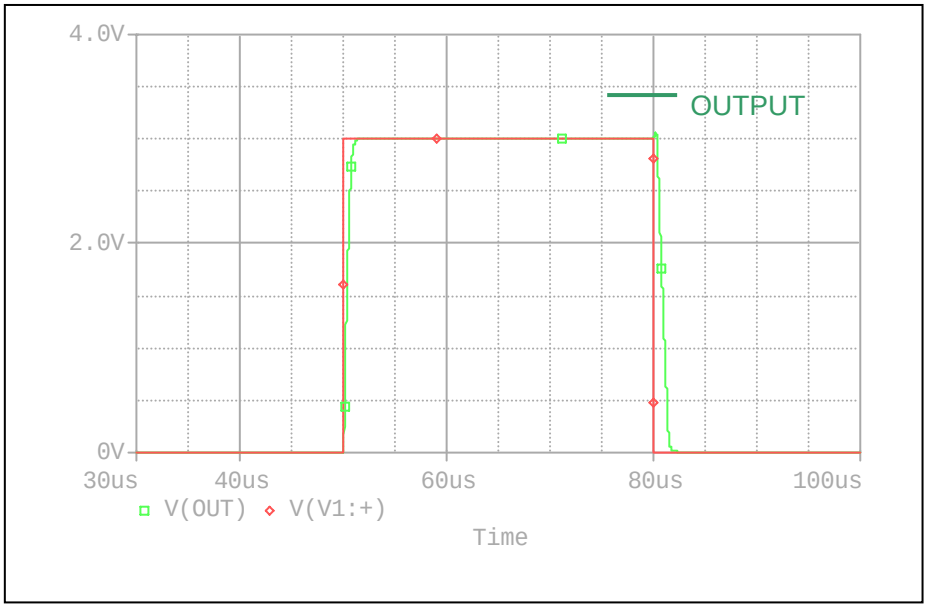
= 20* LOG(3341.5657/(2.0096m/1m))

Comparison Table

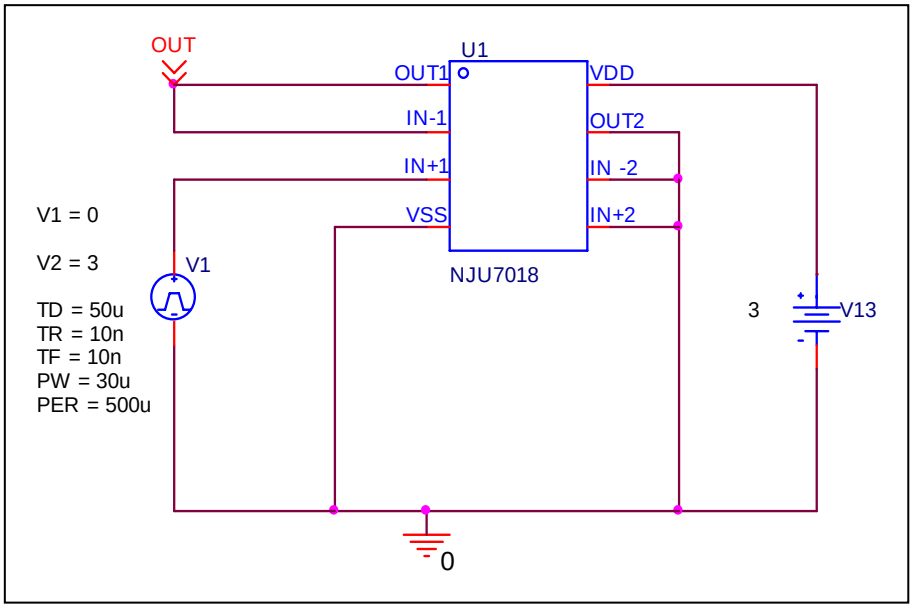
	Measurement	Simulation	%Error
CMRR (dB)	65	64.416	-0.898

Slew Rate

Simulation result



Evaluation Circuit



Comparison Table

	Measurement	Simulation	%Error
SR (V/us)	3.7	3.679	-0.568