Device Modeling Report

COMPONENTS : OPERATIONAL AMPLIFIER (CMOS)
PART NUMBER : NJU7042
MANUFACTURER : NEW JAPAN RADIO

Bee Technologies Inc.

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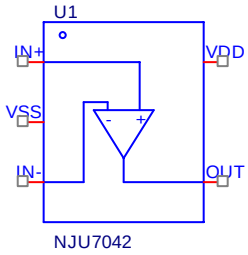
Spice Model

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*$
*PART NUMBER: NJU7042
*MANUFACTURER: NEW JAPAN RADIO
*CMOS OPAMP
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.SUBCKT nju7042    IN+ VSS IN- OUT VDD
m1 3 IN- 6 VSS nix l=6u w=20u
m2 4 7 6 VSS nix l=6u w=25u
m3 8 IN- 5 5 pix l=6u w=25u
m4 9 7 5 5 pix l=6u w=27.05u
eos 7 IN+ poly(1) 25 98 5e-3 0.451
iin1 IN+ 0 -1.5p
iin2 IN- 0 -.5p
i1 VDD 5 50u
i2 6 VSS 50u
r1 VDD 3 4.833k
r2 VDD 4 4.833k
r3 8 VSS 4.833k
r4 9 VSS 4.833k
d3 5 VDD dx
d4 VSS 6 dx
eref 98 0 poly(2) VDD 0 VSS 0 0 0.5 0.5
g1 98 21 poly(2) 4 3 9 8 0 145u 145u
rg 21 98 20.2e6
cc 21 OUT 1p
d1 21 22 dx
d2 23 21 dx
v1 VDD 22 1.37
v2 23 VSS 1.37
ecm 24 98 poly(2) IN+ 98 IN- 98 0 0.5 0.5
r5 24 25    1e6
r6 25 98 0.73k
c1 24 25 0.75p
isy VDD VSS 18.4u
gsy VDD VSS poly(1) VDD VSS -3.334e-4 6.667e-5
```

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```
ep VDD 39 poly(1) 98 21 0.78925 1
en 38 VSS poly(1) 21 98 0.78925 1
m15 OUT 39 VDD VDD pox l=1.5u w=4u
m16 OUT 38 VSS VSS nox l=1.5u w=4.2u
c2 OUT 39 350p
c3 out 9 890p
.model dx d(rs=1 cjo=1p)
.model nix nmos(vto=.75 kp=205.5u rd=1 rs=1 rg=1 rb=1
+ cgso=4e-12 cgdo=4e-12 cbd=1.5e-12)
.model nox nmos(vto=.75 kp=195u rd=.5 rs=.5 rg=1 rb=1
+ cgso=66.667e-12 cgdo=66.667e-12 cbd=2.34e-13)
.model pix pmos(vto=-.75 kp=205.5u rd=1 rs=1 rg=1 rb=1
+ cgso=4e-12 cgdo=4e-12 cbd=1.534e-12)
.model pox pmos(vto=-.75 kp=195u rd=.5 rs=.5 rg=1 rb=1
+ cgso=66.667e-12 cgdo=66.667e-12 cbd=55.538e-10)
.ends
```

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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

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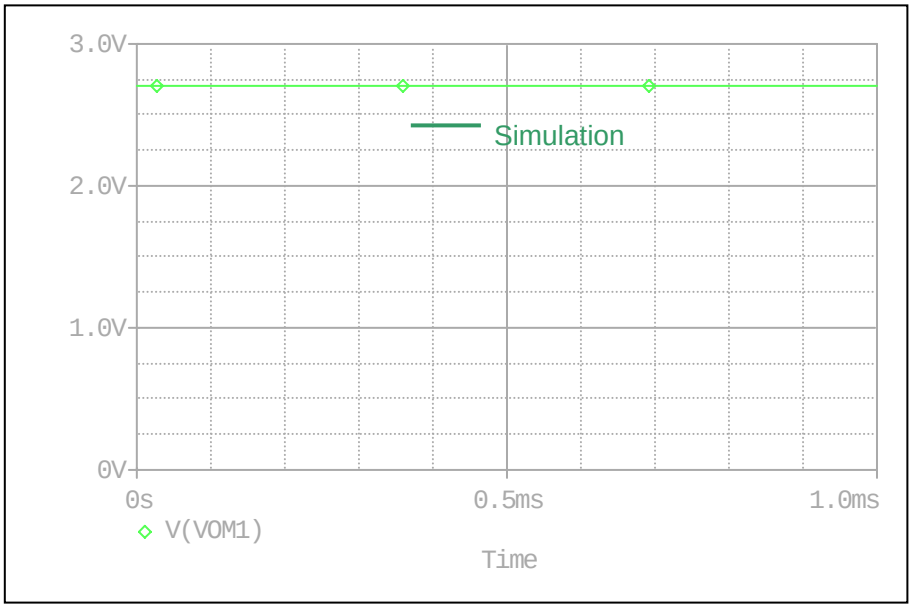
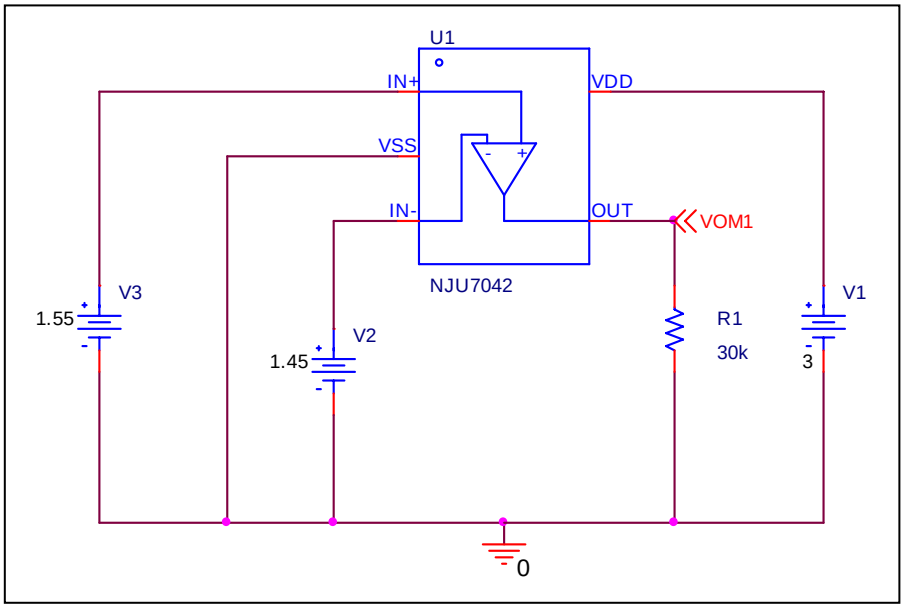
Output Voltage Swing (V_{OM1})

Simulation result



Evaluation Circuit



Comparison Table

	Measurement	Simulation	%Error
V_{OM1} (V)	2.7	2.7046	0.17

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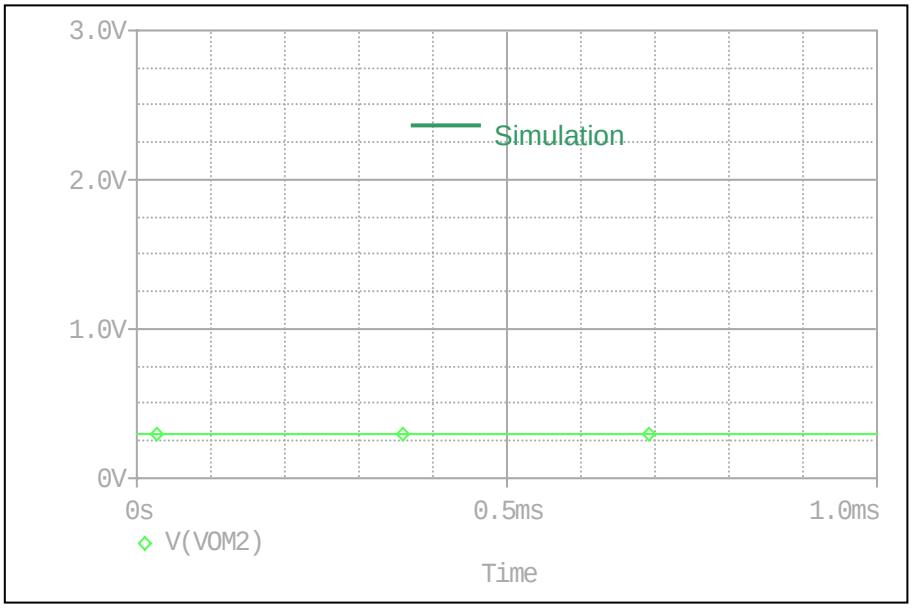
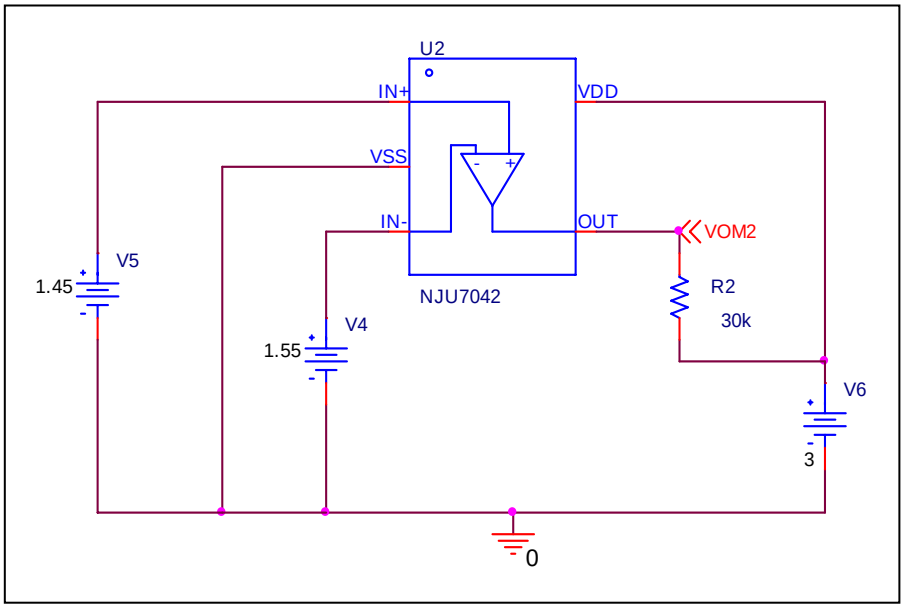
Output Voltage Swing (V_{OM2})

Simulation result



Evaluation Circuit



Comparison Table

	Measurement	Simulation	%Error
V_{OM} (V)	0.3	0.291	-3

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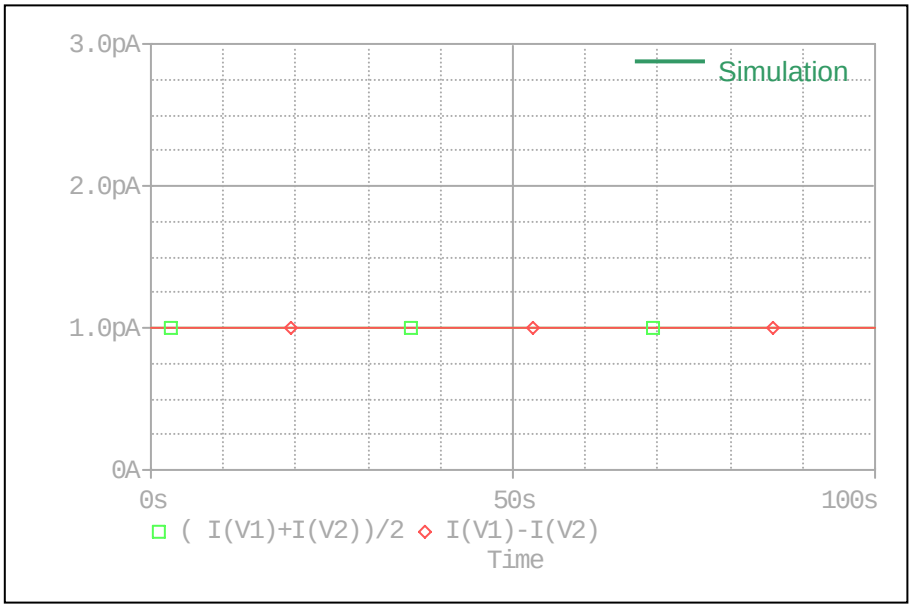
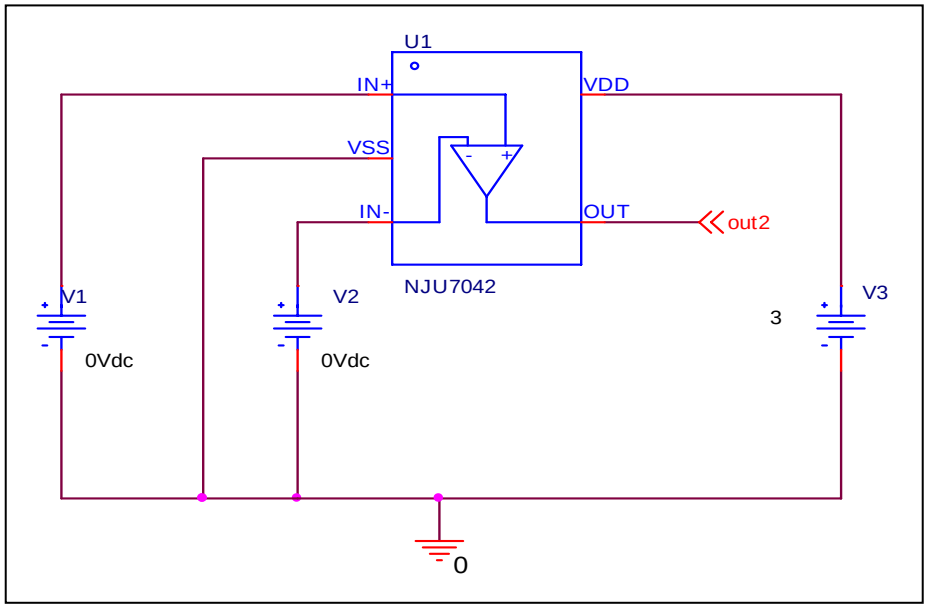
Input Current

Simulation result



Evaluation Circuit



Comparison Table

	Measurement	Simulation	% Error
I_b (pA)	1	1.00	0
I_{OS} (pA)	1	1.00	0

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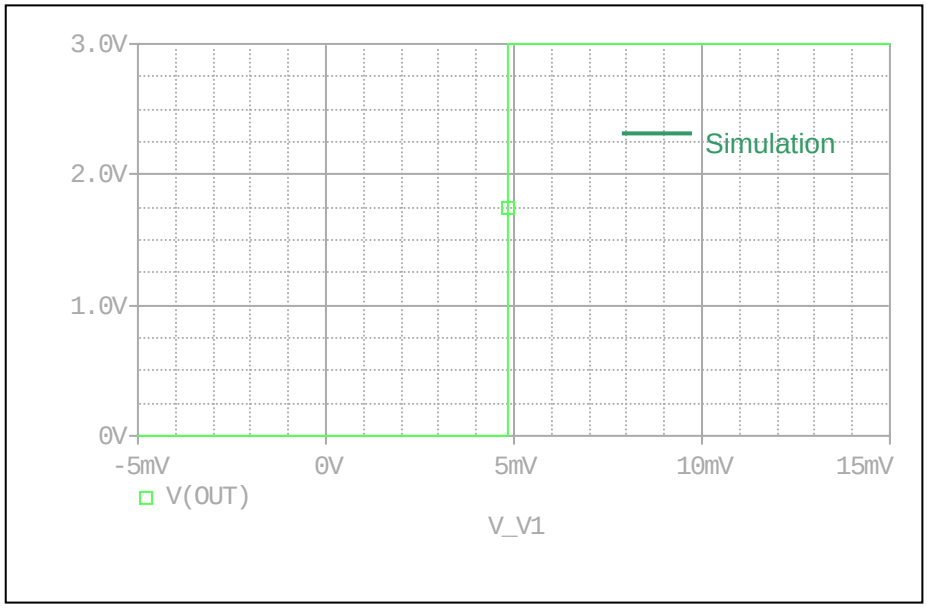
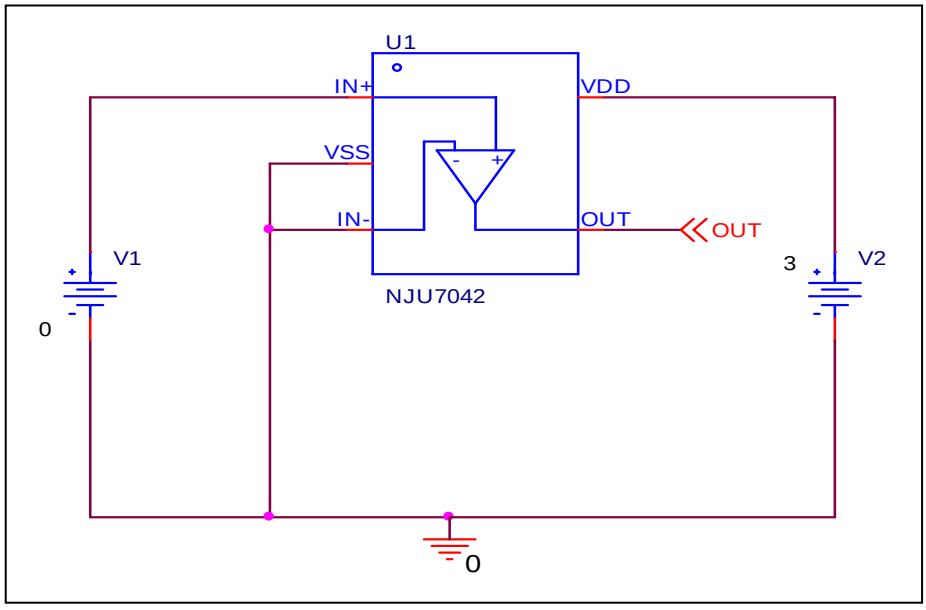
Input Offset Voltage

Simulation result



Evaluation Circuit



Comparison Table

	Measurement	Simulation	%Error
V_{OS} (mV)	5	4.8349	-3.302

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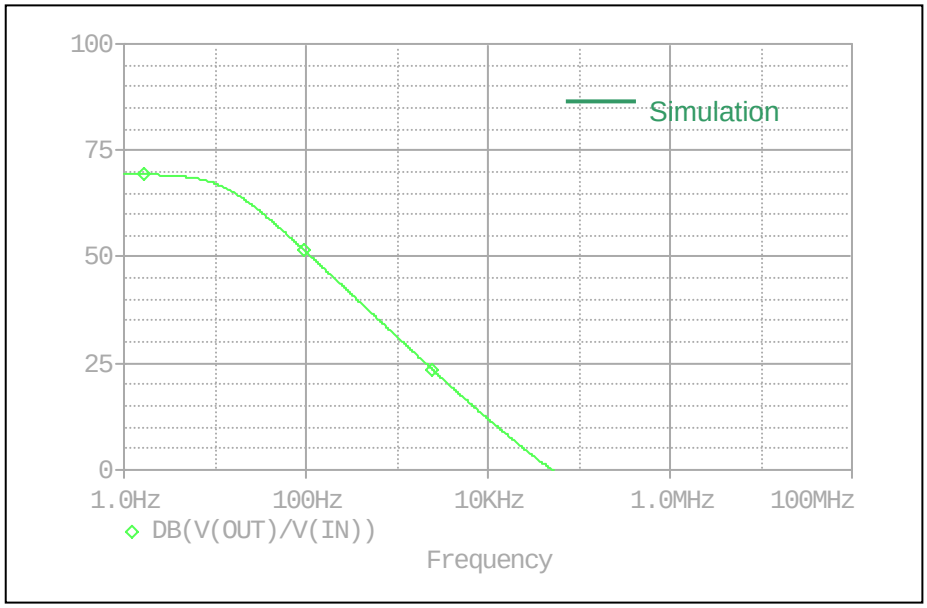
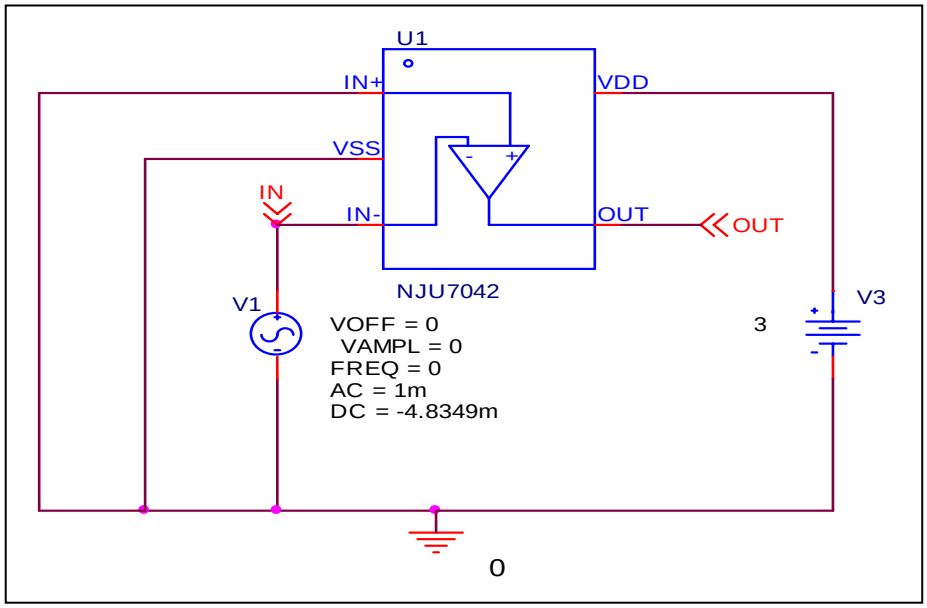
Open loop Voltage Gain

Simulation result



Evaluation Circuit



Comparison Table

	Measurement	Simulation	%Error
Av (dB)	70	69.382	-0.883

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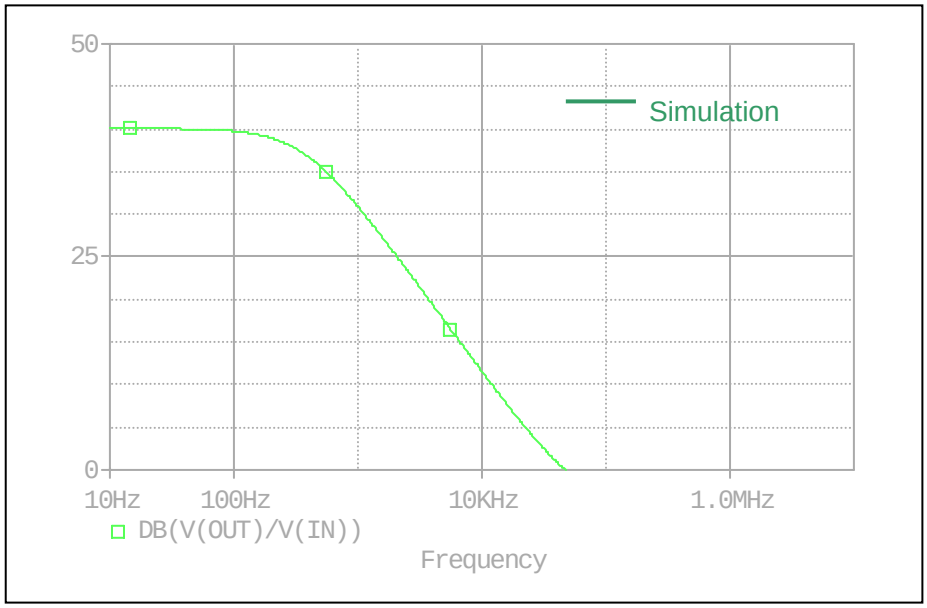
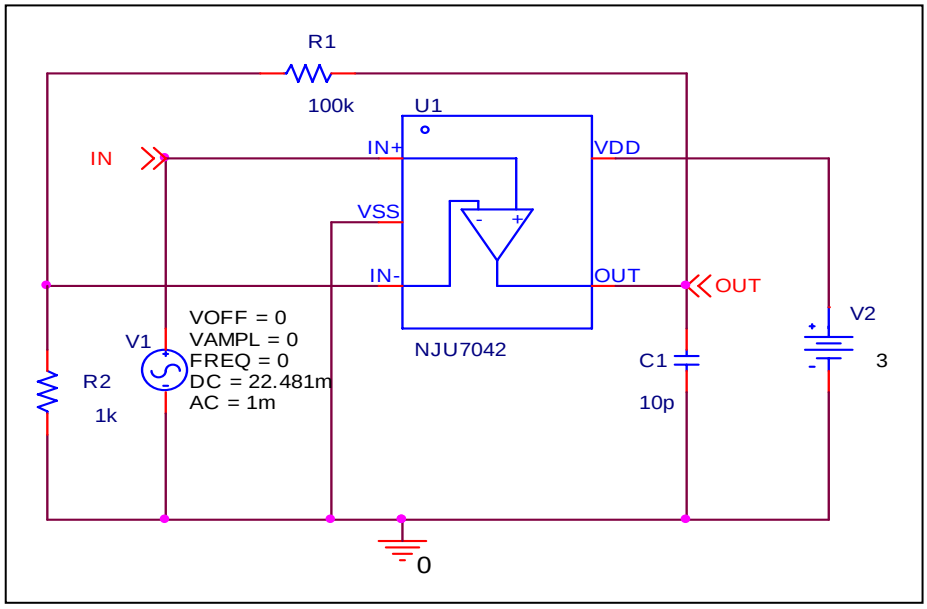
Unity Gain Frequency

Simulation result



Evaluation Circuit



Comparison Table

A_V=40dB,C_L=10pF	Measurement	Simulation	%Error
Ft (kHz)	47	47.184	0.391

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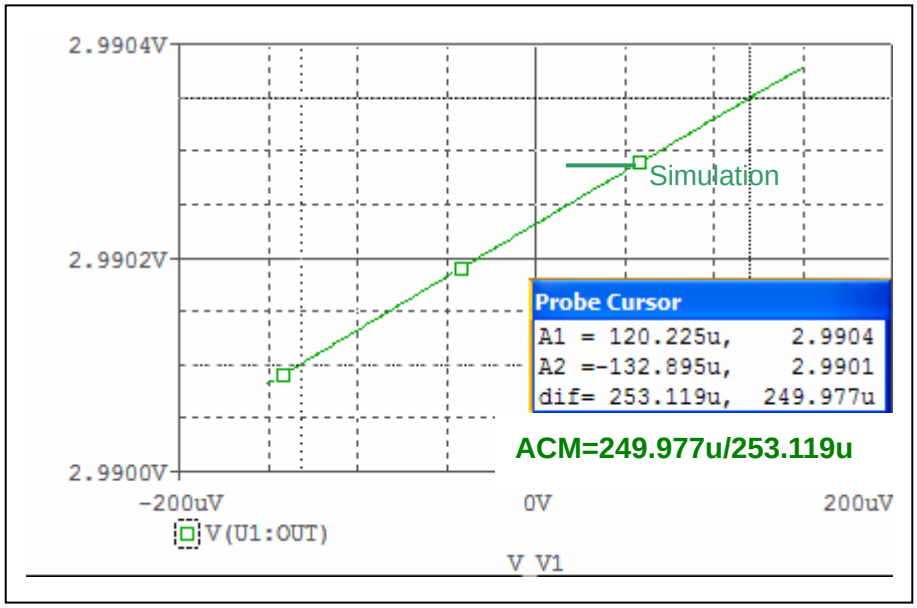
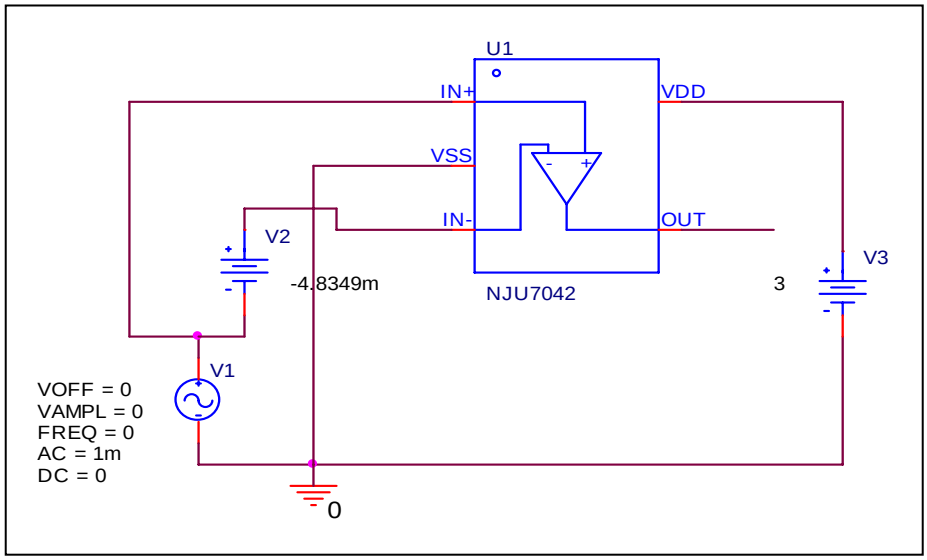
Common-Mode Rejection Ratio

Simulation result



Evaluation Circuit



CMRR = 20*LOG(AV/ACM) = 20*LOG(2982/0.988)

Comparison Table

	Measurement	Simulation	%Error
CMRR (dB)	70	69.595	-1.707

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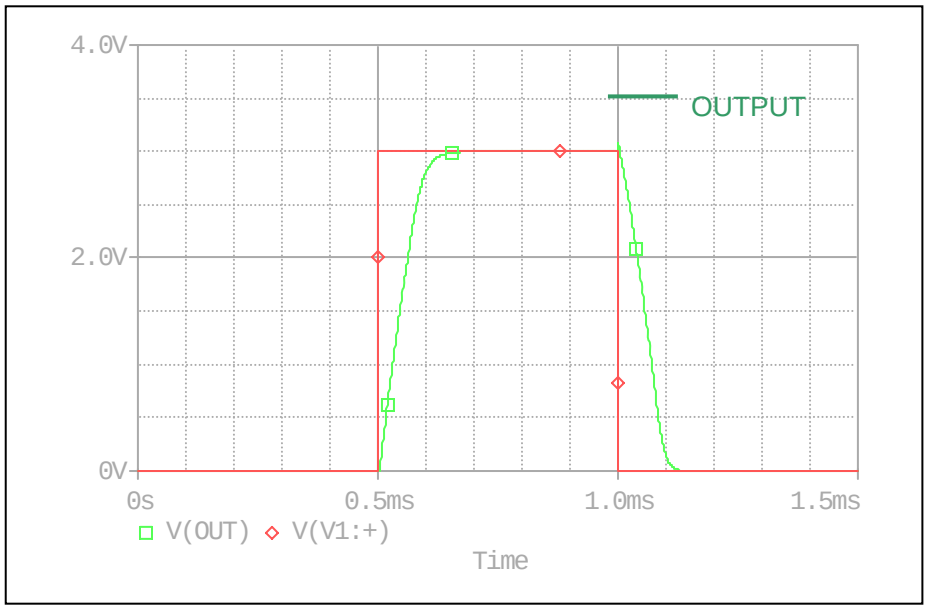
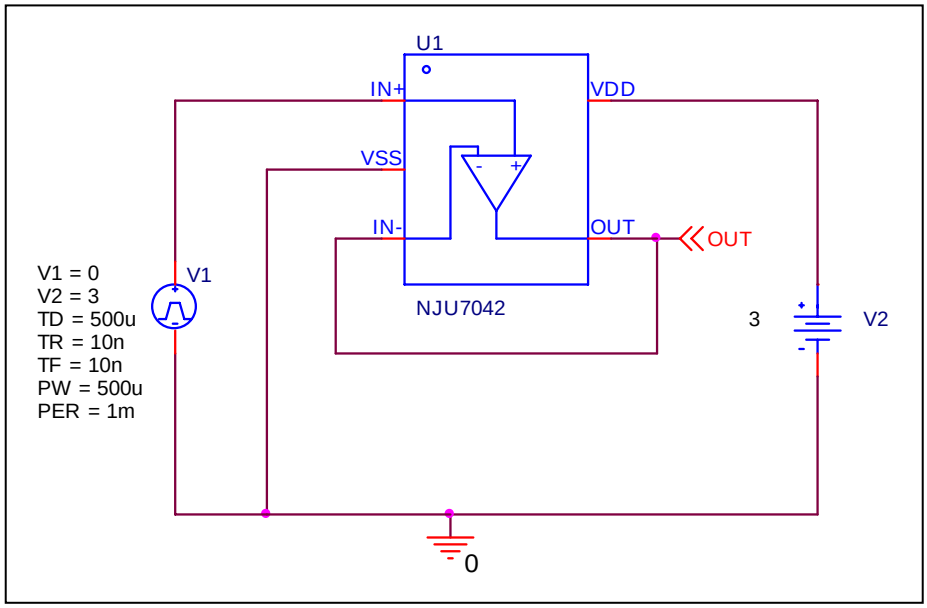
Slew Rate

Simulation result



Evaluation Circuit



Comparison Table

	Measurement	Simulation	%Error
SR (V/us)	0.03	0.0298	-0.667

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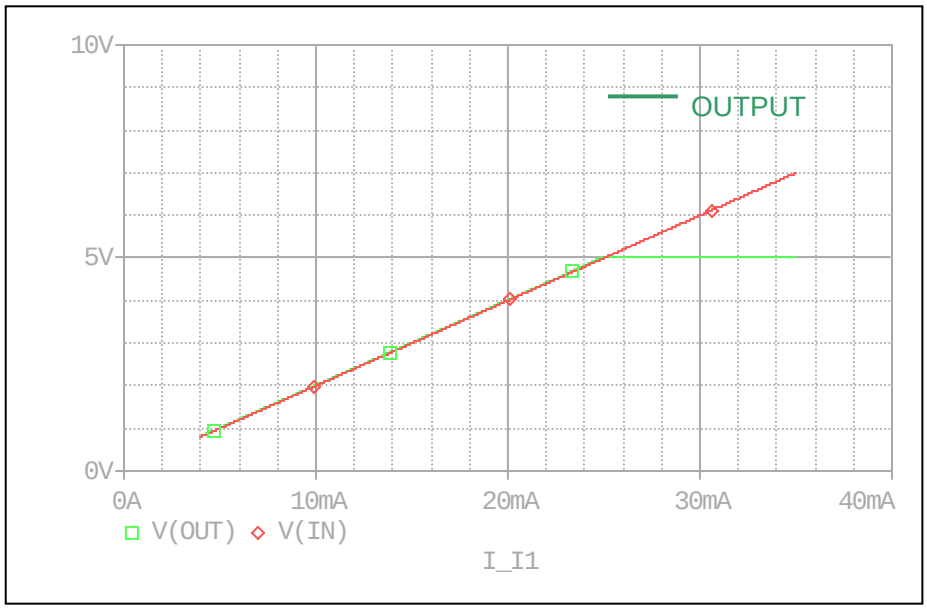
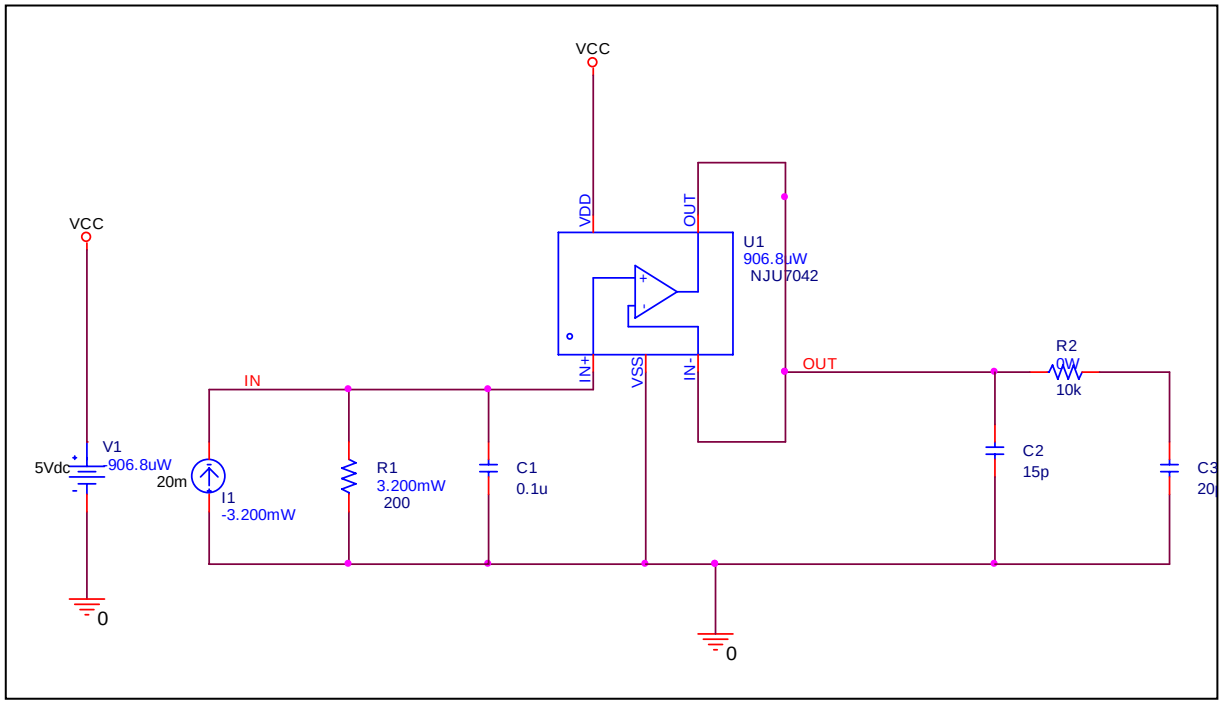
Application circuit

Simulation result



Evaluation Circuit



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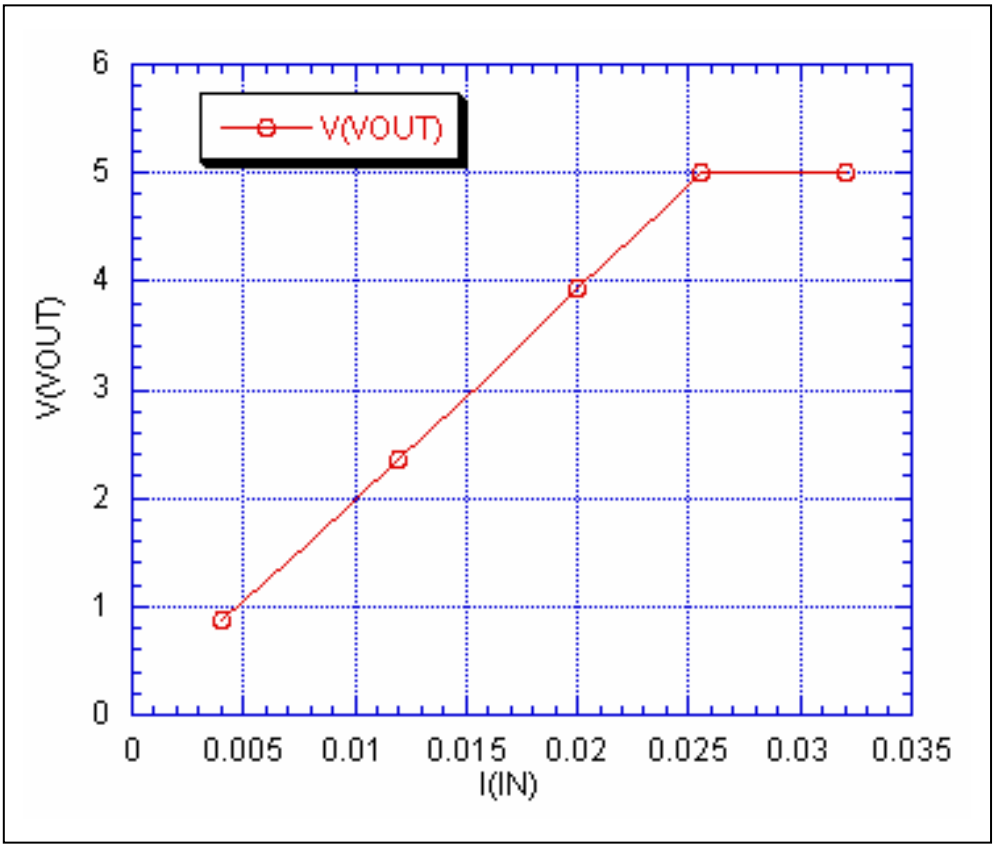
Reference



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