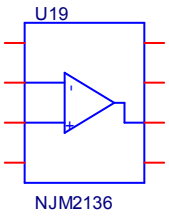
Device Modeling Report

COMPONENTS:MOSFET: OPERATIONAL AMPLIFIER
PART NUMBER:NJM2136
MANUFACTURER: NEW JAPAN RADIO CO.,LTD

Bee Technologies Inc.

Spice Model

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*$
* PART NUMBER:NJM2136
* MANUFACTURER: NEW JAPAN RADIO
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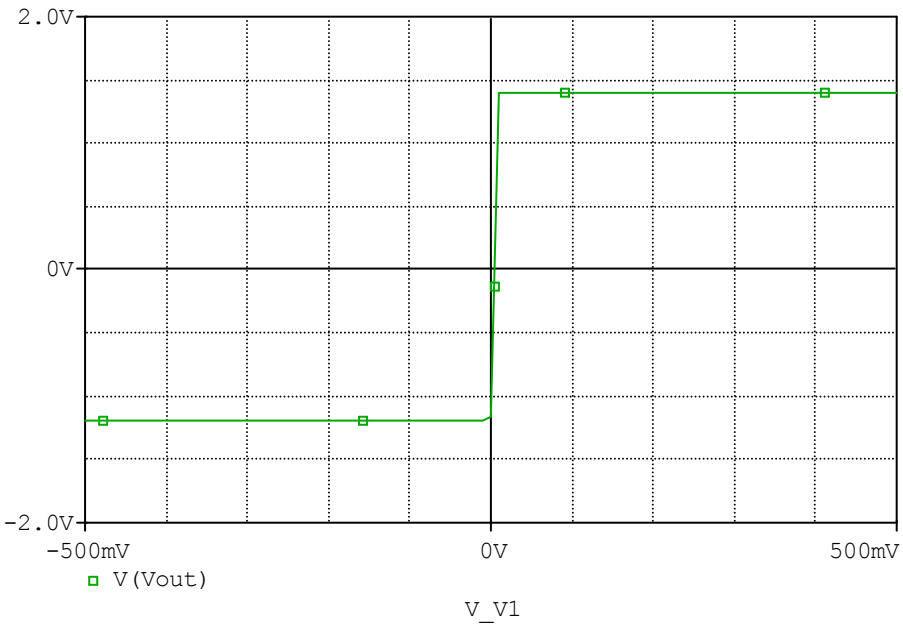
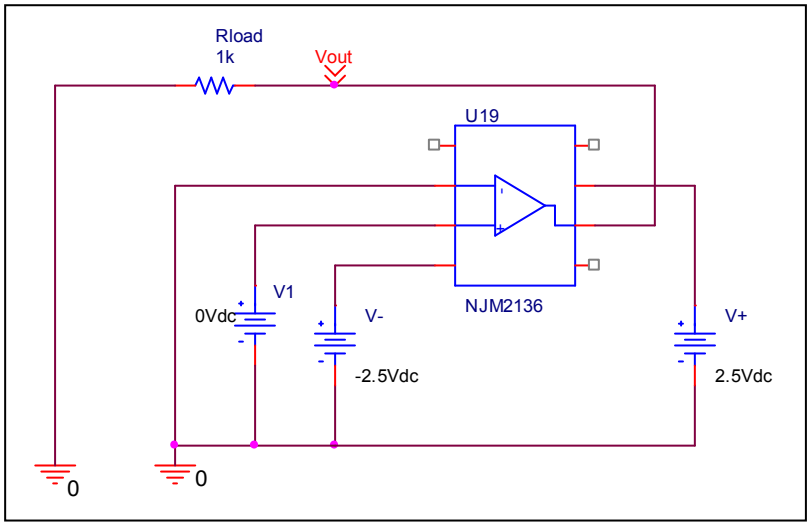
.Subckt NJM2136 -IN +IN V- OUT V+
X_U1     +IN -IN V+ V- OUT NJM2136_ME
.ends  NJM2136
.subckt NJM2136_ME 1 2 3 4 5
  c1   11 12 8.6603E-12
  c2    6  7 30.000E-12
  dc    5 53 dy
  de   54  5 dy
  dlp  90 91 dx
  dln  92 90 dx
  dp    4  3 dx
  egnd 99  0 poly(2) (3,0) (4,0) 0 .5 .5
  fb    7 99 poly(5) vb vc ve vlp vln 0 270.00E3 -1E3 1E3 270E3 -270E3
  ga    6  0 11 12 18.850E-3
  gcm   0  6 10 99 33.520E-6
  iee   3 10 dc 1.6510E-3
  hlim 90  0 vlim 1K
  q1   11  2 13 qx1
  q2   12  1 14 qx2
  r2    6  9 100.00E3
  rc1   4 11 53.052
  rc2   4 12 53.052
  re1  13 10 21.688
  re2  14 10 21.688
  ree  10 99 121.14E3
  ro1   8  5 50
  ro2   7 99 25
  rp    3  4 103.41
  vb    9  0 dc 0
  vc    3 53 dc 1.8979
  ve   54  4 dc 2.0979
  vlim  7  8 dc 0
  vlp  91  0 dc 20
  vln   0 92 dc 20
.model dx D(Is=800.00E-18)
.model dy D(Is=800.00E-18 Rs=1m Cjo=10p)
.model qx1 PNP(Is=800.00E-18 Bf=1.6035E3)
.model qx2 PNP(Is=790.5500E-18 Bf=1.6993E3)
.ends
*$
```

Output Voltage Swing, +Vout and –Vout

Simulation result



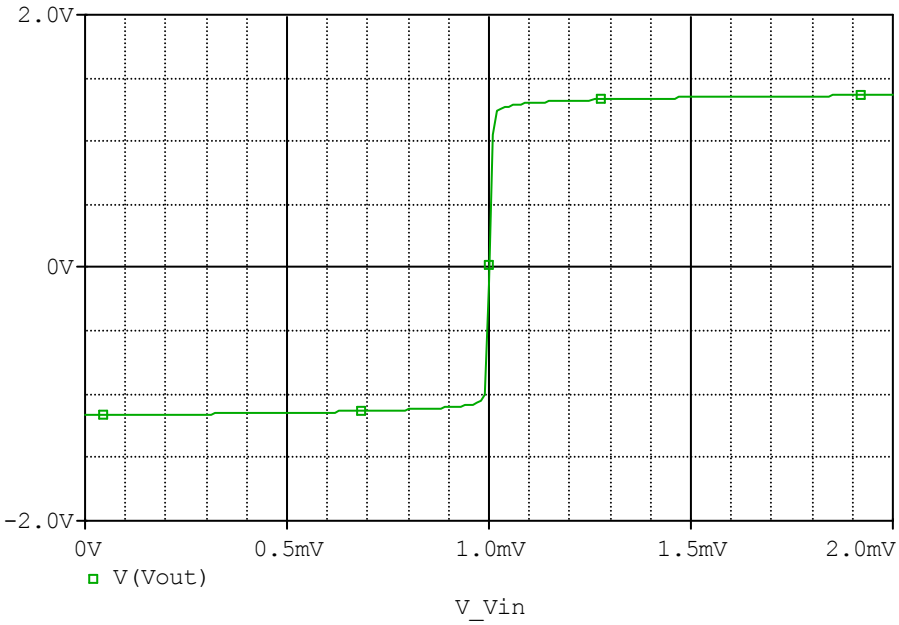
Evaluation circuit



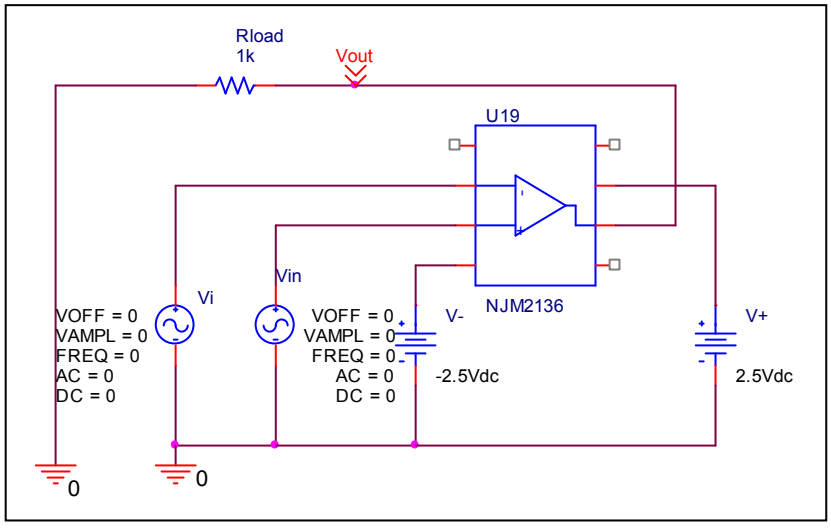
Output Voltage Swing	Data sheet	Simulation	%Error
+Vout(V)	1.400	1.400	0.000
-Vout(V)	1.200	1.200	0.000

Input Offset Voltage

Simulation result



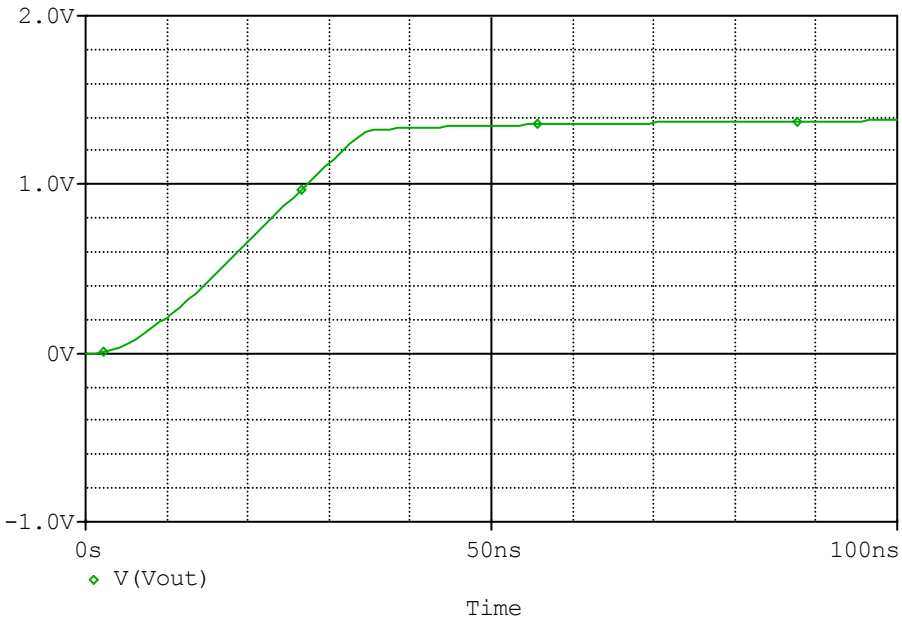
Evaluation circuit



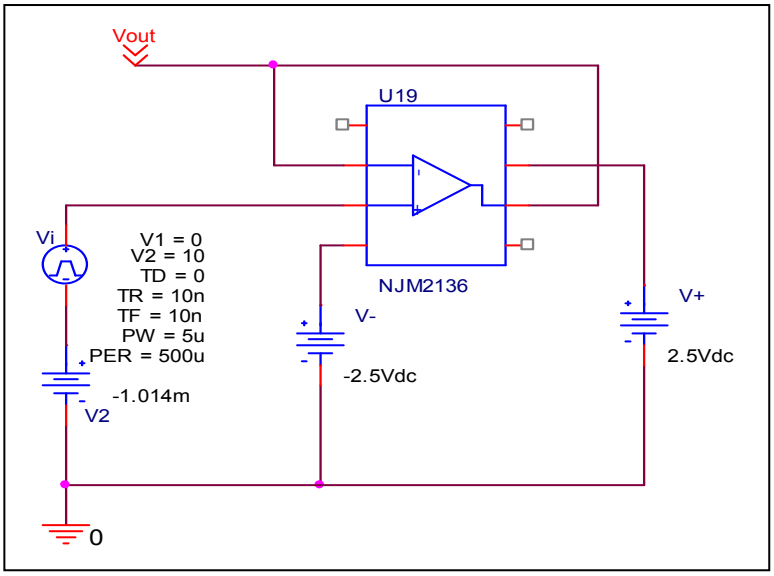
Vos	Measurement		Simulation		Error	
	1.000	mV	1.014	mV	1.400	%

Slew Rate, +SR, -SR

Simulation result



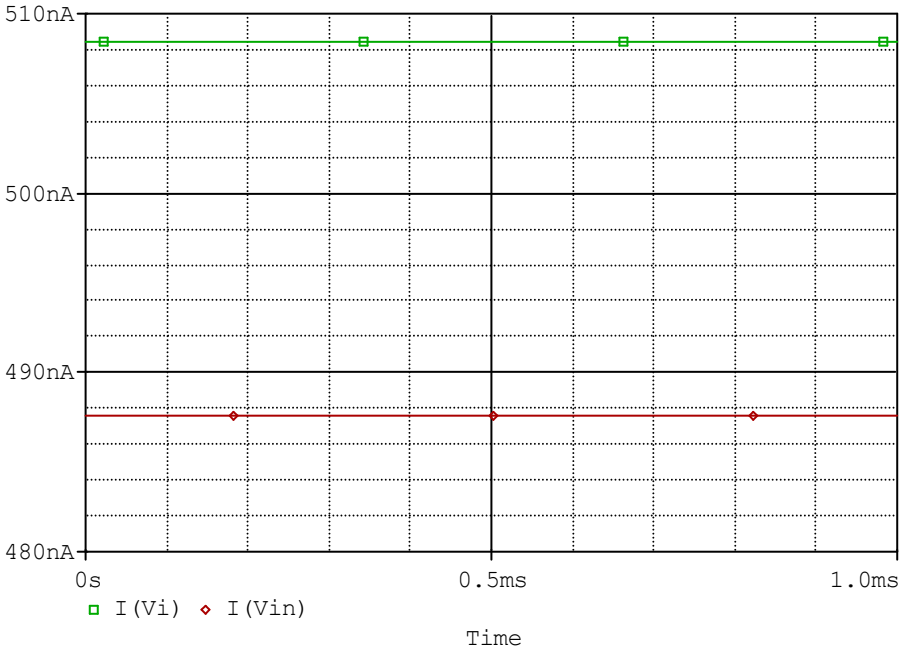
Evaluation circuit



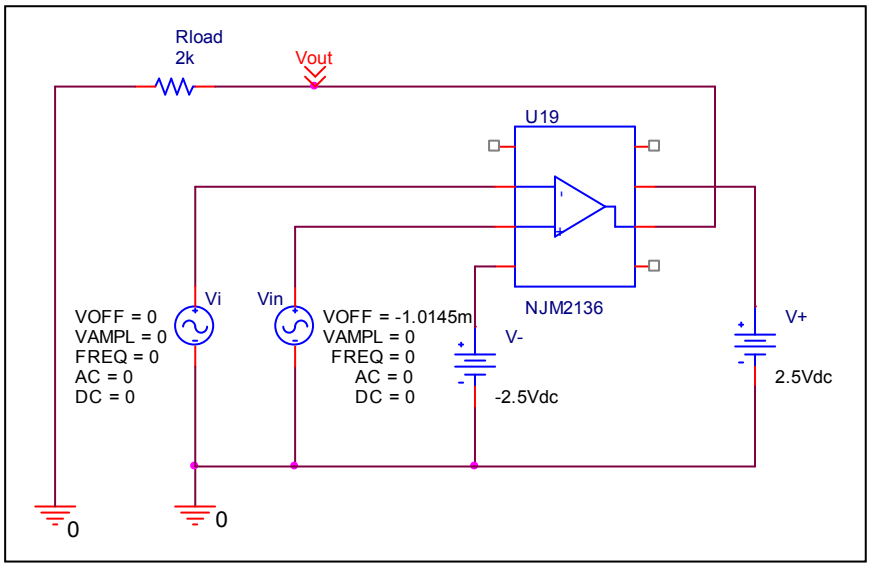
Slew Rate(v/us)	Data sheet	Simulation	%Error
	45.000V/us	44.600V/us	-0.889

Input current Ib, Ibos

Simulation result



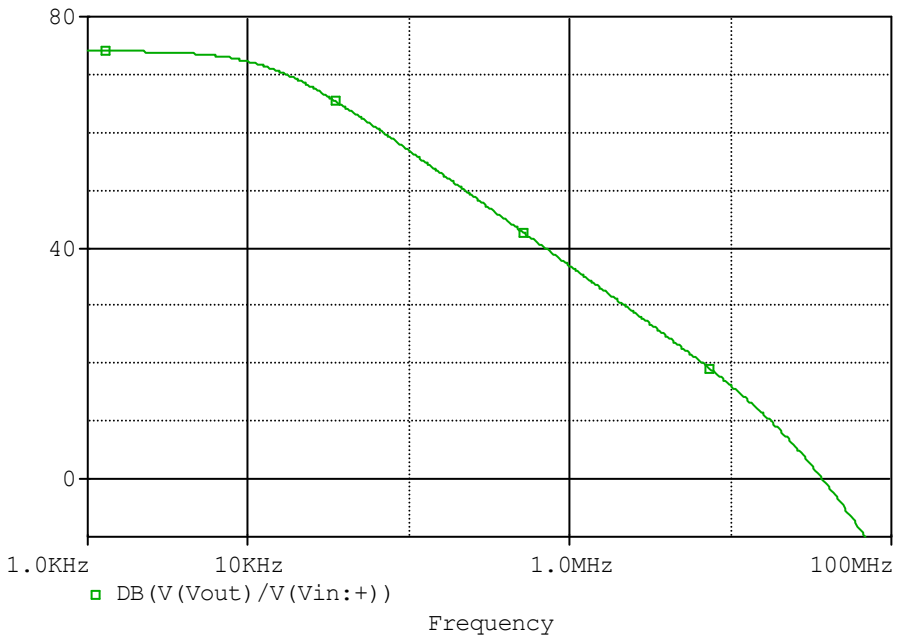
Evaluation circuit



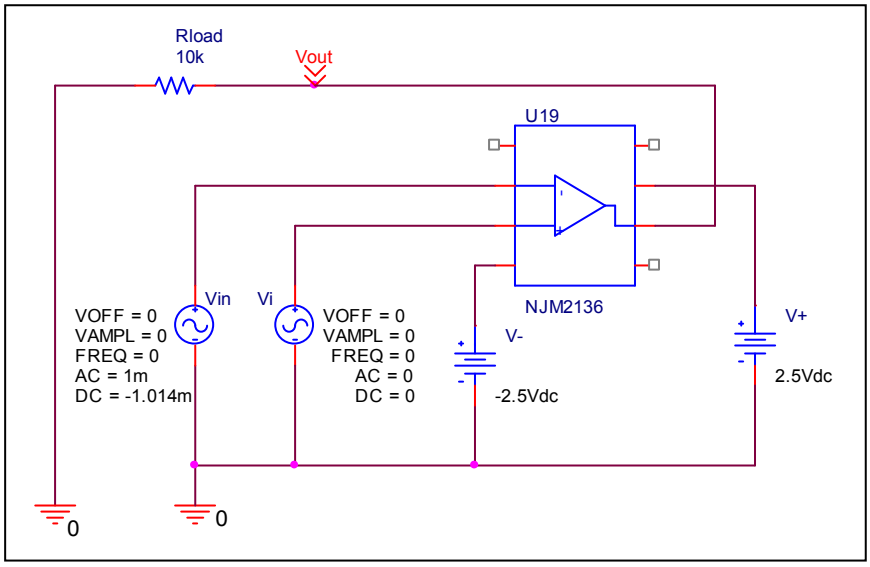
	Data sheet	Simulation	%Error
Ib(nA)	500.000	498.045	-0.391
Ibos(nA)	20.000	20.831	4.155

Open Loop Voltage

Simulation result



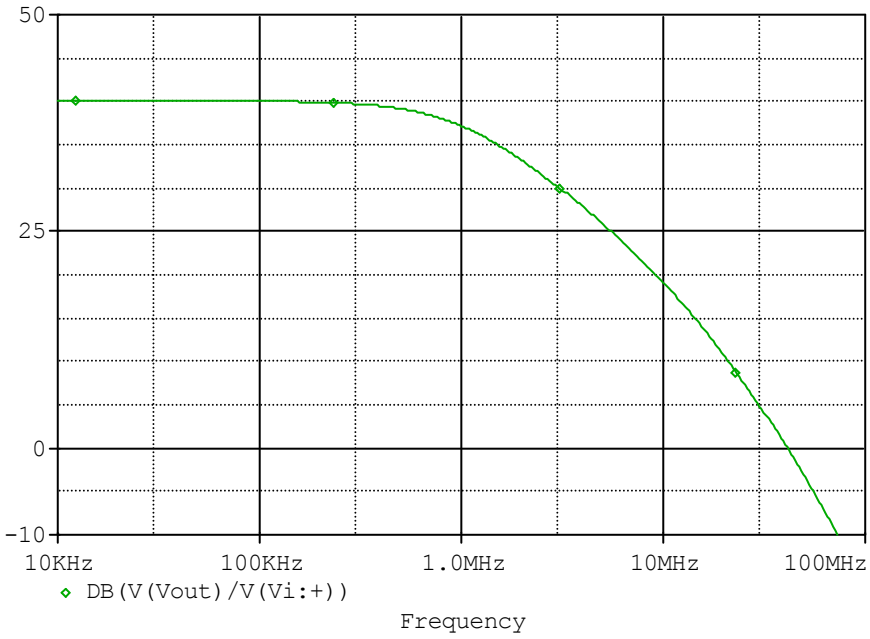
Evaluation circuit



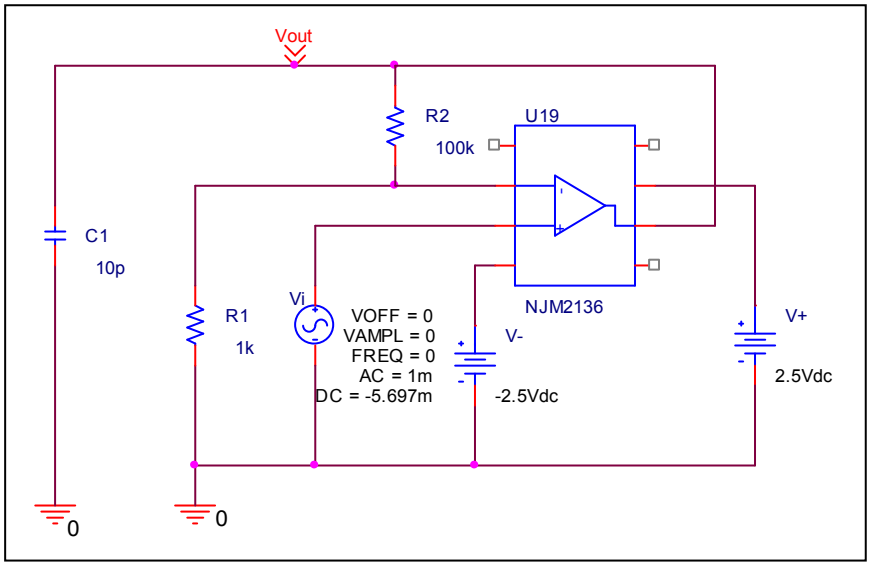
	Data sheet	Simulation	%Error
Av-dc(dB)	75.000	74.055	-1.260

Unity Gain Bandwidth

Simulation result



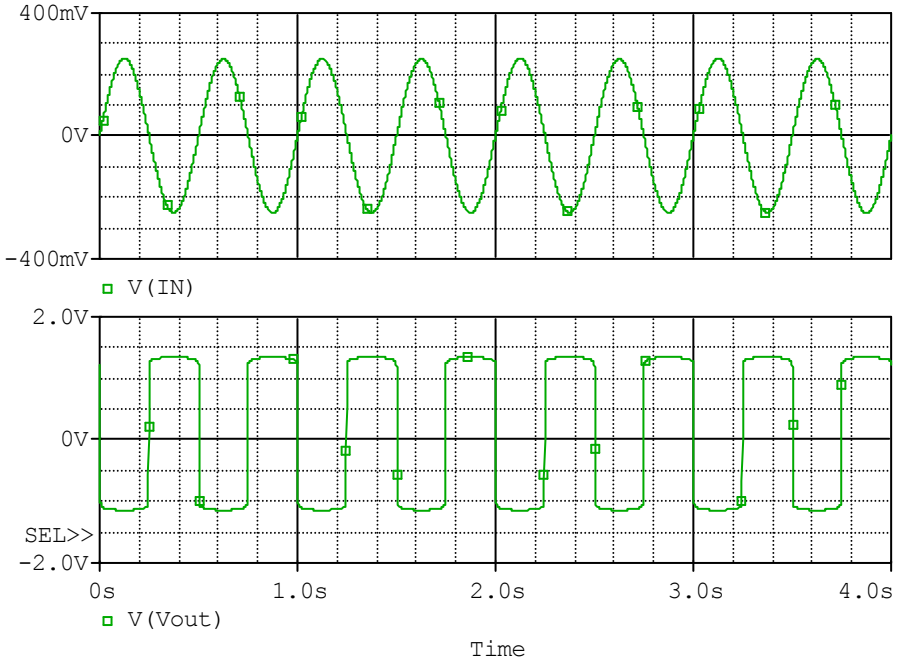
Evaluation circuit



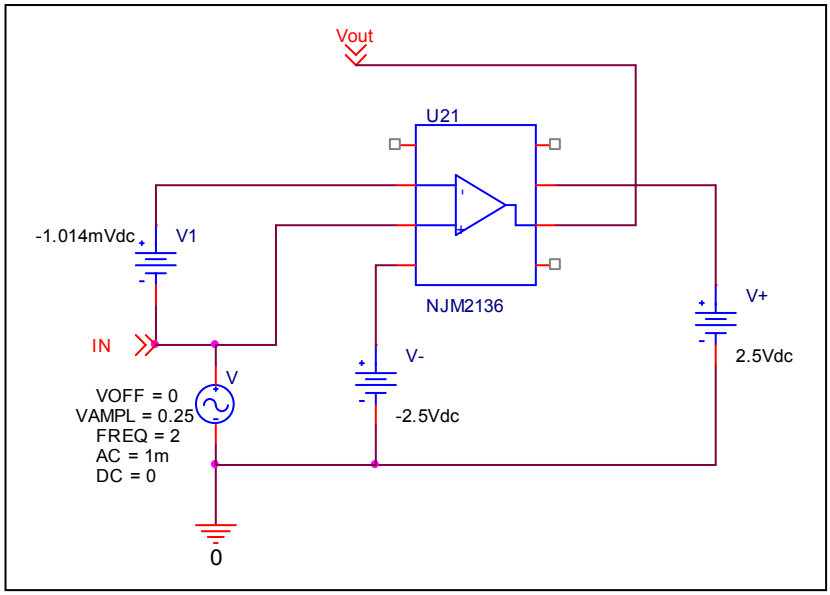
	Data sheet	Simulation	%Error
f-0dB(MHz)	40.000	40.561	1.403
Av-dc(dB)	40.000	40.077	0.192

Common-Mode Rejection Voltage gain

Simulation result



Evaluation circuit



Common Mode Reject Ratio=5043.7/(2.485/0.5)=1014.83

CMRR	Data sheet	Simulation	%Error
	60.000	60.127	0.212