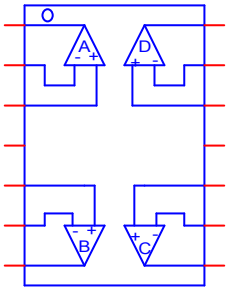
Device Modeling Report

COMPONENTS:OPERATIONAL AMPLIFIER
PART NUMBER:NJM13403
MANUFACTURER: NEW JAPAN RADIO CO.,LTD

Bee Technologies Inc.

SPice Model

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*$
* PART NUMBER:NJM13403
* MANUFACTURER: NEW JAPAN RADIO
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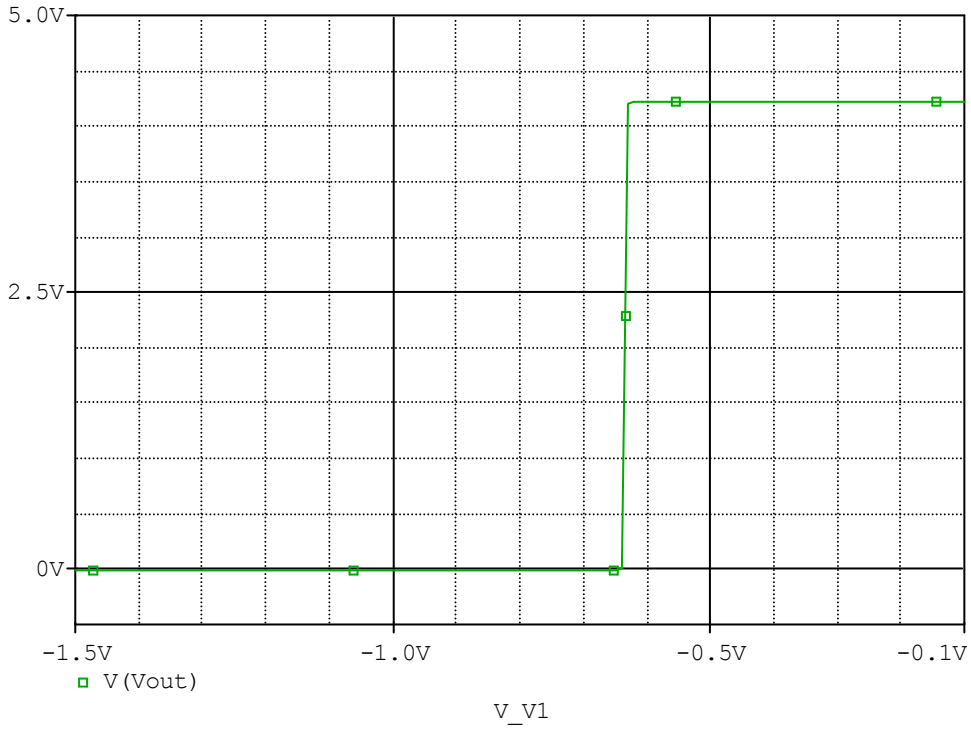
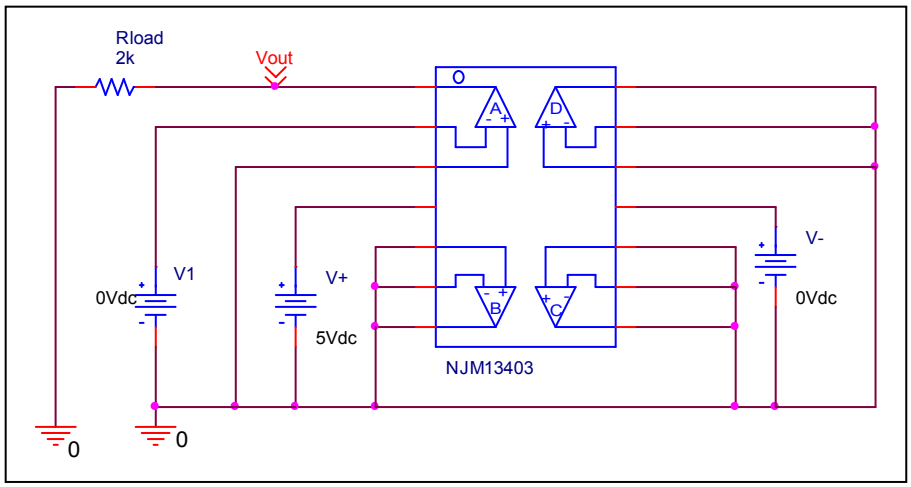
.Subckt NJM13403 OUT1 -IN1 +IN1 V+ +IN2 -IN2 OUT2 OUT3 -IN3 +IN3 V-
+ +IN4 -IN4 OUT4
X_U1     +IN1 -IN1 V+ V- OUT1 NJM13403_ME
X_U2     +IN2 -IN2 V+ V- OUT2 NJM13403_ME
X_U3     +IN3 -IN3 V+ V- OUT3 NJM13403_ME
X_U4     +IN4 -IN4 V+ V- OUT4 NJM13403_ME
.ends  NJM13403
.subckt NJM13403_ME 1 2 3 4 5
  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 10.610E6 -1E3 1E3 11E6 -11E6
  ga    6  0 11 12 403.54E-6
  gcm   0  6 10 99 12.761E-9
  iee   3 10 dc 36.650E-6
  hlim 90  0 vlim 1K
  q1   11  2 13 qx1
  q2   12  1 14 qx2
  r2    6  9 100.00E3
  rc1   4 11 2.4561E3
  rc2   4 12 2.4561E3
  re1  13 10 1.0414E3
  re2  14 10 1.0414E3
  ree  10 99 5.4571E6
  ro1   8  5 50
  ro2   7 99 25
  rp    3  4 35.724
  vb    9  0 dc 0
  vc    3 53 dc 1.5979
  ve   54  4 dc .79791
  vlim  7  8 dc 0
  vlp  91  0 dc 39.500
  vln   0 92 dc 39.500
.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=670.33)
.model qx2 PNP(Is=933.8032E-18 Bf=820.63)
.ends
*$
```

Output Voltage Swing

Simulation result



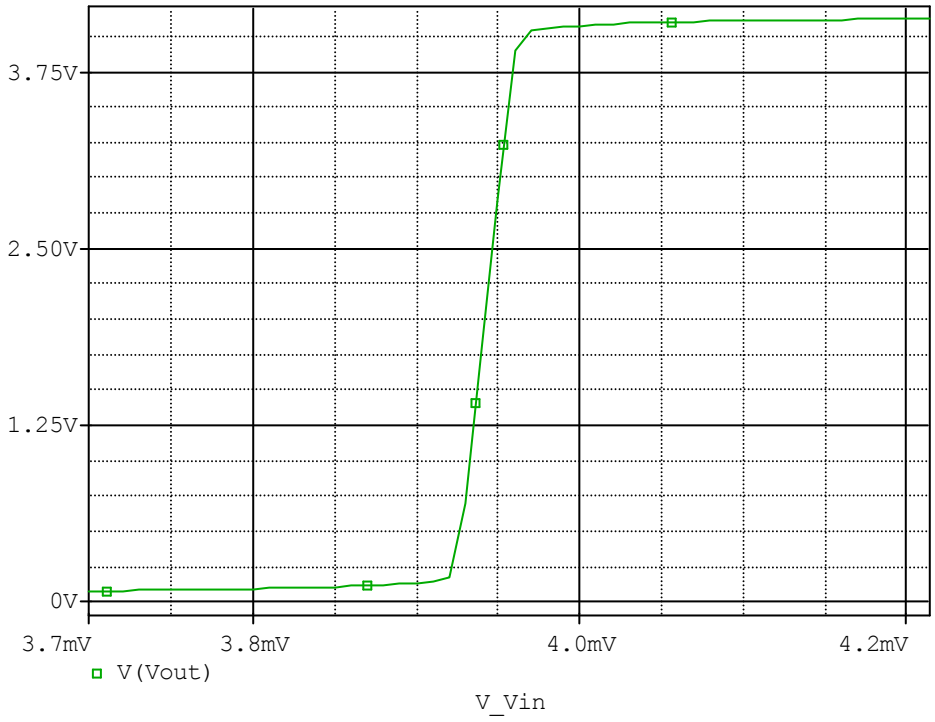
Evaluation circuit



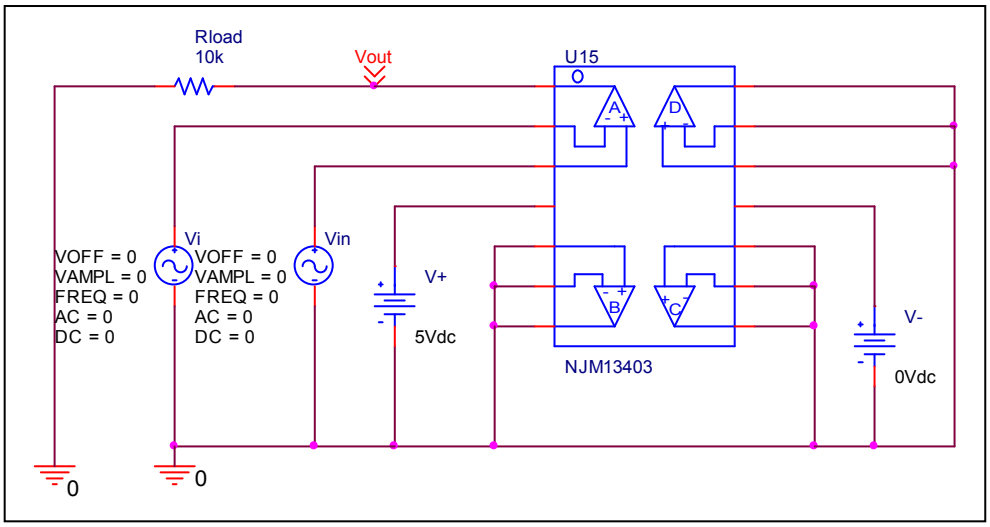
Output Voltage Swing	Data sheet	Simulation	%Error
+Vout(V)	4.200	4.210	0.238

Input Offset Voltage

Simulation result



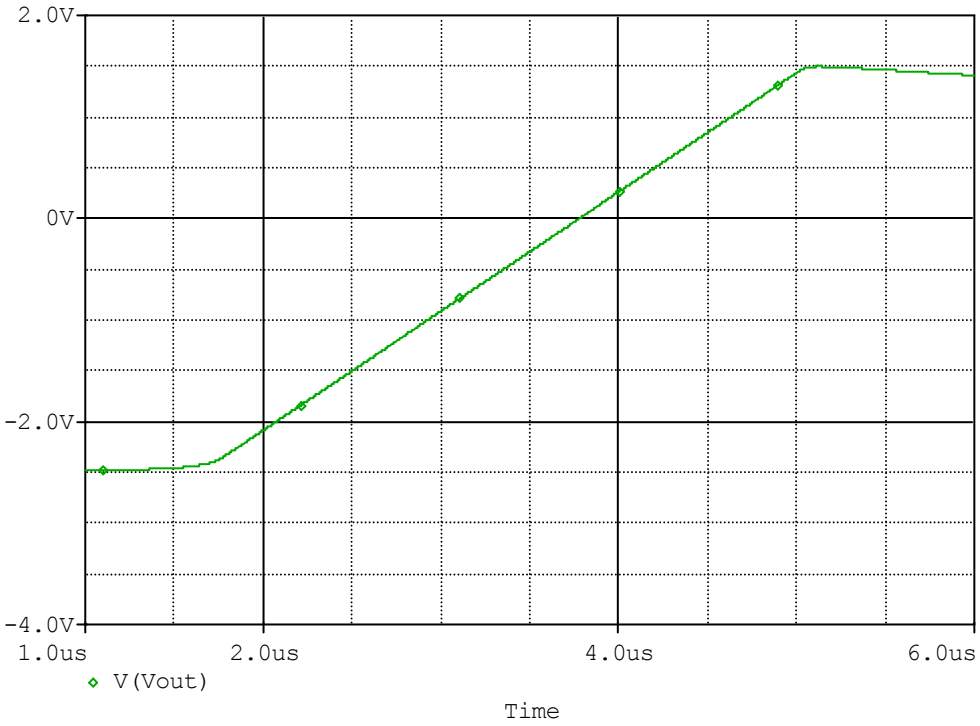
Evaluation circuit



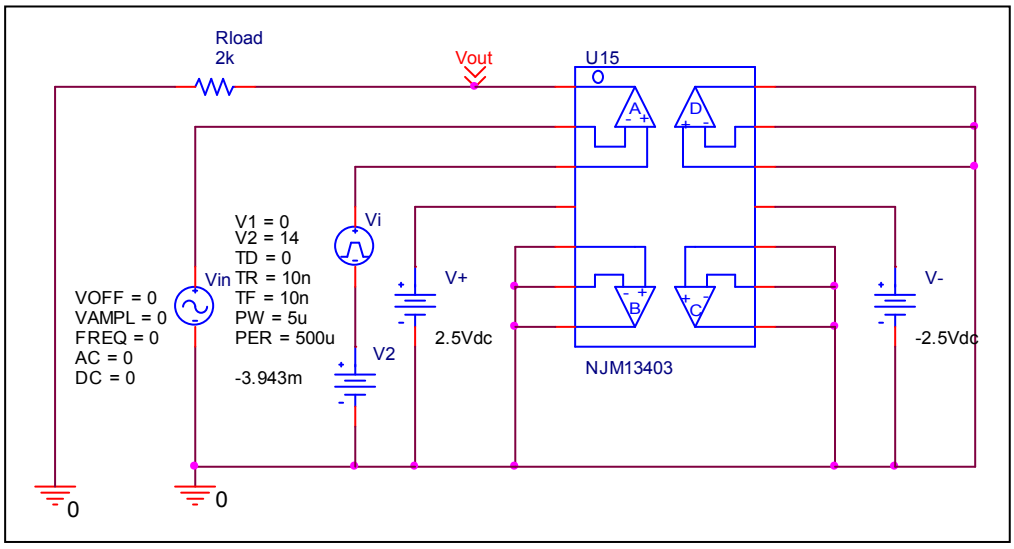
Vos	Measurement		Simulation		Error	
	4.000	mV	3.943	mV	-1.425	%

Slew Rate

Simulation result



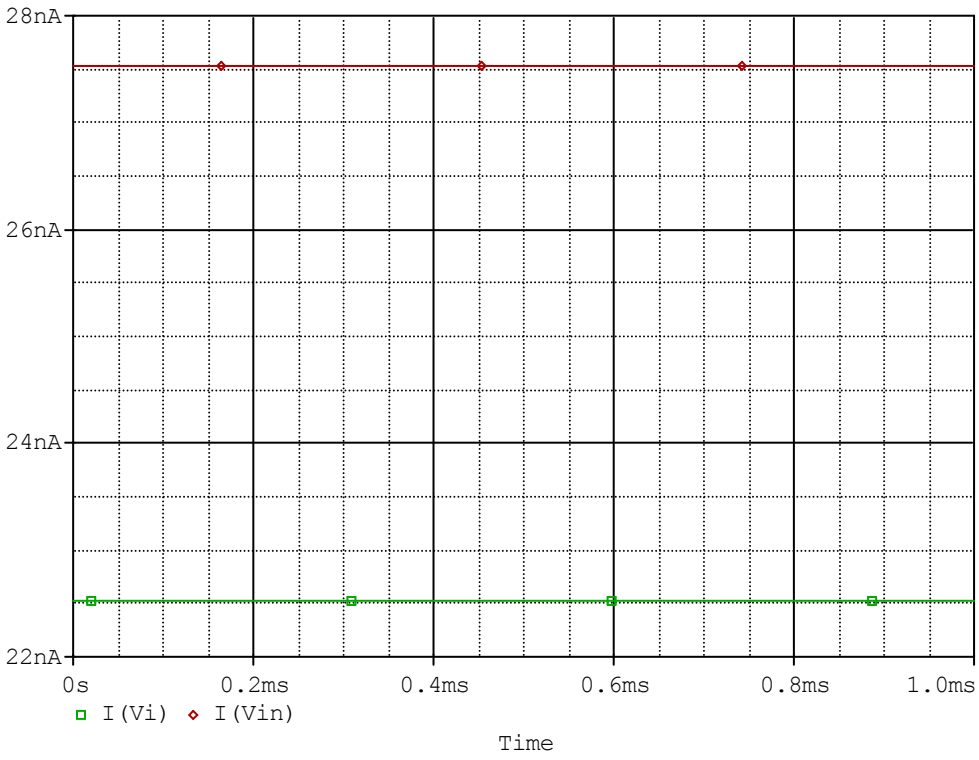
Evaluation circuit



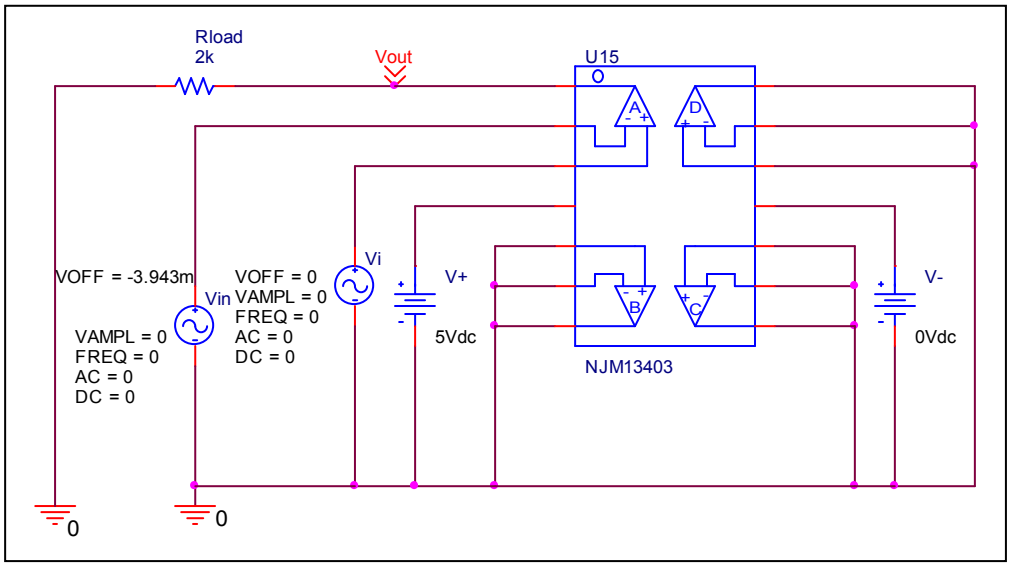
Slew Rate(v/us)	Data sheet	Simulation	%Error
	1.200	1.250	4.167

Input current

Simulation result



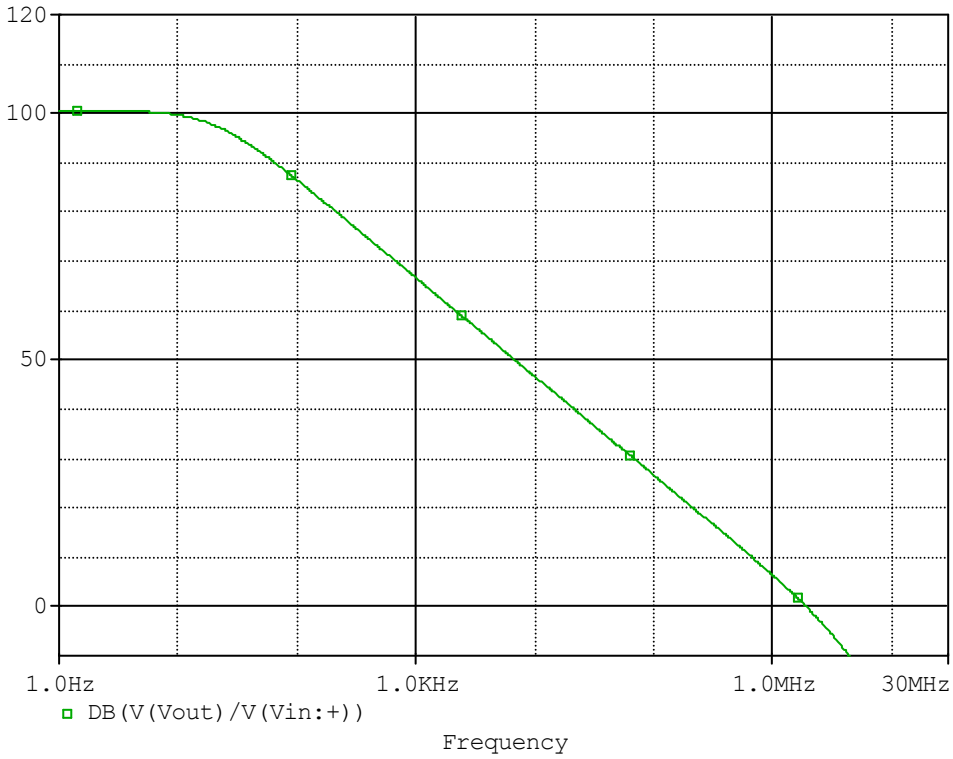
Evaluation circuit



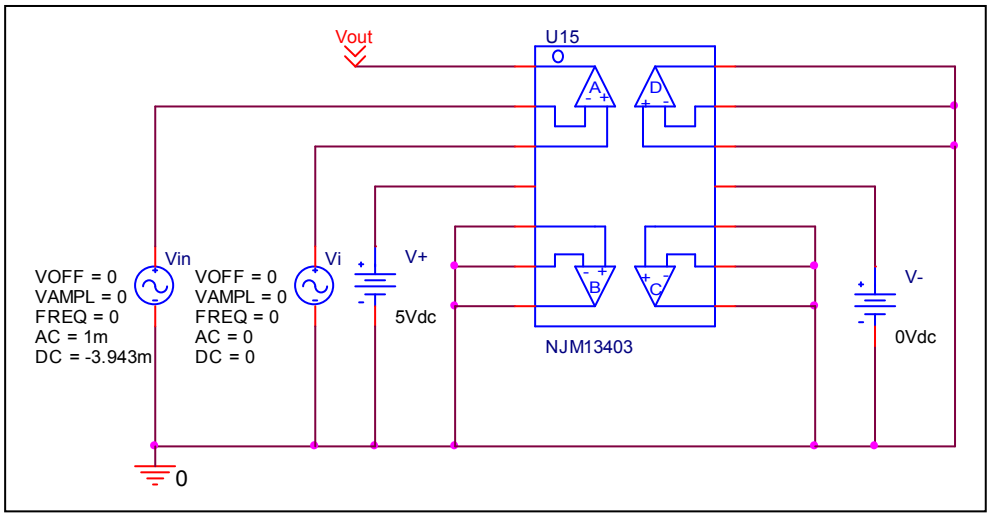
	Data sheet	Simulation	%Error
Ib(nA)	25.000	25.000	0.000
Ibos(nA)	5.000	5.010	0.200

Open Loop Voltage Gain vs. Frequency

Simulation result



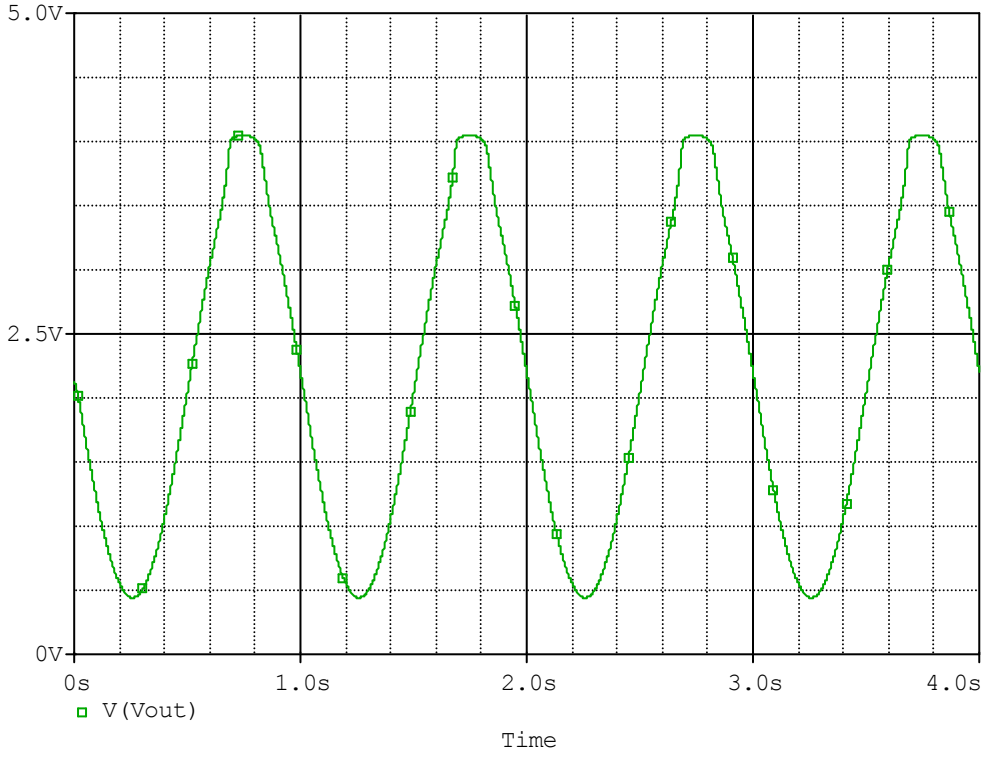
Evaluation circuit



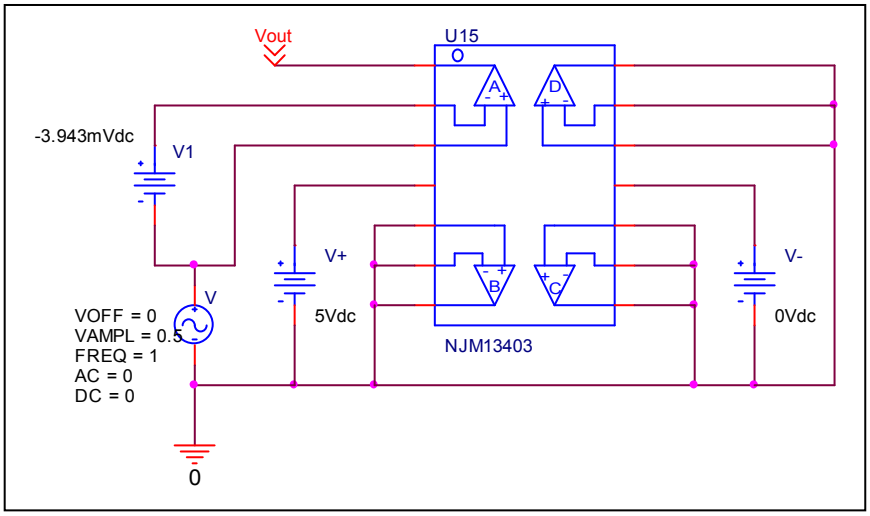
	Data sheet	Simulation	%Error
f-0dB(MHz)	2.000	1.930	-3.500
Av-dc(dB)	100.000	100.620	0.620

Common-Mode Rejection Voltage gain

Simulation result



Evaluation circuit



Common Mode Reject Ratio=107398/3.605=29791.400

CMRR(dB)	Data sheet	Simulation	%Error
	90.000	89.481	-0.577