

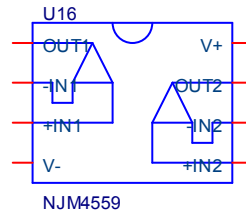
Device Modeling Report

COMPONENTS:MOSFET: OPERATIONAL AMPLIFIER
PART NUMBER:NJM4559
MANUFACTURER: NEW JAPAN RADIO CO.,LTD



Bee Technologies Inc.

Spice Model



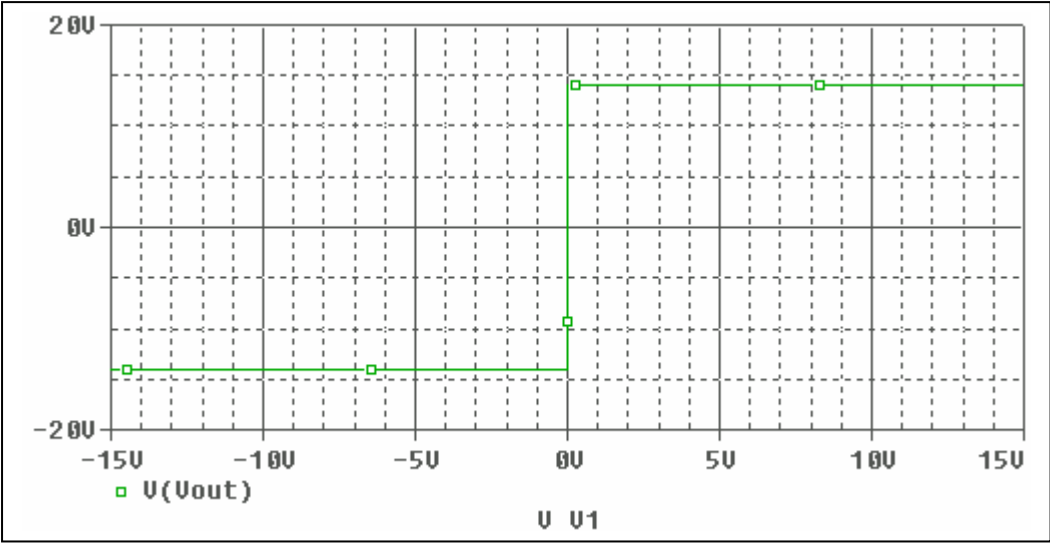
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*$
* PART NUMBER:NJM4559
* MANUFACTURER: NEW JAPAN RADIO
* All Rights Reserved Copyright (c) Bee Technologies Inc. 2004
.Subckt NJM4559 OUT1 -IN1 +IN1 V- +IN2 -IN2 OUT2 V+
X_U1  +IN1 -IN1 V+ V- OUT1 NJM4559_SUB
X_U2  +IN2 -IN2 V+ V- OUT2 NJM4559_SUB
.ends NJM4559
*$
.subckt NJM4559_SUB 1 2 3 4 5
c1 11 12 8.3716E-12
c2 6 7 29.000E-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 3.2647E6 -1E3 1E3 3E6 -3E6
ga 6 0 11 12 1.1982E-3
gcm 0 6 10 99 37.890E-9
iee 3 10 dc 60.051E-6
hlim 90 0 vlim 1K
q1 11 2 13 qx1
q2 12 1 14 qx2
r2 6 9 100.00E3
rc1 4 11 869.70
rc2 4 12 869.70
re1 13 10 7.5532
re2 14 10 7.5532
ree 10 99 3.3305E6
ro1 8 5 50
ro2 7 99 25
rp 3 4 1.8065E3
vb 9 0 dc 0
vc 3 53 dc 1.7484
ve 54 4 dc 1.7484
vlim 7 8 dc 0
vlp 91 0 dc 2.9500
vln 0 92 dc 2.9500
.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=1.0320E3)
.model qx2 PNP(Is=1.008877E-15 Bf=1.3375E3)
.ends
*$

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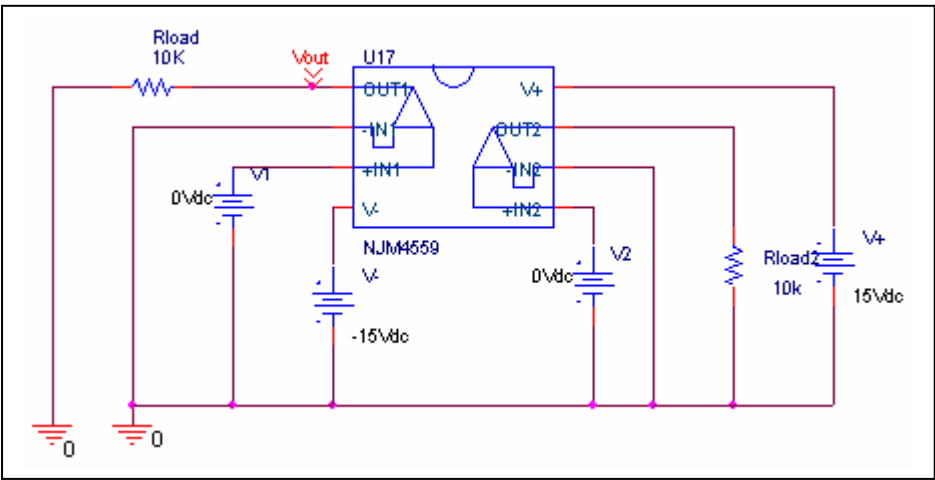
Output Voltage Swing, +Vout and -Vout

Simulation result



These simulation results are compared with $\pm V_{out}$

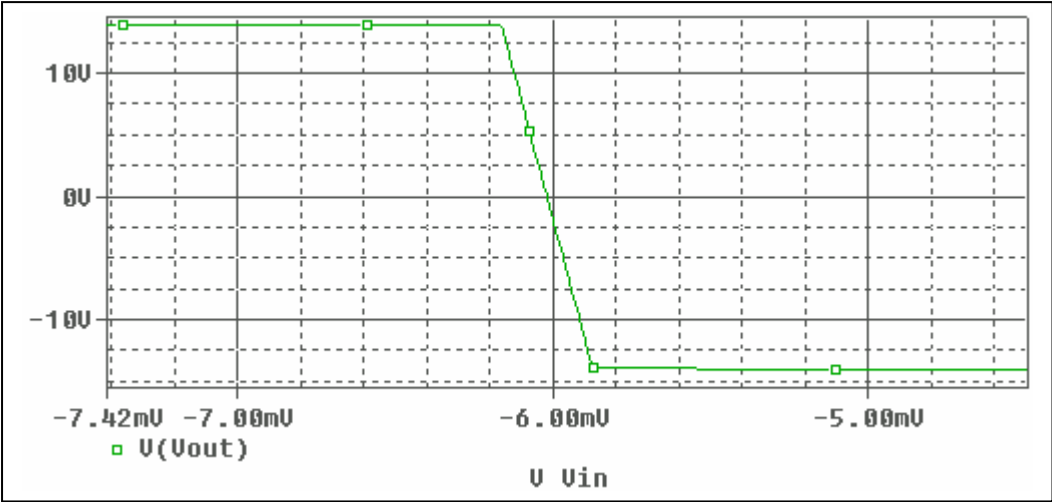
Evaluation circuit



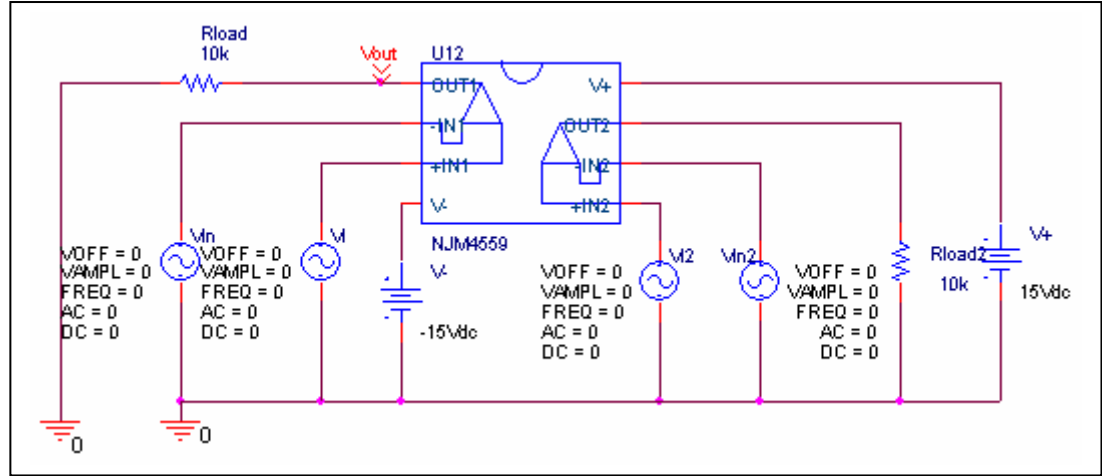
Output Voltage Swing	Data sheet	Simulation	%Error
+Vout(V)	+14	13.993	0.05
-Vout(V)	-14	-13.993	0.05

Input Offset Voltage

Simulation result



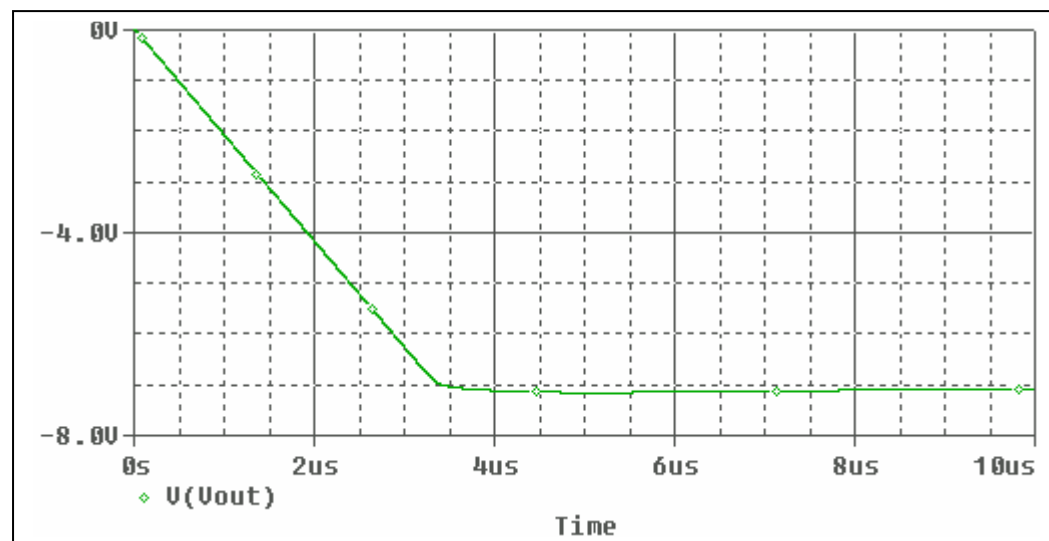
Evaluation circuit



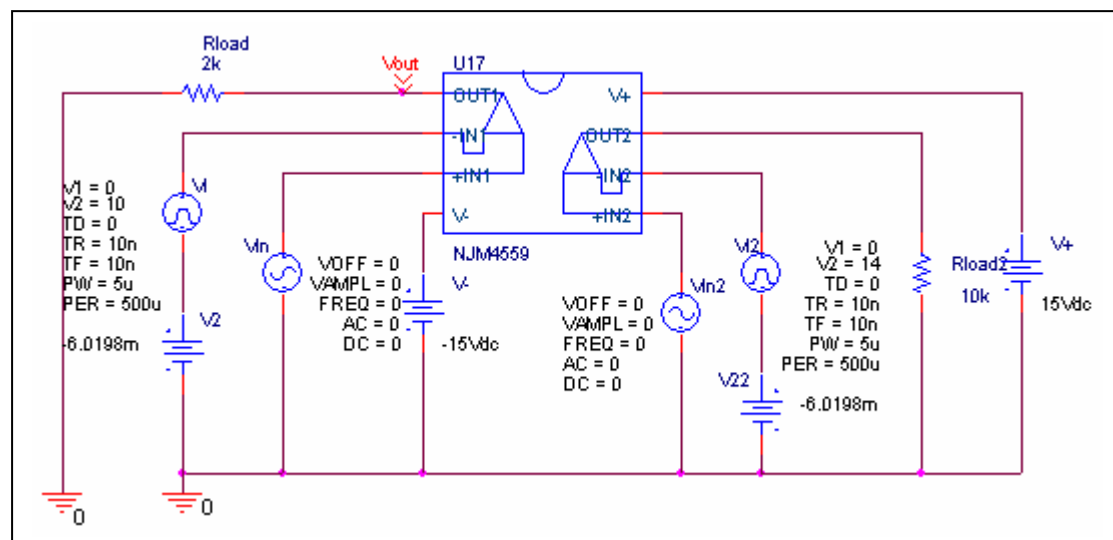
Vos	Measurement		Simulation		Error	
	6	mV	6.0198	mV	0.331	%

Slew Rate, +SR, -SR

Simulation result



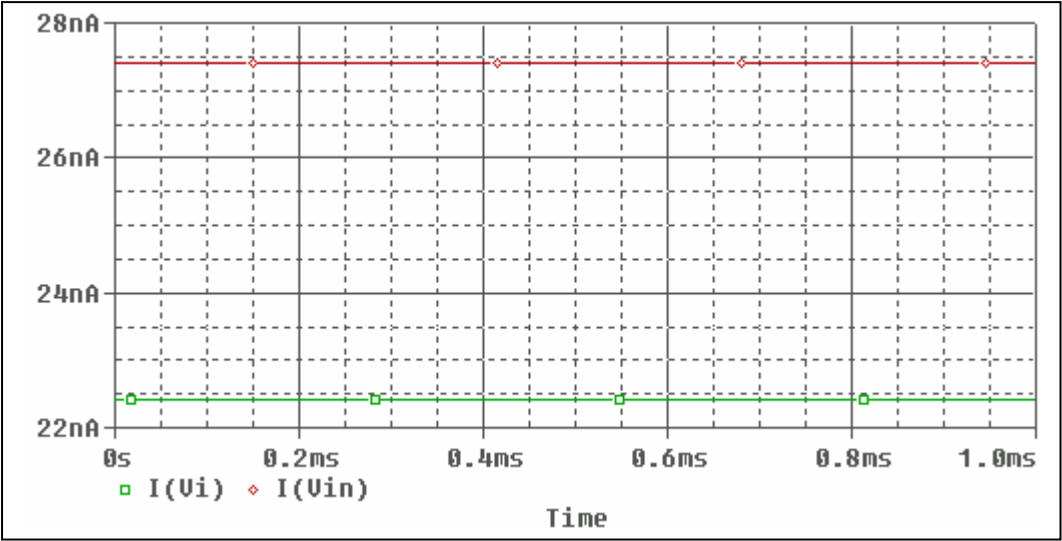
Evaluation circuit



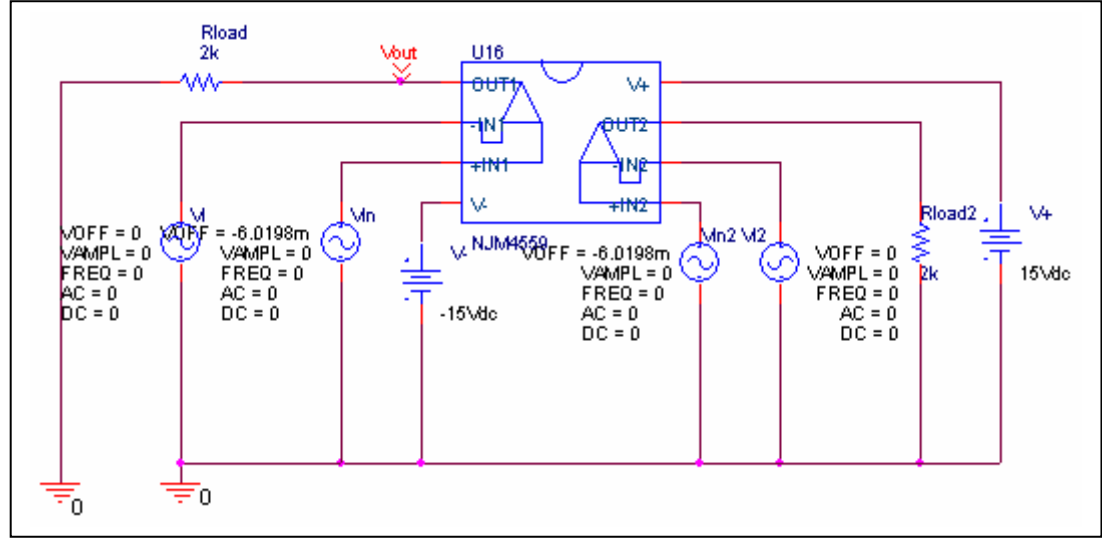
Slew Rate(v/us)	Data sheet	Simulation	%Error
	2V/us	2.09V/us	4.5

Input current Ib, Ibos

Simulation result



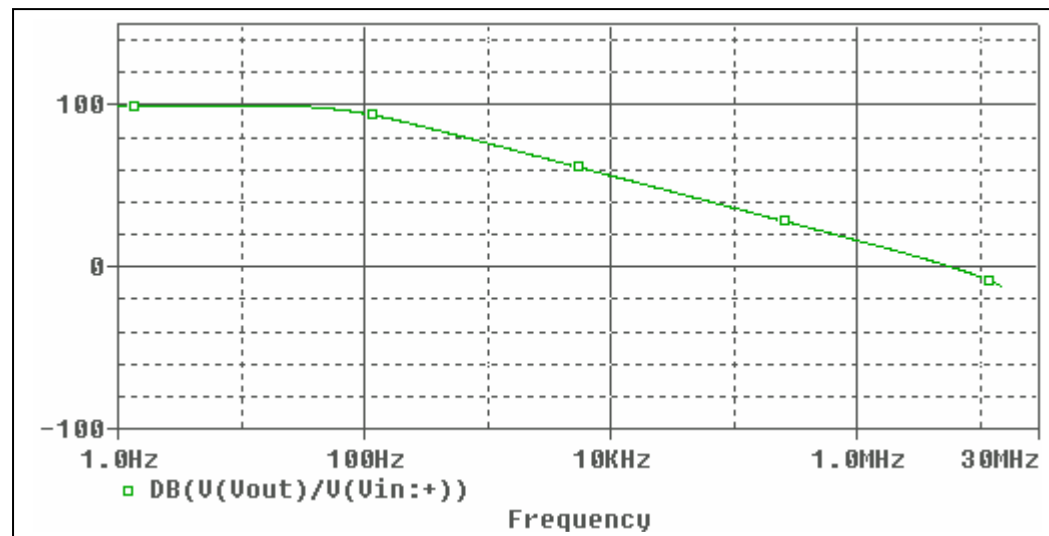
Evaluation circuit



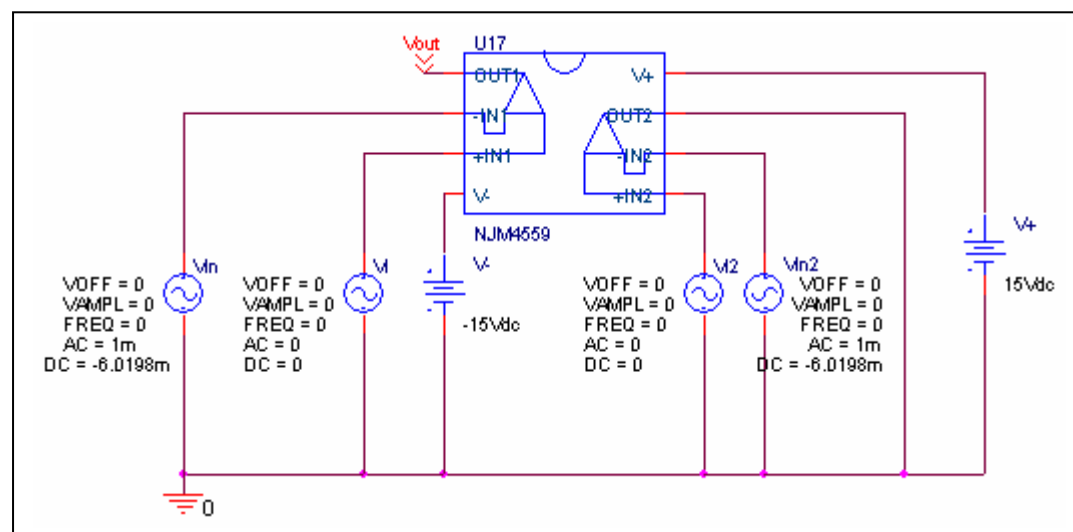
	Data sheet	Simulation	%Error
Ib(nA)	25	24.9	0.4
Ibos(nA)	5	5.0038	0.076

Open Loop Voltage Gain vs. Frequency , Av-dc, f-0dB

Simulation result



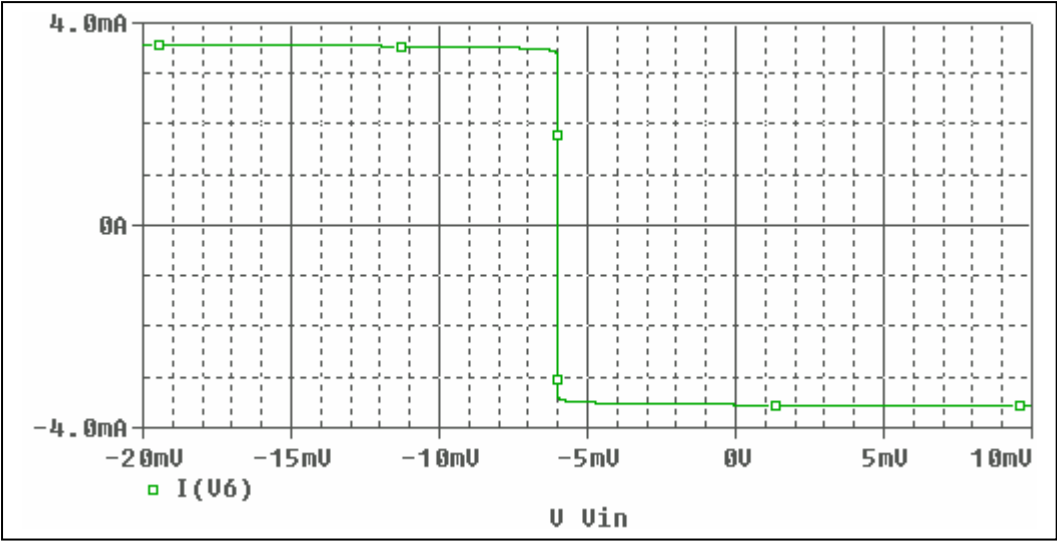
Evaluation circuit



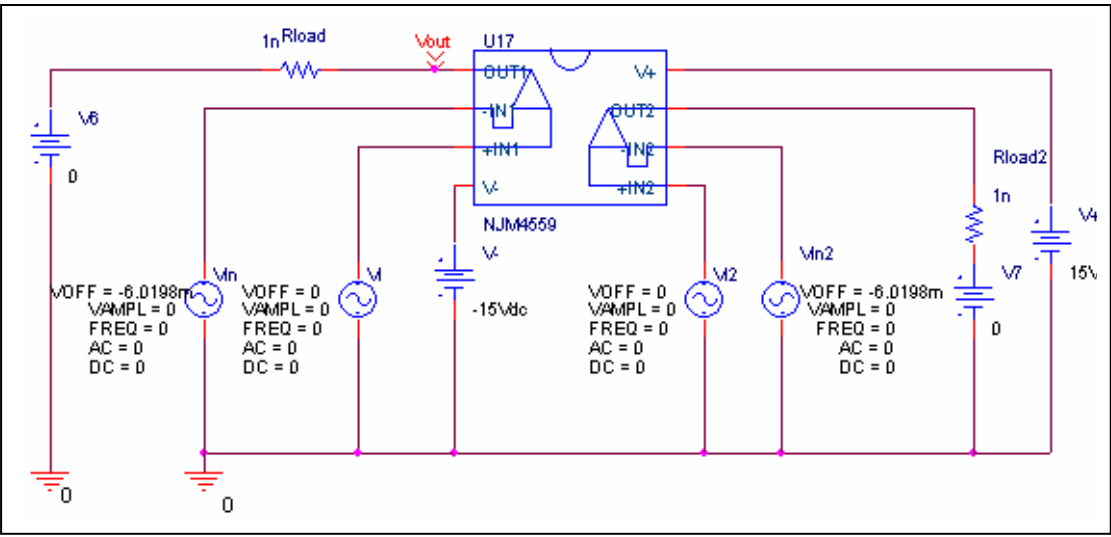
	Data sheet	Simulation	%Error
f-0dB(MHz)	6	5.89	1.83
Av-dc(dB)	100	99.8	0.2

Output Short Circuit Current - Ios

Simulation result



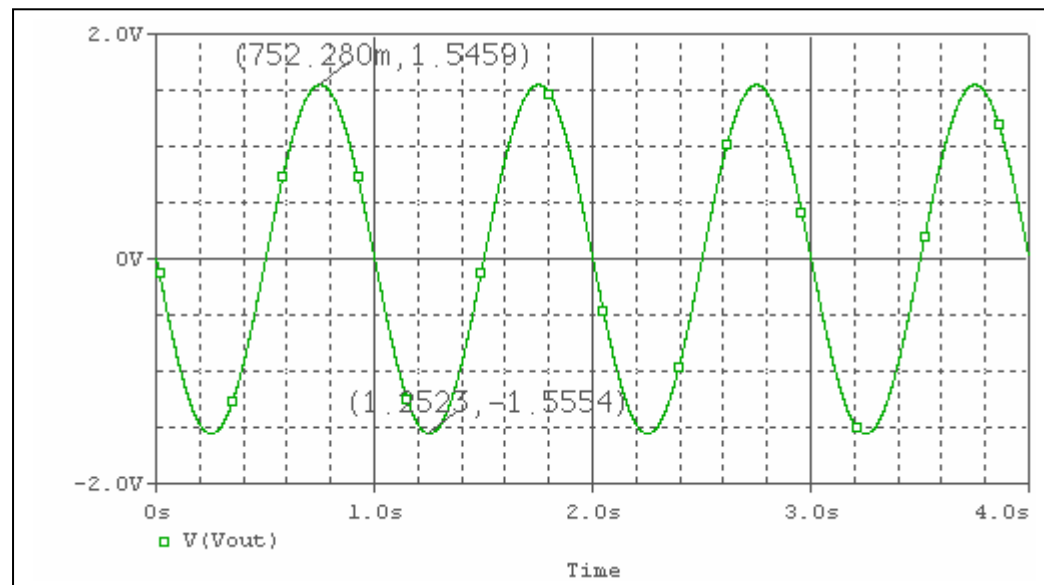
Evaluation circuit



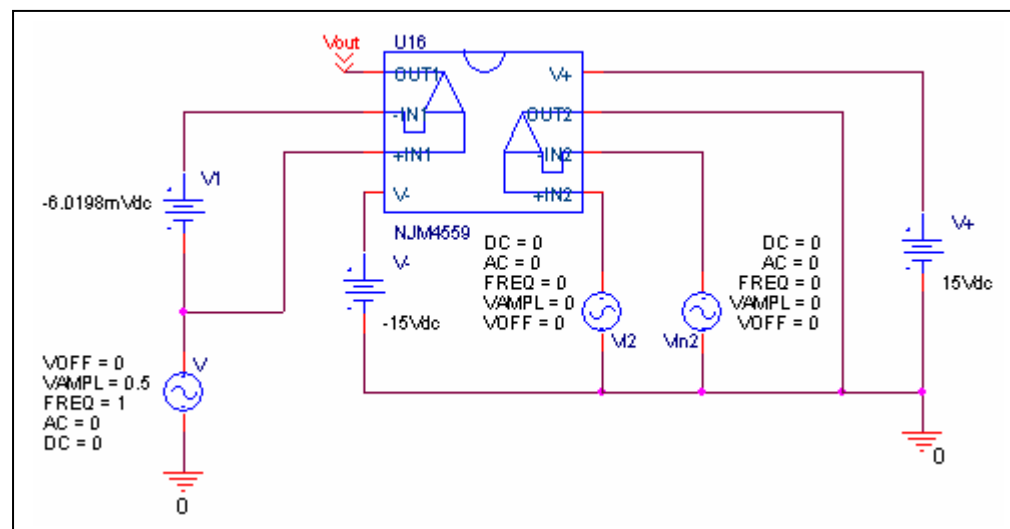
Short Circuit Current	Data sheet	Simulation	%Error
	3.5mA	3.503mA	0.085

Common-Mode Rejection Voltage gain

Simulation result



Evaluation circuit



Common mode gain= $3.1013/1$

Common Mode Reject Ratio= $97723/3.1013 = 31510 = 89.9689 \text{ dB}$

CMRR(dB)	Data sheet	Simulation	%Error
	90	89.9689	-0.0346