

Device Modeling Report

COMPONENTS:MOSFET: OPERATIONAL AMPLIFIER
PART NUMBER:NJM4580E
MANUFACTURER: NEW JAPAN RADIO CO.,LTD



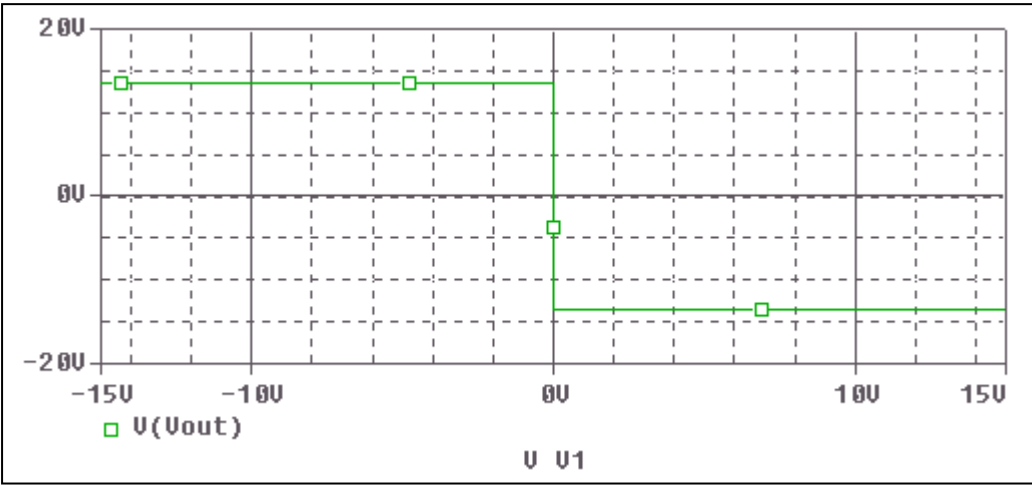
Bee Technologies Inc.

Spice Model

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*$
* PART NUMBER: NJM4580E
* MANUFACTURER: NEW JAPAN RADIO
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.Subckt NJM4580E_SUB OUT1 -IN1 +IN1 VEE +IN2 -IN2 OUT2 VCC
X_U1  +IN1 -IN1 VCC VEE OUT1 NJM4580E
X_U2  +IN2 -IN2 VCC VEE OUT2 NJM4580E
.ends NJM4580E_SUB
.subckt NJM4580E 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 4.4738E6 -1E3 1E3 4E6 -4E6
ga 6 0 11 12 2.9274E-3
gcm 0 6 10 99 9.2572E-9
iee 3 10 dc 150.20E-6
hlim 90 0 vlim 1K
q1 11 2 13 qx1
q2 12 1 14 qx2
r2 6 9 100.00E3
rc1 4 11 353.68
rc2 4 12 353.68
re1 13 10 8.8102
re2 14 10 8.8102
ree 10 99 1.3316E6
ro1 8 5 50
ro2 7 99 25
rp 3 4 1.1314E3
vb 9 0 dc 0
vc 3 53 dc 2.2979
ve 54 4 dc 2.2979
vlim 7 8 dc 0
vlp 91 0 dc 5.4000
vln 0 92 dc 5.4000
.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=689.66)
.model qx2 PNP(Is=898.3900E-18 Bf=821.92)
.ends
*$
```

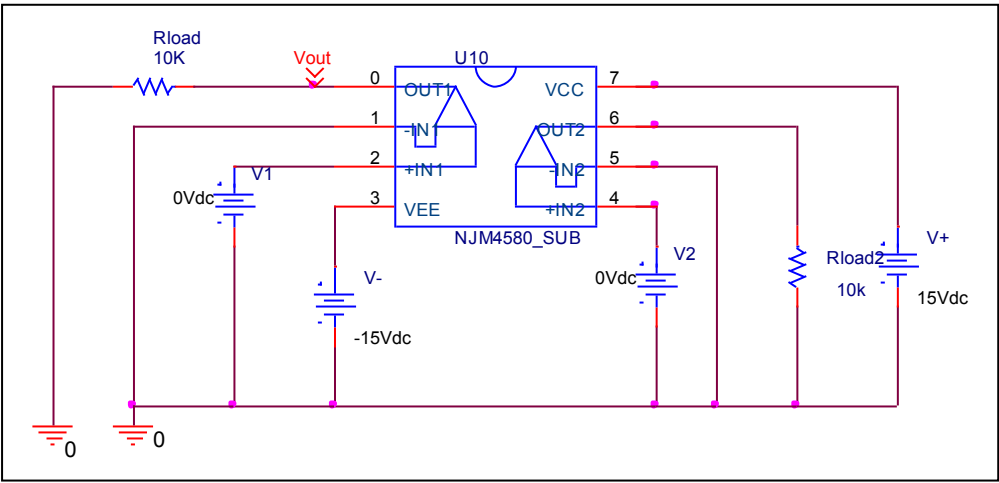
Output Voltage Swing, +Vout and –Vout

Simulation result



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

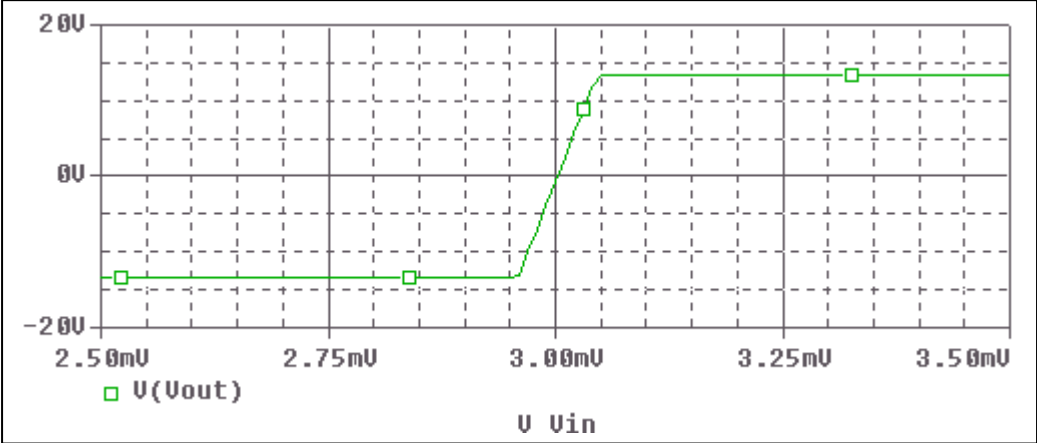
Evaluation circuit



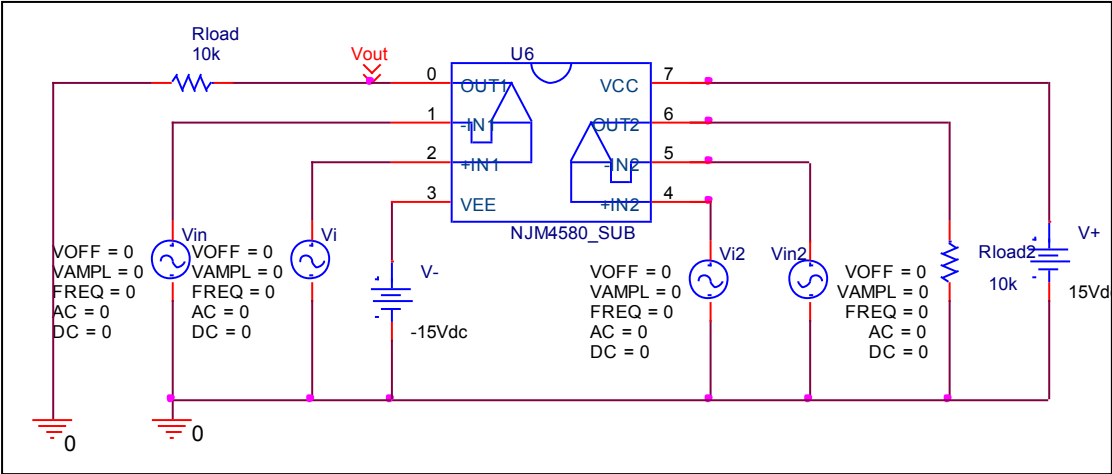
Output Voltage Swing	Data sheet	Simulation	%Error
+Vout(V)	+13.5	+13.466	0.251
-Vout(V)	-13.5	-13.466	0.251

Input Offset Voltage

Simulation result



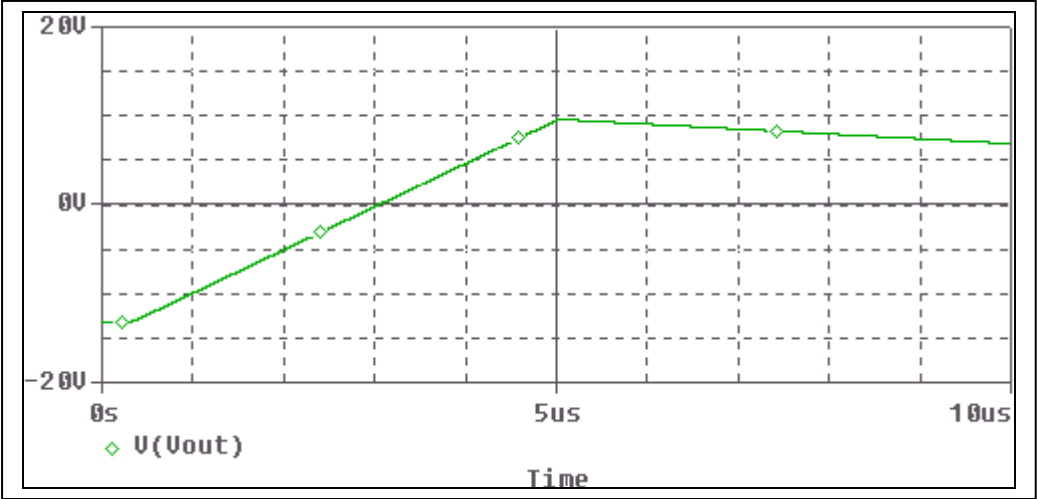
Evaluation circuit



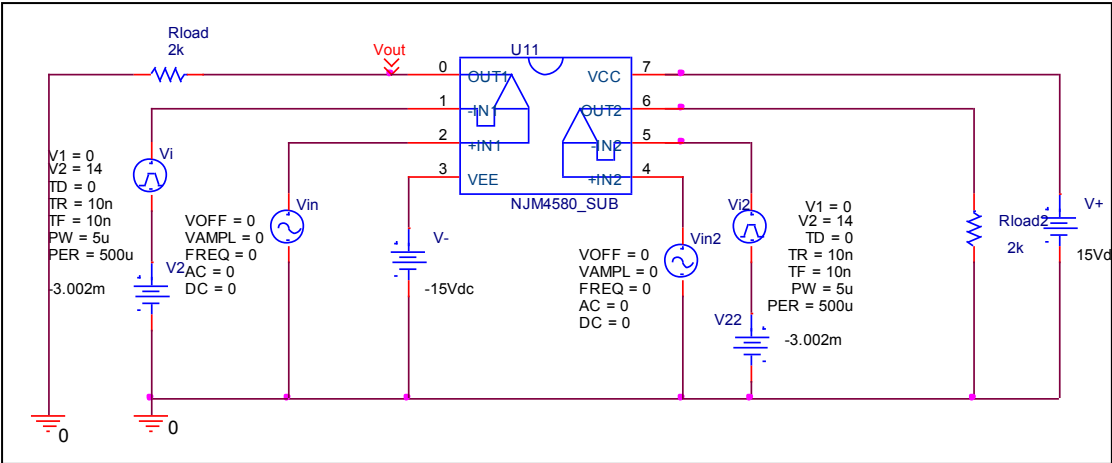
Vos	Measurement		Simulation		Error	
	3	mV	3.002	mV	0.066	%

Slew Rate, +SR, -SR

Simulation result



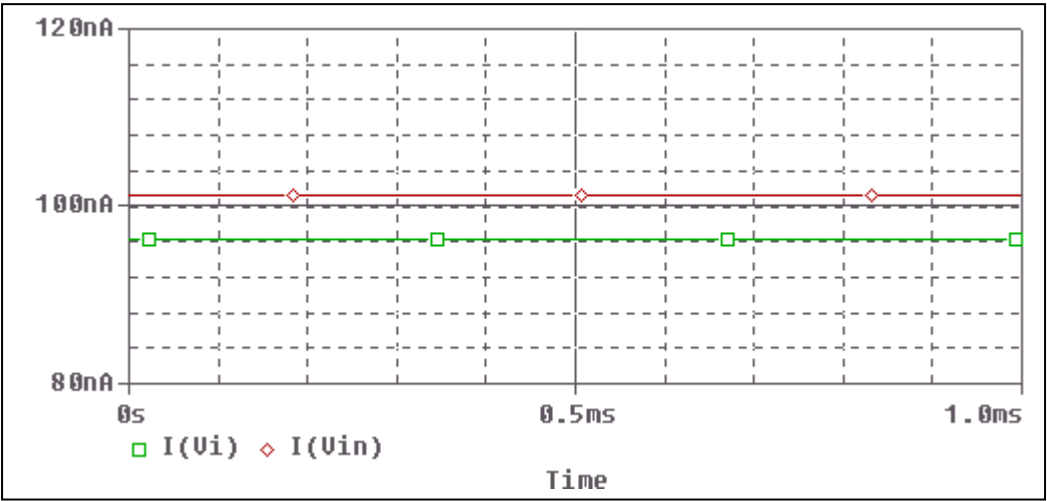
Evaluation circuit



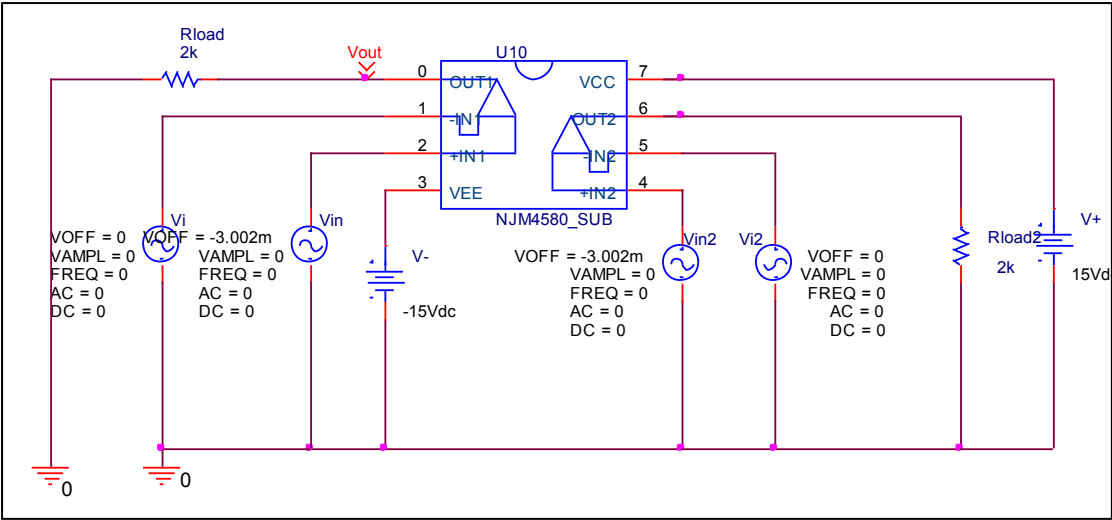
Slew Rate(v/us)	Data sheet	Simulation	%Error
	5V/us	4.85V/us	3

Input current Ib, Ibos

Simulation result



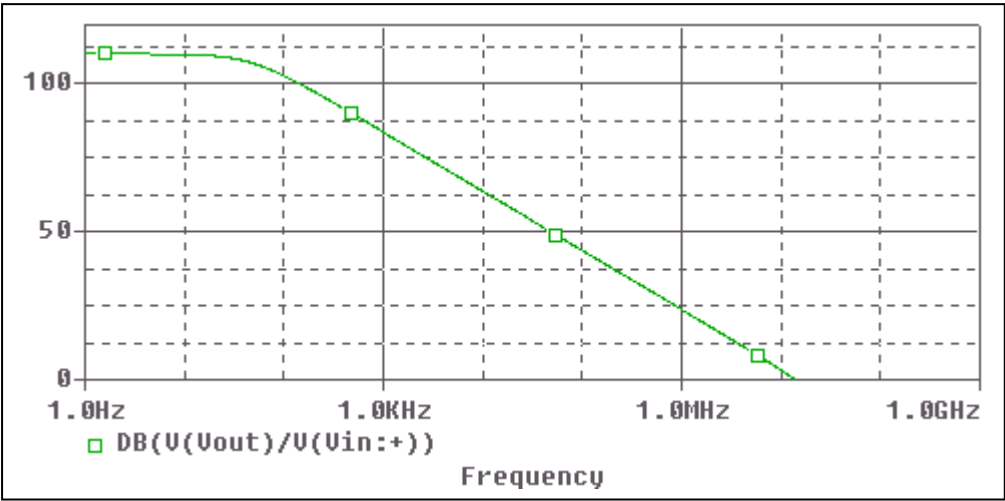
Evaluation circuit



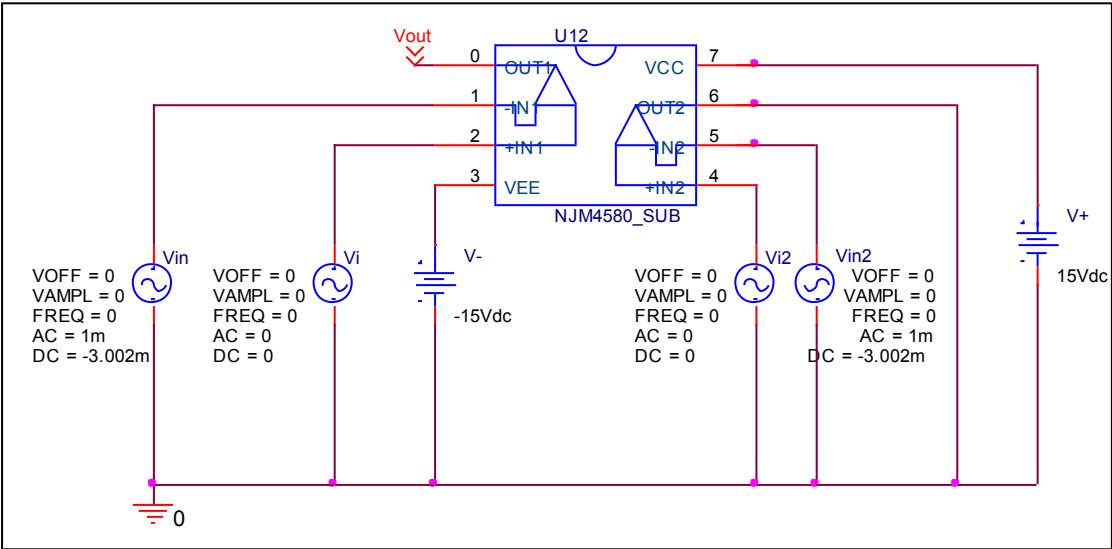
	Data sheet	Simulation	%Error
Ib(nA)	100	98.67	1.33
Ibos(nA)	5	5.019	0.38

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

Simulation result



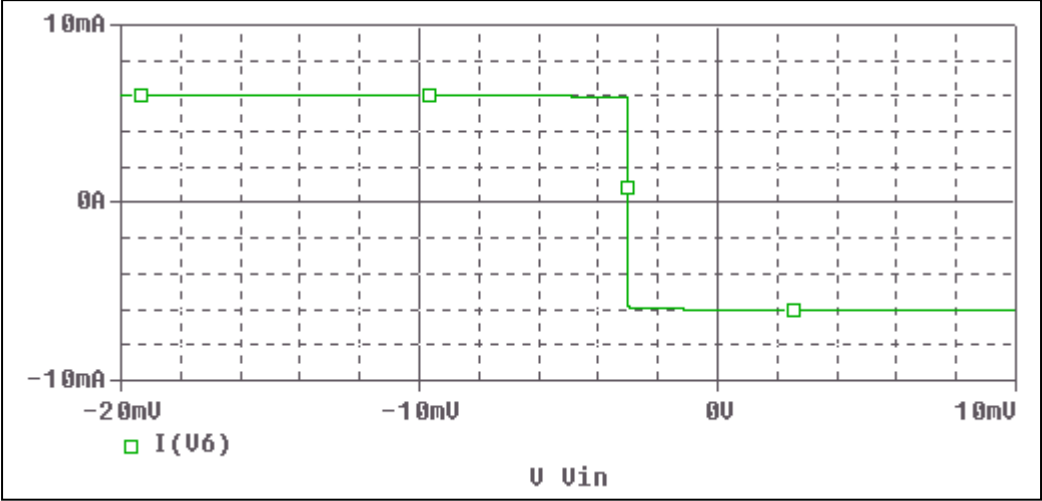
Evaluation circuit



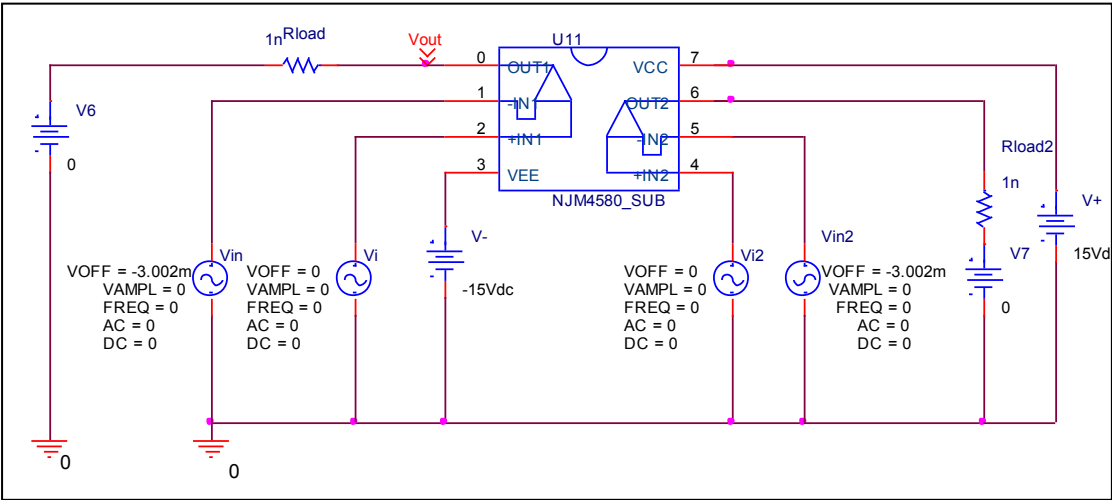
	Data sheet	Simulation	%Error
f-0dB(MHz)	15	14.3	4.666
Av-dc	110	110.2	0.181

Output Short Circuit Current - Ios

Simulation result



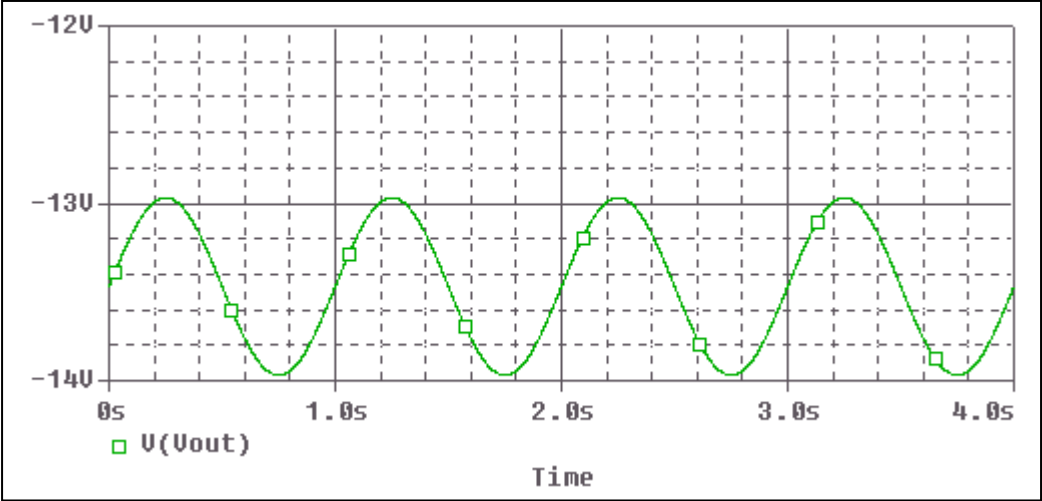
Evaluation circuit



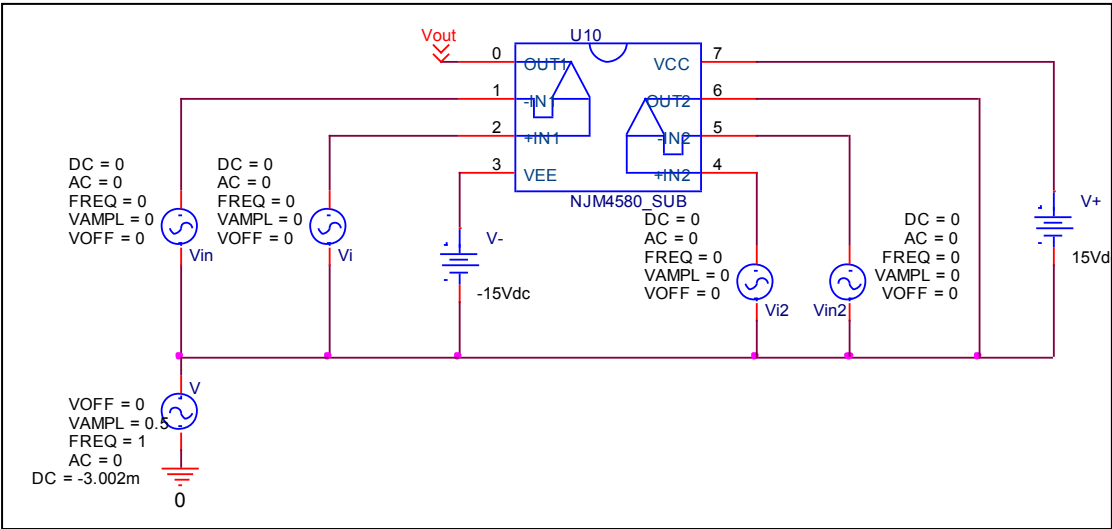
Short Circuit Current	Data sheet	Simulation	%Error
	6mA	6.044mA	0.733

Common-Mode Rejection Voltage gain

Simulation result



Evaluation circuit



Common mode gain=1/1
Common Mode Reject Ratio=323593/1=323593

CMRR	Data sheet	Simulation	%Error
	316230	323593	2.32