Device Modeling Report

COMPONENTS : BIPOLAR OPERATIONAL AMPLIFIER

PART NUMBER : NJM2068

MANUFACTURER : NEW JAPAN RADIO CO.,LTD

Version : 2

JRC 新日本無線株式會社

Spice Model


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*$
*PART NUMBER:NJM2068
*BIPOLAR OPAMP
*Version:2
*Please note that the inaccuracy is involved to it when you use this model.
*Please refrain from the model's resale.
*****************************************************************
*Model Generated by NEW JAPAN RADIO CO.,LTD *
*               All Rights Reserved                 *
*     Commercial Use or Resale Restricted           *
*****************************************************************
.SUBCKT NJM2068 OUT1 -IN1 +IN1 V- +IN2 -IN2 OUT2 V+
X1 +IN1 -IN1 V+ V- OUT1 njm2068_s
X2 +IN2 -IN2 V+ V- OUT2 njm2068_s
.ENDS NJM2068
*$
* connections:      non-inverting input
*                   |   inverting input
*                   |   |   positive power supply
*                   |   |   |   negative power supply
*                   |   |   |   |   output
*                   |   |   |   |   |
*                   |   |   |   |   |
.subckt njm2068_s 1   2   3   4   5
C1 11 12 {C1}
C2 15 16 {C2}
CE 10 0 {CE}
RE 10 0 {RE}
D1 16 17 DMOD1
D2 17 16 DMOD1
D3 5 18 DMOD2
D4 19 5 DMOD2
D5 10 20 DMOD2
VTL 3 20 {VTL}
GB 16 0 15 0 {GB}
GA 15 0 11 12 {GA}
GC 0 17 5 0 {GC}
GCM 0 15 10 0 {GCM}
ITL 3 10 {ITL}
```

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Q1 11 2 13 PNP1
Q2 12 1 14 PNP2
RO1 16 5 {RO1}
RC 17 0 {RC}
RO2 16 0 {RO2}
R2 15 0 100E3
RC1 11 21 {RC1}
RC2 12 22 {RC1}
VRC1 21 4 {VRC}
VRC2 22 4 {VRC}
RE2 10 14 {RE1}
RE1 10 13 {RE1}
ICE 3 4 {ICE}
RP 3 4 {RP}
VE 19 4 DC {VE}
VC 3 18 DC {VC}


.MODEL DMOD1 D(T_MEASURED = 25 IS = 3.56E-30)
.MODEL DMOD2 D(T_MEASURED = 25 IS = 8.00E-16)


.MODEL PNP1 PNP(TREF = 25 IS = 8.00E-16 BF = 2725.695581)
.MODEL PNP2 PNP(TREF = 25 IS = {ISM2} BF = {BFM2})


.PARAM
+ C1    = 1.08E-10
+ C2    = 1.37E-10
+ CE    = 0.00E+00
+ GCM   = 2.24E-08
+ GA    = 7.09E-03
+ GB    = 39.16
+ GC    = 1.67E+05
+ ITL   = 8.33E-04
+ RC1   = 140.98
+ RC    = 5.98E-06
+ RE1   = 79.24
+ RE    = 2.40E+05
+ RO1   = 39
+ RO2   = 36
+ RP    = 4.89E+04
+ VC    = 2.30946
+ VE    = 2.30946
+ VTL   = 1.53E+00
+ VRC   = 1.85
+ ICE   = 1.1E-3
+ ISM2 = 8.0924716E-16
+ BFM2 = 2827.504244


.ends njm2068_s
*$
```

BIPOLAR MODEL

| Pspice model parameter	Model description
T_MEASURED	Measured temperature
IS	saturation current
BF	ideal maximum forward beta
U0	Surface Mobility

Output Voltage Swing (VOM High Side)

Output Voltage(VOMHigh Side)
$V^+=15.0V, V^-=-15.0V, RL=2k$

Evaluation circuit

VOM(V)	Data sheet	Simulation	%Error
	13.5	13.5	0.0

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Date:2016-6-7
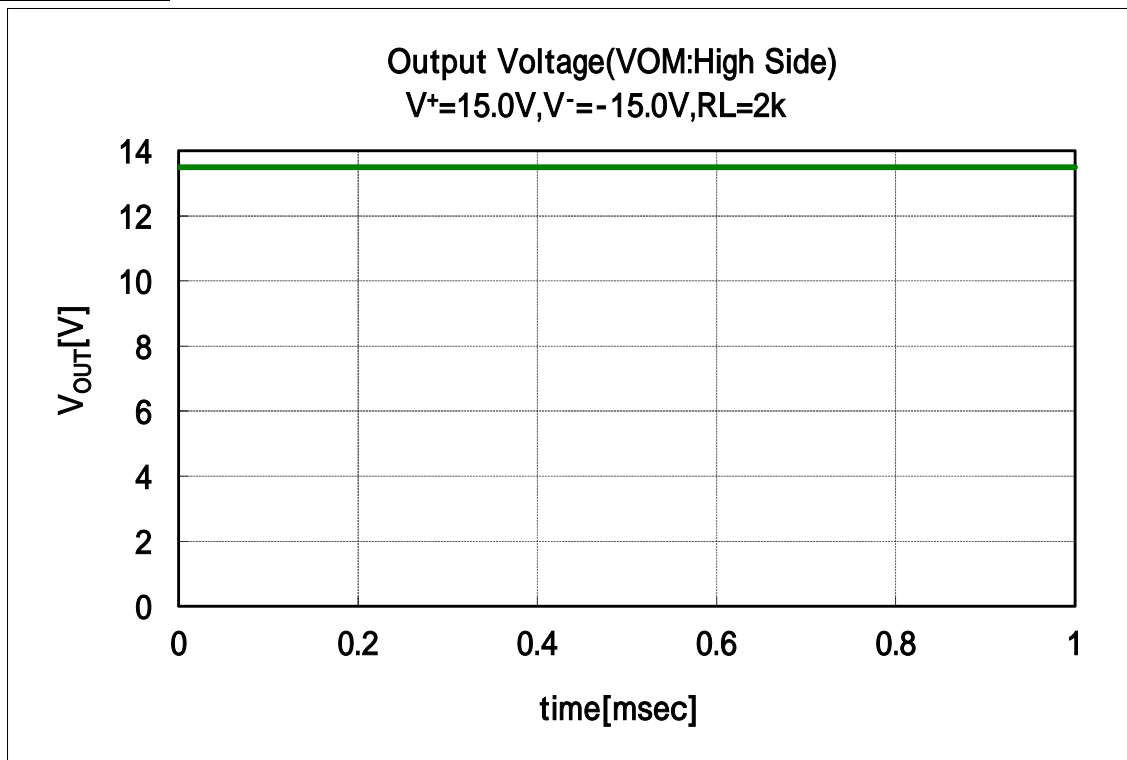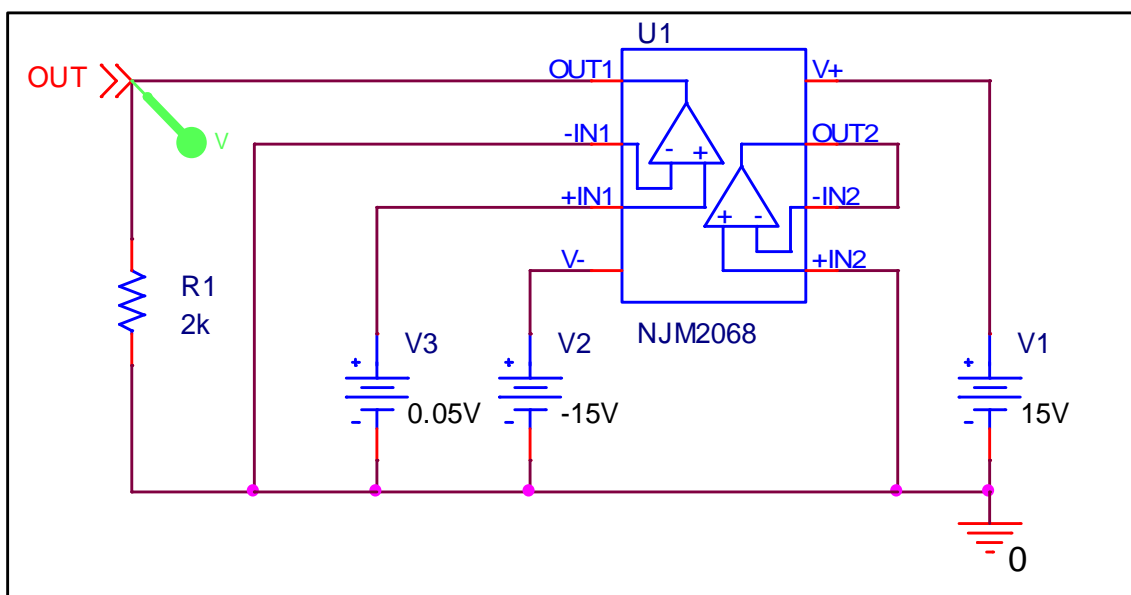
Output Voltage Swing (VOM　Low Side)

Simulation result

Output Voltage(VOM Low Side)
$V^+ = 5.0V, V^- = -15.0V, RL = 2k$
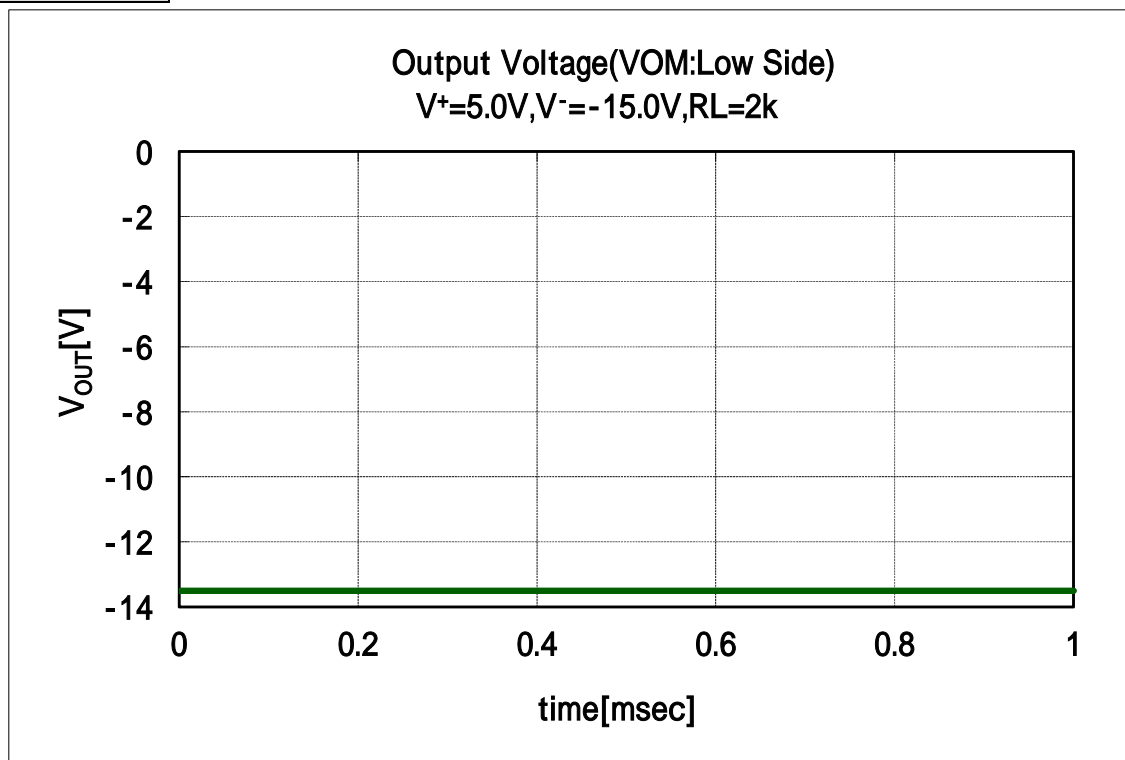
Evaluation circuit
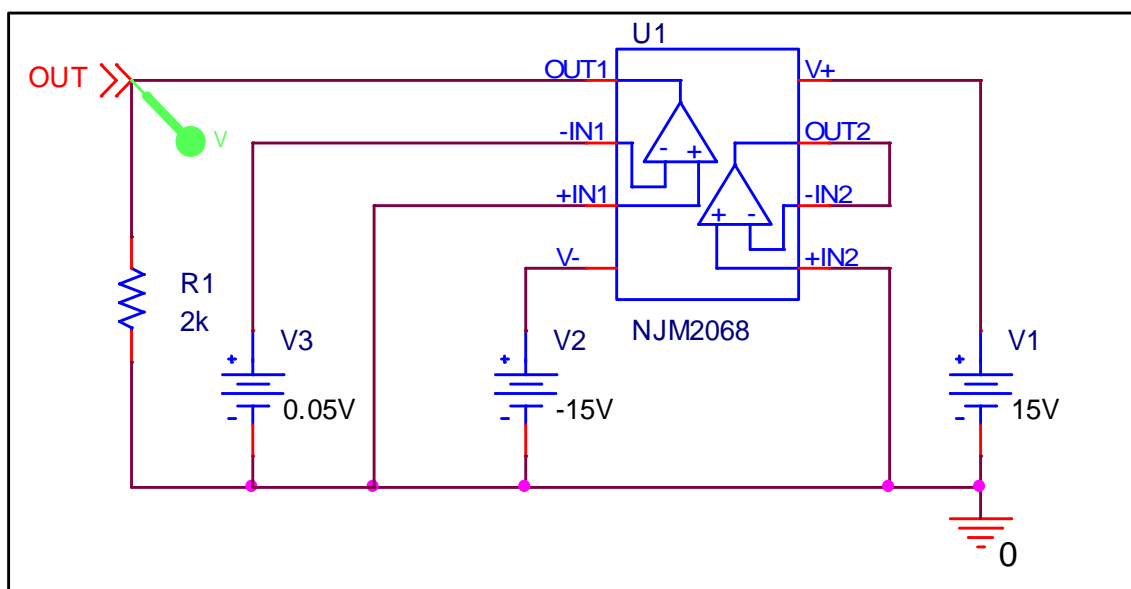
VOM(V)	Data sheet	Simulation	%Error
	-13.5	-13.5	0.0

Input Offset Voltage(VIO)

Simulation result

Offset Voltage(VIO)
V^+=15.0V, V^-=-15.0V, RL=Open
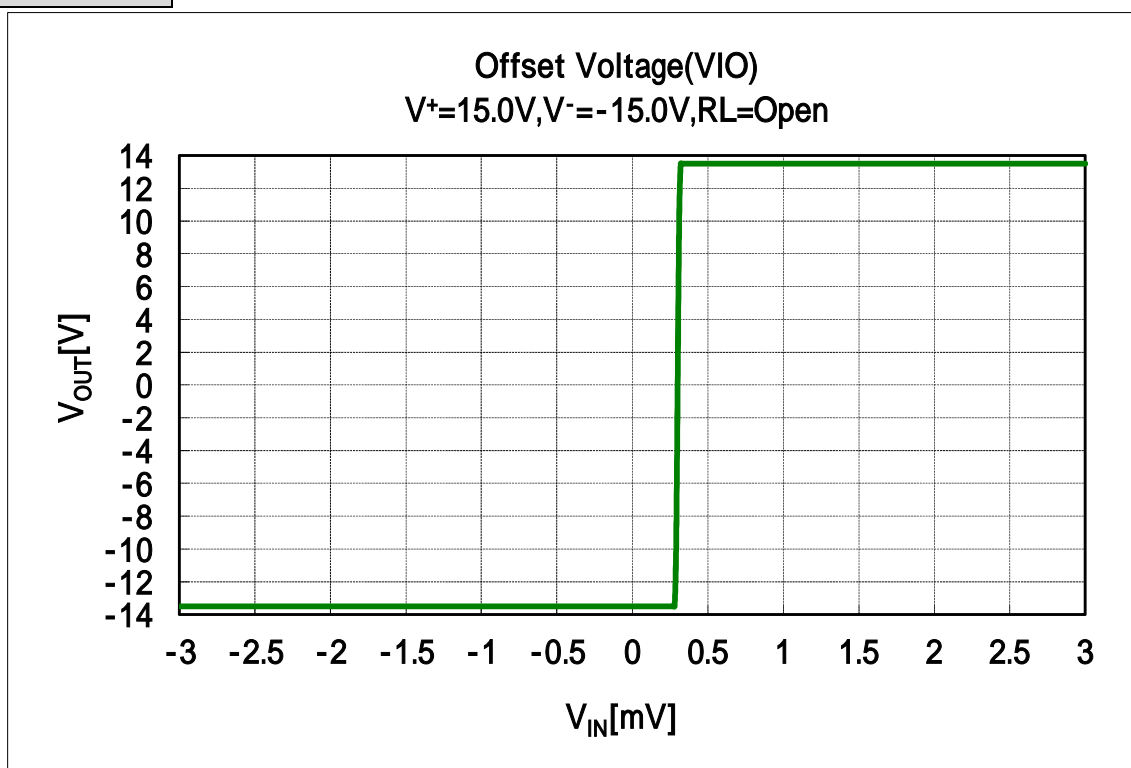
Evaluation circuit
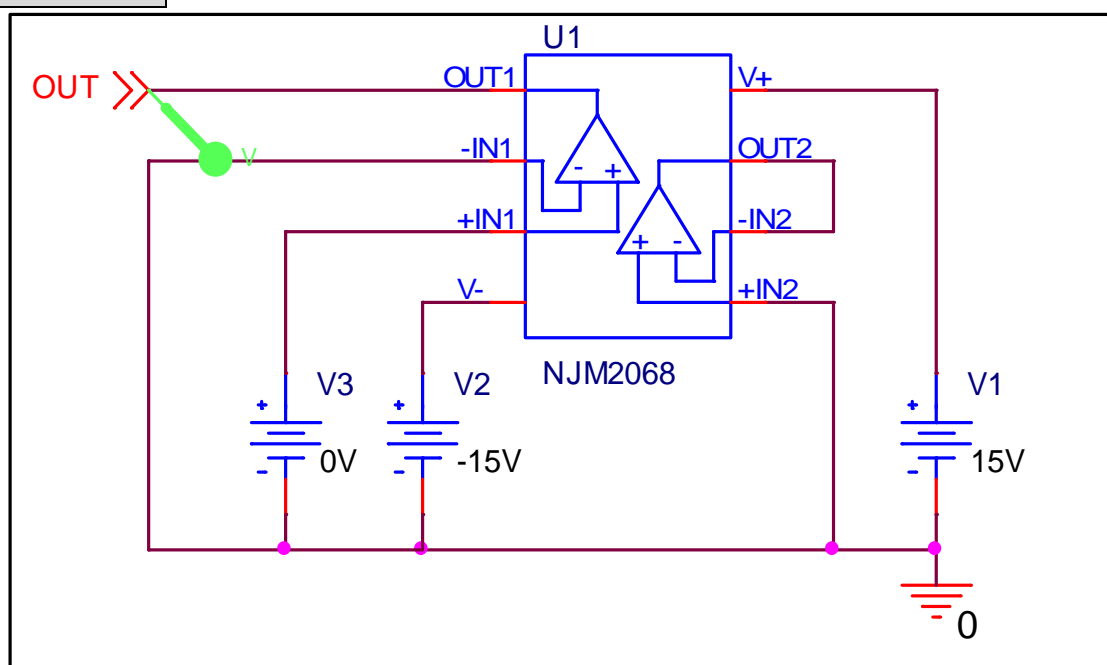
VIO(mV)	Measurement	Simulation	%Error
	0.3	0.3	0.0

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Slew Rate (+SR, -SR)

Simulation result

SlewRate(SR)

$V^+=15.0V, V^-=-15.0V, V_{IN}=10Vpp, RL=2k$
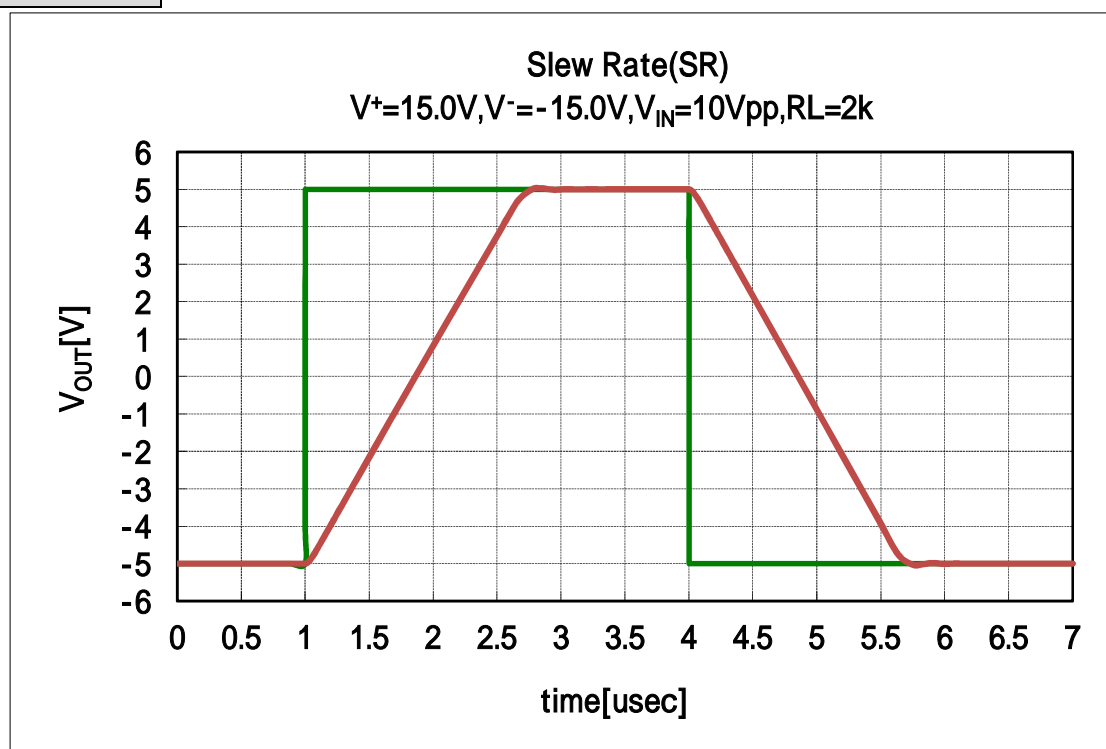
Evaluation circuit
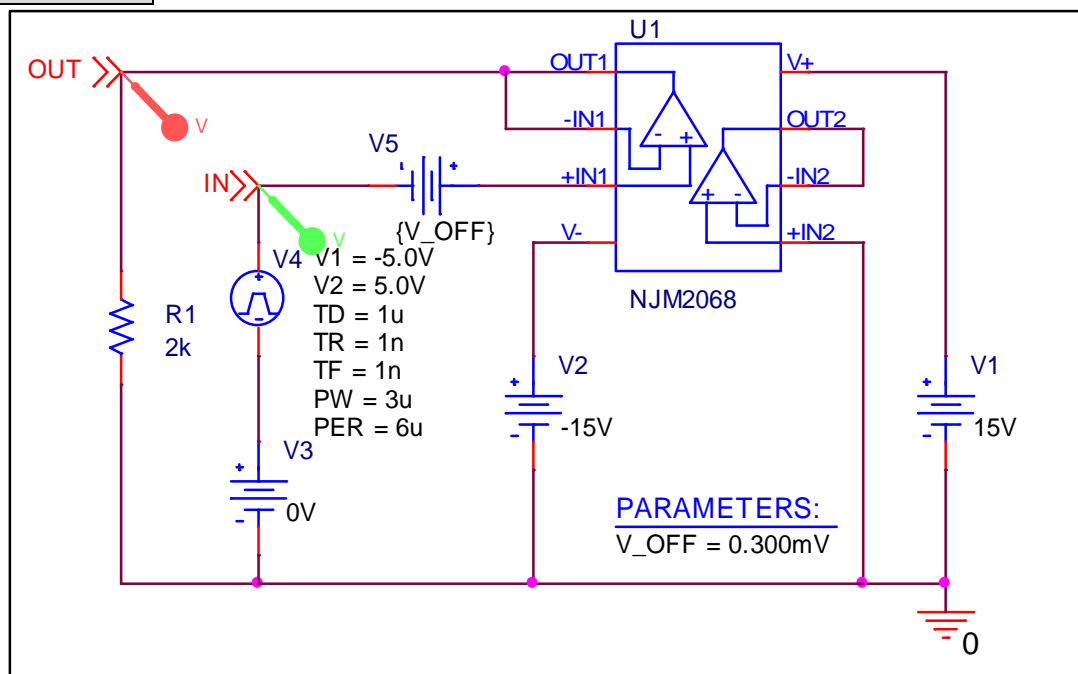
Slew Rate	Data sheet	Simulation	%Error
+SR(V/usec)	6.0	5.936	1.067
-SR(V/usec)	-6.0	-6.080	1.333

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Open Loop Voltage Gain (AV , FT , PM)

Simulation result

Openloop Gain(AV,FT,PM)
V^+=15.0V,V^-=-15.0V,RL=2k ,CL=100pF
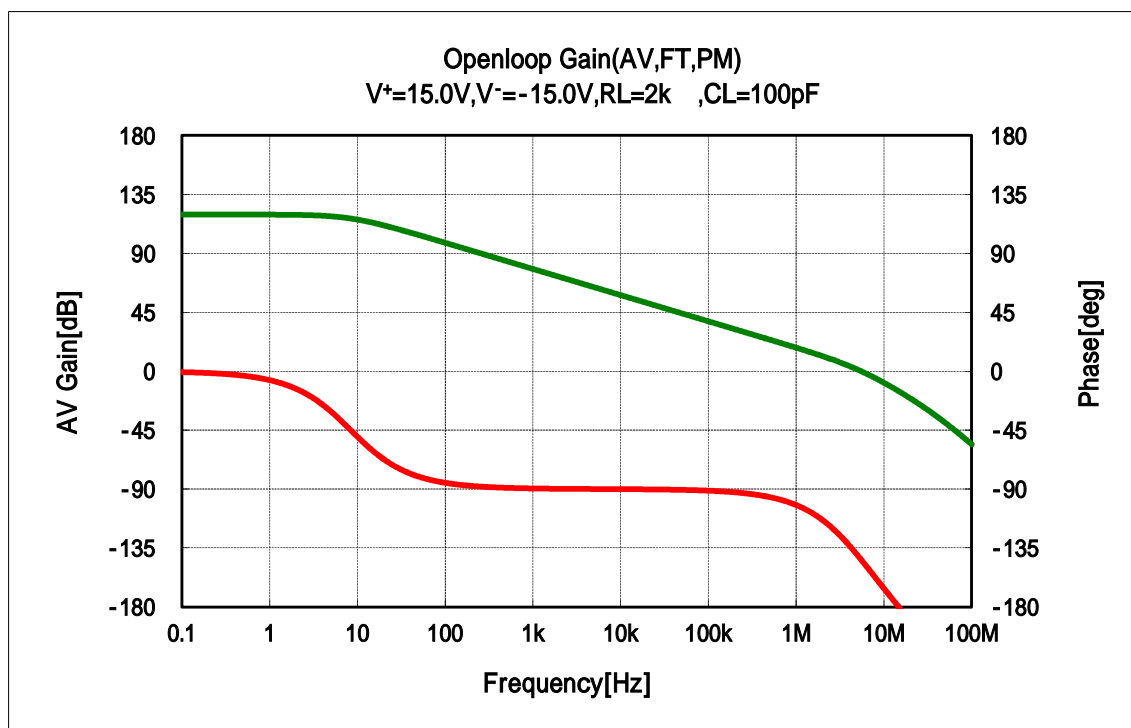
Evaluation circuit
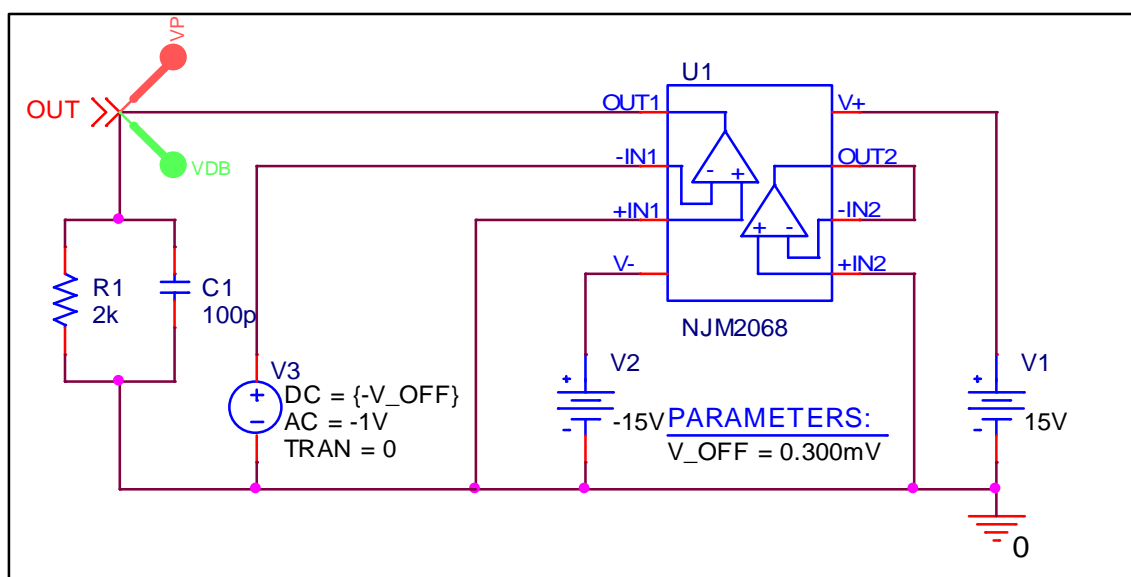
	Data sheet	Simulation	%Error
Av (dB)	120	119.636	0.303
FT(MHz)	5.5	5.493	0.127
PM(deg) * Reference value	-	36.047	-

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Date:2016-6-7

Common-Mode Rejection Ratio(CMR)

Simulation result

Common-Mode Rejection Ratio(CMR)
V⁺=15.0V,V⁻=-15.0V,RL=Open
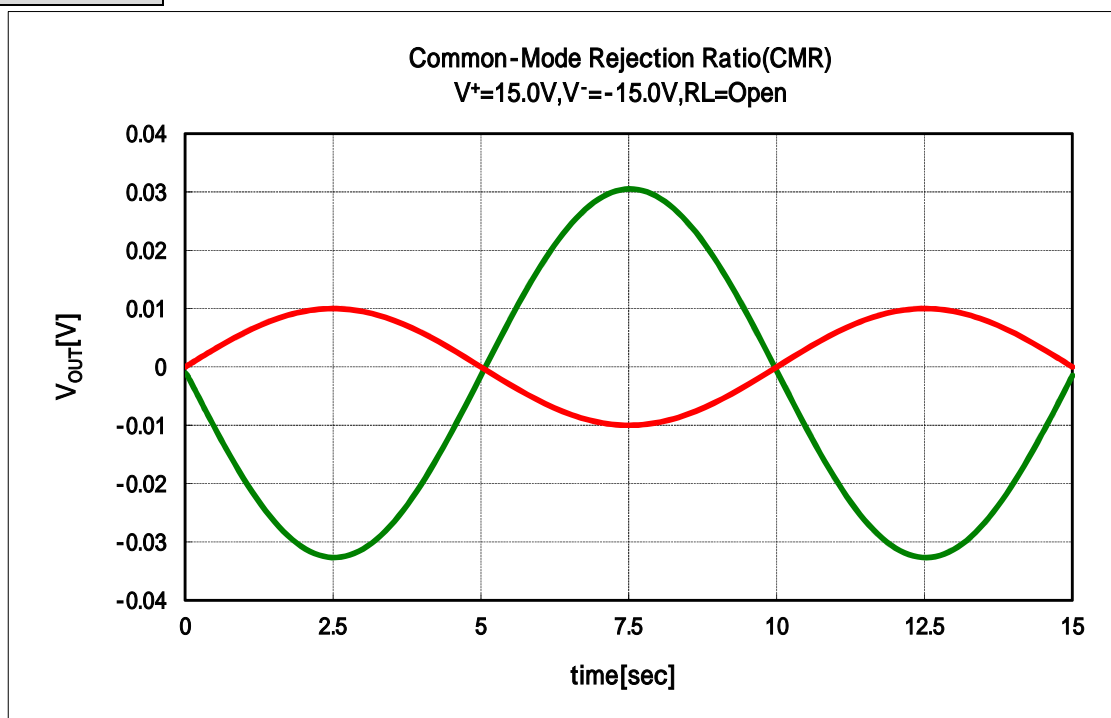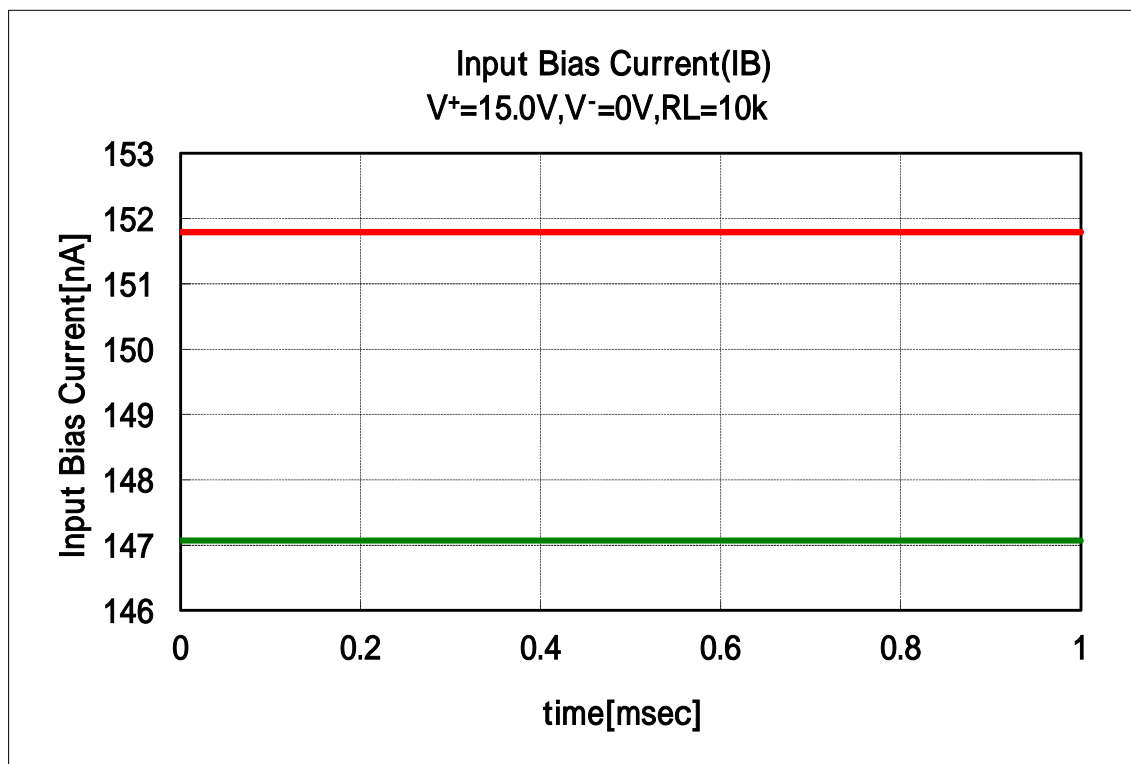
Evaluation circuit
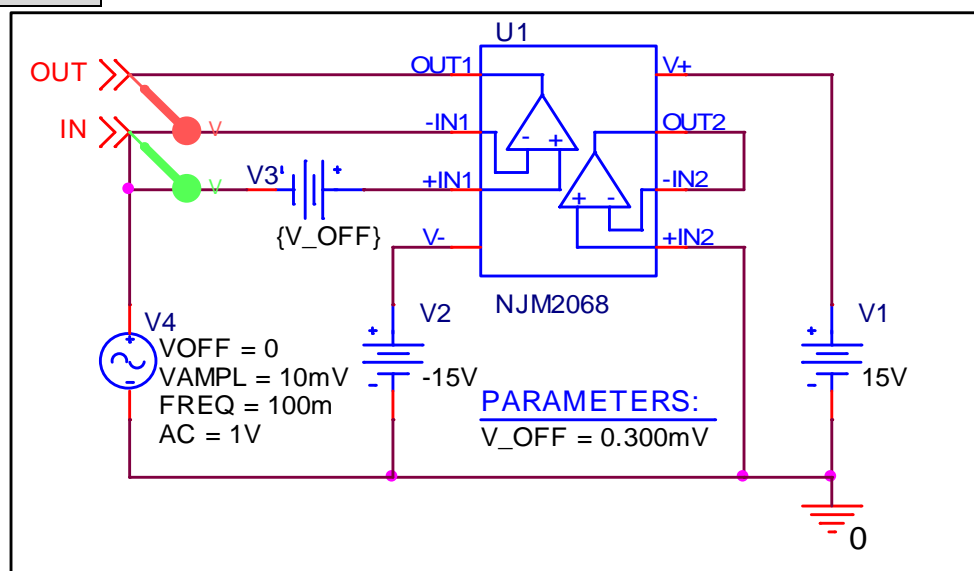
$$A_{CM} = \frac{V_{pp}(V_{out})}{V_{pp}(V_{inm})} = 3.1526 = 9.973[dB], \qquad CMR = \left|\frac{A_{VD}}{A_{CM}}\right| = 119.636 - 9.973 = 109.663[dB]$$
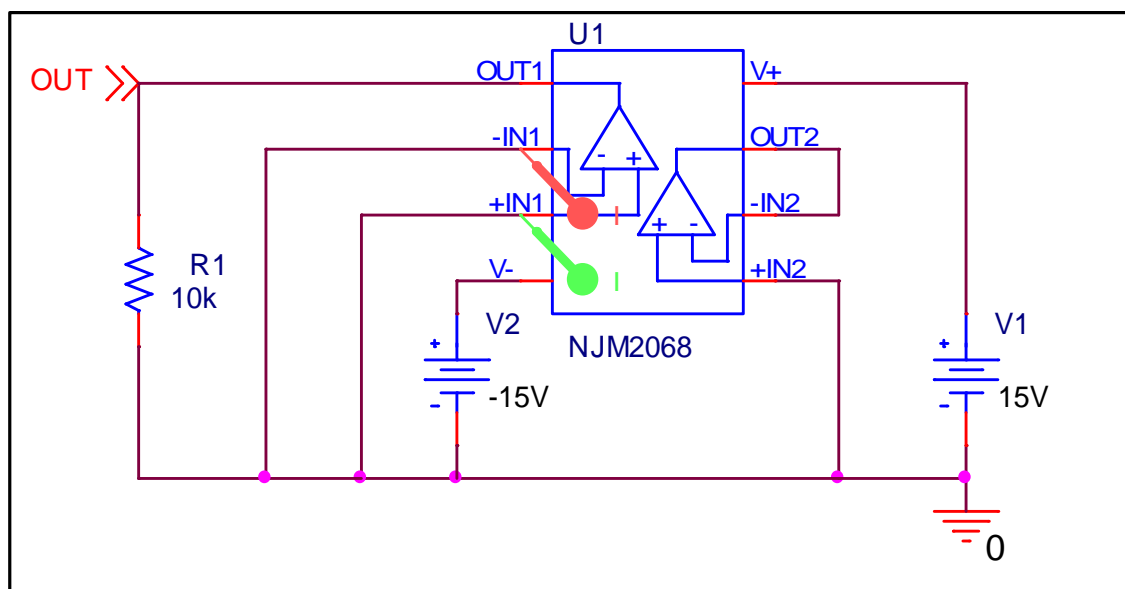
CMR(dB)	Data sheet	Simulation	%Error
	110	109.663	0.306

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Input Bias Current (IB)

Simulation result

Input Bias Current(IB)
V^+=15.0V,V^-=0V,RL=10k

Evaluation circuit

Input Bias Current	Data sheet	Simulation	%Error
IB+(nA)	150	147.071	1.953
IB-(nA)	150	151.793	1.195

Input Offset Current (IIO)

Simulation result

Input Offset Current(IIO)
$V^+=15.0V, V^-=-15.0V, RL=10k$
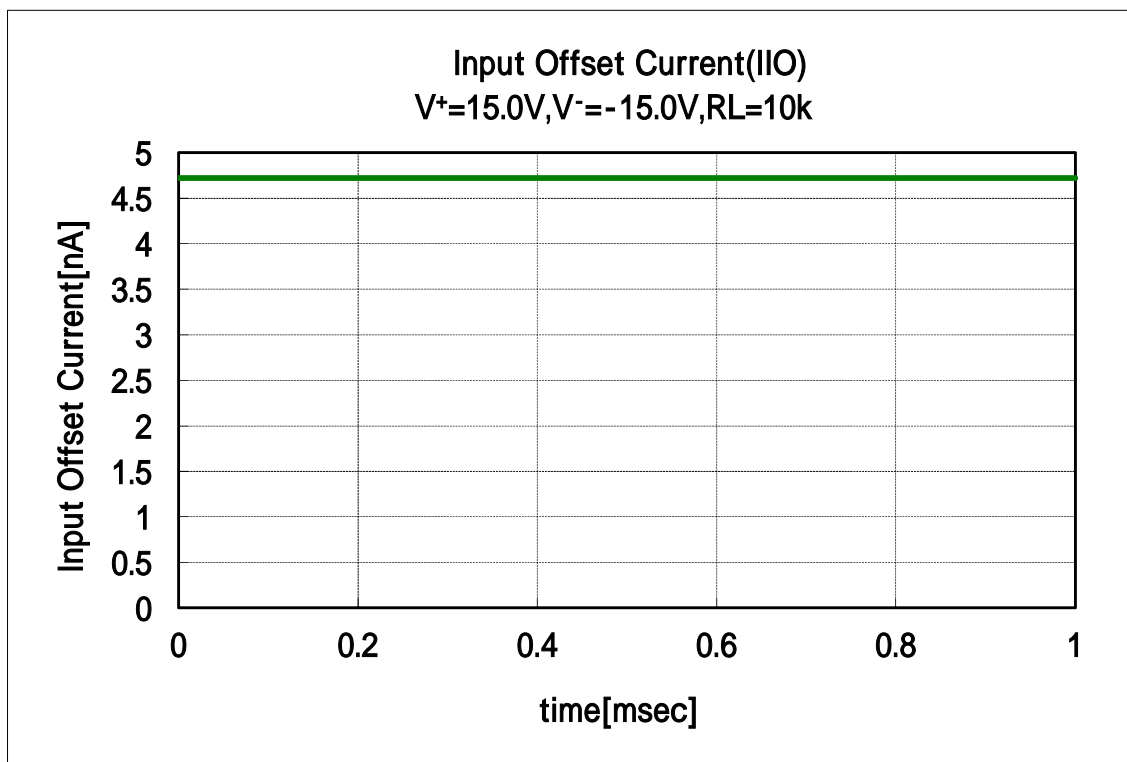
Evaluation circuit
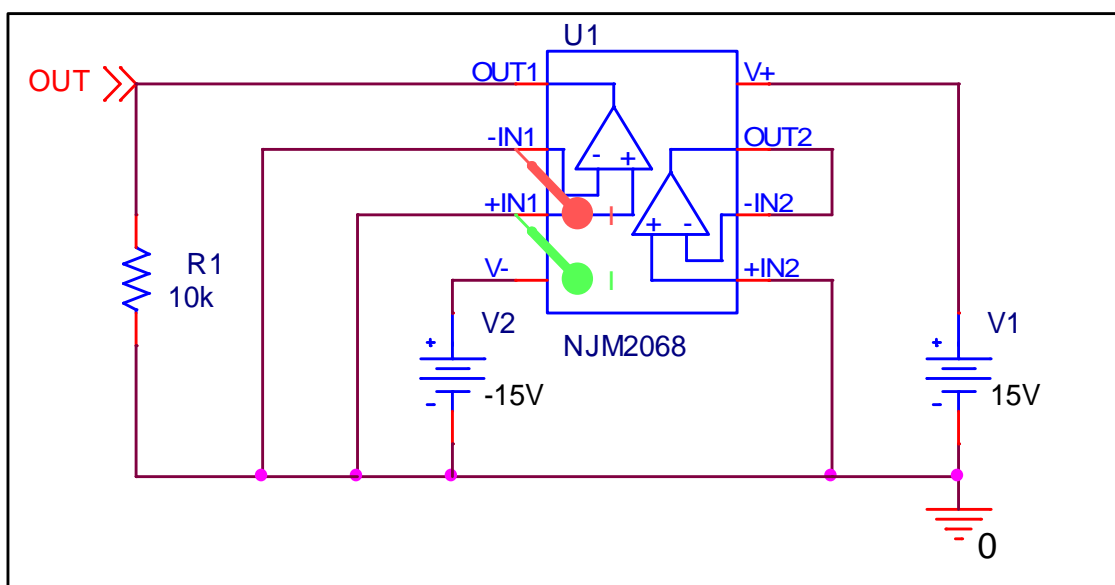
IIO(nA)	Data sheet	Simulation	%Error
	5.0	4.722	5.560