

# Device Modeling Report

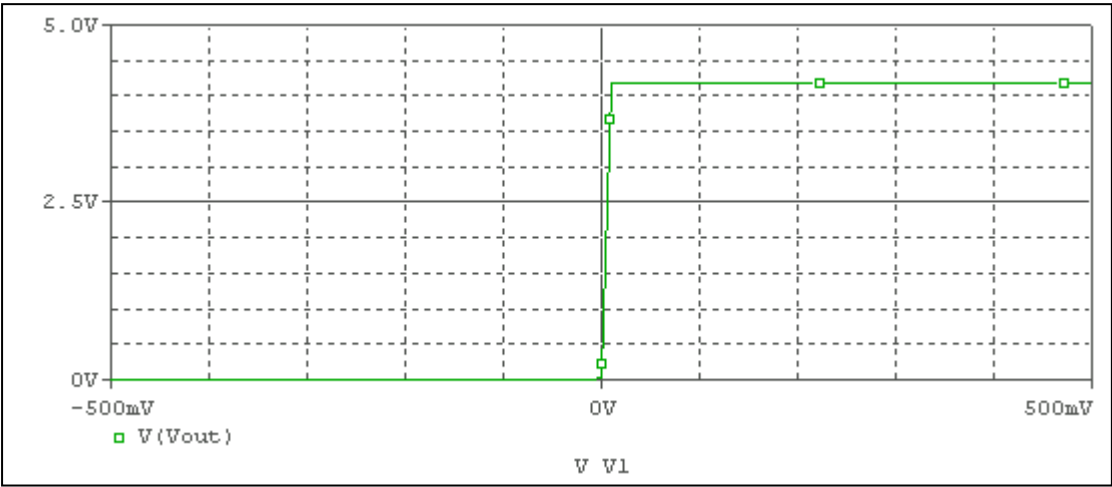
COMPONENTS:MOSFET: OPERATIONAL AMPLIFIER  
PART NUMBER:NJM13404  
MANUFACTURER: NEW JAPAN RADIO CO.,LTD



Bee Technologies Inc.

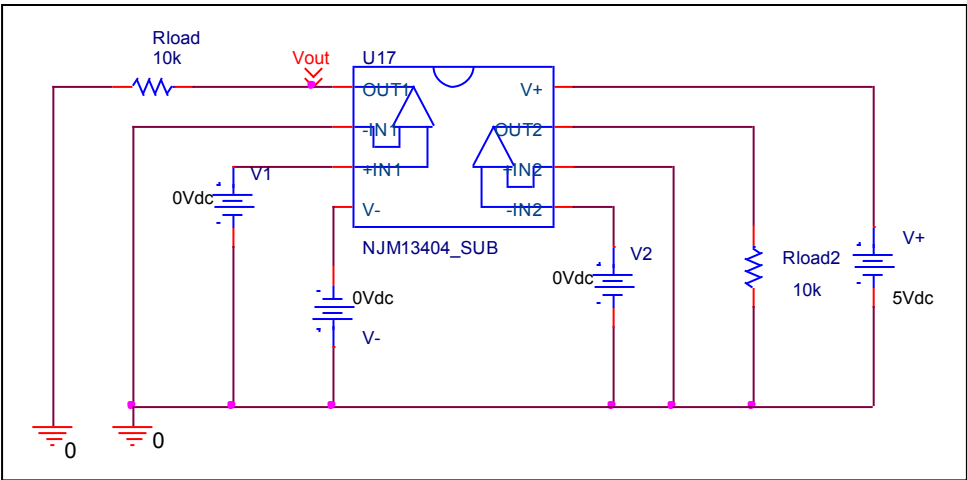
# Output Voltage Swing, +Vout and –Vout

## Simulation result



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

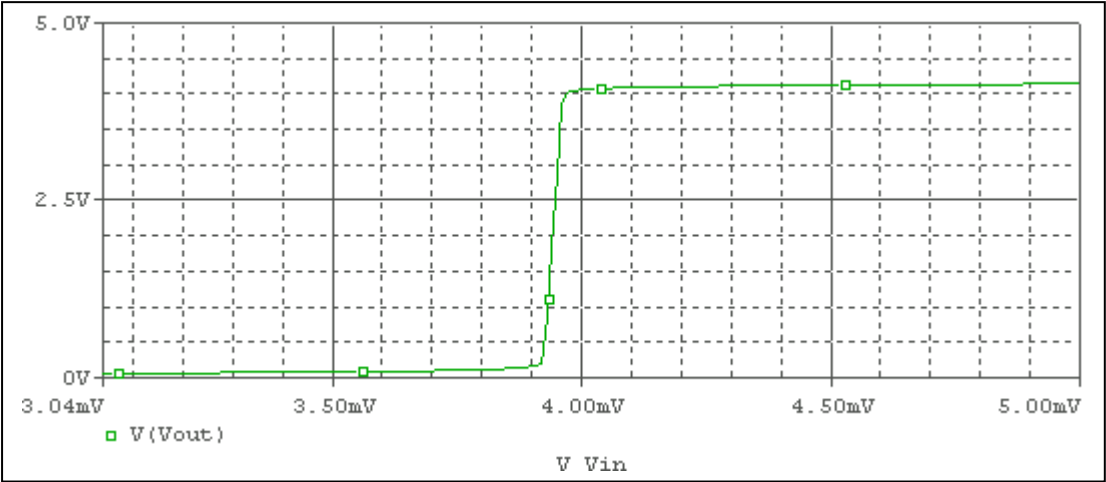
## Evaluation circuit



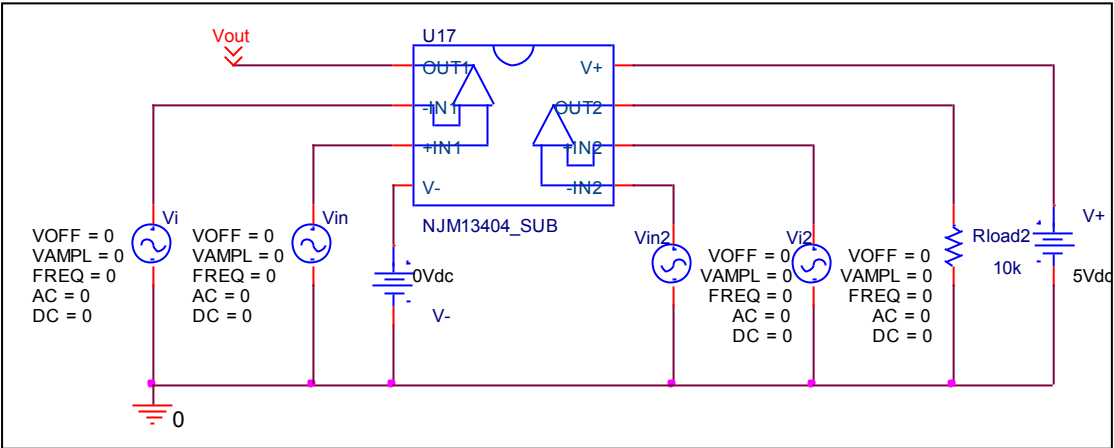
| Output Voltage Swing | Data sheet | Simulation | %Error |
|----------------------|------------|------------|--------|
| +Vout(V)             | 4.2        | 4.19       | 0.238  |

# Input Offset Voltage

## Simulation result



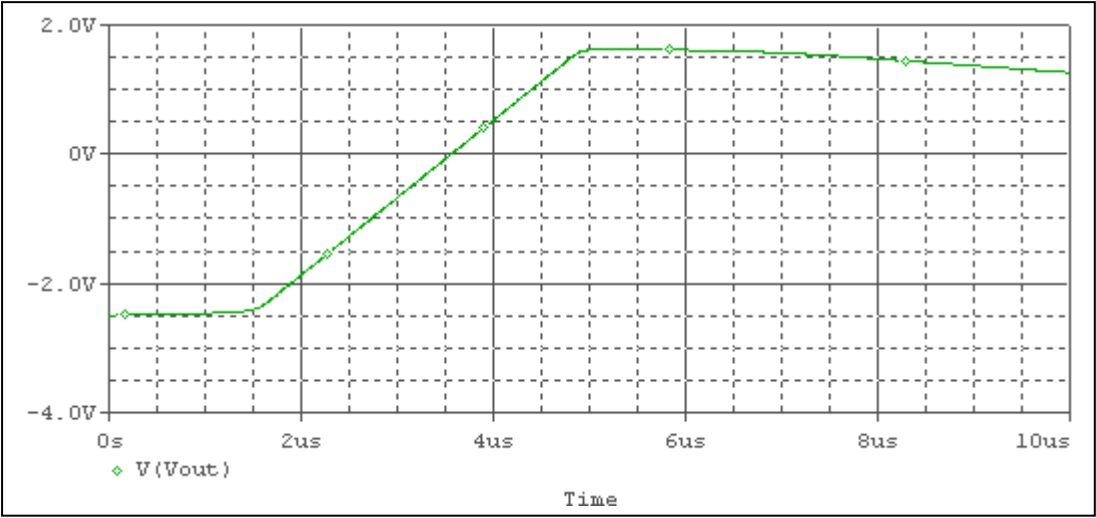
## Evaluation circuit



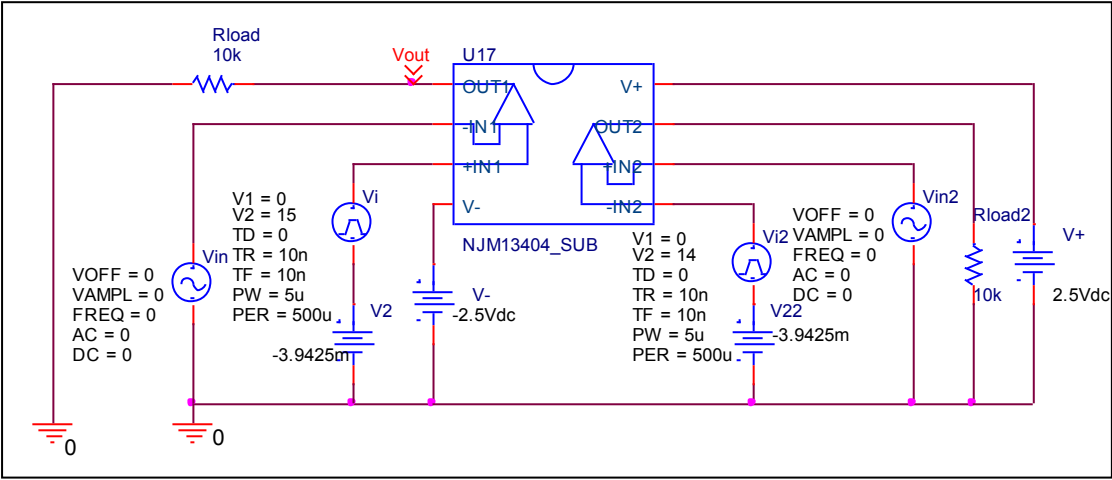
| Vos | Measurement |    | Simulation |    | Error |   |
|-----|-------------|----|------------|----|-------|---|
|     | 4           | mV | 3.9425     | mV | 1.437 | % |

# Slew Rate, +SR, -SR

## Simulation result



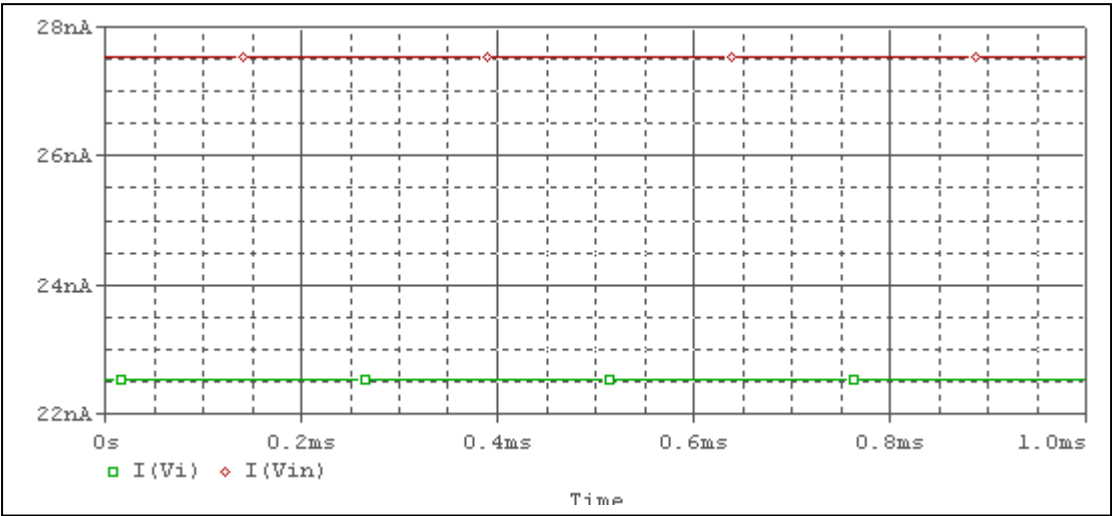
## Evaluation circuit



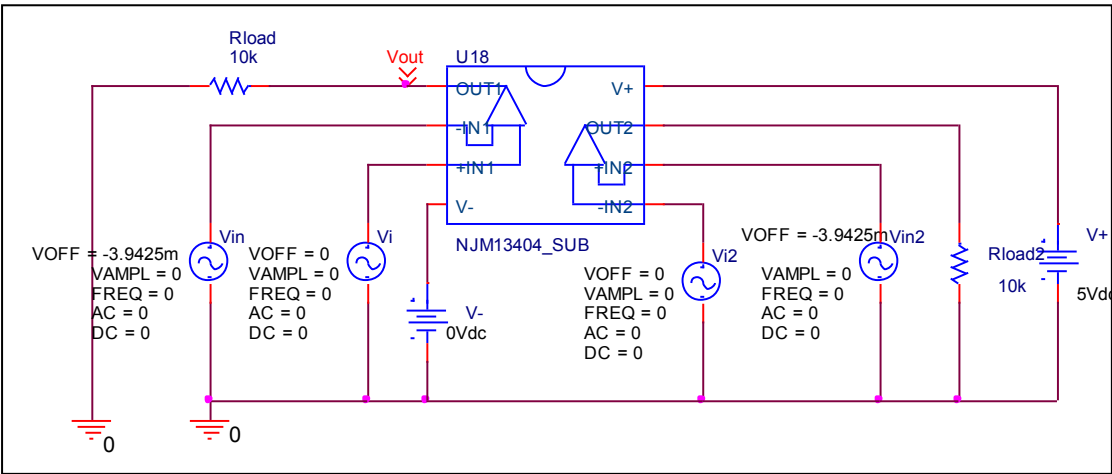
| Slew Rate(v/us) | Data sheet | Simulation | %Error |
|-----------------|------------|------------|--------|
|                 | 1.2V/us    | V/us       | 0.833  |

# Input current Ib, Ibos

## Simulation result



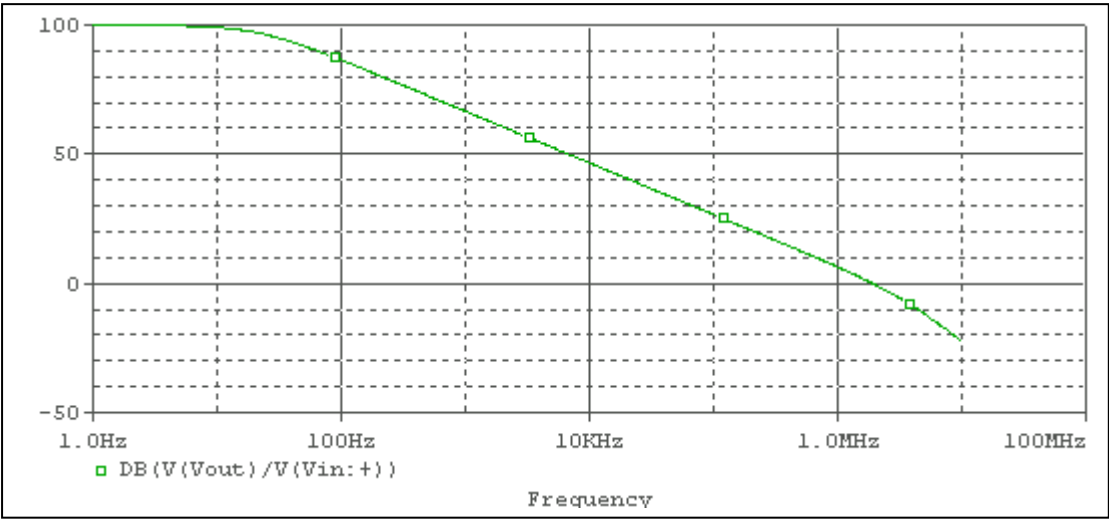
## Evaluation circuit



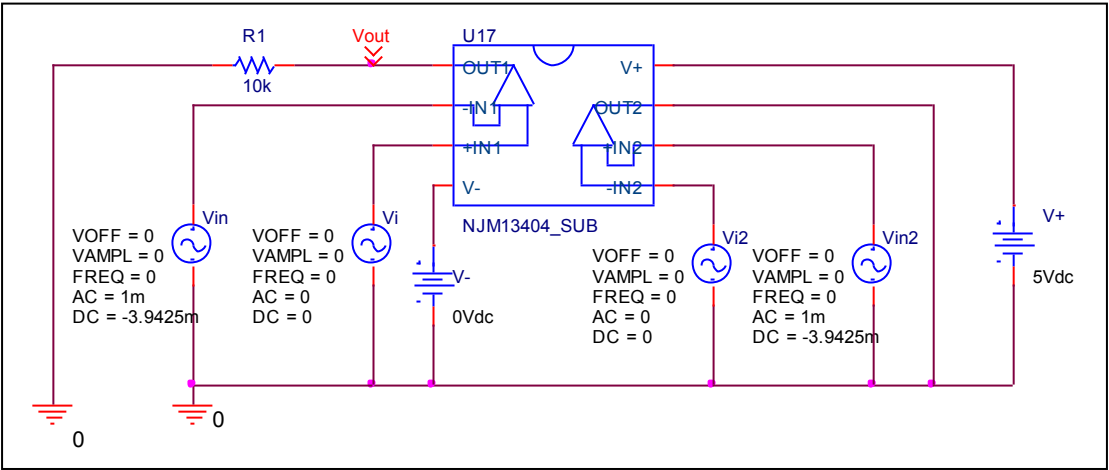
|          | Data sheet | Simulation | %Error |
|----------|------------|------------|--------|
| Ib(nA)   | 25         | 25         | 0      |
| Ibos(nA) | 5          | 5.01       | 0.2    |

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

## Simulation result



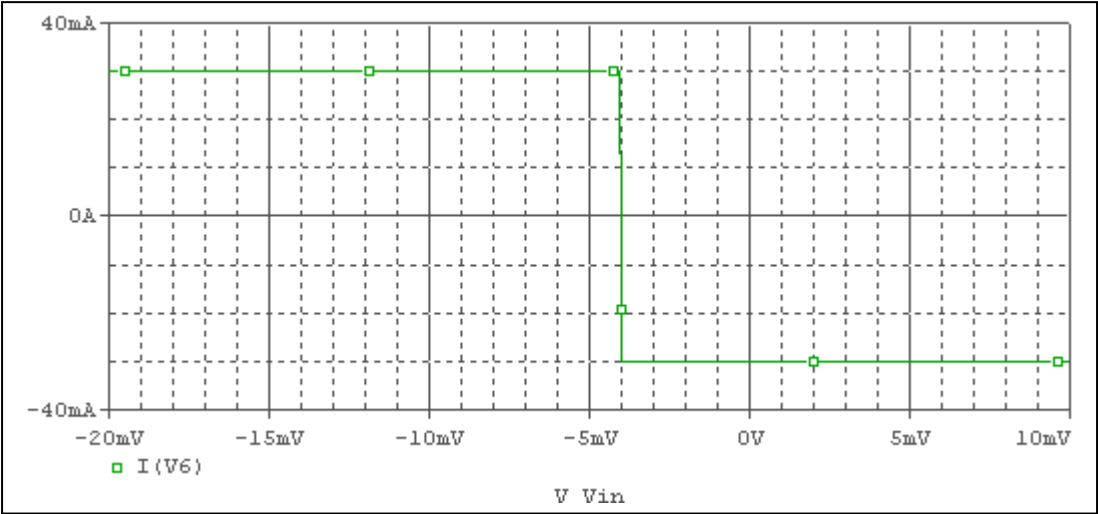
## Evaluation circuit



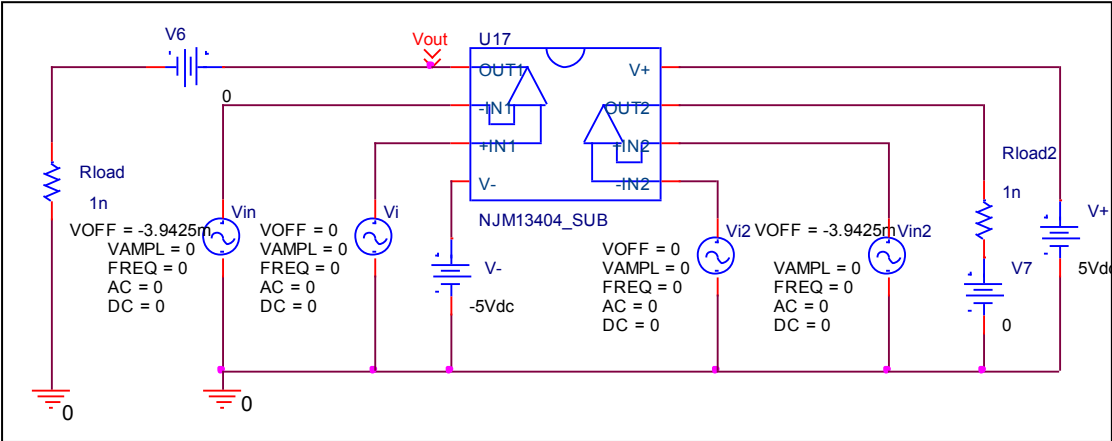
|            | Data sheet | Simulation | %Error |
|------------|------------|------------|--------|
| f-0dB(MHz) | 2          | 1.925      | 3.75   |
| Av-dc(dB)  | 100        | 99.895     | 0.105  |

# Output Short Circuit Current - Ios

## Simulation result



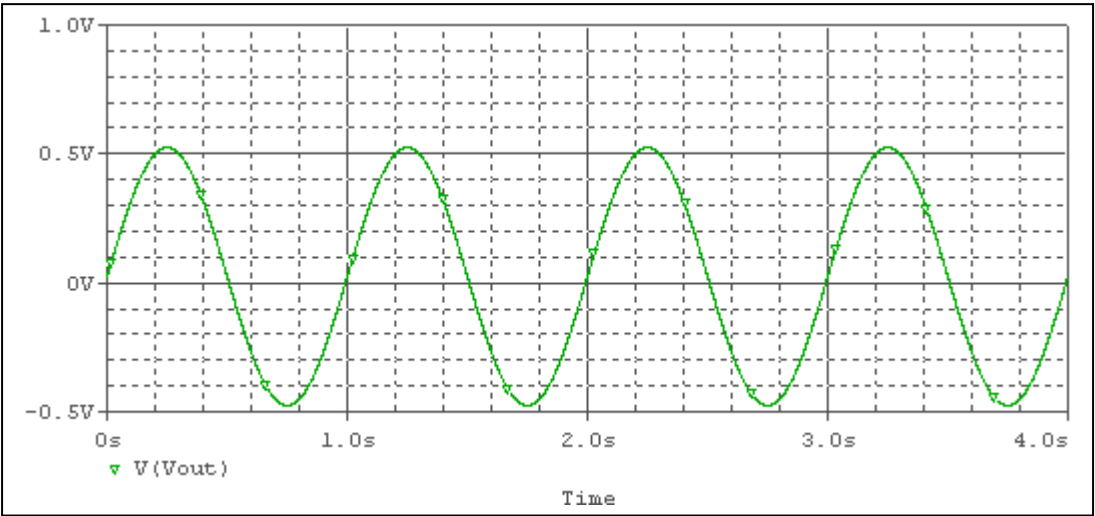
## Evaluation circuit



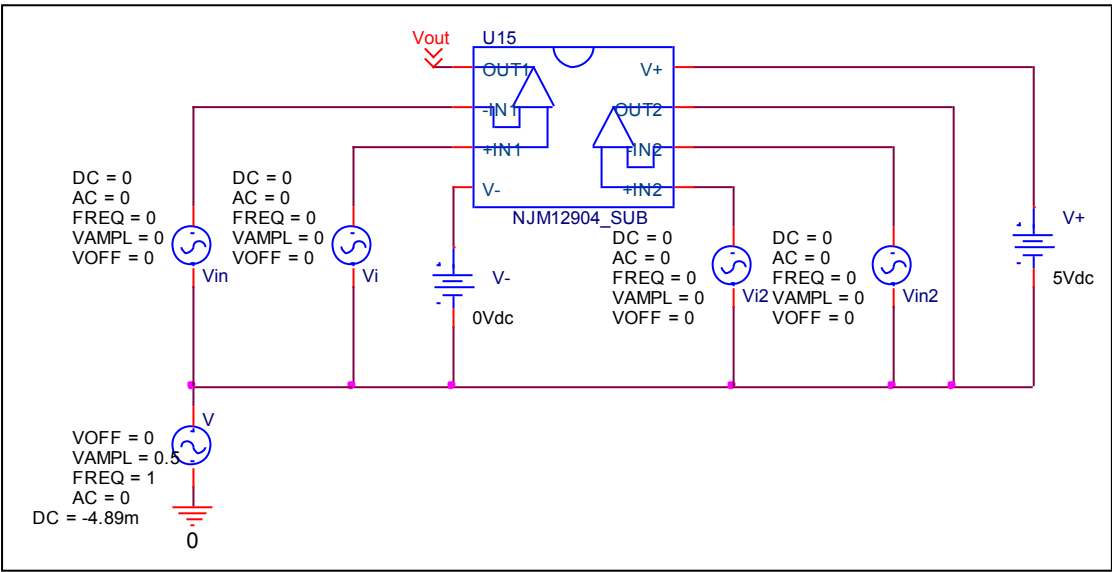
| Short Circuit Current | Data sheet | Simulation | %Error |
|-----------------------|------------|------------|--------|
|                       | 30mA       | 30.09mA    | 0.3    |

# Common-Mode Rejection Voltage gain

## Simulation result



## valuation circuit



Common mode gain=3.162/1  
Common Mode Reject Ratio=98798/3.162=31245

| CMRR(dB) | Data sheet | Simulation | %Error |
|----------|------------|------------|--------|
|          | 90         | 89.89      | 0.122  |