CMOS Analog Circuits (Batch 1) for SmartSpice and Gateway

Robert Villanueva

SILVACO

Status and Information

Current:

- Limited test circuit topologies
- No CMOS analog circuit examples for SmartSpice
- Most test circuit are designed using BJT technology

New:

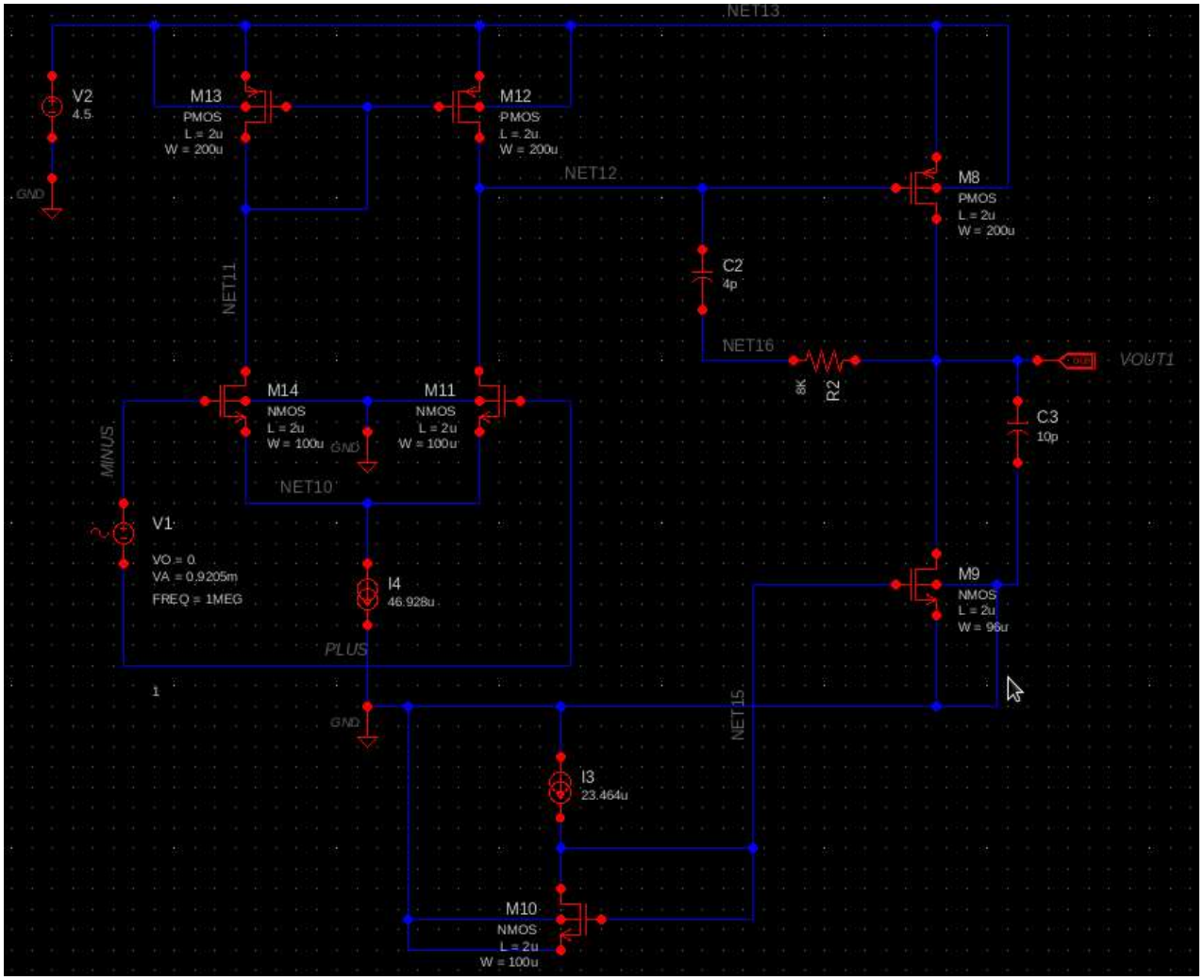
- 10 (Batch 1) Newly designed CMOS analog circuit topologies
- Generic BSIM3v3 nominal 0.18um Device
- Designed using Gateway, SmartSpice and SmartView
- Can be used as sample test circuits for SmartSpice

CIRCUIT 1: Specifications

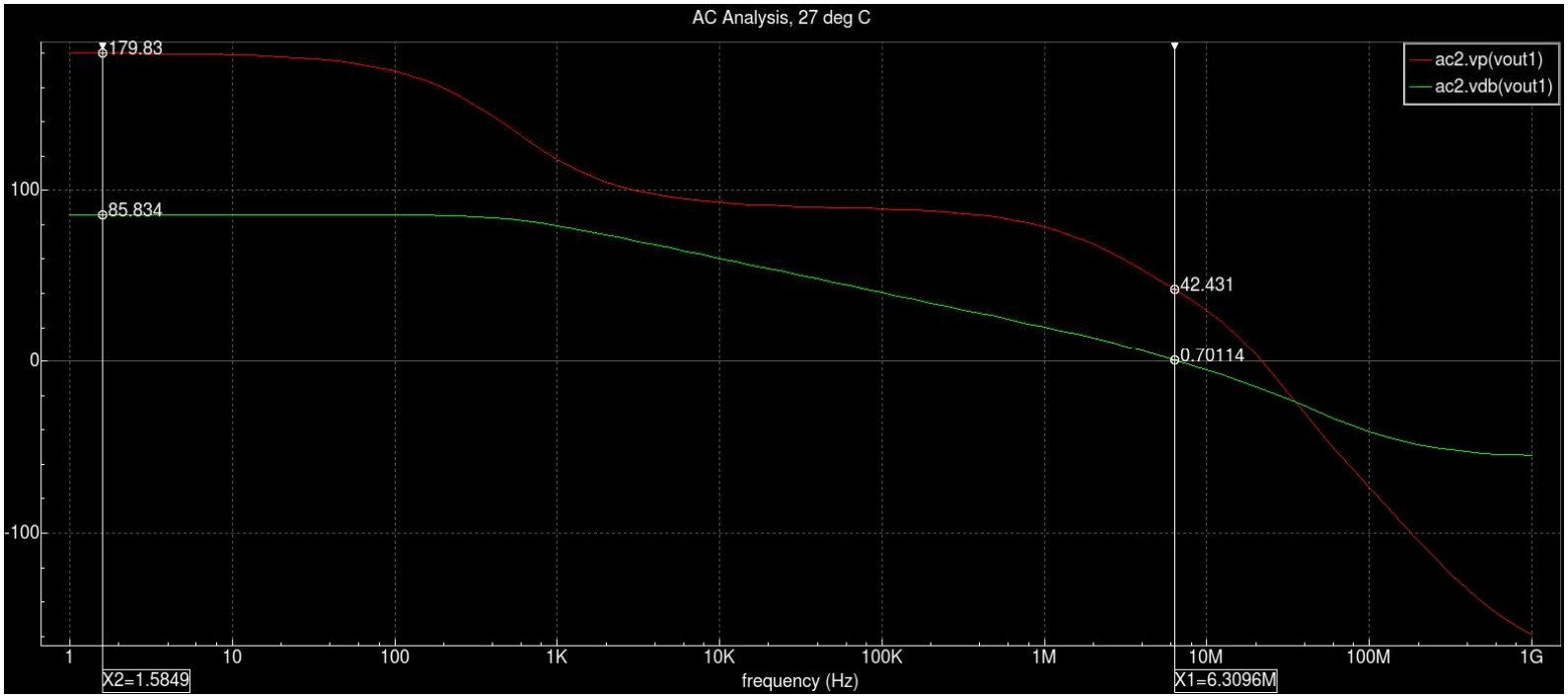
Circuit Type: **Basic Two-Stage Operational Amplifier**

- Av: 85.834 dB
- BW: 6.7 Mhz
- VDD: 4.5 V
- ISS: 46.928 uA
- PM: 40.996 deg
- CL: 10 pF

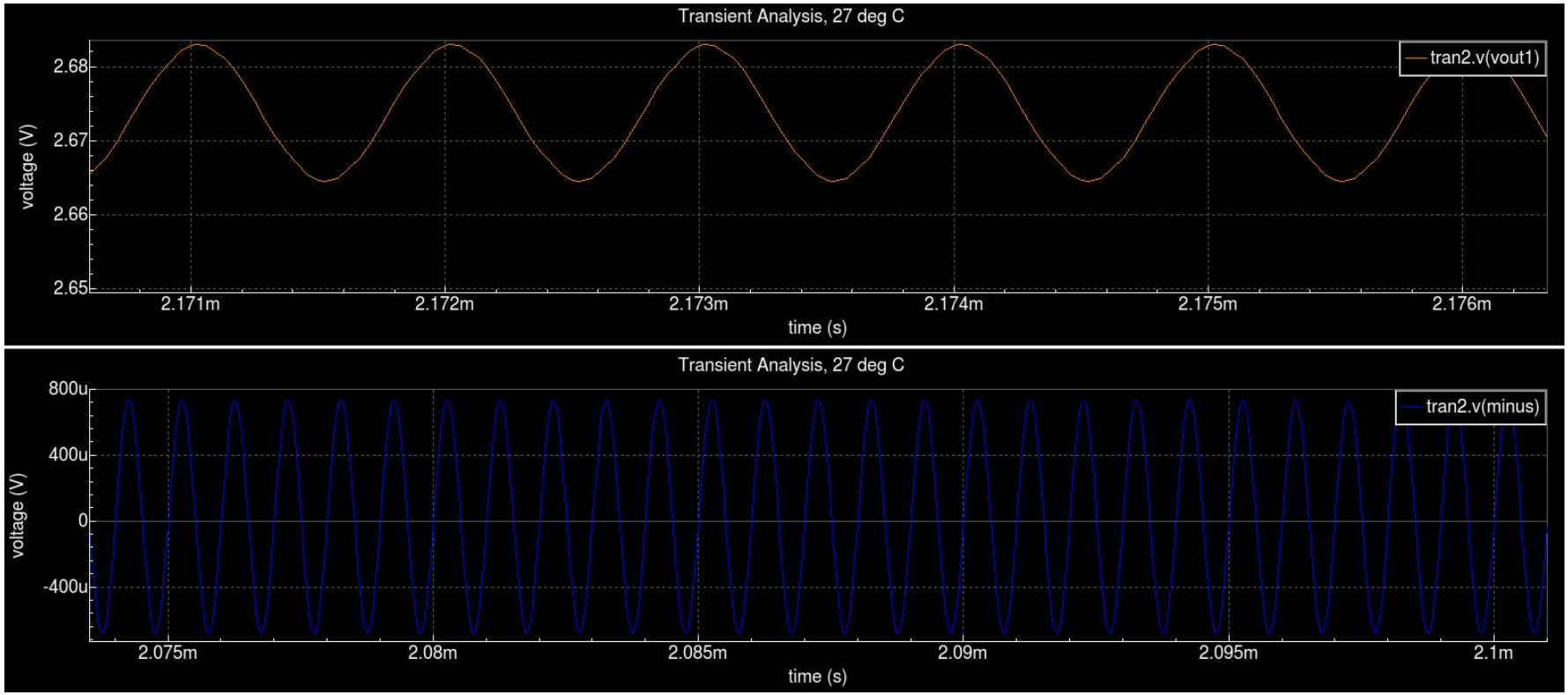
CIRCUIT 1: Circuit Diagram



CIRCUIT 1: Sample Output Response - AC



CIRCUIT 1: Sample Output Response - Transient

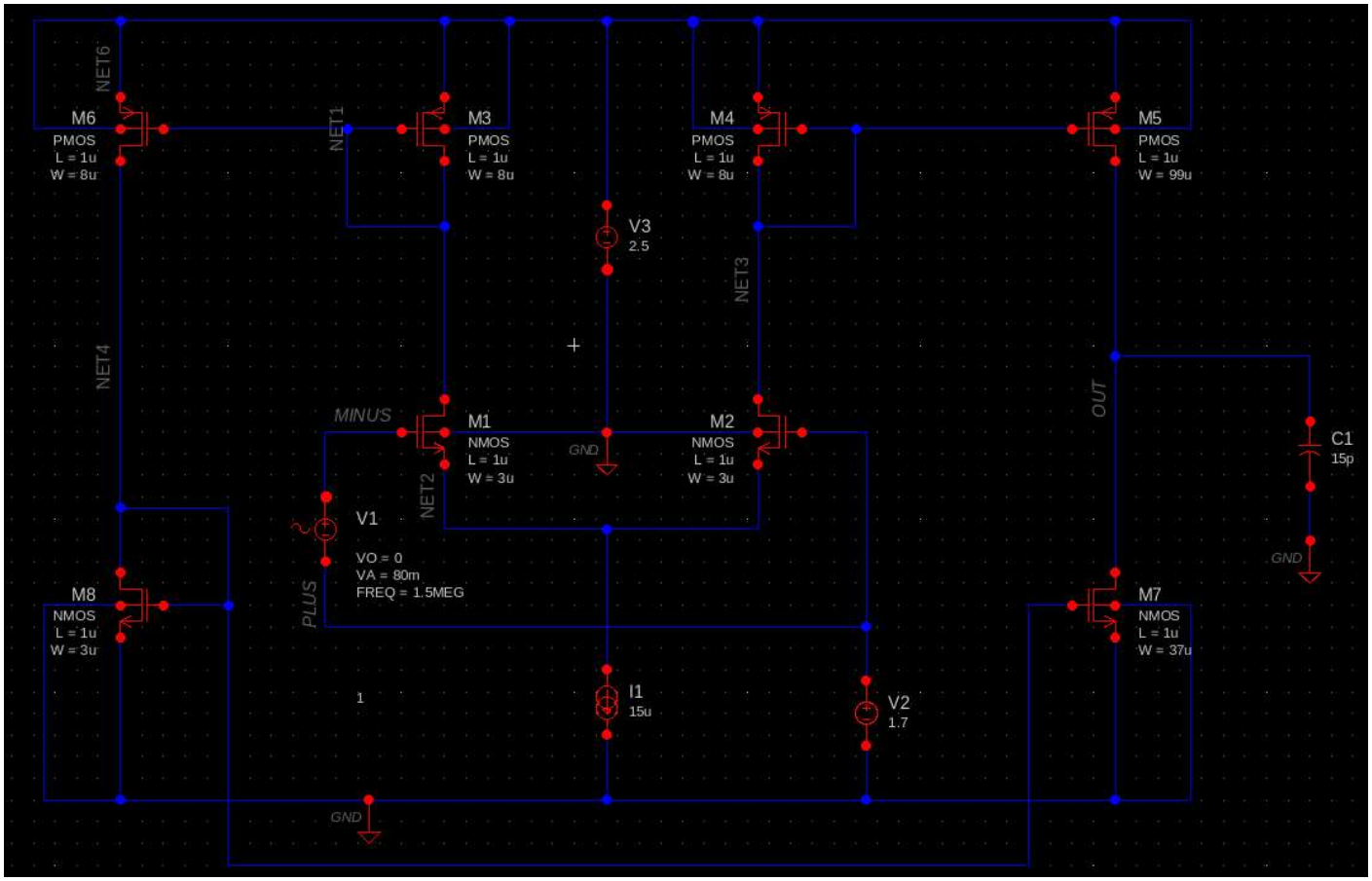


CIRCUIT 2: Specifications

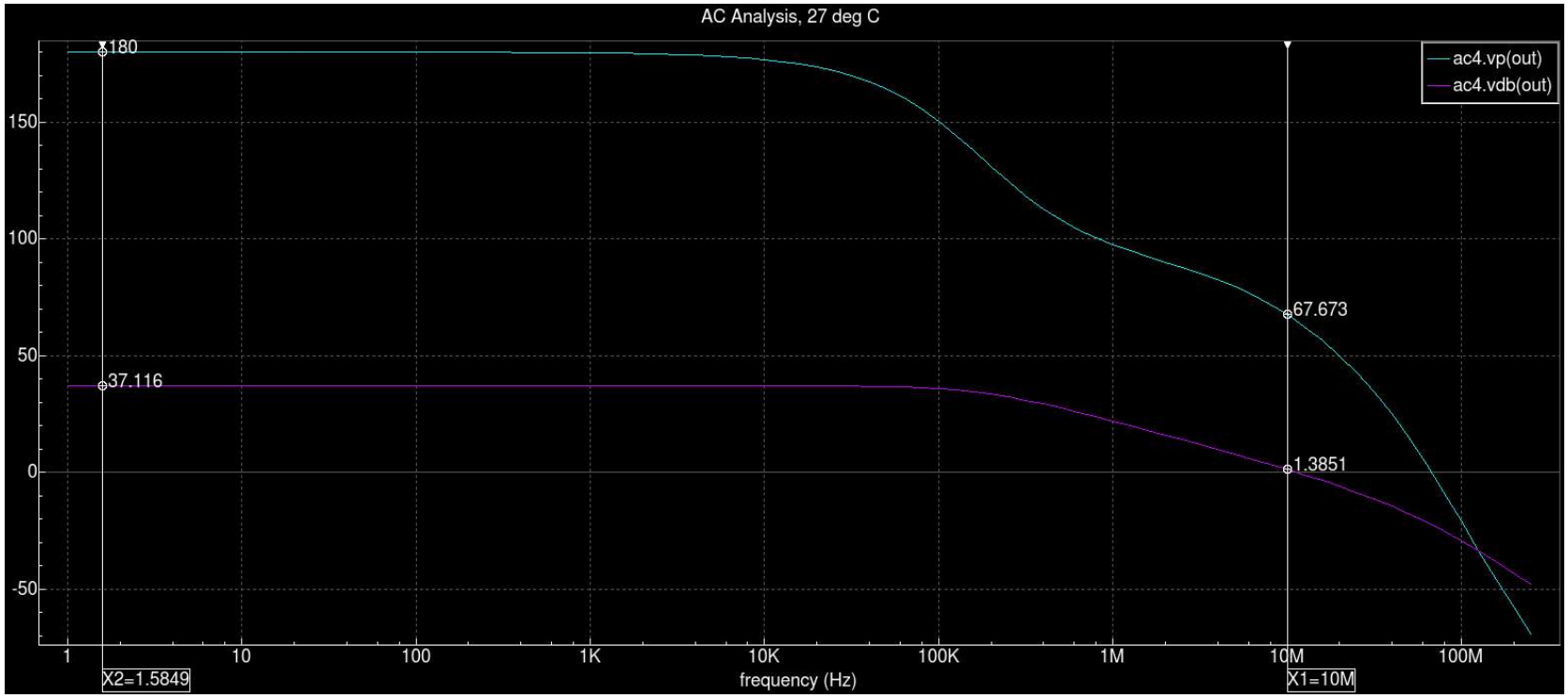
Circuit Type: **Basic Operational Transconductance Amplifier**

- Av: 37.116 dB
- BW: 11.538 Mhz
- VDD: 2.5 V
- ISS: 15 uA
- PM: 64.588 deg
- CL: 15 pF

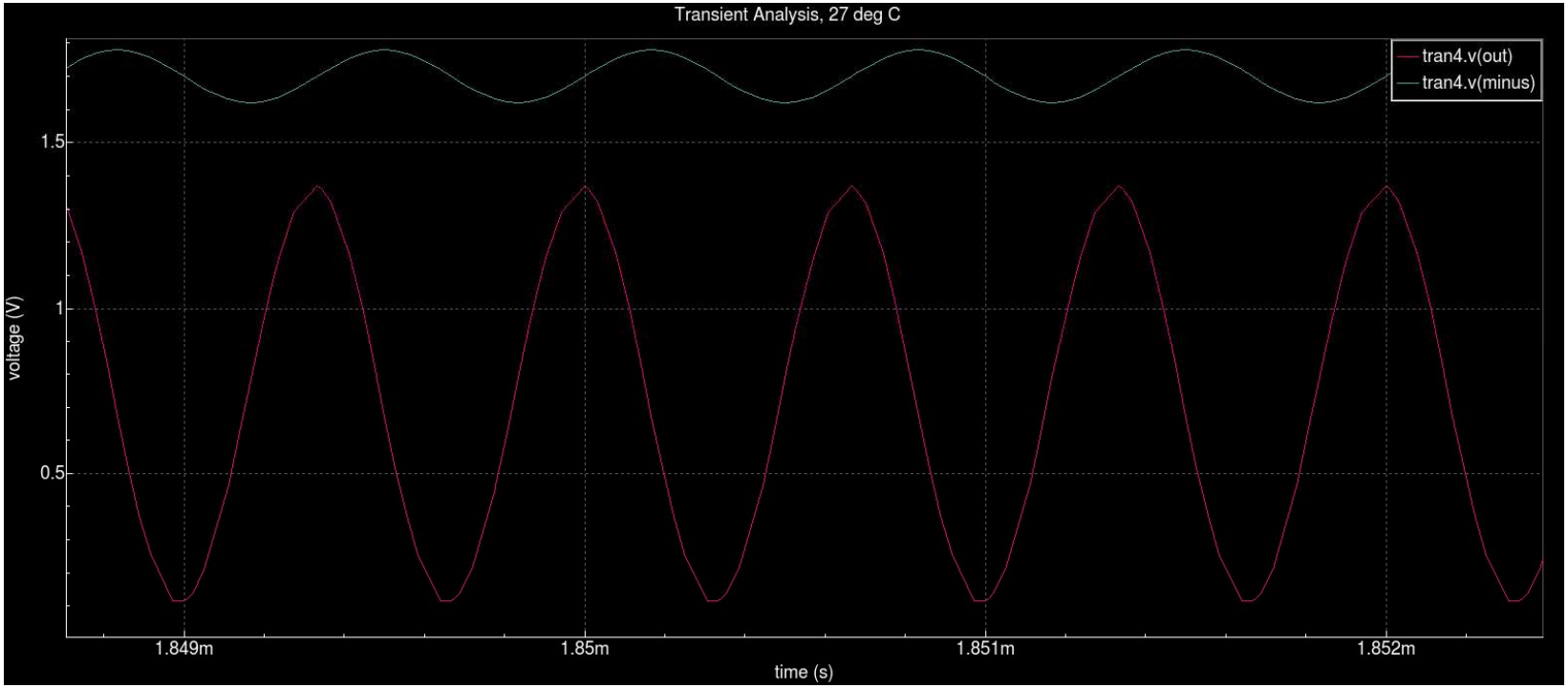
CIRCUIT 2: Circuit Diagram



CIRCUIT 2: Sample Output Response - AC



CIRCUIT 2: Sample Output Response - Transient

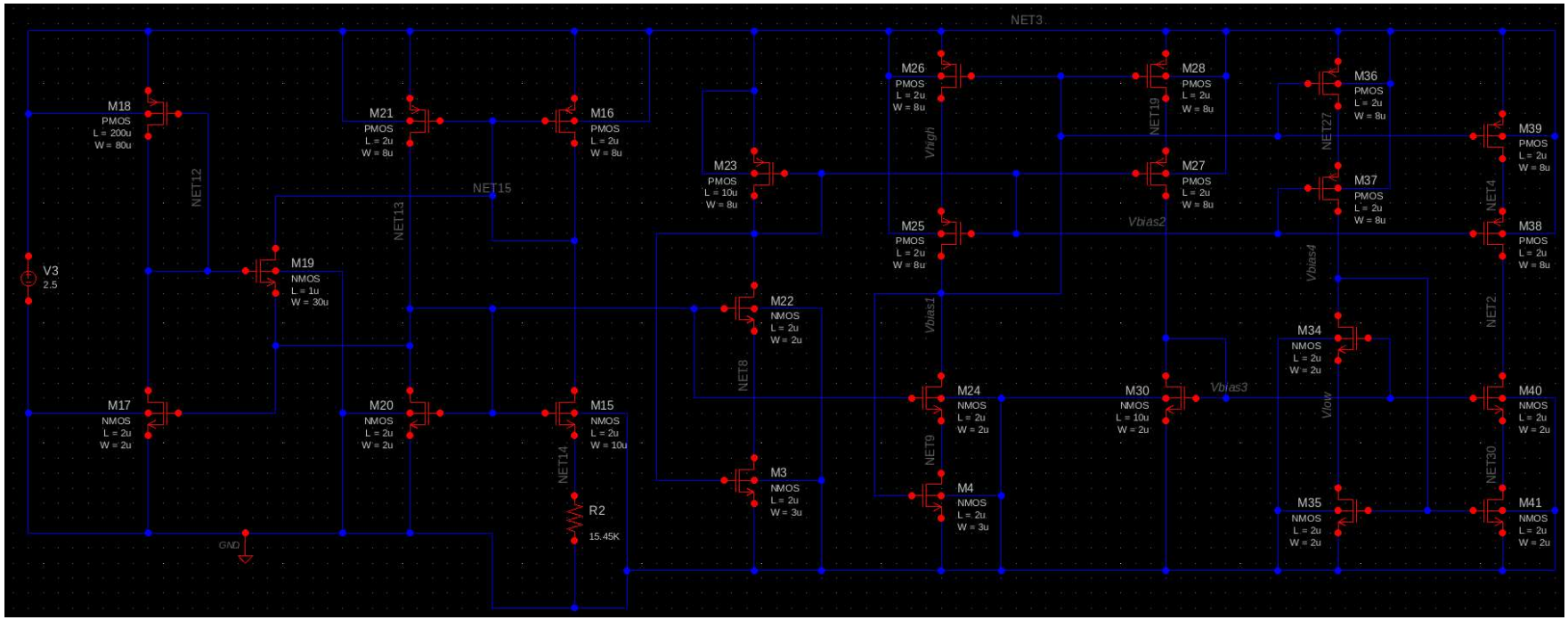


CIRCUIT 3: Specifications

Circuit Type: **Bias Circuit**

- VDD: 2.5 V
- Vbias1: 1.8278 V
- Vbias2: 1.4818 V
- Vbias3: 1.0022 V
- Vbias4: 0.67058 V
- Analysis: Operating Point

CIRCUIT 3: Circuit Diagram



CIRCUIT 3: Sample Simulation Output

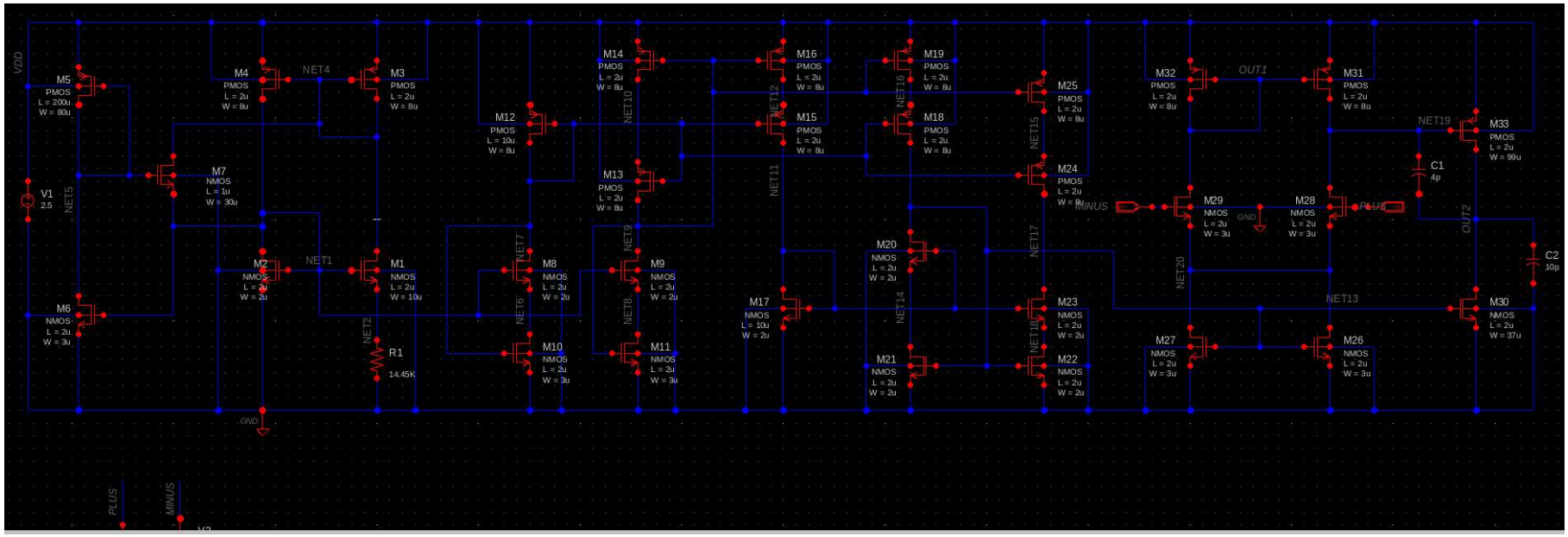
```
--------------------------------------------------------------------------------

Index     v(vbias1)       v(vbias2)       v(vbias3)       v(vbias4)
--------------------------------------------------------------------------------
0         1.8278e+00      1.4818e+00      1.0022e+00      6.7058e-01
***** Operating point information. Tnom = 27, Temp = 27.
***** Operating point status is 'all'.
     node = voltage          node = voltage          node = voltage

+ 0:net3   =  2.5000e+00  0:net15 =  1.8274e+00  0:net13 =  6.8087e-01
+ 0:net14  =  1.3734e-01  0:net12 =  1.1165e+00  0:vbias2 =  1.4818e+00
+ 0:net8   =  1.9412e-02  0:vbias1 =  1.8278e+00  0:net9  =  1.6943e-02
+ 0:vhigh  =  2.2333e+00  0:vbias3 =  1.0022e+00  0:net19 =  2.2286e+00
+ 0:vbias4 =  6.7058e-01  0:vlow   =  2.6635e-01  0:net27 =  2.2270e+00
+ 0:net2   =  6.7058e-01  0:net4   =  2.2270e+00  0:net30 =  2.6635e-01
```

CIRCUIT 4: Specifications

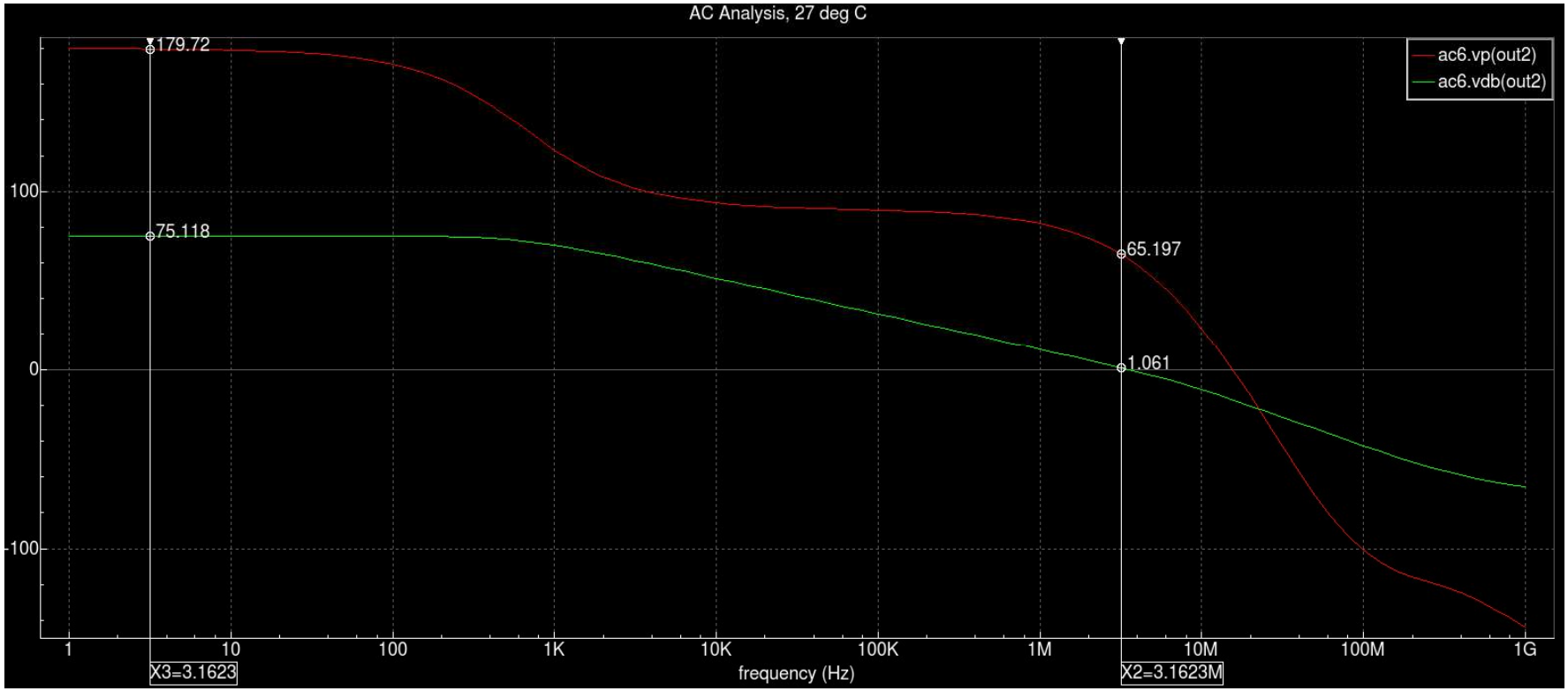
Circuit Type: **Two-Stage Operational Amplifier with BIAS circuit**

- Av: 75.118 dB
- BW: 3.554 Mhz
- VDD: 2.5 V
- ISS: 28.26 uA
- PM: 62.332 deg
- CL: 10 pF

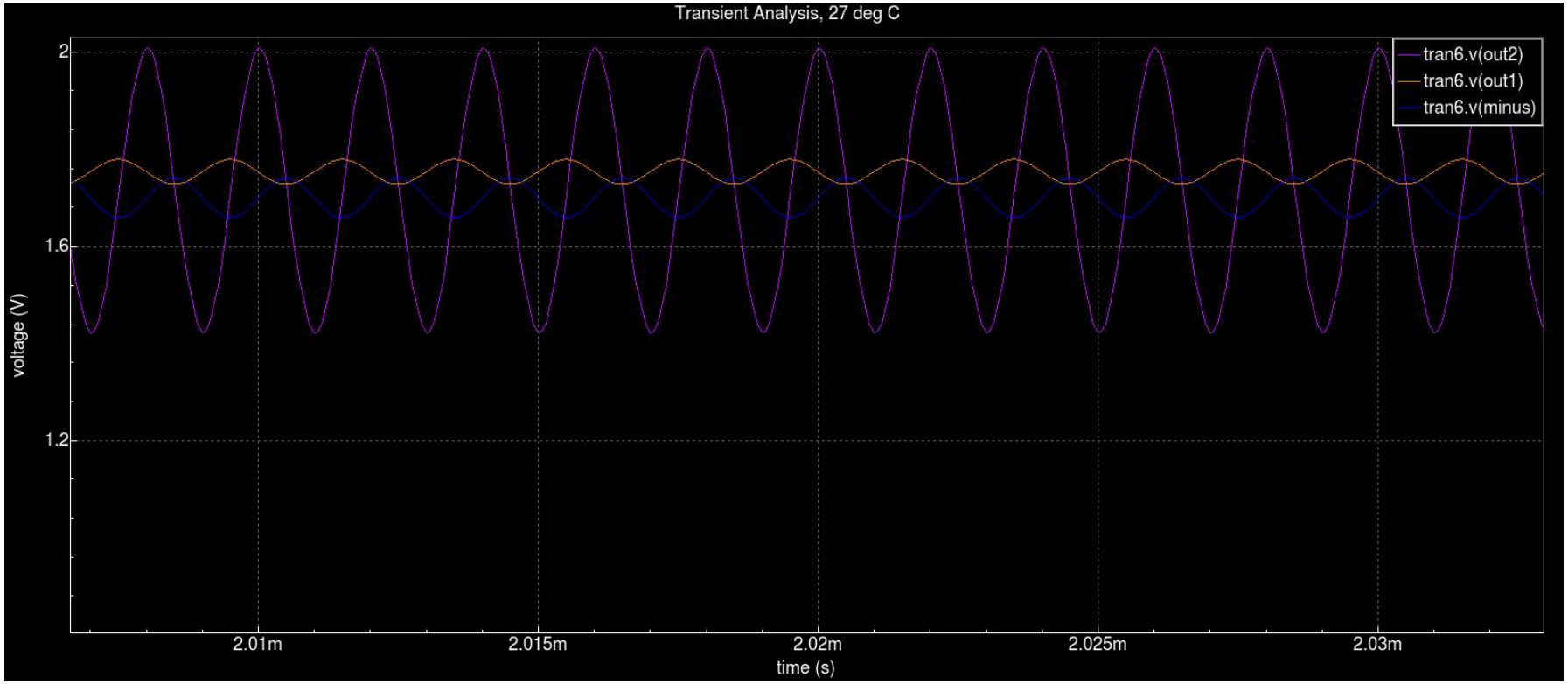
CIRCUIT 4: Circuit Diagram



CIRCUIT 4: Sample Output Response - AC



CIRCUIT 4: Sample Output Response -Transient

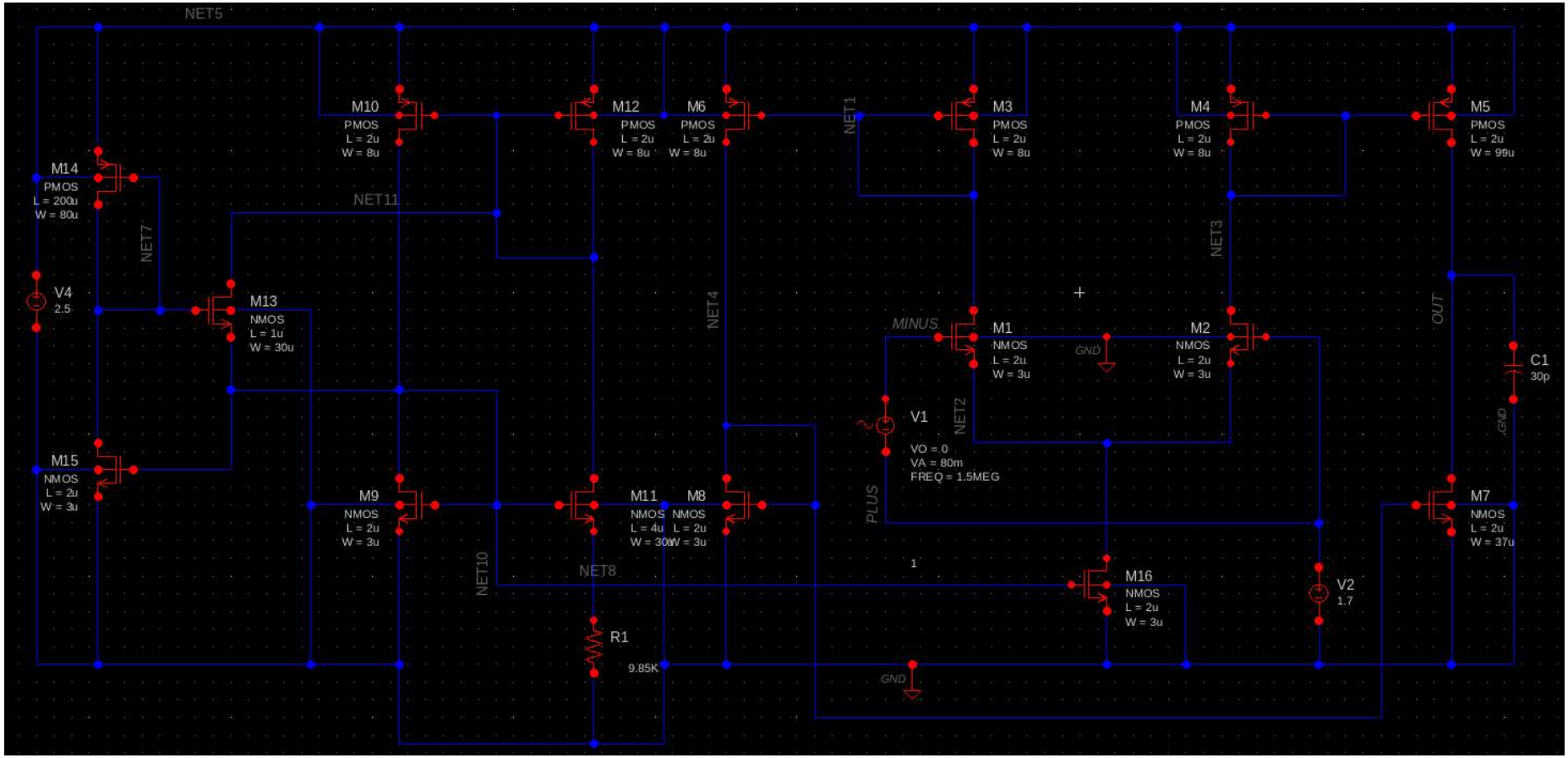


CIRCUIT 5: Specifications

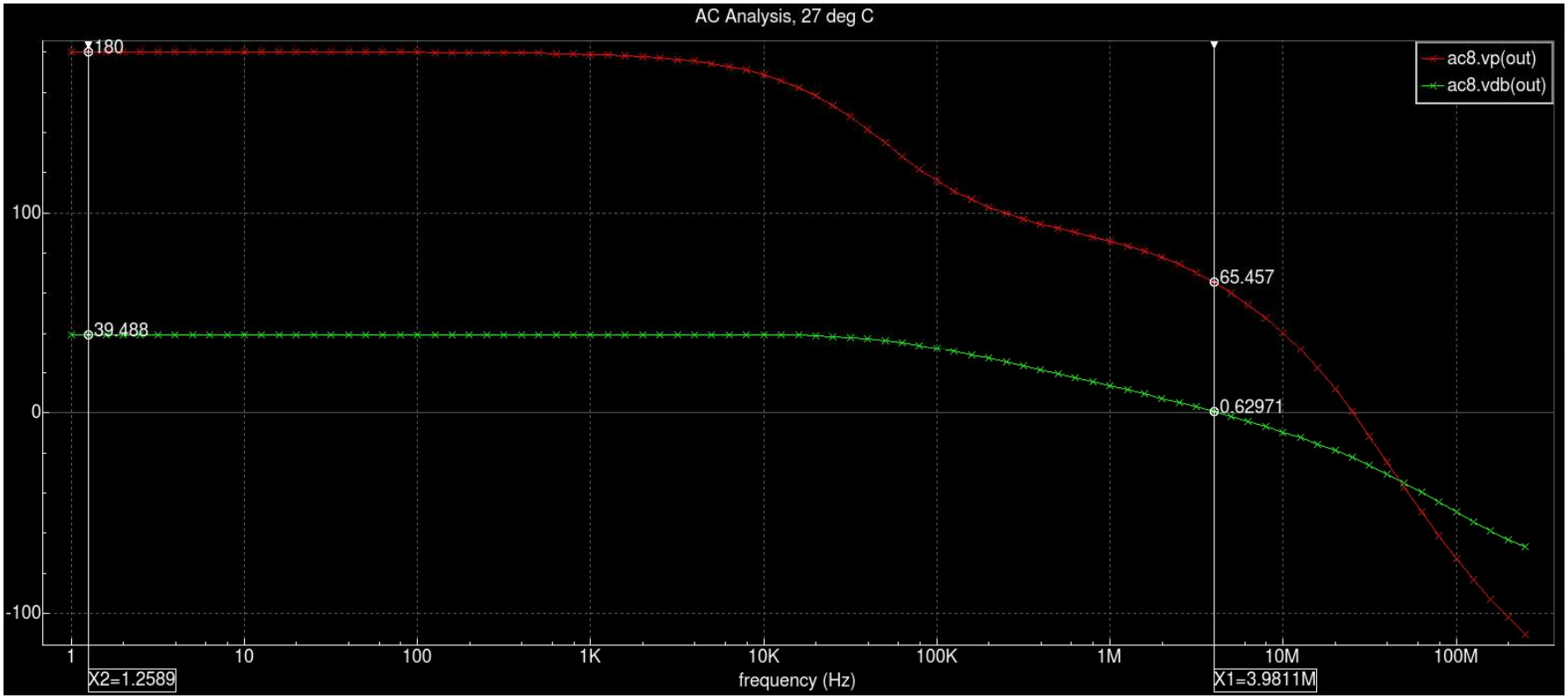
Circuit Type: **Operational Transconductance Amplifier with BIAS circuit**

- Av: 39.488 dB
- BW: 4.2529 Mhz
- VDD: 2.5 V
- ISS: 15.214 uA
- PM: 64.054 deg
- CL: 30 pF

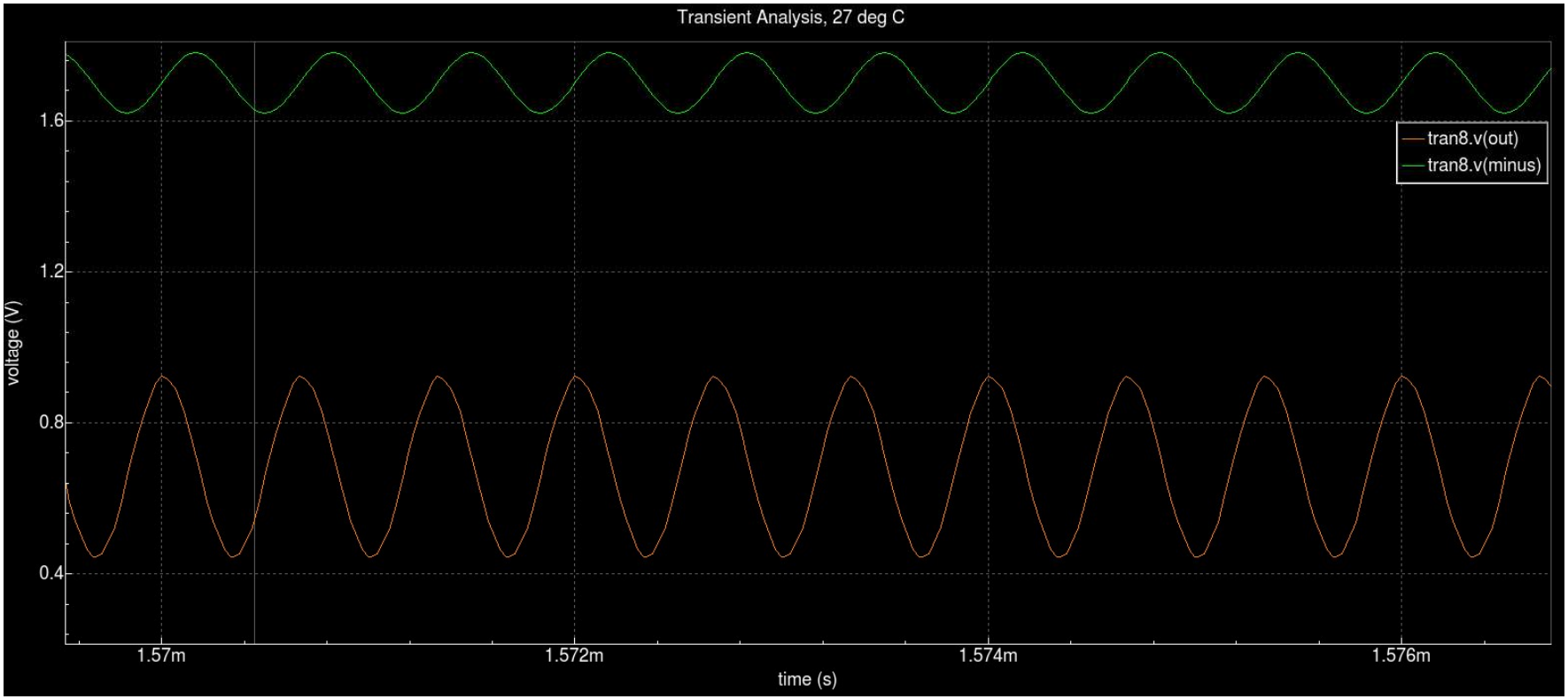
CIRCUIT 5: Circuit Diagram



CIRCUIT 5: Sample Output Response - AC



CIRCUIT 5: Sample Output Response -Transient

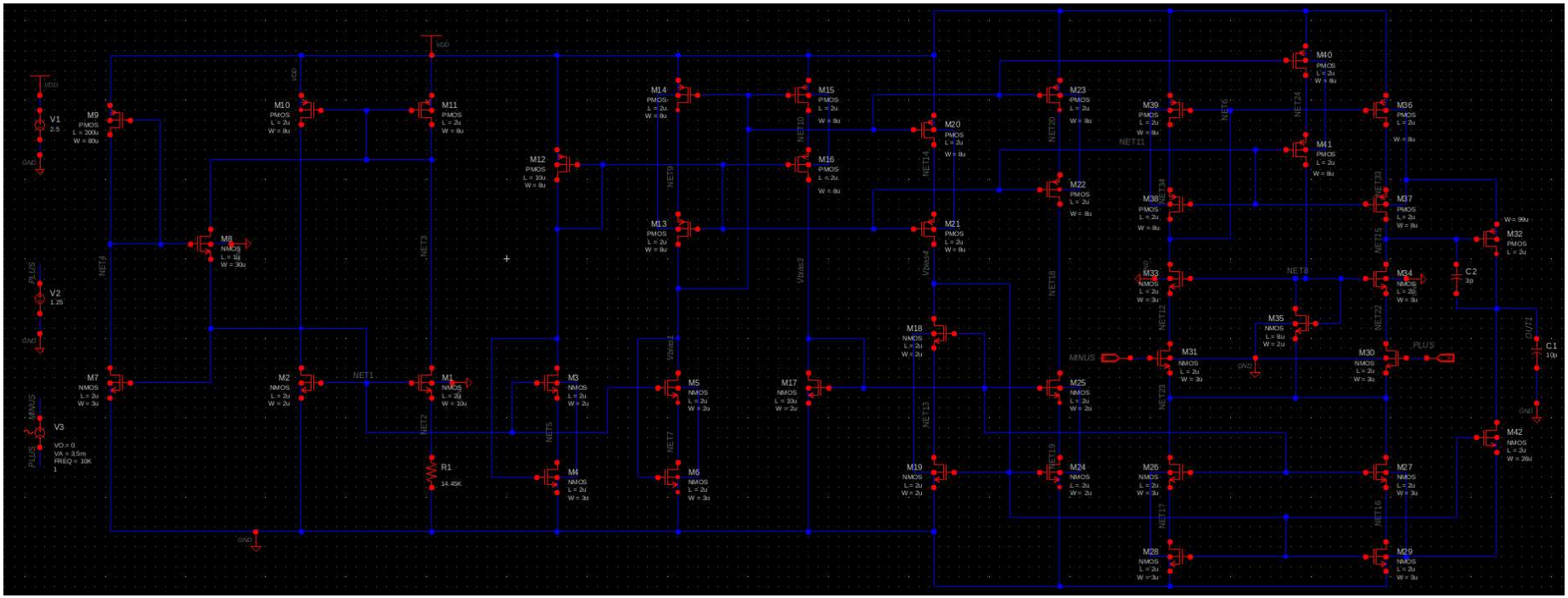


CIRCUIT 6: Specifications

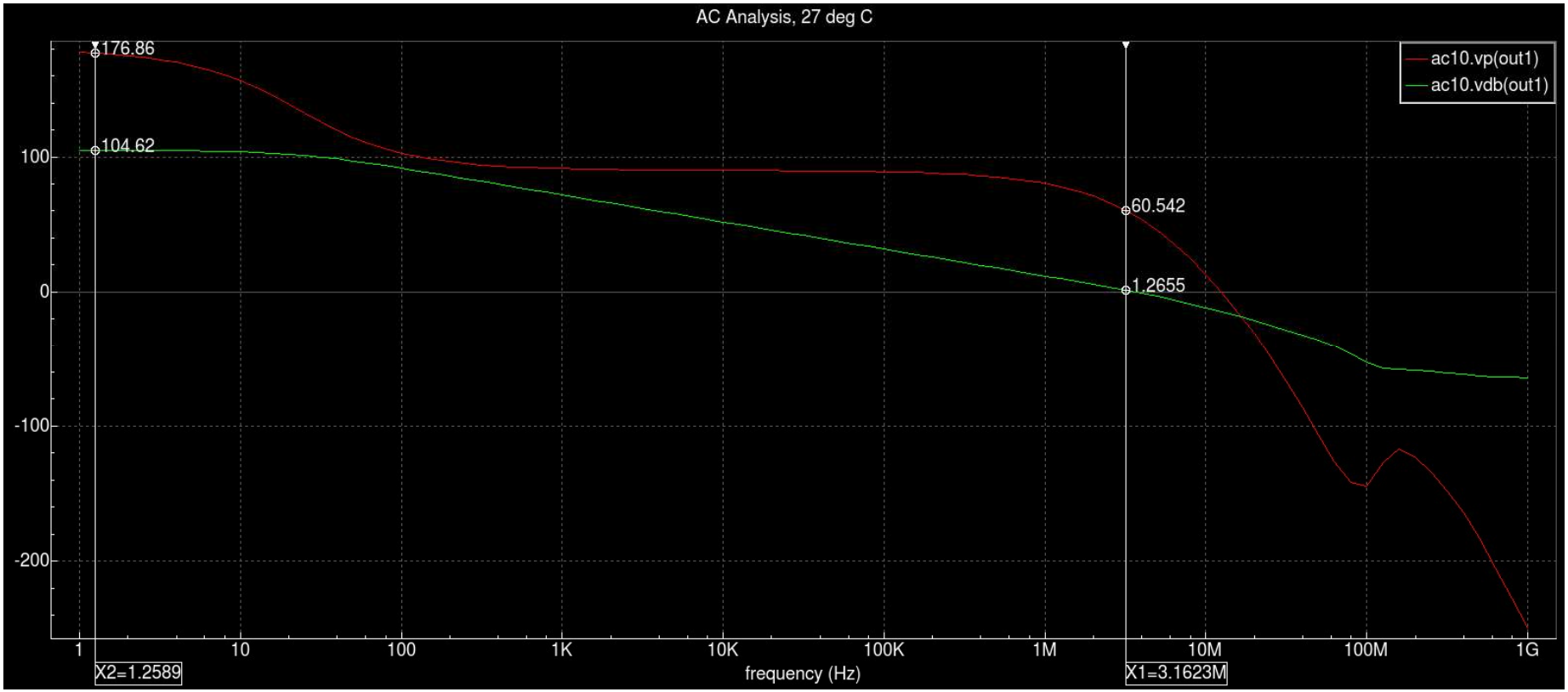
Circuit Type: **Two-Stage Cascode Operational Amplifier with BIAS circuit**

- Av: 104.62 dB
- BW: 3.6141 Mhz
- VDD: 2.5 V
- ISS: 27.192 uA
- PM: 56.712 deg
- CL: 10 pF

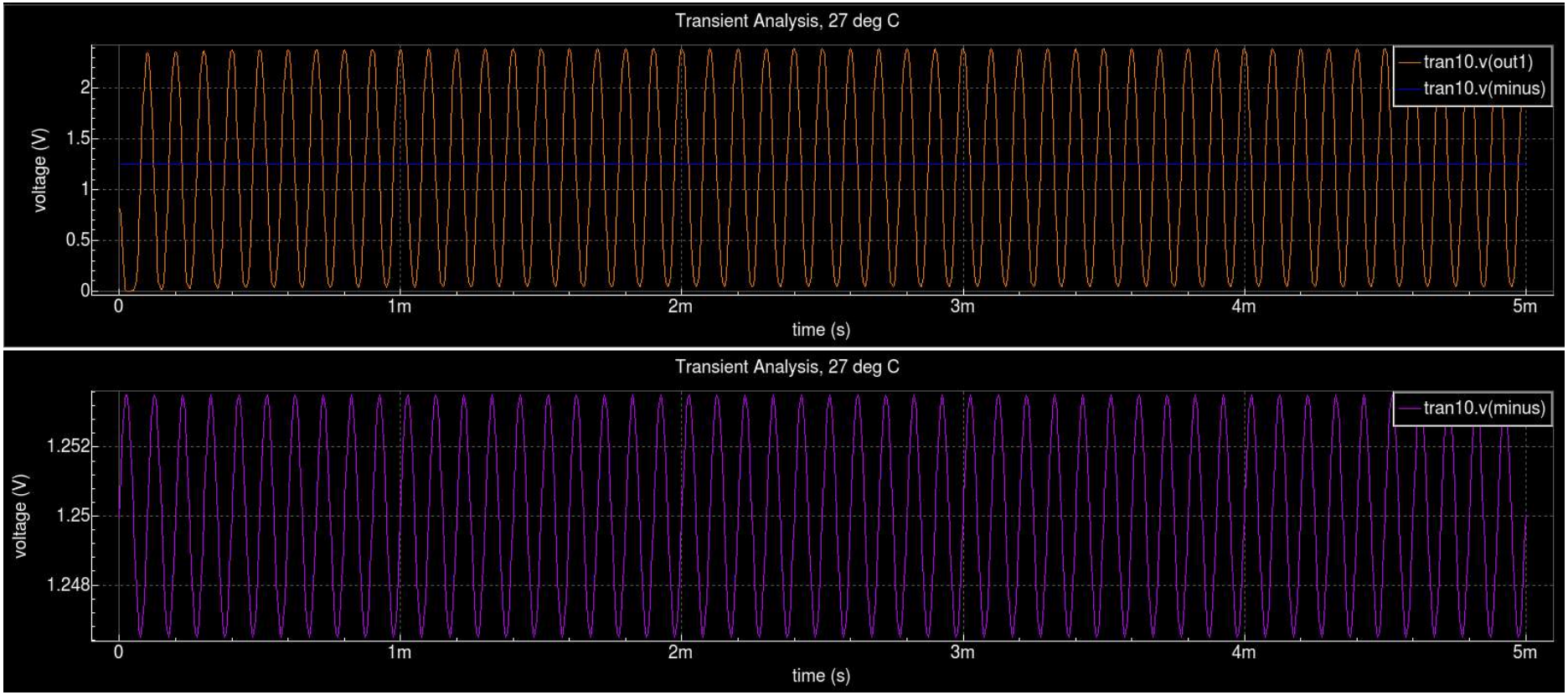
CIRCUIT 6: Circuit Diagram



CIRCUIT 6: Sample Output Response - AC



CIRCUIT 6: Sample Output Response -Transient

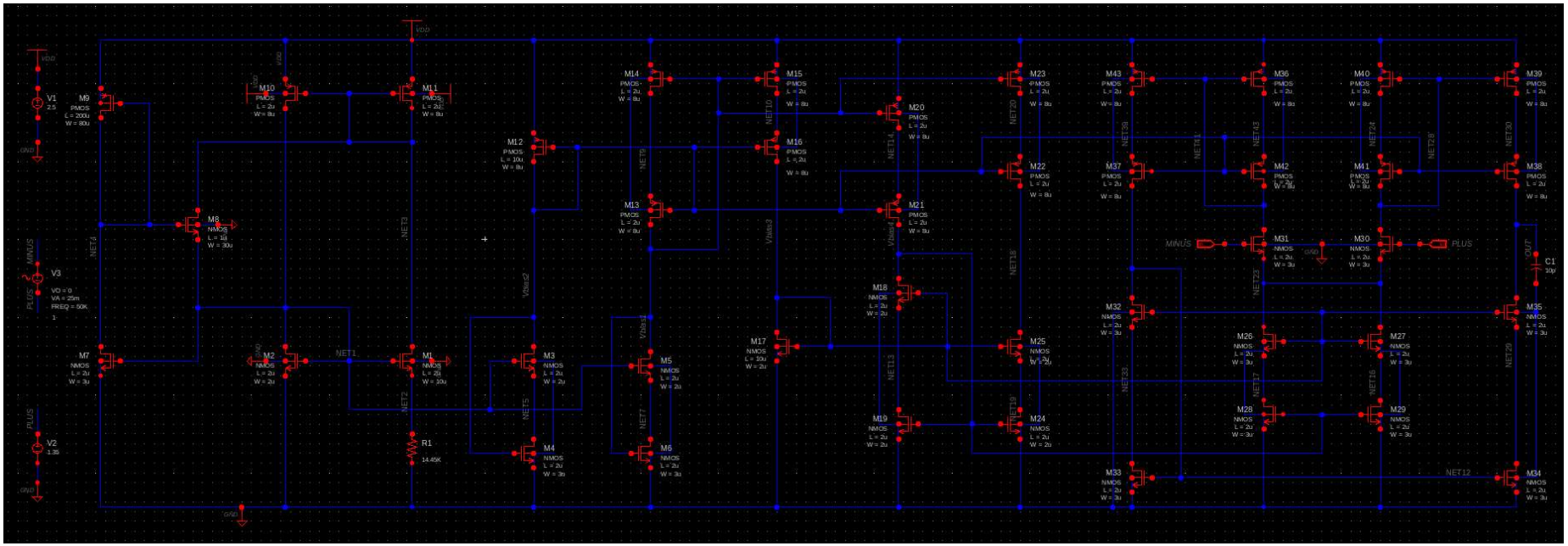


CIRCUIT 7: Specifications

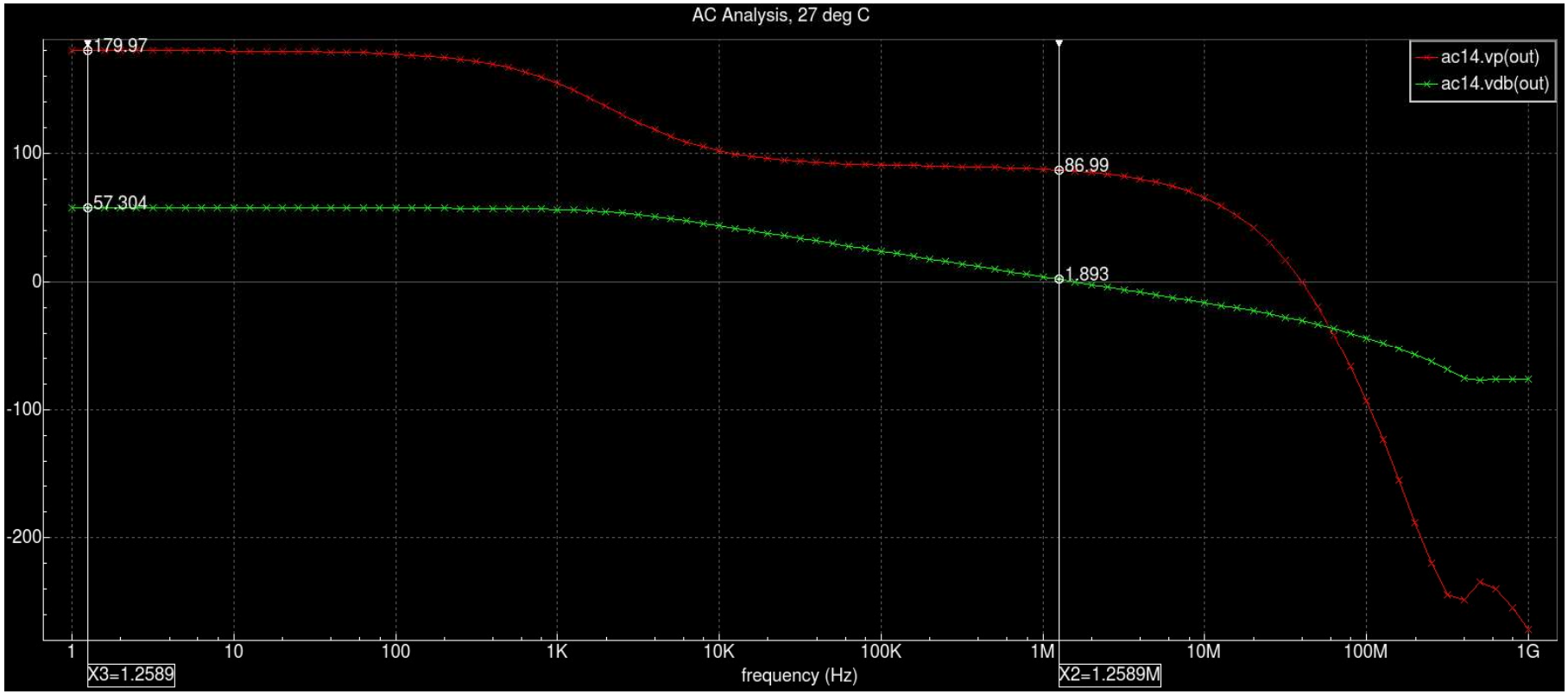
Circuit Type: **Cascode Operational Transconductance with BIAS circuit**

- Av: 57.304 dB
- BW: 1.5671 Mhz
- VDD: 2.5 V
- ISS: 27.21 uA
- PM: 86.21 deg
- CL: 10 pF

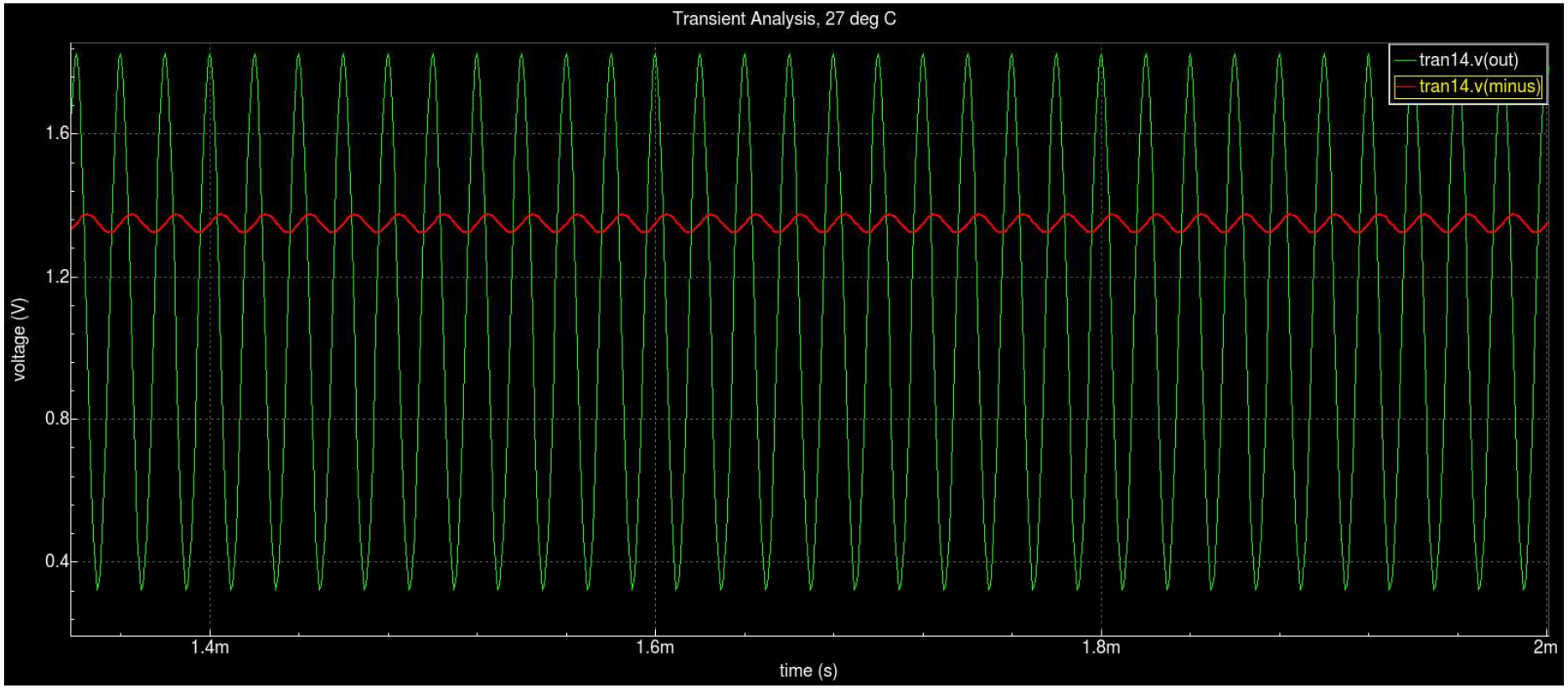
CIRCUIT 7: Circuit Diagram



CIRCUIT 7: Sample Output Response - AC



CIRCUIT 7: Sample Output Response -Transient

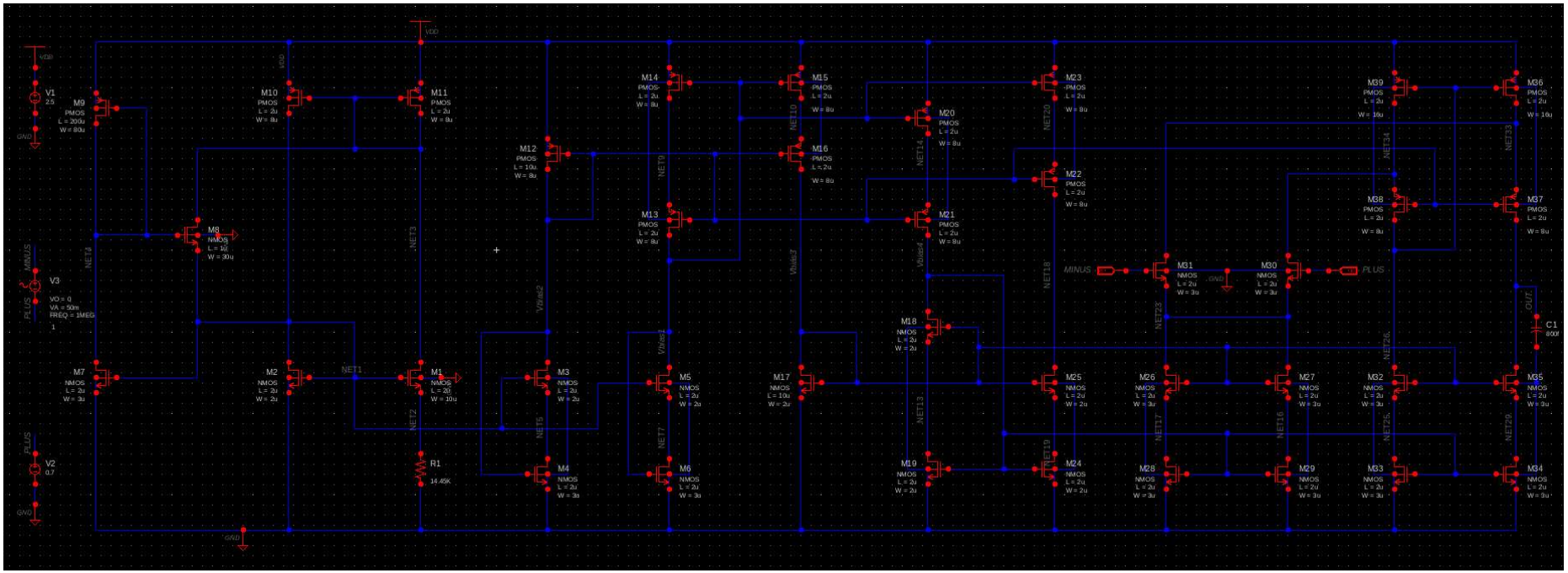


CIRCUIT 8: Specifications

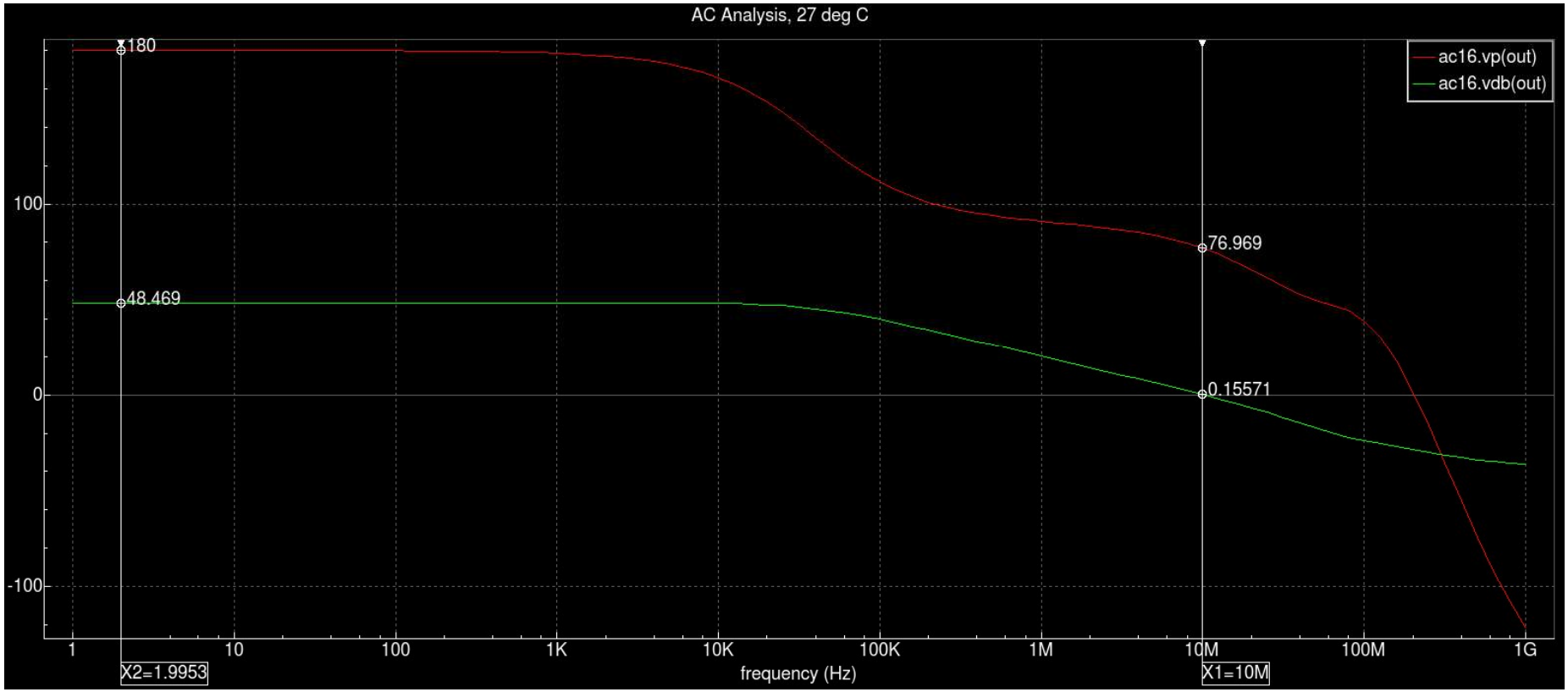
Circuit Type: **Folded Cascode with BIAS circuit**

- Av: 48.469 dB
- BW: 10.185 Mhz
- VDD: 2.5 V
- ISS: 13.3804 uA
- PM: 76.742 deg
- CL: 800 fF

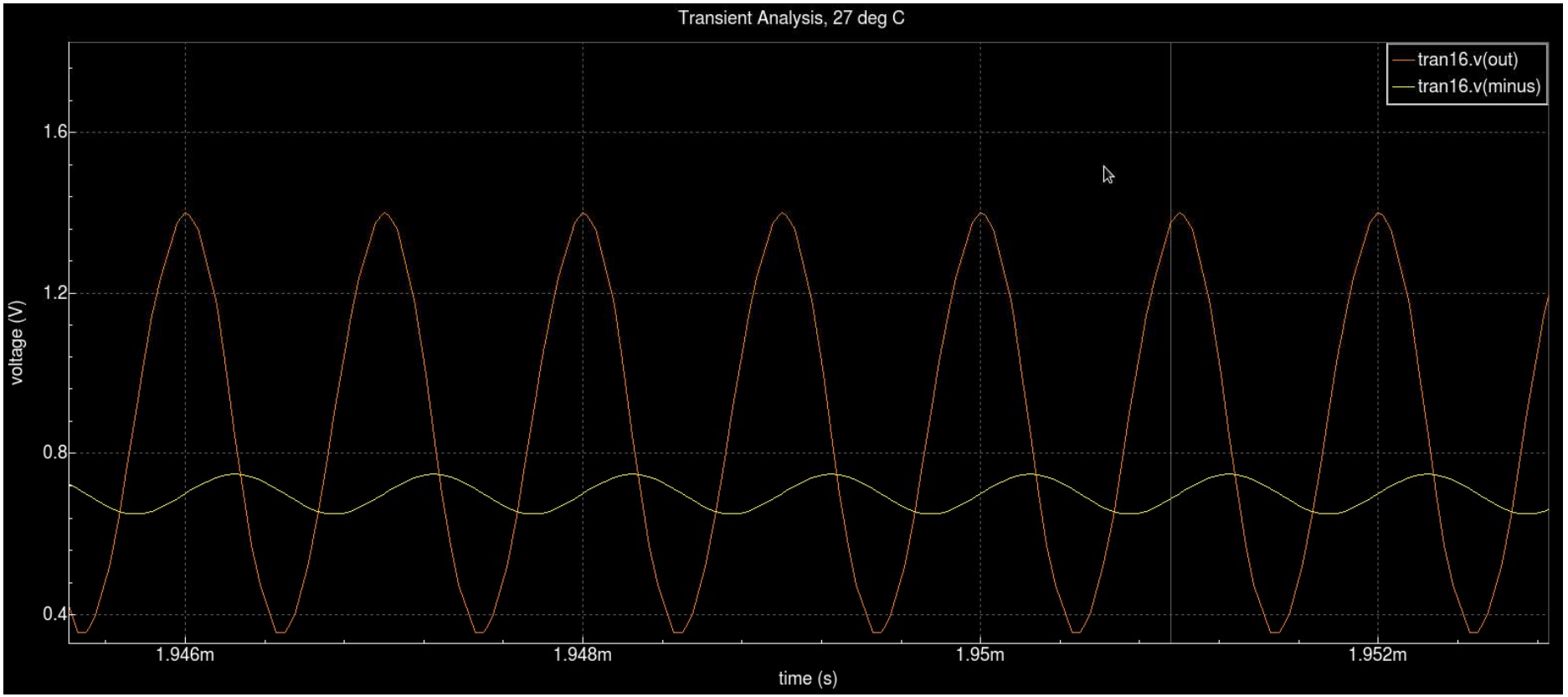
CIRCUIT 8: Circuit Diagram



CIRCUIT 8: Sample Output Response - AC



CIRCUIT 8: Sample Output Response -Transient

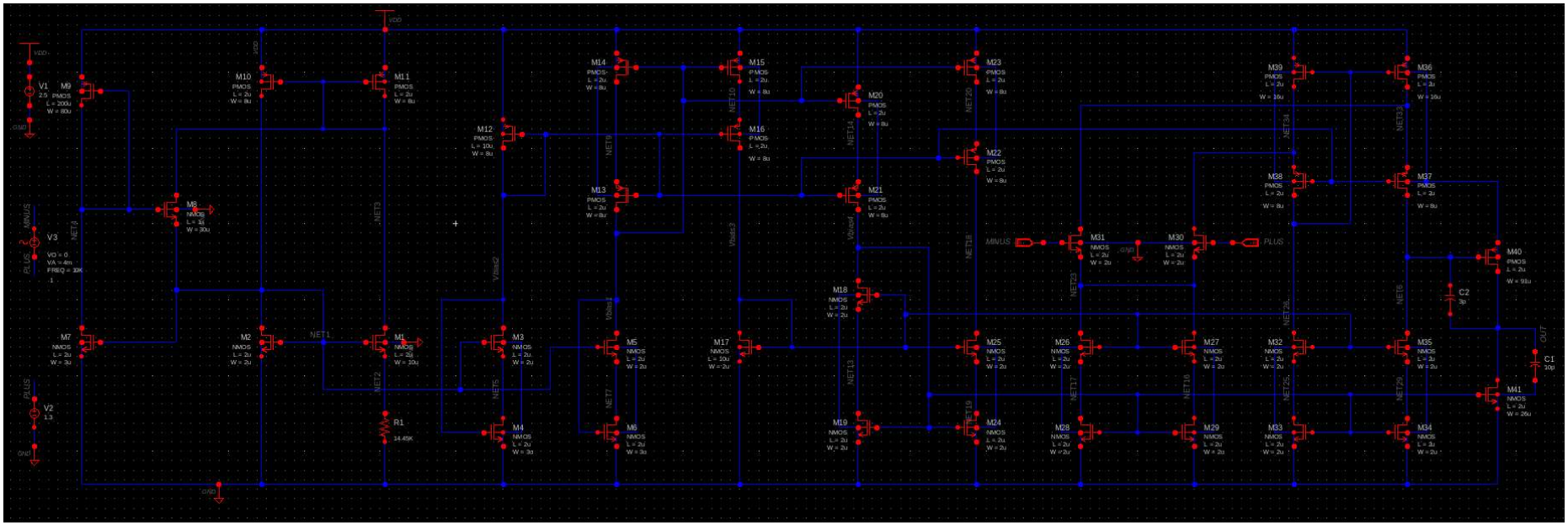


CIRCUIT 9: Specifications

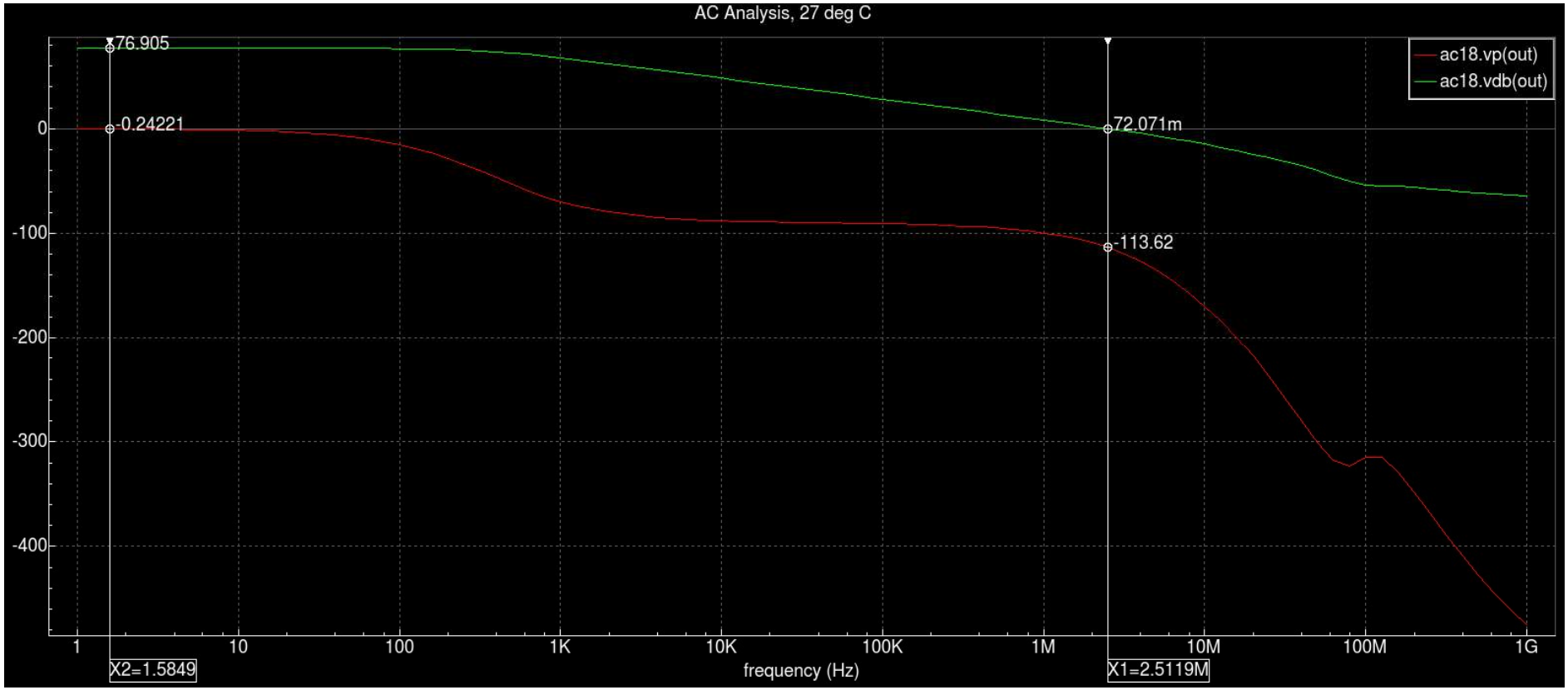
Circuit Type: **Folded Cascode with Push-Pull Output Stage**

- Av: 76.905 dB
- BW: 2.5335 Mhz
- VDD: 2.5 V
- ISS: 18.1356 uA
- PM: 66.19 deg
- CL: 10 pF

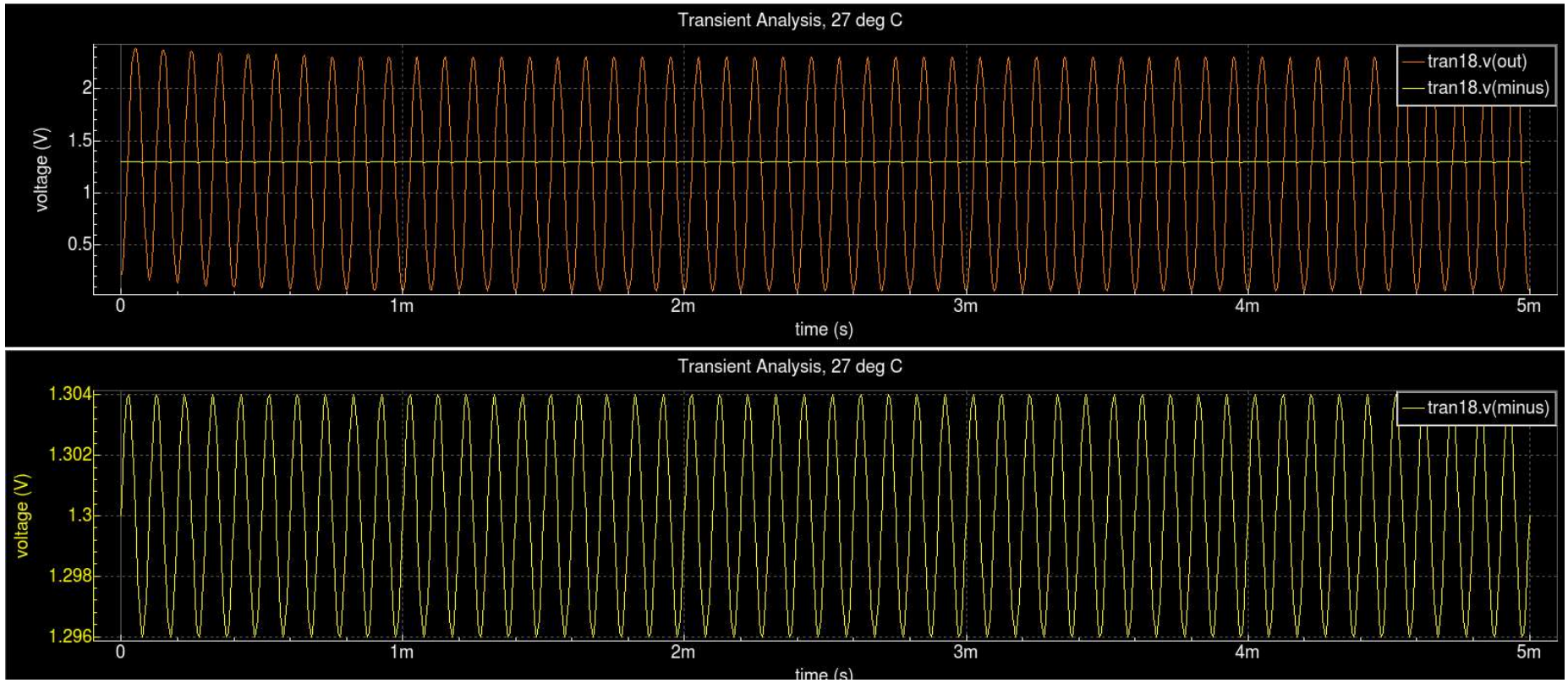
CIRCUIT 9: Circuit Diagram



CIRCUIT 9: Sample Output Response - AC



CIRCUIT 9: Sample Output Response -Transient

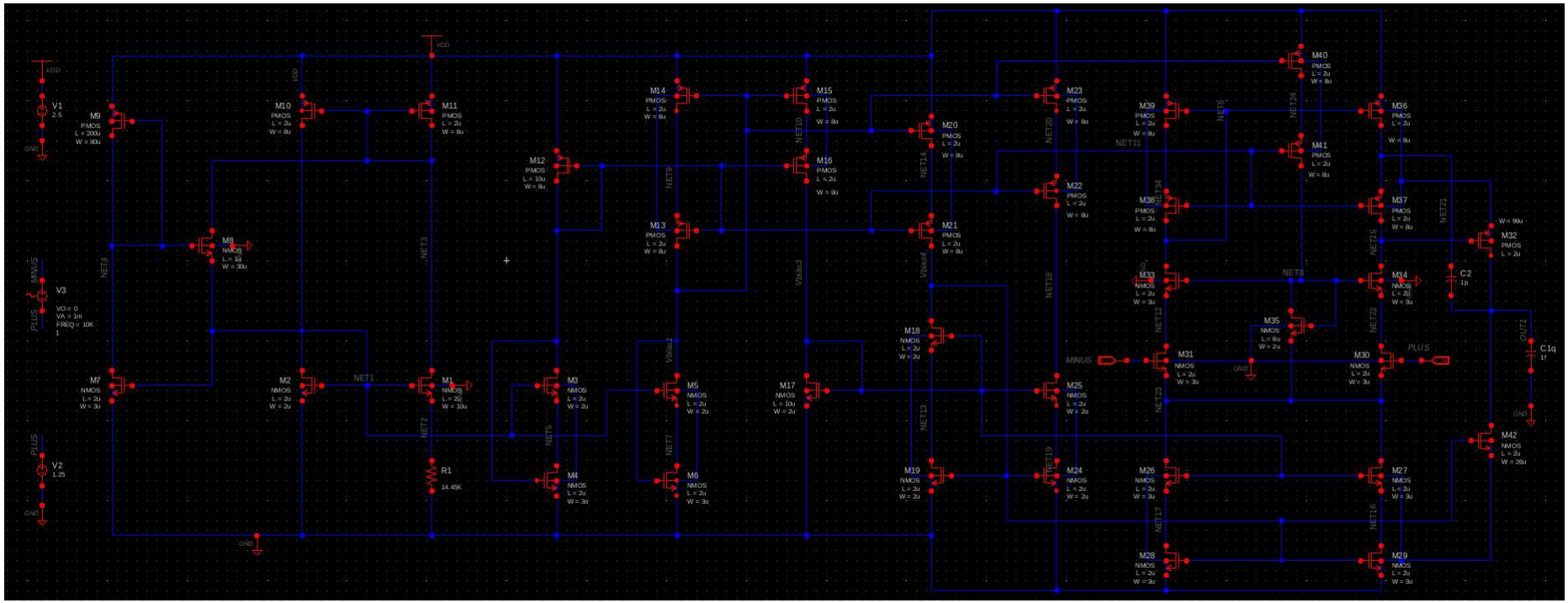


CIRCUIT 10: Specifications

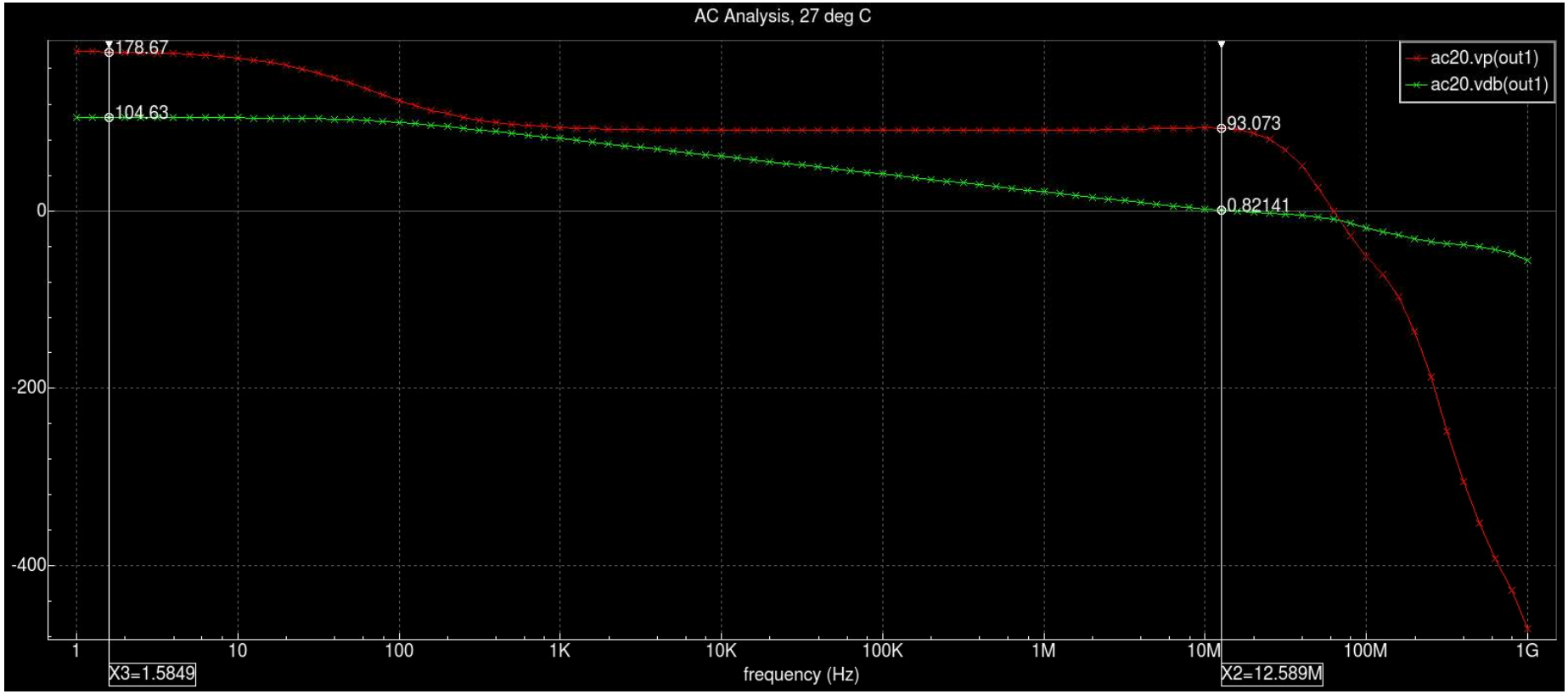
Circuit Type: **Two-Stage Cascode OPAMP with Indirect Compensation**

- Av: 104.63 dB
- BW: 14.658 Mhz
- VDD: 2.5 V
- ISS: 27.192 uA
- PM: 91.946 deg
- CL: 1 fF

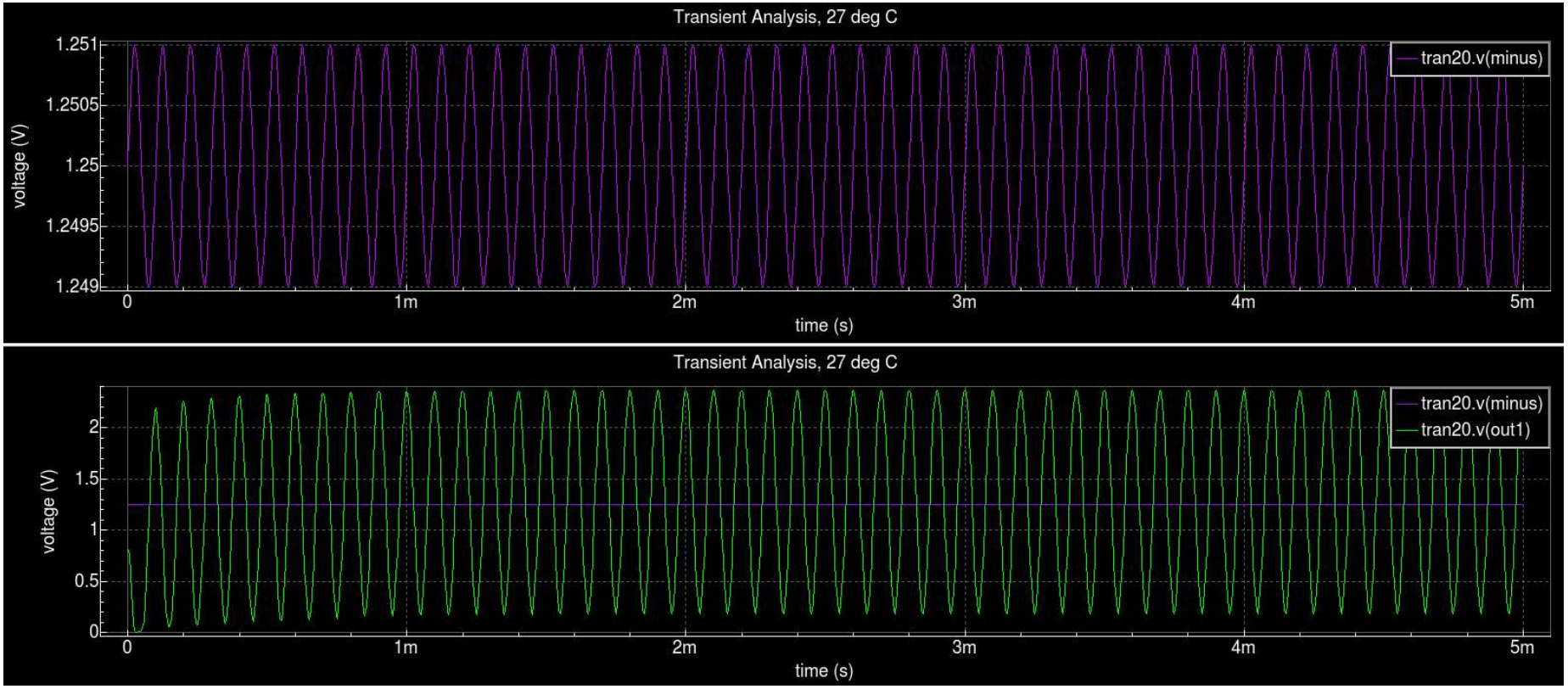
CIRCUIT 10: Circuit Diagram



CIRCUIT 10: Sample Output Response - AC



CIRCUIT 9: Sample Output Response -Transient



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