Yuying Lai 400268588

3EJ4 Lab2

**Q1**

In 1.2, Vomin = -3V, Io = 0.185mA, Ro is about 7.6E+07ohm

In 1.10, Vomin = -3.3V, Io = 0.175mA, Ro is about 3E+04ohm

**Q2**

The value is Vo1 = 4.94V when Vsig is 4.39V. The npn BJT is at cut off state, and there is close to no current through the BJT, so the output voltage will close to VCC.

Vo2 = -3.58V when Vsig is 4.41V. The pnp BJT is at cut off state, and there is close to no current through the BJT. The output voltage will be the voltage between R1 and R2 which act like a voltage divider.

In this module, Vo1 and Vo2 will be the min and max output voltage,

**Q3**

图表, 折线图

描述已自动生成

1. Like what is mentioned in Q2, when one of the BJT is cut off, the voltage will at either max or min. Between the range of input 4.4005 and 4.4025V, both BJT conduct, and the voltage can be somewhere between the min and max. In this range the circuit can work as an amplifier.
2. Input range 4.005V to 4.4025V, output range 4.94V to -3.58V.
3. Vsig = 4.4018V, Ic2 = 0.185mA when Vo = 0V.
4. In the measured data, it have similar behavior as that in simulation.

图表, 折线图

描述已自动生成

**Q4**

**Choosing the offset voltage be 4.4018V**

1. At 100Hz, mg = 72.1dBdB, rounded deg = 180deg. Upper 3dB frequency is 14401Hz since amplitude is 0.707 of that at 100Hz, and the deg is 135deg.
2. The measured voltage gain is 63.5dB. At 14.401kHz, the gain is 60.5dB, and the amplitude is 0.659 of that at low frequency. It is close to 0.707, and since the noise in the system also make impact on the measurement, we considered this as acceptable.

图表

中度可信度描述已自动生成

**Q5**

1. Ve = -0.525V, Ic2 = 90.91uA, Vo = 4.25V
2. Range of Vcm is -2.6V to 4.5V
3. When the Ic2 and Vo are constant, it is in the common-mode range. The upper bond will be highest input to maintain this constant, and lower bond will be the min input to maintain. At this mode, it required all BJT works in the linear region.
4. The measure range of input Vcm is -2.7V to 4.7V

图表, 折线图

描述已自动生成 图表, 折线图

描述已自动生成

**Q6**

The low frequency voltage gain is -86.90dB

**Q7**

1. Input differential-mode range is -0.0125V to 0.0125V.
2. To use this circuit as a small signal amp, it required both BJT operate in linear region. The difference input signal is limited to less than around the midpoint. The midpoint is 0V in this example.

**Q8**

1. Ad = 19.63dB.
2. Upper 3dB frequency is 9128429Hz, at this point the amplitude is 0.707 of that at 100Hz. (Or 8332822Hz since the change in phase is 45deg) The GBW is 6.18E+07Hz at this point.
3. 9.12MHz is significantly larger than 450kHz in Q4. It means the differential amplifier can maintains at the same gain with higher frequency.
4. The gain is 22.3dB.

图片包含 图形用户界面

描述已自动生成

**Q9**

The ratio of CMRR is between the differential gain and the common mode gain. The gain here use the ratio instead of the one have unit dB