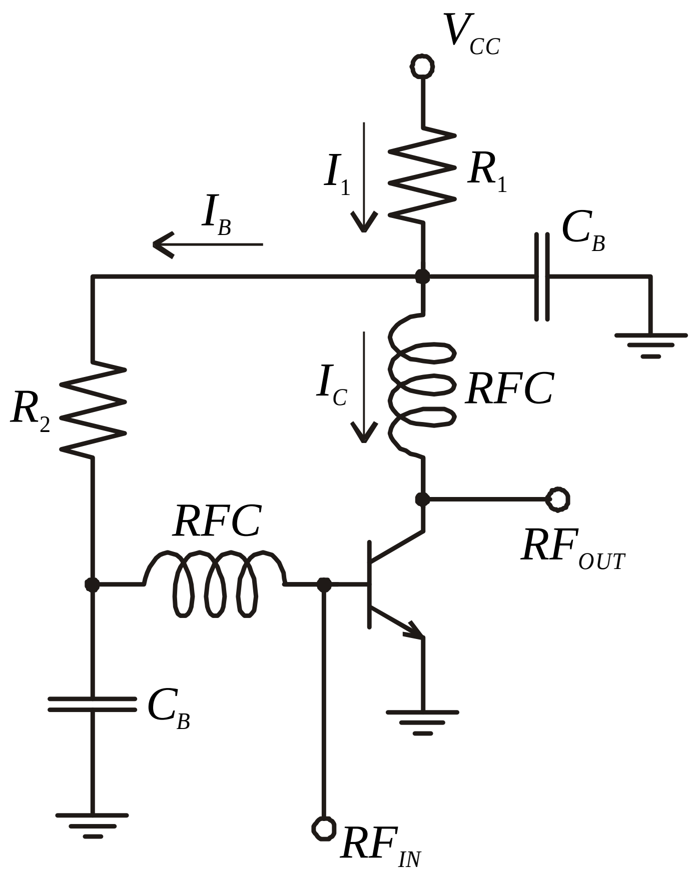
Biasing networks

- Biasing networks are needed to set appropriate operating conditions for active devices

<u>There are two types:</u>

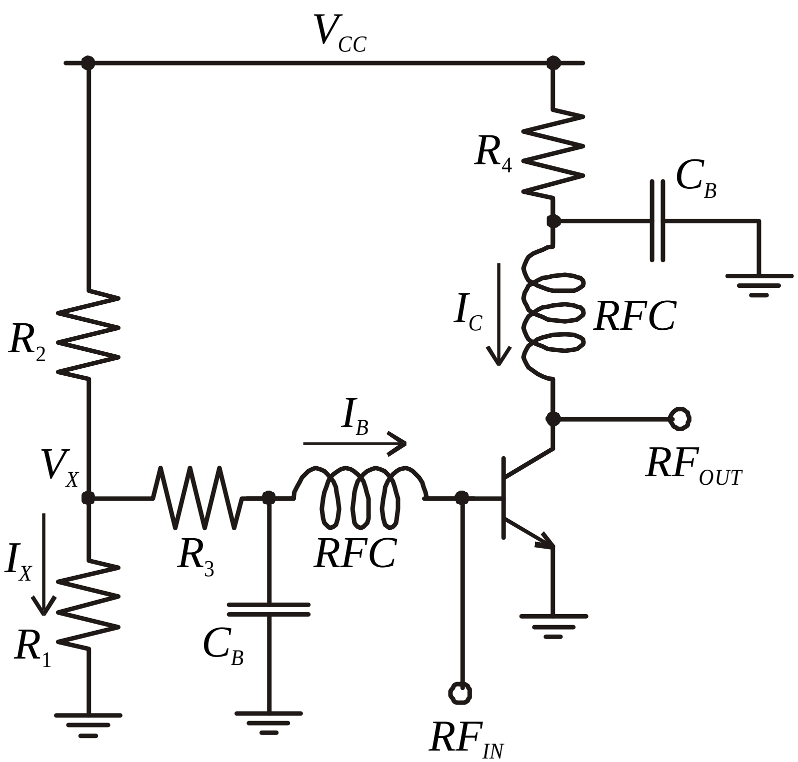
- Passive biasing (or self-biasing)
  - resistive networks
  - drawback: poor temperature stability
- Active biasing
  - additional active components (thermally coupled)
  - drawback: complexity, added power consumption

Passive biasing



- Simple two element biasing
- blocking capacitors C_B and RFCs to isolate RF path
- Very sensitive to collector current variations

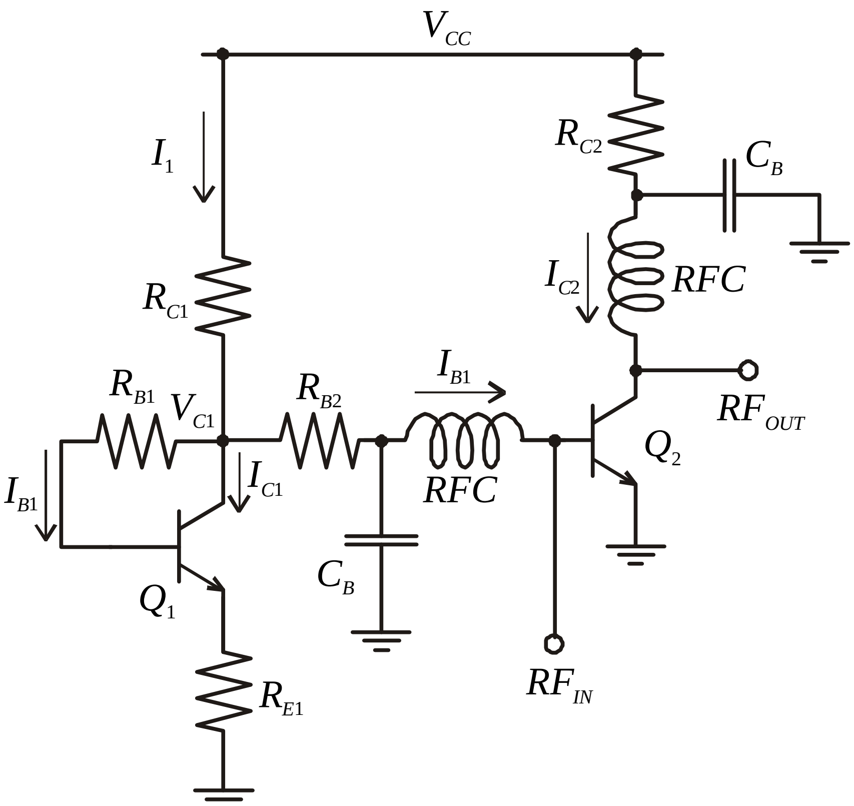
Passive biasing



$I_B \sim 10\ I_X$

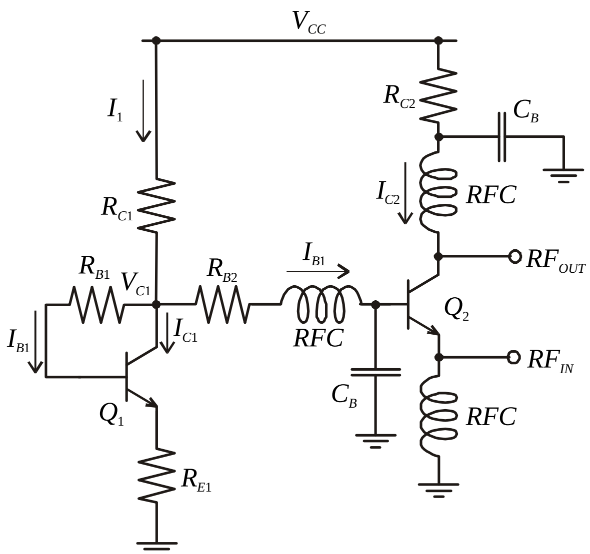
- Voltage divider to stabilize V_{BE}
- Freedom to choose suitable voltage and current settings (V_X, I_X)
- Higher component count, more noise susceptibility

Active biasing

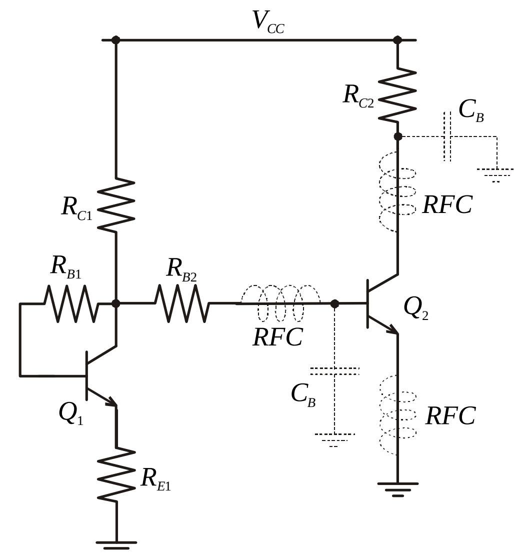


- Base current of RF BJT (Q_2) is provided by low-frequency BJT Q_1
- Excellent temperature stability (shared heat sink)
- high component count, more complex layout

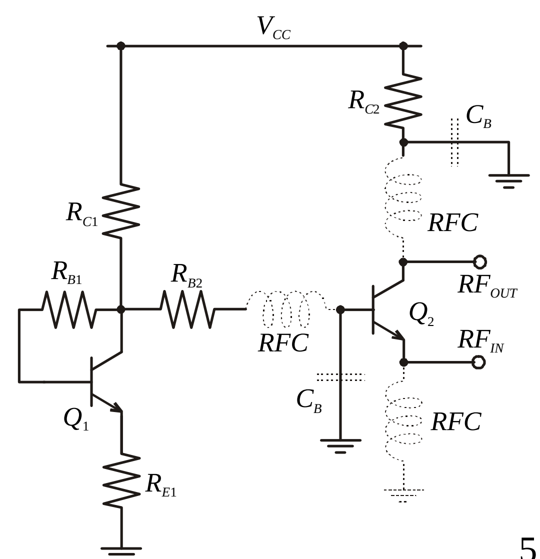
Active biasing in common base



DC path

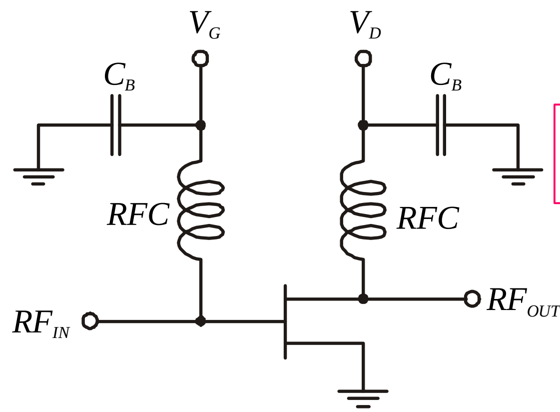


RF path



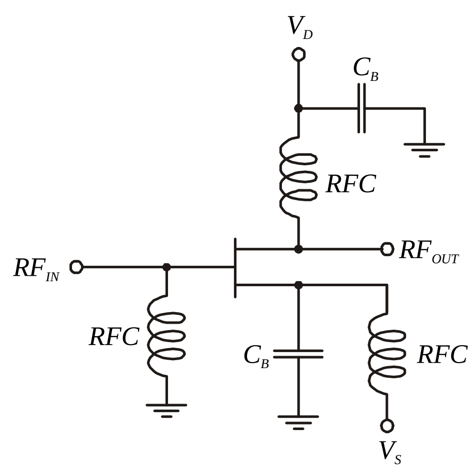
FET biasing

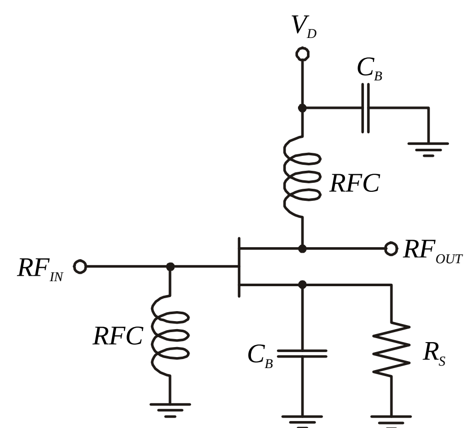
Bi-polar power supply



V_G<0 and V_D>0

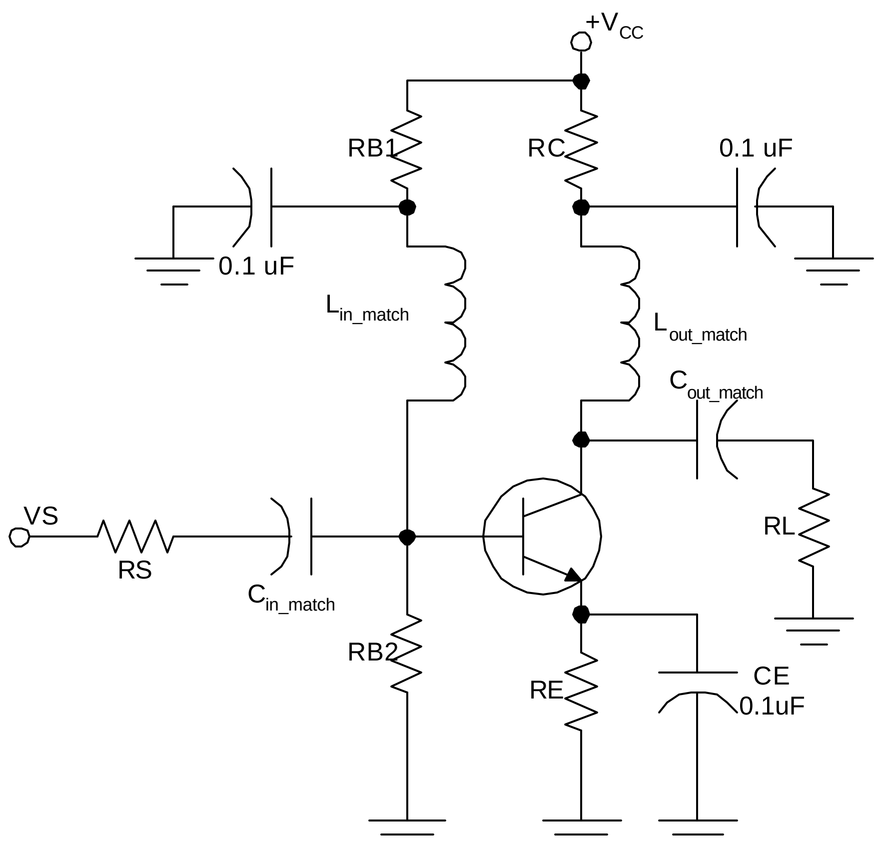
Uni-polar power supply





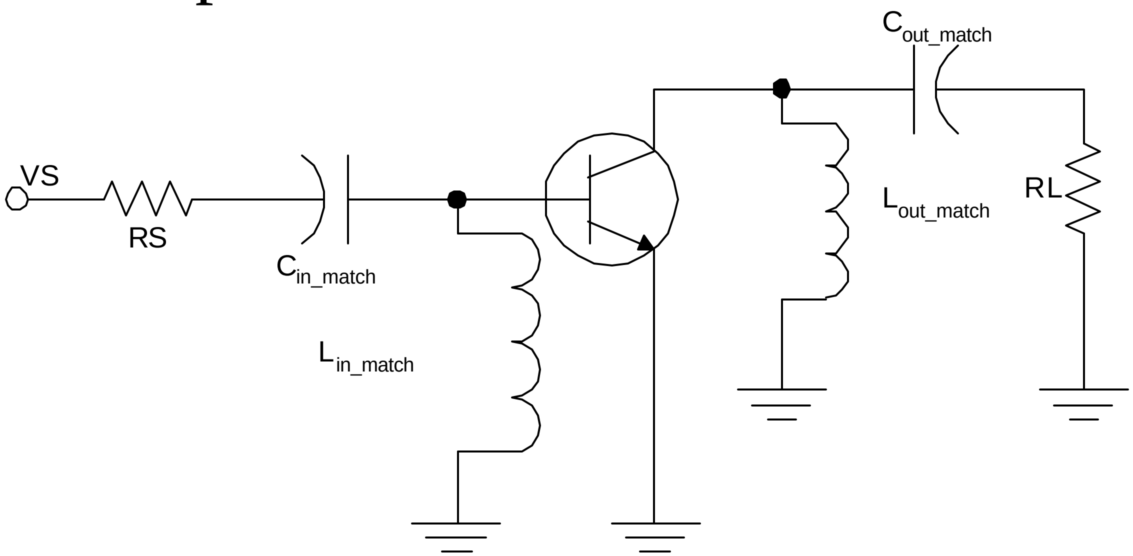
Matching to Self-Biased BJT Amp

- Design self-bias circuit as usual
- Design input and output matches to S11 and S22 respectively



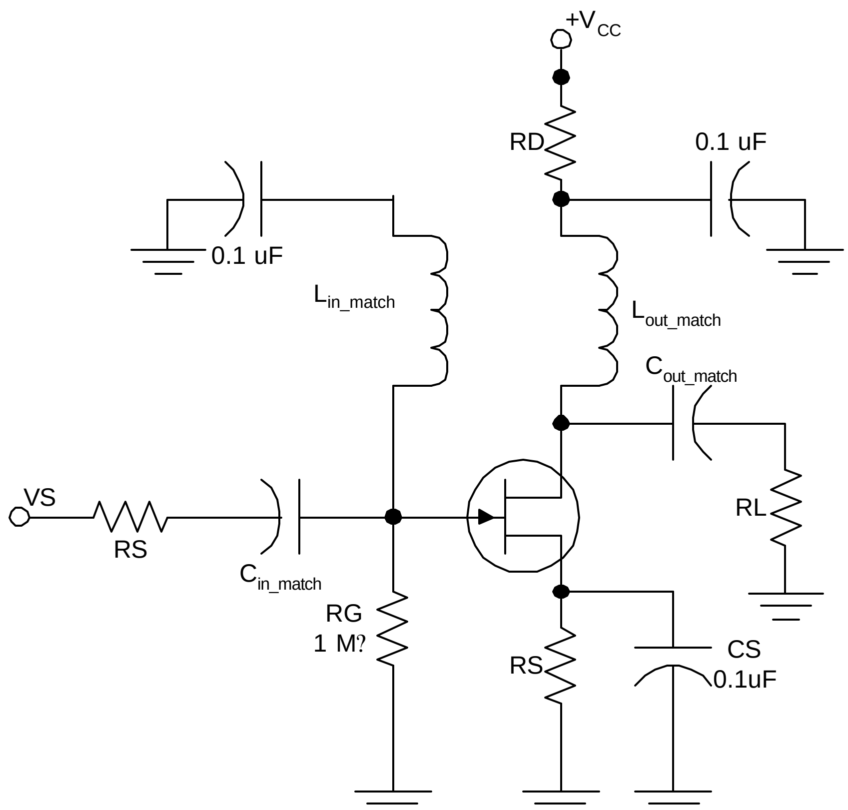
Equivalent RF Model of BJT Amp

- The equivalent RF model of the self-biased BJT amp is shown. Note that bias resistors do not affect RF performance



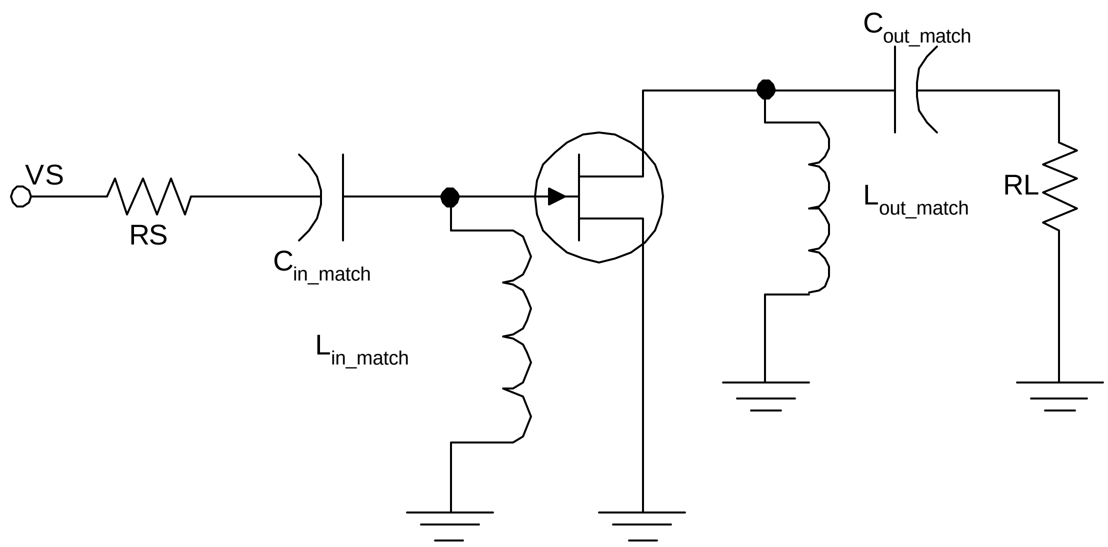
Matching to Self-Biased JFET Amp

- Design self-bias circuit as usual
- Design input and output matches to S11 and S22 respectively



Equivalent RF Model of JFET Amp

- The equivalent RF model of the self-biased JFET amp is shown. Note that bias resistors do not affect RF performance



Matching Networks for Amplifiers

- Conjugate matching must be used for maximum power transfer
- Standard impedance matching using either two element L-C, Pi- or Tee-type network, or microstripline matching.
- Use Smith Charts with associated Node Quality Factor Q_n to determine network

Stub Tuner Matching for RF BJT Amp

- Can implement impedance matching network with microstriplines
- Shown is single stub tuner with shorted stub