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Carlos III de Madrid
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Session 26 – Case Study 1
High frequency multiple-stage amplifier (cascode)

Electronic Components and Circuits

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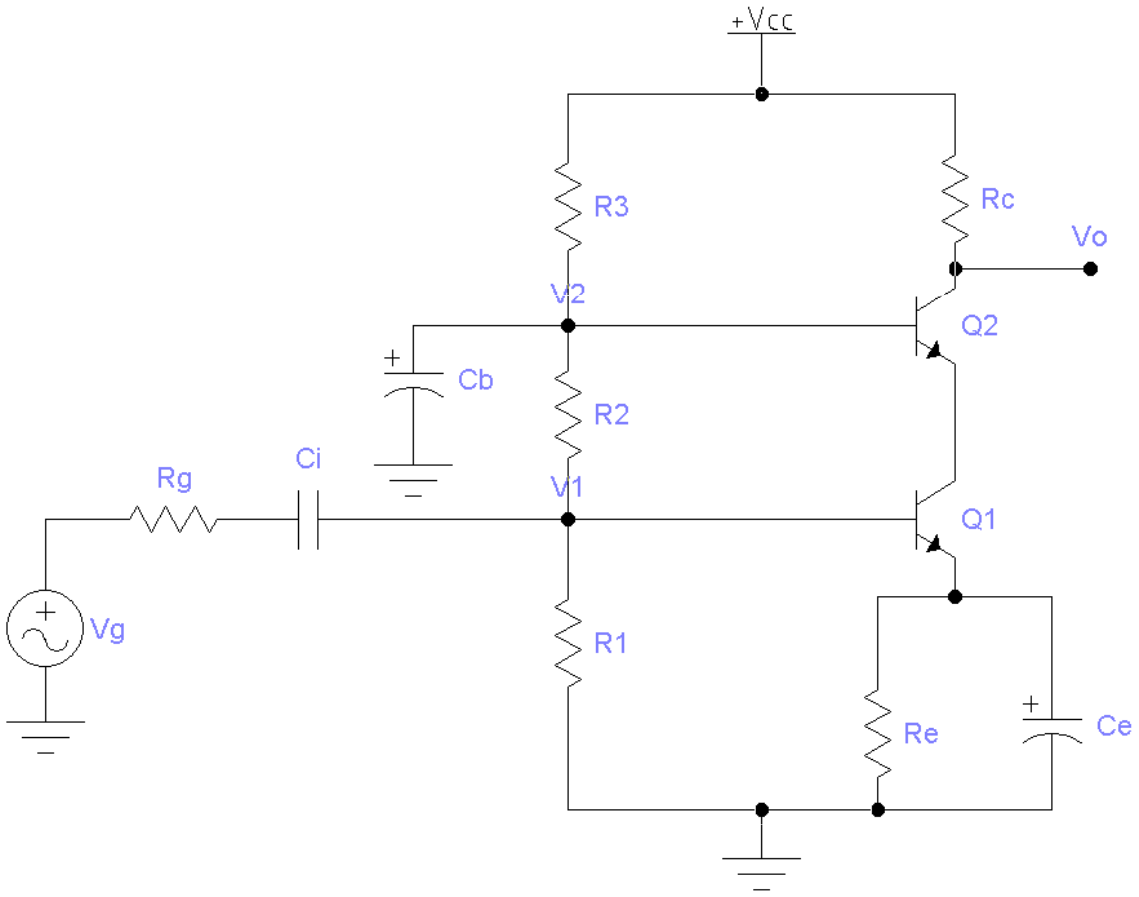
High frequency multiple-stage amplifier (cascode)

OBJECTIVES

- To analyze the bias circuit
- To analyze small-signal equivalent circuits and interpret the characteristics of the amplifier
- To calculate the gain and impedances
- To calculate the cut-off frequencies and the bandwidth
- To plot the basic Bode Diagram of the amplifier
- To review the main features of this multi-stage amplifier

Case study 1 - Bias



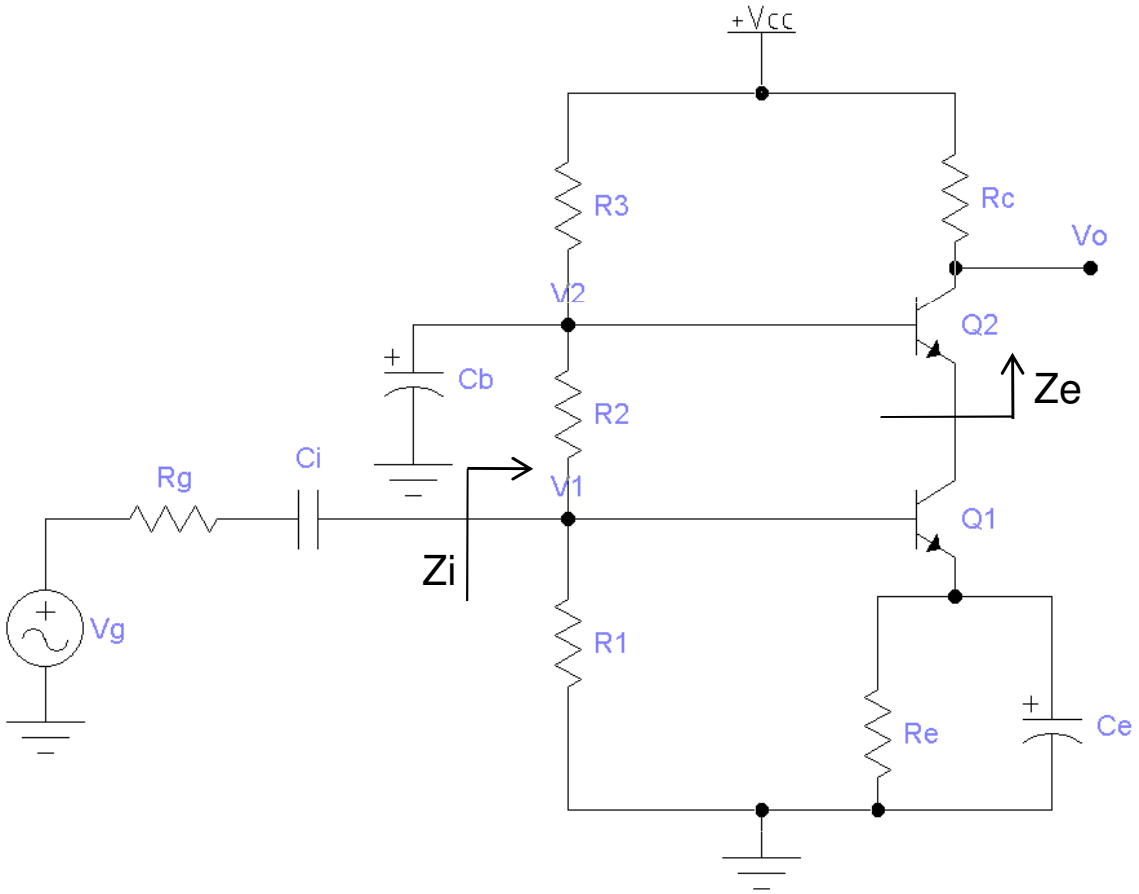
V_{CC} = 15 V
Rg = 50 Ω
R1 = R2 = R3 = 50 KΩ
Re = 4,3KΩ
Rc = 2,5 KΩ

$V_{BE\text{-}ON}$ = 0,7 V
$\beta_F = \beta_0 = 100$
$C\pi_1 = C\pi_2$ = 10 pF
$C\mu_1 = C\mu_2$ = 0 pF
$r_o \rightarrow \infty$
V_T = 25 mV

Ci = 20 μF
Cb, Ce $\rightarrow \infty$

- Get the voltages V1 and V2 in DC. Neglect the base currents.
- Get the bias point of transistors (I_{C1}, I_{C2}, V_{CE1}, V_{CE2}) and Vo in DC.
- Obtain the small signal parameters.

Case study 1 – Small signal



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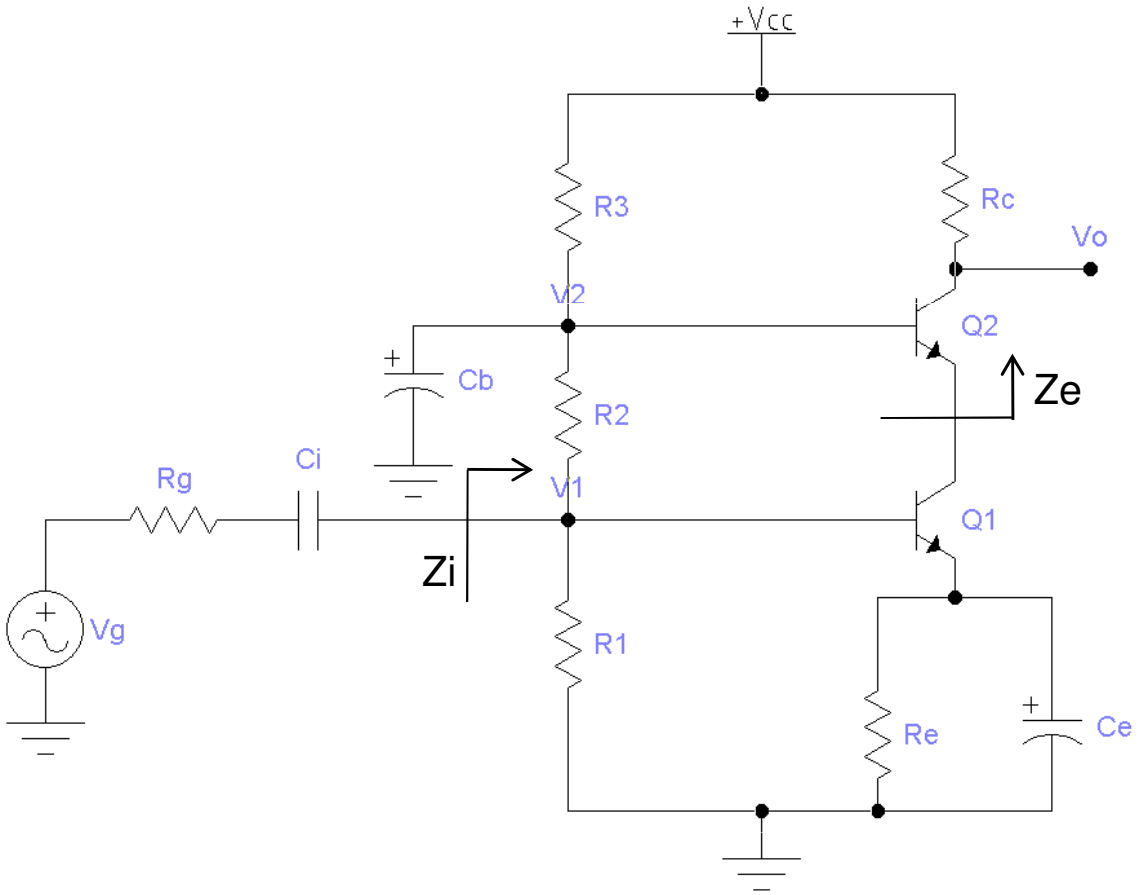
- Draw the equivalent circuit for midrange frequency.
- Obtain the gain Vo/Vg.
- Obtain the impedances Zi and Ze.
- Replace Q2 by the impedance Ze and calculate the gain of Q1.

Case study 1 – Bandwidth



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V_T = 25 mV

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Cb, Ce $\rightarrow \infty$

- Obtain the lower cutoff frequency using the time constants method.
- Draw the equivalent circuit for high frequencies and calculate the upper cutoff frequency.
- Plot the Bode diagram of the amplifier.

Bode diagram