Laboratorij za načrtovanje integriranih vezij

UNIVERZA V LJUBLJANI
Fakulteta za elektrotehniko

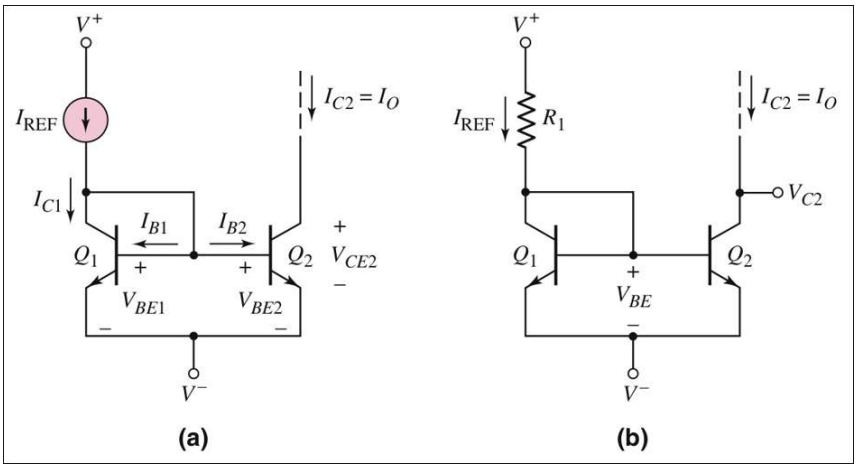
Linearna elektronska vezja

Tokovna zrcala in aktivna bremena

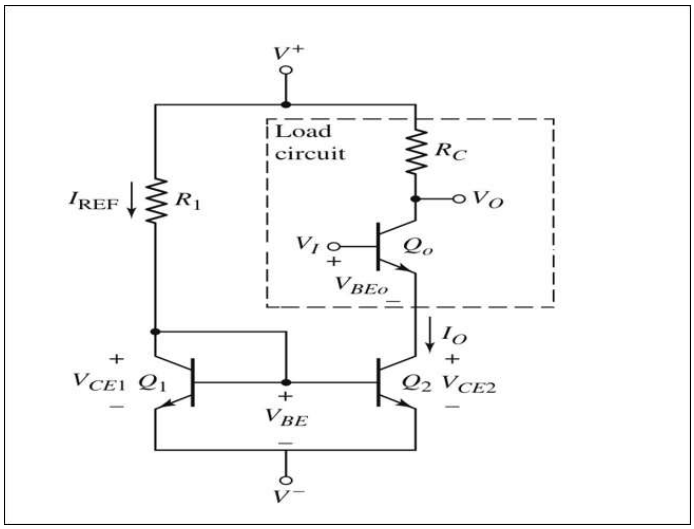
In this chapter, we will:

- Analyze and understand the characteristics of various bipolar circuits used to provide a constant output current.
- Analyze and understand the characteristics of various MOSFET circuits used to provide a constant output current.
- Analyze the dc characteristics of amplifier circuits using transistors as load devices (active loads).
- Analyze the small-signal characteristics of amplifier circuits with active loads.

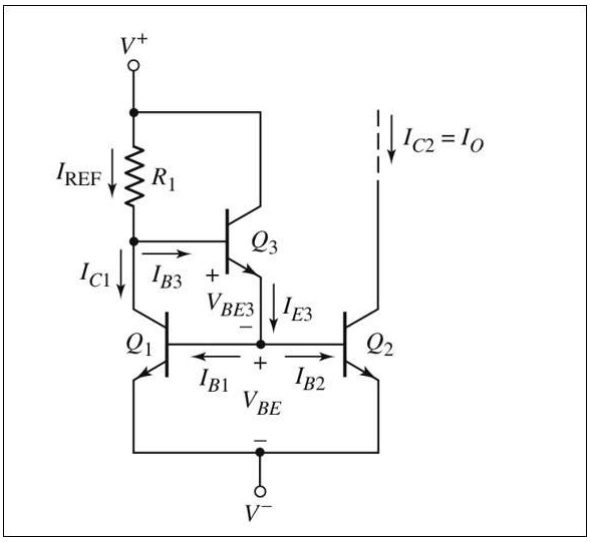
2-Transistor Current Source



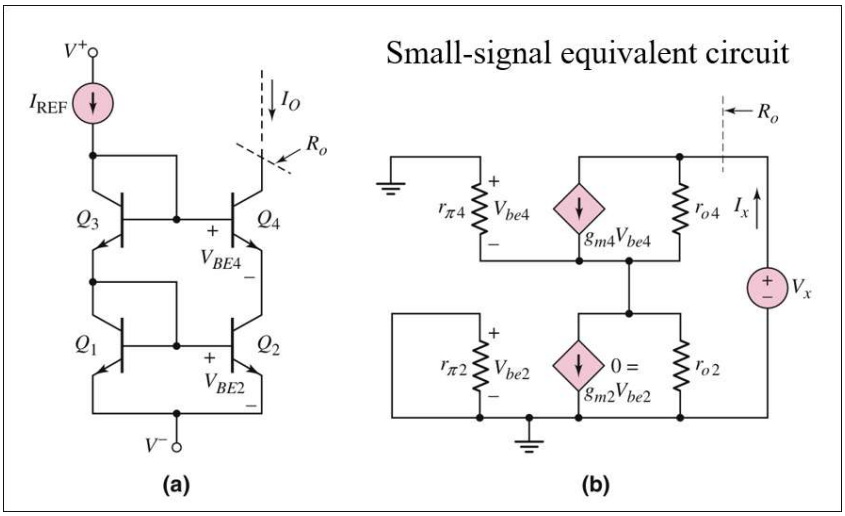
DC Equivalent Circuit: 2-Transistor Current Source



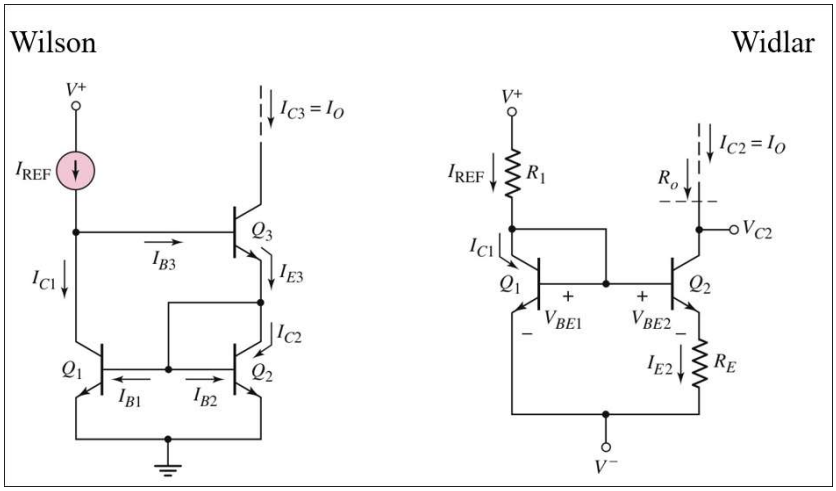
3-Transistor Current Source



Bipolar Cascode Current Mirror



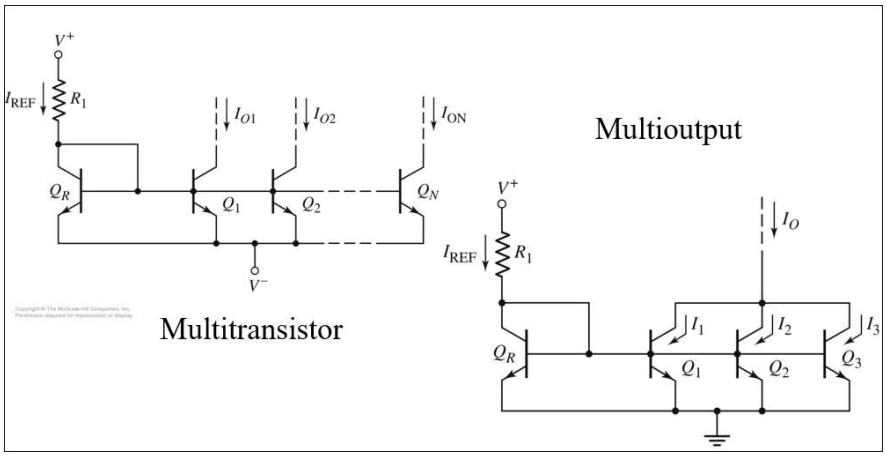
Problem-Solving Technique: Ideal Op-Amp Circuits



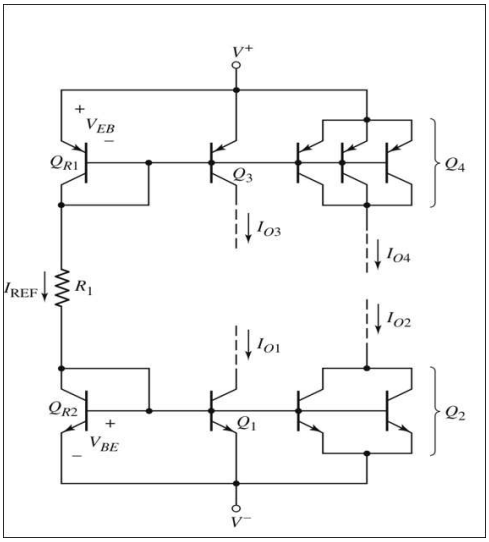
Problem-Solving Technique:BJT Current Source Circuits

- Sum currents at various nodes to find relation between reference and bias currents.
- Place test voltage at output node and analyze small-signal equivalent circuit to find output resistance.
- Reference current is a constant
  - Some base voltages may be constant or at ac ground.

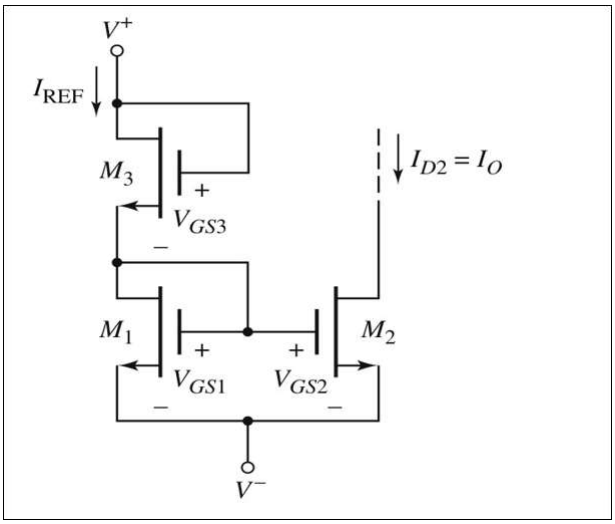
Multitransistor and Multioutput Current Mirror



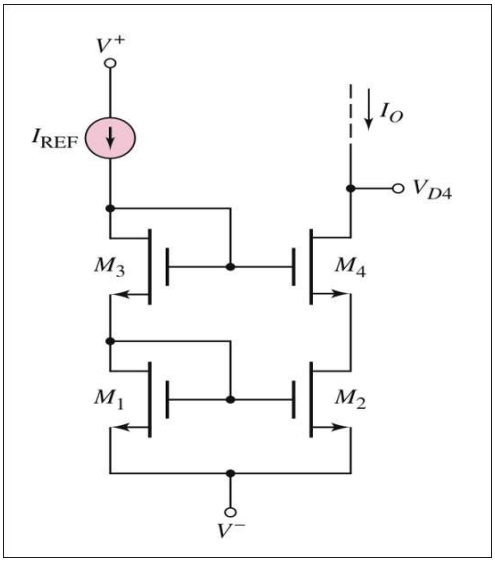
Generalized Current Mirror



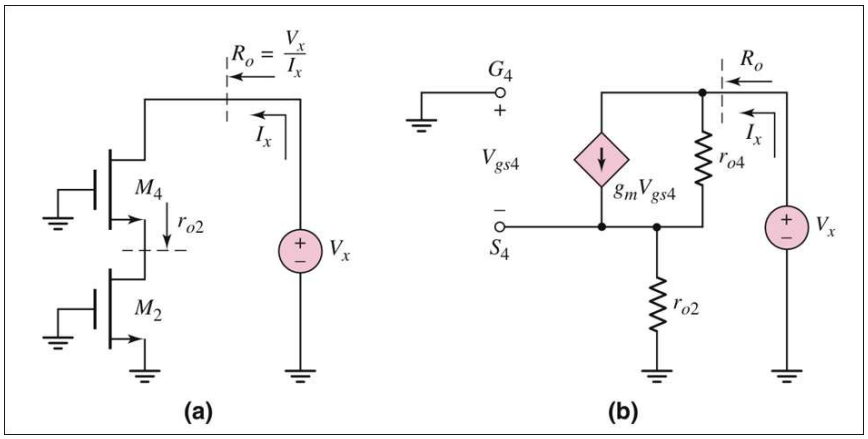
MOSFET Current Source



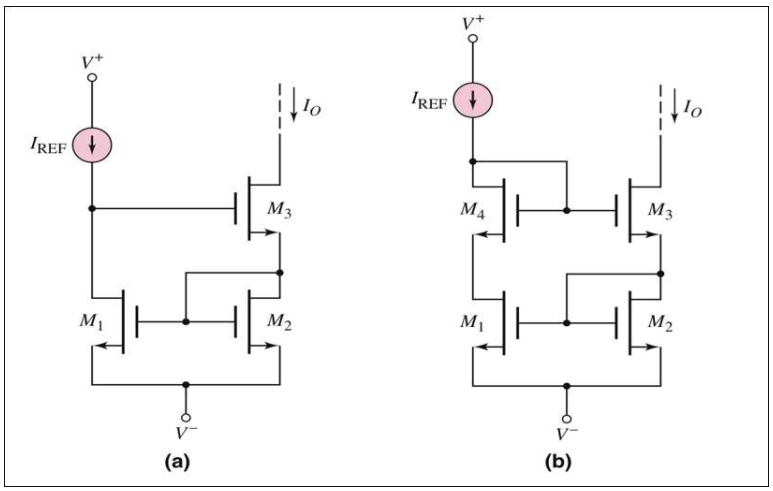
MOSFET Cascode Current Source



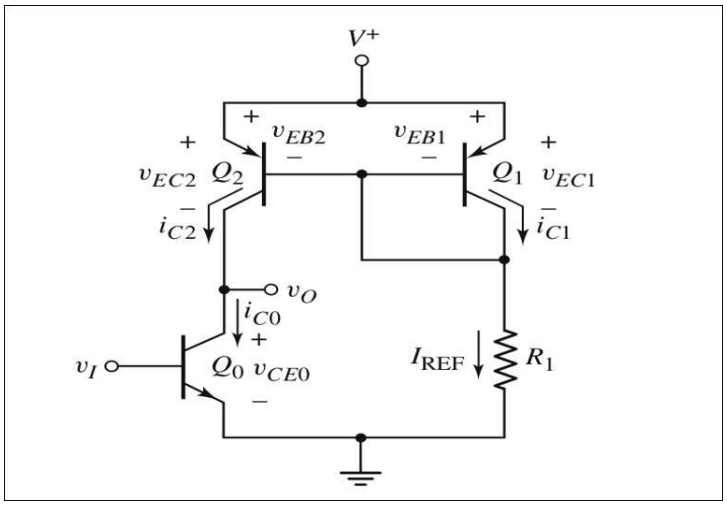
Equivalent Circuits for MOSFET Cascode Current Mirror



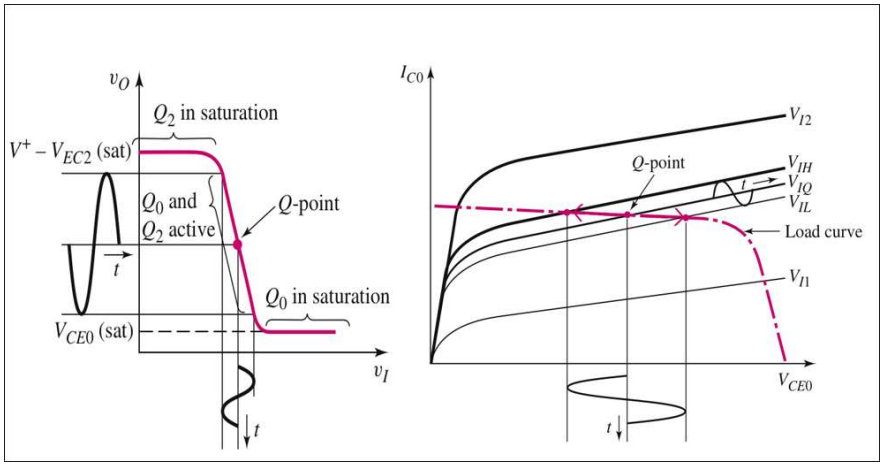
MOSFET Wilson Current Source



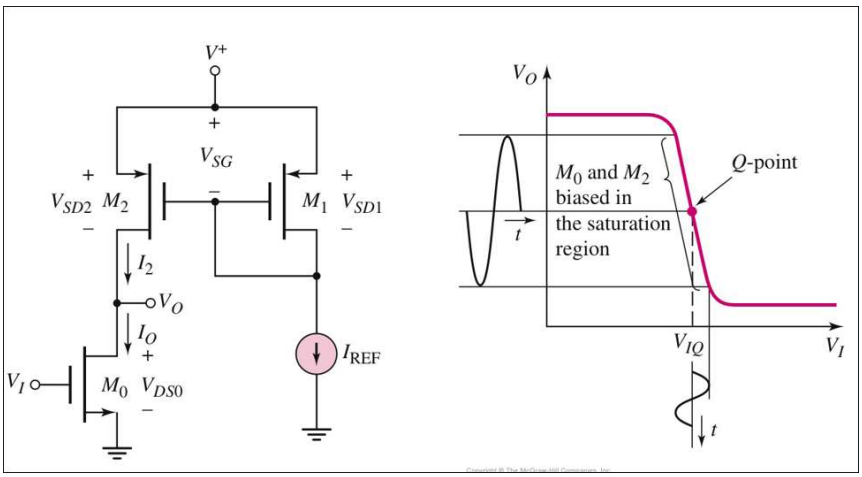
BJT Amplifier with Active Load



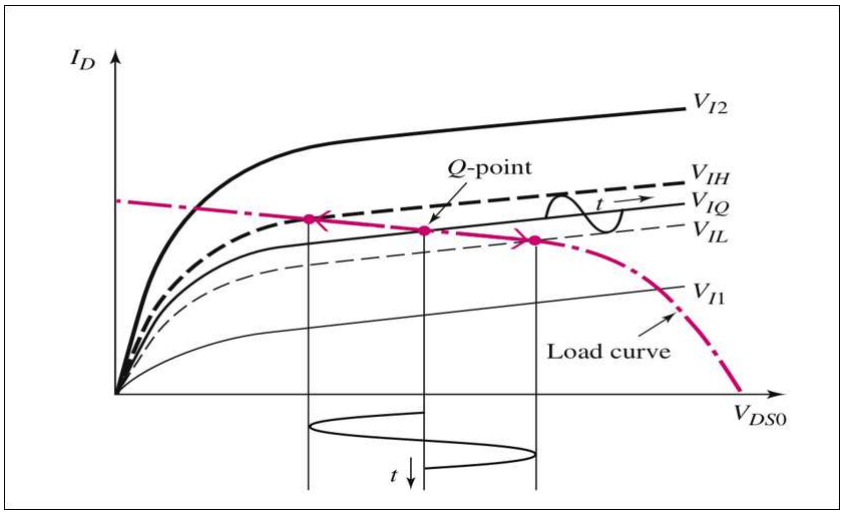
Characteristics of Bipolar Circuit with Active Load



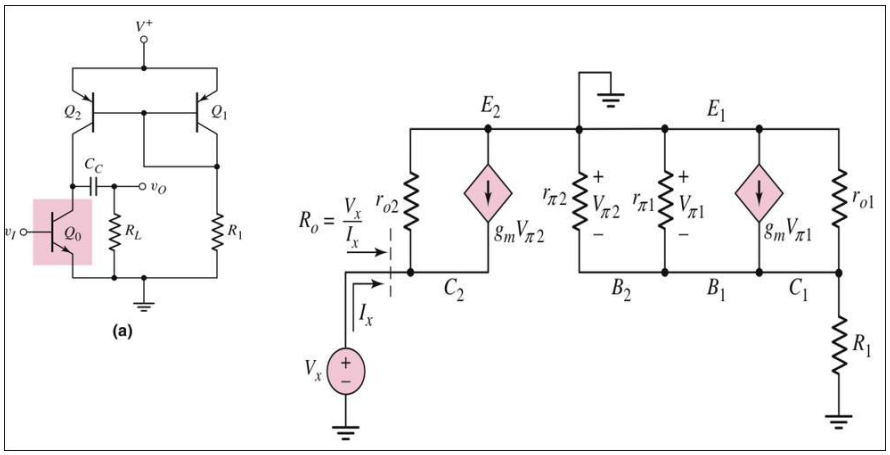
MOSFET Amplifier with Active Load



Driver Characteristics: MOSFET Amplifier with Active Load



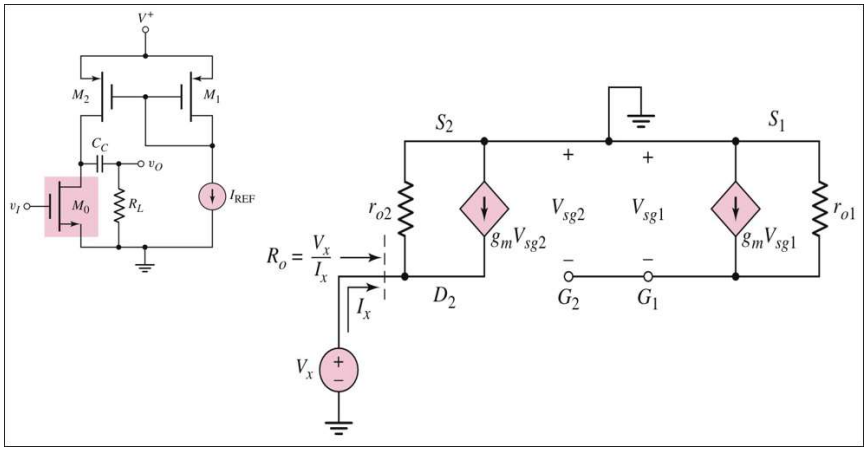
Small-Signal Equivalent Circuit: BJT Active Load



Problem-Solving Technique: BJT Active Loads

- Ensure active load devices are biased in forward active mode.
- Small-signal analysis considers output resistance looking back into output of active load device as well as the equivalent circuit of amplifying transistor.

Small-Signal Equivalent Circuit: MOSFET Active Load



MOSFET Cascode Amplifier with Cascode Active Load