

EE112 - Fall 2016

Analog Integrated Circuits I

Prof. Haoyu Wang
wanghy@shanghaitech.edu.cn
5210 Research Bldg.

Discrete vs Integrated Circuits

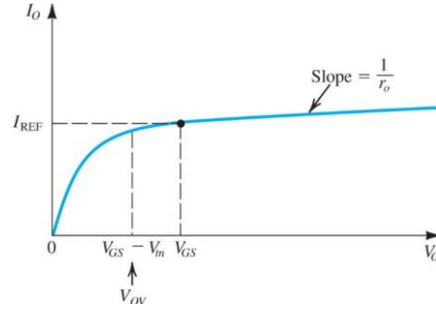
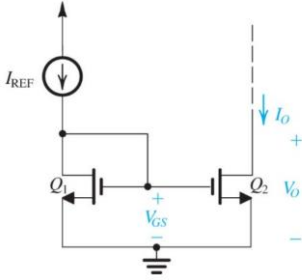
Discrete Circuits

- Resistors and capacitors are frequently used
- AC coupled with coupling capacitors
- Large DC power supply voltage
- Transistor choice limited to available parts
- Mostly BJT, some MOS

IC

- Use mostly transistors
 - » Resistors and capacitors occupy too much areas
- Mostly DC coupled (without capacitors)
- Low DC power supply voltage (~1V)
- Can vary device size
- Predominantly CMOS
 - » BiCMOS provides BJT

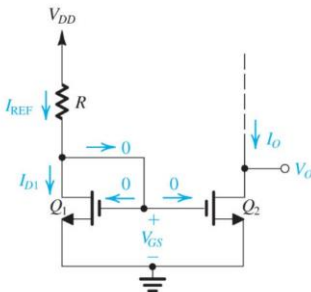
Current Mirrors



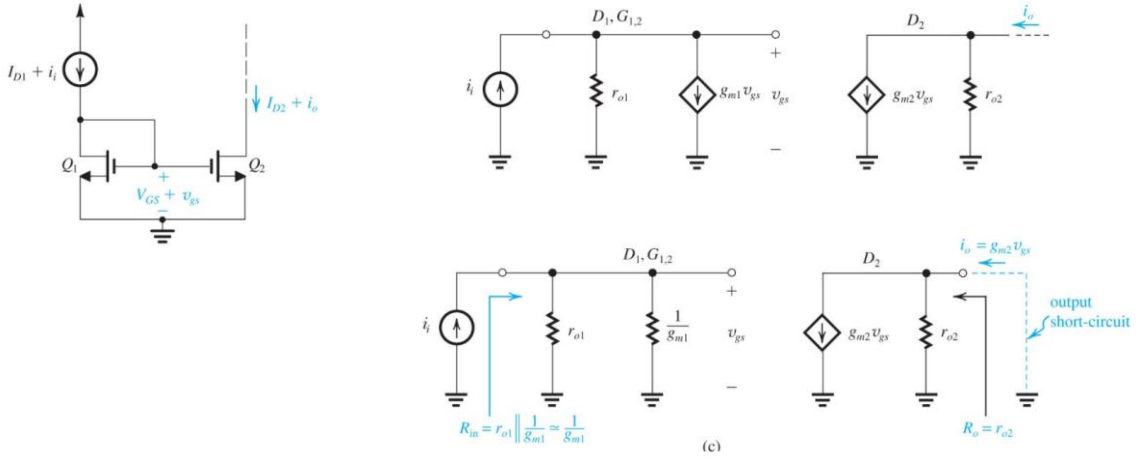
- Neglecting channel length modulation
- If considering channel length modulation

Example Current Mirror with Reference Current Source

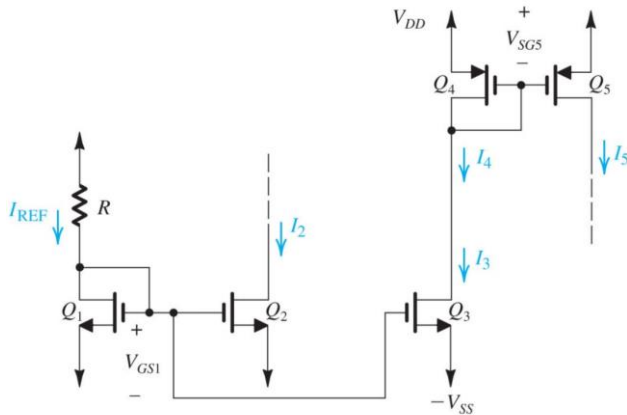
- Neglecting channel length modulation



Small-Signal Model

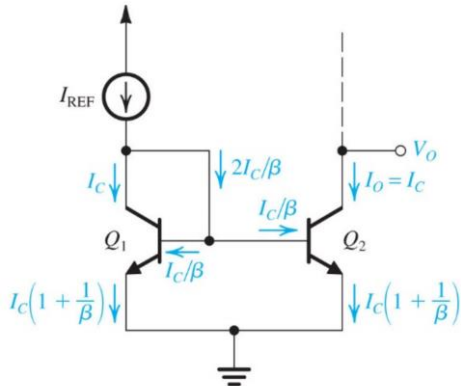


MOS Current Steering Circuits

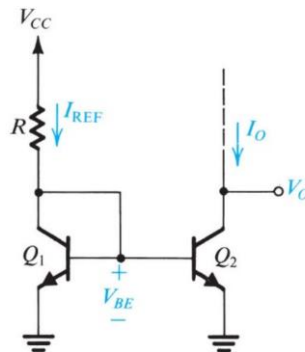


BJT Current Mirror

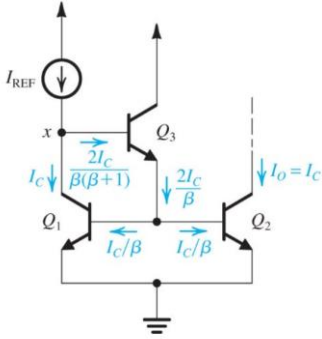
- Neglecting early effect



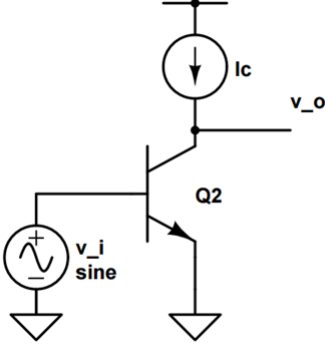
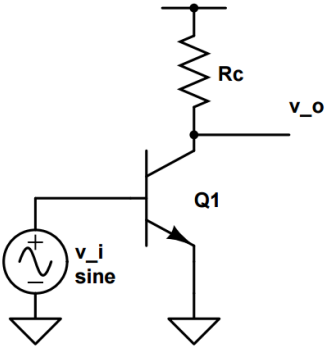
Example BJT Current Source



Current Mirror with Base Current Compensation



Common-Emitter Amplifiers with Ideal Current Source Load



CE Amplifier with Current Mirror Bias

