PH233
L1 (Mon) + L4 (Fri)

Session 0 – Orientation and Introduction to Opamps

PH233 (Electronics Lab – 2)

1. Will run in the same format as PH231. Monday + Friday afternoons
   - Monday: Lab of the week starts, concept discussion
   - Forum active. Submission Wednesday night,
     Late submission (-30%) till Thursday night
   - Friday: Lab wrap-up + follow-up

2. **CONTENT: Everything is done with OPAMPS IC741 in your kit**
   Please retain your astable multivibrator FG on your breadboard – that will still serve as the FG for most experimental tests

Why Opamps?
Discrete Transistor circuits are not good enough, as voltage amplifier

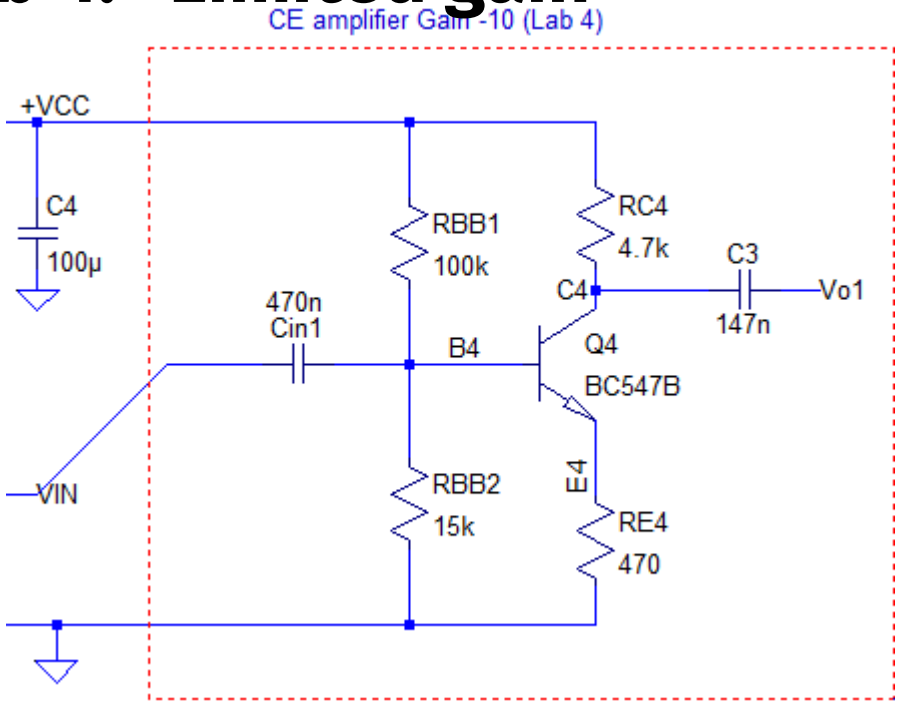
VOLTAGE Amplifier: Want high gain, high input Z, low output Z

Limitation: R_C / emitter resistor sets gain

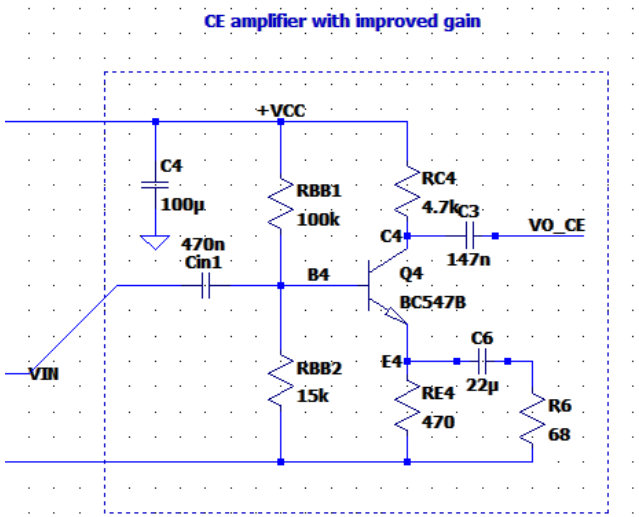
High R_C → High output Z

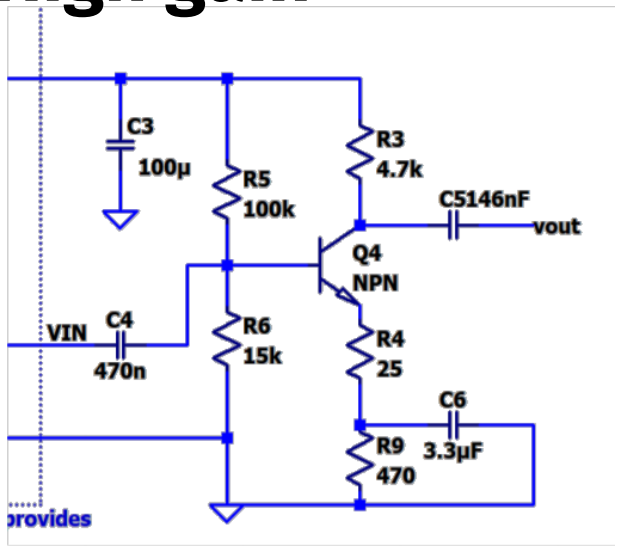
Low emitter resistor → low input Z

Lab 4: Limited gain



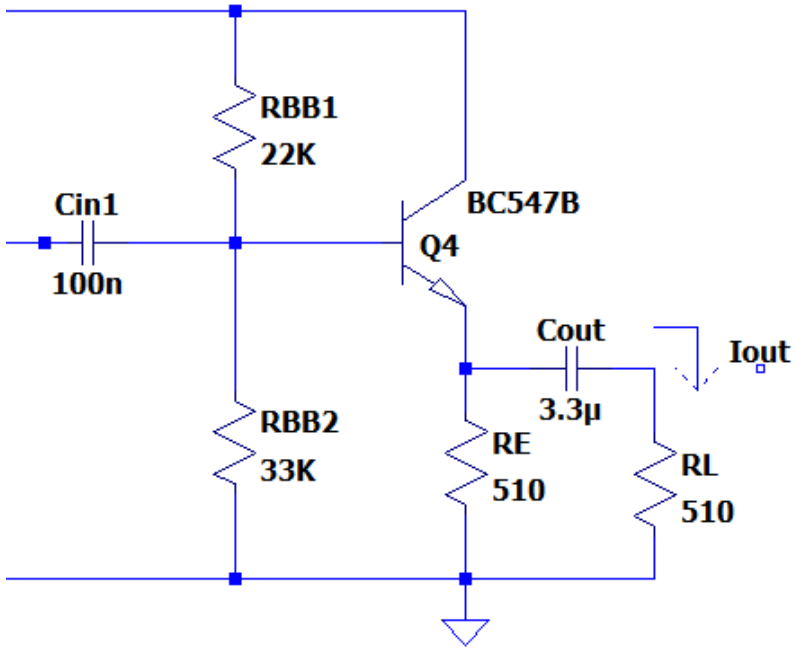
Endsem: High gain





Discrete Transistor circuits are not good enough, as Current amplifier

Want: High Input Z, high Output Z

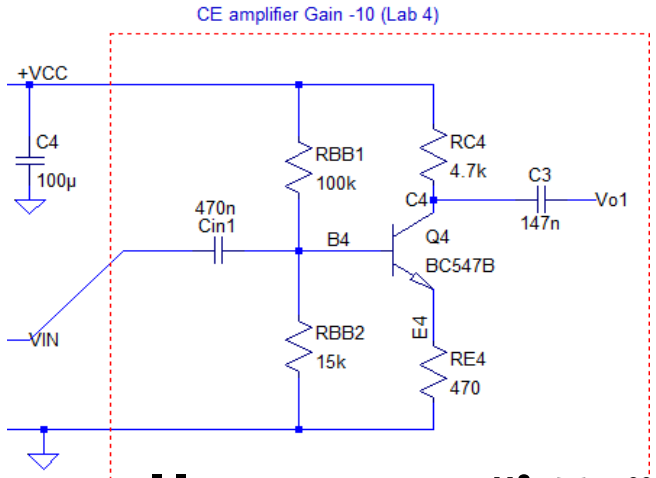


Limitation:

If we want high current gain,
need super high idle power dissipation
(recall efficiency is ~ 2%!)

R_E sets .op in middle of FA, must be low
So output Z and input Z are both low

General limitations of discrete transistor circuits we have not explored so far

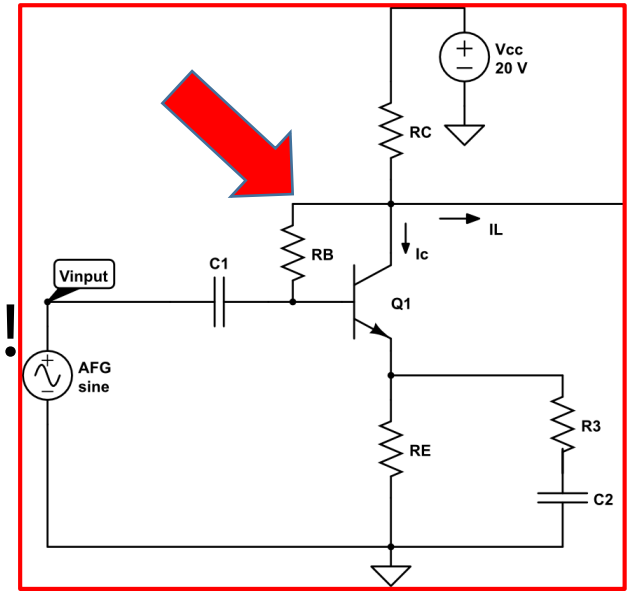


RBB1 || RBB2 are "idle" parts simply to set $V_B = V_E + 0.7$

RBB1, RBB2 value needs to be fine-tuned to keep $i_{b|DC}$ tiny – and they affect input impedance!

BETTER:

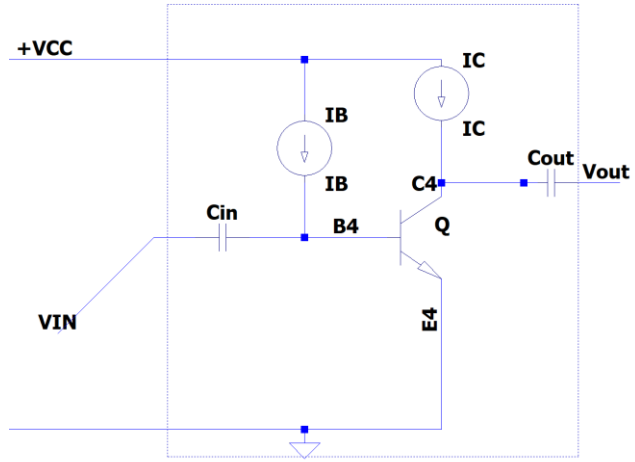
R_B feedback from C to B stabilizes bias!



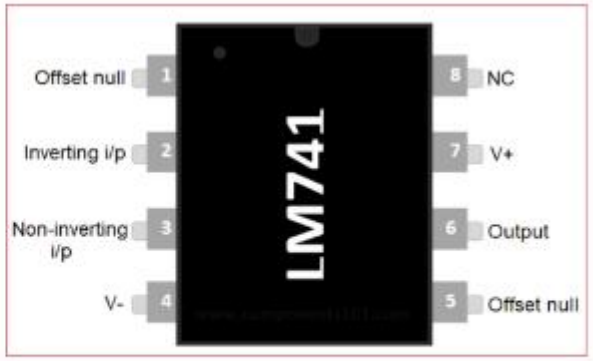
IDEALLY:

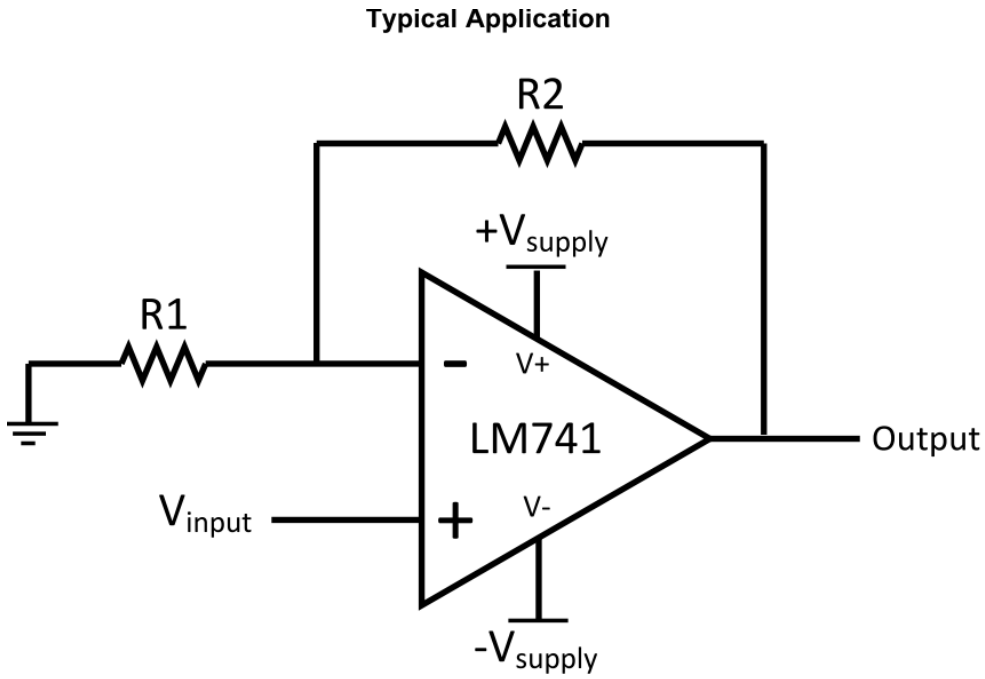
We want a current source supplying I_C, I_B

V_E not dependent on r_e, R_E



OPAMP



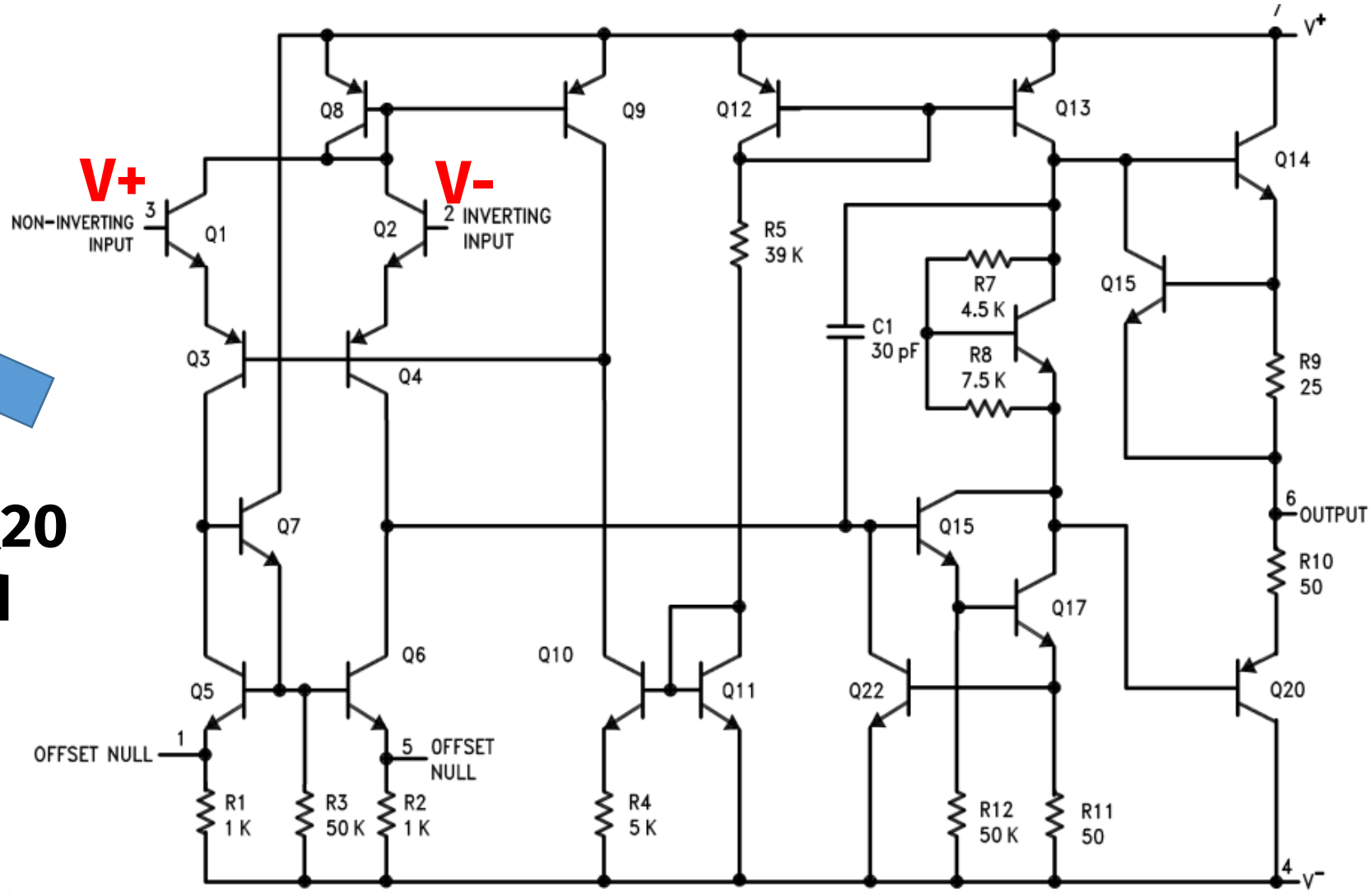


GAIN IS SET BY TWO EXTERNAL resistors R1, R2

No more calculating, fiddling with R_C , R_E , R_B!

WHAT's INSIDE AN OPAMP?

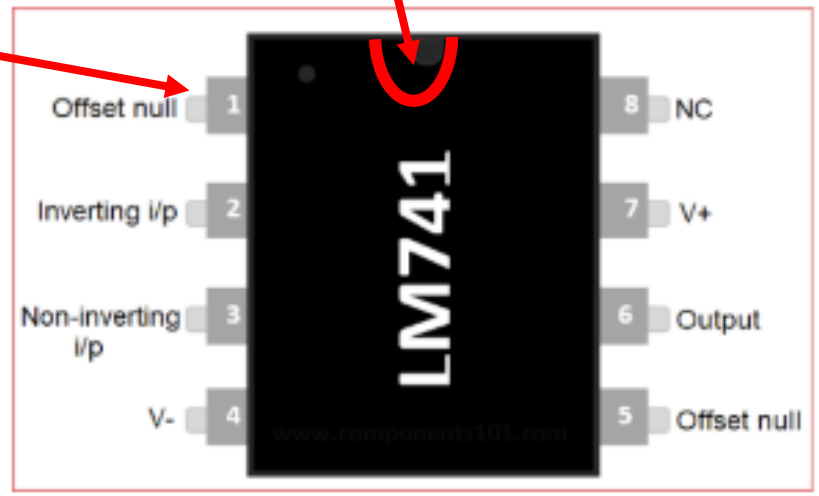
ALL transistors Q1 – Q20 are precisely matched and R values precise

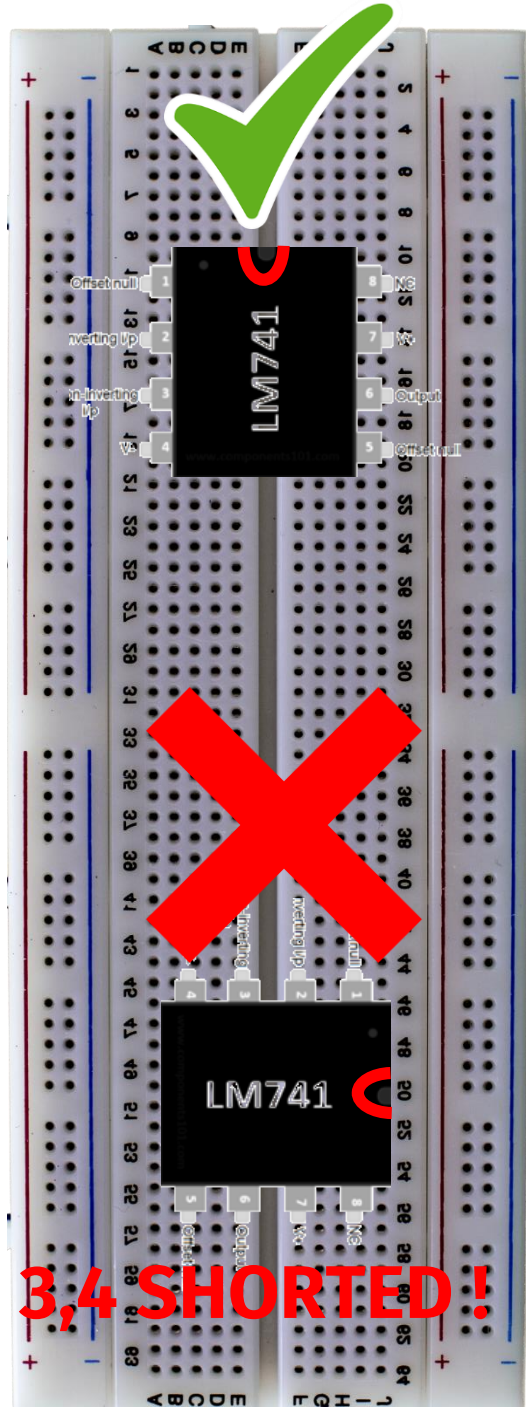


PRACTICAL ISSUES: HOW TO CONNECT AN OPAMP ON YOUR BREADBOARD

WITH RESPECT TO NOTCH ON IC

TOP LEFT PIN IS #1
THEN OTHER PINS ARE
COUNTER-CLOCKWISE





PIN 3,4 SHORTED !

EXERCISE 1: WHAT ARE ALL THESE TRANSISTORS DOING??