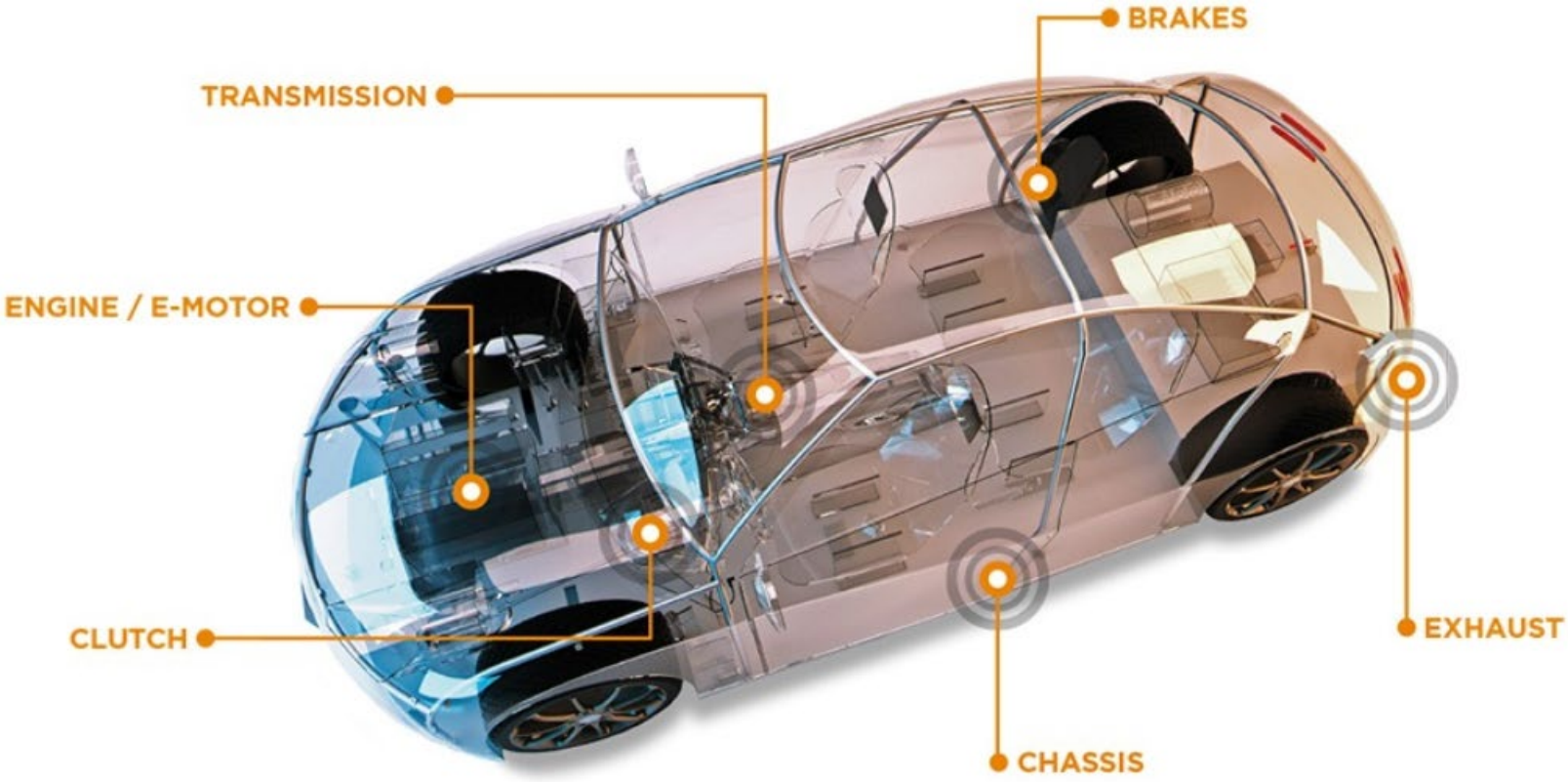
Temperature monitor system

SI100B Fall 2020 EE part Tutorial IV

Yiming Gao, Fengxu Yang, Zirui Wang

Sensor

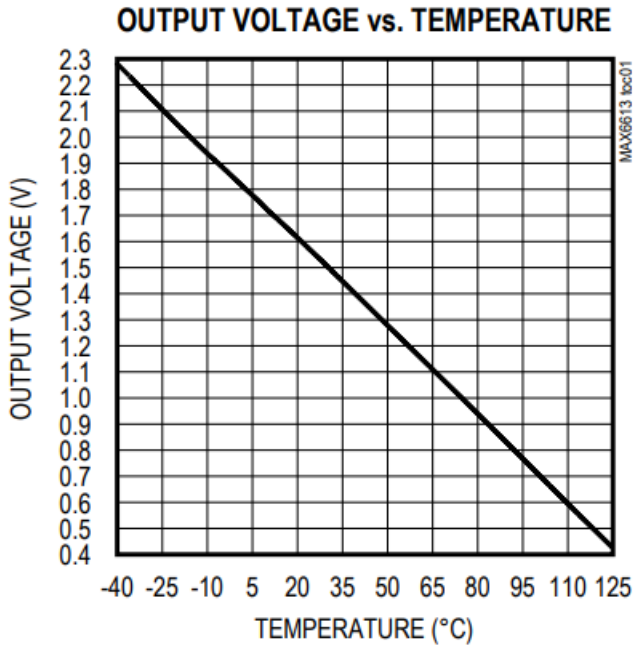
- A sensor is a device used to measure a property, such as pressure, position, temperature, or acceleration, and respond with feedback.



Datasheet reading

- MAX6613

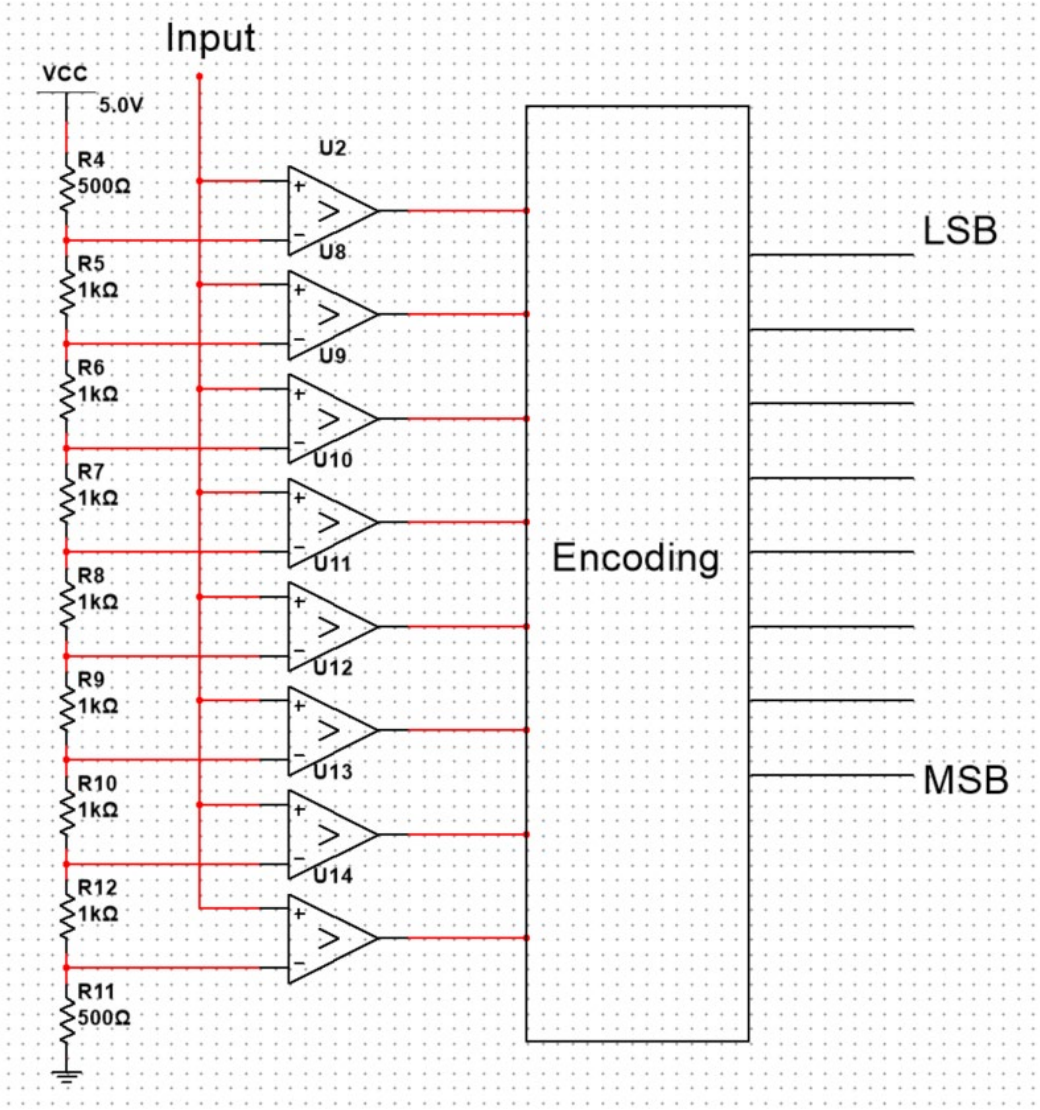
  Low-Voltage Analog Temperature Sensor



https://datasheets.maximintegrated.com/en/ds/MAX6613.pdf

Analog to digital converter (ADC)

Flash ADC

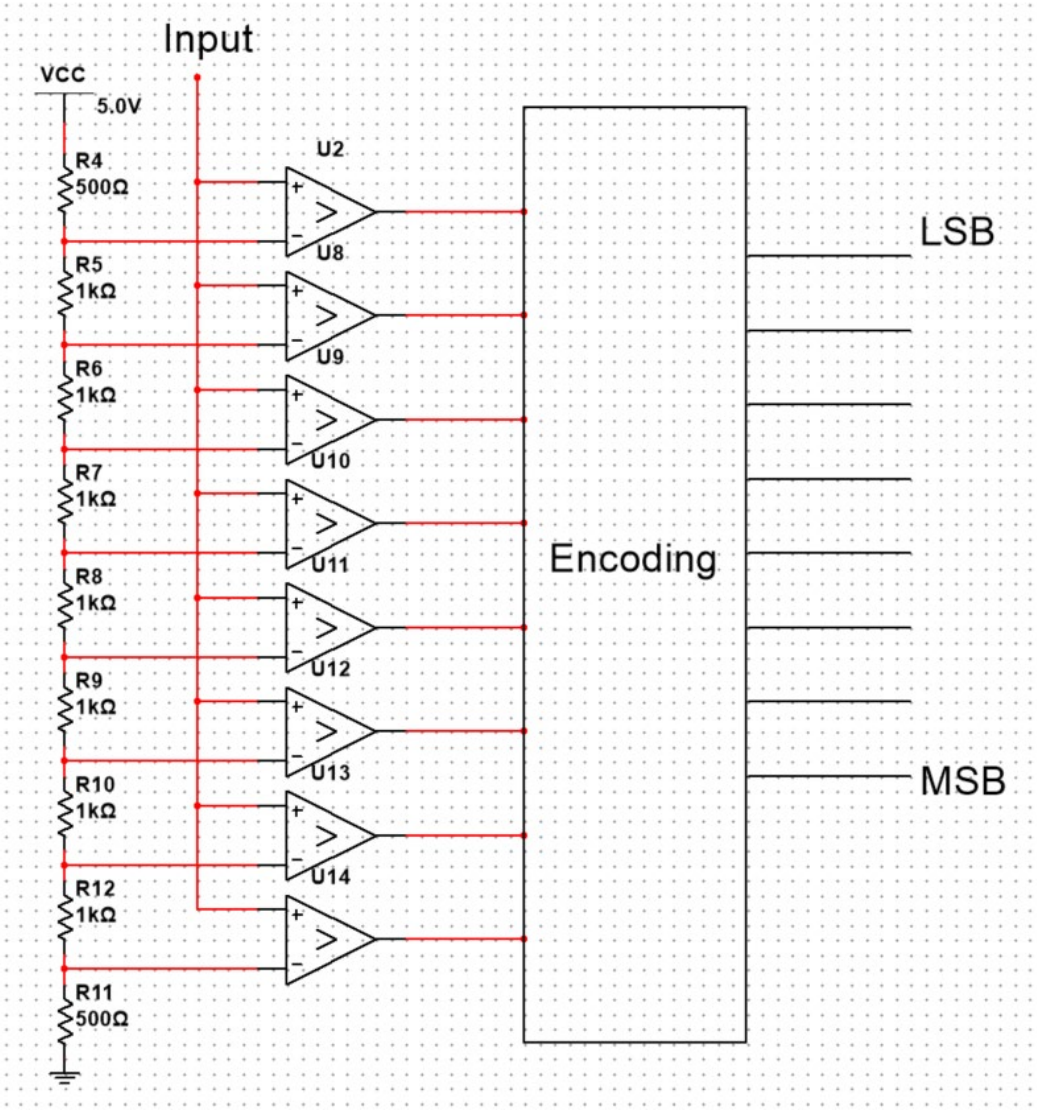


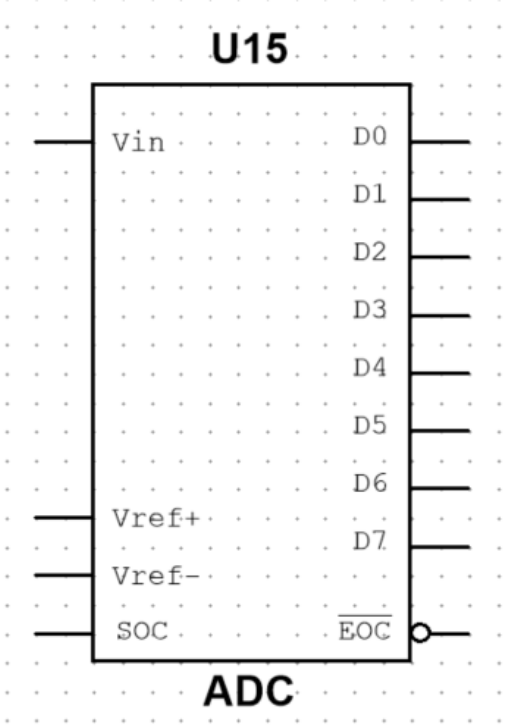
Encoding

0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	0
0	0	0	0	0	1	1	1	0	0	0	0	0	1	0	0
0	0	0	0	1	1	1	1	0	0	0	0	1	0	0	0
0	0	0	1	1	1	1	1	0	0	0	1	0	0	0	0
0	0	1	1	1	1	1	1	0	0	1	0	0	0	0	0
0	1	1	1	1	1	1	1	0	1	0	0	0	0	0	0
1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0

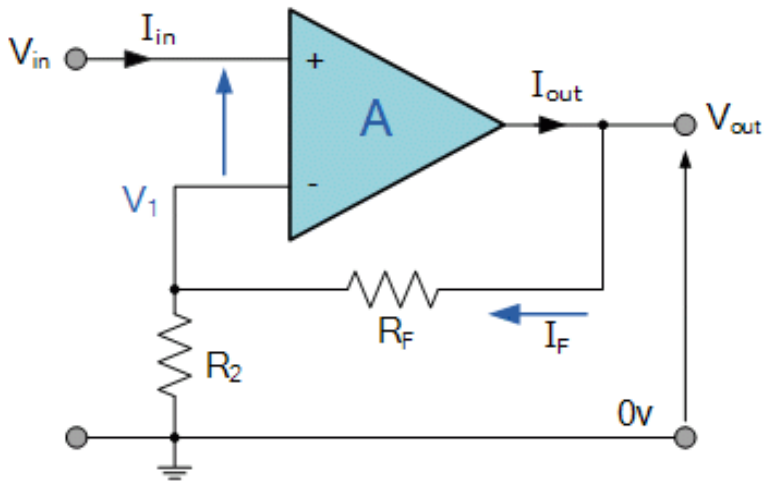
Analog to digital converter (ADC)

Flash ADC





Noninverting amplifier



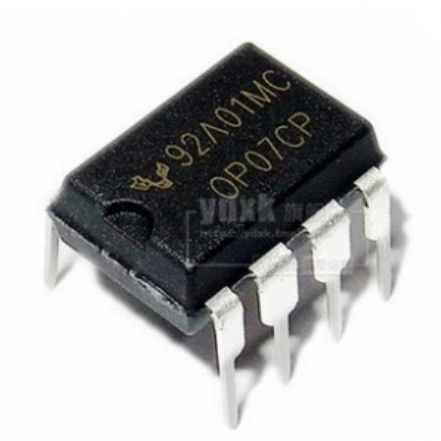
$$V_1 = \frac{R_2}{R_2 + R_F} \times V_{OUT}$$

Ideal Summing Point: $V_1 = V_{IN}$

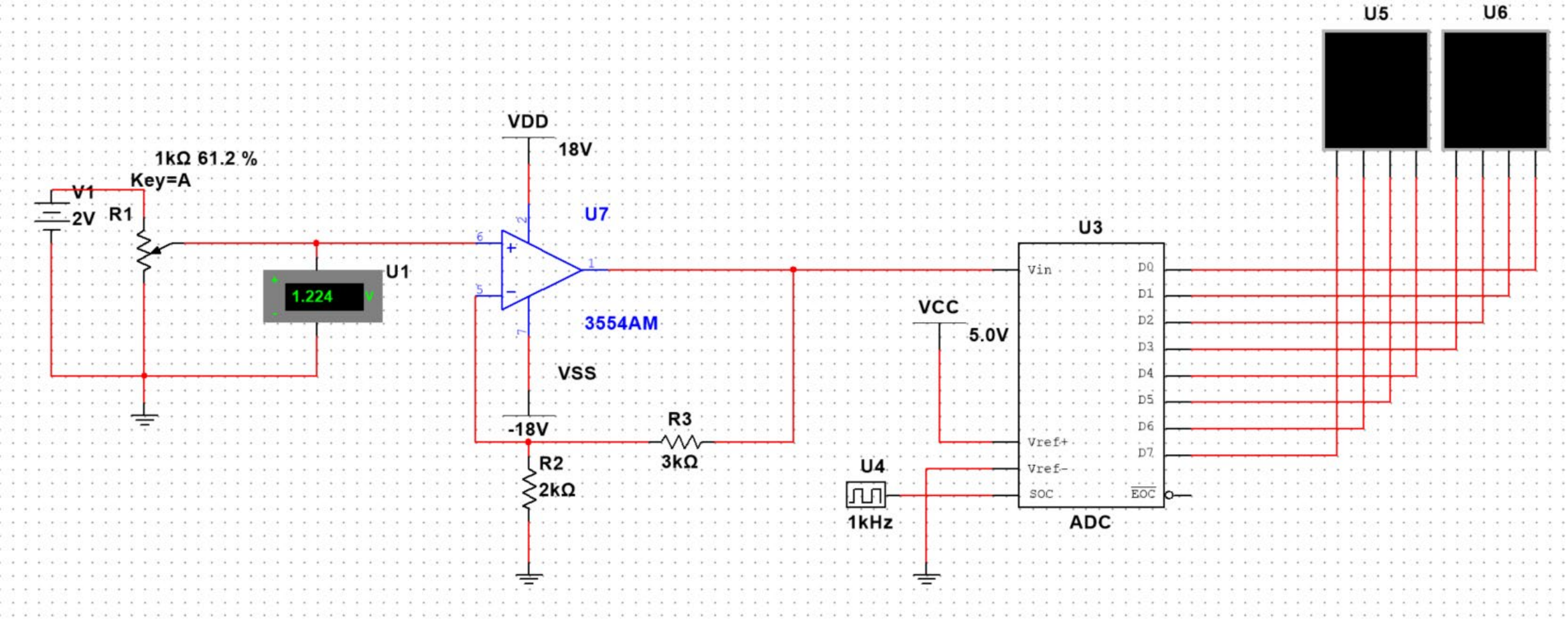
Voltage Gain, $A_{(V)}$ is equal to: $\frac{V_{OUT}}{V_{IN}}$

Then, $A_{(V)} = \frac{V_{OUT}}{V_{IN}} = \frac{R_2 + R_F}{R_2}$

Transpose to give: $A_{(V)} = \frac{V_{OUT}}{V_{IN}} = 1 + \frac{R_F}{R_2}$

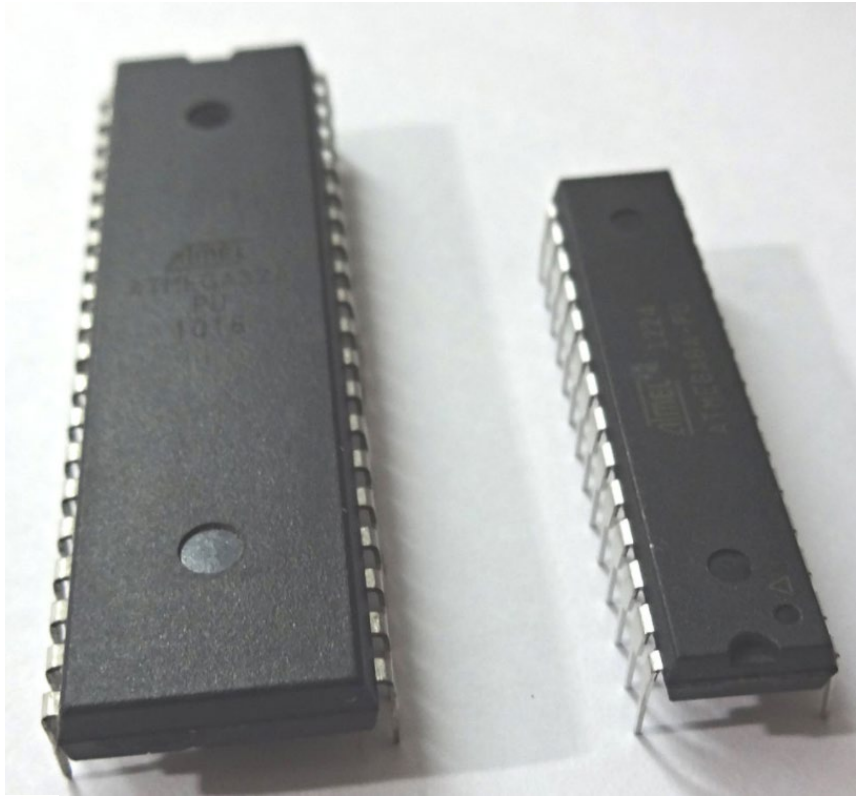


Demo ADC


U5
U6
VDD
18V
1kΩ 61.2 %
Key=A
V1
2V
R1
U1
1.224
U7
3554AM
VSS
-18V
R3
3kΩ
R2
2kΩ
U3
Vin
D0
D1
D2
D3
D4
D5
D6
D7
VCC
5.0V
Vref+
Vref-
SOC
EOC
U4
1kHz
ADC

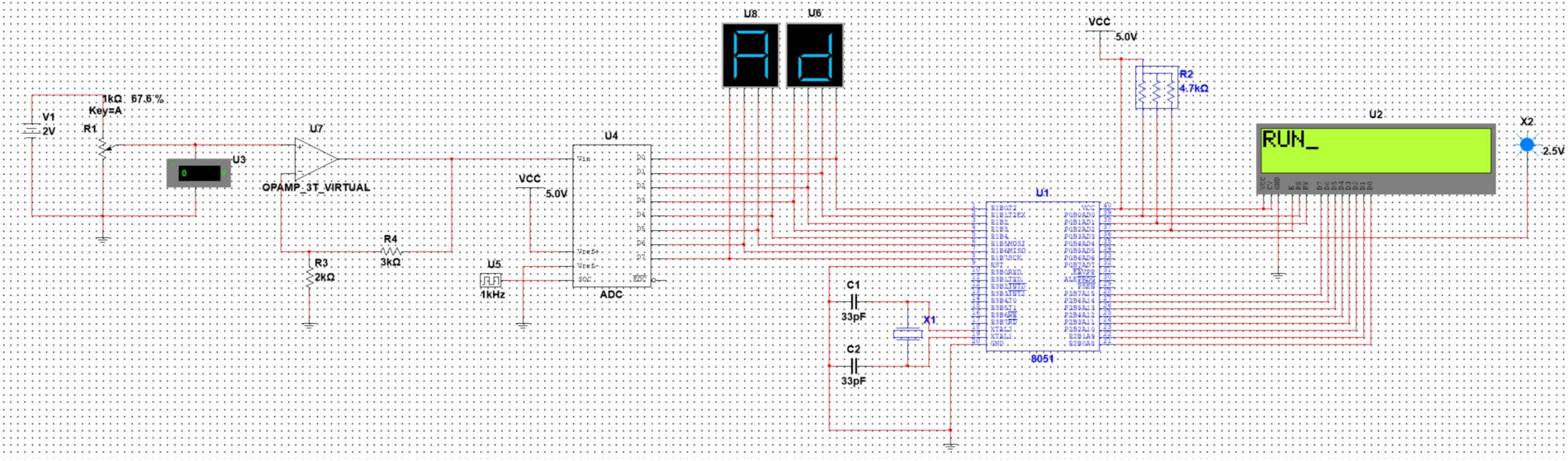
MCU

A **microcontroller** (**MCU** for *microcontroller unit*) is a small computer on a single metal-oxide-semiconductor (MOS) integrated circuit (IC) chip.



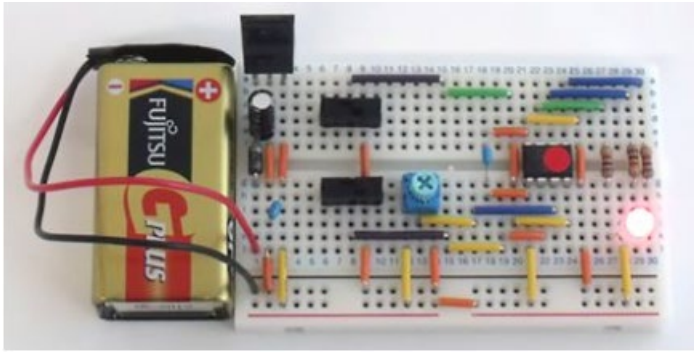
A PIC 18F8720 microcontroller in an 80-pin TQFP package

Demo: MCU

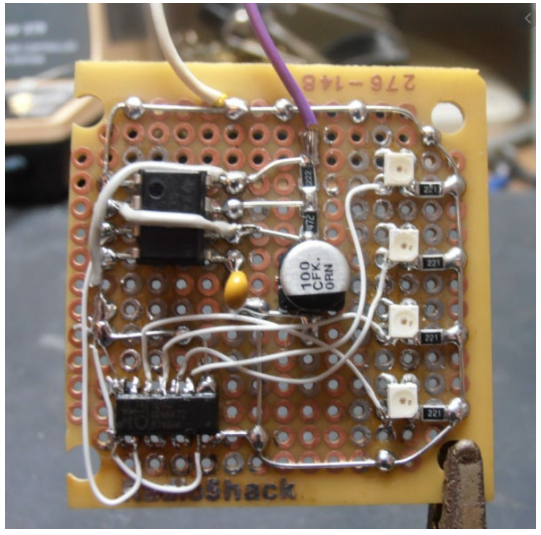

U8
U6
VCC
5.0V
R2
4.7kΩ
U2
X2
2.5V
RUN_
1kΩ 67.6 %
Key=A
V1
2V
R1
U7
U3
OPAMP_3T_VIRTUAL
U4
VCC
5.0V
R4
3kΩ
R3
2kΩ
U5
1kHz
ADC
U1
C1
33pF
X1
C2
33pF
8051

Boarding it

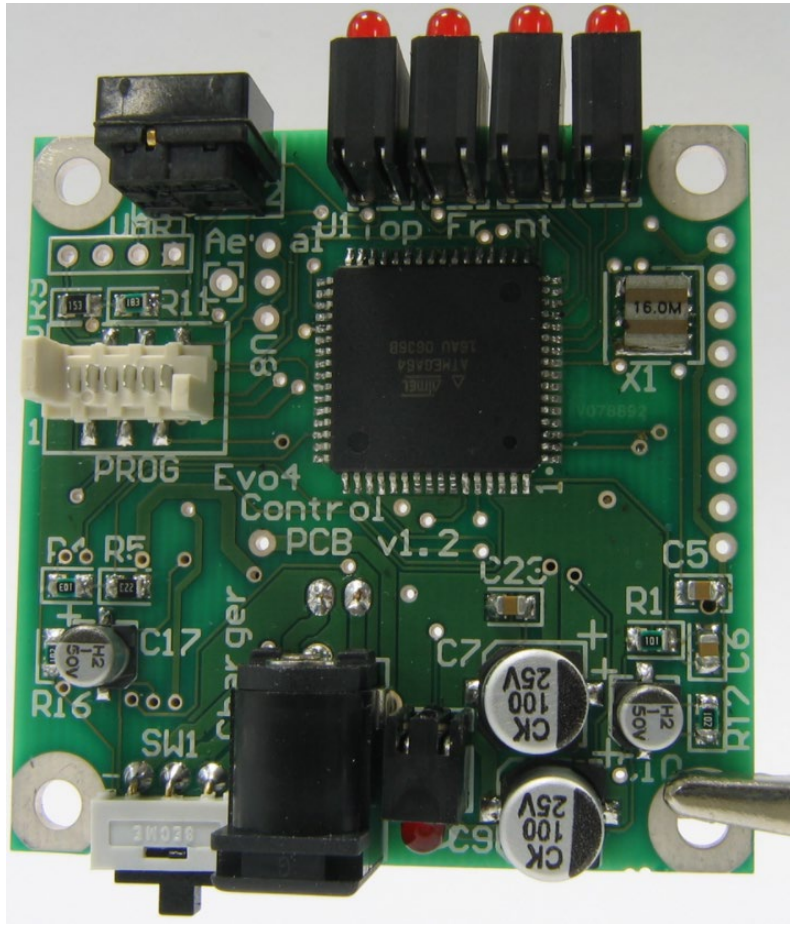
- breadboard



- Perfboard



- Printed circuit board (PCB)



Q&A