Chapter 7

System Design: Peripheral ICs and Interfacing

Lesson 1

DAC - Digital to Analog Converter

Digital to Analog Conversion (DAC)

- Need of analog input needed after conversion of the bits in many applications
- Generate analog output in DAC proportional to using Digital bits at input
- Maximum analog output when input bits = all 1s and is equal to reference + input Vref+
- Minimum analog output when input bits = all 0s and is equal to reference – Vref–

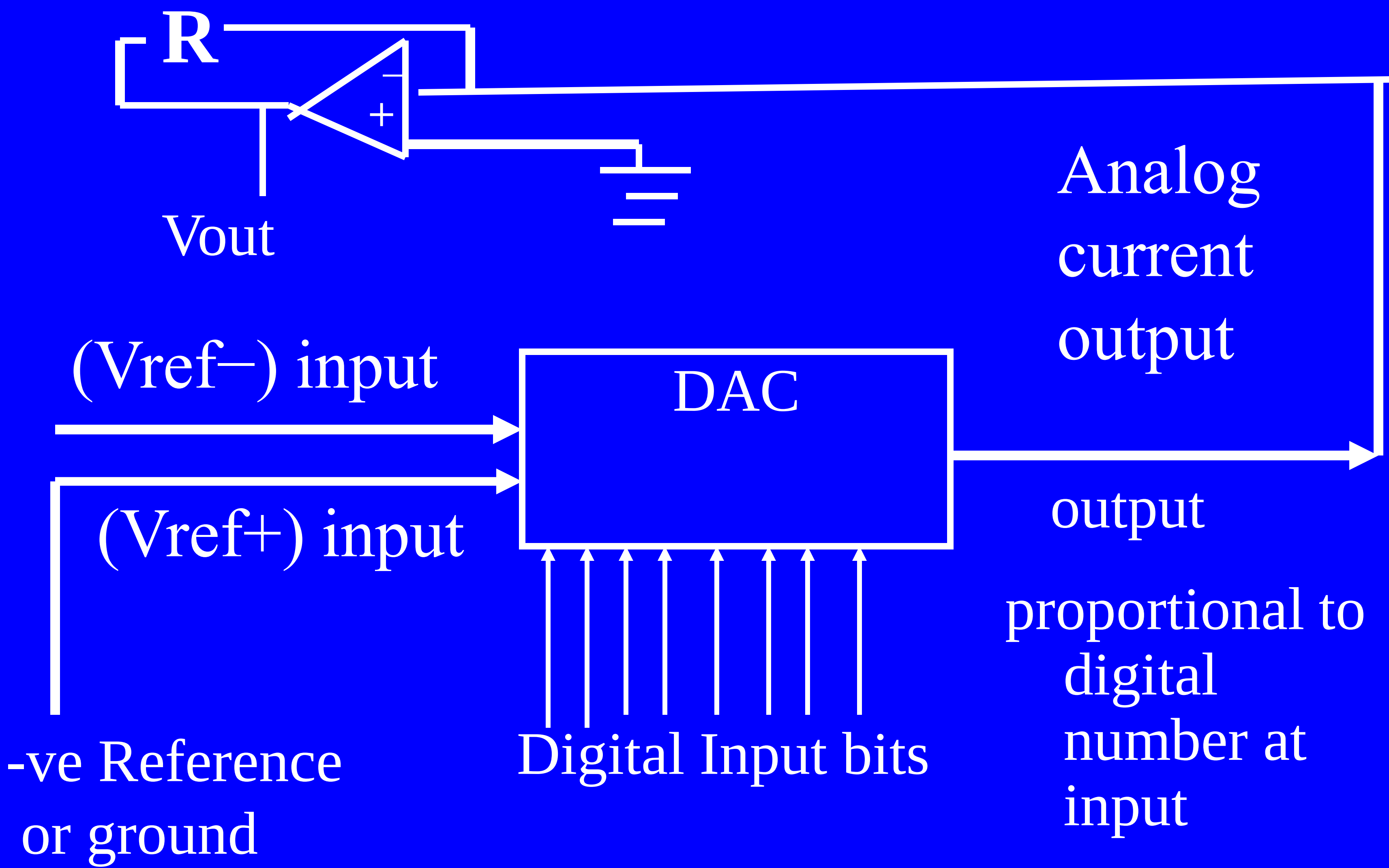
DAC Analog output

- n-bit DAC analog output =

$$\frac{\text{Digital input number} * (\text{Vref+} - \text{Vref}-)}{\{(2^n) - 1\}}$$

8-bit DAC Functioning example

- DAC Reference Inputs are (Vref+) = 1.275 V and (Vref–) = 0 V.
- Input bits = all 0s = 00000000 (=0d) then output = 0V,
- Input bits = 10000000 (= 128d) then output = 1.275 V× 128/255= 0.64V and
- Input bits = 11111111 (= 255d) then output = 1.275V



8-bit DAC example

DAC at MCU

- Most MCUs has PWM(s) unit,an operational amplifier integrator then generates desired output
- 80535 has PWM
- MC68HC11N4 has two channels DAC. DCON register enables/disables DAC outputs, DA1 and DA2 are 8-bit data registers for the channels

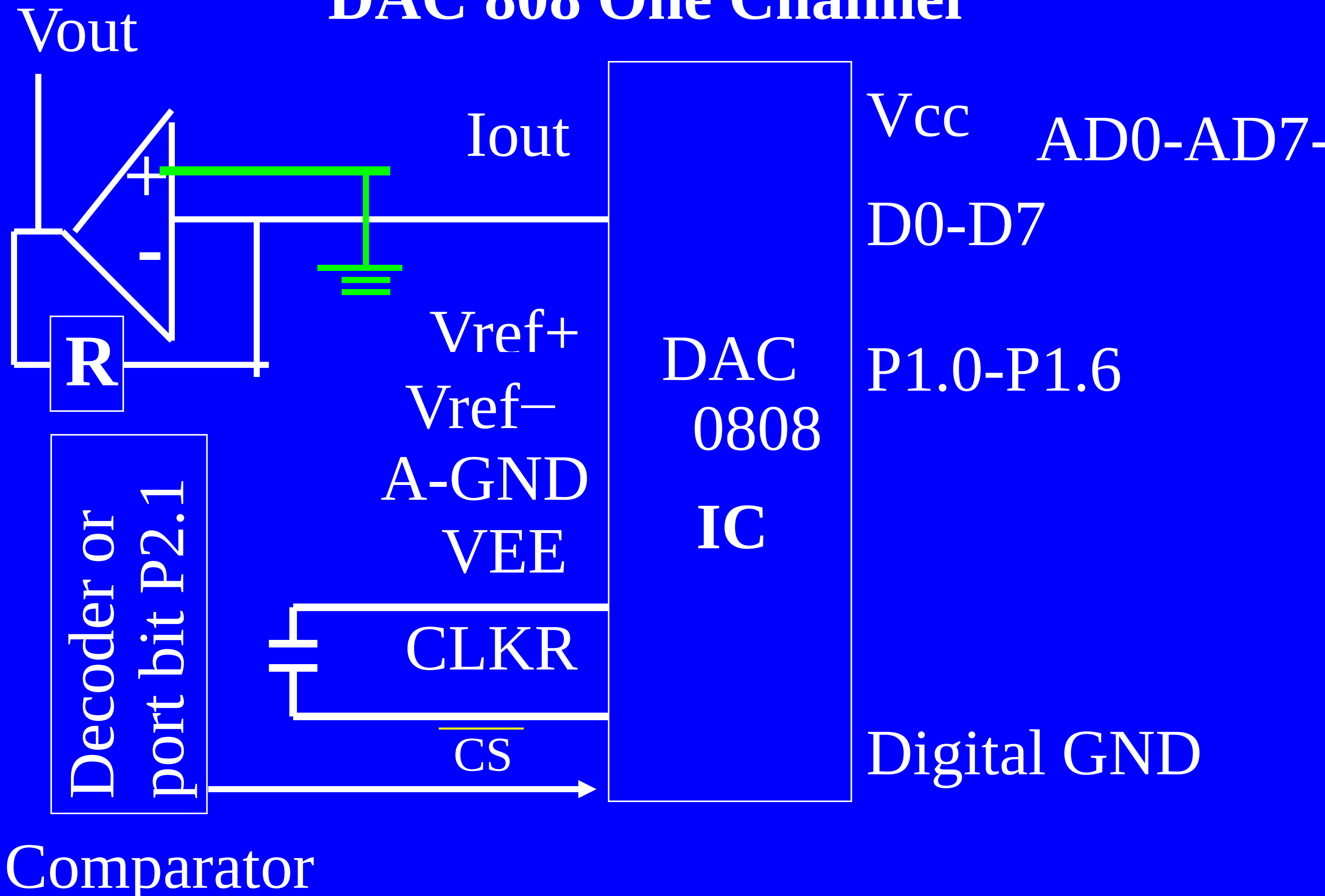
DAC Integrated Circuit

- DAC 808 one channel DAC with voltage references +and -ve analog inputs
- M1408 is one channel DAC

Considerations when using an DAC

- Number of bits, reference (single or dual programmable or non programmable), conversion accuracy,separate analog ground
- Interfacing operational amplifier
- Conversion rate and data input rate
- CMOS or Bipolar based

DAC 808 One Channel



DAC Programming

1.Initial condition P2.6 = 1,A= 00

2.Select DAC write P2.1 (CS) = 0

3. MOV P1, A; Apply DAC input

4.Delay:T/256

5. INC A;

6. Step 3

Summary

We learnt

- Digital 8 bits to analog output
- 16 Pins DAC 808
- Interface with processor buses or MCU ports