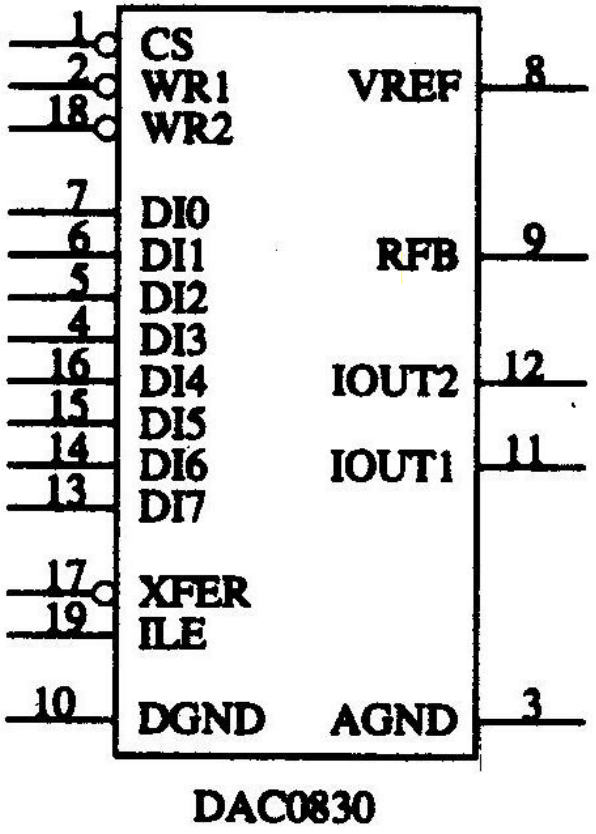
The DAC0830 Digital-to-Analog Converter

- A fairly common and low-cost digital-to-analog converter.
- This device is an 8-bit converter that transforms an 8-bit binary number into an analog voltage.
- The number of voltage steps generated by the converter is equal to the number of binary input combinations. Therefore, an 8-bit converter generates 256 different voltage levels, a 10-bit converter generates 1,024 levels, and so forth.
- The DAC0830 is a medium speed converter that transforms a digital input to an analog output in approximately 1.0 μs.

Pin Diagram of DAC0830

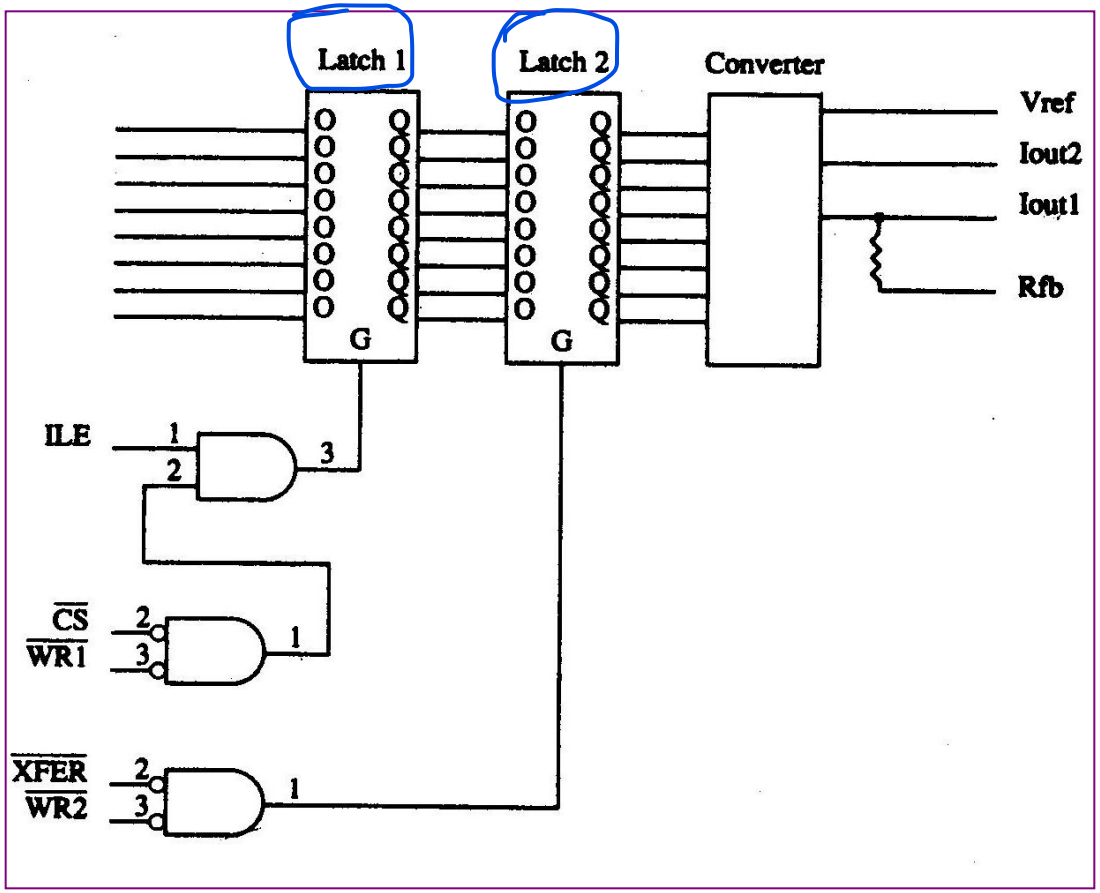
- Figure 11-48 illustrates the pin-out of the DAC0830.
- Because this is an 8-bit converter, its output step voltage is defined as $-V_{REF}$ **(reference voltage)** divided by 255. For example, if the reference voltage is -5.0V, its output step voltage is +.0196V. Note that the output voltage is the **opposite polarity** of the reference voltage.
- If an input of 10010010_2 is applied to the device, the output voltage will be the step voltage times 10010010_2, or in this case +2.862V.



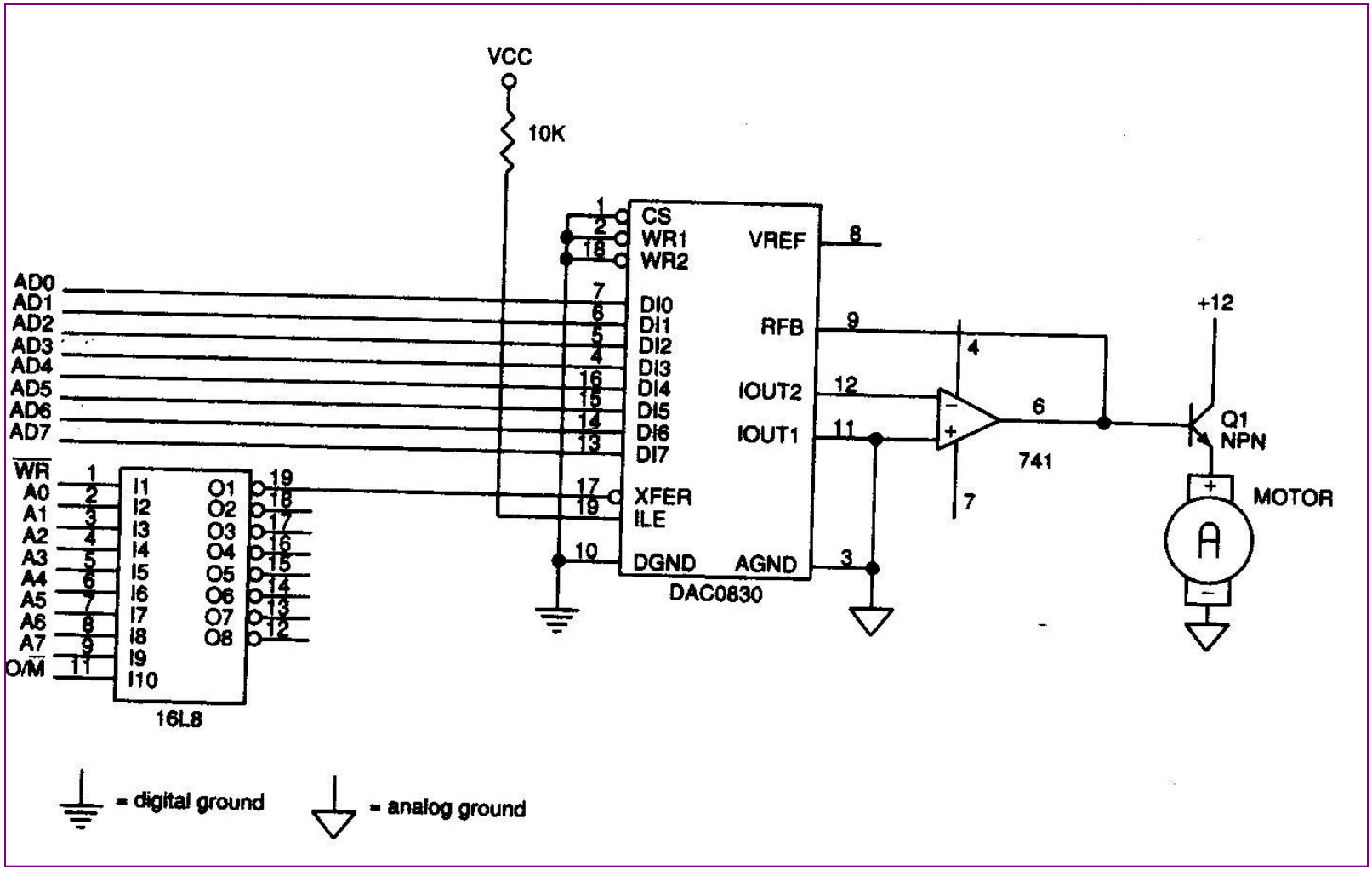
DAC0830

The Internal Structure of the DAC0830

- Figure 11-49 illustrates the internal structure of the DAC0830. Notice that this device contains **two internal registers.** The first is a **holding register**, while the second connects to the R-2R internal ladder converter.



Connecting the DAC0830 to the Microprocessor

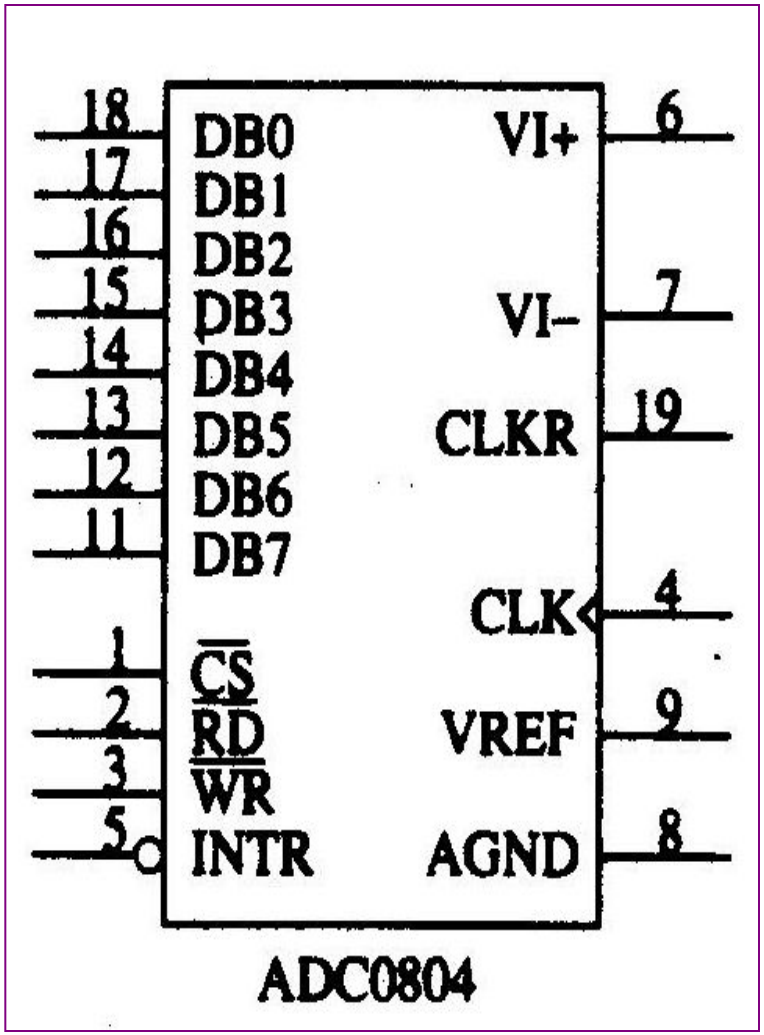


The ADC080X Analog-to-Digital Converter

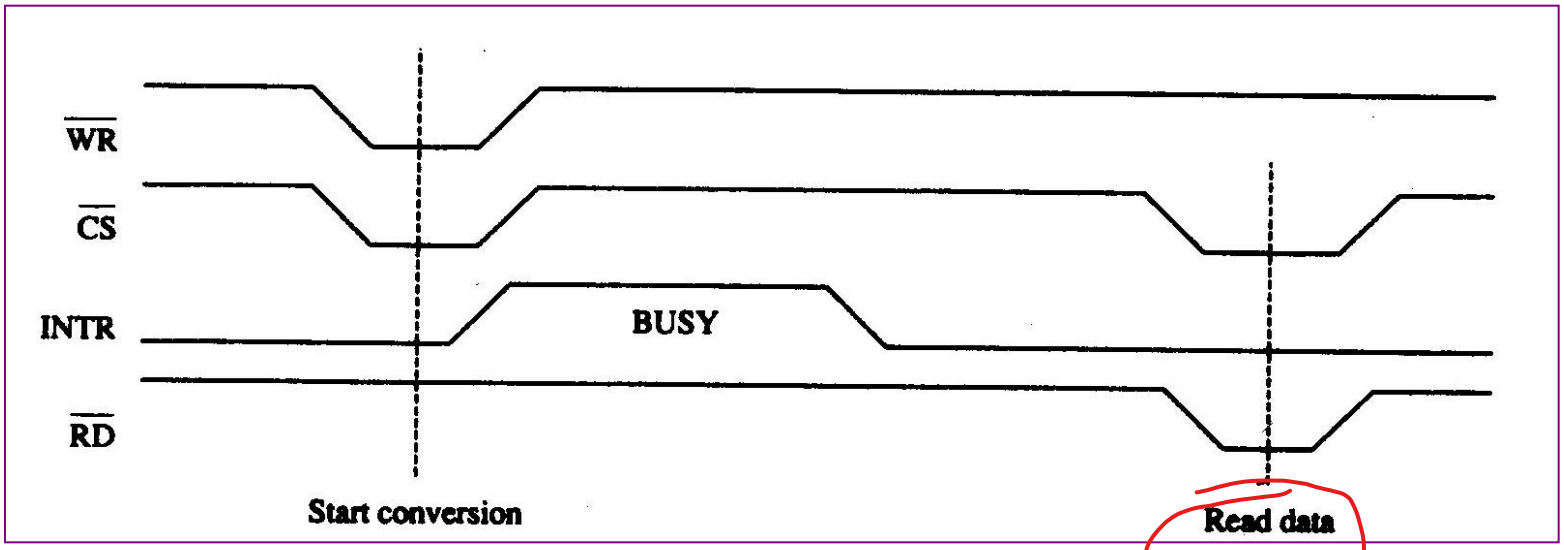
- A common low cost ADC is the ADC080X, which belongs to a family of converters that are all identical except for accuracy.
- This device is compatible with a wide range of microprocessors such as the Intel family.
- The ADC080X requires up to 100 μs to convert an analog input voltage into a digital output code.

The Pin-out of the ADC0804

- To operate the converter, the WR pin is pulsed with CS grounded to start the conversion process. Because this converter requires a considerable amount of time for the conversion, a pin labeled INTR signals the end of the conversion.



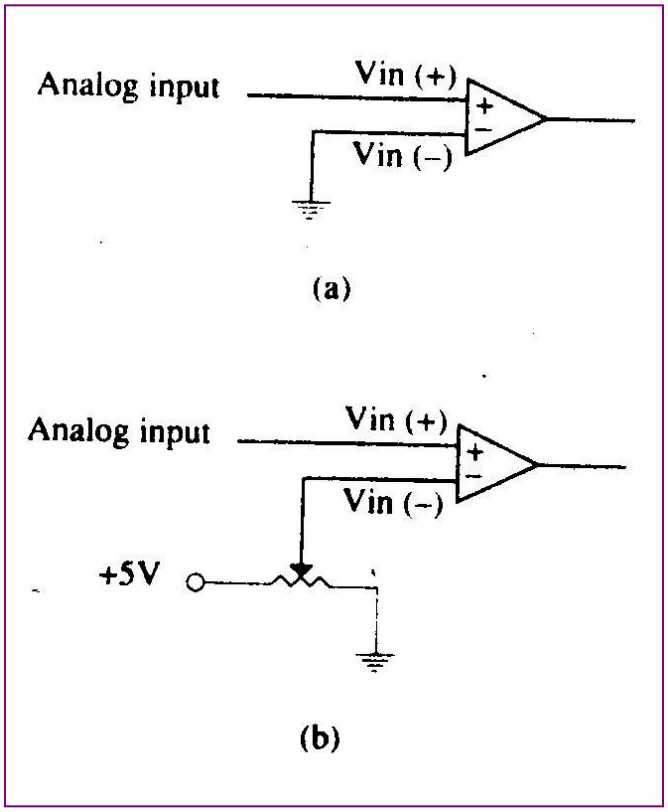
Timing Diagram that Shows the Interaction of the Control Signals



The Analog Input Signal

- There are two analog inputs to the ADC0804:

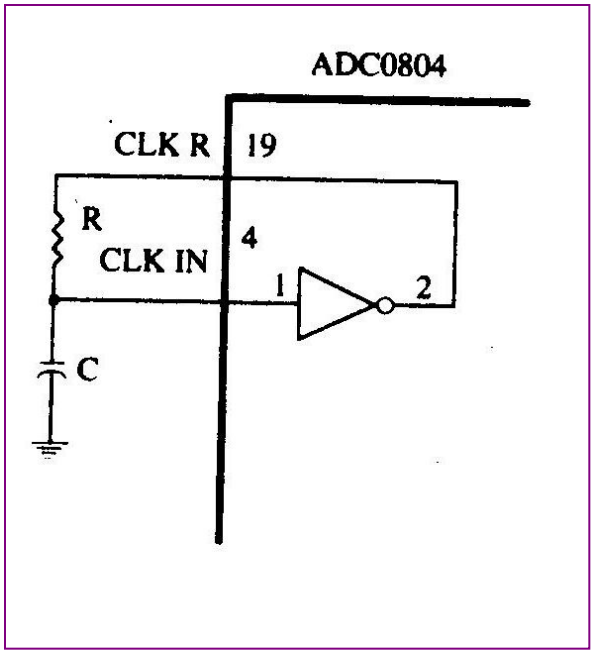
  VIN (+) and VIN (-)
- The differential inputs are **summed by the operational amplifier** to produce a signal for the internal analog-to-digital converter.
- Figure 11-53 shows a few ways to use these differential inputs. **The first** way uses a single input that can vary between 0 V and +5.0 V. **The second** shows a variable voltage applied to the VIN (-) pin so the zero reference for VIN (+) can be adjusted.



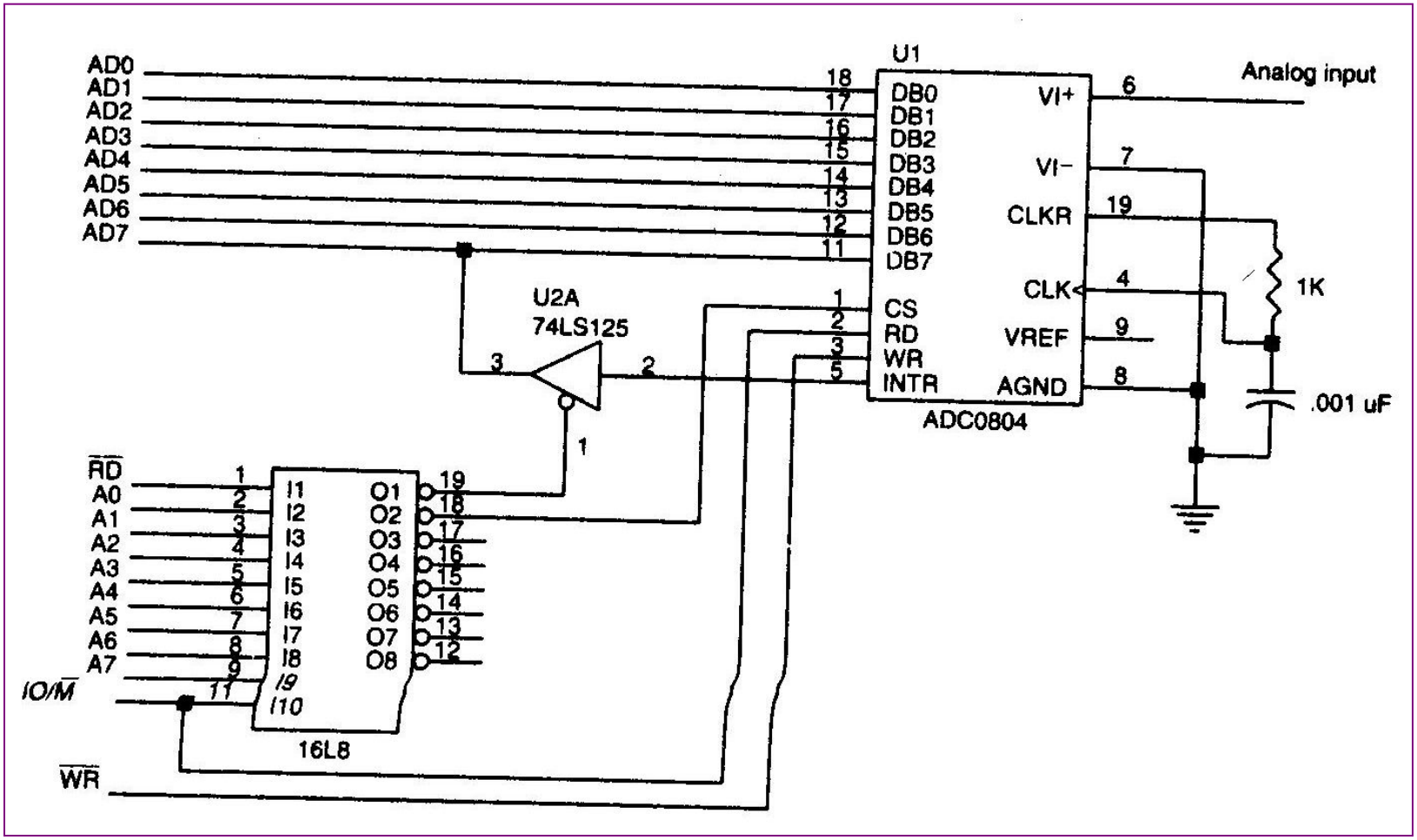
Generating the Clock Signal

- The clock **can be an external** clock applied to the CLK IN pin, or it **can be generated** with an **RC** circuit. The permissible range of clock frequencies is between **100 KHz and 1460 KHz**. It is desirable to use a frequency that is as close as possible to 1460 KHz, so conversion time is kept to a minimum.
- When this connection is in use, the clock frequency is calculated by the following equation:

$$F_{Clk}=1/(1.1\ RC)$$



Connecting the ADC0804 to the Microprocessor

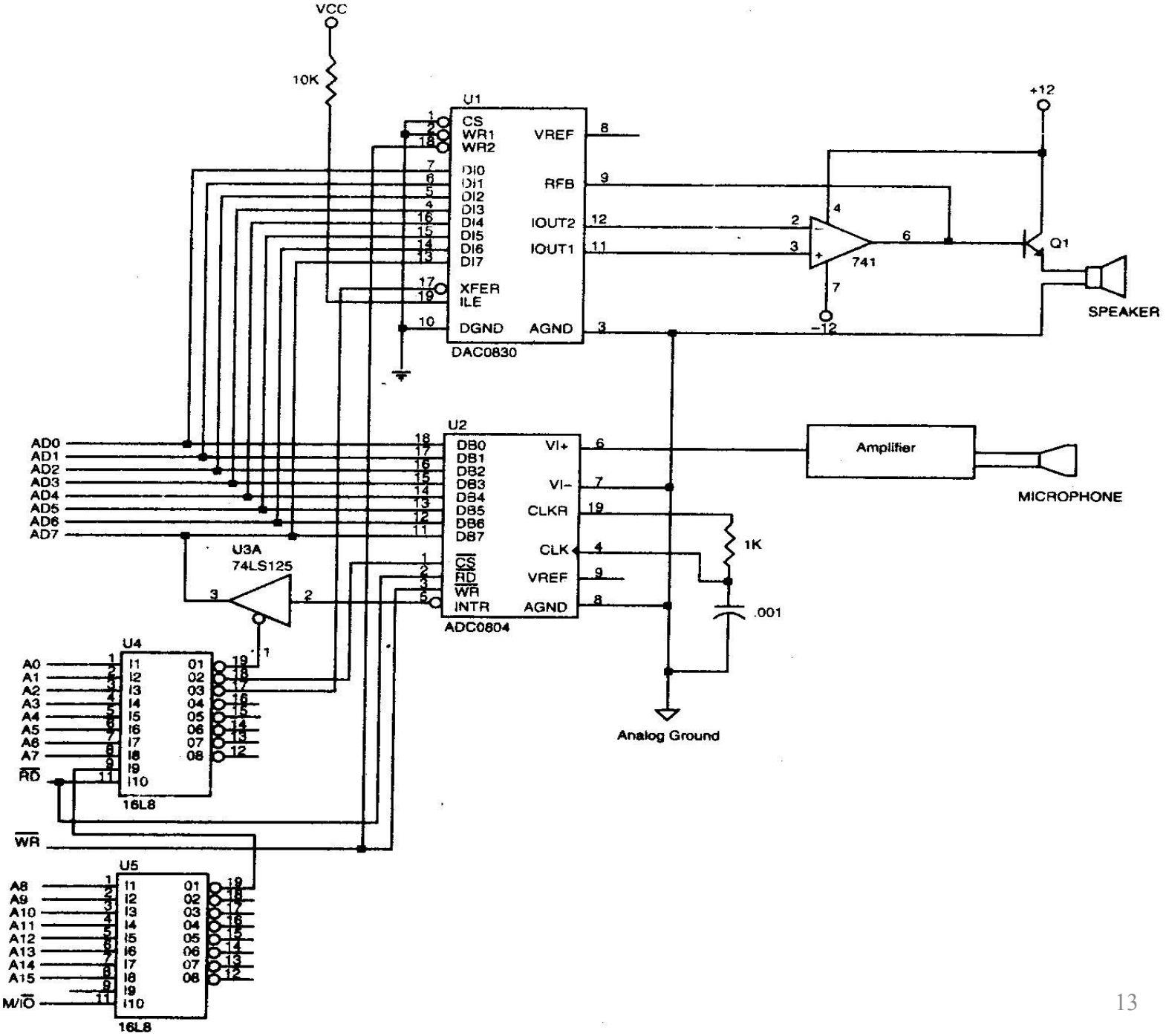


The Procedure Required to Start and Read the Data from the ADC

```
ADC     PROC   NEAR
        OUT    40H, AL
        .REPEAT
            IN      AL, 42H
            TEST  AL, 80H
        .UNTIL ZERO?
        IN     AL, 40H
        RET
ADC           ENDP
```

Using the ADC0804 and the DAC0830

- This section of the text illustrates an example using both the ADC0804 and the DAC0830 to capture and replay audio signals or speech.
- Figure 11-56 illustrates the circuitry required to connect the ADC0804 at I/O ports 0700H and 0702H. The DAC0830 is interfaced at I/O port 0704H. These I/O ports are in the low bank of a 16-bit microprocessor such as the 8086 or 80386SX.
- The software used to run these converters appears in Example 11-29. This software reads a one-second burst of speech and then plays it back 10 times.


VCC
10K
U1
CS
WR1
WR2
DI0
DI1
DI2
DI3
DI4
DI5
DI6
DI7
XFER
ILE
DGND
VREF
RFB
IOUT2
IOUT1
AGND
DAC0830
+12
741
Q1
SPEAKER
-12
AD0
AD1
AD2
AD3
AD4
AD5
AD6
AD7
U2
DB0
DB1
DB2
DB3
DB4
DB5
DB6
DB7
CS
RD
WR
INTR
VI+
VI-
CLKR
CLK
VREF
AGND
ADC0804
Amplifier
MICROPHONE
1K
.001
Analog Ground
U3A
74LS125
U4
A0
A1
A2
A3
A4
A5
A6
A7
RD
16L8
WR
U5
A8
A9
A10
A11
A12
A13
A14
A15
M/IO
16L8