**Interface DAC to a PC**

- **DAC (Digital-to-Analog Converter)**
  - Device used to convert digital pulses to analog signals
  - Two methods of making the DAC
    - Binary weighted
    - R / 2R ladder
  - The vast majority of IC use R / 2R since it can achieve a much high degree of precision

**Criterion for Judging a DAC: Resolution**

- Resolution is a function of the number of binary inputs. Common ones are 8, 10, 12 pins
- The number of analog output levels is equal to $2^n$, where $n$ is the number of data inputs
  - 8-input DAC (MC1408) gives 256 discrete voltage/current levels of output
  - 12-input DAC $\rightarrow$ 4096 voltage/current levels
  - 16-input DAC $\rightarrow$ 65,536 voltage/current levels

**8255 Design Example**

- In MC1480, the digital inputs are converted to current ($I_{out}$) and by connecting a resistor to the $I_{out}$ pin, we convert the result to voltage.
- The current provided by $I_{out}$ is a function of binary numbers at D0-D7 and the reference current.
- $I_{ref}$ is generally set to 2.0 mA.
- $I_{out} = I_{ref} \cdot (D_7/2 + D_6/4 + D_5/8 + D_4/16 + D_3/32 + D_2/64 + D_1/128 + D_0/256)$. 

**Control Word of 8255**

Group B

- Port C Lower PC7-PC4
  - 1 = input, 0 = output
- Mode Selection
  - 0 = Mode0, 1 = Mode1

Group A

- Port A
  - 1 = input, 0 = output
- Mode Selection
  - 00 = Mode0, 01 = Mode1
  - 1x = Mode 2
- 1 = I/O Mode
  - 0 = BSF Mode
Interface DAC to PC

- Example 1
  - Interface MC1480 to Microprocessor through PPI 8255
- Example 2
  - Interface AD558 directly to Microprocessor

Interface AD558 to 8088
8-bit DAC Voltage Output

- Example 2
  - Interface AD558 directly to Microprocessor

Interface MC1480 to Microprocessor through PPI 8255

- Example 1
  - Interface MC1480 to Microprocessor through PPI 8255

MOV AL, 80H
OUT PCtrl, AL
MOV AL, 0
Cont: OUT PA, AL
INC AL
CMP AL, 0
JZ Stop
MOV CX, 0FFFFH
Here: LOOP Here
JMP Cont
Stop: INT 6

Interface DAC and Sensors to a PC

- AD558 is configured as “write only”
- VCC range +4.5V ~ +16.5 V, normally +5V
- Vout Range: 0 ~ 2.56 V, or 0 ~ 10 V
- Digital Input Code

<table>
<thead>
<tr>
<th>Binary</th>
<th>Hex</th>
<th>Decimal</th>
<th>Output Voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>00000000</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>00000001</td>
<td>1</td>
<td>0.010V</td>
<td>0.039V</td>
</tr>
<tr>
<td>00001111</td>
<td>15</td>
<td>0.150V</td>
<td>0.586V</td>
</tr>
<tr>
<td>11111111</td>
<td>FF</td>
<td>255</td>
<td>2.55V</td>
</tr>
<tr>
<td>9.961V</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

AD558
CS
CE
8088
Address Select
Address Bus

IOW
IOSEL5
DB0 ~ DB7
8-bit
Address Bus

AD 558
Address Select
Address Bus

Data Bus
8-bit
DB0 ~ DB7

Vout
0 ~ 2.56 V Range

<table>
<thead>
<tr>
<th>(LSB) DB₀</th>
<th>1</th>
<th>16</th>
<th>Vout</th>
</tr>
</thead>
<tbody>
<tr>
<td>DB₁</td>
<td>2</td>
<td>15</td>
<td>Vout (Sense)</td>
</tr>
<tr>
<td>DB₂</td>
<td>3</td>
<td>14</td>
<td>Vout (Select)</td>
</tr>
<tr>
<td>DB₃</td>
<td>4</td>
<td>13</td>
<td>GND</td>
</tr>
<tr>
<td>DB₄</td>
<td>5</td>
<td>12</td>
<td>GND</td>
</tr>
<tr>
<td>DB₅</td>
<td>6</td>
<td>11</td>
<td>+VCC</td>
</tr>
<tr>
<td>DB₆</td>
<td>7</td>
<td>10</td>
<td>CS</td>
</tr>
<tr>
<td>(MSB) DB₇</td>
<td>8</td>
<td>9</td>
<td>CE</td>
</tr>
</tbody>
</table>

AD 558

0 ~ 10 V Range