MICROCONTROLLER AND INTERFACING

(22EC104013)

UNIT-5
8051 INTERFACING

Syllabus:

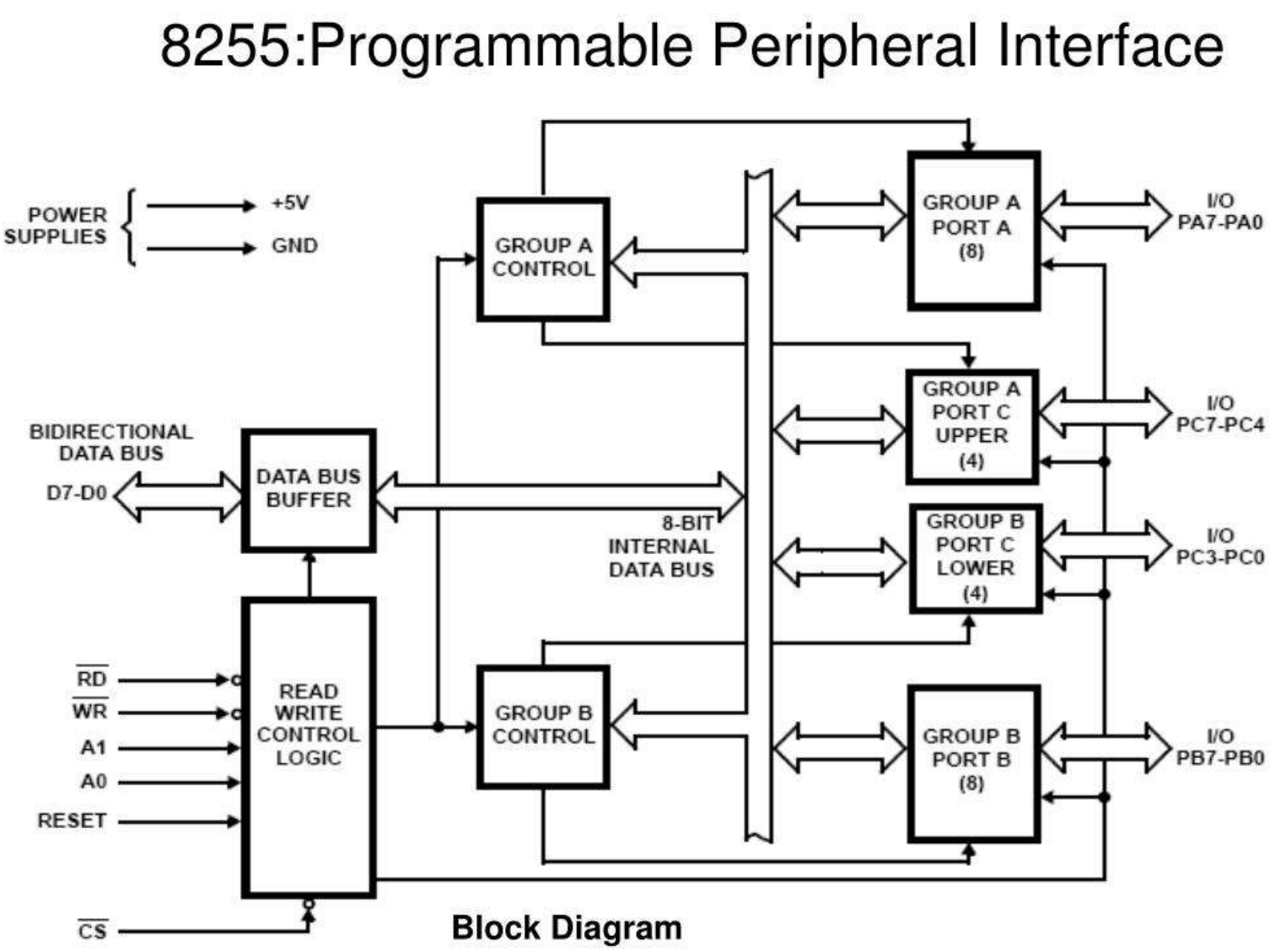
- 8255 Introduction
- Interfacing 8051 to
  - LED
  - 7-segment display
  - LCD
  - Keyboard
  - ADC
  - DAC
  - Sensor interfacing
  - Relay
  - DC motor
  - Stepper motor

Textbooks & References

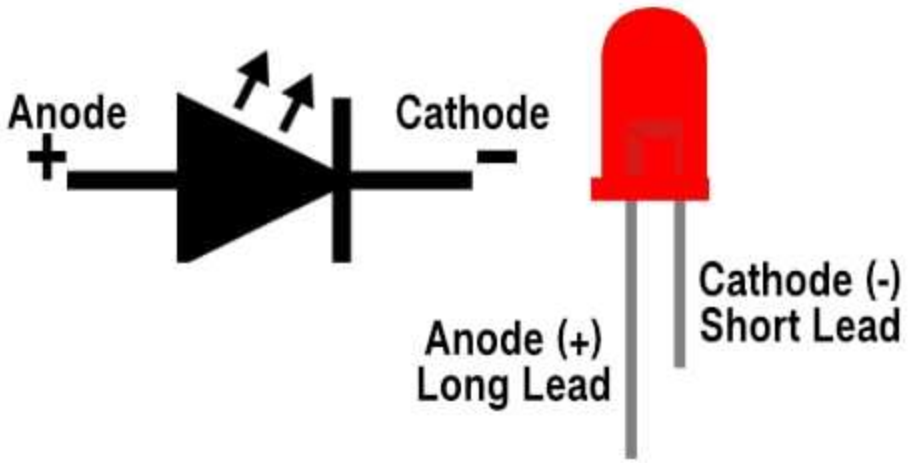
1. Kenneth J. Ayala, The 8051 Microcontroller-Architecture, Programming & Applications, 3 rd Edition, Cengage learning, June 2007.

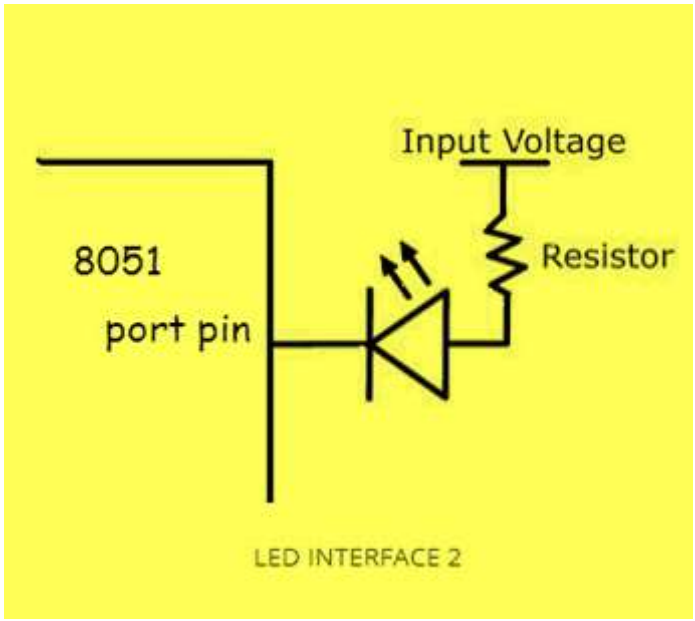
2. Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollin D, The 8051 Microcontroller and Embedded Systems-using assembly and C, PHI, 2006/ Pearson New International Edition 2014.

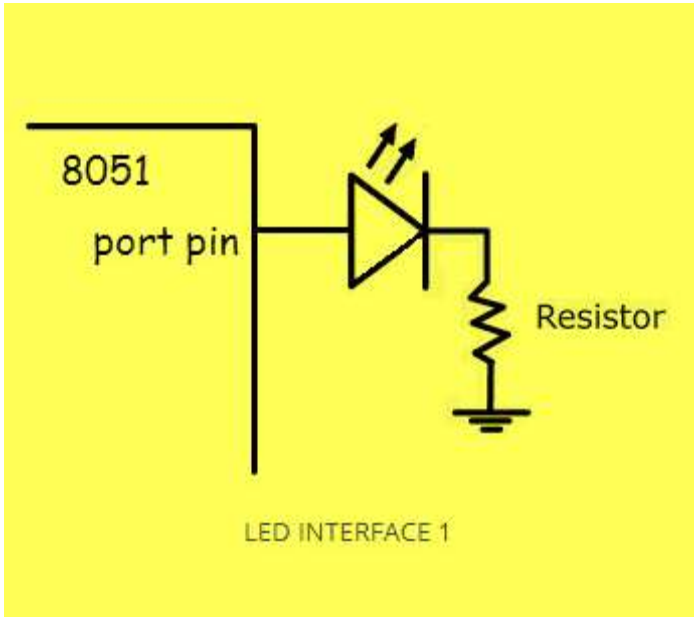
8255 Introduction



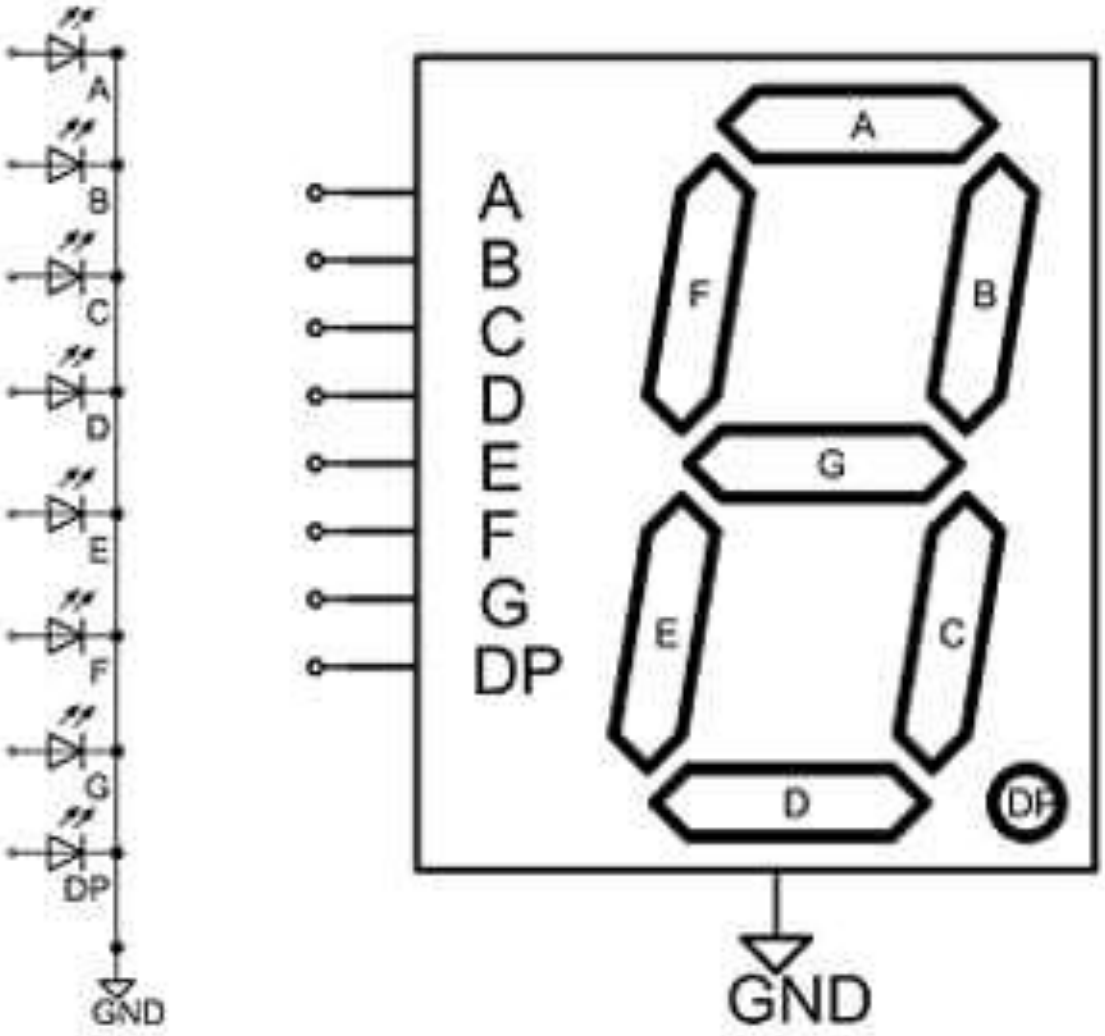
LED


Anode
+
Cathode
−
Anode (+)
Long Lead
Cathode (-)
Short Lead


Input Voltage
8051
port pin
Resistor
LED INTERFACE 2


8051
port pin
Resistor
LED INTERFACE 1

7-SEGMENT DISPLAY



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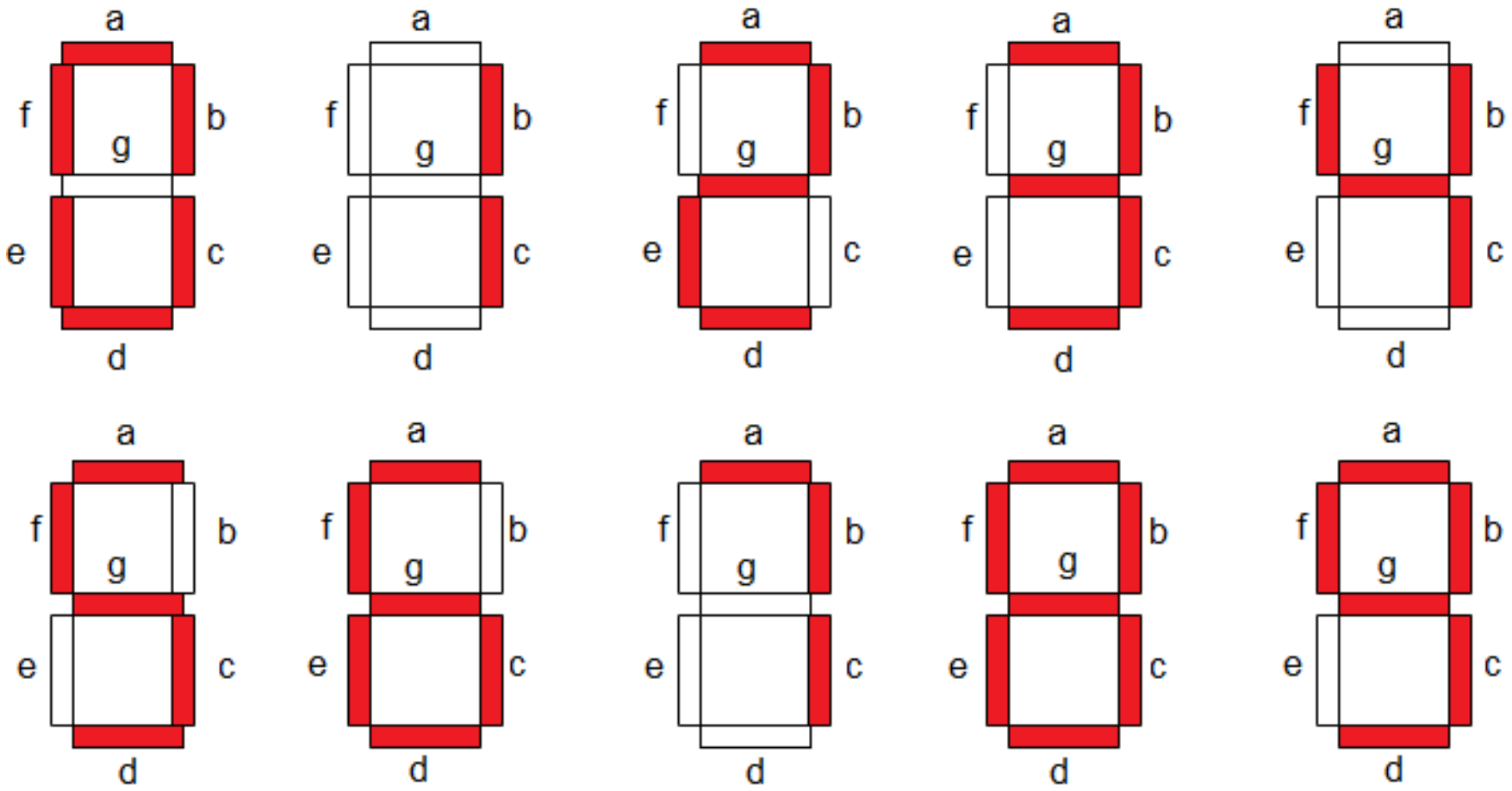
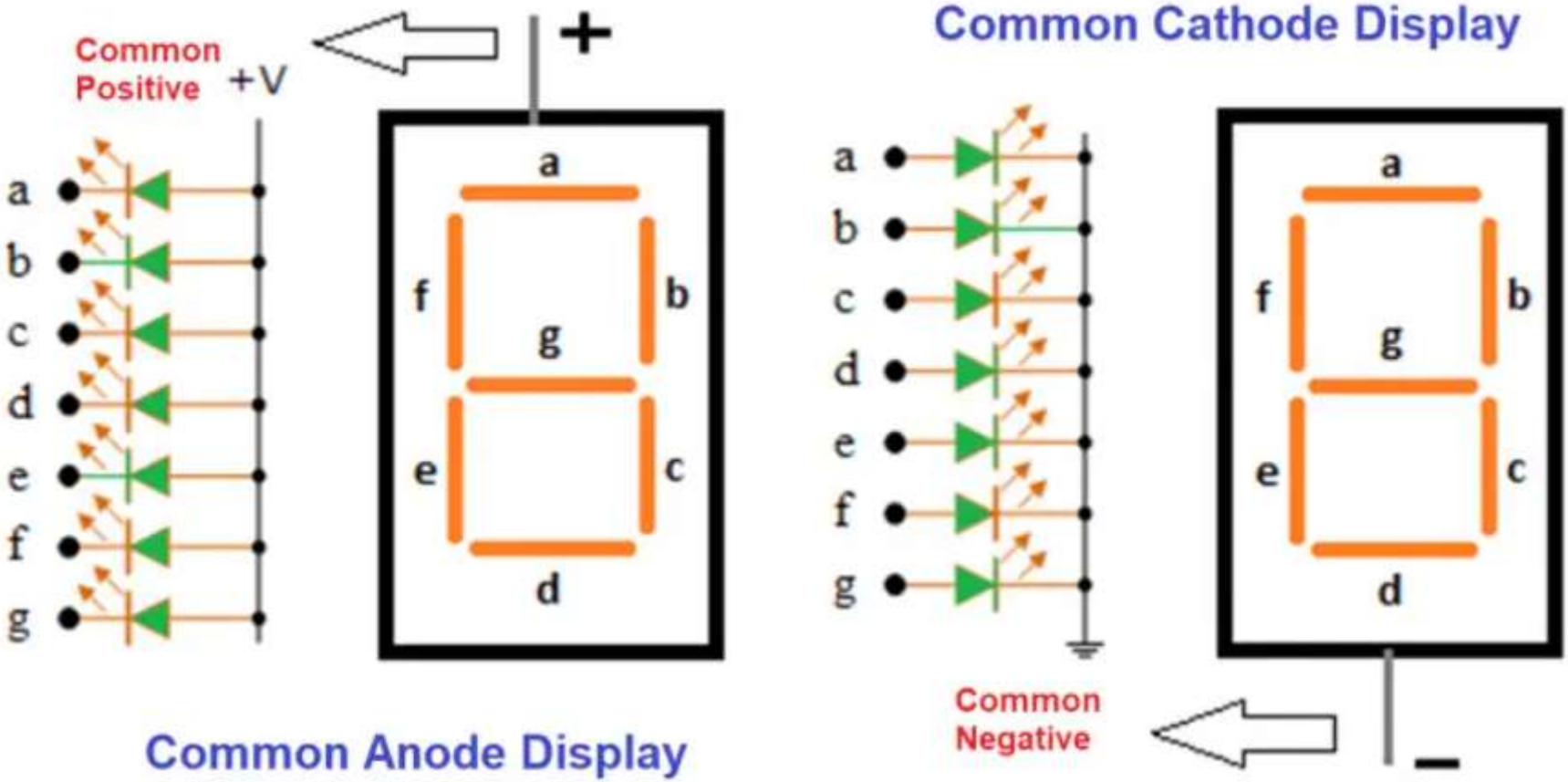
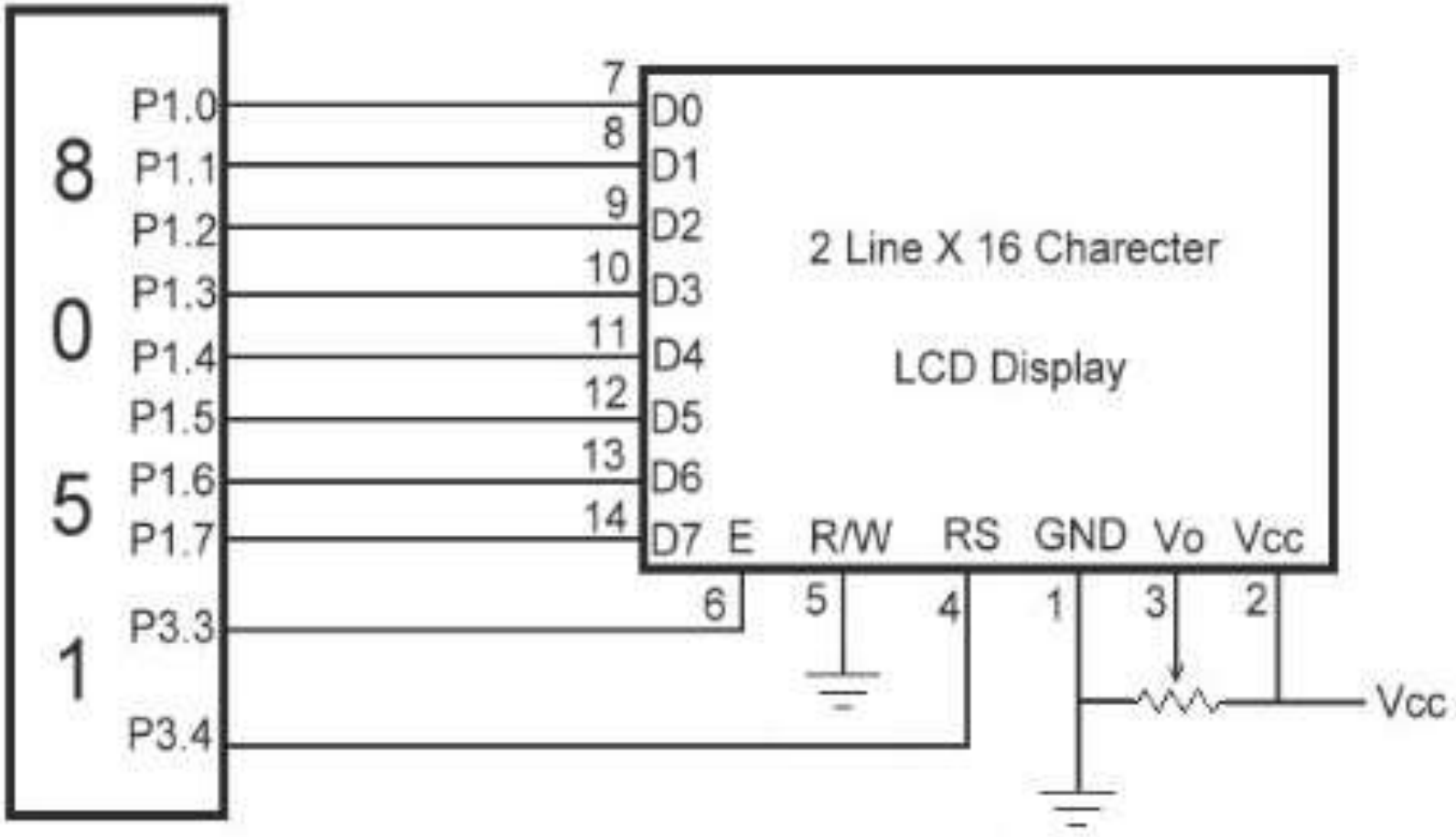


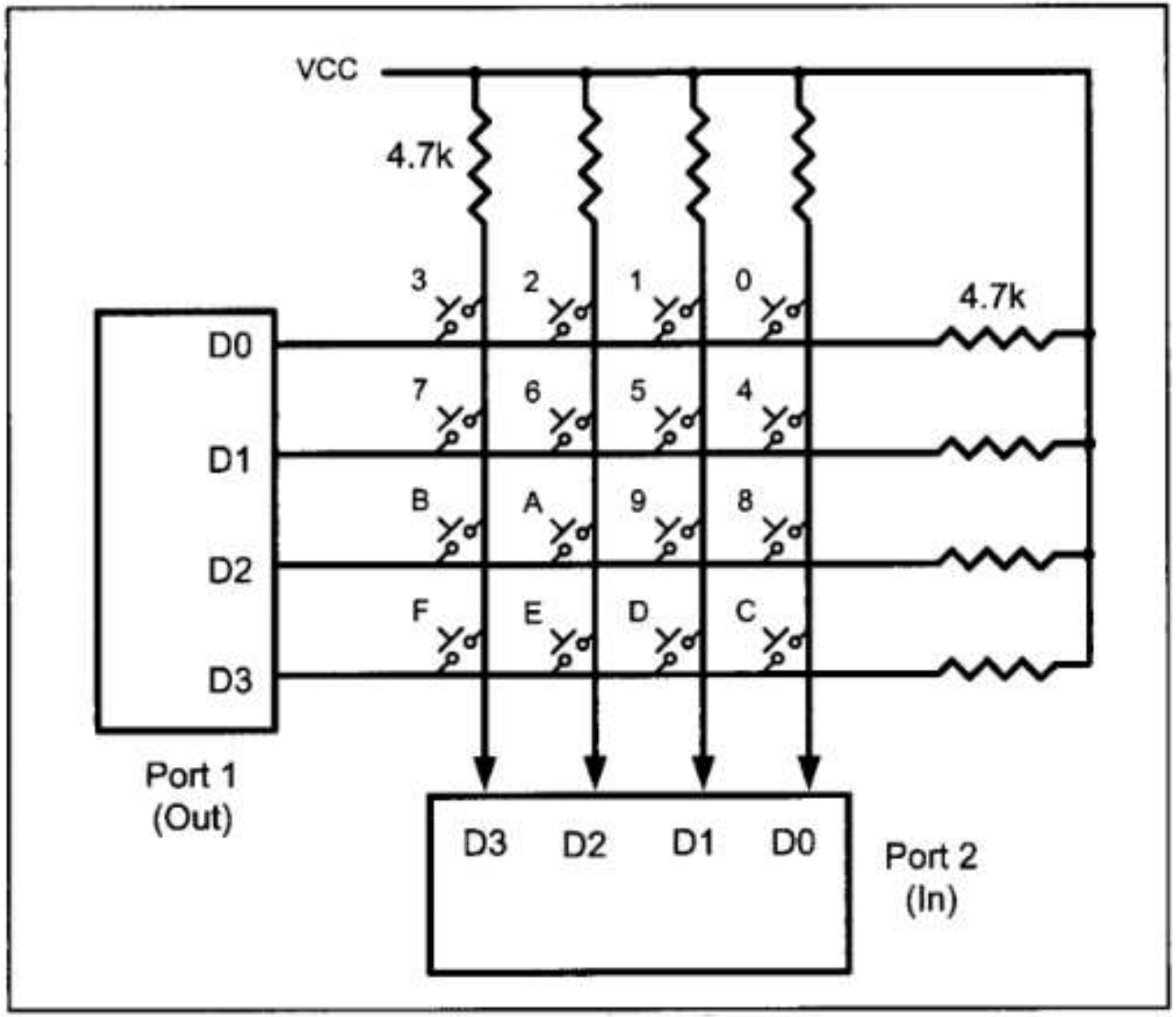
Types of displays



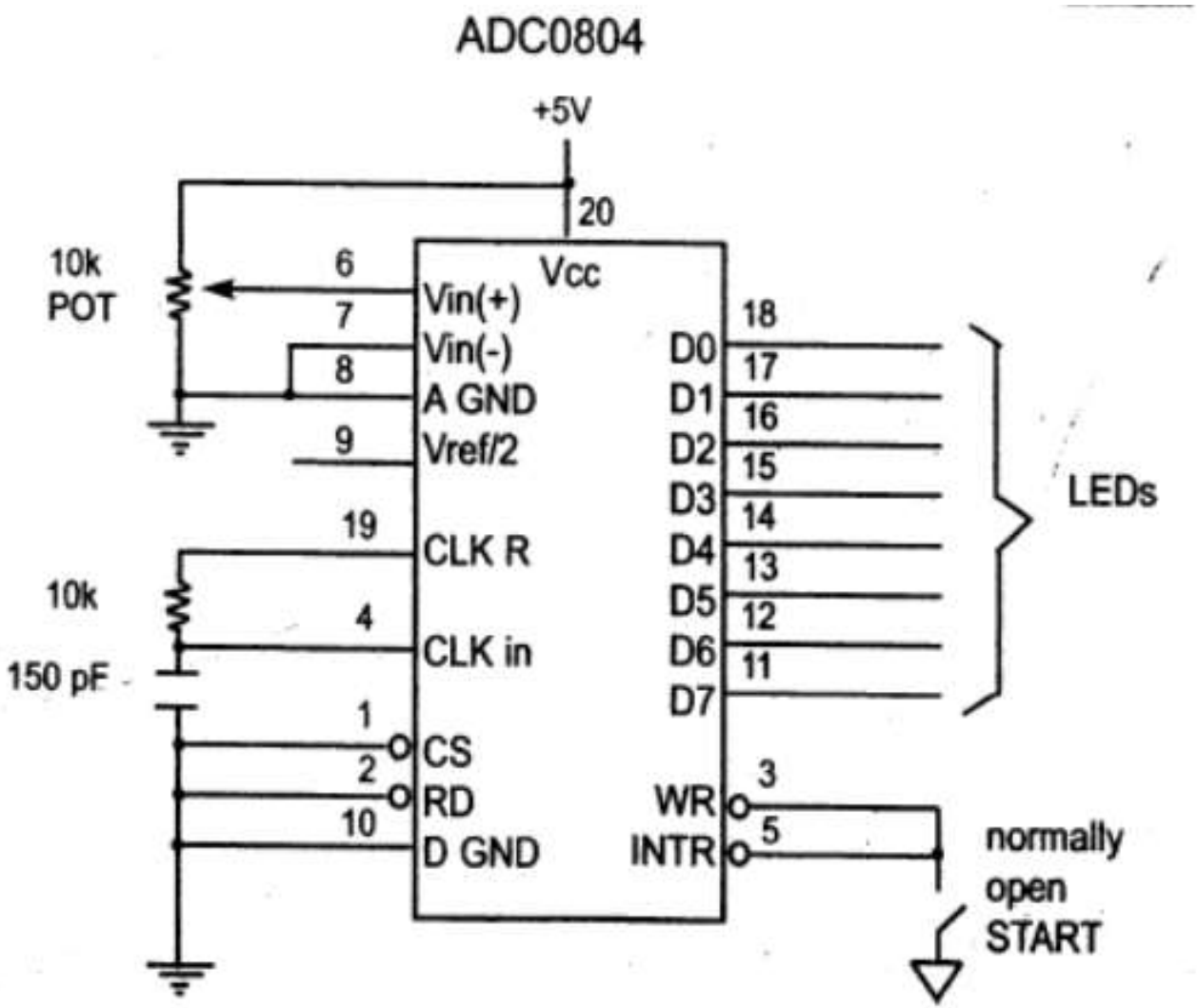
LCD


8051
P1.0
P1.1
P1.2
P1.3
P1.4
P1.5
P1.6
P1.7
P3.3
P3.4
7
8
9
10
11
12
13
14
D0
D1
D2
D3
D4
D5
D6
D7
2 Line X 16 Charecter
LCD Display
E
R/W
RS
GND
Vo
Vcc
6
5
4
1
3
2
Vcc

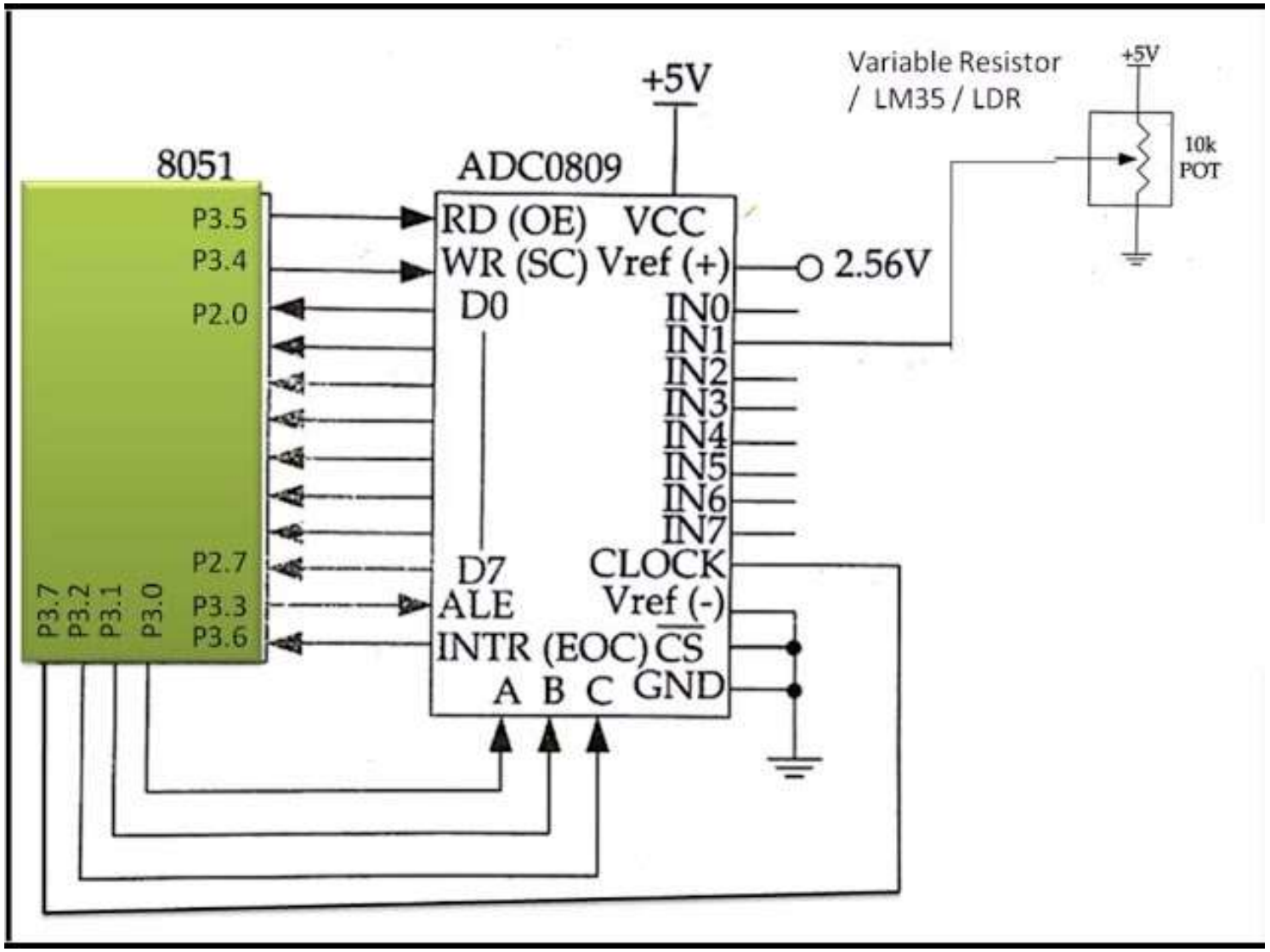
KEYBOARD


VCC
4.7k
3
2
1
0
4.7k
D0
7
6
5
4
D1
B
A
9
8
D2
F
E
D
C
D3
Port 1
(Out)
D3
D2
D1
D0
Port 2
(In)

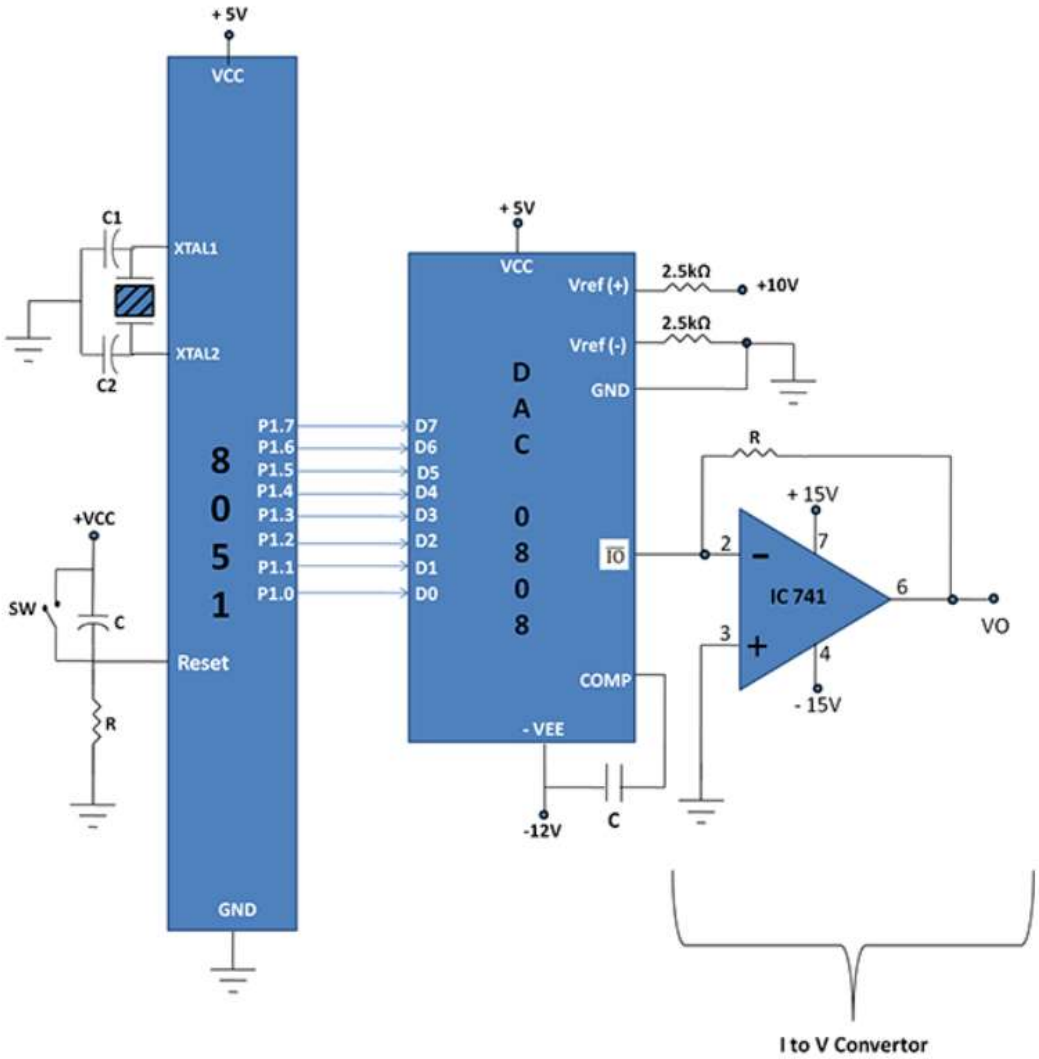
ADC


ADC0804
+5V
20
Vcc
10k
POT
6
Vin(+)
7
Vin(-)
8
A GND
9
Vref/2
19
CLK R
10k
4
CLK in
150 pF
1
CS
2
RD
10
D GND
18
D0
17
D1
16
D2
15
D3
14
D4
13
D5
12
D6
11
D7
LEDs
3
WR
5
INTR
normally
open
START

Contd.,


8051
ADC0809
+5V
Variable Resistor
/ LM35 / LDR
+5V
10k
POT
P3.5
P3.4
P2.0
P2.7
P3.3
P3.6
P3.7
P3.2
P3.1
P3.0
RD (OE)
WR (SC)
D0
D7
ALE
INTR (EOC)
A B C
VCC
Vref (+)
2.56V
IN0
IN1
IN2
IN3
IN4
IN5
IN6
IN7
CLOCK
Vref (-)
CS
GND

DAC


+ 5V
VCC
C1
XTAL1
XTAL2
C2
8051
P1.7
P1.6
P1.5
P1.4
P1.3
P1.2
P1.1
P1.0
+VCC
SW
C
R
Reset
GND
+ 5V
VCC
Vref (+)
2.5kΩ
+10V
Vref (-)
2.5kΩ
GND
DAC 0808
D7
D6
D5
D4
D3
D2
D1
D0
IO
COMP
- VEE
-12V
C
R
+ 15V
IC 741
VO
- 15V
I to V Convertor

Sensor Interfacing

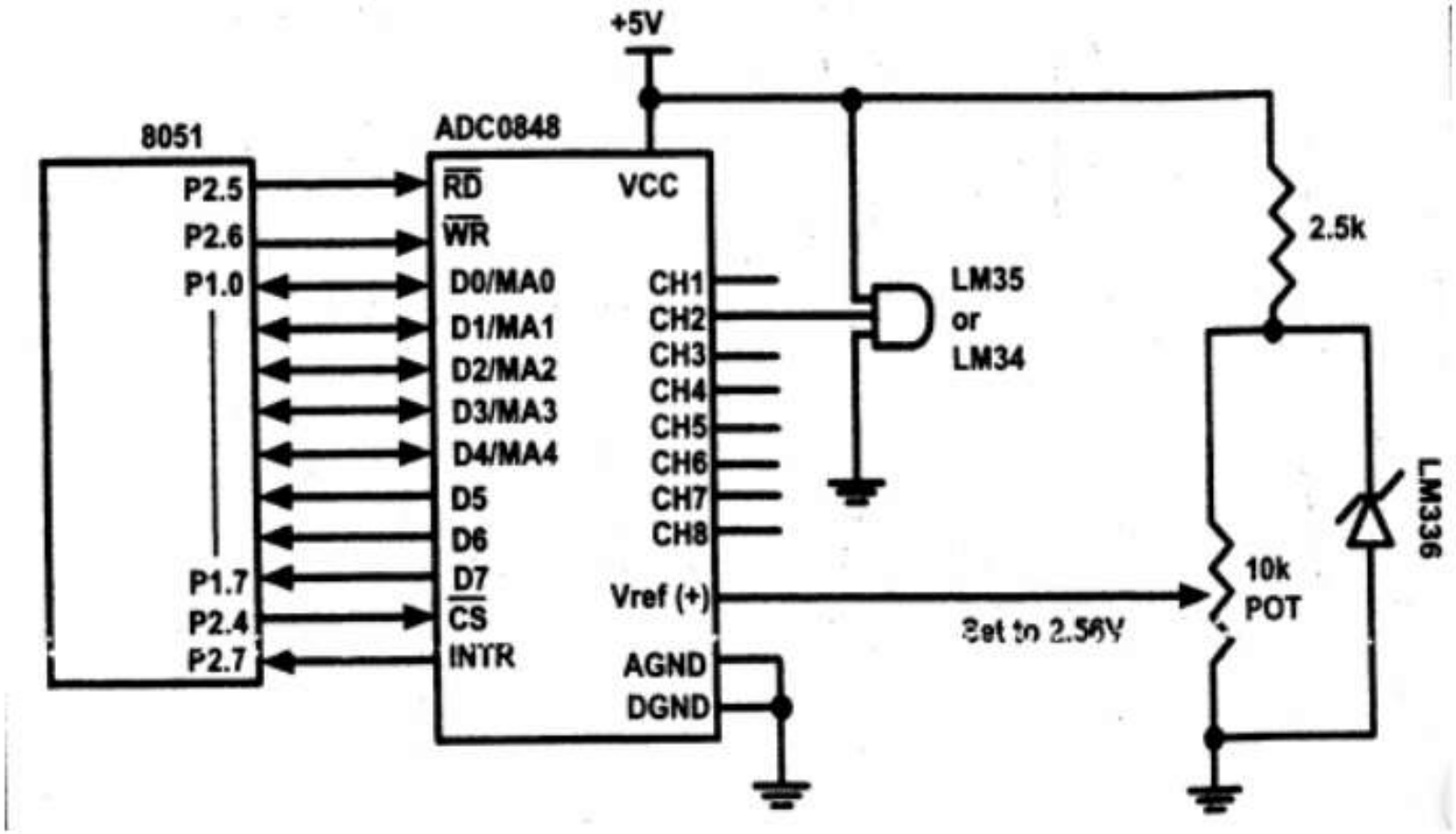
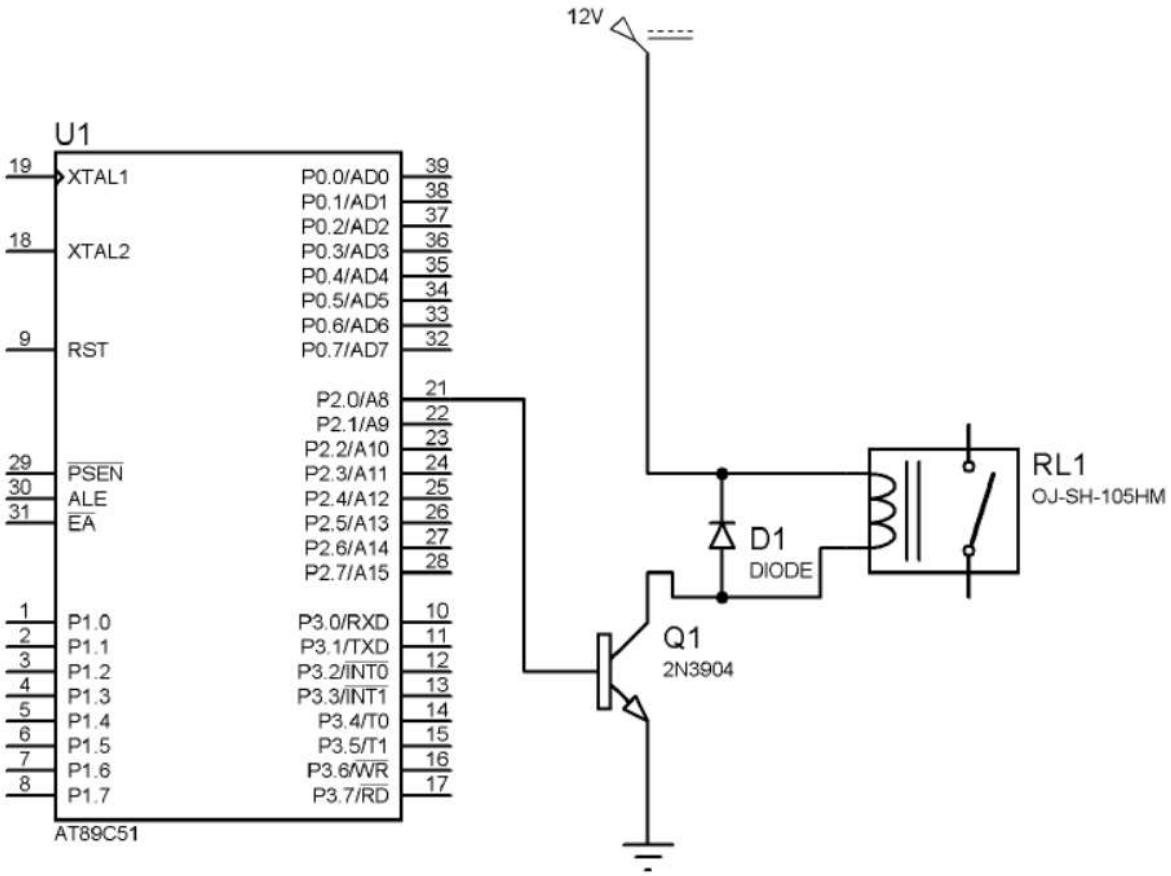


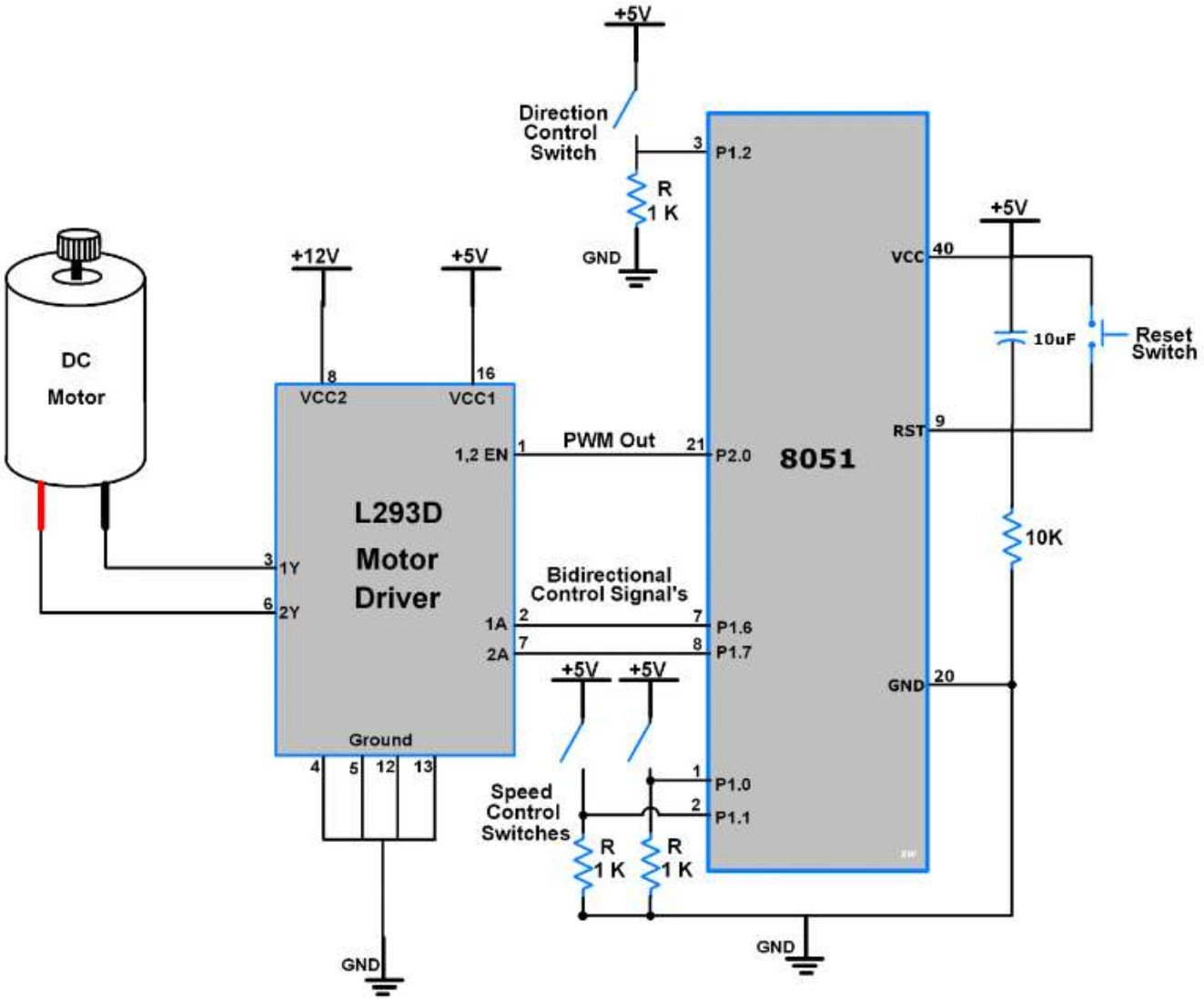
Figure 5.11 8051 Connection to ADC0848 and Temperature sensor

Relay


12V
U1
19 XTAL1
18 XTAL2
9 RST
29 PSEN
30 ALE
31 EA
1 P1.0
2 P1.1
3 P1.2
4 P1.3
5 P1.4
6 P1.5
7 P1.6
8 P1.7
AT89C51
P0.0/AD0 39
P0.1/AD1 38
P0.2/AD2 37
P0.3/AD3 36
P0.4/AD4 35
P0.5/AD5 34
P0.6/AD6 33
P0.7/AD7 32
P2.0/A8 21
P2.1/A9 22
P2.2/A10 23
P2.3/A11 24
P2.4/A12 25
P2.5/A13 26
P2.6/A14 27
P2.7/A15 28
P3.0/RXD 10
P3.1/TXD 11
P3.2/INT0 12
P3.3/INT1 13
P3.4/T0 14
P3.5/T1 15
P3.6/WR 16
P3.7/RD 17
D1
DIODE
RL1
OJ-SH-105HM
Q1
2N3904

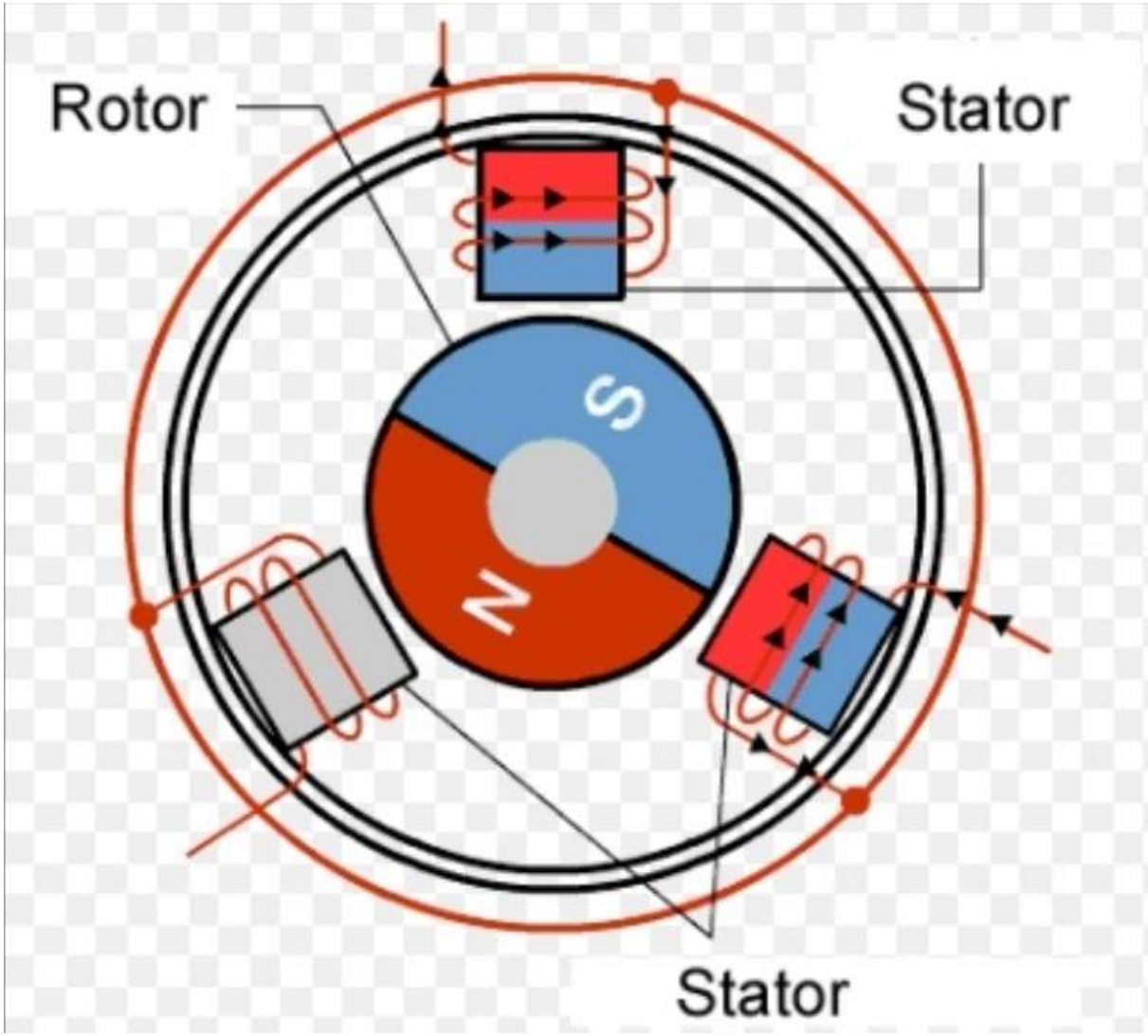
DC Motor

Interfacing with 8051



8051 DC Motor Connection using L293D Motor Driver

Stepper Motor



Some parameters of stepper motors –

- **Step Angle** – The step angle is the angle in which the rotor moves when one pulse is applied as an input of the stator. This parameter is used to determine the positioning of a stepper motor.
- **Steps per Revolution** – This is the number of step angles required for a complete revolution. So the formula is 360° /Step Angle.
- **Steps per Second** – This parameter is used to measure a number of steps covered in each second.
- **RPM** – The RPM is the Revolution Per Minute. It measures the frequency of rotation. By this parameter, we can measure the number of rotations in one minute.

The relation between RPM, steps per revolution, and steps per second is like below:

Steps per Second = rpm x steps per revolution / 60

Modes of stepper motor

- **Wave Drive Mode** – In this mode, one coil is energized at a time. So all four coils are energized one after another. This mode produces less torque than full step drive mode.

The following table is showing the sequence of input states in different windings.

Steps	Winding A	Winding B	Winding C	Winding D
1	1	0	0	0
2	0	1	0	0
3	0	0	1	0
4	0	0	0	1

Contd.,

- **Full Drive Mode** – In this mode, two coils are energized at the same time. This mode produces more torque. Here the power consumption is also high

The following table is showing the sequence of input states in different windings.

Steps	Winding A	Winding B	Winding C	Winding D
1	1	1	0	0
2	0	1	1	0
3	0	0	1	1
4	1	0	0	1

- **Half Drive Mode** – In this mode, one and two coils are energized alternately. At first, one coil is energized then two coils are energized. This is basically a combination of wave and full drive mode. It increases the angular rotation of the motor

The following table is showing the sequence of input states in different windings.

Steps	Winding A	Winding B	Winding C	Winding D
1	1	0	0	0
2	1	1	0	0
3	0	1	0	0
4	0	1	1	0
5	0	0	1	0
6	0	0	1	1
7	0	0	0	1
8	1	0	0	1

Full drive mode interfacing with 8051