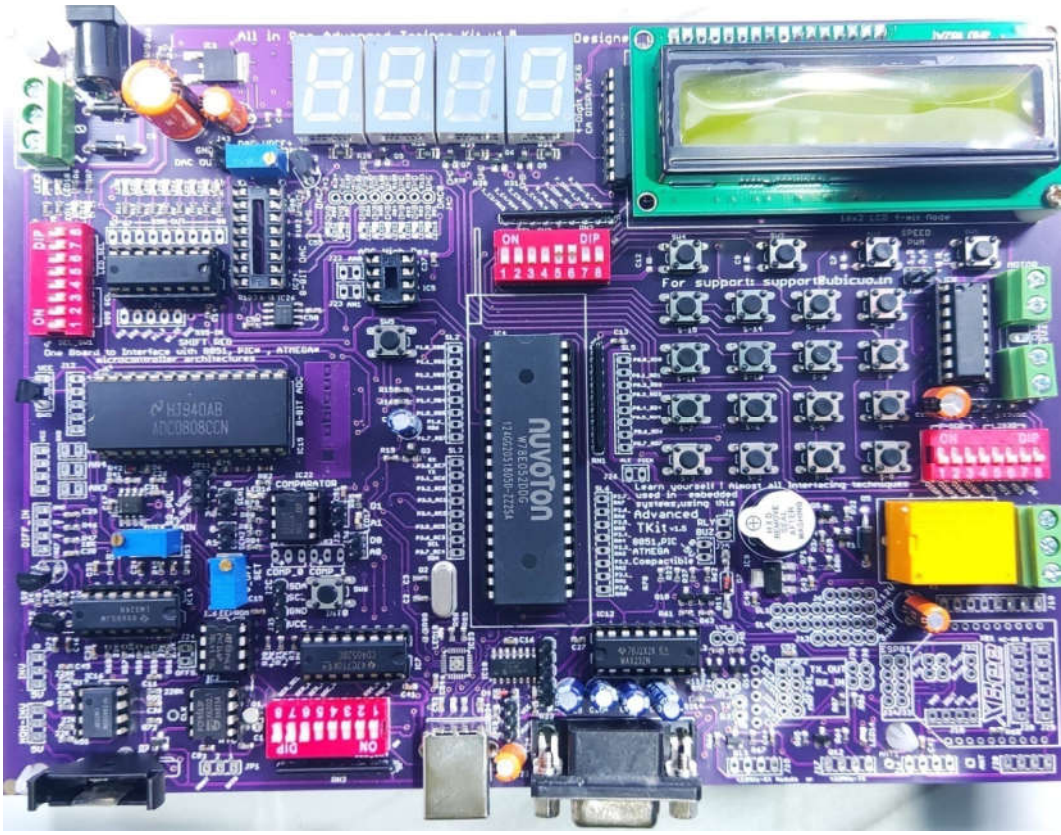
2024

Ubicuo Technologies

V1.5



[8051 TKIT-51 USER MANUAL]

TKit 51 trainer kit is an advanced level 8051 trainer kit developed by Ubicuo Technologies, a GEOES INDIA venture. The kit is mainly focused on real embedded system enthusiasts who are interested in learning how basic things work in this area. We strongly recommend this kit for those who are interested in learning from scratch.

We believe that even though the 8051 microcontroller belongs to an older generation, it can still help acquire the basics of this field, similar to the role of a bicycle in helping to gain balance before moving on to bigger bikes. In this version, we have tried to include almost all basic interfacing techniques. Due to the hardware limitations of this controller, we have used several multiplexing techniques to accommodate maximum interfaces.

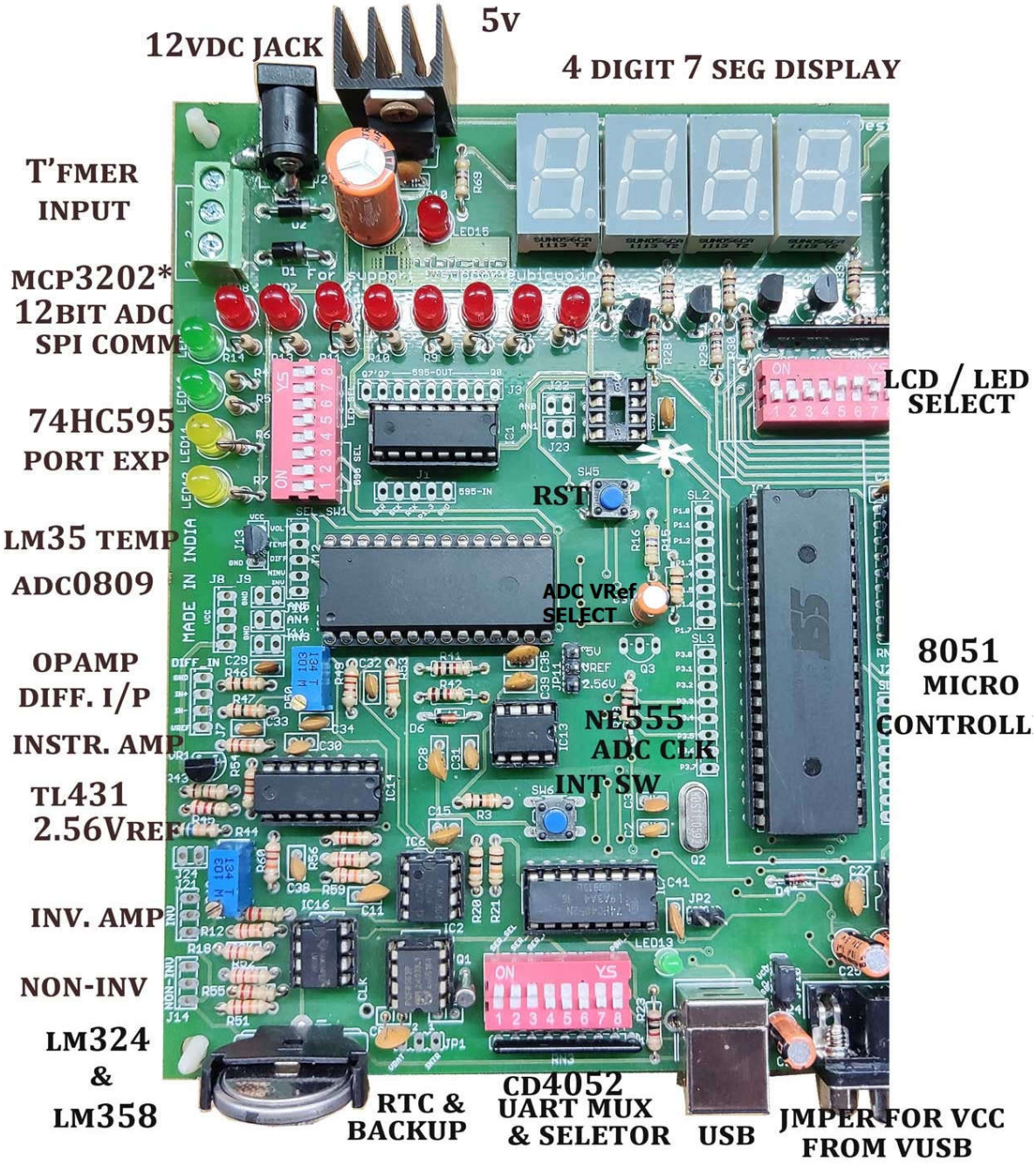
This user manual will guide you through the setup process during the development stages.

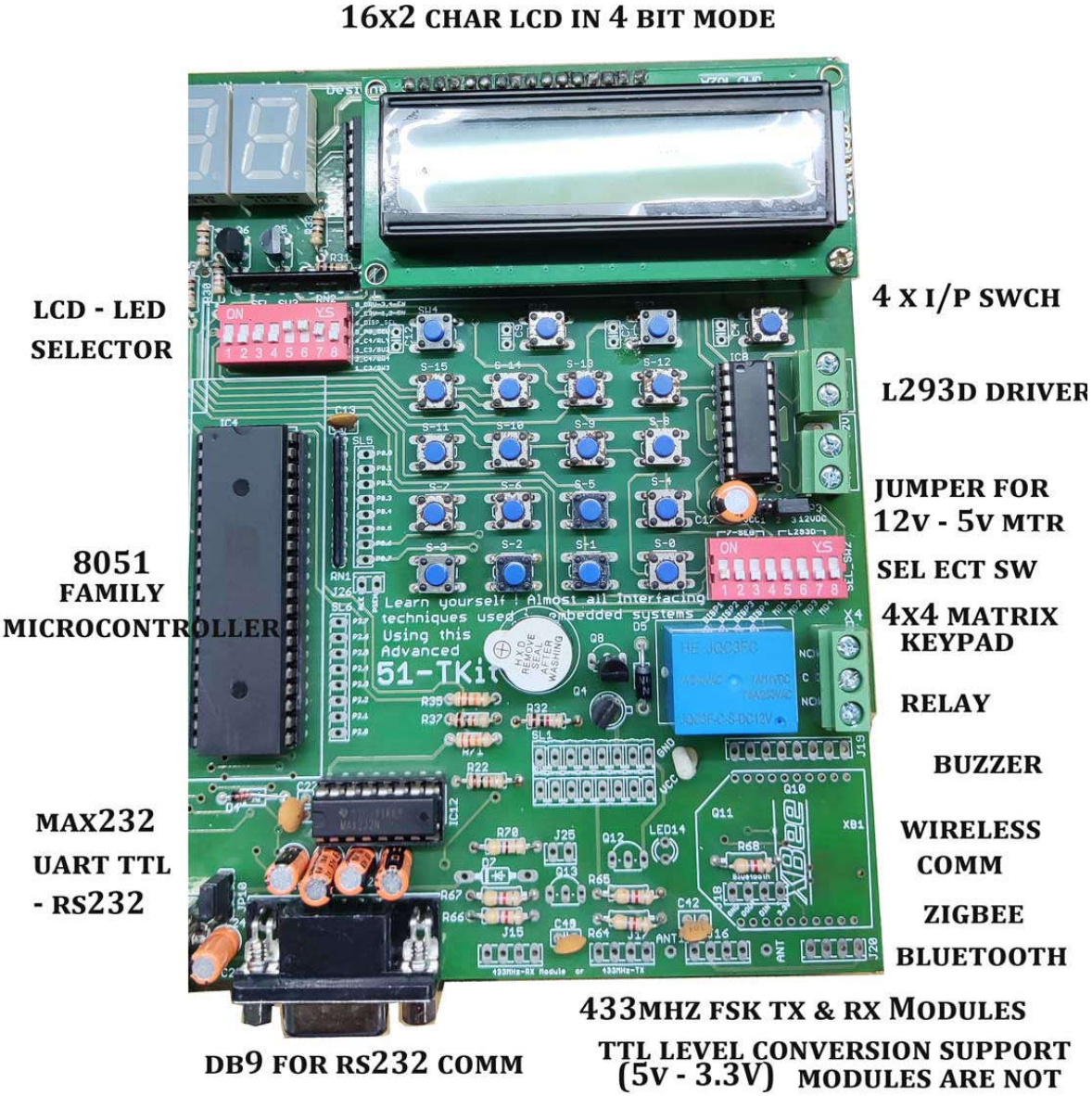
For support, mail to us at **: support@ubicuo.in**

Table of Contents

Document Version: v0.1 2018; v0.2 – 18/04/2023 ; v0.3 – 30/12/2023

1. Board Layouts



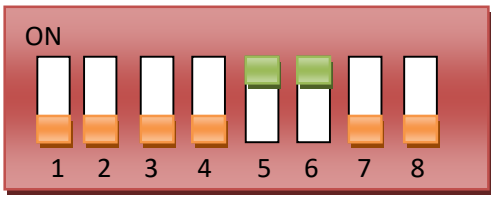

16X2 CHAR LCD IN 4 BIT MODE
LCD - LED SELECTOR
8051 FAMILY MICROCONTROLLER
MAX232 UART TTL - RS232
DB9 FOR RS232 COMM
4 X I/P SWCH
L293D DRIVER
JUMPER FOR 12V - 5V MTR SEL ECT SW
4X4 MATRIX KEYPAD
RELAY
BUZZER
WIRELESS COMM
ZIGBEE
BLUETOOTH
433MHZ FSK TX & RX MODULES
TTL LEVEL CONVERSION SUPPORT (5V - 3.3V) MODULES ARE NOT

2. LCD Interfacing (In 4-bit Mode)

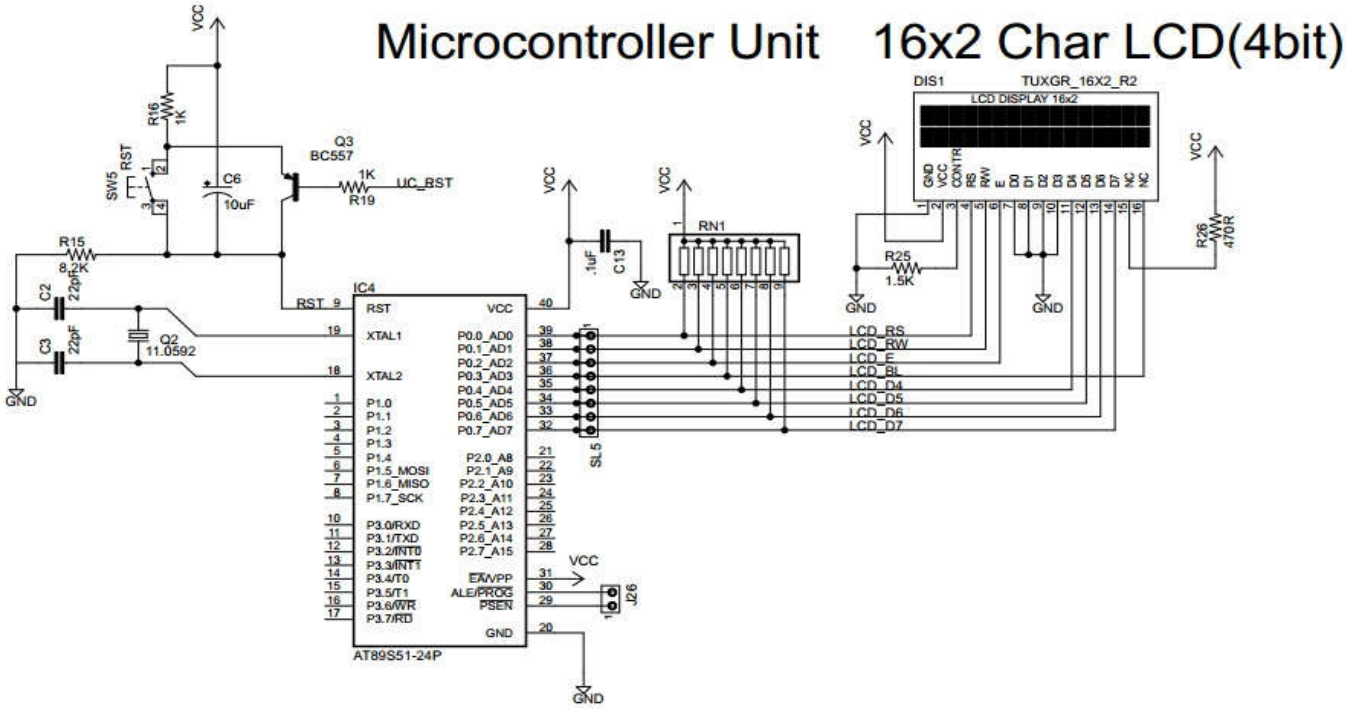
The TKit board is interfaced with a 16x2 Character LCD and a 4-digit 7-segment display. The data interface pins of these displays are multiplexed with P0 of the controller so that only one of these displays works at a time. The 3-channel 2x1 multiplexer IC CD4053 is used for this purpose. The selection pin of these multiplexer ICs determines which display is interfaced with P0.

For the CD4053 IC, the inhibit pin is connected to Switch 5 of the DIP Selection Switch 3. When this pin is kept in the OFF state, a Logic High goes to the inhibit pin of the CD4053 multiplexer IC, keeping these IC pins in a disabled state. In this state, the P0 pin can be used for other GPIO purposes through the SL5 jumper pins. The ON position of Switch 5 will apply a Logic 0 to the inhibit pins, activating the multiplexer pins.

- The **Port 0** will connect to the **LCD module pins** only when both the **DISP_SEL (pin 6)** and **P0_SEL (pin 5)** of the **SELECTION SWITCH 3** is in the **ON position**.



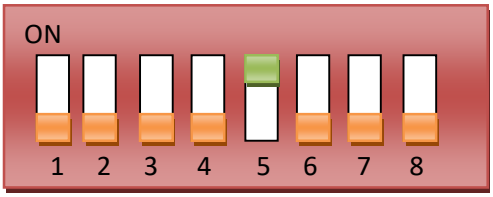
SEL_SW3



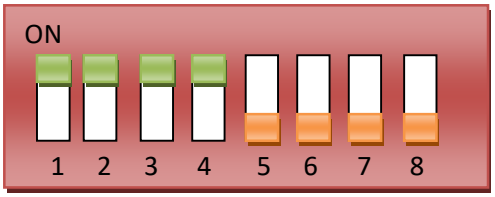
Switch 6 determines which channel should be selected. Keeping this switch in the OFF state will give a Logic High to the multiplexer select pins, connecting PORT 0 with the 7-segment LED display's segment pins through the ULN2803 driver IC. Moving this switch to the ON state will apply a Logic '0' to the channel select pin, connecting LCD interfacing pins to the P0.

4-Digit , 7 SEGMENT LED Common Anode display

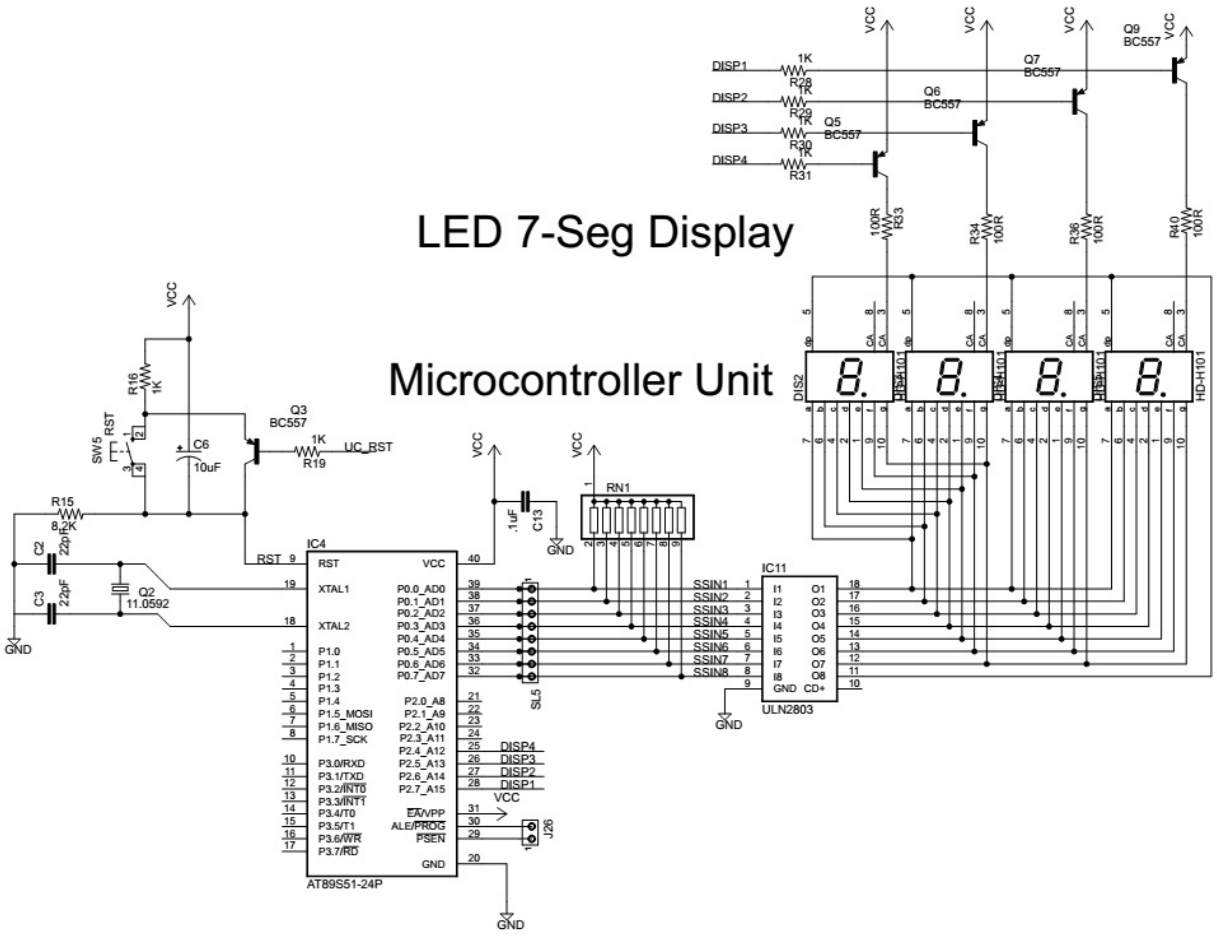
- The **Port 0** will connect to the **7 SEGMENT LED** module's segment pins only when the **SELECTION SWITCH 3 , DISP_SEL (pin 6)** is in **OFF** and **P0_SEL (pin 5)** is in **ON state**.
- The **Switch 1,2,3,4** (DISP1, DISP2, DISP3, DISP4) must be **ON** and **5,6,7,8** (MD1, MD2, MD3, MD4) must be **OFF**, of the **SELECTION SWITCH 2.**
- Also make sure that **Switch 5** of the **SELECTION SWITCH 4** (ADC_OE) also should be in the OFF state. Since its shared with the same DISP4 pin, the 4th Digit may cause display issue.



SEL_SW3



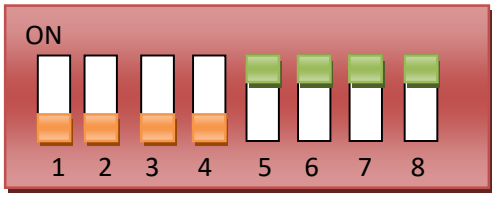
SEL_SW2



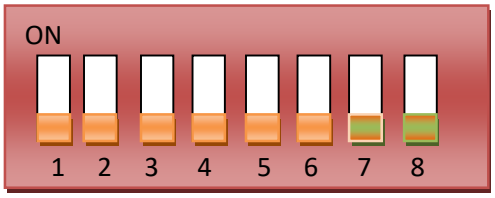
3. MOTOR DRIVER UNIT

The L293D based Motor driver can be used for interfacing the microcontroller with a Stepper motor or 2 DC motors with bidirectional controlling, for robotic purposes. Same can be connected with 4 individual DC motors with Uni directional control .

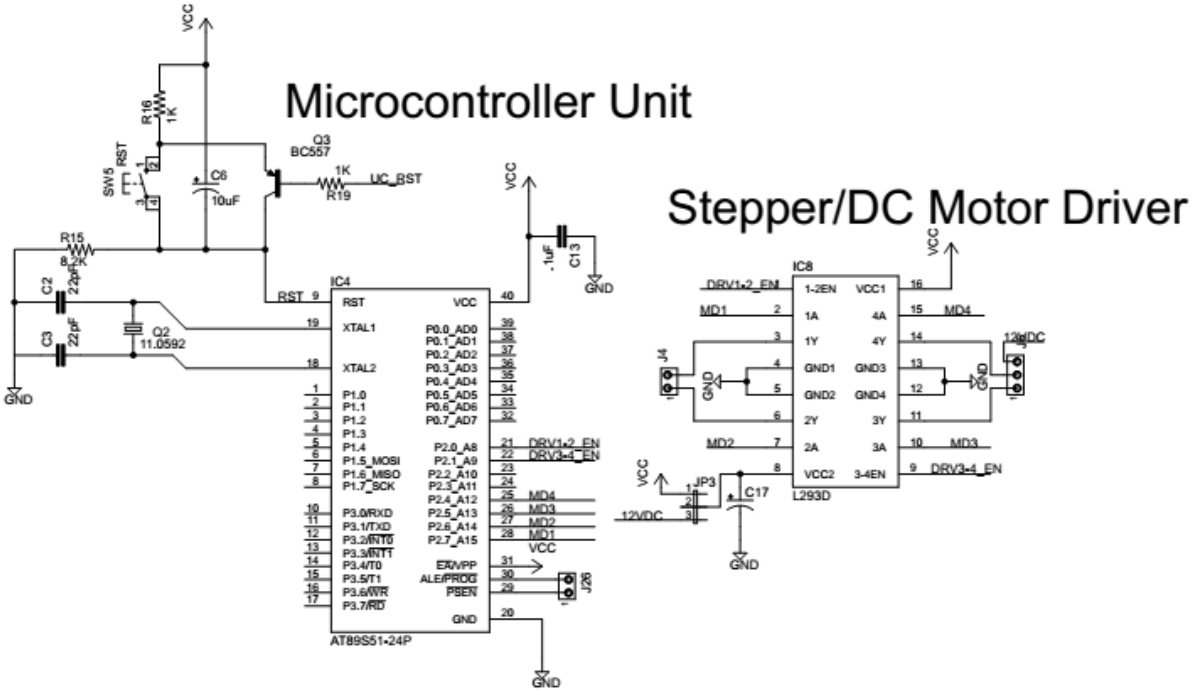
- The stepper motor works when the **Switch 1,2,3,4** (DISP1, DISP2, DISP3, DISP4) is in **OFF** & **5,6,7,8** (MD1,MD2,MD3,MD4) is in **ON** , in **SELECTION SWITCH 2**.
- **Switch 7, 8** of the **SELECTION SWITCH 3** must be in **OFF State**, to keep the driver pairs 1-2 & 3-4 in enabled state. Keeping these switches in ON state will disable the corresponding drivers in disabled state.
- For PWM based speed controlling ,the driver enable pins are popped up near to the IC through the jumper J27. By connecting these pins jumpers to controller's GPIO pin, a PWM pulse can control the speed. Make sure that Switch 7,8 of SEL_SW_3 in OFF state.



SEL_SW2

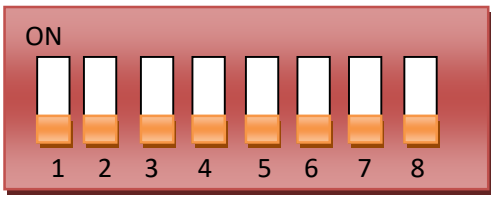


SEL_SW3

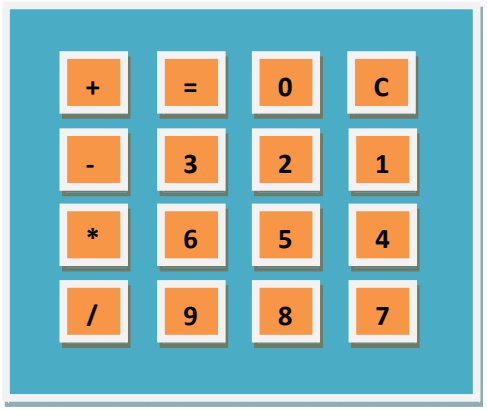


4. MATRIX KEYPAD

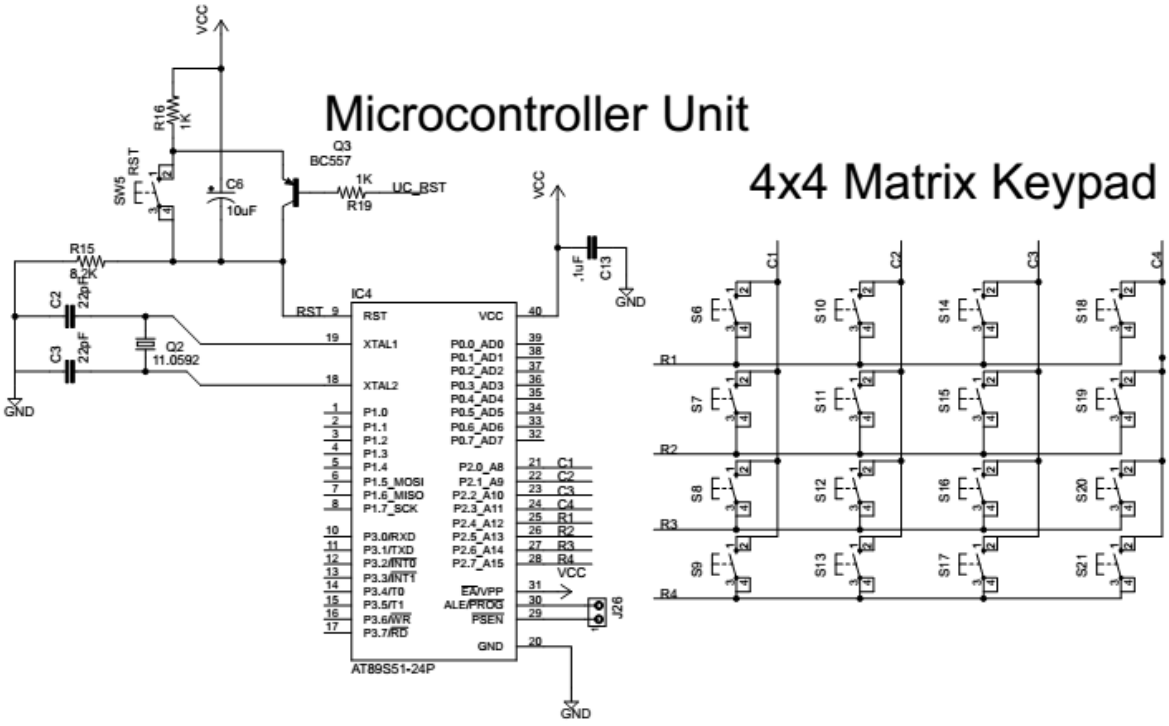
- The matrix keypad is connected to the PORT 2 pins & its recommend to keep all the switches of the **SELECTION SWITCH 2** in **OFF state**. In the example program, the matrix keypad layout as shown



SEL_SW2



4*4 MATRIX KEYPAD Lay Out

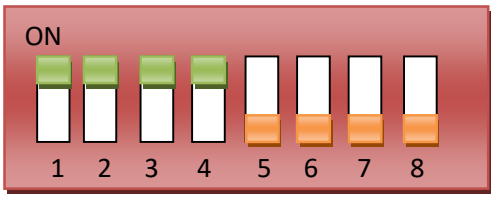


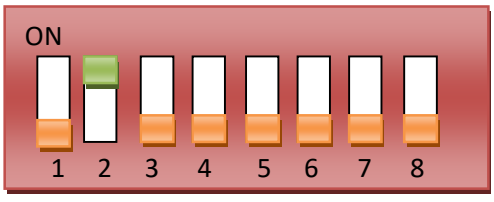
Also please keep the switches 1,2,3,4 of the SEL SWITCH 3 at OFF state, since these are shared with BUZ & Relay and 2 other micro tact switches 3 & 4 .

5. SHIFT REGISTER (Serial In Parallel Out, with Latch)

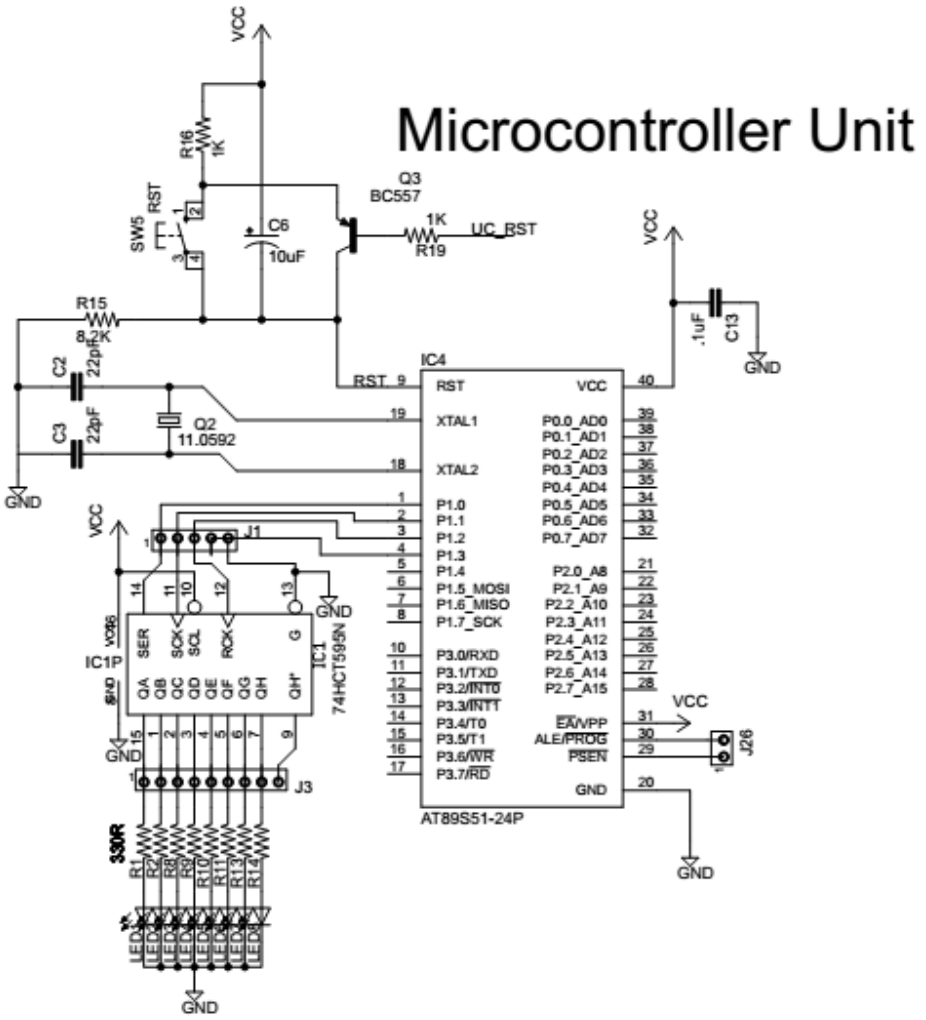
- For the port expansion technique, a 74595 shift register is interfaced to the PORT1 pins. It works only when **Switch 5,6,7,8** is in **OFF state** and **1,2,3,4** is in **ON state**, of the **SELECTION SWITCH 1**.

- The state of the GE pin of the 74595 IC plays a crucial role in determining the OUTPUT Latch control. A Logic 1 to this pin places the OUTPUT latch in a high-impedance state, while a Logic 0 activates it. To facilitate control over the GE pin, it is routed through the J1 connector. Users have the option to connect it with a GPIO (P1.3, located adjacent to it). Alternatively, for continuous enablement, they can set Switch 2 of the SELECT SW4 to the ON state.



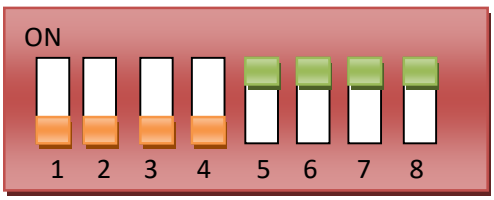


SEL_SW1 **SEL_SW4**

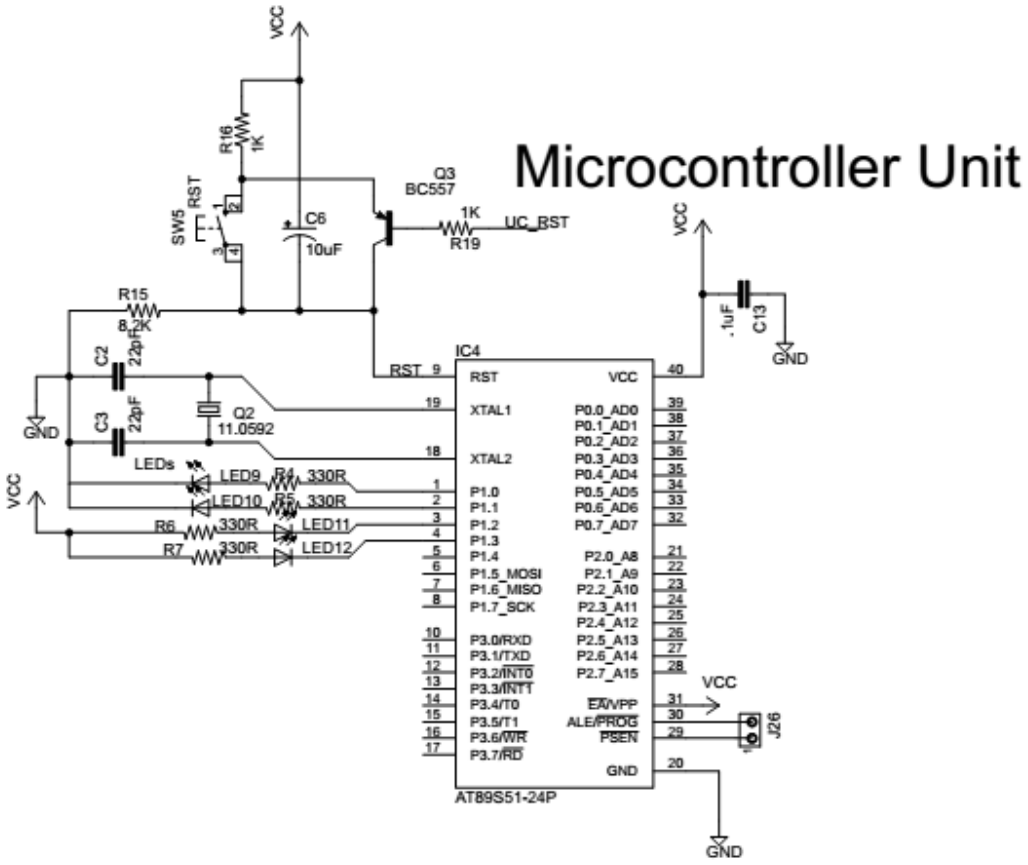


6. LED on GPIO pin

- The LED become ON when the **Switch 1,2,3,4** is in **OFF state** and **5,6,7,8 is in the ON state**, of the **SELECTION SWITCH 1**.

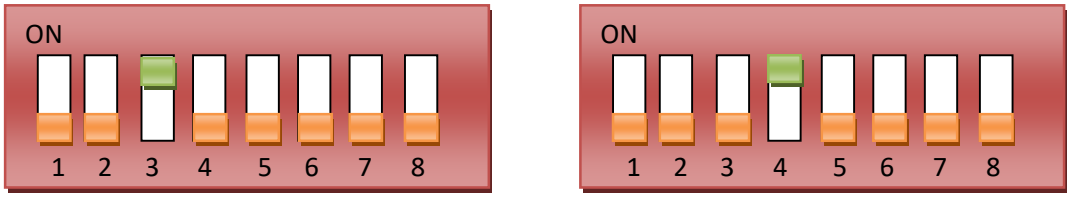


SEL_SW1



7. BUZZER on GPIO pin

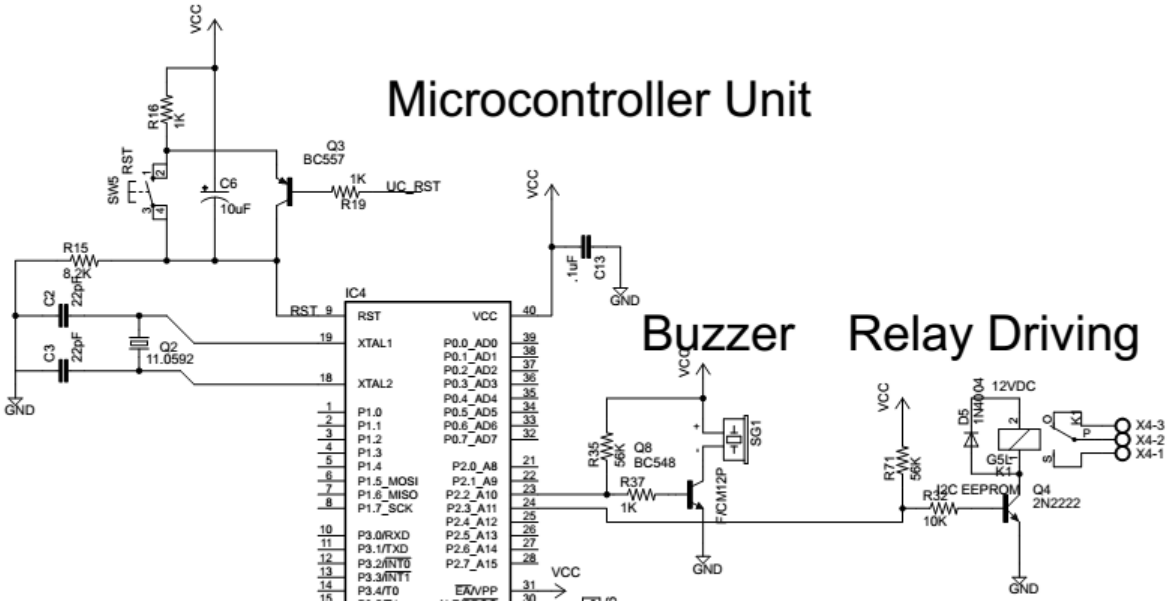
- The **buzzer** can be controlled from the controller only when the **Switch 3** of the **SELECTION SWITCH 3** become is kept at **ON** state.
- Since the BUZZER driving transistor base is pulled up to VCC through a Pull up resistor (R71) , the BUZZER may be always in ON beep state, when this switch is OFF state. Removing this resistor will solve this issue, but some time, its seen that some of the 8051 version's GPIO doesn't provide sufficient current to make it ON.



For Buzzer control **SEL_SW3** **For Relay Control**

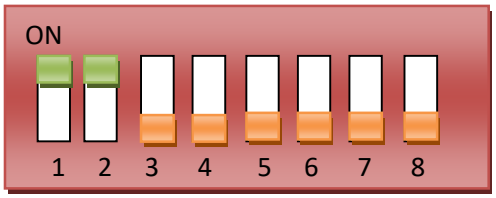
8. RELAY on GPIO pin

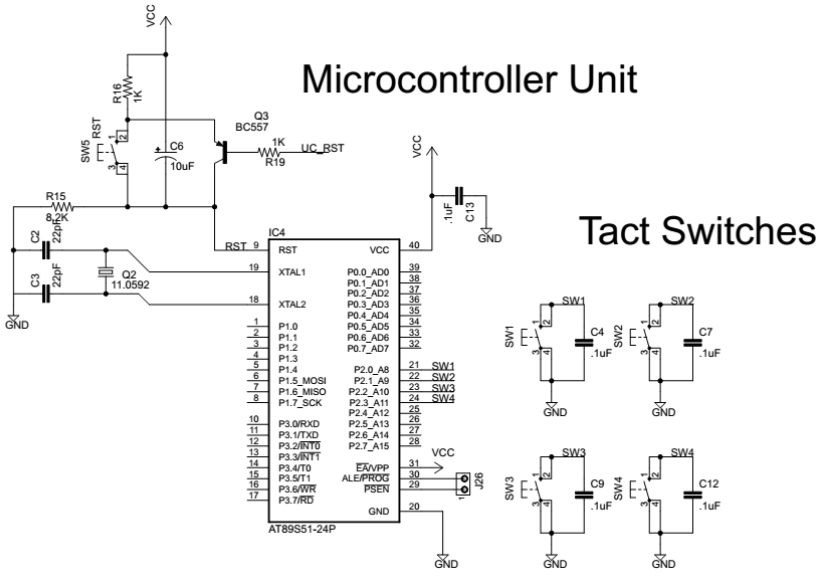
- The **Relay** will become **ON** only when the **Switch 4** of the **SELECTION SWITCH 2** become **ON**



9. SWITCH

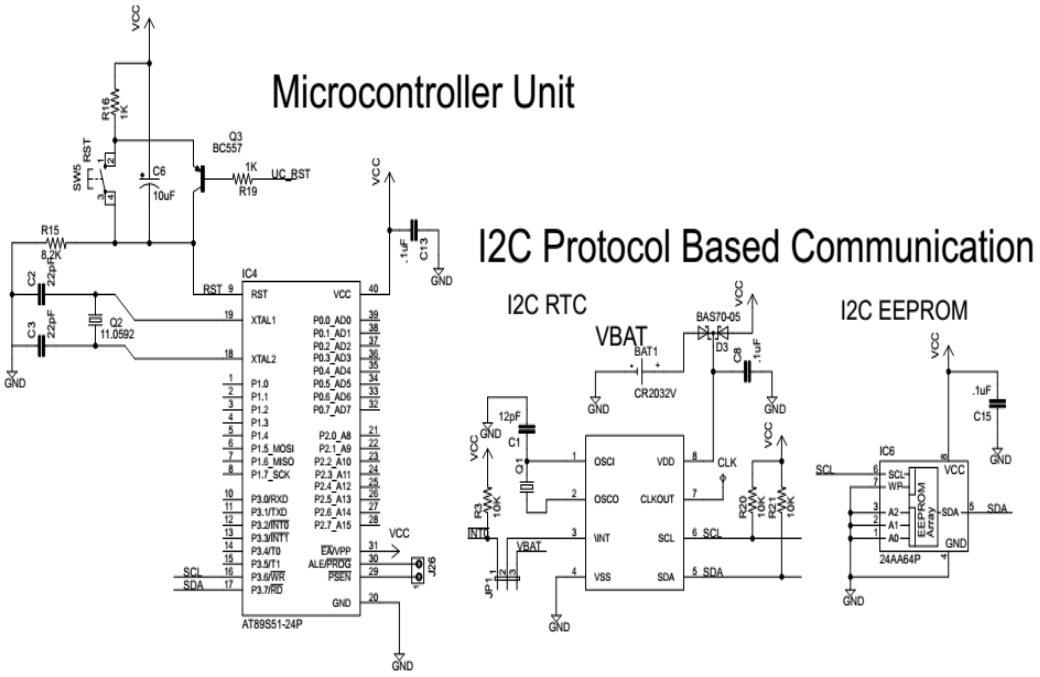
- **The SWITCH 3** and **SWITCH 4** work only when the **switch 3, 4** must be **OFF** and **switch 1, 2** must be **ON**, of the **SELECTION SWITCH 3.**





10. I2C Protocol Based Communication

The I2C Protocol Based Communication includes RTC and EEPROM



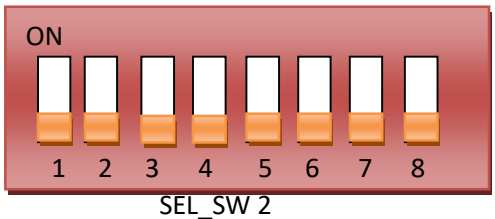
11. ADC 0808 8BIT ADC WITH CLOCK CIRCUIT

To familiarize users with the basic ADC interfacing technique, the TKit features an 8-bit SAR-based ADC chip, ADC0808. This IC comes equipped with an 8-bit parallel data bus and necessary control lines, all of which are interfaced with the microcontroller as depicted in the circuit diagram.

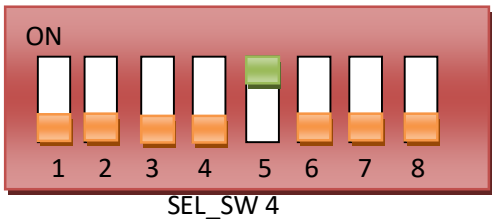
The board includes a jumper selection, J11, which allows users to choose the positive VREF range for the ADC. This range can be selected between 5V and 2.56V. The data output pins of the ADC are connected to PORT 1 of the controller, and by default, these pins are maintained in a high-impedance state by connecting the OE pin of the ADC to GND. In this condition, PORT 1 can be utilized for various GPIO purposes.

When it comes to ADC programming, the OE pin is connected to the P2.4 pin of the controller via Switch 5 of the DIP SELECTION_SW 4. By keeping this switch in the ON state, the OE pin can be controlled from P2.4. Additionally, all the switches of

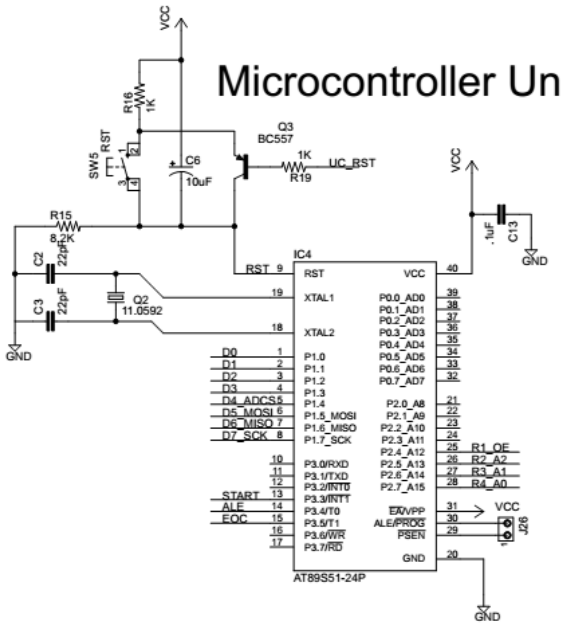
SELECTION_SW 2 should be kept in the OFF position. This is crucial because, along with the OE pin, the ADC Channel address pins are also assigned to P2.4, P2.5, P2.6, P2.7. These same pins are utilized for the 7-segment display's digit scanning and the Motor driver's inputs. Keeping SELECTION_SW2 in the OFF state ensures that those functions remain disabled.

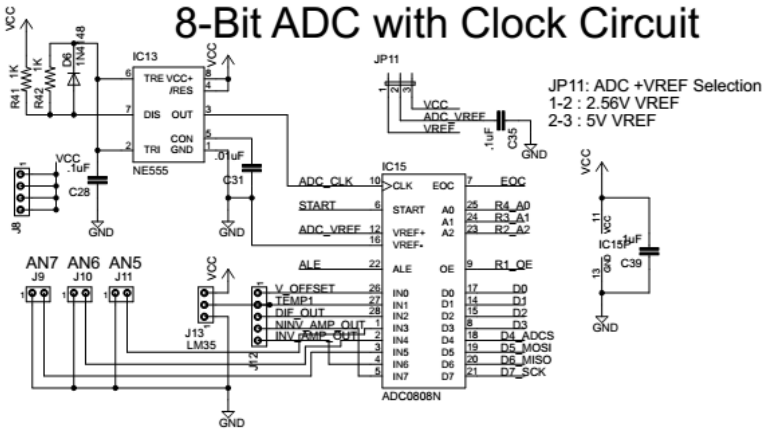


SEL_SW 2



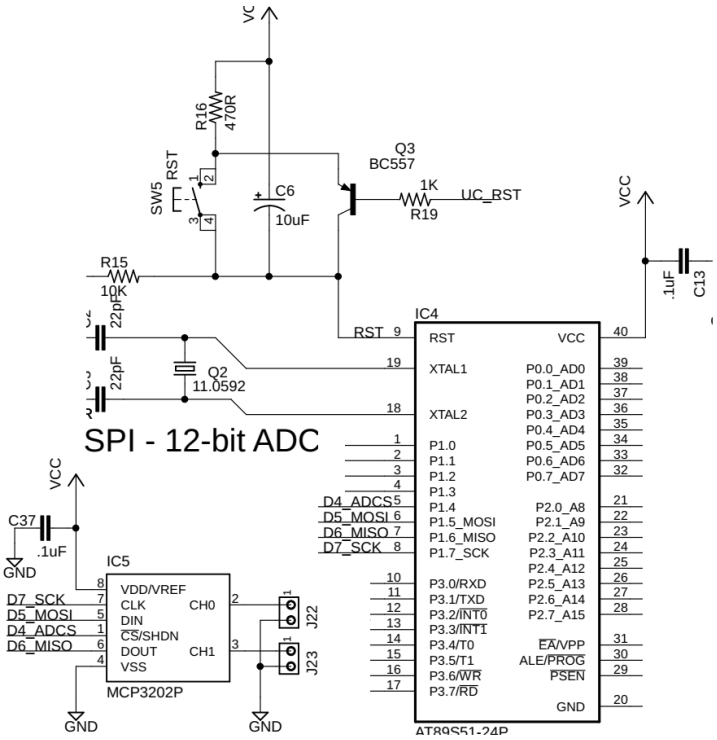
SEL_SW 4





The Analog circuits based on the OPAMPs are working on the 7V power supply derived from the 12V main supply. Therefore while working on the USB powers, those areas won't perform.

12. SPI based 12-bit ADC interface (Optional)



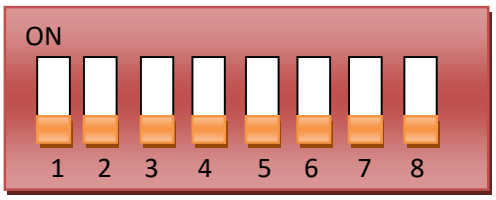
Due to non availability and higher cost, this IC may not be populated on the PCB. Later user can insert the IC to the specified base , according to the requirement.

13. SERIAL COMMUNICATION (Multiplexed)

The board is supported with various mode of communications that utilizes the UART module. The modes are selected using the SEL_SW4. Only any one of the following mode of communication can be selected at time.

TTL UART or P3.0 & P3.1 as GPIO

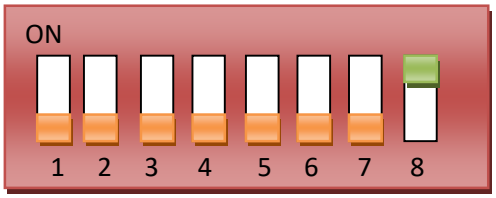
In this case the UART multiplexing is disabled and the pins can be, connector.



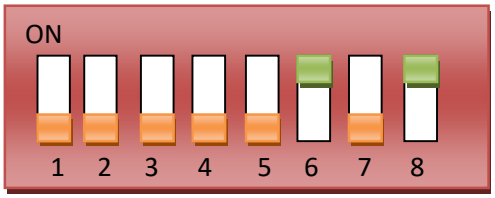
SER_SEL -8
SER_B -7
SER_A -6

SEL_SW4 (SERIAL MUX is Disabled)

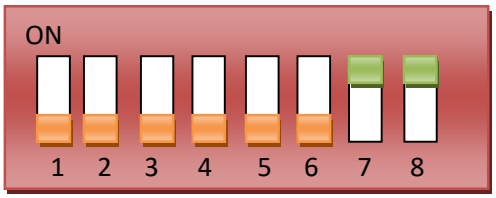
RS232



433MHz Wireless Module



Zigbee & Bluetooth Modules



USB Communication