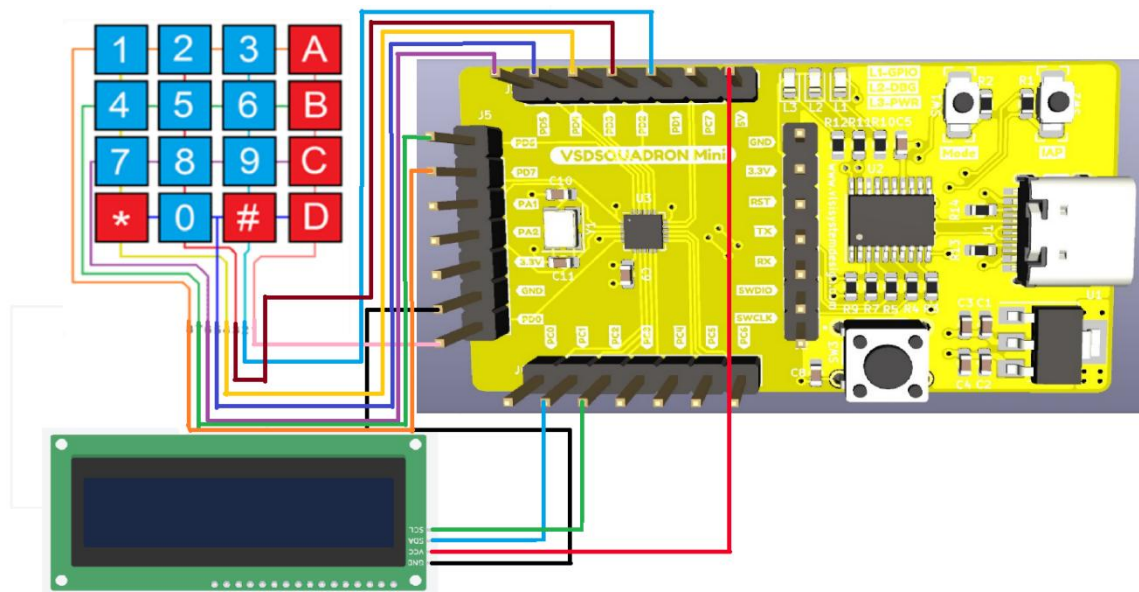


## Project: Simple Calculator using VSD Squadron Mini



### Introduction:

The **Simple Calculator Project** performs basic arithmetic operations such as addition, subtraction, multiplication, and division using hardware logic. It is designed to take inputs, process the selected operation, and display the result efficiently.

This project demonstrates the practical implementation of digital design concepts, focusing on modularity, logic development, and efficient computation. It provides a foundational understanding of arithmetic operations in digital circuits.

### Overview:

The **Simple Calculator Project** is designed to perform basic arithmetic operations—addition, subtraction, multiplication, and division—using hardware logic. It allows the user to input numbers and select operations through a **4x4 keypad**, and the results are displayed on an **LCD display**.

### Key Features of the Calculator:

#### 1. Arithmetic Operations:

- Addition
- Subtraction
- Multiplication

- Division
- 2. **Input Method:**
  - **4x4 Keypad:** Used for entering numbers and selecting operations.
- 3. **Output Display:**
  - **LCD Display:** Shows the results of the arithmetic operations.
- 4. **Control Logic:**
  - A control unit processes the input from the keypad, performs the selected arithmetic operation, and drives the LCD to display the result.

#### **Core Components:**

- **Arithmetic Logic Unit (ALU):** The ALU performs the selected arithmetic operation based on the inputs.
- **Control Unit:** It decodes user inputs from the keypad and triggers the corresponding operation in the ALU.
- **Keypad Interface:** Interfaces the FPGA with the 4x4 keypad for digit and operation selection.
- **LCD Interface:** Displays the results of the calculation in a user-friendly format.

#### **Implementation Workflow:**

1. **Design:**

Develop Verilog code for the ALU, control unit, keypad interface, and LCD driver.
2. **Simulation:**

Simulate the design to ensure proper functionality and correctness.
3. **Synthesis and Implementation:**

Synthesize the design and implement it on the hardware platform, verifying that the keypad and LCD work as expected.
4. **Testing:**

Test the project with different input combinations and verify that the correct results are displayed on the LCD.

#### **Working:**

The **Simple Calculator** operates by receiving inputs through a **4x4 keypad** and displaying results on an **LCD display**. The user enters two numbers and selects an operation (addition, subtraction, multiplication, or division) using the keypad. The control unit decodes the inputs and directs the **Arithmetic Logic Unit (ALU)** to perform the selected operation. After the computation, the result is displayed on the LCD. The system is designed to continuously

accept new inputs, enabling the user to perform multiple calculations in sequence. The interaction between the keypad, ALU, and LCD is seamless, making the calculator simple yet effective for basic arithmetic operations.

### Components Required:

1. VSD Squadron Mini
2. 4x4 Matrix Keyboard
3. LCD Display(I2C)
4. Jumper Wire

### Pin Connections:

#### LCD Display(I2C):

GND	GND
VCC	5V
SDA	PC1
SCL	PC2

#### 4x4 Matrix Keypad:

Pin 1	PD0
Pin 2	PD1
Pin 3	PD2
Pin 4	PD3
Pin 5	PD4
Pin 6	PD5
Pin 7	PD6
Pin 8	PD7