

# Lab B2 – Feasibility Model Phase 2

ECE 298 – 2021

Lab Section:

ONLINE or

IN-PERSON

IN-PERSON

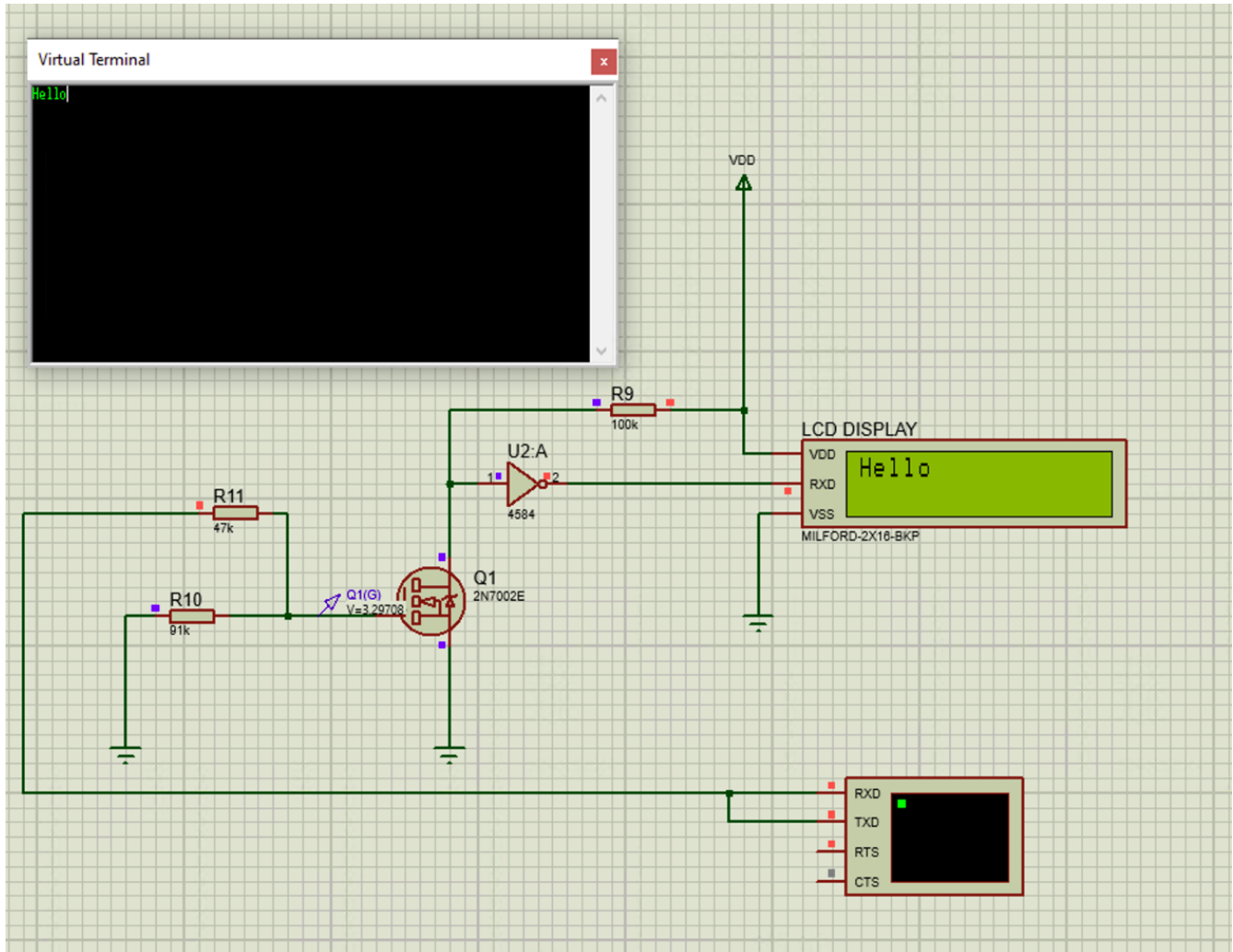
Team: 21

## {LCD}

### Summary

Item	Description
Device: Purpose	Display the Mode, Parameter Name and Parameter Value in Setup Mode and system sensor status in Run Mode
Device: Proteus Library component name	MILFORD-2X16-BKP
Device: Project Operating Range Requirement	The chosen LCD(MILFORD-2X16-BKP) is compatible with all Hitachi 44780 controllers with up to 80 on-screen characters. It is not suitable for 4 x 10 display
Device: Power Connections	+5.0V, GND, +3.3V
Device: Electrical signal type properties	The LCD is a three terminal device with connections to the ground, a 5V digital voltage and a incoming signal from the MCU
Device: Electrical signal range (voltage, or current, resistance, capacitance or time etc.)	<p>The back-lighting current is about 200mA or 170mA by the resistor RBL. It may be adjusted to suit particular LCDs and ensure the current is not exceeded for maximum back-lighting current</p> <p>The driver board will accept RS-232 signals at either 2400 Baud or 9600 Baud</p>
MCU connectivity details	The MCU digital generates 250kHz frequency. A LCD uses an MCU digital output for the RXD and TXD of the virtual terminal which then connects to the RXD port on the LCD
Device/MCU interfacing details	An interfacing circuit will translate a 5V virtual terminal output to 3.3V by a voltage divider for a step-Down voltage interfacing, and the 3.3V will transfer to 5V LCD input by the N-channel MOSFET for a set-up voltage interfacing. An inverter will be used to invert the inverted signal created by the MOSFET. When typing a character in the virtual terminal results in a higher voltage to LCD RXD, then the display will display the typed character

## Snips for Part A Schematics and Simulations



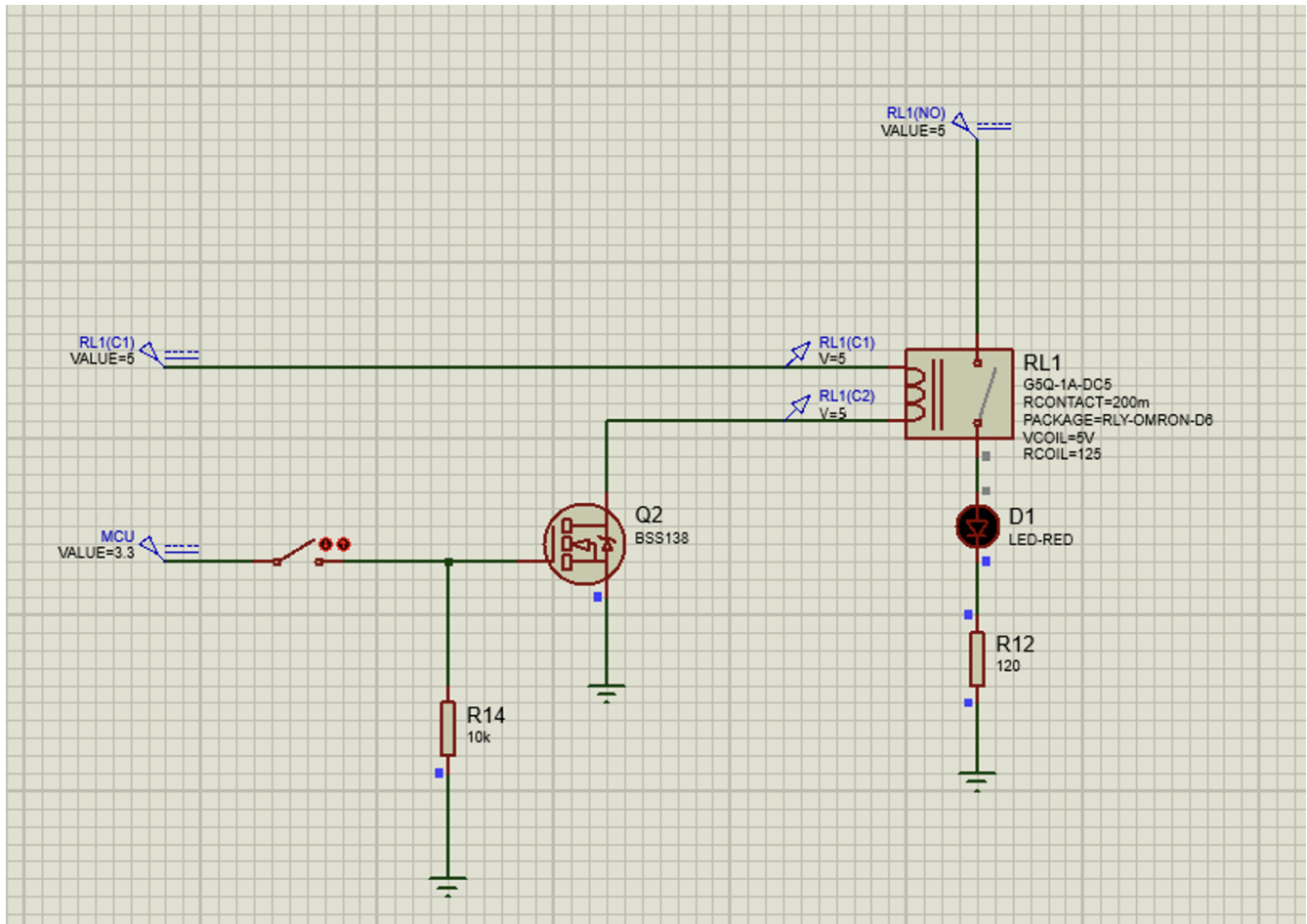
## {Relays}

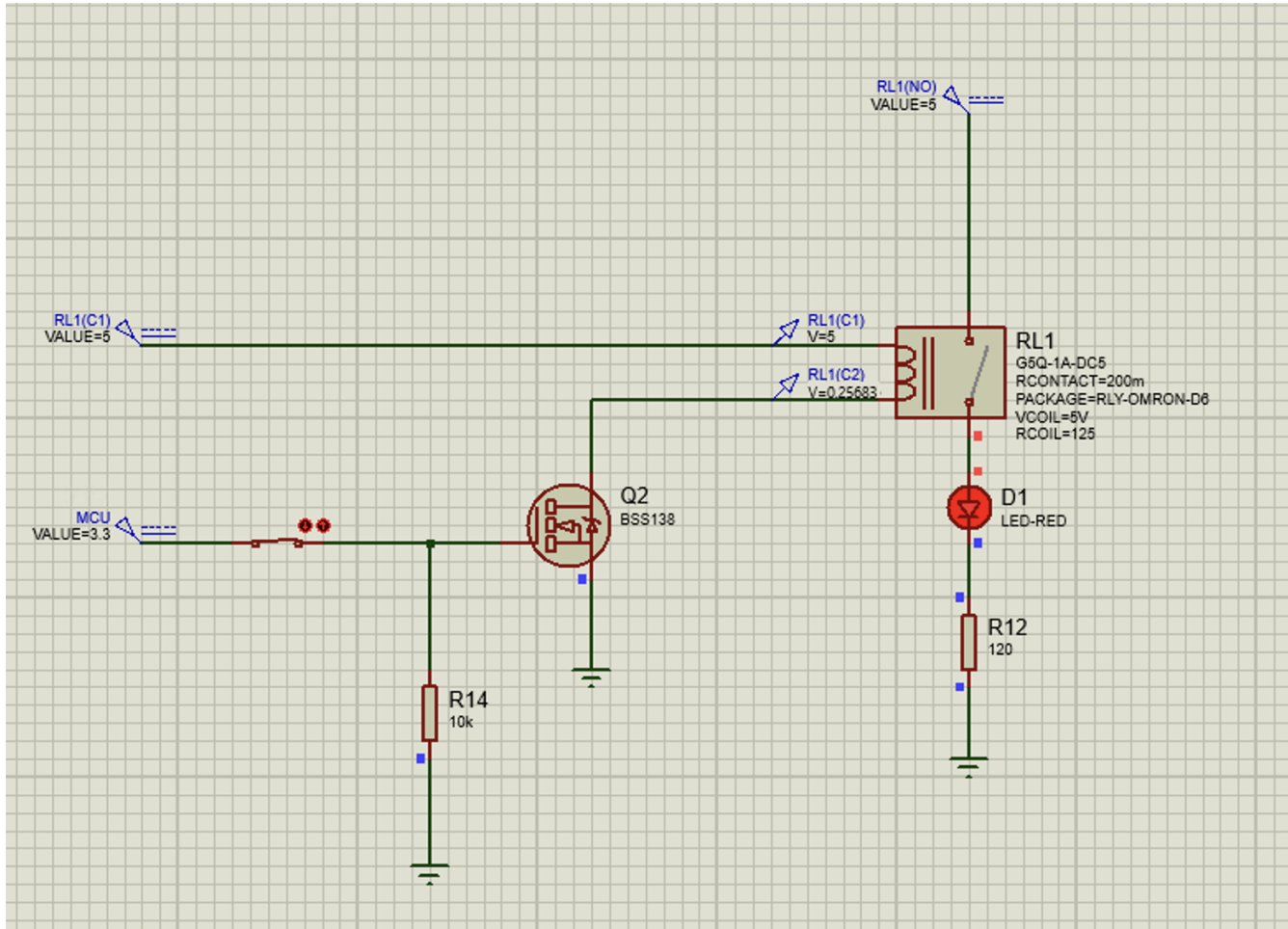
### Summary

Item	Description
Device: Purpose	There are two relays used in the system. One is the AUDIBLE ALARM speaker to sound the alarm, the other is external lighting to detect persons approaching either of the entrances.
Device: Proteus Library component name	G5Q-1A-DC5
Device: Project Operating Range Requirement	The chosen Relays (en-g2rl) operate 15ms Max and release 5ms Max
Device: Power Connections	+5.0V,GND, +3.3V
Device: Electrical signal type properties	The digital output signal is applied to the relays
Device: Electrical signal range (voltage, or current, resistance, capacitance or time etc.)	For a relay with a rated voltage of 5V, the required operating voltage is 70% of the rated voltage, with a maximum operating voltage of 130%

MCU connectivity details	An MCU digital output will generate 5V coil voltage
Device/MCU interfacing details	A N-channel MOSFET is used to pull up the 3.3V MCU digital output to 5V by step-up interfacing. In 5V DC, the rated current will be 80mA and the coil resistance will be 62.5 ohm. The led will be on when relays are closed. A pull down resistance is used to protect the circuit

### Snips for Part A Schematics and Simulations





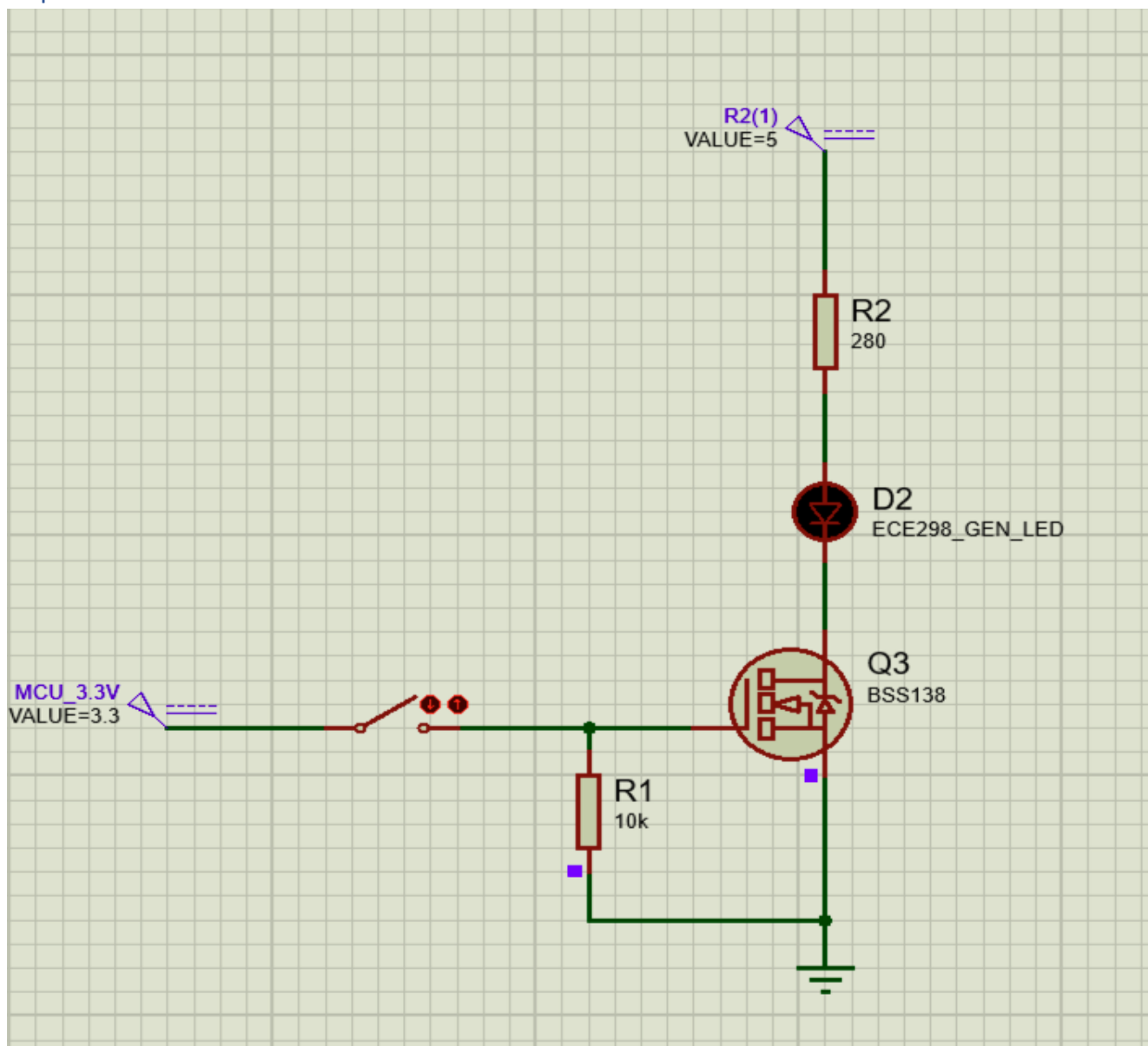
## {LEDs}

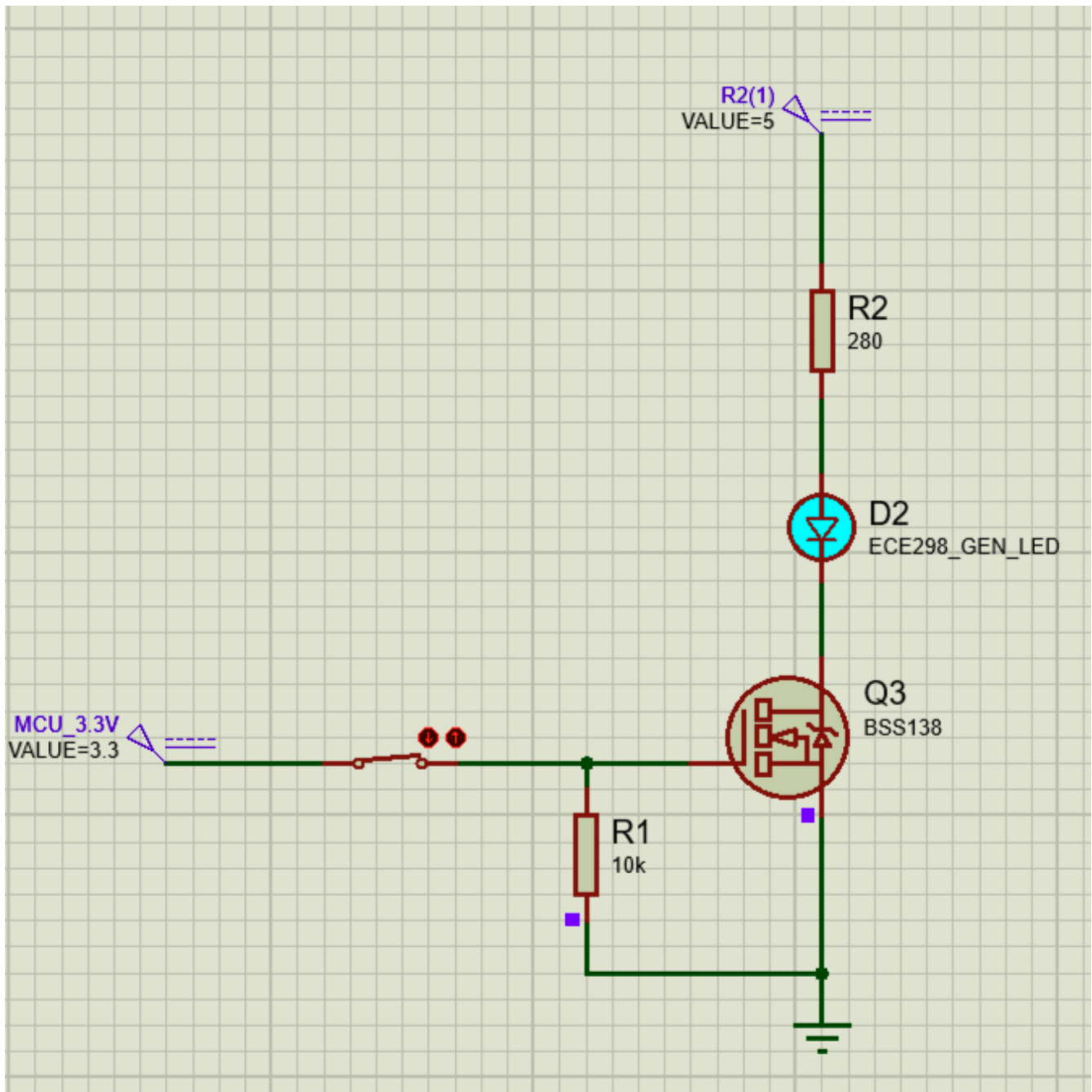
### Summary

Item	Description
Device: Purpose	Three LEDs are used to indicate the ARMED, DISARMED, and ALARM status. They will be labeled as LED-ARMED, LED-DISARMED, LED-ALARM. In addition, the LED-ALARM will always be RED. The system will also have a FLASHING RED LED to indicate the SYSTEM ALARM
Device: Proteus Library component name	ECE298_GEN_LED
Device: Project Operating Range Requirement	LTL-5234 green LED Luminous Intensity Range: 12.6 mcd to 40 mcd PM3RC red LED Luminous Intensity Range: 2.5 mcd LTL1 CHICK Yellow LED Luminous Intensity Range: 120 mcd to 339 mcd
Device: Power Connections	+5.0V, GND, +3.3V

Device: Electrical signal type properties	Digital output from MCU will drive the LEDs
Device: Electrical signal range (voltage, or current, resistance, capacitance or time etc.)	LTL-5234 green forward voltage range from 2.1V to 2.6V PM3RC red forward voltage 2.1V to 2.8V LTL1 CHICK Yellow forward voltage 2.05V to 2.4V
MCU connectivity details	Sensor Status LEDs and System alarm LED would use an MCU digital output for the trigger signal. Use ADC to generate the signal
Device/MCU interfacing details	An opamp is used to pull up MCU output voltage from 3.3V to 5V, then the voltage divider is used to to drive the LEDs in the range of different LEDs

### Snips for Part A Schematics and Simulations





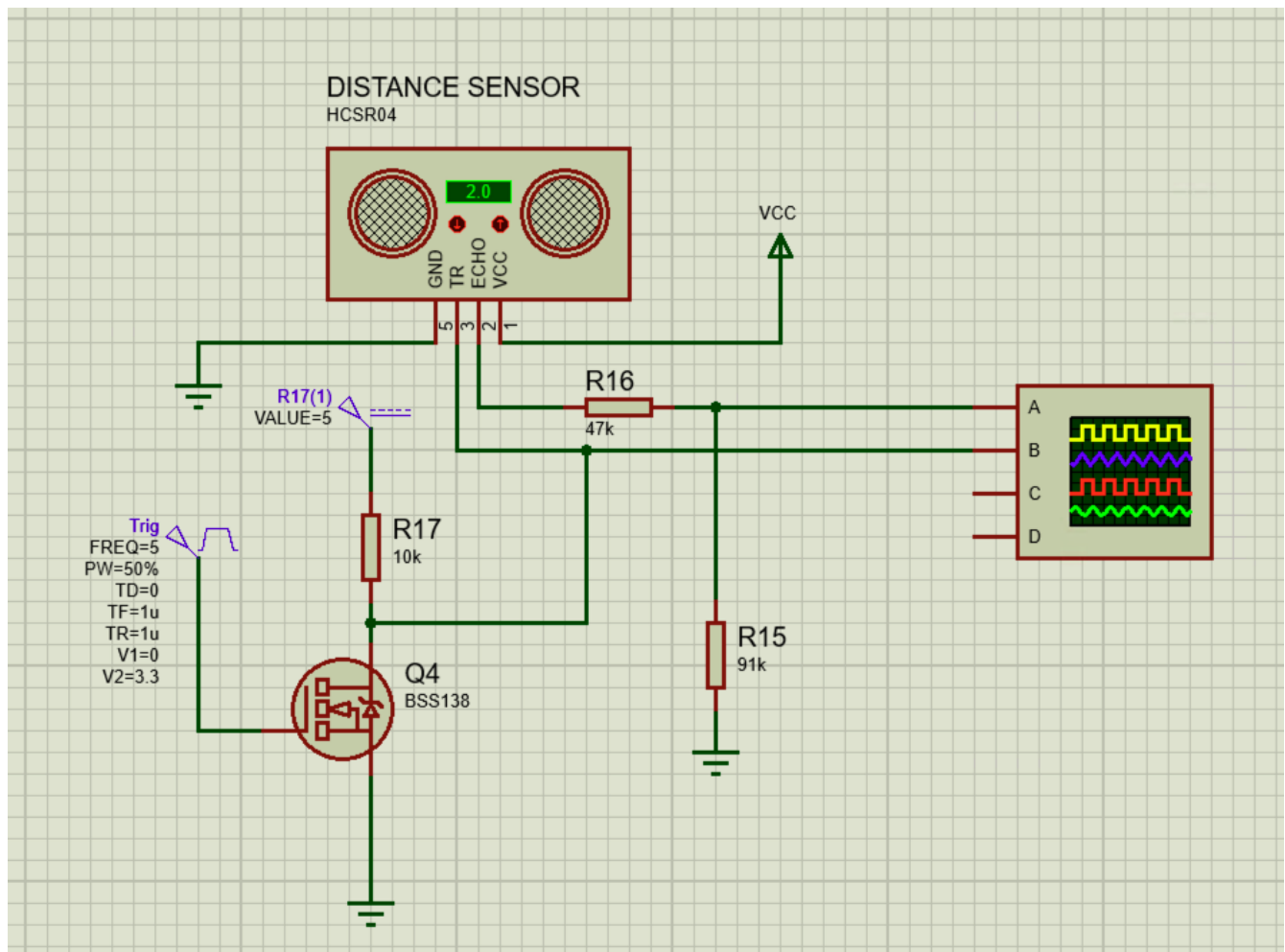
## {Distance Sensor}

### Summary

Item	Description
Device: Purpose	A distance sensor (HCSR04) is placed on each door for monitoring the approach of any person.
Device: Proteus Library component name	HCSR04
Device: Project Operating Range Requirement	The chosen distance sensor will have Range from 2cm to 4m

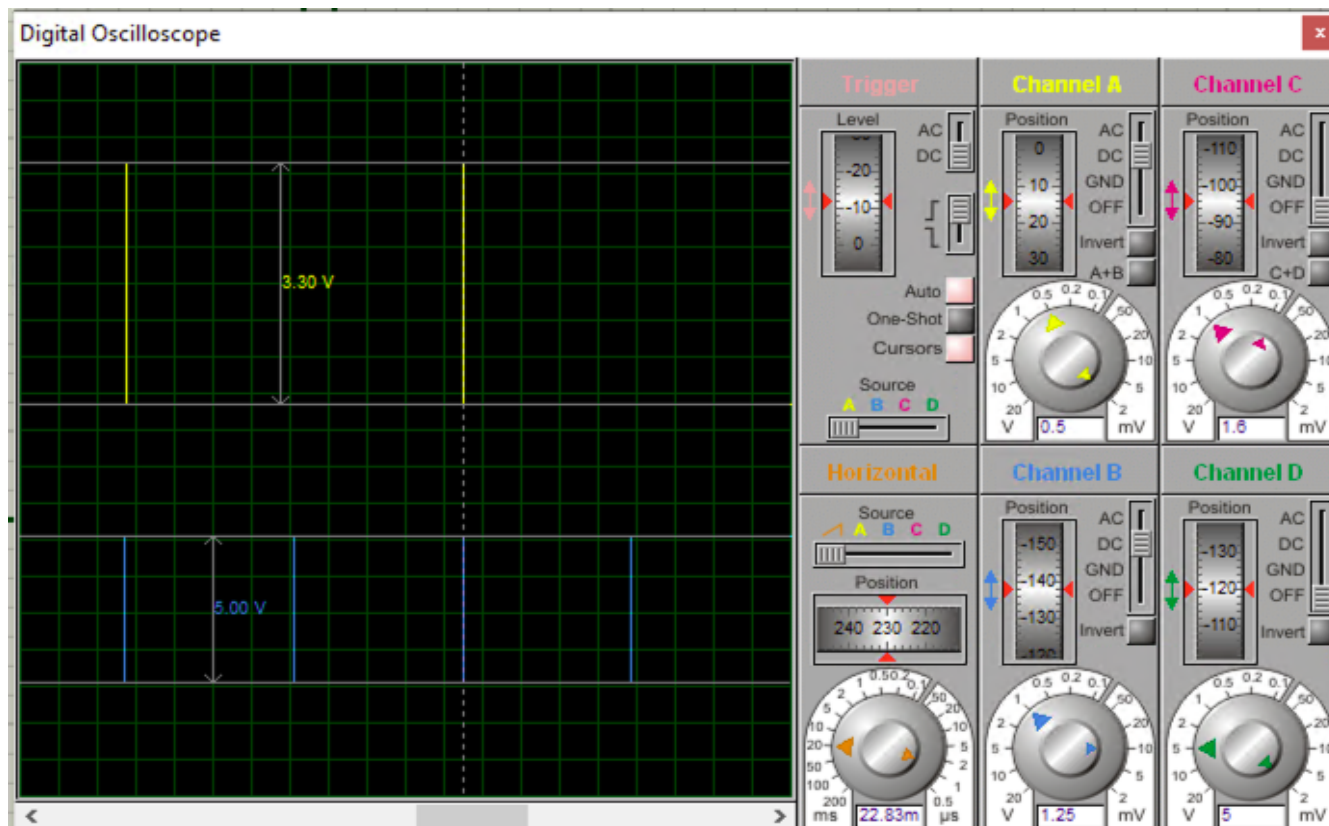
Device: Power Connections	VCC, 5.0V, GND, +3.3V
Device: Electrical signal type properties	Digital input to the MCU
Device: Electrical signal range (voltage, or current, resistance, capacitance or time etc.)	Operating voltage DC 5V, operating current 15mA, working frequency 40Hz
MCU connectivity details	The sensor first uses an analog to signal converter to transform the analog output from the sensor to a digital value that can be read by the MCU.
Device/MCU interfacing details	An op-amp is placed between the sensor and the MCU to transform the output voltage from the sensor to a voltage compatible with the MCU.

### Snips for Part A Schematics and Simulations

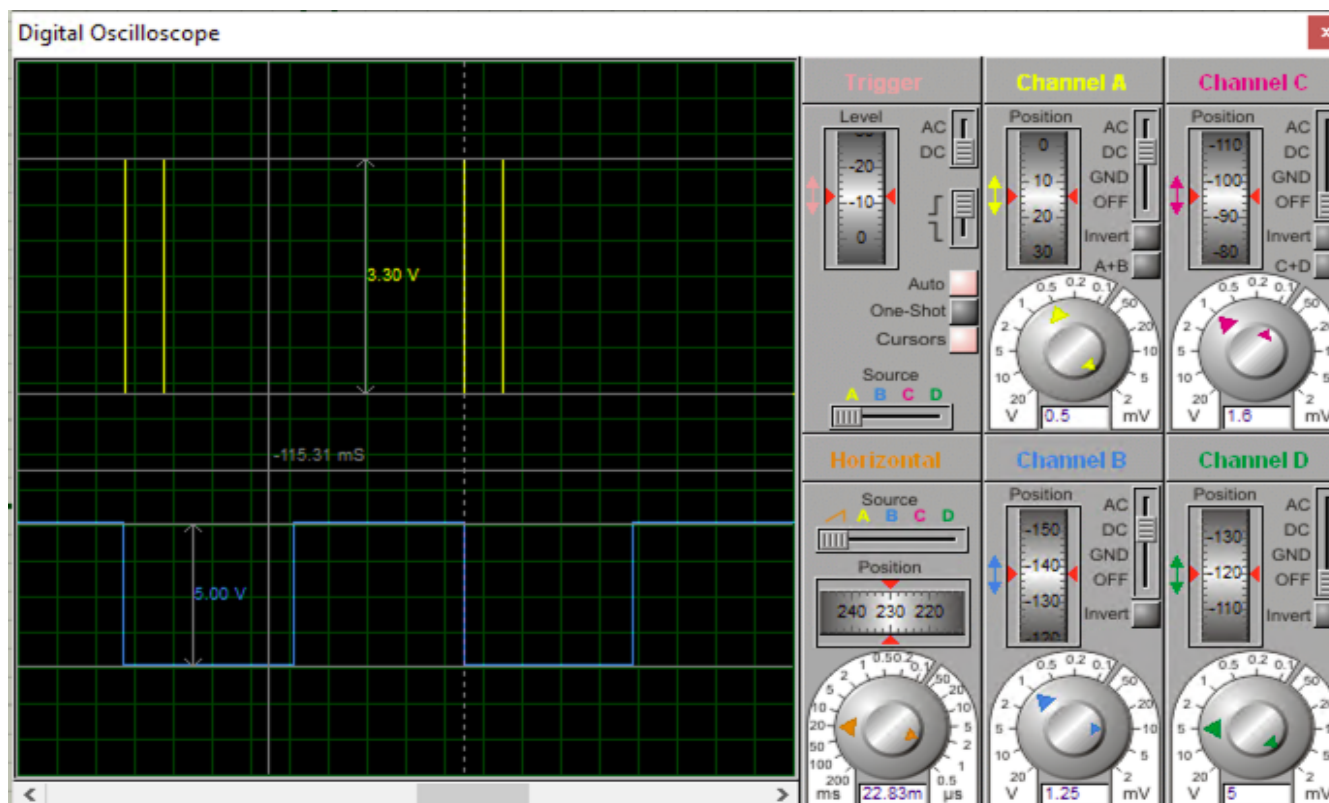




2cm:



4m:



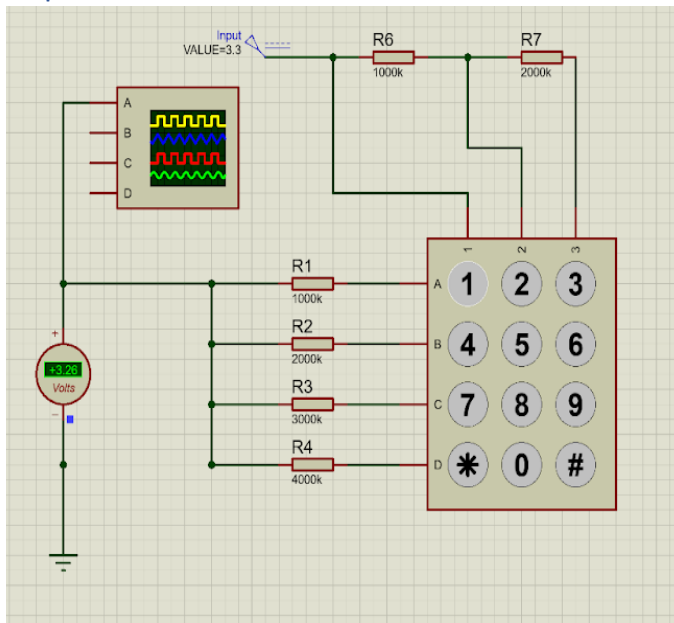


## {Keypad}

### Summary

Item	Description
Device: Purpose	The system would also require a keypad(KEYPAD-PHONE) for entering the passcode.
Device: Proteus Library component name	KEYPAD-PHONE
Device: Project Operating Range Requirement	The chosen keypad(12-button keypad COM-14662) has Keypress resistance will range between 10 and 150 OHMS
Device: Power Connections	+3.3V, GND, 5V
Device: Electrical signal type properties	The device will give a digital input to the MCU
Device: Electrical signal range (voltage, or current, resistance, capacitance or time etc.)	The keypad can accept 0 to 3.3V digital voltage
MCU connectivity details	The MCU will directly connect to the keypad
Device/MCU interfacing details	The voltage divider is used to interface the keypad. The every keypress voltage will below 3.3V

### Snips for Part A Schematics and Simulations



The table shows the different voltages that is measured when different keys are pressed

3.26 V	3.21 V	3.14 V
3.22 V	3.18 V	3.11 V
3.19 V	3.15 V	3.09 V
3.17 V	3.13 V	3.07 V

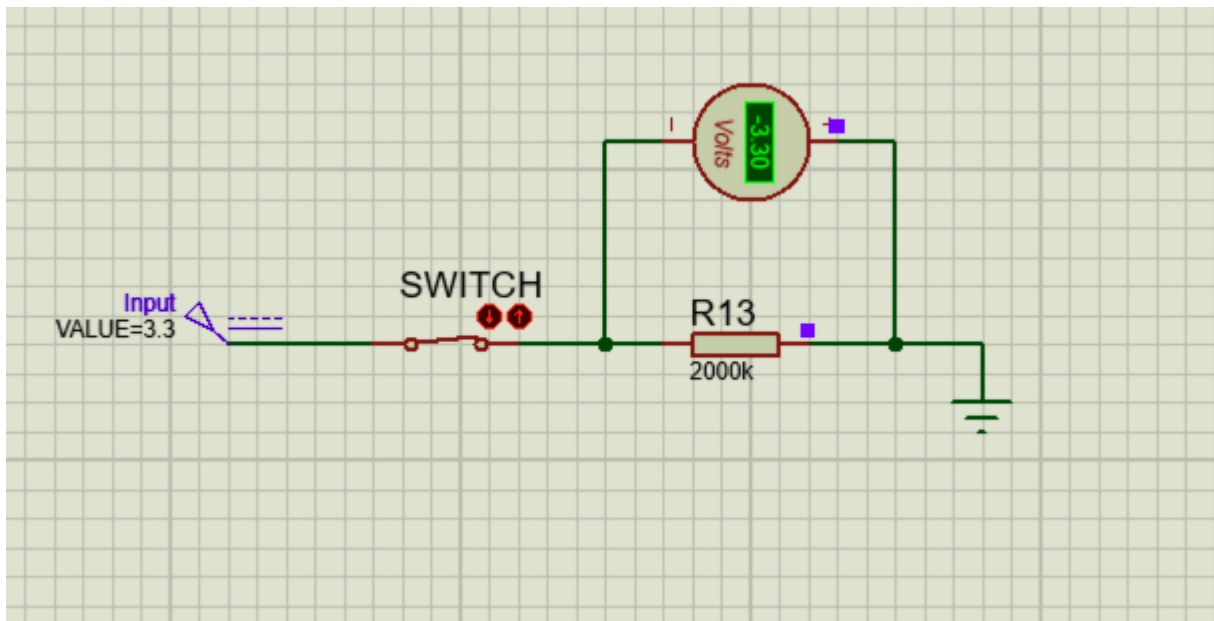
## {Switch-Open/Close Sensor}

### Summary

Item	Description
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Device: Purpose	The switch is used to detect the closing and opening of a door/window.
Device: Proteus Library component name	ECE298_GEN_SWITCH
Device: Project Operating Range Requirement	None
Device: Power Connections	3,3V, GND
Device: Electrical signal type properties	The open/close sensor will give digital output to the MCU
Device: Electrical signal range (voltage, or current, resistance, capacitance or time etc.)	None
MCU connectivity details	An analog to digital converter may be needed to convert the signal output from the switch to a digital signal that can be read by the MCU.
Device/MCU interfacing details	When using the switch, a pull down resistance is used to protect the MCU which can limit the current going to the MCU.

### Snips for Part A Schematics and Simulations



### LAB B2 PART B:

INSTRUCTIONS FOR RUNNING THE PART B SIMULATIONS ARE REQUIRED HERE

#### Step 1.

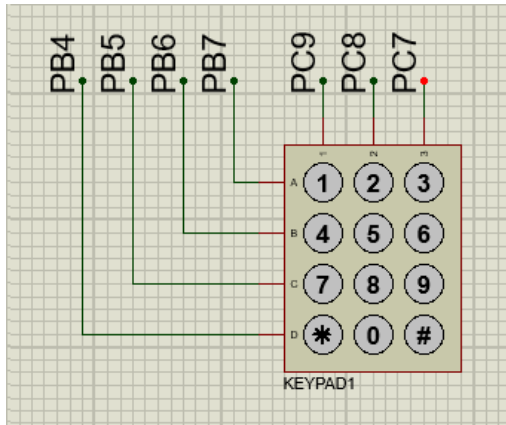
Add the “Blink\_Test.hex” file to the MCU device’s program file.

#### Step 2.

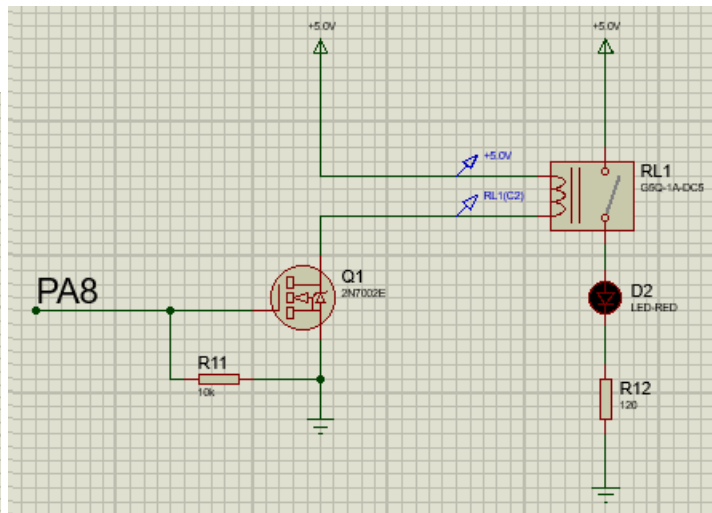
Goto the chile sheet and run the simulation.

### Step 3.

When key 3 of the keypad shown in P1 below is being pressed, the relay in P2 below will be switched on and the LED in that same schematics will light up. When key 3 is being unpressed, or other keys are being pressed, the relay will remain open, and the led will not light up.



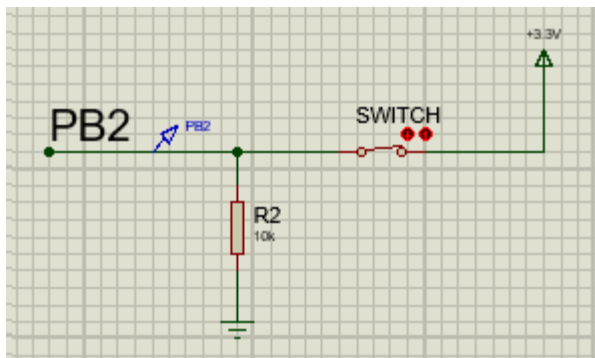
P1. Keypad Schematic



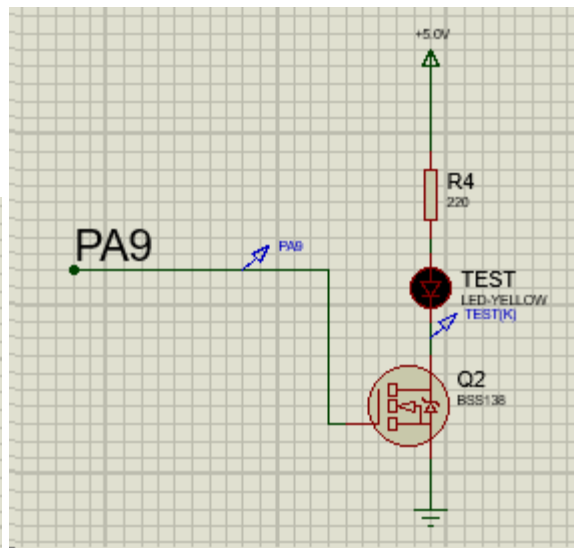
P2. Relay Schematic

### Step 4.

When the switch in P3 below is closed, the LED in P4 below will remain dark. When the switch is opened, the LED will be turned on.



P3. Switch(OPEN/CLOSE Sensor) Schematic



P4. LED Schematic