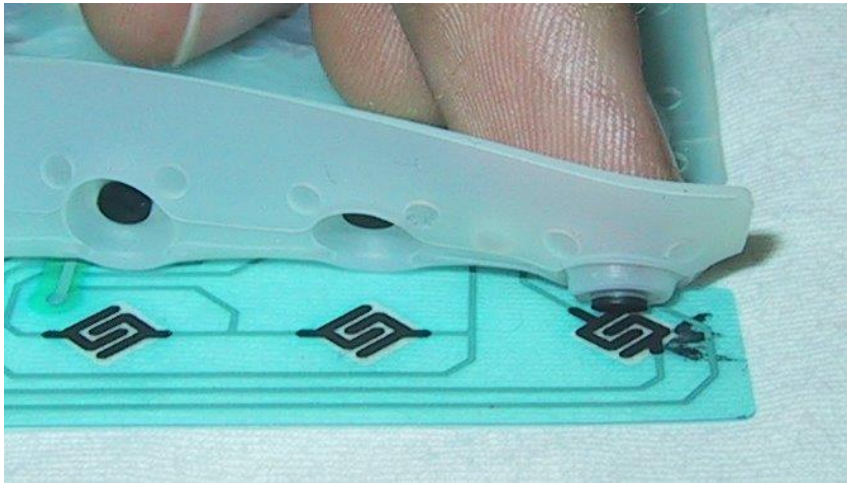
KEYBOARD

- The Keyboard is the most common input device
- When you press a key on a keyboard, you are activating a switch
- To understand a keyboard, one must first understand the **kinds of switches** that are used.

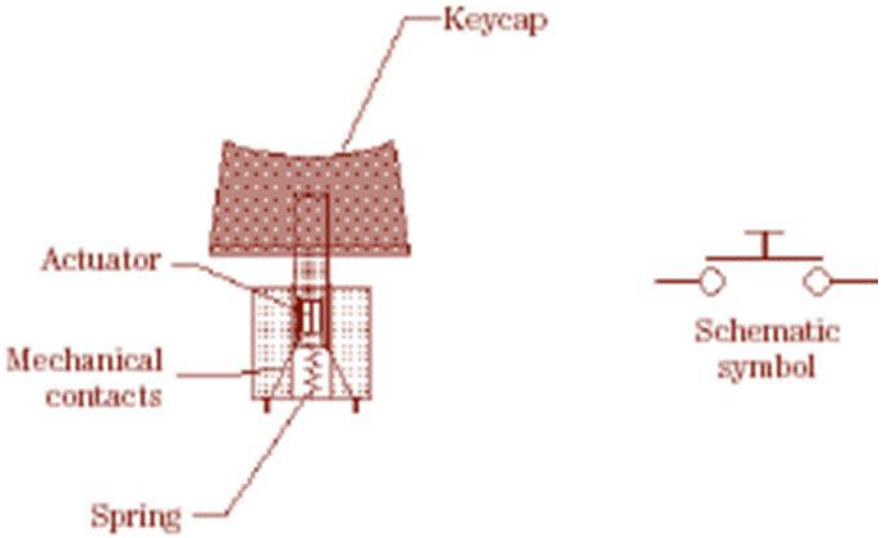


TYPES OF KEYBOARD SWITCHES

- Mechanical key-switches
- Membrane key-switches
- Capacitate key-switches
- Hall effect key-switches:

MECHANICAL KEY-SWITCHES

- Two pieces of metals are pushed together when one presses the key.
- Often made of a phosphor-bronze alloy with gold plating on contact areas.
- Contain a spring to return the key to the non-pressed position
- Also may contain a small piece of foam to help damp out bouncing

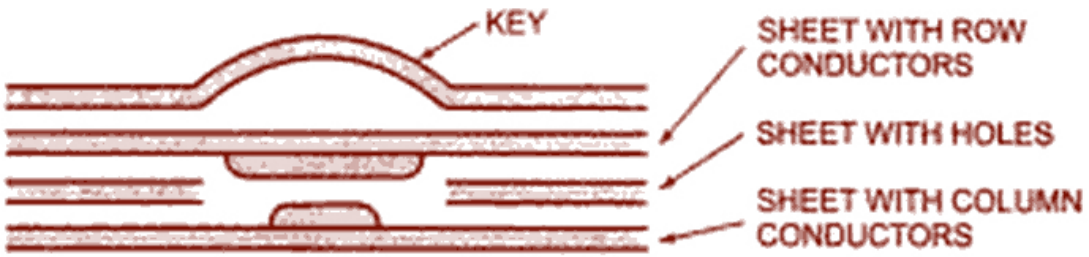


MECHANICAL KEY-SWITCHES

- Mechanical switches are inexpensive but they suffer from contact bounce.
  - A pressed key may make & break contact several times before it makes solid contact.
- contacts may become oxidized or dirty with age. Results in an improper contact.
- They have a lifetime of 1 million keystrokes.

MEMBRANE KEY-SWITCHES

- Special types of mechanical switches.
- Consists of 3 layers of plastic or rubber sandwich.
  - The top layer has a conductive line of silver ink running under each row of keys.
  - The middle layer has a hole under each key position
  - The bottom layer has a conductive line of silver ink running under each column of keys
- When we press a key we push the top ink line through the hole to contact the bottom ink line.
- The advantage is that these types of key-switches can be made very thin and sealed units. Lifetime of these key-switches vary over a wide range.

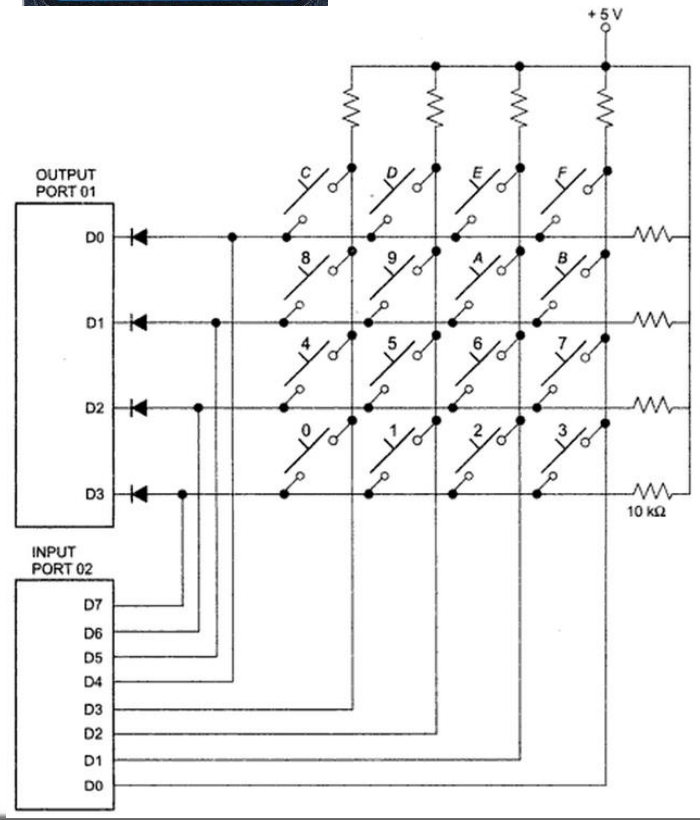


KEYBOARD CIRCUIT CONNECTION & INTERFACING

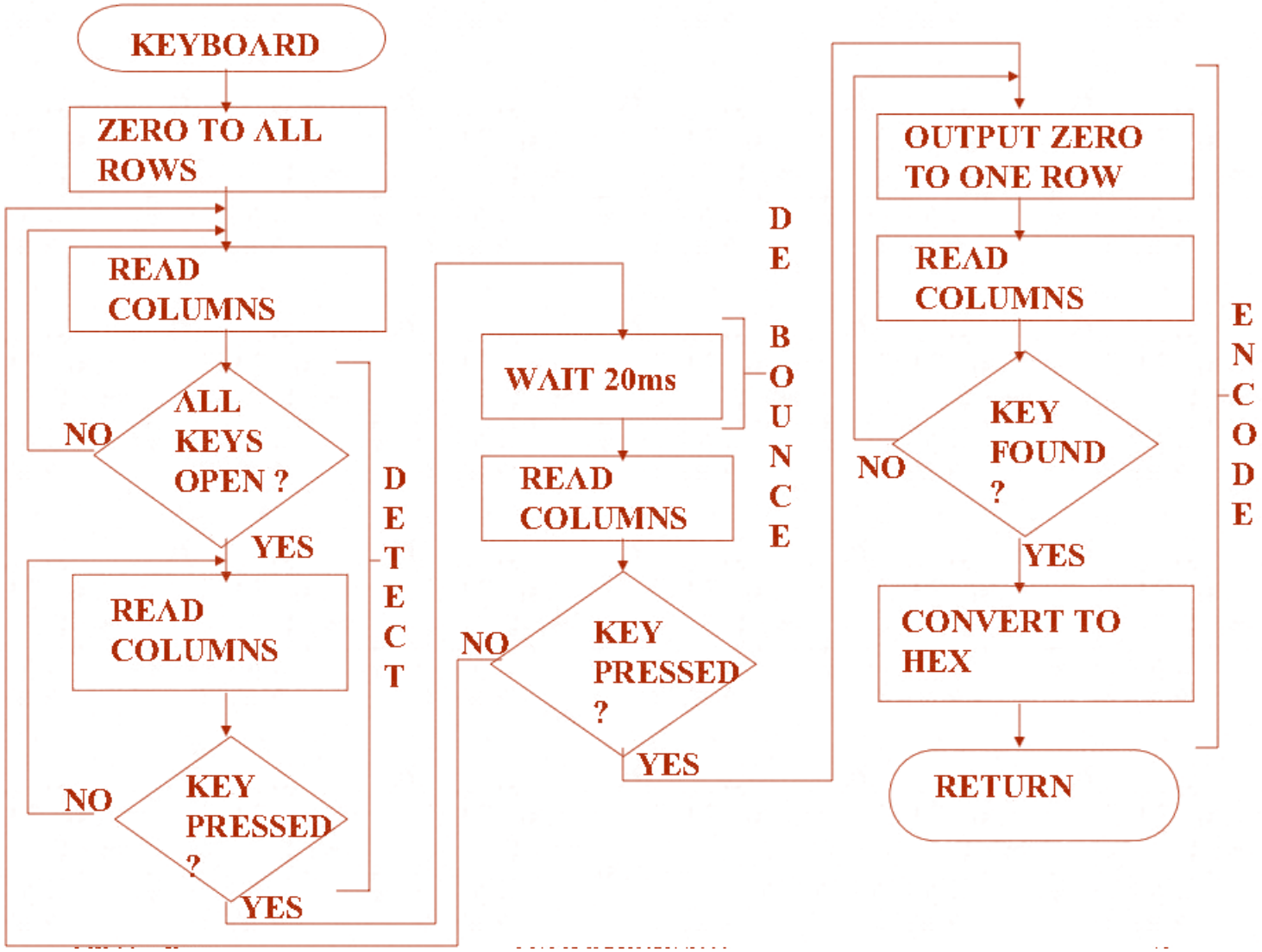
- The architecture of most of the keyboards looks like a matrix.
- Key switches are connected in a matrix of columns & rows.
- The rows of the matrix are connected to output port lines and the column lines of the matrix are connected to input port lines.
- Getting meaningful data from a keyboard, requires three major tasks
  - Detect a keypress
  - Debounce the keypress
  - Encode the keypress (produce a standard code for the pressed key)
- The three tasks can be done with
  - Hardware
  - Software
  - Combination of software and hardware

SOFTWARE KEYBOARD INTERFACING

- A connection between a hexadecimal keypad and a microprocessor
- The rows of the matrix are connected to four output port lines and the column lines of the matrix are connected to four input lines.
- When no key is pressed, the column lines are held high by the pull-up resistors to +5v.
- The main principle here is that pressing a key connects a row to a column.
- If a low is output on a row and a key in that row is pressed, then the low will appear on the column, which contains that key and can be redetected at the input port.
- If one knows the row and the column of the pressed key, one then knows which key is pressed.
- Therefore, the keyboard controller has to do three steps for the detection of a key-press.
  - (1) Scan the rows
  - (2) Sense the columns
  - (3) detect the key-press



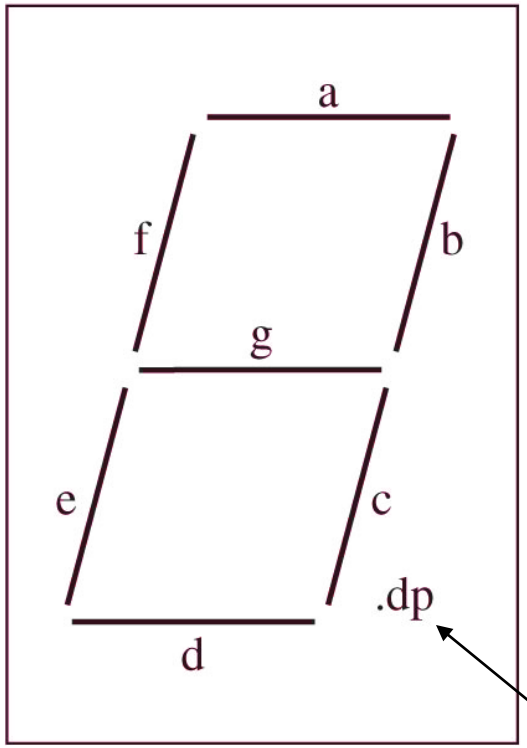
SOFTWARE KEYBOARD INTERFACING



Seven-Segment LEDs

- Seven-segment LEDs
  - Often used to display BCD numbers (1 through 9) and a few alphabets
  - A group of eight LEDs physically mounted in the shape of the number eight plus a decimal point as shown in Figure 9-5 (a)
  - Each LED is called a segment and labeled as ‘a’ through ‘g’.

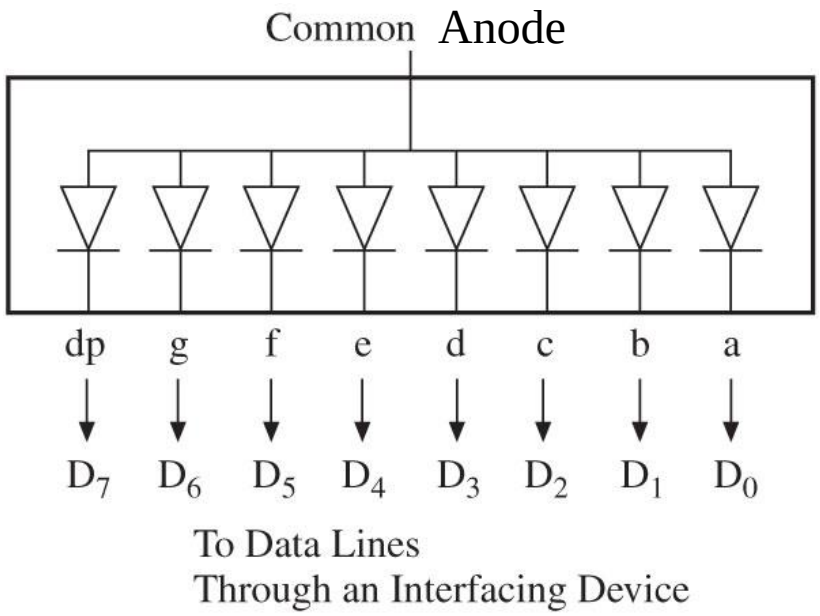
Seven-Segment LEDs



- Two types of seven-segment LEDs
  - Common anode
  - Common cathode

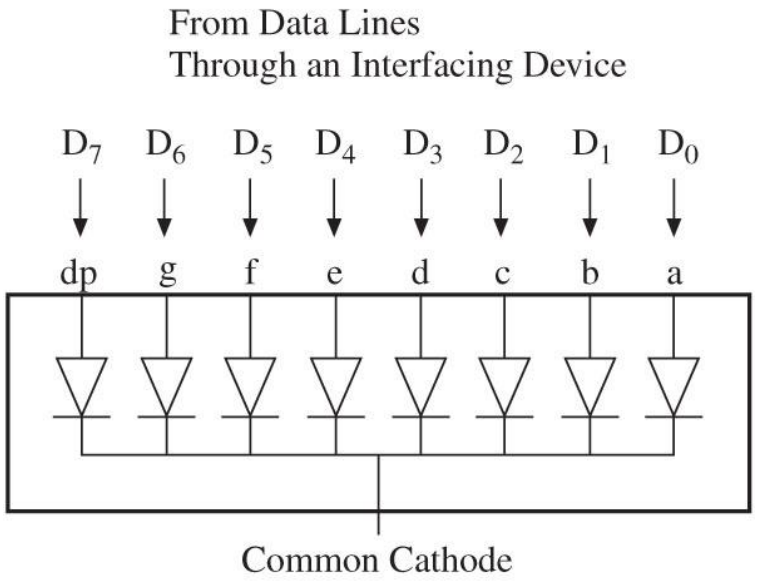
decimal point

Common Anode Seven-Segment LEDs



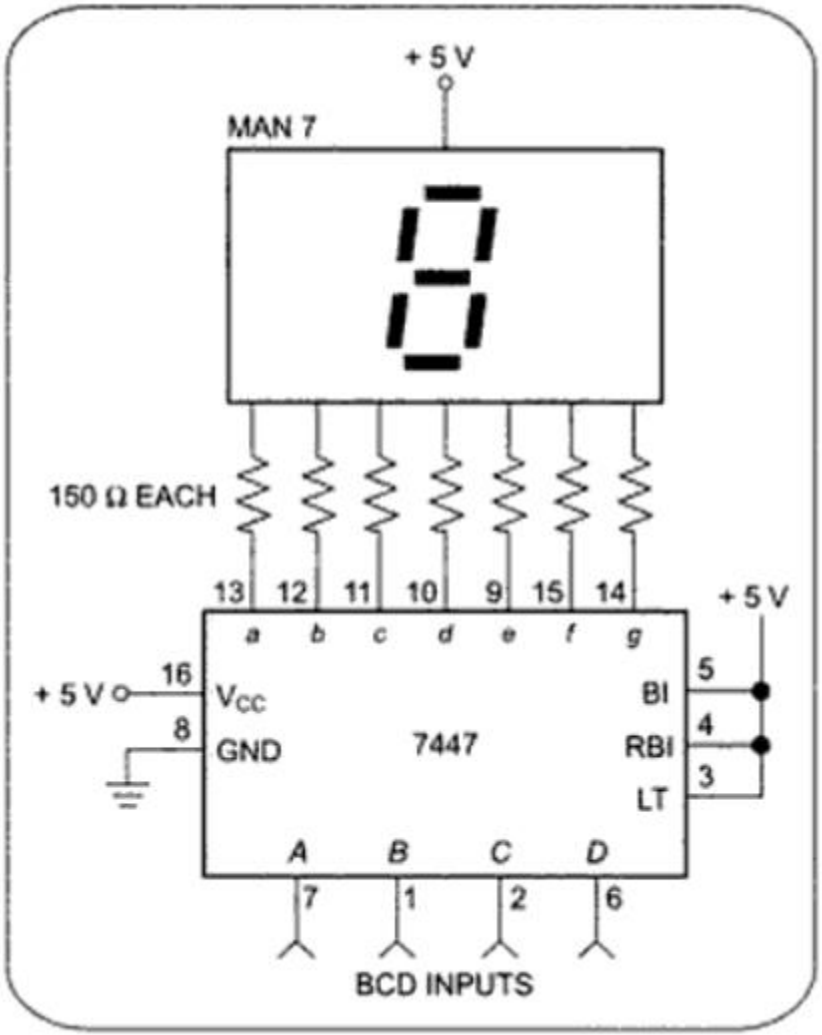
- In a common anode seven-segment LED
  - All anodes are connected together to a power supply and cathodes are connected to data lines
- Logic 0 turns on a segment.
- Example: To display digit 1, all segments except b and c should be off.
- Byte 11111001 = F9H will display digit 1.

Common Cathode Seven-Segment LEDs



- In a common cathode seven-segment LED
  - All cathodes are connected together to ground and the anodes are connected to data lines
- Logic 1 turns on a segment.
- Example: To display digit 1, all segments except b and c should be off.
- Byte 00000110 = 06H will display digit 1.

Directly Driving Seven-Segment LEDs



Directly Driving Seven-Segment LEDs

- Advantages
  - Works well for driving just one or two LEDs
- Disadvantages
  - Have several problems if we want to drive more digits
    - Assume we want to Display 8 Digits
    - For worst case calculation, assume all 8 digits are displaying digit 8
    - 20 mA per segment gives a current of 140 mA per digit
    - Total 1.2A for 8 digits
    - Around 13mA per 7447
    - Around 104 mA for 8 7447
  - As a result, current required to drive the LEDs + decoders might be several times the current required by the rest of the circuitry

THANK YOU