

## KEYBOARD DISPLAY CONTROLLER

### 8279 - PROGRAMMABLE KEYBOARD CONTROLLER

8279 programmable keyboard/display controller is designed by Intel that interfaces a keyboard with the CPU. The important features of 8279 are

- Simultaneous keyboard and display operations
- Scanned keyboard mode
- Scanned sensor mode
- 8-character keyboard FIFO
- 16-character display
- Right or left entry
- 16-byte display RAM.
- Programmable scan timing

The keyboard first scans the keyboard and identifies if any key has been pressed. It then sends their relative response of the pressed key to the CPU and vice-a-versa.

The Keyboard can be interfaced either in the interrupt or the polled mode.

In the **Interrupt mode**, the processor is requested service only if any key is pressed, otherwise the CPU will continue with its main task.

In the **Polled mode**, the CPU periodically reads an internal flag of 8279 to check whether any key is pressed or not with key pressure.

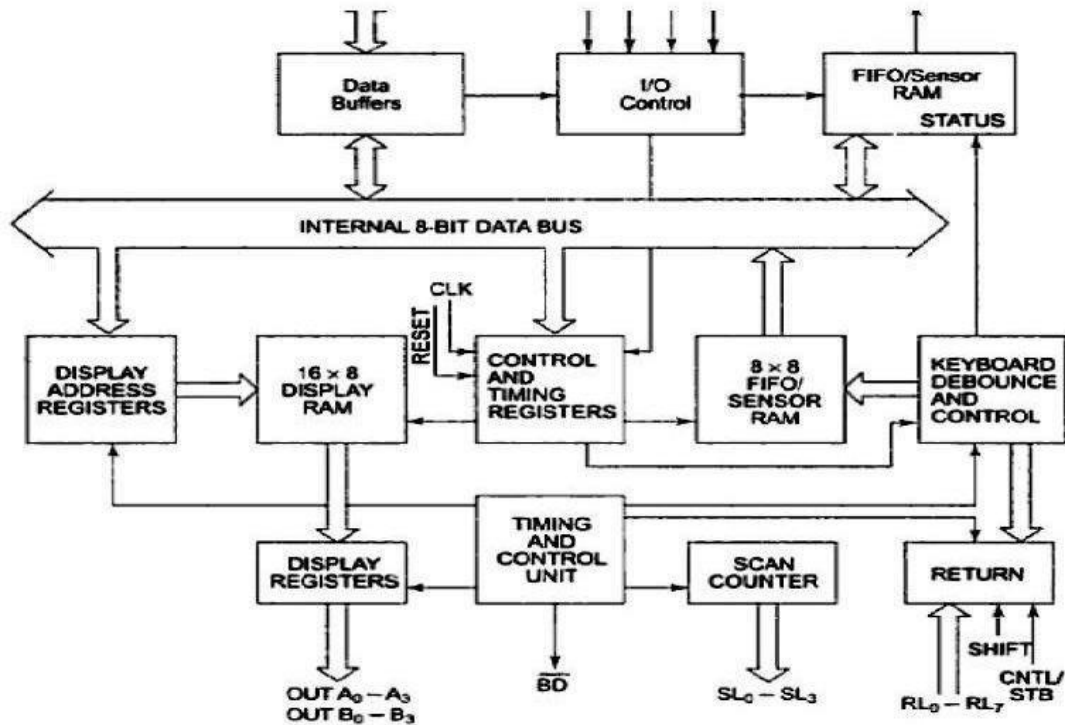
#### **BLOCK DIAGRAM OF 8279:**

The functional block diagram of 8279 is shown in Figure

The four major sections of 8279 are keyboard, scan, display and CPU interface.

## Keyboard section:

The keyboard section consists of eight return lines RL0 – RL7 that can be used to form the columns of a keyboard matrix. It has two additional input : shift and control/strobe. The keys are automatically debounced.

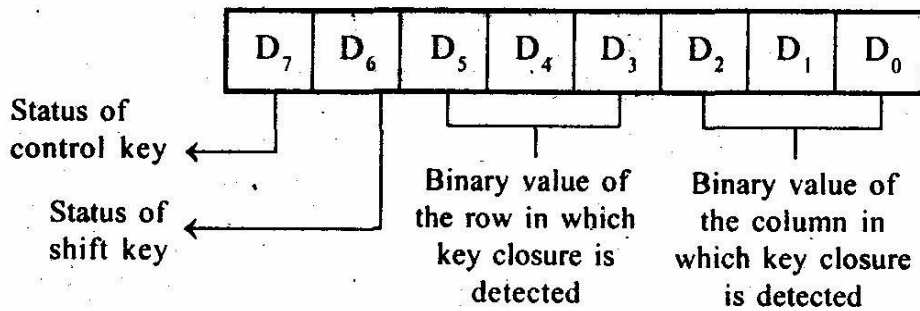


### Internal blocks of Keyboard display controller

The two operating modes of keyboard section are 2-key lockout and N-key rollover. In the 2-key lockout mode, if two keys are pressed simultaneously, only the first key is recognized. In the N-key rollover mode simultaneous keys are recognized and their codes are stored in FIFO.

The keyboard section also has an 8 x 8 FIFO (First In First Out) RAM. The FIFO can store eight key codes in the scan keyboard mode. The status of the shift key and control key are also stored along with key code. The 8279 generate an interrupt signal when there is an entry in FIFO.

The format of key code entry in FIFO for scan keyboard mode is,



In sensor matrix mode the condition (i.e., open/close status) of 64 switches is stored in FIFO RAM. If the condition of any of the switches changes then the 8279 asserts IRQ as high to interrupt the processor.

### DISPLAY SECTION:

The display section has eight output lines divided into two groups A0-A3 and B0-B3. The output lines can be used either as a single group of eight lines or as two groups of four lines, in conjunction with the scan lines for a multiplexed display. The output lines are connected to the anodes through driver transistor in case of common cathode 7-segment LEDs. The cathodes are connected to scan lines through driver transistors. The display can be blanked by BD (low) line. The display section consists of 16 x 8 display RAM. The CPU can read from or write into any location of the display RAM.

### SCAN SECTION:

The scan section has a scan counter and four scan lines, SL0 to SL3. In decoded scan mode, the output of scan lines will be similar to a 2-to-4 decoder. In encoded scan mode, the output of scan lines will be binary count, and so an external decoder should be used to convert the binary count to decoded output. The scan lines are common for keyboard and display. The scan lines are used to form the rows of a matrix keyboard and also connected to digit drivers of a multiplexed display, to turn ON/OFF.

### CPU INTERFACE SECTION:

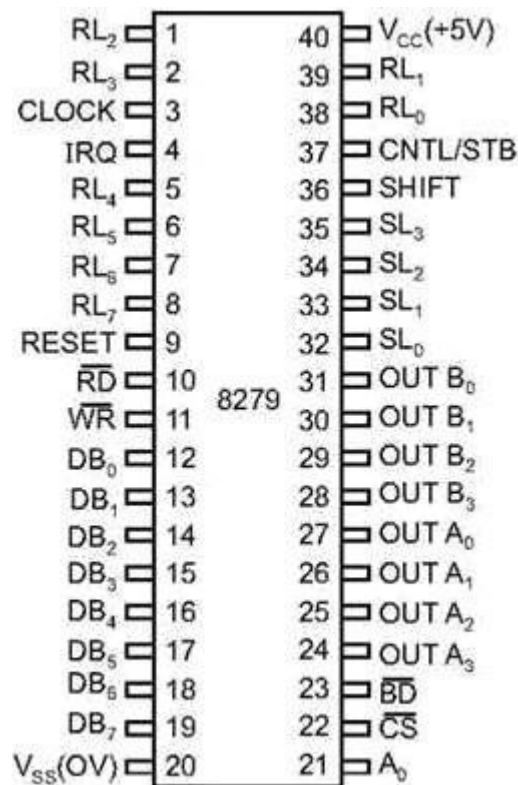
The CPU interface section takes care of data transfer between 8279 and the processor. This section has eight bidirectional data lines DB0 to DB7 for data transfer between 8279 and CPU. It requires two internal address A = 0 for selecting data buffer and A = 1 for selecting control register of 8279.

The control signals WR (low), RD (low), CS (low) and A0 are used for read/write to 8279. It has an interrupt request line IRQ, for interrupt driven data transfer with processor.

The 8279 require an internal clock frequency of 100 kHz. This can be obtained by dividing the input clock by an internal prescaler. The RESET signal sets the 8279 in 16-character display with two -key lockout keyboard modes.

### 8279 – PIN DESCRIPTION

The following shows the pin diagram of 8279.



### Pin Configuration of Keyboard display controller

#### Data Bus Lines, DB0 - DB7

These are 8 bidirectional data bus lines used to transfer the data to/from the CPU.

#### CLK

The clock input is used to generate internal timings required by the microprocessor.

## **RESET**

This pin is used to reset the microprocessor.

## **CS (Chip Select)**

When this pin is set to low, it allows read/write operations, else this pin should be set to high.

## **A0**

This pin indicates the transfer of command/status information. When it is low, it indicates the transfer of data.

## **RD, WR**

This Read/Write pin enables the data buffer to send/receive data over the data bus.

## **IRQ**

This interrupt output line goes high when there is data in the FIFO sensor RAM. The interrupt line goes low with each FIFO RAM read operation. However, if the FIFO RAM further contains any key-code entry to be read by the CPU, this pin again goes high to generate an interrupt to the CPU.

## **Vss, Vcc**

These are the ground and power supply lines of the microprocessor.

## **SL0 – SL3**

These are the scan lines used to scan the keyboard matrix and display the digits. These lines can be programmed as encoded or decoded, using the mode control register.

## **RL0 – RL7**

These are the Return Lines which are connected to one terminal of keys, while the other terminal of the keys is connected to the decoded scan lines. These lines are set to 0 when any key is pressed.

## **SHIFT**

The Shift input line status is stored along with every key code in FIFO in the scanned keyboard mode. Till it is pulled low with a key closure, it is pulled up internally to keep it high

## **CNTL/STB - CONTROL/STROBED I/P Mode**

In the keyboard mode, this line is used as a control input and stored in FIFO on a key closure. The line is a strobe line that enters the data into FIFO RAM, in the strobed input mode. It has an internal pull up. The line is pulled down with a key closure.

## **BD**

It stands for blank display. It is used to blank the display during digit switching.

## **OUTA0 – OUTA3 and OUTB0 – OUTB3**

These are the output ports for two 16x4 or one 16x8 internal display refresh registers. The data from these lines is synchronized with the scan lines to scan the display and the keyboard.