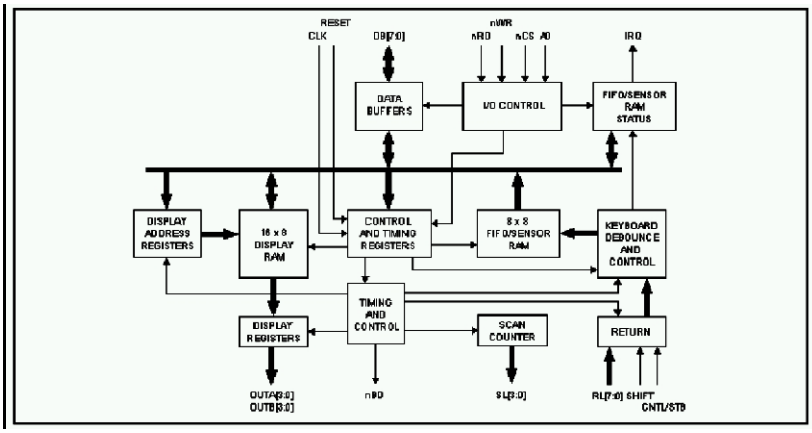
8279 Display and Keyboard Controller

8279 is a programmable display and keyboard controller. Intel 8279 chips are part of many standard microprocessor kits that schools use and also of a variety of industrial applications



with small amounts of data I/O. The device is well suited for driving seven or eighteen segment display units and for interfacing matrix keyboards. Dedicated peripheral for display and keyboard control will free the processors in the host machines from a variety of chores
Basics of Keyboard Interfacing Matrix keyboards are connected in a series of rows and columns as shown in the material. The important tasks in interfacing a keyboard are 1) detecting a keypress, 2) debounce the keypress and 3) encode the key to some standard code. Refer to Pages 281-285 for general introduction to keyboard interfacing. Pay particular attention to the matrix keyboard layout and the flowchart in the material. Understand how the rows are selectively pulled down and how the columns are checked to detect the keys. Two definitions are important for keyboard interfacing. They pertain to detecting multi- ple simultaneous inputs. In 2-Key Lockout mechanism, one key must be released before the other key is detected. In the N-Key Rollover mode, if two keys are pressed almost simultaneously, both keypresses are detected and are placed in a queue.

Basics of Alphanumeric Displays

8279 can be used to control a variety of display units. In this project, 8279 is used to drive LED displays only. In a multi-character LED display, the data inputs are sent on a common bus, but different positions are selectively turned on in sequence. The refresh is done fast enough to hide the multiplexing. This allows the display unit to have very few data lines coming in and also reduces power consumption. For a multiplexed display, timing the character position that is displayed is very critical. 8279 takes care of this timing. Basics of 8279 Programming

• 8279 has two internal addresses which are memory mapped in the host CPU. The input line A0 selects one of these two addresses. If A0=„1“, the control and status registers in the 8279 are chosen. If A0=„0“, 8279 is enabled for reading data from it or writing data to it.

• When control/status is chosen, the device takes in control words. The first 3 bits of the 8-bit control word identify the operation or the mode that is chosen. Rest of the bits are interpreted according to the mode. The material given has detailed descriptions on how to interpret the control word.

8279 - Internal Block Diagram Internal organization of 8279 is shown in Figure . The device runs internally at 100 kHz. Since the CLK input is at 3 MHz, the clock has to be divided inside to 100 kHz. For doing so, proper Program Clock Word must be sent to the device and then the device is ready for Data I/O. The block diagram shows all the internal blocks for both keyboard and display control.

1. Display is achieved using 1) the internal 16×8 Display RAM, 2) the Timing control unit and 3) the Scan Counter. CPU fills the display RAM with data. The data must be in seven segment format. The scan counter counts from "0000" to "1111" and places its output on the line SL3-SL0. Based on the scan count generated, the Decoder shown in Figure 1 selectively turns one of the sixteen characters in the display unit. The timing control for the display is done by the signal BD. The characters are displayed from digit 1 to 16 and then returns back to 1. The time 8279 takes between two updates to the same digit position is called the scan time.

2. The 16 character keyboard is organized as a 4×4 matrix keyboard. We use only the last two bits of the scan counter, namely SL1 and SL0. Keyscan is achieved by driving one row to „0" at a time and detecting for one of the columns being „0". If there is a key press, the corresponding column goes low and the column information is passed on to 8279 through the lines RL3-RL0. 8279 knows the row code that is being generated and we can scan lines RL3- RL0, effectively detecting the exact key that is pressed. After detecting a keypress, 8279 waits for a debounce time and scans the key again. If key press is still present, it produces a 8-bit keycode based on the column and the row in which the key is pressed. The keycode is then placed in the internal 8-byte FIFO RAM. If a valid keypress is found, it asserts an Interrupt Request to the CPU through the line IRQ. It is up to the CPU to read the data. Meanwhile, 8279 increments FIFO count in the internal status register.

3. In both cases, CPU communicates with the 8279 only when there is a character that needs to be displayed or if a keypress is detected. For more details, consult the material given in the class.

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