

LED Array: A Raster Scan Output Device

OBJECTIVES

- Understand the raster scan algorithm to display data on an LED array
- Create a basic oscilloscope by displaying graphical information about a signal using an LED array

LED ARRAY

An LED array can be used to display graphical information. Figure 1 shows an 8x8 LED array used to represent voltage as a function of time, just like an oscilloscope.

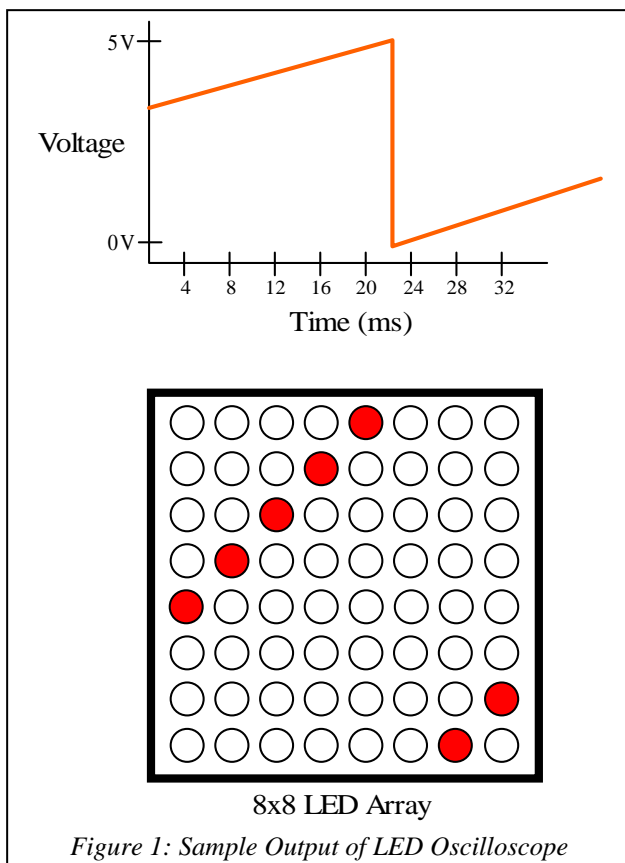


Figure 2 shows the pinout and connections for one manufacturer's 8x8 LED array. Notice that the column pins on the bottom of Figure 2 are connected to the LED cathodes and the row pins are connected to the LED anodes. Recall that an LED goes on only if the cathode is low while the anode is high. If the cathode of an LED is high, the LED can not be turned on.

Writing a zero (low) to the column pin (cathode) will allow the LEDs in that column to light up. Writing a one (high) to a column (cathode) prevents the LEDs in that

column from lighting up. Writing a pattern to the row bits will illuminate those LEDs only in the selected column (i.e., the column with a zero).

The raster scan technique for the LED array will work very much like what we used for the keypad. We turn on the appropriate LEDs in a particular column one, and then move to the next column. Repeat this for each of the columns and then repeat starting with the first column. If we move fast enough between columns, our eyes will be tricked into seeing a static image on the LED array (assuming the data we display on the columns does not change).

Use the following raster scan method to display information on the LED array:

- 1) Look up the data for a column.
- 2) Add a little delay (~1/200 second).
- 3) Turn off all columns.
- 4) Place a column's data on the output rows.
- 5) Turn on that column (other columns off).
- 6) Repeat steps 1-5 for each column.
- 7) Repeat this entire sequence as long as you want the display to be on. Otherwise, turn off display.

Step 1 might take some time, so the LED is left on during that step to keep the display bright. Step 3 is added to keep the display from "ghosting" between steps 4 and 5.

Your delay routine (step 2) should be long enough to update each column between 30 and 50 times each second. (The update for TV is 30 frames per second and for theatre movies is about 24 frames per second.)

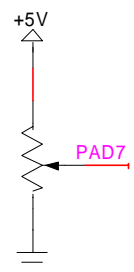
Figure 1 shows a sample of the LED output for a particular voltage waveform with a 4ms sampling rate.

Figure 2 shows the pin-out, internal circuitry and wiring diagram of an 8x8 LED array. Figure 4 shows the same for a 7x5 LED array.

*** Be sure to keep your display data in a table. You **MUST NOT** have a separate subroutine for activating each row. Use a **TABLE LOOKUP**.

TIPS

Use the 10k potentiometer from your lab kit and the A/D system to create a variable input source to test your oscilloscope (wired as shown here). Set the sample rate very slow and turn the pot during program operation. You should see the waveform on the LED array.



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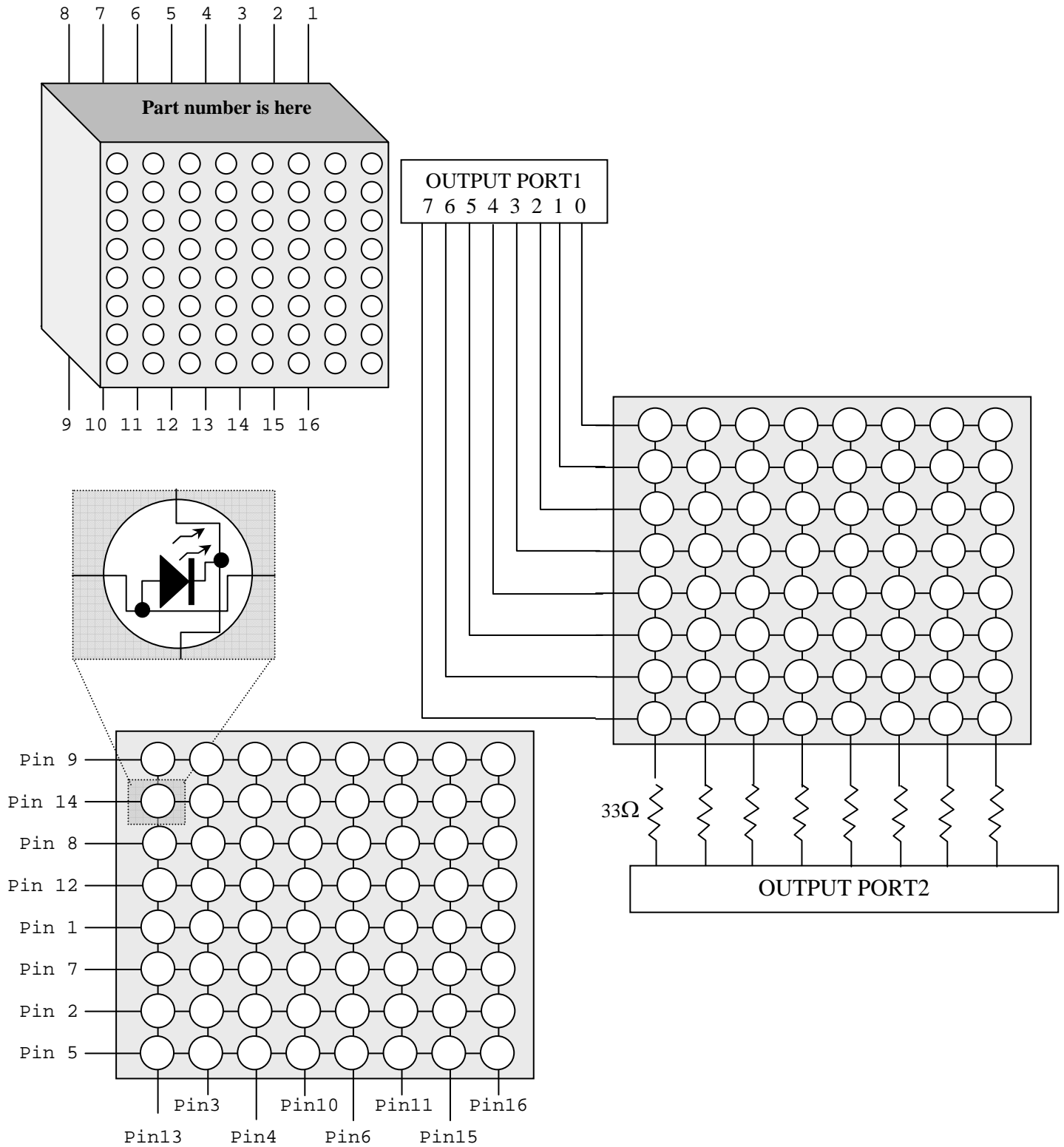


Figure 2: Pin-out, internal circuitry and wiring diagram of 8x8 LED array

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Raster Scan Example for Displaying "Y" on a 3x3 array of LEDs
(Schematic is identical to larger array using the first 3 rows and columns.)

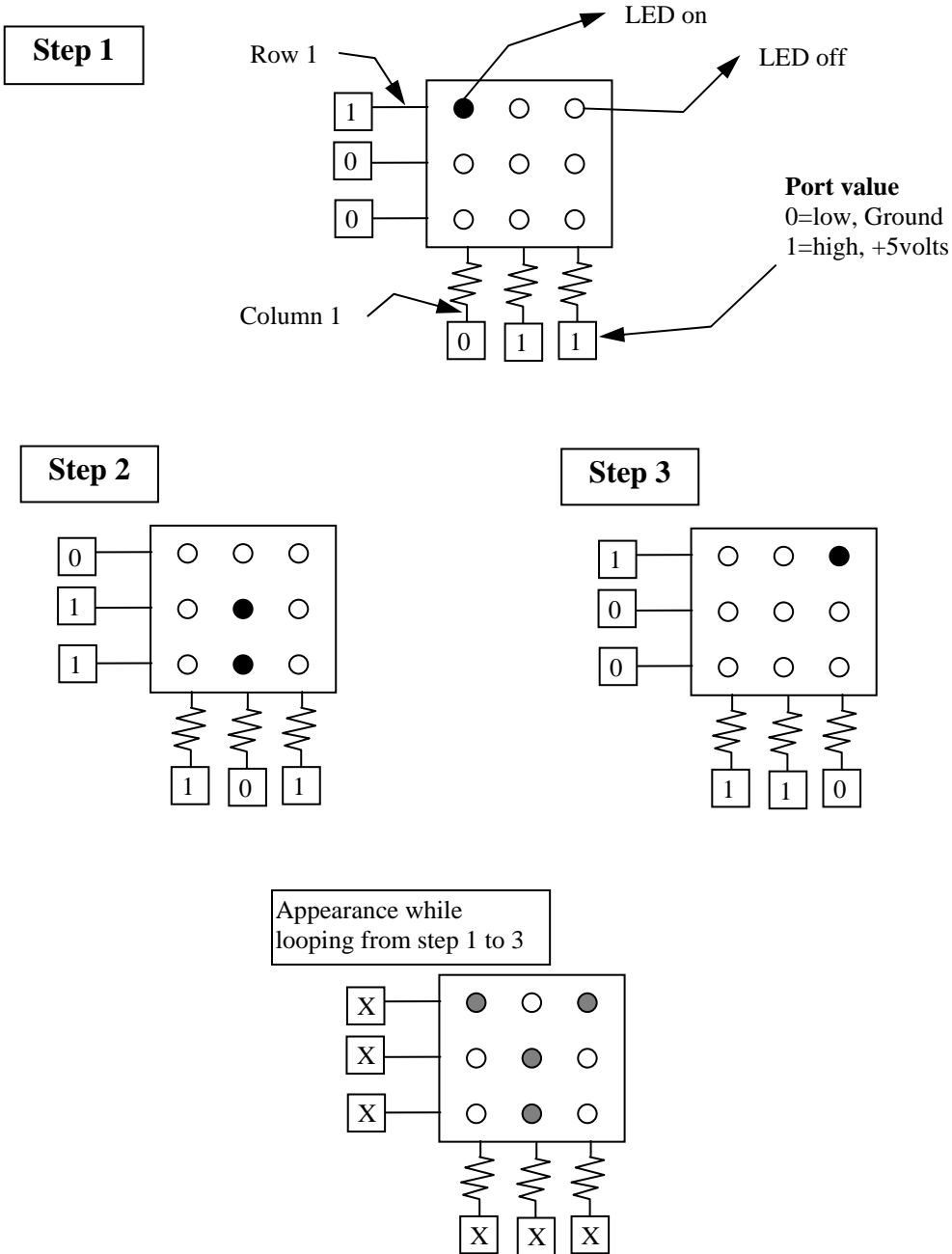


Figure 3: Raster Scan example of LED Array

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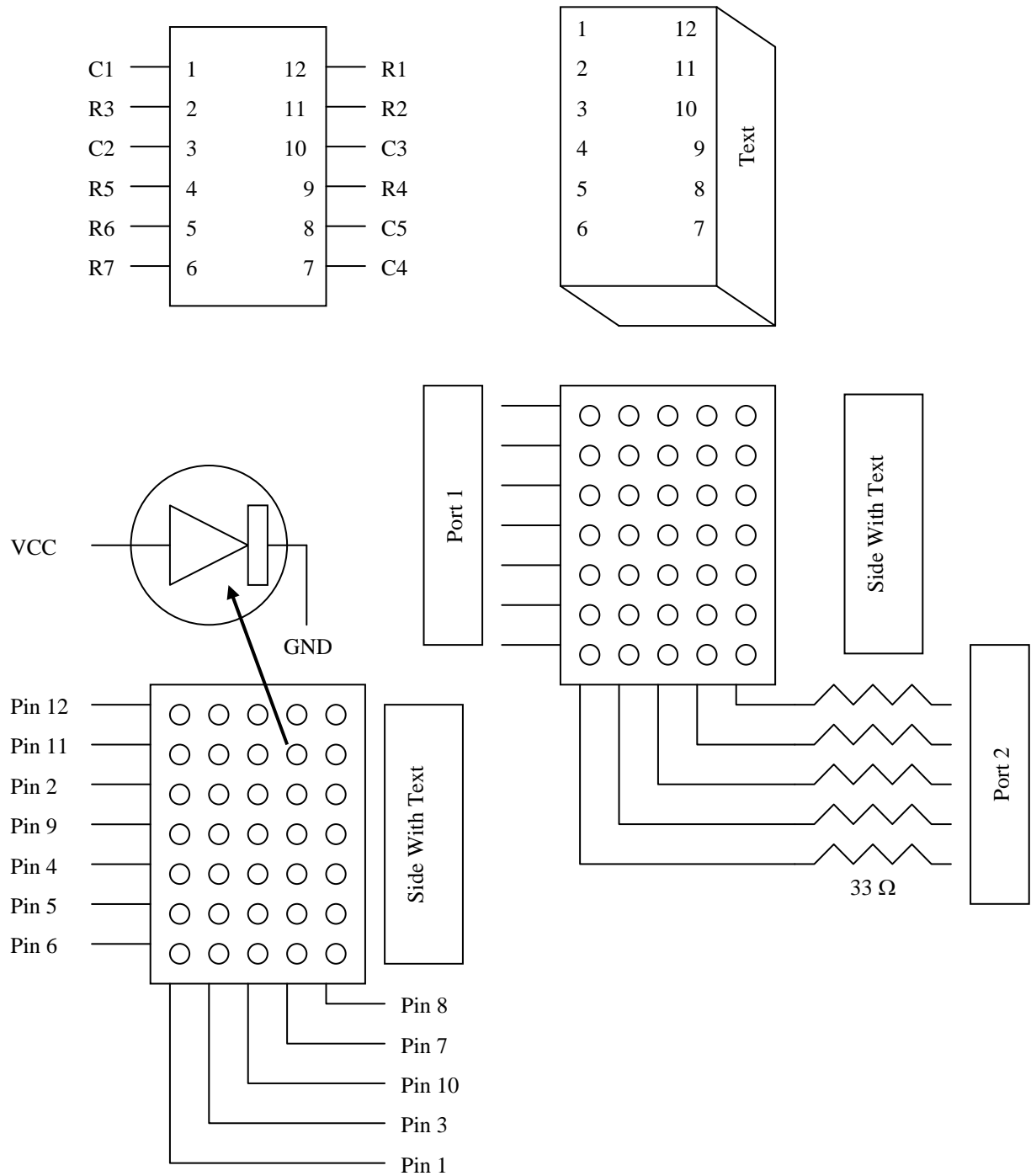


Figure 4: Pin-out, internal circuitry and wiring diagram of 7x5 LED array