

Seven-Segment LED Displays

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Abstract

Seven-segment displays are electronic display devices used as an easy way to display decimal numerals and an alternative to the more complex dot-matrix displays. The LDS-C303RI, a common seven-segment display, will be examined. Common anode vs. common cathode will be outlined. LED drivers such as the CD74HC4511E will also be discussed. Design applications such as digital clocks and electronic meters will be covered briefly.

Keywords: Seven-Segment, LED Display, Common Anode/Cathode, Drivers, LDS-C303RI, CD74HC4511E

Introduction

Seven-segment displays first became widely used as a popular way of displaying numbers. Today they are used as displays in home appliances, cars, and various digital devices. The LDS-C303RI is commonly used in many designs, it includes seven LED bars aligned in a figure eight pattern as seen in Figure 1. It is capable of displaying the numbers 0-9 and the letters A-F by lighting the appropriate segments. This is typically controlled by a driver like the CD74HC4511E.

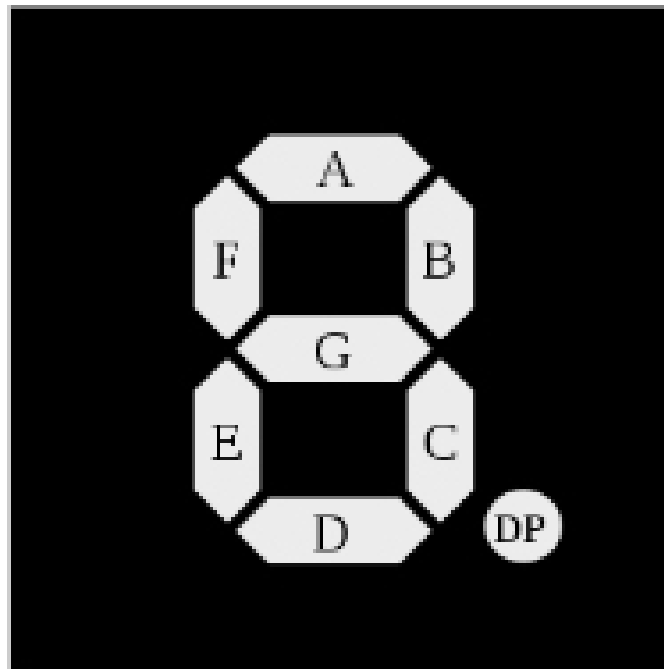


Figure 1: Seven-Segment Layout

Objective

The following will detail the necessary requirements to implement a display into a circuit. This application note will also provide the basic functionality of a seven-segment display. In terms of hardware, the implementation of the display into a counter using a CD74HC4511E driver will be discussed. Schematics are included in order to explicitly show the correct implementation of the display into a simple binary counter.

Methods

Seven-Segment Display

When dealing with seven-segment displays, there are two types. Common anode and common cathode; in common anode all the anodes on the display are tied to a common pin, typically the power source, and the LED are controlled via the cathodes with ground being on and power being off. In common cathode all the cathodes are tied to a common pin, in this case generally ground, and the LED are driven by the state of the anodes where ground is off and power is on.

Hence a seven-segment plus decimal point package will only require nine pins, though commercial products typically contain more pins in order to match industry standard pinouts. See Figure 2 and 3 for reference.

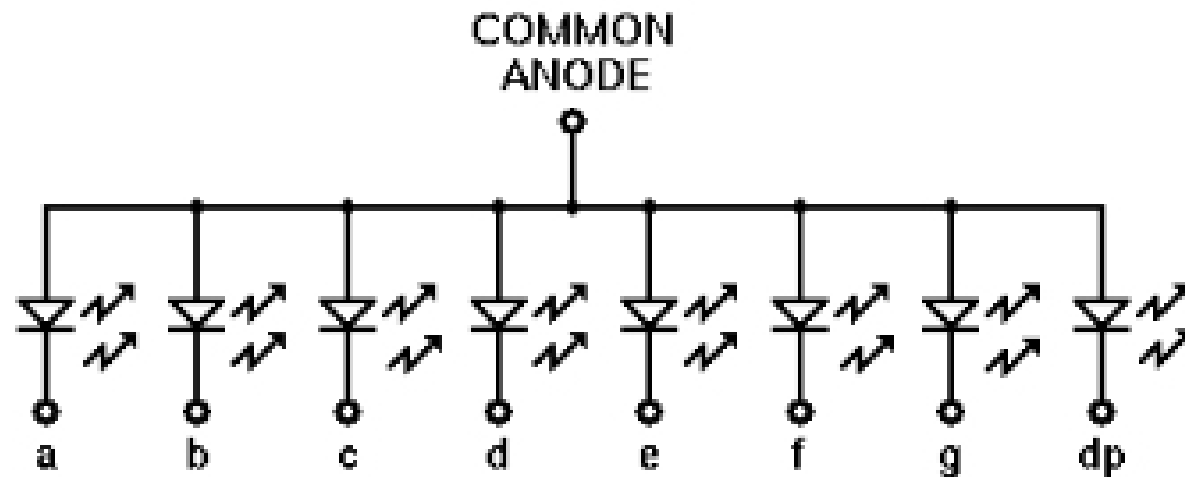


Figure 2: Common Anode

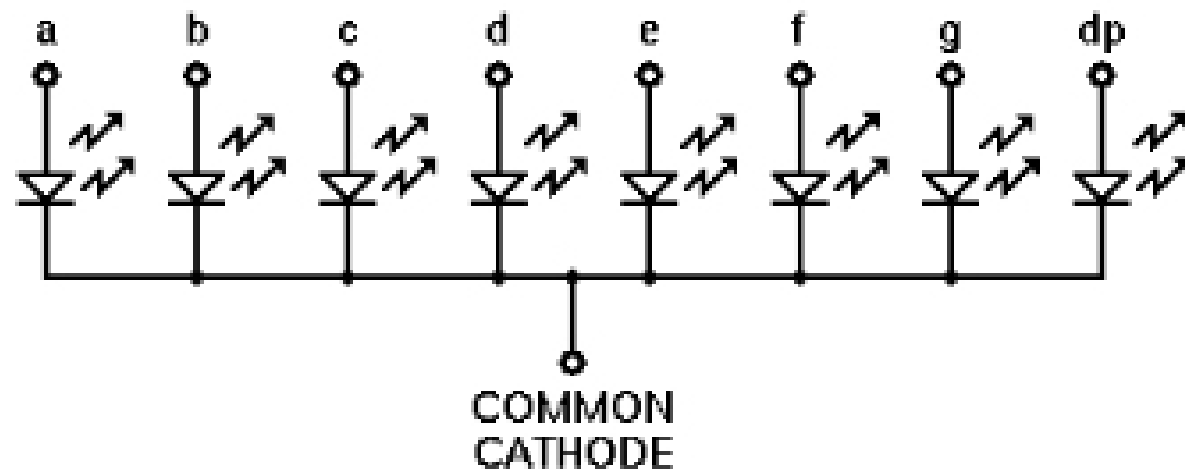


Figure 3: Common Cathode

A simple truth table can be used to show how to display each number and letter. This can be seen in Table 1. For example, it can be seen that if a 0 is wanted to be displayed the a-f LED segments need to be turned on while the g segment is off. Note that B and D are displayed as b and d; this is done to obtain a unique, unambiguous shape for each letter. Otherwise, a capital D would look identical to a 0 and a capital B would look identical to an 8.

Number	a	b	c	d	e	f	g
0	On	On	On	On	On	On	Off
1	Off	On	On	Off	Off	Off	Off
2	On	On	Off	On	On	Off	On
3	On	On	On	On	Off	Off	On
4	Off	On	On	Off	Off	On	On
5	On	Off	On	On	Off	On	On
6	Off	Off	On	On	On	On	On
7	On	On	On	Off	Off	Off	Off
8	On	On	On	On	On	On	On