Two digits Counter

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One Digit	Two Digits	Up/Down Counter	Three Digits	Shuffle Score Board

Introduction

I Introduced for the novices a basic One Digit Counter using CMOS ICs on the previous page . On the following pages you will be able to expand your knowledge about counters after you have had a look and understand the basic of the One Digit Counter described .

Logic is Logic , TTL or CMOS . The CMOS series type 4xxx logic supply source can be any voltage from 3 volts to as high as 18 volts and requires much lower current than TTL (Transistor Transistor Logic) and makes it easier to use with other linear circuitry by using the same voltage supply .

Some TTL versions are available using CMOS technology in the 74Cxx , 74HCxx , 74HCLxx etc ... they are faster versions of the common TTL but still use the 5 volts supply .

The Two Digits Counter

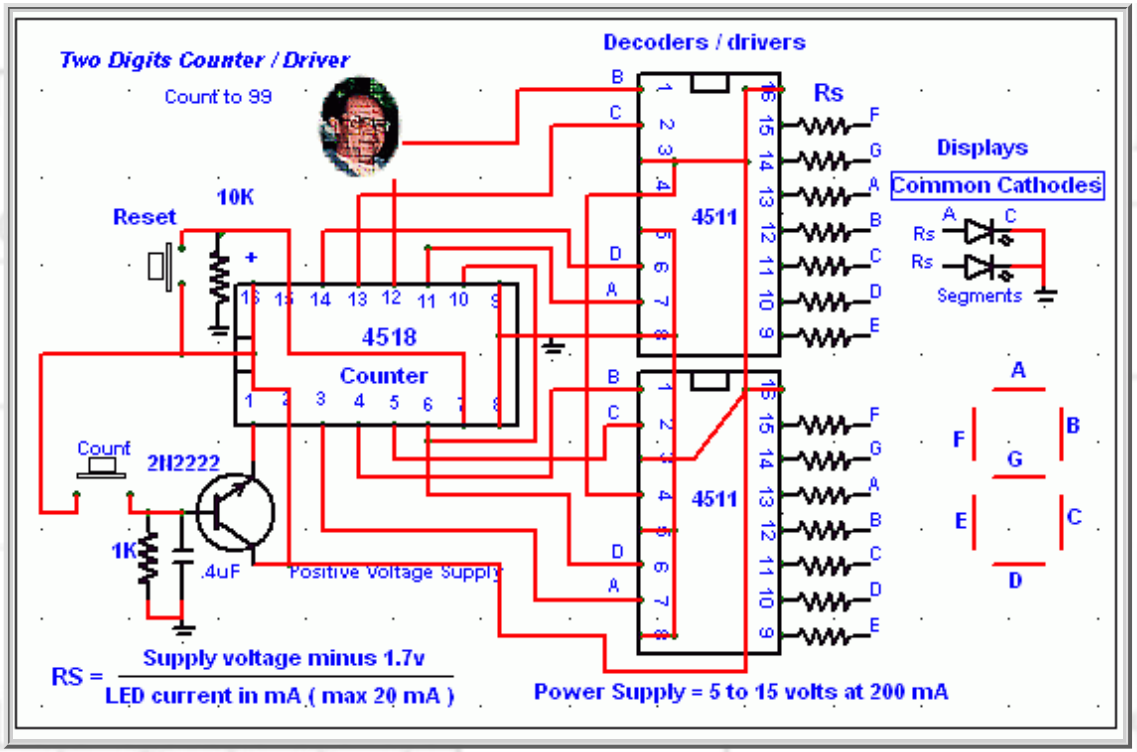
Following the same principle used previously , a two digits counter is shown below . For the One Digit Counter we used only one of the two dual Up-counters available on the CMOS 4518 . Building the Two Digit Counter requires that we use both counters and one half each of the two available counters is used to drive a CMOS 4511Decoder / Driver IC to activate each one of the two displays , in this application Common Cathode LEDs Displays are used for economy and ease of application .

Common Anode displays

Common Anode display can also be used but requires additional transistors to sink the current for each segments but hardly worth the trouble with small display and details for driving Common Anode can be found by dowloading CMOS 4511 and 4518 Data Sheets and other CMOS ICs used in these circuits .

Using large displays

The Two Digit Counter can be used with large displays as detailed in the Shuffle Scoring board project using Common Anode Display format by adding two additional ICs MC1413 or ULN2003 Darlington Arrays , whichever IC is available as they have the same pin-out form .



Using the counter

Since the two counters are independent , one method for passing the overflow to the second counter we can use the high bit from pin 6 and pin 3 at a count of decimal 9 .(See *Binaries* Counter No 1 further below) connect these two high bit into an inverter (using two gates of a CMOS 4011) then its ouput to enable pin 10 of the second counter .The clock pin 9 must also along with pin 1 be connected to receive each a count input .

I chose to eliminate the extra IC by preconditioning the clock(pin 9) of the second counter by connecting it to ground and using the high bit from pin 6 to enable pin 10 of the second counter instead each time and overflow appears at pin 6 .

Using the counter is straight forward , each time the count button is pressed it triggers the clock of the first counter pin 1 , the display advances one count . In order to count the " Enable " function of each counter pins 2 and 10 must be high (logic 1) and the " Reset " pins 7 and 15 must be low (logic 0) .

When the count of the first digit reaches a count of ' 9 ' an overflow occurs at the next count of the first counter and pin 6 of the first counter is high . Since pin 9 (clock) of the second counter is connected to ground the signal from pin 6 connected to pin 10 (enable) of the second counter allows a count each time an over flow is present on the first counter and pin 9 to continue the count on the second digit until the total count reaches '99' then the next count resets the two display to '00'.

As long as the " Reset " is held Low , the count will reset to '00' only when it reaches the next count after displaying '99' . If the counter is to be used only in this manner than the 10K resistor and the ' Reset ' button can be omitted and pins 7 and 15 should be connected directly to ground . Otherwise the " Reset " function button will allow to reset the counter at anytime during the count .

Binaries

The counting system is a " Four bits " logic counter . Referring to the binary code table shown below will enable you to follow each clock logic state of the counters as follows :

Counter No 1				
Bit	D	C	B	A
Pin #	6	5	4	3
Counter No 2				
Bit	D	C	B	A
Pin #	14	13	12	11

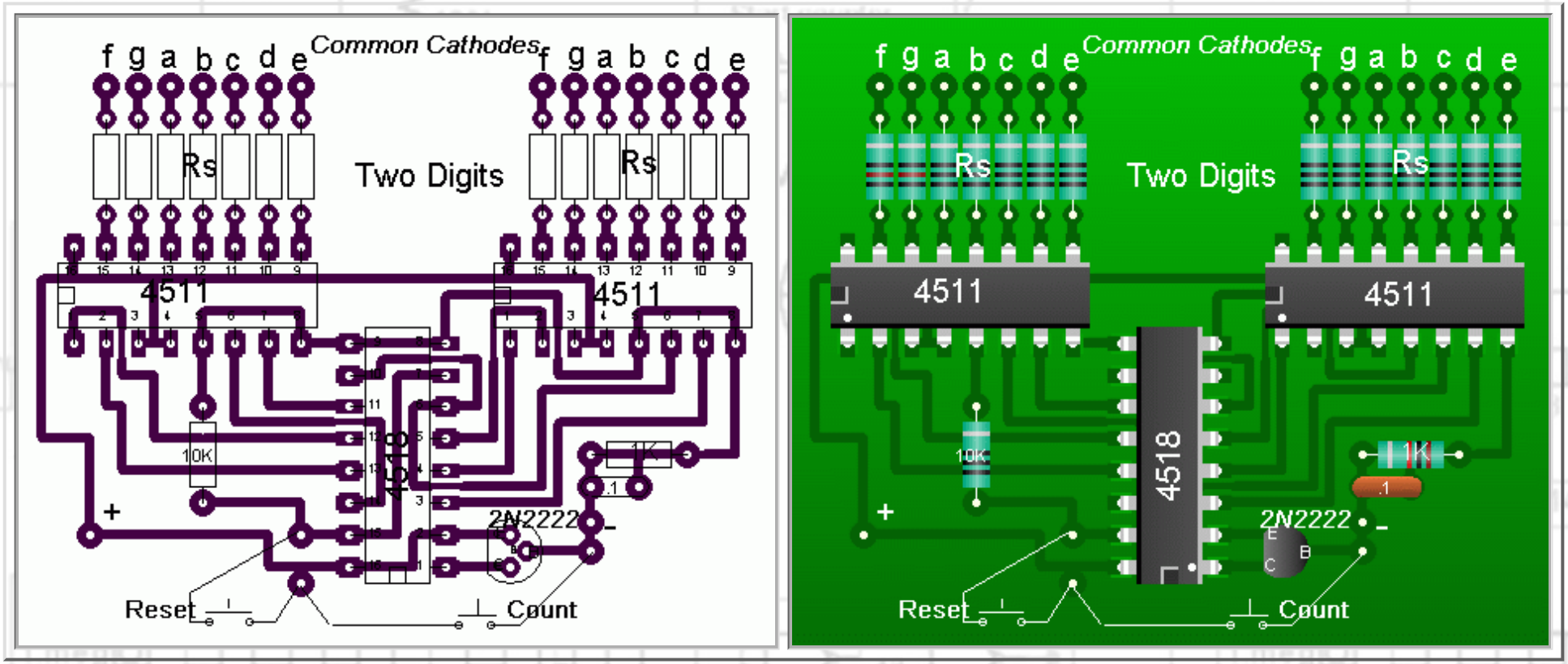
Binaries (4 Bits)

D	C	B	A	=
0	0	0	0	0
0	0	0	1	1
0	0	1	0	2
0	0	1	1	3
0	1	0	0	4
0	1	0	1	5
0	1	1	0	6
0	1	1	1	7
1	0	0	0	8
1	0	0	1	9

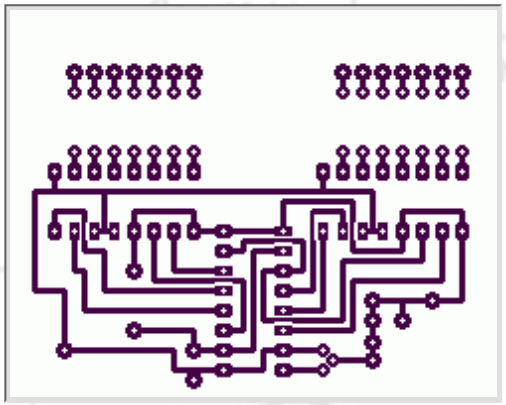
For exemple :when number ' **5** ' appears on the first (Units) display , the bit logic of the first counter must be : pin 6 (D)=**L** (0) , pin 5 (C)=**H** (1) , pin 4 (B)=**L**(0) and pin 3 (A)=**H** (1)
That set of four bits logic is sent to the 4511 which in turn decodes the logic and activates the display LED segments to show the appropriate number .

Construction

A suggested layout is shown below , it is strongly advised that IC sockets be used . Where the Rs resistors are shown 14 pin dip sockets can be inserted and the resistors can be inserted in the socket if preferred which will allow for change of Rs value if required . The circuit can easily be hand wired or a PCB can be used .



PCB layout is actual size



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