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Simple and Low Cost IC Tester for Analog and Digital Labs

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***Abstract* – Integrated Circuits (ICs) are the important component of each and every electronic circuit and can be used for wide variety of purposes. Sometime due to faulty ICs the circuit doesn't work. It takes lot of efforts to troubleshoot the circuit and confirm whether the circuit is creating problem or the IC is faulty. So the proposed project is designed to confirm whether the IC under consideration is properly working or not. Unlike the IC testers available in the market today which are usually expensive, this IC tester is affordable and user-friendly. This Digital and Analog IC tester is constructed using microcontroller along with a keyboard and a display unit. Since it is programmable, any number of ICs can be tested within the constraint of the memory available. This IC tester can be used to test a wide variety of ICs which includes simple logic gates and also sequential and combinational ICs like flip-flops, counters, shift registers etc. This tester able to identify which particular logic gate is faulty in that ICs. This tester can also test frequently required analog ICs in Laboratories like Operational amplifiers, Timers etc.**

Index Terms – Analog IC, Digital IC, IC Tester, Microcontroller.

I. Introduction

When troubleshooting ICs (either digital or analog), one cannot be concerned with what is going on inside the IC. One cannot take measurements or conduct repairs inside the IC. One should, therefore, consider the IC as a black box that performs a certain function and can check the IC, however, to see that it can perform its design functions.We can easily test any digital and analog IC using this kind of an IC tester. Unlike other IC testers, this one is more reliable and easier to operate since we do not need to rig up different kind of circuits for different kind of ICs, each time we need.

When Tester circuit is turned on, it asks to enter IC number. When user enters IC number and presses OK key, microcontroller sends pattern of inputs on ICs Input pins. If IC is functioning properly it generates correct results. Output of IC is checked with expected result. If results are verified, "PASS" message get displayed on LCD. If output of IC is not tallied with expected one then "FAIL" message get displayed on LCD. Selection of microcontroller is based on it's memory capacity.

II. Block Diagram Of System

The block diagram of the programmable analog and digital IC tester is as shown in fig.1. It consists of single microcontroller IC, a 24-pin ZIF socket, a 4x3 matrix keypad unit, a LCD display unit. It needs 5v power supply. We have used regulator IC7805 that gives output voltage of 5V. The minimum input voltage required for the IC7805 is near about 7v. Therefore here transformer of 9 v is used with voltage rating 230v/9v and current rating 500 mA. The output of the transformer is applied to bridge rectifier with capacitor (1000uf/25v) filter. The output of rectifier is more than 8V DC, which is converted to fixed 5v DC by IC7805.

The AT89C55 is a low-power, high-performance CMOS 8-bit microcomputer with 20K bytes of Flash programmable and erasable read only memory. The device is manufactured using Atmel's high density nonvolatile memory technology and is compatible with the industry standard 80C51 instruction set and pinout. The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional nonvolatile memory programmer. By combining a versatile 8-bit CPU with Flash on a monolithic chip, the Atmel AT89C55 is a powerful microcomputer which provides

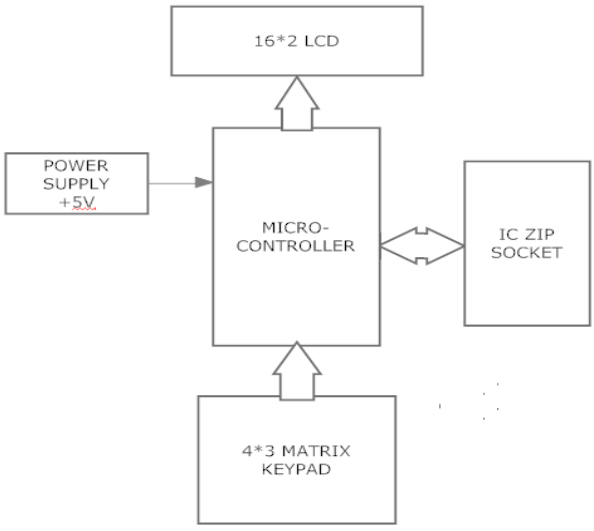


Fig.1. Block Diagram of IC Tester

a highly flexible and cost effective solution to many embedded control applications. Port 0 is an 8-bit open drain bidirectional I/O port. Port 1, Port 2, Port 3 are 8-bit bidirectional I/O ports with internal pull-ups. [5]. Here microcontroller is programmed to generate test signals and to check respective outputs of IC under test.

The keyboard makes use of a 4 line - 3 column matrix keyboard. Many applications require large number of keys connected to MPU. If single key is required then one can connect it directly to I/O pin of microcontroller. But one can not connect multiple keys directly to microcontrollers I/O because it will consume precious I/O lines and MCU to keypad interface will contain lots of wires. One can avoid all these troubles by using clever technique called multiplexed matrix keypad. In this technique keys are connected in matrix style. Rows and columns of keyboard are connected to microcontroller's I/O port pins. At a time only one column is activated and by reading status of all rows, exactly which key is pressed is get identified.

Here the LCD is used in four bit mode. Since 4-bit mode is used the LCD will require a total of 6 data lines (2 control lines plus the 4 lines for the data bus).The third control line RW (Read/Write control pin) is permanently grounded to enable only write operation. Hence lesser number of port pins of microcontroller are required.

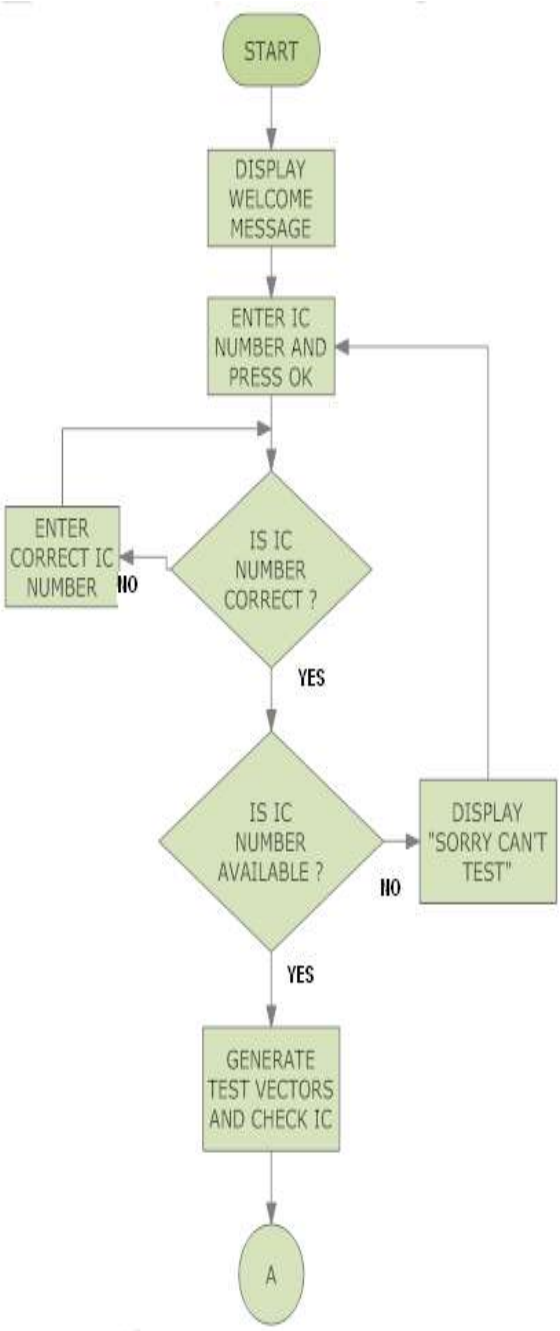
To test the IC, it required to be inserted in ZIF socket. Zero insertion force (ZIF) is a type of IC socket or electrical connector that requires very little force for insertion. With a ZIF socket, before the IC is inserted, a lever or slider on the side of the socket is moved, pushing all the sprung contacts apart so that the IC can be inserted with very little force - generally the weight of the IC itself is sufficient and no external downward force is required. The lever is then moved back, allowing the contacts to close and grip the pins of the IC. ZIF sockets are much more expensive than standard IC sockets and also tend to take up a larger board area due to the space taken up by the lever mechanism. Therefore they are only used when there is a good reason to do so.

Six port pins are required to interface LCD. Seven ports are utilized by 4x3 matrix keypad. Here 13 ports are consumed, while 19 port pins are available for interfacing ZIF socket. While testing IC logic and dealing with LCD, port pins connected to keypad are not required. Hence along with free 19 port pins, these pins are utilized for interfacing ZIF socket. This technique helped us to test IC maximum of 24 pins.

III. Flowchart And Operation

After a power on reset, system displays message 'WELCOME' on first line of LCD and 'IC TESTER' on second line of LCD. Delay of 1 sec. is provided to make message visible properly. Thereafter next message get displayed is ' INSERT IC IN ZIF ', on first line of LCD and ' PRESS OK KEY' on second line of LCD. To test a particular digital or analog IC, one needs to insert the IC into the IC socket.

Then user has to press 'OK' key on keyboard. System asks user to enter IC number through keypad matrix by displaying massage' ENTER IC NUMBER' on LCD. Now user has to enter IC number using 4x3matrix keypad. If correct IC number is entered then user has to press 'OK' key present on keypad and if by mistake wrong number is get entered then provision is given to reenter and correct entered IC number. IC number entered by user is crosschecked by microcontroller with list of IC numbers available with it which controller can test.



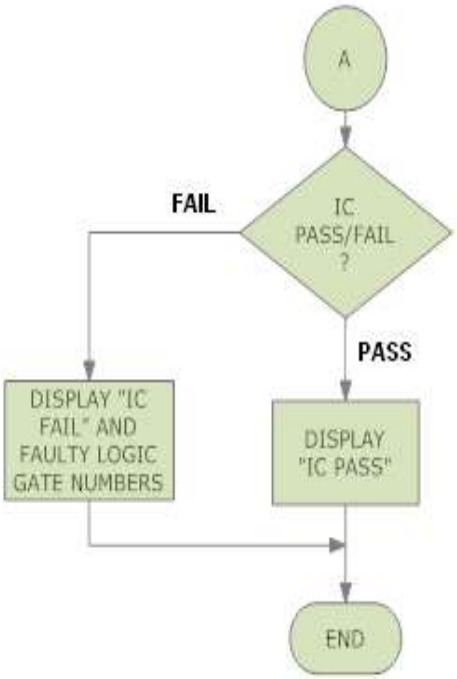


Fig.2. Flowchart of IC Tester

For IC number which is not present in controllers list, the message ‘ SORRY,CAN’T TEST” get displayed on LCD. For IC number in list, microcontroller refers database of that particular IC. Accordingly it generates test vectors and checks output for each test vector.

If desired output is obtained then, it displays ‘IC PASS’ message on LCD. If desired output is not obtained then, microcontroller displays ‘IC FAIL’ message.

If logic gate IC is faulty then along with ‘IC FAIL’ message, this IC tester also provides facility to show which particular logic gate is faulty and which logic gates are working. This facility is not available in conventional IC testers[2]. This tester provides facility of testing , frequently used ,both digital and analog ICs using single ZIF socket, single microcontroller, single keypad and single LCD.

IV. RESULTS

Simulation is done in Proteus software. IC555 is considered for test. Initially controller displays welcome message and project title. Figure 3 shows this welcome message. Then as shown in Figure 4 the message, insert IC in ZIF socket and press OK key is displayed. IC555 is inserted and correct number is entered through keypad (Fig. 5). IC is tested by system and if it is in working condition, figure 6 shows, 555 IC PASS message. When faulty IC555 is tested, 555 IC FAIL message get displayed on LCD, which is shown

in figure 6. After testing IC system again ready for testing new IC. IC number which is not in list of microcontrollers data base, when entered, SORRY,CAN'T TEST message get displayed on LCD. It is shown in figure 9.

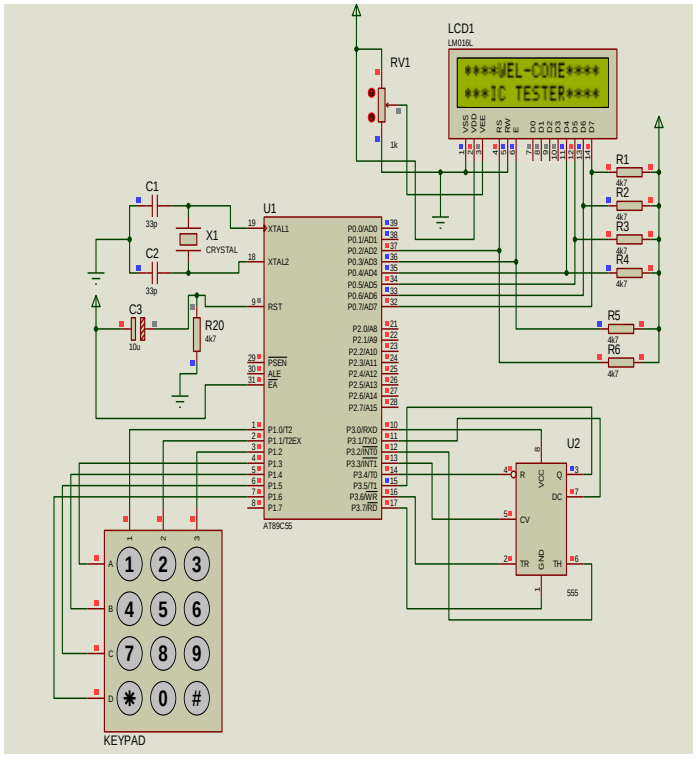


Fig.3. Initial WELCOME message

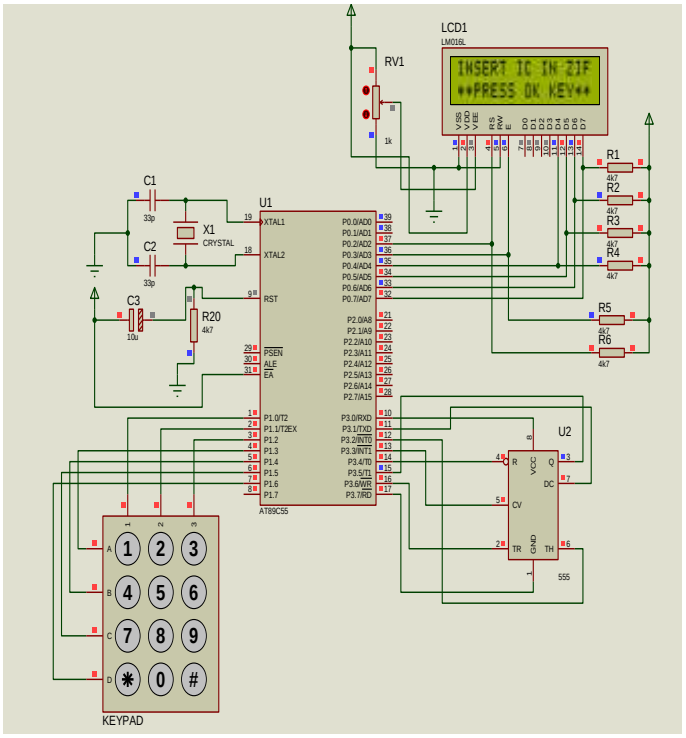


Fig.4. System asks to insert IC under test in ZIF socket

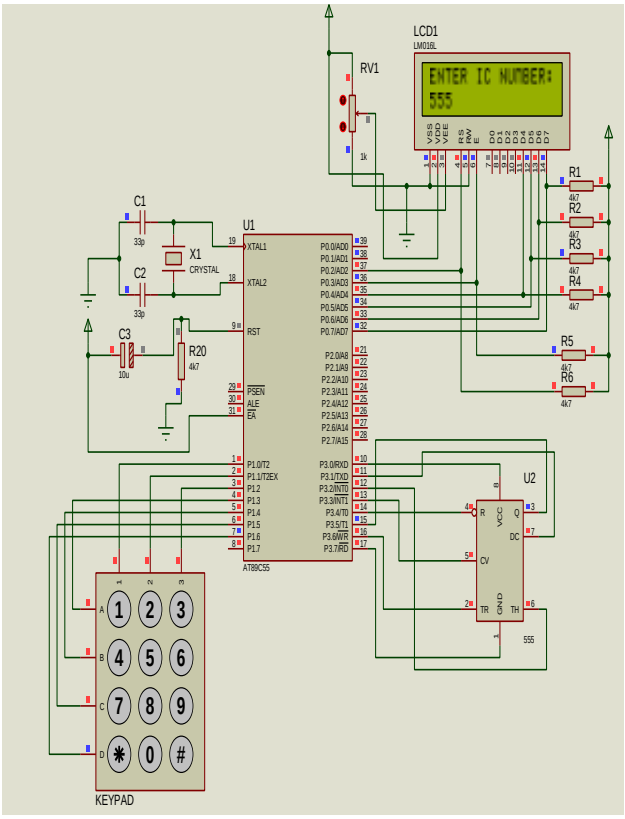


Fig.5. Entered IC number

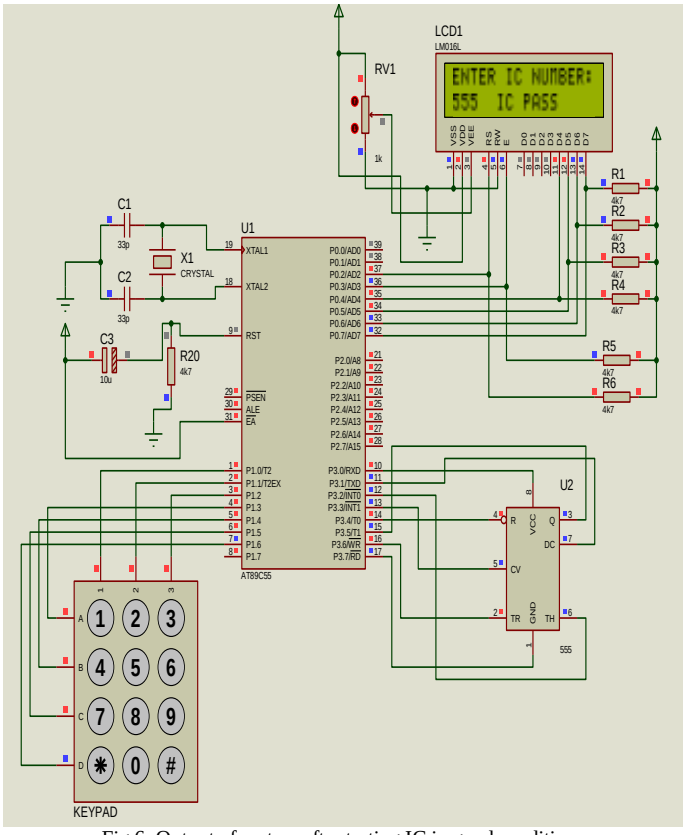


Fig.6. Output of system after testing IC in good condition

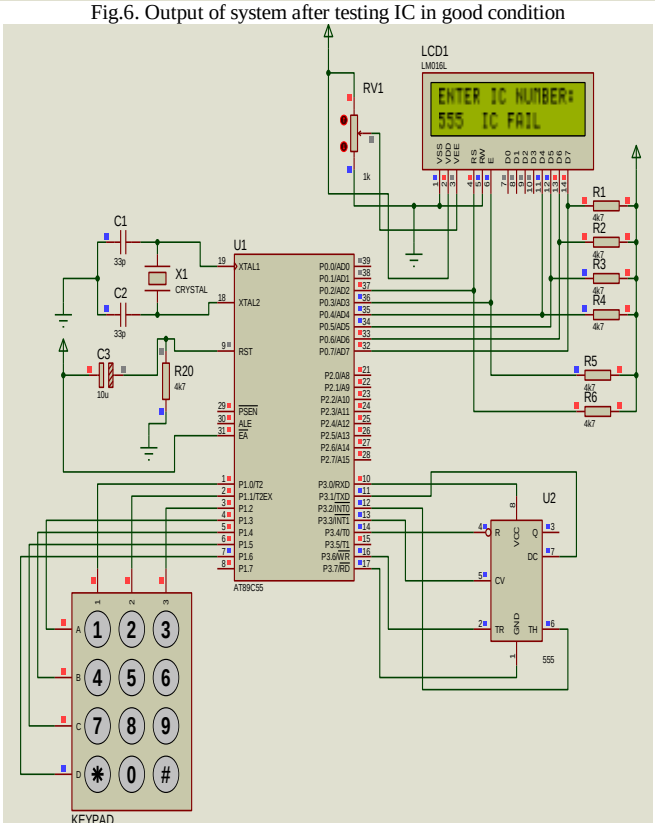


Fig.7. Output of system after testing faulty IC

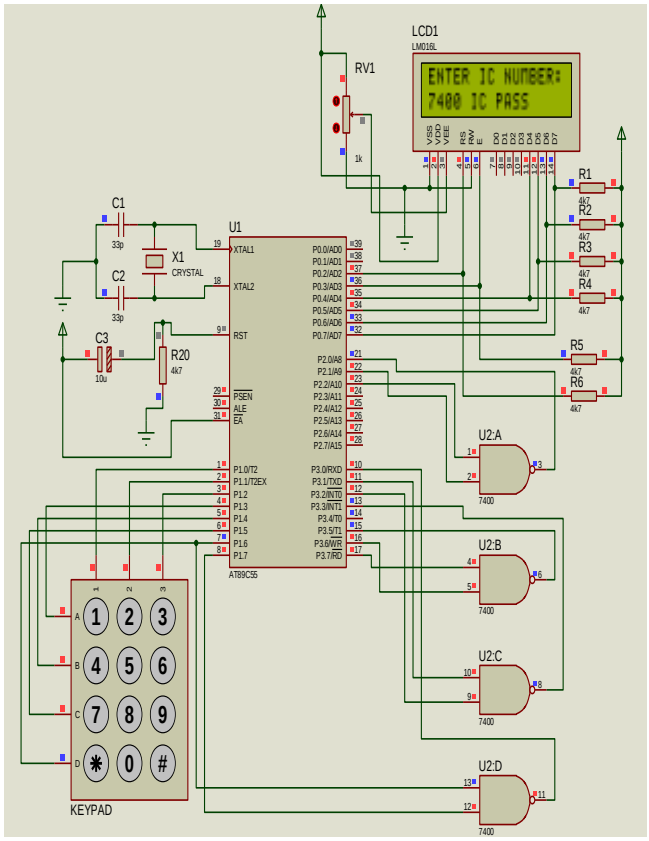


Fig.8. Testing of Digital IC7400

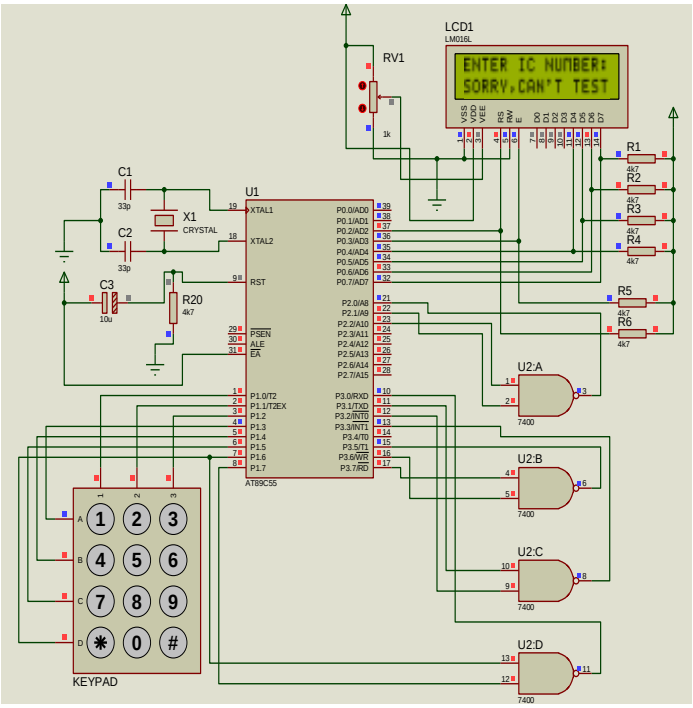


Fig.9. For IC, which cannot be tested by this IC Tester

V. Conclusion

Purchasing IC testers available in market needs large funds to invest. Again keeping proper maintenance of it, is one of the big issue.

Unlike IC testers available in market, this is low cost, easier to operate IC tester. Design and implementation of this IC tester is simple as it requires minimum hardware. It can test 24 pin digital IC. In case of Logic gate ICs, not only IC PASS or FAIL is displayed but along with that which particular gate is faulty is identified and indicated on LCD.

This IC tester is more suitable in Digital and Analog labs, as it covers all IC testing, required for conducting practicals of Digital Electronics and Analog Electronics Labs.

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