

A NOVEL DESIGN OF AUTOMATIC SWITCH CUM FUSE IC FOR DIGITAL CIRCUITS

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Abstract:- The paper focuses on the analysis of switch cum fuse IC. It is proposed to prevent the damage of main IC from the external electrical fluctuations which are common in these days. The proposed FUSE IC's fuse goes off instead of any damage to main IC. The proposed FUSE IC is able to switch between two main IC's in standby type systems. The FUSE IC is also able to act as fuse for many times and for main IC so that it can prevent the damage. It's like the work of MCB but a step ahead that we don't need to set back the switch in ON position again as like the MCB.

Index Terms: - MAIN IC, control signal, FUSE IC, Fuse, MCB

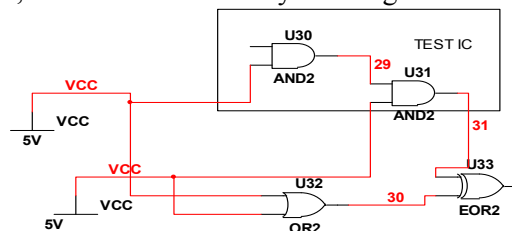
1. Introduction

The FUSE IC consists of circuit which act as a switch between two main IC in standby type system, the FUSE IC also act as a fuse for the main IC. In the condition of electrical fluctuation or in condition of solar flares, these change in electrical level may damage [2][6] main IC and that damage is basically the burning of some gate. To prevent such type of harm the IC circuit introduces some sort of fuse, but fuses [1] [3] (common used wire fuse) are not as viable for electronic circuits and also MCB's are also not a good alternative for such circuit. Although, it makes the operation quite good but it is a bulky device. So the solution that comes out is, to fabricate a device which switches between two main ICs and also work as a fuse. The FUSE IC provides a secure environment [4] for standby mode system IC's and makes the main circuit more reliable and increase the life span of main circuit. In the proposed IC the fuses are physically the AND gate [5] which behaves like a mediator between power supply of main IC and the main IC itself. In the situation of electrical fluctuation AND gate burned out and behave like a fuse.

2. CIRCUIT DESCRIPTION

We can divide this whole circuit into two parts:-

2.1 Switching part :- In the FUSE IC following part (shown in figure (1)) responsible to work as a switch between two main IC's, one which is currently working and another which is on standby mode.



Figureur. 1 Switching Section of Fuse IC

2.2 Fuse Part :-

In FUSE IC the following part (shown in figure (2)) is responsible for protecting the main IC from electrical fluctuations. When the fluctuations comes, internally a fuse (Gate) gets burned and makes the next levels of fuse circuit switch on, so that MAIN IC can work without any problem for many times.

The number of fuse circuit is decided by need of application that is, according to the need number of fuses can be increased to any number.

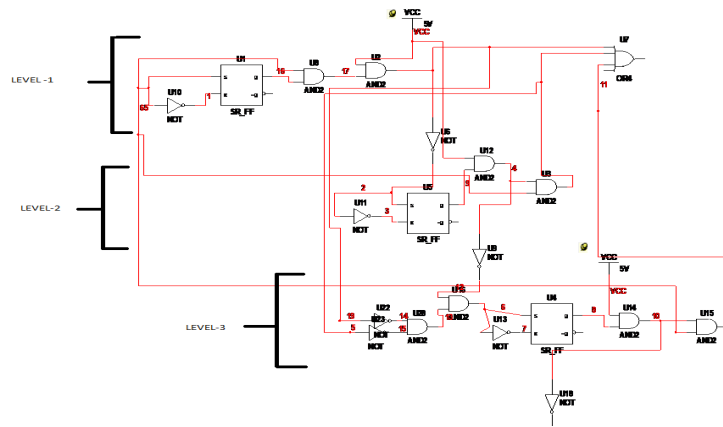


Figure. 2 Fuse Section of Fuse IC

After the not gate (U18) the level can be increased more by adding just the identical circuit as the level-3 of FUSE IC circuit's Fuse section posses.

3. RESULTS:- Using MULTISIM 10, the simulated outputs and the following results are obtained:-

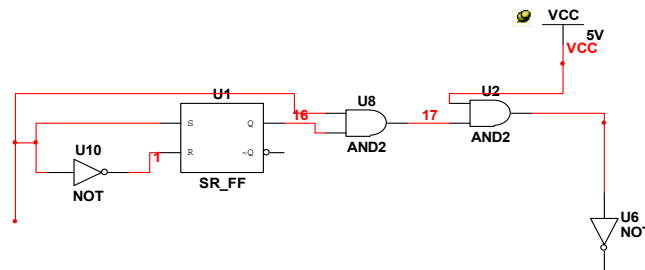


Figure. 3 Gate Diagram of Level-1 in Fuse IC

The starting level of the circuit is shown in Figure. (3). A SR flip flop is governed by the control signal, given by the switcher circuit (i.e. switching circuit after the MAIN IC-II). If MAIN IC-II is in standby mode the control signal generated by that circuit is so that it will make S=1 and R=0 which make this flip-flop operational. As this flip-flop comes into operation it makes Q=1 and the AND gate (U8) starts working as the following truth table:-

A	B	OUT
0	0	0
0	1	0
1	0	0
1	1	1

After this AND gate this signal passes through another AND gate (here U2), which behave like a fuse. This gate's one port is assigned to the control signal and second port is assigned to +VCC of the MAIN IC. If the control signal is TRUE (i.e. '1') the supply moves further to the MAIN IC-I which behaves like +VCC for that MAIN IC-I. If some fluctuations comes in the supply of MAIN IC-I then the AND gate (U2) fuse goes off. Now fuse level 2 of the IC comes to action.

The following is the level-2 of the fuse section:-

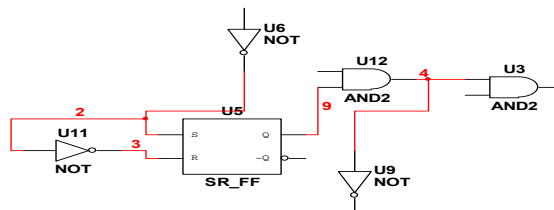


Figure. 4 Gate Diagram of Level-2 in Fuse IC

Now when the previous fuse level goes off and supply to the MAIN IC-I cutoff, level 2 comes into action so that the power supply to MAIN IC remains uninterrupted. As the level-1 fuses off the signal to output of SR flip-flop at this level becomes zero. A NOT gate is used to make this signal inverted so that next stage of SR flip flop comes in action(i.e. the next level of fuse) and high output of FF goes to the AND gate(U12). One port of AND gate (U12) assigned to the Q of SR Flip-Flop and second port is used to check what type of signal is coming from MAIN IC-II means weather the MAIN IC-II is in ON position or in OFF position. The fuse section of MAIN IC-I operates only when the control signal from MAIN IC-II is LOW so output from this U12 become high and goes to another AND gate (U3) which works as fuse on this level.

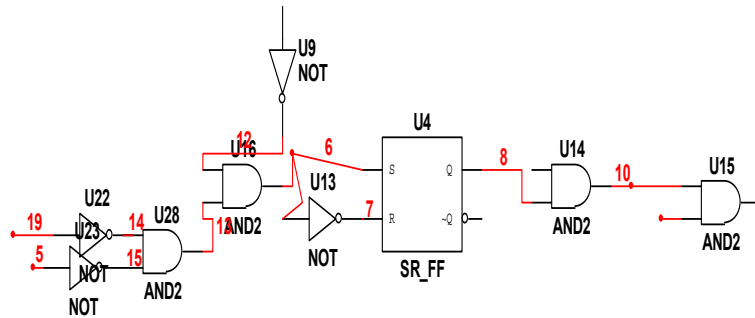


Figure.5 Gate Diagram of Level-3 in Fuse IC

Figure.5 Shows the level 3 of the fuse section. After failure of level-1 and level-2 it comes in action with the help of an inverter gate (here U9). It makes the signal high to make possible the operation on the next level. Here we use a typical combination of NOT gate (U22, U23) and AND gate (U28) for checking the previous circuits (i.e. level-1 and level-2) weather they are fused or not. This circuit's importance becomes more because it prevents the start of level-3 until the previous two are not burned out properly.

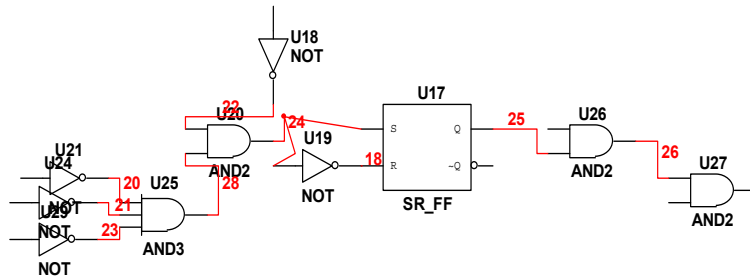


Figure.6 Gate Diagram of Level-4 in Fuse IC

Figure.6 Shows next level of circuit which is come to operation when level-3 got fused. Here the difference between level-3 and level-2 is in the typical combination of NOT gates and AND gate, that is here the number of NOT gates are same as the number of pervious level and according to this rule the next level (i.e. level-5) is comprise of 4 NOT gate combination and this combination is followed by next levels also.

So the general rule can be stated as the number of NOT gate in this typical combination is equal to the number of level on which the circuit is operating (i.e. the present level of operation): **(N-1)**

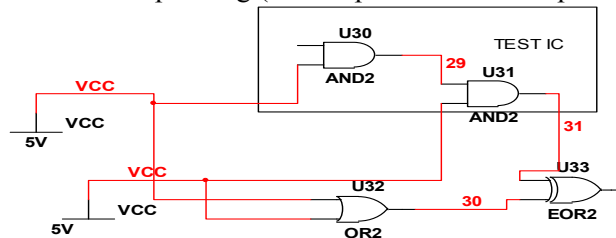


Figure. (7) Gate Diagram of Switching Section in Fuse IC

Figure.7 Shows the MAIN IC for which all the operations of FUSE IC are proposed. A basic comparator circuit is used for a compared output between input data lines and the output of MAIN IC. The compared output is used for producing a control signal which is useful for making fuse section switch ON and OFF. To check whether the IC is working or not if we consider four conditions for MAIN IC :-

	A(Input)	B(Input)	Output	REMARKS
CASE-I	0	0	0	Main IC is in working condition
CASE-II	0	1	1	Not possible, IC is not working properly, next level turns on
CASE-III	1	0	1	Main IC is in working condition
CASE-IV	1	1	0	Main IC is in working condition

In the above four conditions practically three conditions can be attained that are CASE-1, CASE-3, CASE-4. CASE-2 practically can't attain because in this we assumed A=0 and B=1 that interprets that there will be an output without having an input which is practically not possible.

4. Circuit images:

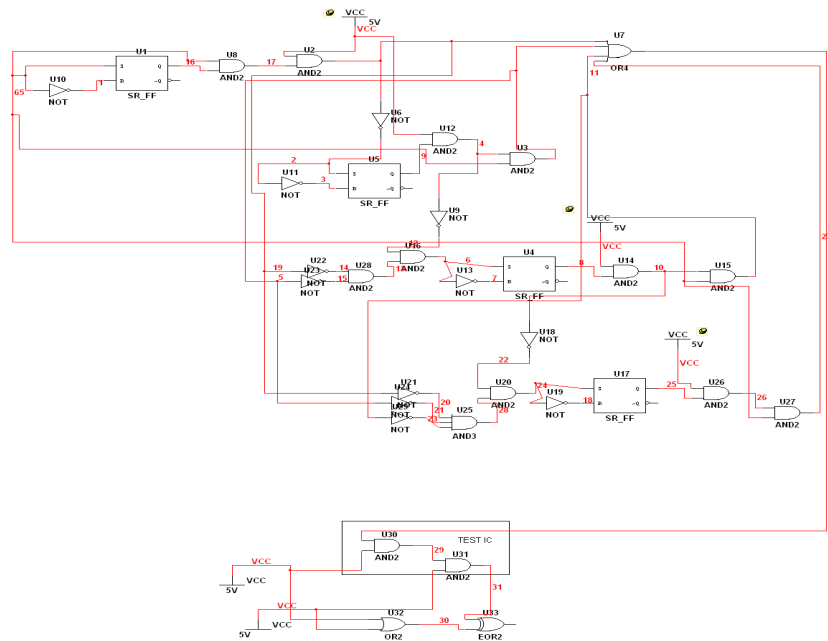


Figure.8 Gate Diagram of fuse cum switch section before first Main IC

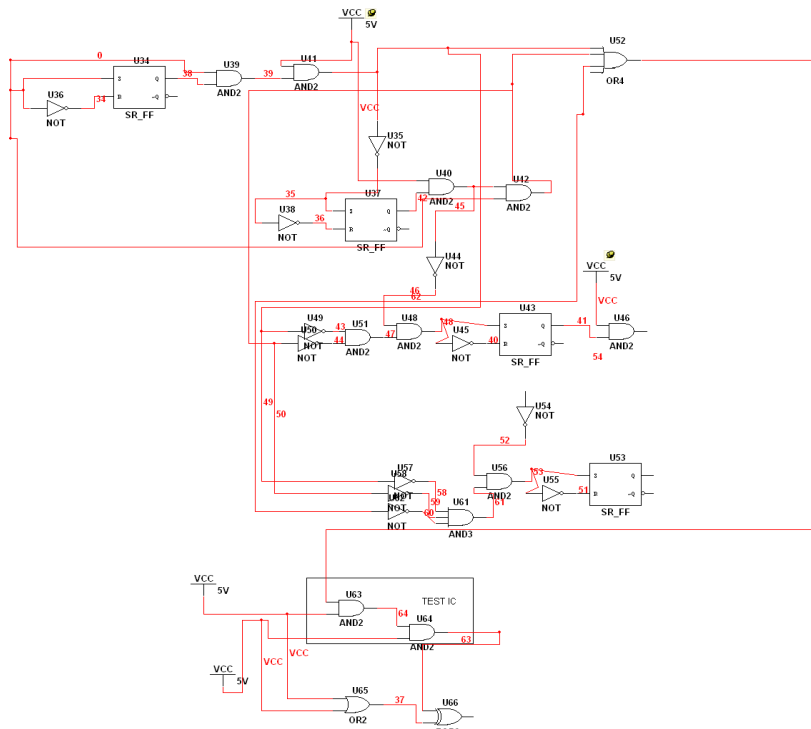


Figure 9 Gate Diagram of fuse cum switch section before second main IC

The same process and symmetry of circuit is carried out for Next MAIN IC (i.e. MAIN IC-II) which is on standby mode for Systems like 2:1 stand by systems.

5. Conclusion

The FUSE IC is capable of preventing damage from the external electrical fluctuation. The FUSE IC is perfectly analyzed for 2:1 standby system. FUSE IC is fully functional to switch between two IC's and is also effectively working as fuse for MAIN IC. The IC is thus, very useful for increasing the life span of the main IC. Furthermore the IC circuit can be implemented for N:N standby mode systems for making it more general for any type of standby systems.

6. References

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