

1.6 RESISTOR TRANSISTOR LOGIC (RTL)

The resistor-transistor Logic(RTL) circuit is one of the basic logic circuits in digital logic families. It is a bipolar saturated device. The RTL logic is popular because of its simplicity.

The RTL circuit consists of resistors at inputs and transistors at the output side. Transistors are used as the switching device. The emitter of the transistor is connected to the ground. The collector terminals are tied together and given to the supply through the resistor R_C . The collector resistor is known as a passive pull-up resistor.

2-input RTL NOR gate

The following figure shows the circuit diagram of 2-input RTL NOR gate. Q_1 and Q_2 are the two transistors. A and B are the two inputs, given to the base of two transistors and Y is the output.

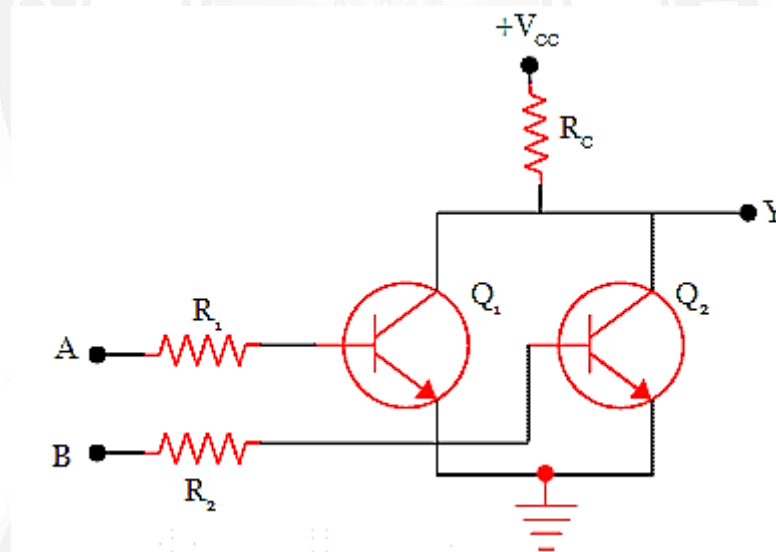


Figure 1.6.1 2-input RTL NOR gate

[Source: <https://www.electrically4u.com/resistor-transistor-logic-rtl/>]

When both the inputs A and B are at 0V or logic 0, it is not enough to turn on the gates of both the transistor. So the transistors will not conduct. Due to this, the voltage +VCC will appear at the output Y. Hence the output is logic 1 or logic HIGH at terminal Y.

When any one of the inputs, either A or B is given HIGH voltage or logic 1, then the transistor with HIGH gate input will be turned on. This will make a path for the supply voltage to go to the ground through the resistor R_C and transistor. Thus there will be 0 v

at the output terminal Y. When both the inputs are HIGH, it will drive both the transistor to turn on. It will make a path for the supply voltage to flow to the ground through resistor R_C and transistor. Therefore, there will be 0 v at the output terminal Y.

The below table shows the truth table for NOR gate.

Inputs		Output
A	B	Y
0	0	1
0	1	0
1	0	0
1	1	0

Table 1.6.1 Truth Table – Nor Gate

[Source: <https://www.electrically4u.com/resistor-transistor-logic-rtl/>]

3-input RTL NOR gate

The above discussed 2-input RTL NOR gate is the basis for all the logic circuits built with resistors and transistors. The 3-input Resistor-Transistor Logic NOR gate can also be constructed as shown below. The operation is similar to the 2-input RTL NOR gate.

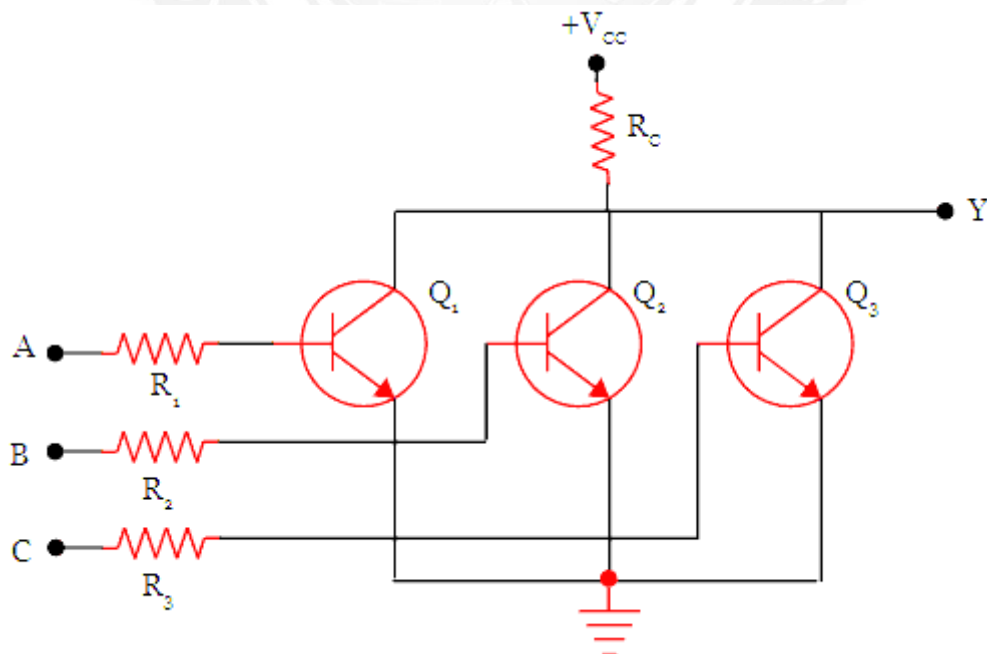


Figure 1.6.2 3-input RTL NOR gate

[Source: <https://www.electrically4u.com/resistor-transistor-logic-rtl/>]

Limitations

When the transistor is switched on, the power dissipation increases as the current flows through base and collector. Also, the RTL gate has poor noise margin, poor fan-out and the propagation delay is more.

