**PULL UP AND PULL DOWN RESISTOR**

**PULL UP RESISTOR**

Pull-up resistors are resistors used in logic circuits to ensure a well-defined logical level at a pin under all conditions. As a reminder, digital logic circuits have three logic states: high, low and floating (or high impedance). The high-impedance state occurs when the pin is not pulled to a high or low logic level, but is left “floating” instead. A good illustration of this is an unconnected input pin of a microcontroller. It is neither in a high or low logic state, and a microcontroller might unpredictably interpret the input value as either a logical high or logical low. Pull-up resistors are used to solve the dilemma for the microcontroller by pulling the value to a logical high state, as seen in the figure. If there weren’t for the pull-up resistor, the MCU’s input would be floating when the switch is open and brought down only when the switch is closed.

**PULL DOWN RESISTOR**

Pull-down resistors work in the same manner as pull-up resistors, except that they pull the pin to a logical low value. They are connected between ground and the appropriate pin on a device. An example of a pull-down resistor in a digital circuit can be seen in the figure. A pushbutton switch is connected between the supply voltage and a microcontroller pin. In such a circuit, when the switch is closed, the micro-controller input is at a logical high value, but when the switch is open, the pull-down resistor pulls the input voltage down to ground (logical zero value), preventing an undefined state at the input. The pull-down resistor must have a larger resistance than the impedance of the logic circuit, or else it might be able to pull the voltage down by too much and the input voltage at the pin would remain at a constant logical low value – regardless of the switch position.  
 **APPLICATION**

Pull-up and pull-down resistors are often used when interfacing a switch or some other input with a microcontroller or other digital gates. Most microcontrollers have in-built programmable pull up/down resistors so fewer external components are needed. It is possible to interface a switch with such microcontrollers directly. Pull-up resistors are in general used more often than pull-down resistors, although some microcontroller families have both pull-up and pull-downs available.   
They are often used in analog to digital converters to provide a controlled current flow into a resistive sensor.   
Another application is the I2C protocol bus, where pull-up resistors are used to enable a single pin to act as an input or an output. When not connected to a bus, the pin floats in a high-impedance state.   
Pull-down resistors are also used on outputs to provide a known output impedance.