

Open Collector Pullup Resistor Calculator

Note: this is not a complete treatise on the calculating open collector pull up resistor values. It is a simplified substitute.

Terms:

R_{PU} - Pull up resistor

V_{PU} - Pull up voltage

I_{IH} - Minimum input current required to drive the input high.

I_{OL} - Maximum output low current the sensor output transistor can sink.

This is 100mA for most Motion Sensors open collector outputs.

V_{IH} - Minimum input voltage required to drive the input to a high state

R_{PUmax} - Maximum pull up resistor value

R_{PUmin} - Minimum pull up resistor value

$$R_{PUmax} = (V_{PU} - V_{IH}) / I_{IH}$$

$$R_{PUmin} = V_{PU} / I_{OL}$$

The pull up resistor must be between R_{PUmin} and R_{PUmax} . Where in between depends on the application. The lower the input resistor, the greater the drive current which is useful when driving capacitive loads and improving signal rise time but also requires larger resistors to dissipate the power. The higher the resistor, the lower the power dissipation requirements of the resistor but with a slower signal rise time.

Example:

For a pull up voltage of 5V with a minimum input voltage at 3.5 at 100uA:

$$R_{PUmax} = (5V - 3.5V) / 100\mu A = 15K \text{ ohms}$$

$$R_{PUmin} = 5V / 100mA = 50 \text{ ohms}$$