

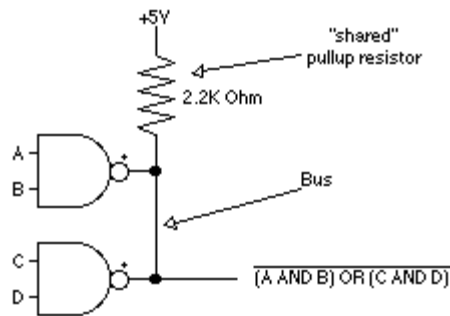
OPEN COLLECTOR OUTPUT

The term open-collector typically refers to a transistor output where the collector (output) of the transistor is not connected to a positive voltage. Since a transistor used in outputs is a saturated switch, the collector needs to be connected to a positive voltage to complete the transistor circuit. This positive voltage need not be any specific value as long as it is above the saturation of the transistor. Because of this, an open collector output can be connected to a range of voltages using a pull-up resistor. This resistor is required for the output to function as it completes the transistor's circuit.

Many logic chips and circuits use open-collector outputs for a couple of reasons:

Wired-OR circuits

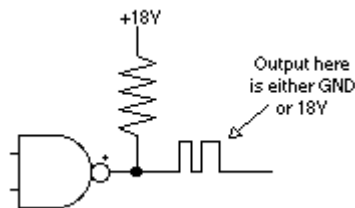
- Since an open collector output "pulls" the output voltage from that of the pull-up resistor to ground, many open-collector outputs can be wired together to create a wired-OR circuit. This means that if any of these outputs are active, the combined output of all the gates will be ground. This effects a logic-OR. This can be useful when several outputs share a single line as would happen on a bus.



Example wired-OR circuit using open-collector outputs of NAND gates.

Different Voltage Interfacing

- Since the exact voltage of the pull-up resistor is not critical, an open-collector output can be used to interface one logic voltage level with another.



Example interface between 5V logic and a higher voltage.

You may also see the term open-drain output. This is simply an open-collector output from a MOSFET which has a drain instead of a collector. The basic idea is the same for open-collector and open-drain.

The value of resistor used to pull up an open-collector is not critical. Smaller values offer faster switching times at the price of higher current consumption. Typical values range from a few thousand to a few hundred thousand Ohms.

In circuit diagrams, logic gates are usually shown with an asterisk (*) when the output is an open-collector or open-drain output.