Re: Very basic transistor usage

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From: CFoley1064 (*cfoley1064_at_aol.com*)
Date: 10/09/04

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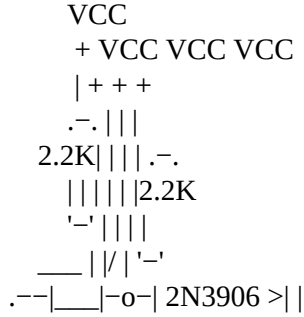
>Subject: Very basic transistor usage
*>From: "Jason Richard" pcjason*SPAMTHIS*@sbcglobal.net*
>Date: 10/9/2004 5:21 PM Central Daylight Time
>Message−id: <JvZ9d.27219$QJ3.21317@newssvr21.news.prodigy.com>
>
>First off, please excuse my ignorance as I know very little about this stuff
>and searching google has only helped to confuse me more.
>What I would like to accomplish is to drive 12 bi−color LEDs (red/blue) from
>two seperate inputs. I would like the red potion of the LEDs to light when
>there is network activity and the blue LEDs to light when there is hard
>drive activity. This seems simple enough, but the bi−color LED is common
>cathode, and judging by the readings I took, the network and hard drive LEDs
>toggle the cathode to turn on or off the LEDs. So, what I was thinking is
>that I could use a transistor to drive the anodes of the 12 LEDs, but thats
>about as far as I got. The specs of the LEDs are Blue: 3.2v at 20mA and
>Red: 2.2v at 20mA. Also, the readings I took showed the hard drive activity
>LED cathode swinging from 5v (off) to 0v (on) and the network LED swinging
>from 3.3v (off) to 0v (on). Any drawing of a suitable circuit would be
>greatly appreciated and any explanation of how the circuit works would be
>even better!
>Thanks for any and all help!
>−Jason

Hi, Jason. You've got two jobs here −− change both logic signals to a common +5V/0V, and then drive the LEDs.

Here's one possible way to do this (view in fixed font or M$ Notepad):



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| 2.2K |< 2N3906 |−o−|___|−−.
| | /| 2.2K |
| | | |
| .−. .−. |
| 75 ohm| | | | |
| | | | |120 ohm |
| '−' '−' |
| | | |
| Blue V ~ Red V ~ |
| − ~ − ~ |
| | | |
| | | |
| '−−−−−−−−−o−−−−−−−−' |
| | |
Netwk|\ | === |
−| >O−−' GND |
|/ |
2/8 74HC244 |
|\ |
−| >O−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−'
HD |/
```

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For your 12 bi−color LEDs, you'll need three 74HC244s and 24 small signal PNP transistors like the 2N3906. The HC244 is a non−inverting buffer, and each logic gate will provide a solid 5.0V output for any input significantly above 1/2Vcc (2.5V if you use a 5V supply for the ICs). For each IC, be sure to make the two enable inputs logic low (0V), or the outputs won't work at all.

Now, when the logic output goes low, it will pull current from the base of the PNP transistors through the 2.2K resistors (around 2 mA). That will turn on the transistors, so they will conduct through the emitter to the collector. This is called using transistors as switches. For a PNP current−sourcing switch, a logic "1" is off, and a logic "0" is on. As long as your base current is around 1/10th of what you want to switch, it will work fine. You notice that I wanted to switch 20 mA, so I made it so the base drive would be about 2 mA.

Now you have to do the math on the series resistors that limit the current going through the LEDs when the transistors are "on". You add the expected voltage across the LED and the voltage across the switching transistor, and find out what's left. For the red LED, let's figure 2.2V for the LED plus about 0.3V for the "on" transistor, which will leave you 2.5V. You need to figure out what value of resistor is necessary to have 2.5V dropped across it when 20mA is going through it. For that, you use Ohm's Law. Sir Georg Ohm said:

V = I * R, or

R = V / I, so

R = 2.5V / 0.02Amps = 125 ohms

Choose 120 ohms as the nearest value. Do the same calculation for a 3.2V LED to get 75 ohms for that series resistor.

Here's the datasheet to give you the pinout for the 74HC244:

http://www.fairchildsemi.com/pf/MM/MM74HC244.html

For a 2N3906, with the pins down and the flat of the plastic TO−92 case facing you, the pinout from left to right is E−B−C.

Good luck
Chris