

## Re: LED & Resistor befuddlement

**Source:** <http://coding.derkeiler.com/Archive/General/comp.arch.embedded/2004-06/0149.html>

---

**From:** Peter Jakacki ([peterjak\\_at\\_tpg.com.au](mailto:peterjak_at_tpg.com.au))

**Date:** 06/03/04

Date: Thu, 03 Jun 2004 11:44:28 +1000

BPing :)

Spehro Pefhany wrote:

> *On Wed, 02 Jun 2004 13:06:46 -0400, the renowned rickman*  
> *<spamgoeshere4@yahoo.com> wrote:*  
>  
>  
>> *Mike Turco wrote:*  
>>  
>>> *I thought this was going to be simple. I have a controller, an LED, a*  
>>> *resistor and a socket. Its a five volt circuit.*  
>>>  
>>> *I want to plug the LED into the socket in a board. The controller needs to*  
>>> *know whether or not the LED is plugged in, and if the LED is plugged in, it*  
>>> *needs to be able to turn it on and off.*  
>>>  
>>> *One issue is that the forward voltage of just about any LED puts all the*  
>>> *voltages out in the middle of no-mans land in terms of logic levels.*  
>>>  
>>> *Anyway, I came up with a solution, but it seems a little too complex and I*  
>>> *get the feeling I'm missing something. My solution is here:*  
>>> <http://miketurco.com/123/ledbef.gif>.  
>>>  
>>> *Basically, if you put a low on the input and there's an LED in the socket,*  
>>> *the LED will turn on and you'll get a low on the output. If there's no LED,*  
>>> *then you'll see a high on the output.*  
>>>  
>>> *Is there a way to accomplish this with one i/o pin? Any way to save a part?*  
>>  
>> *Seems to me you guys are all over thinking the problem... or I am*  
>> *missing something important.*  
>>  
>> *How about just adding one resistor and using the IO pin as an input when*  
>> *you want to check for the presence of the LED and as an output when you*  
>> *want to drive it?*  
>>  
>> \_\_\_\_  
>> /

```
>> /
>> -
>> // R1
>> // current
>> - limiter
>> / ~330 ohms
>> /
>> ---
>> \ / LED
>> _V_
>> /
>> +-----> To MCU IO pin
>> /
>> -
>> // R2
>> // Light
>> - Pulldown
>> / ~10 kohms
>> /
>> _J_
>> \ /
>> V
>>
>> With this circuit the IO pin will be high if the MCU is not pulling it
>> down and the LED is installed. If the IO pin is not driving it low and
>> no LED is plugged in, the IO pin will be low by R2. The IO pin can
>> drive low to turn on the LED.
>
>
> This will work with good margin for some LEDs and some input buffers,
> and not at all or marginally with other choices. For example, a
> super-bright green LED will yield about 2.2-2.3V typically at the
> input with the above circuit and 5V Vdd. Some input buffers need Vdd *
> 0.8 worst-case, others are okay at around 1.9-2.0V (the "TTL" type).
>
> Since this circuit is "measuring" the LED presence with 250uA rather
> than 10-20mA, it has less drop and will work with more LEDs than the
> circuit I showed, however it has one more component.
>
> Best regards,
> Spehro Pefhany
```

I would skip the pulldown resistor altogether and simply drive the output low for a few cycles then switch it back to an input. The CMOS inputs have more than enough capacitance and a low enough leakage to hold the charge from the last driven state.

After driving the pin low and floating with no led connected you should indeed find a logic low on the input even for 100's of microseconds afterwards.

Normally I use this method for reading dip switches etc where the lead length is very short. If you want to run it a bit longer you should shield it somehow.

After driving the pin low and floating it when a led is connected you should see the input charging up to within Vdd in a very short period.

Method:

1. Drive pin low and switch to output mode
2. Hold for a few cycles
3. Switch pin to input mode
4. Wait for a few cycles
5. Read the input – low = (no led)

This way you can still drive the LED with a high current and you don't need any additional components.

--

Peter Jakacki