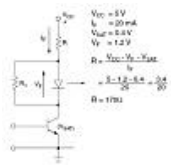
466576266
Member
Join Date: **Mar 2010**
Posts: **31**

11-17-2011, 07:30 AM

hello, anyone. a problem related with opto driving has puzzled me for a long time. and i turn to u for help in here. as u can see from the pic, what i wonder is what is the function of the R1 resistor? and how to design this resistor? thank u in advance.

Attached Thumbnails



OLIVE2222
Senior Member
VIP Member

Join Date: **Oct 2011**
Posts: **509**

11-17-2011, 10:05 AM

Hi,

R1 permit to have a LED threshold higher then Vf. It 's not the "standard" way to drive it Iso.

Olivier

Resqueline
Super Moderator
Moderator
Join Date: **Jul 2009**
Posts: **2,848**

11-17-2011, 12:24 PM

I've not seen it before but I believe it's there to speed up the turn-off of the LED. I guess it could be dimensioned to steal 1/10th of the LED current. R1 = Vf / (If / 10).

466576266
Member
Join Date: **Mar 2010**
Posts: **31**

11-18-2011, 01:28 AM

this circuit is from the fairchild datasheet AN3001.i cannt upload it cause its a little large. i think it does function as sth, even though i donnt know

(*steve*)
Super Moderator

11-18-2011, 09:17 AM

Olive2222 gives you exactly the same answer as that presented on the first page of that pdf.

Moderator

Join Date: **Jan 2010**
Location: **Mid way between Beijing and the the Ronne Ice Shelf (mind your projection) ...and don't call me Sir!**
Posts: **15,039**

Another thing it will do is prevent any emission from the LED until the current rises above a point at which the voltage across R1 due to that current exceeds the Vf of the LED. This may be a useful property if there is some leakage in the switching device (the transistor in this case).

Quote

11-18-2011, 11:47 AM

Harald Kapp
Super Moderator
Moderator
Join Date: **Nov 2011**
Location: **Germany**
Posts: **3,094**

May I add from the datasheet:

Logic to Logic Interface
In logic-to logic coupling using the optocoupler, a simple transistor drive circuit can be used as shown in Figure 12. In the normally-off situation, the LED is energized only when the transistor is in saturation. The design equations are given for calculating the value of the series current limiting resistor. With the transistor off, only minor collector leakage current will flow through the LED. If this small leakage is detectable in the optocoupler detector, the leakage can be bypassed around the LED by the addition of another resistor in parallel with the LED shown as R1. The value of R1 can be large, calculated so that the leakage current develops less than threshold V F (~0.8 volt) from Figure 5. The drive transistor can be the normal output current sink of a TTL or DTL integrated circuit, which will sink 16 mA at 0.2 volt nominal and up to 50 mA in saturation.

In a typical appliction you may leave out R1 unless you have a *very* sensitive photocoupler.

Regards,

Harald

Quote

11-18-2011, 01:36 PM

466576266
Member
Join Date: **Mar 2010**
Posts: **31**

thanks for all. to be honest, i still cannt understand the deep principle of this kind of opto driving circuit design.
do u have general or standard circuit design when u deal with opto design. thanks for ur share if u like that...

Quote

11-18-2011, 11:23 PM

(*steve*)
Super Moderator
Moderator

Join Date: **Jan 2010**
Location: **Mid way between Beijing and the the Ronne Ice Shelf (mind your projection) ...and don't call me Sir!**
Posts: **15,039**

Quote:

> Originally Posted by **466576266**
> *thanks for all. to be honest, i still cannt understand the deep principle of this kind of opto driving circuit design.*

OK, the basic elements are

1) the LED (part of the optocoupler)
2) the transistor (to switch the LED on and off
3) the series resistor (to limit maximum current)
4) the parallel resistor.

I presume you are fully comfortable with 1, 2, and 3.

the parallel resistor is rarely used in this application, but may be used in certain circumstances.

Because the LED represents a very high impedance until the voltage across it reaches Vf, as soon as any current flows at all, Vf will be the voltage across the LED (with minor changes since Vf depends on If to a significant extent where If is small).

Thus if the voltage across the LED and the series resistor rise above Vf, there will be some light emitted from the LED.

Regardless of how good the transistor is, there will always be some leakage, and therefore

some emission from the LED. This may not be significant, but on the other hand it might be...

The fix for this is to place a resistor across the LED. The two resistors act as a voltage divider now, and for any particular current the voltage across the LED depends on the parallel resistor (until that voltage reaches Vf). Thus at small currents the voltage is far lower than Vf and therefore no current flows through the LED and consequently there is no emission from the LED.

So the resistor across the LED ensures that the led will completely extinguish when the current through the switching device (the transistor in this case) falls to some low value, rather than zero (which may be unachievable)

The same issue can be discussed as a voltage rather than current issue, in which case the parallel resistor increases the voltage across the LED/series resistor combination required to turn on the LED.

Resqueline observed that this is useful for a LED driven by a capacitor. In this case the advantage is also that the LED will turn off completely at some calculable time rather than the brightness following a curve which is asymptotic to zero.

> Quote:
>
> do u have general or standard circuit design when u deal with opto design. thanks for ur share if u like that...

Yeah, essentially exactly the same as your original circuit with R1 removed.

R1 is there for a number of special cases which arise infrequently.

Quote

466576266
Member
Join Date: **Mar 2010**
Posts: **31**

11-21-2011, 11:37 AM

steve,really thank u. ur analysis makes me understand this problem a little more advanced.
so let me make a short summary, the function of this parallel resistor are:
1:build the start-up voltage Vf as soon as the external voltag is applied on;
2:reduce the leakage affection of the transistor;
3:speed up the discharge of the optotransistor whrn the transistor is off.
above all ,thanks for all...

Quote

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