Re: Momentary Switch Circuit

Source: http://sci.tech−archive.net/Archive/sci.electronics.design/2005−09/msg02759.html

- *From*: Terry Pinnell <terrypinDELETE@xxxxxxxxxxxxxxxxxxx>
- *Date*: Wed, 14 Sep 2005 08:00:19 +0100

Terry Pinnell <terrypinDELETE@xxxxxxxxxxxxxxxxxxx> wrote:

>ehsjr <ehsjr@xxxxxxxxxxxxxxxx> wrote:
>
>>Terry Pinnell wrote:
>>> ehsjr <ehsjr@xxxxxxxxxxxxxxxx> wrote (to the OP):
>>>
>>>
>>>>I'm curious. Why didn't you try this?
>>>>
>>>>+Vcc −−−o o−−−+−−−|<−−−− Vout
>>>> \ | Zener
>>>> o |
>>>> | |
>>>> [C1] [R1] 220K
>>>> | |
>>>>Gnd −−−−−−+−−−−−+
>>>>
>>>>Vzener is slightly below Vcc − eg 4.7 volts if Vcc is
>>>>5 V, 11 volts if Vcc is 12 volts etc.
>>>>Ed
>>>
>>>
>>> Ed: That looked such an attractively simple circuit that I tried it
>>> myself yesterday. I may have missed something but aren't there a
>>> couple of downsides to it?
>>
>>Yes, absolutely.
>>
>>I don't think the OP specified what sort of
>>> pulse he wanted, but my starting assumptions were a clean, +ve, full
>>> supply signal.
>>
>>He's replacing (or using in place of) a momentary switch.
>>Both the toggle and the momentary are subjecty to switch
>>bounce. Since whatever circuit he's driving will work
>>on a momentary, then switch bounce from a toggle is not
>>a factor.
>>

>>But your observation is correct. The circuit will not
>>provide a clean, +ve, full signal supply. It is a definite
>>downside to the circuit for general use − it is good only
>>for use where switch bounce is irrelevant.
>>
>>
>>Your circuit:
>>>
>>> 1) Delivers only a low amplitude spike, so needs amplifying to get a
>>> 'full' pulse.
>>
>>That's wierd. It should deliver close to Vcc. Your
>>Vcc is 14 volts and the zener is 12. It (the zener)
>>should conduct until Vcap drops to 12, meaning that
>>the pulse amplitude has to be at least 12. Maybe
>>you are scoping at the input to the zener? The
>>duration depends on the load, and to a lesser extent,
>>on the 220K resistor, but primarily on the zener.
>>It will be a spike, but it should be a spike whose
>>amplitude is over the zener voltage. RC is ~ 9.5 mS
>>(way too short) down to ~1/3 vcc − but it is collapsing
>>only 2 volts or about 14% (instead of ~ 63%) when the zener
>>shuts it off. You need a bigger cap! The circuit "looks at"
>>just the top of the cap discharge curve, which is steep.
>
>I think I need a much *smaller* cap! If I make it 10nF instead of 1uf,
>then I see Vout as an initial *very* brief spike.
>
>>We disagree on spike amplitude, but that doesn't change
>>the fact that the output is another downside, as you
>>indicated. You get what amounts to a spike instead of a
>>nice robust square wave.
>
>>Using say a simple NPN stage that results in a −ve going
>>> pulse, which may then need inverting. (BTW, such amplification would
>>> presumably be simplified if the headroom voltage is rather larger than
>>> your examples?)
>>
>>Yes − you need that with a low impedance load, or a long
>>duration pulse, or if the pulse must be square. And as long
>>as you stuff enough drive current into the base, it drives
>>to Vcc minus the transistor Vce. So you can have plenty of
>>headroom between the zener and Vcc and still get square wave
>>output.
>>
>>I got way over 40 seconds with a 120(?) ohm relay driven
>>that way through a darlington with Hfe > 1000 in a delay
>>off circuit I made. Had to add a resitor in parallel with
>>the cap to get it down to the ~40 second target in that
>>circuit. I don't remember all the values, but I can find
>>them if they are of interest.

>
>You've lost me there. Can you draw that circuit please?
>
>>The headroom was to make the pulse voltage unambiguous.
>>RC is ~ 63% discharged − the circuit is "looking"
>>at the top ~6% of discharge (eg from 5.0 down to 4.7).
>>I didn't want the the circuit that is being driven
>>to "see" an ambiguous voltage that was not clearly
>>either a high or a low. By using the top of the
>>discharge curve, the voltage will be at a high
>>until the zener cuts it off. It has a wicked slope,
>>but all of it will be above the zener V. Also, I picked
>>common zener voltages. I run into lots of 11 and 4.7v
>>zeners, but rarely a 4.3.
>>
>>>
>>> 2) Transmits switch noise.
>>
>>Absolutely. As mentioned earlier, I don't think
>>that's a factor for the op, but it certainly is
>>in many applications.
>>
>>>
>>> I used a 14V supply and a nominal 12V 1W zener, with this circuit:
>>> http://www.terrypin.dial.pipex.com/Images/Momentary−Ed1.gif
>>>
>>> Here are a few screenshots of the results I actually saw:
>>
>>Thanks for these − they're great! I have a question, inline
>>below.
>>>
>>> Relatively 'clean' switch
>>> http://www.terrypin.dial.pipex.com/Images/Toggle−Ed−1.gif
>>>
>>> Noisy switch
>>> http://www.terrypin.dial.pipex.com/Images/Toggle−Ed−3.gif
>>>
>>> Noisy switch, detail
>>> http://www.terrypin.dial.pipex.com/Images/Toggle−Ed−5.gif
>>>
>>> Noisy switch, detail, after NPN stage
>>> http://www.terrypin.dial.pipex.com/Images/Toggle−Ed−8.gif
>>
>>I'm puzzled by the Vout curves. It should "fall off the cliff"
>>at 12V when the zener stops conducting, but the traces all show
>>Vout curving down below 12 volts.
>>
>>I think the output (without the noise, which I can't draw)
>>should look like this:
>>
>>+14 |\

>>+12 | \
>> | |
>> | |
>> | |
>>0 −−−− −−−−
>>
>>Can you determine why there is that curve down to 0
>>volts? I wonder if your zener doesn't "zen" :−) ?

We aren't possibly at cross−purposes here? We're talking about the circuit I illustrated above, with Vout taken from zener's anode, yes?

>>>
>>> BTW, I'm puzzled by the roughly triangular shape of the output. I
>>> tried one simulation and got a squarish result:
>>>
>>> http://www.terrypin.dial.pipex.com/Images/Momentary−Ed−SIM1.gif
>>> Maybe it was just the choice of zener?
>>>
>>>
>>
>>Regarding the simulation − my guess is that they treat
>>the switch as noiseless, no bounce.

No, that's down to my choice of input to Circuitmaker's VCS. I simulated a noiseless switch, like the relatively clean one I used in my tests.)

>>But they don't
>>show the Vout "falling off the cliff" pattern − unless
>>the yellow is supposed to be Vout. The green looks
>>more like a capacitor discharge curve than the yellow,
>>but the green doesn't fall off the cliff. And if the
>>yellow is supposed to be Vout, the trailing edge is
>>correct and everything before it is wrong. So I'm
>>clueless.
>>
>>Ed
>
>I'm out for rest of day, but I'll get back on the case tonight. I
>suspect that 'triangle' I saw for Vout might have been an artifact of
>some sort, due to poorly chosen PC−based 'scope settings. All the
>simulations I've tried show a square signal, amplitude Vcc−Vz, *apart*
>from that initial spike which they now show, following the massive
>reduction in the value of C.

I re−assembled the breadboarded circuit yesterday with a different 12V zener. The waveforms now look OK to me. So the only remaining questions are:

1) Amplitude; I still think it should be as seen here, Vcc−Vz, not

close to Vcc?

2) Simulated waveshape versus actual; must be something to do with unrealistic Circuitmaker models. I'll study further.

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Terry Pinnell
Hobbyist, West Sussex, UK
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- ***Follow−Ups***:
  - ♦ ***Re: Momentary Switch Circuit***
    - ◊ *From:* Terry Pinnell

- ***References***:
  - ♦ ***Momentary Switch Circuit***
    - ◊ *From:* kknicker
  - ♦ ***Re: Momentary Switch Circuit***
    - ◊ *From:* amdxjunk
  - ♦ ***Re: Momentary Switch Circuit***
    - ◊ *From:* kknicker
  - ♦ ***Re: Momentary Switch Circuit***
    - ◊ *From:* amdx
  - ♦ ***Re: Momentary Switch Circuit***
    - ◊ *From:* kknicker
  - ♦ ***Re: Momentary Switch Circuit***
    - ◊ *From:* ehsjr
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