Re: Is this a gate/drain capacitance problem?

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- *From*: Robert Baer <robertbaer@xxxxxxxxxxxxx>

- *Date*: Sun, 14 Aug 2005 20:06:20 GMT

Dave wrote:

> Zigoteau wrote:
>
> > Hi, Dave,
> >
> > > I have a noise generator consisting of a reversed bias "zener" diode
> > > (8.2V), a 28V supply and a resistor of about 2 kOhm. There is a
> > > commerical bias T that has and L and C in it.
> > >
> > > As the 28V is witched on/off, so the diode avalances or not, and so
> > > noise is produced. So the circuit is something like this, although the L
> > > & C are are bit more than just simple compoenents, as this bias T worked
> > > from 20 kHz to 8GHz.
> > >
> > > I wanted to add a method of TTL control of the noise. So stuck the drain
> > > of an n−channel fet between the R and L, and grounded the source. As the
> > > gate is driven, it basically crowbars the supply to the zener. That
> > > seems to work OK.

> Not terribly elegant. Apart from your problem of spikes, both with and without 28V, there are issues of quiescent power dissipation.

Which is next to zero. I'm dropping about 20 V across a 2.1 k resistor, which is < 200mW.

Spike I would like to reduce.

How would you do it in a more elegant way?

> With 28V present, the spike will be much bigger because you're essentially changing the current through the Zener.

But that will happen anyway. Normally the 28V line is switched. In that case I am always going to have to fight the V = L dI/dt.

I have a commercial (10 MHz to 18 GHz) noise source that works this way, but the noise is produces is too low (its about 15 dB above thermal noise). This is not enough for what I need.

> > What I find odd is that if there is no 28V supply at all, but the gate of the FET is drive, so "spikes" of noise appear on the output as the TTL signal changes state.
>
> > Do you think I am just injecting charge ito the gate, some of that gets to the drain, and so the drain develops a voltage on it, that is sufficient to cause the diode to generate noise? I can't see how, as the diode will not generate much noise unless it avalacnhes, and the TTL signal is less than the breakdown voltage of the diode. Perhaps the L's that are around are messing things up.
>
> > I'm using a power FET in a TO−220 case, simply because that was all I had, but I'm wondering if swapping to a low power FET will cure this?

> In normal operation, there is no reason to use the TTL drive unless there is the 28V supply present. But I'm concerned that since I can see this effect with no 28V supply, it is probably there (but not so visable) when the supply is there.

> Does your noise generator have a specification?

Not a formal one. I am doing this for a lab experiment, and to have a source around of high noise source I need one again.

> You have done it the
> cheap and cheerful way. Does it need to be any better?

Since I intend keeping it for a while, and perhaps use with a lock−in amplifier, which will be messed up to a small extent by the spikes, I would rather get rid of them if I can.

Applying the TTL without the 28V is not a mode it will be used in. That is for sure.

> But it will be used in

a) 28 V switched on/off at about 10 Hz by a commercial noise figure meter, with the TTL open (i.e. the 28V works to switch the noise on/off).

I assume the noise figure meter gives the transients before it makes measurements.

b) Me applying 28V constantly and using the TTL drive from perhaps a lock−in amplifier for some tests. The TTL was very much an afterthought I added "just in case I have a need for it".

But I am concerned the noise the TTL it is causing. This might

be an issue if it caused a massive spike when it switched the 28V supply. With zero current in the diode, the diode will generate the same noise power as that of a resistor at room temperature (about 295K). With the 28V on, it will generate the same noise power as a resistor about about 100,000K. I hope the transients are not causing it to generate the same noise power as a resistor at 1,000,000 K at the time of the transient.

> Yes, a small−signal FET will clearly have lower
> gate−drain capacitance,
> but not zero.

I realise that. It might be sensible to go to a smaller device. I have some microwave devices around. I might look at using one of those.

> If the spike amplitude is still too high, then you might
> have to go to a reed relay.

I want to avoid a mechanical unit. The delays induced by them will probably mess things up a lot more than the transients.

> Cheers,
>
> Zigoteau.

Consider leaving the noise generator on all of the time.
Then add a PIN RF switch in series with the output of the generator.
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