Re: Missing Schmitt Gates??

Source: http://sci.tech−archive.net/Archive/sci.electronics.design/2007−12/msg00591.html

- *From*: Spehro Pefhany <speffSNIP@xxxxxxxxxxxxxxxxxxxxxx>
- *Date*: Wed, 05 Dec 2007 10:01:27 −0500

On Wed, 05 Dec 2007 08:44:43 −0600, John Fields
<jfields@xxxxxxxxxxxxxxxxxxxx> wrote:

> On Tue, 04 Dec 2007 21:53:49 −0500, Spehro Pefhany
> <speffSNIP@xxxxxxxxxxxxxxxxxxxxxx> wrote:
>
> > On Tue, 04 Dec 2007 19:54:53 −0600, the renowned John Fields
> > <jfields@xxxxxxxxxxxxxxxxxxxx> wrote:
> >
> > > On Tue, 04 Dec 2007 16:47:14 −0800, John Larkin
> > > <jjlarkin@xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx> wrote:
> > >
> > > > On Tue, 04 Dec 2007 16:45:54 −0700, Jim
> > > > Thompson
> > > > <To−Email−Use−The−Envelope−Icon@xxxxxxxxxxxxxx>
> > > > wrote:
> > > >
> > > > > On Tue, 04 Dec 2007
> > > > > 15:40:47 −0800, D from BC
> > > > > <myrealaddress@xxxxxxxxx>
> > > > > wrote:
> > > > >
> > > > > > On Tue, 04
> > > > > > Dec 2007
> > > > > > 22:17:36
> > > > > > GMT, Rich
> > > > > > Grise
> > > > > > <rich@xxxxxxxxxxx>
> > > > > > wrote:
> > > > > >
> > > > > > > On
> > > > > > > Mon,

03
Dec
2007
19:07:08
−0800,
John
Larkin
wrote:

On
Mon,
3
Dec
2007
17:57:28
−0800,
"Joel
Koltner"

"D
from
BC"
<myrealaddress@xxxxxxxxx>
wrote
in
message

A
crystal
needs
a
good
linear
amp.

Everything
is
linear
if
you
look
closely
enough...

I
am
being
a

little
obtuse
here
−−
the
kind
of
oscillator
I
was
thinking
of
was
your
canoncial
microcontroller/FPGA
clock
that
doesn't
need
to
be
particularly
accurate
−−
it's
common
to
use
50
or
even
100ppm
rocks
in
such
systems;
this
is
a
completely
different
league
of
oscillator
than
those
you
build
for,
e.g.,

fancy RF applications where you're after 2.5ppm or better.

I was never able to get the Schmitts to oscillate anywhere near the supposed crystal frequency.

Maybe it's a little late in the thread to bring this up, but I'd think that with the Schmitt characteristics of

the
input,
the
crystal
would
have
to
be
drastically
overdriven,
just
to
get
the
gate
to
notice
that
there's
a
feedback
signal.

But
I
wouldn't
have
any
qualms
about
an
HCU
inverter
or
3.
;−)

Cheers!
Rich

I think Ht
for Logic
with
Schmitt
inputs is
about 1V @
5V.

A
crystal..well...

isn't it just
tiny jiggling
piece of
rock?
Ooops...I
might be
thinking
piezo..
Damn..forgot
all my
crystal
theory...cuts,
shapes,
modes and
all that
jazz.
Anyways.. I
can imagine
that one has
to be kind
to a tiny
piece of
crystal and
not bash it
with lots of
drive.
However....depends
on the
precision
required..
As someone
posted, for
clocking an
uC or CPU
...who cares
about some
drift..

D from BC

A crystal oscillator using an
inverter with hysteresis
WILL NOT
self−start.

...Jim Thompson

> > Of course it will self−start. It just won't run anywhere near the
> > crystal frequency!
>
> −−−
> Nope.
>
> There's no guarantee that it'll self−start because you've only got
> one delta V (on turn−on) to cause the crystal to ring, and if it doesn't ring hard enough to get to the opposite switching threshold
> it'll just sit there, squeezed.

> At what input voltage? Of course it's assumed you will also have a high−value bias resistor across the ST inverter.

−−−
OK, but then I think the ST has to be configured to self−oscillate
in order to pump the crystal up to where it has enough output to run
the ST instead of the ST running itself.

The resistor and some stray capacitance will do that. It can't have a
stable state with the resistor.

> The right way to do it is to use an inverter which can be biased so
> that the input and the output are both at about Vcc/2 and then let
> noise tickle the crystal until it takes off.

> The MCS48 used a ST in the clock oscillator IIRC. It would oscillate at some tens of kHz before the crystal got going. Maybe a "feature" kind of a limp−home thing if the crystal failed (usually, not always, open).

−−−
My 1990 Intel "8−Bit Embedded Controllers" data book states, on page
1−8:

"OSCILLATOR

The on−board oscillator is a high gain parallel resonant circuit
with a frequency range of 1 to 11 MHz. The X1 external pin is the

input to the amplifier stage while X2 is the output. A crystal or ceramic resonator connected between X1 and X2 provides the feedback and phase shift required for oscillation"

Then, on page 4−28, they show:

```
|
+−−[C1]−−−+−−−−−−+−−−−−2|XTAL1
| | | |
| [C2] [1−11MHz] |
| | | |
+−−[C3]−−−+−−−−−−+−−−−−3|XTAL2
| |
GND
```

C1 = 5pF +/− 1/2 + (stray < 5pF)
C2 = (CRYSTAL + STRAY) < 8pF
C3 = 20pF +/− 1 pF (stray < 5pF

Which looks pretty much like a Pierce oscillator.

Finally, in the figure on page 9, they say: "For XTAL1 and XTAL2 define "high" as voltages above 1.6V and "low" as voltages below 1.6V."

I found no mention of self−oscillation, and with that tightly defined trigger point and no hysteresis, it doesn't seem likely that's a Schmitt trigger.

No, it's not clear just from the data sheet, however IDRC (I Did Recall Correctly−− hey, it happens..), if you look further back in your book to AP−155, _Oscillators for Microcontrollers_ (at least I think it's bound into that edition) and you'll find the following:−

−−−−
MCS−48 Oscillator

The NMOS and HMOS MCS−48 oscillator is shown in Figure 21. It differs from the 8051 in that its inverting amplifier is a Schmitt Trigger. This configuration was chosen to prevent crosstalk from the TO pin, which is adjacent to the XTAL1 pin.
....
−−−−
(they go on to discuss the thoroughly nasty "relaxation mode" at ~50kHz and the possible associated problems transitioning to proper crystal operation, with some nice oscilloscope photos)

http://download.intel.com/design/mcs51/applnots/23065901.pdf

(see PDF pages 20−24).

Although the MCS48 NMOS chip is LONG past obsolete, this is still a
good application note and I recommend it to anyone working with micros
and using the internal oscillator.

Best regards,
Spehro Pefhany
−−
"it's the network..." "The Journey is the reward"
speff@xxxxxxxxxxxx Info for manufacturers: http://www.trexon.com
Embedded software/hardware/analog Info for designers: http://www.speff.com
.