Re: decoupling caps placement

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- *Date*: Sun, 21 Dec 2008 22:26:19 −0800 (PST)

On Dec 22, 8:33 am, "tempus fugit"
<tocc...@xxxxxxxxxxxxxxxxxxxxxxxxxxxx> wrote:

> Hey all;
>
> I've got a circuit that uses 3 4049 inverters. On this IC, the V+ is on pin
> 8 and the ground is on pin 1. I know that the decoupling caps need to be as
> close to the IC as possible, but how can I connect 1 end of the cap to V+
> and the other to ground when the pins are so far away?

There are many ways to do this depending on how your board and circuit
are layed out.

For instance, on say 2 layer boards it's common to have a "power
strip" going underneath the IC that feeds ground and power to a whole
row of chips end−on−end, so you can put the cap at the end of the chip
in this case.

When you go to multiple layer board you usually have a ground plane
that provides a nice low impedance ground path for you. So in this
case you would put the cap next to the positive power pin and then to
the ground plane.

Other circuit topologies may dictate something different again.

> Is it sufficient to
> connect 1 end of the cap to V+ and the other to a nearby ground node, or
> should the cap be connected close to the actual ground pin of the IC?

Ideally it should be the ground pin of the IC. But in your case any
nearby ground node will almost certainly do. A 4049 is not a fast
device, so it's not likely to be at all critical.

What you are after is (simplistically) the shortest electrical "loop"
path between the positive power pin, through your decoupling cap, and
back to the ground pin on the chip. The shorter the better.

> Also, do I use 1 cap for each IC?

That's the general rule of thumb, yes.

> If so, (the ICs are fairly close together)
> wouldn't the IC "see" the caps as being the paralleled value of the 3 caps,
> thus reducing the available capacitance?

It's not just the capacitance, it's the inductance (and resistance) of
the entire power/ground "loop" that matters. It's a complex thing.

> I was going to use 0.1uF for the
> value of each decoupling cap. Would it also be wise to use a larger (1uF or
> higher) cap in parallel?

This is complex area and has to do with all sorts of factors.
Generally, if the datasheet for your device does not specifically say
so, then one cap will be sufficient. If it's critical, then the
datasheet might recommend two or three caps of different values and
types.

Dave.
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