Re: Explanation of the whole 300 mA thing

Source: http://coding.derkeiler.com/Archive/General/comp.arch.embedded/2007−12/msg00129.html

- *From*: Jim Granville <no.spam@xxxxxxxxxxxxxxxxxxxxxx>
- *Date*: Tue, 04 Dec 2007 08:15:32 +1300

rickman wrote:

> On Dec 3, 2:09 am, Jim Granville <no.s...@xxxxxxxxxxxxxxxxxxxxxx>
>
> > The voltage budget is getting tight.
> > Few Display LEDs specs to 300mA, but slope of 500mv/50mA is not
> > uncommon, for Green.
> > Most matrix displays expect to be driven at lower than 16:1 duty cycle.
> >
> > The dominant resistive voltage drop, should be the current limiting
> > resistor, not any drivers, and especially not any column drivers.
>
> I have never seen a diode that was resistive in the forward
> direction. I think you will find the forward voltage drop to be
> logarithmic.

Download a kingbright data sheet, and you will see at low currents
the log model is OK, at higher currents, the resistive element dominates.

> Yes, the dominant resistive element is the current
> limiting resistor, that is why it controls the current.

> > That starts to dictate N fet and Pfet column
> > drivers.
> > vanilla 100mOhm fets are 210mV at 2.1A,
> > with no base−drive factors.
> > 50mOhm fets are ~100mV

This is not so much an issue of FET vs bipolar as common

collector vs.
common emitter. Common emitter allows the device to be in saturation
with a lower voltage drop across the transistor output. But that
circuit requires more control circuitry. The point of the emitter
follower stage is that it duplicates a high impedance on the MCU
control pin to the driver output. This is not doable with a common
emitter stage without two control lines per driver. This is also not
doable with FETs in a source follower configuration since the
threshold voltage is so much higher for a FET than for a bipolar
transistor.

If you use the correct voltage levels for the drivers, you will see
that there is adequate drive from a 5 volt power rail.

Depends on the LED. The specs I have for 5x7 matrix displays show none rated to 300mA, and suggest ~3V drop at 100mA drive (green).
That can barely tolerate one follower, so it does need a low saturation column driver. If we lower to 100mA, for the sheet I have, and allow 0.8V for emitter follower + base effects, that leaves 1.2V for column driver, and limiting resistor. Not enough room for a second follower, so it needs a open−collector saturating driver. At 5V targets, FETs are better than bipolars.
[also not nearly enough voltage budget for the OPs original Emitter follower/darlington follower/LED/resistor chain]

I am confused. Are you saying that using an row emitter follower with an open collector column driver will work? That is what I am describing!

The problem with the FET is that you need two control lines per driver in order to get a tristate driver output. How do you connect this to the MCU?

Summary for the OP:
You will need to do a full voltage budget on this, and that
means getting the dats sheets on each device, and checking the

voltage at the driven current.
Include the base−current effects in your design.

When well designed, the series Resistor should dominate the
other resistive elements, in setting the LED current.
That means you want as much voltage across that R as possible,
and as little drop on the common−rail drivers (Column in your drawing).

An 'A' student will find (or try and derive 'best guess' for) Max and Min values, and also give the corner cases.
Spice is your friend, but spice models for LEDs are not easy to find.

The Original SCH has problems in the HC164 drive, and I'd suggest
a LV595, or HEF4094, depending on the final load.
The original darlingtons will have insufficent voltage headroom, so
saturating open collector is called for. Either Bipolar, or
MOSFET.
example Mosfet is FDS8958A, and that can drive straight from
a HEF4094, for example.
A series power switch FET, that is delayed until all values are
loaded is not a bad idea, and also a safety−monostable, that
removes drive if the uC fails to update can avoid frying leds.
A frozen scan will kill std LEDs, and if you turn on both N and P
fets at the same time, that will crow−bar the supply.
A separate LED regulator, from the uC one, is a good idea, at the
2.1A peaks your numbers indicate. If you make that adjustable,
you buy some tolerance in voltage margin, and can give the user
a brightness control.

−jg

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