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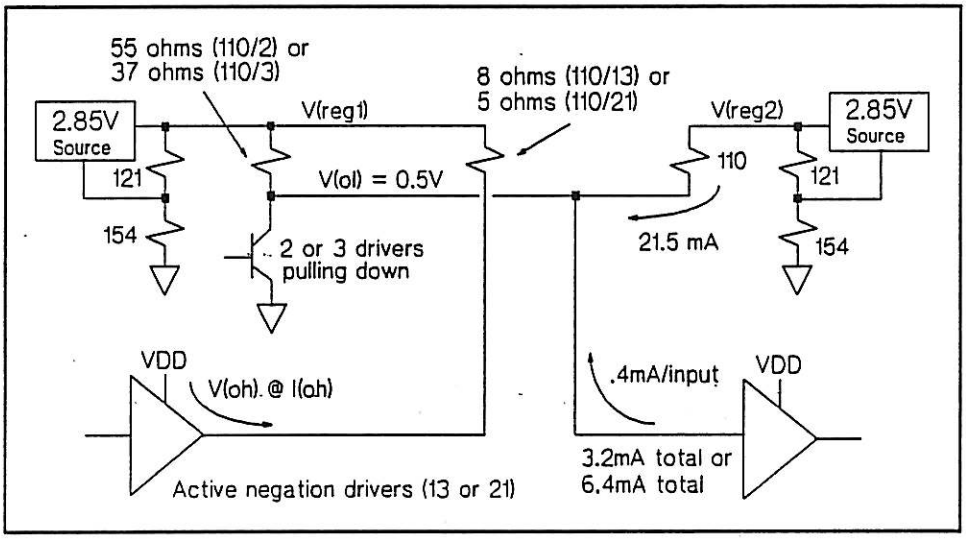
Date: 1 Sep 91 X3T9.2/91-130R1
From: Kurt Chan
To: X3T9.2 Membership
Subject: Active Negation Drivers and Alt-2 Termination

Al Wilhelm and Jeff Taylor from Adaptec recently pointed out a problem to me with single-ended SCSI. The problem has to do with some Alt-2 terminator designs allowing more than 44.8mA to flow to a SCSI signal when using active negation drivers:

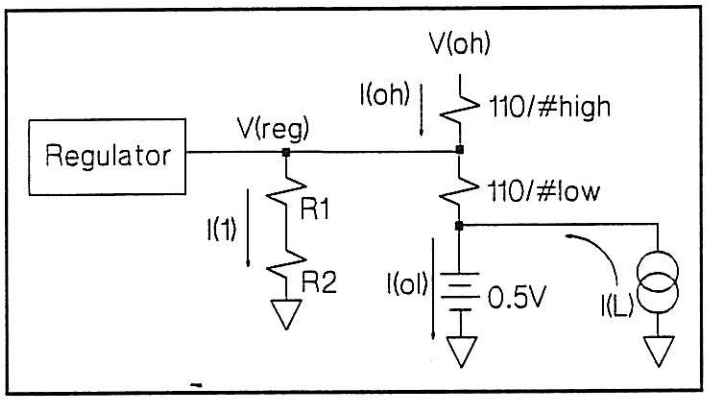


Consider the case of multiple signals driving high and one wired-OR signal driving low. The equivalent circuit for this is shown above. Assuming the active negation drivers all drive to V(oh) into their termination resistors, they have the potential to alter the regulator voltage.

This is because some low-dropout regulators use a "floating" design where a pass transistor is turned off if the output voltage exceeds 2.85V. Since the regulator will not sink any current in order to maintain regulation, it appears as an open circuit and allows the regulated voltage to rise. When this happens, any driver pulling down will be allowed to sink more than 48mA when it's output voltage is at 0.5V.

In 8-bit SCSI, there are three wired-OR signals and 15 signals which can provide positive I(oh). The worst-case scenario occurs in DATA OUT phase, when 13 signals can be active high and 2 low. In 16-bit SCSI, there are also three wired-OR signals, but 21 signals which can be active high. The same phase can therefore result in 21 high, 3 low.

The simplified schematic of the problem used to product this graph is shown below:



Assuming V(reg) = 2.85 and R1+R2 = 275:

$$V_{oh} = \frac{1.14 + low\ (2.35) + high\ (2.85)}{high}$$

1. For 16-bit SCSI, 21 signals can be high while 3 are low, resulting in V_{OH} = **3.24V max.**
2. For 8-bit SCSI, 13 signals can be high while 2 are low, resulting in V_{OH} = **3.30V max.**

One suggestion has been to specify I(oh)@V(oh) for one or more voltages. However, this approach still allows the 48mA I_{OL} specification to be exceeded when several outputs are actively high. The conservative approach would therefore be to change the V(oh) specification from 5.25V to 3.25V for active negation drivers in section 6.1.1 (SPI):

V_{OL} (Low-level output voltage) = 0.0 to 0.5 volts dc at 48 mA sinking (signal assertion)
V_{OH} (High-level output voltage) = 2.5 to **3.25** volts dc (**active** signal negation)

We can discuss alternatives at the 9/91 working group.