

Date: 15 Oct 89
To: X3T9.2 SCSI Committee Members
From: Kurt Chan, Gordon Matheson
Subject: Alt2 Termination: Worst-Case Analysis and Recommendations

X3T9.2/89-115R1

1. TERMPWR Current on SCSI-1

Figure 1 depicts the relationship between I(termpwr), V(termpwr), and V(ol_avg) on SCSI-1 systems (Alternative 1 termination). In order to stay below the 800mA SCSI-1 limit under all V(ol) conditions, V(termpwr) must be around 4.6V or less. Since TERMPWR typically comes from a 4.75-5.25V supply and is diode-protected, it is generally a safe bet that V(termpwr) averages 4.6V or below at both ends of the cable, and explains why 800 mA is not exceeded in most SCSI-1 systems.

2. TERMPWR Current on SCSI-2, Alternative 2 Termination

Figure 2 shows the relationship between I(termpwr), R2, and V(ol_avg) on SCSI-2 systems with the Alt2 terminator (R1=120, Rpullup=110). In order to stay below the SCSI-2 900 mA limit for all V(ol) conditions, R2 must be lowered to 140 ohms, resulting in a reduction of V(out) from 2.84V nominal to 2.70V nominal.

The Rev10b value of R2=154 ohms is acceptable only assuming the average V(ol) for all 16 signals is 0.35V.

3. TERMPWR Current on Mixed Alt1/Alt2 Systems

Figure 3 shows I(termpwr) for systems which have Alt2 termination on one end and Alt1 termination on the other. The four cases are:

"Low": V(ol)=0.50V, V(termpwr)=4.00V, V(alt2)=lowest
"Typ": V(ol)=0.35V, V(termpwr)=4.30V, V(alt2)=nominal
"Hi1": V(ol)=0.20V, V(termpwr)=5.00V, V(alt2)=highest
"Hi2": V(ol)=0.20V, V(termpwr)=5.25V, V(alt2)=highest

Assuming worst-case conditions, there are no viable values for R2 which will ensure I(termpwr)<800 mA. Assuming TYPICAL values, R2=154 is acceptable.

4. 100-ohm Alt 2

Figure 4 shows TERMPWR current for the 100-ohm version of the Alt 2 terminator (Rev 10B, Figure 4-9, note 2). Note that the Rev 10b value will only keep I(termpwr) under 900 mA under typical conditions. Worst-case design would require R2=107, which would yield an unacceptably low termination voltage.

5. Conclusions

A direct tradeoff between performance and reliability exists in the design of the Alt 2 terminator:

- Both Alt 2 terminators described in Rev 10b will function without violating SCSI-2 TERMPWR current limits under MOST (i.e., typical) conditions. BOTH will violate the 900 mA spec under worst-case conditions.
- In addition, one Alt 2 terminator can replace an Alt 1 terminator on a SCSI-1 system - again assuming TYPICAL conditions are not exceeded.

- Two Alt 2 terminators on a SCSI-1 system is guaranteed to violate the 800 mA SCSI-1 spec, and is not recommended (although they should NOT cause opening of a 1000 mA fuse).

6. Recommendation

In an attempt to achieve a balance between performance, reliability, and compatibility, would the following Implementors Note suffice?

"Use of Alternative 2 termination may cause TERMPWR current to exceed 900 mA under certain conditions. One known set of conditions is:

- All 18 SCSI bus signals are asserted,
- Average V(ol) is less than 0.35 volts for all signals, and
- The termination voltage is 4% or more above the nominal V(out) values given in Figure 4-9.

Two Alt 2 terminators will always require at least 800 mA when all signals are driven. ~~Therefore~~ It is recommended that devices supplying current to one Alt 2 and one Alt 1 terminator be capable of sourcing 900 mA.

To handle all possible bus conditions, it is recommended that devices supplying current to two Alt 2 terminators be capable of sourcing 1000 mA."

I(termpwr) vs V(termpwr) vs V(ol)
Alternative 1 Termination

Vol(avgl): .5V Vol(avgl): .4V Vol(avgl): .3V Vol(avgl): .2V
 ---*--- ---+--- ---X--- ---□---

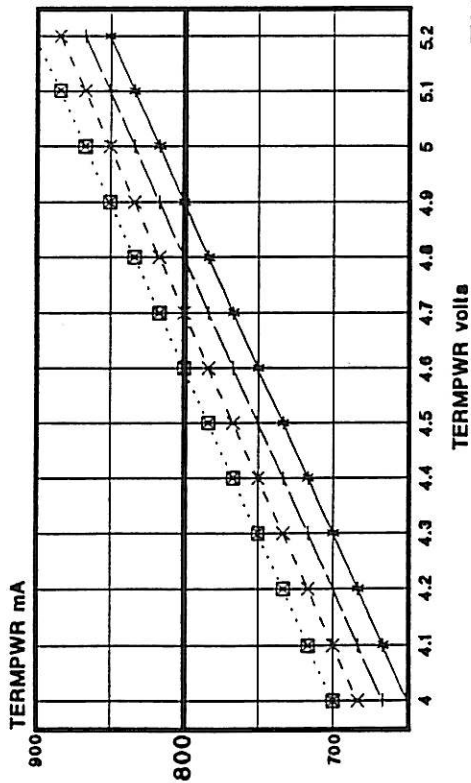


FIG 1

I(termpwr) vs R2 vs V(ol)
Alternative 2 Termination

Vol(avgl): .5V Vol(avgl): .4V Vol(avgl): .3V Vol(avgl): .2V
 ---*--- ---+--- ---X--- ---□---

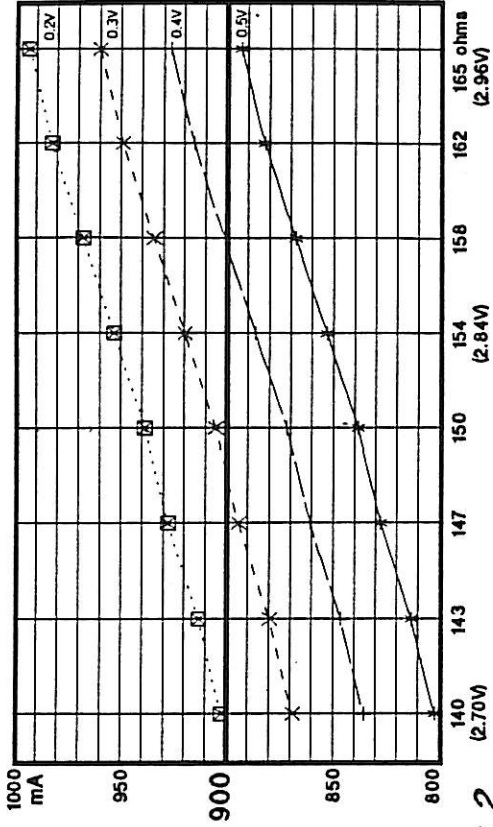


FIG 2

I(termpwr) - Alt1 and Alt2 Mixed

Low Typ H11 H12
 ---*--- ---+--- ---X--- ---□---

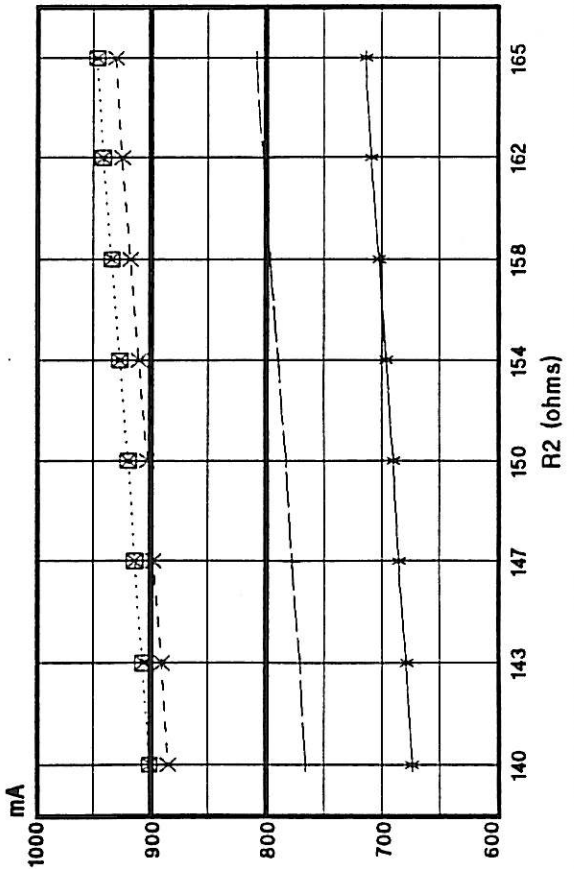


FIG 3

TERMPWR Current vs. R2 vs V(ol)
Alt 2 Termination (Rpullup=100)

Vol(avgl): .5V Vol(avgl): .4V Vol(avgl): .3V Vol(avgl): .2V
 ---*--- ---+--- ---X--- ---□---

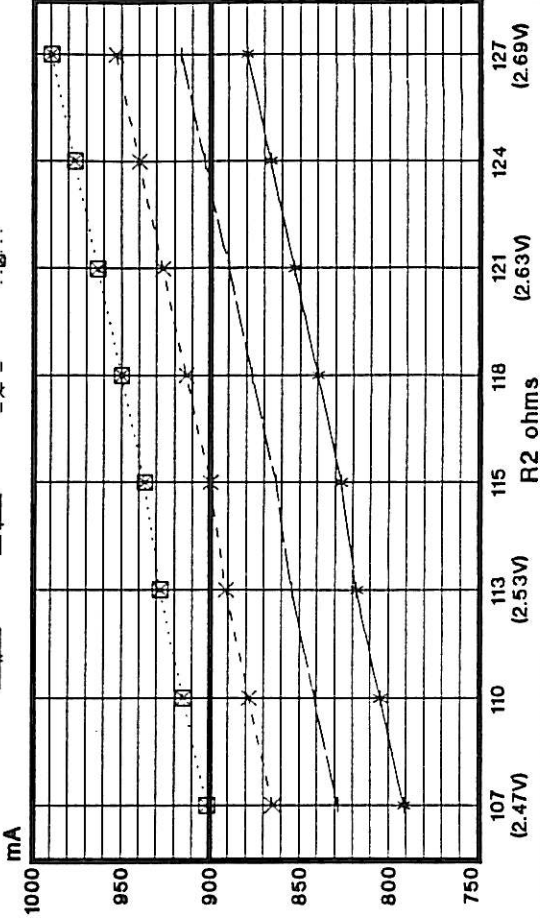


FIG 4

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