Validation of the Power Supply Voltage Detection Logic Circuit Proposed in 08-358 (Annex M)

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Introduction

- Powered mini-SAS devices supporting Active Cables need to operate with passive cables which have the Vcc pin tied to ground. Hence there needs to be a mechanism that turns on the power to the receptacle only when an active cable is plugged in, to avoid shorting the power supply. A voltage sense pin is proposed for Active Cables in 08-358. A circuit that turns on the power supply only when a Sense resistor of 5k Ohm is detected on the sense pin inside the plug is also proposed as an Informative Annex M.

- These are results of a SPICE simulation to verify the functionality of the proposed circuit.
Simulation Setup

- The circuit for the spice simulation is the one proposed in 08-358, Annex M and is shown below:
• The green shaded area is on the plug connector paddle card, and R8 is the Sense Resistor. The circuit is designed to have ~ 5V voltage on the power supply “Enable” pin when the Sense resistor value is 5k Ohm, and ~ 0V otherwise. ~5V on the “Enable” pin turns on the power supply, and it remains off otherwise.

• The circuit has been simulated in SPICE for various values of R8, and the voltage on the “Enable” pin was determined.

• Example output charts and output results are shown below.
Simulation Results: R8 = 1 uOhm
Simulation Results: R8 = 1 MOhm
Simulation Results: R8 = 5k Ohm
## Simulation Results: Summary

<table>
<thead>
<tr>
<th>Sense Resistor Value</th>
<th>Cable Condition</th>
<th>$V_{EN}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1uOhm</td>
<td>Passive</td>
<td>~28 mV</td>
</tr>
<tr>
<td>1M Ohm</td>
<td>Open</td>
<td>~28 mV</td>
</tr>
<tr>
<td>5k Ohm</td>
<td>Active</td>
<td>~5V</td>
</tr>
</tbody>
</table>
Appendix 1: SPICE Netlist

*Libraries:
* Local Libraries:
* From [PSPICE NETLIST] section of pspice91.ini file:
  * .lib "nom.lib"
  *library file for LM393
  .lib "lm393.lib"

*Analysis directives:
  .option post probe Accurate=1 ingold=2
  .option list node
  .TRAN 0 1000ns 0

R_R3    N00726 N00199  5.1k
R_R5    N05249 N00183  3.9k
R_R10   0 N05249  3.9k
X_U23A  N00183 N00726 N00199 0 N11560 LM393
V_V1    N00199 0 5
X_U24A  N00726 N05249 N07003 0 N11560 LM393
V_V2    N07003 0 5
R_R8    0 N00726 1meg
R_R6    0 N11560 5meg
R_R2    N11560 N00199 51.1k
C_C1    0 N00726 47nF
C_C2    0 N00726 1n
R_R1    N00183 N00199 3.9k
.end
Appendix 2: Dual Comparator Library File “lm393.lib”

* connections:  non-inverting input
*         | inverting input
*         |         | positive power supply
*         |         |         | negative power supply
*         |         |         |         | open collector output
*         |         |         |         |         |         |
.subckt LM393  1 2 3 4 5
*
  f1    9  3 v1 1
  iee  3  7 dc 100.0E-6
  vi1 21 1 dc .75
  vi2 22 2 dc .75
  q1    9 21 7 qin
  q2    8 22 7 qin
  q3    9  8  4 qmo
  q4    8  8  4 qmi
 .model qin PNP(Is=800.0E-18 Bf=2.000E3)
 .model qmi NPN(Is=800.0E-18 Bf=1002)
 .model qmo NPN(Is=800.0E-18 Bf=1000 Cjc=1E-15 Tr=475.4E-9)
  e1    10  4 9 4 1
  v1    10 11 dc 0
  q5    5 11 4 qoc
 .model qoc NPN(Is=800.0E-18 Bf=20.69E3 Cjc=1E-15 Tf=3.540E-9 Tr=472.8E-9)
   dp    4  3 dx
   rp    3  4 37.50E3
 .model dx  D(Is=800.0E-18 Rs=1)
*
.ends