X3T10/95-182 R0

X3T10/9[redacted] SPI-LP
SCSI-3 SPI Low Power

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Abstract:
This standard defines the additional requirements for low power applications over the SCSI-3 Parallel Interface (SPI) standard. This is not a standalone document, but an additional requirements document for low power applications, only the differences with SPI are defined in this document.

Editor: Paul D. Aloisi
Unitrode
7 Continental Blvd
Merrimack, NH 03054 USA
Telephone: 603-429-8687
FAX: 603-424-3460
Email: aloisi@uicc.com

1.0 Foreword:

A requirement has developed by low power applications, energy star/green power applications, Laptop and PCMCIA for a low power version of SCSI-3 SPI. This effects the TERMPWR voltage, termination, Signal when Termination is turned off, and powering down devices, it does not effect the thresholds.

Several of the issues can be used on other applications, not just the low power applications.

1.1 Scope:

This document specifies items that are different than SCSI-3 SPI, it is not a complete parallel SCSI definition. Items not define in this document, SCSI-3 SPI rules apply.

2.0 Termination Power Considerations

The single-ended SCSI bus is a traditional open collector style bus requires a lot power to the termination and drivers when the bus is driven. The passive termination requires a lot of power even when the bus is inactive. Terminator current requirements must be minimized.

The differential SCSI bus uses a resistor network with 6.2 mA idle current per line. Alternative solutions would reduce the idle current and shut the transient currents to ground versus the high transient currents that can be applied to the TERMPWR line.

2.1 Single-ended Idle Bus Termination Current (TERMPWR Idle Current Reduction)

The original 220/330 ohm passive termination can consume 181 mA on each end of the bus when the bus is free. **Passive termination shall not be used in low power applications**.

Termination that uses a combination of resistors and diode shall not be used. They normally violate SCSI-3 SPI and they require high idle current.

Regulated terminators draw very little current 1 < 30 mA at each end of the bus for existing regulated terminators when the bus is free. The newer versions of the terminators can be limited

to 5 mA maximum for each end of the bus. Low idle current designs should be encouraged or required.

Terminators in disconnect mode should draw less than 5 µA. This will reduce the current load on the TERMPWR line. Low terminator disconnect current should be encouraged or required.

Regulated terminator power can be drastically reduced when the bus is not active by powering down the terminators. Drives should be spin down first then the termination powered down during inactivity periods and put into sleep mode. Laptops currently spin down drives during inactivity periods, the spin up time is considerably longer

2.2 Single-ended Termination Operation Current - short cable applications

Battery operated systems are generally small systems that do not have heavy device loads or long cable lengths. Small systems do not need high pull up current.

Short buses do not need the normal pull up current to operate, 24 mA maximum at each end of the bus will allow 3 to 6 meter operation, less than 0,2 meters 1 mA pull up with 3 devices is less than 10 ns rise time, less than 0,3 meters 2 mA pull up is less than 10 ns.

2.3 Single-ended Low Power Termination Restrictions

a.) SCSI Low Power shall use regulated terminators.
b.) Regulated terminator idle current shall be <5 mA for 18 lines and <7 mA for 27 lines for each end of the bus.
c.) Disconnect terminators shall be <15 µA per device.

2.4 Differential Termination

2.4.1 Differential Resistor Network Termination

Differential terminators resistor networks will drop the 1 volt bus idle differential voltage, but it will be well above the 200 mV thresholds of the receiver. Table with no receiver loads, the TERMPWR idle current is for each end.

TERMPWR = 5 Volts, Bias = 0,93 Volts, 27 Line TERMPWR Idle = 0,167 A
TERMPWR = 4 Volts, Bias = 0,735 Volts, 27 Line TERMPWR Idle = 0,132 A
TERMPWR = 3 Volts, Bias = 0,555 Volts, 27 Line TERMPWR Idle = 0,100 A

Differential termination power requirements can be very high considering the common mode voltage of -7 Volts to +12 Volts with a maximum 6 volt signal. This means the signal lines can be as low as -10 Volts or as high as +15 Volts. The current resistor network, the 330 ohm resistors must withstand 15 Volts or 680 mW. Peak TERMPWR current for 27 lines could be 1.23 Amps with the -10 volt signals at each end of the cable.

Note: EIA485 is designed for 1200 meter applications with a single ground wire, Differential SCSI cables are limited to 20 meters with a minimum of 7 ground wires. The common mode range reduction would reduce the peak power requirements.

2.4.2 Differential Alternate Termination

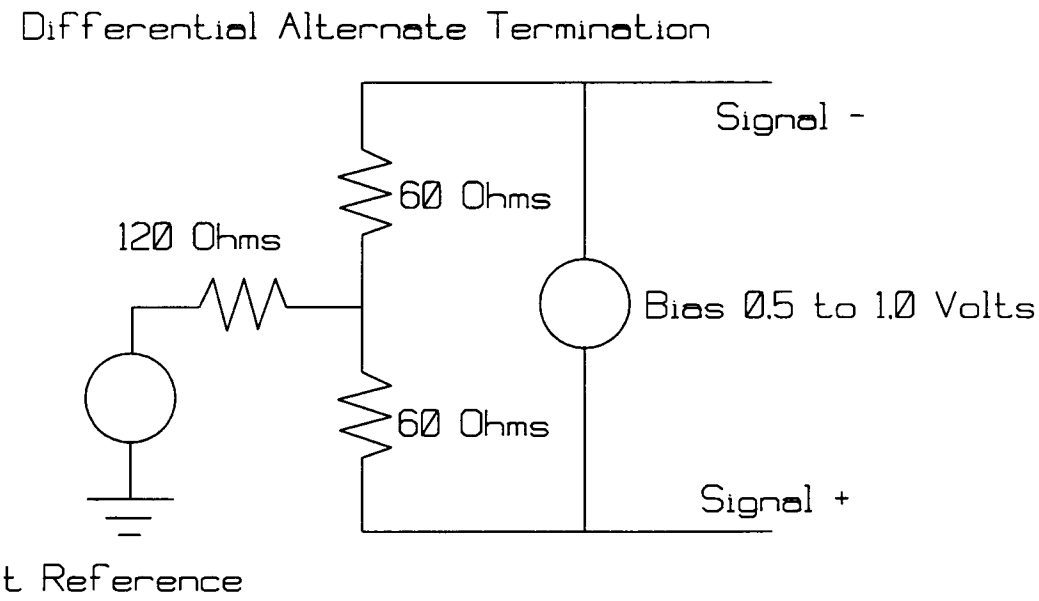
Differential Alternate termination Specifications should be developed, this could reduce the power required over the resistor network.

Alternate termination possibilities should be allowed that establish a bias voltage, with the minimum bias voltage of 0,5 Volts and maintain the differential and common mode termination. The termination is an equivalent 120 ohm differential, and 120 ohm common mode.

Note: the EIA485 specification is just the differential termination resistor of 120 ohms.

A 2 Volt reference point with a 120 ohm common mode impedance to ground, and 120 ohm differential impedance with a bias of 0,5 to 1,0 Volts. This would reduce the power required for the differential termination. The bias would only be loaded by the receivers except when the lines are being driven, at the low voltage this will driving 16 receivers, minimum of 12 K ohms to ground each.

The 2 Volt reference point can reduce the high transient currents that could be passed to the TERMPWR line from the high common mode voltages. The negative and positive transient common mode voltages, the high current can be shunted to ground reducing the TERMPWR transient current.



2.4.3 Differential AC/DC Termination
A combination of AC/DC termination can reduce the power required for the Differential drivers.

3. Sleep mode
Protocol commands need to be added to direct devices to go into sleep mode. Sleep mode for the devices is an entry point to a full shut down of the SCSI bus, where the termination power and the bus controller will be powered down. Sleep mode the drives are spun down only a limited set of the bus logic is powered, all analog control circuitry is shutdown.

Sleep mode is very desirable for battery powered systems, energy star PC and workstations that are required to reduce power on long periods of in activity.

4.0 Powered Down Devices

Powered down devices shall not load the bus. The user can manually power down devices not being used, and repower them if the need arises.

Powered down devices shall meet the maximum capacitance and input current specifications.

Annex A
(Informative)
Drive Spinning Considerations

Spinning down drives to conserve power must consider the life of the drive. Drives must be designed for the application with park and more start/stop life than normal. A basic design rule has been 1 power up cycle per day with a minimum of 3 year life powered on each day. Inactivity spin down can mean 100 drive spin ups a day as an average. The expect start/stop life of a drive should be included in the specifications.

The high spin up power compared to the run power must be carefully reviewed. Spinning down a drive may not conserve power if the drive is stopped for too short of a time. The spin up power and run power of a drive should be specified, this will allow designers to calculate minimum shutdown times that same power.