

Using the TC1264 for Single-Ended SCSI Active Termination

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INTRODUCTION

SCSI (Small Computer Interface) is a bi-directional parallel peripheral bus used in computer systems of all sizes. It is used for computer interface with peripherals such as printers, scanners, magnetic disks, and tape drives. Since its inception, the SCSI bus has grown from 8 to 32 bits, and data rates have risen from 1MHz to 20MHz and upward. Its major benefit is that it allows new peripherals to be added to a computer with no hardware changes.

The SCSI standard provides three electrical configurations: single-ended, differential, and Low Voltage Differential (LVDS). Single-ended is the lowest cost solution and is intended for devices within close proximity (<6 meters) of each other.

SCSI devices are daisy-chained, using a 50-pin "A" or 68-pin "P" (for wide SCSI) conductor cable. Maximum cable impedance, minimum cable size, and connector shielding requirements are specified in the SCSI specifications. Up to eight SCSI devices can be daisy-chained together. The SCSI specification requires all signals, other than GROUND, TERMPWR, and RESERVED, to be terminated at each end of the cable. Any two devices in the chain can be used to terminate the cable. Passive or active termination techniques can be used, but they must meet the following requirements as defined in the SCSI specification:

Passive Termination

1. The termination of each signal shall consist of 220Ω ($\pm 5\%$) to the TERMPWR line, and 330Ω ($\pm 5\%$) to ground. Using resistors with $\pm 1\%$ tolerance improves noise margins.

Active Termination

1. The terminators shall each supply a characteristic impedance between 100Ω and 132Ω .
2. The terminators shall be powered by the TERMPWR line and may receive additional power from other sources, but shall not require such additional power for proper operation.
3. The current available to any signal line driver shall not exceed 48mA when the drive asserts the line and pulls it to 0.5V. Only 44.8mA of this current shall be available from the two terminators.
4. The voltage on all released signal lines shall be at least 2.5V when the TERMPWR line is within specified values.
5. These conditions shall be met with any legal configuration of targets and initiators as long as at least one device is supplying TERMPWR.

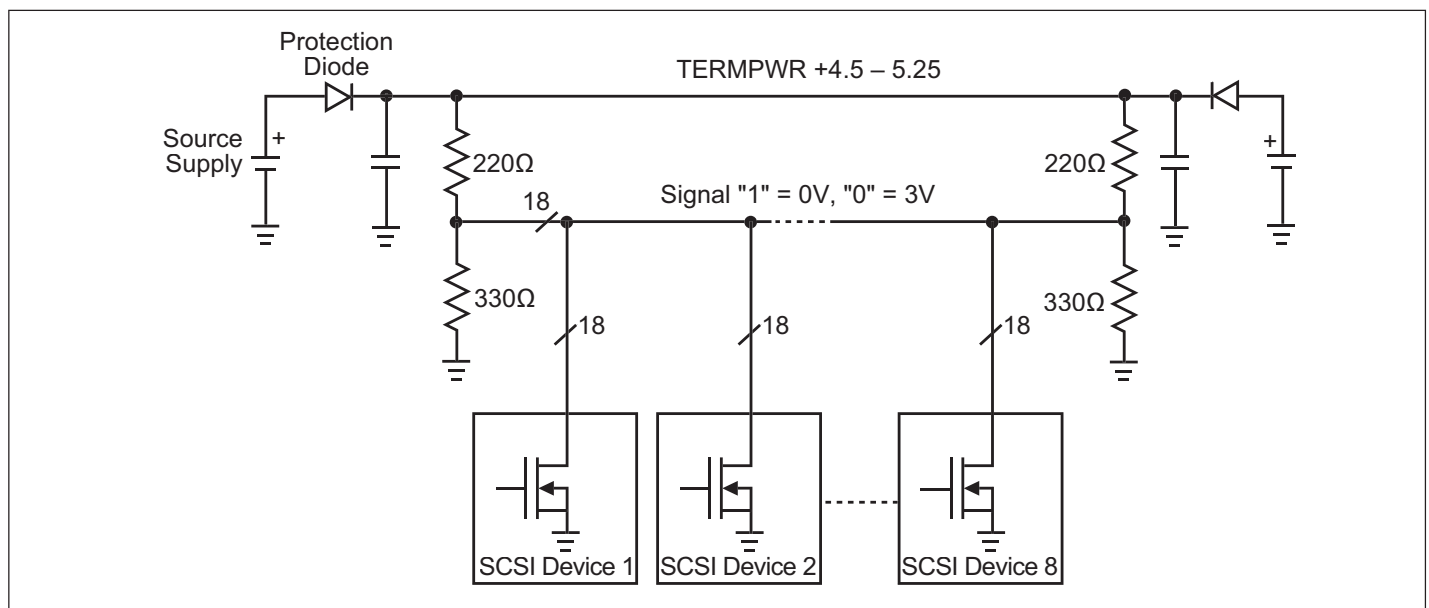


FIGURE 1: Connecting 13-bit remote data logger to 6552 I/O port for data readout.

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PASSIVE TERMINATION PITFALLS

Figure 1 shows a typical SCSI bus using passive termination. This is the lowest cost solution for many applications (not including single-ended SCSI-3 interfaces, which require active termination), but it is not a problem-free solution. The major pitfalls are:

1. The TERMPWR is usually not well-regulated due to ohmic losses as well as variations in supplies and protection diodes. Fluctuations in TERMPWR are transferred directly through the resistor divider, resulting in reduced noise margins on the signal line.
2. When running at higher data rates or on heavily loaded lines (many SCSI devices), passive termination does not ensure signals will be pulled up to their de-asserted states quickly.
3. The resistor divider results in a characteristic impedance of 132Ω , which results in reflections due to the mismatch with the 110Ω cable.

ACTIVE TERMINATION

Active termination is recommended to overcome the pitfalls of passive termination. The recommended configuration that complies with the SCSI requirements is shown in Figure 2. A TC1264 provides a regulated 2.85V to the signal line across the full range of TERMPWR and signal line load variations. An internal bandgap reference and precision feedback resistors maintain a solid 2.85V . The TC1264's low V_{CESAT} pass transistor provides a maximum dropout of 1.3V at 800mA , ensuring plenty of headroom under minimum TERMPWR (4.5V) and full load (all 18 lines asserted $\approx 800\text{mA}$) conditions.

Unlike passive termination, the 1100Ω termination resistor reduces signal reflections, significantly improving signal quality. Thermal shutdown and current limiting are integrated in the TC1264 to prevent system damage from an over-temperature or short circuit condition. The TC1264 is available in either DDPAK-3, TO-220-3 or SOT-223 surface mount packages.

SUMMARY

Microchip's TC1264 three-terminal regulator provides a low cost, easily implemented solution for rectifying the major pitfalls of passive termination.

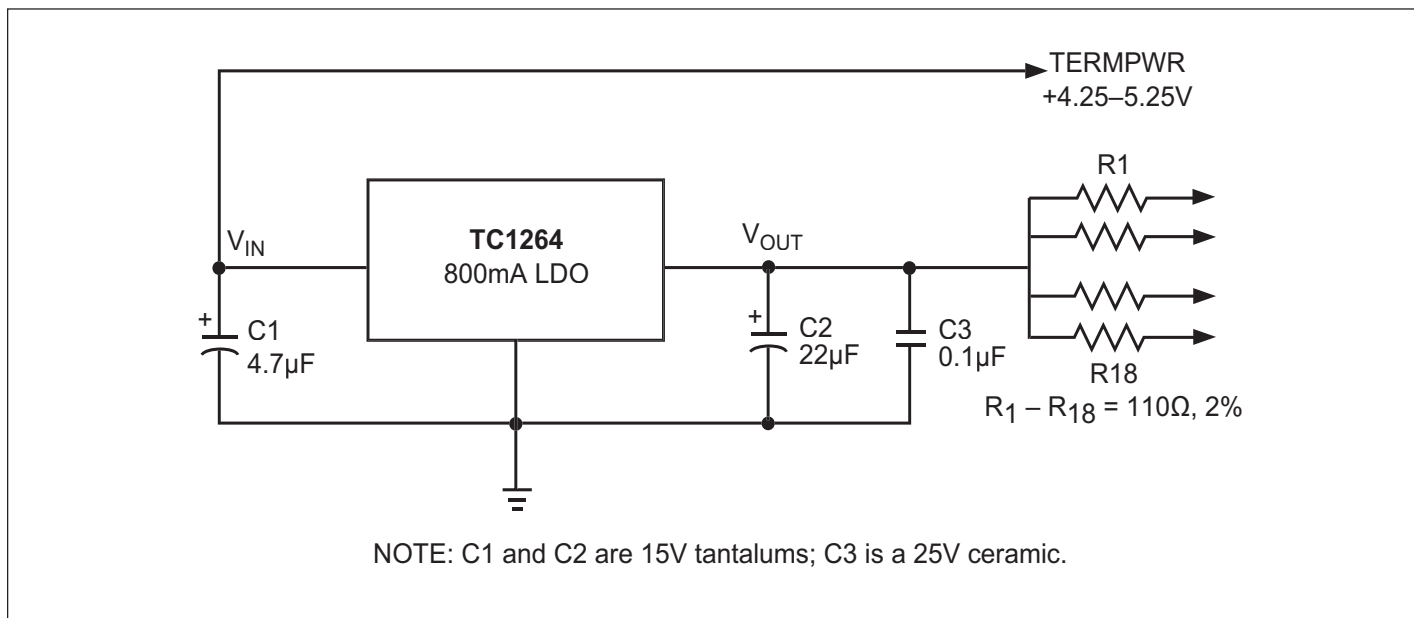


FIGURE 2: TC1264 active termination.

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