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The Future in Microelectronics

CIRCUIT TECHNOLOGY

APPLICATION NOTE #105

CT2525/6/7 Series

CT7005/6 Series

HARDWARE DESIGN CONSIDERATIONS IN 1553 APPLICATIONS

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GENERAL

The CT252X Series of hybrids provide a complete one package interface between the MIL-STD-1553 bus and all microprocessor systems. Since the hybrid contains all the analog transceivers and digital logic to implement a complete Bus Controller (BC) or Remote Terminal (RT), certain guidelines should be followed to insure a successful 1553 design. This paper shall discuss some of the guidelines that should be considered in the hardware design of a RT/BC on a Printed Circuit Board (PCB).

PC BOARD LAYOUT

The design of a RT/BC on a PCB has been greatly simplified by the integration of all the necessary electronics into one hybrid package. One consideration a designer has to be concerned with is placement of the package and the 1553 bus interface components. Figure 1 shows the connections necessary to implement both direct-coupled and transformer-coupled configurations. It is important that the hybrid, transformers, and fault isolation resistors are located as close as possible to the PCB bus interface connector. This is done to ensure that stray impedances introduced by the PCB interconnects are kept to a minimum.

The connections between DATA and $\overline{\text{DATA}}$ of the hybrid and the primary of the bus transformer should be designed to withstand the peak currents that will occur at the required operating duty cycles of the RT/BC design. The designer should also ensure that interconnect capacitance and inductance, in conjunction with transceiver and transformer impedances, does not reduce the overall input impedance of the RT/BC below the value stated in MIL-STD-1553B. Overall, the transceiver PCB connections should be balanced in terms of length, shape, and area.

In an ideal situation the designer will be able to provide a separate ground and power plane in a multilayer PCB. In this case all logic ground and transceiver ground pins of the hybrid should be connected to this ground plane. The ground plane should cover as much area of the PCB as possible, but with one exception: there should be no ground or power plane material underneath the 1553 transformer. Testing has shown that a ground or power plane underneath the transformer can alter the transformer's characteristic impedance.

If a ground plane is not possible then separate PCB traces should be provided for logic and transceiver ground. These traces should be as wide as possible and come together at the point where system ground enters the PCB.

DECOUPLING

Liberal use of decoupling capacitors is highly recommended. At a minimum there should be:

- A 50-100 μ F capacitor connected to ground and each power rail as it enters the PCB.
- A 0.1 μ F ceramic bypass capacitor between ground and every hybrid and IC power pin. The capacitor should be as physically close to the pin as possible.
- CT2527 only, a 0.1 μ F and a 22 μ F (preferably tantalum) capacitor between ground and the primary center tap of the 1553 transformer.

COMPONENT SELECTION

A minimum amount of external parts are needed to complete a RT/BC using the C1252X series, but the criteria for selecting them is important. Here are a few suggestions:

Transformers - Should be designed and approved for MIL-STD-1553 applications. We recommend Technitrol

transformers, see Table 1 below for part numbers.

Fault Isolation Resistors - For direct-coupled configurations they should be 55 ohms ($\pm 2\%$), and for transformer coupled configurations they should be 75% of the nominal impedance of the 1553 bus cable ($0.75 \cdot Z_0$, $\pm 2\%$). In either case the resistors should be *non-inductive*. Wire-wound power resistors should not

be used because the reactance of these resistors at the 1Mz data rate could cause distortion in the 1553 waveform. The power rating of the resistors should be chosen to take into account worst case conditions, which is 100% transmission duty cycle with a short on the data bus cable. The power rating can then be reduced according to the actual transmission duty cycle of the RT/BC application.

Table 1

HYBRID PART NUMBER:	CT2525	CT2526	CT2527 *
POWER SUPPLY REQUIREMENTS:	+15,-15,+5	+12,-12,+5	+ 5
TECHNITROL TRANSFORMER:	QI553-2	QI553-1	QI553-35

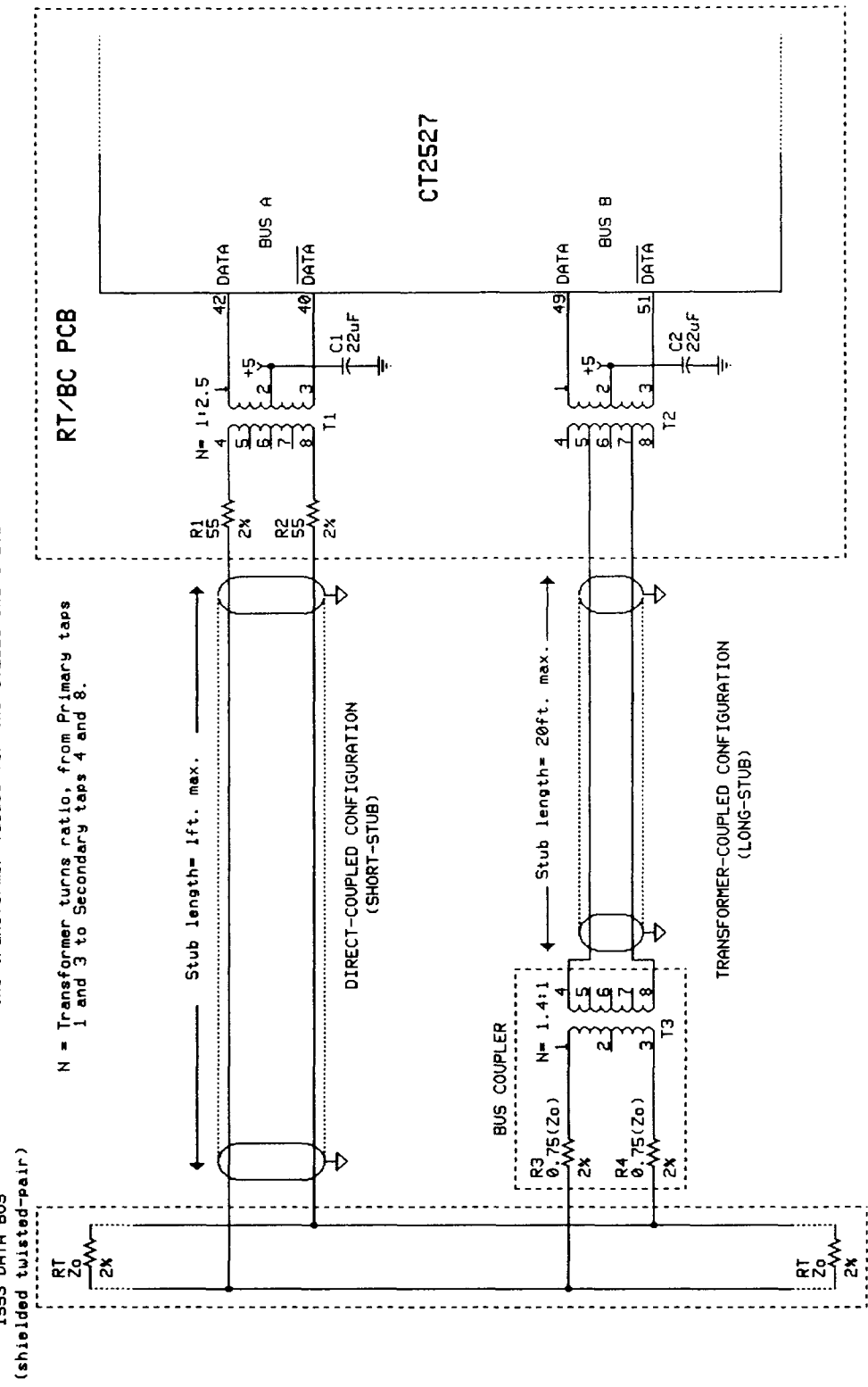
* Applies to CT7005 and CT7006

SUMMARY

This paper has attempted to answer the most commonly asked questions concerning the use of the CT252X series of hybrids. Forthcoming application notes will address additional hardware concerns and software methodology. Information on the CT252X series, or any other 1553 data bus product, can be obtained by calling the Applications Dept. at (516) 752-2484.

The information presented herein is to the best of our knowledge true and accurate. No warranty expressed or implied is made regarding the capacity, performance or suitability of any product. You are strongly urged to ensure that the information given has not been superseded.

NOTE: Transformer values shown are for the CT2527, please refer to the CT2525/6/7 Data Sheet for the transformer values for the CT2525 and CT2526.



Z_0 = Nominal characteristic impedance of the bus cable, which is 70 to 85 ohms @1Mhz.

Figure 1