Possible Ideas on a New DCR Backplane Design

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Introduction

This report describes some recent ideas on the development of a backplane for the Direct Conversion Receivers (DCR) [1]. In the current implementation, no backplane exists and instead each DCR has a aluminum enclosure. These are not compact and difficult (time consuming) to mount in a rack. The new backplane approach would provide the following features:

1. A backplane to distribute power (+9V, +5V, -5V, +5V, +3.3V) which significantly reduces number of regulators (800% reduction). This represents a significant cost reduction (although offset by the cost of a backplane.)

2. A backplane to distribute the ADC clock, instead of distributing it across LVDS cables. A recent document suggests that high speed LVDS signals should not share the same cable [2].

3. A backplane to provide a robust mounting mechanism to support the DCRs. By having no power regulation on each DCR there is no large amount of heat to sink.

4. Enclose each DCR in a low cost case on the back plane. This case consists of a cross section of aluminum tube measuring 5" $\times$ 2" (with a aluminum sheet cover bolted down with six 4-40 screws.) Connectors (RF, LO, LVDS) are soldered to the rear of the PCB. This increases the number of DCR's per cubic inch, since the case is only 3/8" thick.

5. The backplane would support a Rabbit μController which would control a multi-channel DAC (1-4V output) which allows gain control of each DCR.

1 Proposed DCR Backplane

The DCR backplane could possibly consist of a set of 96-pin Euro connector (3 rows of 32 pins spaced at 0.1"), a Rabbit μController, a multi-channel DAC, five voltage regulators and a CMOS-to-LVDS translator, as shown in Figure 1(a). The Euro connectors provide a stable connection for the power supplies, LVDS clock and gain control. The eight channel backplane would be approximately measure 5" $\times$ 14", and the spacing between channels is $1\frac{1}{4}$". ($8 \times 1\frac{1}{4}$" = 10", leaving 4 inches for power regulation and the Rabbit μController.)

The backplane has a simple layout which only requires a 2-layer circuit board; the top layer being a solid ground plane and the bottom containing the power and control traces.

The layout of the new DCR is also shown for reference in Figure 1(b), with a possible layout of the Euro connector There is a redundancy of 9 pins for most of the power connections. Note that there is an extra power connection for -5V, which may be required for the op-amp buffer before the ADC. The DCR PCB could possibly be required to be a 3-layer circuit board in order for the back of the circuit board to be a complete ground plane. The inner layer would then contain the split power planes, and the top the signal paths.

The power consumption of the DCR is listed in Table 1. Due to the negative power supply for the buffer the module would also require a negative 12V power supply. The power supply would thus have a rating of +12V@5A and -12V@0.5A.

Table 1: Estimated power consumption for DCR backplane.

Voltage	Single Channel Current	8-Channel Current
$V_{RF} = 9.0V$	200mA	1.6A
$V_{DCT} = 5.0V$	100mA	0.8A
$V_{BUF} = -5.0V$	20mA	0.2A
$V_{ADC} = 5.0V$	50mA	0.4A
$V_{DIG} = 3.3V$	100mA	0.8A
	Total ≈470mA	Total ≈4A

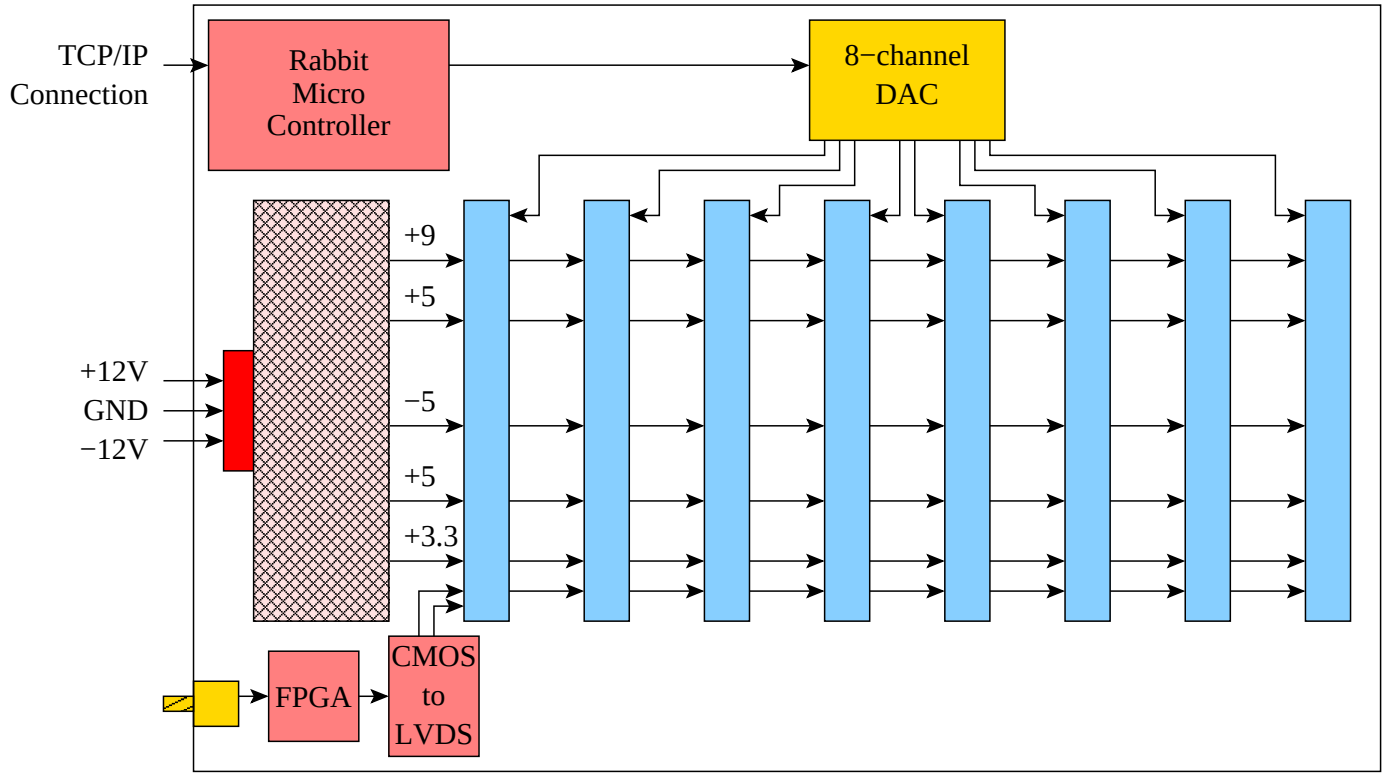
Summary and Conclusions

This report has presented a possible backplane implementation for the ARGUS "2002" architecture. The implementation of a backplane would save considerable time and money, as well as adding several new features. The DCR PCB requires a number of changes to make it possible.

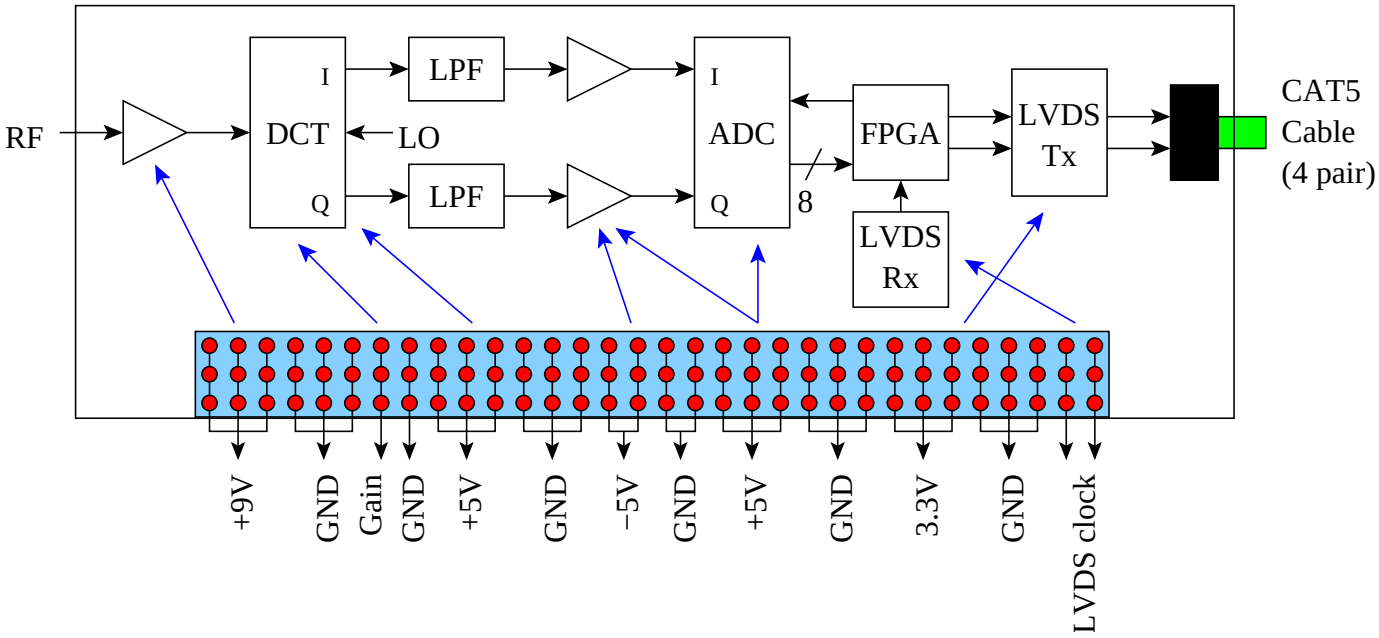
References

[1] G. A. Hampson, "A New Argus Direct Conversion Receiver and Digital Array Receiver/Processor," October 3 2002. http://esl.eng.ohio-state.edu/~swe/argus/argus.pdf.

[2] *National Semiconductor DS92LV16 Design Guide*, National Semiconductor, February 2002. http://www.national.com/appinfo/lvds/files/ds92lv16guide(r1.01).pdf.



(a) The proposed DCR backplane



(b) Backplane Connector Layout

Figure 1: The proposed DCR backplane and new DCR layout.