DEVELOPMENT OF THE PRINTED CIRCUIT UNITS FOR MILTIWIRE CHAMBERS

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Abstract

The paper considers finished 16-channel printed circuit units (PCUs), intended to read out and process preliminary the signals of multiwire chambers. Their characteristics reflect the trends in mount density increase (up to 1 front-end channel per 1 cm.cub.).

The PCUs are built with 8-channel ICs of amplifier-shapers and discriminators based on application specific semicustom arrays.

The considered units are implemented with 4-layer PCBs measuring 90*40 mm.sq, which may be simply combined into a 32-channel unit. ICs and other components are mounted by surface mount technology.

The basic electrical characteristics of PCUs and ICs are presented.

1. INTRODUCTION

The designers of the systems of radiation detector signal acquisition face the problem of reducing unit dimensions at channel number increasing. Its solution consists in the improvement of both the design of the PCB itself and the one of the front-end ICs, which must contain a greater number of channels.

Further (see p.3) there are considered finished 16-channel printed circuit units (PCUs), intended to read out and process preliminary the signals of multiwire chambers. The given units are a development of the PCUs presented at the 3-rd and 4-th Workshops [1,2]. The PCUs are built with 8-channel ICs of amplifier-shapers and discriminators based on application specific semicustom array. These ICs are described in the following section.

2. 8-CHANNEL ICs OF AMPLIFIER-SHAPERS AND DISCRIMINATORS

The structural diagram of a single channel is presented in fig.1. It contains a preamp with differential input, main amplifier-shaper, base line restorer (BLR), comparator and output driver. On the basis of one and the same application specific semicustom array (ASSA), manufactured by an npn bipolar technology with unity-gain frequencies above 6 GHz (at collector current 1 mA), there have been manufactured two eight-channel ICs, one containing amplifier-shapers and the other – the subsequent units of the channel.

In fig.2 the simplified schematics of the amplifier-shaper is shown. The schematics of the subsequent channel part was considered earlier in [3].

Standard input dynamic range makes up 5…200 uA. The discriminator (high-speed comparator) outputs provide a quasidifferential output in the GTL standard. The rest of the channel's electrical characteristics are presented in the table below.

Transresistance, kOhm	25
Input resistance, Ohm	330
Shaper output rise time, ns	10
Output pulse duration at base level, ns	50
Shaper output full swing, V	2,5
Range of comparator threshold setting, mV	10..2000
Comparator rise time at C load = 5pF, ns	3
Comparator fall time at C load = 5pF, ns	5
Comparator propagation delay, ns	8
Power consumption per channel, mW	40
Supply voltage, V	±3

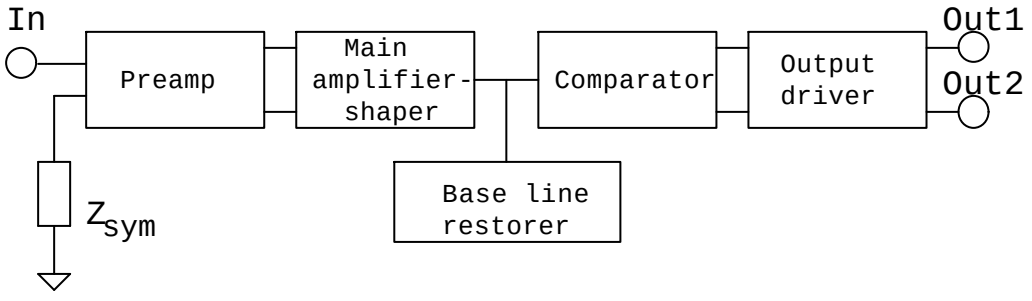

Fig. 1. The structural diagram of a single channel

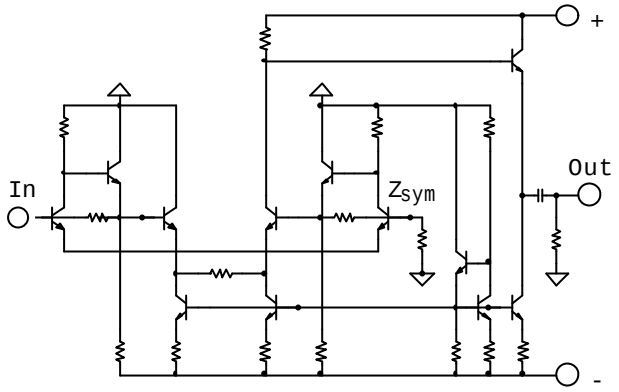

Fig. 2. The simplified schematics of the amplifier-shaper

The features of the ICs are first of all the large maximal output amplitude of the amplifier-shaper (not less than 2.5 V), allowing to use the amplifier-comparator channel not only for timing signal generation, but also to store and process amplitude information. Moreover, at a standard dynamic range of 100 (from noise and up to the maximal amplitude) this allows to operate with higher comparator thresholds and thereby reduce problems with pick-up and cross-talk in a multichannel system.

3. PRINTED CIRCUIT UNITS

The considered units are implemented with 4-layer PCBs measuring 90*40 mm.sq. ICs and other components are mounted by surface mount technology. The unit is connected with the detector by four 10-pin FPC connectors Harwin F10. At the unit`s output a 40-pin Hirose connector with a pitch of 1.27 mm is used.

Two modifications of the PCU (lower one UP25411L and upper one UP25411U), capable to be joined in a bookstand manner, forming a 32-channel unit, have been manufactured. The mount density increases thereat up to the value of 1 front-end channel per 1 cm.cub.

The general view of the PCUs is presented in fig. 3. At present a new modification of the ICs is prepared, having a greater input sensitivity (gain of preamp).

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4. REFERENCES

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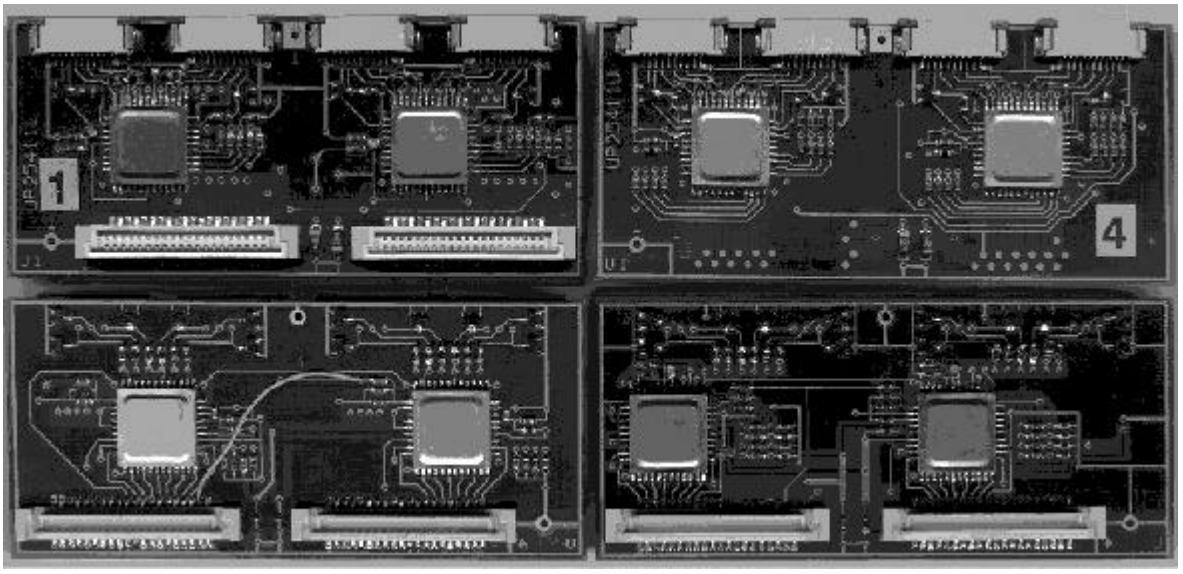

Fig. 3. The photo of UP25411 PCUs (-L and –U modifications)