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Time-Performance Design and Study of Ultra-Wideband Amplifiers for SiPM

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The recent advances in SiPM technology and the high demanding performance required by the current applications, especially in the field of time-of-flight estimation, calls for a new approach in the design of the front-end amplifier to preserve the correct timing of the signals. SiPM manufacturers are offering devices with dedicated pins for fast-time outputs and recommending front-end amplifiers based on commercial devices for microwave and radio-frequency. We present in this paper our experience in designing customized wide-band amplifier front-ends for SiPM signals in high-resolution timing applications.
The design consists of two stages, the first based on a low noise device (typically a JFET/MOSFET, but we have tried etherojunction transistors as well) to achieve the minimum noise figure and the second based on a MMIC used as a gain stage to boost the signal and maximize the power transfer to the output. The design procedure is a combination of the traditional approach of circuit simulation integrated with techniques involving the use of S-parameters, typical of RF applications. Two versions of the amplifier have been laid out and assembled and are currently under test. Together with the preliminary results we show the advantages of our proposal in achieving very good time resolution performance and point out some possible future improvements.

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