ABSTRACT

Low-Voltage, Low-Power Circuits for Data Communication Systems.

(December 2003)

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There are growing industrial demands for low-voltage supply and low-power consumption circuits and systems. This is especially true for very high integration level and very large scale integrated (VLSI) mixed-signal chips and system-on-a-chip. It is mainly due to the limited power dissipation within a small area and the costs related to the packaging and thermal management.

In this research work, two low-voltage, low-power integrated circuits used for data communication systems are introduced. The first one is a high performance continuous-time linear phase filter with automatic frequency tuning. The filter can be used in hard disk driver systems and wired communication systems such as 1000Base-T transceivers. A pseudo-differential operational transconductance amplifier (OTA) based on transistors operating in triode region is used to achieve a large linear signal swing with low-voltage supplies. A common-mode (CM) control circuit that combines common-mode feedback (CMFB), common-mode feedforward (CMFF), and adaptive- bias has been proposed.

With a 2.3V single supply, the filter's total harmonic distortion is less than –44dB for a $2V_{PP}$ differential input, which is due to the well controlled CM behavior. The ratio of the root mean square value of the ac signal to the power supply voltage is around 31%, which is much better than previous realizations.

The second integrated circuit includes two LVDS drivers used for high-speed point-to-point links. By removing the stacked switches used in the conventional structures, both LVDS drivers can operate with ultra low-voltage supplies. Although the Double Current Sources (DCS) LVDS driver draws twice minimum static current as required by the signal swing, it is quite simple and achieves very high speed operation. The Switchable Current Sources (SCS) LVDS driver, by dynamically switching the current sources, draws minimum static current and reduces the power consumption by 60% compared to the previously reported LVDS drivers. Both LVDS drivers are compliant to the standards and operate at data rates up to gigabits-per-second.