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## 低电压全摆幅恒跨导CMOS运算放大器的设计

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### Design of A Low-Voltage, Rail-to-Rail and Constant Trans-ConductanceCMOS Operational Amplifier

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- 摘要
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**摘要** 给出了一种常用两级低电压CMOS运算放大器的输入级、中间增益级及输出级的原理电路图,并阐述其主要工作特性.输入级采用了NMOS管和PMOS管并联的互补差分输入对结构,使输入共模电压范围达到全摆幅(rail-to-rail),并采用了成比例的电流镜技术以实现输入级跨导的恒定;中间增益级采用了适合低电压工作的低压宽摆幅共源共栅结构的电流镜负载,提高了输出电阻,进而提高了增益,同时更好的实现了全摆幅特性;输出级采用了高效率的推挽共源极功率放大器,使输出电压摆幅基本上可以达到全摆幅;为了保证运放的稳定性与精确性,其基准电流源采用一个带电流镜负载的差分放大器;为防止运放产生振荡,采用了带调零电阻的米勒补偿技术对运放进行频率补偿.

**关键词:** 运算放大器 全摆幅 跨导 电流镜 互补差分输入对

**Abstract:** The principle figures of input stage middle gain stage and output stage for a usual two stage low-voltage CMOS operational amplifier and their principal performance are presented in the paper.In the input stage the parallel supplementary differential input pair structure by using NMOS tube and PMOS tube is applied in order to enable the input common mode vottage range to achieve rail-to-rail.To realize the contant transconductance of input stage,the proportional current mirror technology is used.In the middle gain stage,the current mirror load of low voltage wide-swing cascade structure is adopted which is suitable to work in low voltage and increases output resistance,i.e.gain,and realizes rail-to-rail.In the output stage,in order to enhance the efficiency and reach rail-to-raip,it uses the push-pull common soure pole amplifier.To design a norm current source,the differential amplifier with current mirror load is applied which provides the stable bias current and bias voltage to the operational amplifier in order to guarant its stability and accuracy.For preventing op amp oscillation,the Miller compensation technology with adjusting zero resistance is adopted.The simulation by using Hspice software shows that the performance of the operational amplifier well meets the design requirement.

**Key words:** operational amplifier rail-to-rail transconductance current mirror supplementary differential input pair

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