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# IVDAC

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## I. INTRODUCTION

Modules for general market generally use current control for the PA bias to allow good accuracy at low output power settings. This has worked well over several generations of products. Unfortunately, using current control at very high power levels such as those required for B41 power class 2 (PC2) creates a problem known as “gain overshoot” in the phone calibration and users have demanded a fix. An effective fix is using voltage control for the PA bias for the highest output power settings and this has been implemented by having both an IDAC for current control and a VDAC for voltage control in the same controller. This scheme solves the problem but increases the die area for a market that is extremely price sensitive.

## II. DISCUSSION

The invention is a circuit that combines a VDAC (Digital to Analog Converter Voltage source) and an IDAC (Digital to Analog Converter Current source) into one circuit. This is done by reusing the largest elements of the IDAC for the VDAC. The circuit is either in the mode of a VDAC or an IDAC. The two circuits have three main elements which are: Opamp, feedback and output stage. The elements which are shared between the two circuits are the Opamp and the output stage.

The invention is intended to combine the functionality of an IDAC and a VDAC into one circuit which takes up the same space as one of the circuits.

There a three main elements to both the IDAC and the VDAC as shown in Figure 1. These elements are the Opamp, feedback and output stage, of these three elements the IDAC and the VDAC have both the Opamp and output stage in common. It is therefore possible to reuse both the Opamp and output stage from the IDAC to generate a VDAC mode, as illustrated in Figure 2. Figure 2 is a simplified schematic of the new IVDAC where it is illustrated that there is only one Opamp and one output stage left, which also illustrate that the circuit takes up close to the same amount of space as one IDAC. The main difference between the IDAC and VDAC is the feedback, the difference in feedback

is handled by making it switchable in the IVDAC as illustrated in figure 3. The circuit is only able to be in either IDAC or VDAC mode at one point in time, this is however the main idea, as the IDAC and VDAC are currently used as biasing for the same circuit (PA).

Further advantages of the combined circuit is that only one Opamp have to be biased, meaning we only have to generate one bias current instead of two. In addition the combination allows for faster mode changing from IDAC to VDAC as the Opamp and output stage is already in an active state. It is possible to save space on the die by combining the IDAC and VDAC circuits in other ways then described earlier, such as only reusing the output stage which is the largest element, or only reusing the Opamp which is a smaller circuit but allows the circuit to be bias by a single bias current.

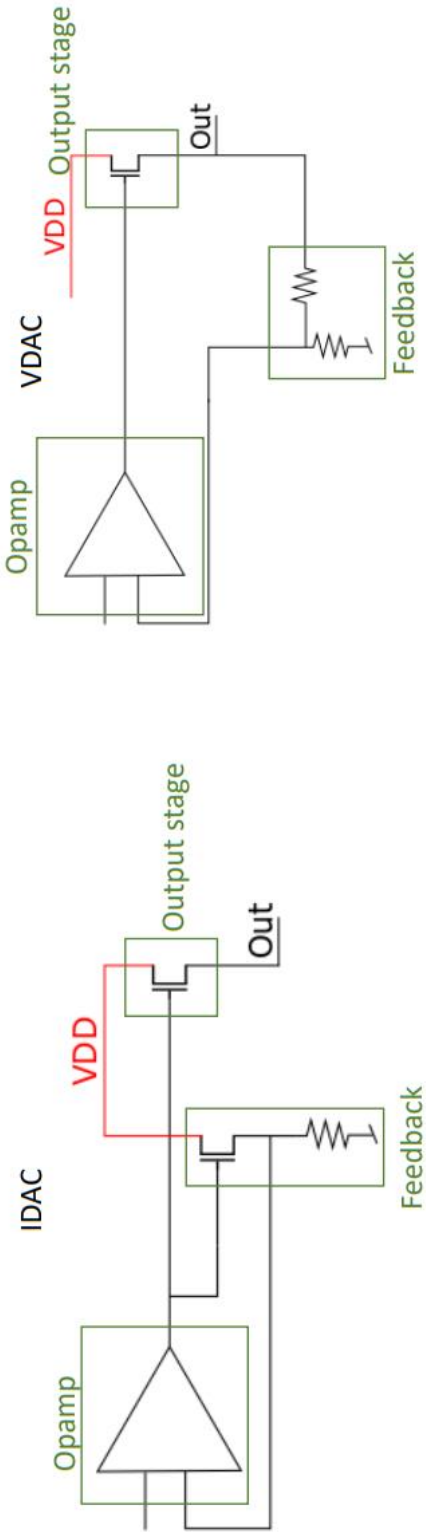

Output stage
Out
VDD
VDAC
Feedback
Opamp
Output stage
Out
VDD
IDAC
Feedback
Opamp

Figure 1

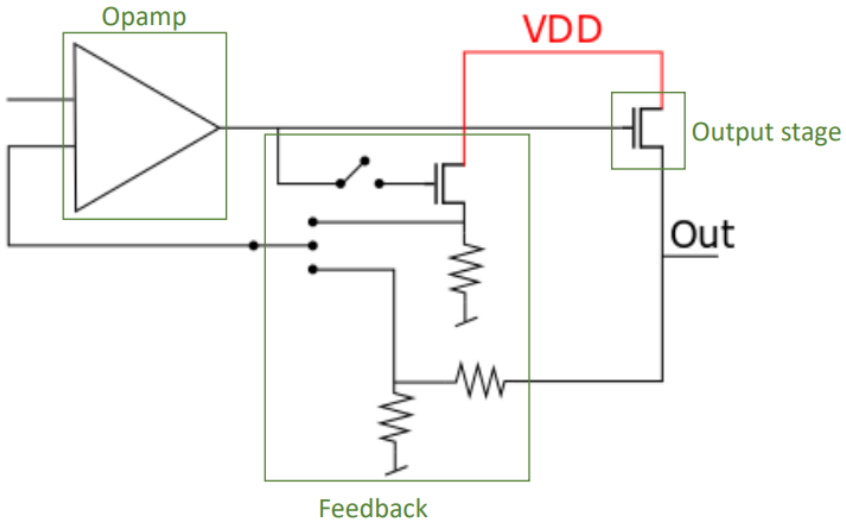
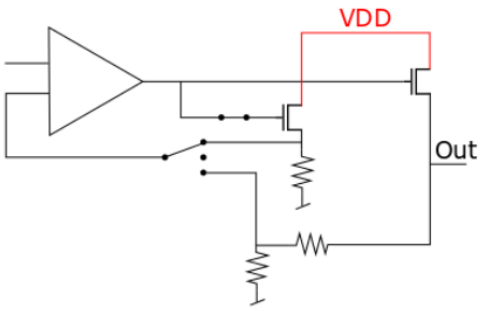



Figure 2

**IDAC mode**




**VDAC mode**

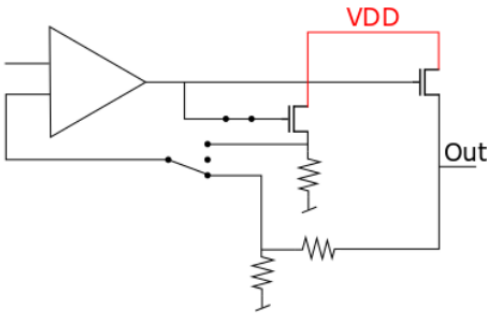



Figure 3