

A Wide Output Range, High Power Efficiency Reconfigurable Charge Pump in 0.18 μm BCD process

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Abstract—This paper presents a wide output range, high power efficiency reconfigurable charge pump for driving touch panels with the high resistances. The charge pump is composed of 4-stages and its configuration automatically changes based on the required output voltage level. In order to keep the power efficiency over the wide output voltage range, internal blocks are automatically activated or deactivated by the clock driver in the reconfigurable charge pump minimizing the switching power loss due to the On and Off operations of MOSFET. In addition, the leakage current paths in each mode are blocked to compensate for the variation of power efficiency with respect to the wide output voltage range. This chip is fabricated using 0.18 μm BCD process with high power MOSFET options, and the die area is 1870 μm x 1430 μm . The power consumption of the charge pump itself is 79.13 mW when the output power is 415.45 mW at the high voltage mode, while it is 20.097 mW when the output power is 89.903 mW at the low voltage mode. The measured maximum power efficiency is 84.01 %, when the output voltage is from 7.43 V to 12.23 V.

Index Terms—Charge pump, reconfigurable, high power efficiency, wide output range

I. INTRODUCTION

A Charge Pump that generates higher voltage than the supply voltage is used for flash memories or touch panel application. These charge pumps should be able to drive the intrinsic panel resistance, because all the panels of a touch panel application include panel resistance. Recently, the need has increased for a charge pump that can drive various resistances of panels due to increasing demands for touch panels with various sizes and performance. To drive panels with a wide range of variable resistance, the range of charge pump output voltage should be as wide as possible. Hence, high output voltage of the charge pump is needed to drive high resistance inside the panel. The structures of the Dickson charge pump and Wu and Chang's Charge Pump have been used as a charge pump, since they can generate higher voltage than input voltage [1].

However, in these structures, the overall power consumption increases due to the power consumption of mode control blocks, and leakage current of charge pump core at low output voltage mode. Hence, it is difficult to adopt these structures for multi-mode charge pump architecture. In other existing charge pump circuits, the output voltage can increase using additional stages of a charge pump [2]. However, to be applied to touch panels, a charge pump must not only have high output voltages, but also enough output current to drive the resistance of the external panel.

In this paper, a clock driver and switch (SW0) are activated or deactivated by the mode control signal to minimize the degradation of power efficiency. Also, a method is proposed to block all current paths except the

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