國立交通大學

電子研究所

碩士論文

應用於帕金森氏症八通道

單端雙相電流電壓刺激器

Design of Monopolar Biphasic 8-channel

Current and Voltage Stimulator

for Parkinson's Disease

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摘　　要

神經調節是一種改變神經行為的技術，可以被應用於非常多的疾病。比如說在帕金森氏症中，病患在長期吃藥後已無法解緩症狀，此時就可以尋求神經調節的幫助。神經調節分為化學手段或是電刺激。化學神經調節是利用植入的方式將藥劑放置到組織中。電神經調節是用電來刺激神經。電刺激有許多種模式，單雙端，單雙相，定電流與定電壓輸出。單端刺激意指為選擇一個電極對地刺激，雙端是選擇兩個電極互相刺激，單雙相則代表刺激的波形，一個波形是單相，兩個波形是雙相。

本篇提出三種單端雙相刺激器，分別為低壓定電流的刺激器，低壓和高壓的定電流電壓刺激器。低壓電路是利用 0.18μm 低壓製程設計，高壓為利用 0.25μm高壓工藝製作。低壓定電流刺激器可產生 $0 \sim \pm 3.6$mA，一個刻度是 0.2mA。所需的電壓是 ±6V, ±3V 和 1.8V。低壓定電壓電流刺激器為定電流低壓產生器再額外加上定電壓輸出功能。電壓輸出範圍是 0∼ ±3.6V 一個刻度是 0.2mA。高壓的定電壓電流刺激器功能是和低壓的相同，但是輸出的電壓電流範圍比較大可以輸出 $0 \sim \pm 10$V and $0 \sim \pm 10$mA，一個刻度是 0.2mA。高壓定電壓電流刺激器所需 ±15V, ±10V ±5V and 2.5V。在量測時這些電壓會直接由電源供應器提供，但整合在 SoC 中可以使用電源管理單元提供。

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ABSTRACT

Neuromodulation is a technique to affect nerve behavior and the device of it can be implanted in many places to treat illness such as Parkinson's disease. Neuromodulation can be chemical or electrical. Chemical neuromodulation is to implant pharmaceutical agents to tissue. Electrical neuromodulation is to use electric to stimulate nerves. The stimulation can have two stimulation modes (voltage and current), two system configurations (monopolar and bipolar), and two kinds of stimulation pulses (monophasic and biphasic). This thesis proposes three monopolar biphasic stimulator architectures, current stimulator in LV and current and voltage stimulator both in LV and HV. The LV circuit is designed in 0.18μm LV 1.8/3.3V CMOS process and HV is designed in 0.25μm 2.5/5/12V HV CMOS process.

The LV current stimulator can provide $0 \sim \pm 3.6$mA with 0.2mA per step. The power supplies are ±6V, ±3V and 1.8V. The LV current and voltage stimulator is the current simulator with an additional function to provide $0 \sim \pm 3.6$V with 0.2V per step. The HV current and voltage stimulator function is the same as the function of LV current and voltage stimulator but the output can be $0 \sim \pm 10$V and $0 \sim \pm 10$mA. The power supplies of HV current and voltage simulator are ±15V, ±10V ±5V and 2.5V. The power mentioned before are generated by power supply at the time of measuring. However, it will be provided by power management unit in SoC.