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Wearable Bio-Sensing Series

Application

Electrodermal Activity (EDA) – also referred to as **Galvanic Skin Response (GSR)** – refers to the variation of the electrical conductance of the skin in response to sweat secretion and is linked to mental states like stress, emotion, and cognitive states. The sympathetic nervous system directs the response of the body to certain situations (for example, a stressful situation) and accordingly sudomotor nerve activity leads to firing of the sweat glands. This leads to a change in conductance of the skin. EDA has the potential for widespread applications including recognition of emotional or cognitive stress, mood, fatigue, depression and diagnosis of epilepsy. By measuring the skin conductance between 2 electrodes contacted by the fingers of the same hand, EDA-based bio-sensing is possible to be implemented on a wrist-worn device like a smart watch. The signal chain for EDA measurement has a mechanism to inject a current between the two electrodes and the measured voltage is an indicator of the conductance. Usually, an AC excitation of low frequency (typically 10s of Hz) is used so that the excitation current flows close to the skin surface and encounters only the skin impedance. Key challenges of EDA signal acquisition on a wearable device include high-contact impedance due to small form factor electrodes, and a need for low power consumption. The AFE4500 enables high-quality EDA signal acquisition with low noise and low power consumption, making the device an ideal choice for Wearable EDA applications.

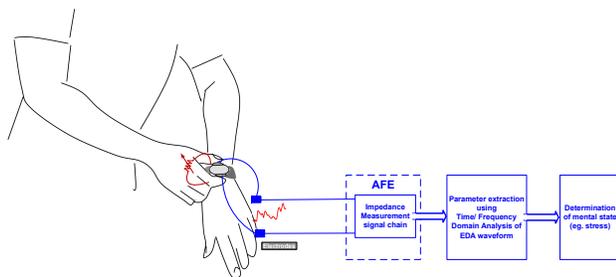


Figure 1. EDA Measurement System

AFE4500

- **Interface:** SPI™, I2C interfaces: Selectable by pin
- **Package:** 3-mm × 2.6-mm DSBGA, 0.4-mm pitch
- **Supplies:** Rx: 1.7 V–3.6 V, IO: 1.7-RX_SUP

Features

- FIFO with 256-sample Depth
- Internal oscillator, External clock options
- Integrated LDO

Differentiation

- Two separate signal chains for *high-accuracy* EDA monitoring as well as *low-power* EDA monitoring
- Supports interface to up to 4 electrodes
- Programmable EDA excitation frequency from 5 Hz
- Supports other bio-sensing modalities like Photoplethysmography (PPG), Electrocardiography (ECG) and Bio-impedance (Bio-Z)

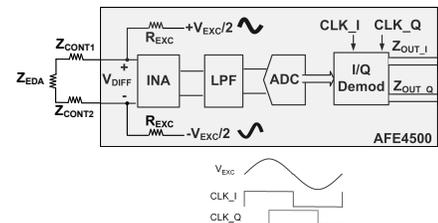


Figure 2. EDA Measurement Signal Chain

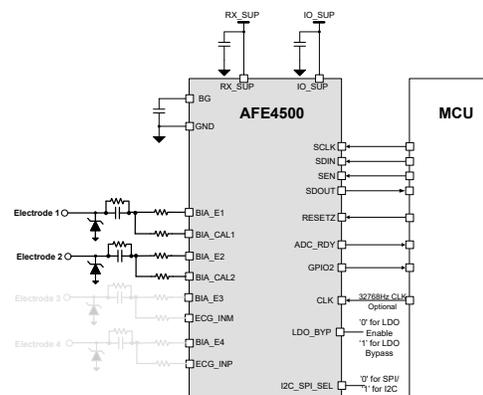


Figure 3. Reference Schematic

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