BISC N65K

Fully Wireless Neural Recording System with a 65536-Electrode Array

Features

- ★ System
  - Integrated 65536 titanium nitride (TiN) surface electrodes
  - Wireless powered from a 13.56 MHz (F_{ref}) Inductive Link
  - Communicates to a relay station through Ultra-wideband (UWB) radio
  - Simultaneous recording from 1024 or 256 electrodes
  - Constant current biphasic stimulation with ± 1.4V compliance
- ★ Processor
  - Full-custom logic running at up to 108.5 MHz (F_{ref} * 8)
- ★ ADC
  - 10-bit SAR ADC running at an average 8.7 MHz (F_{ref} * 16/25)
- ★ Analog Front End
  - Chopper stabilized pixel amplifier with programmable chopping frequency
  - Effective sampling rate of 33.9 kHz (256 electrodes) or 8.5 kHz (1024 electrodes)
- ★ Wireless Transceiver
  - 108.5 MBps uplink and 54.3 MBps downlink
  - Ultra-wide band (3.5-4.5 GHz)
- ★ Power management
  - 60mW maximum received power

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1. Description

BISC is an Implantable Wireless High-Density Microelectrode Array System, a state-of-the-art solution architecturally designed to facilitate a minimally invasive bridge between the brain and computational devices. This system, comprising an integrated circuit chip, a headstage, and a base station, enables users to monitor and modulate neural signals in real-time.

Terminology

BISC refers to the complete system that contains:

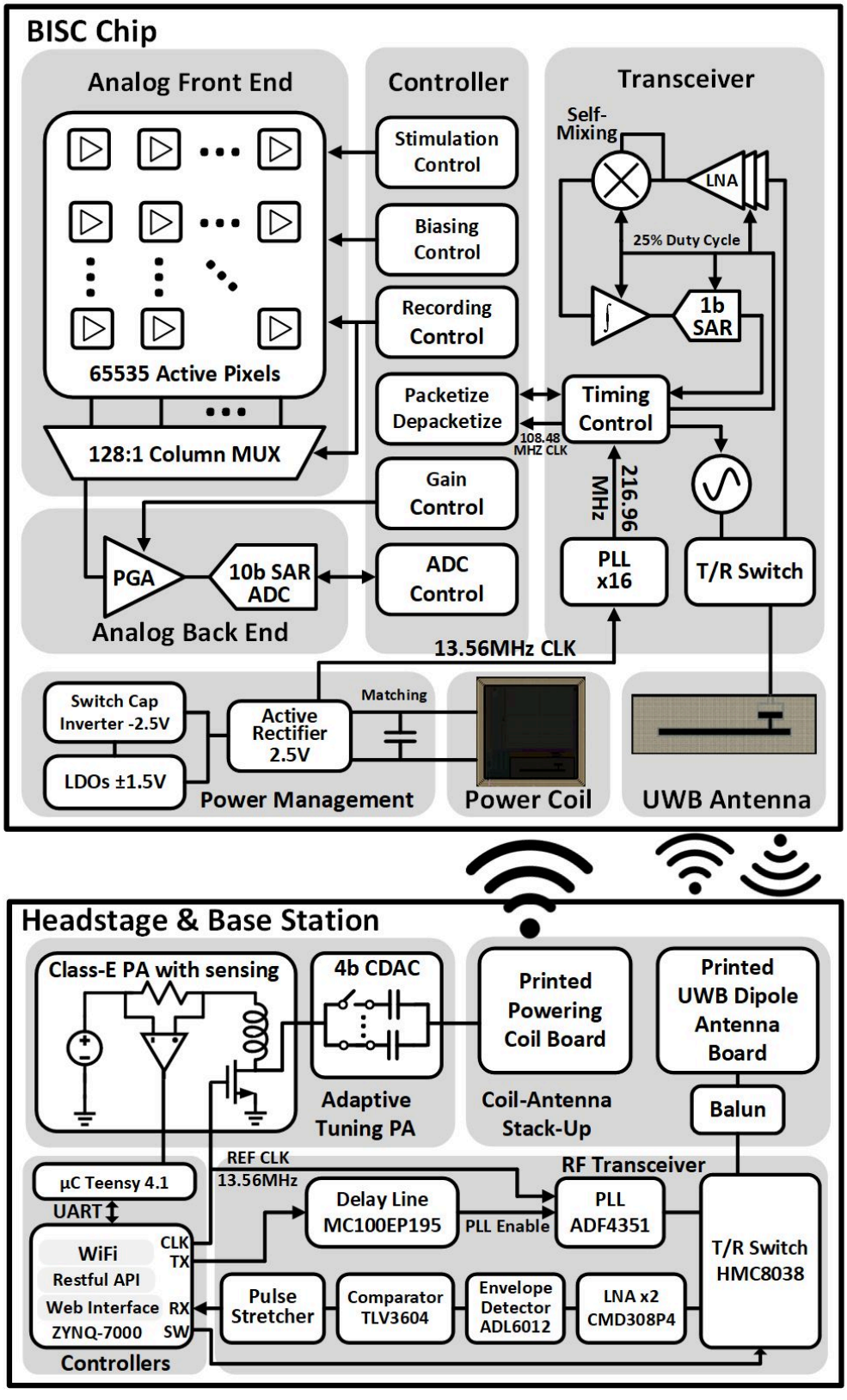
BISC Chip – The implantable integrated circuit chip

BISC Headstage – The external hardware that wirelessly connects to the BISC Chip

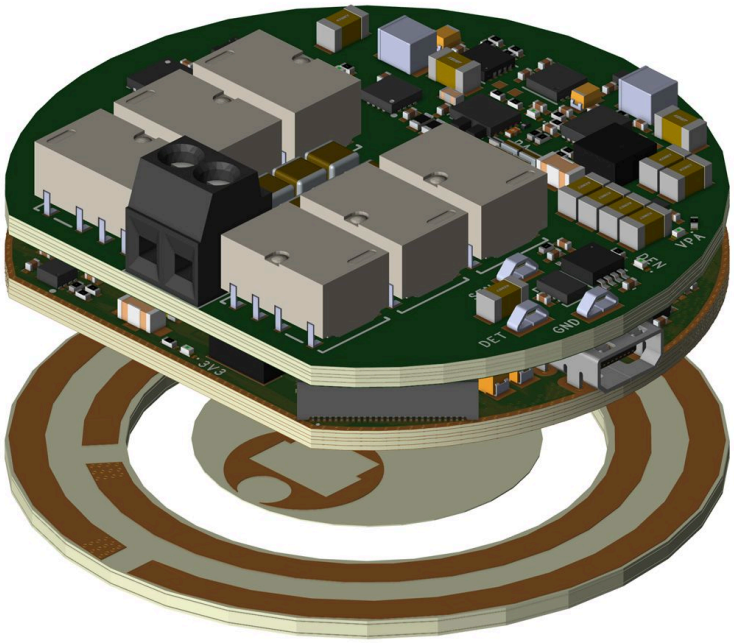
BISC Base Station – The external hardware processor that connects to the BISC Headstage using an HDMI cable

BISC API – The programming interface that allows full control of the BISC system

Functional Block Diagram



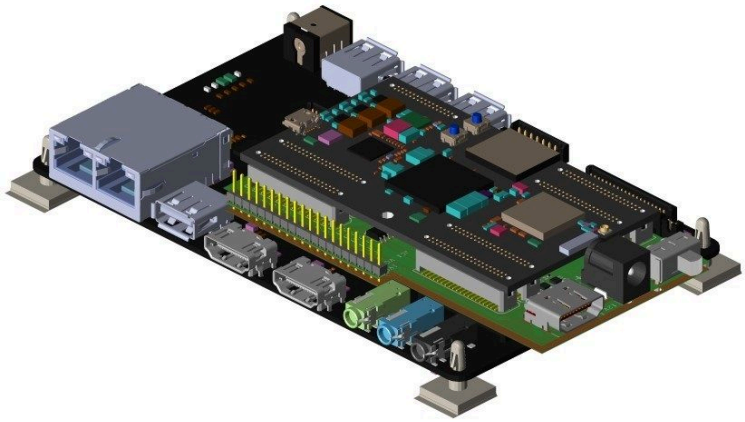
BISC Headstage



BISC Headstage without Case

The current version of the BISC headstage has a diameter of 53mm and a height of 35mm, including the case.

BISC Base Station



BISC Base Station without Case

The BISC Base Station is based on the krtkl Snickerdoodle, PiSmasher, and a custom interface board.

Specifications

Implant Chip Size	12mm × 12mm
Implant Chip Thickness	250µm - 10µm
Total Channels	65536
Simultaneous Readout Channels	1024/256
Readout Sampling Rate	8.475/33.9kHz
Readout Resolution	10-bits
Readout Gain	120 - 2900V/V
Readout High Pass Corner	5 - 120 @ 800pF Electrode Capacitance
Readout Input Refered Noise	5µVrms @ 1650V/V (10 - 8KHz)
Stimulation Scheme	Monopolar or Bipolar
Stimulation Current	10µA - 1120µA
Stimulation Current Profile	Biphasic

Chip Die Shot