

FEATURES

- 4 Independent Differential Sense Channels
- Patented Closed-Loop Chopper Amplifier
- Low Input Referred Noise ($1.2\mu\text{V}_{\text{RMS}}$)
- Low-Power & Low-Noise Modes
- Programmable High-Pass Filter (1, 3, 10Hz)
- Ultra-Low High-Pass Filter Option (0.15Hz)
- High Input Impedance Option ($200\text{M}\Omega$)
- Programmable Gains (100, 200, 400, 800)
- Input Select & Blank Switches
- Programmable Fast-Recovery Control
- 16-Bit Sigma Delta ADCs with SPI Readout
- Integrated Digital Filters
- 5mm x 5mm Plastic QFN Package
- WLCSP Package – available option

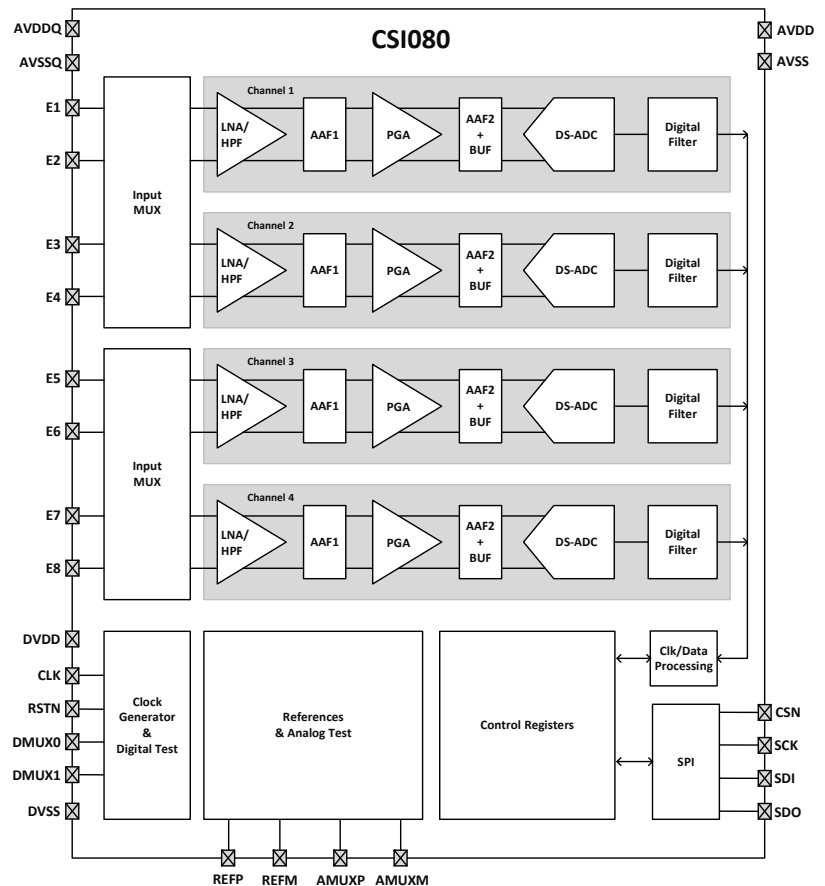
APPLICATIONS

- Simultaneous Neural Recording
- Closed-Loop Neuromodulation
- Biopotential Recording

GENERAL DESCRIPTION

The CSI080 is a 4 channel Neural Sensing IC intended for neural recording and other biopotential applications. Each of 4 independent signal paths is a low noise sensor that amplifies, filters, and converts biopotential signals to digital data. The circuit utilizes a low noise, closed-loop chopper front end amplifier to eliminate $1/f$ noise, thus providing enhanced signal-to-noise ratio. A dedicated 16-bit delta-sigma ADC for each channel supports true simultaneous, high-resolution recording. An input selection multiplexer provides flexibility for electrode pairing, a blanking feature provides isolation from stimulation artifacts, and a fast recovery feature enables virtually continuous sensing in the presence of stimulation. Filter corners and gains are programmable to optimize the circuit for a range of input signals. The part is available in a 5mm x 5mm plastic QFN package, and wafer-level chip-scale packaging (WLCSP) will be available upon request.

CIRCUIT DIAGRAM



PIN DEFINITIONS

PIN	NAME	DESCRIPTION	PIN	NAME	DESCRIPTION
1	NC	No Connect	21	NC	No Connect
2	E1	Electrode 1	22	RSTN	Reset (low active)
3	E2	Electrode 2	23	CLK	Main clock input
4	E3	Electrode 3	24	AVSS	Analog ground
5	E4	Electrode 4	25	SDO	SPI data out
6	E5	Electrode 5	26	SDI	SPI data in
7	E6	Electrode 6	27	SCK	SPI clock
8	E7	Electrode 7	28	CSN	SPI chip select (low active)
9	E8	Electrode 8	29	DVDD	Digital 1.8V supply
10	NC	No Connect	30	NC	No Connect
11	NC	No Connect	31	NC	No Connect
12	AVSS	Analog ground	32	DVSS	Digital ground
13	AVSSQ	Quiet analog ground	33	DMUX0	Digital test mux output 0
14	AVDDQ	Quiet 1.8V supply	34	DMUX1	Digital test mux output 1
15	AVDD	Analog 1.8V supply	35	AVSS	Analog ground
16	REFP	Reference voltage +	36	AMUXP	Analog test mux output +
17	REFM	Reference voltage -	37	AMUXM	Analog test mux output -
18	NC	No Connect	38	AVDD	Analog 1.8V supply
19	AVSS	Analog ground	39	AVSS	Analog ground
20	NC	No Connect	40	NC	No Connect

SPECIFICATIONS

DESCRIPTION	MIN	TYP	MAX	UNITS
Analog Input Referred Noise ⁽¹⁾		1.2		μV_{RMS}
High-Pass Filter Corner		1, 3, 10		Hz
High-Pass Filter Corner (Ultra-Low Option)		0.15		Hz
Analog Input Impedance		3		$\text{M}\Omega$
Analog Input Impedance (High Z Option)		200		$\text{M}\Omega$
Analog Input Dynamic Range	-8		8	mV
Analog Signal Gain (LNA)		100		V/V
Analog Signal Gain (PGA)		1, 2, 4, 8		V/V
Analog Signal Bandwidth		500		Hz
ADC Sample Rate		2.6		ks/s
ADC Resolution		16		Bits
ADC Effective Bit Resolution		14.5		Bits
Supply Current - <i>Per Channel</i>		100		μA
DVDD / AVDD / AVDDQ Supplies	1.7	1.8	1.9	V

$T_A = 0^\circ\text{C}$ to 50°C , typical values at $T_A = 37^\circ\text{C}$

(1) Expected Input Referred Noise is $350\text{nV}_{\text{RMS}}$. Initial testing shows $1.2\mu\text{V}_{\text{RMS}}$. Datasheet will be revised when a final value is determined.