Low-Noise, 2-Channel Analog Front-End for ECG and Biopotential Measurements

Features

♦ Dual-channel low-noise analog front-end;

♦ Supply current: ~130 μA (1-channel);

~200 μA (2-channel);

♦ Shut down mode: <0.1 μA;

♦ Low input-referred noise: ~3 μVrms;

♦ Common-mode rejection ratio: ~85 dB (DC-100 Hz);

♦ Single supply operation: 2.0 V to 3.7 V;

♦ Digital IO level: 1.8 V to 3.6 V;

♦ Programmable gain: 50 to 720;

♦ Built-in filter bandwidth: 0.05 to 220 Hz;

♦ Built-in right leg drive amplifier with lead off;

♦ Built-in high precision 1.8 V LDO;

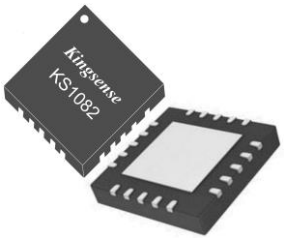
♦ Built-in SPI-compatible serial interface;

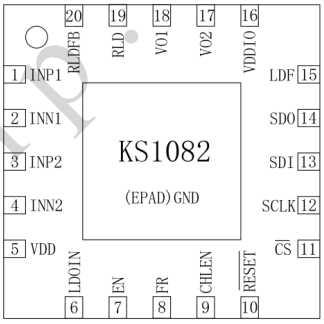
♦ Supports baseline fast restoring;

♦ Supports DC-coupled input;

♦ Supports dry-electrode input;

♦ ±4 kV HBM ESD rating;



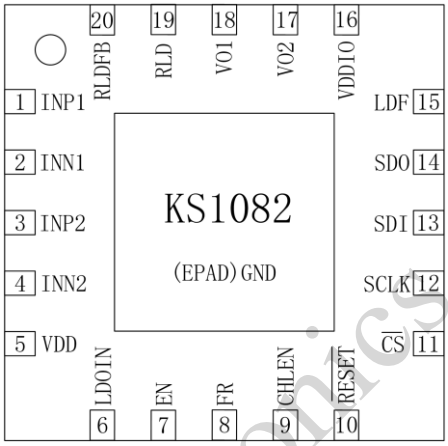


Revision History

Rev. 1.5, Revised Version: Dec. 2024

Pin Configuration and Description

Pin Configuration



Pin Description

PIN NO.	NAME	FUNCTION	DESCRIPTION
1	INP1(1)	Analog input	Differential analog positive input 1.
2	INN1(1)	Analog input	Differential analog negative input 1.
3	INP2(1)	Analog input	Differential analog positive input 2.
4	INN2(1)	Analog input	Differential analog negative input 2.
5	VDD	Supply	Internal LDO output, 1.8V.
6	LDOIN	Supply	Internal LDO input. Chip power supply 2.0-3.7V.
7	EN	Digital input	Chip enable input. Active High. Connected to LDOIN or external logic high. Drive EN low to enter the low power shutdown mode.
8	FR	Digital input	Fast restore control, connect to LDF. Otherwise, drive it low if not used.
9	CHLEN(3)	Digital input	Signal channel enable input. Details see *SPI Registers* setting.
10	$\overline{\text{RESET}}$	Digital input	System reset. Active low. Connect to LDOIN, if not used.
11	$\overline{\text{CS}}$	Digital input	SPI Chip select. Active low.
12	SCLK	Digital input	SPI master clock input.
13	SDI	Digital input	SPI data in.
14	SDO	Digital output	SPI data out.
15	LDF(4)	Digital output	Leads off detection output. Logic high for leads off and logic low for leads on.
16	VDDIO	Supply	Digital interface (SPI) IO level control input (typical 1.8/3.3 V).
17	VO2(2)	Analog output	Signal channel 2 output. Connected to the input of an ADC.
18	VO1	Analog output	Signal channel 1 output. Connected to the input of an ADC.
19	RLD	Analog output	Right leg drive output. Connect to the driven electrode.
20	RLDFB	Analog input	Right leg drive feedback input. Feedback terminal for the right leg drive circuit.
EPAD	GND	Supply	Exposed pad. Chip supply ground. Connects to the global ground.

*(1) connect to GND if not used.

*(2) To enable channel 1 and 2 simultaneously, configure both CHLEN and SPI ***CHLnSET*** register are required.

*(3) only supports RLD lead off detection in strong power line interference condition.

Package Information

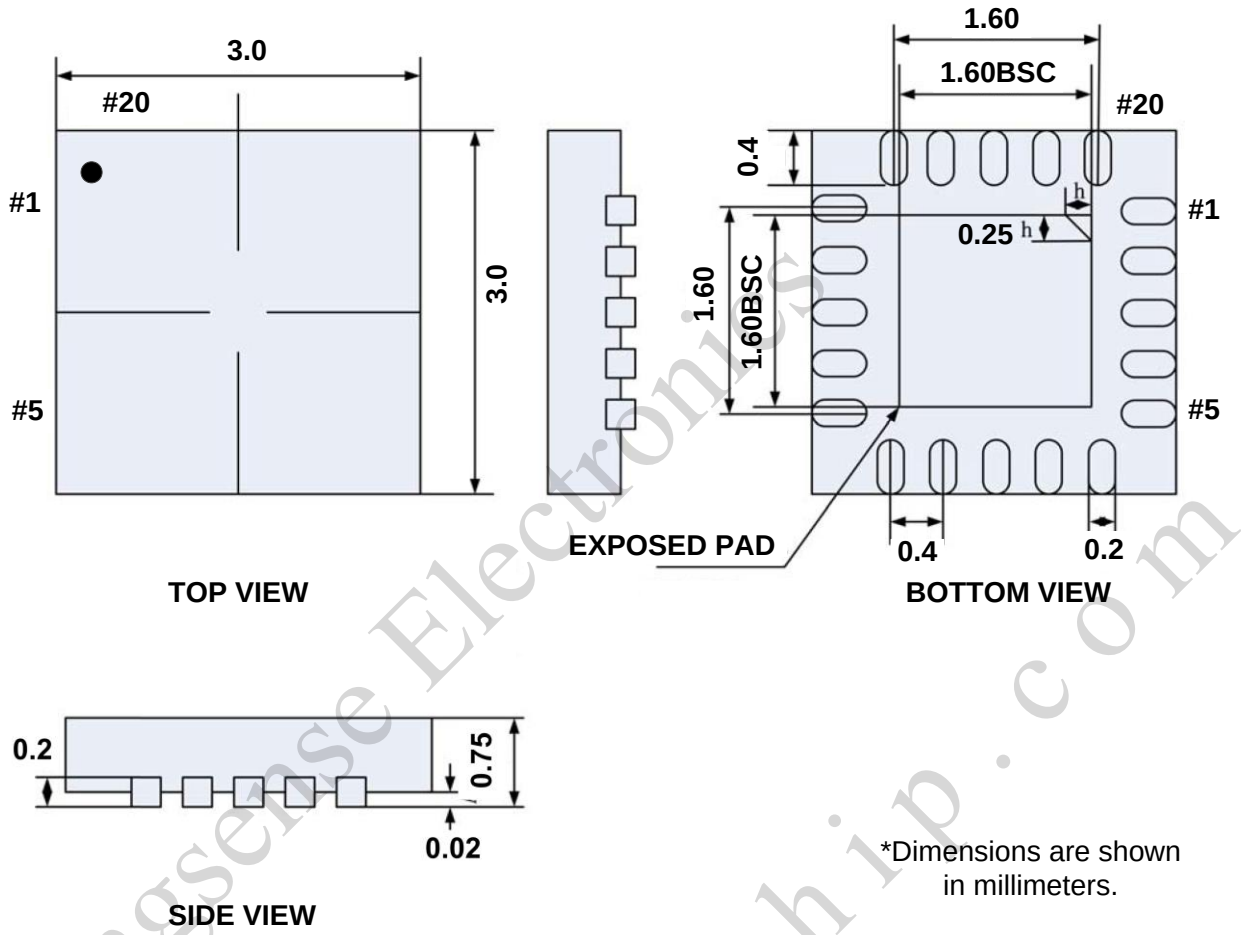
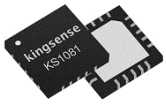
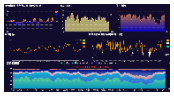


Figure 1. 20-Pin Quad Flat No-Lead Package.

NOTE for Exposed PAD:

This package incorporates an exposed pad that is designed for circuit ground and thermal heatsink. This pad **must** be soldered directly to the ground plane of the printed circuit board (PCB).

Ordering Guide

Model	Device Name	Description	Size	Device Photo
KS1081/2	ECG Chip	Single/Dual-channel analog front-end chip.	QFN-20 3×3 mm	
KS1092	EEG Chip	Dual-channel analog front-end chip.	QFN-20 3×3 mm	
KSECG101	Bluetooth ECG module	Small PCB with the KS1081/2 and the BLE MCU for wireless ECG recording.	PCB 12×19 mm	
KSECG-DK	Bluetooth ECG demo board	PCB with the ECG101, on-board metal-electrodes and the android software (SDK) with real-time ECG waveform and HR display.	PCB 30×80 mm	
KS1081-EB	ECG module & performance evaluation board	PCB with the KS1081 and configure-able IO test pins for analog performance evaluation.	PCB 25×40 mm	
KS108X-/KS109X-EDB	ECG/EEG Evaluation & Development Kit	PC software and PCB with the KS108X/KS109X and the 32-bit MCU for performance evaluation of wearable ECG system.	PCB 45×90 mm/ PCB 39×76 mm	
KS108X-/KS109X-WEDB	Bluetooth ECG/EEG Evaluation & Development Kit	Android software and PCB with the KS108X/KS109X and the BLE MCU for performance evaluation of wearable ECG system.	PCB 45×90 mm/ PCB 39×68 mm	
EEG102/ EEGM102	Bluetooth/UART EEG module	Small PCB with the KS1092 and the BLE 5.0 MCU and embedded EEG algorithms for wireless EEG recording, support UART/ BLE data communication.	PCB 12×19 mm	
EEG102-Kit/ EEGM102-Kit	Bluetooth EEG demo Kit	PCB with the EEGM102/ EEG102, flexible EEG dry-electrodes, and android/windows software (SDK) with real-time EEG waveforms/ spectrums/features display for wearable EEG system.	PCB 17×35 mm/ PCB 17×33 mm	 

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