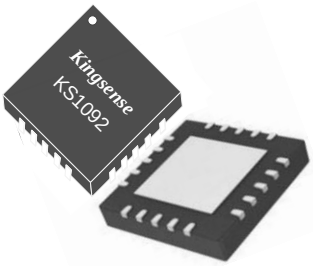
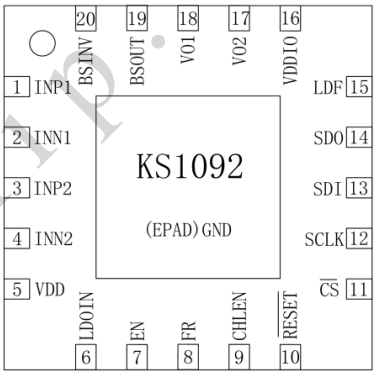
Low-Noise 1-, 2-Channel Analog Front-End for EEG and Biopotential Measurements

Features

- ♦ Single/Dual-channel low-noise analog front-end;
- ♦ Supply current: ~140 μA (1-channel);
  ~210 μA (2-channel);
- ♦ Shut down mode: <0.1 μA;
- ♦ Low input-referred noise: ~1 μVrms;
- ♦ Common-mode rejection ratio: ~100 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: 360 to 2720;
- ♦ Built-in filter bandwidth: 0.05 to 200 Hz;
- ♦ Built-in reference drive amplifier;
- ♦ 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;





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Revision History

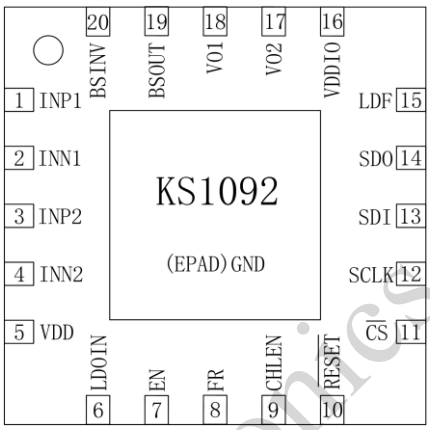
Rev. 1.5, Revised Version: Dec. 2024

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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)(2)	Analog input	Differential analog positive input 2. (2)
4	INN2(1)(2)	Analog input	Differential analog negative input 2. (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	BSOUT	Analog output	Bias drive output. Connect to the driven electrode.
20	BSINV	Analog input	Bias drive inverting input.
EPAD	GND	Supply	Exposed pad. Chip supply ground. Connects to the global ground.

*(1) connect to GND if not used.

*(2) available for dual-channel chip KS1092.

*(3) available for KS1092. To enable channel 1 and 2 simultaneously, configure both CHLEN and SPI ***CHLnSET*** register are required.

*(4) only supports driven lead off detection in strong power line interference condition.

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Package Information

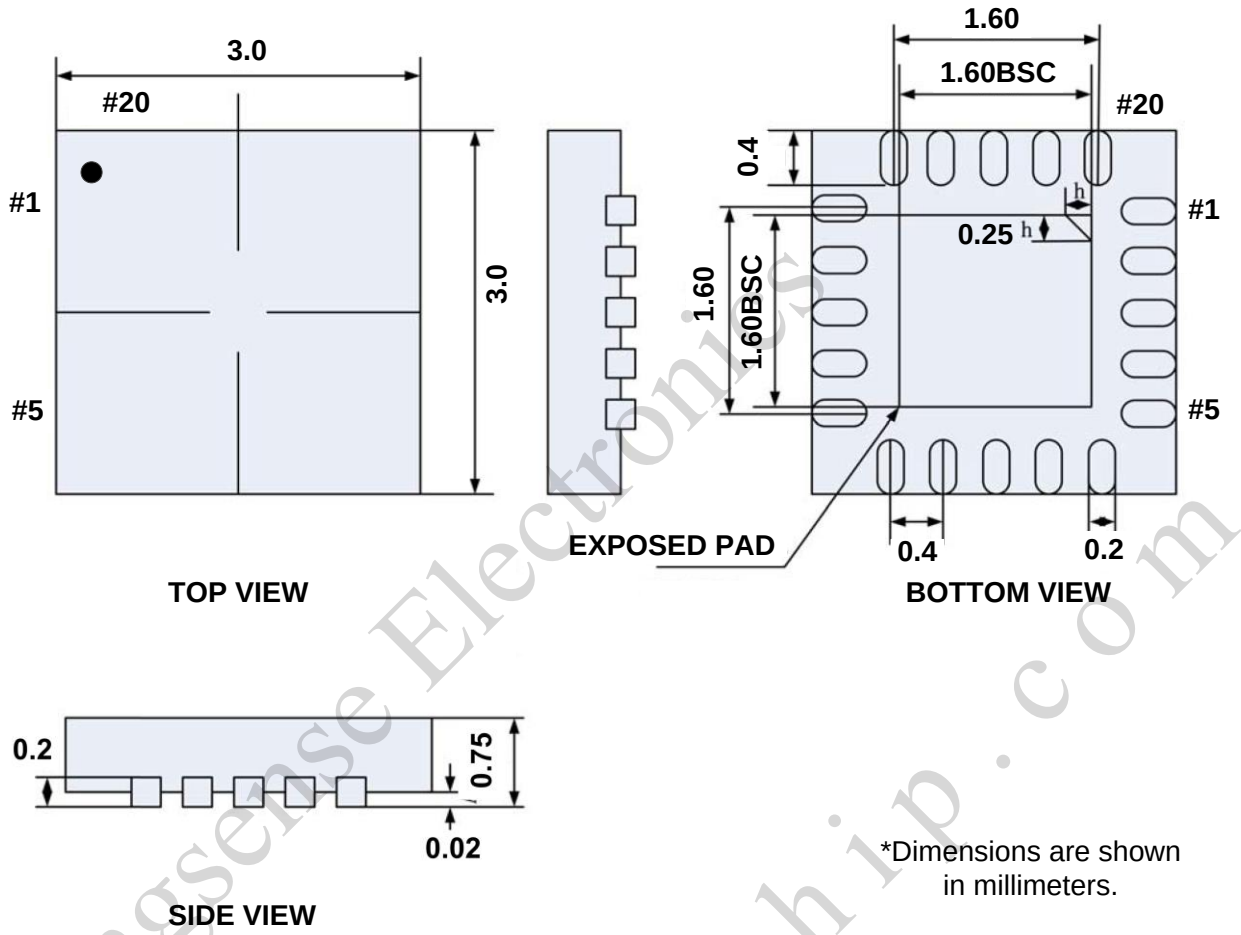


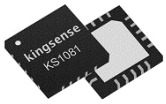
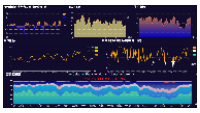
Figure 1. 20-Pin Quad Flat No-Lead Package.

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).

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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	
KS109X-/KS108X-EDB	EEG/ECG Evaluation & Development Kit	PC software and PCB with the KS109X/KS108X and the 32-bit MCU for performance evaluation of wearable ECG system.	PCB 39×76 mm/ PCB 45×90 mm	
KS109X-/KS108X-WEDB	Bluetooth EEG/ECG Evaluation & Development Kit	Android software and PCB with the KS109X/KS108X and the BLE MCU for performance evaluation of wearable ECG system.	PCB 39×68 mm/ PCB 45×90 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	 
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	
ECG101	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	

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