SWS1130
Configurable 24-bit Capacitance-to-Digital Interface IC for High Performance Capacitive MEMS Accelerometer

General Description

The SWS1130 is a capacitive interface with a digital output for capacitive MEMS accelerometers. The SWS1130's configurable interface supports a wide range of MEMS accelerometers of various sensitivities that require a high resolution capacitive readout interface. The SWS1130 interfaces differential capacitors and is capable of sensing capacitance changes down to 50 zF/√Hz.

The SWS1130's capacitive front-end has a trimmable gain and offset to accommodate MEMS process variation during fabrication. The SWS1130 requires only a single 5V supply and few passive components.

The SWS1130 has an on-chip OTP and MTP to store trimming and calibration settings.

Features

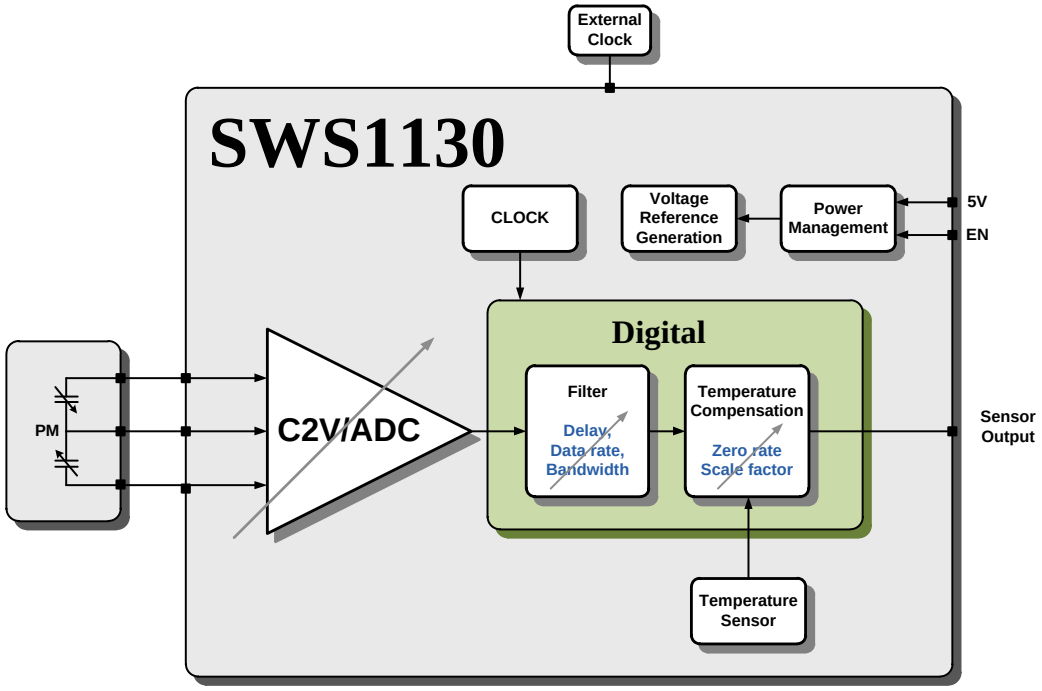
- Ultra low noise capacitive detection front-end with resolution < 50zF/√Hz
- High resolution ADC offering more than 100dB dynamic range in 100HZ BW
- Configurable capacitive front-end to support different sensing element designs
- Charge pump for high voltage excitation option
- Second order scale factor and bias correction using on chip temperature sensor
- Tunable bandwidth output filter
- On chip clock generation
- Low noise reference voltage
- OTP/MTP for sensor trimming and re-calibration
- Single 5V supply operation with 23mA supply current
- 10Mb/s standard SPI interface in slave mode
- Available in QFN56 package or in a bare die format

Applications

The SWS1130 is targeted at applications with low resolution requirements. Typical applications include:

- Industrial
- Navigation
- Inclinometers
- Motion and position measurements
- Seismic

Block Diagram

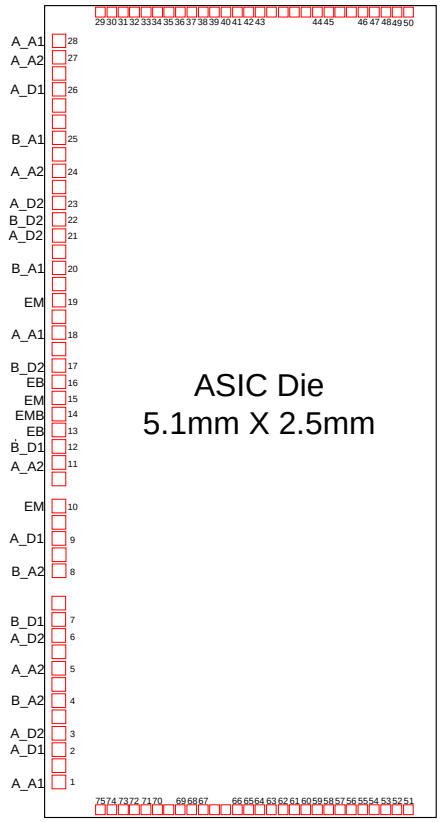


Specifications

Parameter	Conditions	Min	Typ	Max	Units
Front-End					
Supported Nominal Capacitance		0.25		15	pF
Differential Capacitance Range	Low-voltage operation			1.5	pF
	High-voltage operation			0.85	pF
Input Noise	At max gain setting, parasitic capacitance = 50pF		50		zF/√Hz
Linearity	At maximum voltage output	11			Bit
ADC Dynamic Range	In 100 BW		100		dB
Output					
Bandwidth		4		420	Hz
Group Delay		2		710	Ms
Output Resolution	Two's complement format		24		Bit
Supply Voltage		4.75	5	5.25	V
Supply Current	Low-voltage operation		23		mA
	High-voltage operation		29		mA
Power Down Current			1		µA
Operating Temperature Range		-40		85	°C

Bare Die and Pad-Out

Die dimensions are 5.1 mm by 2.5 mm and 300µm thickness. Pad openings are 60µm by 60µm with a pitch of 70 µm on die north and south sides ball bonding to package pads. MEMS interfacing pads are arranged on one side (left) with a pad opening of 80µm by 80µm and a minimum pitch of 100µm. These MEMS side pads are designed to be compatible with both ball and wedge bonding process.



Pad Distribution on Die

MEMS Interface Pad Definitions

As shown in the following table SWS1130 provides two equivalent interface channels: channel-A and channel-B. Only one channel could be used to provide a single axis accelerometer interface. For compatibility with different MEMS pad arrangements, each channel can be configured for MEMS accelerometer capacitive output detection. Also, signals are represented at the MEMS interface by multiple pads to provide additional flexibility for MEMS pad location.

Pin No.	Name	Description
1	**A_A1**	Channel A +ve Actuation
2	**A_D1**	Channel A +ve Detection
3	**A_D2**	Channel A -ve Detection
4	**B_A2**	Channel B -ve Actuation
5	**A_A2**	Channel A -ve Actuation

6	**A_D2**	Channel A -ve Detection
7	**B_D1**	Channel B +ve Detection
8	**B_A2**	Channel B -ve Actuation
9	**A_D1**	Channel A +ve Detection
10	**EM**	Proof Mass
11	**A_A2**	Channel A -ve Actuation
12	**B_D1**	Channel B +ve Detection
13	**EB**	MEMS substrate
14	**EMB**	Inverted Proof Mass
15	**EM**	Proof Mass
16	**EB**	MEMS substrate
17	**B_D2**	Channel B -ve Detection
18	**A_A1**	Channel A +ve Actuation
19	**EM**	Proof Mass
20	**B_A1**	Channel B +ve Actuation
21	**A_D2**	Channel A -ve Detection
22	**B_D2**	Channel B -ve Detection
23	**A_D2**	Channel A -ve Detection
24	**A_A2**	Channel A -ve Actuation
25	**B_A1**	Channel B +ve Actuation
26	**A_D1**	Channel A +ve Detection
27	**A_A2**	Channel A -ve Actuation
28	**A_A1**	Channel A +ve Actuation

QFN Package

The main form of delivery of SWS1130 is bare die for integration in a single package with the MEMS sensing element. For applications that require packaged ICs, please contact SWS for QFN packaging options.

Revision History

Revision Date Description 0.1, September 2013

Revision	Date	Description
0.1	9-9-13	Original datasheet created

Contact Information

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