SWS1110
High Performance Open and Closed Loop Interface IC for Capacitive MEMS Gyroscope and Accelerometer

General Description

The SWS1110 is an open and closed loop interface IC for capacitive MEMS gyroscopes and accelerometers. The SWS1110's high performance, configurable interface supports a wide range of MEMS gyroscopes and accelerometers of various resonance frequencies and sensitivities that require a high resolution capacitive readout interface. The SWS1110 is designed to support both closed loop and open loop operation. The SWS1110 interfaces differential capacitors and is capable of sensing capacitance changes down to 50 zF/$\sqrt{}$Hz.

The SWS1110 capacitive front-end has a trimmable gain and offset to accommodate MEMS process variation during fabrication. The SWS1110 requires only a single 5V supply and few passive components to achieve a working sensor.

Features

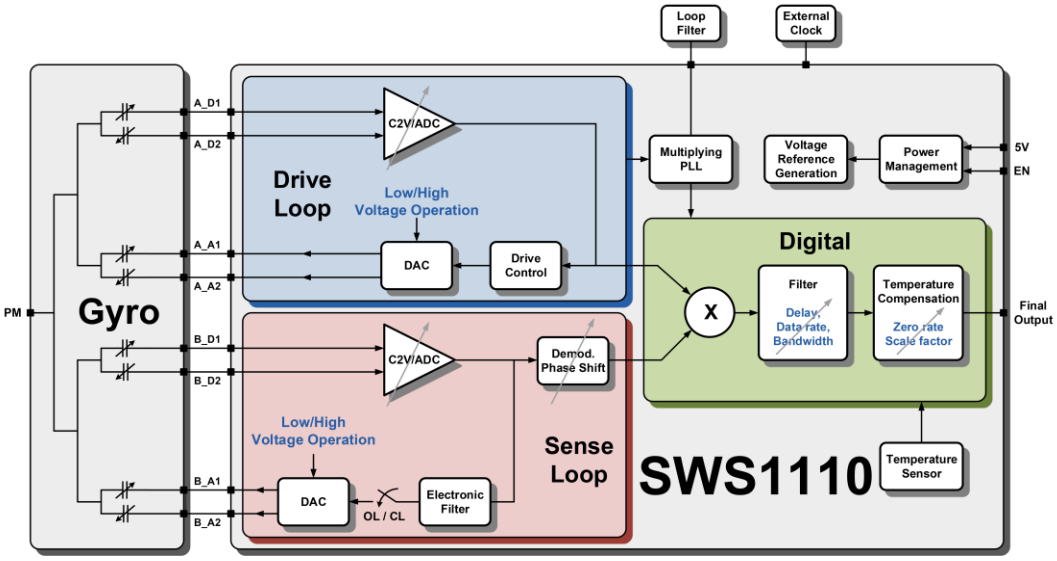
- Ultra low noise capacitive detection front-end with resolution < 50zF/$\sqrt{}$Hz
- Proprietary technology to minimize harmful electrical coupling
- High resolution ADC offering more than 100dB dynamic range in 100HZ BW
- Charge pump for high voltage actuation option
- Gyro drive actuation loop with programmable Automatic Amplitude Control (AAC) and tunable frequency range
- Gyroscope Coriolis output demodulation utilizing proprietary accurate phase tuning technique
- 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

Applications

The SWS1110 is targeted at applications with low resolution requirements. Typical applications include:

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

Block Diagram



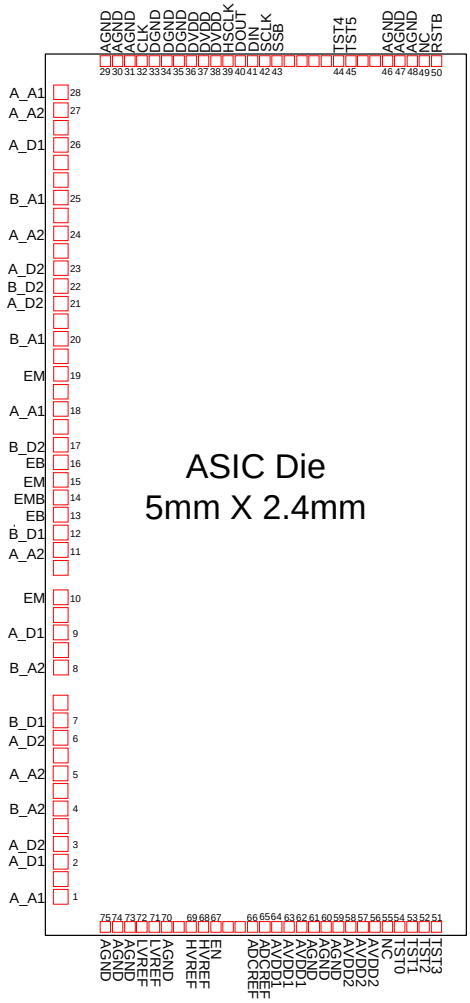
Specifications

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
Drive Actuation Voltage		4.4		8	V
Supported Drive Frequency		1.9		30	KHz
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

Package Description and Pin Assignment

Bare Die & Pad-Out

Die dimensions: 5 mm by 2.4 mm and 11 mils thickness, pad opening is 60 µm by 60 µm with pitch of 70 µm, MEMS interfacing pads opening is 80 µm by 80 µm with a pitch of 100µm (wedge bonding compatible).



Pad Distribution on Die

Pad Definition

Pin No.	Name	X (µm)	Y (µm)	Description
1	A_A1	92.36	214	Channel A +ve Actuation
2	A_D1	92.36	414	Channel A +ve Detection
3	A_D2	92.36	514	Channel A -ve Detection

Pin No.	Name	X (µm)	Y (µm)	Description
4	B_A2	92.36	714	Channel B -ve Actuation
5	A_A2	92.36	914	Channel A -ve Actuation
6	A_D2	92.36	1114	Channel A -ve Detection
7	B_D1	92.36	1214	
8	B_A2	92.36	1514	Channel B -ve Actuation
9	A_D1	92.36	1714	Channel A +ve Detection
10	EM	92.36	1914	Proof Mass
11	A_A2	92.36	2181	Channel A -ve Actuation
12	B_D1	92.36	2281	Channel B +ve Detection
13	EB	92.36	2381	MEMS substrate
14	EMB	92.36	2481	Inverted Proof Mass
15	EM	92.36	2581	Proof Mass
16	EB	92.36	2681	MEMS substrate
17	B_D2	92.36	2781	Channel B -ve Detection
18	A_A1	92.36	2981	Channel A +ve Actuation
19	EM	92.36	3181	Proof Mass
20	B_A1	92.36	3381	Channel B +ve Actuation
21	A_D2	92.36	3581	Channel A -ve Detection
22	B_D2	92.36	3681	Channel B -ve Detection
23	A_D2	92.36	3781	Channel A -ve Detection
24	A_A2	92.36	3981	Channel A -ve Actuation
25	B_A1	92.36	4181	Channel B +ve Actuation
26	A_D1	92.36	4481	Channel A +ve Detection
27	A_A2	92.36	4681	Channel A -ve Actuation
28	A_A1	92.36	4781	Channel A +ve Actuation
29	AGND	346.34	4957.72	Analog Ground
30	AGND	416.36	4957.72	
31	AGND	486.34	4957.72	
32	CLK	556.34	4957.72	5V CMOS Clock I/O
33	DGND	626.34	4957.72	Digital Ground
34	DGND	696.34	4957.72	
35	DGND	766.34	4957.72	
36	DVDD	836.34	4957.72	Chip Digital Supply (5V)
37	DVDD	906.34	4957.72	
38	DVDD	976.34	4957.72	
39	HSCLK	1046.34	4957.72	External High Speed Clock
40	DOUT	1116.34	4957.72	SPI MISO
41	DIN	1186.34	4957.72	SPI MOSI
42	SCLK	1256.34	4957.72	SPI Clock
43	SSB	1326.34	4957.72	SPI Slave Select
44	TST4	1676.34	4957.72	Test Signal 4
45	TST5	1746.34	4957.72	Test Signal 5
46	AGND	1956.34	4957.72	Analog Ground
47	AGND	2026.34	4957.72	

Pin No.	Name	X (µm)	Y (µm)	Description
48	AGND	2096.34	4957.72	
49	NC	2166.34	4957.72	No Connection
50	RSTB	2236.34	4957.72	Chip reset 5V Active Low with Internal Pull Up
51	TST3	2236.34	42.28	Test Signal 3
52	TST2	2166.34	42.28	Test Signal 2
53	TST1	2096.34	42.28	Test Signal 1
54	TST0	2026.34	42.28	Test Signal 0
55	NC	1956.34	42.28	No Connection
56	AVDD2	1886.34	42.28	Chip 2nd Analog Supply (5V)
57	AVDD2	1816.34	42.28	
58	AVDD2	1746.34	42.28	
59	AGND	1676.34	42.28	Analog Ground
60	AGND	1606.34	42.28	
61	AGND	1536.34	42.28	
62	AVDD1	1466.34	42.28	Chip 1st Analog Supply (5V)
63	AVDD1	1396.34	42.28	
64	AVDD1	1326.34	42.28	
65	ADCREF	1256.34	42.28	ADC Reference Voltage
66	ADCREF	1186.34	42.28	
67	EN	976.34	42.28	Chip Enable Active High
68	HVREF	906.34	42.28	High Voltage Internal Reference (8V)
69	HVREF	836.34	42.28	
70	AGND	696.34	42.28	Analog Ground
71	LVREF	626.34	42.28	Low Voltage Internal Reference (4.4V)
72	LVREF	556.34	42.28	
73	AGND	486.34	42.28	Analog Ground
74	AGND	416.34	42.28	
75	AGND	346.34	42.28	

QFN Package

Please contact Si-Ware for QFN packaging options.

Revision History

Revision	Date	Description
1.0	4-23-14	Original datasheet created

Contact Information

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