Preliminary

SCA103T Series

Inclinometer

FEATURES

- High sensitivity by differential analog output or digital output via SPI. Single ended signal available by using a differential amplifier or digitally using internal 11 bit digital output and external micro controller.
- Available ranges ±15°,±30°
- Over damped frequency response (-3dB @ 8...28 Hz)
- Integrated temperature sensor, accessible via SPI
- Digitally activated electrostatic sensing element self test
- Continuous memory parity check
- Advanced internal and external connection failure detection
- Single +5V supply; ratiometric analog voltage outputs
- Serial Peripheral Interface (SPI) compatible digital output
- DIL-12 plastic SMD package, lead-free reflow solderable

BENEFITS

- High immunity to external interference and noise supply voltage.
- Improved temperature dependency and long term stability
- Excellent reliability and stability over time and temperature
- Instrumentation grade performance
- High resolution and low noise
- Wide operating temperature range
- Outstanding overload and shock durability

APPLICATIONS

- Single axis inclination instruments
- Inclination based position measurement

ELECTRICAL CHARACTERISTICS

Electrical characteristics	Condition	Min	Typ	Max	Units
Supply voltage Vdd [1]		4.75	5.0	5.25	V
Current consumption	Vdd = 5 V; No load		4	5	mA
Analog resistive output load	Vout to Vdd or Vss	10			kOhm
Analog capacitive output load				20	nF
Digital output load	@ 500kHz clock			1	nF
SPI clock frequency				500	kHz
AD conversion time			150		µs
Data transfer time	@500 kHz clock		38		µs

PERFORMANCE CHARACTERISTICS

D/S	Performance characteristics	Condition	SCA103T-D04	SCA103T-D05	Units
D	Measuring range [2]	Nominal	±15 ±0.26	±30 ±0.5	° g
D	Measuring direction [3]	Mounting plane horizontal	Horizontal	Horizontal	
S	Zero point [4]	Mounting position	Vdd/2	Vdd/2	V
D	Sensitivity	@ room temperature	280[15] 16[5a]	140[15] 8[5b]	mV/° V/g
S	Offset calibration accuracy [6a, 13]	@ room temperature	0.057 ±1	0.11 ±2	° mg
D	Offset temperature dependency [6b, 13]	0...70°C	< ± 0.11 < ±2	< ±0.11 < ±2	° mg
D		-25...85°C	< ±0.14 < ±2.5	< ±0.14 < ±2.5	° mg
D		-40...125°C	< ±0.29 < ±5	< ±0.29 < ±5	° mg
S	Sensitivity calibration accuracy [7a, 13]	@ room temperature	±0.5	±0.5	%
D	Sensitivity temperature error [7b, 13]	-40...85°C	-1...1	-1...1	%
D		-40...125°C	-2.5...1	-2.5...1	%
D	Typical non-linearity [8]	Over measuring range	±T.B.D ±T.B.D	±0.11 ±2	° mg
S	Cross-axis sensitivity [11]	@ room temperature	4	4	%
S	Frequency response -3dB (LP) [9]	@ room temperature	8...28	8...28	Hz
S	Ratiometric error [10]	Vdd = 4.75...5.25V	1	1	%
D	Output noise density [12]	From DC...100Hz	0.0004	0.0004	°/√Hz
D	Digital output resolution	Effective Differential	0.009 12	0.017 12	°/LSB Bits
D	Long term stability [14]	@ steady temp	< 0.014	< 0.014	°

Parameters marked as D are measured in differential mode using external differential amplifier. The performance of selected amplifier may have an effect to some parameters. Differential signal is determined as a Out_diff = Out_1 - Out_2 (pin 11 - pin 5).

VDD = 5.00 V, APPLIES TO BOTH CHANNELS UNLESS OTHERWISE SPECIFIED

Note 1. For maximum accuracy the supply voltage should be 5 ± 0.05 V. 100nF supply filtering capacitor should be used.
Note 2. The measuring range is limited by sensitivity, offset and supply voltage rails of the device.
Note 3. Measuring direction parallel to mounting plane, arrow showing positive direction.
Note 4. Offset specified as Voffset = Vout(0g) [V]. See note 12.
Note 5a. Sensitivity specified as Vsens = {Vout(+0.26g) - Vout(-0.26g)}/0.52 [V/g]. See note 12
Note 5b. Sensitivity specified as Vsens = {Vout(+0.5g) - Vout(-0.5g)}/1 [V/g]. See note 12
Note 6a. Offset calibration error specified as Offset_Calib_error = {Vout(0g) - Vdd/2} / Vsens [g].
Note 6b. Offset temperature error specified as Offset Error @ temp. = {Vout @ temp. - Vout @ room temp.} / Vsens [g] Vsens = Nominal sensitivity. See note 12.
Note 7a. Sensitivity calibration error specified as Sensitivity_calibr_error = { Vsens - Vsens_nom} / Vsens_nom x 100% [%] Vsens_nom = nominal sensitivity
Note 7b. Sensitivity temperature error specified as Sensitivity error @ temp = { [Vsens @ temp -Vsens @ room temp] / Vsens @ room temp x 100% [%]. See note 12.
Note 8. From straight line through sensitivity calibration points.
Note 9. The output has true DC (0Hz) response.
Note 10. The ratiometric error is specified as: $RE = 100\% \times \left[1 - \frac{Vout(@Vx) \times \frac{5.00V}{Vx}}{Vout(@5V)} \right]$
Note 11. The cross-axis sensitivity determines how much inclination / acceleration, perpendicular to the measuring axis, couples to the output. The total cross-axis sensitivity is the geometric sum of the sensitivities of the two axis which are perpendicular to the measuring axis.
Note 12. In addition, supply voltage noise couples to the output due to the ratiometric nature of the accelerometer.
Note 13. Factory calibration value.
Note 14. Power continuously connected.
Note 15. Is valid between angles 0° to 1°.

VTI TECHNOLOGIES

ABSOLUTE MAXIMUM RATINGS

Parameter	Value	Unit
Acceleration (powered or non powered)	20 000	g
Supply voltage	-0.3 V to +5.5 V	V
Voltage at input/output pins	-0.3 V to (Vdd+0.3V)	V
Temperature range	-55...125	°C

ELECTRICAL CONNECTION

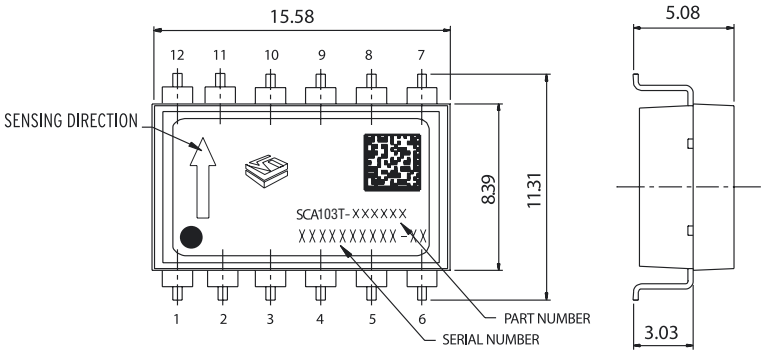
Pin#	Pin Name	I/O	Connection
1	SCK	Input	Serial clock
2	Ext_C_1	Input	Channel 1 external capacitor input
3	MISO	Output	Master in slave out; data output
4	MOSI	Input	Master out slave in; data input
5	Out_2	Output	Channel 2 output
6	VSS	Power	Negative supply voltage (VSS)
7	CSB	Input	Chip select (active low)
8	Ext_C_2	Input	Channel 2 external capacitor input
9	ST_2	Input	Self test input for Channel 2
10	ST_1	Input	Self test input for Channel 1
11	Out_1	Output	Channel 1 output
12	VDD	Power	Positive supply voltage (VDD)

If The SPI interface is not used SCK (pin1), MISO (pin3), MOSI (pin4) and CSB (pin7) must be left floating.

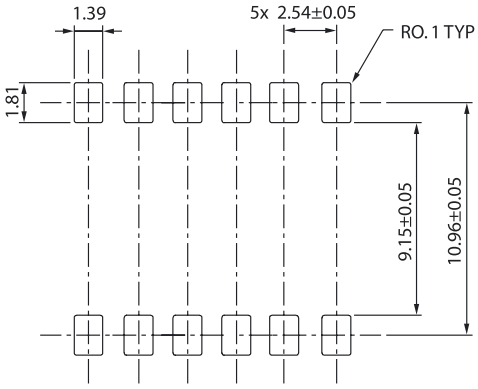
Self test can be activated applying logic "1" (positive supply voltage level) to ST pins (pins 9 & 10). If ST feature is not used, then pins 9 & 10 must be left floating or connected to GND.

DIMENSIONS

The part weights < 1.2 g. The size is approximately 9 x 5 x 16 mm (w x h x l). Pin pitch is standard 100 mils.

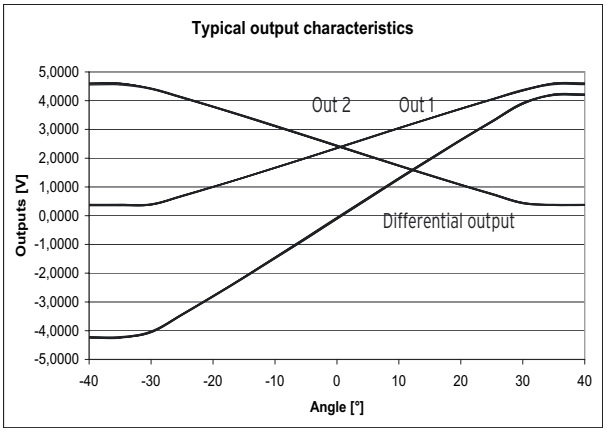


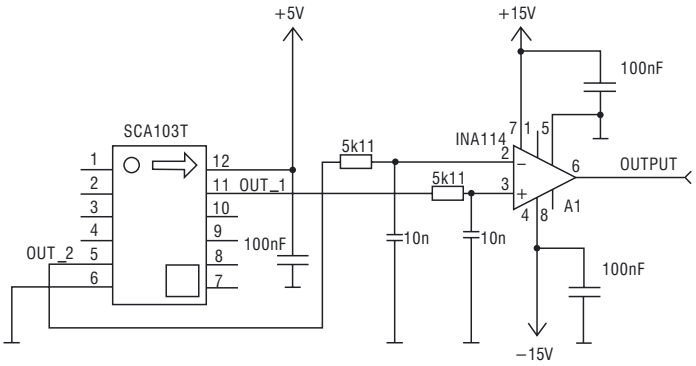
PCB PAD LAYOUTS



APPLICATION EXAMPLE

Single ended output can be formed from differential outputs by using external differential amplifier.





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