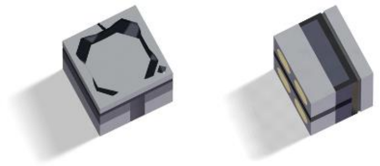
Data Sheet



CAPACITIVE ABSOLUTE 1.2 BAR SCB10H-B012FB PRESSURE SENSOR ELEMENT

Features

- Small size 1.4 x 1.4 x 0.85 mm (w x l x h)
- High isolation resistance and low passive capacitance enables very low power consumption, high stability and accuracy over temperature and time
- High sensitivity
- High pressure shock survival
- RoHS compliant
- Proven capacitive 3D-MEMS technology

Applications

Typical applications:

- Medical devices
- Flow meters
- Barometers
- Altimeters

General Description

SCB10H series pressure elements are high performance absolute pressure sensors. The sensors are based on Murata's proven capacitive 3D-MEMS technology. They enable exceptional possibility for OEM customers to integrate pressure measurement function in an optimal way into their products. SCB10H series elements can be designed to match the application specific pressure range. It is a bare capacitive sensor element that enables optimized application specific package and electronics design.

Absolut Maximum Ratings

Parameter	Max. Value	Unit
Proof pressure	3200	kPa
Maximum continuous operating temperature	125	ºC
Minimum operating temperature	-55	ºC
Maximum storage temperature	125	ºC
Minimum storage temperature	-55	ºC
Maximum momentary temperature during assembly	260	ºC
Electrostatic discharge[1]	60	V, HBM
	40	V, MM

Technical Specification

Ambient temperature unless otherwise specified

Parameter	Nominal Value	Tolerance	Unit
Size l,w,t	1.40, 1.40, 0.85	±0.05	mm
Measuring range[2]	0-120 (30-120)		kPa
Equivalent series resistance (ESR) at 1 MHz		<150	Ω
Parallel resistance at DC		>10	GΩ
Diaphragm thickness[3]	27		µm
Lowest mechanical resonance frequency of the diaphragm[4]	450		kHz

[1] ESD precaution must be taken when handling and assembling the device.
Interface circuitry has to provide protection.
[2] Element is not tested below 30 kPa, but no mechanism is known to prevent its functioning.
[3] Acceleration sensitivity can be estimated from $\Delta p_{eff} = \rho_{Si} h_{dia} a$, where ρ_{Si} = 2330 kg/m^3 is the sensitivity of the silicon, h_{dia} is the diaphragm thickness, and a is the acceleration parallel to the diaphragm normal.
[4] For information only. Measured using electrostatic excitation.

Capacitance - Pressure Characteristics

The capacitance can be modeled as a function of the pressure with the following equation:

$$C_{\mathrm{model}}(p) = C_{00} + rC_0 + \frac{C_0}{1 - \frac{C_0}{K}p} + \frac{aC_0}{1 - \frac{C_0}{bK}p}$$

where the statistical variables C_{00}, C_0 and K are independent and vary from batch to batch and unit to unit with the standard deviations. Parameters a and b are constants for a given sensor type. The applied absolute pressure is p. In the following table these parameters for SCB10H-B012FB element are presented.

Parameter	Nominal Value	Tolerance	Unit
r	0		
a	1.759		
b	1.485		
C_{00}[1]	0.9 pF	±0.22	pF
C_0	2.24 pF	±0.13	pF
K	509	+112 -103	kPa*pF
Sensitivity dC/dp at 100 kPa[2]	55	+38 -19	fF/kPa
Model accuracy[3]	Max 0.04		kPa
Nonlinearity, parallel plate model[4]	0.047		kPa
Pressure (kPa)	Nominal Capacitance (pF)	Tolerance (pF)	
30	7.82	±0.50	
120	11.79	-1.58 +2.71	

Temperature Dependency

[1] Element packaging increases the total stray capacitance and its variation, and should be added to the C_{00}-term.
[2] Sensitivity is calculated from $C_{(model)}(p)$.
[3] Model accuracy defined as maximum pressure error over the specified operating pressure range using Eq. (1) with C_{00}, C_0 and K as fitting parameters.
[4] Nonlinearity defined as maximum pressure error over the specified operating pressure range at reference temperature T_{ref} using parallel plate model.

In addition to pressure element behavior is also dependent on temperature ($p_{comp}(p, T)$). P_{comp} is the temperature compensation, and T is the temperature. Function p_{comp} is further separated into two parts

$$p_{comp}(p, T) = \alpha(T) + \beta(T)\cdot(p-p_{ref}),$$

where the functions α(T) and β(T) can be written as a polynomial expansion

$$\alpha(T) = \alpha_1\cdot (T - T_{ref}) + \alpha_2\cdot(T - T_{ref})^2 \text{ and}$$

$$\beta(T) = \beta_1\cdot(T - T_{ref}) + (\beta_2\cdot(T - T_{ref})^2).$$

In the following table these parameters are given for element only attached to ceramics with soft adhesive and wirebonded. This case is the most optimal from performance point of view.

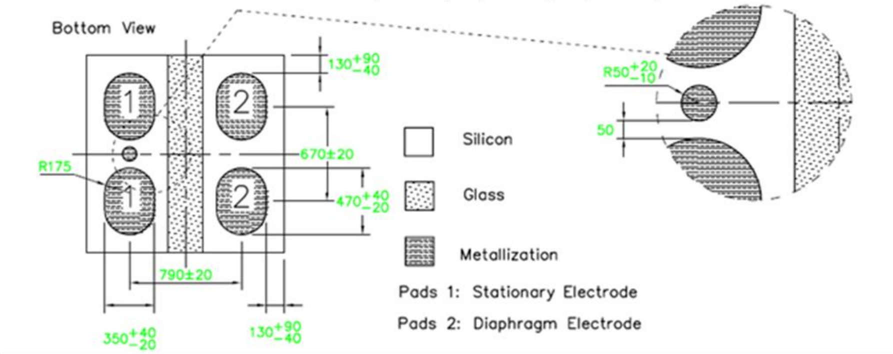
Parameter	Condition	Nominal Value	Tolerance	Unit
T_{ref}[1]		+25		°C
p_{ref}[2]		100		kPa
Total pressure error[3] with thermal compensation	$p = p_{oper}$ -40 – (+125) °C	0.08	± 0.12	kPa
α_1[4]	Wirebonded, not protected	-13	± 0.16	Pa/°C
α_2	Wirebonded, not protected	0.12	± 0.04	Pa/°C^2
β_1	Wirebonded, not protected	-46	± 25	ppm/°C

Note: β_2 is has only very minor effect and therefore is not specified.

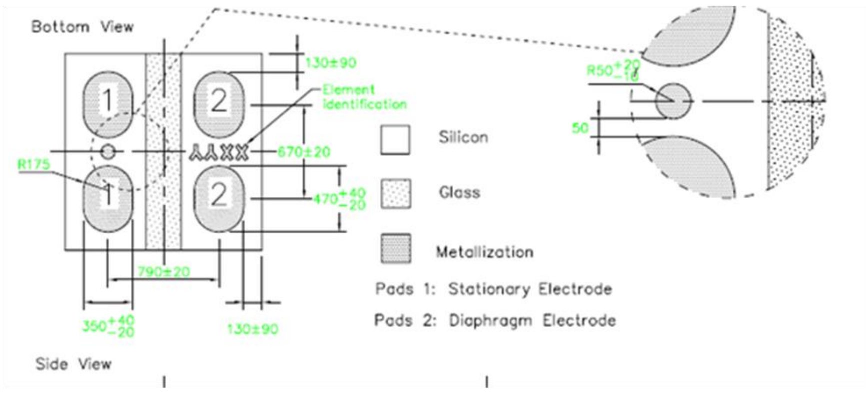
Dimensional Drawing and Connections

[1] The choice of reference temperature T_{ref} is arbitrary.
[2] The choice of reference pressure p_{ref} is arbitrary.
[3] Pressure error includes linearity, hysteresis and repeatability errors on the given temperature range.
[4] Average first order thermal coefficient of offset can be tuned to zero for high volume applications.

solderable and wirebondable version with Ti(125nm)-Pt(225nm)-Au(125nm) contact pads



only wirebondable version with TiW(150nm)-AlCu(800nm) contact pads



Side View