Model FD101
Force Sensor Dies

Description

Model FD101 is a piezoresistive force sensor die, which is made from monocrystalline silicon and specially designed for force measurement universally or sensor application to measure extreme low-level forces.

This model FD101 force sensor die has its four piezoresistive resistors each laid perpendicularly to the adjacent ones, similar pattern to the EB-type of metal foil strain gauges from BCM SENSOR. As a result, this force sensor die can be used to measure a force in all directions.

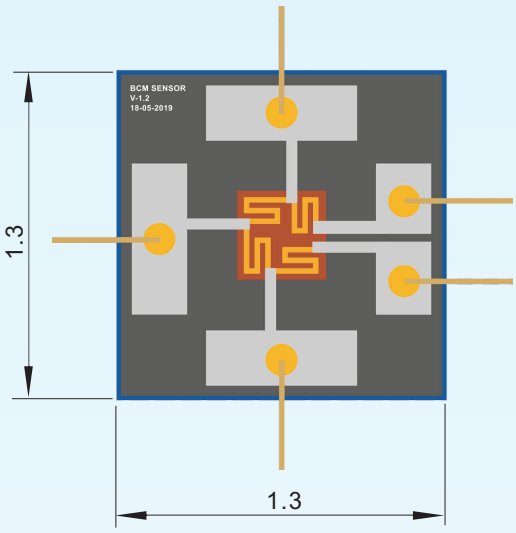
For example, if one of such the sensor dies is bonded on a bending beam, it forms a half bridge measuring circuit, or if two of such the sensor dies are bonded on the top- and bottom-surface of the bending beam respectively, they form a full bridge measuring circuit. In case of an either tension or compression beam where this sensor die is bonded on, it can form a full bridge measuring circuit. In addition, if this sensor die is bonded on a shear beam or torsion beam, it can also form a full bridge circuit to measure shear force or torque.

The four piezoresistive resistors of the FD101 force sensor die constitute a full-bridge circuit, resulting in a high sensitivity for low-level force measurement down to a few microstrains.

On the FD101, its Wheatstone bridge circuit is configured to the open-bridge circuit of 5 solder pads, on which gold leads can be attached on request. 5 solder pads also bring advantage to facilitation of its zero-offset adjustment and temperature compensation. As there is no signal-conditioning circuitry on this sensor die, its output signal is directly from its Wheatstone bridge circuit.

Thanks to MEMS technology, the FD101 features a small size (1.3mm x 1.3mm) and capacity of high volume per batch in mass production.

Dimensions



Notes:
1) Thickness is 0.1mm.
2) All dimensions are in mm.

Features

- excellent non-linearity up to: ±0.5%fs
- high output sensitivity: ⩾ 29mV/V
- small foot-print, high product rate per wafer for cost-effective application
- gold leads on solder pads available on request

Applications

- automation: mass production of force sensors, force switches, and force controllers
- medical: clinical devices and patient monitoring systems (e.g. dialysis instruments)
- stress analysis: stress, strain, and vibration monitoring
- consumer: consumer electronics

BCM SENSOR TECHNOLOGIES BVBA

Industriepark Zone 4, Brechtsebaan 2
B-2900 Schoten - Antwerpen, BELGIUM

Tel.: +32-3-238 6469
Fax: +32-3-238 4171

website: www.bcmsensor.com
email: sales@bcmsensor.com

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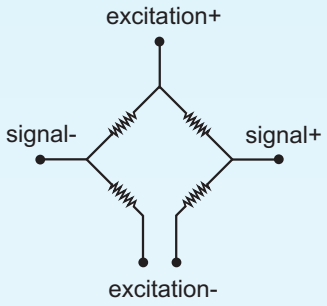
Wheatstone Bridge Circuit Diagram



open-bridge circuit diagram

Technical Data

Parameters		Units	Specifications	Notes
measuring range		με	5~500	
safe load limit		%fs	200	1
ultimate overload		%fs	400	1
full scale output (fso)		mV	⩾ 148	2 & 3
excitation	voltage	Vdc	5 (typical), or any voltage in the range of 1, ..., 12Vdc	
	current	mA	1 (typical), or any current in the range of 0.3, ..., 4mA	
zero offset		mV	⩽ ±42	3
non-linearity (NL)		%fs	⩽ ±0.5	4
hysteresis (HY)		%fs	⩽ ±0.15	
repeatability (RP)		%fs	⩽ ±0.15	
long-term stability		%fs/year	⩽ ±0.2	
bridge resistance		kΩ	2.4±0.2	
storage temperature range		°C	-55 ~ +85	
operating temperature range		°C	-55 ~ +75	
temp. coeff. (TC) of bridge resistance		%/°C	0.11 ±0.02	5
TC of zero offset		%fso/°C	⩽ ±0.08	6
TC of span		%fso/°C	⩽ |-0.71|	6
thermal HY of zero offset		%fso/°C	⩽ ±0.04	
electrical interface			solder pads (standard), gold leads	7
dimensions		mm	1.3 x 1.3 x 0.1	

General conditions for measurements: temperature = 25°C, humidity = 40%RH.

Notes:
1. fs refers to full scale strain.
2. Measured at nominal strain of 500με with orientation laterally along any of the resistor of the sensor die.
3. Measured at 5Vdc excitation.
4. Calculated according to Terminal Base Line (the endpoint method).
5. Calculated as a rate of resistance change between -55°C and +75°C, and normalized by the resistance at 25°C.
6. Calculated as a rate of output change between -55°C and +75°C, and normalized by the output at 25°C, when the die is not temperature compensated.
7. Dimensions of gold leads: Ø0.03mm diameter, and 10mm length.

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Ordering Information

position (pos.) 1: model	pos. 2: nominal strain	pos. 3: output signal	pos. 4: non-linearity	pos. 5: bridge type	pos. 6: package	pos. 7: solder-pad finishing	pos. 8: customized specifications
FD101	500 = 500με	148mV	0.5%fs	OB = open-bridge circuit	X = individually packaged die in plastic package (standard for sample order) Y = diced wafer on tape (standard for volume order) Z = non-diced wafer	SP = naked solder pads (standard) GL = gold leads (only available for package X)	"(*)" is necessary only if any customized parameter is required, otherwise it is neglectable.
pos.1	**pos. 2**	**pos. 3**	**pos. 4**	**pos. 5**	**pos. 6**	**pos. 7**	**pos. 8**

Examples of Ordering Code

- standard sensor die:

  FD101-500-148mV-0.5%fs-OB-Y

The listed dimensions, specifications and ordering information are subject to change without prior notice.

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