INTERLINK ELECTRONICS | ie SENSORS

DATASHEET

Piezo Film Sensor Dynamic Strain Gauge

Model: SGL-R25-30 | Part No: 44-00525

SGL series piezo film sensors are thin, light weight and flexible strain gauges that can be used for a broad range of applications including impact sensing, surface vibration sensing and motion sensing. The SGL-R25-30 sensor consists of a 30μm thick piezo film and a laminated 127μm (5mil) thick PET. The thick PET layer brings the sensor neutral axis from the piezo film to the PET layer and thus the SGL-R25-30 works as a stand-alone bending mode dynamic strain gauge. In addition, the PET layer provides protection for the electrodes against abrasion. The SGL-R25-30 sensor can be attached onto any target sensing surfaces using a pressure sensitive adhesive. SGL-R25-30 has high voltage sensitivity and external power supply is not required to operate. The sensor shape and size can be easily customized depends on the applications. Piezo film is robust and its piezo activity does not decay over time, and thus it is a highly reliable sensing material.

FEATURES

- Thin, lightweight, and flexible polymer strain gauge
- Piezo film generates electrical signals without external power supply
- High voltage sensitivity allows simple interface electronics
- Broad frequency band characteristics for Hz to MHz applications
- Wide dynamic range covers from μV to kV output applications
- Low mechanical Q suitable for acoustic vibration sensing without signal distortion
- Easy customization in shape and size

APPLICATIONS

- Impact sensing
- Surface vibration sensing
- Contact microphone for medical and industrial applications
- Artificial skin sensor for AI robots and interactive toys
- Scoring sensor for sports and gaming devices
- Solid state switches and counters
- Motion sensor for security and safety

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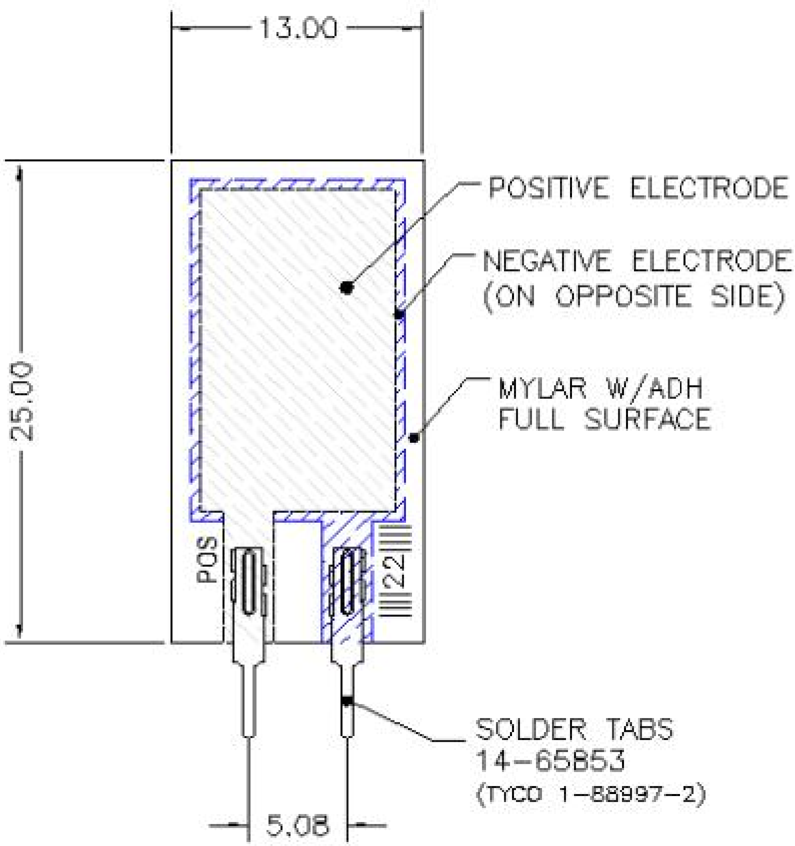
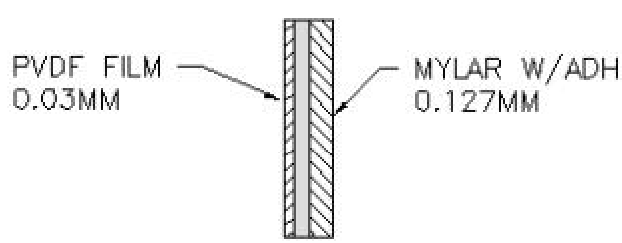
Schematics (units in mm)





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DEVICE CHARACTERISTICS (25。C)

Parameter	Typical Value	Unit
Voltage sensitivity to 1μm strain ($V_o/\Delta L$)*	56.5	V/μm
Voltage sensitivity to micro strain ($V_o/\mu\varepsilon$)*	1.4	V/μ
Voltage sensitivity to applied force (V_o/N)*	1.7	V/N
Charge sensitivity to 1μm strain ($Q/\Delta L$)*	33.9	nC/μm
Charge sensitivity to micro strain ($Q/\mu\varepsilon$)*	0.8	nC/μ
Charge sensitivity to applied force (Q/N)*	1.0	nC/N
Voltage output per 1°C temperature change (V/Δ°C)**	10.2	V/°C
Capacitance @1KHz	0.6	nF
Dissipation factor (tan δ) @1KHz	0.02	
Low-end cutoff frequency (f_{cutoff}) @10MΩ load resistance	27	Hz
Linearity	±1	%
Operating temperature	-25 to +85	°C
Storage temperature	-40 to +85	°C

*Force is applied to the length direction (1-axis). Open circuit output @10Hz.
**Pyro effect of piezo film. Open circuit voltage output.

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TYPICAL PIEZO FILM PARAMETERS (25。C)

Parameters	Symbols	Typical Value	Unit	Note
Available thickness	t	30, 110	μm	
Piezo strain constant	d_{31}	25	pC/N	@10Hz
	d_{32}	2		
	d_{33}	35		
Piezo stress constant	g_{31}	220	10^{-3} Vm/N	@10Hz
	g_{32}	20		
	g_{33}	300		
Piezo charge constant	e_{31}	75	C/m^2	@10Hz
	e_{32}	6		
	e_{33}	105		
Pyroelectric constant	p	39	μC/m^2°C	
Coupling coefficient	k_{31}	12	%	@10Hz
Relative permittivity	ε_r	13		@1KHz
Permittivity	ε	113	pF/m	@1KHz
Young's module	Y	3	GPa	@10Hz
Tensile strength	s	0.50	GPa	1-Axis
Volume resistivity	ρ_R	$>10^{14}$	Ωcm	
Dielectric breakdown voltage		200	V/μm	
Dielectric loss factor	tan δ	0.015		@1KHz
Density	ρ	1.78	g/cm^3	
Melting point		165.0	C°	

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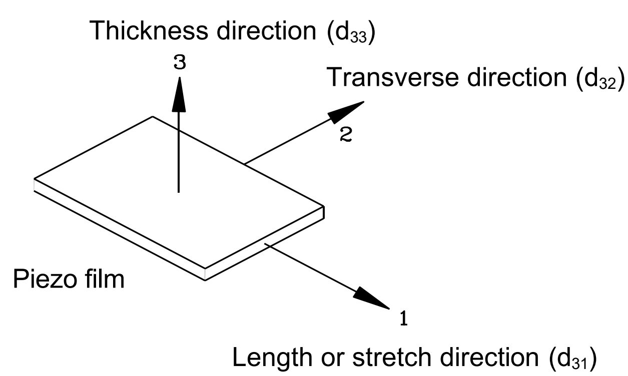
SENSOR INSTALLATION

Piezo film is anisotropic and its proper installation is important to ensure the sensor performance. Also, piezo film is a thin and light weight polymer sensor thus the sensor lead tail or sensor cable needs to be secured to avoid undesired signals caused by the strain from the sensor leads.

1. Sensor directivity – As shown in the figure below, piezo film is anisotropic and has directional sensitivity. Piezo film has the highest sensitivity in the length direction (also, called Stretch direction or 1-direction) and SGL series sensors are designed to use in the length mode. Therefore, the sensor's length direction should be aligned with the strain direction of the sensing targets to maximize the sensor output. Sensitivity of the transverse direction (d_{32}) is only 1/10 of that of the length direction (d_{31}).
2. Strain relief of the sensor lead tail – As the piezo film sensors are highly sensitive to the stress applied in its length direction, it is necessary to firmly secure the sensor lead tail to avoid any strain or stress caused by the sensor lead tail. Unsecured sensor lead tail might create undesired signals.



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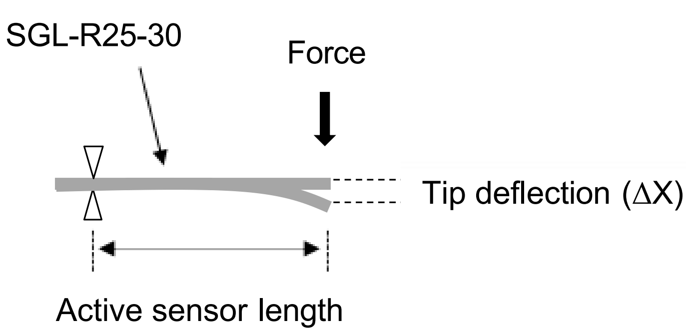
SGL-R25-30 as a bending mode sensor (flexible switch)
When the SGL-R25-30 is used as a bending mode sensor, the voltage output increases as the tip deflection increases. Examples of voltage output vs. sensor tip deflection are shown below. The generated voltage is high enough to trigger a MOSFET directly and it can be used as a flex switch or as a solid state switch. In addition, the voltage output depends on the active length of the sensor, i.e., the piezo film length between the sensor tip and the clamped position at the bottom.

Voltage output vs. Sensor tip deflection

Tip deflection (ΔX)	Peak voltage (V)
8mm	4.7
13mm	5.9
18mm	6.1

Active piezo film sensor length = 14mm
Load resistance = 10MΩ



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