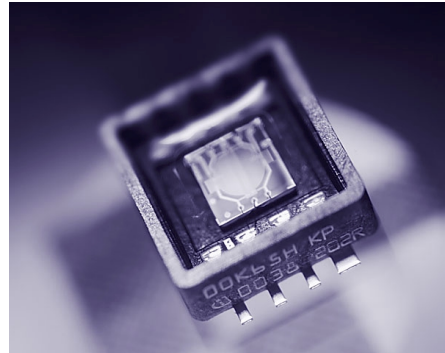




Sensory Thinking

KP20x-R- Series

Silicon Piezoresistive Relative Pressure Sensors
Low Cost Surface Mounted Version

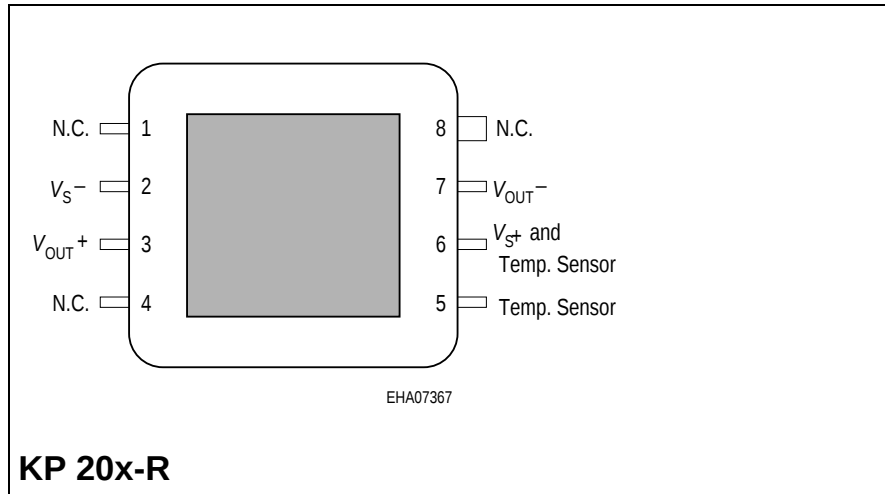


Features

- High sensitivity and linearity
- Fast response
- Very small dimensions
- Low cost
- Produced in qualified semiconductor fabrication lines
- SMD housing
- Built in silicon temperature sensor

Type	Marking	Ordering Code	Pressure Range	Package
KP 202-R	KP202R	Q62705K0424	0 ... 60 kPa (0.6 bar)	P-DSOF-8-6
KP 203-R	KP203R	Q62705K0430	0 ... 160 kPa (1.6 bar)	P-DSOF-8-6

Pin Configuration



Pin Definitions and Functions

Pin No.	Function
1	Not connected
2	$V_S -$
3	$V_{OUT} +$
4	Not connected
5	Temperature Sensor, typ. $R_{25} = 2 \text{ k}\Omega$
6	$V_S +$ and Temperature Sensor
7	$V_{OUT} -$
8	Not connected

Electric Network

Four piezoresistors form a bridge circuit, providing a very accurate and linear output voltage, directly proportional to the applied pressure.

$$V_{\text{OUT}} = V_{\text{O}} = V_{\text{FIN}} = V_{\text{S}} \times (R_1(p) \times R_3(p) - R_2(p) \times R_4(p)) / [(R_1(p) + R_2(p)) \times (R_3(p) + R_4(p))]$$

with

$$R_1(0) \cong R_2(0) \cong R_3(0) \cong R_4(0) \cong R_{\text{B}}$$

A temperature sensor chip R_{T} , that is built in the housing, can be used to compensate the temperature drift of the pressure sensor.

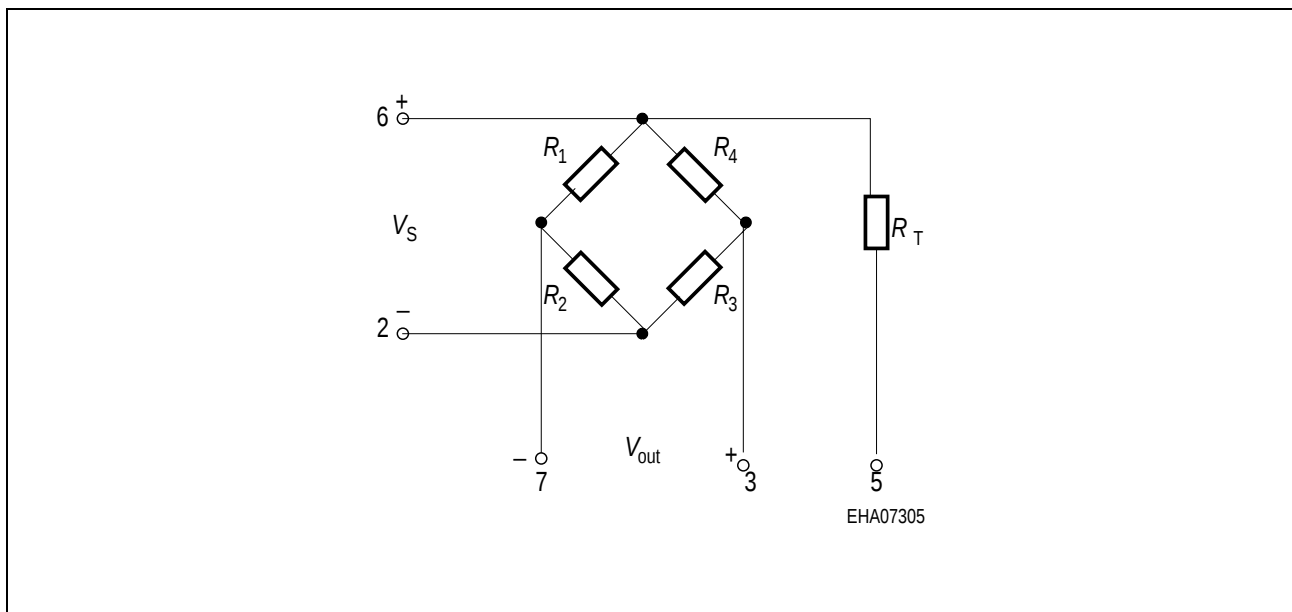


Figure 1 Sensor Schematic

Piezoresistors $R_1 \dots R_4$ denote the pressure sensitive resistors connected as a Wheatstone bridge. R_{T} is a KTY-series temperature dependent resistor with a positive TC.

Absolute Maximum Ratings

Parameter	Symbol	Limit Values	Unit
Supply voltage	$V_{S\ MAX}$	12	V
Overpressure ¹⁾	p_{MAX}	250	kPa
Burst Pressure KP 202-R, KP 203-R	p_{BURST}	400 800	kPa
Operating temperature range	T_{OP}	– 40 ... + 125	°C
Storage temperature range	T_{STG}	– 40 ... + 125	°C
Mechanical shock survival	–	2000	g

¹⁾ Overpressure is limited to p_{max} , due to absorption of gas into the protective gel covering the sensor at higher pressures. Abrupt decrease of pressure from values higher than p_{max} to low pressures can cause in the gel to rupture.

Electrical Characteristics

at $T_A = 25\ ^\circ\text{C}$ and $V_S = 5\ \text{V}$ unless otherwise specified

Parameter	Sym- bol	Limit Values			Unit
		min.	typ.	max.	
Pressure Range KP 202-R KP 203-R	P_N	0 0	– –	60 160	kPa
Bridge Resistance	R_B	5.5	6.3	7.5	k Ω
Sensitivity KP 202-R KP 203-R	s	0.24 0.11	0.44 0.20	0.74 0.30	mV / V / kPa
Full Scale Span ($p = p_N$, $V_S = 5\ \text{V}$) KP 202-R KP 203-R	V_{FIN}	80 88	132 160	222 240	mV
Offset signal $p = p_0$	V_O	– 25	–	+ 25	mV
Linearity error (best fit straight line) $p = p_0 \dots p_N$ KP 202-R KP 203-R	F_L	– –	± 3 ± 3	– –	% V_{FIN}

Pressure Hysteresis	P_H				% V_{FIN}
KP 202-R		—	—	—	
KP 203-R		—	± 0.1	—	

Temperature Characteristics

at $T_1 = 25\text{ °C}$, $T_2 = 90\text{ °C}$, $T_3 = 25\text{ °C}$ and $V_S = 5\text{ V}$ unless otherwise specified

Parameter	Sym- bol	Limit Values			Unit
		min.	typ.	max.	
Temperature Coefficient of Span ¹⁾	$TC_{V_{FIN}}$	—	— 0.17	—	% K^{-1}
Temperature Coefficient of Offset ¹⁾	TC_{V_0}				% K^{-1}
KP 202-R		—	± 0.01	—	
KP 203-R		—	± 0.01	—	
Temperature Coefficient of Bridge Resistance ²⁾	TC_{RB}	—	+ 0.26	—	% K^{-1}
Temperature Hysteresis of Span ³⁾	$TH_{V_{FIN}}$				% K^{-1}
KP 202-R		—	± 0.4	—	
KP 203-R		—	± 0.3	—	
Temperature Hysteresis of Offset ³⁾	TH_{V_0}				% V_{FIN}^{-1}
KP 202-R		—	± 0.3	—	
KP 203-R		—	± 0.3	—	

¹⁾ Change in value of $TC_{V_{FIN}}$ or TCV between 25 °C and 125 °C relative to V_{FIN} (25 °C)

²⁾ Change in RB between 25 °C and 125 °C relative to RB (25 °C)

³⁾ Change in V_0 (25 °C) or V_{FIN} (25 °C) after temp. cycle $25\text{ °C} \rightarrow 125\text{ °C} \rightarrow 25\text{ °C}$ relative to V_{FIN} (25 °C)

Temperature Compensation

Cost-effective temperature compensation can be achieved using standard ohmic resistors in combination with the built in temperature sensor.

With fixed values for R_V and R_L a temperature compensation error of the output signal (span plus offset) of typical less than $\pm 1\%$ is achieved in the range $10\text{ }^{\circ}\text{C}$ to $40\text{ }^{\circ}\text{C}$ (see **Figure 2**).

A better temperature compensation is possible by measurement of the temperature coefficients of the sensor. In this case R_V is optimized as described in Chapter 3.10 (see Data Book).

Alternatively an ASIC can be used for calibration and compensation.

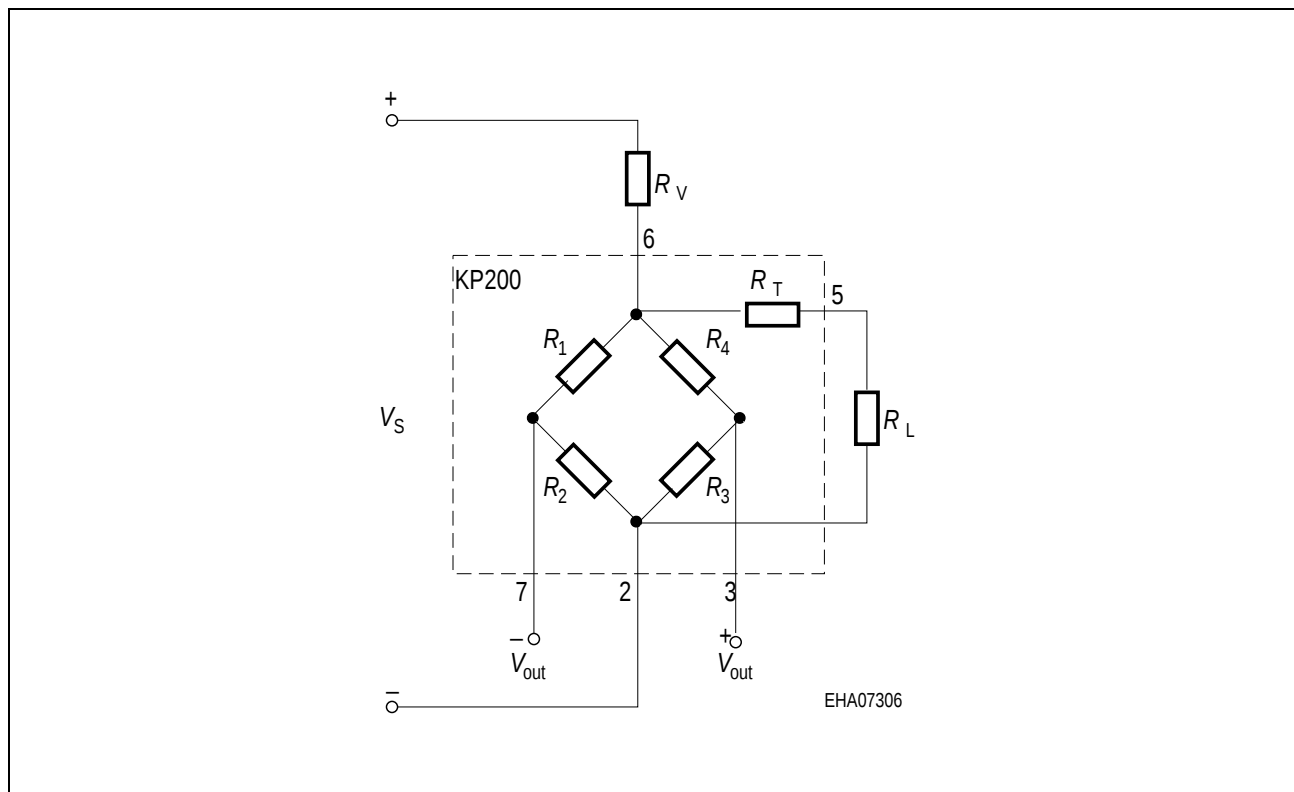


Figure 2 Electrical Circuit for Temperature Compensation

Broken line denotes sensor assembly. R_V and R_L need to be added externally.

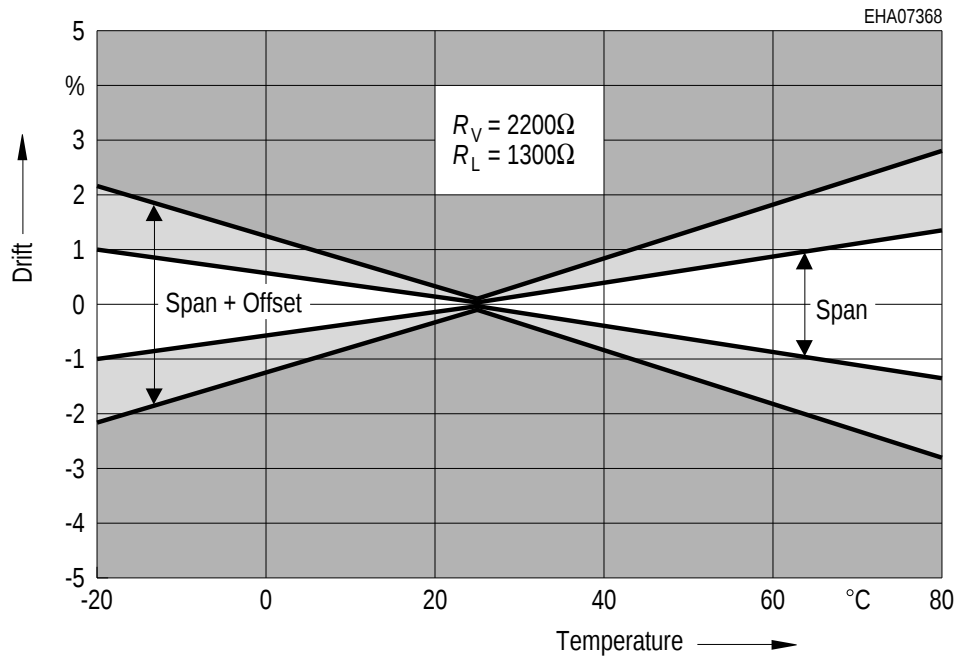


Figure 3 Error Band of Typical Signal Drift after Temperature Compensation Using Fixed Values for R_V and R_L

Using fixed resistor $R_V = 2200\ \Omega$ and $R_L = 1300\ \Omega$. Graph shows typical results for compensated span + offset signals.

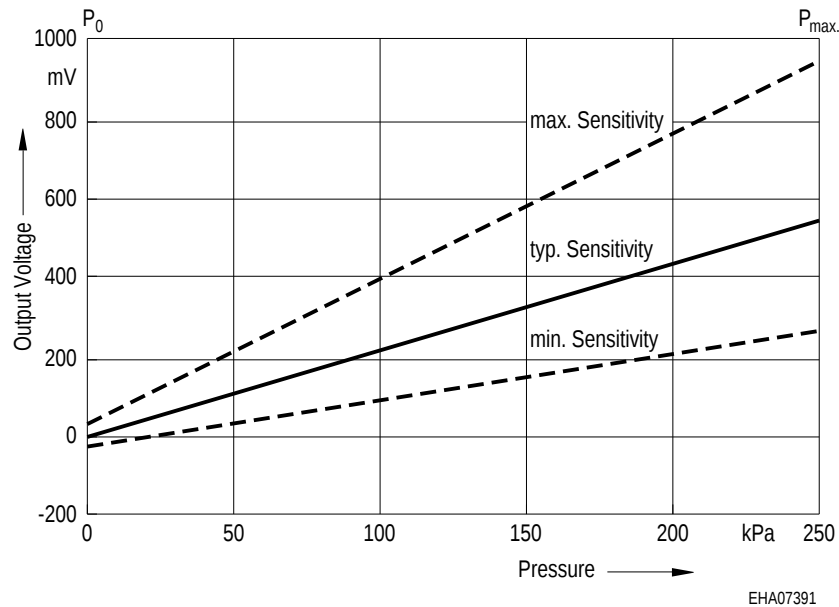


Figure 4 Output Voltage for Nominal and Maximal Pressure Range
KP 202-R

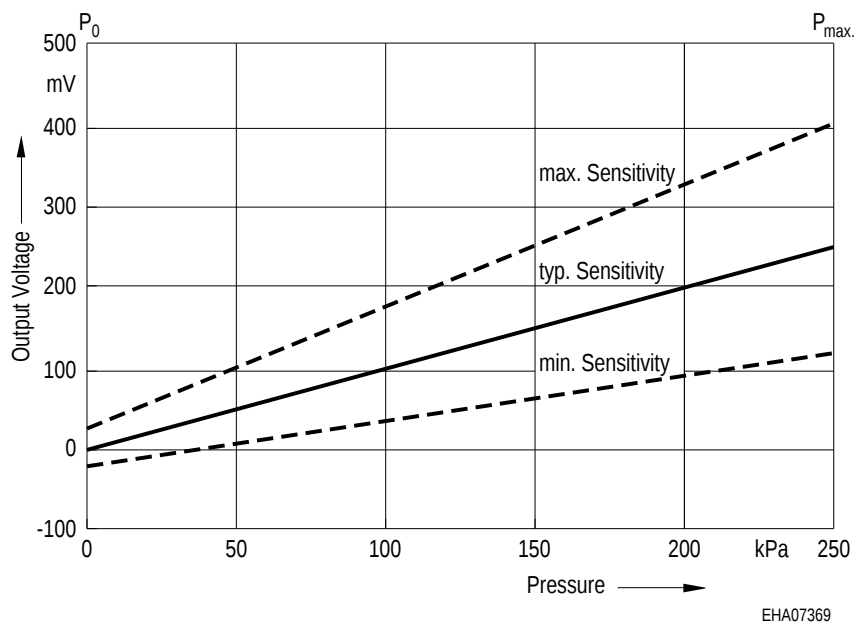


Figure 5 Output Voltage for Nominal and Maximal Pressure Range
KP 203-R

P-DSOF-8-6
(Plastic Dual Small Outline Flat Package)

Technical drawing of a microfluidic chip (Figure 1) showing top, side, and detail views with dimensions and labels.

Top View:

- Overall dimensions: 8.6 ± 0.1 mm (width) and 7 ± 0.1 mm (height).
- Internal dimensions: 7 ± 0.1 mm (width) and 3.8 ± 0.1 mm (height).
- Central feature: A square with rounded corners, labeled 1, 4, 5, and 8.
- Central hole: $\phi 1 \pm 0.1$ mm.
- Corner radius: $R0.55$.
- Side features: Two sets of holes, one labeled $2 \times \phi 0.2$ and the other $6 \times \phi 0.2$.
- Other dimensions: 1.27 , 0.8 ± 0.05 , 0.4 ± 0.10 , 0.2 ± 0.05 , and 0.1 ± 0.1 .

Side View:

- Overall height: 2.8 ± 0.1 mm.
- Top layer thickness: 1.05 ± 0.25 mm.
- Angle: 3° max. .
- Bottom layer thickness: 0.1 ± 0.1 mm.

Detail View (M 1.4:1):

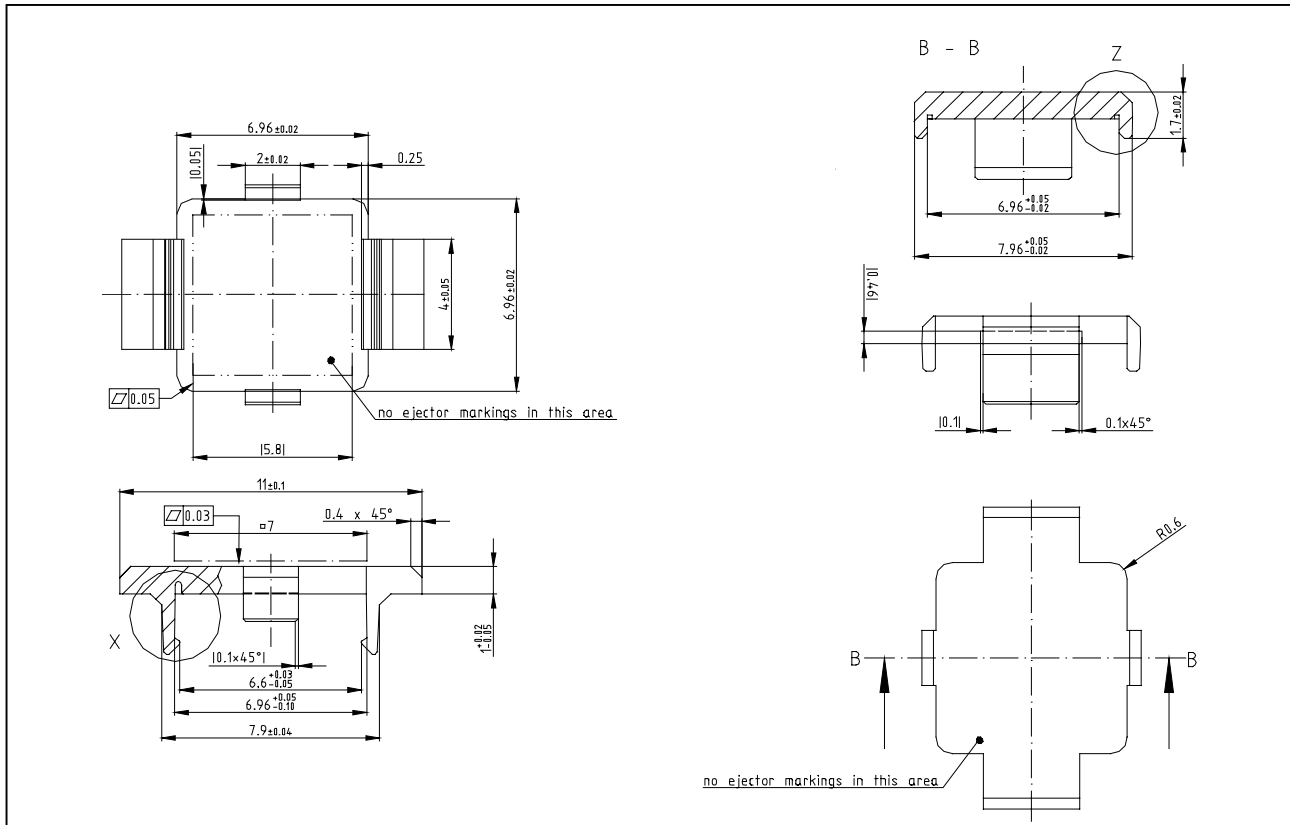
- Shows a cross-section of a hole with a diameter of $\phi 0.2$ mm.

Other Views:

- A side view showing the chip's profile with a width of 8.2 mm and a height of 1.2 mm.
- A top view of the chip showing a width of 8.2 mm and a height of 1.2 mm.

08.01

Cap:



Dimensions in mm

The package is made of a thermoplast housing and copper leadframe with NiPdAu finish. The chip is glued into the premolded plastic package using silicone glue, gold-wire bonded and covered with a protective gel. The pressure vent hole in the rear side of the package is 2.0 ± 0.3 mm in diameter. Finally the pressure port cap is mounted on the housing.

Sorts of Packing

Package outlines for tubes, trays etc. are contained in our Data Book "Package Information".

Dimensions in mm

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