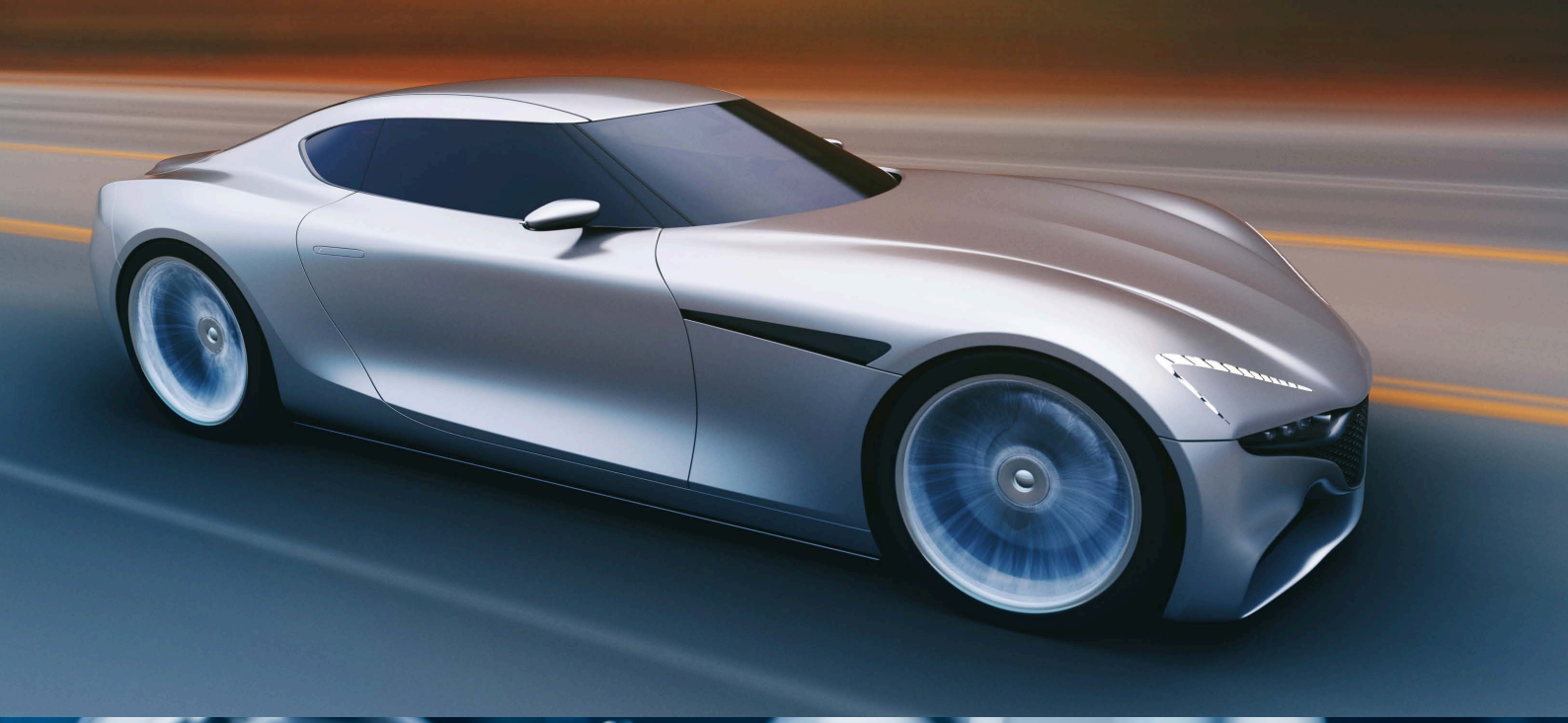

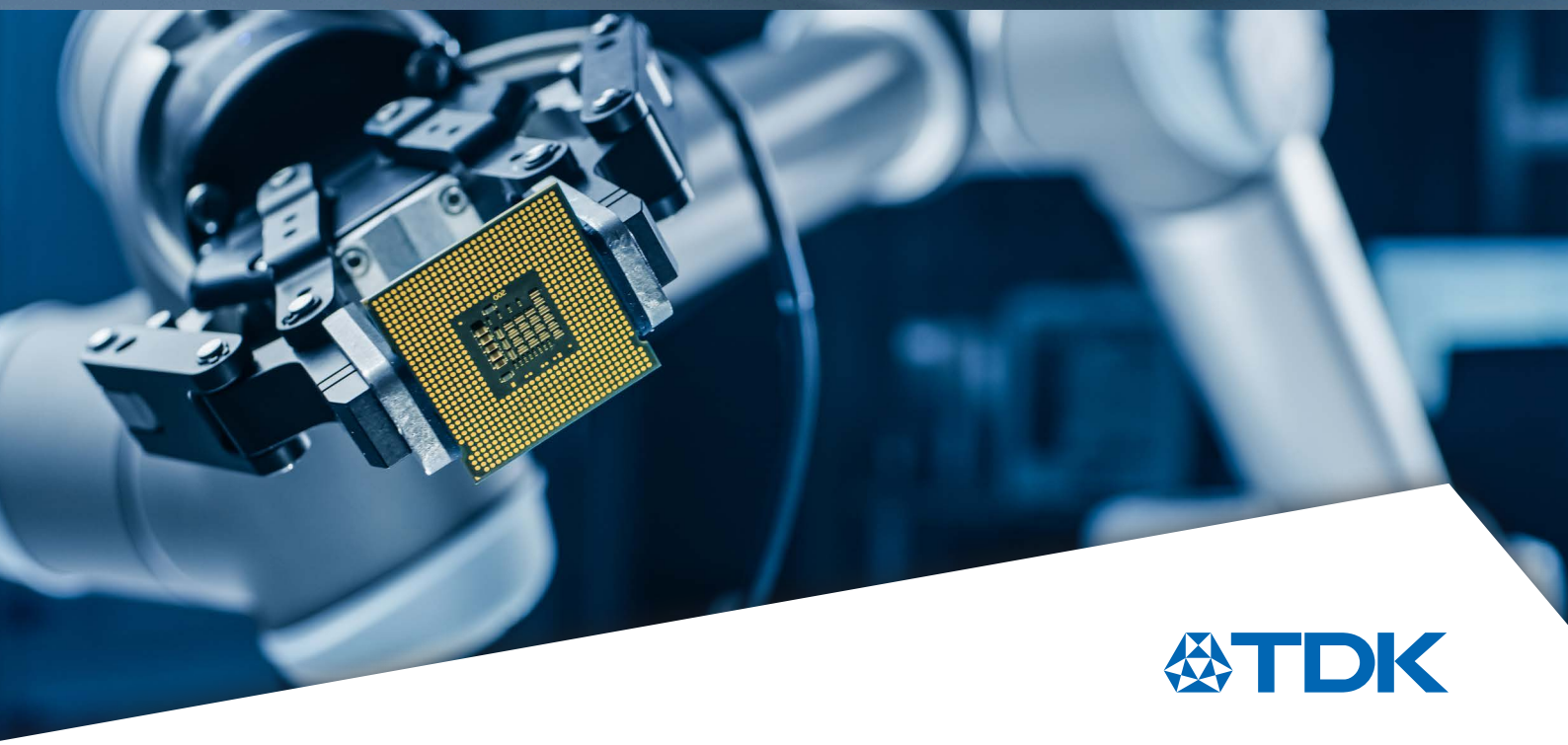

Product Brief 2022

Pressure Sensor Dies

Industrial and Automotive Applications

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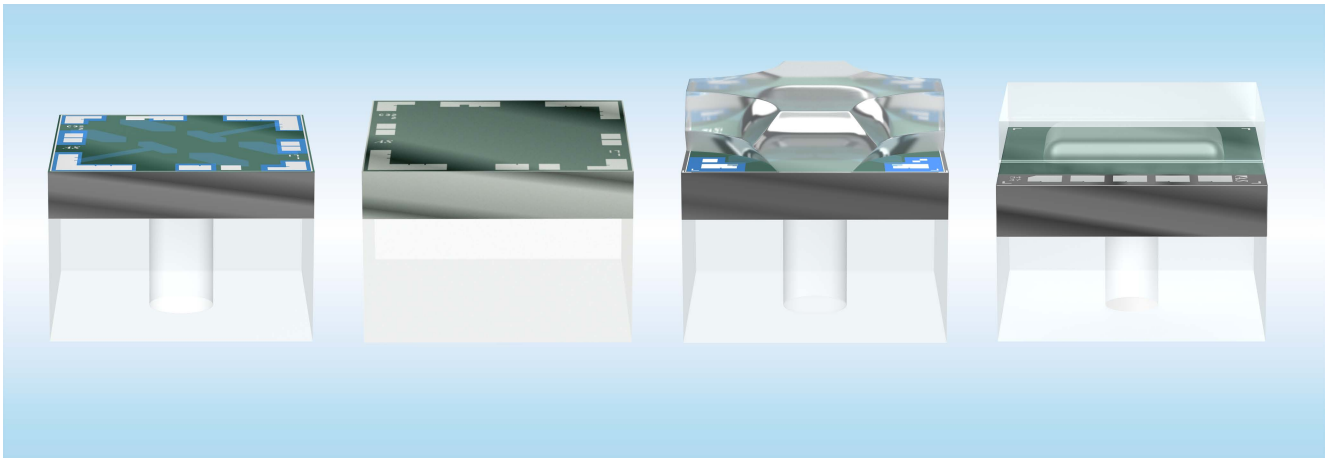
Pressure Sensor Dies for Industrial and Automotive Applications



The C32/ C38 and the latest C43/ C44 pressure sensor dies with their 1.65 × 1.65 mm footprint provide wide pressure ranges and fulfill increasing requirements of automotive and industrial applications. The dies are available in various configurations for absolute and gauge pressure sensing and with a single side or all around bond pad layout. Its robust design ensures high signal stability over lifetime and offers a simplified packaging.

Features

- Piezoresistive MEMS technology
- Rated pressure range of 0.4 to 40 bar
- Small dimensions: 1.65 × 1.65 × 1.1 mm
- Wheatstone bridge with mV output, ratiometric to supply voltage
- Outstanding high long-term stability
- Electrical shield on front side
- Gauge or absolute measurement

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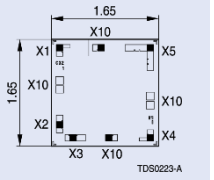
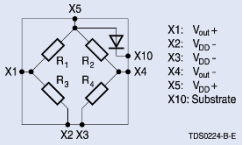
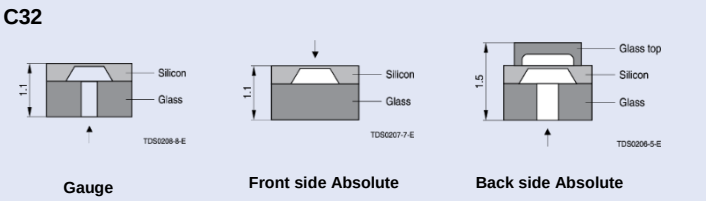
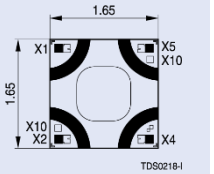
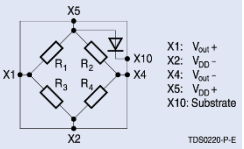
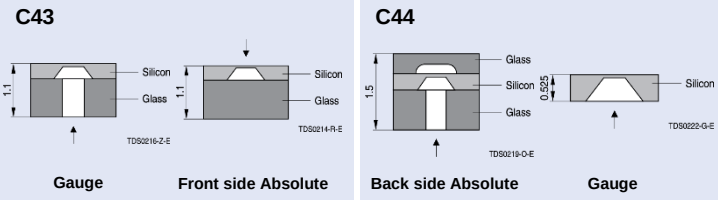
Pressure Sensor Dies for Industrial and Automotive Applications

Features

- Gauge or absolute (front or back side) measurements
- Rated pressure ranges: 0… 0.4 to 0… 40 bar
- Media: Non-aggressive gases and fluids
- C43 / C44 DIEs with high burst pressure up to 150 bar
- High signal stability
- Outstanding long-term stability [6]

DIE	Layout	Circuit diagram	Cross-section (Dimensions in mm)
C32 / C43 Open bridge			
C32 / C44 Close bridge			

Technical data

	Symbol	Conditions	Minimum	Typical	Maximum	Unit
Temperature maximum ratings						
Operating temperature range	T_a	[1]	–40	–	150	°C
Electrical specifications @ V_{DD} = 5 V						
Total bridge resistance	R_b	@ 25 °C [2]	2.6	3.3	4.0	kΩ
Temperature coefficient of total bridge resistance	α_{Rb}	@ 25 °C [3]	2.0	2.3	2.7	10^{-3}/K
	β_{Rb}		0	5.0 / 6.0	8.0	10^{-6}/K^2
Temperature coefficient of the sensitivity	α_S	@ 25 °C [4]	–2.5	–2.1	–1.9	10^{-3}/K
	β_S		0	4.0 / 5.0	8.0	10^{-6}/K^2
Pressure hysteresis	pHys	[5]	–0.1	0	0.1	% FSON
Long-term stability of offset (Full scale normal output FSON = 120 mV)	$LTSV_0$	[6]	–0.3	±0.1	0.3	% FSON

Rated pressure @ 25 °C, V_{DD} = 5 V

Operating pressure [7]	Over pressure [8]	Burst pressure [9]	Nonlinearity [10]	Sensitivity [11]
p_r, bar	p_{ov}, bar	p_{burst}, bar	L, % FS typ. / max.	S, mV/bar min. / typ. / max.
C32				
0.40	1.00	1.20	±0.4/±0.7	160/215/270
1.00	2.50	3.00	±0.4/±0.7	130/160/190
1.60	4.00	4.80	±0.2/±0.3	45/70/95
4.00	10.0	12.0	±0.2/±0.3	23/30/38
10.0	25.0	30.0	±0.2/±0.3	9/12/15
25.0	62.5	75.0	±0.2/±0.3	3.6/4.8/6
C43 / C44				
10.0	40.0	50.0	±0.1/±0.3	9/12/15
25.0	100	125	±0.1/±0.3	3.6/4.8/6
40.0	120	150	±0.2/±0.3	2.2/3/3.8

For ordering codes and other pressure ranges, please check the datasheets or product catalogue on the TDK website

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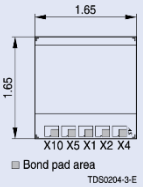
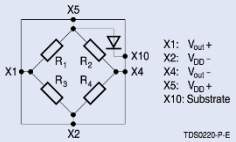
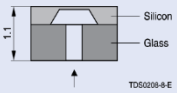
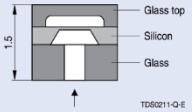
Pressure Sensor Dies for Industrial and Automotive Applications

Features

- Gauge or absolute back side measurements
- Rated pressure ranges: 0… 10 to 0… 40 bar
- Media: Non-aggressive gases and fluids
- Single side bond pads for direct die to ASIC wire bonding
- High signal stability
- Outstanding long-term stability [6)]

DIE	Layout	Circuit diagram	Cross-section (Dimensions in mm)
C38			 Gauge  Back side Absolute

Technical data

	Symbol	Conditions	Minimum	Typical	Maximum	Unit
Temperature maximum ratings						
Operating temperature range	T_a	[1)]	–40	–	150	°C
Electrical specifications @ V_{DD} = 5 V						
Total bridge resistance	R_b	@ 25 °C [2)]	3.4	4.0	4.6	kΩ
Temperature coefficient of total bridge resistance	α_{Rb}	@ 25 °C [3)]	2.0	2.3	2.7	10^{-3}/K
	β_{Rb}		0	6.0	8.0	10^{-6}/K^2
Temperature coefficient of the sensitivity	α_S	@ 25 °C [4)]	–2.5	–2.1	–1.9	10^{-3}/K
	β_S		0	4.0	8.0	10^{-6}/K^2
Pressure hysteresis	pHys	[5)]	–0.1	0	0.1	% FSON
Long-term stability of offset (Full scale normal output FSON = 120 mV)	$LTSV_0$	[6)]	–0.3	±0.1	0.3	% FSON

Rated pressure @ 25 °C, V_{DD} = 5 V

Operating pressure [7)]	Over pressure [8)]	Burst pressure [9)]	Nonlinearity [10)]	Sensitivity [11)]
p_r, bar	p_{ov}, bar	p_{burst}, bar	L, % FS typ. / max.	S, mV/bar min. / typ. / max.
10.0	30.0	50.0	±0.2/±0.3	7/10/13
25.0	75.0	110	±0.2/±0.3	4/5/6
40.0	75.0	110	±0.2/±0.3	2/3/4

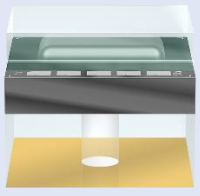
Additional Special Features

C32 - gold bond pad layout

- High corrosion resistance for front side application
- High temperature resistance up to +165 °C

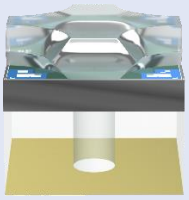
C38 - solderable back side metallization

- Solder joint for high media resistance
- Stable assembly for high pressure requirements (operating pressure up to 40 bar)



C44 - solderable back side metallization

- Solder joint for high media resistance
- Stable assembly for high pressure requirements (operating pressure up to 40 bar)



For ordering codes and other pressure ranges, please check the datasheets or product catalogue on the TDK website

Symbols and Terms

1) Operating temperature range T_a
This is the operating temperature range $T_{a,min}$ to $T_{a,max}$. Because most of the sensor parameters depend on assembling conditions like gluing, wire bonding, etc., the die has to be tested over the operating temperature range by the customer fully assembled.

2) Total bridge resistance R_b
Total bridge resistance is defined between pads X5 and X2 (see the dimensional drawing in the data sheet) of the closed piezoresistive bridge circuit. In approximation, the total bridge resistance equals the output impedance of the piezoresistive bridge circuit.

3) Temperature coefficients of total bridge resistance α_{Rb} and β_{Rb}:
The temperature coefficients of first and second order are defined by the polynomial:

$$R_b(T) = R_b(T = 25°C)[1 + \alpha_{Rb} (T - 25°C) + \beta_{Rb} (T - 25°C)^2]$$

The coefficients α_{Rb} and β_{Rb} are calculated using the three measurement points of $R_b(T)$ at T_{min} to T_{max} with T_R = 25 °C.

4) Temperature coefficient of sensitivity α_S and β_S: The temperature coefficients of first and second order are defined by the polynomial:

$$S(T) = S (T = 25°C) [1 + \alpha_S (T - 25°C) + \beta_S (T - 25°C)^2]$$

The coefficients α_S and β_S are calculated using three measurement points of S(T) at T_{min} to T_{max} with T_R = 25 °C.

5) Pressure hysteresis pHys
Pressure hysteresis is the difference between output voltages at constant pressure and constant temperature while applying a pressure cycle with pressure steps of $p_{r,min}$, p_1, p_2, p_3, $p_{r,max}$, p_3, p_2, p_1, $p_{r,min}$:

$$pHys = \frac{V_{out,2}\,(p_k) - V_{out,1}\,(p_k)}{FS}$$

With k = min., 1, 2, 3, max. the pressure steps are: $p_{r,min}$=0, p_1=0.25 · $p_{r,max}$, p_2=0.5 · $p_{r,max}$, p_3=0.75 · $p_{r,max}$, $p_{r,max}$.

6) Reliability data
For long-term stability of offset voltage $LTSV_0$ refer to TDK standard AS100001 in chapter “Reliability data” on the internet.

7) Operating pressure range p_r
For the rated pressure range 0 bar to $p_{r,max}$ the pressure sensor die output characteristic is according to this specification.

8) Overpressure p_{ov}
Pressure cycles in the pressure range from 0 bar to p_{ov} do not affect the performance of the pressure sensor dies.

9) Burst pressure p_{burst}
The diaphragm of the sensor die will not suffer mechanical destruction up to the burst pressure p_{burst}.

10) Nonlinearity L
Nonlinearity is measured using the endpoint method. Assuming a characteristic, this can be approximated by a polynomial of second order, where the maximum is at $p_x = p_{r,max}/2$. The nonlinearity is defined at $p_x = p_{r,max}/2$, using the equation:

$$L = \frac{V_{out}\,(p_x) - V_o}{V_{out}\,(p_{r.max}) - V_o} - \frac{p_x}{p_{r.max}}$$

11) Sensitivity S
Sensitivity is defined for a bridge voltage supply V_{DD} = 5V It can be determined by the formula:

$$S = \frac{V_{out}\,(p_{r,max}) - V_o}{p_{r,max}}$$

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