

## SCPK-Diff-i2C-R3.3-N.N.

Differential Pressure Sensors  
Customized for N.N.  
Pressure ranges  $\pm 25\text{Pa}$  ...  $1\text{MPa}$   
I<sup>2</sup>C-bus Digital Output 14bit  
3.0...3.6V DC Supply

### Features

- Temperature Compensated  $-25\dots 85\text{ }^{\circ}\text{C}$
- Zero and Span Calibrated
- Internal referenced output
- Supply Voltage range  $3.0 \dots 3.6\text{ V}$
- Accuracy incl. all errors  $1.25\%$

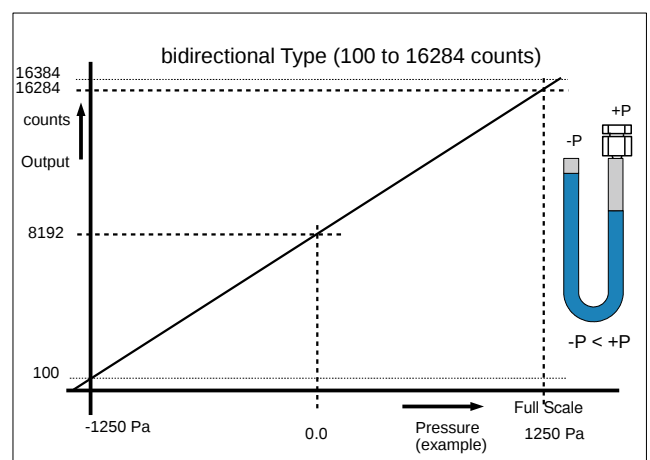
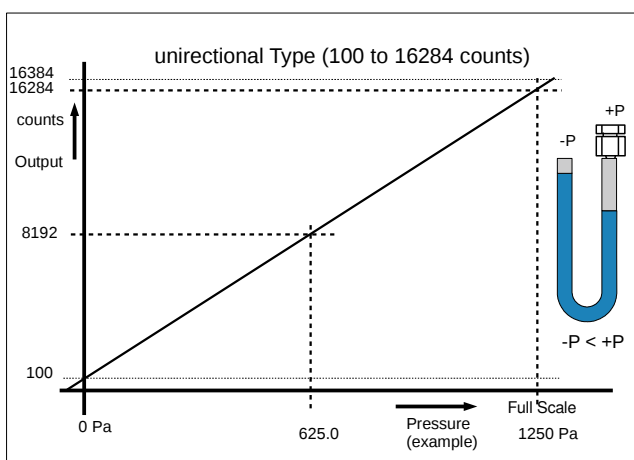


### Description

The SCPK...-Series of amplified pressure sensors use state of the art silicon micro machined pressure sensors in conjunction with stress free packaging techniques to provide cost effective temperature compensated pressure sensors and highly reliable precision signal conditioning using state of the art 600nm semiconductor technology.

The SCPK-sensor-Type provides a digital output of 100 to 16284 LSB according to the nominal pressure range. The R3.3-Type works within a supply voltage range of 3.0V to 3.6V. The output is set with „Life Zero to 100“ and a secure level below the maximum output to 16384 LSB. Other individual calibration is possible.

The SCPK...I2C communicates as a slave digitally via an I<sup>2</sup>C-bus interface and delivers within less than 1ms continuously serial 14bit pressure data after powering up the sensor. It answers on I<sup>2</sup>C-bus Master requests. The SCPK has a factory set I<sup>2</sup>C address. Other slave addresses (0x00 to 0x7F) are individually factory and user settable. For renewed data read synchronization the DTR Pin 6 is set high when a new corrected pressure value is available at the sensors communication register.



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### Maximum Values

Supply Voltage : 5.6V DC  
 Ambient Temperature:  $-40^{\circ}\text{C}$  /  $+125^{\circ}\text{C}$   
 Storage Temperature:  $-40^{\circ}\text{C}$  /  $+150^{\circ}\text{C}$   
 EMI-Protection:  $\pm 2000\text{V}$   
 Latch up free:  $\pm 100\text{mA}$  or  $+8\text{V}/-4\text{V}$  to GND

Characteristics SCP-K-Diff- bidirect. i2C-R3.3-N.N. (related to $V_s=3.3\text{V}$ rather than otherwise stated)				
PARAMETER	MINIMUM	NOMINAL	MAXIMUM	UNIT
Supply Voltage	3.0	3.3	3.6	V
Supply Current (with $>1\text{M}\Omega$ output load resistance)	70.0	2,000	2,400	$\mu\text{A}$
Internal Reference Voltage		supply Voltage		
Operating Temperature	$-40.0$	25.0	125.0	deg C
Compensated Temperature (guaranteed accuracy)	$-40,0$	25,0	125.0	deg C
Temp. caused Offset Error ( $-25$ to $85$ deg C)	0,0	$\pm 0.25$	$\pm 0.5$	% FSO
Temp. caused Span Error ( $-25$ to $85$ deg C)	0,0	$\pm 0.15$	$\pm 0.25$	% FSO
Linearity Error (best straight line fit)	0,0	$\pm 0.15$	$\pm 0.25$	% FSO
Hysteresis Error (Nominal Pressure Cycle)	0,0	$\pm 0.05$	$\pm 0.07$	% FSO
Hysteresis Error Offset (Operating Temperature Cycle)	0,0	$\pm 0.15$	$\pm 0.10$	% FSO
Combined total Error (at all specified operating conditions allowed & aging 6 years)			$\pm 1.25$	% FSO
Nominal Pressure	25 Pa		1MPa	
Output Calibration digital at lowest pressure	59	100	141	counts (LSB)
Output Calibration at Zero Pressure	8151	8192	8233	counts (LSB)
Full Scale Output Calibration digital at highest pressure	16243	16284	16325	counts (LSB)
Offset & Full Scale Output calibration accuracy	-0.3	-	0.25	% FSO
Overpressure (no irreversible change of parameters)	5(7)x nom P	-	-	hPa
Burst Pressure	10(14) x nom P	-	-	hPa
I <sup>2</sup> C pressure read value renew Time (1ms up to 125ms values on request)	-		5,0	ms
Slow data conversion enabled ( to reduce pressure noise)		NO		
Input Capacitance (each Pin)			10.0	pF
Load Capacitance (SDA)			200	pF
Power on reset: V+ Pin to GND resistor	30			Ohm
Ambient Humidity guaranteed operation (not operating)	0		95 (100)	%r.H.

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### Calibration Output Settings

Pressure [ individual ]	I <sup>2</sup> C-bus Output [decimal value]	Ratio vs 16384 [%]
nominal	16284	99.390
½ nominal	12238	74.695
0	8192	50.000
- nominal	100	0.6104

### Characteristics SCPk-Pa-1250/1250D-i2C-R3.3-N.N.

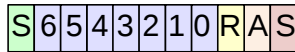
PARAMETER	MINIMUM	NOMINAL	MAXIMUM	UNIT
Resolution I <sup>2</sup> C Data Transmission		14		bit
Actual Resolution serial digital Output	-	13 ½	-	bit
I <sup>2</sup> C-bus Clock Frequency from Master	10.0	-	100.0	kHz
I <sup>2</sup> C-bus 7 bit address (factory setting, can be changed)		0x20		hex
Sensor Die connection check enabled		no		
Internal clock frequency	1.0		1.0	MHz
Temperature Output calibrated		no		
Temperature Output @-25°C		-		LSB
Temperature Output @75°C		-		LSB
Temperature Calibration accuracy		-		°C
Power On Recovery time			6.0	ms
Pull-up Resistor at I <sup>2</sup> C bus SCL, SDA	500,0			Ohm
Input Low Level $V_{in\_low}$ SCL and SDA	0.0		0.2	times $V_{DD}$
Input High Level $V_{in\_high}$ SCL and SDA	0.8		1.0	times $V_{DD}$
Input leakage to $V_{SS}$ $I_{il}$ SCL and SDA	-1.0		1.0	$\mu\text{A}$
Input leakage to $V_{DD}$ $I_{ih}$ SDA with output disabled	-1.0		1.0	$\mu\text{A}$
Input leakage to $V_{DD}$ $I_{ih\_PU}$ with weak pull-up		-1.2	-5.0	$\mu\text{A}$

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## SCPk I<sup>2</sup>C Data Transmission

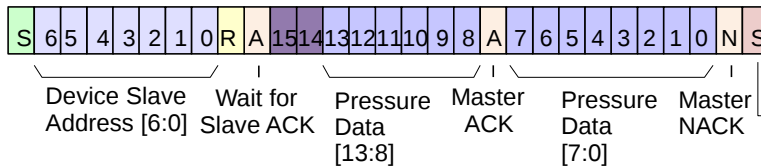
1) I<sup>2</sup>C Read\_Pressure/Temperature-Data Request:  
 Slave (SCPk 0x28) starts a measurement and DSP calculation cycle.



Device Slave Address [6:0]      Wait for Slave ACK  
 Example: SCPk (fixed I<sup>2</sup>C-address=0x1A)  
**S 0 0 1 1 0 1 0 1 A S**

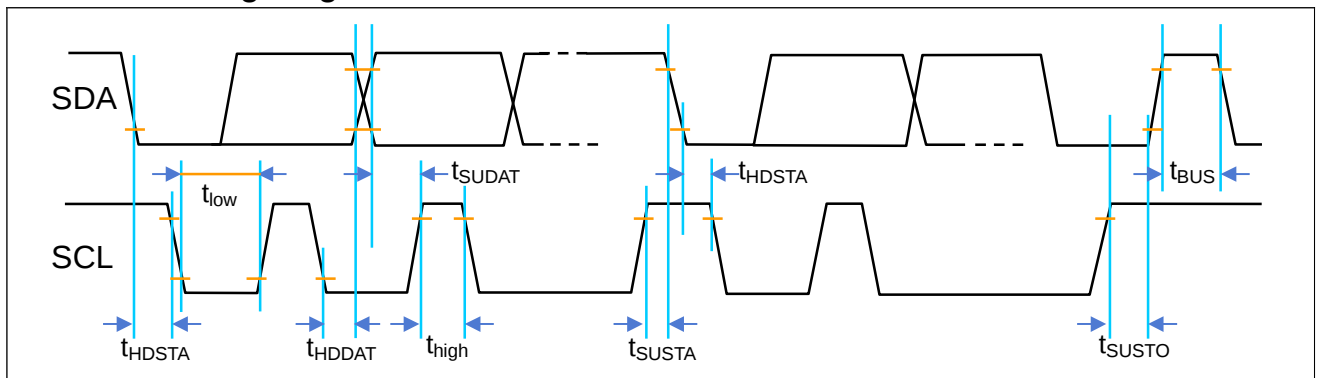
- S I<sup>2</sup>C Start Condition
- 5 Device Slave Address (example: Bit 5)
- 2 Data Bit (example: Bit 2)
- R Read/Write Bit ( Read=1, Wriht=0)
- A Acknowledge by Slave or Master (ACK)
- N No Acknowledge (NACK)
- S Stop Condition
- Status Bit (example: Data at output register not yet renewed)

2) I<sup>2</sup>C Read\_Pressure-Data „Fetch 2 Bytes“:  
 Slave SCPk returns only pressure data to the master in 2 bytes.



Example:  
 SCPk (fixed I<sup>2</sup>C-address=0x1A): answers @30mb for a 0 to 30mb full scale sensor  
**S 0 0 1 1 0 1 0 1 A 0 0 1 1 1 1 1 1 A 1 0 0 1 1 1 0 0 N S**

## SCPk I<sup>2</sup>C Timing Diagram



### Characteristics SCPk-Pa-1250/1250D-i2C-R3.3-N.N.

I <sup>2</sup> C PARAMETER	MINIMUM	NOMINAL	MAXIMUM	UNIT
Start condition hold time relative to SCL edge $t_{HDSTA}$	0.1			µs
Minimum SCL clock low width <sup>1)</sup> $t_{low}$	0.6			µs
Minimum SCL clock high width <sup>1)</sup> $t_{high}$	0.6			µs
Start condition setup time relative to SCL edge $t_{SUSTA}$	0.1			µs
Data hold time on SDA relative to SCL edge $t_{HDDAT}$	0.1			µs
Data setup time on SDA relative to SCL edge $t_{SUDAT}$	0.1			µs
Stop condition setup time on SCL $t_{SUSTO}$	0.1			µs
Bus free time between stop condition and start condition $t_B$	2.0			µs

<sup>1)</sup> Combined low and high widths must equal or exceed minimum SCLK period.

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**Note I<sup>2</sup>C<sup>®</sup>:** *There are three differences in the SCPK protocol compared with the original I<sup>2</sup>C<sup>®</sup> protocol:*

- Sending a start-stop condition without any transitions on the CLK line (no clock pulses in between) creates a communication error for the next communication, even if the next start condition is correct and the clock pulse is applied. An additional start condition must be sent, which results in restoration of proper communication.
- The restart condition—a falling SDA edge during data transmission when the CLK clock line is still high—creates the same situation. The next communication fails, and an additional start condition must be sent for correct communication.
- A falling SDA edge is not allowed between the start condition and the first rising SCL edge. If using an I<sup>2</sup>C<sup>®</sup> address with the first bit 0, SDA must be held low from the start condition through the first bit.

**Note Power-on-reset:**

The SCPK POR-threshold has a hysteresis at ON to OFF and vice versa. A timing such as  $dV/dt$  [MIN/MAX] for Power-On or Power-Off is not specified.

**Note DTR (new data ready Pin No. 6):**

The DTR Pin rises to „high“ when new output data is ready and falls when the next I<sup>2</sup>C communication occurs. It is most useful to optimize I<sup>2</sup>C-bus data communication.

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### Outline Drawings and Connection Diagrams

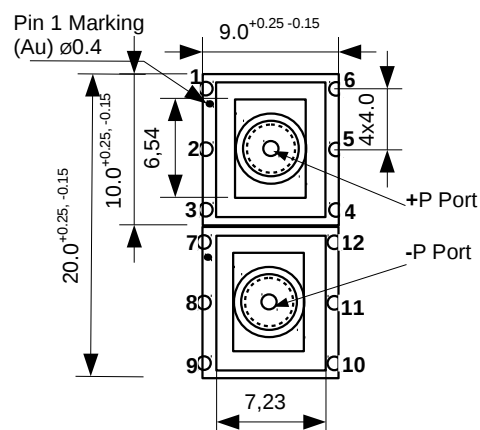
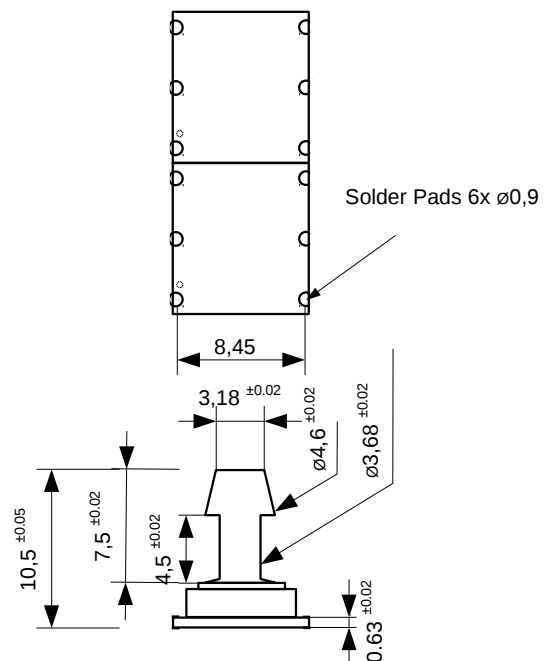
**SCPk\_D** (differential)  
FN12-Package (12-pad direkt SMD-solder-Type)

Dimensions in mm

**Materials**

Lid and Pressure Port: Polyamide 30% GF  
Substrate: Al<sub>2</sub>O<sub>3</sub> Ceramic  
RTV Glue, Epoxy-Glue  
Thickfilm: AgPd, Au, Glaze  
Solderpads: AgPd,Pt

Sensor Pin No.	Function
1	VDD V+ Supply
2	N/C Not connected
3	GND
4	SCL I <sup>2</sup> C bus clock
5	SDA I <sup>2</sup> C bus data
6	DTR new data ready (see Note @ page 5)
7-12	No function, only for fixing



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**Ordering Information and Labeling**  
**!!!EXAMPLE !!!**

SensDev Part No.:

**SCPK-Pa-1250/1250D-i2C-R3.3-N.N.**

Customer Id-Nummer / Purchase Spec.-No.:

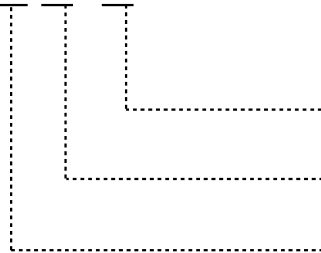
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**Lasermarking at Lid:**

**SenSpecial(TM)**  
**SCPK-Pa-1250/1250D**  
**I2C-R3.3-N.N.**  
**162108**

**Individual Lot- No.:**

16 21 08



Lot No., inkrementated weekly

Week of the year

Production year

**Packaging**

**Xx** mm Tape, 24mm pitch

