DSDX Series
Digital pressure transducers

FEATURES

- **0...1 to 0...100 psi, 0...±1 to 0...±100 psi**
- **Absolute, gage or differential pressure**
- **Digital readout via I²C-bus**
- **Precision ASIC conditioning**
- **Temperature compensated**
- **Non-ratiometric output**

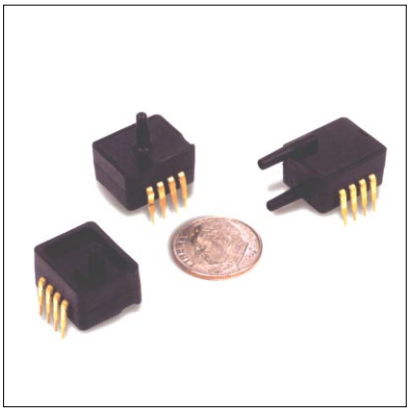
APPLICATIONS

- **Medical instrumentation**
- **Barometry**
- **HVAC controls**
- **Pneumatic controls**

GENERAL DESCRIPTION

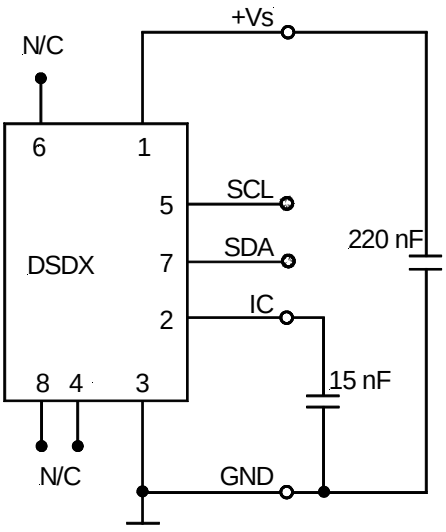
The DSDX series offers a digital interface on a very cost-effective basis. This family is fully calibrated and temperature compen-sated using an on-board ASIC. These sensors are intended for use with non-corrosive, non-ionic working fluids such as air and dry gases.

Devices are available to measure absolute, differential, and gage pressures from 1 to 100 psi. The absolute devices have an internal vacuum reference and an output signal proportional to absolute pressure. Differential devices allow application of pressure to either side of the sensing diaphragm and can be used for gage or differential measurements.



All DSDX devices are accurate to within ±2.0 %FSS for all gage and absolute devices. The devices are characterized for operation from a single 5 V supply. The sensor is designed and manufactured according to standards laid down in ISO 9001.

ELECTRICAL CONNECTION



Note: **A capacitor of 220 nF is required between +Vs and GND.**

Pin 2 is an internal device connection and should be connected to ground with a 15 nF capacitor.

It is important to place the capacitors as close to the pins as possible!

Pins 4, 6 and 8 are internal device connections and should not be connected for any reason!

PRESSURE SENSOR CHARACTERISTICS

Maximum ratings

Supply voltage V_S	4.75 to 5.25 V_{DC}
	max. 6.50 V_{DC}
Lead temperature (2 - 4 sec.)	250°C

Environmental specifications

Temperature ranges	
Compensated	0 to +85°C
Operating	-20 to +105°C
Storage	-40 to +125°C
Vibration:	10 g at 20 - 2000 Hz
Shock:	100 g for 11 ms

Caution! The sensor is not reverse polarity protected.
Incorrect applications of excitation voltage or ground to the wrong pin can cause electrical failure.
Application of supply voltage above the maximum can cause electrical failure.

PRESSURE RANGES SPECIFICATIONS

(V_S = 5.0 V_{DC}, T_A = 25°C)

Part number	Pressure range		Burst pressure[1]		Sensitivity (typ.)	
DSDX015A2R	0 to 15		30		218	
DSDX030A2R	0 to 30	psi(a)	60	psi(a)	109	
DSDX100A2R	0 to 100		150		33	
DSDX001G2R / D4R	0 to 1		5		3277	
DSDX005G2R / D4R	0 to 5		20		655	
DSDX015G2R / D4R	0 to 15		30		218	
DSDX030G2R / D4R	0 to 30		60		109	counts/ psi
DSDX100G2R / D4R	0 to 100		150		33	
DSDX001D4D	0 to ±1	psi(g,d)	5	psi(g,d)	1638	
DSDX005D4D	0 to ±5		20		328	
DSDX015D4D	0 to ±15		30		109	
DSDX030D4D	0 to ±30		60		55	
DSDX100D4D	0 to ±100		150		16	

PERFORMANCE CHARACTERISTICS

The output signal is <u>not ratiometric</u> to the supply voltage (V_S = 5.0 V_{DC}, T_A = 25°C)

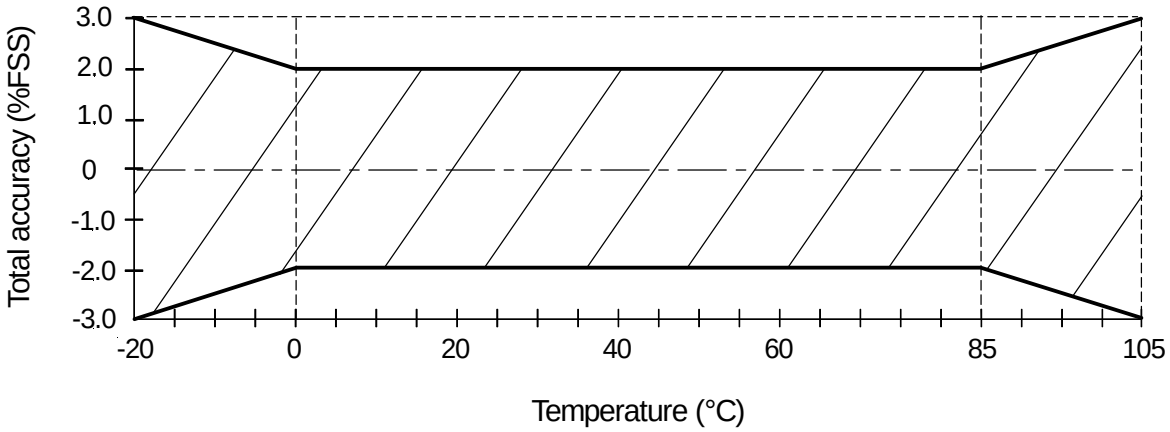
All DSDX...R

Characteristics	Min.	Typ.	Max.	Unit
Zero pressure offset	347	410	473	counts
Full scale span (FSS)[2]		3276		
Full scale output	3624	3686	3750	
Total accuracy (0 to 85°C)[3]			±2.0	%FSS
Sample rate	100			Hz
Response delay[4]	2.73		14.11	ms
Startup time (power up to 1st result)			40	
Quantization step[5]		3		counts
Current consumption		6		mA

All DSDX...D

Characteristics		Min.	Typ.	Max.	Unit
Zero pressure offset		1985	2048	2111	counts
Full scale span (FSS)[2]			3276		
Output	at max. specified pressure	3624	3686	3750	
	at min. specified pressure	347	410	473	
Total accuracy (0 to 85°C)[3]				±2.0	%FSS
Sample rate		100			Hz
Response delay[4]		2.73		14.11	ms
Startup time (power up to 1st result)				40	
Quantization step[5]			3		counts
Current consumption			6		mA

TOTAL ACCURACY (-20 TO +105°C)



Specification notes:

1. If maximum burst pressure is exceeded, even momentarily, the package may leak or burst, or the pressure sensing die may fracture.
2. Span is the algebraic difference between the output signal for the highest and lowest specified pressure.
3. Total accuracy is the combined error from offset and span calibration, linearity, pressure hysteresis, and temperature effects. Linearity is the measured deviation based on a straight line. Hysteresis is the maximum output difference at any point within the operating pressure range for increasing and decreasing pressure. Calibration errors include the deviation of offset and full scale from nominal values.
4. Delay time between sampling and signal change at the output.
5. The smallest change in the output voltage, given any change in pressure.

INTRODUCTION

The DSDX is capable to generate a digital output signal. It runs a cyclic program, which will store a corrected 12-bit sensor value about every 10 ms within the output registers of the internal ASIC. In order to use the pressure transducer for digital signal readout, the device should be connected to a bidirectional I²C-bus.

According to the I²C-bus communication specification, the bus is controlled by a master device, which generates the clock signal, controls the bus access and generates START and STOP conditions. The DSDX is designed to work as a slave, hence it will only respond to requests from a master device.

The I²C-bus master-slave concept requires a unique address for each device. The DSDX has a hard coded slave address (1111000xb), therefore it is **not** possible to access more than one DSDX on the same I²C-bus line.

DIGITAL I²C INTERFACE

The DSDX complies with the following protocol (FIGURE I):

Bus not busy: During idle periods both data line (SDA) and clock line (SCL) remain HIGH.

START condition (S): HIGH to LOW transition of SDA line while clock (SCL) is HIGH is interpreted as START condition. START conditions are always generated by the master. Each request for the current pressure value must be initiated with a START.

STOP condition (P): LOW to HIGH transition of SDA line while clock (SCL) is HIGH determines STOP condition. STOP conditions are always generated by the master. More than one request for the current pressure value can be transmitted without generation of intermediate STOP condition.

DATA valid (D): State of data line represents valid data when, after START condition, data line is stable for duration of HIGH period of clock signal. Data on line must be changed during LOW period of clock signal. There is one clock pulse per bit of data.

Acknowledge (A): Data is transferred in pieces of 8 bits (1 byte) on serial bus, MSB first. After each byte receiving device – whether master or slave – is obliged to pull data line LOW as acknowledge for reception of data. Master must generate an extra clock pulse for this purpose. When acknowledge is missed, slave transmitter becomes inactive. It is on master either to send last command again or to generate STOP condition in that case.

Slave address: Each device connected to the bus has a unique slave address. After generating a START condition, the master has to transmit the slave address for the DSDX with a READ command: $F1. The DSDX must not be accessed with a WRITE command ($F0) as the correct function of the device can not be guaranteed in this case (note: a power-down power-up change will force the sensor to use factory data again).

DATA operation: The DSDX starts to send 2 data bytes containing the current pressure value placed in the output registers.

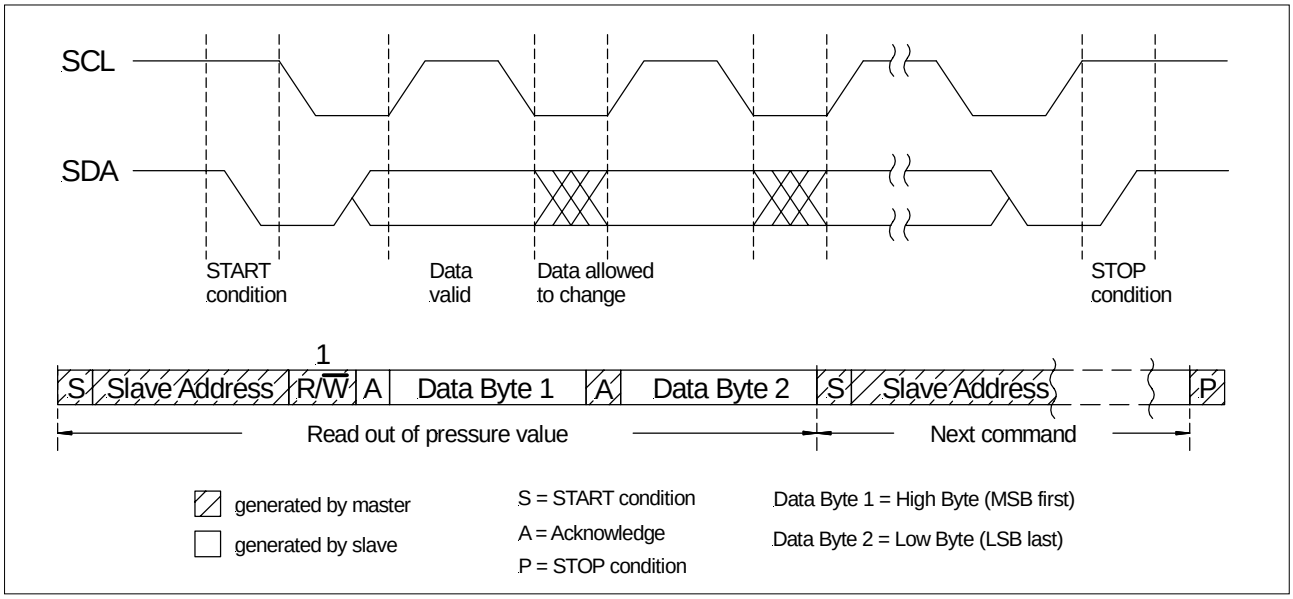


FIGURE I: **I²C-BUS Protocol of DSDX**

I²C INTERFACE PARAMETERS

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Input high level			90		100	% of Vs
Input low level			0		10	
Output low level		(open drain, IOL = -4 mA)			10	
Pull up current		(pins SCL and SDA)	5		20	µA
Load capacitance SDA					400	pF
SCL clock frequency	F_{SCL}		---		100	kHz
Bus free time between STOP and START condition	t_{BUF}		4.7			µs
Hold time (repeated) START condition	$t_{HD.STA}$	to first clock pulse	4.0			µs
LOW period of SCL	t_{LOW}		4.7			µs
HIGH period of SCL	t_{HIGH}		4.0			µs
Setup time repeated START condition	$t_{SU.STA}$		4.7			µs
Data hold time	$t_{HD.DAT}$		0			ns
Data setup time	$t_{SU.DAT}$		250			ns
Rise time of both SDA and SCL	t_R		---		300	ns
Fall time of both SDA and SCL	t_F		---		300	ns
Setup time for STOP condition	$t_{SU.STO}$		4			µs
Input filter spike suppression	t_{SP}	spikes on SDA or SCL of that length are suppressed			50	ns

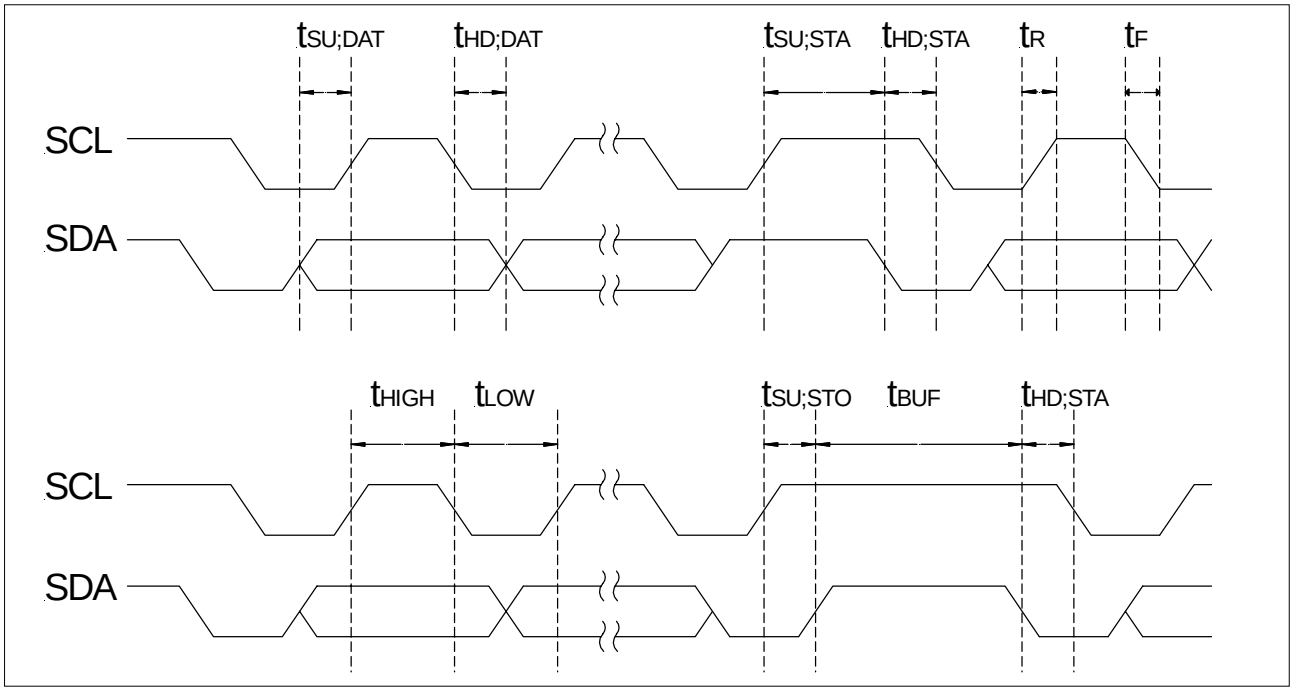
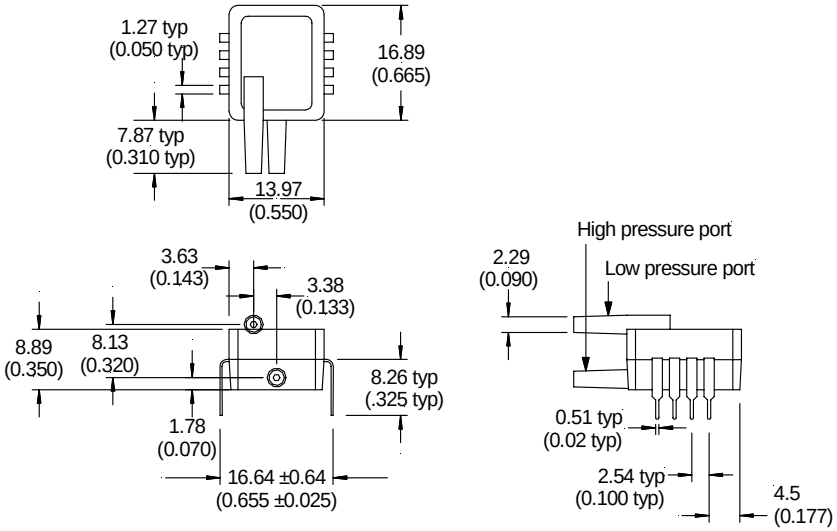


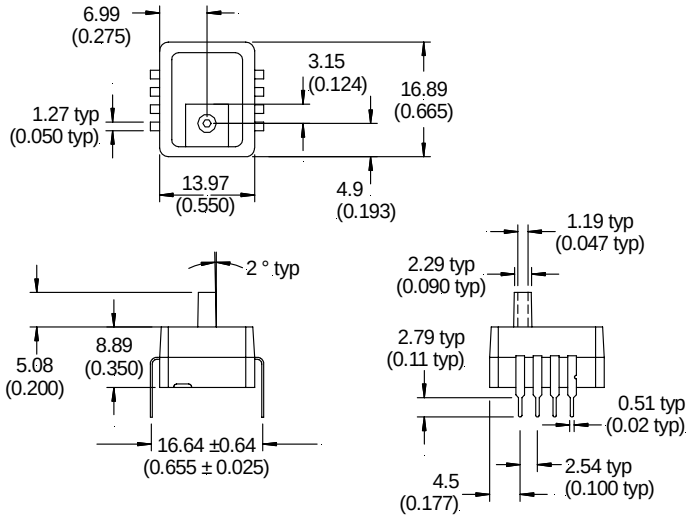
FIGURE II: **Timing characteristics of the I²C interface**

PHYSICAL DIMENSIONS

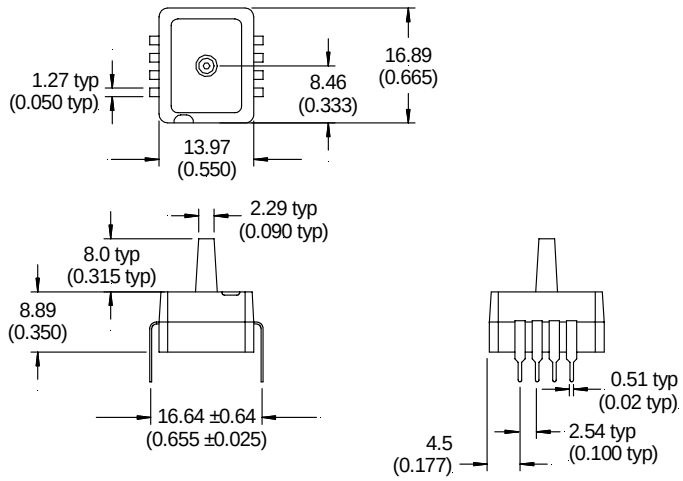
D4 package

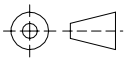


G2 package



A2 package



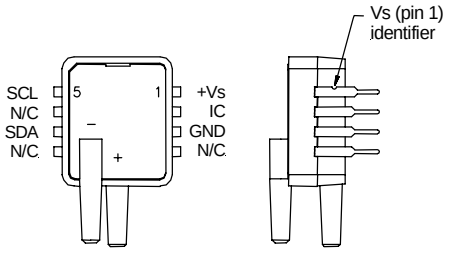


third angle projection

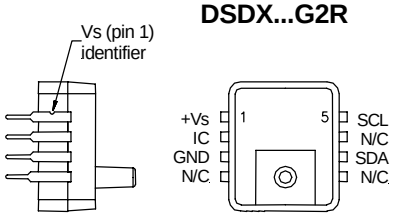
dimensions in mm (inches)

ELECTRICAL CONNECTIONS

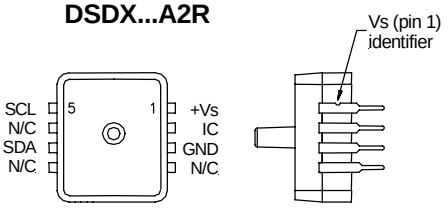
DSDX...D4...



DSDX...G2R



DSDX...A2R



Note: Pins 4, 6 and 8 are internal device connections and should not be connected for any reason.

Pin 2 is an internal device connection and should be connected to ground with a 15 nF capacitor.

ORDERING INFORMATION

Pressure range	Absolute	Gage	Differential/Gage
0 to 1 psi		DSDX001G2R	DSDX001D4R
0 to 5 psi		DSDX005G2R	DSDX005D4R
0 to 15 psi	DSDX015A2R	DSDX015G2R	DSDX015D4R
0 to 30 psi	DSDX030A2R	DSDX030G2R	DSDX030D4R
0 to 100 psi	DSDX100A2R	DSDX100G2R	DSDX100D4R
0 to ±1 psi			DSDX001D4D
0 to ±5 psi			DSDX005D4D
0 to ±15 psi			DSDX015D4D
0 to ±30 psi			DSDX030D4D
0 to ±100 psi			DSDX100D4D

Other pressure ranges or calibrations are available on request

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