Smartec Sensor Product Catalogue

MMS-e

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smartec

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Temperature Sensors

Introduction

The Smartec temperature sensor is a sophisticated full silicon temperature sensor with a digital output. The one wire output (duty-cycle modulated) can be directly connected to all kinds of micro-controllers without the need of A/D conversion. The temperature range is –45 °C to 150 °C. The very high resolution (< 0.005 °C) makes the sensor useful for high precision applications. The sensor is based on a PTAT element, a semiconductor structure with an accurate and well defined output relative to temperature. The output of this PTAT is digitized by means of a duty cycle generator. The sensors are calibrated during production for direct use in any kind of application. The duty cycle output can be interpreted in a digital way as well in an analogue way. In applications where multiple sensors are used, easy multiplexing can be obtained by using a corresponding number of microprocessor inputs or by using low cost digital multiplexers.

Applications

- Heater systems
- Measuring instruments
- Washing machines
- Overheating protection
- Home appliances
- Medical equipments

In case a temperature probe is needed Smartec can deliver the sensor in a stainlesss tube with almost any kind of cable.

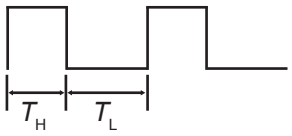
For "plug and play" applications evaluation boards and dedicated software can be delivered

About the Output Signal

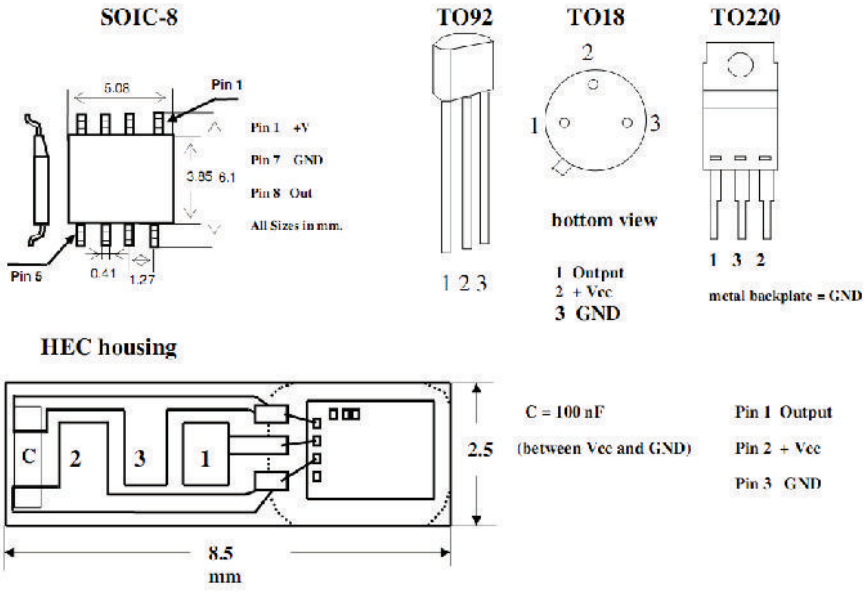
The output is a square wave with a well-defined temperature-dependent duty cycle. The duty cycle of the output signal is linearly related to the temperature according to the equation:

$D.C.=0.32+0.0047*t$ where $D.C.$ = Duty Cycle $=T_H/(T_H+T_L)$

t = Temperature in ˚C

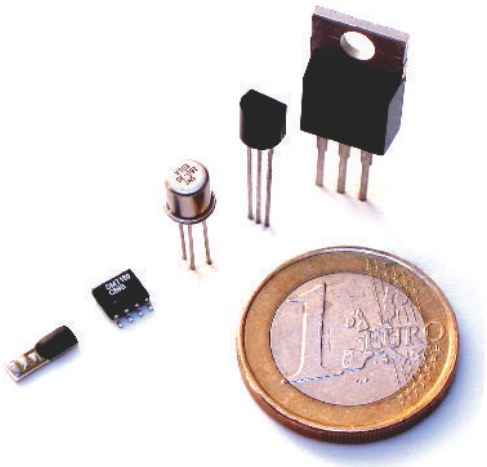


Pin-outs



Sensor Elements

SMT16030



- Absolute accuracy ± 0.7 °C
- Linear output within 0.2 °C
- Resolution better then 0.005 °C
- Duty Cycle output
- Calibrated on chip
- TTL, CMOS compatible
- Temperature range 175 °C (-45 to +130 °C)
- Directly connectable to data input of microprocessor
- Easy multiplexing of multiple sensors

Package options

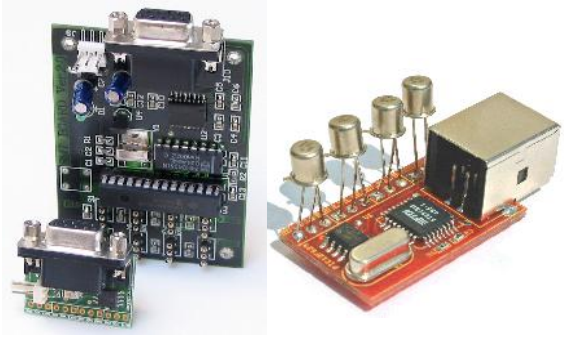
- TO18 (accurate)
- TO92 (low cost)
- TO220
- SOIC
- HEC
- Other types possible on request

SMTRVS1801

- Stainless steel tube with TO18 Smartec sensor inside
- Isolated tube
- Shielded 3-wire PVC cable
- Deliverable with cable length between 10 cm and 20 meter
- Other sensor encapsulations on request.

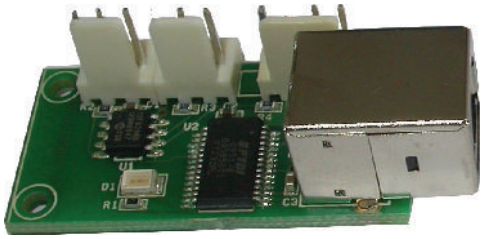
Evaluation Boards

SMTAS04/08



- Multiple (4 or 8) temperature sensors can be read out simultaneously
- Reduced self-heating by fast switching the sensors
- Output data indicates T_H and T_L value
- Output standard RS232 (4 or 8 sensors) and USB (4 sensors) interface
- Free PC software available

SMTAS02I2C



- Two Smartec temperature sensors can be read out simultaneously
- Extra I^2C interface to connect other Smartec I^2C sensor modules
- USB interface for both power and data communications
- Sensor signals are all converted into ASCII code at the output
- Free PC software available

Infrared Sensors

Introduction

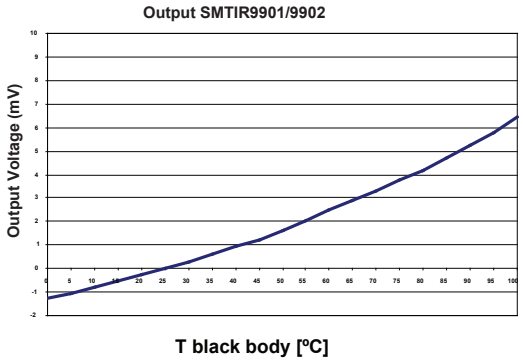
The Smartec infrared sensor SMTIR9901 and SMTIR9902 are sophisticated full silicon infrared sensors. The sensors can be used in measuring the radiation temperature without any contact. For the different radiation temperature ranges various filters are available. The sensor type SMTIR9902 contains a temperature sensor for measuring the temperature of the sensor itself.

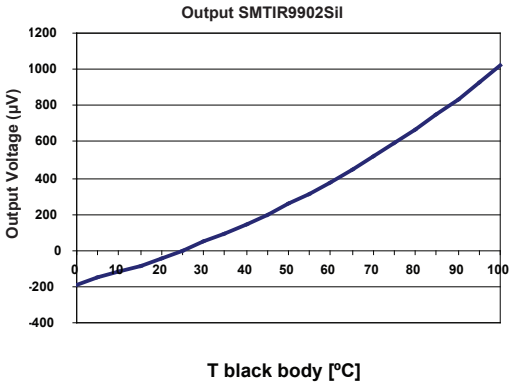
The sensor is available in a standard TO-05 encapsulation and with a 5.5 um high pass filter.

Applications

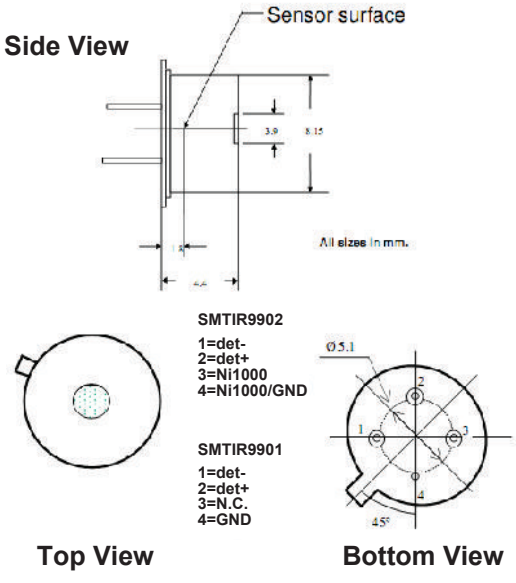
- Contactless temp. measurement
- Infrared radiation detection
- Temp. measurement on moving objects
- Continuous temperature control
- Thermal alarm systems
- Climate control
- Medical instruments
- Long distance measurement (9902Sil)

Output Characteristics

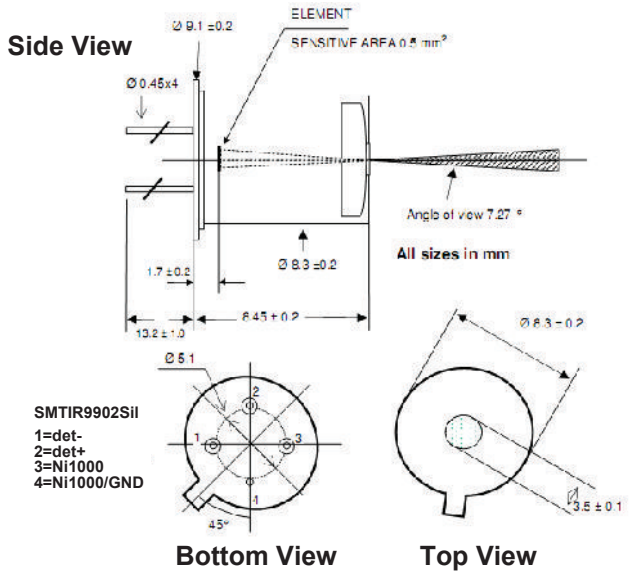




Housing and Pin-outs (TO-05)



SMTIR9901/9902



SMTIR9902Sil

Sensor Elements

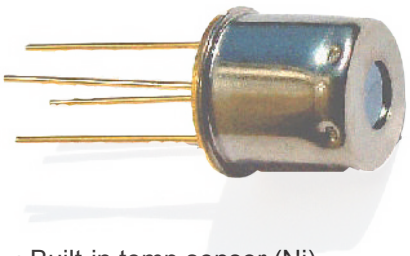
SMTIR9901

- High accuracy
- High sensitivity (110 V/W)
- High SNR (Rs~50 KΩ)
- Fast response time (40 ms)
- Low cost thin film technology
- High pass IR filter (>5.5µm)
- Standard TO-05 package

SMTIR9902

- Built-in temp sensor (Ni)
- High accuracy
- High sensitivity (110 V/W)
- High SNR (Rs~50 KΩ)
- Fast response time (40 ms)
- High pass IR filter (>5.5µm)
- Low cost thin film technology
- Standard TO-05 package

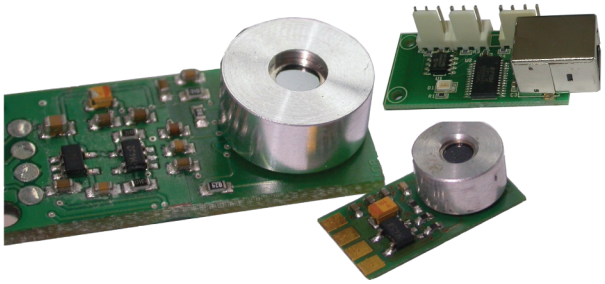
SMTIR9902Sil



- Built-in temp sensor (Ni)
- High accuracy
- High SNR (Rs~50 KΩ)
- Fast response time (50 ms)
- Silicon lens for small viewing angle (7.27º)
- Low cost thin film technology
- Extended TO-05 package

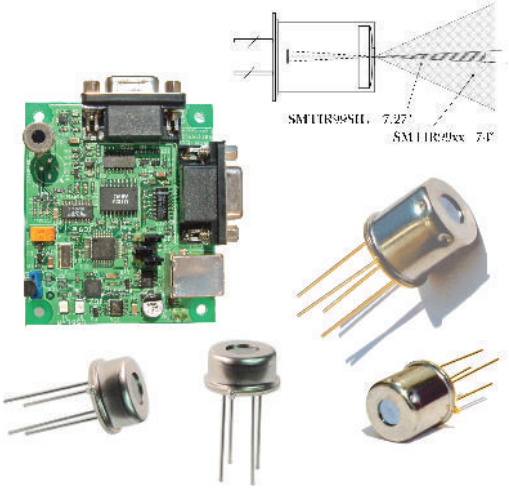
Modules and Evaluation Boards

SMTIRMOD09Sil/Std/Micro



- Wide supply range: 09Sil, 09Std: 4-16V
  09Micro: 2.2-3.3V
- Low current consumption < 2 mA
- Up to 0.5% accuracy
- I²C output with preconfigurable address by request
- Field of view: SMTIRMOD09Sil…… 14º
  SMTIRMOD09Std …… 70º
  SMTIRMOD09Micro … 120º
- Object temperature range:
  SMTIRMOD09Sil…… < 300 ºC
  SMTIRMOD09Std …… < 50 ºC
  SMTIRMOD09Micro … < 50 ºC

SMTIRIN06



- Evaluation board for fast prototyping
- Inputs for SMTIR9902 and 9902sil
- Input for temperature sensor SMT16030xxx
- Software free to download
- Easy connection to PC through USB and RS 232 interface

Humidity Sensors

Introduction

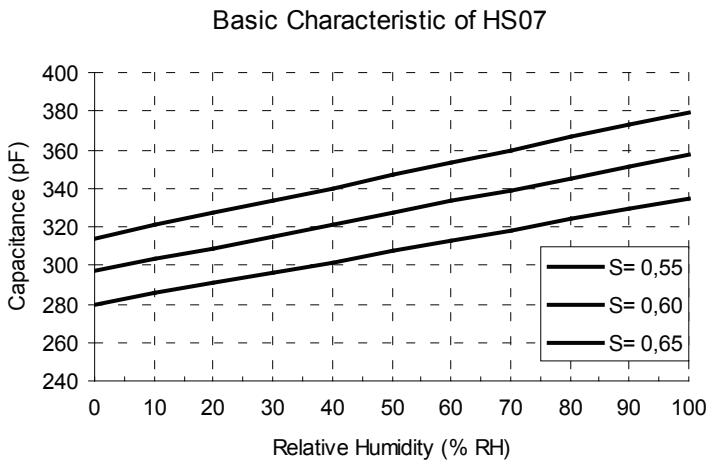
The capacitive humidity sensor of Smartec is based on silicon technology on glass wafer. Due to the use of this process it is possible to make sensors with a high volume scale in a low cost way. The Smartec humidity sensor consists of three layers. The base and top layer are conductive and the layer in between is humidity sensitive polyimide. The correct selection of this sensitive interface makes the sensor highly independent to temperature changes. The top layer has a grid like structure. The sensor converts the humidity into a capacitance. Due to the construction the response to humidity is rather fast (<15 sec) and the hysteresis is very low (<2% RH). Two types are available, one with a nominal value of 330 pF and one with a value of 180 pF.

Applications

- Hygrometers, consumer goods
- Humidifiers and Dehumidifiers
- Medical applications
- Weather stations
- Automotive
- HVAC
- Food processing
- Room comfort control
- Battery operated equipment (TH08I)

About the Output Signal

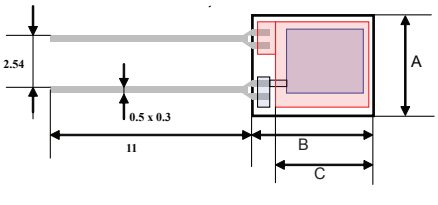
The HS07/08A humidity sensors can by used in a wide range of applications. The sensor can be used for low cost commercial application as well in medical and industrial products. To achieve more feeling for the specifications below the relation between the humidity and the capacitance of HS07 is given in a graph for easy understanding. For further detailed specifications please see the respective datasheet.
For the new SMTH08I, a starndard I²C output is available, therefore no hassle for the interface circuits.



Sensor Elements

SMTHS07/08A

- Wide RH range (0-100%)
- Ability to survive condensation
- Single point calibration
- High linearity within 2% between 20% and 95% RH
- Fast response time < 15 s
- Long-term stability 0.2%/year



	A	B	C
HS07	5	7	5
HS08A	4.5	4	2

- All size in mm
- Do not touch active area or use glue
- Base material: glass (0.3mm)

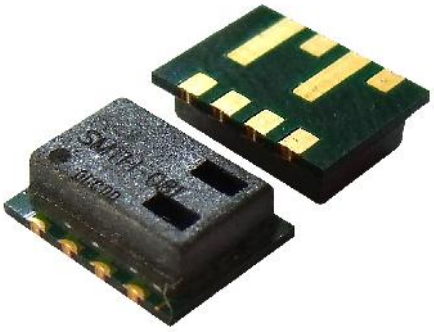
Specifications:

Measured @ 25 °C, Sensor excitation: 1V@ 20 kHz

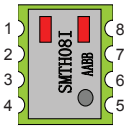
		HS07			HS08A			
Parameter	**Condition**	**Min**	**Typ**	**Max**	**Min**	**Typ**	**Max**	**Unit**
Capacitance	**55% RH**	**310**	**330**	**350**	**170**	**180**	**190**	**pF**
Sensitivity	**20 - 95 % RH**		**0.6**			**0.34**		**pF/%RH**
Hysteresis	**20 - 95 % RH**			**2**			**2**	**%RH**
Linearity	**20 - 95 % RH**			**2**			**2**	**%RH**
Response time	**30 - 90 % RH**			**15**		**15**		**sec**
Temp coeeficient	**5 - 70 °C**	**0.15**	**0.16**	**0.17**			**0.07**	**pF/°C**
Long term stability				**0,2**			**0,5**	**%RH/year**
Temperature range		**-40**		**120**	**-40**		**120**	**°C**
Operating humidity range		**0**		**100**	**0**		**100**	**%RH**
Frequency range		**1**		**100**	**1**		**100**	**kHz**

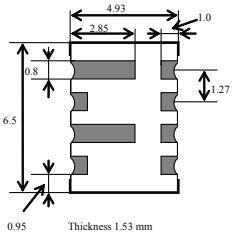
Modules

SMTH08I



- On-chip Humidity & Temperature sensor
- Fully calibrated
- Excellent long-term stability
- Low power consumption (<1 µA idle)
- I²C standard output
- Available in 8-pins SOP





All sizes in mm (not to scale)

Pinout: 1. GND
2. SDA
3. SCK
4. VCC
5-8. NC

(All N.C. pins must be left open)

Pressure Sensors

Introduction

Smartec provides a wide range of pressure sensors in different package options. Besides the wide choices we give, customer tailored solutions are also possible on request.

Important Features

- Input: Absolute, Gauge, Differential
- Output: Bridge, Analog, Digital (serial), I^2C
- Package: Sil, Dil, SMD with various options on porting holders.

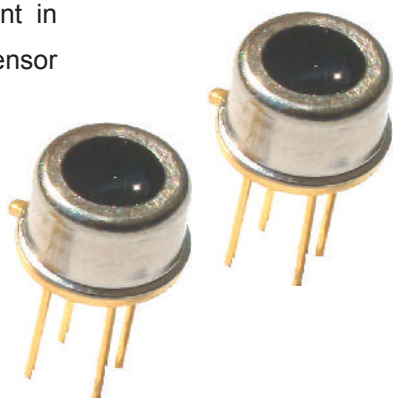
All Pressure Sensors

+: available; -: unavailable

Type of sensor		SPDxxxYZ	SPDxxxYZsil	SPDxxxYZhyb	SPDxxxYZTO5	SPDxxxYZsoic	SPDxxxYZhyb
Pressure range (xxx in PSI)		5 - 100	0.3 - 100	0.3 - 100	15 - 300	15 - 300	5 - 150
Input (Y)	A-Absolute	+	+	+	+	+	+
	G-Gauge	+	+	+	-	+	+
	D-Differential	-	+	+	-	+	-
Output (Z)	B-Bridge	+	+	+	+	+	+
	A-Analog	+	+	+	+ (< 200 PSI)	+	-
	D-Digital(serial)	+	+	+	-	+	-
	I-IIC	-	-	+	-	-	-
Note							automatic mounting
Single output (Differential)		-	+	+	-	-	-
Examples		SPD015GA	SPD002GAsil	SPD102DAhyb	SPD300ABTO5	SPD100GDsoic	SPD015GBhyb

SPD300ABTO5

This 20 Bar absolute sensor is specially designed for measurement in explosive environments like liquefied gasses (LPG/GPL). Using this sensor means a distinct safety advantage for these applications.

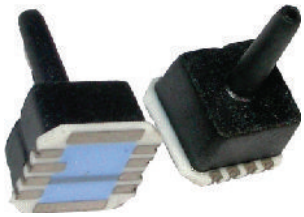


Applications

- Water supply system
- Liquefied gases(LPG/GPL)
- Explosive environment

SPD015GBhyb

This sensor is miniature sized and due to its surface mount / MEMS character ideal for high volume application. Two pressure inlets are available. The version with the hole is suitable for measuring barometric pressure or pressure in sealed enclosures. The version with the tube inlet (1/8") provides a convenient connection using tubing. Pressure ranges 15/30/100/150 PSI and in gauge/absolute.



Applications

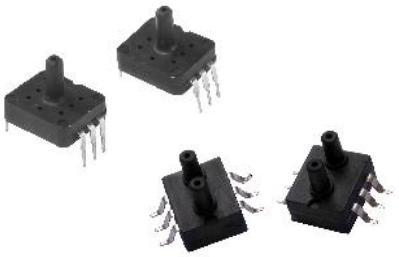
- Barometer
- Medical intruments
- White goods
- Process control

SPD015GA(soic)

This Smartec pressure sensor has an amplified analogue output and can be considered as the successor of the popular SPD series with the bridge output. The analogue output is ratio metric to the applied supply voltage. It's a real easy design-in type of pressure sensor and is available in ranges of 5 to 100 PSI.

Features & Applications

- Easy design-in
- Temperature/offset compensated
- Amplified and calibrated output
- Process control
- HVAC/Medical/Consumers

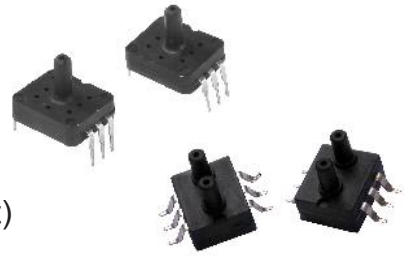


SPD100GD(soic)

This Smartec pressure sensor has a digital output and is compensated for offset, sensitivity, temperature drift and nonlinearity. The sensor is available in ranges form 1 to100 psi and in gauge and absolute type. The SPD digital series can be considered as a "digital" successor of the bridge type SPD series.

Features & Applications

- Easy design-in with digital output
- Temperature/offset compensated
- Calibrated & digitized output (14bit)
- HVAC/Medical/Consumers

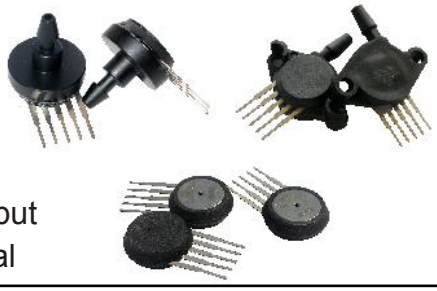


SPD002GAsil/AAsil

These Smartec pressure sensors are specially designed for low pressure applications and are also temperature compensated. The products can be operated in the voltage range of 2.7 to 5.5 V. and due to its low power consumption ideal for battery operation. Pressure ranges from 0.3 to 100 PSI, Gauge, Absolute and Differential.

Features & Applications

- Low cost sensor solution
- Calibrated span and offset
- Easy interfacing, analogue output
- Gauge, absolute and differential

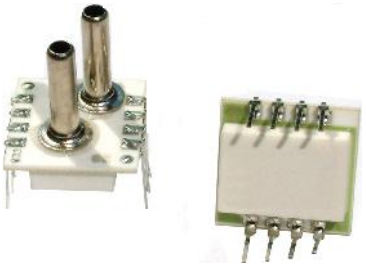


SPD102DAhyb

This Smartec differential pressure sensor has an amplified output and is also available with a I I^2C digital output. The sensor is compensated for offset, temperature drift and linearity. The sensors are available in Gauge, Absolute and Differential (and single) type. Pressure ranges from 0.3 to 100 PSI.

Features & Applications

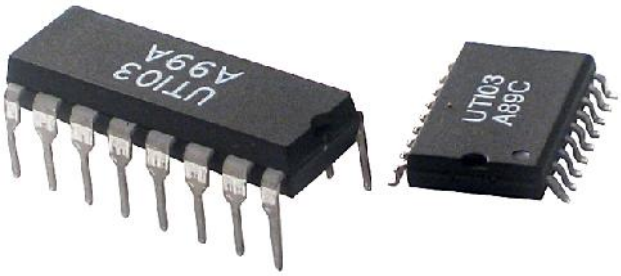
- DIP package
- Calibrated span and offset
- Compensated linearity
- Analog, Digital and I^2C output



Introduction

The **Universal Transducer Interface** (UTI) is a complete analog front end for low frequency measurement applications, based on a period modulated oscillator. Sensing elements can be directly connected to the UTI without the need for extra electronics. Only a single reference element, of the same kind as the sensor, is required. The UTI outputs a microcontroller compatible period-modulated signal. The UTI can provide interfacing for:

- Capacitive sensors 0 - 2 pF, 0 -12 pF, variable range up to 300 pF
- Platinum resistors Pt100, Pt1000
- Thermistors 1 Ohm - 25 kW
- Resistive bridges 250 Ohm - 10 kW with maximum imbalance +/- 4% or +/- 0.25%
- Potentiometers 1 kOhm - 50 kOhm



Features

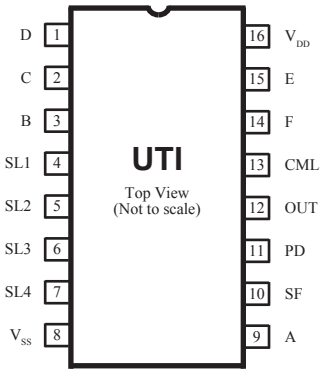
- Single 2.9 V - 5.5 V power supply, current consumption below 2.5 mA
- Continuous auto-calibration of offset and gain
- Microcontroller-compatible output signal
- Tri-state output
- Typical measurement time 10 ms or 100 ms
- 2/3/4-wire measurement available for resistive measurements
- AC excitation voltage signal for all sensor elements
- Suppression of 50/60 Hz interference
- Power down mode
- Operating temperature range for DIL and SOIC -40 ºC to 85 ºC
- Operating temperature range for naked die -40 °C to 180 ºC

Applications

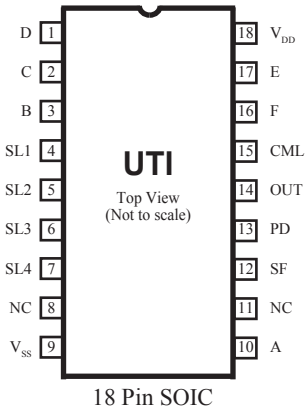
Automotive, industrial and medical applications for

- Capacitive level sensing and distance
- Position sensing
- Angle sensing
- Accurate temperature measurement (Platinum, NTC)
- Bridge sensors for pressure, force etc.

Pin-outs and their functions



16 Pin DIL



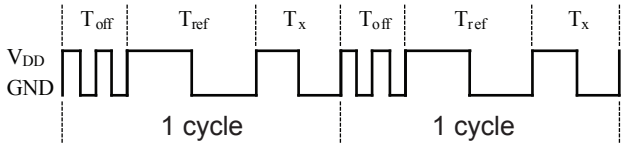
18 Pin SOIC

Name	Function of the pin
VDD, VSS	Power supply
A, B, C, D, E, F	Sensor connections
SL1 – SL4	Mode selection
OUT	Output
SF	Slow/Fast model selection
CML	CMUX02/CMUX12 mode selection
PD	Power down (tri-state)

Modes List

SEL 1	SEL 2	SEL 3	SEL 4	Mode	No. of Phases	Name	Mode No.
0	0	0	0	5 Capacitors, 0-2pF	5	C25	0
0	0	0	1	3 Capacitors, 0-2pF	3	C23	1
0	0	1	0	5 Capacitors, 0-12pF	5	C12	2
0	0	1	1	Capacitors, 0-2pF, external MUX CML=0 Capacitors, 0-12pF, external MUX CML=1	-	CMUX	3
0	1	0	0	3 Capacitors, variable range to 300pF	3	C300	4
0	1	0	1	Platinum resistor Pt100-Pt1000, 4-wire	4	Pt	5
0	1	1	0	Thermistor 1kΩ-25kΩ, 4-wire	4	Ther	6
0	1	1	1	2 or 3 platinum resistors Pt100-Pt1000	5	Pt2	7
1	0	0	0	2 or 3 thermistors, 1kΩ-25kΩ,	5	Ther2	8
1	0	0	1	Resistive bridge, ref. is V_{bridge}, +/- 200mV	3	Ub2	9
1	0	1	0	Resistive bridge, ref. is V_{bridge}, +/- 12.5mV	3	Ub1	10
1	0	1	1	Resistive bridge, ref. is I_{bridge}, +/- 200mV	3	Ib2	11
1	1	0	0	Resistive bridge, ref. is I_{bridge}, +/- 12.5mV	3	Ib1	12
1	1	0	1	Res. bridge and two resistors, +/- 200mV	5	Brg2	13
1	1	1	0	Res. bridge and two resistors, +/- 12.5mV	5	Brg1	14
1	1	1	1	3 Potentiometers 1kΩ-50kΩ	5	Potm	15

About the Output Signal



Typical output signal

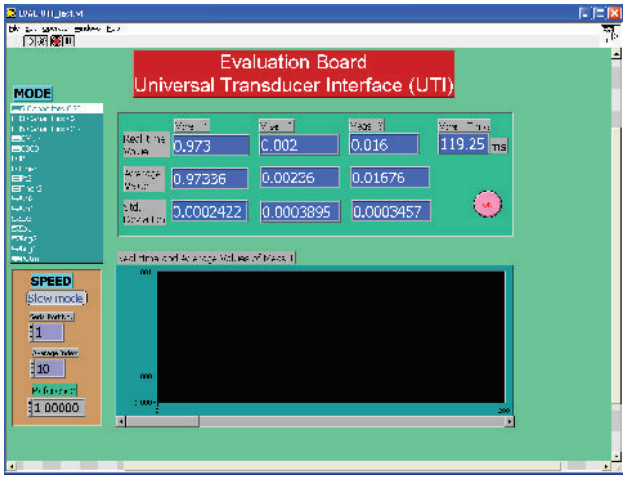
$$Z_x = \frac{T_x - T_{off}}{T_{ref} - T_{off}} Z_{ref}$$

where Z_{ref} could be Capacitance or Resistance

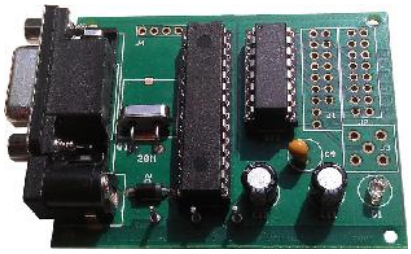
By applying a known reference value (Z_{ref}) that is of the same type as the input, a ratio-metric measurement is obtained. Therefore slow-varying noise, offset and interference are removed.

Evaluation Kit

To accelerate concept verifying and new application development, evaluation kits are provided as well as free to download PC software. The on-board crystal oscillator provides the timing reference for digitizing UTI output. The calculated results will then be transfered to the PC for further processing. Developers can easily view the UTI output data coming out of the standard serial port (available in both RS232 and USB) with our free-download software.

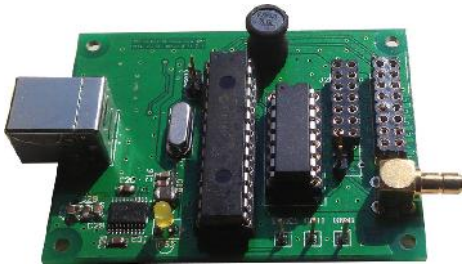


Evaluation Kit (continue)



Classic RS232 Board

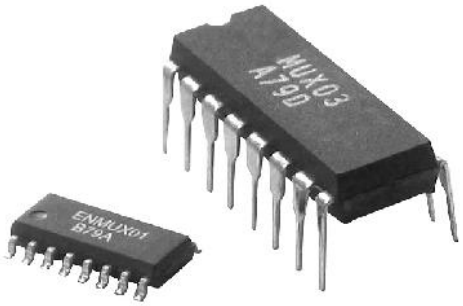
Standard RS232 interface
Seperate 9-12V DC supply
PIC/51 controller
No PC side driver needed

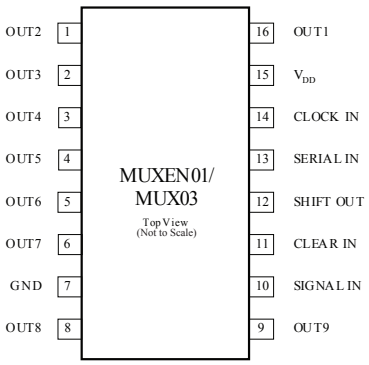


USB Board

Single calbe for both power and data communication
PIC controller
Standard FTDI driver for PC
Plug and Play for new desktop and laptop

MUXC01 (Multiplexer for capacitive sensors)





16-pins DIL(MUX03) and SOIC(MUXEN01)

Features

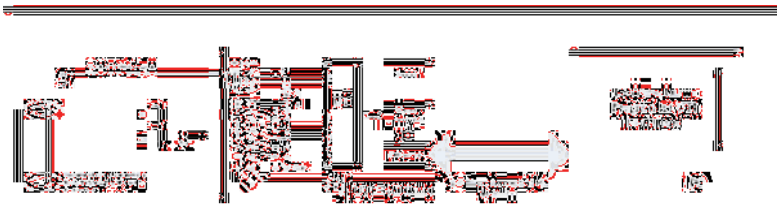
- Very well suited for multiple-capacitance measurement
- Low-cost CMOS
- Low output impedance
- Rail-to-rail digital outputs
- All inputs and outputs are ESD protected
- High digital output currents possible (8 mA at 10% voltage drop)
- Large capacitive driving capability
- Available in 16-pins DIL(MUX03) in 16-pins SOIC(MUXEN01) and as bare die(MUXC01)
- Temperature range -40ºC to 85ºC

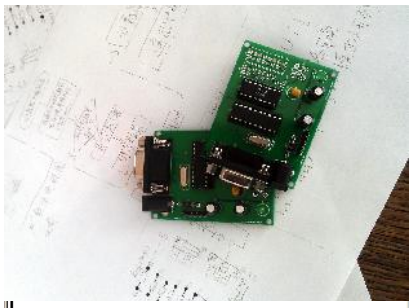
The Smartec multiplexer is designed especially for working in combination with the UTI for measuring multiple capacitive sensors.

Smartec Design Service

Electronic system design

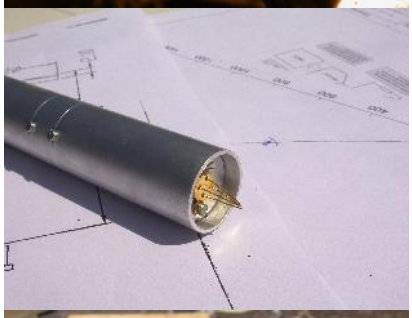
- Fast idea verification with our standard kits
- System level solution for your specific need
- Wiring and grounding
- Software development





Special packaging requirement

- For temperature sensors more packaging options are available



Customized pressure sensor

- New combination of pressure range and package

Customized mechanical design

- Fit standard sensors into your own system environment

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