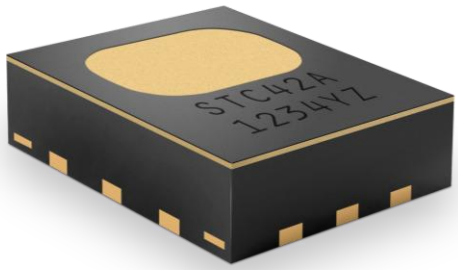
SENSIRION

Datasheet – STC42A H_2 Sensor

Automotive-Grade Hydrogen Thermal Conductivity Sensor

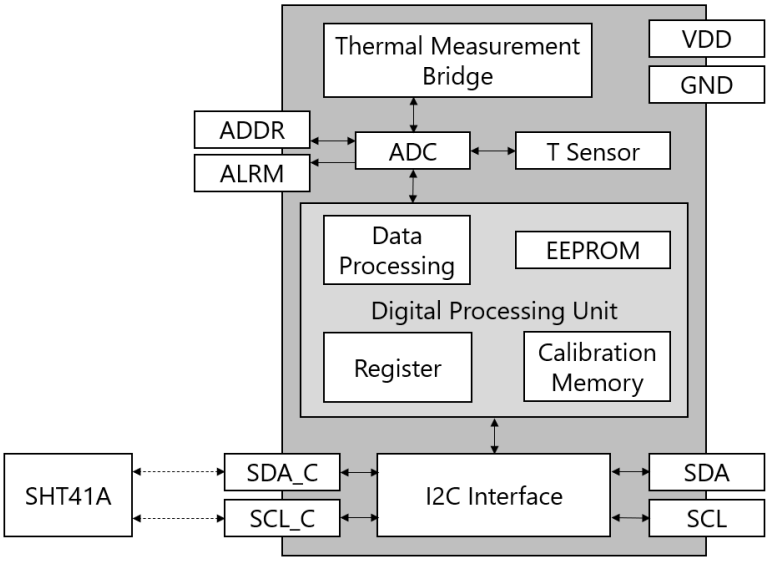


Highlights

- H_2 measurement accuracy ±(0.4 vol% + 2 %m.v.) from 0 vol% to 40 vol%
- Digital I^2C interface and calibrated output signal
- AEC-Q100 grade 2 qualified
- Low power mode with current consumption below 7 µA
- High reliability and long-term stability
- Industry-proven sensing technology

STC42A is designed for applications that require reliable hydrogen concentration measurements in clean air. The STC42A utilizes the thermal conductivity measurement principle, resulting in superior repeatability and long-term stability. It features an I^2C controller interface for autonomous humidity compensation from a corresponding humidity-temperature sensor SHT41A-AD1B. QFN and tape & reel packaging offer cost- and space-effective integration of the STC42A for high-volume production.
The outstanding performance of STC42A is based on Sensirion's CMOSens® sensor technology, which combines the sensor element, signal processing and digital calibration on a single CMOS chip.

Functional Block Diagram



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WARNING

Designing and operating sensors in explosive atmospheres must only be conducted by qualified personnel who can identify risks and mitigate potential hazards. Measures such as implementing current limitations on the PCB board to protect against shorts between VDD and VSS and others must be carefully considered. Please also refer to *STC42A Design Guide* for more information on sensor integration.

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1 Measurement Specifications

1.1 H_2 Sensing Performance

The H_2 sensing performance specification provided in **Table 1** applies within the specified ranges of temperature, humidity, and pressure (see **Section 2.1**), provided that compensation for these effects is applied. The internal temperature sensor is used to compensate the H_2 concentration output for temperature effects.

Conditions for H_2 Sensing Accuracy:

- absolute humidity is compensated using an SHT41A-AD1B sensor (or equivalent with an accuracy of ±2 %RH or better)
- pressure is compensated using a pressure sensor with an accuracy of 1 hPa or better.
- a Forced Recalibration (FRC), see **Section 3.4.7**, has been performed after soldering.
- Automatic Self Calibration (ASC), see **Section 3.4.8**, is enabled.
- supply voltage is maintained between 3.15 V and 3.45 V.
- sampling frequency is set to 1 Hz.

Operating the sensor outside its specified range will still provide measurement values; however, these may deviate from specified accuracies and might be flagged according to **Section 3.4.2**.

Parameter	Conditions	Min.	Typ.	Max	Unit
H_2 measurement range	In fresh clean air	0		40	vol%
H_2 measurement accuracy	-40 °C to 85 °C, DP ≤ 35 °C			±(0.4 vol% + 2 %m.v.)	
Response time (τ_{63})			1		s
Resolution			16		bit

Table 1. H_2 sensing performance.

1.1.1 Thermal Conductivity Measurement Principle

The STC42A measures the thermal conductivity of the gas surrounding the sensing element. Any variation in the gas composition results in a thermal conductivity deviating from clean air (defined as consisting of 78% N_2, 21% O_2, 0.93% Ar, 400 ppm CO_2, plus a variable content of H_2O depending on the relative humidity) and is interpreted as a change in H_2 concentration. In practice, the dry air composition, *i.e.*, the N_2:O_2:Ar ratio, is constant in indoor and outdoor ambient environments. Trace gases such as VOCs are only present in concentrations significantly less than 100 ppm and hence their influence on the sensing output is negligible. The presence of gases other than clean air and H_2, such as CO2 in concentrations significantly more than 1'000 ppm, can impact the sensor's accuracy and must be evaluated for each use case. The thermal conductivity of gases is additionally affected by temperature, humidity and pressure and should be compensated for. These dependencies are not linear and not always monotonous.
Note: The compositions of artificial reference gas mixtures commonly used in laboratory tests such as 100% N_2 or 80% N_2 / 20% O_2 deviate substantially from clean air and can lead to measurement errors.

1.1.2 Warm-up

Warm-up effects are included in the STC42A H_2 sensing accuracy.

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2 Sensor Specifications

2.1 Environmental Conditions

Valid environmental range for sensor signal output.

Parameter	Details	Min.	Max.	Unit
Operating temperature		-40	105	°C
Storage temperature	Recommended long-term storage: non-freezing	0	50	°C
Operating relative humidity	Non-condensing, max. dew point 35°C	0	100	%RH
Storage humidity	Recommended long-term storage: non-condensing	30	70	%RH
Pressure		500	1'200	hPa

Table 2. Valid environmental conditions.

2.2 Internal Temperature Measurement Specification

Parameter	Conditions	Min.	Typ.	Max	Unit
Temperature measurement accuracy	-40 °C to 105 °C	-2		2	°C
Resolution			16		bit

Table 3. Internal temperature sensor specifications.

2.3 Electrical Specifications

Parameter	Symbol	Condition	Freq.	Min.	Typ.	Max.	Units	Comments
Supply voltage	V_{DD}			3.15	3.3	5.25	V	
Unloaded supply voltage ripple	V_{RPP}	Without the load of the sensor				30	mV	
Power-up level	V_{PU}	25°C				2.7	V	
Power-down level	V_{PD}	25°C		1.85			V	
Supply current	I_{DD}	Periodic measurement	0.1 Hz		0.5		mA	Max peak current 4.2mA.
			1 Hz		0.7			
		Single shot measurement	0.1 Hz		0.1		mA	
			1 Hz		0.3			
		Low-power mode	0.03 Hz		7		µA	
			0.1 Hz		21			

Table 4. Electrical specifications.

2.4 Qualification

Norm	Conditions
AEC-Q100 Grade 2	-40 °C to 105 °C and at 1 Hz sampling frequency.

Table 5. Qualification.

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2.5 Absolute Maximum Ratings

Stress levels beyond those listed in **Table 6** may cause permanent damage to the sensor. Exposure to minimum/maximum rating conditions for extended time periods may affect sensor performance and reliability.

Parameter	Conditions	Min	Max	Unit
MSL level			1	
Short-term storage temperature[1)]	Non-condensing	-40	105	°C
Supply voltage		-0.3	5.5	V
Voltage on all pins		-0.3	V_{DD}+0.3	V
Operating dew point	Non-condensing		60	°C
ESD HBM	JEDEC JS-001		4	kV
ESD CDM	JEDEC JS-002		750	V
Latch-up	JESD78 Class II, 125 °C	-100	100	mA

Table 6. Absolute maximum ratings.

2.6 Hardware Interface Specifications

The STC42A is a QFN-packaged sensor with pin assignment as described in **Table 7**.

Pin no.	Name	Description
1	SDA_C	I²C serial data input/output to/from SHT41A-AD1B.
2	INTR	Interrupt pin (see **Section 3.4.4** for the activation methodology)
3	ADDR	I²C address configuration[2)] 0x29: ADDR to GND. 0x2A: ADDR with 39 kOhm to VDD. 0x2B: ADDR with 18 kOhm to VDD.
4	SCL	I²C serial clock input; target interface.
5	VSS	Ground (negative supply).
6	VDD	Power supply (positive supply).
7	SDA	I²C serial data input/output; target interface.
8	-	Reserved. Do not connect.
9	SCL_C	I²C serial clock output to SHT41A-AD1B.
10	-	Reserved. Do not connect.
11	-	Reserved. Do not connect.
12	-	Reserved. Do not connect.

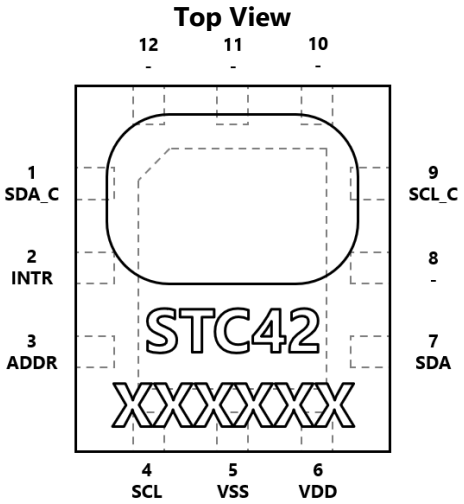


Table 7. Pin assignment (transparent top view). Dashed lines are only visible from the bottom of the sensor.

2.7 Absolute Humidity and Pressure Compensation

To achieve the STC42A sensor accuracy, the sensor must be externally compensated for absolute humidity (AH) and pressure (P). Continuous relative humidity (RH) and corresponding temperature (T) is achieved through an external SHT41A-AD1B sensor controlled via the STC42A I²C controller interface or through the respective I²C

[1)] Short term storage refers to temporary conditions *e.g.*, during transport.
[2)] To be configured at start-up. Maximum tolerance for resistor is ±5%. Do not connect the ADDR pin directly to VDD.

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command (see **Section 3.4.5**). Both RH and corresponding T data are required from the same source to accurately calculate the AH, which is essential for compensation of the H_2 concentration output. The sensor can be compensated for P manually by inputting the values directly to the sensor (see **Section 3.4.6**). Temperature compensation is performed using the internal temperature sensor.
The recommended application circuit for STC42A is shown in **Figure 1**.
The power supply pin should be decoupled with a 100 nF capacitor placed as close to the sensor as possible. The I^2C controller interface pads of the STC42A have an internal pull up resistor of 10 kOhm. Additional pull-up resistors between the STC42A and SHT41A-AD1B are not recommended if the SHT41A-AD1B is designed close to the STC42A. The pull-up resistor values (R_{Pull}) must be dimensioned based on the bus capacity, communication frequency and NXP I2C-bus specification and user manual[3)]. The I^2C address can be configured by choosing a resistor (R_{ADDR}), described in **Section 2.6.**
The SCL and SDA pins of the target interface of the STC42A do not have internal pull-up resistors.

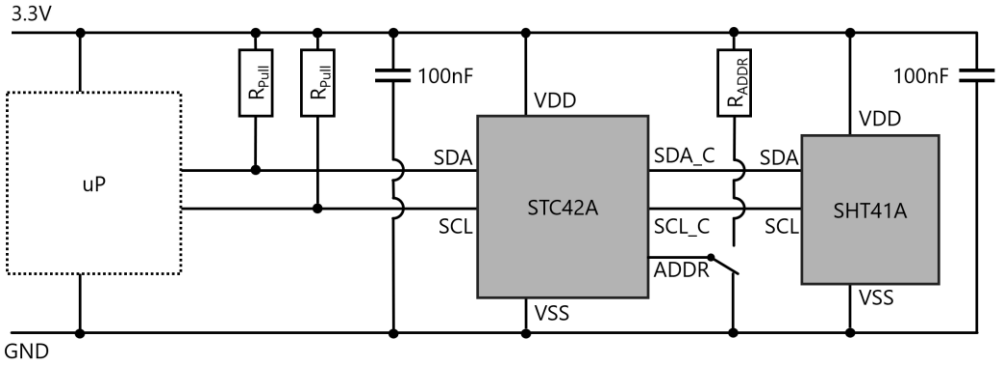


Figure 1. Recommended application circuit. The positioning of the pins is only for illustrative purposes.

2.8 Timing Specifications

Parameter	Symbol	Typ.	Max.	Units	Comments
Power-up time	t_{PU}	25	30	ms	Time until the sensor is ready.
Soft reset time	t_{SR}		20	ms	Time between soft reset command or exit sleep mode and sensor ready.
Measurement duration	t_{ME}	78		ms	
I^2C SCL frequency	f_{I2C}		1'000[4)]	kHz	
Measurement interval		1'000[5)]	65'535	ms	In periodic mode.

Table 8. Timing specifications.

[3)] NXP I2C-bus specification and user manual UM10204, Rev.7, 01 November 2021.
[4)] For bus rates above 400 kHz, the sink current is limited to 3 mA. Therefore, pull-up resistors greater than 1.5 kOhm are recommended for a maximum bus capacitance of 90 pF. The I^2C bus voltage must not exceed the VDD supply voltage.
[5)] Measurement intervals deviating from the default interval (1'000 ms) may affect sensor accuracy and/or lifetime.

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2.9 Mechanical Specifications

Parameter	Symbol	Typ.	Max.	Units	Comments
Mass	m	<0.03	0.03	g	

Table 9. Mechanical specifications.

2.10 Material Specifications

Parameter	Conditions
REACH, RoHS	Compliant

Table 10. Material specifications.

3 Sensor Operation

The STC42A uses I²C communication based on the NXP I²C-bus specification and user manual[6]. Supported I²C modes are Standard-mode, Fast-mode and Fast-mode Plus. Clock stretching is not supported.

3.1 I²C Address

The I²C address for the STC42A is 0x29. See **Section 2.6** to select an alternative I²C address (0x2A or 0x2B).

3.2 I²C Data Transfer Formats

The write, read and combined data transfer formats are visualized in **Figure 2**. Data and commands are transferred in multiples of 16-bit words, with the most significant byte (MSB) transmitted first. All transfers must begin with a start condition (S) and terminate with a stop condition (P). A sensor is addressed by sending its 7-bit I²C address, followed by an eighth data direction bit denoting the communication direction (W/R): "zero" indicates transmission to the target (*i.e.*, "WRITE") and "one" indicates a request for data (*i.e.*, "READ"). Data words are succeeded by an 8-bit checksum (cyclic redundancy check CRC-8, see **Section 3.3**). Command words (CMD) contain a 3-bit CRC. In the write direction, the checksum must be transmitted. In read direction, the master may abort transmission after any data byte by sending a not acknowledge (NACK) and a stop condition. After receiving a command, the sensor requires the specified execution time before responding with a ACK.

[6] NXP I²C-bus specification and user manual UM10204, Rev.7, 01 November 2021

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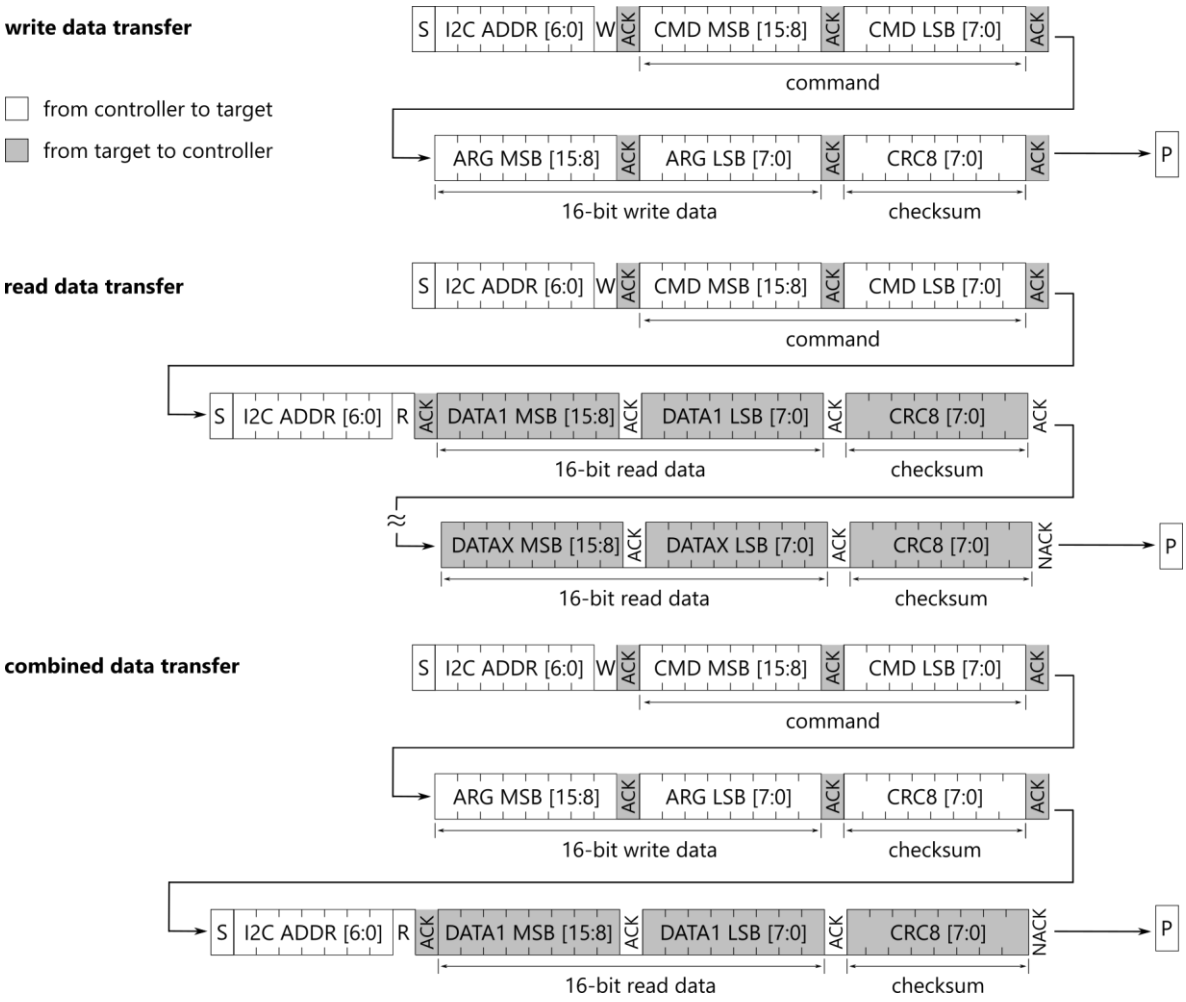


Figure 2. Write, read and combined data transfer formats.

3.3 Checksum Calculation

The 8-bit checksum is calculated from the two previously transmitted data bytes with the algorithm described in **Table 11**.

Property	Value
Name	CRC-8
Width	8 bits
Protected data	read and/or write data
Polynomial	0x31 ($x^8 + x^5 + x^4 + 1$)
Initialization	0xFF
Reflect input/output	False/False
Final XOR	0x00
Example	CRC (0xBEEF) = 0x92

Table 11. Data checksum properties.

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3.4 I²C Commands

Table 12 lists the STC42A commands. Required arguments are described in the detailed command sections below.

Section	Command	Hex code	Argument needed	Typ. execution time [ms]	Exec. during meas.
Measurement Control Commands					
3.4.1	Start Concentration Measurement	0x2152	Yes	~78	No
3.4.2	Read Measurement	0xEC05	No	~1	Yes
3.4.3	Stop Measurement	0x3FF9	No	<1	Yes
3.4.4	Enable Low-Power Mode	0x3F90	No	<1	No
3.4.4	Set Alert Upper Threshold	0x2787	Yes	<1	No
3.4.4	Set Alert Lower Threshold	0x278C	Yes	<1	No
3.4.4	Exit Low-Power Mode	0x3F11	No	<1	Yes
Environmental Compensation					
3.4.5	Automatic AH compensation with RH and T input from SHT41A-AD1B (recommended)	0x2657 0x2628	No	<1	No
3.4.5	Manual AH compensation. i) Initial one-time enabling required - Enable manual RH (default 0%RH) and - Enable manual T (only for AH calc., default is internal T sensor) input. ii) Set manual compensation value - Set RH value - Set T value	0x264A 0x2623 0xE00B 0xE000	No Yes	<1 <1	No Yes
3.4.6	Manual P compensation - Enable manual P Input (default 0hPa) - Set P value	 0x2698 0xE016	 No Yes	<1	 No Yes
Note: The compensation type for RH and T must always be the same. Environmental conditions must be set before start concentration measurement.					
Calibration					
3.4.7	Perform Forced Recalibration	0xE01D	Yes	<1	Yes
3.4.8	Enable Automatic Self Calibration (default)	0x3F86	No	<1	Yes
3.4.8	Disable Automatic Self Calibration	0x3F07	No	<1	Yes
Power & Reset					
3.4.9	Enter Sleep Mode	0x36E0	No	<1	No
3.4.9	Exit Sleep Mode	0x36F6	No	<1	N/A
3.4.10	I²C Soft Reset	0x06	No	~6	Yes
Note: After a reset or power-up, the sensor defaults to an RH value of 0% and uses its internal temperature reading for AH calculation, along with a P value of 1013hPa for compensation. These default values remain in effect unless updated using the commands listed above.					
Sensor Information					
3.4.11	Read Product Info	0x365B	No	~5	No
3.4.12	Read Serial Number of SHT	0x2A01	No	~13	No

Table 12. Command set.

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3.4.1 Start Concentration Measurement

The gas concentration measurement starts with the following command:

Command	Command code (Hex)	Argument	Description
start_concentration_measurement	0x2152	0	Does a single measurement.
	0x2152	 1000 65535	Starts continuous concentration measurement, *e.g.*: - every 1'000ms (lower limit) - every 65'535ms (upper limit)

Note: Measurement intervals deviating from the default interval (1'000ms) may affect sensor accuracy and/or lifetime.

3.4.2 Read Measurement

Measurement data is read out through the *read_measurement* command. The measurement data buffer is emptied upon read-out.

RH, T and P values can be updated at any time during continuous H_2 measurements (*i.e.*, send new compensation data without stopping the H_2 measurement). The measurement will continue uninterrupted - even during a Forced Recalibration (see **Section 3.4.7**) - ensuring consistent output without disruption to concentration readings. After updating RH, T or P values, or performing an FRC, the *read_measurement* command must be sent to retrieve the updated concentration values via an I^2C read header.

Command	Command code (Hex)	Argument	Description
read_measurement	0xEC05	NA	Reads out the measurement data.

The sensor will respond with a NACK if no measurement data is available. The I^2C master can abort the read transfer with a NACK followed by a STOP condition after any data byte. See **Section 3.5** for the signal output and input conversion.

Consecutive read	Description
Byte1: Gas concentration 8msb Byte2: Gas concentration 8lsb Byte3: CRC Byte4: Temperature 8msb Byte5: Temperature 8lsb Byte6: CRC Byte7: Relative Humidity 8msb Byte8: Relative Humidity 8lsb Byte9: CRC Byte10: Pressure 8msb Byte11: Pressure 8lsb Byte12: CRC Byte13: Status 8msb Byte14: Status 8lsb Byte15: CRC Byte16: Scale Factor 8msb Byte17: Scale Factor 8lsb Byte18: CRC	The RH, T and P values are: 1) the RH & T values sent to the sensor from the SHT41A-AD1B via the I^2C controller interface 2) the last values that have been written into the sensor with the respective *'Manual compensation'* commands 3) default values (0 %RH and 1013 hPa) on power-up and must be updated before measurement to meet sensor specifications. Scale factor (Bit 0...11) is a constant that can be ignored once conversion formula is defined. See **Section 3.5** for more details on how the factor is applied to calculate the H_2-gas concentration. The status should be read out regularly and provides the following information: Bit 8: I^2C communication error with SHT41A-AD1B Bit 9: T, dew point (DP) or P outside of specified range. (T: <-42 °C or >107 °C; DP: >47 °C (calculated at 1013 hPa); P: <450 hPa or >1'250 hPa) Bit 10: Measurement error limit (<-10% lower limit, no upper limit defined)

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	Bit 11: VDD outside of limits (<2.9 V lower limit, >5.5 V upper limit) Bit 12: No baseline found. When this bit is set ASC is disabled. Attempt FRC to set a baseline. If FRC cannot resolve the issue, the EEPROM is considered damaged, and the sensor must be replaced. Bit 13: Memory error. When this bit is set ASC and FRC are disabled. In severe cases, the sensor may fail to restart and must be replaced. Bit 14: Baseline outside of error limits. Sensor output is no longer reliable, and sensor should be replaced. Bit 15: Baseline outside of warning limits. Sensor may need to be replaced soon.

3.4.3 Stop Measurement

The gas concentration measurement stops with the following command:

Command	Command code (Hex)	Argument	Description
stop_measurement	0x3FF9	NA	Stops the continuous measurement and puts the sensor into snooze mode.

3.4.4 Low-Power Mode

The low-power mode enables autonomous measurements with lower current consumption (see **Section 2.3**). When the measured concentration moves outside a defined range, the sensor generates an interrupt signal (low) to wake up the connected microcontroller.

Command	Command code (Hex)	Argument	Description
enable_low_power_mode	0x3F90	NA	Enables low power mode and activates the interrupt pin. Measurements are started by a regular start_measurement command (see **Section 3.4.1**)
set_alert_upper_threshold	0x2787	17203 18022	Set upper threshold (in ticks), *e.g.*: - a threshold of 1% is set - a threshold of 2% is set Default is 0x000, indicating no upper limit test is applied.
set_alert_lower_threshold	0x278C	15565 14746	Sets lower threshold (in ticks), *e.g.*: - a threshold of -1% is set - a threshold of -2% is set Default is 0x000, indicating no lower limit test is applied.
exit_low_power_mode	0x3F11	NA	The sensor exits low power mode.

Once the measurement is started, the interrupt pin is set high (logic level corresponding to 100% VDD). If the H_2 concentration exceeds either the lower or upper threshold set, the pin switches low (0V) and can be used to wake up a connected microcontroller. The alarm is cleared by issuing a new start_concentration_measurement command. If both the upper and lower threshold values are set to 0x000 (default), the alarm function is disabled. See **Section 3.5** for the threshold input conversion.

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Note: In this mode, no data output is available. Measurements may not be taken at equidistant time intervals. T-dependent sampling-frequency deviations of up to 30% may occur over the entire T range.

Note: All flags described in **Section 3.4.2** will trigger the alarm pin, except the ASC limit warning, which does not affect measurement performance.

3.4.5 Absolute Humidity Compensation

The sensor can be compensated for AH either automatically through an SHT41A-AD1B RH and T sensor connected through the I^2C controller interface (recommended) or manually by inputting the values directly into the sensor. Both values must be provided consistently from the same source - either via the SHT41A-AD1B or entered manually. The T input is used solely for calculating AH. For the actual temperature compensation an internal temperature sensor is used.

Option 1: Automatic compensation via SHT41A-AD1B RH and T sensor (recommended)

Command	Command code (Hex)	Argument	Description
compensate_humidity_with_sht	0x2657	NA	Automatically writes RH values for compensation from SHT41A-AD1B.
compensate_temperature_with_sht	0x2628	NA	Automatically writes T values for compensation from SHT41A-AD1B.

Option 2: Manual compensation with RH and T values written via the I^2C bus. RH and related T must be updated whenever there is a change. See **Section 3.5** for the signal input conversion.

Command	Command code (Hex)	Argument	Description
enable_manual_humidity_compensation	0x264A	NA	Enables manual RH compensation.
set_humidity	0xE00B	29360	Writes the RH for compensation until a new value is written to the sensor, *e.g.*: - a RH of 50% is set. Default is 0% RH.
enable_manual_temperature_compensation	0x2623	NA	Enables manual T compensation.
set_temperature	0xE000	26214	Writes the T for compensation until a new value is written to the sensor, *e.g.*: - a T of 25 °C is set. Default is internal T information.

The command sequences require a valid CRC byte for the 16-bit argument.
When the CRC byte does not match the argument, the sensor will respond with a NACK. The sensor will ignore the command and retain the previous value.

3.4.6 Set Pressure

Pressure compensation is required to the sensor for accurate density compensation of the gas concentration measurement. See **Section 3.5** for the signal input conversion.

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Command	Command code (Hex)	Argument	Description
enable_pressure_compensation	0x2698	NA	Enables manual P compensation.
set_pressure	0xE016	1023	Writes the P for compensation until a new value is written to the sensor, *e.g.*: - a P of 1023 hPa is set. Default is 0 hPa.

The command sequences require a valid CRC byte for the 16-bit argument.
When the CRC byte does not match the argument, the sensor will respond with a NACK. The sensor will ignore the command and retain the previous value. A pressure of 1013 hPa is assumed after power-up.

3.4.7 Forced Recalibration (FRC)

Forced recalibration is used to improve sensor accuracy by applying a known reference value (typically clean air with 0 $\%H_2$) to correct any offset to the sensor output after reflow soldering or handling. The correct RH, T, and P values must be written to the sensor before initiating forced recalibration, as outlined in **Section 3.4**. Recalibration should only be applied under defined gas conditions.
It is recommended to perform this measurement in the same manner as it will be conducted in the application. For best accuracy, send the command after the first start_concentration_measurement command and when ambient conditions (RH, T and P) are stable.

Command	Command code (Hex)	Argument	Description
perform_forced_recalibration	0xE01D	16384	Sensor output is changed to correspond to the reference value given, *e.g.*: - a concentration of 0 $\%H_2$ is set.

The recalibration takes effect with the first measurement following the FRC command. The FRC correction is written to the internal EEPROM and is reloaded after power cycling.

3.4.8 Automatic Self-Calibration (ASC)

The sensor runs in ASC mode by default. This mode improves accuracy in applications where the target gas is absent most of the time and is required to maintain long-term stability. When ASC is enabled, the sensor performs a zero-point self-calibration, gradually adjusting its output over time to compensate for slow, minor drifts.

Command	Command code (Hex)	Description
disable_automatic_self_calibration	0x3F07	The sensor will not apply ASC. Recommended for applications with a continuous H_2 background.
enable_automatic_self_calibration	0x3F86	The sensor will apply Automatic Self-Calibration (default configuration).

The ASC correction value is stored in the EEPROM and reloaded after reset or power cycling of the sensor.

Note: No baselines are written at temperatures higher than 85 °C or if any status flag is set (see **Section 3.4.2**).

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3.4.9 Sleep Mode

In sleep mode, the sensor is powered down, and all register values are cleared. This is done using the following commands.

Command	Command code (Hex)	Argument	Description
enter_sleep_mode	0x36E0	NA	The sensor enters sleep mode and clears all register values.
exit_sleep_mode	0x36F6	NA	The sensor exits sleep mode.

Upon wake-up, configuration registers shall be reprogrammed.

Note: Any single byte sent to the sensor will cause the device to exit sleep mode. The byte value is ignored and serves only to generate bus activity required to wake up the device.

3.4.10 I²C Soft Reset

The command triggers a soft reset of the sensor through the I²C general call reset as implemented according to the NXP I²C-bus specification and user manual[7]. The command is not acknowledged by the sensor. During the execution time, the sensor will not acknowledge its I²C address nor accept commands. The general call I²C address is 0x00, the command is 8 bits long and all devices on the same I²C bus designed to respond to a general call I²C reset will also complete a soft reset.

Command	Command code (Hex)	Argument	Description
perform_soft_reset	0x06	NA	Resets the sensor to the same state as after a power cycle.

After the soft reset command, the sensor is in the same state as after a power-up cycle.



WARNING

All devices that support this command will perform a reset.
Note that FRC and ASC values that have been stored in the internal EEPROM will be restored during reset and power-up cycling of the sensor. However, RH, T and P will be reset to their default values.

[7] NXP I2C-bus specification and user manual UM10204, Rev.7, 01 November 2021

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3.4.11 Read Product Info

Command	Command code	Consecutive read	Description
read_product_info	0x365B	Byte1: Product number [31:24] Byte2: Product number [23:16] Byte3: CRC Byte4: Product number [15:8] Byte5: Product number [7:0] Byte6: CRC Byte7: Serial number [63:56] Byte8: Serial number [55:48] Byte9: CRC Byte10: Serial number [47:40] Byte11: Serial number [39:32] Byte12: CRC Byte13: Serial number [31:24] Byte14: Serial number [23:16] Byte15: CRC Byte16: Serial number [15:8] Byte17: Serial number [7:0] Byte18: CRC	The read returns: - 32-bit unique product and revision number. The number is listed in the table below. *Note that the last 8 bits are the revision number and are subject to change.* - 64-bit unique serial number as ASCII representation of the serial number on the sensor.

Product	Product number
STC42A	0x08030103

3.4.12 Get Serial Number of SHT

The serial number of the SHT41A-AD1B connected to STC42A via the I^2C controller interface can be read using the following command:

Command	Command code	Consecutive read	Description
get_serial_number_sht	0x2A01	Byte1: Serial number [31:24] Byte2: Serial number [23:16] Byte3: CRC Byte4: Serial number [15:8] Byte5: Serial number [7:0] Byte6: CRC	The read returns the serial number of the SHT41A-AD1B sensor.

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3.5 Conversion of Signal Input and Output

The conversion formulas for I²C command inputs and digitally calibrated outputs can be found in **Table 13**.

Signal	Symb.	Type	Int.	Conversion Formula	Example
H_2 gas concentration	C	Output	u16	$C[vol\%] = \frac{Output - 2^{14}}{2^{15}} \cdot SF$	$Output = \mathbf{32768}$: $\frac{\mathbf{32768} - 2^{14}}{2^{15}} \cdot 40 = 20\%$
Threshold or FRC H_2 concentration	I_{H2}	Input	u16	$I_{H2} = \frac{C_{H2}[vol\%\ in\ air] \cdot 2^{15}}{SF} + 2^{14}$	$C_{H2} = \mathbf{0}\ vol\%$: $\frac{\mathbf{0} \cdot 2^{15}}{40} + 2^{14} = 16384$
C-Range: 0 … 65'535 (16 bit) → -20 vol% H_2 … +60 vol% H_2. Where *SF* is the scale factor (see **Section 3.4.2**).					
Relative humidity	RH	Input	u16	$Input = \frac{(RH\ [\%RH] + 6)(2^{16} - 1)}{125}$	$RH = \mathbf{50}\ \%RH$: $\frac{(\mathbf{50} + 6)(2^{16} - 1)}{125} = 29360$
		Output	u16	$RH[\%] = 125 \cdot \frac{Output}{2^{16} - 1} - 6$	$Output = \mathbf{29360}$: $125 \cdot \frac{\mathbf{29360}}{2^{16} - 1} - 6 = 50\ \%RH$
RH-range: 0 … 65'535 (16 bit) → -6 %RH … +119 %RH, clipped to 0 %RH and 100 %RH.					
Temperature	T	Input	u16	$Input = \frac{(T\ [°C] + 45)(2^{16} - 1)}{175}$	$T = \mathbf{25}°C$: $\frac{(\mathbf{25} + 45)(2^{16} - 1)}{175} = 26214$
		Output	u16	$T = 175 \cdot \frac{Output}{2^{16} - 1} - 45$	$Output = \mathbf{26214}$: $175 \cdot \frac{\mathbf{26214}}{2^{16} - 1} - 45 = 25\ °C$
T-range: 0 … 65'535 (16 bit) → -45 °C … +130 °C, clipped to -42.5 °C and +107.5 °C.					
Pressure	P	Input	u16	$Input = P\ [hPa]$	$1023 = 1023\ hPa$
P-range: 0 … 65'535 (16 bit) → 0 hPa … 65'535 hPa, clipped to 500 hPa … 1'200 hPa.					

Table 13. Signal input and output conversion formulas.

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4 Physical Specifications

4.1 Package Outline

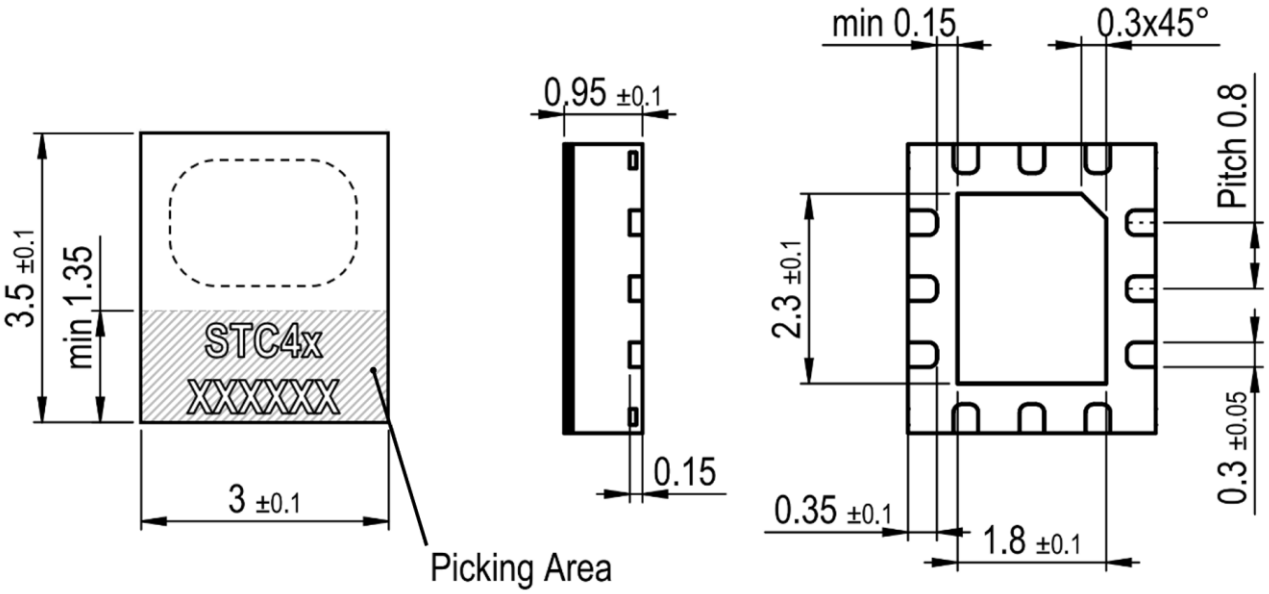


Figure 3. Dimensional drawing of STC42A including package tolerances (units mm). XXXXXX denotes the sensor serial number and serves as an internal batch tracking code.

4.2 Land Pattern

The land pattern is recommended to be designed according to the used PCB and soldering process together with the physical outer dimension of the sensor. For more details about soldering see separate Handling and Assembly Instructions for the STC42A.
The die pad or center pad is visible from below and located in the center of the package. It should be connected to GND.

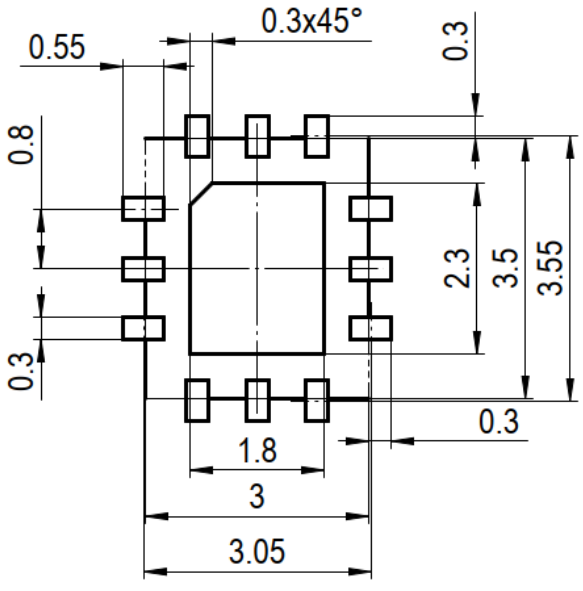
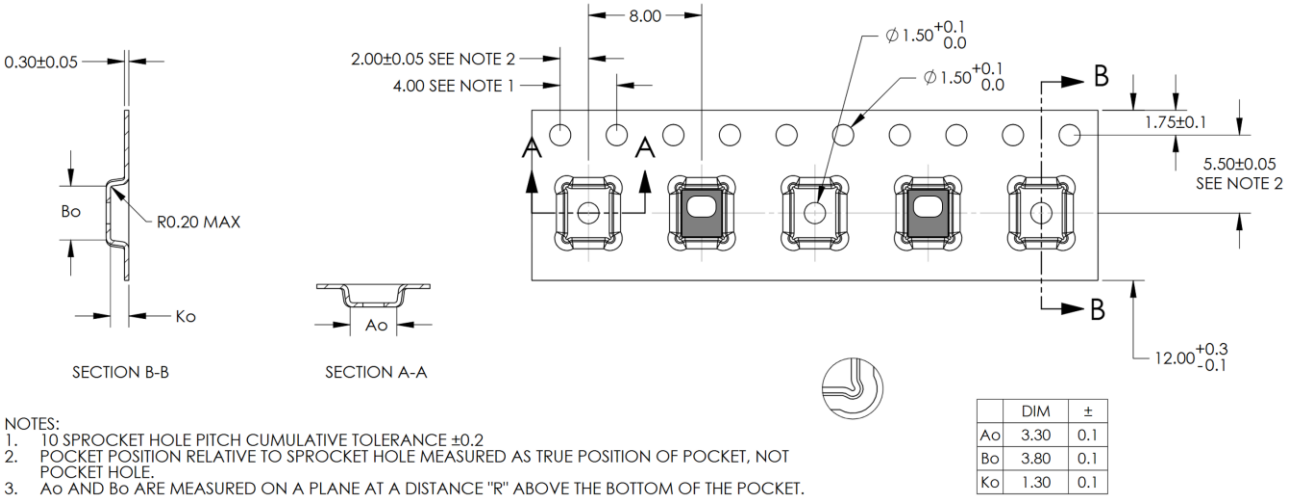


Figure 4. Example land pattern: Top view. All dimensions in mm.

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5 Tape and Reel Packaging

Product will be delivered in a 13" Tape & Reel configuration, containing 5kpcs, with the dimensions Ø300mm x 20mm and an approximate weight of 560g.



	DIM	±
Ao	3.30	0.1
Bo	3.80	0.1
Ko	1.30	0.1

Figure 5. Technical drawing of the packaging tape with sensor orientation in tape (units mm).

6 Getting Started Resources

Sensirion provides an evaluation kit SEK-STC42A which includes an STC42A and an SHT41A-AD1B for immediate testing. Paired with Sensirion's SensorBridge interface and ControlCenter software, this allows quick reading of sensor data. Refer to the *Eval Kit User Guide* for a step-by-step setup.



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7 Ordering Information

Part Name	Part Number	Description	Quantity (pcs)
STC42A-D-R5	3.001.170	STC42A variant in 13" Tape & Reel	5'000
SEK-STC42A	3.001.289	Single package evaluation kit	1

Table 14. Ordering information.

8 Revision History

Date	Version	Sections	Changes
Feb 2026	1	all	Initial Release.
Mar 2026	1.1	all	Editorial changes.
Apr 2026	1.2	1.1 2.3 3.4.2 3.4.2 3.4.11 all	Accuracy specs for extended temperature range removed. Supply voltage range extended. DP warning flag threshold increased. Behavior of error bit 12 modified. Product number updated. Minor editorial changes.

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Important Notices

Warning, Personal Injury

Do not use this product as safety or emergency stop devices or in any other application where failure of the product could result in personal injury (including death). Do not use this product for applications other than its intended and authorized use. Before installing, handling, using or servicing this product, please consult the data sheet and application notes. Failure to comply with these instructions could result in death or serious injury.

If the Buyer purchases or uses SENSIRION products for any unintended or unauthorized application, Buyer shall defend, indemnify and hold harmless SENSIRION and its officers, employees, subsidiaries, affiliates and distributors against all claims, costs, damages and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if SENSIRION is allegedly negligent with respect to the design or the manufacture of the product.

ESD Precautions

The inherent design of this component causes it to be sensitive to electrostatic discharge (ESD). To prevent ESD-induced damage and/or degradation, take customary and statutory ESD precautions when handling this product. See application note "ESD, Latchup and EMC" for more information.

Warranty

SENSIRION solely warrants to the original purchaser of this product for a period of 12 months (one year) from the date of delivery that this product is of the quality, material and workmanship defined in SENSIRION's published specifications of the product. Within such period, if proven to be defective, SENSIRION shall as sole and exclusive remedy, in SENSIRION's discretion, repair this product or send a replacement product, free of charge to the Buyer, provided that:

- notice in writing describing the defects shall be given to SENSIRION within fourteen (14) days after their appearance;
- such defects shall be found, to SENSIRION's reasonable satisfaction, to have arisen from SENSIRION's faulty material or workmanship;
- the defective product shall be returned to SENSIRION's factory at the Buyer's expense; and
- the warranty period for any repaired or replaced product shall be limited to the unexpired portion of the original period.

The Buyer shall at its own expense arrange for any dismantling and reassembly that is necessary to repair or replace the defective product. This warranty does not apply to any product which has not been installed or used within the specifications recommended by SENSIRION. EXCEPT FOR THE WARRANTIES EXPRESSLY SET FORTH HEREIN, SENSIRION MAKES NO WARRANTIES, EITHER EXPRESS OR IMPLIED, WITH RESPECT TO THE PRODUCT. ANY AND ALL WARRANTIES, INCLUDING WITHOUT LIMITATION, WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, ARE EXPRESSLY EXCLUDED AND DECLINED.

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SENSIRION does not assume any liability arising out of any application or use of any product or circuit and specifically disclaims any and all liability, including without limitation indirect, consequential, and incidental damages, and loss of profit. No obligation or liability shall arise or grow out of SENSIRION's rendering of technical advice, consulting, or implementation instructions or guidelines. All operating parameters, including without limitation recommended parameters, must be validated for each Buyer's applications by Buyer's technical experts. Recommended parameters can and do vary in different applications.

SENSIRION reserves the right, without further notice, (i) to change the product specifications and/or the information in this document and (ii) to improve reliability, functions and design of this product.

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