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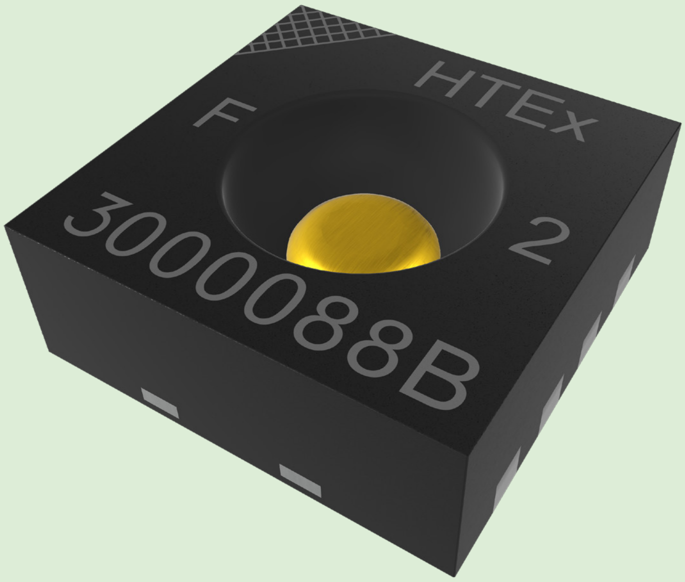
Datasheet HTE301

Digital Humidity and Temperature Sensor



HTE301

Digital Humidity and Temperature Sensor

The HTE301 is the next generation of the digital RH/T series HTEx01. The sensor provides an accuracy of up to 1.8 %RH incl. hysteresis, a constant current heater and integrated sensor coating. With a 16-bit unsigned integer value and a different pin assignment compared to HTE501, the HTE301 allows an easy upgrade for your existing application with minimal integration effort.

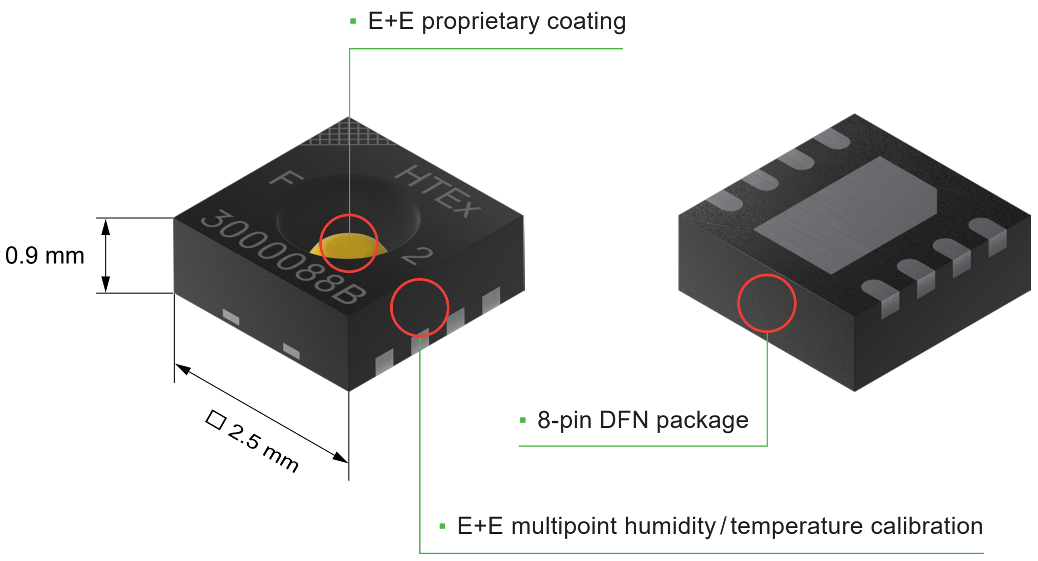
Furthermore the sensor covers a wide application range from -40 to +125 °C and 0 to 100 %RH. Therefore, the HTE301 offers a versatile measuring device for demanding tasks. With a footprint of only 2.5 x 2.5 mm and the expansion of up to 4 I2C addresses, it ensures an outstanding performance at an excellent price-performance ratio.

Key Features

- Accuracy:
  up to ±1.8 %RH (incl. hysteresis)
  up to ±0.2 °C
- E+E proprietary coating
- Supply voltage 2.35 - 3.60 V
- 8-pin DFN package
- Constant current heater
- I^2C interface with pin-selectable addresses
- I^2C glitch suppression
- Relative humidity hysteresis compensation
- Excellent repeatability

Typical Applications

- Automotive industry
- Building automation
- Consumer electronics
- Home appliances
- Industrial automation
- Medical devices
- Smart home
- Wearable devices
- White goods



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Acronym	Meaning
A	Ambient
B	Bus
CDM	Charged Device Model
ESD	Electrostatic Discharge
HBM	Human Body Model
HI	Heater Invalid
MEAS	Measurement, Measuring
PORI	Power On Reset, Idle Mode
PU	Pull-up
POR	Power On Reset
PORP	Power On Reset, Periodic Mode
PUPE	Pull-up external
PUPI	Pull-up internal
RH	Relative humidity
Td	Dew point temperature
T	Temperature

Table 1: List of HTE301 specific acronyms

1 Pin Configuration

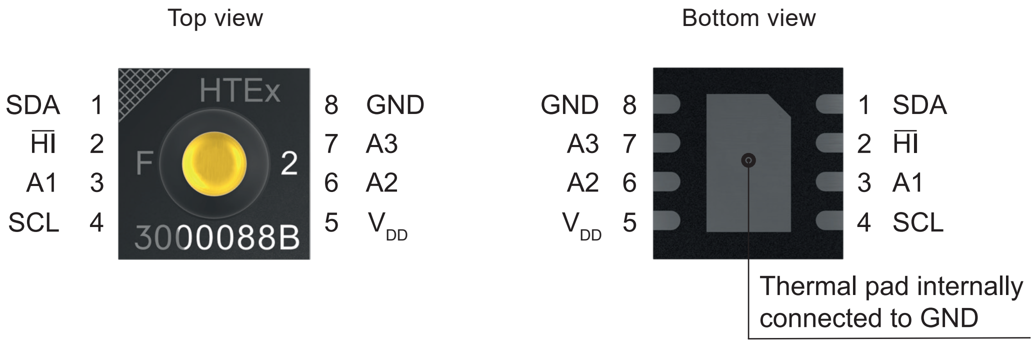


Figure 1: DFN8 pin configuration

Pin	Name	Pin Type	Description
1	SDA	I/O	Serial data line for I^2C communication. The external pull-up resistors (e.g. Rp = 4.7 kΩ) are required to pull the signal high.
2	A1	Input high-Z	I^2C device address pin; bit 1 of the 7 bit address; do not leave floating, to be connected to the GND for default I^2C address.
3	ALERT	Output push-pull	Indicates alarm condition; leave floating if unused.
4	SCL	I/O	Serial clock line for I^2C communication. The external pull-up resistors (e.g. R_p = 4.7 kΩ) are required to pull the signal high.
5	V_{DD}	Power	Positive supply pin
6	Reset	Inverted input with pull-up	Reset pin active low; leave floating if unused; can be connected to V_{DD} with a series resistor of R ≥ 2 kΩ.
7	A2	Input high-Z	I^2C device address pin, bit 2 of the 7 bit address; do not leave floating, to be connected to the GND for default I^2C address.
8	GND	Power	Ground (internally connected to thermal pad)[1)]

1) Soldering of the thermal pad is optional. However, the soldering is recommended. Do not use the heat conduction pad on the PCB for heat dissipation but purely as a mounting surface, otherwise heating energy is lost.

Table 2: HTE301 pin assignment

2 Typical Application

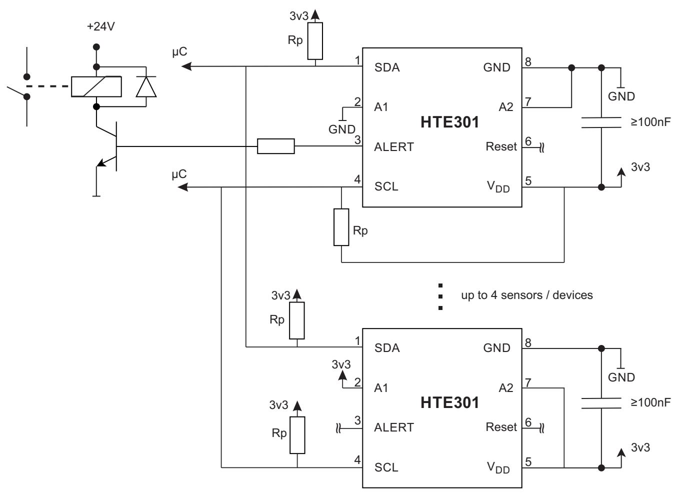


Figure 2: Typical application schematic

3 Specification

3.1 Relative Humidity Sensor

PARAMETER	CONDITION(S)	MIN	TYP	MAX	UNITS
Operating range		0		100	%RH
Accuracy[1) 2) 3)]	Periodic mode		±1.8	See Figure 3	%RH
Hysteresis[2)]			±0.9		%RH
Resolution[4)]	13 bit		0.02		%RH
Repeatability[5)]	13 bit		0.02		%RH
Response time[6)]	τ_{63}		5		s
Long term drift[7)]			<0.5%		%RH/yr

Table 3: Relative humidity sensor

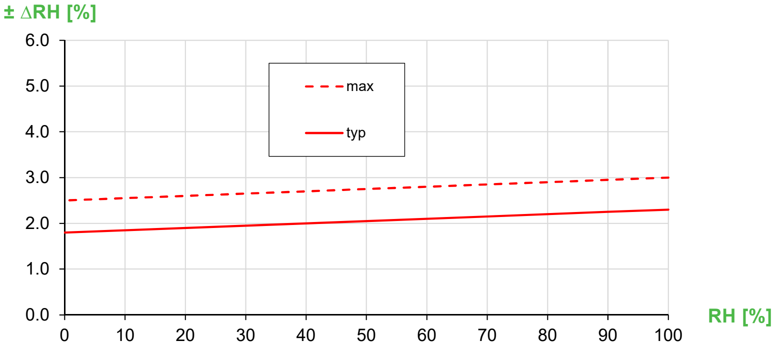


Figure 3: Humidity measurement accuracy @ 25 °C (incl. hysteresis)

3.2 Temperature Sensor

PARAMETER	CONDITION	MIN	TYP	MAX	UNIT
Operating Range[8)]	Heater OFF	-40		135	°C
Accuracy			0.2	See Figure 4	°C
Resolution[9)]	high		0.01		°C
Repeatability[5)]	high		0.03		°C
Response time[10)]	τ_{63}	2			s
Long Term Drift			<0.03		°C/yr

Table 4: Temperature sensor parameters

1) In the periodic mode the humidity hysteresis is included. See also chapter 3.3 Recommended Operating Conditions.
2) In the periodic mode the humidity accuracy is within the hysteresis. In the single shot measurement, the humidity hysteresis must be added to the given humidity accuracy to obtain the overall accuracy.
3) The detailed definition of "typ." and "max." is given in the document Sensor Specification Accuracy, available at www.epluse.com/hte301.
4) Default resolution is 13 bit temperature / 13 bit humidity. Resolution is changeable with register value.
5) The stated "Noise/Repeatability" is 3 times the standard deviation (3σ) of multiple consecutive measurement values at constant environmental conditions.
6) Time for achieving 63 % of a step function, valid at 25°C and 1 m/s airflow.
The actual response time in application strongly depends on the surrounding of the sensor in the final application (heat conductivity of sensor substrate, dead volume,…).
7) Value may be higher in environments with vaporized solvents, out-gassing tapes, adhesives, packaging materials, etc. For more details please refer to the HTE301 Handling Instructions.
8) With the "Heater ON" take care that the sensor temperature does not get higher than the maximum allowed temperature
9) Default resolution is 13 bit temperature / 13 bit humidity. Resolution is changeable with register value.
10) Time for achieving 63 % of a step function, valid at 25°C and 1m/s airflow.
The actual response time in application strongly depends on the surrounding of the sensor in the final application (heat conductivity of sensor substrate, dead volume, …).

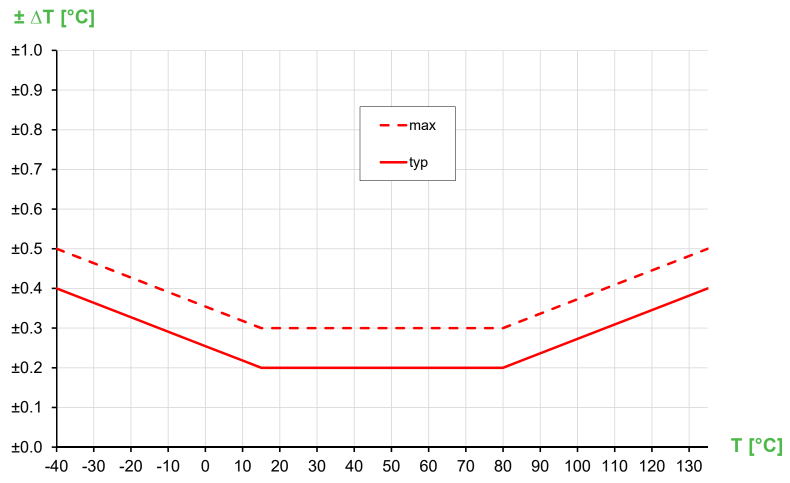


Figure 4: Temperature sensor accuracy

3.3 Recommended Operating Conditions

The sensor shows best performance when operated within the normal operating conditions (dark green area in Figure 5). This means 20…80 %RH, temperature >0 °C and dew point temperature <60 °C.
Exposure conditions outside this "Normal operating condition" for a long time, especially at high humidity >80 %RH may cause a temporary humidity gain error. If the sensor is brought back to normal operating conditions, the initial values will recover. Applications with high humidity at high temperatures will result in slower recovery. Reconditioning procedures can accelerate the recovery process.
Although the sensors would not fail beyond the normal operating condition limits, the specification is guaranteed within the "Normal operating condition" or within the "Extended operating conditions" (light green area) after a reconditioning procedure.
Prolonged exposure to extreme operating conditions (marked orange in Figure 5) may accelerate ageing.

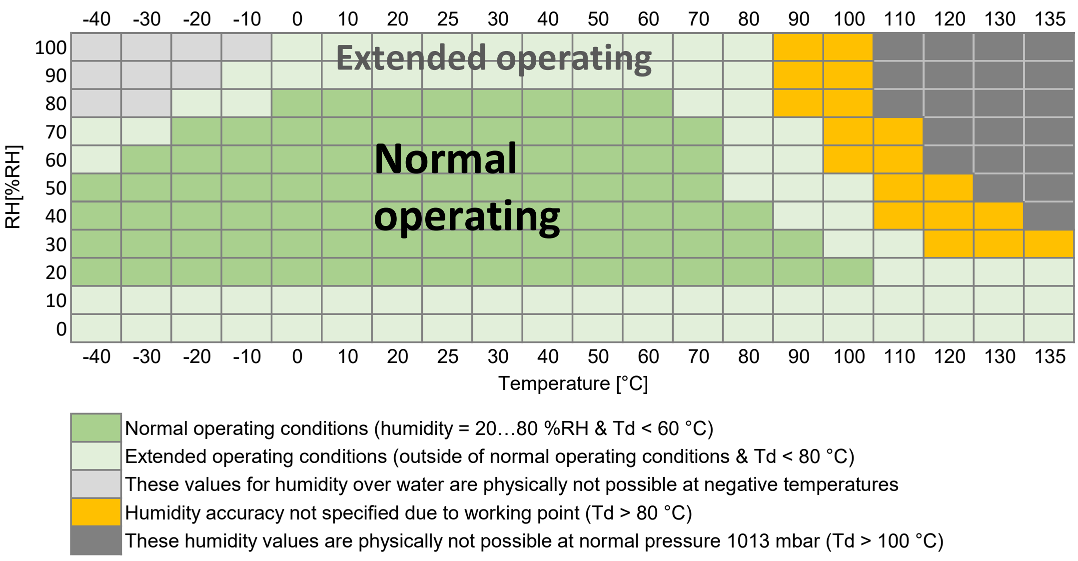


Figure 5: Operating conditions

4 Electrical Characteristics

4.1 Absolute Maximum Ratings

The absolute maximum ratings as given in Table 5 are stress ratings only and give additional information. Functional operation of the device at these conditions is not implied. Exposure to absolute maximum rating conditions for extended periods may affect the device reliability (e.g. hot carrier degradation, oxide breakdown).

PARAMETER	SYMBOL	MIN	MAX	UNIT
Power Supply	V_{DD}	-0.3	3.6	V
Digital I/O pins	V_{LOGIC}	-0.3	5.0	V
Input Current on any pin	I_{IN}	-50	50	mA
Storage Temperature	T_{STG}	-55	150	°C
ESD HBM[1)]	ESD_{HBM}	-	4	kV
ESD CDM[2)]	ESD_{CDM}	-	750	V

1) Human Body Model according to AEC-Q100-002
2) Charged Device Model according to AEC-Q100-011

Table 5: HTE301 absolute maximum ratings

4.2 Electrical Specification

Typical values correspond to V_{DD} = 3.3 V and T_A = 25 °C.
Min. and max. values are valid in the full temperature range -40 °C … 135 °C and at declared V_{DD} levels, unless otherwise noted.

PARAMETER	SYMBOL	CONDITION / COMMENT	MIN	TYP	MAX	UNIT
Supply Voltage	V_{DD}		2.35	3.0	3.6	V
POR voltage periodic mode	V_{PORP}	Static power supply	2.10	2.20	2.35	V
POR voltage idle mode	V_{PORI}	Static power supply		1.8		V
Supply current	I_{DD}	Single mode (idle)[1)]		6		µA
		Periodic mode[1)]		80		µA
		Measuring T, RH, Calculation		900		µA
		Constant current heater[2)]		5		mA
Thermal resistance	R_{TH}	Dependent on PCB layout and enviromental conditions		150		K/W

1) Without I^2C communication and when not measuring.
2) The chip temperature must not exceed 125°C with heater on.

Table 6: General operation

PARAMETER	SYMBOL	CONDITION / COMMENT	MIN	TYP	MAX	UNIT
Input voltage	V_{IL}	Low level			$0.3{*}V_{DD}$	V
	V_{IH}	High level	$0.7{*}V_{DD}$		V_{DD}	V
Output voltage	V_{OL}	Current into pin: I_{OL}= 4.0 mA	0	0.25	0.40	V
	V_{OH}	High level → open drain				
Internal pull-up resistor	R_{PUPI}	V_{DD}=3.60 V & pin voltage = $0.7{*}V_{DD}$		25		kΩ
		V_{DD}=3.30 V & pin voltage = $0.7{*}V_{DD}$		27		kΩ
		V_{DD}=3.00 V & pin voltage = $0.7{*}V_{DD}$		30		kΩ
		V_{DD}=2.35 V & pin voltage = $0.7{*}V_{DD}$		34		kΩ
External pull-up resistor	R_{PUPE}	At I²C lines, pull-up current ≤4.0 mA @ 3.3 V	0.725	4.7		kΩ
Capacitive bus load	C_B	Standard			400	pF
		Fast mode			400	pF
		Fast mode plus			177	pF

Table 7: I^2C communication pins SCL & SDA

PARAMETER	SYMBOL	CONDITION / COMMENT	MIN	TYP	MAX	UNIT
Input voltage	V_{IL}	Low level			$0.3{*}V_{DD}$	V
	V_{IH}	High level, 5V tolerant input	$0.7{*}V_{DD}$	V_{DD}	5.0	V
Input leakage current	I_{VDD}	Voltage @pin = 0…V_{DD}	-10	0	+10	µA
	I_{I5V}	Voltage @pin = V_{DD}…5 V		TBD		µA
Output resistance	R_{OH}	Voltage @pin = V_{DD}-0.4 V		116		Ω
	R_{OL}	Voltage @pin = 0.4 V		100		Ω

Table 8: I/O pins

PARAMETER	SYMBOL	CONDITION / COMMENT	TYP	UNIT
Power-up time	t_{PWRU}	After V_{DD} > V_{PORP}, exclude measurement at power-up	1.1	ms
Reset time	t_{RESET}	Any reset except power-up	0.9	ms
T Measurement	t_T	Low repeatability	1.2	ms
		Medium repeatability	2.3	ms
		High repeatability	8.9	ms
RH Measurement	t_{RH}	Low repeatability	0.5	ms
		Medium repeatability	1.0	ms
		High repeatability	4.1	ms
Measurement calculation	t_{CALC}	After every measurement	1.2	ms
SCL SDA input filter	t_{spike}	Short voltage spikes are ignored	25	ms

Table 9: General timing

Subsequently, the typical measurement time with high repeatability is:

$$t_{MEAS} = t_T + t_{RH} + t_{CALC}$$
$$= 8.9 + 4.1 + 1.2$$
$$= 14.2 \text{ ms.}$$

	Temperature	Humidity
Repeatability	Resolution [°C]	Resolution [%RH]
High	0.01	0.02
Medium	0.06	0.09
Low	0.11	0.18

Table 10: Measurement resolution

5 Interface

5.1 Pin Configuration, Assignment and Description

Please refer to chapter 1.

5.2 Supply Pins (V_{DD}, GND)

The supply pins must be equipped with a bypass ceramic capacitor of at least 100 nF.
When using the constant current heater, a current change in the heater must not lead to a voltage drop below the minimum V_{DD} value (refer to Table 6). This means the bypass capacitor needs to be dimensioned sufficiently large so that the voltage controller is supplied adequately.

Sensor Power-up

As soon as V_{DD} exceeds the POR voltage V_{PORP}, the device gets initialized. After t_{PWRU}, the initialization procedure is completed.

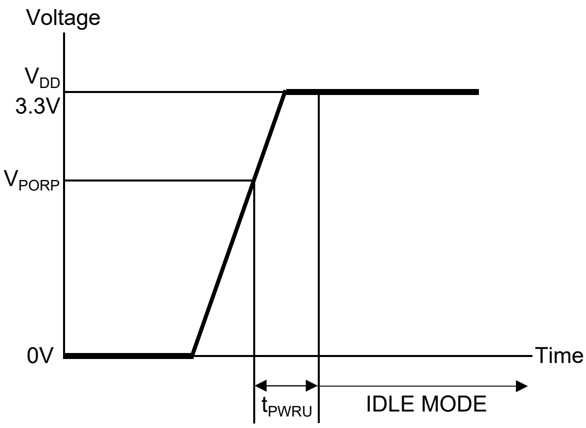


Figure 6: Sensor behaviour at power-up

5.3 I²C Communication

The I²C communication is based on the NXP UM10204 I²C bus specification and user manual[1).]
The HTE301 supports the modes “standard“ (100 kHz), “fast mode“(400 kHz) and “fast mode plus” (1 000 kHz).
The sensor works as SLAVE and needs to be queried by a MASTER.

1) Revision 7, 1 October 2021, download from https://www.nxp.com/webapp/Download?colCode=UM10204&location=null.
The document is located behind a login access barrier.

5.4 I²C Address Pins

The sensor's I²C base address is 0x44 (without R/ bit). Pins A1...A2 define the I²C base address.

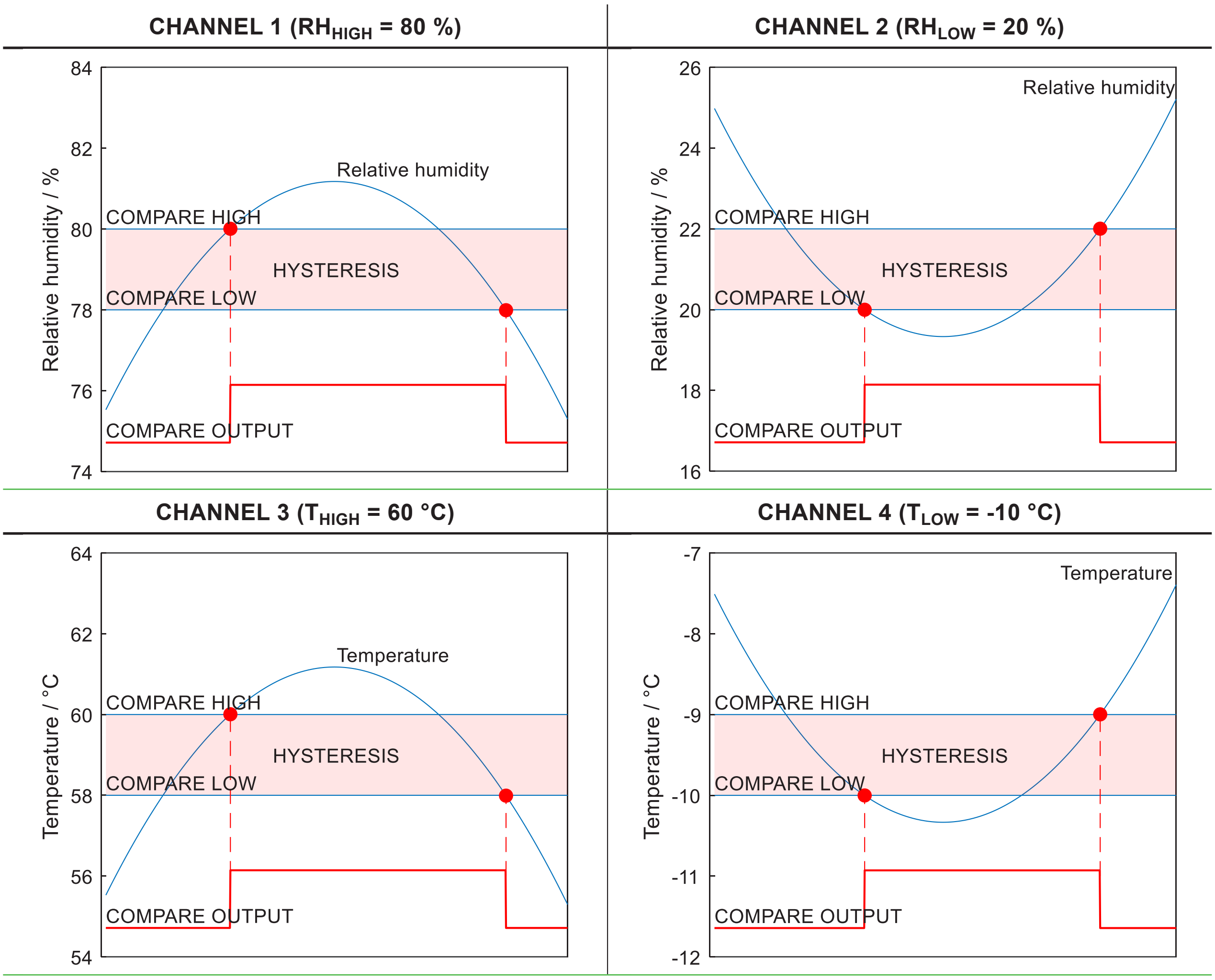
						PIN 7	PIN 2		SLAVE Address (unshifted)	SLAVE Address (with W)	SLAVE Address (with R)
						A2	A1	R/W			
Bit #	7	6	5	4	3	2	1	0			
	1	0	0	0	0	0	0	1/0	0x44	0x88	0x89
	1	0	0	0	0	0	1	1/0	0x45	0x8A	0x8B
	1	0	0	0	1	1	0	1/0	0x46	0x8C	0x8D
	1	0	0	0	1	1	1	1/0	0x47	0x8E	0x8F

5.5 ALERT Pin (3)

The ALERT pin indicates low when the temperature and relative humidity are in the range:

- $RH = [RH_{LOW}, RH_{HIGH}] = [20\ \%, 80\ \%]$
- $T = [T_{LOW}, T_{HIGH}] = [-10\ °C, +60\ °C]$

If any of temperature or relative humidity measurement values goes outside this range the ALERT pin will output high, which will remain high as long as the corresponding value will go back inside the given temperature or humidity range including the hysteresis as shown in the plots below.



5.6 Reset Pin (6)

As soon as the falling edge on the reset pin is in the logic “0” blue area (low signal), as shown in the diagram below, the device goes into the reset and remains in this state as along as the voltage on the reset pin remains in the logic “0” area. In particular, during this phase, the device is in the cycle of being powered-up and reset immediately after power-up, thus the current consumption corresponds to the power-up current, approximately 1 mA. During the reset time, the device will not respond to any request on the I^2C interface and set all digital outputs into a tristate mode.

As soon as the voltage rising edge reaches the logic “1” green area (high signal), the devices will be powered-up properly. The default (non-reset) pin state is high (typically 3.3V). If unused, the reset pin can be connected to the V_{DD}.

Already short voltage drops (10 ns) on the reset pin will lead to the reset state. Thus, it is recommended to use an appropriate capacitor to avoid unwanted resets.

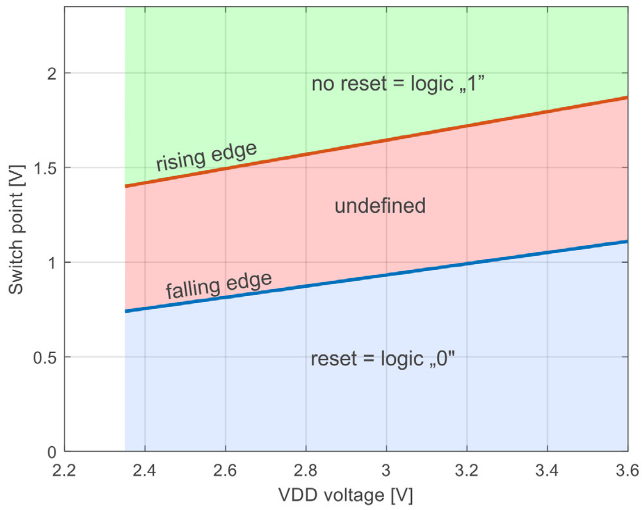


Figure 7: I/O input reset pin behavior versus the V_{DD} voltage

6 Sensor Communication

6.1 Command Overview

Measurement commands

Measurement mode	Description	CMD Hex Code		Repeatability
	I^2C clock stretching	MSB	LSB	
Single-shot	enabled	2C	06	High
			0D	Medium
			10	Low
	disabled	24	00	High
			0B	Medium
			16	Low
	Measurement interval	**MSB**	**LSB**	
Periodic	0.5 mps	20	32	High
			24	Medium
			2F	Low
	1 mps	21	30	High
			26	Medium
			2D	Low
	2 mps	22	36	High
			20	Medium
			2B	Low
	4 mps	23	34	High
			22	Medium
			29	Low
	10 mps	27	37	High
			21	Medium
			2A	Low

Table 11: HTE301 commands

Further commands

CMD Hex Code	Description
0xE000	Fetch periodic measurement data
0x30A2	Soft Reset
0x3093	Break
0x306D	Heater ON
0x3066	Heater OFF
0x3041	Clear status register
0xF32D	Readout of status register
0x06	I^2C Reset at general call address 0x0

6.2 Measured Data Format

Temperature [°C] = -45 + 175 · (Temperature MSB * 256 + Temperature LSB) / (2^{16}-1)

Humidity [%RH] = 100 · (Humidity MSB * 256 + Humidity LSB) / (2^{16}-1)

6.3 Measurement Modes

There are two different operation modes to communicate with the sensor:

1. Single Shot Measurement

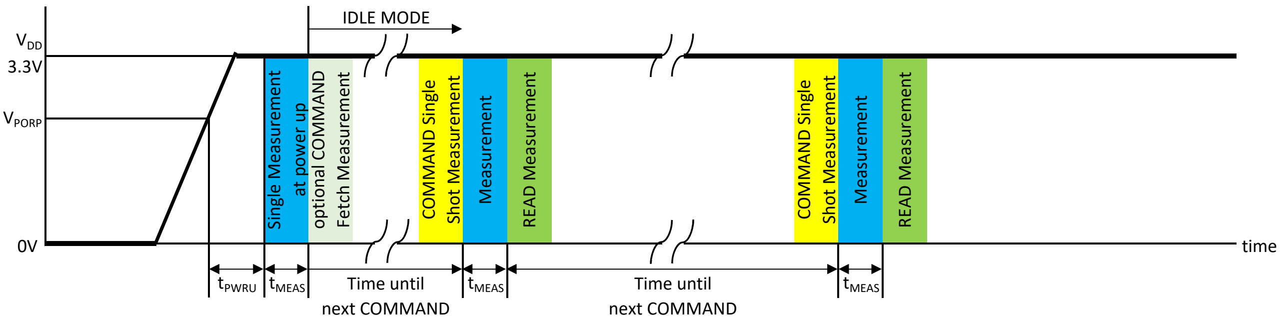


Figure 8: Single shot measurement

2. Periodic Measurement

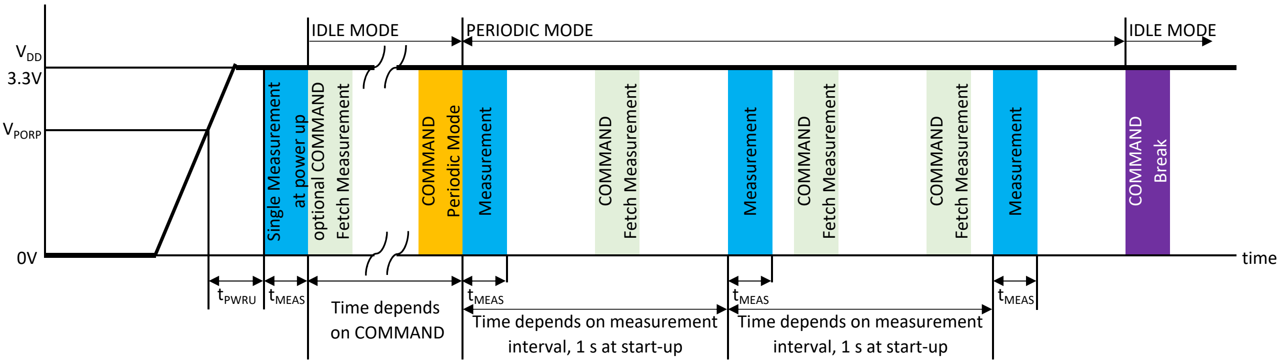


Figure 9: Periodic measurement

6.4 Single Shot Measurement

The command initiates a single measurement, the measured data is available for query after t_{MEAS}. I^2C clock stretching enabled: waiting for the end of the measurement during command execution.

Condition	CMD Hex Code		Repeatability
I^2C clock stretching	**MSB**	**LSB**	
Enabled	2C	06	High
		0D	Medium
		10	Low
Disabled	24	00	High
		0B	Medium
		16	Low

Table 12: Single shot measurement with or without clock stretching

A single-shot measurement is started after the command has been received successfully. The readout of the calculated values RH and T is started by sending the I^2C address again in read mode:

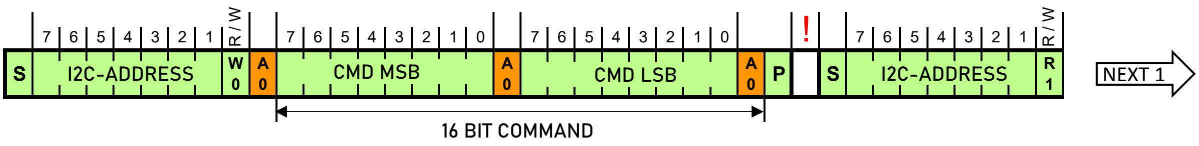


Figure 10: Start single shot measurement readout

In case a command with clock stretching enabled has been issued, the slave holds SCL low until the calculation has been finished:

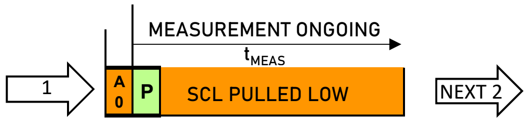


Figure 11: Clock stretching during measurement

In case a command without clock stretching has been issued, the slave does not acknowledge (NACK) a read header as long as the calculation has not been finished:

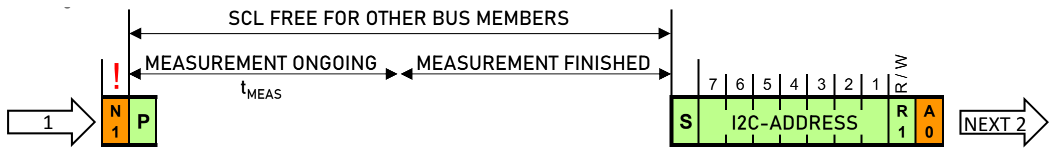


Figure 12: Poll for meauring values until ACK

After the calculation is finished, the slave responds to a read header with a pair of data words, each of them is followed by an 8 bit checksum (CRC8). The first data word contains the temperature value while the second word contains the relative humidity value. The master has to acknowledge each single data byte by an acknowledge (ACK), otherwise the slave will stop sending any further data and wait for a stop condition (P):

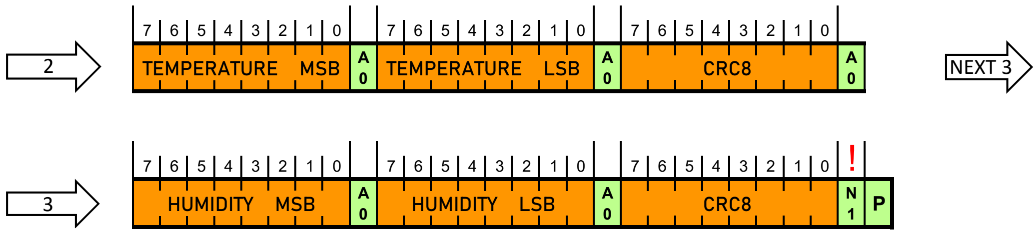


Figure 13: Measured value readout

6.5 Periodic Measurement

Once issued, measurements and calculations are started automatically with a given measuring interval and resolution. This mode does not support clock stretching.

Data Bit From Master to Slave
Data Bit From Slave to Master

! = Note the deviation!

S = Start condition
P = Stop condition

R = Read Bit
W = Write Bit

A = Acknowledge (SDA low)
N = Not Acknowledge (SDA high)

Condition	CMD Hex Code		Repeatability
Measurement interval	MSB	LSB	
0.5 mps	20	32	High
		24	Medium
		2F	Low
1 mps	21	30	High
		26	Medium
		2D	Low
2 mps	22	36	High
		20	Medium
		2B	Low
4 mps	23	34	High
		22	Medium
		29	Low
10 mps	27	37	High
		21	Medium
		2A	Low

PLEASE NOTE

A short measurement interval can influence the power consumption and therefore the self-heating of the sensor.

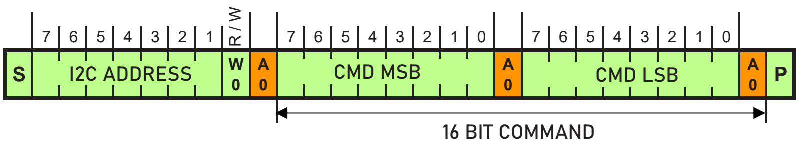


Figure 14: Periodic measurement commands

A periodic measurement command with a different measurement interval / resolution can be issued at any time, but the calculated value will be updated according the new settings earliest after a measurement with the new settings has been performed.

6.6 Fetch Periodic RH&T Measurement Results (0xE000)

Readout of calculation results in periodic measurement mode can be performed using the fetch command. This is similar to the readout of measurement results in single-shot mode, except that clock stretching is always disabled. The slave will answer with NACK if no measurement results are available.

Command	CMD Hex Code
Fetch data	E000

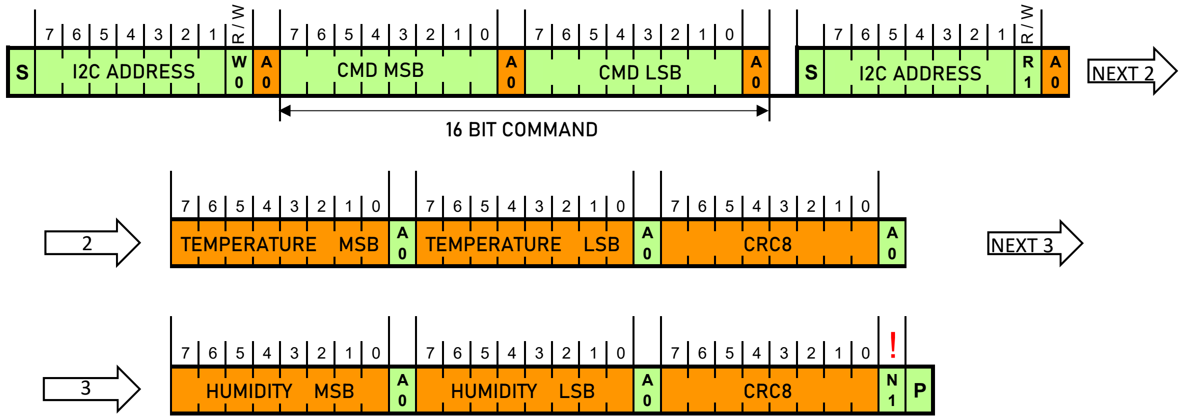


Figure 15: Fetch command

This command is also suitable for reading out the measured data generated by the power-up procedure.

6.7 Break Command (0x3093)

The periodic measurement mode can be stopped using the break command. After finishing an ongoing measurement, the sensor will enter the idle mode. An ongoing measurement can delay the transition into the idle mode.

Command	CMD Hex Code
Break	3093

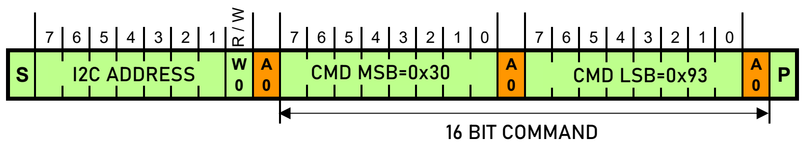


Figure 16: Break command

A single measurement (command) or a reset (command or power-up) both stop the periodic measurement, too.

6.8 Reset Commands (0x30A2, 0x06)

The slave supports multiple commands to reset the device. Once a reset command is received, the device is completely reset, like a reset during power-up. During the reset time, the device will not respond to any request on the I^{2}C interface.

In order to execute the reset on a specific device, the command “Soft Reset” can be used. This forces the system to execute the startup procedure without the need to remove the power supply. The protection will be re-established with the “Soft Reset”.

Command	CMD Hex Code
Soft reset	30A2

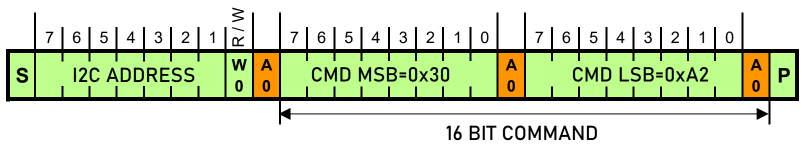


Figure 17: Soft reset

In order to reset all devices on the bus, the master can use the “General call” mode. This generates a reset (system startup) in all devices on the bus which support this function. The effect is the same as for the “Soft Reset” command.

Command	CMD Hex Code
Address byte	00
Second byte	06

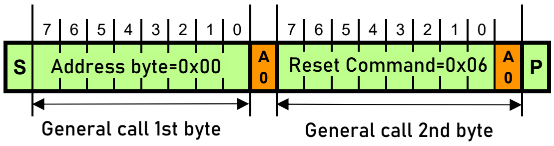


Figure 18: Reset through general call

In order to reset the I^{2}C interface only, keep SDA high while toggling SCL nine times or more. This must be followed by a start condition preceding the next command. This sequence does not affect any configuration, status register or system status.

6.9 Status Register (0xF32D)

The sensor implements a 16 bit status register.
Its contents can be read using the following command:

Command	CMD Hex Code	
	MSB	LSB
Read out Status Register	F3	2D

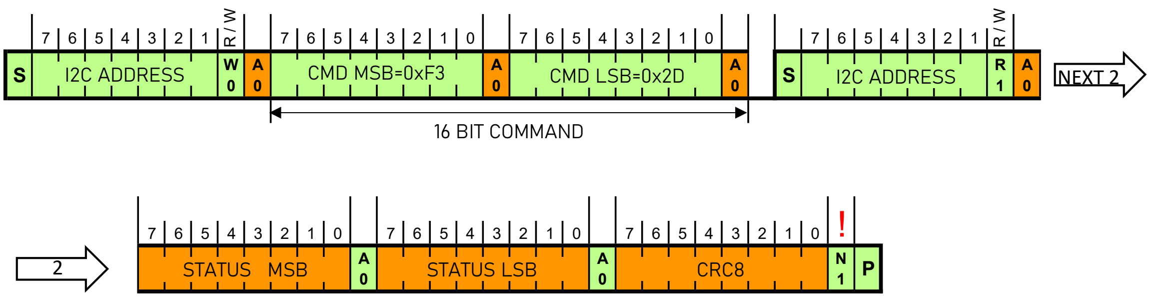


Figure 19: Read out status register

Upon receipt of the following clear command, bits 15, 4 and 3 are cleared in the status register. All other bits remain unaffected:

Command	CMD Hex Code
Clear Status Register	3041

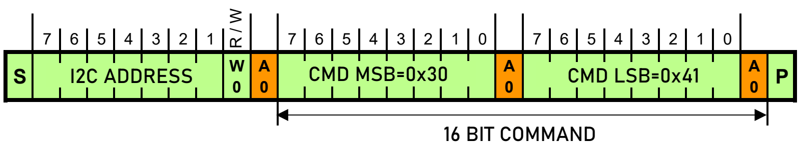


Figure 20: Clear status register

Bit	Name	Description
15	OVERALL_ERROR	0: none of bits [11:0] set 1: at least one of bits [11:0] set This bit is cleared upon the Clear Status Register command
14	Reserved	-
13	CONSTANT_HEATER	0: Heater OFF 1: Heater ON
12	Reserved	-
11	T out of RANGE	0: no alert 1: alert (see ALERT pin) These bits are cleared upon “Clear status register” command
10	RH out of RANGE	
9	RH or T out of RANGE	
8	$T < T_{LOW}$	
7	$T > T_{HIGH}$	
6	$RH < RH_{LOW}$	
5	$RH > RH_{HIGH}$	
4	System Reset	0: no reset since status 1 clear 1: POR or I^2C reset This bit is cleared upon the Clear Status Register command
3	POR	0: no POR since status 1 clear 1: POR occurred This bit is cleared upon the Clear Status Register command
2	Reserved	-
1	Reserved	-
0	CRC	1: checksum of the latest write transfer failed

Table 13: Status register

6.10 Constant Current Heater (0x306D, 0x3066)

The constant current heater serves various purposes:

- Sensor function test, switching on of heater at constant environmental conditions and adapted time constants for T and RH
  - Temperature T rises
  - Humidity RH falls
- Faster removal of condensation on the sensor
- Avoid condensation for faster response time at highest humidity
  - Humidity sensor operation at a constant over-temperature of approx. 5° C
  - The actual temperature is measured by a second unheated sensor.

The advantage of the “constant current heater” is that the power introduced by the heater, and thus also the overtemperature of the sensor, only changes linearly with the supply voltage.

Switching on/off the heater:

Command	CMD Hex Code	
	MSB	LSB
Heater ON	30	6D
Heater OFF		66

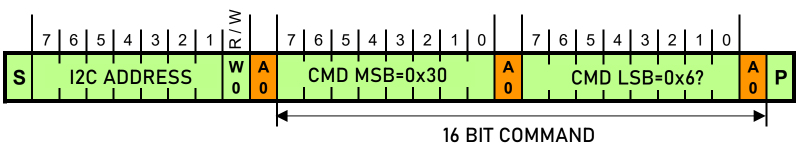


Figure 21: Constant current heater commands

At any kind of reset the heater gets deactivated automatically.

The heater current value is adjustable between 5 mA and 80 mA. The default value for the heater current after power-up is 5 mA.

NOTICE

The heater current must not lead to a temperature that exceeds the sensor's max. upper temperature limit of 135 °C.

6.11 CRC Calculation

Response data words/memory write data are protected by a CRC8 checksum:

Property	Value
Name	CRC8
Width	8 bit
Polynomial	0x31 (x8 + x5 + x4 + 1)
XOR input	0xFF
Reflect input	False
Reflect output	False
XOR output	0x00

Table 14: CRC checksum calculation

6.12 Package / Dimensions

The HTE301 sensor is provided as an open-cavity DFN (= Dual Flat No Leads) package.
The humidity sensor opening is centered on the top side of the package.

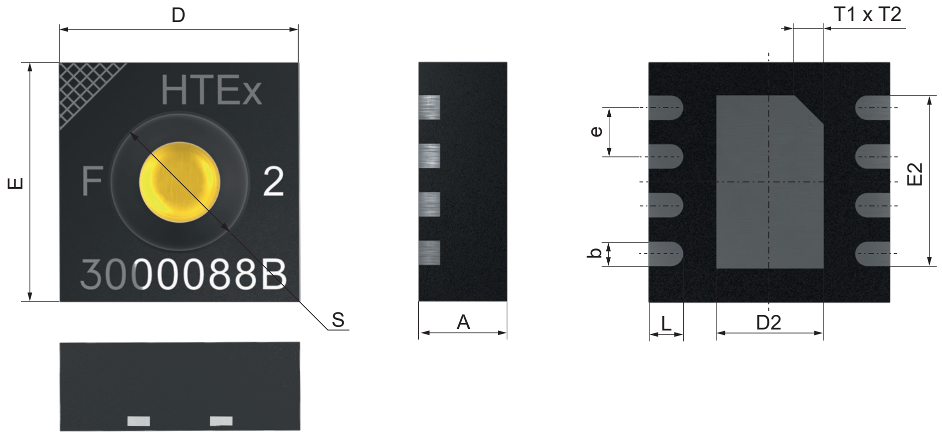


Figure 22: Package layout

PARAMETER	SYMBOL	MIN.	NOM.	MAX.	UNIT	COMMENT
Package width	D	2.40	2.50	2.60	mm	
Package length	E	2.40	2.50	2.60	mm	
Package height	A	0.80	0.90	1.00	mm	
Cavity diameter	S		1.30		mm	On top of package
Leadframe height	A3		0.20		mm	Not shown in the drawing
Pad pitch	e		0.50		mm	
Pad width	b	0.20	0.25	0.30	mm	
Pad length	L	0.30	0.35	0.40	mm	
Thermal pad length	D2	1.00	1.10	1.20	mm	
Thermal pad width	E2	1.70	1.80	1.90	mm	
Thermal pad marking	T1xT2		0.30x0.30		mm	Indicates pin 1

Table 15: Package dimensions

6.13 Tape and Reel Packaging

The HTE301 has a Moisture Sensitivity Level (MSL) of 1, according to IPC/JEDEC J-STD-020.
At the same time, it is recommended to further process the sensors within 1 year after date of delivery.

Dimensions T&R in mm:

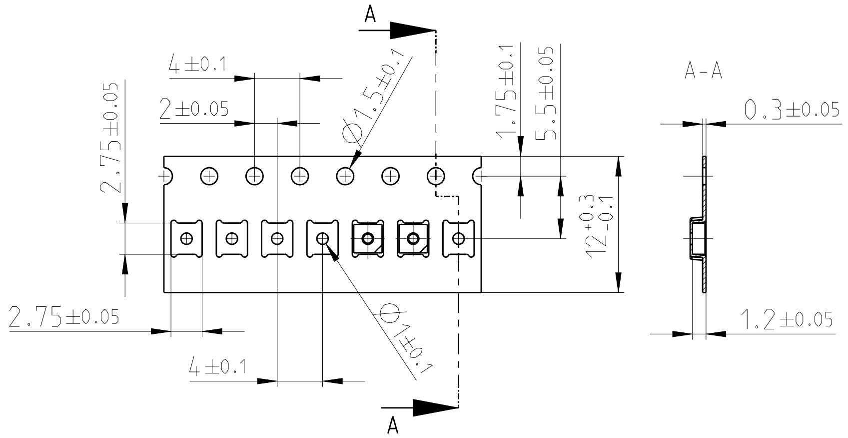


Figure 23: Tape layout

Reel size 330.2 mm (13"), Leader 520 mm (20.5"), Trailer 1240 mm (48.8").

Orientation on the tape:

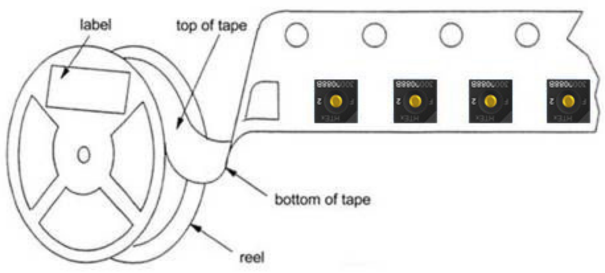


Figure 24: Orientation on the tape

6.14 Traceability

The laser marking upon the sensor's top side can be used for sensor identification / traceability.

A triangular mark at the top left indicates pin 1.

The upper line represents the designation of the component and consists of up to 6 characters. The "x" is a placeholder for the exact type, e.g. 301.

The remaining characters are a tracking code and are used by the manufacturer for identification.

Figure 25: HTEx laser marking

6.15 Ordering Information

Feature	Description	Code
		HTE301-
Tape and reel packaging	2500 pcs. per reel	**TR2,5**

Ordering example: **HTE301-TR2,5**

Feature	Code	Description
Model	**HTE301**	Digital Humidity and Temperature Sensor
Tape and reel packaging	**TR2,5**	2500 pcs. per reel

6.16 Recommended Layout

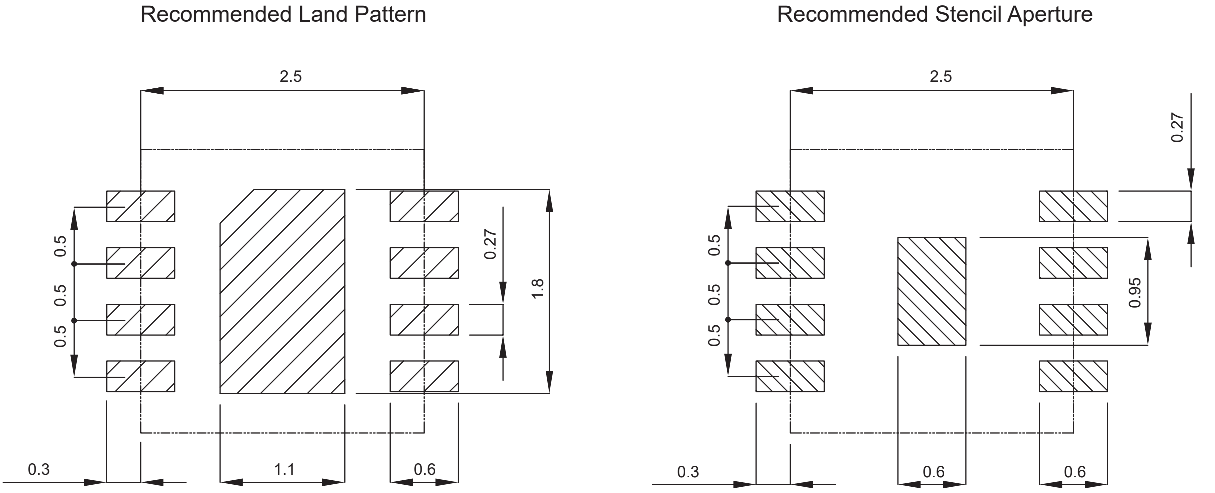


Figure 26: Recommended land pattern and stencil aperture

7 Quality

The HTE301 is qualified for automotive applications according to AEC Q100 grade 1 with an extended operating temperature range of +135 °C. In addition, the HTE301 is qualified for industrial and commercial operating environments according to JEDEC JESD47.

8 Additional Documentation

Document	Description	Link
HTE301 Handling Instructions	HTE301	www.epluse.com/hte301
HTE301 CRC8 Code Example	Code samples for Arduino and Raspberry PI	https://github.com/EplusE

Table 16: Applicable documentation

9 Revision History

Date	Version	Page(s)	Changes
June 2022	1.0	1-23	Initial release
October 2022	1.1	1-23	Chapter 6.10 Constant Current Heater: overtemperature approx. 2-3 °C
December 2022	1.2	1-23	Acronym List updated Chapter 6.15 Ordering Information updated Fig. 24 Tape layout: ASIC orientation corrected on the tape Link to NXP's UM10204 updated and hint added
June 2023	1.3	1-25	New Layout Typical Applications: Automotive Industry added and reference to automotive standards in chapter 7 Table 3: Footnote hint on Sensor Specification Accuracy Figure 5: Normal operating area extended to negative temperatures Chapter 7: Hint on Automotive Standard AEC Q100 added.

Table 17: Revision history

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