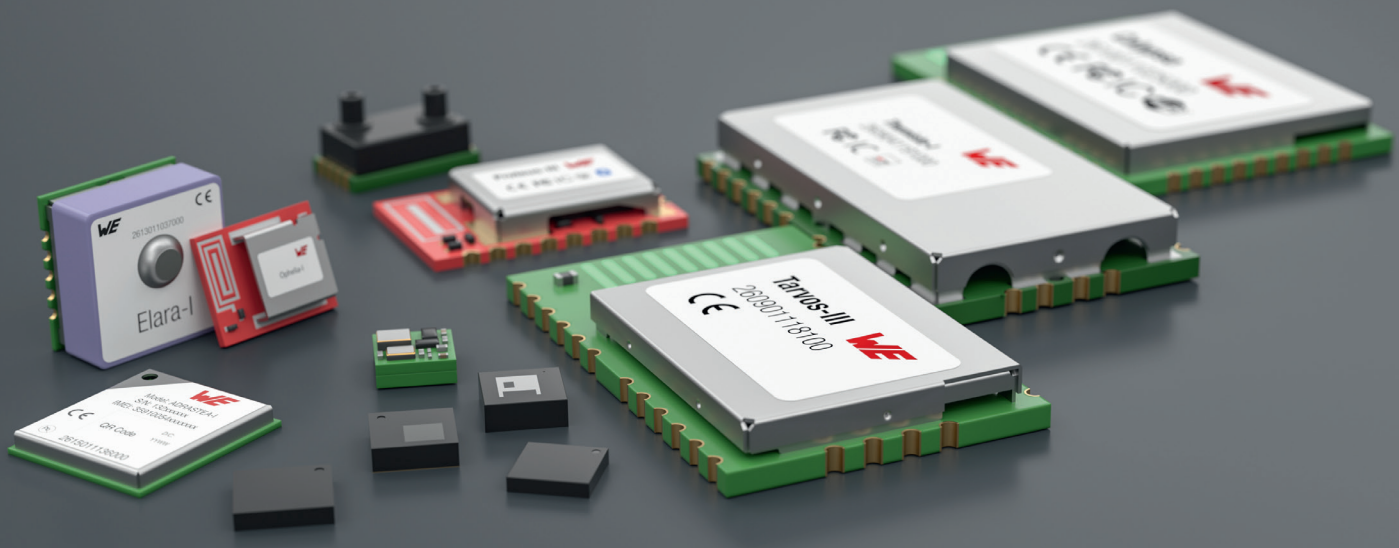


ANM006

How to Upgrade from 2525020210001 to 2525020210002

Version 1.0

September 12, 2023

WÜRTH ELEKTRONIK MORE THAN YOU EXPECT

Revision history

App note version	Notes	Date
1.0	• Initial release of the app note	August 2023

Abbreviations

Abbreviation	Description
DFN	Dual Flat No-Leads
I^2C	Inter Integrated Circuit
MEMS	Micro-Electro-Mechanical System
LSB	Least Significant Bit
MSB	Most Significant Bit

Contents

1 Introduction

This document serves as a comprehensive guide highlighting the distinctions and shared features between the 2525020210001 and 2525020210002 humidity sensors. Its primary objective is to provide a high-level guideline for seamlessly replacing the existing 2525020210001 humidity sensor with the new and improved 2525020210002 humidity sensor family. By understanding the variations and similarities between these two sensor models, engineers and designers can make informed decisions to facilitate the integration of the 2525020210002 sensor into their applications effectively.

Note that the humidity sensor 2525020210001 is essentially the same as the larger quantity reel version, 25250202100011. Technically, there exists no distinction between these two.

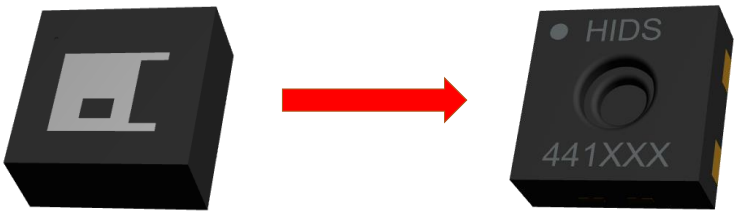


Figure 1

1.1 Important changes

Parameter	2525020210001	2525020210002
Dimensions (mm^3)	2.0 x 2.0 x 0.9	1.5 x 1.5 x 0.5
Pin assignment	6-pin HLGA package	4-pin DFN package
PCB space (mm^2)	30	20.25
Interface	3 wire SPI and I^2C	I^2C
Supply voltage (V)	1.7 - 3.6	1.08 - 3.6
Rel. humidity accuracy (%)	±3.5 ... ±5.0	±1.8 ... ±3.0
Temperature accuracy (°C)	±0.5 ... ±1.0	±0.2 ... ±0.6
Response time (s)	10	4
Quantity per reel (pcs)	1000	2500
Supported I^2C modes	Standard and fast mode	Standard, fast mode, and fast mode plus

Table 1: Important Changes

2 Specification comparison

2.1 Relative humidity sensor specifications

Parameters	Test conditions	2525020210001	2525020210002	Unit
Measurement range	-	0 - 100	0 - 100	% rH
Accuracy	-	±3.5 ... ±5.0	±1.8 ... ±3.0	% rH
Repeatability[1]	High	-	±0.08	% rH
Resolution	-	0.05	0.01	% rH
Hysteresis	-	±1	±0.8	% rH
Long-term drift	-	0.5	<0.2	% rH/Year
Response time	Step response time of 63%	10	4	s

Table 2: Relative humidity specifications of 2525020210001 and 2525020210002. For further details, kindly refer to the respective user manuals.

2.2 Temperature sensor specifications

Parameters	Test conditions	2525020210001	2525020210002	Unit
Measurement range	-	-40 - +120	-40 - +125	℃
Accuracy	-	±0.5 ... ±1.0	±0.2 ... ±0.6	℃
Repeatability[1]	High	-	±0.04	℃
Resolution	-	0.01	0.01	℃
Long-term drift	-	-	<0.03	℃ /Year
Response time	Step response time of 63%	-	2	s

Table 3: Temperature specifications of 2525020210001 and 2525020210002. For further details, kindly refer to the respective user manuals.

The datasheet and user manual of both the sensors can be downloaded from *https://www.we-online.com/en/components/products/WSEN-HIDS*

[1] *The stated repeatability is 3 times the standard deviation (3σ) of consecutive measurements taken under constant conditions at 25℃ and 50% rH (indicating the sensor's output noise)*

2.3 Electrical specifications

Parameters	Test conditions	2525020210001	2525020210002	Unit
Supply voltage	-	1.7 - 3.6	1.08 - 3.6	V
Current consumption (no heater)	Idle state	0.5	0.08	µA
	Measurement	-	320	µA
	Average[1]	8.9	1.2	µA

Table 4: Electrical specifications of 2525020210001 and 2525020210002. For further details, kindly refer to the respective user manuals.

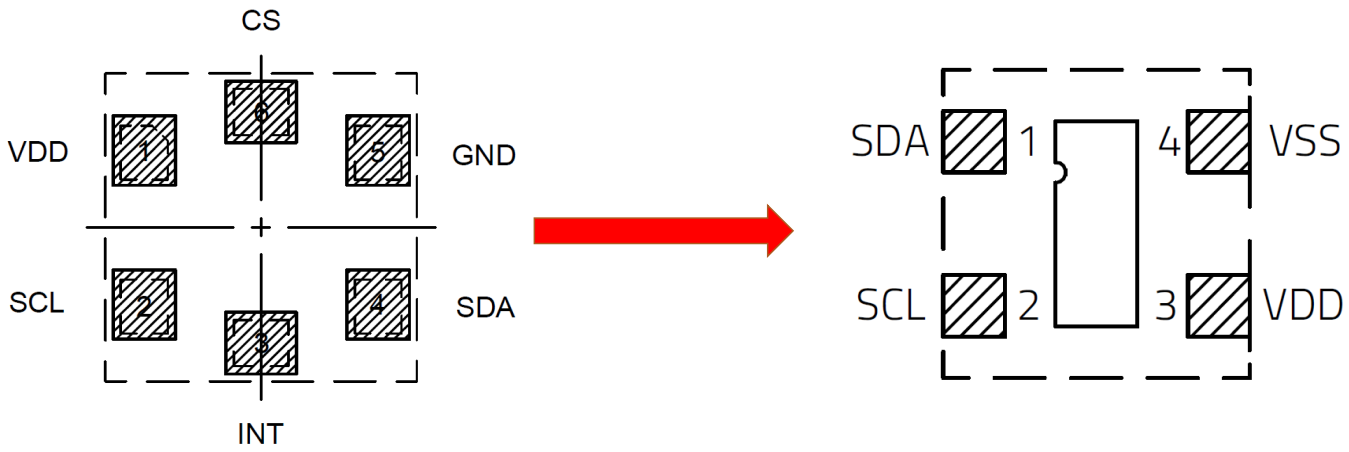
[1] *The average current/power consumption of a device during continuous operation, with one measurement taken per second (i.e. 1 Hz ODR).*

3 Package design comparison

Parameters	2525020210001	2525020210002	Unit
Size	2.0 x 2.0 x 2.0	1.5 x 1.5 x 0.5	mm^3
Pin size	0.30 x 0.35	0.30 x 0.30	mm^2
Pin pitch	1.0	0.8	mm
Pin material	Ni/Au	Ni/Pd/Au coated Cu	
Housing material	Epoxy housing	Epoxy housing	

Table 5: Package design comparison of 2525020210001 and 2525020210002. For further details, kindly refer to the respective user manuals.

3.1 Pinning description



2525020210001 pinout (top view)

2525020210002 pinout (top view)

Figure 2: Pinout comparison. For further details, kindly refer to the respective user manuals.

No	Function	Description	Input/Output
1	*VDD*	Positive supply voltage	Supply
2	*SCL*	I^2C serial clock	Input
3	*INT*	Data ready output signal	Output
4	*SDA*	I^2C / SPI: serial data input/output	Input/Output
5	*GND*	Negative supply voltage	Supply
6	*CS*	I^2C/SPI enable/disable	Input

Table 6: 2525020210001 Pin description

No	Function	Description	Input/Output
1	*SDA*	Serial data	Input/Output
2	*SCL*	Serial clock	Input
3	*VDD*	Positive supply voltage	Supply
4	*VSS*	Ground	Supply

Table 7: 2525020210002 Pin description

3.2 Module drawing

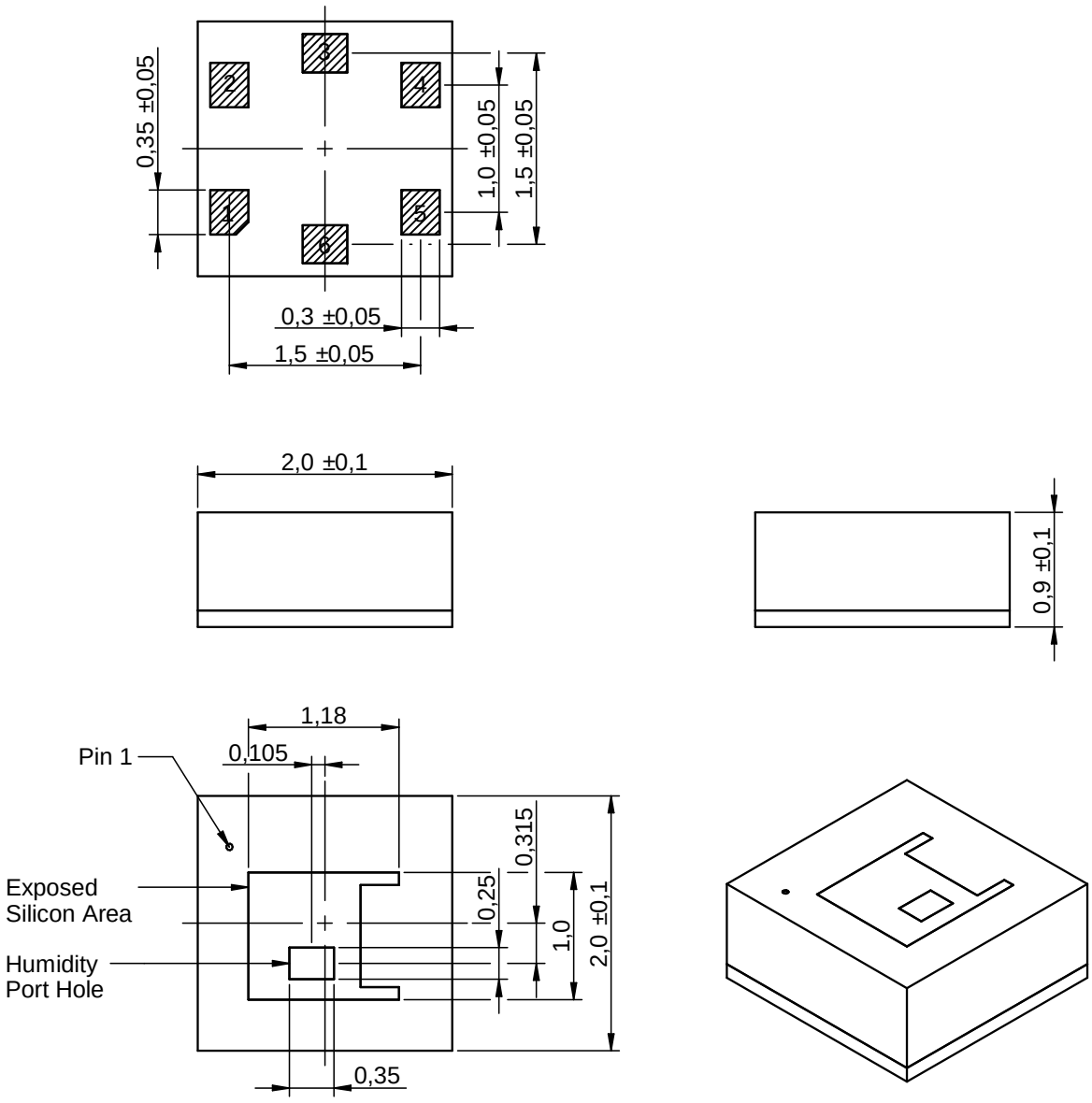


Figure 3: 2525020210001 sensor dimension [mm]. For further details, kindly refer to the respective user manuals.

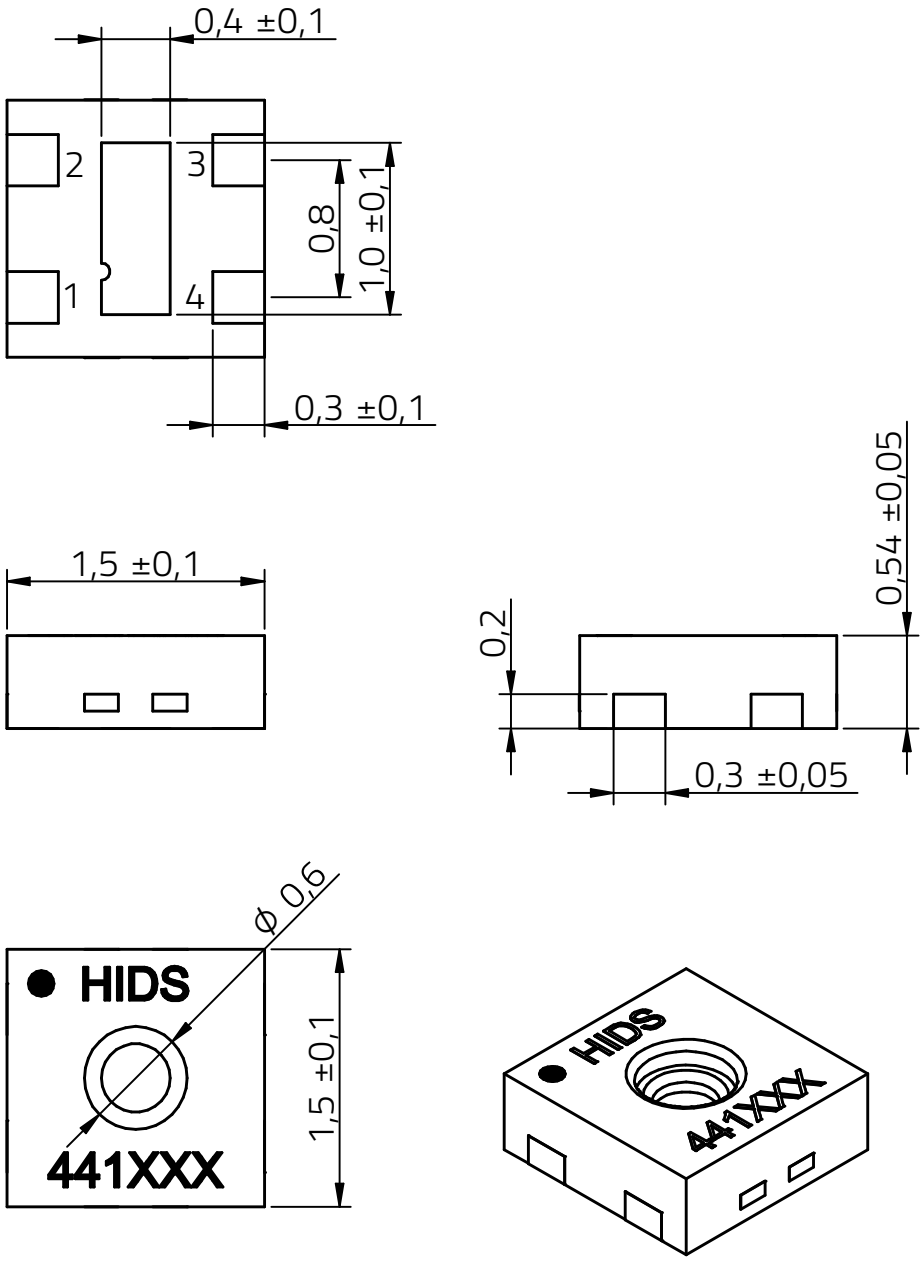
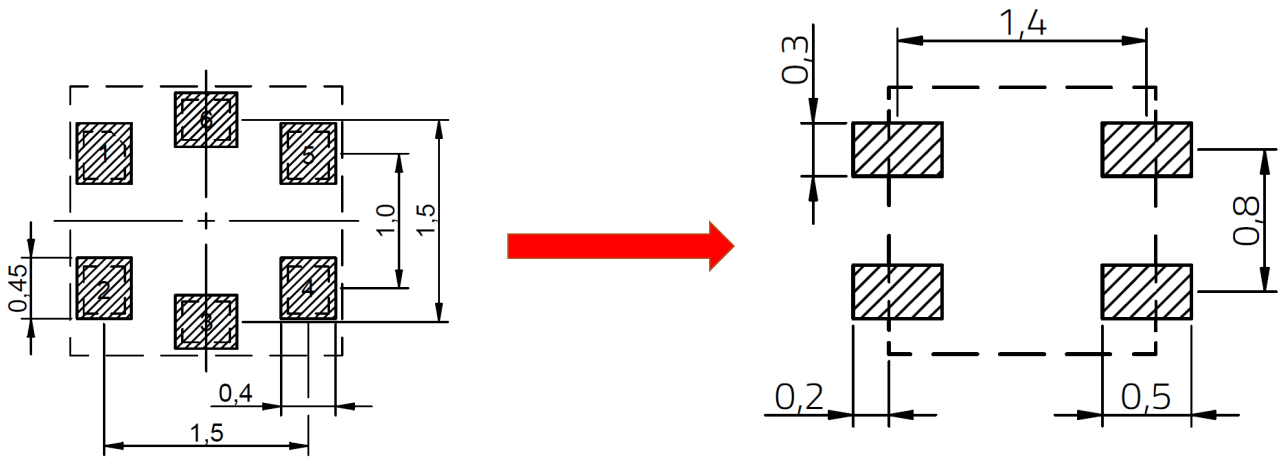


Figure 4: 2525020210002 sensor dimension [mm]. For further details, kindly refer to the respective user manuals.

3.3 Footprint

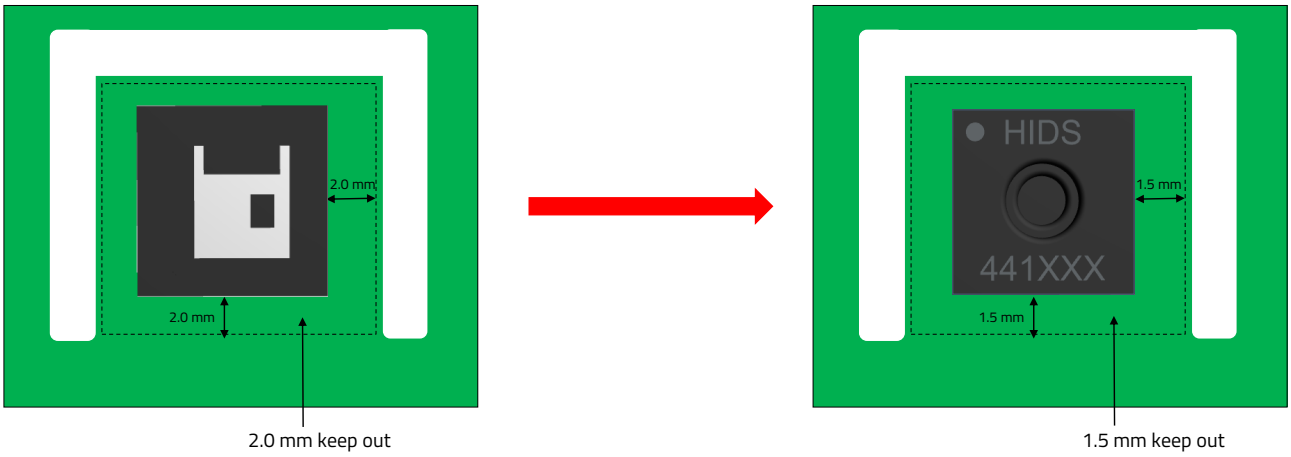


2525020210001 recommended land pattern [mm] (top view)

2525020210002 recommended land pattern [mm] (top view)

Figure 5: Recommended land pattern comparison. For further details, kindly refer to the respective user manuals.

4 PCB design comparison



2525020210001 recommended keep out area

2525020210002 recommended keep out area

Figure 6: Recommended keep out area comparison. For further details, kindly refer to the respective user manuals.

5 Digital interface

Both sensors are equipped with the I²C communication protocol. They are each assigned a 7-bit unique I²C addresses for identification purposes. The 2525020210001 has an I²C address of 0x5F, while the 2525020210002 has an I²C address of 0x44. To communicate with the sensor, a specific addressing procedure is followed. The I²C protocol uses a 7-bit address, so to address the sensor, the 7-bit I²C address is sent, followed by an additional eighth bit. This eighth bit serves as a communication direction indicator. When the eighth bit is set to "0", it signifies a transmission to the sensor, indicating a "write" operation. Conversely, when the eighth bit is set to "1", it denotes a "read" request, indicating a desire to retrieve data from the sensor. By employing this addressing scheme, communication with the sensors can be efficiently managed, allowing for both read and write operations as needed.

5.1 2525020210001 Read/Write operation

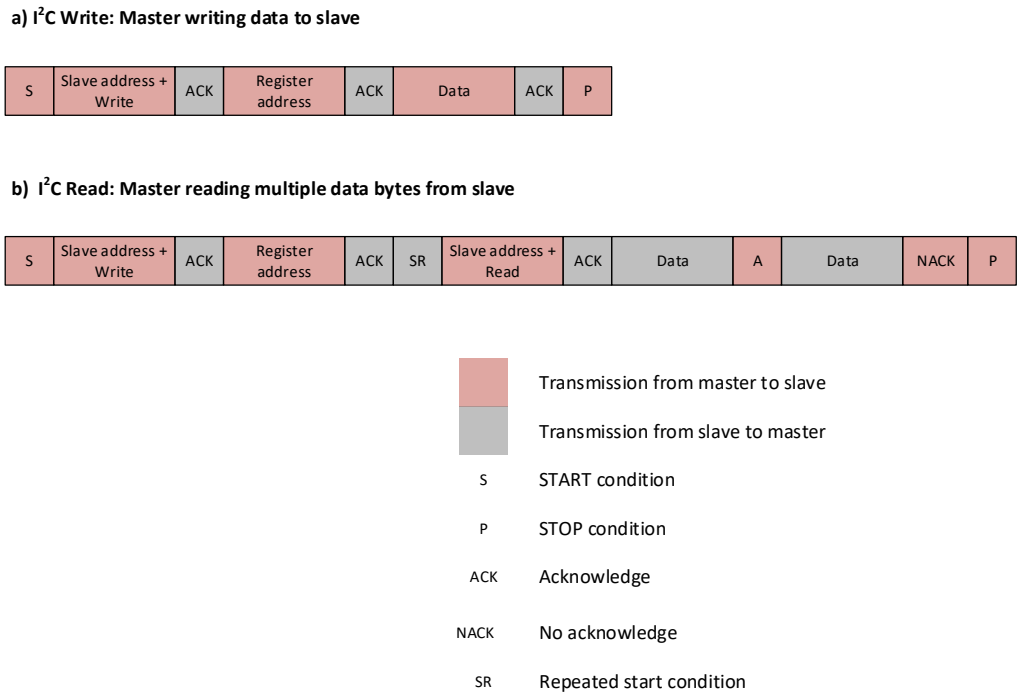


Figure 7: Write and read operations of the 2525020210001 sensor

In the I²C communication process, once the master transmits the slave address and data direction bit, the slave acknowledges the master. The master then sends the next byte, which represents the register address of the sensor where data is to be written or read. After receiving the register address, the slave sends an Acknowledgement (ACK). If the master intends to write to the slave (R/W bit = 0), it sends the data to the slave in the same direction. Alternatively, if the master wants to read from the addressed register (R/W bit = 1), a repeated

start (SR) condition is sent to the slave. The master acknowledges the slave after receiving each data byte. If the master no longer wishes to receive more data from the slave, it sends a No-Acknowledge (NACK) signal. Finally, the master can terminate the data transfer by sending a STOP condition. Figure 7 illustrates the writing and reading procedures between the master and the slave device (sensor) in the I²C communication protocol. For more details about the I²C and application circuit diagram, kindly refer to the 2525020210001 user manual.

5.2 2525020210002 Read/Write operation

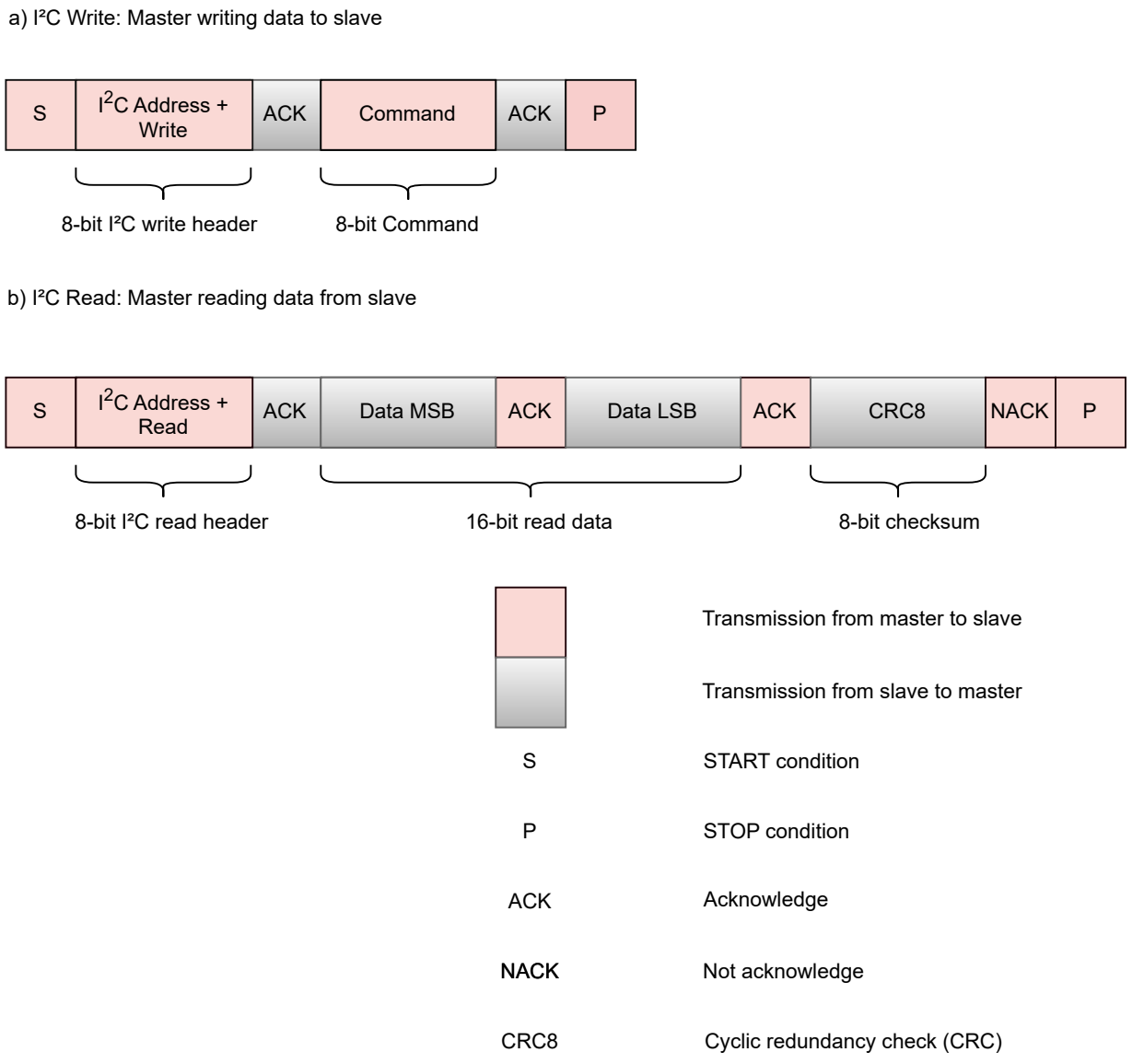


Figure 8: Write and read operations of the 2525020210002 sensor

To interact with the sensor, the user sends its 7-bit I²C address followed by an eighth bit indicating the communication direction and an 8-bit command. "0" for the eighth bit denotes a write operation, while "1" indicates a read operation. For write transfers, a write header is sent to the sensor, followed by a command. **Following a measurement command, 10 ms pause**

is required before proceeding with the read access. Once the requested measurement is finished, a read request can be executed, and the sensor will promptly respond by transmitting humidity and temperature data in a consistent format. Each data transmission includes two values, representing temperature and humidity signals, with 8-bit CRC for error detection. Once the first I^2C read header is sent and acknowledged, the measurement data is deleted from the sensor's register. It's important to note that the sensor does not support clock stretching and may return a not acknowledge (NACK) response if busy performing tasks when receiving a read header, indicating it's not ready to transmit data at that time.

The 2525020210002 offers various measurement options tailored to different precision requirements and includes a heater option. For more details, kindly refer to the 2525020210002 user manual.

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