Alert Mode of SHT3x-DIS

Allows to use SHT3x-DIS as a humidity and temperature watchdog

SHT3x-DIS features an Alert Mode, when operated in the periodic data acquisition mode[1]. The Alert Mode allows to monitor the environmental condition (humidity and temperature) relative to programmable limits. When limits are reached the value of a dedicated ALERT pin will change. Additionally, a status register bit indicates the cause of the alert. Using the ALERT pin allows to create a switch with a minimal bill of materials. For example, only a transistor is needed next to the sensor to switch an LED on or start a climate control.

Alternatively, the ALERT pin may be connected to the interrupt pin of a microcontroller. After an alert from SHT3x the microcontroller can wake-up from sleep mode and then perform certain actions.

1 Activation and Deactivation of the Alert Mode

Whenever the sensor operates in periodic data acquisiton mode the alert mode is active. It is possible to deactivate the limit for temperature and humidity individually, by setting the Minimum set point to values higher than the Maximum set point (LowSet>HighSet for deactivation of the alert mode).

2 Alert Mode Limits

The limits can be controlled by the user through the corresponding commands (see Table 2). SHT3x-DIS allows to set different limits for temperature and humidity as well as for high and low limits. Additionally, the activation and the deactivation of the alert can be controlled seperately from another, by choosing the set and clear limit appropriately. This allows to remove fast oscillations of the ALERT pin close to set limit values. The different limits are shown in Figure 1.

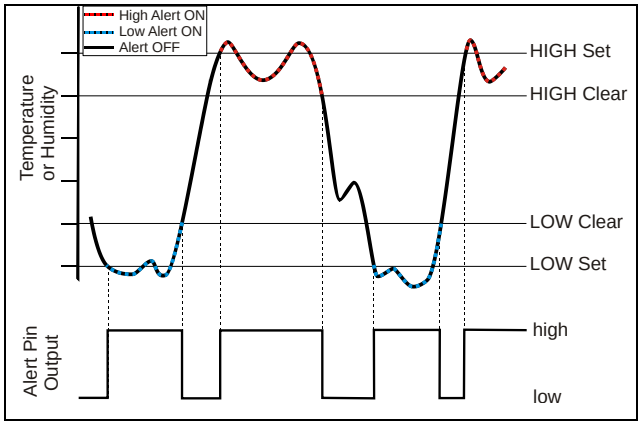

Figure 1 Different limits for the Alert Mode

2.1 Data Format for the Alert Limits

The sensor stores the limit information in a reduced data format. The standard data format of SHT3x-DIS has a width of 16 bits. For the limits only the most significant bits (MSB) are used to determine whether an alert has been met (7 bits for humidity and 9 bits for temperature), see Figure 2.

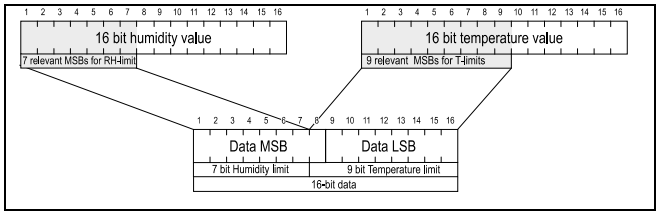

Figure 2 Relevant Bits for the limits

This allows to transfer temperature and humidity limits with the same command and to process them internally more efficient.

As a consequence the limits have a different resolution than the measurement values. The resolution of the temperature limits are $\Delta T \approx 0.5°C$, whereas the humidity limits can be set with a resolution of $\Delta RH \approx 1\%$. Please note that data is always measured and stored in the full 16 bit format. The reduced data format is only used to judge whether an alert condition is met.

[1] See Datasheet SHT3x-DIS Section 4 for the distinction between periodic and single shot mode.

2.2 Standard values for the Alert Limits

During power-up or during resets pre-defined limits are loaded into the register. These values can be changed as explained in Table 2.

Alert Limit		Initial Value	
		Physical Value (RH/T)	Hex Value
high alert limit	set limit	80% / 60°C	0x CD 33
	clear limit	79% / 58°C	0x C9 2D
Low alert limit	Clear limit	22% / -9°C	0x 38 69
	set limit	20% / -10°C	0x 34 66

Table 1 Initial values for the alert limits. The limits can be changed with the command shown in Table 2

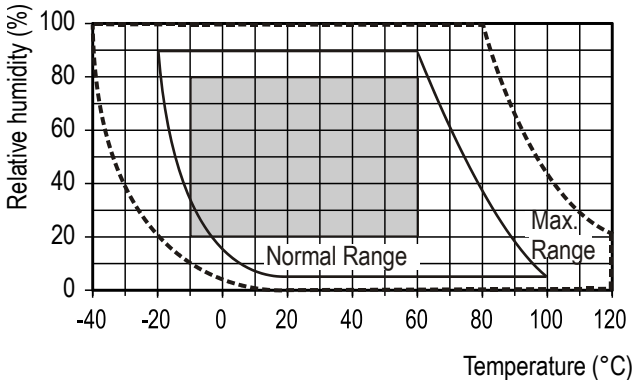

Figure 3 The alert is active in the areas outside the shaded area.

2.3 Alert Mode Commands

The eight different limits can be read through the commands shown in Table 2. With each command temperature and humidity limits are read from the sensor.

Command			Hex Code	
			Command MSB	Command LSB
READ	High alert limit	set	0xE1	1F
		clear		14
	Low alert limit	clear		09
		set		02
WRITE	High alert limit	set	0x61	1D
		clear		16
	Low alert limit	clear		0B
		set		00

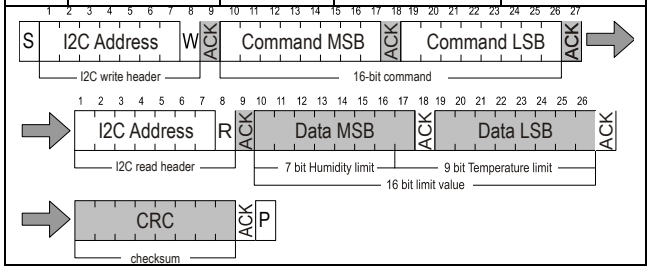

Table 2 Alert limit commands for reading the alert limits. Read or write behavior is controlled through the first bit in the MSB.

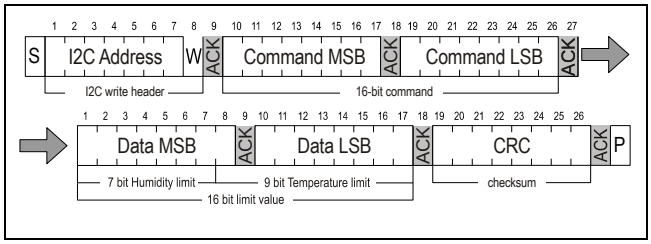

Table 3 Alert limit commands for writing the alert limits. Read or write behavior is controlled through the first bit in the MSB.

2.4 Typical procedure to calculate the limits

The reduced data format is shown in Figure 2.

1. Choose the limits for RH and T (e.g. MaxSet limit, RH_{MaxSet}=80% & T_{MaxSet}=60°C)
2. Convert the RH_{MaxSet} and the T_{MaxSet} limits to their respective 16 bit binary value
   a. RH_{MaxSet}= ***1100'110***0'1100'1101
   b. T_{MaxSet}= **1001'1001'1**001'1010
3. Remove the 9 LSBs of the RH_{MaxSet} limits
   a. RH_{MaxSet}=***1100'110***~~0'1100'1101~~
4. Remove the 7 LSBs of the T_{MaxSet} limits
   a. T_{MaxSet}=**1001'1001'1**~~001'1010~~
5. Combine the reduced values (step 3 and 4) according to **Figure 2**
   a. RH,T_{MaxSet}=***1100'110*****1'0011'0011**=0xE699
6. Calculate the 8 bit CRC from the 16 bit limit value

An excel sheet is supplied as well that can be used to calculate the Alert limits.

2.5 Typical procedure to change the alert condition

1. Calculate the limits as explained in section 2.4 (the predefined values are the normal range and shown in Table 1)
2. Set the periodic frequency to the desired value through issuing of the appropriate command

The alert mode is now active.

3 Further condition that can raise an alert

The ALERT pin will also become active (high) after power-up and after resets, regardless whether the later was triggered by a brown-out, by a user command (soft reset, general call) or via the nRESET pin.

Description of the Content of the status register

Bit	Field description	Default value
15	Alert pending status '0': no pending alerts '1': at least one pending alert	'1'
14	Reserved	'0'
13	Heater status '0' : Heater OFF '1' : Heater ON	'0'
12	Reserved	'0'
11	RH tracking alert '0' : no alert '1' . alert	'0
10	T tracking alert '0' : no alert '1' . alert	'0'
9:5	Reserved	'00000'
4	System reset detected '0': no reset detected since last 'clear status register' command '1': reset detected (hard reset, soft reset command or supply fail)	'1'
3:2	Reserved	'00'
1	Command status '0': last command executed successfully '1': last command not processed. It was either invalid, failed the integrated command checksum	'0'
0	Write data checksum status '0': checksum of last write transfer was correct '1': checksum of last write transfer failed	'0'

Table 4 Status register of SHT3x

3.1 Readout the status register

Command	Hex Code
Read Status register	0x F3 2D

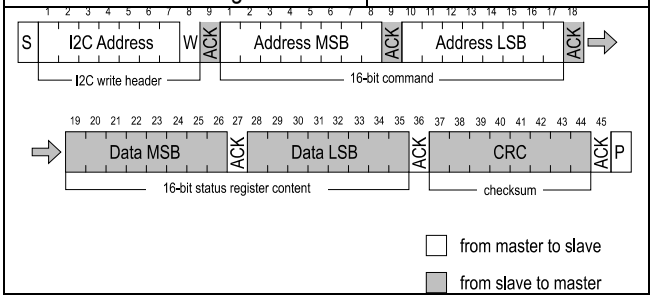

Table 5 Read out status register. The content of the user register is described below (Clear blocks are controlled by the microcontroller, grey blocks by the sensor.)

3.2 Clear Status register

All flags (Bit 15, 11, 10, 4) in the status register (Table 4) can be cleared (set to zero) by sending the command shown in Table 6.

Command	Hex Code
Clear Status Register	0x 30 41

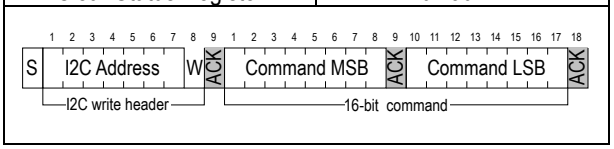

Table 6 Command to clear all status register flags (Clear blocks are controlled by the microcontroller, grey blocks by the sensor.)

3.3 Behaviour in the case of brown-out or power-up

If a brown-out or power-up occurs, the sensor will restart automatically. This sets all values to the default values (Table 1). Therefore, all customer defined limits are lost. As explained above an Alert is issued in this case.

Revision History

Date	Version	Page(s)	Changes
May 2015	1	all	Release of Version 1

Headquarters and Subsidiaries

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