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Humidity and Temperature Sensor IC
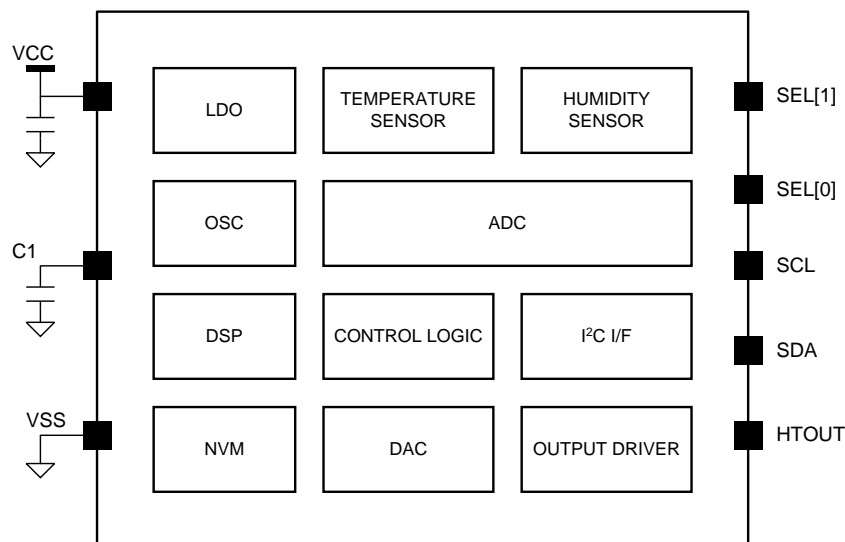
1. FEATURES

- Relative Humidity and Temperature Sensor with fully calibrated and temperature compensated.
- Various selectable outputs.
    - I^2C interface & digital output
    - PWM output (Humidity / Temperature Selectable)
    - PDM output (Humidity / Temperature Selectable)
    - Analog output (Humidity)
- Excellent Long term stability.
- Summary

    MXH1100 is a humidity and temperature sensor of Magnachip semiconductor (MX) with various output formats. It provides calibrated, linearized signals in digital format, I^2C, Pulse Width Modulated (PWM) format, Pulse Density Modulated (PDM) format, and in analog format. Its sensors are individually calibrated and tested. The resolution of MXH1100 can be changed by command (8/12bit up to 12/14bit for RH/T). Every sensor is individually calibrated and tested. Lot identification is printed on the sensor.

2. BLOCK DIAGRAM

[Figure 1] block diagram

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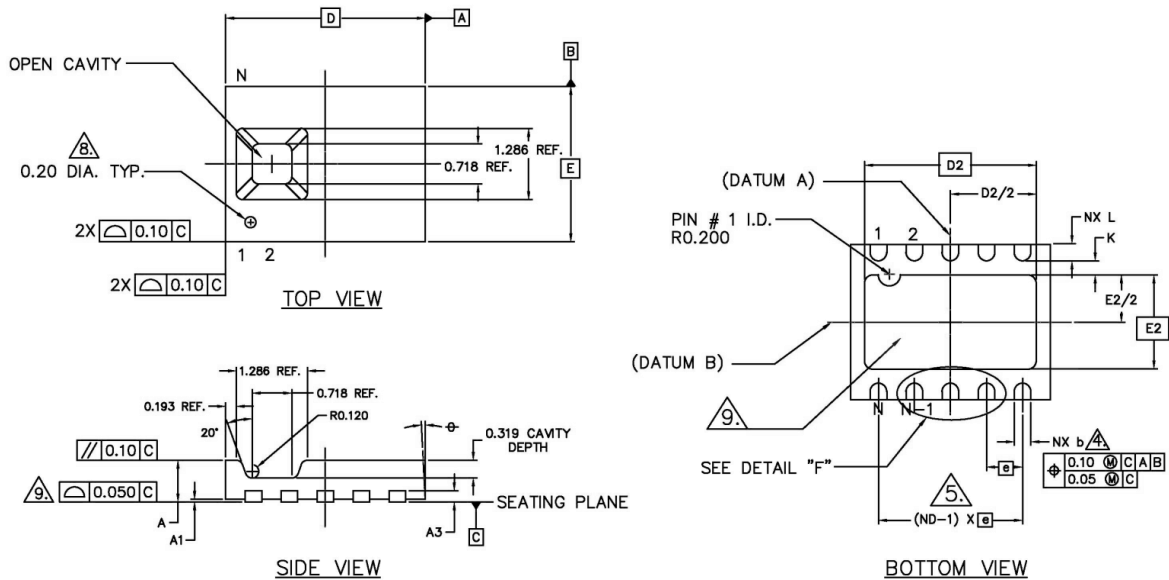issued date : Mar.18, 2015

3. PIN CONFIGURATION
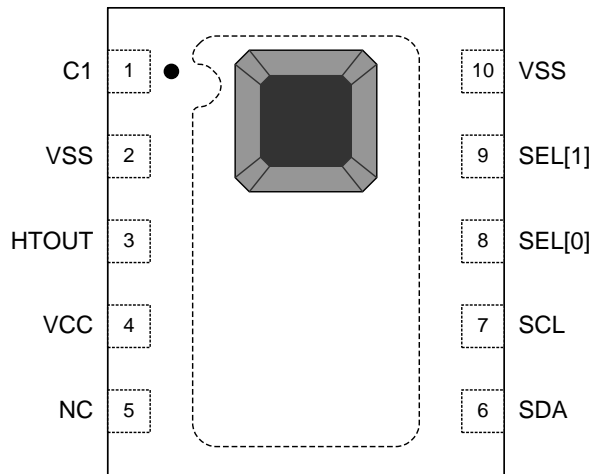
[Figure 2] Pin Assignment (Through View) : DFN-10 3.6x2.8

3.1. PIN DESCRIPTION

Name	Pin#	Type	Description
C1	1	I/O	Capacitor connection Pin for Regulated Voltage. Recommended capacitance is 1uF/6.3V.
VSS	2	G	Ground
HTOUT	3	O	Humidity / Temperature Voltage Output
VCC	4	P	VCC Power Supply
NC	5	NC	No connection
SDA	6	I/O	I2C serial data signal & PWM Output
SCL	7	I/O	I2C serial clock signal
SEL[0]	8	I	Mode Selection
SEL[1]	9	I	Mode Selection
VSS	10	G	Ground
EP			Exposed Pad. EP is electrically connected to GND.

[Table 1] Pin description table

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3.2. Package Description

[Figure 3] MXH1100 Sensor package

SYMBOL	DIMENSIONS			NOTE
	MIN.	NOM.	MAX.	
A	0.70	0.75	0.80	
A1	0.00	0.02	0.05	
A3	0.20 REF.			
b	0.25	0.30	0.35	4
L	0.25	0.30	0.35	
e	0.65 BSC			
N	10			3
ND	5			5
D2	3.00	3.10	3.20	
E2	1.60	1.70	1.80	
D	3.60 BSC			
E	2.80 BSC			
θ	0°	—	—	2
K	0.20	—	—	

[Table 2] Package dimension table

NOTES:
1. DIMENSIONING AND TOLERANCING CONFORME TO ASME Y14.5M — 1994.
2. ALL DIMENSIONS ARE IN MILLIMETERS, θ IS IN DEGREES.
3. N IS THE TOTAL NUMBER OF TERMINALS.
△4. DIMENSION b APPLIES TO METALLIZED TERMINAL AND IS MEASURED BETWEEN 0.15 AND 0.30mm FROM TERMINAL TIP. IF THE TERMINAL HAS THE OPTIONAL RADIUS ON THE OTHER END OF THE TERMINAL, THE DIMENSION b SHOULD NOT BE MEASURED IN THAT RADIUS AREA.
△5. ND REFERS TO THE NUMBER OF TERMINALS ON D SIDE RESPECTIVELY.
6. MAX. PACKAGE WARPAGE IS 0.05 mm.
7. MAXIMUM ALLOWABLE BURRS IS 0.076 mm IN ALL DIRECTIONS.
△8. PIN #1 ID ON TOP WILL BE LASER MARKED.
△9. UNILATERAL COPLANARITY ZONE APPLIES TO THE EXPOSED HEAT SINK SLUG AS WELL AS THE TERMINALS.

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4. ELECTRICAL CHARACTERISTICS

4.1. Absolute Maximum Ratings

The absolute maximum ratings as given in Table 3 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).

SYMBOL	PARAMETER	MIN	MAX	UNIT
VCC	Power Supply	-0.3	6	V
VLOGIC	Digital I/O Pins (SDA, SCL, SEL[1:0])	-0.3	VCC + 0.3	V
VANALOG	Analog output pins (HTOUT)	-0.3	VCC + 0.3	V
I_{IN}	Input Current on any Pin	-100	100	mA
T_{STG}	Storage temperature	-55	150	°C
T_{OP}	Operation temperature	-40	125	°C

[Table 3] Absolute maximum ratings

4.2. ELECTRICAL SPECIFICATION

The electrical characteristics such as power consumption, low and high level input and output voltages depend on the supply voltage. For proper communication with the sensor it is essential to make sure that signal design is strictly within the limits given in Table 4 & 5 and Figure 4.

Parameter	Condition	min	typ	max	units
Supply voltage	VCC	4.5	5.0	5.25	V
Current dissipation	Sleep		65		uA
	Measuring, SEL[1:0]=11		270		uA
	Average 8bit, SEL[1:0]=11		68		uA
	HTOUT enable, SEL[1:0]=00		300		uA
PWM Freq.	SEL[1:0]=01		120		Hz
Measure Freq.	SEL[1:0]=00,01		2		Hz
Driving Load	HTOUT, Capacitive Load	-	-	10	uF
	HTOUT, Resistive Load	1K	-	-	Ω
Communication	Digital 2-wire interface, I2C, SEL[1:0]				

[Table 4] DC characteristics of digital input/output pads. VCC = 5V, T = 25°C, unless otherwise noted.

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Parameter	Condition	min	typ	max	units
Output low voltage, VOL		0	-	0.4	V
Output High Voltage, VOH		VCC X 0.7	-	VCC	V
Output Sink Current, IOL		-	-	-4	mA
Input Low Voltage, VIL		0	-	VCC X 0.3	V
Input High Voltage, VIH		VCC X 0.7	-	VCC	V
SCL frequency, fSCL		0	-	0.4	MHz
SCL High Time, tSCLH		0.6	-	-	µs
SCL Low Time, tSCLL		1.3	-	-	µs
SDA Set-Up Time, tSU		100	-	-	ns
SDA Hold Time, tHD		0	-	900	ns
SDA Valid Time, tVD		0	-	400	ns
SCL/SDA Fall Time, tF		0	-	100	ns
SCL/SDA Rise Time, tR		0	-	300	ns
Capacitive Load on Bus Line		0	-	400	pF

[Table 5] Timing specifications of digital input/output pads for I2C fast mode. Entities are displayed in Figure 4. VCC = 5V, T = 25°C, unless otherwise noted.
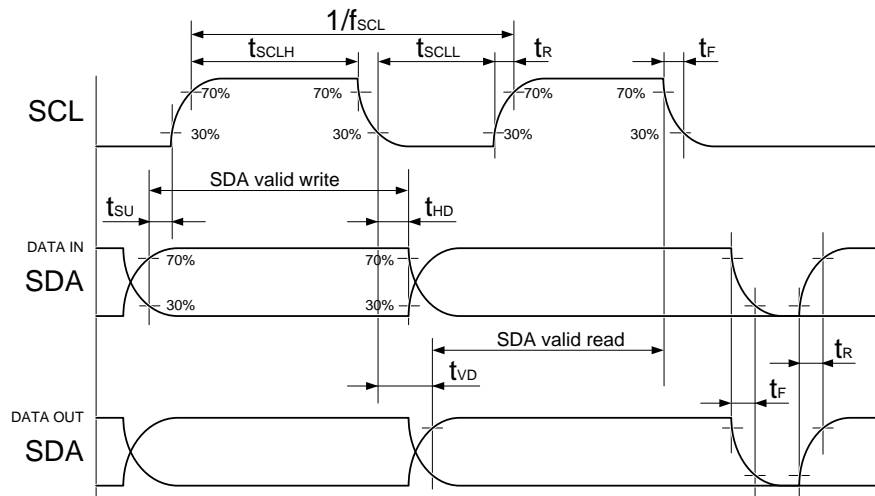
[Figure 4] Timing Diagram for Digital Input / Output Pads, abbreviations are explained in Table 5. SDA directions are seen from the sensor. Bold SDA line is controlled by the sensor, plain SDA line is controlled by the micro-controller. Note that SDA valid read time is triggered by falling edge of anterior toggle.

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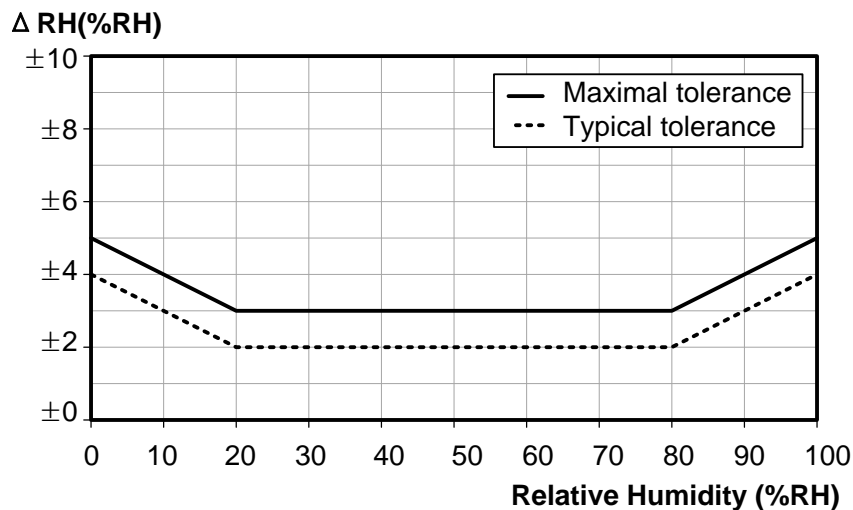www.magnachip.com
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5. SENSOR PERFORMANCE

MXH1100 is a relative humidity sensor and temperature sensor with band gap circuit, it contains oscillator, A/D convertor, regulator, D/A convertor, NVM, digital processing unit and calibration circuit.

5.1. Relative Humidity Sensor

Parameter	Condition	min	typ	max	units
Resolution[1]	12 bit		0.04		%RH
	8 bit		0.7		%RH
Accuracy tolerance[2]	typ		±2.0		%RH
Repeatability	12 bit		±0.1		%RH
Hysteresis			±1		%RH
Response time[3]				10	sec
Operating Range	extended[4]	0		100	%RH
Long Term Drift[5]			0.5		%RH/yr

1. Default resolution is 14bit (temperature) / 12bit (humidity). It can be reduced to 12/8bit, 11/11bit or 13/10bit by command.
2. Accuracies are tested at Outgoing Quality Control at 25°C and 5.0V. Values exclude hysteresis and long term drift and are applicable to non-condensing environments only.
3. Time for achieving 63% of a step function, valid at 25°C and 1m/s airflow.
4. Normal operating range: 0-80%RH, beyond this limit sensor may read a reversible offset with slow kinetics (+3%RH after 60h at humidity >80%RH).
5. Value may be higher in environments with vaporized solvents, out-gassing tapes, adhesives, packaging materials, etc. For more details please refer to Handling Instructions.
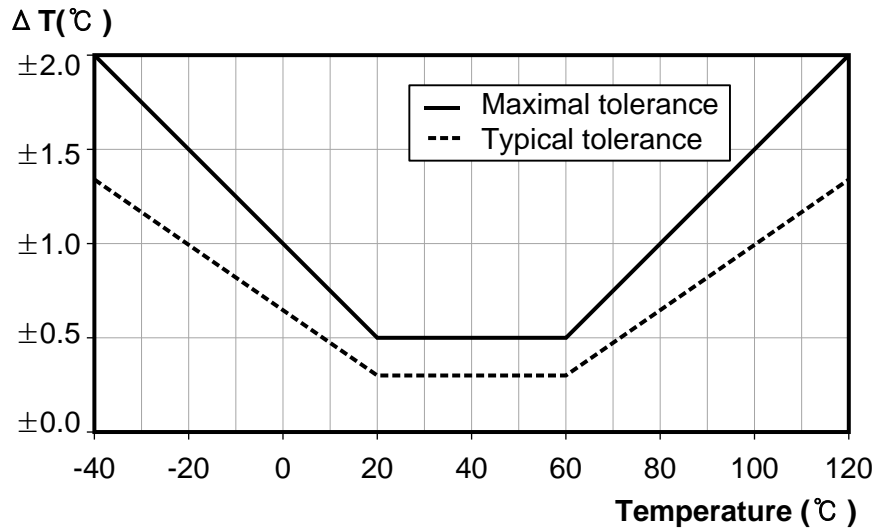

[Figure 5] Typical and maximal tolerance at 25°C for relative humidity.

MXH1100 is a relative humidity sensor and temperature sensor with band gap circuit, it contains oscillator, A/D convertor, regulator, D/A convertor, NVM, digital processing unit and calibration circuit.

5.2. Temperature Sensor

| Parameter	Condition	min	typ	max	units
Resolution[1]	14 bit		0.01		°C
	12 bit		0.04		°C
Accuracy tolerance	14 bit		±0.3		°C
Repeatability	12 bit		±0.1		°C
Response time[2]				30(TBD)	sec
Operating Range	extended[3]	-40		125	°C
Long Term Drift			0.05		°C/yr

1. Default resolution is 14bit (temperature) / 12bit (humidity). It can be reduced to 12/8bit, 11/11bit or 13/10bit by command.
2. Response time depends on heat conductivity of sensor substrate.
3. Normal operating range : -30 ~ +85°C, exposure to beyond this normal operating range for extended periods may affect the device reliability.

[Figure 6] Typical and maximal tolerance.

5.3. Operating Range

The standard working range with regard to the humidity / temperature limits is shown by the dark gray area in Figure 7. The relative humidity signal may offset temporarily as a result of continuous exposure to conditions outside the dark gray region, especially at humidity > 80% RH. If the sensor is brought back to the standard working range, the initial values will recover. Applications with high humidity at high temperatures will result in slower recovery. Reconditioning procedures (see 9.4) can accelerate this process. Although the sensors would not fail beyond working range limits, the specification is guaranteed within the normal working range only.
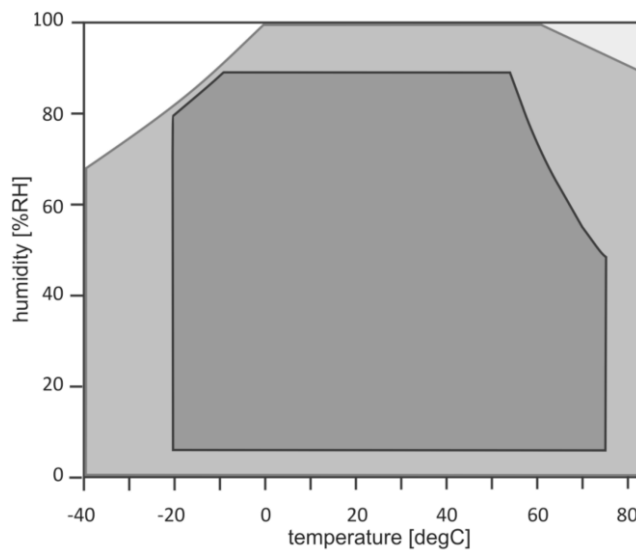
[Figure 7] Operating range – dark gray: standard working range, gray: normal working range, light gray: beyond

normal working range, and white: not possible due to the technical definition of relative humidity above ice.

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6. Interface

6.1. Power Pins (VCC, VSS)

The recommended supply voltage of MXH1100 is 5.0V. Supply Voltage (VCC) and Ground (VSS) must be decoupled with a 100nF capacitor, which placed as close as possible to the sensor.

6.2. Serial clock, SCL

SCL is used to synchronize the communication between microcontroller (MCU) and the sensor. Since the interface consists of fully static logic there is no minimum SCL frequency.

6.3. Serial data & Bit stream, SDA

The SDA port is used as two purposes according to the SEL[1:0] pin setting. The first is as I2C interface data port and the second is usage as PWM output port.
On SDA the sensor is providing PWM output.   The signal is carrying humidity or temperature data depending on SEL[1:0] setting. Refer to the Table 6
When MXH1100 is used at I2C interface mode, the SDA pin is used to transfer data in and out of the sensor.   For sending a command to the sensor, SDA is valid on the rising edge of SCL and must remain stable while SCL is high. After the falling edge of SCL the SDA value may be changed. For safe communication SDA shall be valid tSU and tHD before the rising and after the falling edge of SCL, respectively – see Figure 4. For reading data from the sensor, SDA is valid tVD after SCL has gone low and remains valid until the next falling edge of SCL.
To avoid signal contention the micro-controller unit (MCU) must only drive SDA and SCL low. External pull-up resistors (e.g. 10kΩ), are required to pull the signal high. For the choice of resistor size please take bus capacity requirements into account (compare Table 5).   It should be noted that pull-up resistors may be included in I/O circuits of MCUs. See Table 4 and Table 5 for detailed I/O characteristic of the sensor.

SEL[1:0]	LOGIC		ANALOG
	SCL	SDA	HTOUT
00	0	NA	T
00	1	NA	RH
01	0	PWM -T	NA
01	1	PWM - RH	NA
10	0	PDM - T	NA
10	1	PDM - RH	NA
11	Controlled by I^{2}C		NA

[Table 6] SEL[1:0] pin setting condition table.

The SDA and SCL pins are set as 'L' or 'H' when the analog output ports are used.
The SCL pin has to be fixed as 'L' or 'H' under PWM/PDM mode and leave the analog output ports, HTOUT as floating.

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6.4. Startup sensor

As a first step, the sensor is powered up to the chosen supply voltage VCC (typical 5.0V). After power-up, the sensor needs at most 10ms, while SCL is high, for reaching idle state, i.e. to be ready accepting commands from the master (MCU) or the sensor starts measuring and providing data on PWM bit-stream. If MXH1100 is under ANALOG mode, analog voltage output will provide the data on analog mode.

Whenever the sensor is powered up, but not performing a measurement or communicating, it is automatically in idle state (sleep mode).

7. COMMUNICATION BY I^{2}C PROTOCOL WITH SENSOR

7.1. Start / Stop Sequence on I^{2}C

I2C communication can be initiated by sending a START condition from the master, a high-to-low transition on the SDA line while the SCL is high. A Stop condition, a low-to-high transition on the SDA line while the SCL input is high, is sent by the master (see Figure).
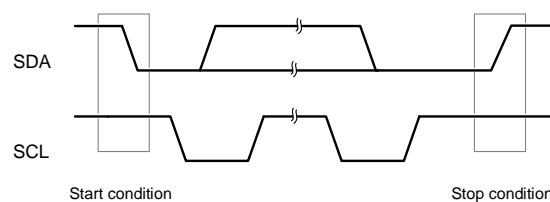
[Figure 9] Definition of I2C Start and Stop Conditions.

7.2. Sending a Command

After sending the Start condition, the subsequent I^{2}C header consists of the 7-bit I^{2}C device address '1000000' and an SDA direction bit (Read R: '1', Write W: '0'). The sensor indicates the proper reception of a byte by pulling the SDA pin low (ACK bit) after the falling edge of the 8th SCL clock.

After the issue of a measurement command ('11100011' for temperature, '11100101' for relative humidity), the MCU must wait for the measurement to complete. The basic commands are summarized in Table 7.

Command	Comment	Code
Trigger T measurement	hold master	11100011
Trigger RH measurement	hold master	11100101
Trigger T measurement	no hold master	11110011
Trigger RH measurement	no hold master	11110101
Write user register		11100110
Read user register		11100111
Soft reset		11111110

[Table 7] Basic command set, RH stands for relative humidity, and T stands for temperature.
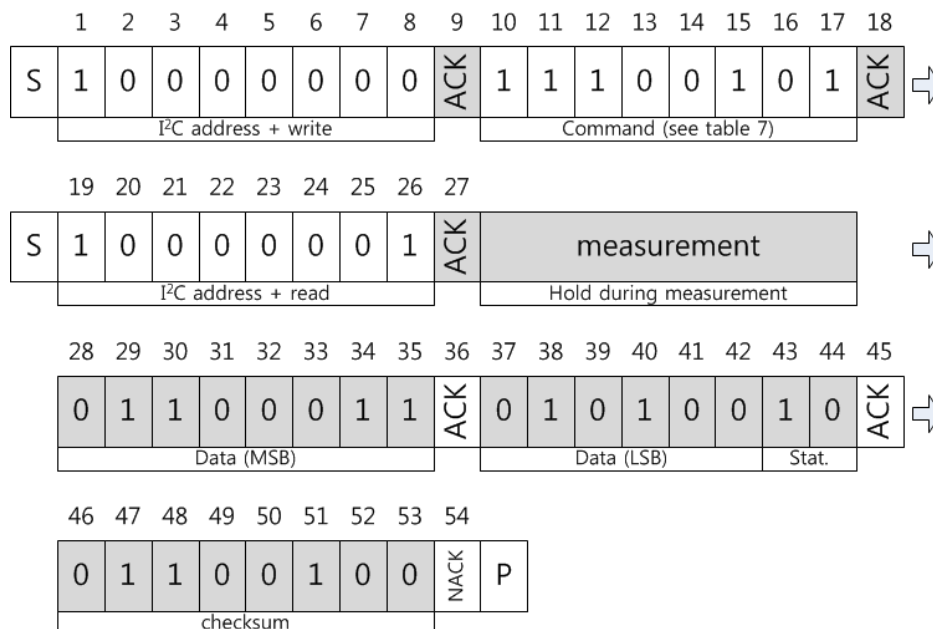
7.3. Hold / No Hold Master Mode

There are two different operation modes to communicate with the sensor: Hold Master mode or No Hold Master mode.

In the first case the SCL line is blocked (controlled by sensor) during measurement process while in the latter case the SCL line remains open for other communication while the sensor is processing the measurement.

No hold master mode allows for processing other I^{2}C communication tasks on a bus while the sensor is measuring. A communication sequence of the two modes is displayed in Figure 10 and Figure 11, respectively.

In the hold master mode, the MXH1100 pulls down the SCL line while measuring to force the master into a wait state.   By releasing the SCL line the sensor indicates that internal processing is terminated and that transmission may be continued.
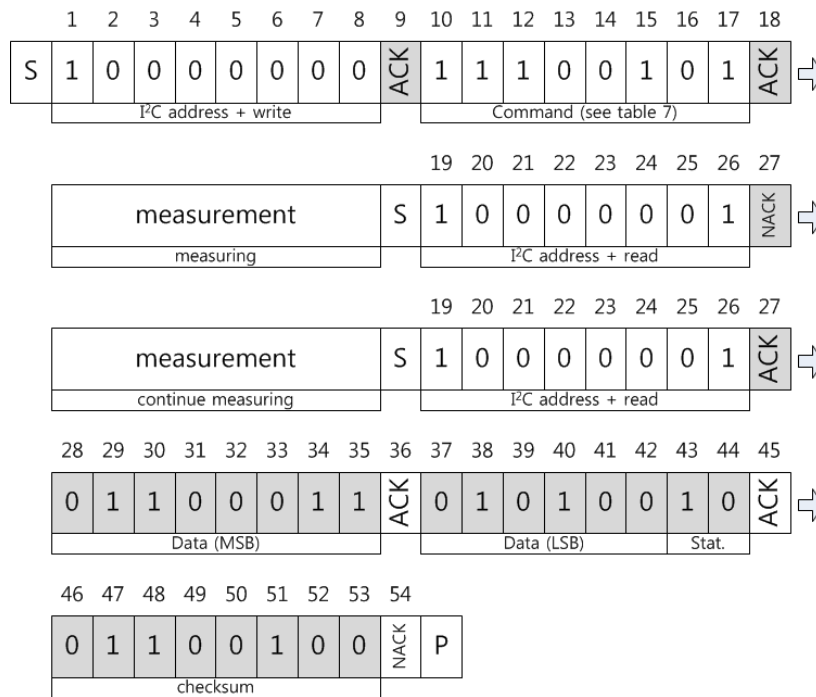

[Figure 10] Hold master communication sequence – grey blocks are controlled by MXH1100. Bit 45 may be changed to NACK followed by Stop condition (P) to omit checksum transmission.

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In no hold master mode, the MCU has to poll for the termination of the internal processing of the sensor. This is done by sending a Start condition followed by the I²C header (10000001) as shown in Figure 11.

If the internal processing is finished, the sensor acknowledges the poll of the MCU and data can be read by the MCU. If the measurement processing is not finished the sensor answers no ACK bit and the Start condition must be issued once more.

For both modes, since the maximum resolution of a measurement is 14 bit, the two last least significant bits (LSBs, bits 43 and 44) are used for transmitting status information. Bit 1 of the two LSBs indicates the measurement type ('0':temperature, '1':humidity). Bit 0 is currently not assigned.

[Figure 11] No Hold master communication sequence – grey blocks are controlled by MXH1100. If measurement is not completed upon "read" command, sensor does not provide ACK on bit 27 (more of these iterations are possible). If bit 45 is changed to NACK followed by Stop condition (P) checksum transmission is omitted.

In the examples given in Figure 10 and Figure 11 the sensor output is D_{RH} = '0110'0011'0101'0000'. For the calculation of physical values Status Bits must be set to '0' – see Chapter 6.

The maximum duration for measurements depends on the type of measurement and resolution chosen – values are displayed in Table 8. Maximum values shall be chosen for the communication planning of the MCU.
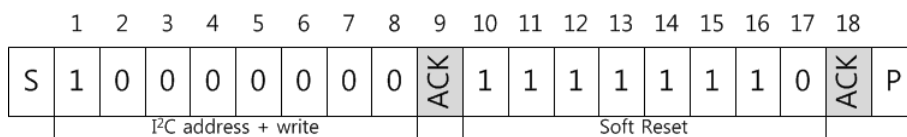
Resolution	RH (typ)	T (typ)	units
14 bit		34	ms
13 bit		17	ms
12 Bit	38	17	ms
11 bit	22	9	ms
10 bit	22		ms
8 bit	9		ms

[Table 8] Measurement times for RH and T measurements at different resolutions

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Please note : I2C communication allows for repeated Start conditions (S) without closing prior sequence with Stop condition (P) – compare Figures 10, 11 and 13. Still, any sequence with adjacent Start condition may alternatively be closed with a Stop condition.

7.4. Soft Reset

This command (see Table 7) is used for rebooting the sensor system without switching the power off and on again. Upon reception of this command, the sensor system reinitializes and starts operation according to the default settings – with the exception of the heater bit in the user register (see Sect. 7.5). The soft reset takes less than 15ms.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
S	1	0	0	0	0	0	0	0	ACK	1	1	1	1	1	1	1	0	ACK	P
				I²C address + write									Soft Reset						

[Figure 12] Soft Reset – grey blocks are controlled by MXH1100.

7.5. User Register

The content of User Register is described in Table 9. Please note that reserved bits must not be changed and default values of respective reserved bits may change over time without prior notice. Therefore, for any writing to the User Register, default values of reserved bits must be read first. Thereafter, the full User Register string is composed of respective default values of reserved bits and the remainder of accessible bits optionally with default or non-default values.
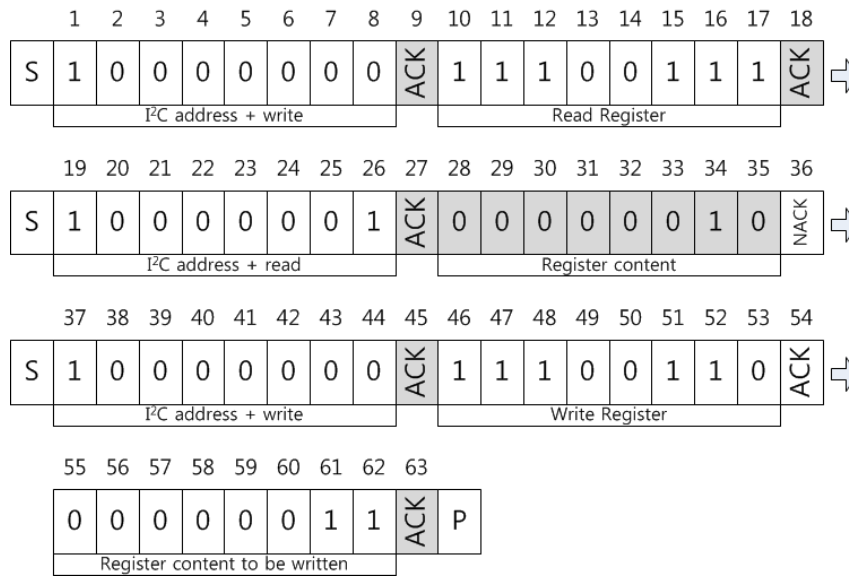OTP Reload is a safety feature and loads the entire OTP settings to the register before every measurement. This feature is disabled per default and is not recommended for use. Please use Soft Reset instead – it contains OTP Reload.

bit	#bits	Description / coding			default
7,0	2	Measurement resolution			00
			RH	Temp	
		00	12 bit	14 bit	
		01	8 bit	12 bit	
		10	10 bit	13 bit	
		11	11 bit	11 bit	
6,5,4,3	4	Reserved			0111
2	1	Reserved			0
1	1	Disable OTP reload			1

[Table 9] User Register. Reserved bits must not be changed. "OTP reload" = '0' loads default settings after each time a measurement command is issued.

Remark (*1) : This status bit is updated after each measurement.

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An example for I2C communication reading and writing the User Register is given in Figure 13.

[Figure 13] Read and write register sequence – grey blocks are controlled by MXH1100. In this example, the resolution is set to 8bit / 12bit.

7.6. CRC Checksum

The MXH1100 provides a CRC-8 checksum for error detection.
The polynomial used is $x^8 + x^5 + x^4 + 1$.

7.7. Conversion of Signal Output

Default resolution is set to 12 bit relative humidity and 14 bit temperature reading.
Measured data are transferred in two byte packages, i.e. in frames of 8 bit length where the most significant bit (MSB) is transferred first (left aligned).
Each byte is followed by an acknowledge bit. The two status bits, the last bits of LSB, must be set to '0' before calculating physical values. In the example of Figure 10 and Figure 11, the transferred 16 bit relative humidity data is '011000110101000**00**' = 25424.

7.7.1. Relative Humidity Conversion

With the relative humidity data output D_{RH} the relative humidity RH is obtained by the following formula (result in %RH), no matter which resolution is chosen:

$$RH = -6 + 125 \cdot \frac{D_{RH}}{2^{16}}$$

In the example given in Figure 10 and Figure 11 the relative humidity results to be 42.5%RH.

$$RH = -6 + 125 \cdot \frac{25424}{65536} = 42.492 \approx 42.5$$

The physical value RH given above corresponds to the relative humidity above liquid water according to World Meteorological Organization (WMO). For relative humidity above ice RHi the values need to be transformed from relative humidity above water RHw at temperature t.
The equation is given in the following, compare also Application Note "Introduction to Humidity":

$$RH_i = RH_W \cdot \exp\left(\frac{\beta_W \cdot t}{\lambda_W + t}\right) / \exp\left(\frac{\beta_i \cdot t}{\lambda_i + t}\right)$$

Units are %RH for relative humidity and °C for temperature. The corresponding coefficients are defined as follows: βw = 17.62, λw = 243.12°C, βi = 22.46, λi =272.62°C.

7.7.2. Temperature Conversion

The temperature T is calculated by inserting temperature data output D_T into the following formula (result in °C), no matter which resolution is chosen:

$$T = -46.85 + 175.72 \cdot \frac{D_T}{2^{16}}$$

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8. STAND-ALONE RELATIVE HUMIDITY OUTPUT

8.1. Analog Output

MXH1100 support direct analog output of relative humidity. By setting SEL[1:0] as '00', Analog output is selected. SCL level setting '1' for humidity output mode is possible. The sensor measures twice per second. Output resolution of RH is set to 10bit.

8.1.1. Conversion of Signal Output

The sensor reading is linear and hence it can be converted to a physical value by an easy linear equation.

With the relative humidity signal output the relative humidity RH is obtained by the following formula (result in %RH):

$$V_{HOUT}(\mathrm{mV}) = 26.23 \cdot RH(\%) + 1032$$

$$\mathrm{RH}(\%) = \frac{1}{26.23} \cdot (-1032 + V_{HOUT}(mV))$$

The physical value RH given above corresponds to the relative humidity above liquid water according to World Meteorological Organization (WMO).

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8.2. PWM output

PWM signal runs on a base frequency of 120Hz, the data signal is provided on SDA line. By setting SEL[1:0] as '01', the PWM output mode is selected. SCL level setting '1' for humidity and '0' for temperature output mode is possible. The sensor measures twice per second. Output resolution of RH and Temperature are set to 10bit and 12 bit each.

8.2.1. PWM Specification

Pulse Width Modulation runs on a constant frequency and the measured information is provided as duty cycle on that frequency – see Figure 14.
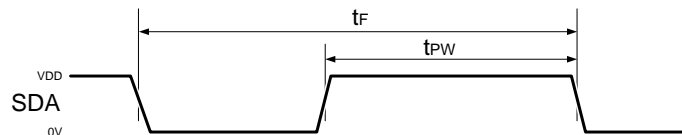
[Figure 14] PWM signal. Base frequency runs constantly at approximately 120 Hz. hence t_F is about 8.3ms. The signal is provided on t_{PW} as a ratio of t_F.

The measured data – either humidity or temperature – is provided as ratio of t_{PW} and t_F. t_{PW} shall always be given as ratio of t_F to make it independent of variations of the base frequency.

8.2.2. Conversion of Signal Output

The sensor reading is linear and hence it can be converted to a physical value by an easy linear equation.

With the relative humidity signal output the relative humidity RH is obtained by the following formula (result in %RH):

$$\text{RH} = -6 + 125 \cdot \frac{t_{PW}}{t_F}$$

The physical value RH given above corresponds to the relative humidity above liquid water according to World Meteorological Organization (WMO).

The temperature T is calculated by inserting the ratio of t_{PW} and t_F into the following formula (result in °C):

$$\text{T} = -46.85 + 175.72 \cdot \frac{t_{PW}}{t_F}$$

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8.3. PDM output

PDM signal is a pulse sequence that with a low pass filter may be converted into analog voltage output. The data signal is provided on SDA line. By setting SEL[1:0] as '10', the PDM output mode is selected. Humidity and temperature output mode is selected by SCL level. The sensor measures twice per second. Output resolution of RH and Temperature are set to 10bit and 12 bit each.

8.3.1. PDM output

Pulse Density Modulation is a bit-stream of pulses; the more high pulses the higher the value in the full measurement range – see Figure 15.
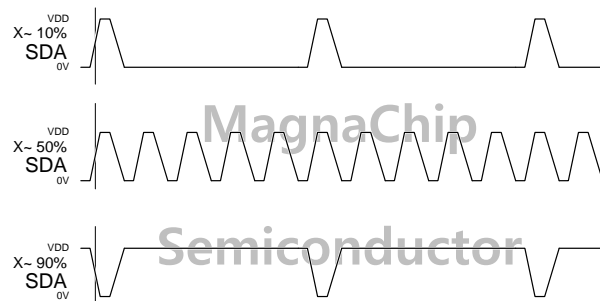
[Figure 15] Schematic principle of PDM signal. X represents either RH or T at different levels of sensor output.

8.3.2. Converting PDM to Analog Signal

A PDM signal normally is converted to an analog voltage signal by the addition of a low-pass filter. Figure 16 displays a typical circuit where a simple RC-filter is used. For conversion into physical values please read the following Chapter.
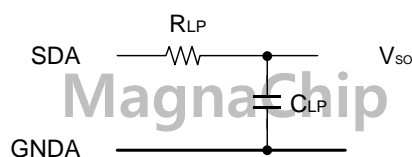
[Figure 16] Typical circuit with low pass filter (surrounded by hatched line) for analog output. Recommended component size: RLP = 100kΩ and CLP = 220nF. By pulling SCL low or high, the output value is switched to temperature or humidity, respectively.

For an acceptable small ripple of the analog voltage signal, a cut-off frequency of 7Hz is recommended. Typical values for the low pass filter components are R = 100kΩ and C = 220nF. The corresponding ripple of the signal is limited to maximal amplitude of ±0.2%RH and ±0.28°C, respectively. If larger deviations are acceptable the capacitor size can be reduced.

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9. APPLICATIONS

9.1. Storage instruction

Moisture Sensitivity Level (MSL) is 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.

It is of great importance to understand that a humidity sensor is not a normal electronic component and needs to be handled with care.   Chemical vapors at high concentration in combination with long exposure times may offset the sensor reading.

For this reason it is recommended to store the sensors in original packaging including the sealed ESD bag at following conditions: Temperature shall be in the range of 10°C – 50°C and humidity at 20 – 60%RH (sensors that are not stored in ESD bags).

9.2. Post reflow treatment

We recommend high humidity storage of the boards including the sensor packages after reflow soldering. 16-24 hours at 80±10%RH (room temperature) is advisable. Calibration or testing should be done after a short further rest (>1 hour) at room conditions.

9.3. Handling information

During the whole transportation process it should be avoided to expose the sensor to high concentrations of chemical solvents for longer time periods. Otherwise the "Reconditioning procedure (9.4)" must be followed.

9.4. Reconditioning Procedure

After exposure to extreme conditions or chemical solvents or storage time of several months, the sensor characteristic curve may offset. Exposure to higher temperature will reset the contamination offset (reflow soldering process or e.g. 110°C, 5-7h). When the parts come back to room temperature a humidity exposure to 70±5°C,75±5% RH for 8 hours completes the reconditioning process.

9.5. Temperature Effects

Relative humidity is strongly depends on temperature.   Therefore, it is essential to keep humidity sensors at the same temperature as the air of which the relative humidity is to be measured.   In case of testing or qualification the reference sensor and test sensor must show equal temperature to allow for comparing humidity readings.

If the sensor shares a PCB with electronic components that produce heat it should be mounted in a way that prevents heat transfer or keeps it as low as possible.

Furthermore, there are self-heating effects in case the measurement frequency is too high.   To keep self-heating below 0.1°C, MXH1100 should not be active for more than 10% of the time – e.g. maximum two measurements per second at 12bit accuracy shall be made.

9.6. Light

The MXH1100 is not light sensitive but direct exposure to sunshine or strong UV radiation may age the sensor.

9.7. Forbidden packaging materials

Significant concentrations of chemical vapors and long exposure times can influence the characteristic of the sensor. Outgassing of certain packaging materials in a constant volume such as foams (e.g.: Type MOS 2200) glues, adhesive tapes and foils are strictly forbidden and may change the characteristic of the sensor.

9.8. Wiring and signal integrity

When this MXH1100 is used under I^2C mode, carrying the SCL and SDA signal parallel and in close proximity (e.g. in wires) for more than 10cm may result in cross talk and loss of communication. Furthermore, slowing down SCL frequency will possibly improve signal integrity.

Under analog output modes, the output pin has to be protected from external noise source to get stable output. Power supply pins (VCC,VSS) must be decoupled with a 100nF capacitor.

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10. Document Revision History

date	R-page	Revised contents	Total page	Rev. No.
2013-12-06	-	Initial release()	22	0.0
2014-04-18	3	Package Drawing added	23	0.1
	11	Fixed to Typo : Figure 14,15 → 10,11 Fxied to Typo : Figure 16 → 11		
	12	Fxied to Typo : Figure 12, 13 → 10,11		
	13	Fxied to Typo : Figure 14,15,18 → 10,11,13 Fixed to Typo : Table 8 → Table 9 Fixed to Typo : reserved bit default 0 → 0111 Deleted to contents of heater		
	14	Fxied to Typo : Figure 18 → 13		
	15	Fxied to Typo : Figure 15,16 → 10,11		
	17	Fxied to Typo : Figure 19 → 14		
	18	Fxied to Typo : Figure 21 → 16		
2014-06-19	4	Update Table 3,4	23	0.2
	5	Update Table 5		
	6	Update Figure 5		
	7	Update Figure 6		
2014-07-08	1	IC photograph added	21	0.3
	2,9,10	PDM Mode removed		
2014-07-29	2	Pin Configuration update.	21	0.31
2015-01-20	4	Table 4 updated.	21	0.32
2015-03-18	4	Table 4 updated.	22	0.4
	18	PDM output added		

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