Application Report
SNIA025–October 2017

Humidity Sensor: Storage and Handling Guidelines

Ben Kasemsadeh

ABSTRACT

Texas Instruments' family of humidity sensors, or Humidity-to-Digital Converters (HDCs), provide excellent measurement accuracy at industry's lowest power consumption levels. The low power consumption facilitates use in battery powered IoT applications such as smart thermostats, and wireless data loggers while the excellent accuracy supports applications such as white goods, smart home assistants and gas sensing. The HDC ICs come factory calibrated for ease of use and are available in small packages (WSON or DSBGA) to simplify board design.

In contrast to ordinary ICs in WSON or DSBGA packages, the exposed humidity sense layer of the HDC requires additional precautions during storage, assembly and packaging to meet datasheet performance specifications. Special handling is also required during PCB assembly. Reducing stress on the package helps to ensure the best performance. This application note describes storage and handling guidelines of humidity sensors, including the HDC1010, HDC1080, and HDC2010.

Contents

1 Exposure to Contaminants

Humidity sensors are not standard ICs and therefore must not be exposed to particles or volatile chemicals such as solvents or other organic compounds. The opening in the package exposes the sense layer to the environment and makes it susceptible to pollutants. Typical ambient conditions do not present a significant risk for chemical exposure but manufacturing and storage environments are a known source of volatile contamination. The innovative DSBGA package of the HDC1010 and HDC2010 with the sensing element placed on the bottom part of the device (see Figure 1) makes the sensor more robust against dirt, dust, and other particulate contamination compared to the WSON solution (HDC1080).

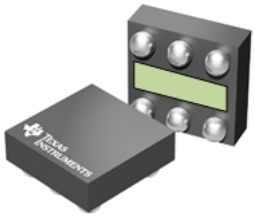

Figure 1. DSBGA Package with Sensing Element on Bottom of the Device (HDC2010)

Exposure to a range of chemicals must be avoided or minimized. Exposure of the following chemicals is known to cause drift of the humidity output readings which may be irreversible:

- Solvents such as
  - Toluene: C_7H_8
  - Acetone: $(CH_3)_2CO$
  - Ethanol: C_2H_6O

  - Methanol: CH_3OH
  - Isopropyl Alcohol: C_3H_8O
  - Di-isopropyl Ether: $C_6H_{14}O$
  - Ethylene Glycol: $(CH_2OH)_2$
  - Ethyl Acetate: $C_4H_8O_2$
  - Butyl Acetate: $C_6H_{12}O_2$
  - Methyl Ethyl Ketone: $CH_3C(O)CH_2CH_3$
- Acids such as
  - Hydrochloric acid: HCl
  - Sulphuric acid: H_2SO_4
  - Nitric Acid: HNO_3
- Other Chemicals, including
  - Ketenes
  - Ammonia: NH_3
  - Hydrogen Peroxide: H_2O_2
  - Ozone: O_3
  - Formaldehyde: CH_2O

Such chemicals are an integral part of epoxies, glues, adhesives, or reaction by-products that outgas during baking and curing processes.

The sense layer must not have direct contact with cleaning agents such as PCB board wash after soldering. Applying cleaning agents to the sense layer may lead to drift of the RH output or even complete breakdown of the sensor. Avoid strong blasts from aerosol dusters and use only low pressure oil free air dusting.

If it is necessary to expose the HDC to contaminates, concentration, concentration and exposure time must be reduced as much as feasible. Good ventilation (fresh air supply) aids in lowering the concentration of volatile chemicals, particularly solvents.

2 Packaging and Storage

TI's Humidity sensors are shipped in sealed anti-static tape and reel cavities. The sensors may be stored in a humidity and temperature controlled environment after being removed from the tape and reel cavity prior to assembly. Storage temperature and humidity limitations are defined by the MSL level of the sensor. Refer to application note MSL Ratings and Reflow Profiles for details.

Do not store the humidity sensors with anti-static polyethylene bags or packing materials (pink foam) as these materials emit gases that can affect the sensor. Metallized, anti-static, sealable bags are recommended for storage. Do not use adhesives or tape inside the storage container.

3 Assembly

The HDC must be added in the last assembly step. In case the PCB passes through multiple solder cycles (as is the case for PCBs that are assembled on the top and bottom side), it is recommended to assemble the HDC in the last solder cycle. This reduces the risks of sense layer exposure. Contaminants such as those listed in Section 1 must be avoided or minimized. Maximum assembly temperatures and exposure times must not be not exceeded.

NOTE: It is important that "no-clean" solder paste is used and no board wash is applied once the sensor is assembled onto the PCB.

4 Application In Extreme Environments

Some applications require usage of the HDC in harsh environments. Ensure that the exposure of the sensor to the maximum limit of temperature and humidity operating conditions meets the datasheet guidelines. Limiting exposure to volatile organic compounds at high concentration and long exposure time is critical. Usage in harsh environments must be carefully tested and qualified.

Exposure to any aqueous solutions is highly discouraged. In the event that some aqueous exposure cannot be avoided, use the following guidelines:

- Exposure to acids or bases may affect humidity output accuracy readings.
- Bases are less damaging than acid solutions. All acid solutions must be considered damaging to the sensor. Etching substances such as H_2O_2 or NH_3 at high concentrations is damaging to the sensor.
- Corrosive solutions at very low concentrations are not damaging to the sensor itself. However, care must be taken to ensure that the solder contacts are not attacked.

IMPORTANT NOTICE FOR TI DESIGN INFORMATION AND RESOURCES

Texas Instruments Incorporated ('TI") technical, application or other design advice, services or information, including, but not limited to, reference designs and materials relating to evaluation modules, (collectively, "TI Resources") are intended to assist designers who are developing applications that incorporate TI products; by downloading, accessing or using any particular TI Resource in any way, you (individually or, if you are acting on behalf of a company, your company) agree to use it solely for this purpose and subject to the terms of this Notice.

TI's provision of TI Resources does not expand or otherwise alter TI's applicable published warranties or warranty disclaimers for TI products, and no additional obligations or liabilities arise from TI providing such TI Resources. TI reserves the right to make corrections, enhancements, improvements and other changes to its TI Resources.

You understand and agree that you remain responsible for using your independent analysis, evaluation and judgment in designing your applications and that you have full and exclusive responsibility to assure the safety of your applications and compliance of your applications (and of all TI products used in or for your applications) with all applicable regulations, laws and other applicable requirements. You represent that, with respect to your applications, you have all the necessary expertise to create and implement safeguards that (1) anticipate dangerous consequences of failures, (2) monitor failures and their consequences, and (3) lessen the likelihood of failures that might cause harm and take appropriate actions. You agree that prior to using or distributing any applications that include TI products, you will thoroughly test such applications and the functionality of such TI products as used in such applications. TI has not conducted any testing other than that specifically described in the published documentation for a particular TI Resource.

You are authorized to use, copy and modify any individual TI Resource only in connection with the development of applications that include the TI product(s) identified in such TI Resource. NO OTHER LICENSE, EXPRESS OR IMPLIED, BY ESTOPPEL OR OTHERWISE TO ANY OTHER TI INTELLECTUAL PROPERTY RIGHT, AND NO LICENSE TO ANY TECHNOLOGY OR INTELLECTUAL PROPERTY RIGHT OF TI OR ANY THIRD PARTY IS GRANTED HEREIN, including but not limited to any patent right, copyright, mask work right, or other intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information regarding or referencing third-party products or services does not constitute a license to use such products or services, or a warranty or endorsement thereof. Use of TI Resources may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

TI RESOURCES ARE PROVIDED "AS IS" AND WITH ALL FAULTS. TI DISCLAIMS ALL OTHER WARRANTIES OR REPRESENTATIONS, EXPRESS OR IMPLIED, REGARDING TI RESOURCES OR USE THEREOF, INCLUDING BUT NOT LIMITED TO ACCURACY OR COMPLETENESS, TITLE, ANY EPIDEMIC FAILURE WARRANTY AND ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, AND NON-INFRINGEMENT OF ANY THIRD PARTY INTELLECTUAL PROPERTY RIGHTS.

TI SHALL NOT BE LIABLE FOR AND SHALL NOT DEFEND OR INDEMNIFY YOU AGAINST ANY CLAIM, INCLUDING BUT NOT LIMITED TO ANY INFRINGEMENT CLAIM THAT RELATES TO OR IS BASED ON ANY COMBINATION OF PRODUCTS EVEN IF DESCRIBED IN TI RESOURCES OR OTHERWISE. IN NO EVENT SHALL TI BE LIABLE FOR ANY ACTUAL, DIRECT, SPECIAL, COLLATERAL, INDIRECT, PUNITIVE, INCIDENTAL, CONSEQUENTIAL OR EXEMPLARY DAMAGES IN CONNECTION WITH OR ARISING OUT OF TI RESOURCES OR USE THEREOF, AND REGARDLESS OF WHETHER TI HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

You agree to fully indemnify TI and its representatives against any damages, costs, losses, and/or liabilities arising out of your non-compliance with the terms and provisions of this Notice.

This Notice applies to TI Resources. Additional terms apply to the use and purchase of certain types of materials, TI products and services. These include; without limitation, TI's standard terms for semiconductor products http://www.ti.com/sc/docs/stdterms.htm), evaluation modules, and samples (http://www.ti.com/sc/docs/sampterms.htm).

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265