Installation Instructions for the **Honeywell HumidIcon™ Digital Humidity/Temperature Sensors: HIH6120/6121 Series**

GENERAL INFORMATION

The following associated literature is available on the Web**:**

- Product data sheet
- Product application note
- Application sheets:
  – Humidity Sensor Performance Characteristics
  – Humidity Sensor Theory and Behavior
  – Humidity Sensor Moisture and Psychrometrics
  – Humidity Sensor Chemical Resistivity
  – Thermoset Polymer-based Capacitive Sensors
- Technical Notes:
  – I^2C Communication with the Honeywell HumidIcon™ Digital Humidity/Temperature Sensors
  – Using Alarms on the Honeywell HumidIcon™ Digital Humidity/Temperature Sensors
  – Entering and Using Command Mode on the Honeywell HumidIcon™ Digital Humidity/Temperature Sensors Series
  – Total Error Band Specification for Honeywell Digital Humidity/Temperature Sensors

CAUTION
IMPROPER HANDLING
- Do not remove the sensor from its original protective packaging until it is ready to be installed.
- Do not touch the sensor surface. Use latex finger cots. Handle the sensor by its package edges or leads.
- Do not allow objects to enter the cavity of the sensor element.
- Do not allow debris or contaminants to accumulate on the filter.

Failure to comply with these instructions may result in product damage.

SOLDERING AND ASSEMBLY

CAUTION
IMPROPER CLEANING
- Insert and solder the sensor after the PCB cleaning process.

Failure to comply with these instructions may result in product damage.

CAUTION
IMPROPER SENSOR POSITIONING
- Position the sensor so that its face is exposed to the atmosphere being monitored.

Failure to comply with these instructions may result in product damage.

CAUTION
IMPROPER SOLDERING
- For better product reliability, the HIH6120/6121 Series is factory-shipped with a protective tape on the cover (sensing face). This tape must remain in place during soldering.
- After soldering, remove the protective tape as described below to activate the sensor.

Failure to comply with these instructions may result in product damage.

PROTECTIVE TAPE REMOVAL
1. Use proper ESD protection.
2. Using covered fingers or tweezers to ensure that no debris falls into the filter, sensor cover or die, grip the overhanging front edge of the protective tape and peel it back from the top surface of the sensor.
3. Ensure the complete rectangle of protective tape is removed.

Figure 1. Protective Tape Removal
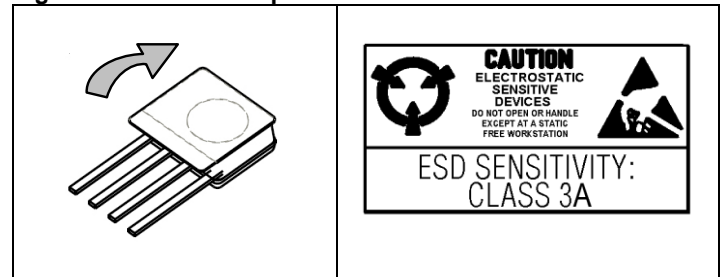
SOLDERING

Process
- Automated: Use a no-clean flux. Limit the contact of the flux to the leads only. Reflow soldering profile is specified by J-STD-020D for a small package with a peak temperature of 260 °C [500 °F].
- Manual: Do not exceed 350 °C [662 °F] for 4 s max.

SENSOR REHYDRATION

NOTICE

SENSOR REHYDRATION
- Exposure to elevated temperatures, such as those experienced during solder reflow, may dry out the sensing element. It is recommended that the sensor be allowed time to rehydrate after soldering or other high temperature/dry exposures.
- Exposure to these conditions will not permanently damage the sensor. It will generally return to its factory-calibrated value after rehydration.
- If rehydration is not performed, the sensor may read a slight offset that slowly disappears over time as the sensor becomes exposed to ambient conditions. Conversely, extended exposure to condensing and high humidity environments (>90 %RH) may cause a revisable shift in readings which will generally return to normal after the sensor has been allowed to dry off.

To rehydrate the sensor, expose it to room temperature under ambient conditions (>50 %RH) for a minimum of five hours.

MOISTURE SEALING THE LEADS

If, in the presence of intermittent moisture or other contaminants, there is the possibility of galvanic paths between the leads, moisture seal the leads and exposed pads.

Table 1. Environmental Specifications

Characteristic	Condition	Min.	Typ.	Max.	Unit
Operating temperature range	–	-25 [-13]	–	85 [185]	°C [°F]
Storage temperature range	–	-40 [-40]	–	85 [185]	°C [°F]
Storage humidity	–	30	–	50	%RH

Soldering:
  automated
  manual
	IPC/EIA/JEDEC J-STD-020D
	apply heat for 4 s max. for manual soldering
		–
		–
			–
			–
				260 [500]
				350 [662]
					°C [°F]

ESD	MIL-STD 883H, Method 3015.7	–	–	±4	kV
Latch-up immunity	–	–	–	±100	mA
Shock	MIL-STD 202G, Method 213D, Test Condition C, half-sine, 6 ms ±3 perpendicular axis, 3 shock pulses per axis	–	–	100	g
Vibration	MIL-STD 202G, Method 204D, Test Condition D, 10 Hz to 2000 Hz	–	–	20	g
Light sensitivity	exposed to 50 lumens yellow light; exhibited no change in output				

Table 2. Humidity Performance Specifications

Characteristic	Condition	Min.	Typ.	Max.	Unit
Supply voltage variation	2.3 Vdc to 5.5 Vdc	–	0.1	0.5	%RH
Compensated humidity range[1]	–	10	–	90	%RH
Compensated temp. range[1]	–	5 [41]	–	50 [122]	°C [°F]
Resolution	14 bit ADC resolution	–	–	0.04	%RH
Accuracy[2]	–	–	–	±4	%RH
Total error band[3]	–	–	–	±5	%RH
Response time	airflow minimum 20 l/min	–	6	8	s
Operating range	non-condensing	0	–	100	%RH
Long term stability	50 %RH for 5 years	–	±0.05	±1.2	%RH
Impact of soldering	IPC/EIA/JEDEC J-STD-020D, peak temp. of 260 °C [500 °F]	–	–	±2.5	%RH

Notes:

1. Conversion formulas:

14 bit ADC output for humidity to %RH:	14 bit ADC output for temperature conversion to ºC:
$$\text{Humidity}(\%RH) = \frac{Humidity\_14\_bit\_ADC\_output}{2^{14}-2} \times 100$$	$$\text{Temperature}(°C) = \frac{Temperature\_14\_bit\_ADC\_output}{2^{14}-2} \times 165 - 40$$

2. Accuracy is specified at the typical supply voltage of 3.3 Vdc and at 25 °C [77 °F]. It is the maximum deviation from the ideal transfer function of relative humidity measured over the humidity range of 10 %RH to 90 %RH and includes all errors due to humidity non-linearity, humidity hysteresis and humidity non-repeatability.
3. Total error band is the maximum deviation from the ideal transfer function of relative humidity over the compensated range of 5 °C [41 °F] to 50 °C [122 °F]. It includes all errors due to humidity non-linearity, humidity hysteresis, humidity non-repeatability, thermal effect on zero, thermal effect on span and thermal hysteresis.

Table 3. Temperature Performance Specifications

Characteristic	Condition	Min.	Typ.	Max.	Unit
Supply voltage variation	2.3 Vdc to 5.5 Vdc	–	0.5	1.0	°C
Compensated temp. range	–	5 [41]	–	50 [122]	°C [°F]
Resolution	14 bit ADC resolution	–	–	0.025	°C
Accuracy (BFSL)[1]	–	–	–	±1.0	°C
Response time	1/e slow moving air	5	–	30	s
Long term stability	25 °C for 5 years	–	–	±0.05	°C/yr
Impact of soldering	IPC/EIA/JEDEC J-STD-020D, peak temp. of 260 °C [500 °F]	–	–	±0.1	°C

Note:
1. Accuracy is specified over the compensated temperature range.

Table 4. Current Consumption

Characteristic	VDD	Abbr.	Condition	Typ.	Max.	Unit
Sleep current	3.3	I_{SLEEP}	–	0.6	1	µA
Supply current	3.3	I_{DD}	14 bit fastest update, no sleep	0.65	1	mA

Table 5. Input and Output Characteristics

Characteristic	Abbr.	Condition	Min.	Typ.	Max.	Unit
Supply voltage	V_{DD}	–	2.3	3.3	5.5	Vdc
Low level output voltage	V_{OL}	I_{OL} = 2.8 mA min.	–	–	20%	V_{DD}
High level output voltage	V_{OH}	I_{OH} = -2.8 mA min.	80%		–	V_{DD}
Low level input voltage	V_{IL}	–	–	–	20%	V_{DD}
High level input voltage	V_{IH}	–	80%		–	V_{DD}
I²C pull-up resistor	R_P	–	–	2.2	–	kOhm

Table 6. Measurement Timing

Characteristic	Abbr.	Condition	Min.	Typ.	Max.	Unit
Start-up time (Power-On to data ready)	T_{STA}	14 bit TH and 14 bit humidity resolution	–	50	60	ms
Update rate		application dependent: measurements are taken only when the application requests them				

Figure 2. I²C Timing
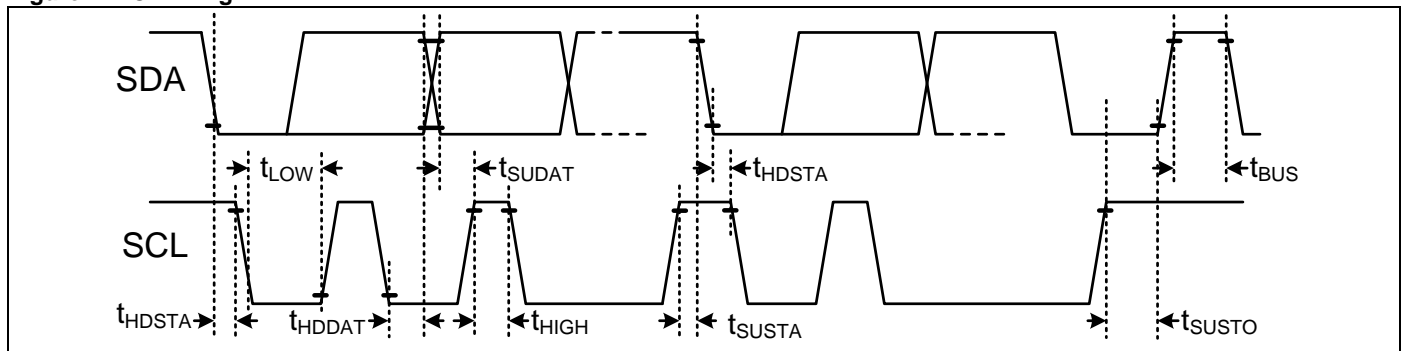
Characteristic	Abbr.	Min.	Typ.	Max.	Unit
SCL clock frequency	F_{SCL}	100	–	400	kHz
Start condition hold time relative to SCL edge	t_{HDSTA}	0.1	–	–	µs
Minimum SCL clock low width	t_{LOW}	0.6	–	–	µs
Minimum SCL clock high width	t_{HIGH}	0.6	–	–	µs
Start condition setup time relative to SCL edge	t_{SUSTA}	0.1	–	–	µs
Data hold time on SDA relative to SCL edge	t_{HDDAT}	0	–	-0.5	µs
Data setup time on SDA relative to SCL edge	t_{SUDAT}	0.1	–	–	µs
Stop condition setup time on SCL	t_{SUSTO}	0.1	–	–	µs
Bus free time between stop and start condition	t_{BUS}	1	–	–	µs

Figure 3. SIP 4 PIN Dimensions and Pinout (For reference only. mm/[in], shown with protective tape removed.)

Pin	ASIC Pad	Description
Mounting		
1	V_{DD}	connect via 0.22 µF to ground
2	V_{SS}	supply ground
3	S_{CL}	I^2C clock
4	S_{DA}	I^2C data

Mounting

Landing Pattern

Tape and Reel
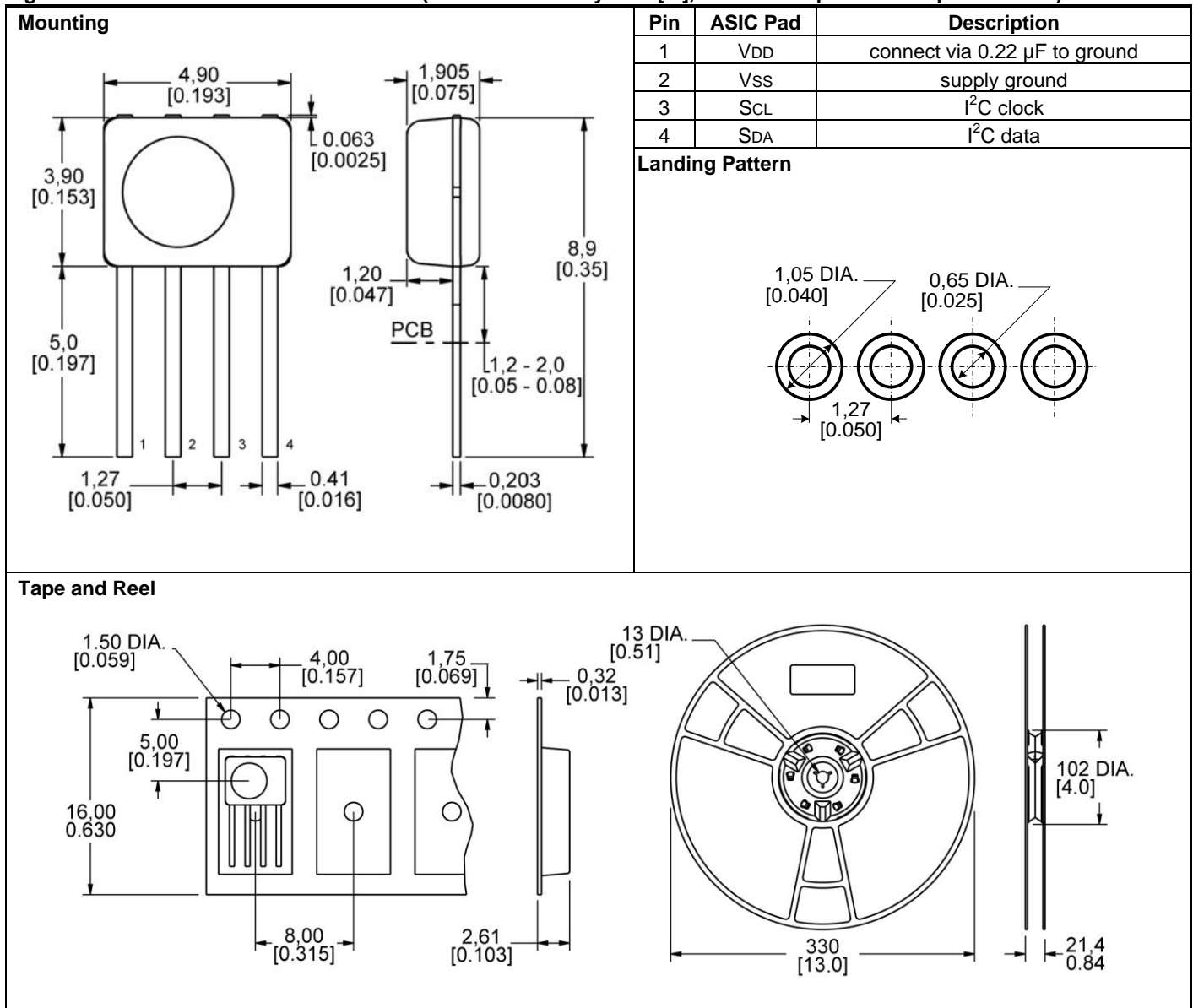
Figure 4. Typical Application Circuit

VSUPPLY = 2.3 Vdc to 5.5 Vdc

Digital Humidity/Temp. Sensor

2.2 kOhm   2.2 kOhm

1 VDD   SCL 3

0.22 µF

2 VSS   SDA 4
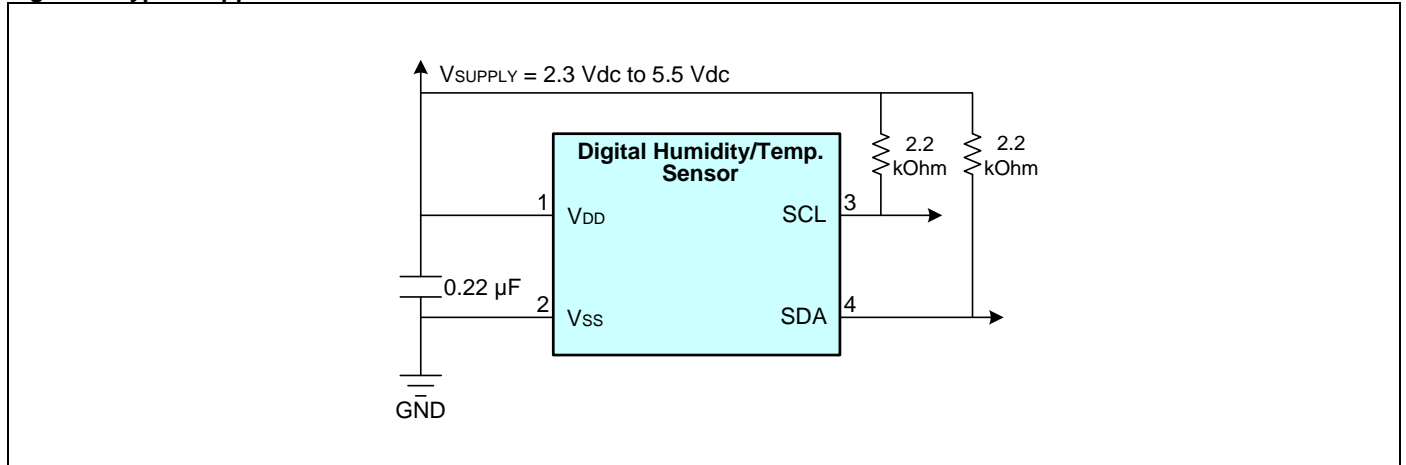
GND

Figure 5. HIH6120/6121 Series Maximal Accuracy[1] (Performance is specified between 10 %RH and 90 %RH.)

Relative Humidity (%RH)

90	±1	±2	±2	±2	±3	±3	±3	±3	±3	±2
	±1	±2	±2	±2	±3	±3	±3	±3	±3	±2
80	±1	±2	±2	±2	±2	±2	±2	±2	±2	±1
	±2	±2	±2	±2	±2	±2	±2	±2	±2	±2
70	±2	±3	±3	±3	±2	±2	±2	±2	±2	±2
	±2	±3	±3	±3	±3	±3	±3	±3	±3	±2
60	±2	±3	±3	±3	±3	±3	±3	±3	±3	±2
	±2	±3	±3	±3	±3	±3	±3	±3	±3	±2
50	±2	±3	±3	±3	±3	±3	±3	±3	±3	±2
	±2	±3	±3	±3	±3	±3	±3	±3	±3	±2
40	±2	±3	±3	±3	±3	±3	±3	±3	±3	±2
	±2	±3	±3	±3	±3	±3	±3	±3	±3	±2
30	±2	±3	±3	±3	±3	±3	±3	±3	±3	±2
	±2	±3	±3	±3	±3	±3	±3	±3	±3	±2
20	±1	±3	±3	±3	±3	±3	±3	±3	±3	±1
	±1	±3	±3	±3	±3	±3	±3	±3	±3	±1
10	±1	±3	±3	±3	±3	±3	±3	±3	±3	±1

0   10   20   30   40   50

Temperature (°C)

Note:
1. Maximal accuracy is the mean value between rising and falling RH points.

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⚠ WARNING

PERSONAL INJURY
- DO NOT USE these products as safety or emergency stop devices or in any other application where failure of the product could result in personal injury.
- The sensor's housing does not provide electrical safety isolation. Mount the sensor in a location where it cannot be touched, or where a surrounding barrier prevents human contact.

Failure to comply with these instructions could result in death or serious injury.

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WARRANTY/REMEDY

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