

HDC1010 Pin FMEA

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ABSTRACT

The HDC1010 is a digital humidity sensor with integrated temperature sensor that provides excellent measurement accuracy at very low power. The HDC1010 operates over a wide supply range, and is a low cost, low power alternative to competitive solutions in a wide range of common applications. The innovative WLCSP (Wafer Level Chip Scale Package) simplifies board design with the use of an ultra-compact package. The sensing element of the HDC1010 is placed on the bottom part of the device, which makes the HDC1010 more robust against dirt, dust, and other environmental contaminants. The humidity and temperature sensors are factory calibrated and the calibration data is stored in the chip.

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1 Pin FMEA

This application note provides a Failure Modes and Effects Analysis (FMEA) for the device pins of the HDC1010 Low Power, High Accuracy Digital Humidity Sensor with Temperature Sensor. The failure conditions covered in this document include typical failure scenarios such as short-circuit to GND, short-circuit to VDD, and short-circuit to a neighboring pin.

The following tables list how these conditions affect the device:

- [Table 1](#) shows the different classification of failure effects.
- [Table 2](#) [Table 3](#) and [Table 4](#) list how these failure conditions affect the device.

In greater detail, the 1st and 2nd columns list the pin designator and name. The 3rd column shows whether the failure condition have damaged the pin or the device. The 4th column labeled “Functionality” specifies whether the device is functional after the condition has been applied. The 5th column describes how the particular condition affects the device operation. The 6th column reports the classification of the considered failure effect.

Table 1. Classification of Failure Effects

CLASS	FAILURE EFFECTS
A	DAMAGE TO DEVICE AFFECTS APPLICATION FUNCTIONALITY
B	NO DAMAGE TO DEVICE BUT THERMAL DAMAGE MUST BE CONSIDERED
C	NO DAMAGE TO DEVICE BUT CAN AFFECT APPLICATION FUNCTIONALITY
D	NO DAMAGE TO DEVICE AND NO AFFECT TO APPLICATION FUNCTIONALITY

Table 2. Pin FMEA Analysis for Pin Short-Circuit to GND

Pin	Short to GND				
No.	Name	Damage	Functionality	Comments	Class
A1	SCL	NO	YES	I2C communication does not function properly, no damage, increases leakage	C
B1	VDD	NO	NO	Undefined operating condition, no damage, increases leakage	C
C1	ADR0	NO	YES	Can alter device I2C slave address, no damage, increases leakage	C
D1	ADR1	NO	YES	Can alter device I2C slave address, no damage, increases leakage	C
A2	SDA	NO	YES	I2C communication does not function properly, no damage, increases leakage	C
B2	GND	NO	YES	Normal operating condition	D
C2	DNC	NO	YES	Normal operating condition	D
D2	DRDYn	NO	YES	Data ready signal does not function properly, no damage, increases leakage	C

Table 3. Pin FMEA Analysis for Pin Short-Circuit to VDD

Pin	Short to VDD				
No.	Name	Damage	Functionality	Comments	Class
A1	SCL	NO	YES	I2C communication does not function properly, no damage, increases leakage	C
B1	VDD	NO	YES	Normal operating condition	D
C1	ADR0	NO	YES	Can alter device I2C slave address, no damage, increases leakage	C
D1	ADR1	NO	YES	Can alter device I2C slave address, no damage, increases leakage	C
A2	SDA	NO	YES	I2C communication does not function properly, no damage, increases leakage	C
B2	GND	NO	NO	Undefined operating condition, no damage, increases leakage	C
C2	DNC	NO	YES	Undefined operating condition, no damage, increases leakage	C
D2	DRDYn	NO	YES	Data ready signal does not function properly, no damage, increases leakage	C

Table 4. Pin FMEA Analysis for Pin Short-Circuit to Neighboring Pin

Pin		Short to Neighboring Pin			
No.	Name	Damage	Functionality	Comments	Class
A1	SCL TO VDD	NO	YES	I2C communication does not function properly, no damage, increases leakage	C
B1	VDD TO ADR0	NO	YES	Can alter device I2C slave address, no damage, increases leakage	C
C1	ADR0 TO ADR1	NO	YES	Can alter device I2C slave address, no damage	C
D1	ADR1 TO DRDYn	NO	YES	Can alter device I2C slave address, no damage	C
D2	DRDYn TO DNC	NO	YES	Undefined operating condition, no damage, increases leakage	C
C2	DNC TO GND	NO	YES	Normal operating condition	D
B2	GND TO SDA	NO	YES	I2C communication does not function properly, no damage, increases leakage	C
A2	SDA TO SCL	NO	YES	Undefined operating condition, no damage, increases leakage	C

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