SENSYLINK Microelectronics

(CHT8336A)
Analog Output Humidity &Temperature Sensor

CHT8336A is an Analog Output Humidity and Temperature Sensor with ± 2.0%RH accuracy for humidity and ± 0.2°C accuracy for temperature. The sensor supports multi slope gain of temperature & humidity to Voltage. It is ideally used in HVAC, Refrigerator, environment monitor etc.

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1 Description

The CHT8336A is an analog output humidity and temperature sensor with ±2.0%RH(Typ.) accuracy for humidity and ± 0.2 ℃ (Typ.) accuracy for temperature. It provides high accuracy measurement over a wide supply range (1.8 V – 5.5 V), along with ultra-low power consumption. Humidity and Temperature data can be read out directly via different IO pins.

Each chip is specially calibrated for temperature and humidity accuracy in factory before shipment to customers. There is no need for re-calibration anymore.

It includes a high precision band-gap circuit, an analog to digital converter, a calibration unit with non-volatile memory and two DAC outputs.

Available Package: DFN2x2-4 package

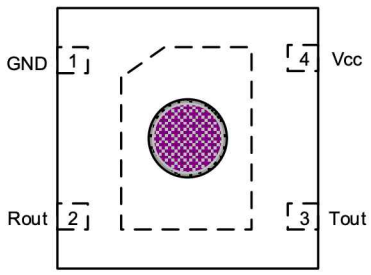
2 Features

- Operation Voltage: 1.8V to 5.5V
- Average Operating Current: 220uA (Typ.)@ 3.3V, 2Con/s for Both temperature and humidity Conversion
- High reliability and long-term stability
- Temperature Accuracy with calibration:
  ±0.2℃(Typ.), ±0.5℃(Max.)from 10℃ to 50℃
  ±0.5℃(Typ.), ±1.0℃(Max.) from -40℃ to 125℃
- Humidity Accuracy with calibration:
  ±3%RH(Max.) from 20%RH to 80%RH
- Temperature Range: -40℃ to 125 ℃
- Humidity Range: 0%RH to 100%RH
- High process capability
- High signal-to-noise ratio

3 Applications

- Smart HVAC System
- Refrigerator, Washer & dryer
- Industry Thermal Control

4 PIN Configurations (Top View)



DFN2x2-4(Package Code DN)

5 Typical Application

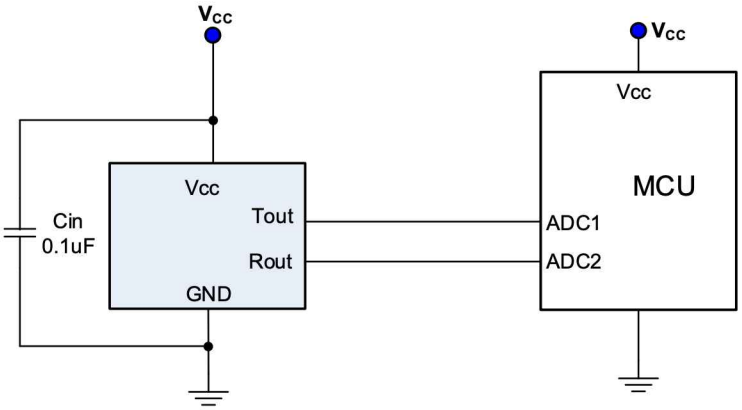


Figure 1 Typical Application of CHT8336A

6 Pin Description

PIN No.	PIN Name	Description
1	GND	Ground pin.
2	Rout	Analog voltage out; Humidity output
3	Tout	Analog voltage out; Temperature output.
4	Vcc	Power supply input pin, using 0.1uF low ESR ceramic capacitor to ground
	Exposed Thermal PAD	Exposed thermal pad (bottom side).

7 Function Block

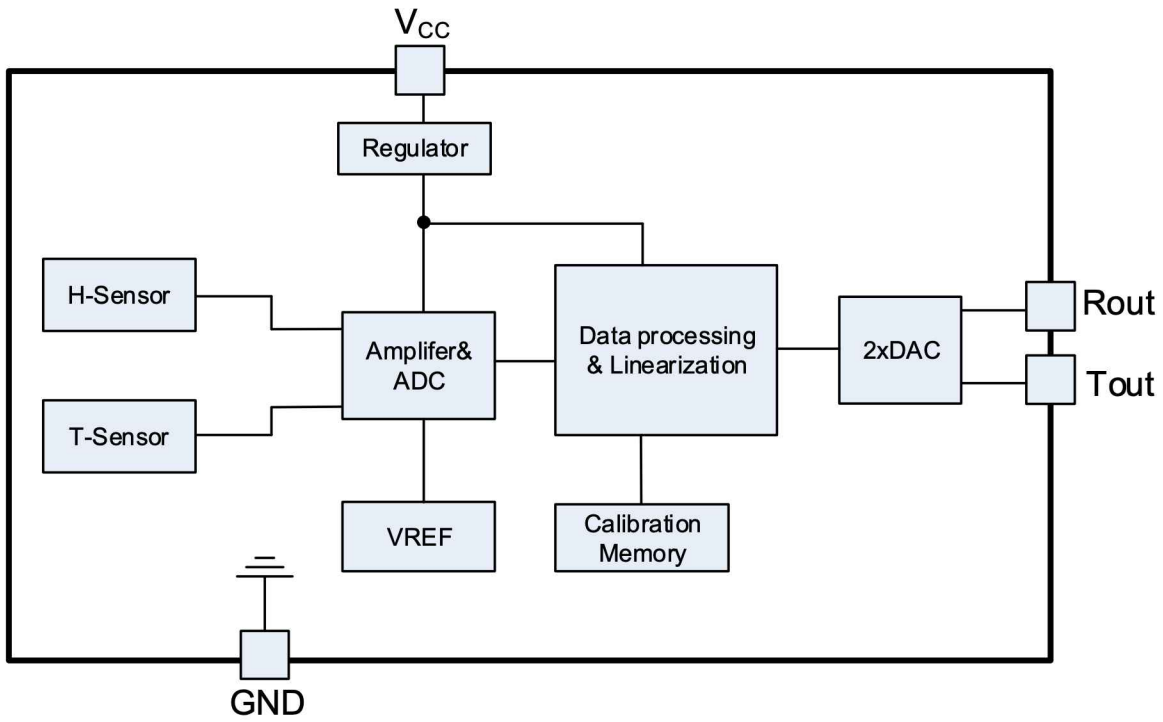
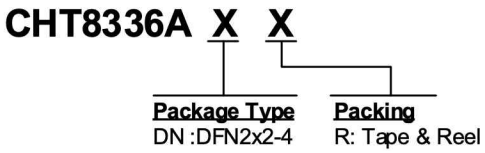


Figure 2 CHT8336A function block

8 Ordering Information



Order PN	Accuracy	Green[1]	Package	Marking ID[2]	Packing	MPQ	Operation Temperature
CHT8336ADNR	±0.2℃ ±2%RH	Halogen free	DFN2X2-4	HT YWXA	Tape & Reel	3,000	-40℃~+125℃

Notes

1. Sensylink can meet RoHS 2.0/REACH requirement. So most package types Sensylink offers only states halogen free, instead of lead free.

2. Marking ID includes 2 rows of characters. In general, the 1st row of characters are part number, and the 2nd row of characters are date code plus production information.

9 Absolute Maximum Ratings (Note1)

9.1. Absolute Maximum Ratings

Parameter	Symbol	Value	Unit
Supply Voltage	V_{CC} to GND	-0.3 to 7.0	V
Rout Tout pin Voltage	V_{Rout}/V_{Tout} to GND	-0.3 to 7.0	V
Operation junction temperature	T_J	-50 to 150	ºC
Storage temperature Range	T_{STG}	-65 to 150	ºC
ESD HBM	ESD_{HBM}	±4000	V
ESD CDM	ESD_{CDM}	±1000	V

Note1

1. *Stresses greater than those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only. Functional operation of the device at the "Absolute Maximum Ratings" conditions or any other conditions beyond those indicated under "Recommended Operating Conditions" is not recommended. Exposure to "Absolute Maximum Ratings" for extended periods may affect device reliability.*

9.2. Recommended Operating Conditions

Parameter	Symbol	Value	Unit
Supply Voltage	V_{CC}	1.8~ 5.5	V
Ambient Operation Temperature Range	T_{AT}	-40~+125	°C
Ambient Operation Temperature Range for Humidity measurement	T_{ATH}	0~ +80	°C
Ambient Operation Humidity Range	T_{AH}	0~100	%RH

9.3. Electrical Characteristics

Test Conditions: CIN = 0.1uF, Vcc =3.3V, TA=25℃ unless otherwise specified.

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Supply Voltage	Vcc		1.8		5.5	V
Power-up/down level	V_{POR}		1.5	1.6	1.75	V
Supply current	Icc	At a measurement rate of 2 Hz	-	220	350	uA
Output current	A_{OIOUT}		-100	-	100	uA
Capacitive load	C_L		-	-	5	nF
Timing Specification						
Power-up time	t_{PU}	After hard reset, Vcc ≥ V_{POR}	-	-	17	ms
Analog output settling time	$t_{AOsettle}$	For a step of Vcc/2	-	0.3		ms
Relative Humidity Sensor						
Humidity Accuracy(1)	H_{AC}	HA = 20%RH to 80%RH		±2	±3	%RH
		HA = 5%RH to 95%RH		**Figure 4**		%RH
Repeatability(2)				0.1		%RH
Resolution				0.02		%RH
Integrated Non-Linearity(3)				0.2		%RH
Hysteresis	RH_{HYS}	TA = 25°C, 10% to 90% RH		±0.8		%RH
Response Time(4)	RH_{RT}	TA = 25°C, 10% to 90% RH t63% step.		5		s
Long-term Drift (5)	RH_{LTD}			0.21		%RH/yr
Sensitivity		Vcc@5V		40		mV/%RH
Temperature Sensor						
Temperature Accuracy	T_{AC}	TA = 10 to 50℃		±0.2	±0.5	°C
		TA = -40 to 125℃		±0.5	±1	°C
Repeatability(2)				0.06		°C
Resolution	Typ.			0.03125		°C
Response Time (in air) (6)	T_{RT}	25C <TA< 75C t63% step	2			S
Long-term Drift (5)	T_{LTD}				0.03	°C /yr
Sensitivity		Vcc@5V		22.9		mV/°C

Note :

1. For definition of typical and maximum accuracy tolerance, please refer to the document "Sensirion Humidity Sensor Specification Statement"
2. The stated repeatability is 3 times the standard deviation (3σ) of multiple consecutive measurements at constant ambient conditions. It is a measure for the noise on the physical sensor output. It is measured with analog circuit and integrated over 1 second.
3. Maximum deviation from the ideal shape (linear curve).
4. Time for achieving 63% of a humidity step function, valid at 25°C and 1m/s airflow. Humidity response time in the application depends on the design-in of the sensor.
5. Typical value for operation in normal RH/T operating range, see section 1.1. Maximum value is < 0.5 %RH/yr. Value may be higher in environments with vaporized solvents, out-gassing tapes, adhesives, packaging materials, etc. For more details please refer to Handling Instructions.
6. The temperature response time depends largely on the design of the sensor in the final application. When the thermal sensor at T1 is placed on a good conductive surface with a temperature of T2, the minimum response time can be achieved.

9.4. Parameter Measurement Information

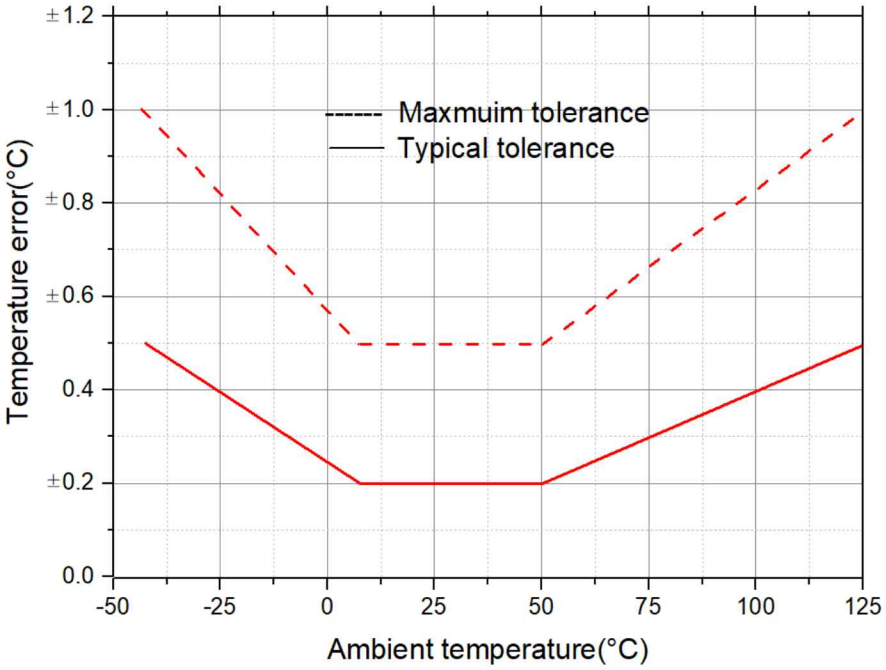


Figure 3 Temperature Error vs. Ambient Temperature

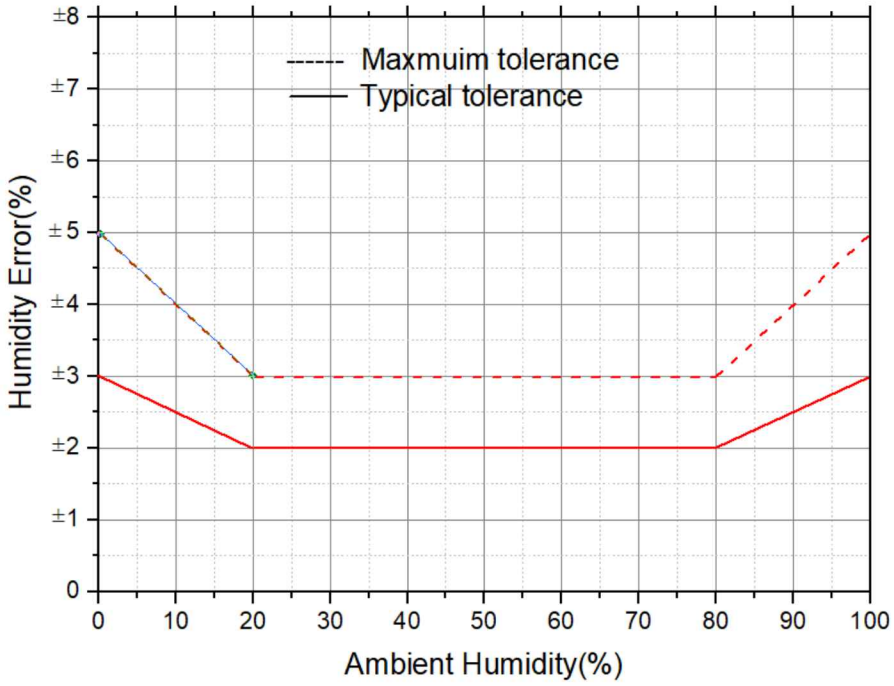


Figure 4 Humidity Error vs Ambient Humidity

10 Function Descriptions

10.1. Start-up of the sensor

The sensor starts up after reaching the power-up threshold voltage V_{POR}. After reaching this threshold voltage the sensor needs the time t_{PU} until the first measurement signal is available as voltage output on the respective output pins. During that time the temperature and humidity pins have an undefined state.

10.2. Conversion of the Signal Output

The physical values as measured by the sensor are mapped to a ratio metric voltage output (VX, x=T, RH as 10 to 90% of VDD). Prior to conversion into a voltage signal, the physical values are linearization and compensated for temperature and supply voltage effects by the sensor. Additionally, the voltage output is calibrated for each sensor. Hence the relationship between temperature and humidity and the voltage output is the same for each sensor, within the limits given by the Electrical Characteristics (9.3).

This allows to describe the relationship between physical values (RH and T) and the voltage output for temperature and humidity (VX, x=T, RH) through a generic linear formula given by equations (1), (2) and (3); its graphical representation can be found in Figure 7 & Figure 8.

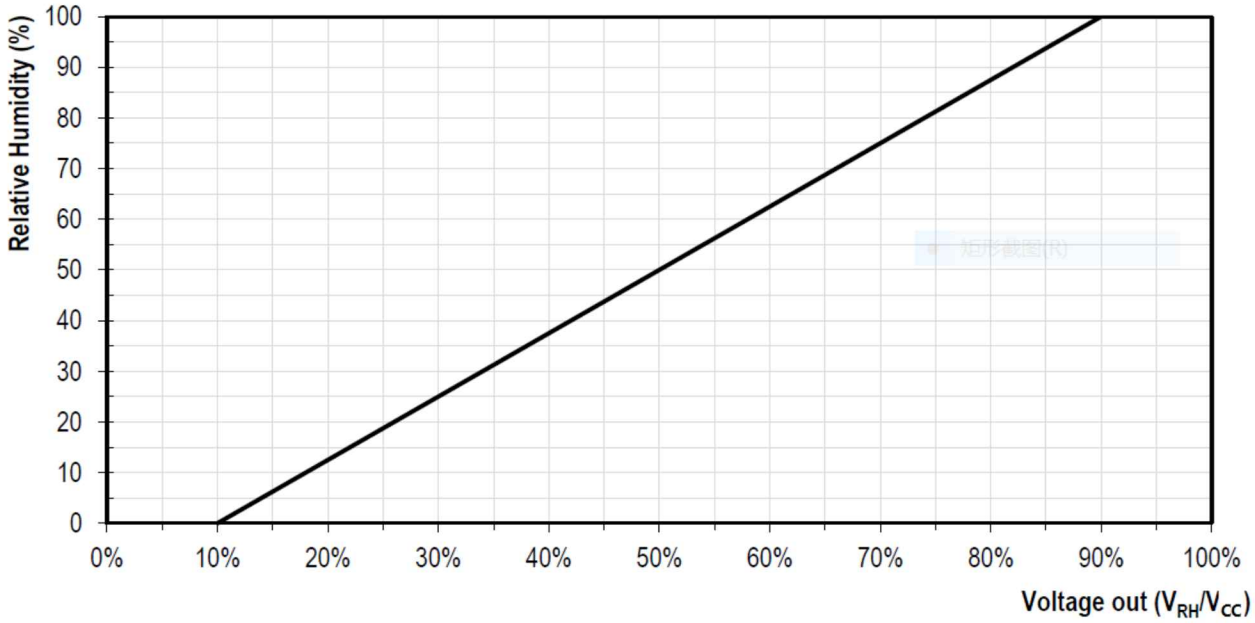


Figure 5 Relationship between the ratio metric analog voltage output and the measured relative humidity.

$$\text{Relative Humidity(RH)} = -12.5 + 125 \cdot \frac{V_{RH}}{Vcc} = -\frac{10}{0.8} + \frac{100}{0.8} \cdot \frac{V_{RH}}{Vcc} \qquad (1)$$

Equation (1) describes the conversion formula for the RH signal.

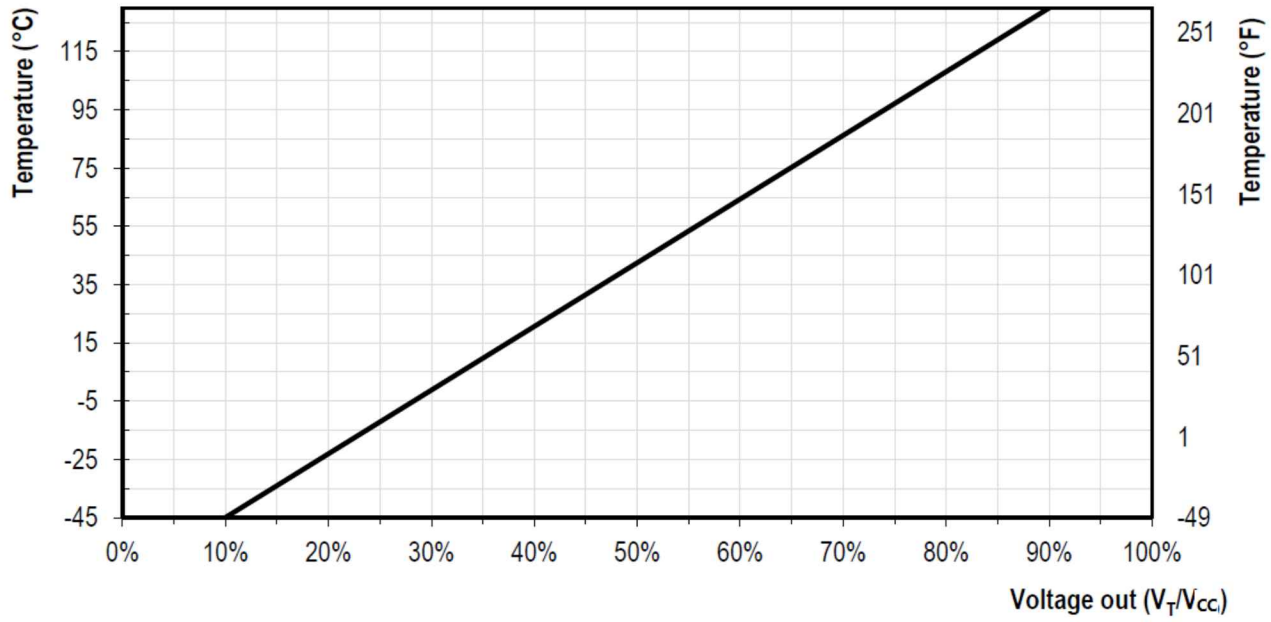


Figure 6 Relationship between the ratio metric analog voltage output and the measured temperature

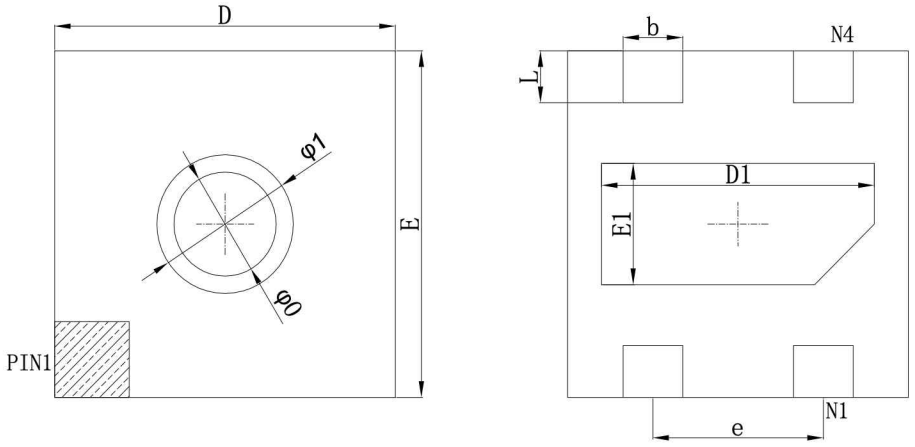
$$\text{Temperature}(°C) = -66.875 + 218.75 \cdot \frac{V_T}{V_{CC}} = -45 - \frac{17.5}{0.8} + \frac{175}{0.8} \cdot \frac{V_T}{V_{CC}} \quad (2)$$

$$\text{Temperature}(°F) = -88.375 + 393.75 \cdot \frac{V_T}{V_{CC}} = -49 - \frac{31.5}{0.8} + \frac{315}{0.8} \cdot \frac{V_T}{V_{CC}} \quad (3)$$

Equations (2) and (3) describe the conversion formulae for the temperature signal in °C and °F.

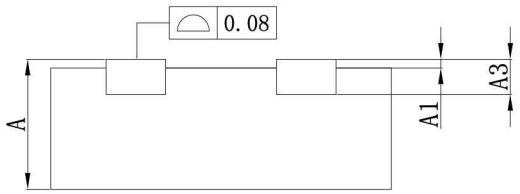
Package Outline Dimensions (DFN2X2-4)

DFN2X2-4 Unit (mm)



Top View

Bottom View



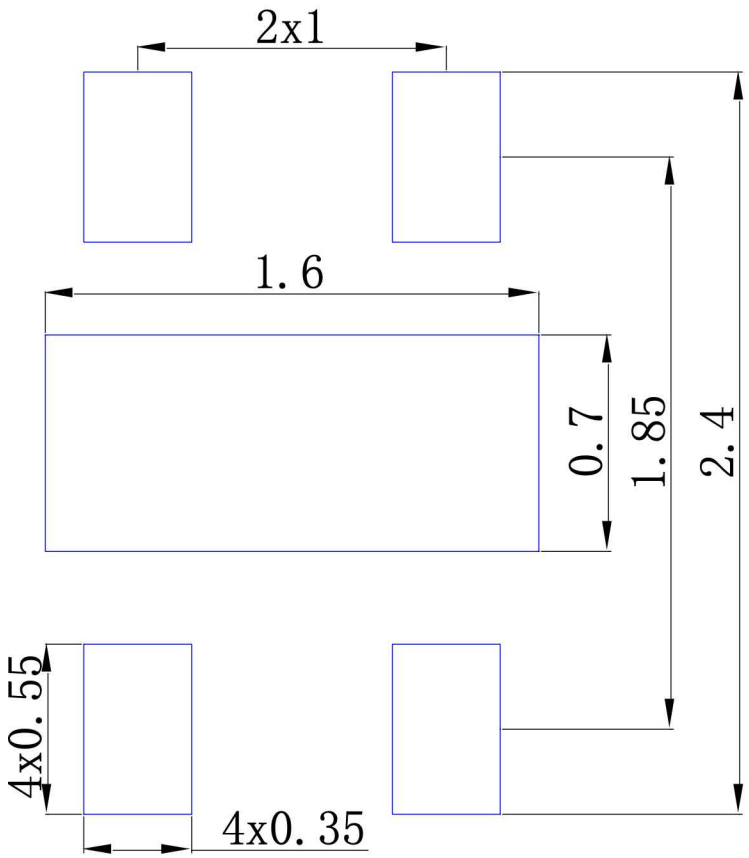
Side View

Symbol	Dimensions in Millimeters		Dimensions in Inches	
	Min.	Max.	Min.	Max.
A	0.700	0.800	0.028	0.031
A1	0.000	0.050	0.000	0.002
A3	0.203REF.		0.008REF	
D	1.900	2.100	0.075	0.083
E	1.900	2.100	0.075	0.083
D1	1.500	1.700	0.059	0.067
E1	0.600	0.800	0.024	0.031
b	0.300	0.400	0.012	0.016
e	1.000TYP.		0.039TYP	
L	0.250	0.350	0.010	0.014
φ0	0.600REF		0.024REF	
φ1	0.800REF		0.031REF	

Note：Pin1 shape on backside is not limited to bevel, it can be a notch or arch

Recommended PCB Layout Pattern (DFN2X2-4)

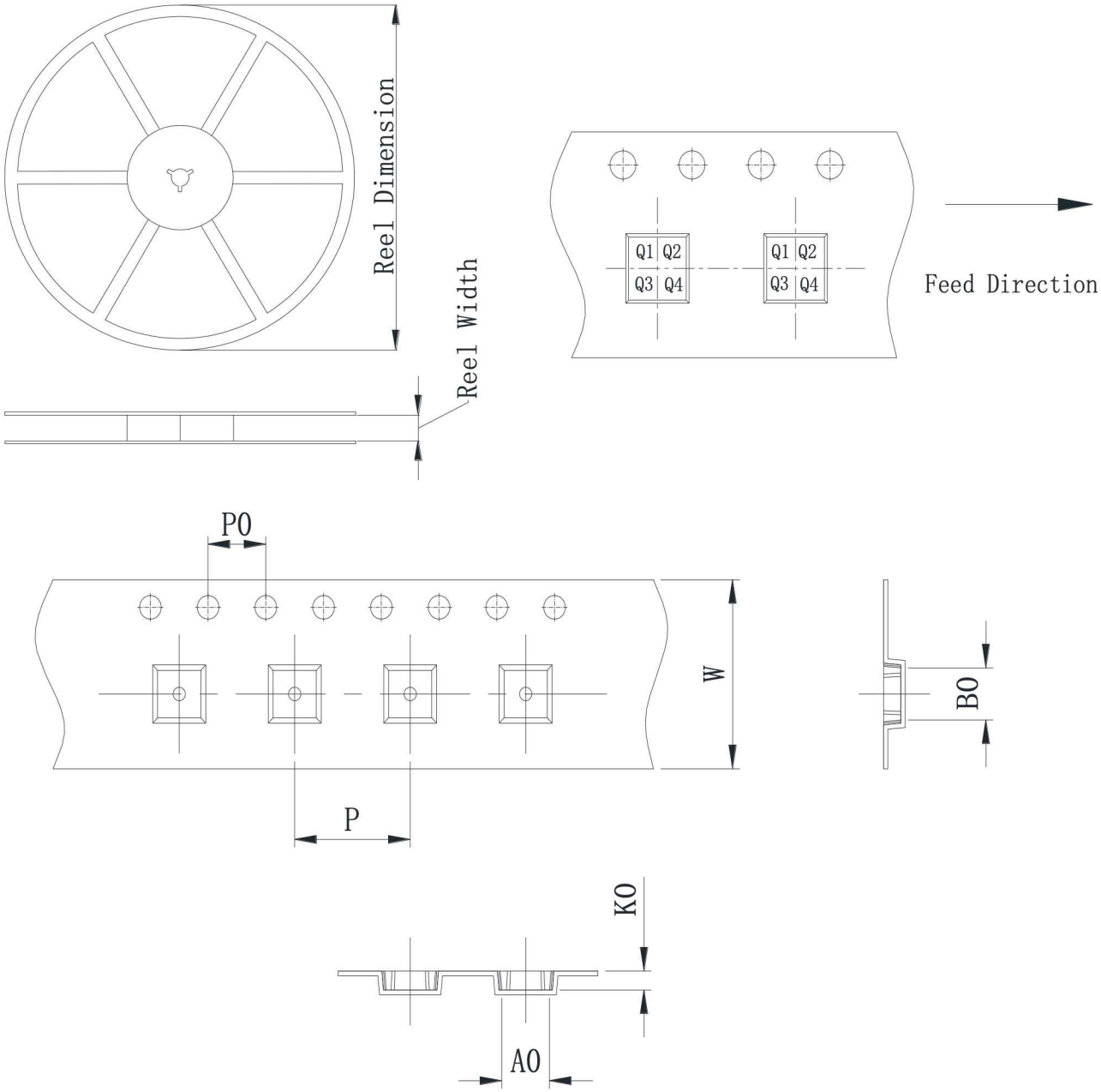
DFN2X2-4 Unit (mm)



Note:

1. All dimensions are in millimeter
2. Recommend tolerance is within ±0.1mm
3. If the thermal pad is not necessary, designer can leave the land pattern area blank
4. Change without notice

Packing information



Package type	Reel size	Reel dimension (±3.0mm)	Reel width (±1.0mm)	A0 (±0.1mm)	B0 (±0.1mm)	K0 (±0.1mm)	P (±0.1mm)	P0 (±0.1mm)	W (±0.3mm)	Pin1
DFN2X2-4	7'	180	8.4	2.2	2.2	1.1	4.0	4.0	8.0	Q2

Revision History

Version	Date	Change Content
Ver1.0	2024/04	Initial Version

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