

Chip Dew Sensor



The chip dew sensors DPS 0603 and DPS 1206 are ideal to detect the atmospheric dew between 70 and 100 % relative humidity on sensitive electronics. The sensors impedance changes in dependence on the ambient relative humidity with a pronounced signal change while being bedewed. The typical application is dew protection in the fields of consumer electronics, household appliances, automotive, climatic control, and industrial.

FEATURES

- Reliable dew detection
- Fast response time: < 1 s
- Temperature independent ≥ 98 % RH
- SMD assembly

APPLICATIONS

Dew detection for:

- Consumer electronics
- Household appliances
- Climatic control
- Automotive
- Industrial

TECHNICAL SPECIFICATIONS					
DESCRIPTION		DPS 0603		DPS 1206	
Operating voltage U_{AC} ^{(1), (2)}		0.5 V to 4 V		0.5 V to 4 V	
Operating frequency f ⁽¹⁾		50 Hz to 100 kHz		50 Hz to 100 kHz	
Operating temperature range		0 °C to 85 °C		0 °C to 85 °C	
Operating humidity range		0 % RH to 100 % RH		0 % RH to 100 % RH	
Dew detection accuracy (98 % to 100 % RH)		< 2 % RH		< 2 % RH	
Humidity response rise time t_r ⁽³⁾ (27 % to 98 % RH; 1 kHz, 1 V, 25 °C)		< 1 s		< 1 s	
Humidity response fall time t_f ⁽⁴⁾ (98 % to 27 % RH; 1 kHz, 1 V, 25 °C)		< 2 s		< 2 s	
Capacity (1 kHz, 1 V, 25 °C)		≤ 70 % RH	98 % RH	≤ 70 % RH	98 % RH
	min.	0.5 pF	0.1 nF	1.5 pF	0.5 nF
	typ.	1.0 pF	0.5 nF	4.0 pF	1.0 nF
	max.	3.0 pF	1.0 nF	7.0 pF	2.0 nF
Resistance (1 kHz, 1 V, 25 °C)		≤ 70 % RH	98 % RH	≤ 70 % RH	98 % RH
	min.	10 M Ω	10 k Ω	10 M Ω	20 k Ω
	typ.	50 M Ω	50 k Ω	100 M Ω	50 k Ω
	max.	1 G Ω	125 k Ω	1 G Ω	100 k Ω

Notes:

- (1) Recommended operating voltage and operating frequency: $U_{AC} = 1$ V; $f = 1$ kHz
(2) It is recommended not to use DC or superposed DC operating voltage
(3) Rise time is measured between 10 % and 90 % of the capacitive value of the sensor
(4) Fall time is measured between 90 % and 10 % of the capacitive value of the sensor

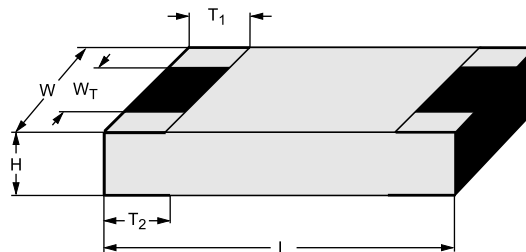
PART NUMBER AND PRODUCT DESCRIPTION (1)														
PART NUMBER: DPS060300G0P500														
D	P	S	0	6	0	3	0	0	G	0	P	5	0	0
MODEL	SIZE	SPECIAL CHARACTER	TEMPERATURE RANGE	DETECTION RANGE	SPECIAL CHARACTER	PACKAGING (2)	SPECIAL							
DPS	0603 1206	0 = Neutral	0 = Standard temperature range	G = ≥ 70 % RH	0 = Neutral	P1 P5	00 = Standard							
PRODUCT DESCRIPTION: DPS 0603 70 % P5														
DPS	0603	70 %	P5											
MODEL	SIZE	DETECTION RANGE	PACKAGING (2)											
DPS = Dew Protection Sensor	0603 1206	≥ 70 % RH	P1 P5											

Notes:

- (1) Products can be ordered using either the PART NUMBER or the PRODUCT DESCRIPTION
- (2) Please refer to table PACKAGING, see below

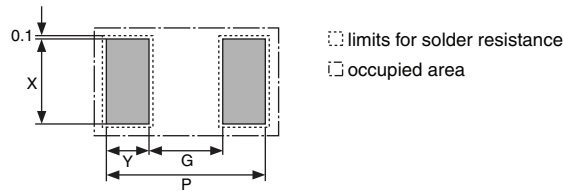
PACKAGING			
MODEL	REEL		
	DIAMETER	PIECES/REEL	CODE
DPS 0603	180 mm/7"	1000	P1
	180 mm/7"	5000	P5
DPS 1206	180 mm/7"	1000	P1
	180 mm/7"	5000	P5

DIMENSIONS



DIMENSIONS - dew sensor types, mass and relevant physical dimensions							
TYPE	H (mm)	L (mm)	W (mm)	WT (mm)	T1 (mm)	T2 (mm)	MASS (mg)
DPS 0603	0.45 + 0.1/- 0.05	1.55 ± 0.05	0.85 ± 0.1	> 75 % of W	0.3 + 0.15/- 0.2	0.3 + 0.15/- 0.2	1.9
DPS 1206	0.55 ± 0.1	3.2 + 0.1/- 0.2	1.6 ± 0.15	> 75 % of W	0.5 ± 0.25	0.5 ± 0.25	9.2

PATTERN STYLES FOR CHIP DEW SENSORS



RECOMMENDED SOLDER PAD DIMENSIONS FOR CHIP DEW SENSORS				
TYPE	G (mm)	Y (mm)	X (mm)	Z (mm)
DPS 0603	0.5	0.95	0.95	2.4
DPS 1206	1.5	1.25	1.75	4.0

THEORY OF OPERATION

The sensor changes its impedance and its capacity due to the absorption and adsorption of water molecules on its active surface. Condensation nuclei on the active surface promote the adsorption of water molecules and ensure an early stage of dew detection. As soon as there is dew on top of the sensor its electric characteristic changes significantly. This results in a reliable detection of dew.

PRODUCTION

Production is strictly controlled and follows an extensive set of instructions established for reproducibility. A homogeneous metal oxide film is deposited on a high grade ceramic substrate (96 % Al₂O₃). A special laser is used to generate the sensitive element structure followed by a conditioning of the sensor surface. The terminations receive a final pure tin on nickel plating.

QUALITY

After passing through the factory calibration process 100 % of the individual sensors are verified by an extensive testing procedure. Only accepted products are laid directly into the paper tape in accordance with IEC 60286-3. The immunity of the plating against tin whisker growth has been proven under extensive testing.

STORAGE

The sensors should be stored in original packing according to IEC 60115-1. Solderability is specified for 2 years after production or re-qualification. The permitted storage time is 20 years.

ASSEMBLY

The sensors are suitable for automatic reflow soldering. They are resistant to all cleaning solvents commonly used in the electronics industry, including alcohols, esters and aqueous solutions. They are RoHS compliant; the pure tin plating provides compatibility with lead (Pb)-free and lead-containing soldering processes.

PRECAUTION & ENVIRONMENTAL CONDITION

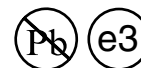
The environment of the sensor application should be without any corrosive substances. Contamination, e.g. grease, fingerprints etc. can influence and limit the performance of the sensor. In case of particle contamination it can be removed by dry pressured air or by using ethanol or isopropyl alcohol for fingerprints.

DIRECTIVES

All products comply with the GADSL⁽¹⁾ and the CEFIC-EECA-EICTA⁽²⁾ list of legal restrictions on hazardous substances. This includes full compliance with the following directives:

- 2000/53/EC End Vehicle life Directive (ELV) and Annex II (ELV II)
- 2002/95/EC Restriction of the use of Hazardous Substances directive (RoHS)
- 2002/96/EC Waste Electrical and Electronic Equipment Directive (WEEE)

APPROVALS



Pb-free Identification on the Package Label

Notes:

⁽¹⁾ Global Automotive Declarable Substance List, see www.gadsl.org

⁽²⁾ CEFIC (European Chemical Industry Council), EECA (European Electronic Component Manufactures Association), EICTA (European trade organisation representing the information and communications technology and consumer electronics), see www.eicta.org → issues → environment policy → chemicals → chemicals for electronics

FUNCTIONAL PERFORMANCE

Simple read out electronics for a variable capacitor are based on charge/discharge-cycles. For this purpose the Vishay application test circuit comprises a well-known 555 timer module. The functional block diagram of the test circuit is shown in Figure 1.

In the circuit both the resistance and the capacitance of the sensor is transferred into a frequency signal, which is temperature independent. The circuit uses the characteristic difference in electronic behaviour between the two states “no dew” and “dew” on the sensors surface.

The 555 timer module delivers a frequency signal which depends on the capacity of the dew sensor and therefore on the relative humidity value. Up to approximately 98 % RH this output signal has an almost constant frequency of about 80 kHz with a voltage amplitude of 5 V. If the relative humidity exceeds 98 % the frequency changes significantly and reaches a value below 10 Hz at

100 % RH allowing a precise detection of the occurrence of dew.

The AC signal is converted to a DC voltage by an active rectifier. By choosing an adequate threshold, a comparator element discriminates between the two states “dew” and “no dew” on the sensor’s surface, displayed in the test circuit by “LED 1” and “LED 2”. A typical application is to protect hard disk drives, camcorders, or other sensitive electronic components from moisture failure.

In Figure 2, the frequency output of the 555 timer module is displayed versus relative humidity at different ambient temperatures. Below 98 % RH the frequency level is about 80 kHz. As soon as the sensor’s surface is dewed, the frequency signal drops to a level below 10 Hz. This well-defined frequency signal is independent from temperature within a range from 0 °C up to 85 °C.

For further information please refer to the Technical Note for the Chip Dew Sensors of the Vishay DPS Series.

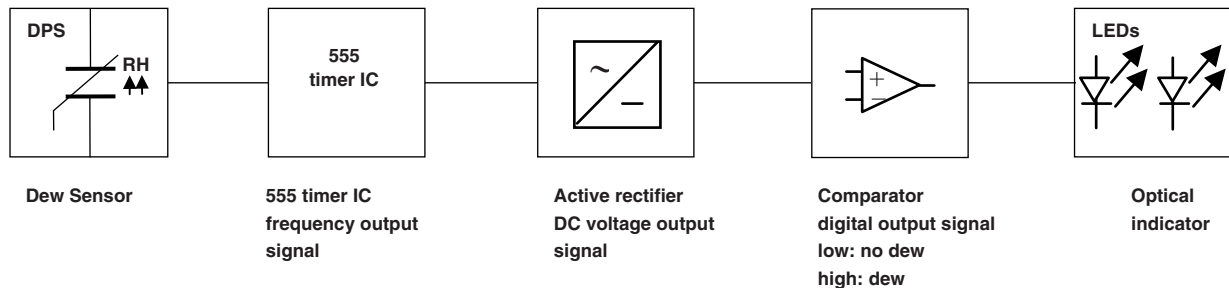


Figure 1: Functional block diagram of Vishay application test circuit

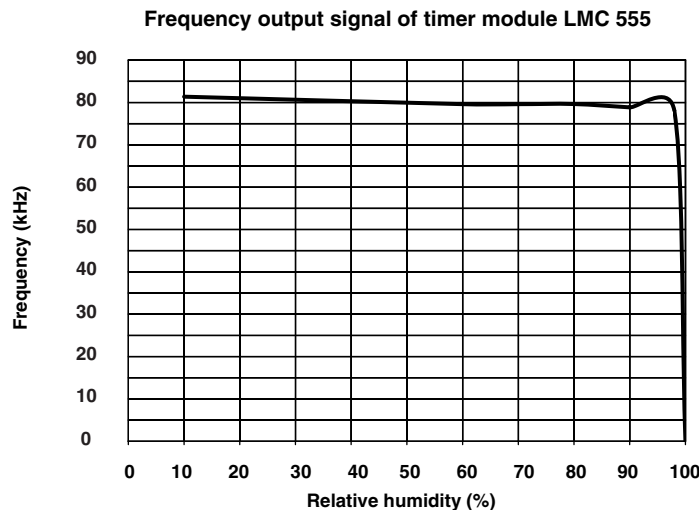


Fig.2 DPS 0603; typical characteristic correlation of frequency output signal of Vishay application test circuit and relative humidity