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Micro-electromechanical systems (MEMS) technology - MEMS silicon piezoresistive pressure and temperature composite sensor chips

微机电系统（MEMS）技术 MEMS硅压阻温压复合压力传感器芯片

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5.1 Measurement Range

5.1.1 Pressure Measurement Range Unless otherwise specified, the pressure measurement range of the sensor chip should preferably be selected from the following numerical systems. ±1.0x10^n, ±1.6x10^n, ±2.0x 10n, ±2.5x10n, ±3.0x10n, ±4.0x10n, ±5.0x10n, ±6.0x10n, ±8.0x10n. Where n is an integer. The units for the measurement range can be. Pa, hPa, kPa, MPa.

5.1.2 Temperature Measurement Range Unless otherwise specified, the lower limit of the temperature measurement range of a PN junction temperature sensor chip should preferably be selected from the following number system. -55 °C, -45°C, -40°C, -30°C, -20°C, -10°C, 0°C. Unless otherwise specified, the upper limit of the temperature

measurement range of a PN junction temperature sensor chip should preferably be selected from the following numerical series. 50°C, 60°C, 70°C, 85°C, 100°C, 125°C, 150°C. Unless otherwise specified, the lower limit of the temperature measurement range of a resistance temperature sensor chip should preferably be selected from the following numerical series. -55 °C, -45°C, -40°C, -30°C, -20°C, -10°C, 0°C. Unless otherwise specified, the upper limit of the temperature measurement range of a resistance temperature sensor chip should preferably be selected from the following numerical series. 50°C, 60°C, 70°C, 85°C, 100°C, 125°C, 150°C, 175°C,.200°C, 250°C.

5.2 Operating Temperature Range Unless otherwise specified, the lower limit of the operating temperature range should be. -55°C, -45°C, -40°C, -30°C, -20°C, -10°C. 0°C. Unless otherwise specified, the upper limit of the operating temperature range should be. 50°C, 60°C, 70°C, 85°C, 100°C, 125°C, 150°C. 175°C,.200°C, 250°C.

5.3 Compensation Temperature Range Unless otherwise specified, the lower limit of the pressure compensation temperature range for the sensor chip should be. -55 °C, -45 °C, -40 °C. -30°C, -20°C, -10°C, 0°C. Unless otherwise specified, the upper limit of the pressure compensation temperature range for sensor chips should be. 50°C, 60°C, 70°C, 85°C, 100°C. 125°C, 150°C, 175°C,.200°C, 250°C.

5.4 Excitation Power Supply

5.4.1 Constant Current Excitation When the sensor chip uses constant current excitation for voltage measurement, the value of the DC excitation current should not exceed 8mA. When the sensor chip uses constant current excitation for temperature measurement, the value of the DC excitation current should not exceed 2mA.

5.4.2 Constant Voltage Excitation When the sensor chip uses constant voltage excitation for voltage measurement, the DC excitation voltage should preferably be selected from the following values. 1.6VDC, 3VDC, 3.3VDC. 5VDC, 6VDC, 9VDC, 10VDC, 12VDC, 15VDC, 18VDC, 24VDC, 36VDC. When the sensor chip uses constant voltage excitation for temperature measurement, the operating current should not exceed 2mA.

6 Requirements

6.1 General Requirements The sensor chip shall comply with the provisions of this document and the relevant product technical conditions (detailed specifications). When the requirements of this document differ from the product technical conditions... In case of discrepancies between the requirements of the parts (detailed specifications) and the product technical conditions (detailed specifications), the product technical conditions (detailed specifications) shall prevail.

6.2 Basic Performance

6.2.1 Electrical connection for pressure testing The electrical connection method for voltage measurement using a sensor chip should be selected from the following. closed-loop, semi-open-loop, or open-loop. (See diagram for voltage measurement electrical connection method.) As shown in Figure 5.

b) Semi-open loop

6.2.2 Appearance

6.2.2.1 Front The front of the sensor chip adopts the following specifications.

a) Defects, cracks, and scratches should not extend to an area within 25 μm of the effective pattern and sensitive diaphragm;

b) Defects, cracks, or scratches. Cracks should not extend to or come into contact with the metallization area of the sensor chip;

c) The passivation layer should not have pits or pinholes within 25μm of the varistor;

d) If the metallization layer is damaged and the underlying passivation layer is exposed, the width of the undamaged metal strip should be greater than the nominal metal strip width. 50%;

e) The size of any extraneous material adhering to the surface of the sensor chip should not exceed 25 μm in any direction. The area occupied by excess material attached to the surface should not exceed 10% of the effective area of the graphic.

6.2.2.2 Back side Where applicable, the following specifications shall apply to the back of the sensor chip.

a) The sealing surface should be closed;

b) Static sealing defects should not affect the sealing of the nominal sealing surface;

c) There should be no excess material on the sensitive membrane.

6.2.3 Leakage Current The permissible leakage current between the sensor chip's sensing elements (including temperature sensing elements and varistors) and the silicon substrate under a specified bias voltage. The current should not exceed 15 μA. The bias voltage should be selected from the following values. 10VDC, 15VDC, 20VDC, 25VDC, 30VDC, 35VDC, 40VDC.

6.2.4 Breakdown Voltage For PN junction isolated sensor chips, the sensing elements (including temperature sensing elements and varistors) of the sensor chip are separated from the silicon substrate by... Under the maximum allowable test current, its breakdown voltage should not be less than the specified minimum breakdown voltage. The test current should be selected from the following values. 2μA, 5μA, 10μA, 20μA, 50μA. The specified minimum breakdown voltage should be selected from the following values. 10VDC, 15VDC,

20VDC, 25VDC, 30VDC. 40VDC, 50VDC, 80VDC, 100VDC.

6.2.5 Isolation Voltage For dielectric-isolated sensor chips, the sensing elements (including temperature sensing elements and varistors) of the sensor chip are separated from the silicon substrate. Under the maximum permissible test current, its isolation voltage should not be less than the specified minimum isolation voltage. The test current should be selected from the following values. 1μA, 2μA, 5μA, 10μA. The minimum isolation voltage should be selected from the following values. 10VDC, 15VDC, 20VDC, 25VDC, 30VDC, 40VDC. 50VDC, 80VDC, 100VDC.

6.3 Basic Characteristics of Sensor Chip Pressure Measurement

6.3.1 Varistor The nominal resistance value of the varistor for the sensor chip should be selected from the following values. 350Omega, 600Omega, 1kOmega, 2kOmega, 3kOmega, 4kOmega. 5kOmega, 8kOmega, 10kOmega, 12.5kOmega, 15kOmega, 20kOmega, 25kOmega. The tolerance of the resistance value of a varistor is expressed as a percentage of the resistance value, and the following values should be used. ±10%, ±15%, ±20%, ±25%.

6.3.2 Zero-point offset voltage For an open-reference pressure-sensing cavity sensor chip, under a specified excitation power supply, the zero-point offset voltage value measured by the sensor chip is... The values should be selected from the following. ±1mV, ±5mV, ±10mV, ±15mV, ±20mV, ±30mV, ±50mV.

6.3.3 Offset Voltage at Normal Voltage For a closed-type reference pressure-sensing cavity sensor chip, under a specified excitation power supply, the constant pressure offset voltage value measured by the sensor chip is... The values should be selected from the following. ±1mV, ±5mV, ±10mV, ±15mV, ±20mV, ±30mV, ±50mV. <=100mV, <=150mV.

6.3.4 Static Performance

6.3.4.1 Full-scale output Under the specified excitation power supply, the full-scale output value of the sensor chip should be selected from the following values. 30mV, 40mV, 60mV, 80mV, 100mV, 120mV, 150mV,.200mV, 300mV, 400mV, 500mV. The error range should be selected from the following values. ±10%, ±15%, ±20%, ±25%.

6.3.4.2 Nonlinearity The nonlinearity of the sensor chip's voltage measurement should comply with the product technical specifications (detailed specifications) and should be selected from the following values. <=0.03%FS. <=0.05%FS, <=0.15%FS, <=0.30%FS, <=0.50%FS, <=1.50%FS.

6.3.4.3 Hysteresis The hysteresis of the sensor chip for voltage measurement should comply with the product technical specifications (detailed specifications) and should be selected from the following values. <=0.02%FS. <=0.05%FS, <=0.10%FS, <=0.20%FS, <=0.50%FS, <=1.00%FS.