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Microwave hybrid integrated circuits - Synthesized frequency sources

微波混合集成电路 合成频率源

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1 Scope

This document sets the definition, the technical requirements, the inspection rules and the marking of synthesized frequency sources and describes the test methods.

This document applies to synthesized frequency sources designed and made with microwave hybrid integrated circuit technology.

3 Terms and definitions

The terms and definitions given in GB/T 9178-1988 and the following apply to this document.

3.1 synthesized frequency source. A frequency source produced by frequency synthesis technology, that is, by performing some mathematical operation on a reference frequency to obtain a large number of signals of the same accuracy as that reference frequency, from which the frequency actually needed is then selected. Note: according to the synthesis principle used, synthesized frequency sources fall mainly into three kinds, direct synthesis, phase-locked synthesis and direct digital synthesis.

4 Parameter classification and characteristic requirements

4.1 Static parameter. The static parameter of a synthesized frequency source shall include the supply current.

4.2 Dynamic parameters. The dynamic parameters of a synthesized frequency source are as follows: a) output frequency; b) output power; c) harmonic suppression; d) spurious suppression; e) single sideband phase noise; f) power flatness, where specified; g) power

stability with temperature, where specified; h) frequency step, where specified; i) frequency stability with time, where specified; j) frequency stability with temperature, where specified; k) frequency accuracy, where specified; l) frequency hopping time, where specified; m) isolation, where specified; n) settling time, where specified.

4.3 Derating. Shall meet 2.2 of GB/T 11498-2018.

4.4 Packaging characteristics. For ease of use, 2.3.1 of GB/T 11498-2018 shall be followed. There shall be an outline drawing of the circuit so that it can be identified easily and compared with other circuits. Normally the length, width and height of the case and the spacing of the leads shall be given; for a cylindrical case, the diameter and length of the case and the diameter of the leads shall be given.

4.5 Mounting. The mounting requirements shall meet 2.3.2 of GB/T 11498-2018.

4.6 Other characteristics. For ease of use, the following applicable characteristics shall be specified: a) operating temperature range, which unless otherwise specified is normally 0 °C to 70 °C, minus 40 °C to 85 °C, minus 55 °C to 85 °C or minus 55 °C to 125 °C, or as given in 2.5 of GB/T 8976-1996; b) storage temperature range, which unless otherwise specified is normally minus 65 °C to 150 °C; c) electrostatic discharge sensitivity class; d) a brief description of the circuit process, type or function; e) a description of the typical or special construction, where applicable; f) the quality assessment level, and where the circuit uses unqualified add-on components, the assessment level shall carry the suffix N in accordance with GB/T 13062-2018.

5 Test methods for electrical characteristics

5.1 General environmental conditions. Unless otherwise specified, the standard atmospheric conditions for testing shall meet 4.2.1 of GB/T 8976-1996.

5.2 Static parameter. Supply current is measured as specified in 5.13 of GB/T 35002-2018.

5.3 Dynamic parameters. Output frequency is measured as specified in 5.1, output power as in 5.6, harmonic suppression as in 5.9, spurious suppression as in 5.10 and single sideband phase noise as in 5.11 of GB/T 35002-2018. Where specified, power flatness is measured as in 5.7, power stability with temperature as in 5.8, frequency step as in 5.2, frequency stability with time as in 5.3, frequency stability with temperature as in 5.4, frequency accuracy as in 5.5 and frequency hopping time as in 5.12 of the same standard.

5.3.13 Isolation, where specified. The power difference between the outputs of the two frequency source channels, measured with a spectrum analyser, is the isolation.

5.3.14 Settling time, where specified. The time from the moment the supply voltage has settled after switch-on to the moment the output frequency has settled is measured.

6 Inspection rules

6.1 General. A product shall pass inspection before it leaves the works and shall be accompanied by a document or mark certifying that its quality conforms. Where a requirement differs from GB/T 11498-2018 or GB/T 8976-1996, this document governs.

6.2 Inspection requirements. The qualification approval procedure shall meet GB/T 11498-2018 and 6.4 of this document. The inspection level, acceptance quality limit, lot tolerance percent defective, fixed sample size and test period shall follow Table 7 of GB/T 11498-2018 and shall be written into the product detail specification. In Tables 1 to 6 a cross marks a required item and a dash a non-required item; p is the period in months, n the sample size, c the acceptance number, that is the number of nonconforming items allowed, D destructive and ND non-destructive.

6.3 Screening. Before being submitted to qualification inspection and quality conformance inspection, a product shall be screened as set out in Table 1. The screening sequence covers, in order, visual inspection before sealing, high temperature storage, rapid change of temperature, constant acceleration, seal test, an electrical test before burn-in on the electrical parameters of 5.2 and 5.3 with rejection of nonconforming items, burn-in as required by the detail specification, and an electrical test after burn-in in which nonconforming items are again rejected and the lot is rejected outright where more than 10 % fail. The table assigns the required items and the test conditions to inspection groups A to E; the scan of that assignment is not legible enough for the individual conditions to be attributed with confidence. Note 1: screening is carried out before the group A, group B and group C inspections. Note 2: additional post-screening tests may be required by the detail specification of a particular type. Footnote a: unless otherwise specified in the product detail specification, the item does not normally apply to non-hermetic devices. Footnote b: unless otherwise specified in the product detail specification, the measured results shall be recorded.

6.4 Qualification approval. The qualification approval tests and procedure are given in 3.5 of GB/T 8976-1996. The qualification approval procedure based on a fixed sample size is given in 3.2 of GB/T 11498-2018 together with Table 2 of this document. The quality conformance inspection procedure based on lot-by-lot and periodic testing is given in Tables 6 and 7 of GB/T 11498-2018. The qualification approval procedure table for a fixed sample size and the quality conformance inspection procedure table for lot-by-lot and periodic inspection together set the minimum test programme for a finished circuit. The manufacturer may choose assessment level K, L or M in accordance with 3.2 of GB/T 11498-2018. Additional tests needed for a particular application shall be set out in the product detail specification, which shall also state the electrical limits to be measured after environmental testing. The sample size and acceptance number for qualification approval shall follow 3.2.1 and Table 6 of GB/T 11498-2018; where a group is added to the

inspection table, the number of circuits required for group 0 shall be increased by the number the added group requires.

6.4 continued. Table 2 sets the qualification approval test programme. Group 0 covers external visual inspection and marking, dimensions, static characteristics at 25 °C, static characteristics at the highest and at the lowest operating temperature on the same subgroup, and dynamic characteristics at 25 °C unless otherwise specified. Group 1 covers lead strength, solderability and resistance to soldering heat. Group 2 covers rapid change of temperature, cyclic damp heat for non-hermetic devices and seal test for hermetic devices, and shock or vibration with constant acceleration for hermetic devices. Group 3 covers electrical endurance, high temperature storage, steady state damp heat for non-hermetic circuits, resistance of the marking to solvents, and flammability, given for information only. Test durations and cycle counts differ by assessment level K, L and M and by the product detail specification.

6.5 Quality conformance inspection. Quality conformance inspection shall meet 3.2.2 of GB/T 11498-2018, covering sampling, period, conditions and requirements, and is divided into lot-by-lot and periodic inspection. Where required, all circuits to be delivered shall be screened, the screening tests being those of Table 1. The quality conformance inspections are set out in Tables 3 to 6. An inspection lot is drawn from products made within one week, or from products made in another period declared by the manufacturer, the period being at most one month. Table 3 sets the group A lot-by-lot inspection, covering external visual inspection and marking and the dynamic and static electrical characteristics at 25 °C and, except for level M products, at the highest and lowest operating temperature. Table 4 sets the group B lot-by-lot inspection, covering dimensions, verification of electrical parameter ratings, solderability and electrical endurance. Table 5 sets the group C periodic inspection, covering dimensions, electrical characteristics at 25 °C and at the highest and lowest operating temperature, verification of instantaneous energy ratings, lead strength, resistance to soldering heat, rapid change of temperature with the associated seal and electrical tests, constant acceleration for hermetic devices, steady state damp heat, electrical endurance and high temperature storage, and durability of the marking. Table 6 sets the group D periodic inspection, covering electrical endurance, which does not apply to level M products.

7 Marking

The marking of the circuit and of its original packaging shall meet 2.6 of GB/T 8976-1996. The content of the marking on the circuit and on the original packaging shall be given in full in the product detail specification.

8 Ordering information

A circuit ordered to this document shall be ordered with at least the following information: a)