# 2403 260 00098

## SPEAKER-1115-4-SC-COBRA SF

The 11×15×4 mm COBRA SF is high-end miniature speaker of rectangular shape with lateral sound outlets. Specifically designed for side-firing applications, this speaker version enables a reduced application height in small, slim consumer devices, such as music phones, smartphones or tablet computers where high quality sound and maximum space efficiency are required.
In addition, COBRA SF features Knowles' advanced membrane technologies resulting in a state-of-the-art silicone membrane. This unique silicone membrane enables ultra-high excursion rates and superior robustness.

**Features:**

- Lateral sound outlet integrated in cover of speaker
- Significant height reduction for side-firing applications
- 100% in-line measurement of all specified acoustical and electrical parameters
- Pre-tested and integrated side-porting acoustics
- Manufactured to the highest standards
- High power handling capacity of 1000mW

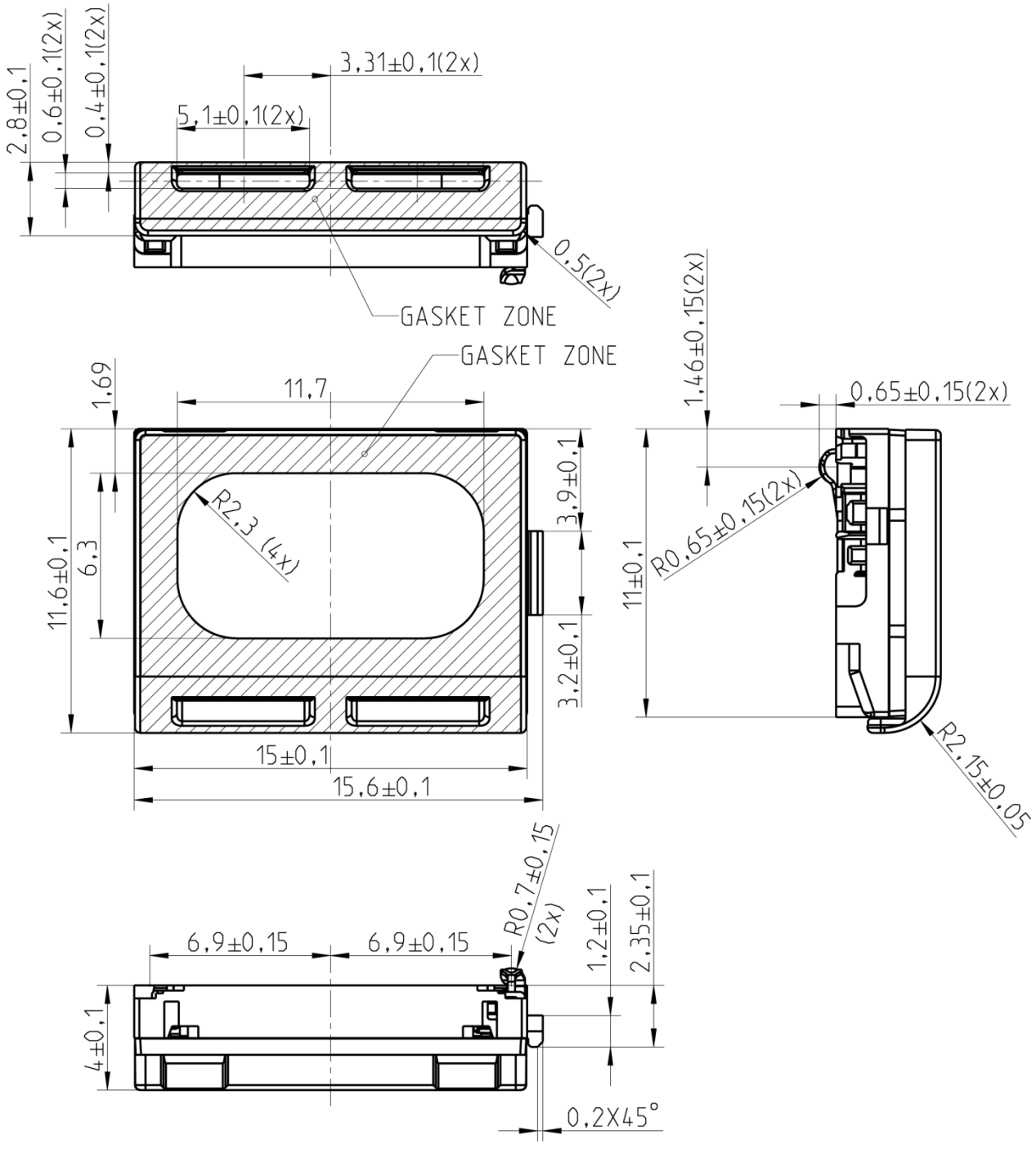
# Contents

# 1. Theory of operation

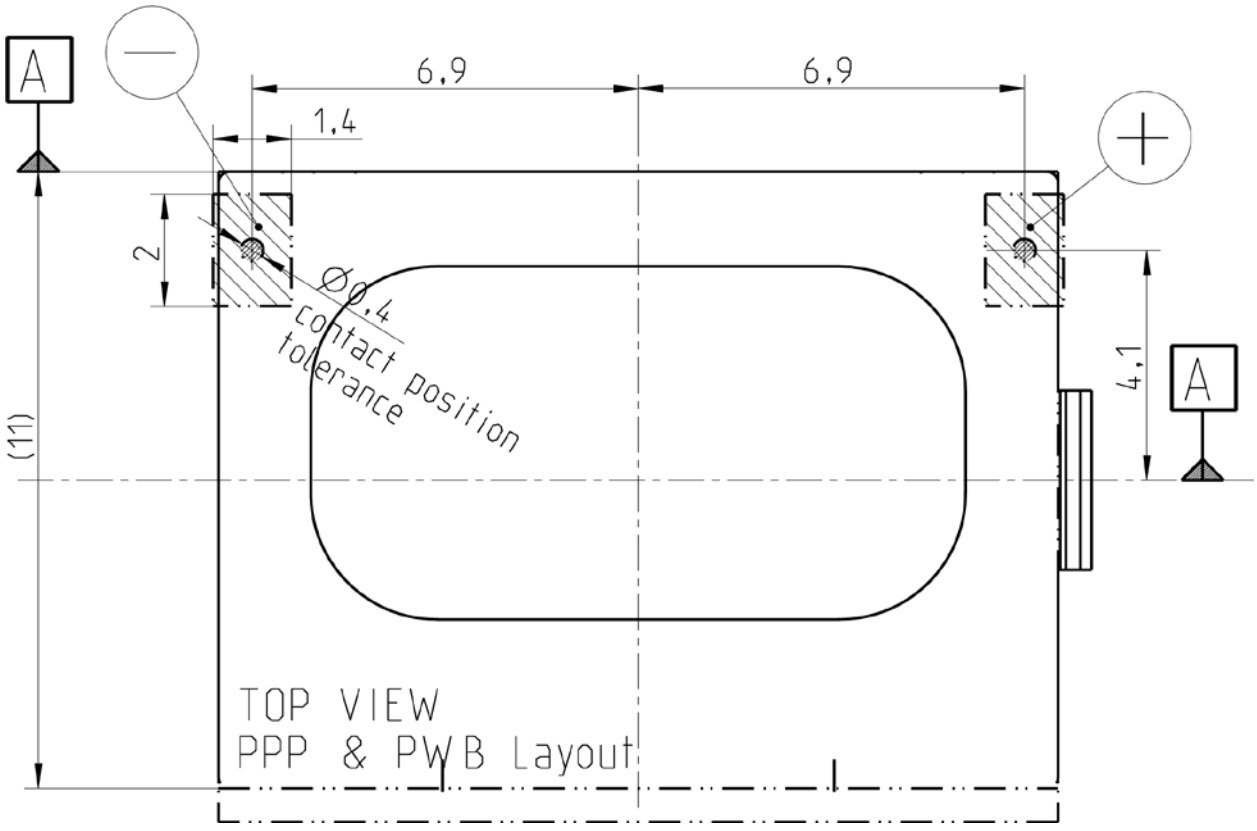
SPEAKER-1115-4-SC-COBRA SF is an electrodynamic transducer, designed to translate electrical analog signals into acoustic waves. The input signal is fed into a coil which is exposed to a permanent magnetic field and where a membrane is attached to. Through the principle of the resulting electromagnetic force, the membrane is moved according to the contents of the input signal and thus emitting sound by the air shifted.

# 2. Mechanical Layout and Dimensions

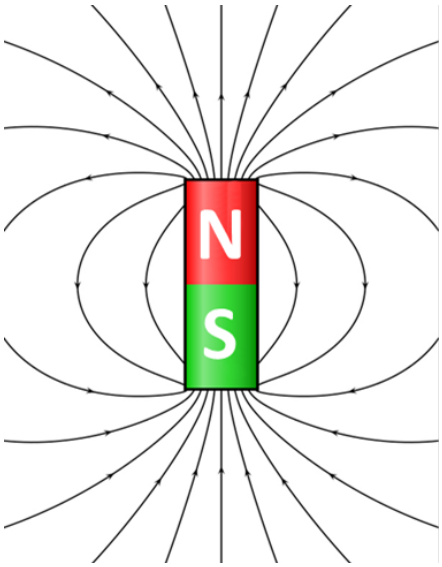
## 2.1. Main dimensions

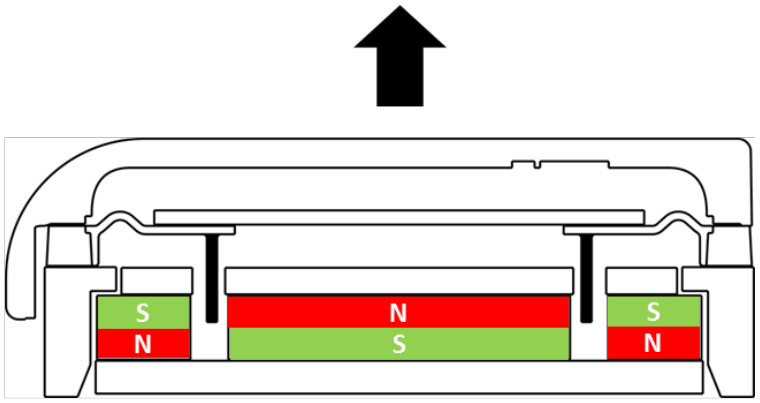


## 2.2. PWB layout & electric polarity



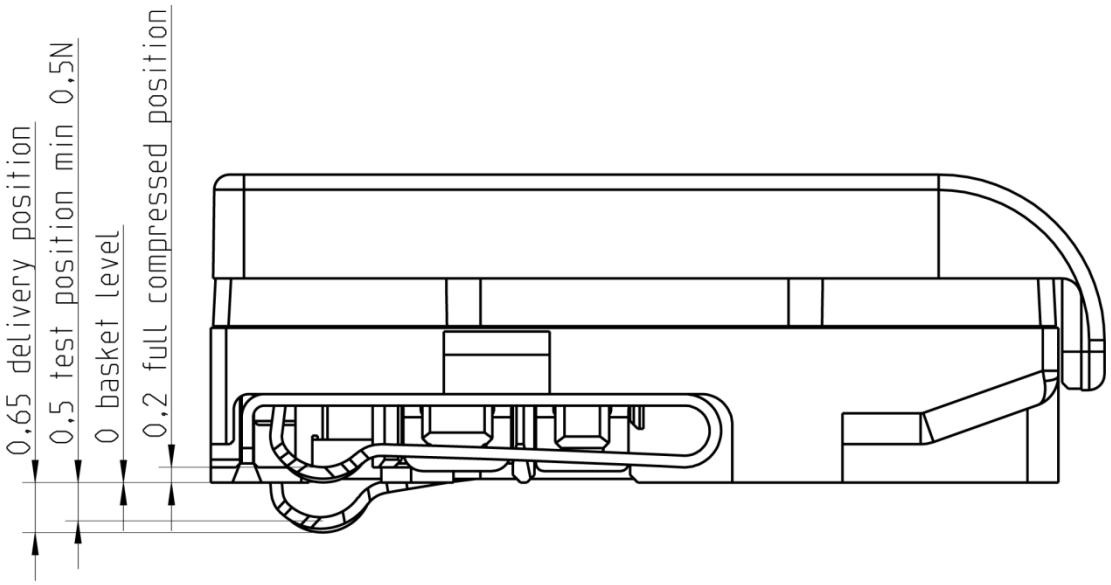

## 2.3. Magnetic polarity

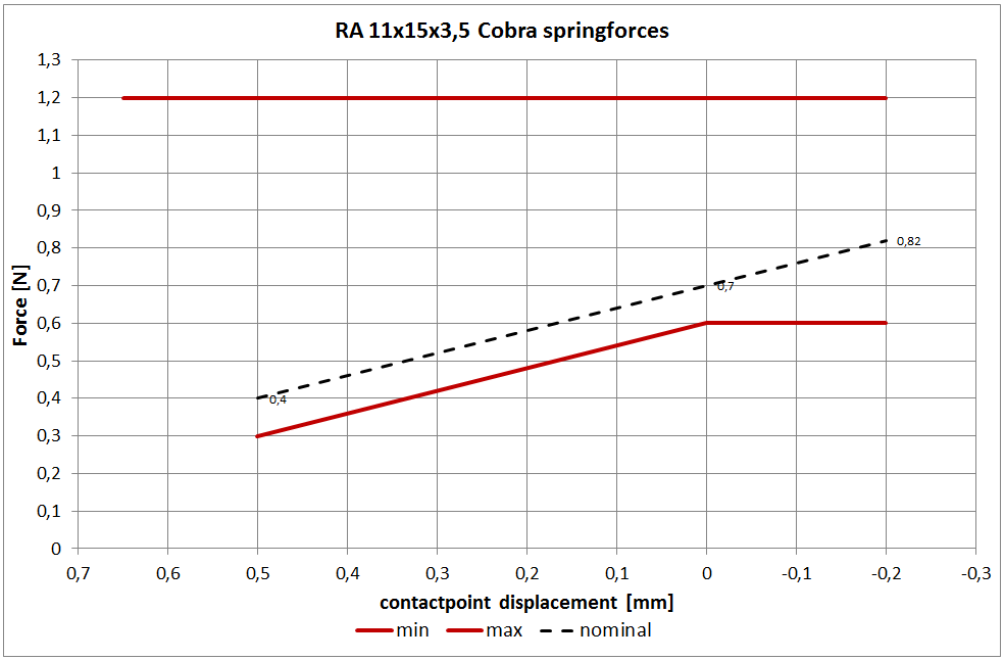



Positive voltage on pin +
Moves the membrane in direction of arrow

## 2.4. Spring force

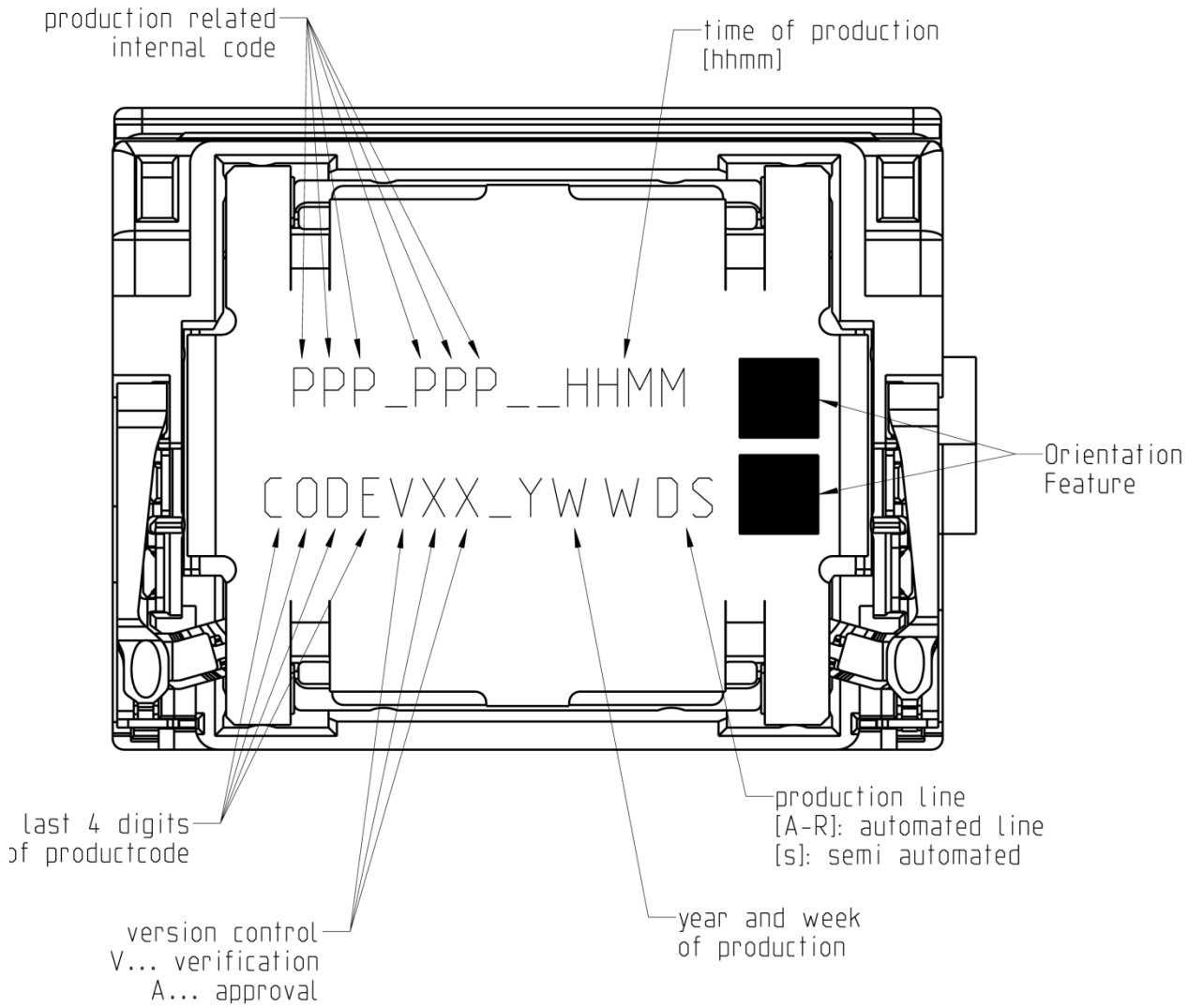



| SPRING FORCE TABLE | | |
|---|---|---|
| Force at Basket level | 0.0 mm | min. 0.6 N |
| Force at Start Working position | 0.5 mm | min. 0.3 N |
| uncompressed (delivery position) | 0.65 ±0.15mm | 0.0 N |
| Force at PPP level | -0.2 mm | max 1.2 N |

## 2.5. Part marking/labeling

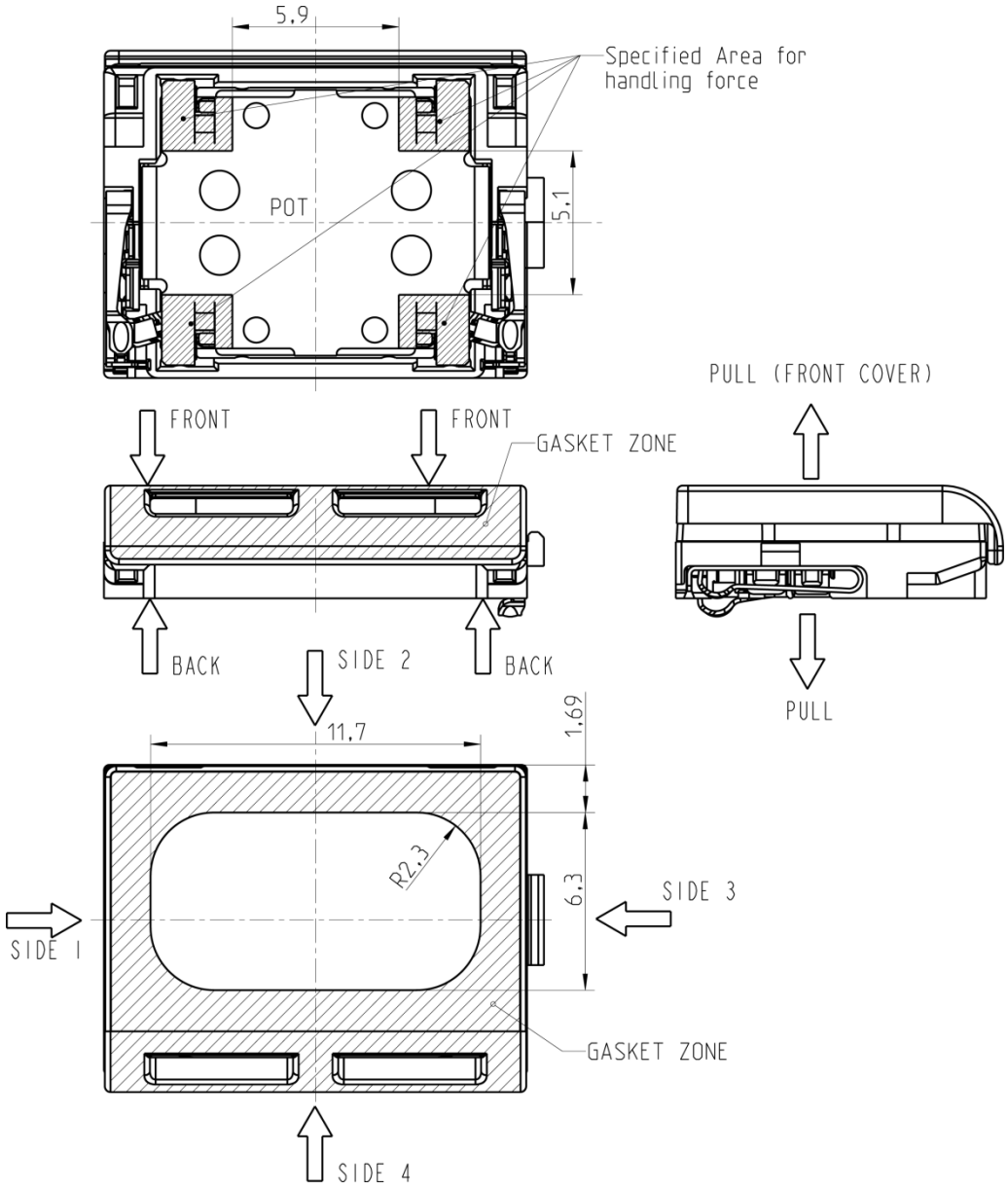
The samples have a serial number on bottom (pot) side



## 2.6. Material list

| | |
|---|---|
| Material of basket: | Polycarbonate |
| Material of membrane: | Silicone |
| Material of membrane frame | Polybutylene Terephthalate (PBT) |
| Material of pot: | soft magnetic Iron |
| Material of magnet: | Nd Fe B |
| Material of contact | CrNi-Steel, gold plated |
| Material of cover: | Polycarbonate |
| Dimensions (in mm): | 11 × 15 × 4 |
| Mass: | 1.56 g |

## 2.7. Force on component

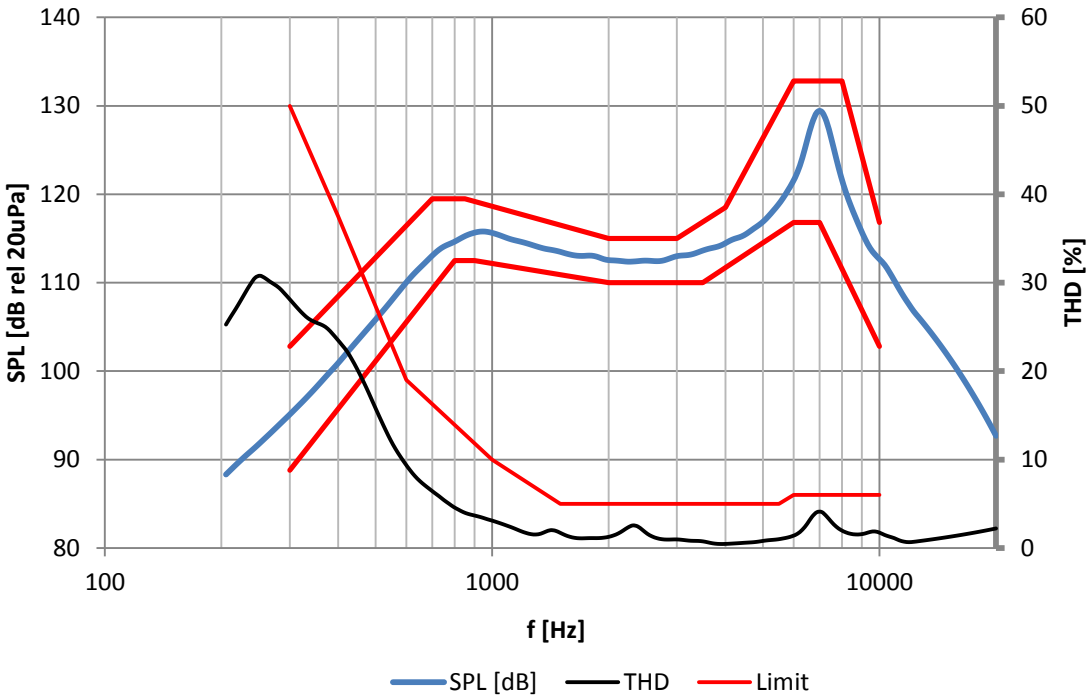



| FORCES ON DIFFERENT STATE OF COMPONENT | | | |
|---|---|---|---|
| STATE | MIN. SURFACE OF PRESSURE [mm²] | MAX. PERMANENT FORCE [N] | MAX. HANDLING FORCE [N] |
| FROM FRONT TO BACK (GASKET AREA) | - | 10 | 15 |
| FROM SIDE 1 TO SIDE 3 | 3 | 10 | 15 |
| FROM SIDE 2 TO SIDE 4 | 10 | 10 | 15 |
| TO POT | - | 10 | 15 |
| TO MEMBRANE | - | 0 | 0 |
| PULL OFF FORCE | - | 0 | 20 |

# 3. Electrical and Acoustical Specifications

## 3.1. Frequency response

Typical frequency response measured on baffle according to chapter 3.5
(distance d = 1cm, p = 1000mW, 1cm³)




| Tolerance window | | | | |
|---|---|---|---|---|
| Frequency Response | | | THD | |
| f [Hz] | lower limit (floating) [dB] | upper limit (floating) [dB] | f [Hz] | upper limit [%] |
| 300 | 88.8 | 102.8 | 300 | 50 |
| 700 | - | 119.5 | 450 | 37.5 |
| 800 | 112.5 | - | 650 | 19 |
| 850 | - | 119.5 | 1000 | 10 |
| 900 | 112.5 | - | 1300 | 5 |
| 2000 | 110 | 115 | 5500 | 5 |
| 3000 | - | 115 | 6000 | 6 |
| 3500 | 110 | - | 10000 | 6 |
| 4000 | - | 118.5 | | |
| 6000 | 116.8 | 132.8 | | |
| 7000 | 116.8 | - | | |
| 8000 | - | 132.8 | | |
| 10000 | 102.8 | 116.8 | | |

## 3.2. Electro-acoustic parameters

Loudspeaker mounted in adapter acc. to 3.5.

| | | |
|---|---|---|
| 1. Rated impedance | Z: | 6Ω |
| 2. Voice coil DC resistance | R: | 5.4Ω±10% |
| 3. Resonance frequency (measured @1cm³, 1000mW) | $f_0$: | 780Hz±10% |
| 4. Maximum usable excursion (peak-to-peak) | $x_{max}$: | 0.74$mm_{p-p}$ |
| 5. Nominal characteristic sensitivity (measured at 1W in 1cm, calculated to 1m average from 2kHz to 3kHz, thermal compression included) | | 73.5±2.5dB |
| 5.1 Measured characteristic sensitivity (at 1W in 10cm) average from 2kHz to 3kHz | | 86.5±2dB |
| 6. THD | | according chapter 3.1 |
| 7. Rub & buzz | | no audible Rub & Buzz |

All acoustic measurements at 23±2°C

## 3.3. Power handling

Speaker mounted in 1cm³ test device (open front)

| | | |
|---|---|---|
| 1. Max sine Power | | 1000mW (RMS) |
| 2. Max short term power (pink noise, 2nd order high pass filtered, -3dB at 1.2kHz, crest factor 2) | (70°C, 1 sec. ON / 60sec. OFF) | 1200mW (RMS) |
| 3. Max continuous power (pink noise, 2nd order high pass filtered, -3dB at 800Hz, crest factor 2) | (70°C, 500h) | 1000mW (RMS) |

## 3.4. Measured parameters

### 3.4.1. Sensitivity

SPL is expressed in dB rel 20µPa, computed according to IEC 268-5.
Measurement set up and parameters according chapter 3.5.
This test is performed for 100% of products in the production line.

### 3.4.2. Frequency response

Frequency response is measured according test set up in chapter 3.3 data sheet and checked against the tolerance window defined in chapter 3.5. This Test is performed for 100% of products in the production line.

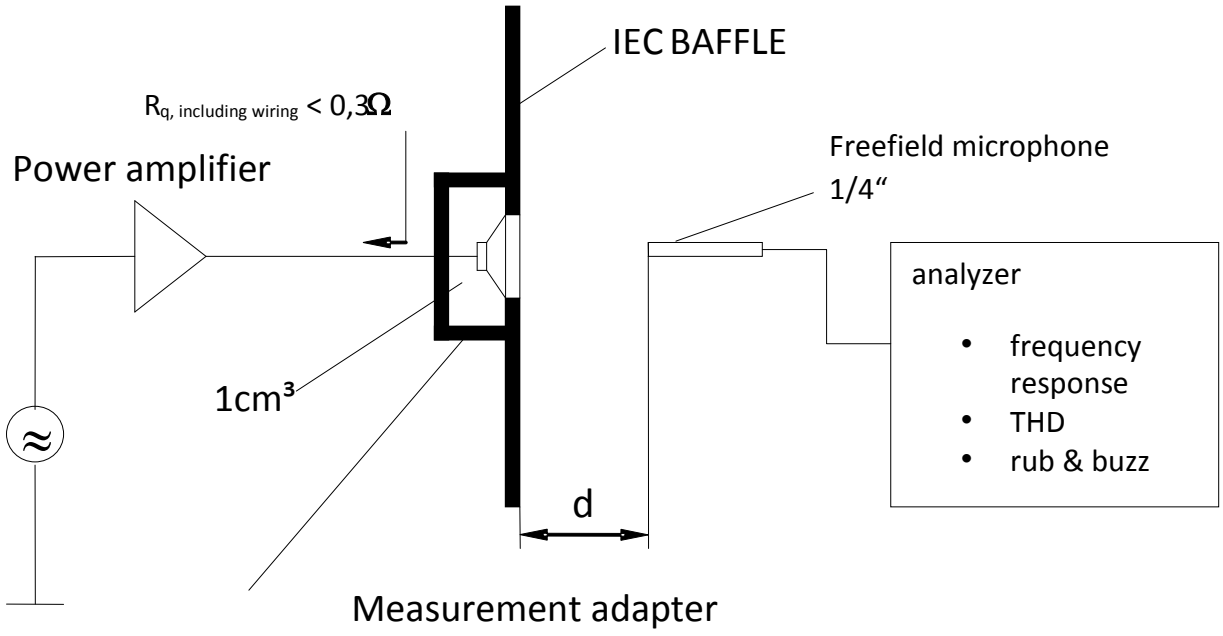
### 3.4.3. Total harmonic distortion (THD)

Is measured according IEEE and test set up in chapter 3.5. This test is performed for 100% of products in the production line.

### 3.4.4. Rub & buzz

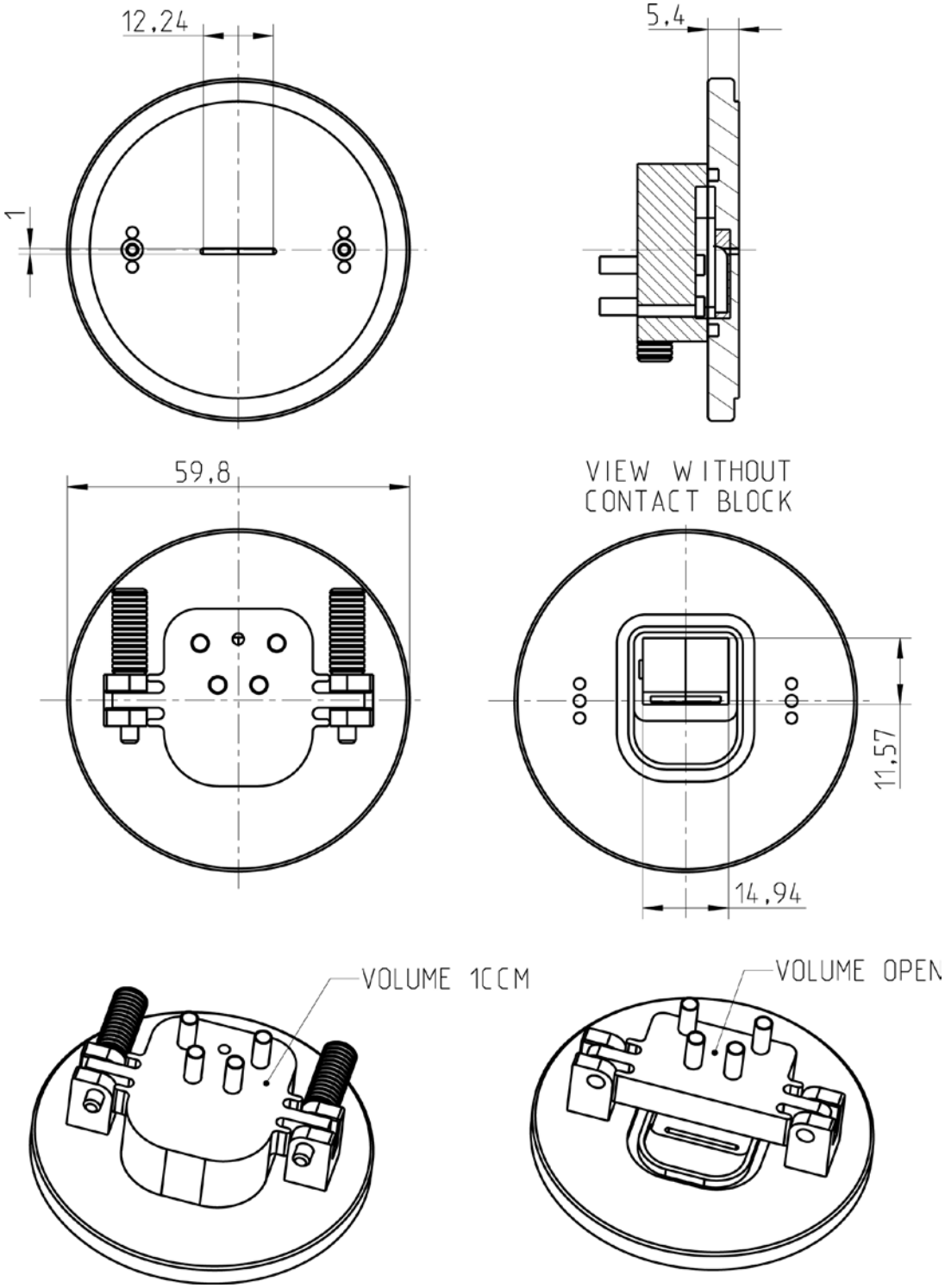
Rub & buzz will be measured in the Inline-measuring device with a sinusoidal sweep. Rub and buzz is defined as the maximum peak sound pressure in transmission range of the 5kHz high pass filter.
This test is performed for 100% of products in the production line.

## 3.5. Measurement setup




Measurement signal: Logarithmic sine sweep, 1.5s, 22kHz-180Hz

## 3.6. Measurement adapter



# 4. Environmental Conditions

## 4.1. Storage

The transducer fulfills the specified data after treatment according to the conditions of

| | |
|---|---|
| **ETS 300 019-2-1** | Specification of environmental test: Storage<br>Test spec. T 1.2: Weather protected, not temperature controlled storage locations. |

## 4.2. Transportation

The transducer fulfills the specified data after treatment according to the conditions of

| | |
|---|---|
| **ETS 300 019-2-2** | Specification of environmental test: Transportation<br>Test Spec. T 2.3: Public Transportation |

## 4.3. Functionality

The transducer fulfills the specified data after treatment according to the conditions of

| | |
|---|---|
| **ETS 300 019-2-5** | Specification of environmental test: Ground vehicle installations<br>Test spec. T 5.1: Protected installation |
| **ETS 300 019-2-7** | Specification of environmental test: Portable and non-stationary use<br>Test spec. T 7.3E: Partly weather protected and non-weather protected locations. |

# 5. Environmental Tests

## 5.1. Qualification tests

According to our milestone plan (Product Creation Process), a complete qualification test will be done at design validation of products manufactured under serial conditions.
1x per year and product family a requalification takes place. The qualification process covers all tests described under 4.5 and a complete inspection.

## 5.2. Reliability tests

1x per month and product family samples are taken and submitted to tests described under 4.5.2

## 5.3. Sample size, sequence

Unless otherwise stated 20 arbitrary new samples will be used to perform each test for both, qualification and requalification test as described under 4.1 and 4.2.

## 5.4. Period of shelf-life

The period of shelf-life is 2 years.

## 5.5. Testing procedures

### 5.5.1. Storage tests

#### 5.5.1.1. Cold storage test

| Parameter | Test Method and Conditions | Duration | Evaluation Standard |
|---|---|---|---|
| Low Temperature Storage (Ref. EN 60068-2-1) | -40°C rel. humidity not controlled | 168h | Measurements after 2 hours recovery time. All samples fully operable. All acoustical parameters according specification with tolerances increased by 50 %. |

#### 5.5.1.2. Heat storage test

| Parameter | Test Method and Conditions | Duration | Evaluation Standard |
|---|---|---|---|
| Dry Heat Storage (Ref. EN 60068-2-2) | +85°C rel. humidity not controlled | 168h | Measurements after 2 hours recovery time. All samples fully operable. All acoustical parameters according specification with tolerances increased by 50 %. |

### 5.5.1.3. Temperature cycle test

| Parameter | Test Method and Conditions | Duration | Evaluation Standard |
|---|---|---|---|
| Change of Temperature (Ref. EN 60068-2-14) | -40°C/+85°C<br>Transition time <3 min.<br>See Figure 4-1 below | 5 cycles<br>>2h for each temperature | Measurements after 2 hours recovery time.<br>All samples fully operable.<br>All acoustical parameters according specification with tolerances increased by 50 %. |

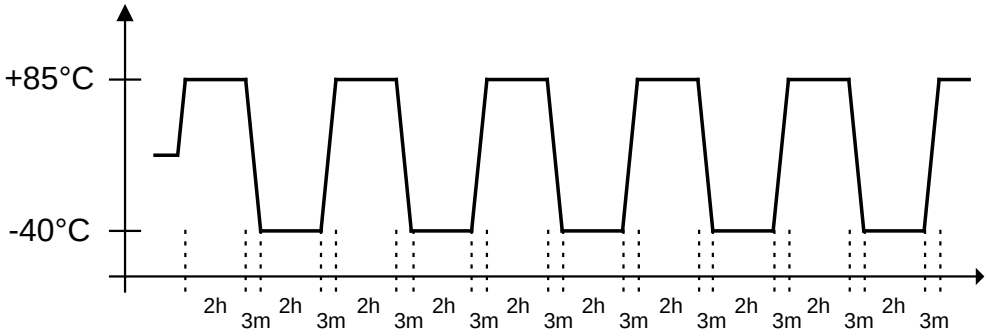



Figure 4-1: Temperature Cycle Test

### 5.5.1.4. Temperature/humidity cycle test

| Parameter | Test Method and Conditions | Duration | Evaluation Standard |
|---|---|---|---|
| Damp heat, cyclic (Ref. IEC 60068-2-30) | +25°C/+55°C<br>90% to 95% RH.<br>Temp. change time <3h<br>See Figure 4-2 below<br>Caution: no condensed water on products! | 6 cycles.<br>12h at each temperature | Measurements after 2 hours recovery time.<br>All samples fully operable.<br>All acoustical parameters according specification with tolerances increased by 50 %. |

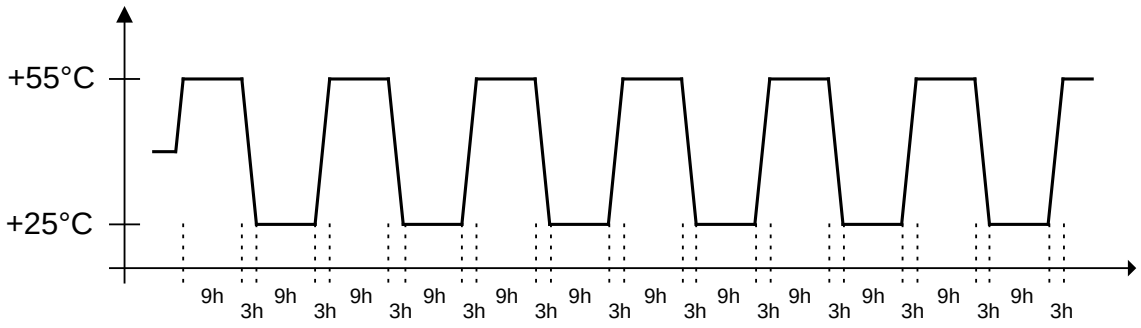



Figure 4-2: Temperature / Relative Humidity Cycle Test

### 5.5.2. Operating tests

#### 5.5.2.1. Cold operation test

| Parameter | Test Method and Conditions | Duration | Evaluation Standard |
|---|---|---|---|
| Cold Operation Test (Ref. EN 60068-2-1) | -20°C rel. humidity not controlled signal acc. chapter 3.3 | 72h | Measurements after 2 hours recovery time. All samples fully operable. THD may be increased after test. All other acoustical parameters according specification with tolerances increased by 50 %. |

#### 5.5.2.2. Heat operation test

| Parameter | Test Method and Conditions | Duration | Evaluation Standard |
|---|---|---|---|
| Dry Heat Operation (Ref. EN 60068-2-2) | +70°C rel. humidity not controlled signal acc. chapter 3.3 | 500h | Measurements after 2 hours recovery time. All samples fully operable. The allowable change in sensitivity shall not be greater than 3 dB. All other acoustical parameters according specification with tolerances increased by 50 %. |

### 5.5.3. Salt mist test

| Parameter | Test Method and Conditions | Duration | Evaluation Standard |
|---|---|---|---|
| Salt Mist (Ref. IEC60068-2-52, Kb / Severity 2 | The part must be subjected to 2 hours spray of 5% NaCl salt mist, at 35°C then be left at 40°C and 95% RH for 22h. | 3 cycles | The samples shall be washed after the test with distilled water and dried at T< 50°C. Component may have reduced performance, but must still function properly. The allowable sensitivity difference shall not be greater than ±3dB from initial sensitivity. |

### 5.5.4. Guided free fall test - protected product

| Parameter | Test Method and Conditions | Conditions / Sample size | Evaluation Standard |
|---|---|---|---|
| Mechanical shock (Ref. IEC60068-2-32 Ed), Procedure 1 | Speaker in drop test box or representative mechanics from a height of 1.5m onto concrete floor. | 30 units Two drops on each side (2x6) One drop on each edge (1x12) Two drops on each corner (2x8) (40 drops in total) | Component may have reduced performance, but must still function properly. The allowable sensitivity difference shall not be greater than ±3dB from initial sensitivity. |

### 5.5.5. Random free fall test (tumble test) – protected product

| Parameter | Test Method and Conditions | Conditions / Sample size | Evaluation Standard |
|---|---|---|---|
| Impact durability (in a Tumble Tester) (Ref. IEC60068-2-32 Ed) (SPR a7.1.1) | Speaker *in drop test box or* representative mechanics. Random drops on steel base. | 30 units 180 drops, 1m DUT power off | Component may have reduced performance, but must still function properly. The allowable sensitivity difference shall not be greater than ±3 dB from initial sensitivity. |

### 5.5.6. Resistance to electrostatic discharge

| Parameter | Test Method and Conditions | Conditions / Sample size | Evaluation Standard |
|---|---|---|---|
| Resistance to ESD IEC61000-4-2 Level 4 (SPR c 2.5.1) | One pole is grounded and the ESD pulse is applied to the other pole. The speaker must be stressed first with one polarisation and then with the other polarisation. DUT must be discharged between each ESD exposure. Level 4: contact +/- 8kV, air +/- 15kV | 10 exposures on each polarity / 5 units DUT Power off | All samples fully operable. All acoustical parameters according specification with tolerances increased by 50%. |

## 6. Related Documents

| | |
|---|---|
| **IEC 268-5** | Sound System equipment<br>Part 5: Loudspeaker |
| **IEC 68-2** | Environmental testing |
| **EN 60068-2** | Environmental testing |
| **ISO 2859 - 1** | Sampling procedures for inspection by attributes<br>Part 1: Sampling plans indexed by acceptable quality level (AQL) for lot-by-lot inspection |
| **ISO 3951** | Sampling procedures and charts for inspection by variables for percent defectives. |
| **ETS 300 019-2-1** | Specification of environmental test: Storage<br>Test spec. T 1.2: Weather protected, not temperature controlled storage locations |
| **ETS 300 019-2-2** | Specification of environmental test: Transportation<br>Test spec. T 2.3: Public Transportation |
| **ETS 300 019-2-5** | Specification of environmental test: Ground vehicle installations<br>Test spec. T 5.1: Protected installation |
| **ETS 300 019-2-7** | Specification of environmental test: Portable and non-stationary use<br>Test spec. T 7.3E: Partly weather protected and non-weather protected locations |

## 7. Change History

| Status | Version | Date | ECR | Comment / Changes | Initials of owner |
|---|---|---|---|---|---|
| Release | A | 05.08.13 | 4015 | First release | BW/CP/ZG/EP/SG |

## 8. Disclaimer

Stresses above the Absolute Maximum Ratings may cause permanent damage to the device. These are stress ratings only. The device may not function when operated at these or any other conditions beyond those indicated under “Electrical and Acoustical Specifications”. Exposure beyond those indicated under “Electrical and Acoustical Specifications” for extended periods may affect device reliability.

This product is not qualified for use in automotive applications

Frequency range in telecom application:
300 Hz – 3.4 kHz