

# ANTREX Electronics

## Electronic Components Sourcing Information

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### Product Reference Information

**Part Number:** 2403 260 00086  
**Manufacturer:** Knowles  
**Package:** Tray  
**Availability:** Please confirm with sales

**Product Page:**

<https://antrexco.com/product/details/knowles/2403-260-00086.html>

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### Quality & Trust

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CoC / RoHS / REACH documents available on request

Secure sourcing support for OEM / EMS projects

**Note:**

This PDF includes an ANTREX product reference cover page.

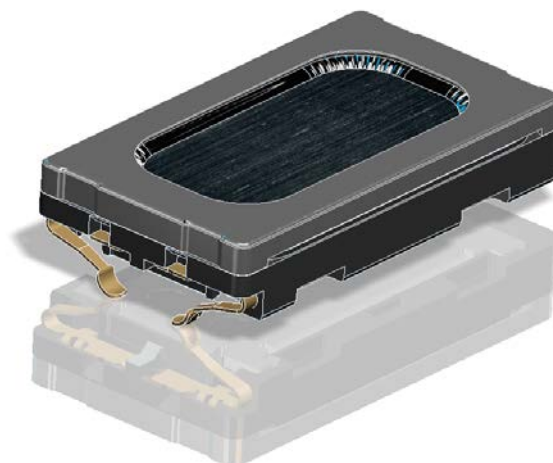
The original manufacturer datasheet follows from the next page.

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## SPEAKER-916-3-SC-FOX

The 9 x 16 x 3 mm Rectangular Fox speaker is a high end miniature speaker specifically designed for portable devices, music phones and smartphones where high quality sound is required.

Production on fully automated manufacturing lines guarantees consistent high quality in large volumes.



### Features:

- Industry-leading dimensions: 9 x 16 x 3.0 mm
- Optimized for use in mobile handsets
- Maximum power handling capacity: 500 mW
- Extremely robust spring connector
- Manufactured to the highest standards
- 100% in-line measurement of all specified acoustical and electrical parameters

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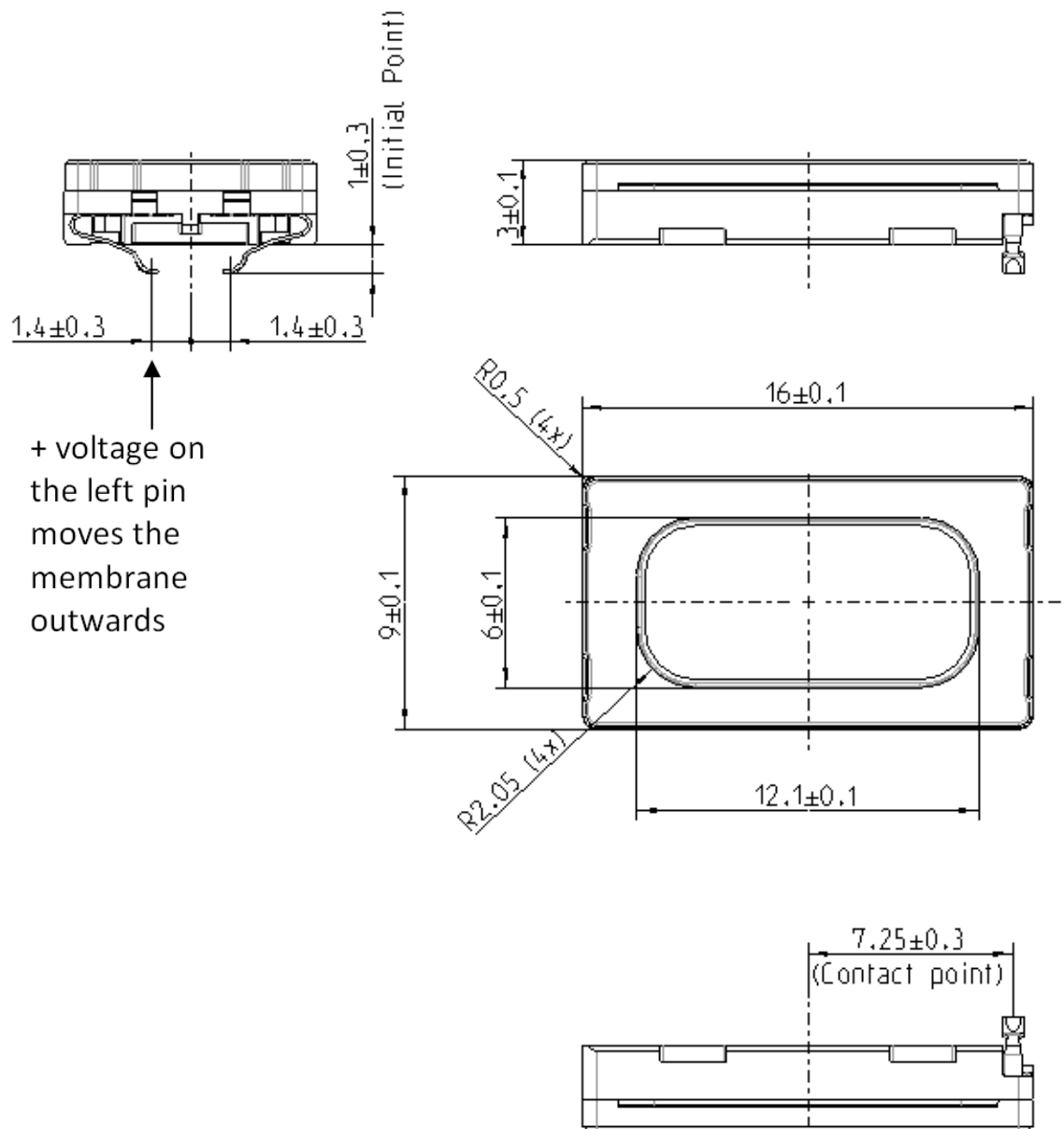
## 1. Theory of operation

SPEAKER-916-3-SC-FOX The Fox is a high end micro size speaker specifically designed for mobile phone and other applications where high quality sound is needed and only very little space for components is available.

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## 2. Mechanical Layout and Dimensions

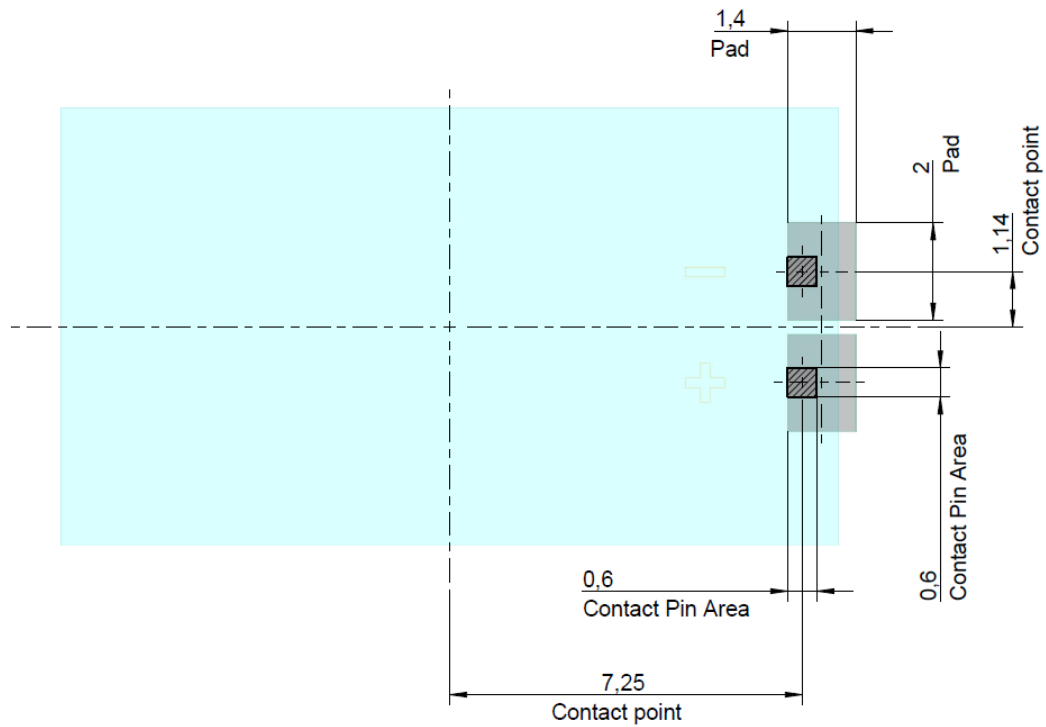
### 2.1. Main Dimensions



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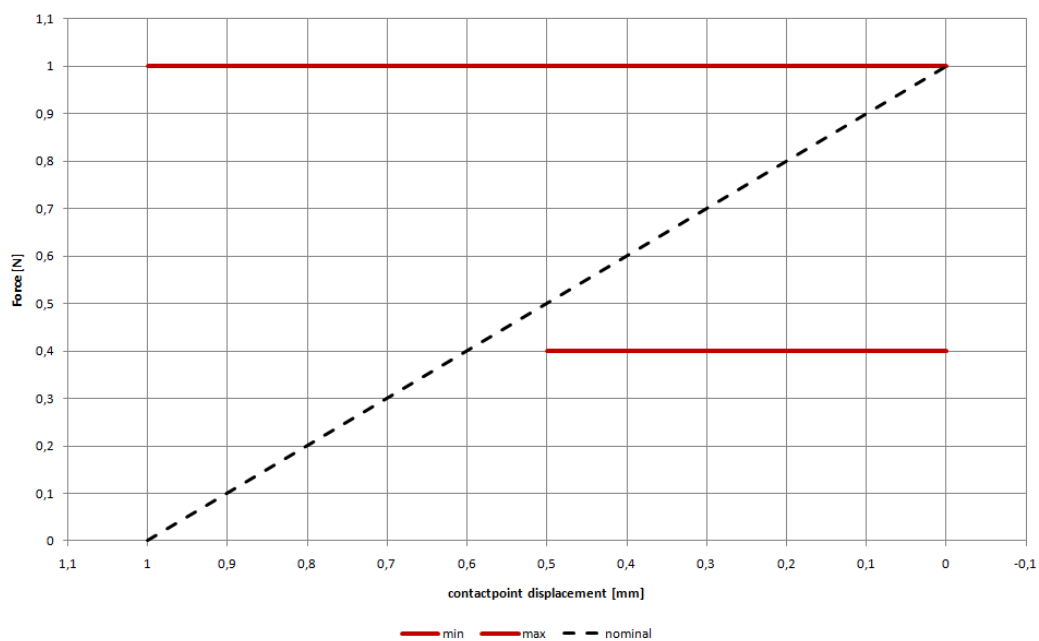
## 2.2. PWB Layout

PAD LAYOUT (VIEW TO PWB / TOPSIDE)



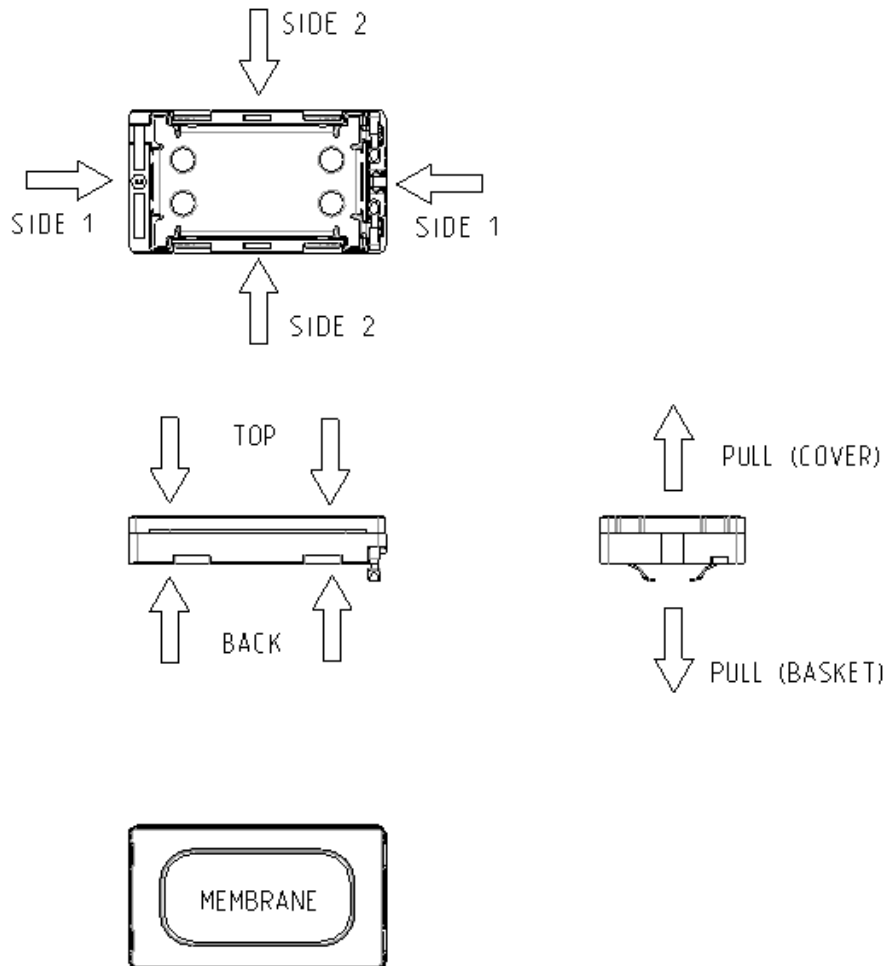
## 2.3. Spring Force

RA 9x16x3 springforce



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## 2.4. Forces on Component



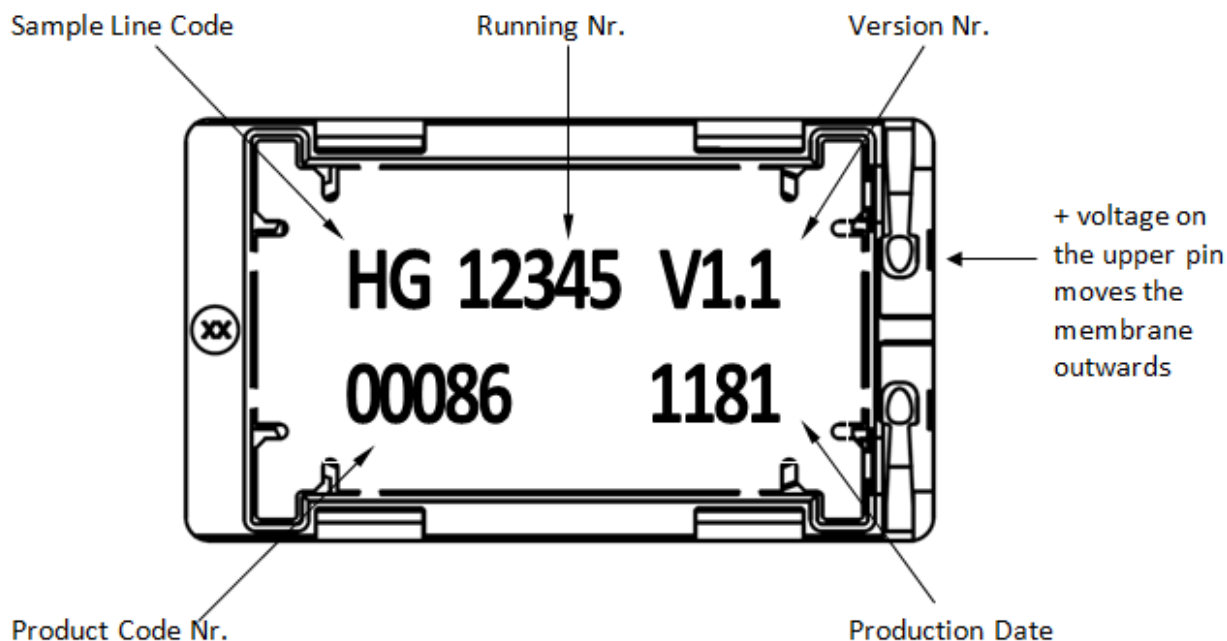
| STATE                                                       | MINIMUM SURFACE<br>OF PRESSURE<br>[mm <sup>2</sup> ] | MAXIMUM<br>PERMANENT FORCE<br>[N] | MAXIMUM<br>HANDLING FORCE<br>[N] |
|-------------------------------------------------------------|------------------------------------------------------|-----------------------------------|----------------------------------|
| FROM FRONT (DISTRIBUTED TO<br>GASKET AREA TO BACK (BASKET)) | -                                                    | 10                                | 15                               |
| FROM SIDE 1 TO SIDE 1                                       | 3                                                    | 10                                | 15                               |
| FROM SIDE 2 TO SIDE 2                                       | 10                                                   | 10                                | 15                               |
| TO POT                                                      | -                                                    | 10                                | 15                               |
| TO MEMBRANE                                                 | -                                                    | 0                                 | 0                                |
| PULL OFF FORCE (COVER/BASKET)                               | -                                                    | -                                 | 10                               |

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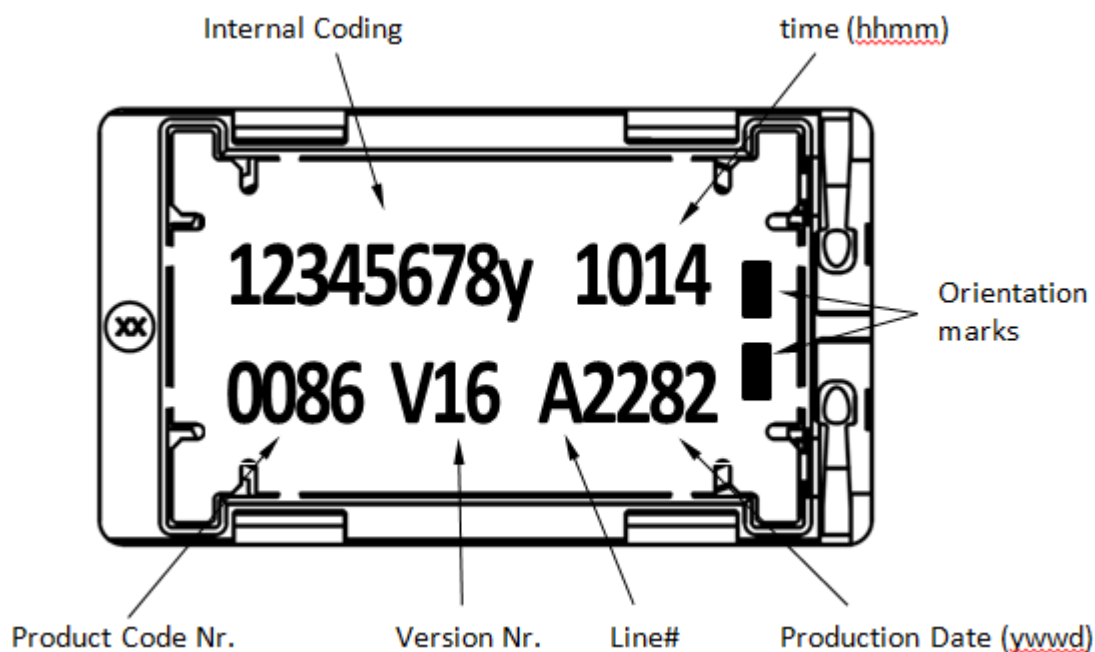
## 2.5. Part Marking/Labeling

The products have a serial number on bottom side

### Semi Line:



### Auto Line:



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## 2.6. Material List

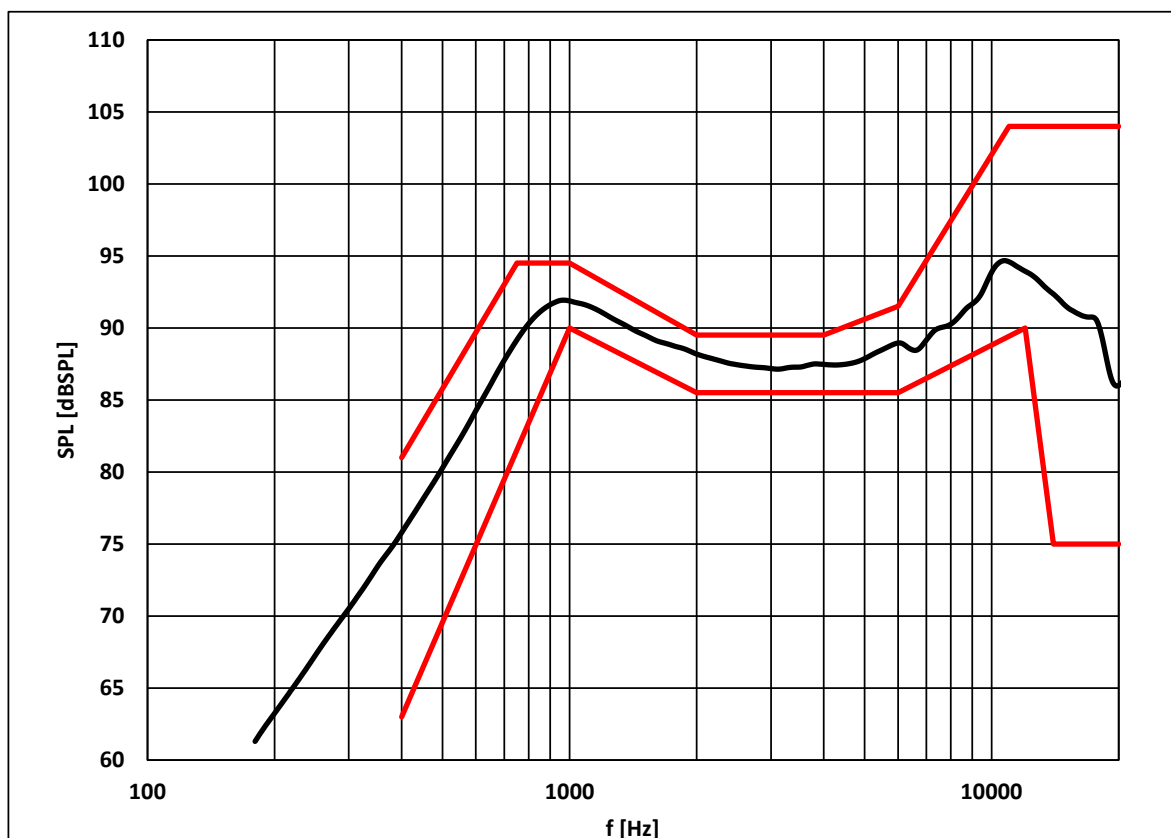
- |                          |                                    |
|--------------------------|------------------------------------|
| 1. Material of basket:   | Polycarbonate                      |
| 2. Material of membrane: | Polyethylene Naphthalene -Compound |
| 3. Material of pot:      | soft magnetic Iron                 |
| 4. Material of magnet:   | Nd Fe B                            |
| 5. Material of contact   | CrNi-Steel, gold plated            |
| 6. Material of cover:    | Polycarbonate                      |
| 7. Dimensions:           | 9x16x3.0mm                         |
| 8. Mass:                 | 0.55g                              |

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### 3. Electrical and Acoustical Specifications

Typical frequency response measured on baffle acc. Chapter 3.6  
(distance  $d=10\text{cm}$ , with back cavity  $1\text{cm}^3$  at  $500\text{mW}$ )

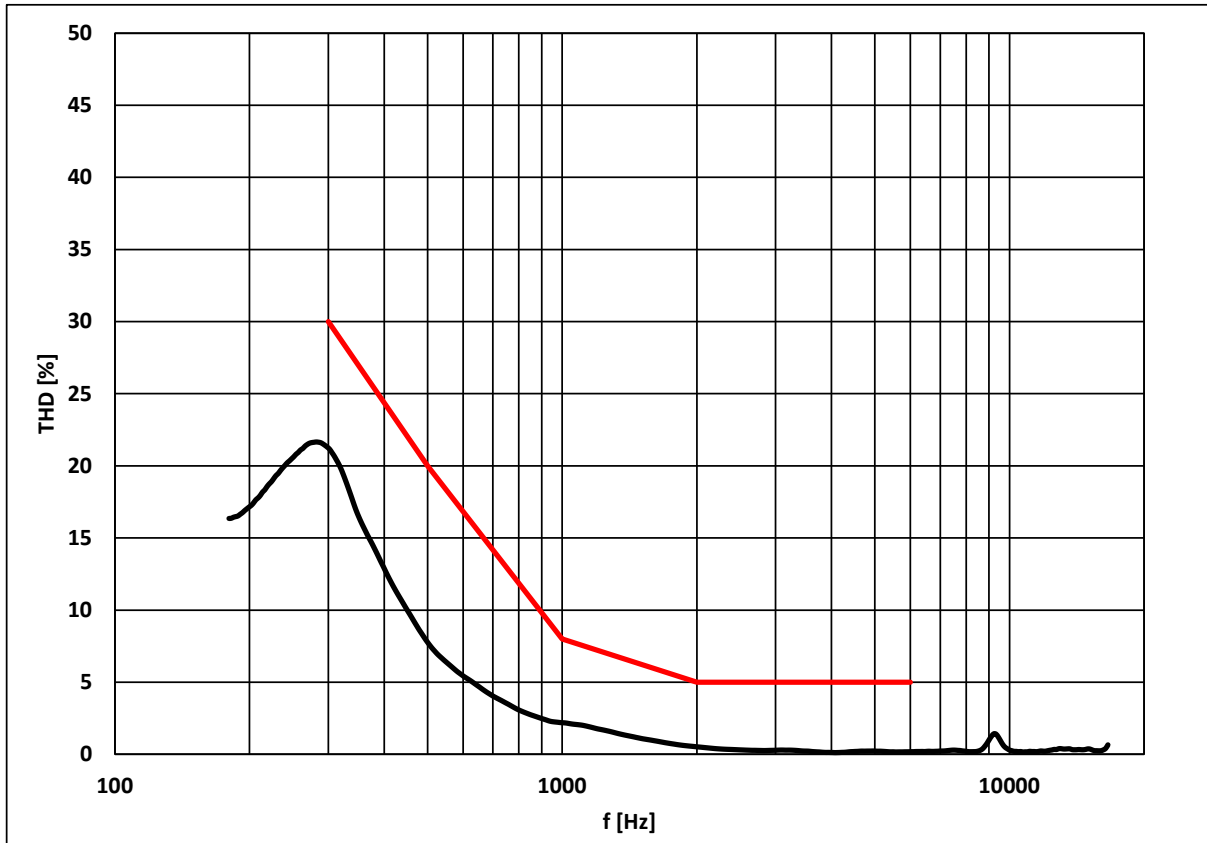
#### 3.1. Frequency response



| SPL tolerance window |                      |        |                      |
|----------------------|----------------------|--------|----------------------|
| f [Hz]               | lower limit [dB SPL] | f [Hz] | upper limit [dB SPL] |
| 400                  | 63                   | 400    | 81                   |
| 1000                 | 90                   | 750    | 94.5                 |
| 2000                 | 85.5                 | 1000   | 94.5                 |
| 6000                 | 85.5                 | 2000   | 89.5                 |
| 12000                | 90                   | 4000   | 89.5                 |
| 14000                | 75                   | 6000   | 91.5                 |
| 20000                | 75                   | 11000  | 104                  |
|                      |                      | 20000  | 104                  |

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### 3.2. THD Response



| THD tolerance window |         |
|----------------------|---------|
| f [Hz]               | THD [%] |
| 300                  | 30      |
| 500                  | 20      |
| 1000                 | 8       |
| 2000                 | 5       |
| 6000                 | 5       |

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### 3.3. Electro-Acoustic Parameters

Loudspeaker mounted in adapter acc. to 3.6 and 3.8. Test signal is a sinusoidal sweep.

|                                                                                              |                        |                       |
|----------------------------------------------------------------------------------------------|------------------------|-----------------------|
| 1. Rated impedance                                                                           | Z:                     | 8Ω                    |
| 2. Voice coil resistance                                                                     | R:                     | 6.8Ω±10%              |
| 3. Resonance frequency (in 1cm <sup>3</sup> back volume @ 500mW)                             | f <sub>0</sub> :       | 850Hz±10%             |
| 4. Maximum usable excursion x <sub>max</sub>                                                 | p-p:                   | 0.6 mm <sub>p-p</sub> |
| 5. Nominal characteristic sensitivity (calculated for 1W in 1m)<br>average from 2kHz to 5kHz |                        | 70.5±3dB              |
| 5.1. Measured characteristic sensitivity (at 500mW in 10cm)<br>average from 2kHz to 5kHz     |                        | 87.5±2dB              |
| 6. THD                                                                                       | according chapter 3.2. |                       |
| 7. Rub & buzz                                                                                | no audible Rub & Buzz  |                       |

All acoustic measurements at 23±2°C

### 3.4. Power Handling

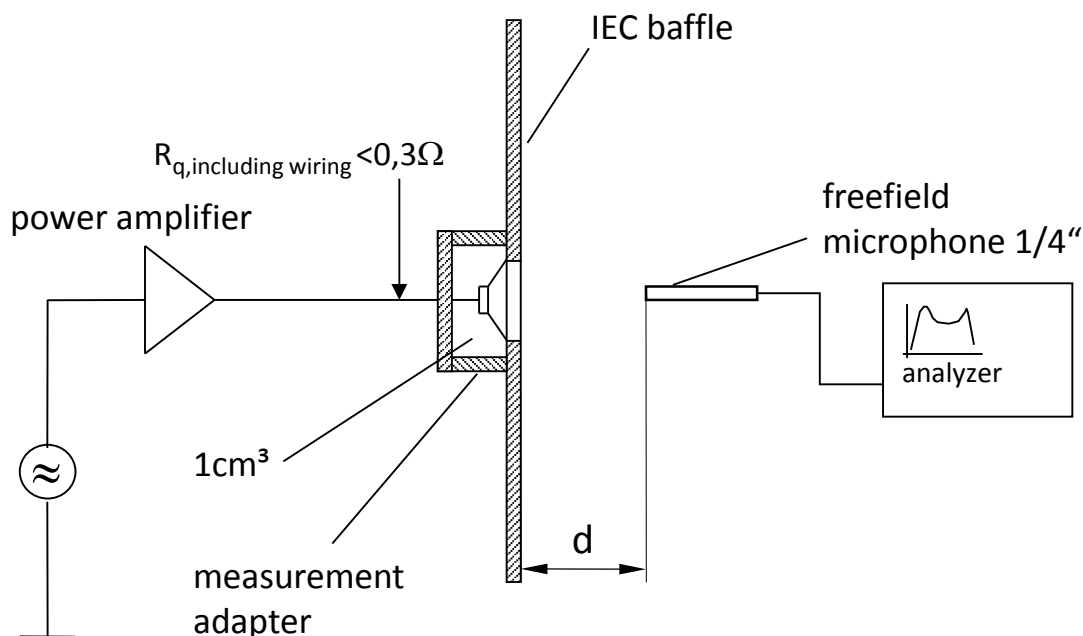
Speaker mounted in lifetime test device (1cm<sup>3</sup> back volume/open front)

Pink noise with high pass 12dB/Oct. at 850Hz, crest factor 2, used for all operating lifetime tests

|                          |                                 |             |
|--------------------------|---------------------------------|-------------|
| 1. Max short term power  | 1sec. ON, 1 min. OFF, 60 cycles | 700mW (RMS) |
| Ambient temperature 70°C |                                 |             |
| 2. Max noise power       | (PHC continuous) 500h           | 500mW (RMS) |
| Ambient temperature 70°C |                                 |             |

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### 3.5. Measurement Setup



### 3.6. Measured Parameters

#### 3.6.1. Sensitivity

SPL is expressed in dB rel  $20\mu\text{Pa}$ , 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.

#### 3.6.2. Frequency response

Frequency response is measured according test set up in chapter 3.5. data sheet and checked against the tolerance window defined in chapter 3.1. This Test is performed for 100% of products in the production line.

#### 3.6.3. Total harmonic distortion (THD)

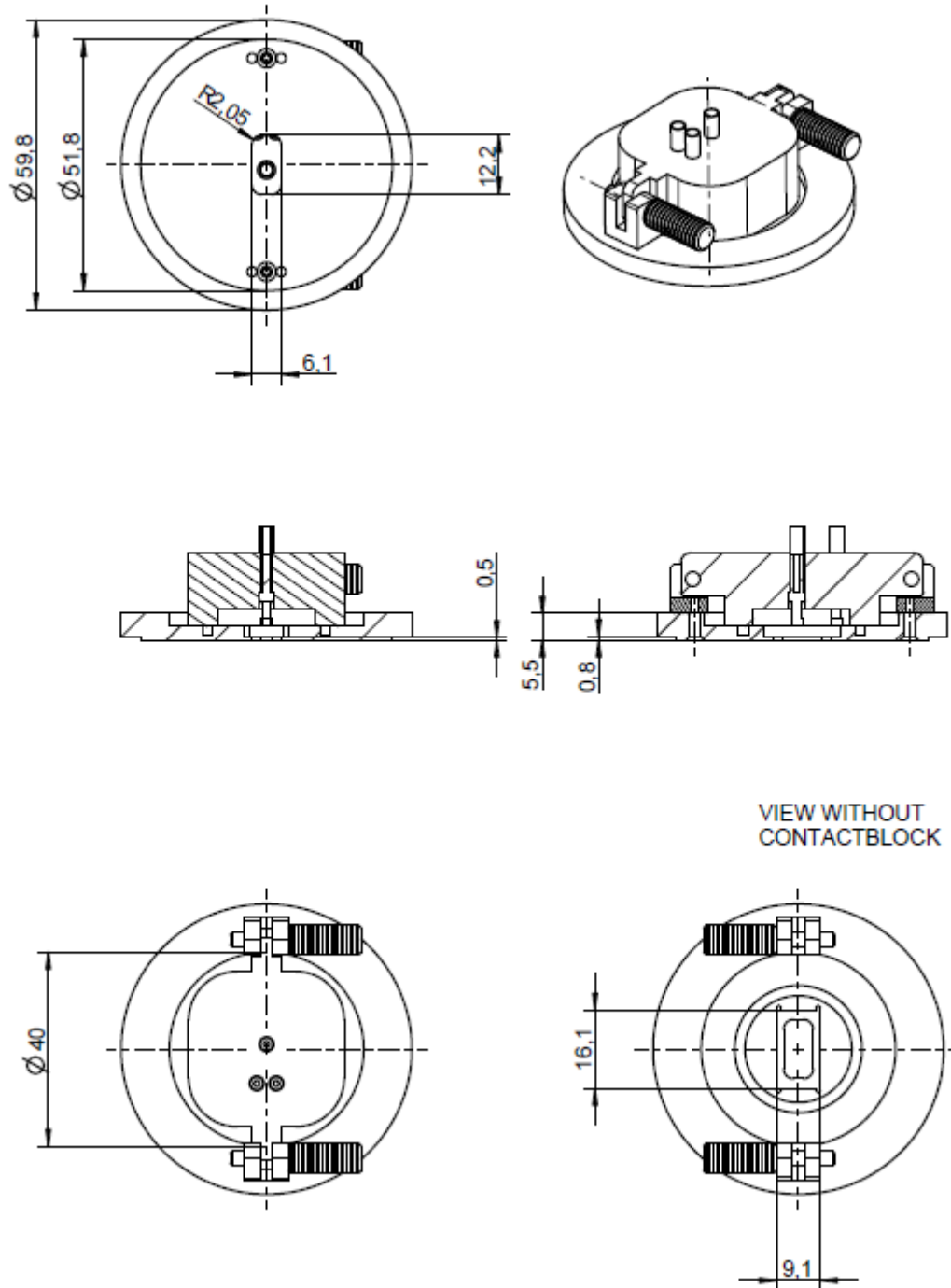
Is measured according IEC 268-5 (2nd to 5th harmonics) and test set up in chapter 3.5. This test is performed for 100% of products in the production line.

#### 3.6.4. Rub & Buzz

Rub & Buzz will be measured in the Inline-measuring device with a sinusoidal sweep. Rub & Buzz is defined as the maximum level of no harmonic energy, expressed as signal to non-harmonic content ratio, in a certain frequency-range. Signal and evaluation criteria are according to chapter 3.3. This test is performed for 100% of products in the production line.

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### 3.7. Measurement adapter



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## 4. Environmental Conditions

### 4.1. Storage

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

|                        |                                                                                                                                    |
|------------------------|------------------------------------------------------------------------------------------------------------------------------------|
| <b>ETS 300 019-2-1</b> | 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

|                        |                                                                                                |
|------------------------|------------------------------------------------------------------------------------------------|
| <b>ETS 300 019-2-2</b> | 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

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

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## 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 5.5 and a complete inspection.

### 5.2. Reliability tests

1x per month and product family samples are taken and submitted to tests described under 5.5.2

### 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 5.1 and 5.2.

### 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<br>(Ref. EN 60068-2-1) | -40°C<br>rel. humidity not controlled | 168h     | Measurements after 2 hours recovery time.<br>All samples fully operable.<br>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<br>(Ref. EN 60068-2-2) | +85°C<br>rel. humidity not controlled | 168h     | Measurements after 2 hours recovery time.<br>All samples fully operable.<br>All acoustical parameters according specification with tolerances increased by 50 %. |

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### 5.5.1.3. Temperature Cycle Test

| Parameter                                     | Test Method and Conditions                                     | Duration                             | Evaluation Standard                                                                                                                                              |
|-----------------------------------------------|----------------------------------------------------------------|--------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Change of Temperature<br>(Ref. EN 60068-2-14) | -40°C/+85°C<br>Transition time <3 min.<br>See Figure 5-1 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 %. |

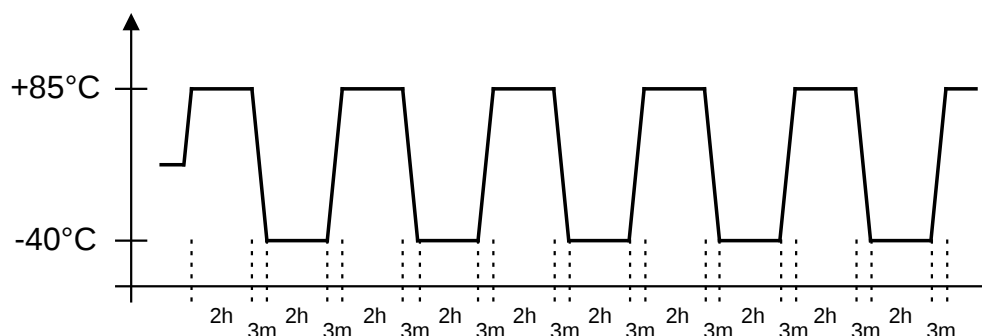


Figure 5-1: Temperature Cycle Test

### 5.5.1.4. Temperature / Humidity Cycle Test

| Parameter                                  | Test Method and Conditions                                                                                                        | Duration                                                                    | Evaluation Standard                                                                                                                                              |
|--------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Damp heat, cyclic<br>(Ref. IEC 60068-2-30) | +25°C/+55°C<br>90% to 95% RH.<br>Temp. change time <3h<br>See Figure 5-2 below<br><u>Caution:</u> no condensed water on products! | 6 cycles / 144h<br>12h at each temperature<br>(inclusive temp ramp up/down) | Measurements after 2 hours recovery time.<br>All samples fully operable.<br>All acoustical parameters according specification with tolerances increased by 50 %. |

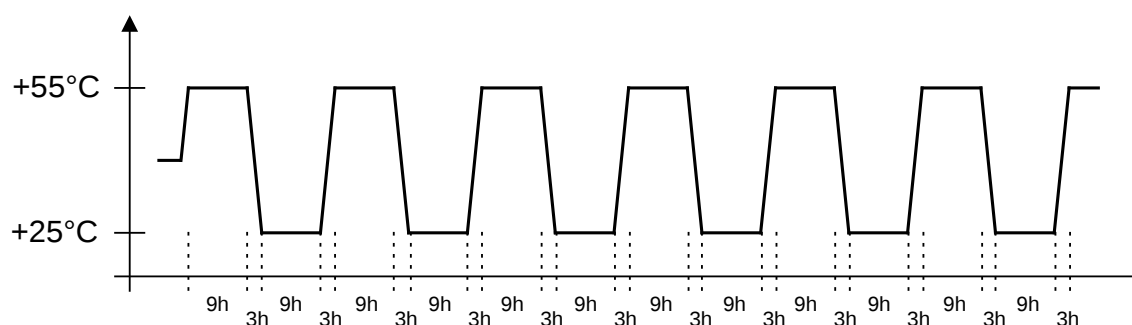


Figure 5-2: Temperature / Relative Humidity Cycle Test

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**5.5.2. Operating Tests****5.5.2.1. Cold Operation Test**

| Parameter                                  | Test Method and Conditions                                       | Duration | Evaluation Standard                                                                                                                                                                                     |
|--------------------------------------------|------------------------------------------------------------------|----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Cold Operation Test<br>(Ref. EN 60068-2-1) | -20°C<br>rel. humidity not controlled<br>signal acc. Chapter 3.4 | 72h      | Measurements after 2 hours recovery time.<br>All samples fully operable.<br>THD may be increased after test. All other acoustical parameters according specification with tolerances increased by 50 %. |

**5.5.2.2. Dry Heat Operation Test**

| Parameter                                 | Test Method and Conditions                                       | Duration | Evaluation Standard                                                                                                                                                                                                                        |
|-------------------------------------------|------------------------------------------------------------------|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Dry Heat Operation<br>(Ref. EN 60068-2-2) | +70°C<br>rel. humidity not controlled<br>signal acc. Chapter 3.4 | 500h     | Measurements after 2 hours recovery time.<br>All samples fully operable.<br>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<br>(Ref. IEC60068-2-52,<br>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.<br>Component may have reduced performance, but must still function properly. The allowable sensitivity difference shall not be greater than ±3dB from initial sensitivity. |

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**5.5.4. Guided Free Fall Test - protected product**

| Parameter                                                | Test Method and Conditions                                                                      | Conditions / Sample size                                                                                                       | Evaluation Standard                                                                                                                                                                 |
|----------------------------------------------------------|-------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Mechanical shock<br>(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<br>Two drops on each side (2x6)<br>One drop on each edge (1x12) Two drops on each corner (2x8)<br>(40 drops in total) | Component may have reduced performance, but must still function properly. The allowable sensitivity difference shall not be greater than $\pm 3\text{dB}$ 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)<br>(Ref. IEC60068-2-32 Ed)<br>(SPR a7.1.1) | Speaker in drop test box or representative mechanics. Random drops on steel base. | 30 units<br>180 drops, 1m<br>DUT power off | Component may have reduced performance, but must still function properly. The allowable sensitivity difference shall not be greater than $\pm 3\text{ dB}$ from initial sensitivity. |

**5.5.6. Resistance to Electrostatic Discharge**

| Parameter                                                  | Test Method and Conditions                                                                                                                                                                                                                                                         | Conditions / Sample size                                 | Evaluation Standard                                                                                                |
|------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|
| Resistance to ESD<br>IEC61000-4-2 Level 4<br>(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.<br>Level 4: contact $\pm 8\text{kV}$ , air $\pm 15\text{kV}$ | 10 exposures on each polarity / 5 units<br>DUT Power off | All samples fully operable.<br>All acoustical parameters according specification with tolerances increased by 50%. |

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## 6. Related Documents

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

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## 7. Change History

| Status   | Version | Date     | ECR  | Comment / Changes                                   | Initials of owner |
|----------|---------|----------|------|-----------------------------------------------------|-------------------|
| Obsolete | A       | 06.04.12 | 3657 | First Release                                       | ET/SZ/CP          |
| Obsolete | B       | 25.06.12 | 3736 | Update pulloff force                                | MS/CP             |
| Obsolete | C       | 11.07.12 | 3768 | New membrane material/change RDC to 6.8 $\Omega$    | SZ/CP             |
| Release  | D       | 20.08.12 | 3902 | Update Rib-design pictures/final production release | MS/CP/CS/RB       |

## 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 for Telekom use

The information contained in this literature is based on our experience to date and is believed to be reliable and it is subject to change without notice. It is intended as a guide for use by persons having technical skill at their own discretion and risk. We do not guarantee favorable results or assume any liability in connection with its use. Dimensions contained herein are for reference purposes only. For specific dimensional requirements consult factory. This publication is not to be taken as a license to operate under, or recommendation to infringe any existing patents. This supersedes and voids all previous literature.