AKU350
Analog, HD Voice Silicon MEMS Microphone

Key features

- Single-ended analog voltage output
- Bottom-port package
- Omni-directional silicon acoustic sensor
- Ultra-high performance: 66dB SNR
- Tight sensitivity tolerance: -38dB +/- 1 dB
- Package immune to RF/EM interference
- Lead-free, surface-mountable and RoHS2 compliant
- Halogen-free compliant, IEC61249-2-21
- Thin profile, SMT packaging
- Industry standard package: 2.65 x 3.50 x 0.98 mm^3

Typical applications

- Smartphones and mobile phones which require high quality acoustic performance
- Voice-activated entertainment systems, set-top-boxes, and remote controls
- Smart-home sensor hubs / clusters, and IoT acoustic sensor nodes
- Wearable accessories requiring small footprint and high performance
- Digital cameras
- Digital voice recorders
- Gaming consoles, and controllers
- Microphone arrays – multi-mic applications

General description

AKU350 is an HD Voice quality, bottom port, analog output MEMS semiconductor microphone. It is a microphone consisting of a MEMS acoustic sensor and an integrated circuit (IC) with a pre-amplifier, charge pump, and supporting circuitry in an industry standard package footprint of 2.65mm x 3.50mm x 0.98mm.

Designed specifically to provide ultra-high acoustic performance in a small footprint package, the AKU350 is ideal for use in mobile handsets, set-top-boxes, TV remote controls, and other applications requiring excellent acoustic performance for speech recognition and far field applications. The AKU350 offers 66dB signal-to-noise ratio (SNR) and uniform sensitivity matching of just +/-1dB between microphones. It also provides a flat super wideband frequency response delivering uniform audio capture across a broad audio spectrum.

AKU350 metal lid package is immune to RF and Electromagnetic (EM) interferences, allowing for easy integration into wireless devices.

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1. Absolute maximum ratings

Supply Voltage, V_{DD} to GND	5.5V
ESD Tolerance	
Human Body Model	2000V
Machine Model	200V
Storage Temperature Range	-40°C to 105°C

2. Standard operating conditions

Operating Temperature Range	-40°C to 100°C
Supply Voltage (V_{DD})	1.62V to 3.6V

3. Electrical and acoustic specifications

Unless otherwise noted, test conditions are:
V_{DD} = 1.8V Ta = 25°C RH = 50%

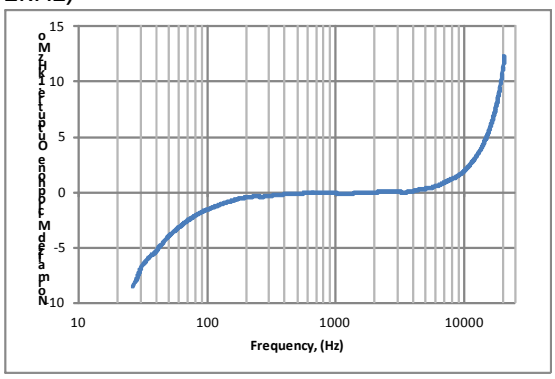
Parameter	Test Conditions	Min.	Typ.	Max.	Unit
Directivity		Omni-directional			
Signal to Noise Ratio (SNR)	f_{in} = 1 kHz, A-weighted		66		dB
Low Frequency Corner	-3dB from 1kHz sensitivity value	55	70	85	Hz
Upper Frequency Corner	+3dB from 1kHz sensitivity value		12.5		kHz
Sensitivity[1]	1kHz, 94dB SPL	-39	-38	-37	dBV/Pa
Total Harmonic Distortion (THD)	@ 94dB SPL, f_{in} = 1kHz			0.5	%
	@ 116dB SPL, f_{in} = 1kHz[1]			3	
Acoustic Overload Point (AOP)	< 10% THD at max sensitivity		123		dBSPL
Power Supply Rejection Ratio (PSR)	100mVpp, f = 217Hz, square wave, A-weighted 20Hz – 20kHz		-100		dBV(A)
Power Supply Rejection Ratio (PSRR)	200mVpp, f = 1kHz, sine wave		67		dB
Current Consumption[1]	No load		205	275	µA
Output Impedance				200	Ω
Sensitivity loss across voltage	Change in sensitivity over 3.6V to 1.62V		0		dB
Part-to-part phase matching	From nominal @ 1kHz		±4		°
Polarity	Increasing sound pressure	Increasing output voltage			

Note 1: Parameter 100% tested

4. Typical device characteristics

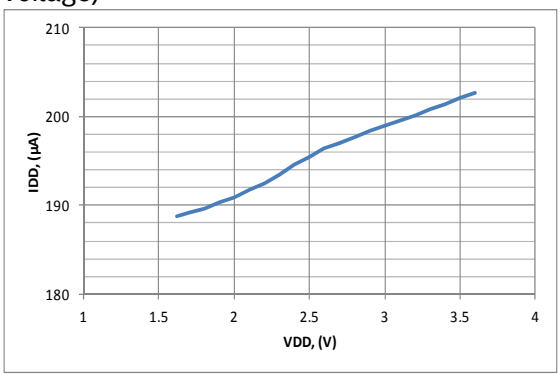
4.1 Frequency Response

(Measured frequency response normalized to 1kHz)



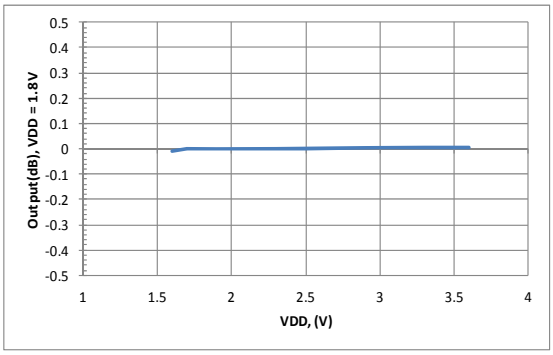
4.2 I_{DD} vs. V_{DD}

(Measured current consumption relative to supply voltage)



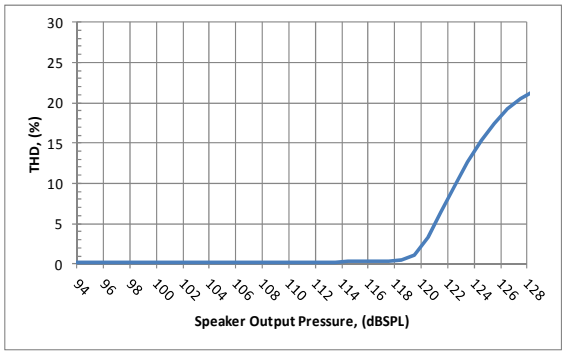
4.3 Sensitivity vs. VDD

(Measured sensitivity changes relative to supply voltage)



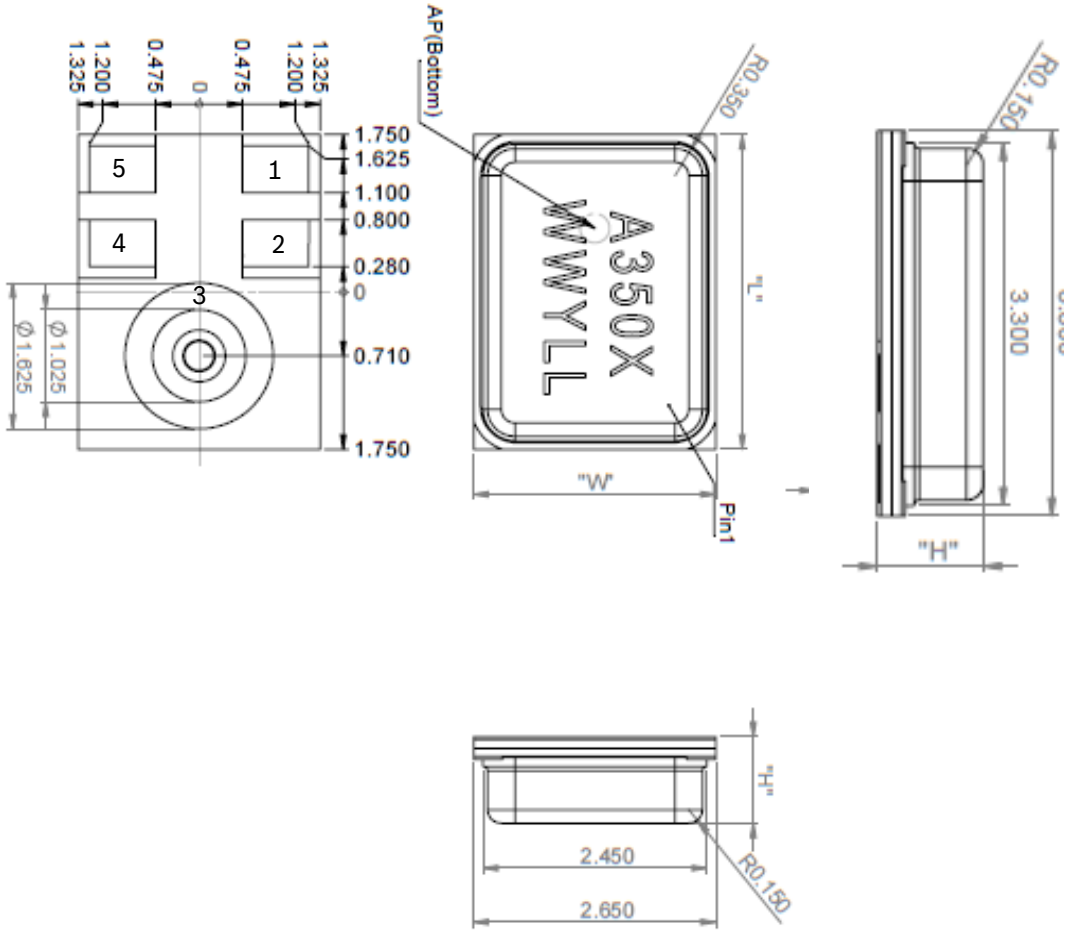
4.4 Total Harmonic Distortion

(Measured THD relative to speaker output pressure level)



5. Mechanical Specifications

Bottom View **Top View** **Side View**

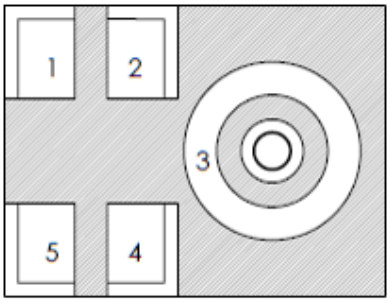


Item	Dimension	Tolerance	Units
Length (L)	3.50	± 0.10	mm
Width (W)	2.65	± 0.10	mm
Height (H)	0.98	± 0.10	mm
Acoustic Port (AP)	0.325	± 0.05	mm
Planarity	Top/Bottom	± 0.05	mm
All dimensions in mm Tolerance ± 0.05mm unless otherwise specified			

6. Pin-Out and connection diagrams

6.1 Pin-Out

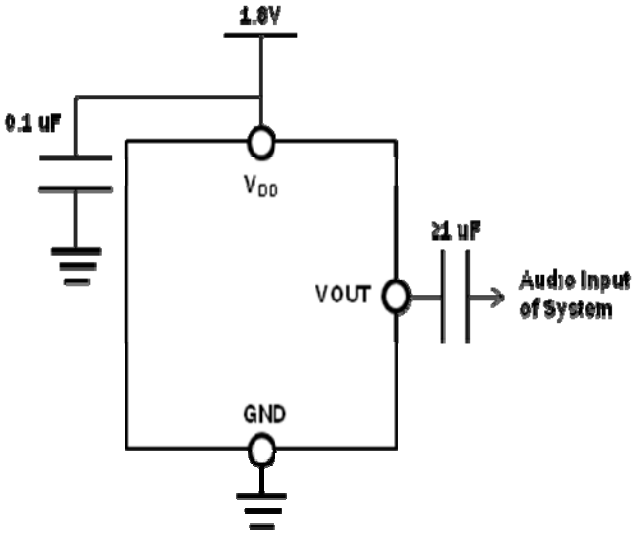
(As viewed from **bottom** of package)



Pin	Name	Function
1	V_{OUT}	Analog output voltage
2	GND	Ground
3	GND	Ground
4	GND	Ground
5	V_{DD}	Power

6.2 Typical Application Schematics

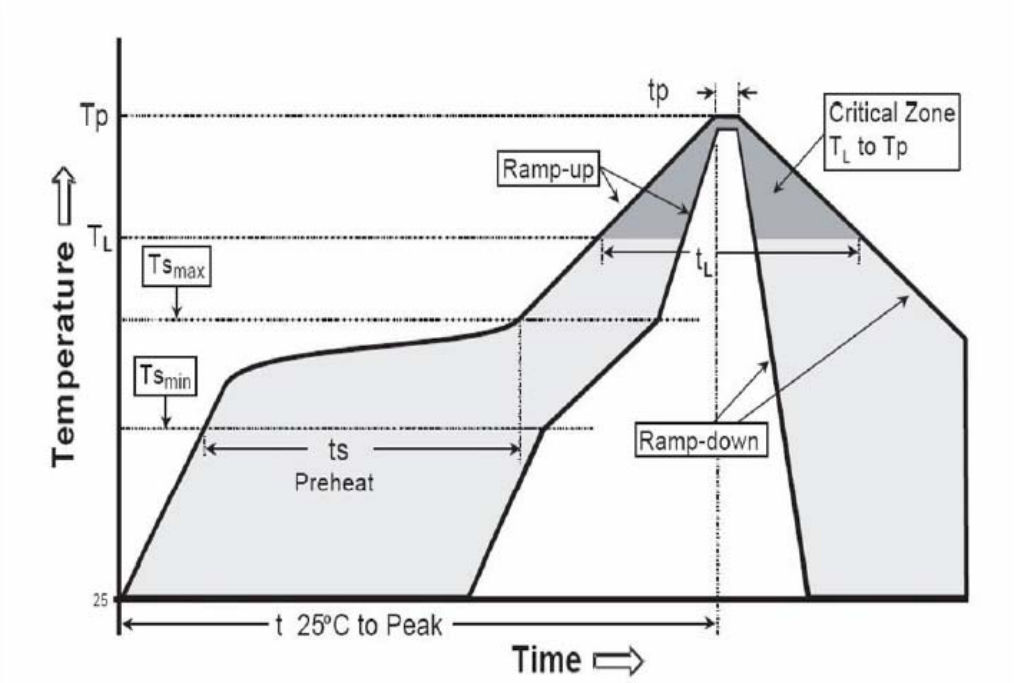
6.2.1 3-wire mode



7. Manufacturing notes

7.1 Solder Reflow

Typical solder reflow profile



Description	Parameter	Pb free
Average ramp-up rate	T_L to T_P	max. 3°C/s
Time between Ts_{min} (150°C) and Ts_{max} (200°C)	t_S	60s – 120s
Time above liquidous temperature T_L (217°C)	t_L	60s – 90s
Peak temperature	T_P	max. 260°C
Time at T_P	t_P	max. 20s
Average ramp-down rate	T_P to 25°C	max. 6°C/s

Note: It is recommended to fine-tune the reflow process to optimize for variations in materials, environment, handling, PCB board size and thickness, etc.

Please refer to AN60-Handling, Soldering, and Mounting Instructions for more detailed information and precautions.

7.2. Microphone Handling

Although the microphone may not appear damaged immediately due to inappropriate handling, there can be long term effects that affect the lifetime of the component.

Rule of thumb: The microphone is an artificial ear so treat it like your own ear.

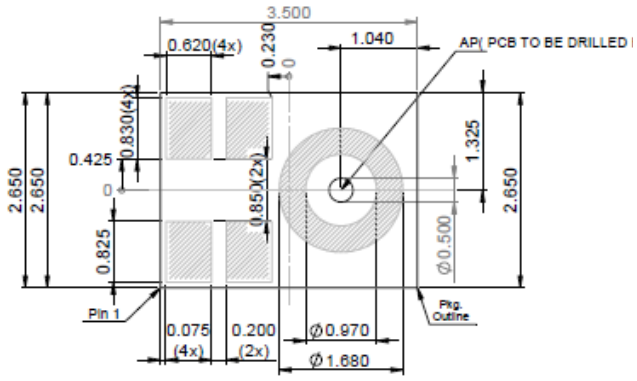
- Do not blow air into the acoustic port of the microphone for any reason. Do not subject it to pressurized air
  - e.g. when cleaning the board or other components on the same board
- Do not apply vacuum to the acoustic port of the microphone
- Do not insert liquids
  - If populated circuit boards are washed, the microphone must be protected
- Do not insert dust
  - The production facilities must be clean
  - e.g. if PCB routing/sawing is done close to the microphone after SMT assembly and reflow
- Do not insert any objects
  - If assembly or rework is done manually, care must be taken that the tools cannot enter the microphone sound port
  - It is best to choose tool size so that it does not fit through the sound port of the microphone
- Do not cover the acoustic port with tape when heating during assembly or reflow
- Do not apply extreme mechanical stresses on the microphone, including mechanical shocks above 10kG or compression of the microphone package.
- After a bottom port microphone has been assembled on a circuit board, protect the sound port (now on the other side of the board) from dust, liquids, and other foreign materials as well as any tools and pressurized air.

ESD Handling Procedures

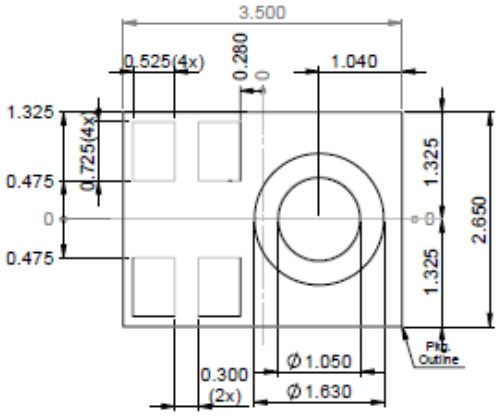
Follow CMOS handling procedures with MEMS microphones. Handle the microphone with proper workplace grounding to include wrist straps and ionized airflow over open trays and reels of microphones. Do not hot-swap/hot-plug during testing. Device pins have ESD ratings of 2kV/200V for HBM/MM respectively.

7.3 PCB Land Pattern and Stencil Pattern Examples

Land Pattern



Stencil Pattern



Note: the aperture of the stencil pattern may require adjustment / optimization based on the thickness of the stencil.

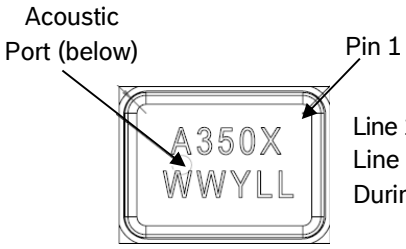
Please refer to AN60-Handling, Soldering, and Mounting Instructions for more detailed information and precautions.

8. Reliability Specifications

The microphone sensitivity after stress must deviate by no more than 3dB from the initial value.

	Test	Test Condition	Standard
1	Cold Temp Operation	Temperature = -40°C, 1000 hours (with bias)	IEC 60068-2-1
2	Hot Temp Operation	Temperature = 105°C, 1000 hours (with bias)	IEC 60068-2-2
3	Humidity Operation	Temperature = 85°C, RH = 85%, 1000 hours (with bias)	JESD22-A101-B
4	Cold Temp Storage	Temperature = -40°C, 1000 hours (without bias)	IEC 60068-2-1
5	Hot Temp Storage	Temperature = 105°C, 1000 hours (without bias)	IEC 60068-2-2
6	Humidity Storage	Temperature = 85°C, RH = 85%, 1000 hours (without bias)	JESD22-A101-B
7	Thermal Cycle	100 Cycles, -40 to +125C, 15min soaks, <30sec ramps	IEC 60068-2-4
8	Vibration	Sinusoidal Vibration, 20Hz-2000Hz, 4min sweeps, 16min along each of 3 axis, amplitude 3 limits of 20G and 0.06”	Mil-Std-883E, Test A
9	Mechanical Shock	10,000G shocks, 5 impacts along each of 6 axes	MIL-STD-883E
10	Drop Test	Using 150gm aluminum fixture, 3 drops along each of 6 axes (total 18 drops) from 1.5m height onto concrete drop surface.	IEC 60068-2-32
11	ESD (HBM)	+/- 2000V, 1 discharge for each polarity, 11 pin combinations, 22 total discharges per microphone	JESD22-A114-B
12	ESD (MM)	+/- 200V, 1 discharge for each polarity, 11 pin combinations, 22 total discharges per microphone	JESD22-A115-A
13	ESD	+/- 8kV, contact discharge to lid with DUT grounded	IEC 61000-4-2
14	Moisture Sensitivity Level	24 hour bake at 125°C, followed by 168 hours at 85°C, 85%RH, followed by 3 passes solder reflow (MSL Level 1)	JSTD020D-01
15	Reflow Solder	3 pass reflow, peak temperature = 260°C, time duration - see reflow profile in section 7	JSTD020D-01

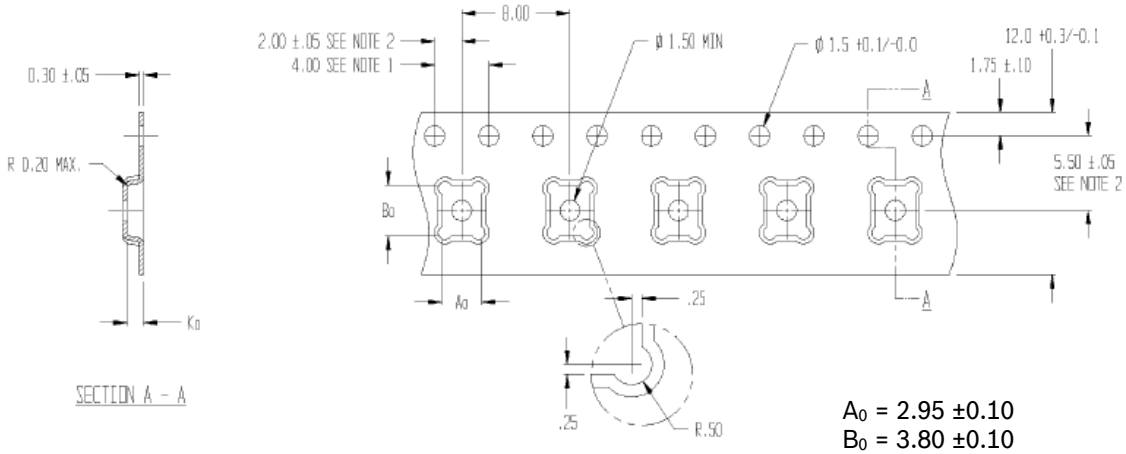
9. Part marking information



Line 1: A350 (Akustica, 350 = Part Code | X = Assembly Facility)
Line 2: WWYLL (WW = Work Week | Y = Year | LL= Lot Number Processed During Work Week)

10. Packaging information

10.1 Tape Specification

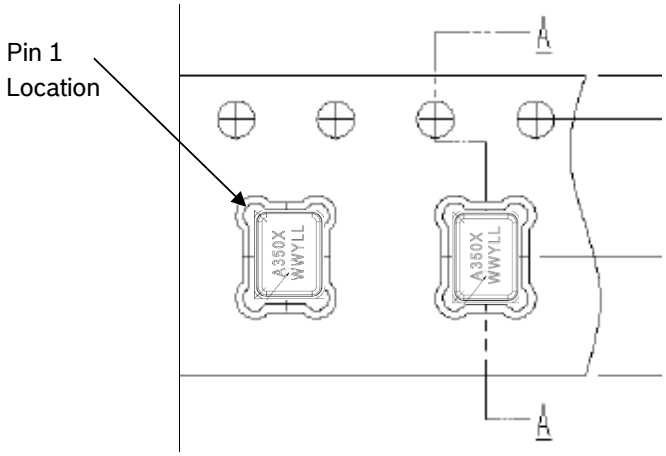


A_0 = 2.95 ±0.10
B_0 = 3.80 ±0.10
K_0 = 1.20 +0.10/-0.05

Notes:

1. 10 sprocket hole pitch cumulative tolerance +/- 0.2
2. Camber in compliance with EIA-481
3. Pocket position relative to sprocket hole measured as true position of pocket, not pocket hole
4. A_0 and B_0 are calculated on a plane at a distance of “R” above the bottom of the pocket.

10.2 Component Orientation



11. Ordering information

Order Number	Sensitivity Tolerance (dB)	RF Filter	Part Code	Package	Shipping Method	Standard Quantity
0 273 0A0 025	+/- 1	Yes	A350	5-Pad LGA	13” Reel	5,900

12. Legal Disclaimer

12.1 Engineering samples

Engineering Samples are marked with an asterisk (*) or (e). Samples may vary from the valid technical specifications of the product series contained in this data sheet. They are therefore not intended or fit for resale to third parties or for use in end products. Their sole purpose is internal client testing. The testing of an engineering sample may in no way replace the testing of a product series. Akustica assumes no liability for the use of engineering samples. The Purchaser shall indemnify Akustica from all claims arising from the use of engineering samples.

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12.3 Application examples and hints

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13. Document history and modification

Revision Number	Chapter	Description of modification/changes	Date
1.00	10	Released 1.0. Updated pocket tape	07-Dec-2015
1.01	All	Applied new datasheet template	11-Feb-2016
1.02	3, All	Updated phase. Applied new datasheet template	22-Mar-2016
1.03	All	Applied new datasheet template	05-May-2016
1.1a	All	Applied new datasheet template	29-June-2016

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