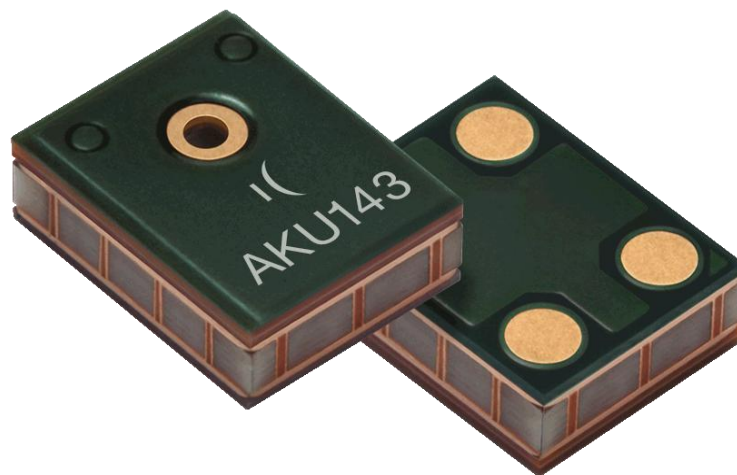


AKU143

Top Port, Analog Silicon MEMS Microphone



Data Sheet

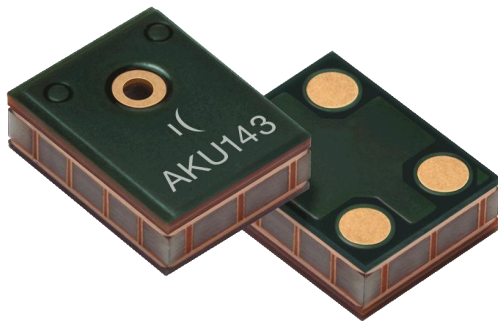
| | |
|---------------------|---|
| Part number(s) | AKU143 |
| Package type | 4-pin LGA top port |
| Data sheet revision | 1.01 |
| Release date | 12 December 2014 |
| Document number | DS37-1.01 AKU143 Data Sheet |
| Notes | Specifications are subject to change without notice. Product photos and pictures are for illustration purposes only and may differ from the real product's appearance. |

AKU143

Analog, HD Voice Silicon MEMS Microphone

General Description

AKU143 is an HD Voice quality, top 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 2.95mm x 3.76mm x 1.10mm.



Designed specifically to meet the demanding requirements of mobile handset OEMs, AKU143 offers excellent acoustic performance with 65dB signal-to-noise ratio (SNR) and uniform sensitivity matching of just ± 1 dB between microphones. Unlike other top port analog microphones, AKU143 offers a flat wideband frequency response, with deviations less than 5dB from 50Hz to 14kHz and a resonance past 20kHz, delivering uniform audio capture across a broad acoustic spectrum. The AKU143 Faraday-cage constructed package is immune to RF and Electromagnetic (EM) interferences, allowing for easy integration into wireless devices.

Key Features

- Analog output, Top Port Design with Bottom Port Performance
- Omni-directional silicon microphone
- Excellent acoustic performance: 65dB SNR
- Tight sensitivity tolerance: $-42\text{dB} \pm 1\text{dB}$
- Acoustic Overload Point (AOP): 126dB SPL
- Matched microphones in frequency and phase response for array applications
- Flat frequency response for super-wideband audio
- Package immune to RF/EM interference
- Lead-free, surface-mountable and RoHS2 compliant
- Halogen-free compliance, IEC61249-2-21
- Thin profile, SMT packaging
- Industry std. package: 2.95x3.76x1.10mm³
- Built-in support for 2-wire mode

Typical Applications

- Smartphones and mobile phones
- Digital still/video cameras
- IC / digital voice recorders
- Portable media players
- Gaming consoles / controllers
- Voice activated entertainments systems and remote controllers
- Smart-home sensor hubs / clusters, and IoTS acoustic sensor nodes
- Microphone arrays – multi-mic applications and noise cancellation algorithms which benefit from uniform microphones

| | | |
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|  | AKU143 Analog Silicon MEMS Microphone | Data Sheet |
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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 85°C |
| Supply Voltage (V_{DD}) | 1.62V to 3.6V |

3. ELECTRICAL AND ACOUSTIC SPECIFICATIONS

Unless otherwise noted, test conditions are:
 $V_{DD} = 2.0V$ $T_a = 25^\circ C$ $RH = 50\%$ Mode = 3-wire

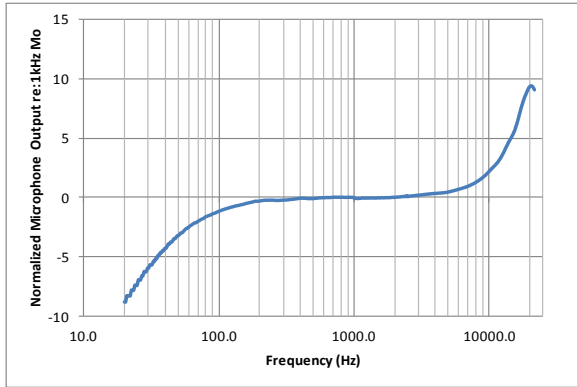
| Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|--|--|---------------------------|------|----------|----------|
| Directivity | | Omni-directional | | | |
| Signal to Noise Ratio (SNR) | $f_{in} = 1kHz$, A-weighted, 20Hz-10kHz | | 65 | | dB |
| Low Frequency Corner ¹ | -3dB from 1kHz sensitivity value | | 50 | 100 | Hz |
| Upper Frequency Corner | +3dB from 1kHz sensitivity value | | 11.5 | | kHz |
| Sensitivity ¹ | 1kHz, 94dB SPL | -43 | -42 | -41 | dBV/Pa |
| Total Harmonic Distortion ¹ (THD) | @ 94dB SPL, $f_{in} = 1kHz$ | | | 1 | % |
| | @ 114dB SPL, $f_{in} = 1kHz$ | | | 3 | |
| Acoustic Overload Point (AOP) | < 10% THD, $f_{in} = 1kHz$ | | 126 | | dB SPL |
| Power Supply Rejection Ratio (PSRR) | 100mVpp, $f = 217Hz$ | | 55 | | dB |
| Current Consumption ¹ | No load | | 155 | 170 | μA |
| Output Impedance | | | | 200 | Ω |
| Sensitivity loss across voltage | Change in sensitivity over 3.6V to 1.62V | | | 0.75 | dB |
| Part-to-part phase matching | From nominal @ 1kHz | | | ± 10 | $^\circ$ |
| Polarity | Increasing sound pressure | Increasing output voltage | | | |

Note 1: Max./min. value of parameter 100% tested

4. DEVICE CHARACTERISTICS

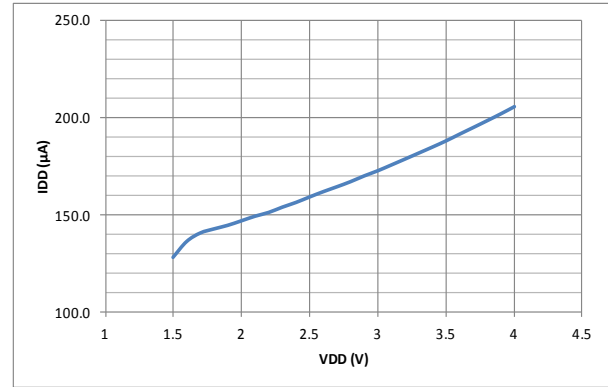
4.1 Frequency Response

(Measured frequency response normalized to 1kHz)



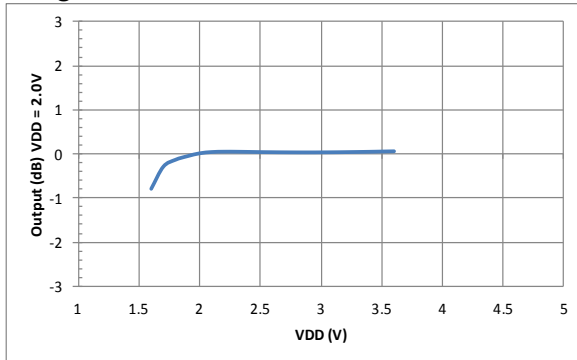
4.2 I_{DD} vs. V_{DD}

(Measured current consumption relative to supply voltage)



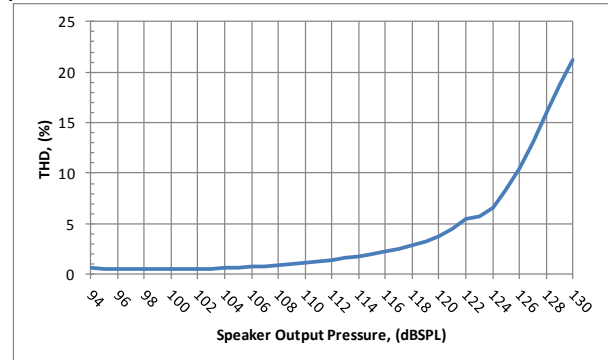
4.3 Sensitivity vs. V_{DD}

(Measured sensitivity changes relative to supply voltage)



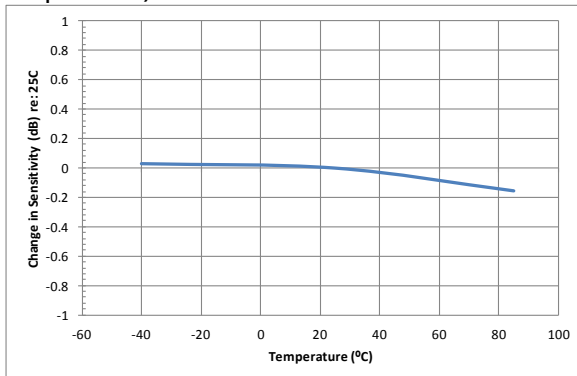
4.4 Total Harmonic Distortion

(Measured THD relative to speaker output pressure level)



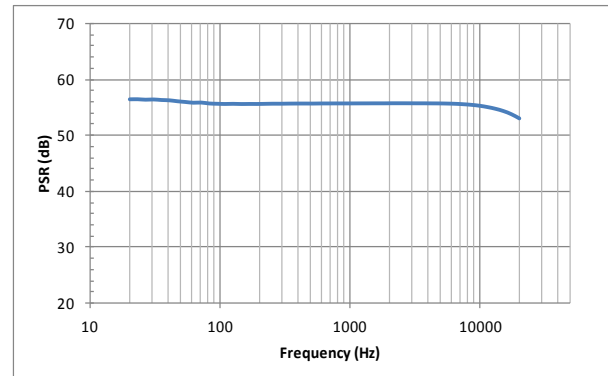
4.5 Sensitivity vs. Temperature

(Typical sensitivity changes relative to temperature)

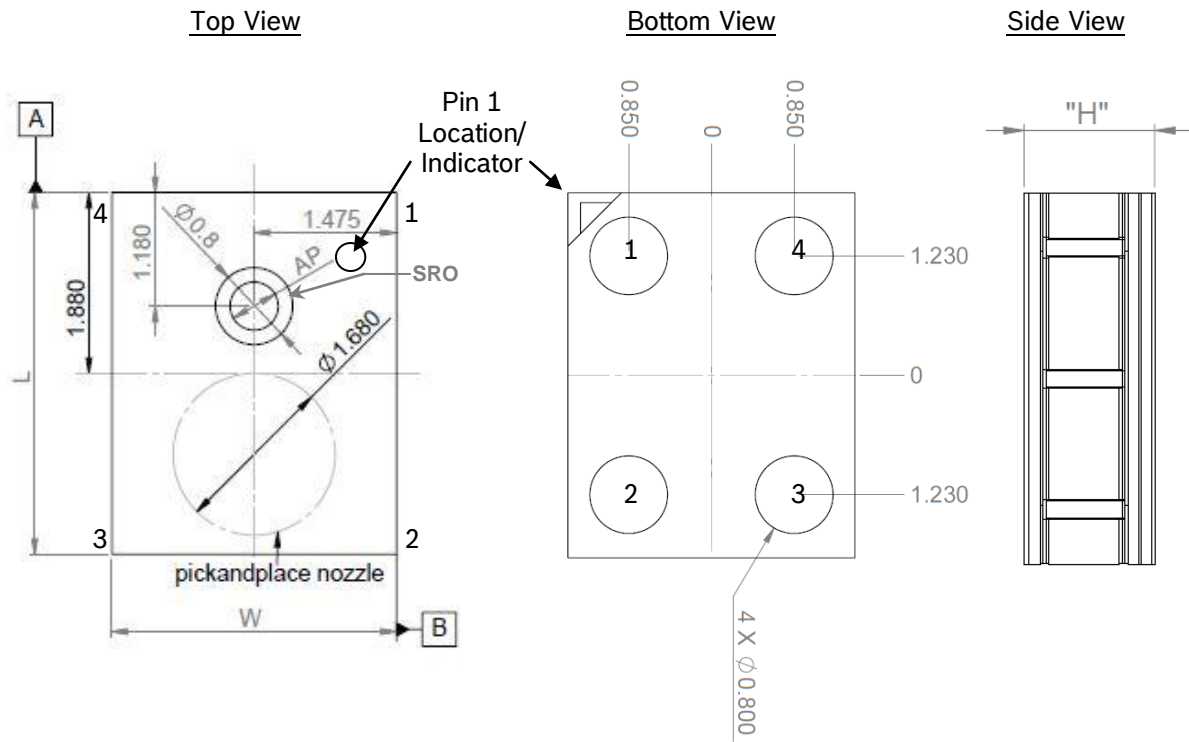


4.6 PSRR vs. Frequency

(Typical PSRR relative to frequency)



5. MECHANICAL SPECIFICATIONS

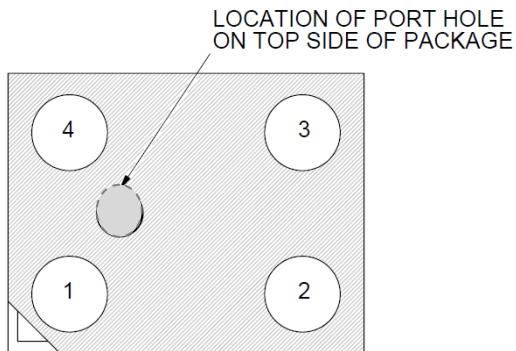


| Item | Dimension | Tolerance | Units |
|--|------------|------------|-------|
| Length (L) | 3.76 | ± 0.10 | mm |
| Width (W) | 2.95 | ± 0.10 | mm |
| Height (H) | 1.10 | ± 0.10 | mm |
| Acoustic Port (AP) | 0.50 | ± 0.05 | mm |
| Solder Mask (SRO) | 0.850 | ± 0.05 | mm |
| Planarity | Top/Bottom | ± 0.10 | mm |
| All dimensions in mm Tolerance ± 0.05 mm unless otherwise specified | | | |

6. PIN-OUT AND CONNECTION DIAGRAMS

6.1 Pin-Out

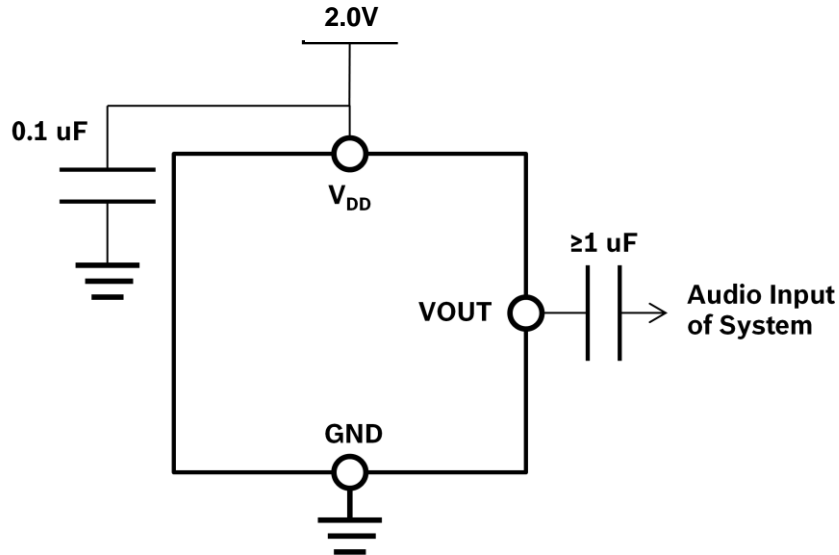
(As viewed from **bottom** of package)



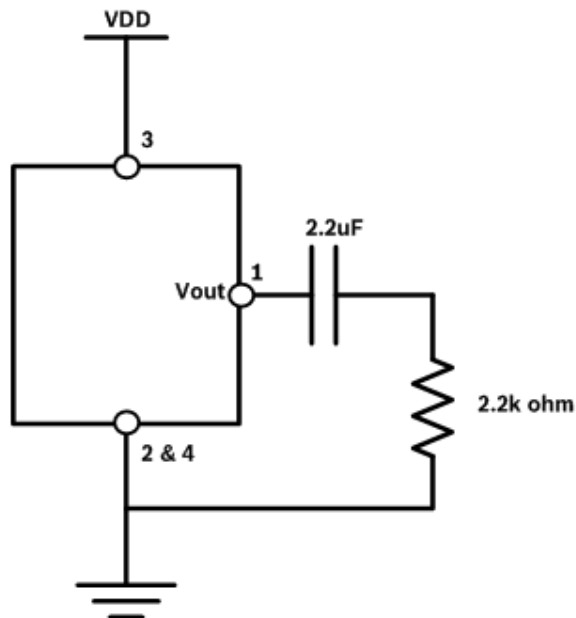
| Pin | Name | Function |
|-----|------------------|-----------------------|
| 1 | V _{DD} | Power supply voltage |
| 2 | GND | Ground |
| 3 | GND | Ground |
| 4 | V _{OUT} | Analog output voltage |

6.2 Typical Application Schematic

6.2.1 3-wire mode application diagram*



6.2.2 2-wire mode application diagram

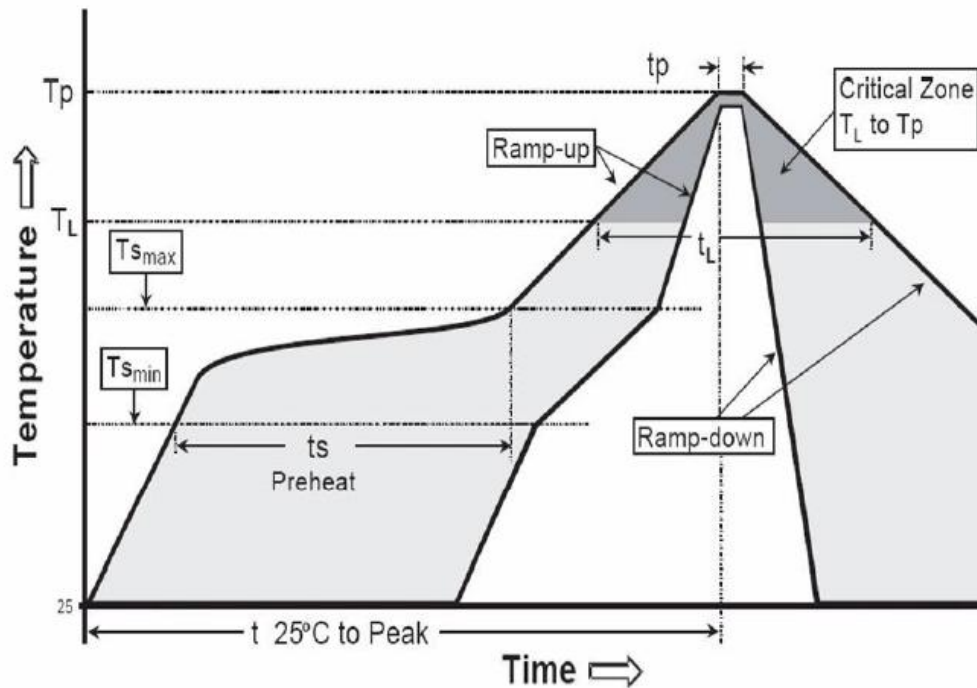


*All testing performed in 3-wire mode.

7. MANUFACTURING NOTES

7.1 Solder Reflow

Typical solder reflow profile



IPC-0206-5-1

| | |
|--|------------|
| Average ramp-up rate | max. 3°C/s |
| Time t_s between $T_{s_{min}}$ (150°C) and $T_{s_{max}}$ (200°C) | 60s – 120s |
| Time t_L above liquidous temperature T_L (217°C) | 60s – 90s |
| Peak temperature T_p | max. 260°C |
| Time t_p at T_p | max. 20s |
| Average ramp-down rate | 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.

| | | |
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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
 - See section 5.0 for pick & place location
- 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 mic 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.

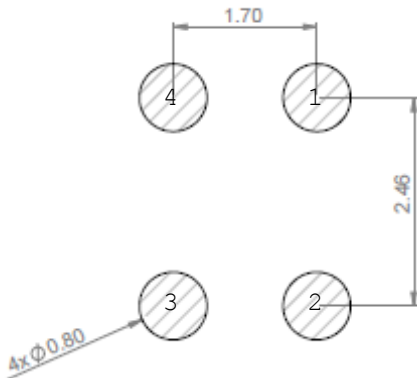
ESD Handling Procedures



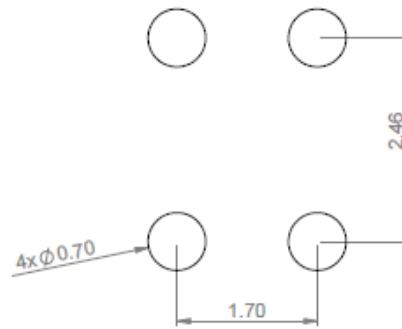
Follow CMOS handling procedures with Akustica MEMS microphones. Handle the microphone with proper workplace grounding to include wrist straps and ionized airflow over open trays and reels of microphones. Do not hot-swap/hot-plug during testing. Device pins have ESD ratings of 2kV/200V for HBM/MM respectively.

7.3 PCB Land Pattern and Stencil Pattern

**PCB Land
Pattern Layout**



**Suggested Solder Paste
Stencil Pattern Layout**



Note: Stencil printer settings will likely require minor optimizations when transferring this stencil pattern to a high volume production printer.

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

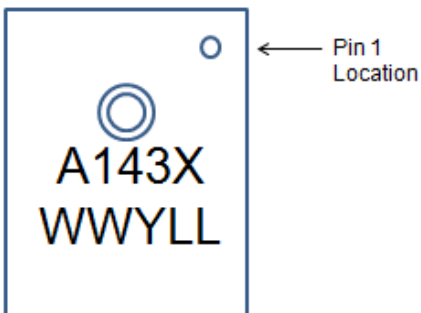
| | | |
|---|---|------------|
|  | AKU143 Analog Silicon MEMS Microphone | Data Sheet |
|---|---|------------|

8. RELIABILITY SPECIFICATIONS

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

| | Test | Test Condition |
|----|----------------------------|--|
| 1 | Cold Temp Operation | Temperature = -40°C, 1000 hours (with bias) |
| 2 | Hot Temp Operation | Temperature = 105°C, 1000 hours (with bias) |
| 3 | Humidity Operation | Temperature = 85°C, RH = 85%, 1000 hours (with bias) |
| 4 | Cold Temp Storage | Temperature = -40°C, 1000 hours (without bias) |
| 5 | Hot Temp Storage | Temperature = 105°C, 1000 hours (without bias) |
| 6 | Humidity Storage | Temperature = 85°C, RH = 85%, 1000 hours (without bias) |
| 7 | Thermal Cycle | 100 Cycles, -40°C to +125°C, 15min soaks, <30sec ramps |
| 8 | Vibration | Sinusoidal Vibration, 20Hz-2000Hz, 4min sweeps, 16min along each of 3 axis, amplitude 3 limits of 20G and 0.06" |
| 9 | Mechanical Shock | 10,000G shocks, 5 impacts along each of 6 axes |
| 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. |
| 11 | ESD (HBM) | +/- 2000V, 1 discharge for each polarity, 11 pin combinations, 22 total discharges per microphone |
| 12 | ESD (MM) | +/- 200V, 1 discharge for each polarity, 11 pin combinations, 22 total discharges per microphone |
| 13 | ESD | +/- 8kV, contact discharge to lid with DUT grounded |
| 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) |

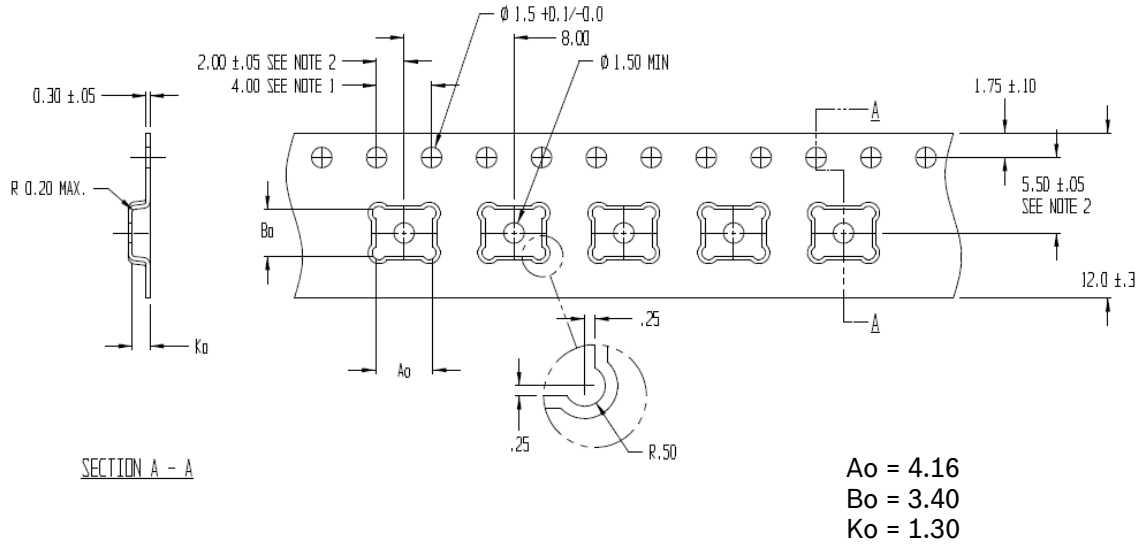
9. PART MARKING INFORMATION



Line 1: A143X (A = Akustica | 143 = Part Num | X = Assembly Facility)
Line 2: WWYLL (WW = Work Week | Y = Year | LL = Lot Number
Processed During Work Week)

10. PACKAGING INFORMATION

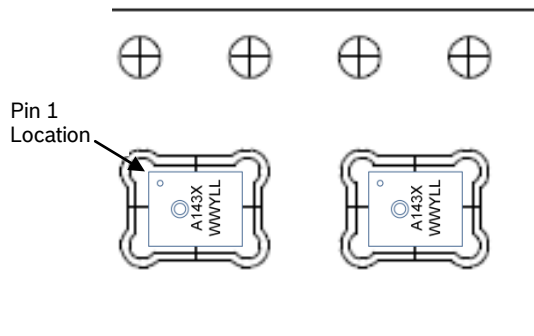
10.1 Tape Specification



Notes:

1. 10 sprocket hole pitch cumulative tolerance +/- 0.2
2. Pocket position relative to sprocket hole measured as true position of pocket, not pocket hole.
3. A_o and B_o are calculated on a plane at a distance of "R" above the bottom of the pocket.

10.2 Component Orientation



| | | |
|---|---|------------|
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|---|---|------------|

11. ORDERING INFORMATION

| Order Number | Part Marking | Package | Shipping Method | Standard Quantity |
|--------------|--------------|-----------|-----------------|-------------------|
| 02730A0014 | A143 | 4-Pad LGA | 13" Reel | 5,700 |

For more information, sample requests, or to place an order, please contact Akustica.

12. DOCUMENT REVISIONS

| Rev. No | Description of modification/changes | Date |
|---------|--|-----------|
| 0.75 | Released preliminary datasheet | 24-Feb-14 |
| 0.76 | Added AOP value to section 3. Updated 2-wire mode diagram. | 28-Apr-14 |
| 0.77 | Updated pin-out | 09-Sep-14 |
| 1.0 | Released 1.0 | 12-Nov-14 |
| 1.01 | Updated section 3 | 12-Dec-14 |

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