


AKU440

Bottom Port, Digital MEMS Microphone



Preliminary Data Sheet

Part number(s)	AKU440
Package type	5-pin LGA bottom port
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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.

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AKU440

Digital, HD Voice MEMS Microphone

Key Features

- Digital MEMS Microphone with PDM (pulse density modulation) output
- Excellent acoustic performance with 63dB SNR
- Compatible with Microsoft® Windows8 & Intel® Ultrabook Requirements for Digital Microphones
- Tightly controlled sensitivity of -26dBFS +/- 2dB
- Industry leading Power Supply Rejection (PSR) of -80dBFS
- Robust digital-output immune to RF/EM interference
- Matched microphones in frequency and phase response for array applications
- Output supports dual-microphone, single-wire multiplexing
- Industry standard microphone interface compatible with multiple codecs
- Low current power-down mode
- Lead-free surface-mountable and RoHS compliant
- Halogen-free in accordance with IEC61249-2-21
- Thin profile, SMT packaging
- Industry-standard package 4.00 x 3.00 x 1.00 mm³


Typical Applications

- Mobile phones
- Media tablets
- Microphone arrays
- Webcams and camera modules

General Description


AKU440 is an HD Voice quality, bottom port, digital output MEMS microphone in a small 4.0 x 3.0 x 1.0 mm³ package. The robust digital output stream from the AKU440 is virtually immune to all forms of Radio Frequency Interference (RFI) and Electromagnetic Interference (EMI) allowing the microphone to be integrated anywhere on the platform regardless of proximity to displays, Wi-Fi antennae, or other sources of interference that would degrade the signal of conventional analog microphones. In addition, the AKU440's metal lid package and digital output are resistant to radiated RF interference. For the device manufacturer, this translates to a higher degree of design flexibility by providing a consistent SNR level regardless of environment, resulting in shorter design cycles.

The output of the microphone is pulse density modulated (PDM), a single-bit digital output stream designed to enable the multiplexing of stereo microphone data onto a single wire. With a user selectable L/R channel option, the AKU440 is ideal for use in multiple microphone applications.

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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
Clock Frequency	1.00MHz to 3.25MHz

3. ELECTRICAL AND ELECTRO-ACOUSTIC SPECIFICATIONS

Unless otherwise noted, test conditions are:
 $V_{DD} = 1.8V$ $T_a = 25^\circ C$ $RH = 50\%$ $CLK = 2.4MHz$

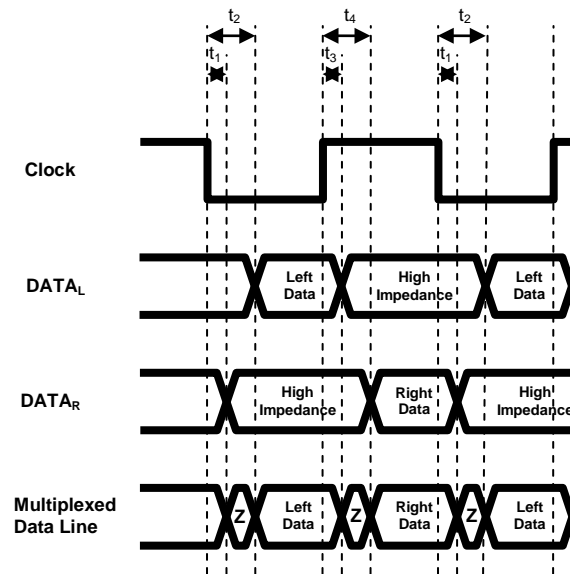
Parameter	Test Conditions	Min.	Typ.	Max.	Unit
Directivity		Omni-directional			
Signal to Noise Ratio (SNR)	$f_{in} = 1$ kHz, A-weighted, 20Hz-10kHz		63		dB
Low Frequency Corner	-3dB from 1kHz sensitivity value			100	Hz
High Frequency Corner	+3dB from 1kHz sensitivity value		10		kHz
Sensitivity ¹	1kHz, 94 dB SPL, full-scale=100% 1's density at PDM output of microphone	-28	-26	-24	dBFS
Total Harmonic Distortion (THD) ¹	@ 100dB SPL, $f_{in} = 1$ kHz			1	%
	@ 110dB SPL, $f_{in} = 1$ kHz			5	
Acoustic Overload Point (AOP) ¹	@ 116dB SPL, $f_{in} = 1$ kHz			10	
Power Supply Rejection (PSR)	Signal on $V_{DD} = 217$ Hz, 100 mV _{pp}		-73		dBFS
Part-to-part phase matching from nominal	$f_{in} = 1$ kHz			± 10	°
Current Consumption ¹ (with no load)	Clock > 1MHz			950	μA
	Clock off		5		μA
Power-up initialization	Data invalid time from clock on			28	ms
Polarity	Increasing sound pressure	Increasing 1's density			

Note 1: Parameter 100% tested


3.1 Timing Characteristics

(Typical performance with load capacitance <20pF and a clock frequency of 2.4 MHz)

	Data Valid	Data Sampled	L/R_SELECT Connected to
DATA_L	Falling clock	Rising clock	GND
DATA_R	Rising clock	Falling clock	V _{DD}



Output	Parameter	Typical Value	Description
DATA_R	t₁	6ns	Time from falling edge of clock until data becomes high impedance
DATA_L	t₂	61ns	Time from falling edge of clock until data becomes valid
DATA_L	t₃	6ns	Time from rising edge of clock until data becomes high impedance
DATA_R	t₄	53ns	Time from rising edge of clock until data becomes valid

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3.2 Digital Logic Characteristics

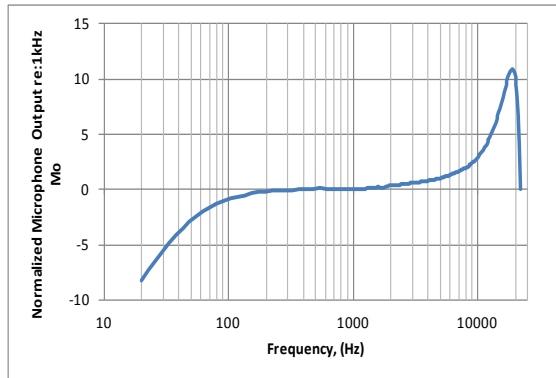
(Typical performance with load capacitance <20pF and a clock frequency of 2.4 MHz)

Symbol	Parameter	Min	Max	Units
$V_{IL\ MAX}$	Maximum level considered a logic 0		$0.4 \cdot V_{DD}$	V
$V_{IH\ MIN}$	Minimum level considered a logic 1	$0.5 \cdot V_{DD}$		V
$V_{OL\ MAX}$	Maximum level a driven output logic 0 can be		$0.05 \cdot V_{DD}$	V
$V_{OH\ MIN}$	Minimum level a driven output logic 1 can be	$0.95 \cdot V_{DD}$		V

4. DEVICE CHARACTERISTICS

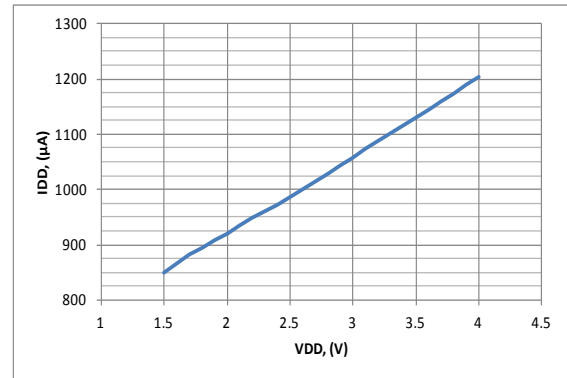
4.1 Frequency Response

(Measured frequency response normalized to 1kHz)



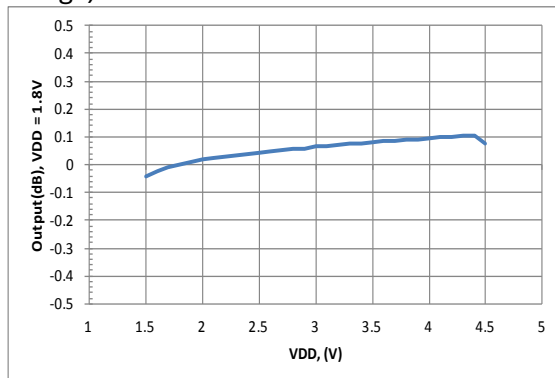
4.2 I_{DD} vs. V_{DD}

(Measured current consumption relative to supply voltage)



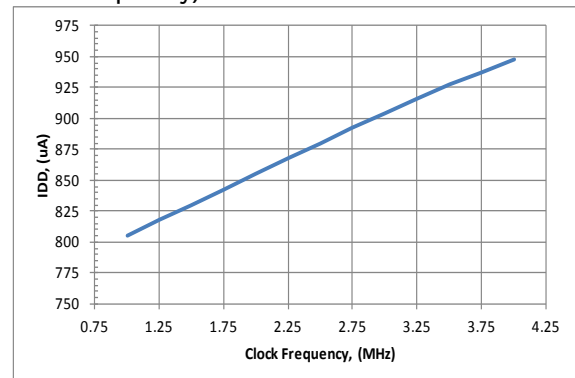
4.3 Sensitivity vs. VDD

(Measured sensitivity changes relative to supply voltage)



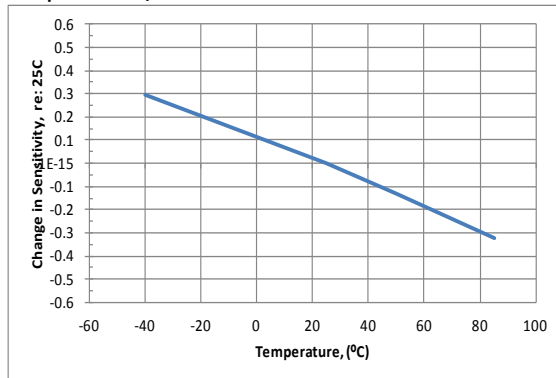
4.4 I_{DD} vs. Clock Frequency


(Measured current consumption relative to clock frequency)



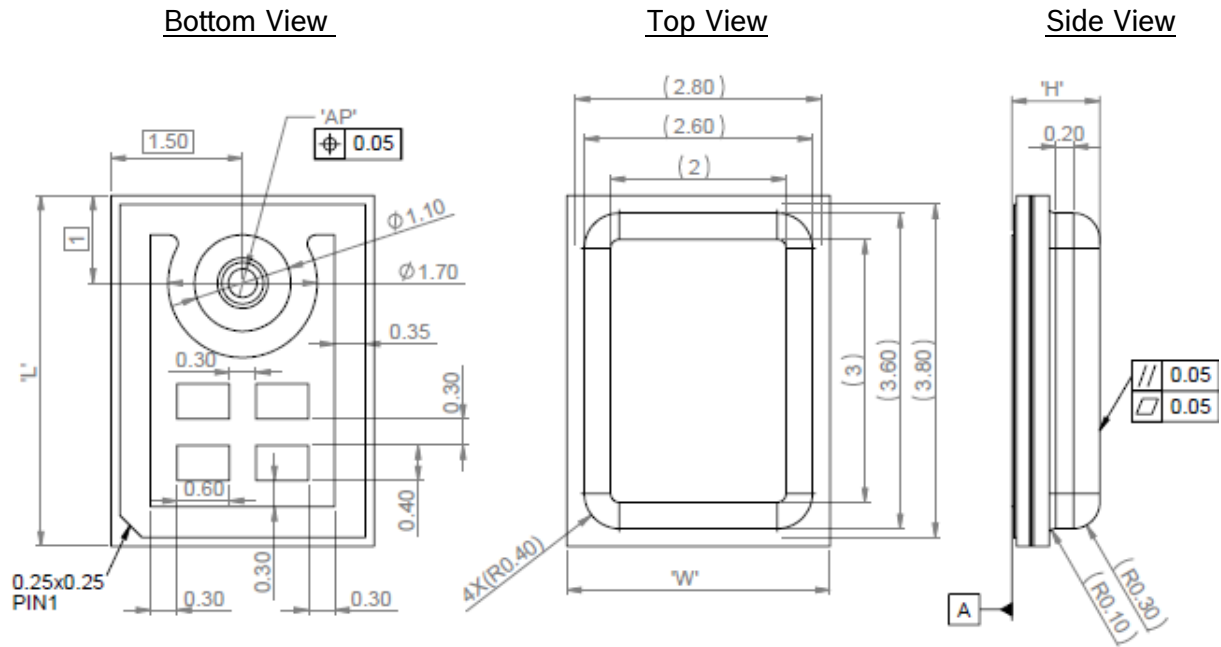
4.5 Sensitivity vs. Temperature

(Typical sensitivity changes relative to temperature)



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5. MECHANICAL SPECIFICATIONS

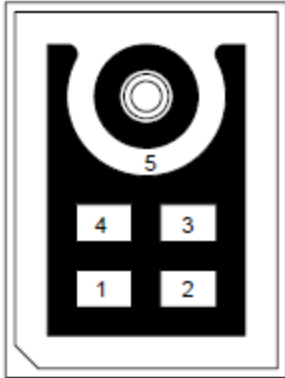


Item	Dimension	Tolerance	Units
Length (L)	4.00	± 0.10	mm
Width (W)	3.00	± 0.10	mm
Height (H)	1.00	± 0.10	mm
Acoustic Port (AP)	0.325	± 0.03	mm
Planarity	Top/Bottom	± 0.05	mm
All dimensions in mm Tolerance ± 0.05mm unless otherwise specified			

6. PIN-OUT AND CONNECTION DIAGRAMS

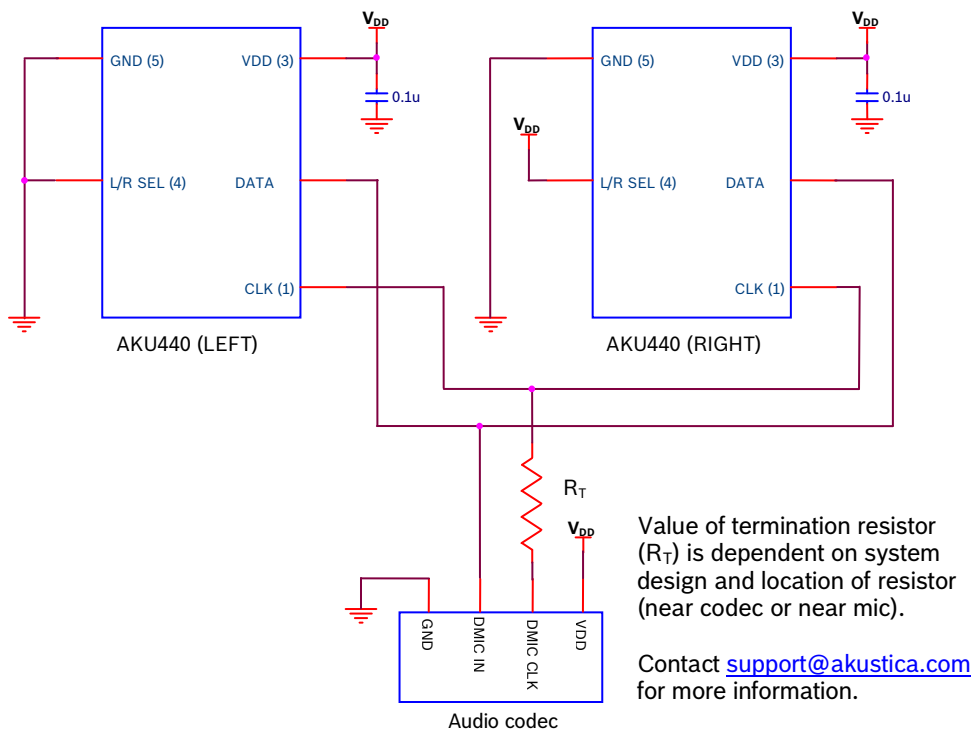
6.1 Pin Out

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



Pin	Name	Function
1	CLK	Clock
2	DATA	PDM Data output
3	V _{DD}	Power
4	L/R SELECT	Left / Right Select
5	GND	Ground

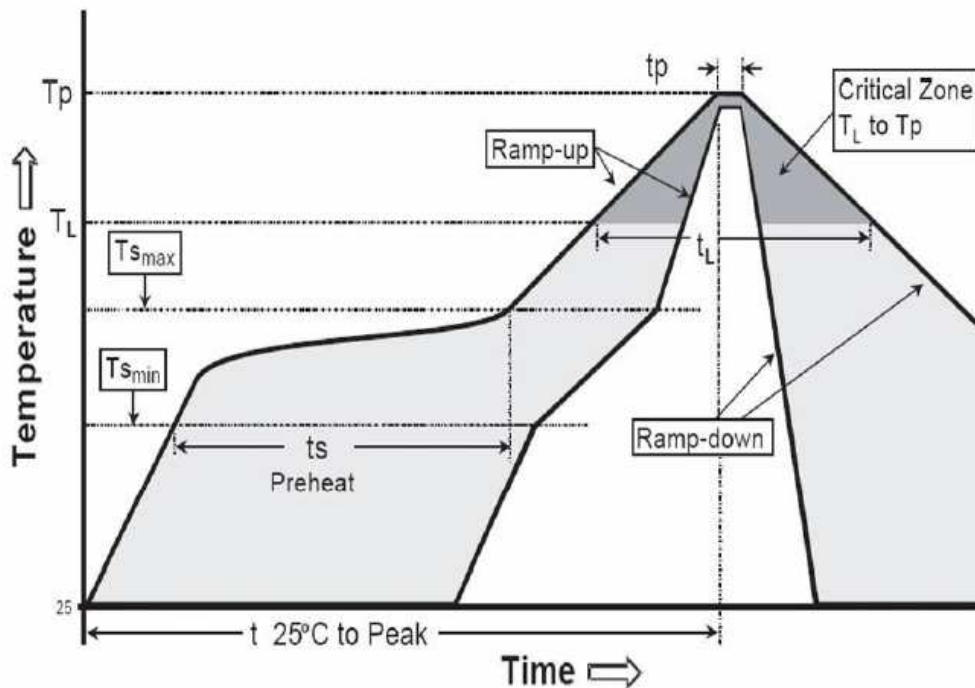
6.2 Typical Application Schematic



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 $T_{s_{max}}$ ° C	60 – 120 s
Time t_L above liquidous temperature T_L (217° C)	60 – 90 s
Peak temperature T_p	max. 260° C
Time t_p at T_p	max. 20 s
Average ramp-down rate	max. 6° C/s

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 shoot it with pressurized air
 - e.g. when cleaning the board or other components on the same board
- Do not apply vacuum to 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.

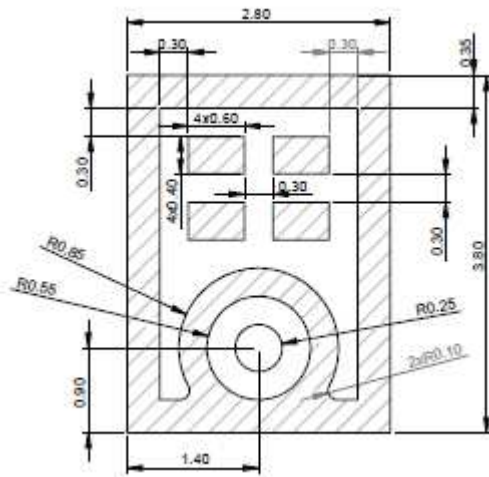
ESD Handling Procedures



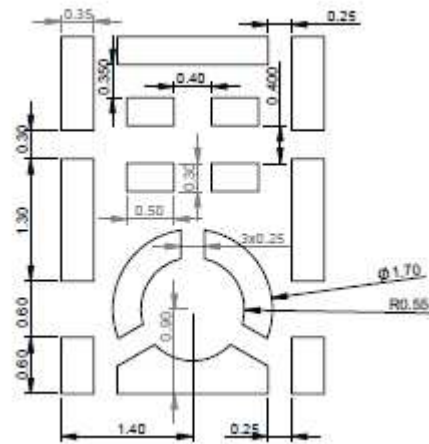
Follow CMOS handling procedures with Akustica MEMS microphones. Handle the microphone with proper workplace grounding to include wrist straps and ionized airflow over open trays and reels of microphones. Do not hot-swap/hot-plug during testing. Device pins have ESD ratings of 2kV/200V for HBM/MM respectively.


7.3 PCB Land Pattern & Stencil Pattern

Land Pattern



Stencil Pattern



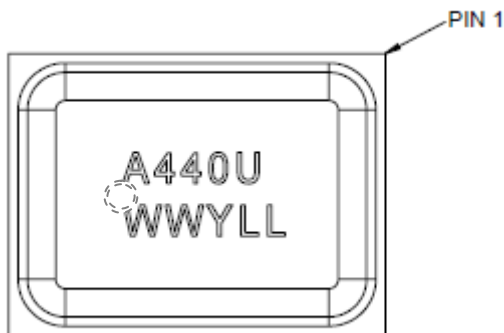
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8. RELIABILITY SPECIFICATIONS

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


	Test	Test Condition
1	Cold Temp Operation	Temperature = -40C, 1000 hours (with bias)
2	Hot Temp Operation	Temperature = 105C, 1000 hours (with bias)
3	Humidity Operation	Temperature = 85C, RH = 85%, 1000 hours (with bias)
4	Cold Temp Storage	Temperature = -40C, 1000 hours (without bias)
5	Hot Temp Storage	Temperature = 105C, 1000 hours (without bias)
6	Humidity Storage	Temperature = 85C, RH = 85%, 1000 hours (without bias)
7	Thermal Cycle	100 Cycles, -40 to +125C, 15min soaks, <30sec ramps
8	Vibration	Sinusoidal Vibration, 20-2000Hz, 4min sweeps, 16min along each of 3 axis, amplitude 3 limits of 20G and 0.06"
9	Mechanical Shock	10,000 G 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 125C, followed by 168 hours at 85C, 85%RH, followed by 3 passes solder reflow (MSL Level 1)

9. PART MARKING INFORMATION



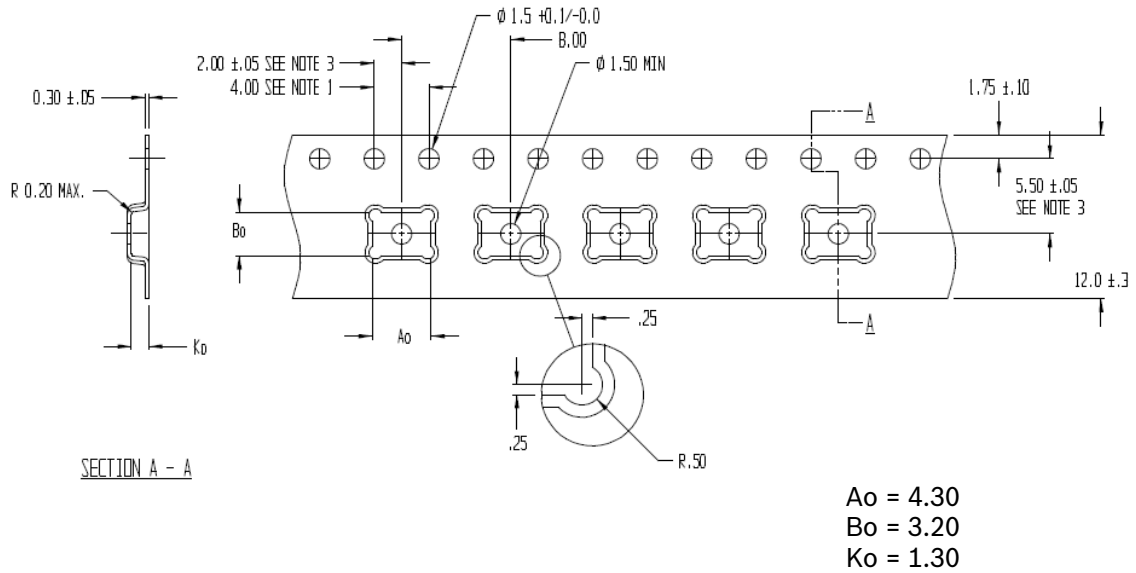
Line 1: A440X (A=Akustica, Part Code=440, U=Assembly Facility)

Line 2: WWYLL (WW= Work Week, Y= Year, LL= Lot Number Processed During Work Week)

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10. PACKAGING INFORMATION

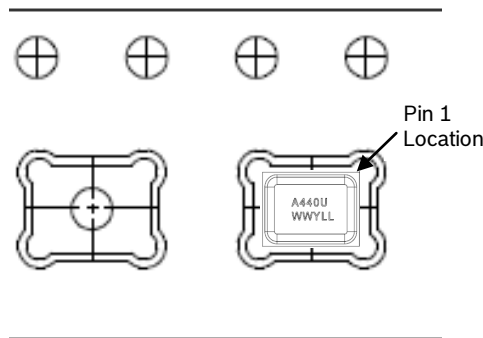
10.1 Tape Specification




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

10.2 Component Orientation



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11. ORDERING INFORMATION

Part Number	Order Number	Part Code	Package	Shipping Method	Standard Quantity
AKU440	02730A0004.C00	A440	5-Pad LGA	13" Reel	5,700

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

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