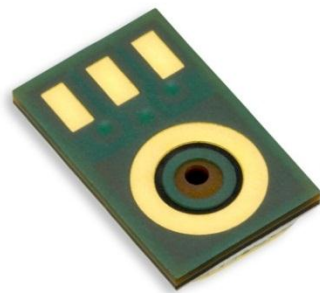


Microphone



The SPY1824LR5H-E is a miniature, high-performance, low power, bottom port silicon microphone. Using Knowles' proven high performance SiSonic™ MEMS technology, the SPY1824LR5H-E consists of an acoustic sensor, a low noise input buffer, and an output amplifier. These devices are suitable for applications such as cellphones, smart phones, laptop computers, sensors, digital still cameras, portable music recorders, and other portable electronic devices where excellent wideband audio performance and RF immunity are required.

Features:

- Small package
- Flat Frequency Response
- Low Current
- MaxRF protection
- Zero-Height Mic™
- Ultra-Stable Performance
- Standard SMD Reflow
- Omnidirectional

1. ABSOLUTE MAXIMUM RATINGS

Parameter	Absolute Maximum Rating	Units
V _{DD} to Ground	-0.5, +5.0	V
OUT to Ground	-0.3, V _{DD} + 0.3	V
Input Current to Any Pin	±5	mA
Temperature Range	-40 to +100	°C

Stresses exceeding these “Absolute Maximum Ratings” may cause permanent damage to the device. These are stress ratings only. Functional operation at these or any other conditions beyond those indicated under “Acoustic & Electrical Specifications” is not implied. Exposure beyond those indicated under “Acoustic & Electrical Specifications” for extended periods may affect device reliability.

2. ACOUSTIC & ELECTRICAL SPECIFICATIONS

TEST CONDITIONS: 23 ±2°C, 55±20% R.H., V_{DD}(min) ≤ V_{DD} ≤ V_{DD}(max), no load, unless otherwise indicated

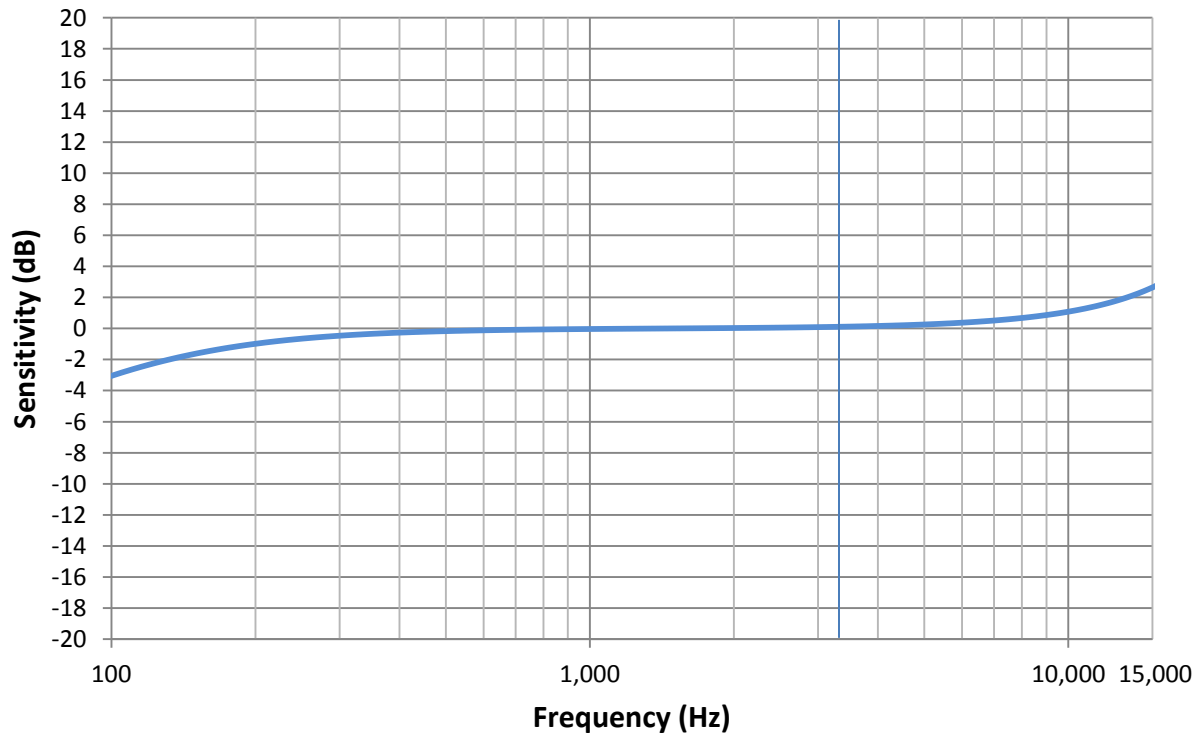
Parameter	Symbol	Conditions	Min	Typ	Max	Units
Supply Voltage ¹	V _{DD}		1.5	-	3.6	V
Supply Current ^{1,2}	I _{DD}		-	120	160	μA
Sensitivity ¹	S	94 dB SPL @ 1 kHz	-40	-38	-36	dBV/Pa
Signal to Noise Ratio	SNR	94 dB SPL @ 1 kHz, A-weighted	-	62	-	dB(A)
Total Harmonic Distortion	THD	94 dB SPL @ 1 kHz, S = Typ, R _{load} > 3 kΩ	-	-	0.5	%
Acoustic Overload Point	AOP	5% THD @ 1 kHz, S = Typ, V _{DD} = 3.6V, R _{load} > 3 kΩ	115	-	-	dB SPL
DC Output		V _{DD} = 1.5V	-	0.72	-	V
Output Impedance	Z _{OUT}	@ 1 kHz	-	-	400	Ω
Directivity			Omnidirectional			
Polarity		Increasing SPL	Increasing output voltage			

¹ 100% tested

² Maximum specifications are measured at maximum V_{DD}. Typical specifications are measured at V_{DD} = 1.8V.

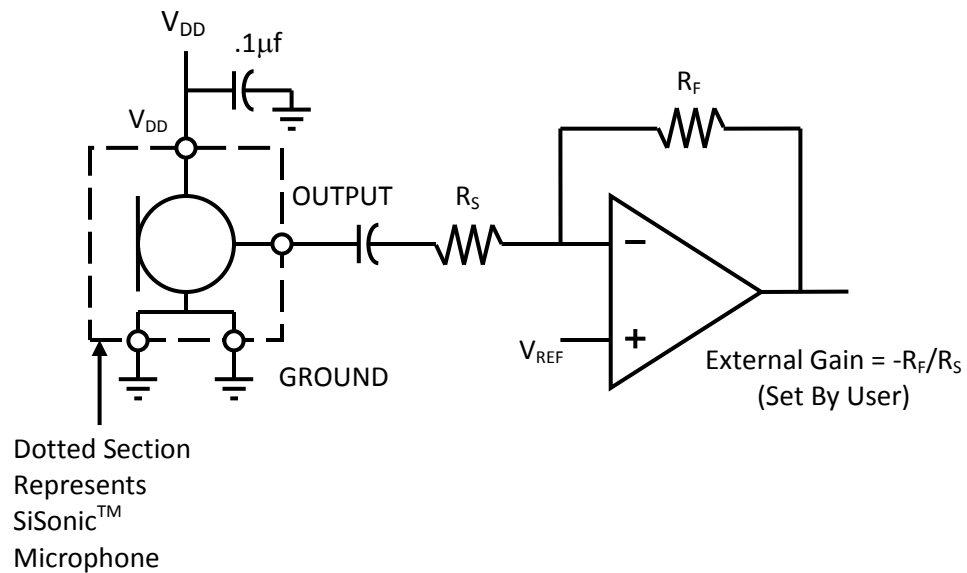
3. FREQUENCY RESPONSE CURVE

**Typical Free Field Response
Normalized to 1kHz**



Free Field Frequency Response Test Mask (Relative to 1 kHz)						
Frequency (Hz)	Lower Limit (dB)	Upper Limit (dB)		Frequency (Hz)	Lower Limit (dB)	Upper Limit (dB)
100	-4.5	-2		6300	-2	2
2000	-2	2		6500	-2	2
2500	-2	2		7000	-2	2
3000	-2	2		7200	-2	2
3500	-2	2		7500	-2	2
4000	-2	2		8000	-2	2
4500	-2	2		8500	-2	2
5000	-2	2		9000	-2	2
5500	-2	2		9500	-2	2
6000	-2	2		10000	-2	2

4. INTERFACE CIRCUIT

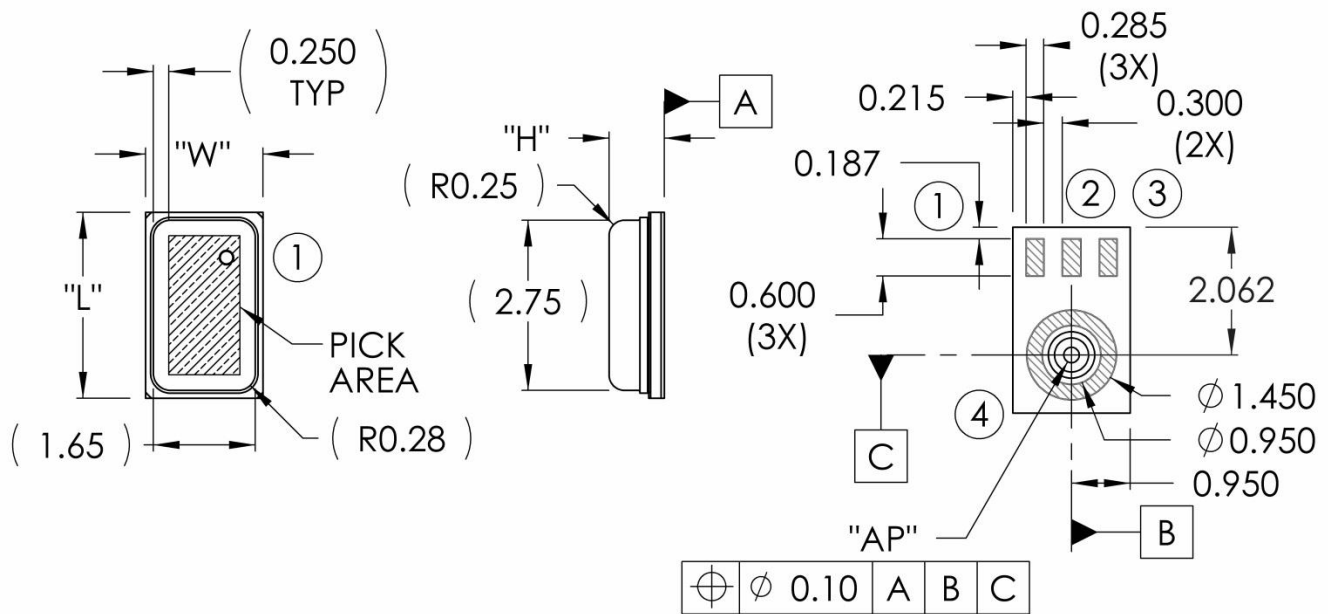


Note: All Ground pins must be connected to ground.

Capacitors near the microphone should not contain Class 2 dielectrics.

Detailed information on acoustic, mechanical, and system integration can be found in the latest *SiSonic™ Design Guide* application note.

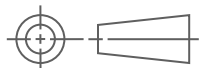
5. MECHANICAL SPECIFICATIONS



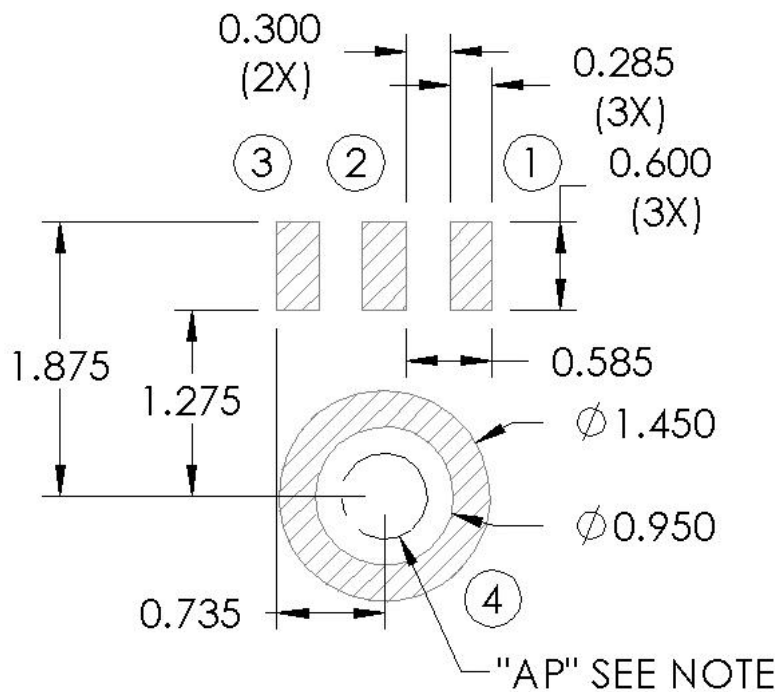
Item	Dimension	Tolerance
Length (L)	3.00	± 0.10
Width (W)	1.90	± 0.10
Height (H)	0.90	± 0.10
Acoustic Port (AP)	$\phi 0.25$	± 0.05

Pin #	Pin Name	Type	Description
1	V _{DD}	Power	Power Supply
2	GROUND	Power	Ground
3	OUTPUT	Signal	Output Signal
4	GROUND	Power	Ground

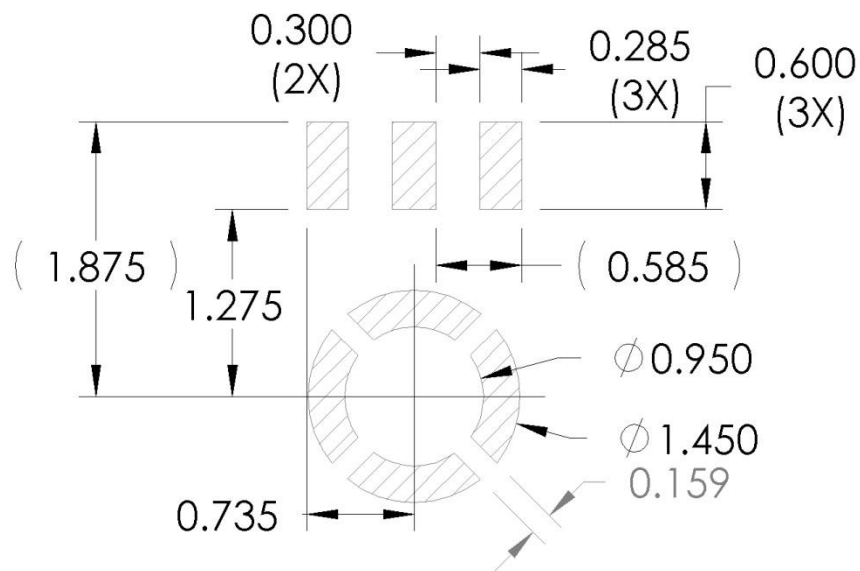
Notes: Pick Area only extends to 0.25 mm of any edge or hole unless otherwise specified.
 Dimensions are in millimeters unless otherwise specified.
 Tolerance is $\pm 0.15\text{mm}$ unless otherwise specified



6. EXAMPLE LAND PATTERN



7. EXAMPLE SOLDER STENCIL PATTERN

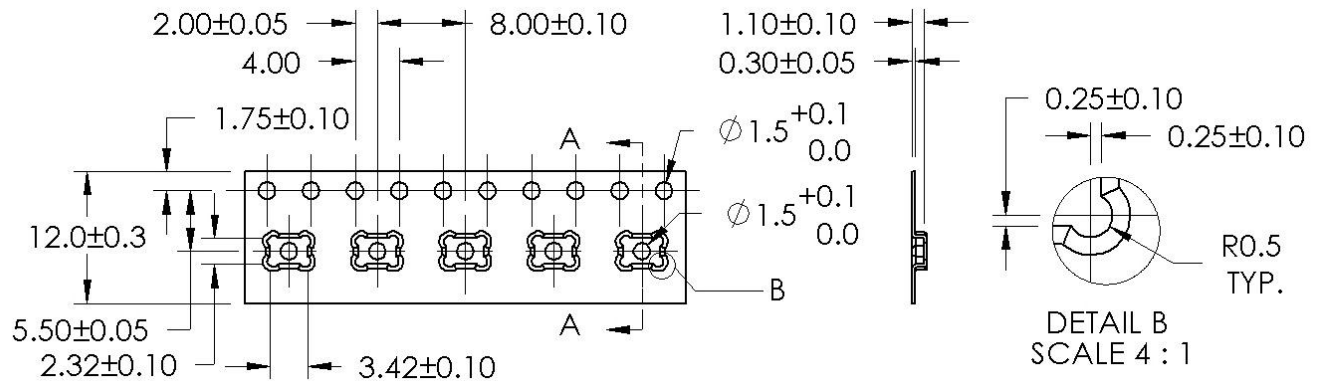


Notes: Dimensions are in millimeters unless otherwise specified.

Detailed information on AP size considerations can be found in the latest *SiSonic™ Design Guide* application note.

Further optimizations based on application should be performed.

8. PACKAGING & MARKETING DETAIL



Model Number	Suffix	Reel Diameter	Quantity Per Reel
SPY1824LR5H-E	-8	13"	5,900

Alpha Character A:

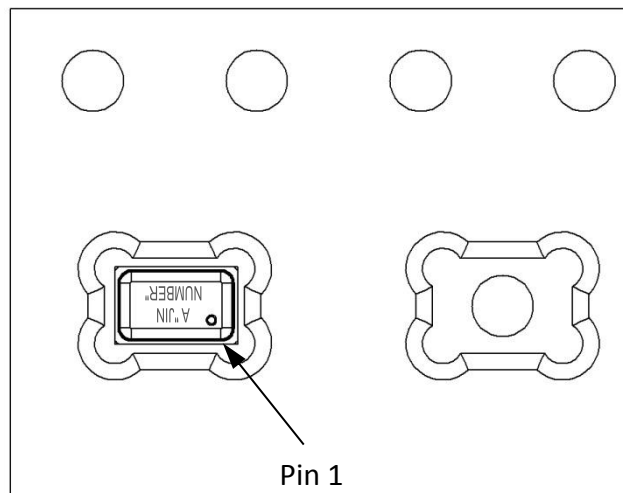
"S": Knowles SiSonic™ Production

"E": Knowles Engineering Samples

"P": Knowles Prototype Samples

"JIN NUMBER":

Unique Job Identification Number
for product traceability



Notes: Dimensions are in millimeters unless otherwise specified.

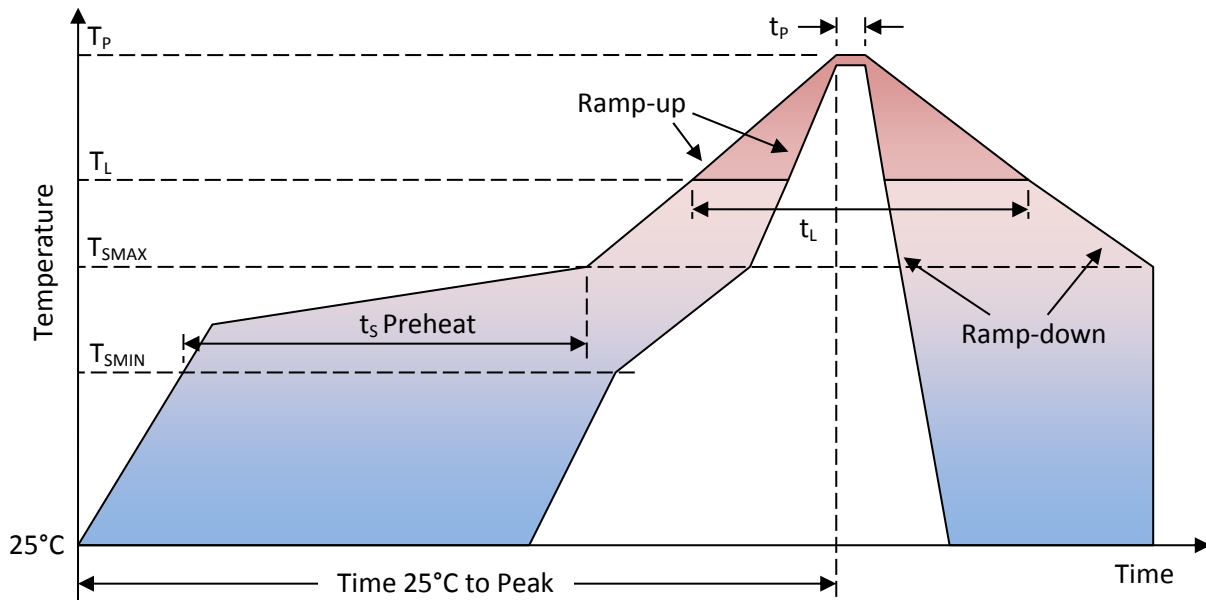
Vacuum pickup only in the pick area indicated in Mechanical Specifications.

Tape & reel per EIA-481.

Labels applied directly to reel and external package.

Shelf life: Twelve (12) months when devices are to be stored in factory supplied, unopened ESD moisture sensitive bag under maximum environmental conditions of 30°C, 70% R.H.

9. RECOMMENDED REFLOW PROFILE



Profile Feature	Pb-Free
Average Ramp-up rate ($T_{S\text{MAX}}$ to T_P)	3°C/second max.
Preheat <ul style="list-style-type: none"> Temperature Min ($T_{S\text{MIN}}$) Temperature Max ($T_{S\text{MAX}}$) Time ($T_{S\text{MIN}}$ to $T_{S\text{MAX}}$) (t_s) 	150°C 200°C 60-180 seconds
Time maintained above: <ul style="list-style-type: none"> Temperature (T_L) Time (t_L) 	217°C 60-150 seconds
Peak Temperature (T_P)	260°C
Time within 5°C of actual Peak Temperature (t_p)	20-40 seconds
Ramp-down rate (T_P to $T_{S\text{MAX}}$)	6°C/second max
Time 25°C to Peak Temperature	8 minutes max

Notes: Based on IPC/JDEC J-STD-020 Revision C.

All temperatures refer to topside of the package, measured on the package body surface.

10. ADDITIONAL NOTES

(A) MSL (moisture sensitivity level) Class 1.

(B) Maximum of 3 reflow cycles is recommended.

(C) In order to minimize device damage:

- Do not board wash or clean after the reflow process.
- Do not brush board with or without solvents after the reflow process.
- Do not directly expose to ultrasonic processing, welding, or cleaning.
- Do not insert any object in port hole of device at any time.
- Do not apply over 30 psi of air pressure into the port hole.
- Do not pull a vacuum over port hole of the microphone.
- Do not apply a vacuum when repacking into sealed bags at a rate faster than 0.5 atm/sec.

11. MATERIALS STATEMENT

Meets the requirements of the European RoHS directive 2011/65/EC as amended.

Meets the requirements of the industry standard IEC 61249-2-21:2003 for halogenated substances and Knowles Green Materials Standards Policy section on Halogen-Free.

Ozone depleting substances are not used in the product or the processes used to make the product, including compounds listed in Annex A, B, and C of the “Montreal Protocol on Substances That Deplete the Ozone Layer.”

12. RELIABILITY SPECIFICATIONS

Note: Microphones must meet all acoustic and electrical specifications before and after reliability testing

Test	Description
Preconditioning	All environmental and reliability tests shall be pre-conditioned with three cycles of reflow using a 260°C peak temperature
Thermal Shock	200 cycles of air-air thermal shock from -40°C to +125°C with 30 minute soaks (IEC 68-2-4)
High Temperature Storage	+105°C environment for 1,000 hours (IEC 68-2-2 Test Ba)
Low Temperature Storage	-40°C environment for 1,000 hours (IEC 68-2-2 Test Aa)
High Temperature Bias	+105°C environment while under bias for 1,000 hours (IEC 68-2-2 Test Ba)
Low Temperature Bias	-40°C environment while under bias for 1,000 hours (IEC 68-2-2 Test Aa)
Temperature/Humidity Bias	+85°C/85% R.H. environment while under bias for 1,000 hours (IEC 68-2-78 Test Cab)
Vibration	16 minutes in each axis from 20 to 2,000 Hz in X,Y, and Z directions with peak acceleration of 20g (MIL 883E, Method 2007.2,A)
Electrostatic Discharge	3 discharges at +/-8kV direct contact to lid when unit is grounded (IEC 61000-4-2) and 3 discharges at +/-2kV direct contact to I/O pins (MIL 883E, Method 3015.7) and 3 discharges at +/- 200V pin-to-pin (ESDA STM 5.2, ESD-MM)
Reflow	5 reflow cycles with peak temperature of +260°C
Compressed Air Test	Ramp-up positive air pressure in 0.1 MPa increments and apply directly to microphone acoustic port hole for 1s
Air Suction Test	Ramp-up negative air pressure in 0.1 MPa increments and apply directly to microphone acoustic port hole for 1s
Tumble test	200 tumbles in 100g block from a height of 1m onto a steel base
Mechanical Shock	5 pulses of 10,000g in each of the $\pm X$, $\pm Y$, $\pm Z$ directions while under bias (IEC 68-2-27 Test Ea)
Accelerated Life Test	96 hours of 130 dB SPL of simulated normal program material under bias (IEC 60268-1)

13. SPECIFICATIONS REVISIONS

[illegible]