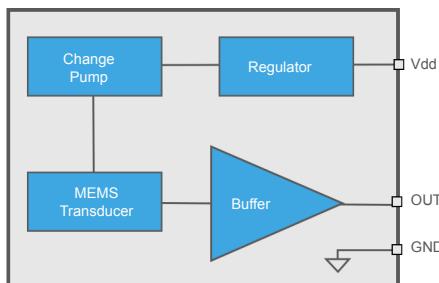


WIDE BANDWIDTH, LOW NOISE, PRECISION TOP PORT SISONIC™ MICROPHONE



The SPH1642HT5H-1 is a miniature, high-performance, low power, matched sensitivity top port silicon microphone. Using Knowles' proven high performance SiSonic™ MEMS technology, the SPH1642HT5H-1 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.



PRODUCT FEATURES

- Matched Sensitivity
- LGA Package
- Flat Frequency Response
- Low Current
- MaxRF Protection
- Top Port
- Ultra-Stable Performance
- Standard SMD Reflow
- Omnidirectional

ABSOLUTE MAXIMUM RATINGS

Table 1: Absolute Maximum Ratings

| Parameter | Absolute Maximum Rating | Units |
|--------------------------|-------------------------|-------|
| Vdd to Ground | -0.3, +5.0 | V |
| Out to Ground | -0.3, Vdd+0.3 | V |
| Input Current to any pin | ±5 | mA |
| Storage Temperature | -40 to +100 | °C |
| Operating Temperature | -30 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.

TYPICAL APPLICATIONS

- Portable electronics
- Cellphones
- Laptop Computers
- Tablets
- Digital Still Cameras
- Portable Music Recorders



ACOUSTIC & ELECTRICAL SPECIFICATIONS¹

Table 2: General Microphone Specifications

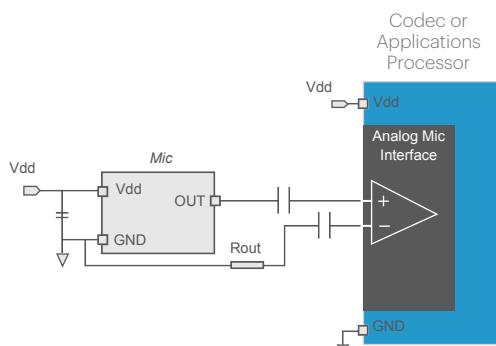
Test Conditions: 23 ±2°C, 55±20% R.H., Vdd=1.8V, no load, unless otherwise indicated

| Parameter | Symbol | Conditions | Min | Typ | Max | Units |
|------------------------------|--------|--|-----|------|---------------------------|--------|
| Supply Voltage | Vdd | | 1.5 | - | 3.6 | V |
| Supply Current | Idd | Vdd = 3.6V | - | 132 | 185 | µA |
| | | Vdd = 1.8V | - | 117 | 130 | |
| Sensitivity | S | 94 dB SPL @ 1 kHz | -39 | -38 | -37 | dBV/Pa |
| Signal to Noise Ratio | SNR | 94 dB SPL @ 1 kHz, A-weighted | - | 65 | - | dB(A) |
| Total Harmonic Distortion | THD | 94 dB SPL @ 1 kHz, S = Typ, Rload > 2kΩ | - | 0.25 | - | % |
| | | 1% THD @ 1 kHz Vdd = 1.8V, S = Typ, Rload > 2kΩ | - | 107 | - | dB SPL |
| Acoustic Overload Point | AOP | 10% THD @ 1 kHz, Vdd = 1.8V, S = Typ, Rload > 2kΩ | - | 124 | - | dB SPL |
| Low Frequency Rolloff | LFRO | -3dB relative to 1kHz | - | 55 | - | Hz |
| Power Supply Rejection Ratio | PSRR | 200 mVpp sinewave @ 1kHz, Vdd = 1.8 v | - | 77 | - | dB |
| Power Supply Rejection | PSR+N | 200 mVpp 7/8 duty cycle rectangular wave @ 217 Hz, Vdd = 1.8V, A-weighted | - | -102 | - | dBV(A) |
| DC Output | | Vdd = 1.8V | - | 1.30 | - | V |
| Output Impedance | | @ 1 kHz | - | | 500 | Ω |
| Sensitivity Drop | | Vdd(min) ≤ Vdd ≤ Vdd(max) | - | - | ±0.25 | dB |
| Directivity | | | | | Omnidirectional | |
| Polarity | | Increasing sound pressure | | | Increasing output voltage | |

¹ Sensitivity and Supply Current are 100% tested.

APPLICATION NOTES

Figure 1: Typical Application Circuit



NOTES:

All Ground pins must be connected to ground.

Capacitors near the microphone should not contain Class 2 dielectrics due to their piezoelectric effects.

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



PERFORMANCE CURVES

Test Conditions: Vdd=1.8V, no load, unless otherwise indicated

Figure 2: Typical Free Field Response Normalized to 1 kHz

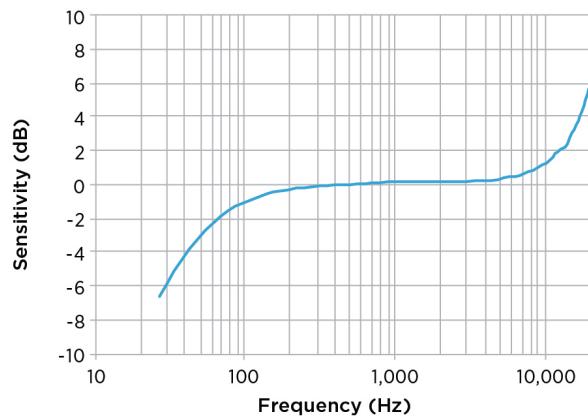


Figure 4: Typical THD vs SPL

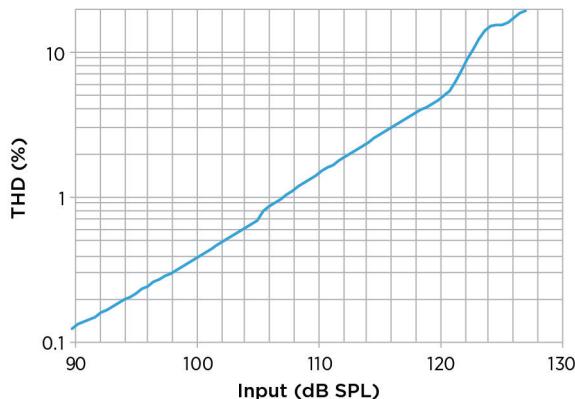


Figure 6: THD vs Frequency

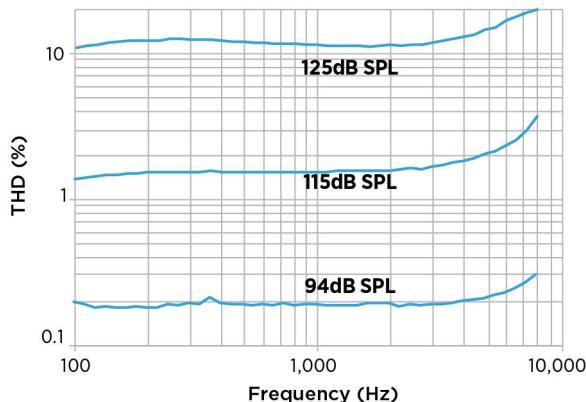


Figure 3: Typical PSRR vs Frequency

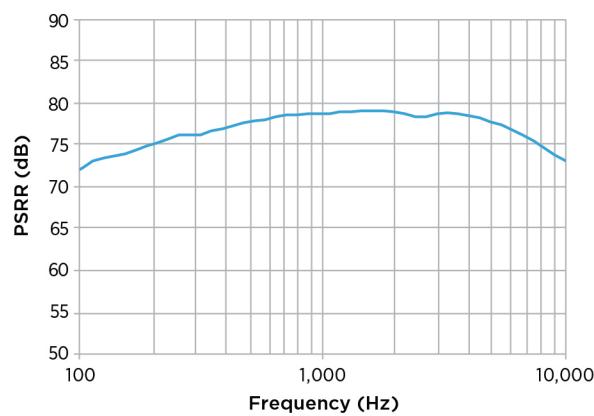


Figure 5: Typical Idd vs Vdd

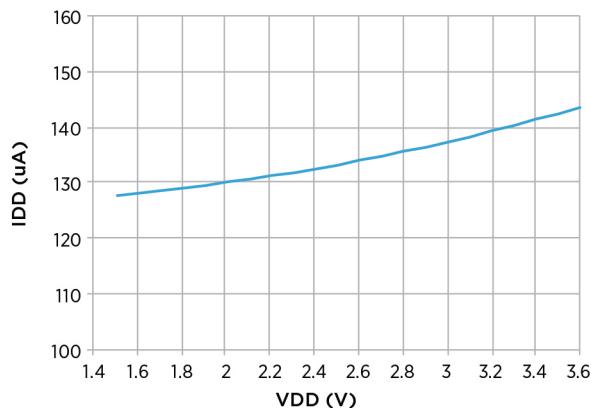
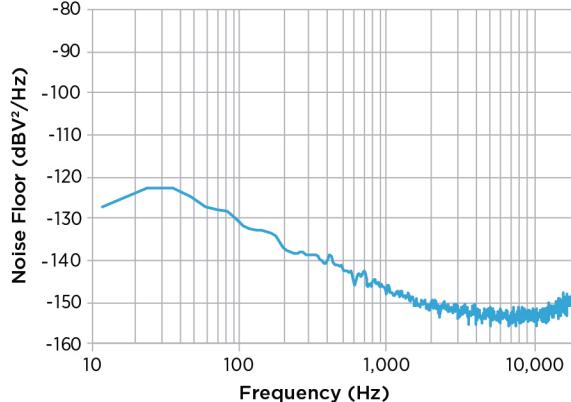
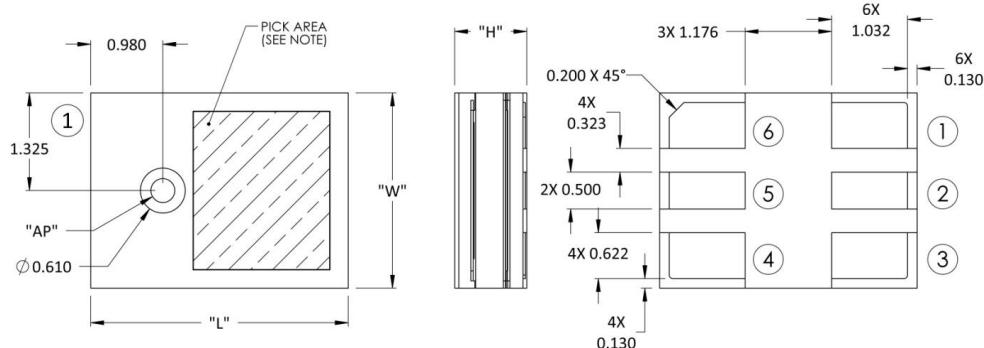


Figure 7: Noise Floor Power Spectral Density

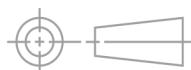


MECHANICAL SPECIFICATIONS



| Item | Dimension | Tolerance |
|--------------------|-----------|------------|
| Length (L) | 3.50 | ± 0.10 |
| Width (W) | 2.65 | ± 0.10 |
| Height (H) | 1.00 | ± 0.10 |
| Acoustic Port (AP) | 0.325 | ± 0.10 |

| Pin # | Pin Name | Type | Description |
|-------|---------------------------------|--------|-------------------|
| 1 | GROUND | Power | Ground |
| 2 | GROUND | Power | Ground |
| 3 | GROUND | Power | Ground |
| 4 | OUTPUT | Signal | Output Signal |
| 5 | TEST PIN (Knowles Internal Use) | N/A | Connect to Ground |
| 6 | Vdd | Power | Power Supply |



NOTES:

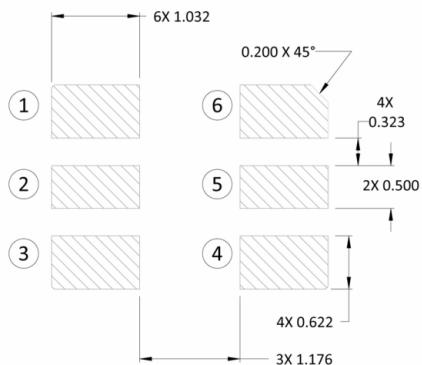
Pick Area only extends to 0.25 mm of any edge or hole unless otherwise specified.

Dimensions are in millimeters unless otherwise specified. Tolerance is ± 0.15 mm unless otherwise specified.

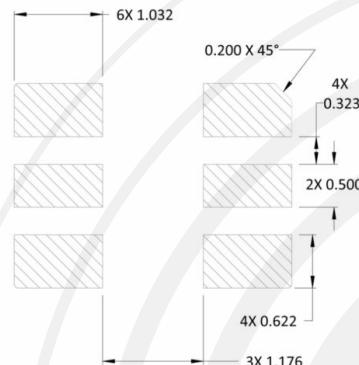
Detailed information on AP size considerations can be found in the latest SiSonic™ Design Guide application note.

Further optimizations based on application should be performed.

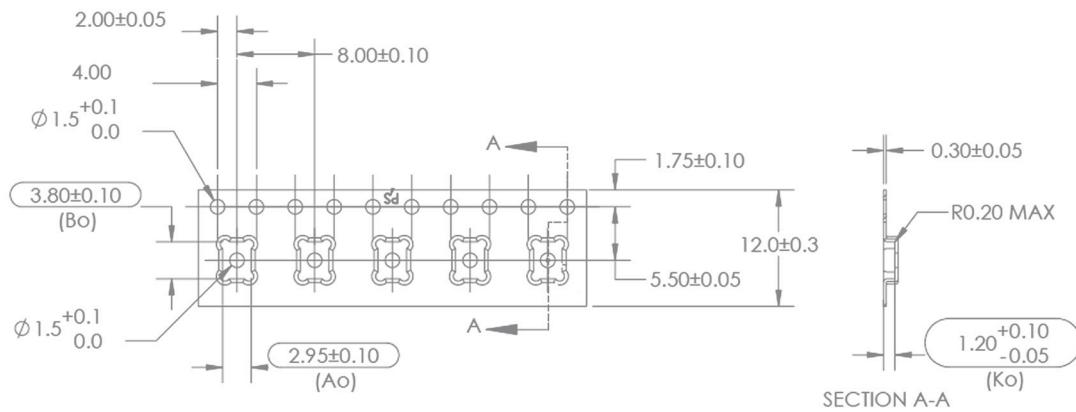
Example Land Pattern



Example Solder Stencil Pattern



PACKAGING & MARKING DETAIL



| Model Number | Suffix | Reel Diameter | Quantity Per Reel |
|---------------|--------|---------------|-------------------|
| SPH1642HT5H-1 | -8 | 13" | 5,900 |

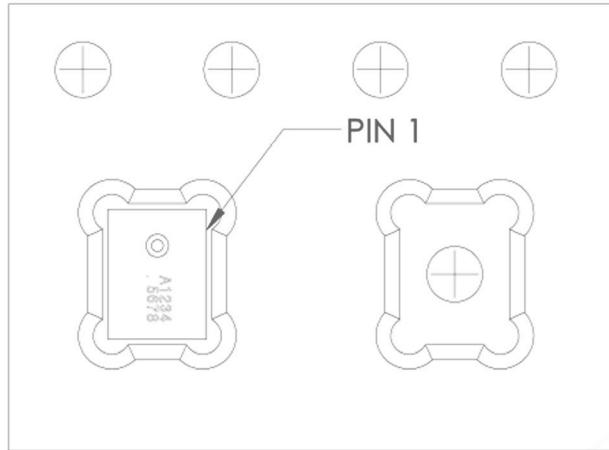
“o”: orientation mark

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.

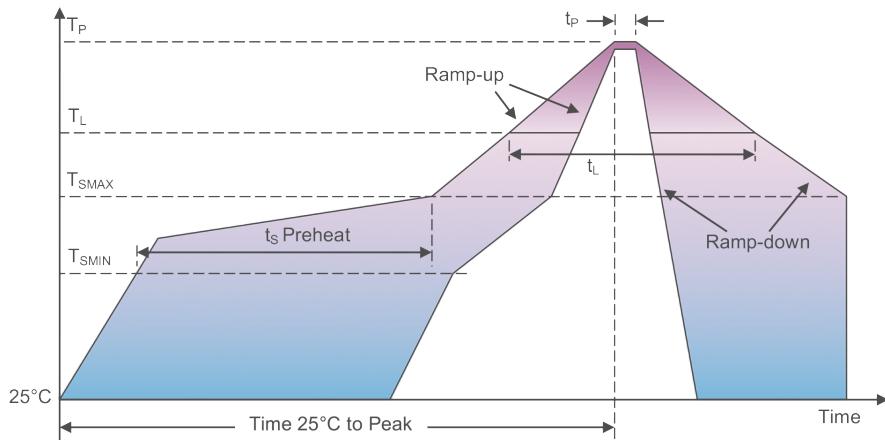
Tape & reel per EIA-481.

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.



RECOMMENDED REFLOW PROFILE



| Profile Feature | Pb-Free |
|--|----------------------------------|
| Average Ramp-up rate ($T_{S\text{MIN}}$ 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 (TL) Time (tL) | 217°C 60-150 seconds |
| Peak Temperature (TP) | 260°C |
| Time within 5°C of actual Peak Temperature (tP) | 20-40 seconds |
| Ramp-down rate (TP to TSMAX) | 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.

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.



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."

RELIABILITY SPECIFICATIONS

| Test | Description |
|---------------------------|--|
| Reflow | 5 reflow cycles with peak temperature of +260°C |
| 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 68-2-1 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 68-2-1 Test Aa) |
| Temperature/Humidity Bias | +85°C/85% R.H. environment while under bias for 1,000 hours (JESD22-A101A-B) |
| Thermal Shock | 100 cycles of air-air thermal shock from -40°C to +125°C with 15 minute soaks (IEC 68-2-4) |
| Vibration | 12 minutes in each X, Y, Z axis from 20 to 2,000 Hz with peak acceleration of 20 G (MIL 883E, Method 2007.2,A) |
| Mechanical Shock | 3 pulses of 10,000 G in each of the X, Y, and Z directions (IEC 68-2-27 Test Ea) |
| ESD-HBM | 3 discharges of $\pm 2\text{kV}$ direct contact to I/O pins (MIL 883E, Method 3015.7) |
| ESD-HBM (LID/GND) | 3 discharges of $\pm 8\text{kV}$ direct contact to lid while unit is grounded (MIL 883E, Method 3015.7) |
| ESD-MM | 3 discharges of $\pm 200\text{V}$ direct contact to IO pins (ESD STM5.2) |

NOTES:

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

After 3 reflow cycles, the sensitivity of the microphones shall not deviate more than 1 dB from its initial value.



SPECIFICATION REVISIONS

| Revision | Specification Changes | Date |
|----------|---|------------|
| A | Initial Release ECR#15-181 | 5/21/2015 |
| B | Changed THD to 0.25% ECR#15-129 | 7/21/2015 |
| C | Changed microphone photograph ECR#16-1240 | 10/27/2016 |
| D | Update Pin description ECR #17-1656 | 5/15/17 |
| E | Update Temperature range ECR#17-2010 | 11/13/17 |

Information contained herein is subject to change without notice. It may be used by a party at their own discretion and risk.
We do not guarantee any results or assume any liability in connection with its use. This publication is not to be taken as a license to operate under any existing patents.

Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

Knowles:

[SPH1642HT5H-1](#) [SPH1642HT5H-1-8](#)