



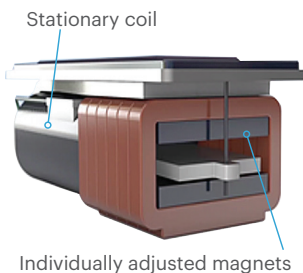
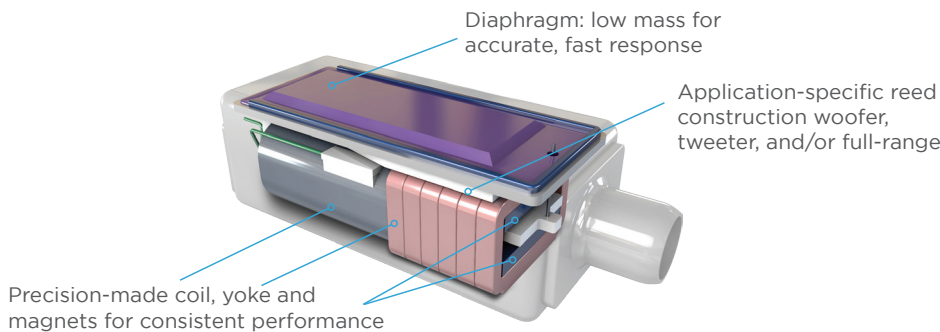
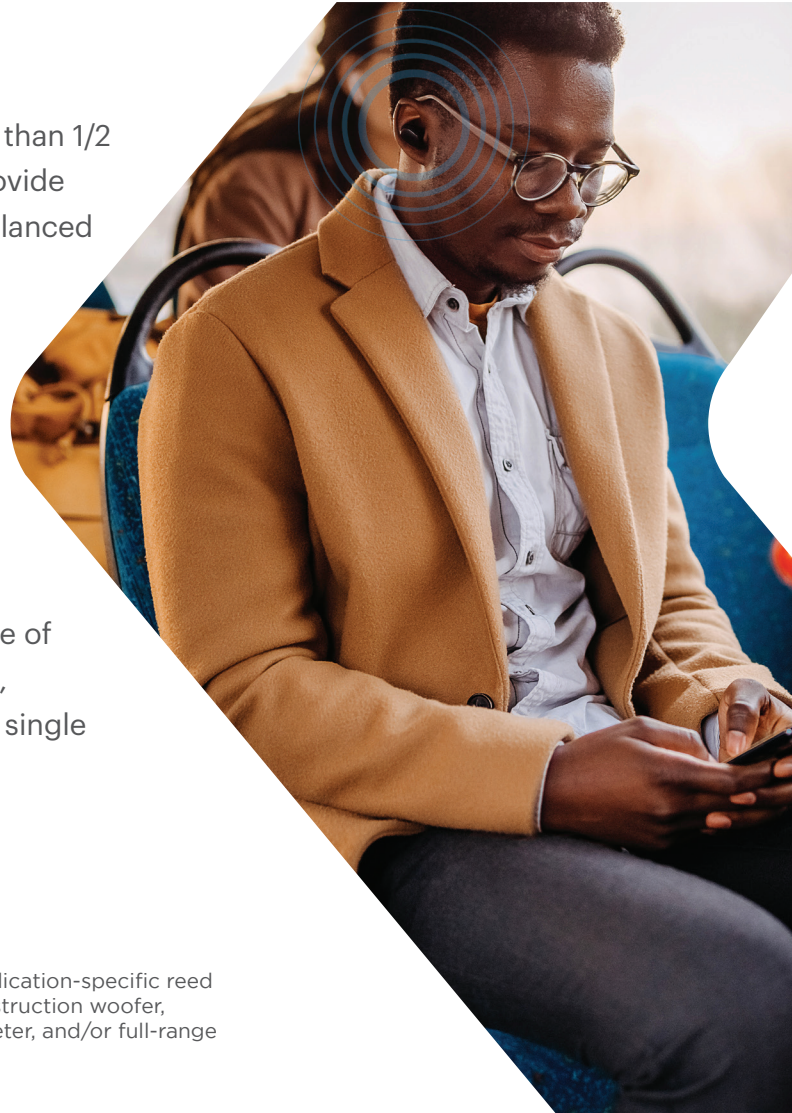
KNOWLES BALANCE ARMATURE DRIVERS FOR
PREMIUM SOUND: TRUE WIRELESS HEARABLES
SELECTION GUIDE

MARCH 2023

Small Size, Premium Sound

Knowles' tiny balanced armature drivers occupy less than 1/2 the volume of the smallest dynamic speakers, yet provide premium sound. Small enough to fit in the ear tip, balanced armature drivers allow more room in hearables for sensors, additional features, or a larger battery, without sacrificing comfort. Their high efficiency means longer battery life in the coming next generation of hearables as they do for hearing aids today.

In wired or wireless earphones, balanced armature drivers are small enough to replicate the performance of premium loudspeakers by allowing separate woofers, mid-range drivers, and tweeters to be combined in a single package.

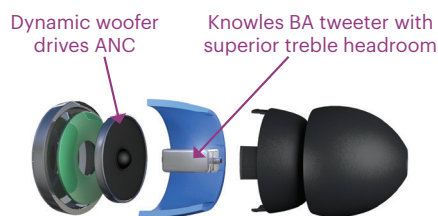


THE BALANCED ARMATURE ADVANTAGE

- ▶ Balanced Armature (BA) drivers offer improved fidelity, realism and detail over traditional dynamic drivers. They are incredibly small and lightweight, and provide greater output with less power.
- ▶ A BA driver can also be combined with a dynamic speaker to form a hybrid earphone. In this configuration, the BA drivers focus on the critical high end portion of the audio spectrum, bringing a new level of clarity and realism.

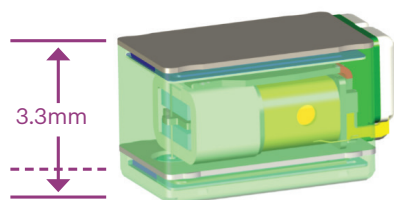
| | PART NUMBER | CONFIGURATION | SIZE IN (mm) | Z @ 1KHz (Ω) | SENS (dB SPL) TO 100mV / TO 1mW | MAX SPL 10% THD 1kHz (dB SPL) | THD@ 94dB SPL / THD@ 100dB SPL | VENTED | |
|------------|----------------|----------------------------|--------------|--------------|---------------------------------|-------------------------------|--------------------------------|--------|--|
| TWEETER | RAN-33860-B148 | Single | 5.1x2.8x2.0 | 14 | 94 | 108 | 0.3% / 0.5% | No | |
| | SWFK-31736-000 | Dual | 5.0x2.7x3.9 | 6.9 | 102 / 100 | 114 | 0.2% / 0.2% | No | |
| | RAU-34832-B148 | Single Supertweeter | 5.1x2.8x2.0 | 14(*) | 103(*) / n/a | 122(*) | 0.3% / 0.3%(*) | No | |
| | RDU-35000-000 | Dual Supertweeter | 5.1x2.8x4.1 | 7(*) | 109(*) / n/a | 127(*) | 0.2% / 0.2%(*) | No | |
| FULL RANGE | RAQ-35091-000 | Single | 5.3x2.7x1.6 | 74 | 109 / 117 | 122 | 1.1% / 1.3% | Yes | |
| | RAQ-33862-000 | Single | 5.3x2.7x1.6 | 56 | 106 / 113 | 120 | 0.7% / 0.8% | No | |
| | RLQ-34240-000 | Dual-diaphragm high-output | 5.3x3.1x2.7 | 57 | 111 / 120 | 126 | 0.3% / 0.4% | Yes | |

* Supertweeter performance is specified at 10kHz
Other models available, please contact a Knowles representative



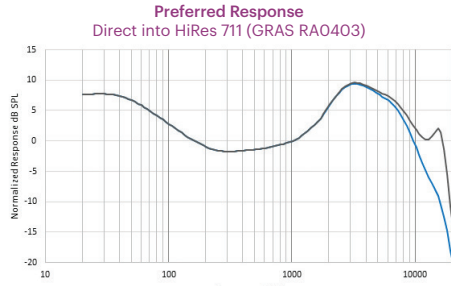
HYBRID WITH KNOWLES BA TWEETER SOLVES ACOUSTIC CHALLENGES IN MODERN TWS EARPHONES

- ▶ Combination of ANC, extended treble, and hearing personalization pose challenges for small full-range speakers:
 - ▶ Potential overload of equalizer, DAC, or power amp.
 - ▶ Excessive power consumption.
- ▶ Hybrid drivers solve these problems by splitting woofer and tweeter functions using high-output BA for superior treble.



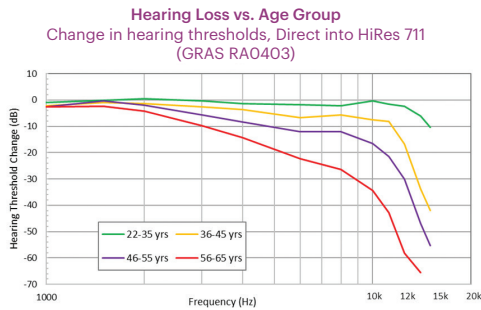
NEW DUAL-DIAPHRAGM RLQ DELIVERS BEST-IN-CLASS OUTPUT FOR SIZE

- ▶ Patented design has two separate diaphragms driven by a single motor.
- ▶ 5 dB more output than single diaphragm RAQ with very little size impact.
- ▶ Each diaphragm is in its own chamber, resulting in rich sound.



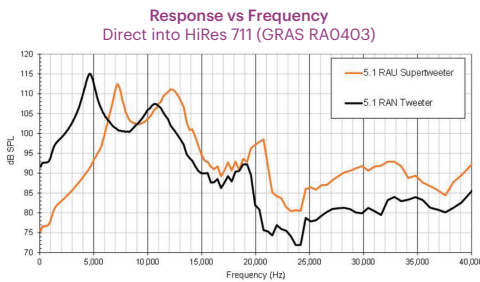
PREFERRED RESPONSE CURVE FOR EARPHONES

- ▶ A traditional industry-standard target response curve (blue), characterized the preferred earphone response curve up to 10kHz.
- ▶ With evolution of Hi Res Audio, Knowles studied user preference between 8kHz and 20kHz (black).
- ▶ Preferred response white paper: <https://www.knowles.com/preferred-listening-response>



DELIVERING HD AUDIO EXPERIENCE AT ANY AGE REQUIRES HIGH-PERFORMANCE DRIVERS

- ▶ Biggest difference with HD audio is in the treble.
- ▶ Threshold of hearing changes as we age.
- ▶ With BA drivers, running high gain for hearing personalization avoids overloading the equalizer, DAC, and power amp while minimizing power draw.



NEW RAU SUPERTWEETER DELIVERS SUPERIOR OUTPUT LEVEL AND TREBLE EXTENSION TO 40 KHZ AND BEYOND

- ▶ Knowles BA tweeter and new Supertweeter deliver hi-res audio with superior performance.
- ▶ Drive directly from DSP.
- ▶ No high voltage amplifier or transformer needed.
- ▶ Micro-sized RAU: 5.1 × 2.8 × 2.0mm.
- ▶ Also available in Dual and Quad configurations.

KNOWLES TURNKEY TWS REFERENCE DESIGNS

Key Benefits

- ▶ Turnkey reference design - Fast time to market for TWS with premium sound and ANC
- ▶ Manufactured by leading ODMs
- ▶ Outstanding performance

Key Features Common to KN1 and KN2

- ▶ Premium hybrid driver: Knowles BA RAN + dynamic
- ▶ Hybrid ANC & transparency mode
- ▶ Long battery life
- ▶ Dual-mic outgoing noise reduction

Model KN1

Knowles P/N TC-35030-000

- ▶ Extended treble for premium sound
- ▶ Long battery life:
 - ~13 hours streaming, ANC off
 - ~10 hours streaming, ANC on
- ▶ SoC Airoha 1562A
- ▶ Audio codecs:
 - ▶ SBC
 - ▶ AAC



Model KN2

Knowles P/N TC-35064-000

- ▶ Extended treble according to Knowles Preferred Listening Curve
- ▶ Long battery life:
 - ~8 hours streaming
- ▶ Temperature & in-ear sensors
- ▶ Demo Android app
- ▶ SoC Qualcomm QCC5144
- ▶ Audio codecs:
 - ▶ SBC
 - ▶ AAC
 - ▶ aptX (+ Adaptive with license)



Available on Digi-Key

ADDITIONAL RESOURCES

Knowles Premium Sound: www.KnowlesPremiumSound.com
 The evolution of in-ear video: <https://vimeo.com/252195208>
 Datasheets: <https://www.knowles.com/subdepartment/dpt-balanced-armature-receivers-and-speakers/subdpt-premium-audio>
 White papers: <https://www.knowles.com/applications/ear-solutions/premium-sound/resource-center>

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