1. Product Overview

The SKM4610-HC is a plug-and-play digital microphone module for consumer electronics with a PDM output that incorporates an SKR0610 dipole microphone. It streamlines acoustic design by rerouting both sound ports onto a single surface with a pre-installed acoustic mesh for ingress protection, delivering exceptional directional audio capture with minimal integration effort. The SKM4610-HC outputs a hypercardioid polar pattern.

Characteristics

- Hypercardioid polar pattern
- 66 dBA SNR
- 5.3 dB DI
- Integrated meshes for IP58
- Pre-tested sealing: >15 dB at 100 Hz–5 kHz, >10 dB at 5–8 kHz, >15 dB at 8–20 kHz
- Two acoustic ports on the same surface
- 780 µA supply current at 3.072 MHz
- 16.40 × 7.00 × 6.40 mm³

Applications

- AR & VR devices
- Conferencing devices
- Webcams & security cameras
- Headsets
- Intercoms & video doorbells
- Voice badges
- Smart home devices

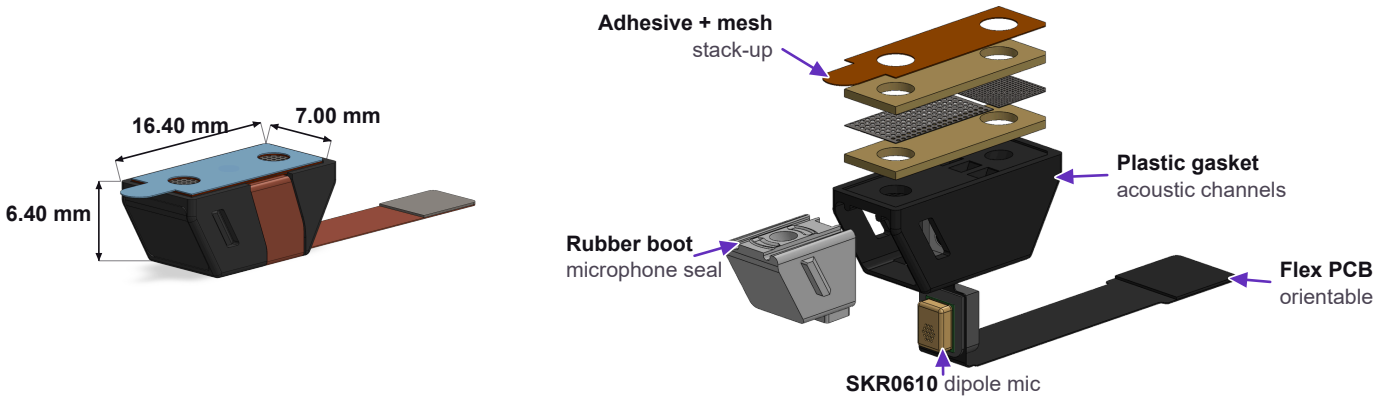


Figure 1.1: Module design features

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3. Typical Application Circuit

The SKM4610-HC module is a single hypercardioid microphone built around the SKR0610, as shown in the application circuit.

The recommended operating conditions are CLK = 3.072 MHz and V_{dd} = 1.8 V. Using CLK < 3.072 MHz will increase high-frequency noise and decrease SNR due to insufficient oversampling of the PDM signal. CLK > 3.072 MHz will increase the current consumption without any improvement in SNR, AOP, or any other specification. Using V_{dd} > 1.8 V will increase current consumption without any improvement in SNR, AOP, or any other specification.

The PDM interface (PDM to PCM converter) of the application processor should have a resolution ≥ 24 bit to achieve maximum SNR. A 16-bit resolution can also be used but will add high-frequency noise to the microphone and reduce SNR by 1 dB.

A 0.1 µF capacitor should be placed between V_{dd} and GND as close to the microphone as possible to reduce supply noise. According to the PCB trace impedance, damping resistors R_{term} of 33 Ω to 100 Ω may be placed near the microphone DATA pin and near the application processor's CLOCK to reduce overshoots and ringing.

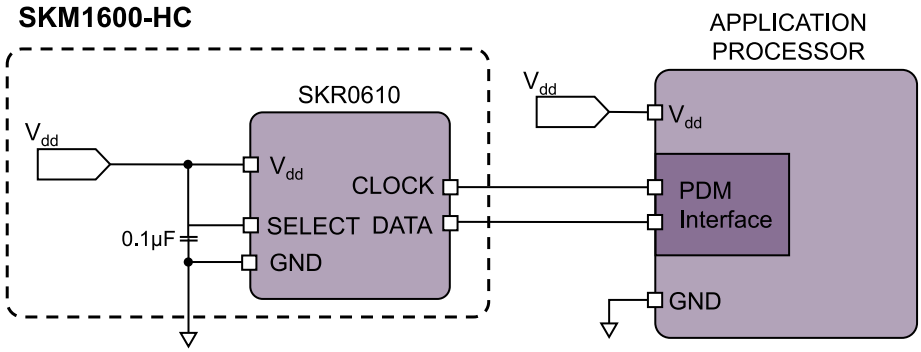


Figure 3.1: Typical module application circuit

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4. Specifications

Module specifications, one column per microphone. Unless otherwise specified, all measurements are taken at 25 °C, V_{dd} = 1.8 V, 1 m, f_{clock} = 3.072 MHz. Power, dimensions and packaging are module-level.

Parameter	Symbol	Condition	Hypercardioid	Unit
Acoustic				
Output		1-bit stream; level is the density of 1s	PDM	
Pickup pattern			Hypercardioid	
Polarity		Increasing pressure at the front port	Increasing density of 1s	
		Increasing pressure at the back port	Decreasing density of 1s	
Microphone			SKR0610	
Signal-to-noise ratio	SNR	94 dB SPL, A-wtd	66	dBA
Sensitivity	S	1 kHz, 94 dB SPL	−29 ±2	dBFS/Pa
Noise floor		A-weighted	−90	dBFS(A)
Avg. directivity index	DI	20 Hz–20 kHz	5.3	dB
Unidirectional index	UI	20 Hz–20 kHz	6.2	dB
Total harmonic distortion	THD	1% THD, 1 kHz	109	dB SPL
Acoustic overload point	AOP	10% THD, 1 kHz	127.5	dB SPL
Resonant frequency	F_{res}		4	kHz
Null angle			110, 250	°
Power				
PSRR	PSRR	1 kHz	75	dB
Supply voltage	V_{dd}		1.6–3.6	V
Supply current	I_{dd}	f_{clock} = 3.072 MHz	780	µA
		f_{clock} = 2.400 MHz	730	
		f_{clock} = 1.536 MHz*	675	
		f_{clock} = 0.768 MHz*	290	
Standby current	$I_{standby}$	f_{clock} < 0.100 MHz	5	µA
Startup time	t_{on}		60	ms
Physical & packaging				
Dimensions			16.40 × 7.00 × 6.40	mm
Ingress protection			IP58	
Quantity per box			960	
Absolute maximum ratings				
Vdd to GND	V_{dd}		5.0	V
Input current			±5	mA
Storage temperature	T_{stg}		−40 to 85	°C
Operating temperature	T_{op}		−40 to 85	°C

Table 4.1: Module acoustic and electrical specifications

* Lower clock rates raise the noise floor at high frequencies; see the SKR0610 datasheet.

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5. Performance Curves

Typical performance at 25 °C, V_{dd} = 1.8 V, 1 m. Each plot names the microphone it was measured on.

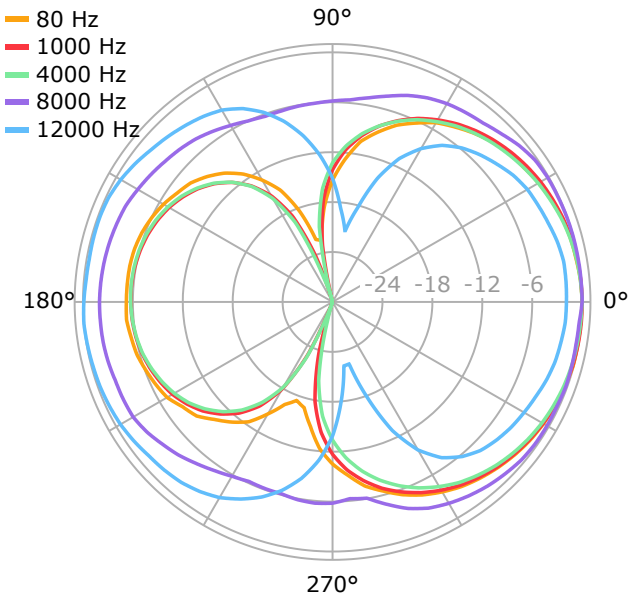


Figure 5.1: Polar pattern

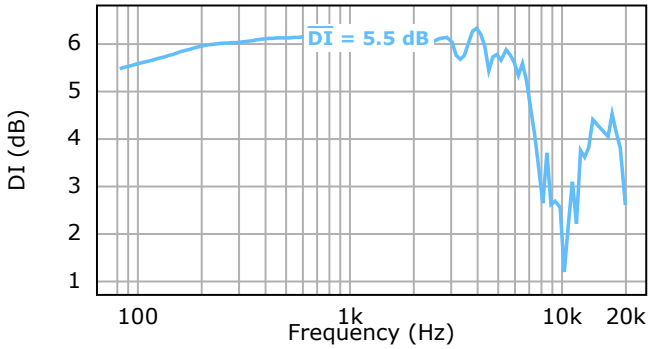


Figure 5.2: Directivity index vs. frequency

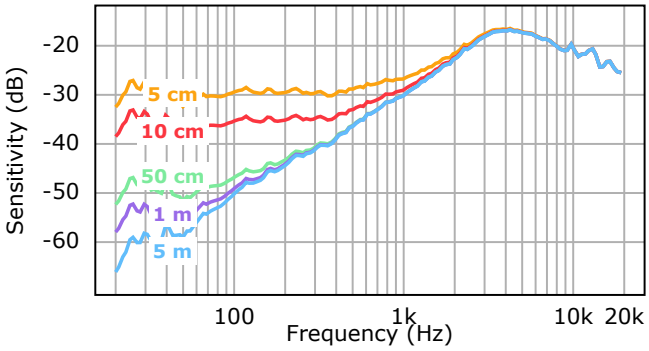


Figure 5.3: Magnitude response

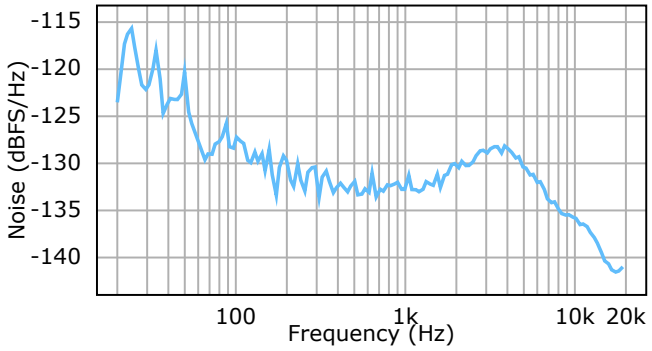


Figure 5.4: Noise floor

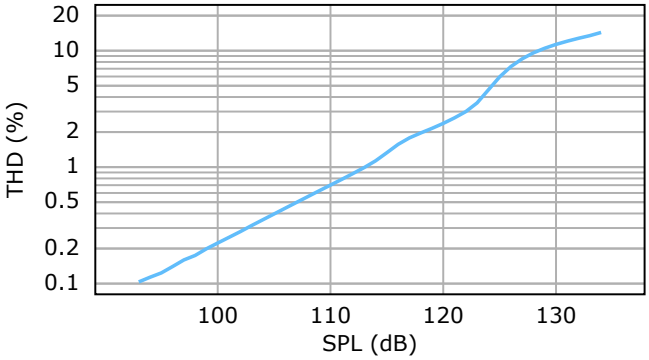


Figure 5.5: THD vs. SPL (1 kHz)

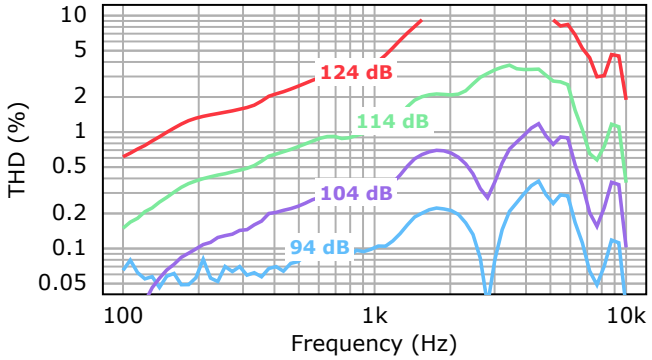


Figure 5.6: THD vs. frequency

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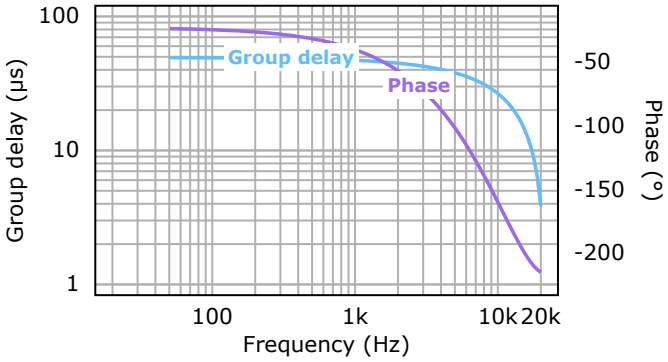


Figure 5.7: Phase & group delay

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6. Specification Calculation Details

Directivity Index and Average Directivity Index Calculation

The directivity index (DI) measures the ratio of the microphone output for a sound positioned directly in front of the microphone (θ = 0°) versus sound with the same amount of total acoustic power coming from all directions equally.

$$\mathrm{DI} = 10\log_{10}\left(\frac{4 \cdot \mathrm{amplitude}\left(\theta = 0\right)^2}{\int_0^{2\pi} \mathrm{amplitude}\left(\theta\right)^2 |\sin\ \theta| d\theta}\right)$$

The average directivity index is calculated by logarithmically weighting the directionality index at each frequency and then taking the average of these weighted values from 20 Hz to 20 kHz.

SNR Calculation

The SNR of a directional microphone with a non-flat frequency response must be calculated for the entire frequency range: the electrical noise at each frequency is divided by the corresponding sensitivity squared to obtain the input-referred acoustic noise, which is A-weighted, integrated over the full audio bandwidth and converted to an equivalent sound pressure level, then subtracted from 94 dB SPL.

$$\mathrm{SNR} = 94 - 10\log_{10}\left(\frac{1}{P_{\mathrm{ref}}^2}\int_{20\mathrm{Hz}}^{20\mathrm{kHz}} \frac{\mathrm{noise}}{\mathrm{sensitivity}} A_w^2 \mathrm{df}\right)$$

THD Calculation

THD is calculated by playing an acoustic sine wave at a specific sound pressure level and frequency and dividing the sum of the powers of the harmonic components of the captured signal by the power of the fundamental frequency. For a non-flat frequency response the response is first equalized to equally weigh the fundamental and its harmonics.

For more information, refer to the app note: AN-110: Attributes of Soundskrit Directional Microphones.

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7. Mechanical & Integration

Mechanical Drawing (mm)

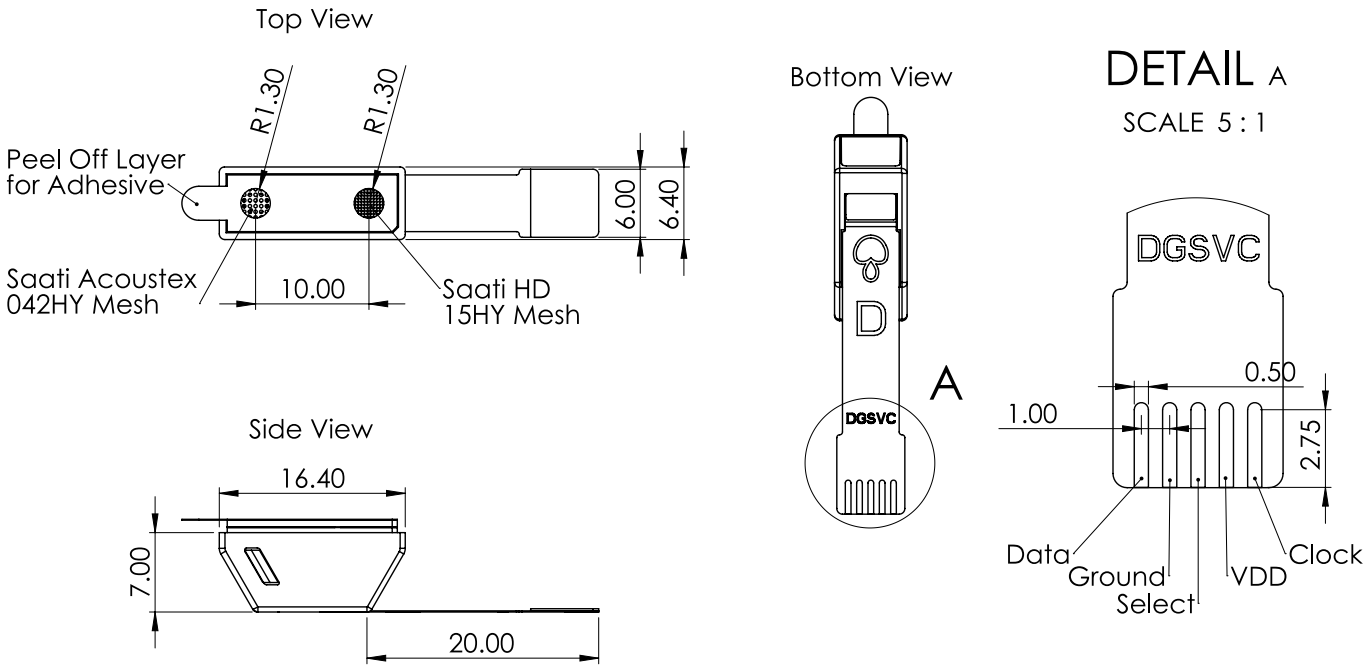
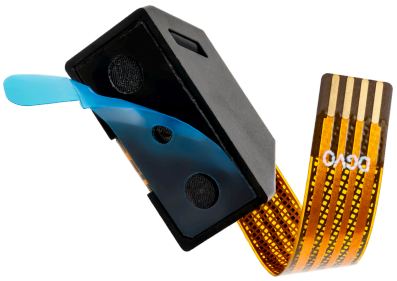
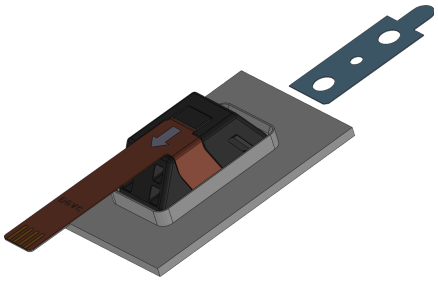


Figure 7.1: Module mechanical drawing and pinout

Product Shell Integration



Peel-off layer removed to expose the adhesive



Module seated in the product shell pocket, port plate above

- Match the product shell acoustic ports to the module: at least 1.8 mm across for each dipole port, and at least 1 mm for the centre omni port.
- Include a raised lip so the module self-aligns during placement.
- Remove the adhesive peel-off layer to expose the adhesive.
- Firmly insert the module into the alignment features and press for a secure acoustic seal — the adhesive forms the seal between module and product shell ports.
- Example mating connector: HFW5R-1STE1H1LF.

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8. Reliability Qualification

The sensitivity of each microphone in the module assembly must deviate by no more than 3 dB after each test. The microphone components have separately passed the full component reliability suite listed in their respective datasheets.

Test	Condition	Standard
Humidity Soak	+85 °C / 93 % R.H., 240 hours	IEC 60068-2-78
Thermal Shock	100 cycles, air-to-air, −40 °C to +85 °C, 30 min soak	JESD22.A104-F
High Temperature Storage	+85 °C for 96 hours	JESD22 A-103-B
Low Temperature Storage	−40 °C for 96 hours	JESD22-A119A
Drop (package)	Modules in standard shipping box, drop from 1 m, 10 drops total	ASTM D4169-22
Vibration (package)	Truck spectrum 13 min 20 s per axis, then air spectrum 2 hours	ASTM D4169-22

Table 8.1: Reliability specifications

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9. Ordering Information

Modules ship in anti-static blister boxes (no tape-and-reel).

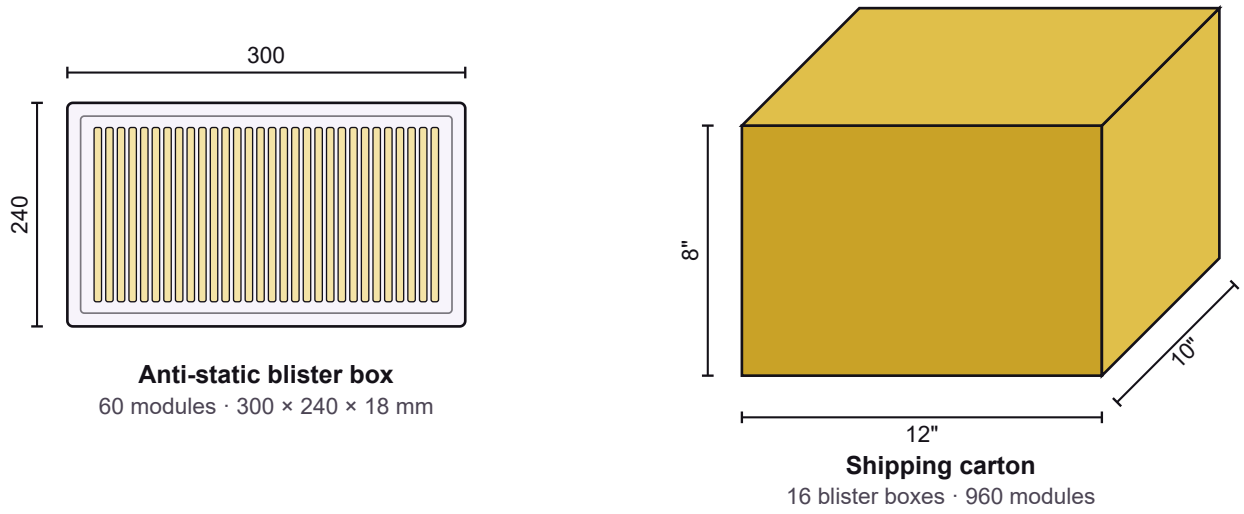


Figure 9.1: Module packaging

Model number	Quantity per box
SKM4610-HC	960

Table 9.1: Ordering information

10. Revision History

Date	Rev.	Changes
November 2026	—	Preliminary release

Table 10.1: Revision history

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