Product brief

ES – IM70A135UT Engineering samples

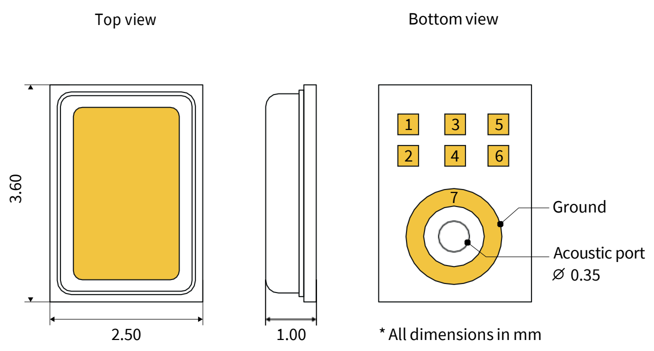
XENSIV™ MEMS microphone with 70 dB(A) SNR and ultrasonic receiving/sending capabilities

IM70A135UT is designed for applications that require a microphone with extended capabilities into the ultrasonic range, for both receiving and sending ultrasonic pulses. It is perfect for devices with built-in XENSIV™ MEMS microphones that want to benefit from any of the multiple uses of ultrasound.

When operating as a microphone, the IM70A135UT provides high SNR (low self-noise) and low distortion (high AOP). Its Signal to Noise Ratio (SNR) of 70 dB enables far field and low volume audio pick-up. The frequency response and tight manufacturing tolerances result in close phase matching and low latency, key performance parameters for multi-microphone (array) applications.

Its ultrasonic receiving characteristic allows for unique detection of ultrasonic frequencies between 20-100 kHz. Its unique sending characteristic is very well suited for high frequencies above 20 kHz, where its wide bandwidth fits perfectly applications that benefit from band hopping for higher resolution. Its sending characteristic response matches best its receiving performance at the resonance frequency, around 30 kHz, and can be used for accurate depth sensing in applications such as presence detection or gesture sensing.

Package Information



Pin number	Name	Description
1	OUT_P	Differential output positive
2	OUT_N	Differential output negative
3	V_{DD}	Power supply
4	SEND	Transceiver functionality select
5	ACTUATE	Arbitrary frequency pattern
6	NC	
7	GND	Ground

Key features

- Sealed Dual Membrane MEMS
- 70 dB(A) Signal-to-Noise Ratio
- Dynamic range above 100 dB
- AOP ~135 dB SPL
- Tight sensitivity (-38±1 dB/Pa)
- ~45 Hz low frequency roll-off
- 225 µA current consumption in high performance mode
- Single-digit µA additional current consumption for actuation

Key benefits

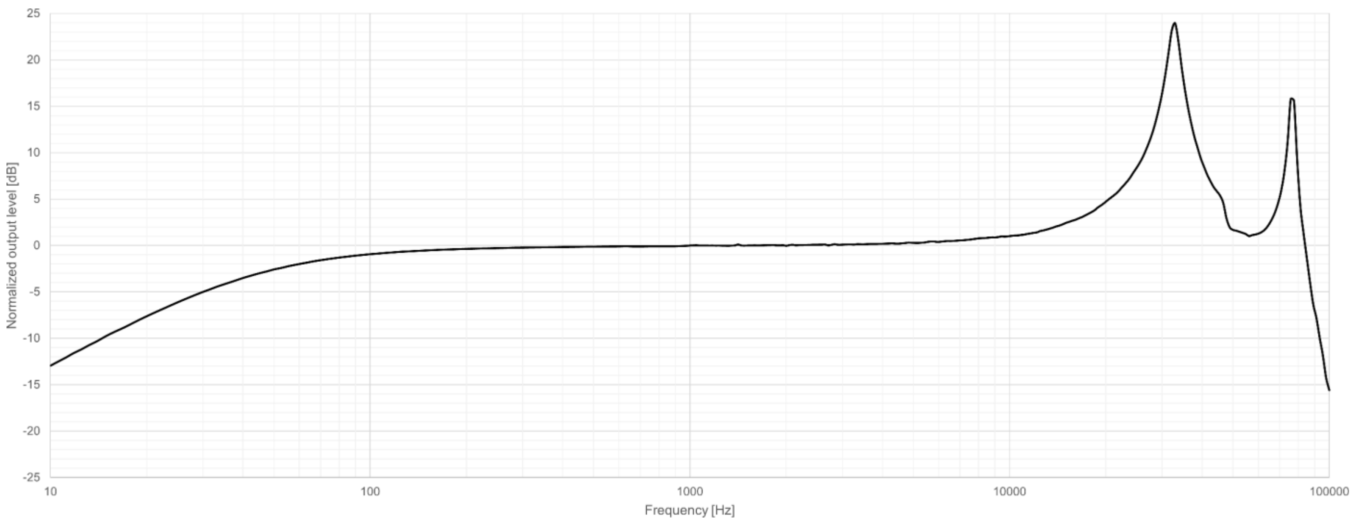
- Far field and low volume audio pick-up
- Clear audio signals even for highest sound pressure levels
- Highest precision of audio and ultrasonic beamforming algorithms

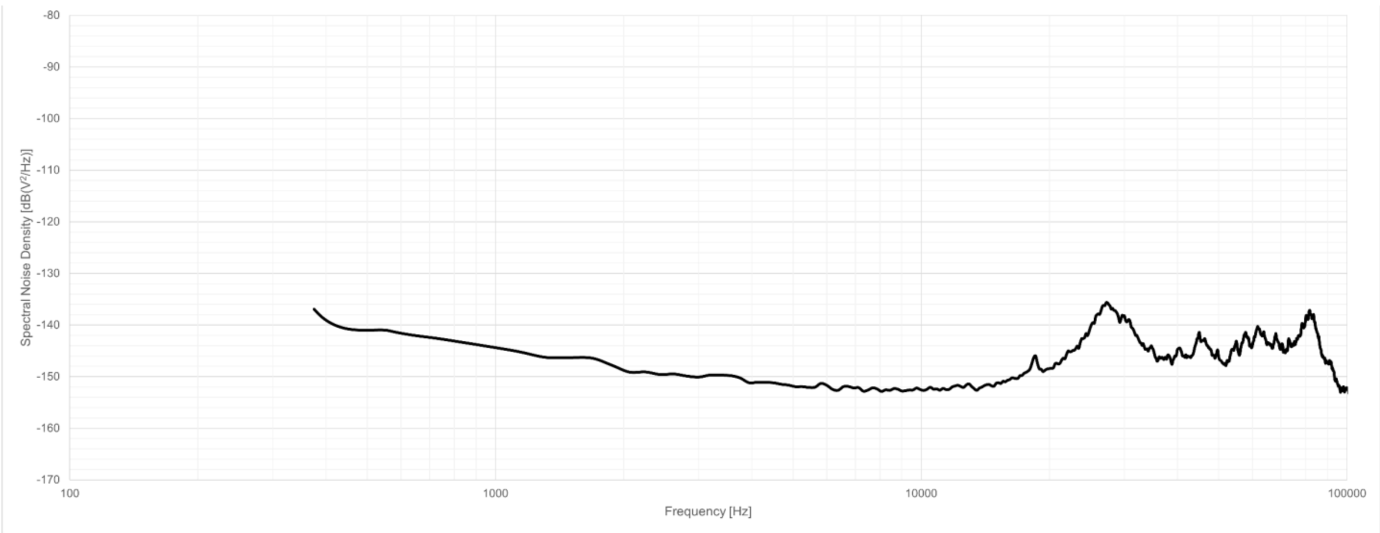
Typical applications

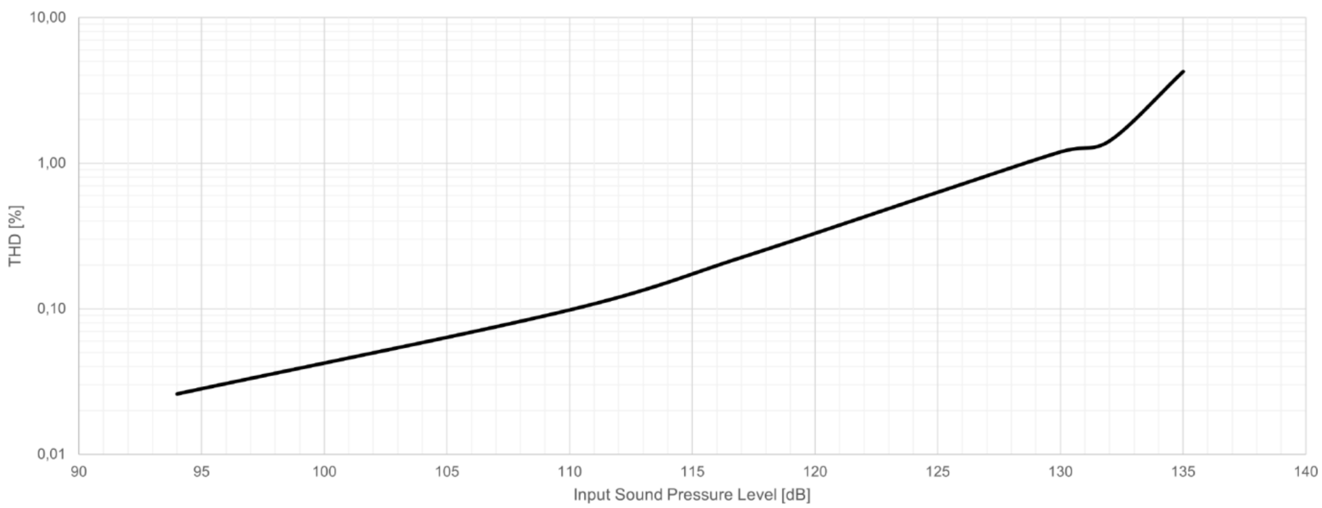
- High quality audio capturing
- Active Noise Cancellation (ANC)
- Ultrasonic receiving for e.g. data reception, animal detection, industrial equipment monitoring or echo-localization and positioning
- Ultrasonic sending for gesture control, proximity and distance sensing or data transmission
- Ultrasonic beamforming

Typical acoustic and ultrasonic performance

Test conditions: V_{DD} = 2.75 V (normal power mode)





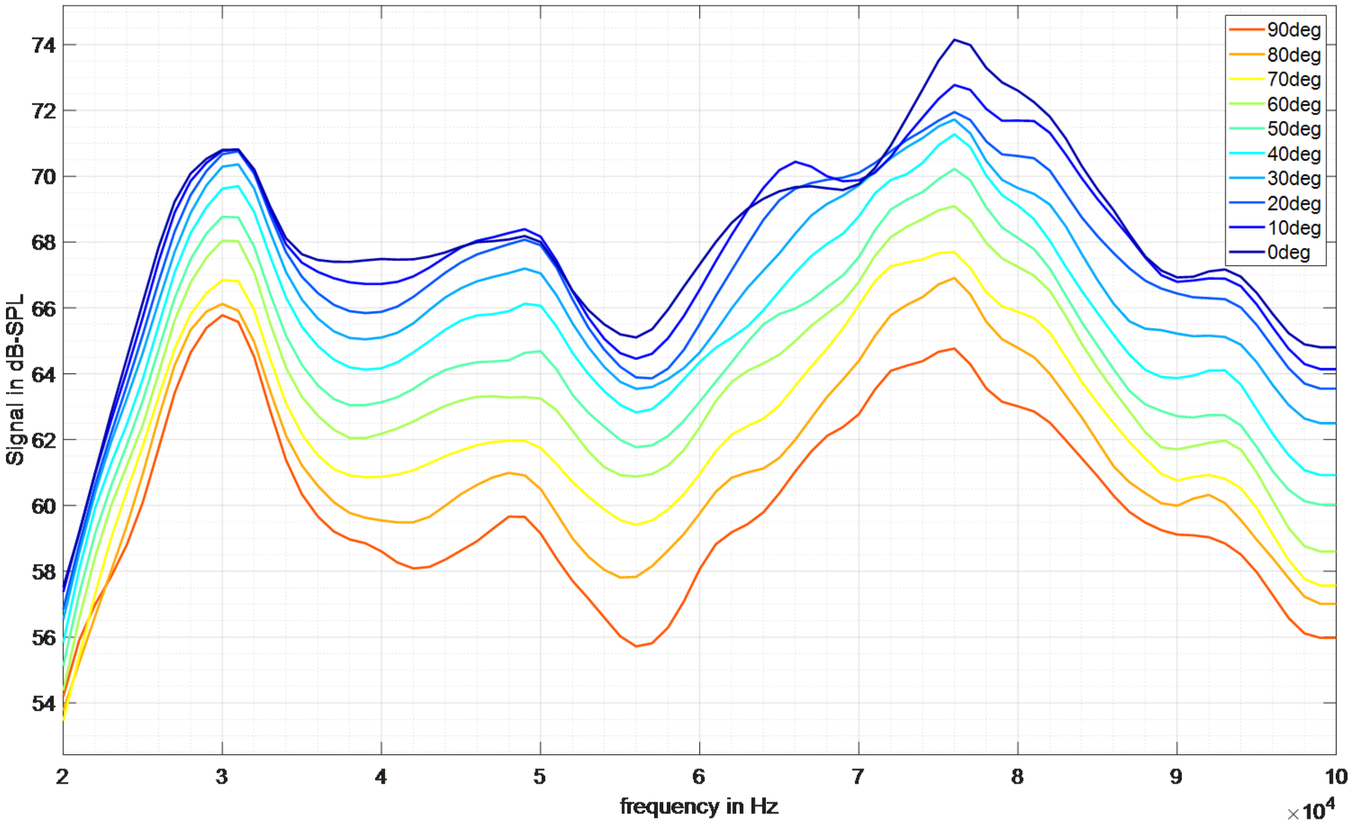


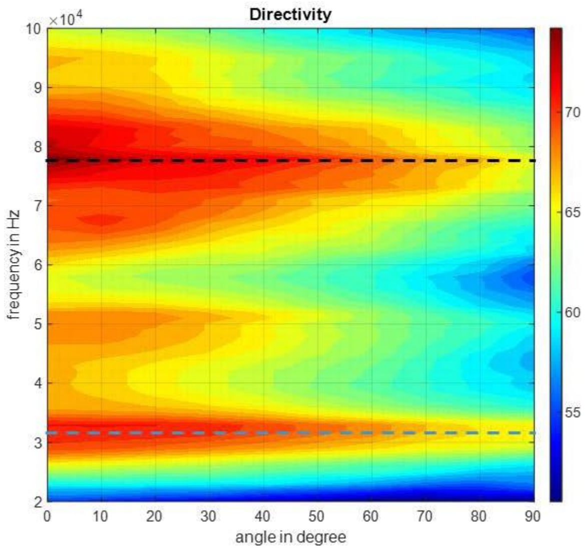
Typical ultrasonic transmit performance

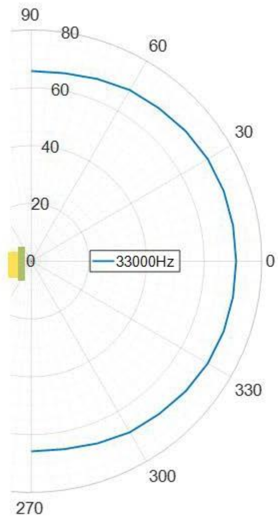
Test conditions: DUT mounted on a flex-PCB of 200 µm thickness in an anechoic chamber with ultrasonic reference microphone at 10 cm distance. The angle convention is such that at 0° the sound channel of the DUT is pointing directly towards the reference microphone.

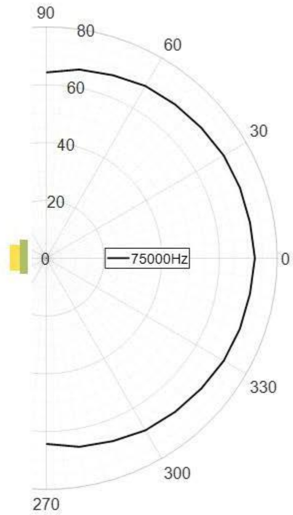
Note:

1. Resonance frequencies may be shifted depending on the dimensions of the final sound channel in application
2. Directivity is strongly influenced by the geometry of the respective application









Electrical parameters

Parameter		Symbol	Values			Unit	Note/test condition
			Min.	Typ.	Max.		
Supply voltage	Normal mode	V_{DD}	2.30	2.75	3.0	V	A 100 nF bypass capacitor (C_{VDD}) should be placed close to the microphone V_{DD} pin to ensure best SNR performance
	Low power mode	V_{DD}	1.52	1.60	1.8	V	
V_{DD} ramp-up time					5	ms	V_{DD} reaches its final value within ± 10 % tolerance
Output load	C_{load}	C_a, C_b			100	pF	
		C_d			100	pF	
	R_{load}	R_p, R_n		25		kΩ	
Input V_{CM}	Normal mode	V_{CM}	1.17	1.3	1.43	V	Input V_{CM} is the voltage at the input pins of the audio front end if not driven
	Low power mode	V_{CM}	0.765	0.85	0.935	V	

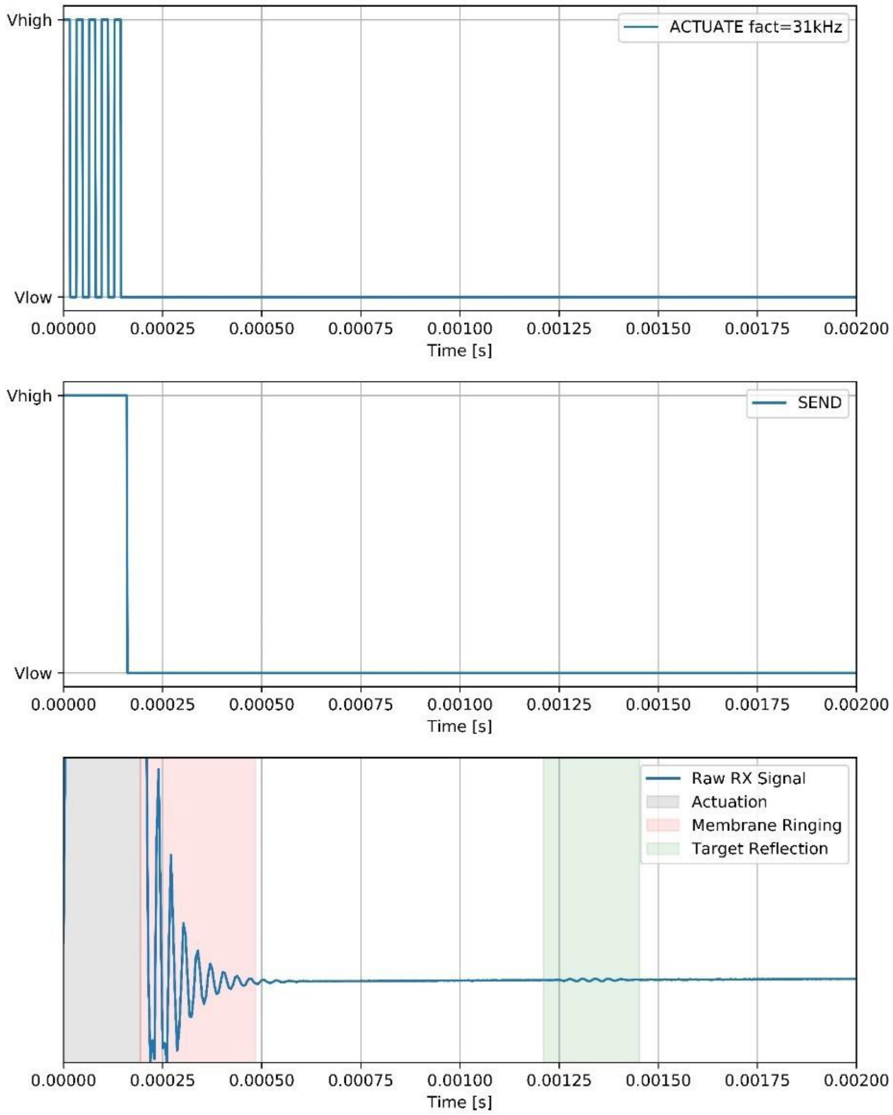
Electrical characteristics

Test conditions (unless otherwise specified in the table): V_{DD} = 2.75 V, T_A = 25°C, 55% R.H.

Parameter		Symbol	Values			Unit	Note/test condition
			Min.	Typ.	Max.		
Current consumption	Normal mode	I_{DDNP}		225		µA	Input ≤ 94 dBSPL
	Low power mode	I_{DDLP}		115		µA	
Start-up time		$t_{startup}$		10	30	ms	Start-up time in all operating modes after V_{DDmin} is applied
Mode switching time		$t_{ModeChange}$		10		ms	Time of undefined output after mode change detected
Brown out voltage		$V_{BrownOut}$		1.2		V	Brown out is triggered for voltage below $V_{BrownOut}$
Vout DC-voltage	Normal mode	$V_{OUT\_DC\_NP}$		1.35		V	
	Low power mode	$V_{OUT\_DC\_LP}$		0.9		V	
Power supply rejection ratio in band (differential)	Normal mode	$PSRR_{InBand\_NP}$		80		dB	V_{DD} = 2.75 V + 100 mV_{pp} sinewave (PSR=1/ A_{power}; A_{power} = Transfer function V_{DD} → Differential Output of ASIC)
	Low power mode	$PSRR_{InBand\_LP}$		80		dB	V_{DD} = 1.6 V + 100 mV_{pp} sinewave (PSR=1/A_{power}; A_{power} = Transfer function V_{DD} → Differential Output of ASIC)
Power supply rejection ratio common mode	Normal mode	$PSRR_{CM\_NP}$		65		dB	V_{DD} = 2.75 V + 100 mV_{pp} sinewave
	Low power mode	$PSRR_{CM\_LP}$		60		dB	V_{DD} = 1.6 V + 100 mV_{pp} sinewave
Output impedance	Normal mode	Z_{out_NP}			250	Ω	
	Low power mode	Z_{out_LP}			500	Ω	

Example actuation waveform and readout

The figures illustrates an exemplary actuation scheme, together with raw data measurement. From top to bottom:
1) ACTUATE command with pulsed actuation signal, five half-square wave cycles at 31 kHz
2) SEND command set to one (log level high) during transmission and to zero (ground) during reception
3) Corresponding raw data measurement, in presence of reflecting target



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