Product brief

ES – IM67D131UT

Engineering samples

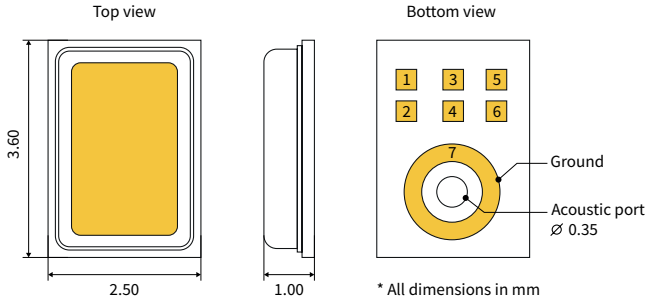
XENSIV™ MEMS microphone with 67 dB(A) SNR and ultrasonic receiving/sending capabilities

IM67D131UT 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 IM67D131UT provides high SNR (low self-noise) and low distortion (high AOP). Its Signal to Noise Ratio (SNR) of 67 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	V_{DD}	Power supply
2	DATA	PDM data output
3	CLOCK	PDM clock input
4	SELECT	PDM left/right select
5	SEND	Transceiver functionality select
6	ACTUATE	Arbitrary frequency pattern
7	GND	Ground

Key features

- Sealed Dual Membrane MEMS
- 67 dB(A) Signal-to-Noise Ratio
- Dynamic range above 100 dB
- AOP ~131dB SPL
- Tight sensitivity (-36 ±1 dBFS)
- ~45 Hz low frequency roll-off
- 1100 µA current consumption in high performance mode
- Single-digit µA additional current consumption for actuation

Key benefits

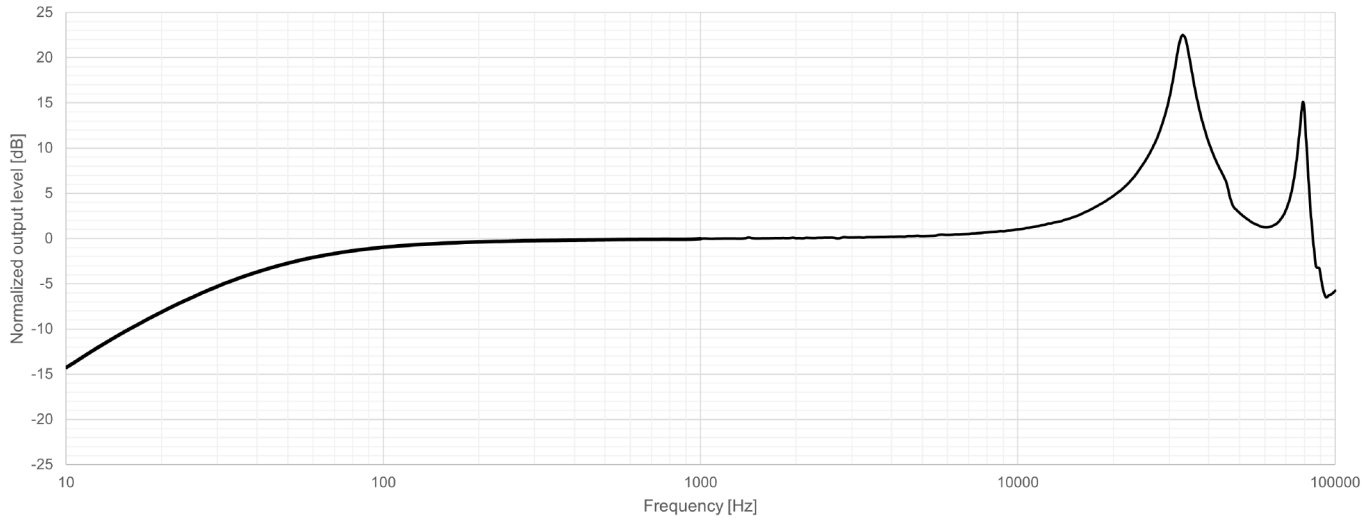
- Far field and low volume audio pick-up
- Clear audio signals even for highest sound pressure levels
- Highest precision of audio and ultrasonic beamforming algorithms

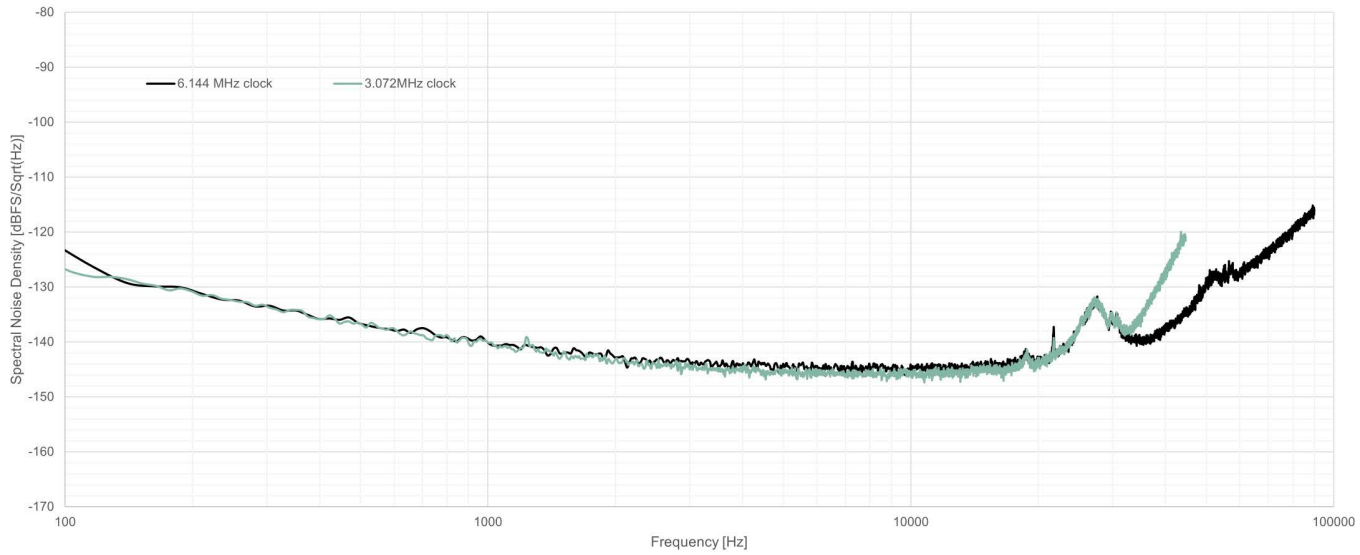
Typical applications

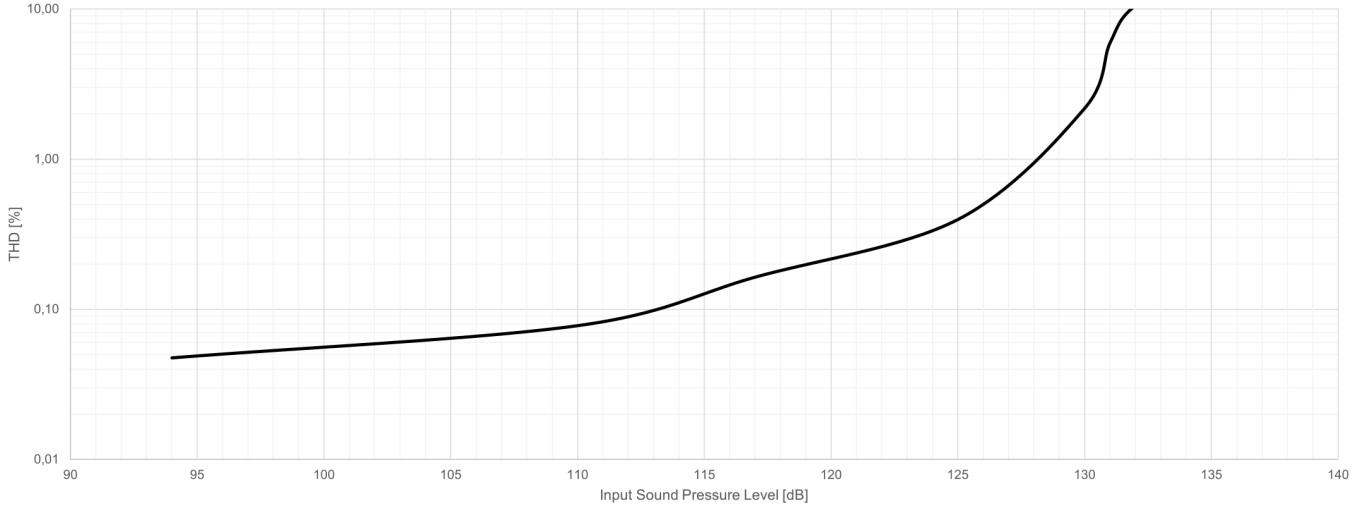
- High quality audio capturing
- Active Noise Cancellation (ANC)
- Ultrasonic receiving for e.g. data reception, animal detection, industrial equipment monitoring or echo-localization and positioning
- Ultrasonic sending for gesture control, proximity and distance sensing or data transmission,
- Ultrasonic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

Typical acoustic and ultrasonic performance

Test conditions: V_{DD} = 1.8 V, no load on DATA. Typical noise floor (unweighted) for f_{CLK} = 3.072 MHz and f_{CLK} = 6.144 MHz





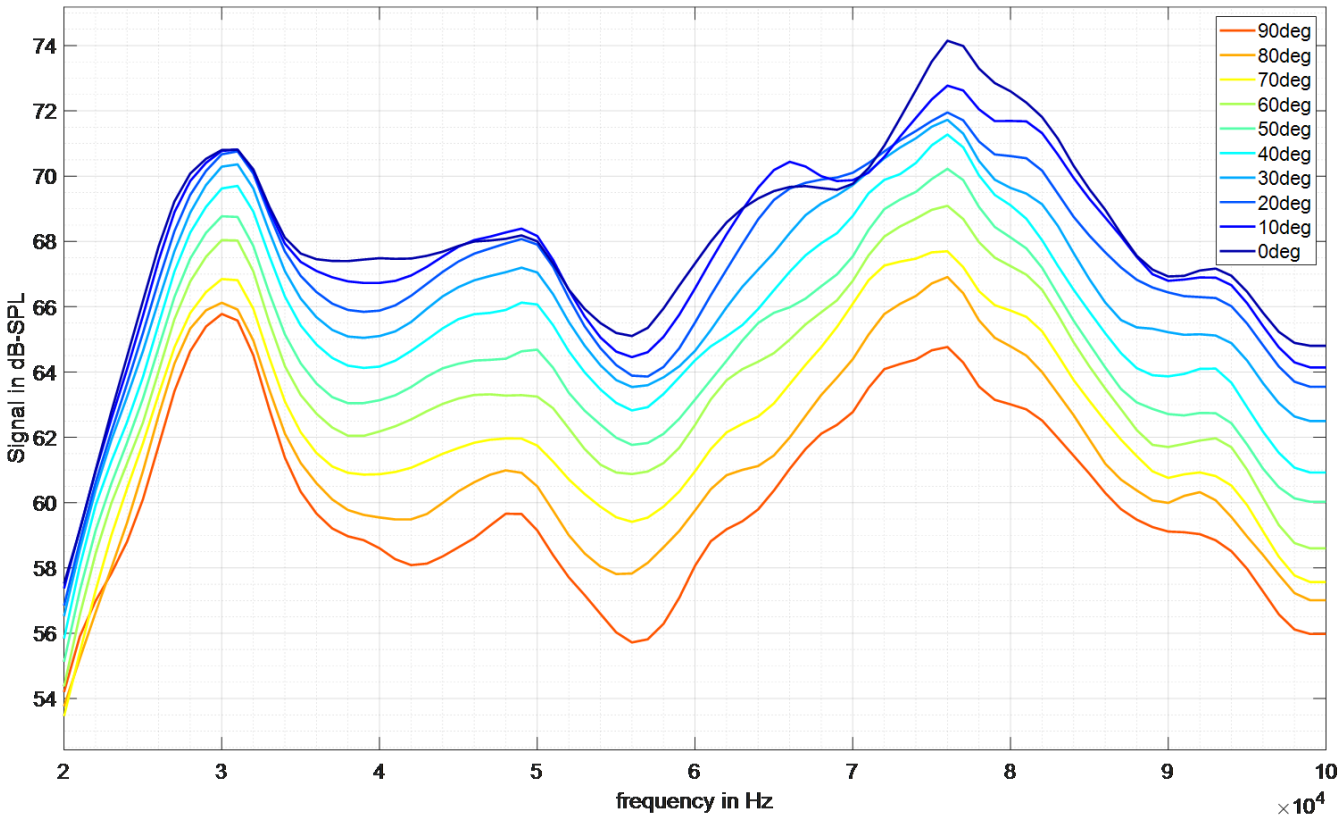


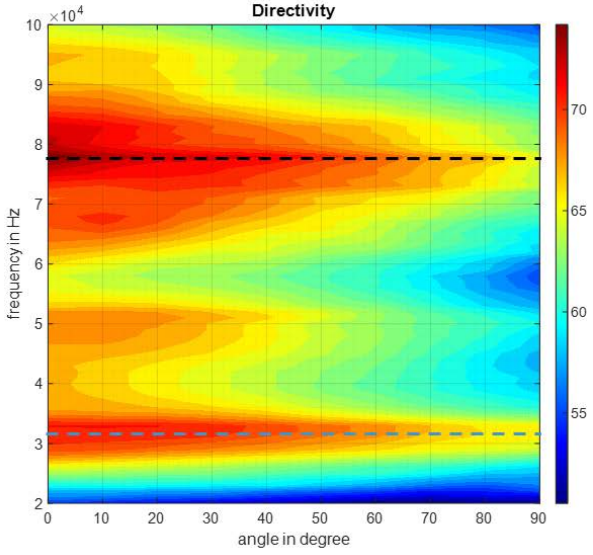
Typical ultrasonic transmit performance

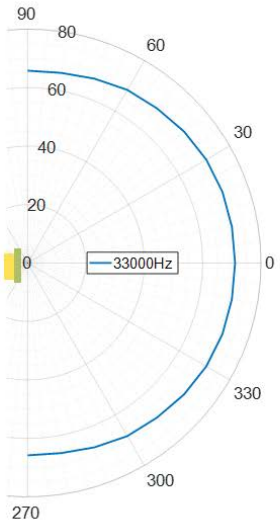
Test conditions: DUT mounted on a flex-PCB of 200 µm thickness in an anechoic chamber with ultrasonic reference microphone at 10 cm distance. The angle convention is such that at 0° the soundport of the DUT is pointing directly towards the reference microphone.

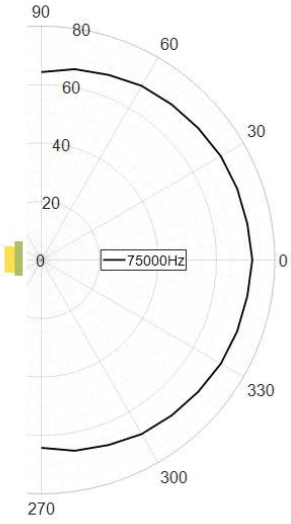
Note:

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

General electrical and clock operating range

ASIC verified operational for the following parameters. Operating temperature range -40 to 85°C. Test conditions (unless otherwise specified in the table): V_{DD}= 1.8 V. Typical values: T_A= 25°C. Max/min values: T_A=-20°C to 70°C. No load on data.

Parameter		Symbol	Values			Unit	Note/test condition
			Min.	Typ.	Max.		
Supply voltage		V_{DD}	1.62	1.8	3.6	V	[1]
Clock frequency range: clock detect fused on	Standby mode	f_{clock}	–	–	350 ±5%	kHz	[2]
	Low power mode	f_{clock}	450	768	850	kHz	Clock detection fused ON. Different ADC parameters for each clock mode. Only listed frequencies supported.
	Normal mode	f_{clock}	1.2	1.536	1.65	MHz	
	High performance	f_{clock}	2.0	2.4	2.6	MHz	
		f_{clock}	2.9	3.072[3]	3.3	MHz	
	Ultrasonic mode	f_{clock}	4.56	4.8	5.04	MHz	
		f_{clock}	5.8	6.144	6.6	MHz	
Input logic low level		V_{IL}	-0.3	–	0.3 x V_{DD}	V	–
Input logic high level		V_{IH}	0.6 x V_{DD}	–	V_{DD} + 0.3	V	–
Hysteresis width		V_{hys}	0.1 x V_{DD}	–	–	V	–
Clock rise/fall time		–	–	–	13	ns	10 to 90%
Clock duty cycle		–	40	–	60	%	0.768, 1.536, 2.4, 4.8 MHz
Clock duty cycle		–	48	–	52	%	3.072, 6.144 MHz
Output load capacitance on DATA		C_{load}	–	–	200	pF	–

1) A 1 µF bypass capacitor should be placed close to the microphone VDD pad to ensure best SNR performance.
2) Data pad is high impedance in standby mode.
3) Smallest f_{clock} for Ultrasonic functionaly.

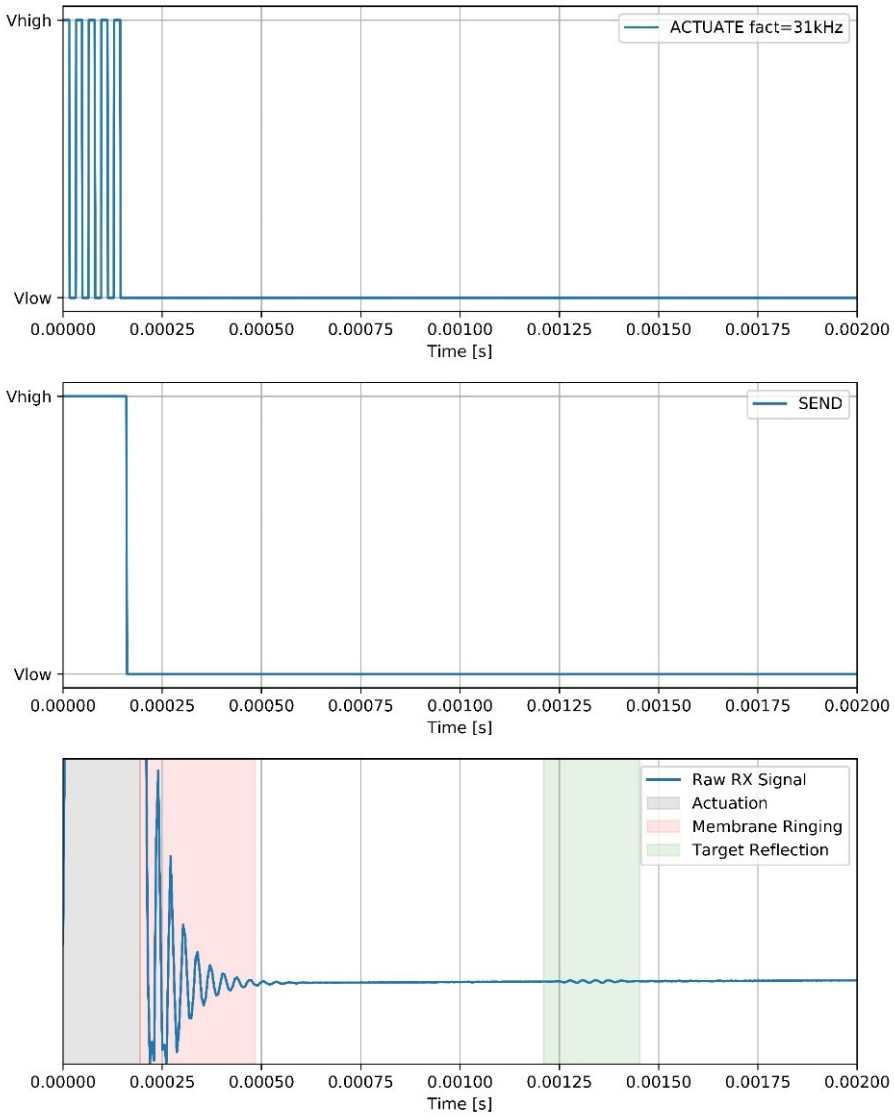
Current consumption

Test conditions (unless otherwise specified in the table): V_{DD}= 1.8 V, T_A = 25°C, 55% R.H. Specifications for ASIC and Ultrasonic actuation.

Parameter		Symbol	Values			Unit	Note/test condition
			Min.	Typ.	Max.		
Current consumption	Low power mode	I_{DD}		645		µA	<5 pF load on DATA
	Normal mode	I_{DD}		745		µA	
	High performance	I_{DD}		935		µA	
		I_{DD}		1100		µA	
	Ultrasonic mode	I_{DD}		1125		µA	
		I_{DD}		1320		µA	

Example actuation waveform and readout

The figures illustrate 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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