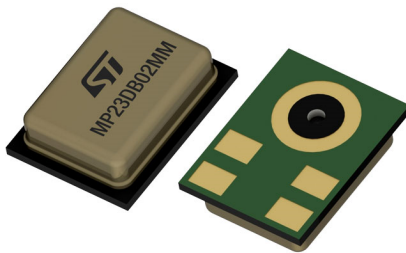


MEMS audio sensor: digital microphone with multiple performance modes



RHLGA 5LD (3.5 x 2.65 x 0.98 mm)

Features

- Omnidirectional digital microphone
- Sensitivity: $-26 \text{ dBFS} \pm 1 \text{ dB}$
- “Always-on” experience with low power consumption
- Multiple performance modes (low power, normal)
- Typical current consumption
 - $285 \mu\text{A}$ (low-power mode)
 - $800 \mu\text{A}$ (normal mode)
- 122 dB SPL acoustic overload point for all operative modes
- PDM single-bit output with option for stereo configuration
- RHLGA package
 - Bottom-port design
 - SMD-compliant
 - EMI-shielded
 - ECOPACK, RoHS and “Green” compliant

Applications

- Smartphones and handsets
- Laptop and notebook computers
- Wearable devices
- Digital still and video cameras
- Antitheft systems

Description

The **MP23DB02MM** is an ultra-compact, low-power, omnidirectional, digital MEMS microphone built with a capacitive sensing element and an IC interface with optional stereo configuration.

The sensing element, capable of detecting acoustic waves, is manufactured using a specialized silicon micromachining process dedicated to produce audio sensors.

The IC interface is manufactured using a CMOS process that allows designing a dedicated circuit able to provide a digital signal externally in PDM format.

The MP23DB02MM offers multiple performance modes enabled by different clock frequency ranges (power down, low power and normal mode). The device has a narrow sensitivity range of $\pm 1 \text{ dB}$, high SNR and low distortion for all operative modes.

The MP23DB02MM is available in a bottom-port, SMD-compliant, EMI-shielded package and is guaranteed to operate over an extended temperature range from $-40 \text{ }^\circ\text{C}$ to $+85 \text{ }^\circ\text{C}$.

Product status link

[MP23DB02MM](#)

Product summary

Order code	MP23DB02MMTR
Temp. range [°C]	-40 to +85
Package	RHLGA 5LD (3.5 x 2.65 x 0.98) mm
Packing	Tape and reel

1 Pin description

Figure 1. Pin connections

Bottom View

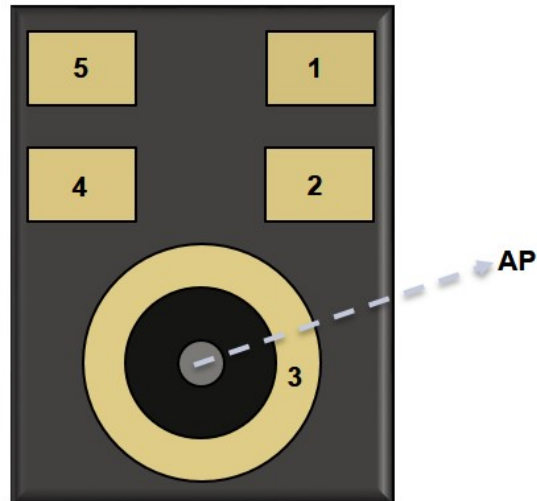


Table 1. Pin description

Pin #	Pin name	Function
1	DOUT	Left/right PDM data output
2	L/R	Left/right channel selection
3 (ground ring)	GND	0 V supply
4	CLK	Synchronization input clock
5	VDD	Supply voltage

2 Acoustic and electrical specifications

2.1 Acoustic and electrical characteristics

The values listed in the table below are specified for Vdd = 1.8 V, Clock = 2.4 MHz, T = 25 °C, no load, unless otherwise noted.

Table 2. Acoustic and electrical characteristics

Symbol	Parameter	Test condition	Min.	Typ. ⁽¹⁾	Max.	Unit
Vdd	Supply voltage		1.6		3.6	V
f _{CLK}	Clock frequency range ⁽²⁾	Power-down mode	0		0.15	MHz
		Low-power mode	0.54	0.768	1.1	
		Normal mode	1.5	2.4	3.3	
I _{dd}	Current consumption in normal mode	F _c = 2.4 MHz		800		μA
	Current consumption in low-power mode	F _c = 768 kHz		285		
I _{ddPdn}	Current consumption in power-down mode ⁽³⁾		2		5	
I _{cc}	Short-circuit current		1		10	mA
V _{IOL}	Low-level logic input/output voltage	I _{out} = 1 mA	-0.3		0.35xV _{dd}	V
V _{IOH}	High-level logic input/output voltage	I _{out} = 1 mA	0.65xV _{dd}		V _{dd} +0.3	V
T _{WK}	Wake-up time ⁽⁴⁾	guaranteed by design			20	ms
Roll-off	Frequency response	at -3 dB		35		Hz
C _{load}	DOUT load capacitance				100	pF
Top	Operating temperature range		-40		+85	°C

1. Typical specifications are not guaranteed.
2. Duty cycle: min = 40% max = 60%
3. Input clock in static mode
4. Time from the first clock edge to valid output data

The values listed in the table below are specified for Vdd = 1.8 V, Clock = 768 kHz, no load, T = 25 °C, unless otherwise noted.

Table 3. Low-power mode

Symbol	Parameter	Test condition	Min.	Typ. ⁽¹⁾	Max.	Unit
I _{dd}	Current consumption			285		μA
S _o	Sensitivity	94 dBSPL @ 1 kHz	-27	-26	-25	dBFS
SNR	Signal-to-noise ratio	94 dBSPL @ 1 kHz A-weighted (20 Hz - 8 kHz)		64		dB(A)
THD	Total harmonic distortion	94 dBSPL @ 1 kHz		0.5		%
		120 dBSPL @ 1 kHz		4		
AOP	Acoustic overload point			122		dB SPL
PSR	Power supply rejection	100 mVpp sinewave @ 217 Hz		-90		dBFS

1. Typical specifications are not guaranteed.

The values listed in the table below are specified for $V_{dd} = 1.8\text{ V}$, Clock = 2.4 MHz, no load, $T = 25\text{ }^{\circ}\text{C}$, unless otherwise noted.

Table 4. Normal mode

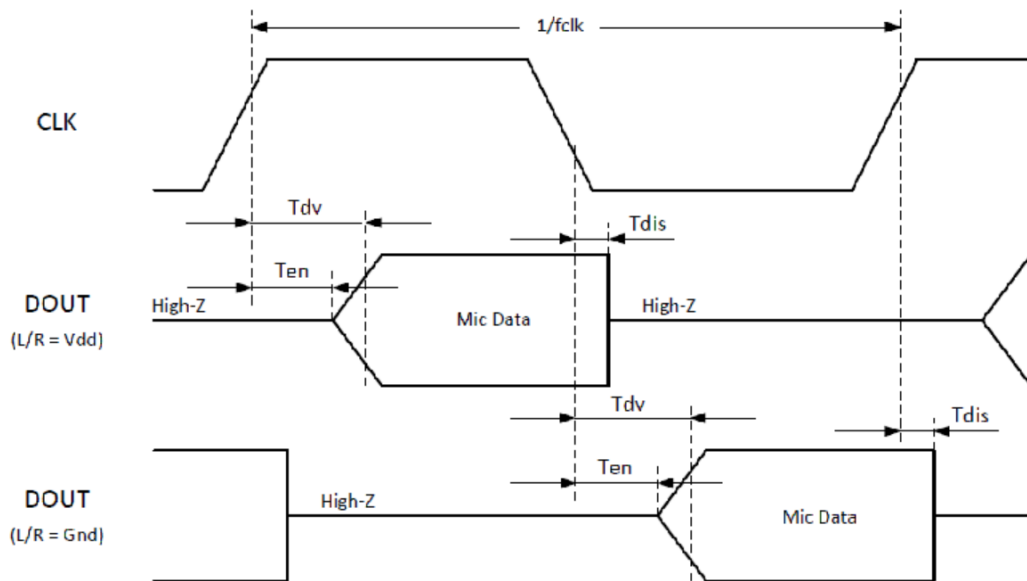
Symbol	Parameter	Test condition	Min.	Typ. ⁽¹⁾	Max.	Unit
I _{dd}	Current consumption			800		μA
S _o	Sensitivity	94 dB SPL @ 1 kHz	-27	-26	-25	dBFS
SNR	Signal-to-noise ratio	94 dB SPL @ 1 kHz A-weighted (20 Hz - 8 kHz)		65		dB(A)
THD	Total harmonic distortion	94 dB SPL @ 1 kHz		0.5		%
		120 dB SPL @ 1 kHz		4		
AOP	Acoustic overload point			122		dB SPL
PSR	Power supply rejection	100 mV _{pp} sinewave @ 217 Hz		-90		dBFS

1. Typical specifications are not guaranteed.

2.2 Timing characteristics

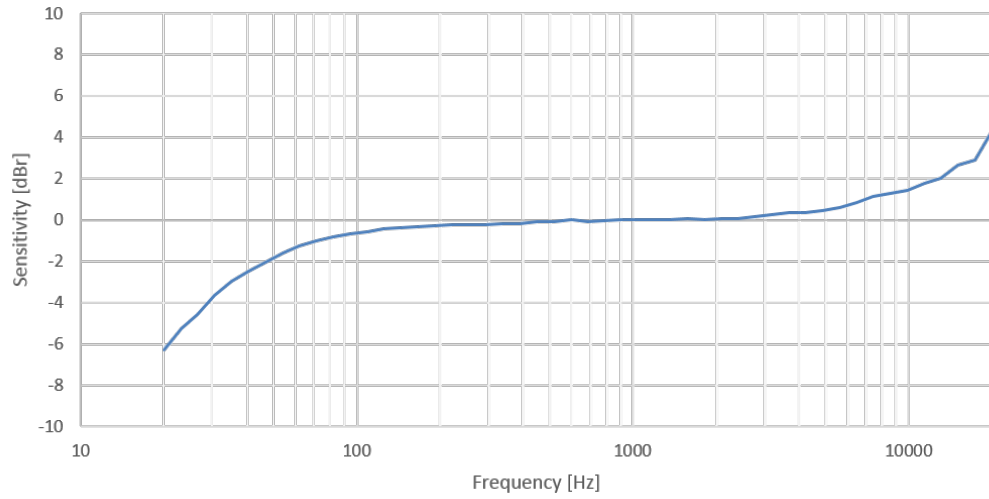
Table 5. Timing characteristics

Symbol	Description	Min.	Max.	Unit
T _{dv}	Delay time to valid data (Cload = 100 pF)		120	ns
T _{en}	Delay time to data driven	19		ns
T _{dis}	Delay time to Hi-Z	4	17	ns

Figure 2. Timing waveforms


2.3 Frequency response

Figure 3. Normalized frequency response



3 Absolute maximum ratings

Stresses above those listed as “Absolute maximum ratings” may cause permanent damage to the device. This is a stress rating only and functional operation of the device under these conditions is not implied. Exposure to maximum rating conditions for extended periods may affect device reliability.

Table 6. Absolute maximum ratings

Symbol	Ratings	Maximum value	Unit
V _{dd}	Supply voltage	-0.3 to 4.8	V
V _{in}	Input voltage on any control pin ⁽¹⁾	-0.3 to V _{dd} +0.3	V
T _{STG}	Storage temperature range	-40 to +125	°C
ESD	(HBM) ANSI/ESDA/JEDEC JS001	±2000	V
	(MM) EIA/JESD22-A115	±200	
	(CDM) JESD22-C101	±750	
ESD ⁽²⁾	Per IEC61000-4-2, 150 pF, 330 Ω direct contact to housing	±8000	V

1. Supply voltage on any pin should never exceed 4.8V
2. Bypass capacitor of 200nF or 1 μF (better) is highly recommended for ESD main clamp integrity.



This device is sensitive to mechanical shock, improper handling can cause permanent damage to the part.



This device is sensitive to electrostatic discharge (ESD), improper handling can cause permanent damage to the part.

4 Functionality

4.1 L/R channel selection

The L/R digital pad lets the user select the DOUT signal pattern as indicated in the following table. The L/R pin must be connected to Vdd or GND.

Table 7. L/R channel selection

L/R	CLK low	CLK high
GND	Data valid	High impedance
Vdd	High impedance	Data valid

Note: As the L/R pin is internally connected to GND via a 200 kΩ pull-down resistor, it is not mandatory to connect the pin itself to GND for the respective channel selection.

5 Application recommendations

Figure 4. MP23DB02MM electrical connections

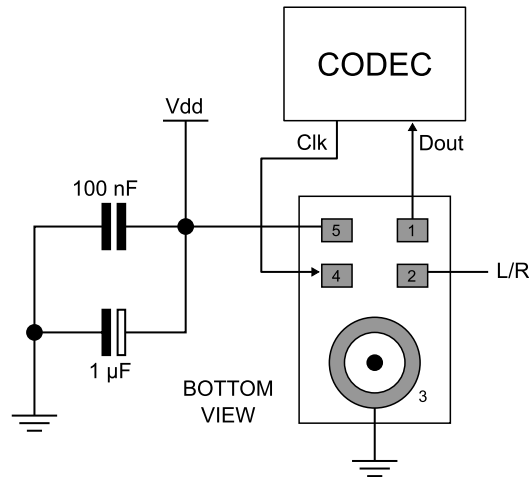
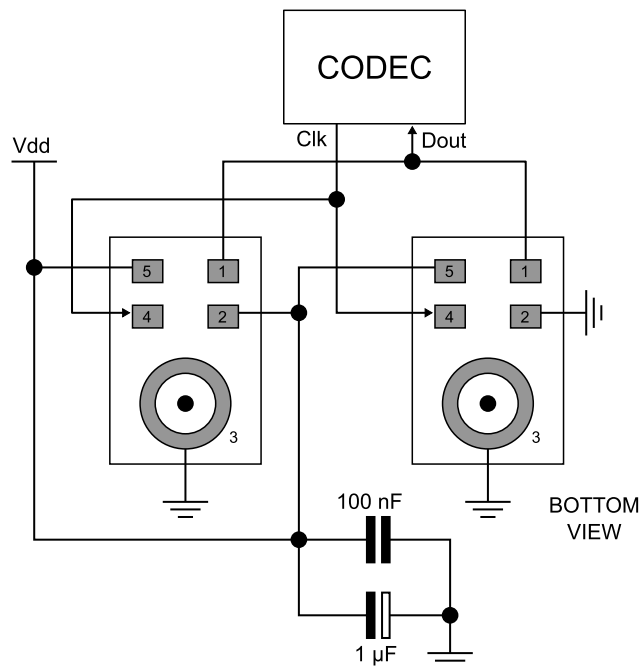


Figure 5. MP23DB02MM electrical connections for stereo configuration



Power supply decoupling capacitors (100 nF ceramic, 1 μF ceramic) should be placed as near as possible to pin 2 of the device (common design practice).

The L/R pin must be connected to Vdd or GND (refer to [Table 7](#)).

6 Package information

In order to meet environmental requirements, ST offers these devices in different grades of **ECOPACK** packages, depending on their level of environmental compliance. ECOPACK specifications, grade definitions and product status are available at: www.st.com. ECOPACK is an ST trademark.

6.1 Soldering information

The RHLGA (3.5 x 2.65 x 0.98) mm package is also compliant with the RoHS and “Green” standards and is qualified for soldering heat resistance according to JEDEC J-STD-020.

Landing pattern and soldering recommendations are available at www.st.com.

Figure 6. Recommended soldering profile limits

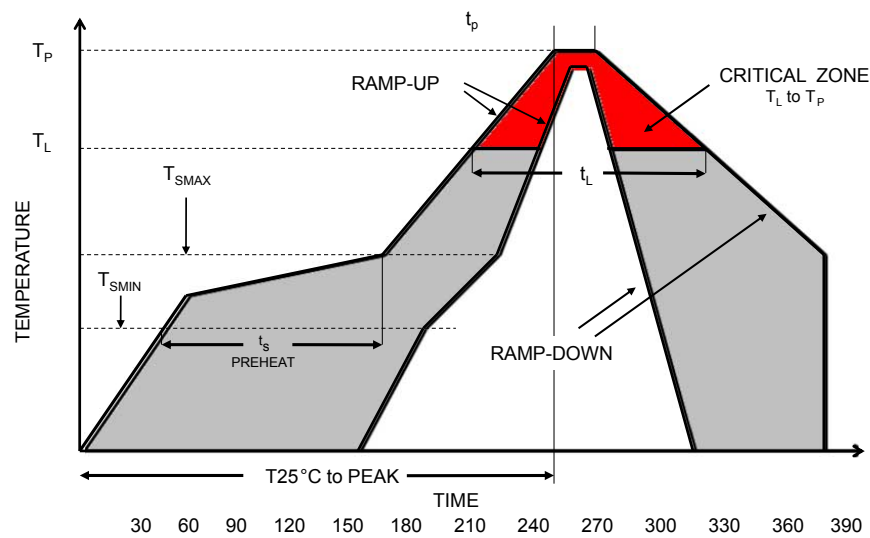
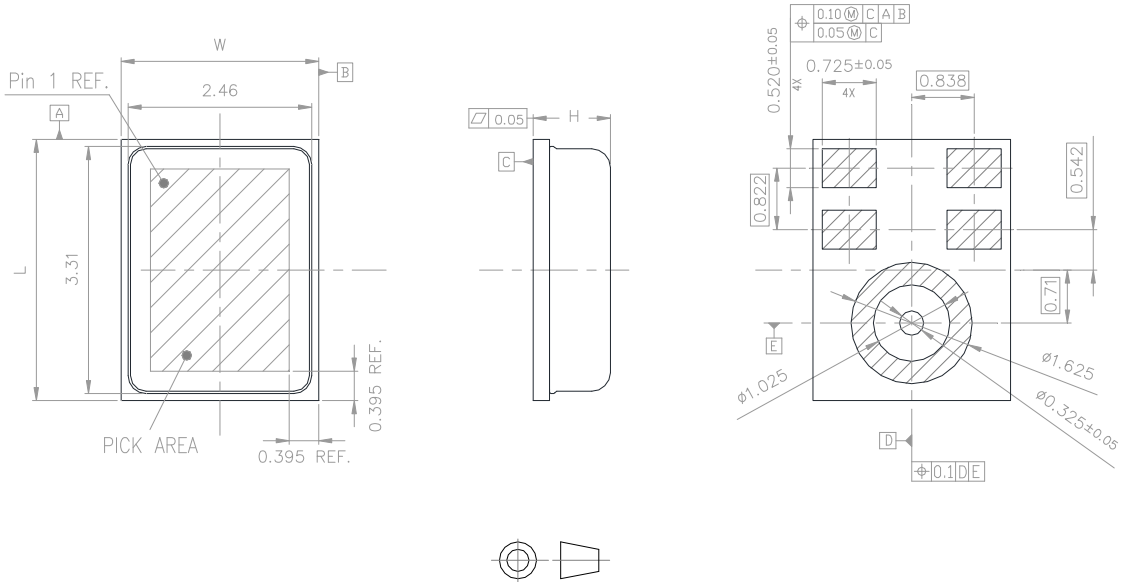


Table 8. Recommended soldering profile limits

Description	Parameter	Pb free
Average ramp rate	T_L to T_P	3 °C/sec max
Preheat		
Minimum temperature	T_{SMIN}	150 °C
Maximum temperature	T_{SMAX}	200 °C
Time (T_{SMIN} to T_{SMAX})	t_s	60 sec to 120 sec
Ramp-up rate	T_{SMAX} to T_L	
Time maintained above liquidus temperature	t_L	60 sec to 150 sec
Liquidus temperature	T_L	217 °C
Peak temperature	T_P	260 °C max
Time within 5 °C of actual peak temperature		20 sec to 40 sec
Ramp-down rate		6 °C/sec max
Time 25 °C ($t_{25\text{ °C}}$) to peak temperature		8 minutes max

6.2 RHLGA-5L package information

Figure 7. RHLGA 3.5 x 2.65 x 0.98 mm (metal cap) 5L package outline



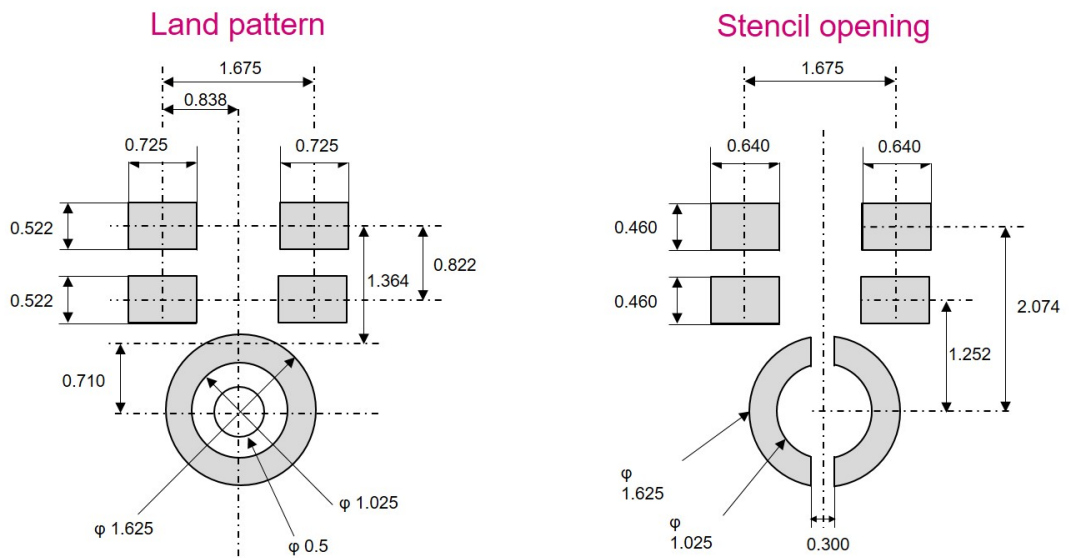
Dimensions are in millimeter unless otherwise specified
General Tolerance is +/- 0.15mm unless otherwise specified

OUTER DIMENSIONS

ITEM	DIMENSION [mm]	TOLERANCE [mm]
Length [L]	3.5	±0.1
Width [W]	2.65	±0.1
Height [H]	1.08 MAX	

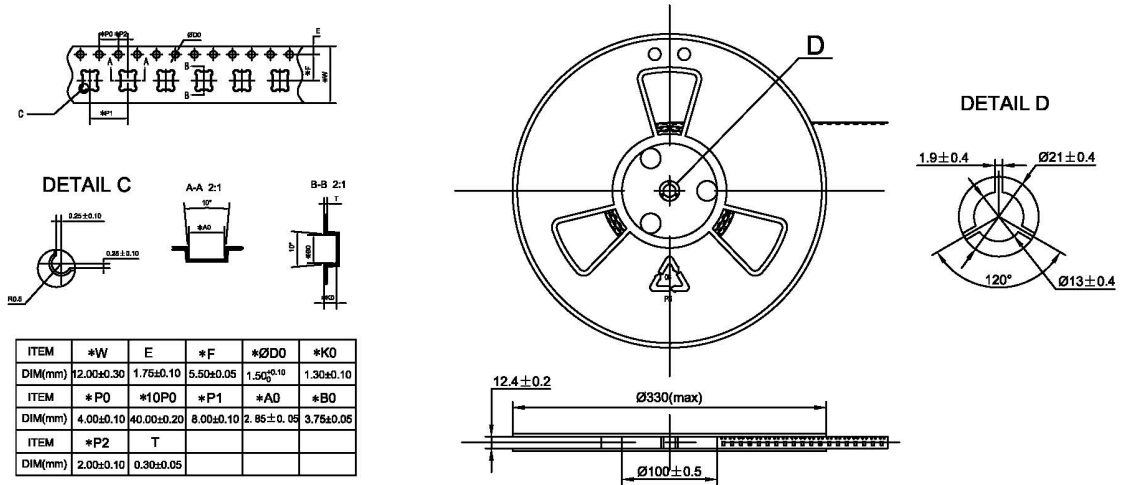
DM00368430_3

Figure 8. Land pattern and recommended stencil opening



6.3 RHLGA-5L packing information

Figure 9. Carrier tape and reel mechanical specifications



Specifications:

1. Unmarked tolerance: $\pm 0.1\text{mm}$;
2. Surface resistance: $10^2 - 10^{12} \Omega/\text{SQ}$, $25 \pm 5^\circ\text{C}/50 \pm 5\%\text{RH}$;

Revision history

Table 9. Document revision history

Date	Version	Changes
13-Oct-2020	1	Initial release

Contents

1	Pin description	2
2	Acoustic and electrical specifications	3
2.1	Acoustic and electrical characteristics	3
2.2	Timing characteristics	4
2.3	Frequency response	5
3	Absolute maximum ratings	6
4	Functionality	7
4.1	L/R channel selection	7
5	Application recommendations	8
6	Package information	9
6.1	Soldering information	9
6.2	RHLGA-5L package information	10
6.3	RHLGA-5L packing information	11
	Revision history	12
	Contents	13

IMPORTANT NOTICE – PLEASE READ CAREFULLY

STMicroelectronics NV and its subsidiaries (“ST”) reserve the right to make changes, corrections, enhancements, modifications, and improvements to ST products and/or to this document at any time without notice. Purchasers should obtain the latest relevant information on ST products before placing orders. ST products are sold pursuant to ST’s terms and conditions of sale in place at the time of order acknowledgement.

Purchasers are solely responsible for the choice, selection, and use of ST products and ST assumes no liability for application assistance or the design of Purchasers’ products.

No license, express or implied, to any intellectual property right is granted by ST herein.

Resale of ST products with provisions different from the information set forth herein shall void any warranty granted by ST for such product.

ST and the ST logo are trademarks of ST. For additional information about ST trademarks, please refer to www.st.com/trademarks. All other product or service names are the property of their respective owners.

Information in this document supersedes and replaces information previously supplied in any prior versions of this document.

© 2020 STMicroelectronics – All rights reserved

X-ON Electronics

Largest Supplier of Electrical and Electronic Components

Click to view similar products for [MEMS Microphones](#) category:

Click to view products by [STMicroelectronics](#) manufacturer:

Other Similar products are found below :

[8103AC8333S25.00000X](#) [S-VM2020-C](#) [SPK0838HT4H-1](#) [MMICT4076-00-908](#) [MMICT4078-00-908](#) [ICS-41352](#) [1007079-1](#) [ASFLM1-25.000MHZ-C](#) [5000AC-8E-25E0-25.000000X](#) [ICS-40300](#) [ICS-40618](#) [ICS-43432](#) [3807ACTC3-33EG-8.19200](#) [501AAA27M0000CAF](#) [SIT9120AC-2C2-25E125.000000](#) [SIT9120AC-2C2-25E200.000000](#) [SIT9121AI-2C3-33E100.000000](#) [9120AI-2C3-25E100.0000](#) [MP34DB01TR](#) [8002AI-13-33E16.00000](#) [5001AI-2D-18N0-20.000000](#) [UC2000-30GM-IUR2-V15](#) [MM042602-4](#) [MM042602-5](#) [MM033802-1](#) [ICS-43434](#) [ASFLM2-28.224MHZ-LR-T](#) [ICS-40310](#) [ICS-40720](#) [9003AC-14-33EQ25.00000](#) [SIT9120AC-2C2-33E125.000000](#) [1618AA-13-33S-16.000000G](#) [PMM-3738-VM1000-R](#) [64-8801](#) [IM69D120V01XTSA1](#) [SPA1687LR5H-1](#) [SPG08P4HM4H-1](#) [SPH0611LR5H-1](#) [SPH0641LM4H-1](#) [SPH0644LM4H-1](#) [SPH0645LM4H-B](#) [SPH0690LM4H-1](#) [SPH1642HT5H-1](#) [SPH1668LM4H-1](#) [SPH6611LR5H-1](#) [SPK0415HM4H-B](#) [SPK0641HT4H-1](#) [SPM0687LR5H-1](#) [SPM1423HM4H-B](#) [SPQ1410HR5H-B](#)