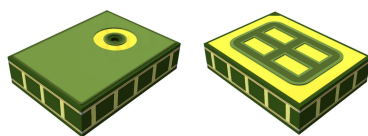


## MEMS audio sensor omnidirectional digital microphone for industrial applications



HCLGA - 4LD (3 x 4 x 1 mm)

### Features

- Single supply voltage
- Low power consumption
- AOP = 122.5 dB SPL
- 64 dB signal-to-noise ratio
- Omnidirectional sensitivity
- -26 dBFS  $\pm 3$  dB sensitivity
- PDM output
- HCLGA package
  - Top-port design
  - SMD-compliant
  - EMI-shielded
  - ECOPACK, RoHS, and “Green” compliant

### Applications

- Anti-tampering devices
- Vibration monitoring
- Audio-activated functions
- Predictive maintenance
- Noise cancelling
- Sound detection for alarm systems
- Human / machine voice interface
- Anti-theft systems

### Description

The **IMP34DT05** is an ultra-compact, low-power, omnidirectional, digital MEMS microphone built with a capacitive sensing element and an IC interface.

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

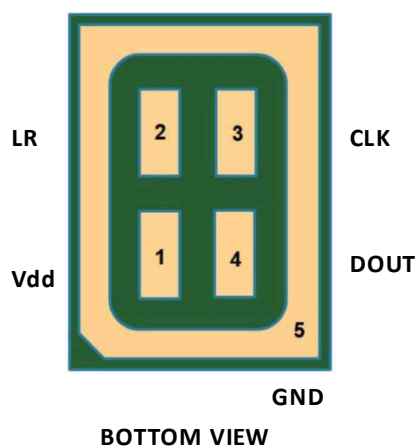
The IMP34DT05 is a low-distortion digital microphone with a 64 dB signal-to-noise ratio and -26 dBFS  $\pm 3$  dB sensitivity.

The IMP34DT05 is available in a top-port, SMD-compliant, EMI-shielded package and is guaranteed to operate over an extended temperature range from -40 °C to +85 °C.

Product status link	
<a href="#">IMP34DT05</a>	
Product summary	
Order code	IMP34DT05TR
Temperature range [°C]	-40 to +85
Package	HCLGA 4LD (3 x 4 x 1 mm)
Packing	Tape and reel
Product label	
	

## 1 Pin description

**Figure 1. Pin connections**



**Table 1. Pin description**

Pin #	Pin name	Function
1	Vdd	Power supply
2	LR	Left/Right channel selection
3	CLK	Synchronization input clock
4	DOUT	Left/Right PDM data output
5 (ground ring)	GND	Ground

## 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, unless otherwise noted.

**Table 2. Acoustic and electrical characteristics**

Symbol	Parameter	Test condition	Min.	Typ. <sup>(1)</sup>	Max.	Unit
Vdd	Supply voltage		1.6	1.8	3.6	V
Idd	Current consumption in normal mode	Mean value		650		μA
IddPdn	Current consumption in power-down mode <sup>(2)</sup>				5	μA
Sc	Short-circuit current		1		10	mA
AOP	Acoustic overload point			122.5		dB SPL
So	Sensitivity		-29	-26	-23	dBFS
SNR	Signal-to-noise ratio	A-weighted @1 kHz, 94 dB SPL		64		dB(A)
PSR	Power supply rejection	100 mVpp sine 1 kHz			-90	dBFS
f <sub>CLK</sub>	Input clock frequency <sup>(3)</sup>		1.2	2.4	3.25	MHz
Ton	Turn-on time <sup>(4)</sup>	Guaranteed by design			10	ms
Top	Operating temperature range		-40		+85	°C
V <sub>IOL</sub>	Low-level logic input/output voltage	I <sub>out</sub> = 1 mA	-0.3		0.35xVdd	V
V <sub>IOH</sub>	High-level logic input/output voltage	I <sub>out</sub> = 1 mA	0.65xVdd		Vdd+0.3	V
C <sub>LOAD</sub>	Capacitive load				100	pF

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

**Table 3. Distortion specifications @ 1 kHz**

Parameter	Test condition	Typical value <sup>(1)</sup>
Distortion	94 dB SPL	0.2% THD + N
Distortion	110 dB SPL	0.7% THD + N
Distortion	120 dBSP	6% THD + N

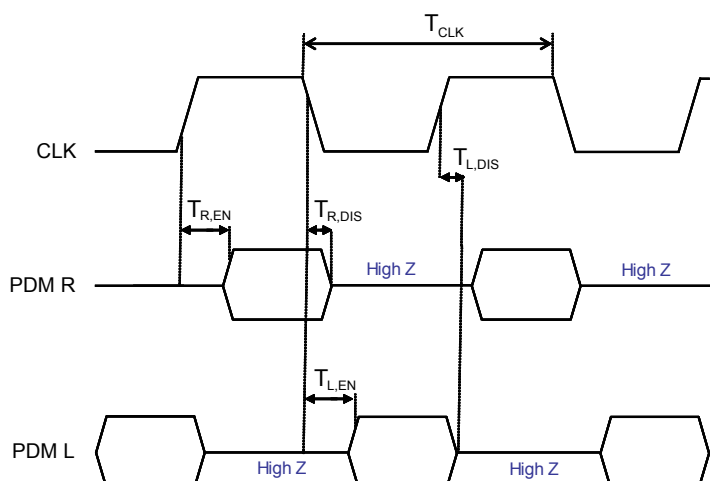
1. Typical specifications are not guaranteed.

## 2.2 Timing characteristics

**Table 4. Timing characteristics**

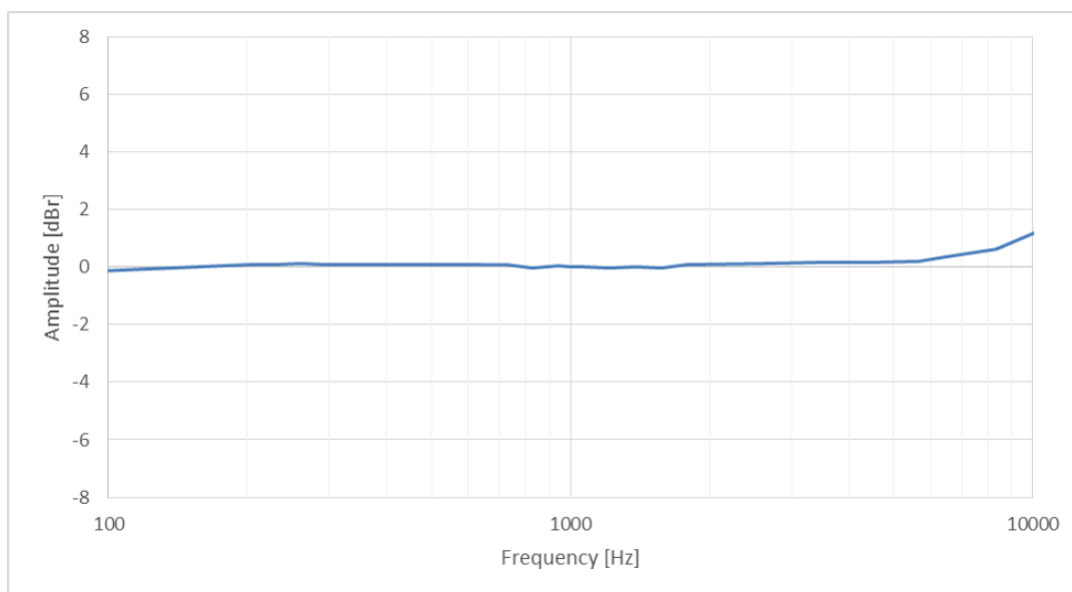
Parameter	Description	Min.	Max.	Unit
$f_{CLK}$	Clock frequency for normal mode	1.2	3.25	MHz
$f_{PD}$	Clock frequency for power-down mode		0.23	MHz
$T_{CLK}$	Clock period for normal mode	308	1000	ns
$T_{R,EN}$	Data enabled on DATA line, L/R pin = 1	40		ns
$T_{R,DIS}$	Data disabled on DATA line, L/R pin = 1		30	ns
$T_{L,EN}$	Data enabled on DATA line, L/R pin = 0	40		ns
$T_{L,DIS}$	Data disabled on DATA line, L/R pin = 0		30	ns

**Figure 2. Timing waveforms**



## 2.3 Frequency response

**Figure 3.** Typical frequency response normalized to 1 kHz



### 3 Application recommendations

Figure 4. IMP34DT05 electrical connections (top view)

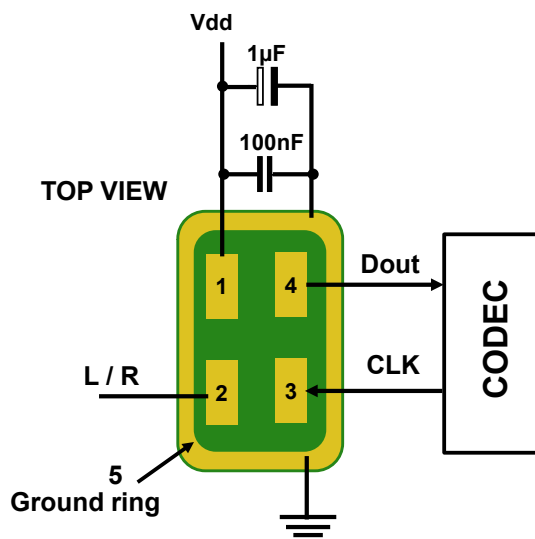
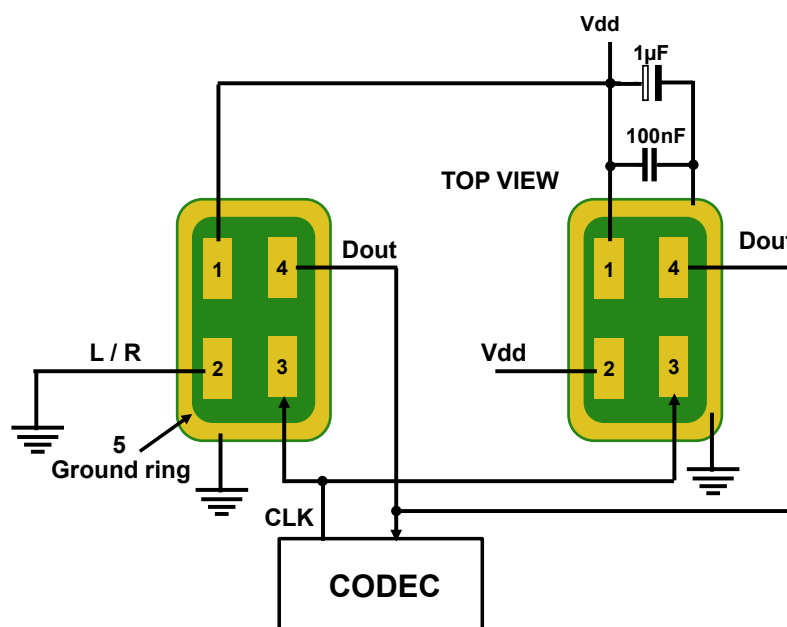


Figure 5. IMP34DT05 electrical connections for stereo configuration (top view)



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

The L/R pin must be connected to Vdd or GND (refer to [Table 6. L/R channel selection](#)).

## 4 Carrier tape mechanical specifications

Figure 6. Carrier tape without microphone (top view)

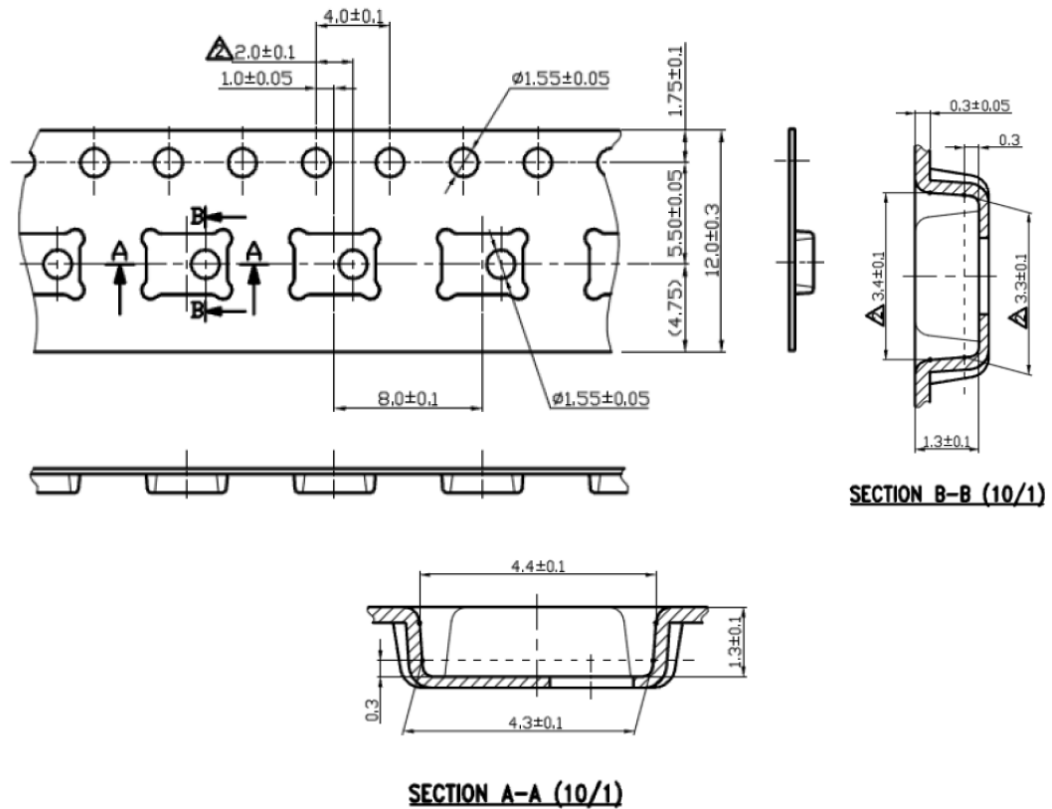
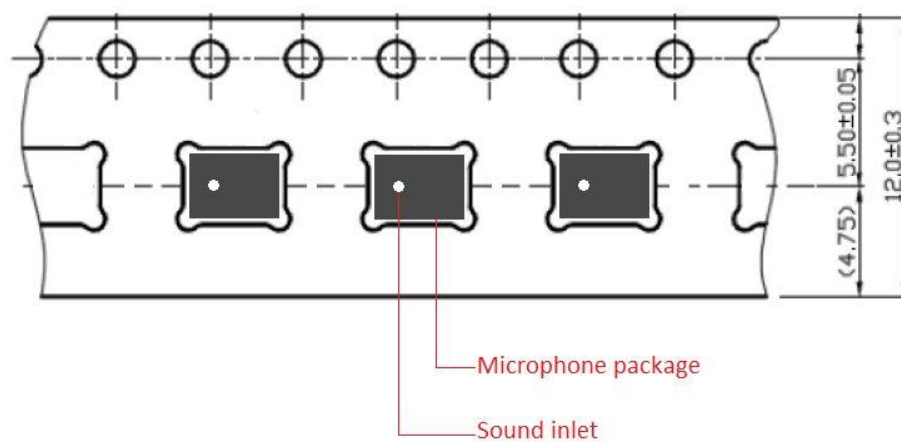


Figure 7. Carrier tape with microphone (top view)

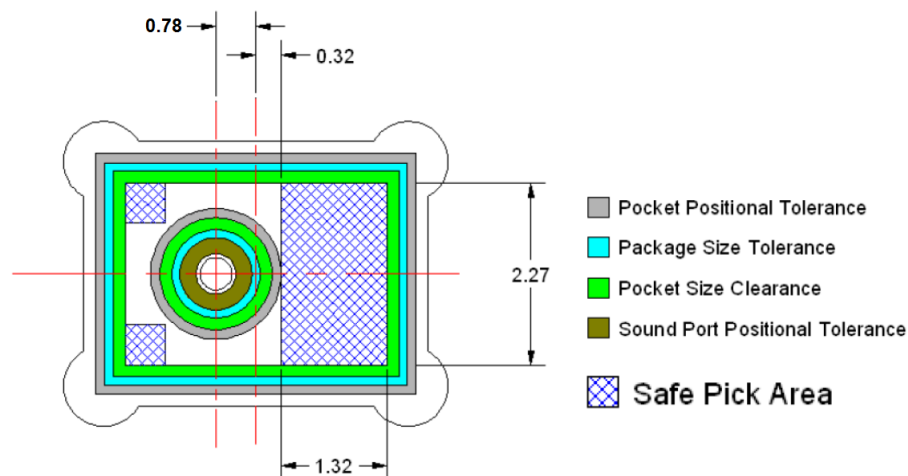


## 5 Process recommendations

To ensure a consistent manufacturing process it is strongly advised to comply with following recommendations:

- The recommended pick-up area for the IMP34DT05 package must be defined using the worst case (ie. no device alignment during picking process). This area has been defined considering all the tolerances of the components involved (reel, package, sound inlet). Picker tolerance shall be considered as well.
- To prevent damage to the MEMS membrane or incorrect pick-up and placement, do not pick up the component on the inlet area
- For the package outline please refer to [Figure 7. Carrier tape with microphone \(top view\)](#). Nozzle shape, size, and placement accuracy are the other key factors to consider when deciding on the coordinates for the picking.
- Device alignment before picking is highly recommended.
- A vacuum force greater than 7 psi must be avoided
- $1 \text{ kPa} = 0.145 \text{ psi (lb/in}^2\text{)} = 0.0102 \text{ kgf/cm}^2 = 0.0098 \text{ atm}$
- MSL (moisture sensitivity level) Class 3
- Maximum of 3 reflow cycles is recommended
- All recommended dimensions (device safe-picking area) do not include the pick-and-place equipment tolerances

**Figure 8. Recommended picking area**



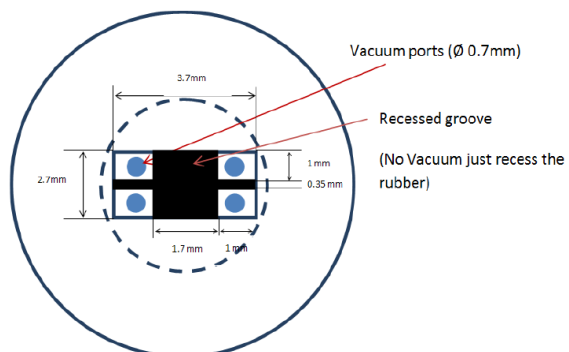
To have a safe pick-up "by design", ST strongly advises an ad hoc nozzle.

The following picker ensures that the holes for the vacuum and the air stream are ALWAYS away from the porthole of the device (4 vacuum ports located at each corner of the device).

The recommended nozzle also has a recess, in the form of a cross, which guarantees that the porthole is always left at atmospheric pressure. By using the recommended nozzle, the membrane will not suffer any sudden air disturbances during the picking or placing of the devices in the tape and reel.



**Figure 9. Recommended picker design**



---

## 6 Sensing element

---

The sensing element shall mean the acoustic sensor consisting of a conductive movable plate and a fixed plate placed in a tiny silicon chip. This sensor transduces the sound pressure into the changes of coupled capacity between those two plates.

## 7 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 5. Absolute maximum ratings**

Symbol	Ratings	Maximum value	Unit
V <sub>dd</sub>	Supply voltage	-0.3 to 5	V
V <sub>in</sub>	Input voltage on any control pin	-0.3 to V <sub>dd</sub> +0.3	V
T <sub>STG</sub>	Storage temperature range	-40 to +125	°C
ESD	Electrostatic discharge protection	±2000 (HBM)	V
		±200 (MM)	
		±750 (CBM)	
ESD	Product standard EN 55024:2010 - 3 air discharges	±15000	V



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.

## 8 Functionality

### 8.1 L/R channel selection

The L/R digital pad lets the user select the DOUT signal pattern as shown in [Table 6. L/R channel selection](#). The L/R pin must be connected to Vdd or GND.

**Table 6. 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 kohm pull/down resistor, it is not mandatory to connect the pin itself to GND for the respective channel selection.*

## 9 Package information

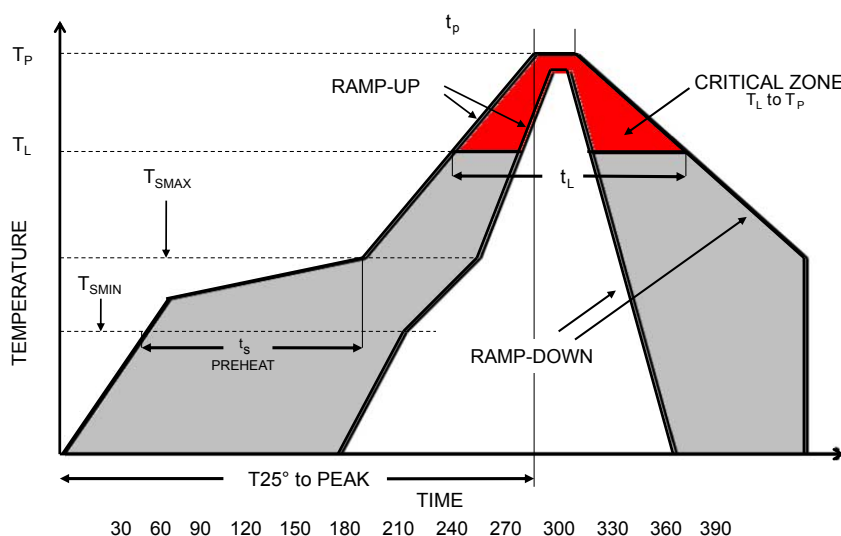
In order to meet environmental requirements, ST offers these devices in different grades of **ECOPACK** packages, depending on their level of environmental compliance. ECOPACK specifications, grade definitions and product status are available at: [www.st.com](http://www.st.com). ECOPACK is an ST trademark.

### 9.1 Soldering information

The HCLGA (3 x 4) 4LD package is also compliant with the RoHS and “Green” standards and is qualified for soldering heat resistance according to JEDEC J-STD-020.

Land pattern and soldering recommendations are available at [www.st.com](http://www.st.com).

**Figure 10. Recommended soldering profile limits**

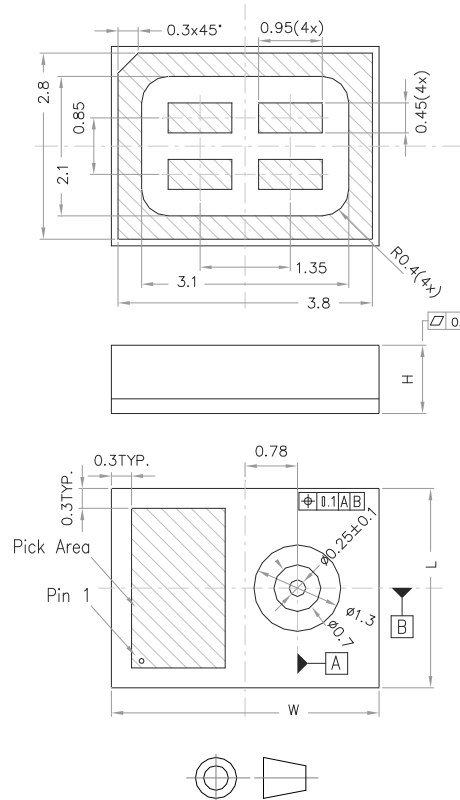


**Table 7. Recommended soldering profile limits**

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 ( $t_{25}$ ) to peak temperature		8 minutes max

## 9.2 HCLGA package information

**Figure 11. HCLGA (3 x 4 x 1 mm) 4-lead package outline and mechanical data**



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

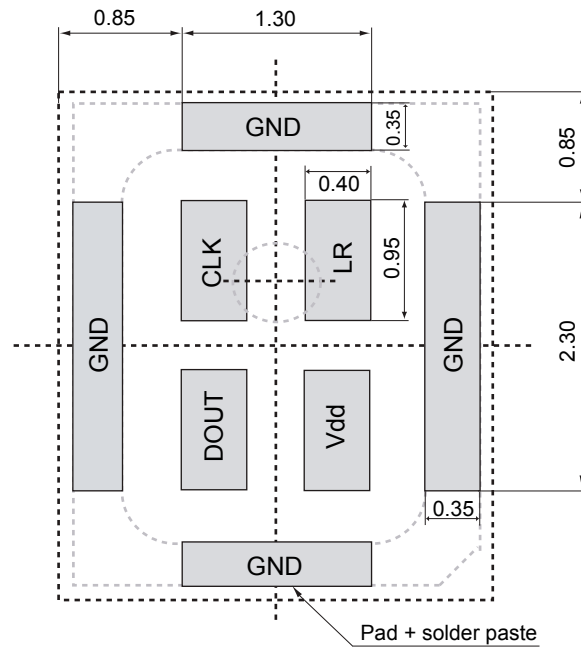
### OUTER DIMENSIONS

ITEM	DIMENSION [mm]	TOLERANCE [mm]
Length [L]	3	±0.1
Width [W]	4	±0.1
Height [H]	1.00	±0.1
AP	Ø 0.25	±0.1

DM00231908\_3

1. The MEMS microphone plastic cap can exhibit some level of variation in color when the device is subjected to thermal processes. This variation does not affect acoustic or electrical performance.
2. Ring plating can be subject to change not affecting acoustic and electrical performance.

**Figure 12. Land pattern**



## Revision history

**Table 8. Document revision history**

Date	Version	Changes
02-Aug-2018	1	Initial release
04-Sep-2018	2	Added product label indicating ST's 10-year longevity commitment
29-Apr-2019	3	Updated <a href="#">Table 4. Timing characteristics</a>



## Contents

<b>1</b>	<b>Pin description .....</b>	<b>2</b>
<b>2</b>	<b>Acoustic and electrical specifications .....</b>	<b>3</b>
2.1	Acoustic and electrical characteristics .....	3
2.2	Timing characteristics .....	4
2.3	Frequency response .....	5
<b>3</b>	<b>Application recommendations .....</b>	<b>6</b>
<b>4</b>	<b>Carrier tape mechanical specifications .....</b>	<b>7</b>
<b>5</b>	<b>Process recommendations .....</b>	<b>8</b>
<b>6</b>	<b>Sensing element .....</b>	<b>10</b>
<b>7</b>	<b>Absolute maximum ratings .....</b>	<b>11</b>
<b>8</b>	<b>Functionality .....</b>	<b>12</b>
8.1	L/R channel selection .....	12
<b>9</b>	<b>Package information .....</b>	<b>13</b>
9.1	Soldering information .....	13
9.2	HCLGA package information .....	13
	<b>Revision history .....</b>	<b>16</b>

## List of tables

<b>Table 1.</b>	Pin description . . . . .	2
<b>Table 2.</b>	Acoustic and electrical characteristics . . . . .	3
<b>Table 3.</b>	Distortion specifications @ 1 kHz . . . . .	3
<b>Table 4.</b>	Timing characteristics . . . . .	4
<b>Table 5.</b>	Absolute maximum ratings . . . . .	11
<b>Table 6.</b>	L/R channel selection . . . . .	12
<b>Table 7.</b>	Recommended soldering profile limits . . . . .	13
<b>Table 8.</b>	Document revision history . . . . .	16

## List of figures

<b>Figure 1.</b>	Pin connections . . . . .	2
<b>Figure 2.</b>	Timing waveforms . . . . .	4
<b>Figure 3.</b>	Typical frequency response normalized to 1 kHz . . . . .	5
<b>Figure 4.</b>	IMP34DT05 electrical connections (top view) . . . . .	6
<b>Figure 5.</b>	IMP34DT05 electrical connections for stereo configuration (top view) . . . . .	6
<b>Figure 6.</b>	Carrier tape without microphone (top view) . . . . .	7
<b>Figure 7.</b>	Carrier tape with microphone (top view) . . . . .	7
<b>Figure 8.</b>	Recommended picking area . . . . .	8
<b>Figure 9.</b>	Recommended picker design . . . . .	9
<b>Figure 10.</b>	Recommended soldering profile limits . . . . .	13
<b>Figure 11.</b>	HCLGA (3 x 4 x 1 mm) 4-lead package outline and mechanical data . . . . .	14
<b>Figure 12.</b>	Land pattern . . . . .	15

**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](http://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.

© 2019 STMicroelectronics – All rights reserved