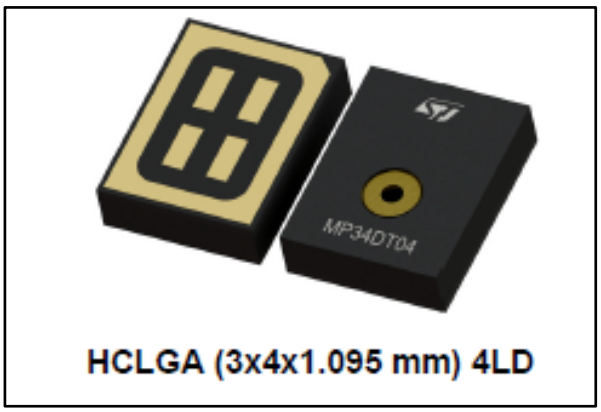
MP34DT04

MEMS audio sensor omnidirectional digital microphone

Datasheet - production data



HCLGA (3x4x1.095 mm) 4LD

Features

- Single supply voltage
- Low power consumption
- 120 dBSPL acoustic overload point
- 64 dB signal-to-noise ratio
- Omnidirectional sensitivity
- –26 dBFS sensitivity
- PDM output
- HCLGA package
  - Top-port design
  - SMD-compliant
  - EMI-shielded
  - ECOPACK®, RoHS, and “Green” compliant

Applications

- Mobile terminals
- Laptop and notebook computers
- Portable media players
- VoIP
- Speech recognition
- A/V eLearning devices
- Gaming and virtual reality input devices
- Digital still and video cameras
- Antitheft systems

Description

The MP34DT04 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 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 MP34DT04 has an acoustic overload point of 120 dBSPL with a 64 dB signal-to-noise ratio and –26 dBFS sensitivity.

The MP34DT04 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.

Table 1: Device summary

Order codes	Temp. range [°C]	Package	Packing
MP34DT04	-40 to +85	HCLGA (3x4 x1.095 mm) 4LD	Tray
MP34DT04TR	-40 to +85	HCLGA (3x4x1.095 mm) 4LD	Tape and reel

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1 Pin description

Figure 1: Pin connections

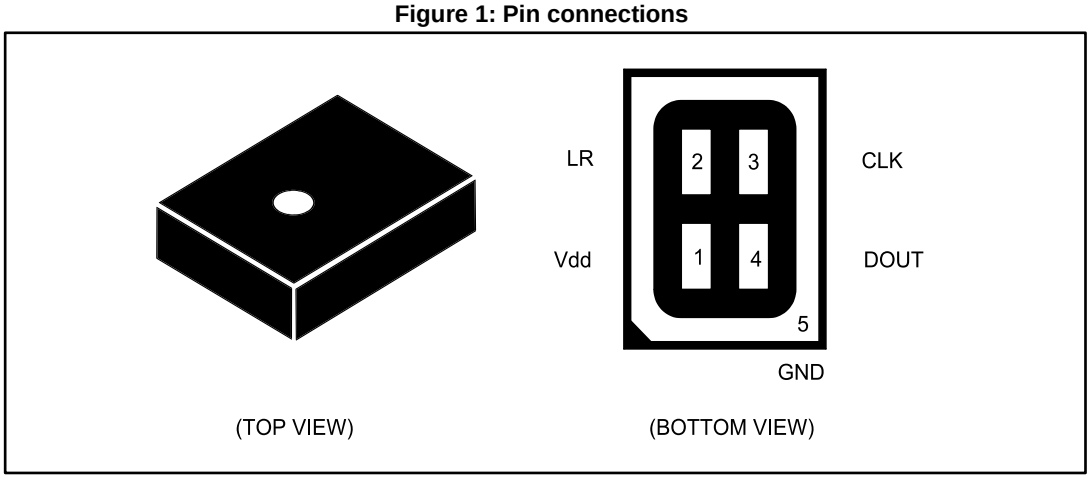


Table 2: Pin description

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	0 V supply

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 3: Acoustic and electrical characteristics

Symbol	Parameter	Test condition	Min.	Typ. (1)	Max.	Unit
Vdd	Supply voltage		1.6	1.8	3.6	V
Idd	Current consumption in normal mode	Mean value		600	700	µA
IddPdn	Current consumption in power-down mode (2)				10	µA
Scc	Short-circuit current		1		10	mA
AOP	Acoustic overload point			120		dBSPL
So	Sensitivity		-29	-26	-23	dBFS
SNR	Signal-to-noise ratio	A-weighted at 1 kHz, 94 dB SPL		64		dB (A)
PSR	Power supply rejection	100 mVpp sine 1 kHz		-70		dBFS
f_{CLK}	Input clock frequency (3)		1	2.4	3.25	MHz
Ton	Turn-on time (4)	Guaranteed by design			10	ms
Top	Operating temperature range		-40		+85	°C
V_{IOL}	Low-level logic input/output voltage	I_{out} = 1 mA	-0.3		0.35xVdd	V
V_{IOH}	High-level logic input/output voltage	I_{out} = 1 mA	0.65xVdd		Vdd+0.3	V
C_{LOAD}	Capacitive load				100	pF

Notes:

(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 4: Distortion specifications

Parameter	Test condition	Value
Distortion	100 dBSPL (50 Hz - 4 kHz)	< 1% THD + N
Distortion	115 dBSPL (1 kHz)	< 5% THD + N

2.2 Timing characteristics

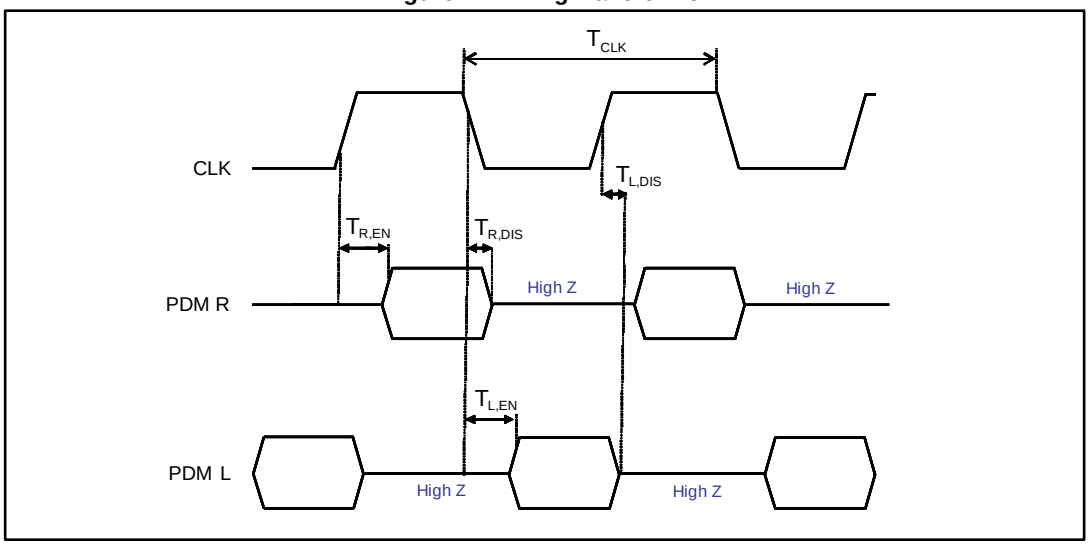
Table 5: Timing characteristics

Parameter	Description	Min.	Max.	Unit
f_{CLK}	Clock frequency for normal mode	1	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	18 *(1)*		ns
$T_{R,DIS}$	Data disabled on DATA line, L/R pin = 1		16*(1)*	ns
$T_{L,EN}$	Data enabled on DATA line, L/R pin = 0	18*(1)*		ns
$T_{L,DIS}$	Data disabled on DATA line, L/R pin = 0		16*(1)*	ns

Notes:

(1)From design simulations

Figure 2: Timing waveforms



2.3 Frequency response

Figure 3: Frequency response and mask

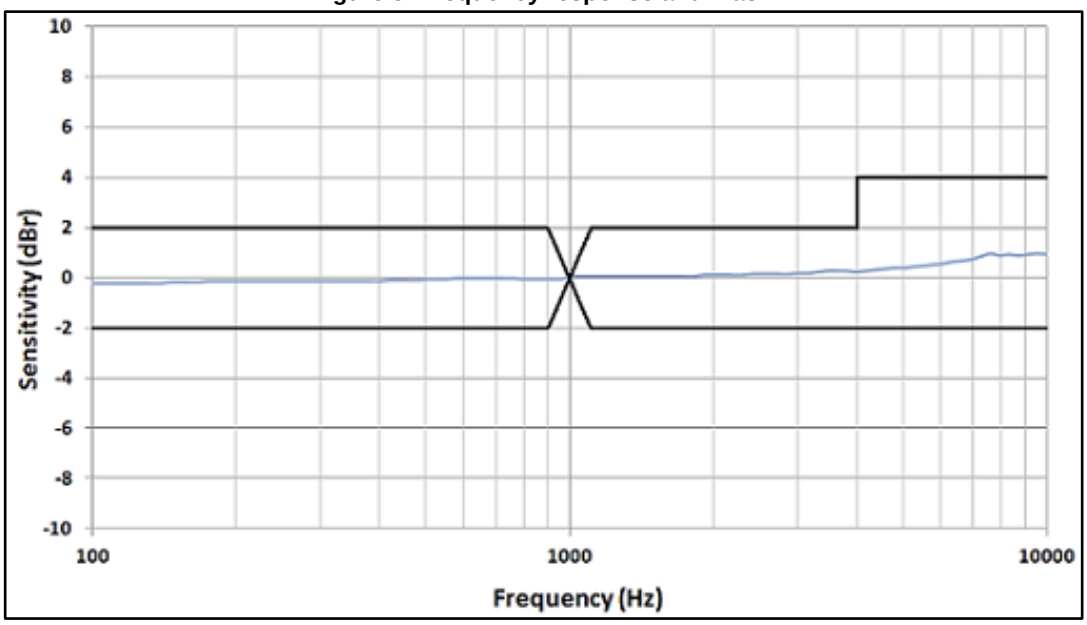


Table 6: Frequency response mask for digital microphones

Frequency / Hz (1)	Lower limit	Upper limit	Unit
100...4000	-2	+2	dBr 1 kHz
4000...10000	-2	+4	dBr 1 kHz

Notes:

(1)At T = 20 °C and acoustic stimulus = 1 Pa (94 dB SPL)

3 Application recommendations

Figure 4: MP34DT04 electrical connections for stereo configuration

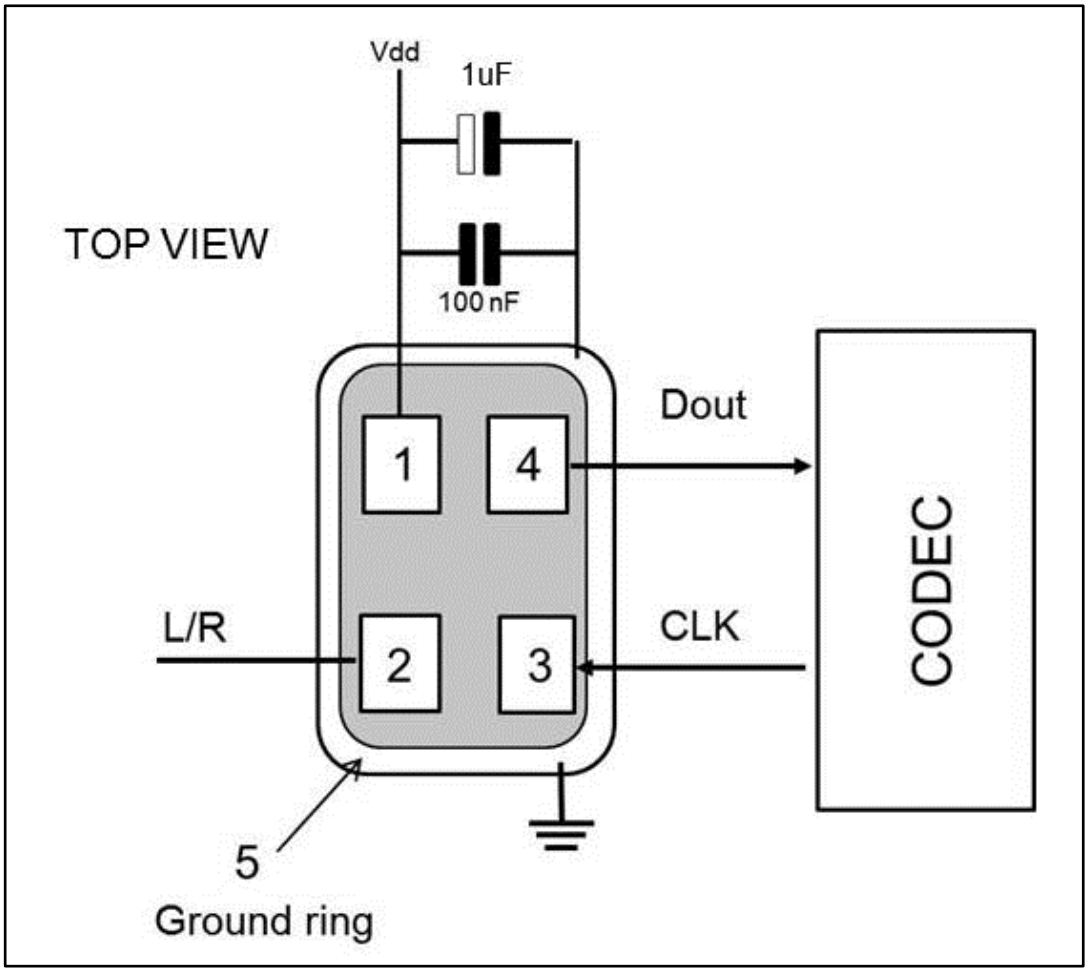
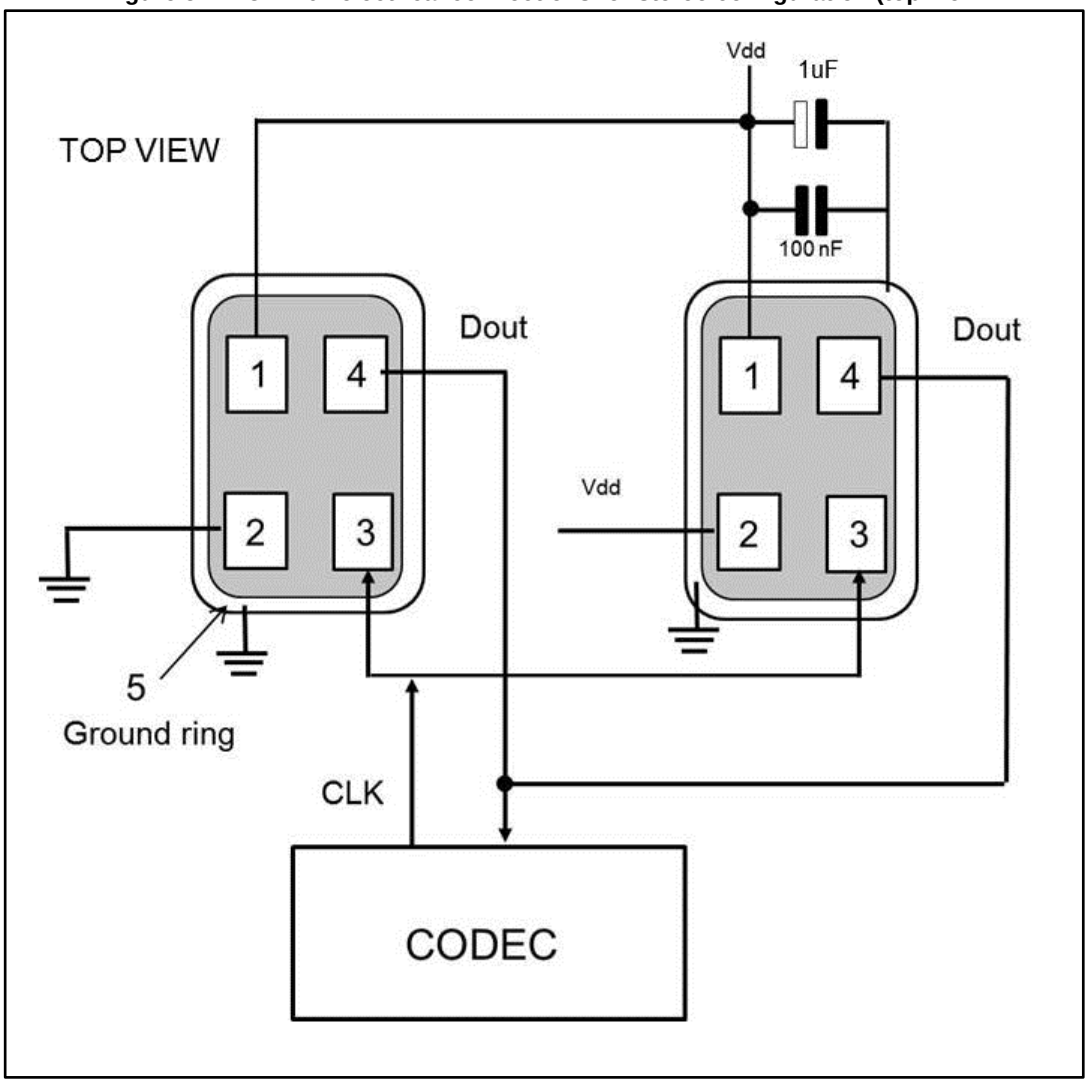


Figure 5: MP34DT04 electrical connections for stereo configuration (top view



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 8: "L/R channel selection"*).

4 Carrier tape mechanical specifications

Figure 6: Carrier tape without microphone (top view)

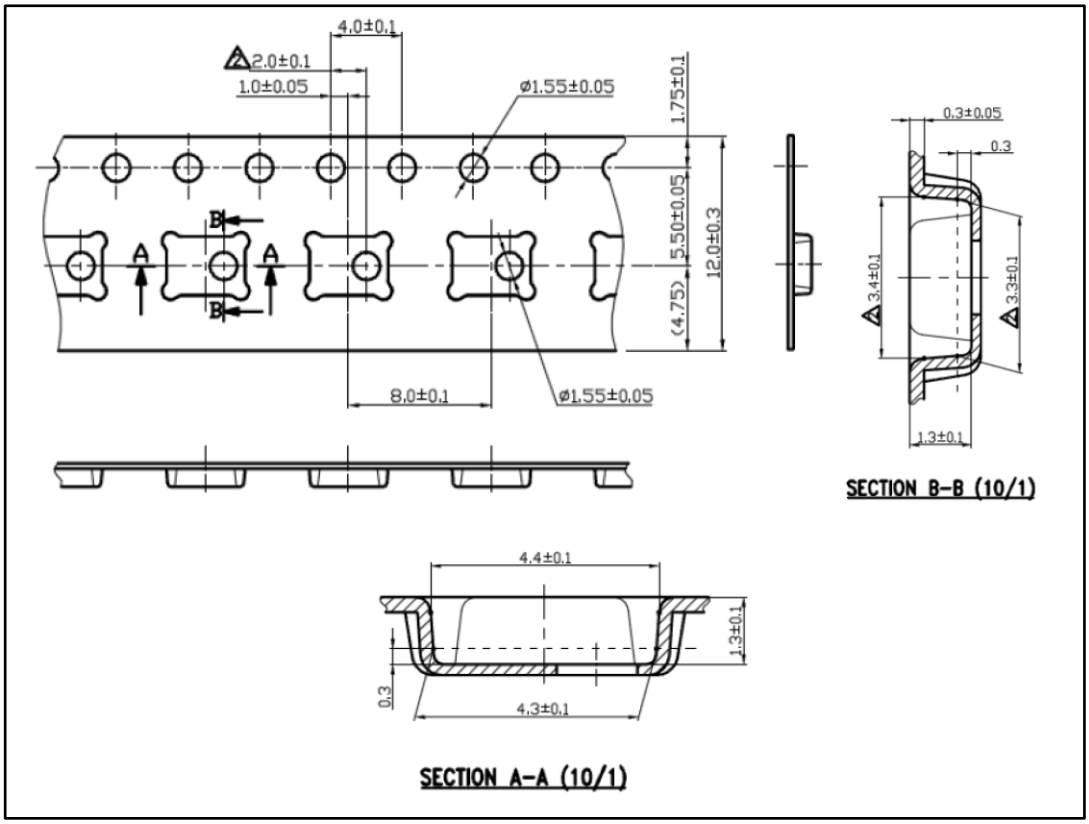
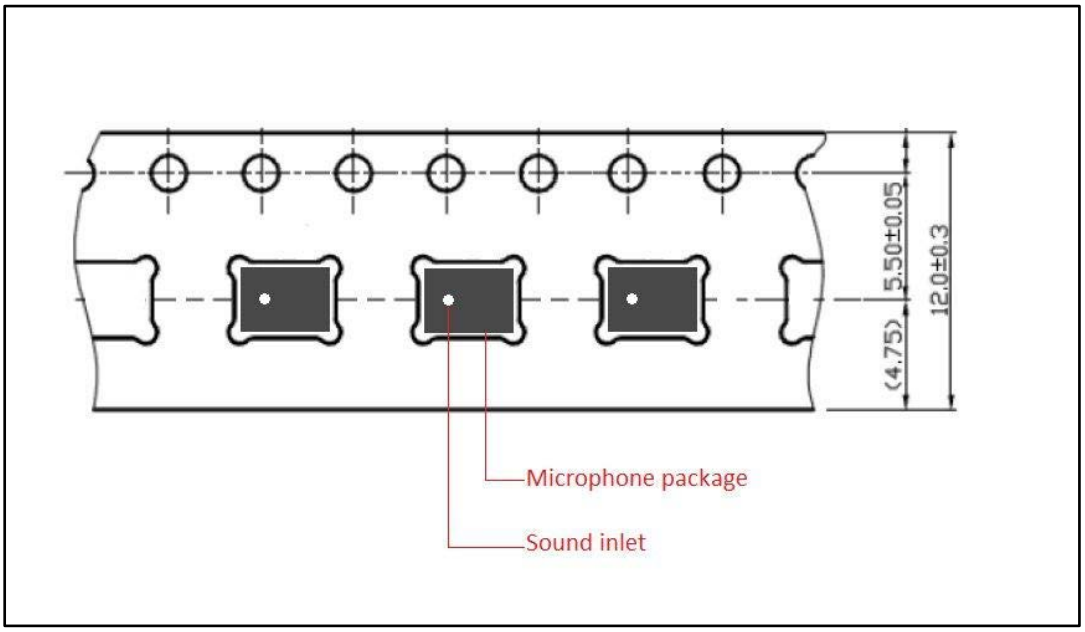


Figure 7: Carrier tape with microphone (top view)

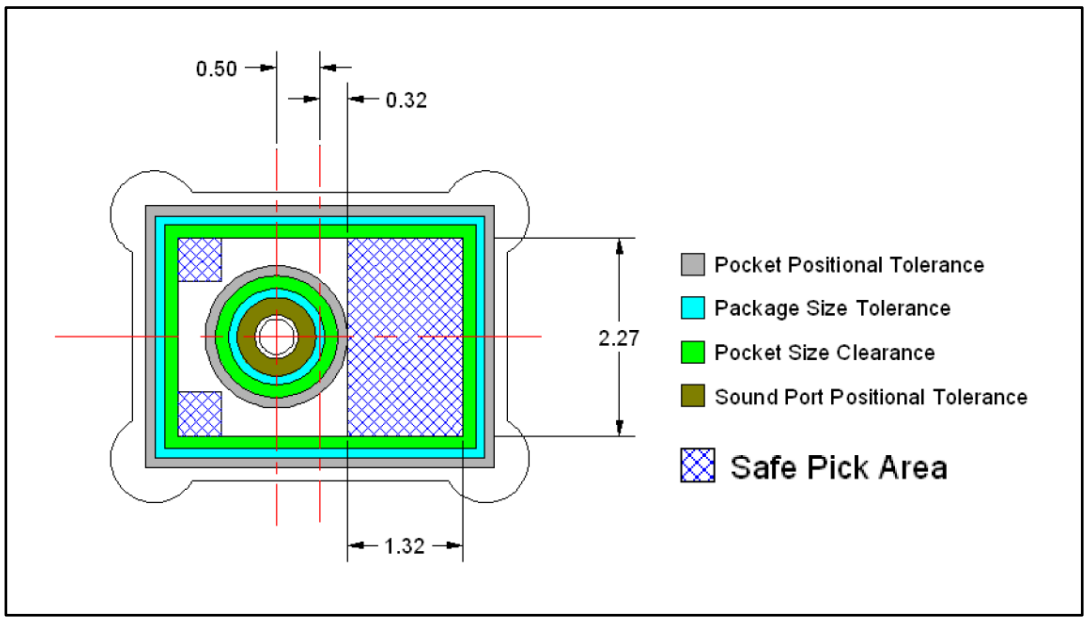


5 Process recommendations

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

- The recommended pick-up area for the MP34DT04 package must be defined using the worst case (ie. no device alignment during the picking process). This area has been defined considering all the tolerances of the components involved (reel, package, sound inlet). The 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 picking.
- Device alignment before picking is highly recommended.
- A vacuum force greater than 7 psi must be avoided
- 1 kPa = 0.145 psi (lb/in^2) = 0.0102 kgf/cm^2 = 0.0098 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

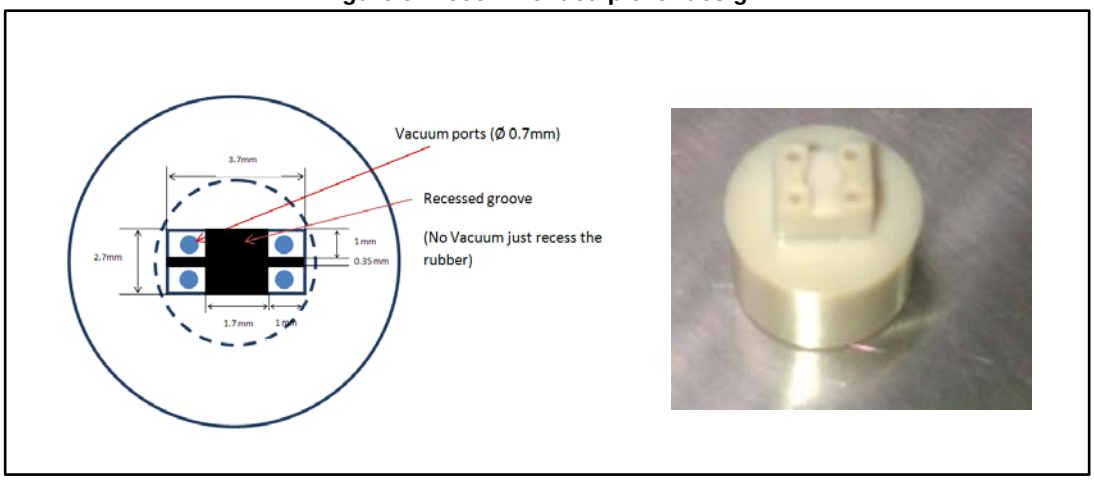


To have a safe pick-up "by design", ST strongly advises an ad hoc nozzle.

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.

Omron Corporation supplies this element for STMicroelectronics.

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 7: Absolute maximum ratings

Symbol	Ratings	Maximum value	Unit
Vdd	Supply voltage	-0.3 to 5	V
Vin	Input voltage on any control pin	-0.3 to Vdd +0.3	V
T_{STG}	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 discharge	±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 8: "L/R channel selection"*. The L/R pin must be connected to Vdd or GND.

Table 8: L/R channel selection

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

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***. 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.

Figure 10: Recommended soldering profile limits

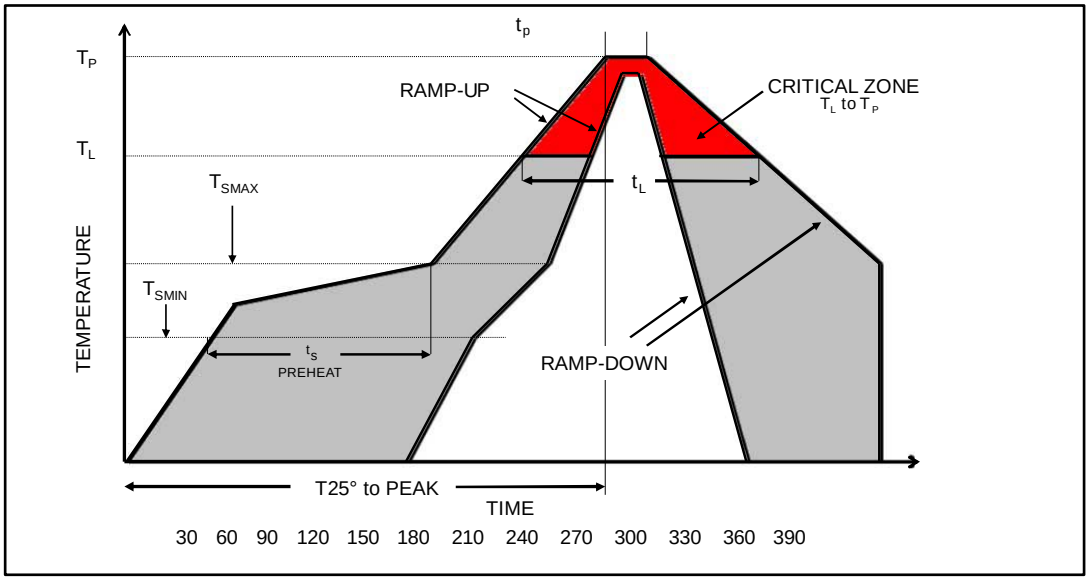
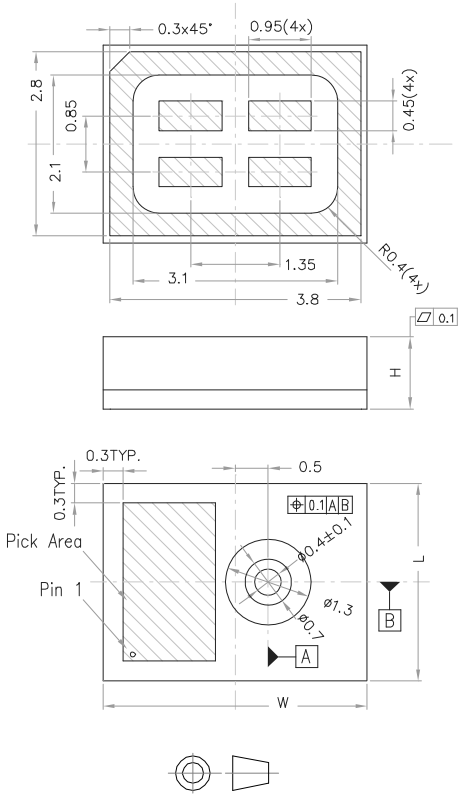


Table 9: Recommended soldering profile limits

Description	Parameter	Pb free
Average ramp rate	T_L to T_P	3 °C/sec max
Preheat Minimum temperature Maximum temperature Time (T_{SMIN} to T_{SMAX})	 T_{SMIN} T_{SMAX} t_S	 150 °C 200 °C 60 sec to 120 sec
Ramp-up rate	T_{SMAX} to T_L	
Time maintained above liquids temperature Liquids temperature	t_L T_L	60 sec to 150 sec 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 (t25 °C) to peak temperature		8 minutes max

9.2 HCLGA package information

Figure 11: HCLGA (3x4x1.095) 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]	1.095	±0.1
AP	ϕ 0.4	±0.1

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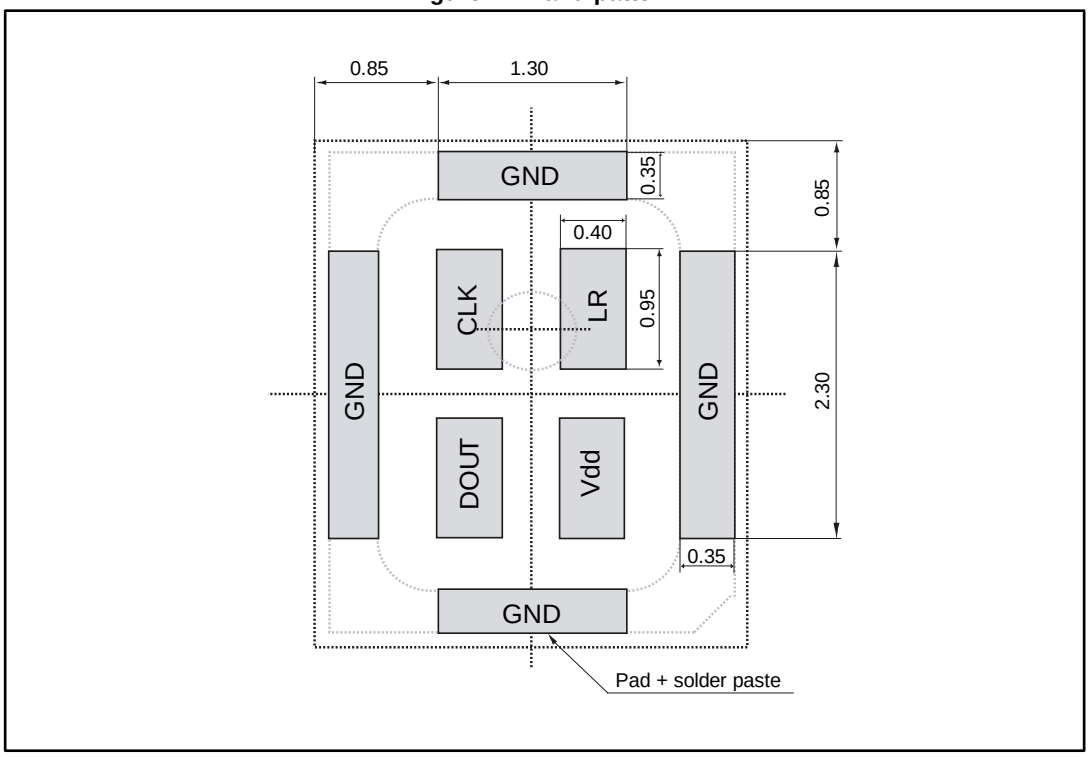
1. The MEMS microphone plastic cap can exhibit some level of variation in color when the device is subjected to thermal processes. This variation does not affect acoustic or electrical performance.
2. Ring plating can be subject to change not affecting acoustic and electrical performance.

Figure 12: Land pattern



10 Revision history

Table 10: Document revision history

Date	Revision	Changes
10-Mar-2015	1	Initial release
07-May-2015	2	Updated *Section 9.2: "HCLGA package information"*
04-Nov-2016	3	Added C_{LOAD} to *Table 3: "Acoustic and electrical characteristics"* Updated *Section 3: "Application recommendations"* Updated *Section 5: "Process recommendations"*

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