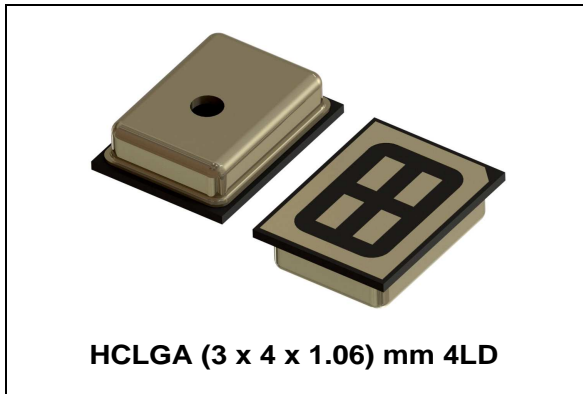


MEMS audio sensor omnidirectional digital microphone

Datasheet - production data



- Speech recognition
- A/V eLearning devices
- Gaming and virtual reality input devices
- Digital still and video cameras
- Antitheft systems

Description

The MP34DT02 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 MP34DT02 has an acoustic overload point of 120 dB SPL with a 60 dB signal-to-noise ratio and -26 dBFS sensitivity.

The MP34DT02 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.

Features

- Single supply voltage
- Low power consumption
- 120 dB SPL acoustic overload point
- 60 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

Table 1. Device summary

| Order codes | Temperature range [°C] | Package | Packing |
|-------------|------------------------|-----------------------------|---------------|
| MP34DT02 | -40 to +85 | HCLGA (3 x 4 x 1.06) mm 4LD | Tray |
| MP34DT02TR | -40 to +85 | HCLGA (3 x 4 x 1.06) mm 4LD | Tape and reel |

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1 Pin description

Figure 1. Pin connections

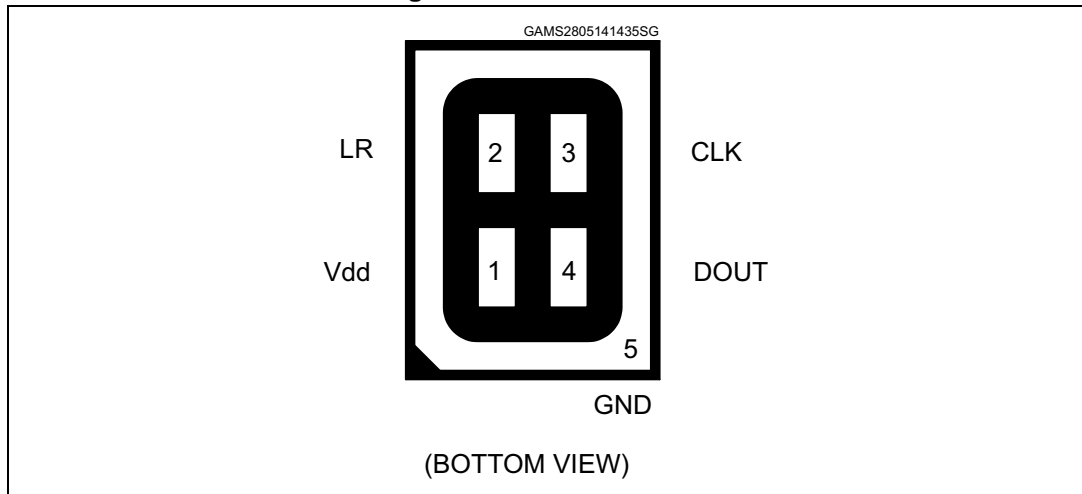


Table 2. Pin description

| Pin n° | 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 | | 1.64 | 1.8 | 3.6 | V |
| Idd | Current consumption in normal mode | Mean value | | 0.6 | | mA |
| IddPdn | Current consumption in power-down mode ⁽²⁾ | | | 20 | | μA |
| Sc | Short-circuit current | | 1 | | 10 | mA |
| AOP | Acoustic overload point | | | 120 | | dB SPL |
| So | Sensitivity | | -29 | -26 | -23 | dBFS |
| SNR | Signal-to-noise ratio | A-weighted at 1 kHz, 1 Pa | | 60 | | dB |
| PSR | Power supply rejection | Guaranteed by design | | -70 | | dBFS |
| Clock | 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 |

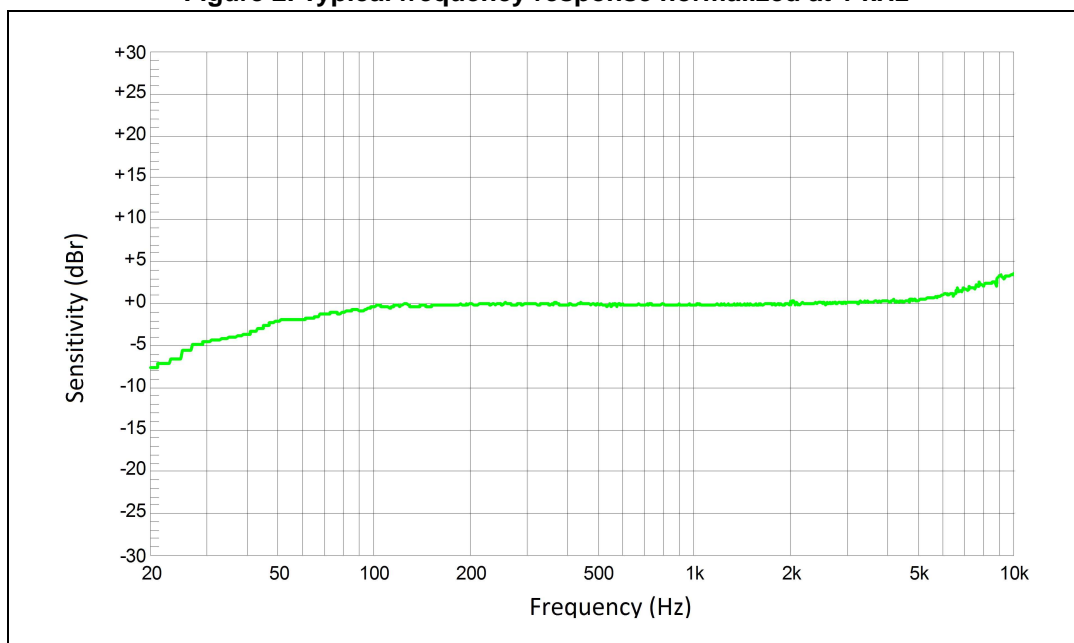
1. Typical specifications are not guaranteed.
2. Input clock in static mode.
3. Duty cycle: min = 40% max = 60%.
4. Time from the first clock edge to valid output data.

Table 4. Distortion specifications

| Parameter | Test condition | Value |
|------------|--------------------|-------------|
| Distortion | 100 dB SPL (1 kHz) | < 1% THD+N |
| Distortion | 115 dB SPL (1 kHz) | < 2% THD+N |
| Distortion | 120 dB SPL (1 kHz) | < 10% THD+N |

2.2 Frequency response

Figure 2. Typical frequency response normalized at 1 kHz



3 Application recommendations

Figure 3. MP34DT02 electrical connections (Top view)

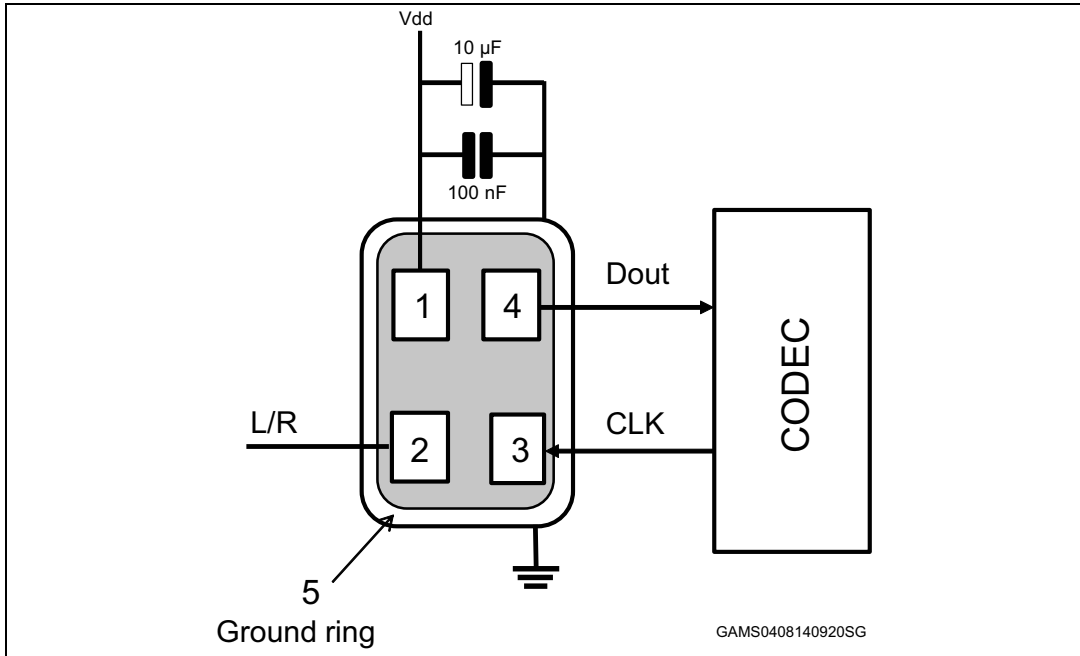
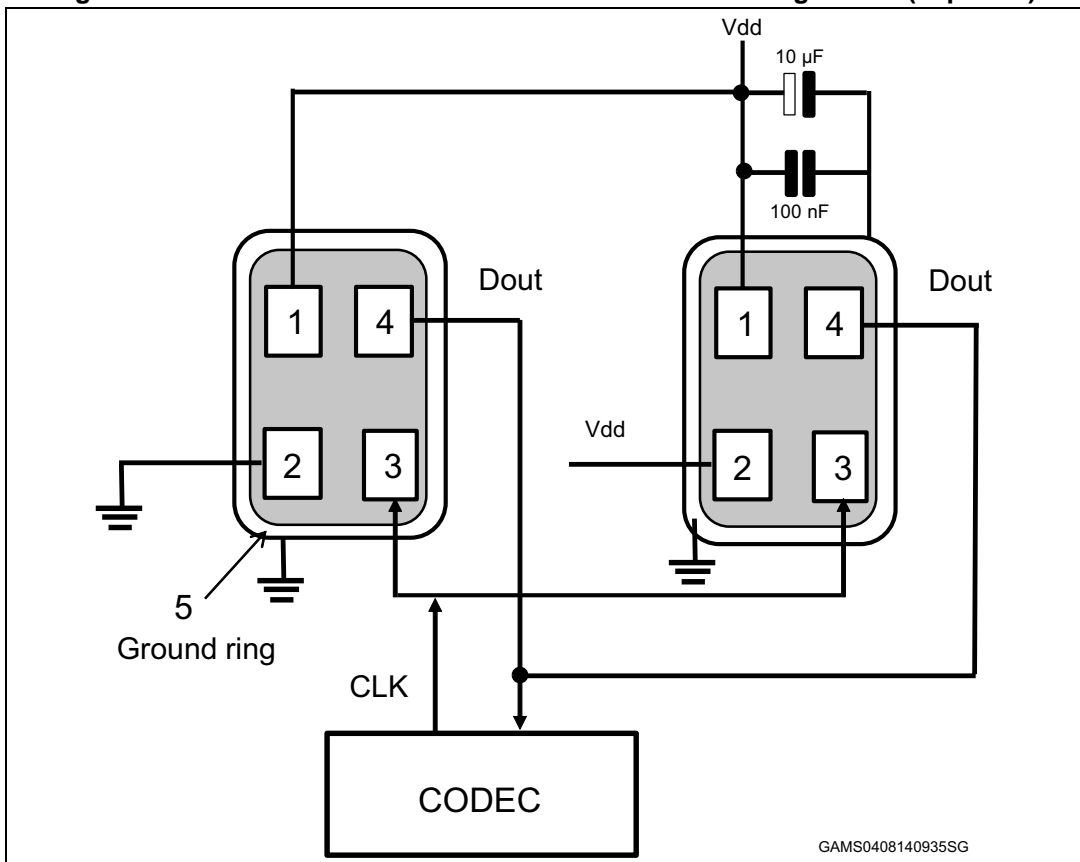


Figure 4. MP34DT02 electrical connections for stereo configuration (Top view)



Power supply decoupling capacitors (100 nF ceramic, 10 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 5](#)).

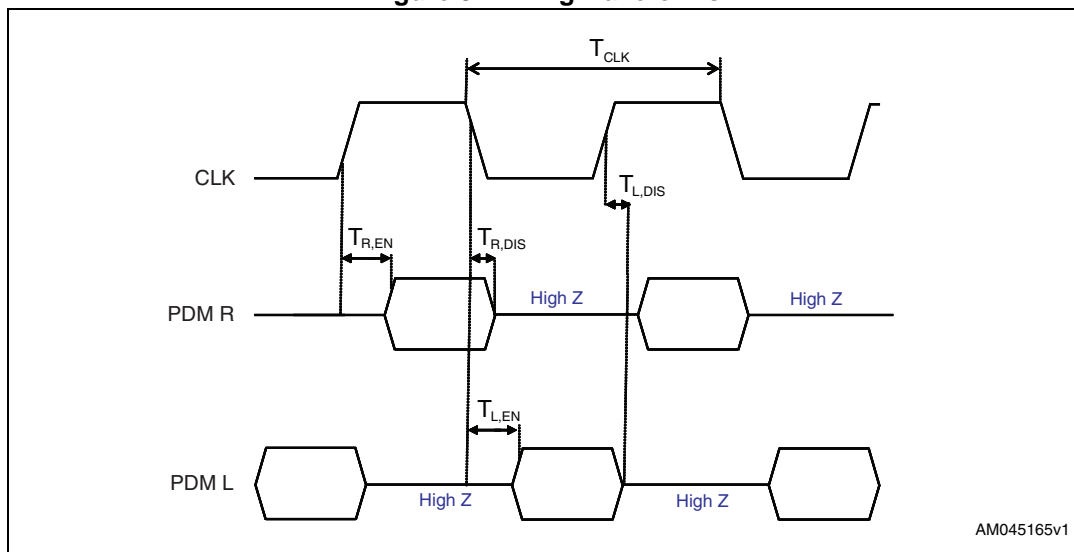
3.1 Timing characteristics

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 |

1. From design simulations

Figure 5. Timing waveforms



AM045165v1

4 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 transducers the sound pressure into the changes of coupled capacity between those two plates.

Omron Corporation supplies this element for STMicroelectronics.

5 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 6 | V |
| V _{in} | Input voltage on any control pin | -0.3 to V _{dd} +0.3 | V |
| T _{STG} | Storage temperature range | -40 to +125 | °C |
| ESD | Electrostatic discharge protection | 2 (HBM) | kV |
| | 3 discharges at ± 8 kV direct contact to lid when unit is grounded (IEC 61000-4-2) and 3 discharges at ± 2 kV direct contact to I/O pins. (MIL 883E, Method 3015.7) | ± 8 | kV |



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



This device is ESD-sensitive, improper handling can cause permanent damage to the part.

6 Functionality

6.1 L/R channel selection

The L/R digital pad lets the user select the DOUT signal pattern as shown in [Table 7](#). 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 |

7 Package mechanical data

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.

Soldering information

The HCLGA 3x4 4LD 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

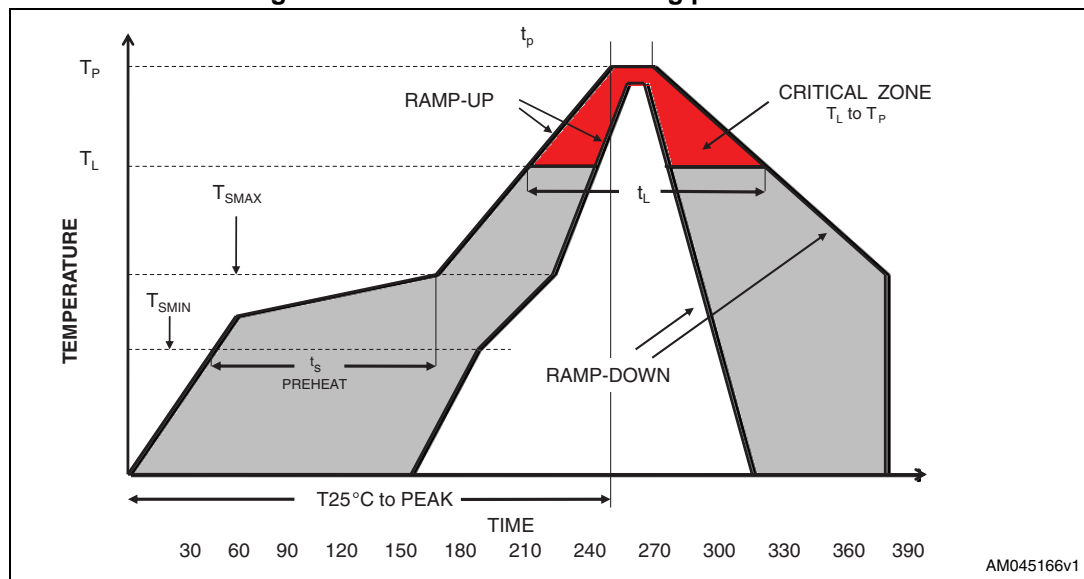
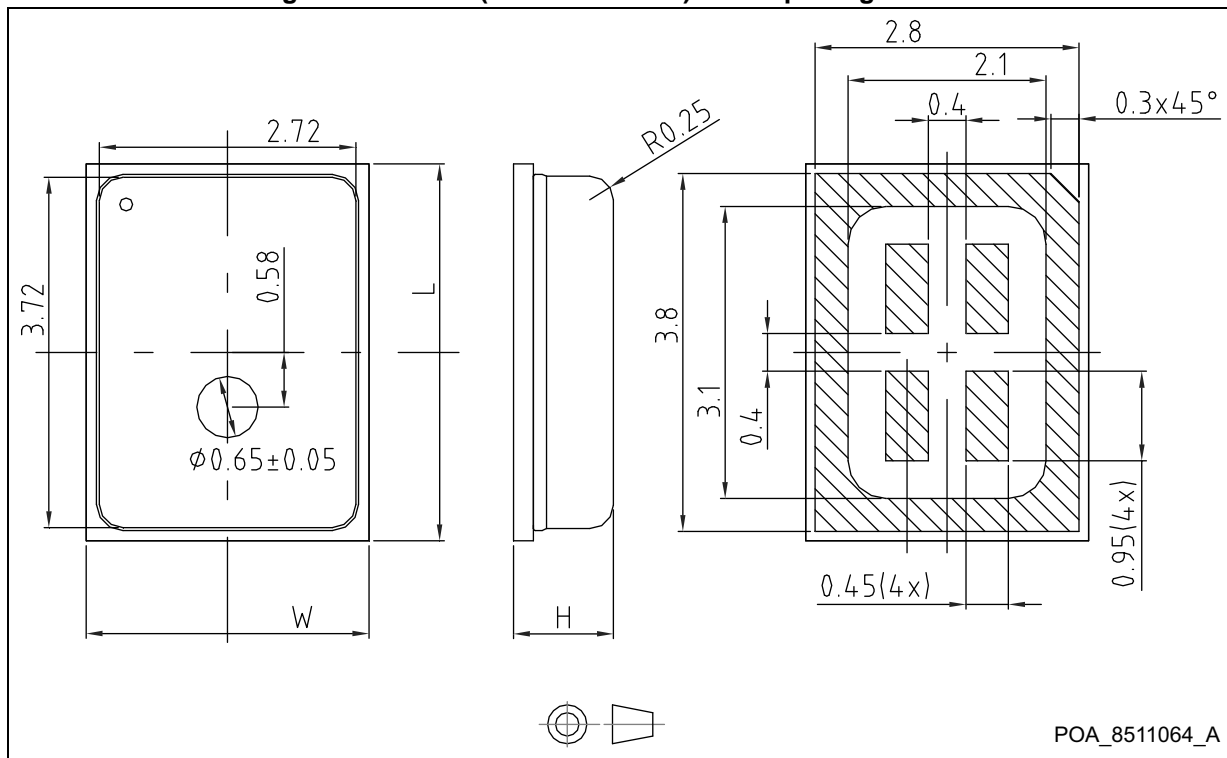


Table 8. Recommended soldering profile limits

| 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 |

Figure 7. HCLGA (3 x 4 x 1.06 mm) 4-lead package outline



Note: The MEMS microphone metal cap can exhibit some level of variation in color when the device is subjected to thermal process.
 Dimensions are in millimeter unless otherwise specified. General tolerance is ± 0.15 mm unless otherwise specified.

Table 9. HCLGA (3 x 4 x 1.06 mm) mechanical data

| Item | Dimension (mm) | Tolerance (mm) |
|------------|----------------|----------------|
| Length [L] | 4 | ± 0.1 |
| Width [W] | 3 | ± 0.1 |
| Height [H] | 1.06 | ± 0.1 |

8 Carrier tape mechanical specifications

Figure 8. Carrier tape without microphone-top view

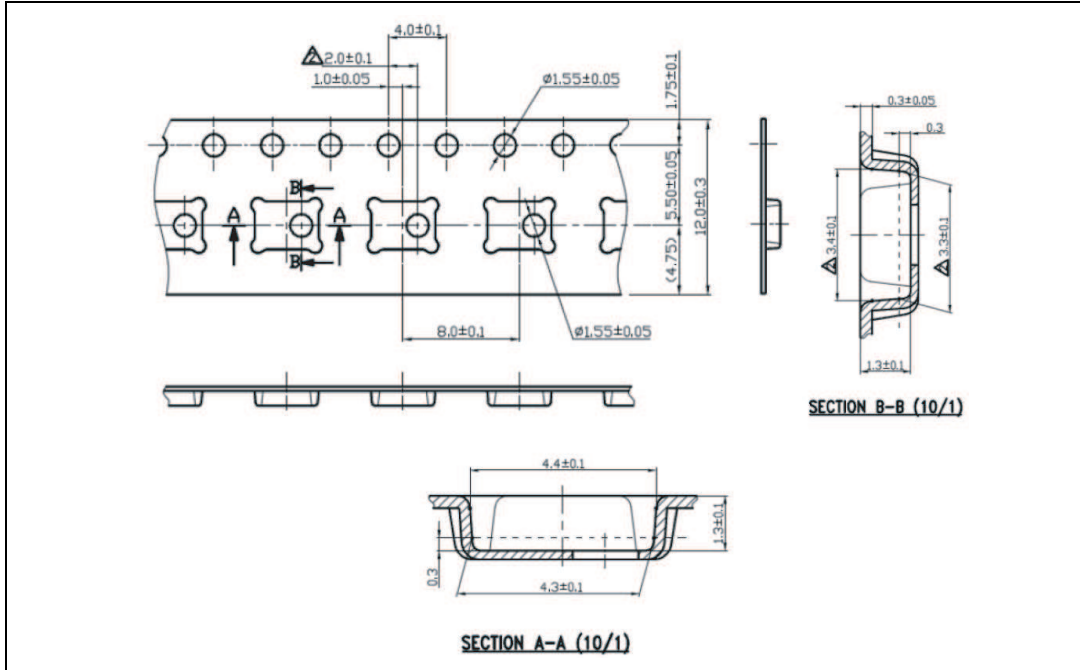
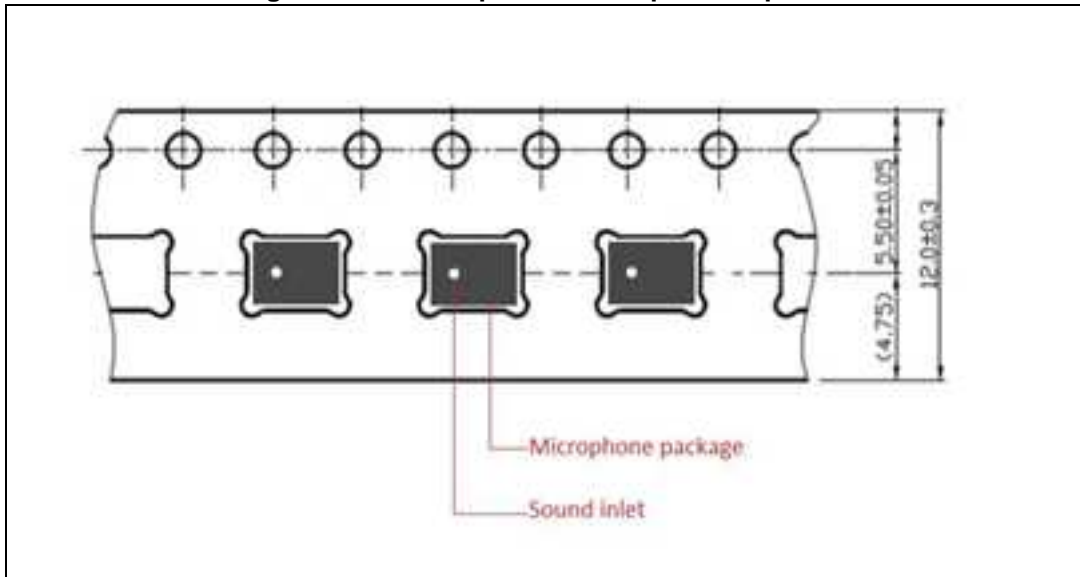


Figure 9. Carrier tape with microphone-top view

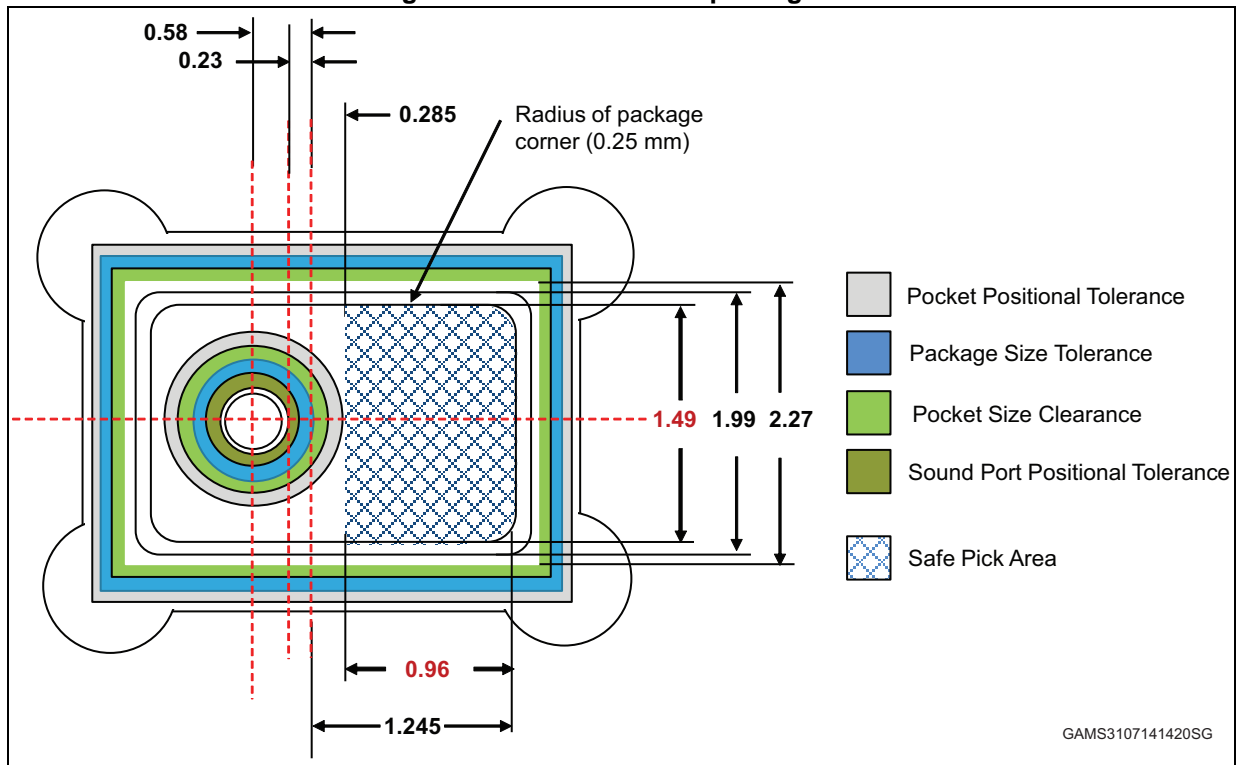


9 Process recommendations

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

- The recommended pick-up area for the MP34DT02 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 10](#). 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
- $1 \text{ kPa} = 0.145 \text{ psi (lb/in}^2) = 0.0102 \text{ kgf/cm}^2 = 0.0098 \text{ atm}$
- All the recommended dimensions (device safe pick area) do not include the pick and place equipment tolerances
- According to [Figure 10](#), standard picker tool can be used to handle this device

Figure 10. Recommended picking area



10 Revision history

Table 10. Document revision history

| Date | Revision | Changes |
|-------------|----------|---|
| 19-Jun-2014 | 1 | Initial release |
| 03-Sep-2014 | 2 | Updated sensitivity values parameter Table 3 on page 4 Added: <ul style="list-style-type: none">– Table 4: Distortion specifications on page 4 and Figure 2: Typical frequency response normalized at 1 kHz on page 5– Section 3: Application recommendations on page 6– Section 9: Process recommendations on page 14 |

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