

MEMS audio sensor omnidirectional digital microphone

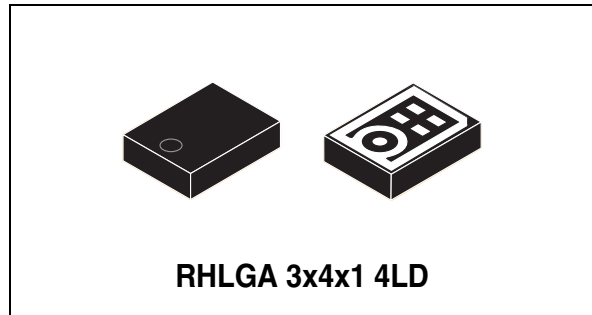
Datasheet – production data

Features

- Single supply voltage
- Low power consumption
- 120 dB SPL acoustic overload point
- 62.6 dB signal-to-noise ratio
- Omnidirectional sensitivity
- -26 dBFS sensitivity
- PDM single-bit output with option for stereo configuration
- RHLGA package
 - Bottom-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 MP34DB01 is an ultra-compact, low-power, omnidirectional, digital MEMS microphone built with a capacitive sensing element and an IC interface with stereo operation capability.

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 MP34DB01 has an acoustic overload point of 120 dB SPL with a best on the market 62.6 dB signal-to-noise ratio and -26 dBFS sensitivity.

The MP34DB01 is available in a bottom-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

| Part number | Temperature range [°C] | Package | Packing |
|-------------|------------------------|----------------------|---------------|
| MP34DB01 | -40 to +85 | RHLGA (3x4x1) mm 4LD | Tray |
| MP34DB01TR | -40 to +85 | RHLGA (3x4x1) mm 4LD | Tape and reel |

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1 Pin description

Figure 1. Pin connections

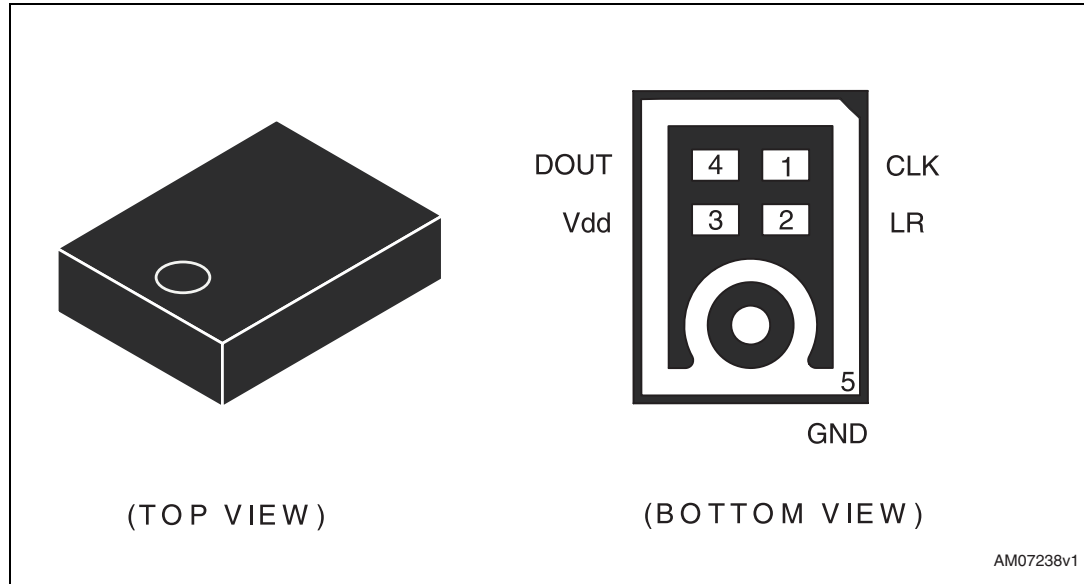


Table 2. Pin description

| Pin # | Pin name | Function |
|-----------------|----------|------------------------------|
| 1 | CLK | Synchronization input clock |
| 2 | LR | Left/right channel selection |
| 3 | Vdd | Power supply |
| 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 ⁽²⁾ | | 0.65 | | mA |
| IddPdn | Current consumption in power-down mode ⁽³⁾ | | | 20 | | µA |
| Sc | Short-circuit current | | 1 | | 10 | mA |
| AOP | Acoustic overload point | | | 120 | | dB SPL |
| So | Sensitivity | at 1 kHz, 1 Pa | -29 | -26 | -23 | dBFS |
| SNR | Signal-to-noise ratio | A-weighted at 1 kHz, 1 Pa | | 62.6 | | dB |
| PSR | Power supply rejection | Guaranteed by design | | -70 | | dBFS |
| Clock | Input clock frequency ⁽⁴⁾ | | 1 | 2.4 | 3.25 | MHz |
| TWK | Wake-up time ⁽⁵⁾ | 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. No load on DOUT line.
3. Input clock in static mode.
4. Duty cycle: min = 40% max = 60%
5. Time from the first clock edge to valid output data.

Table 4. Distortion specifications

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

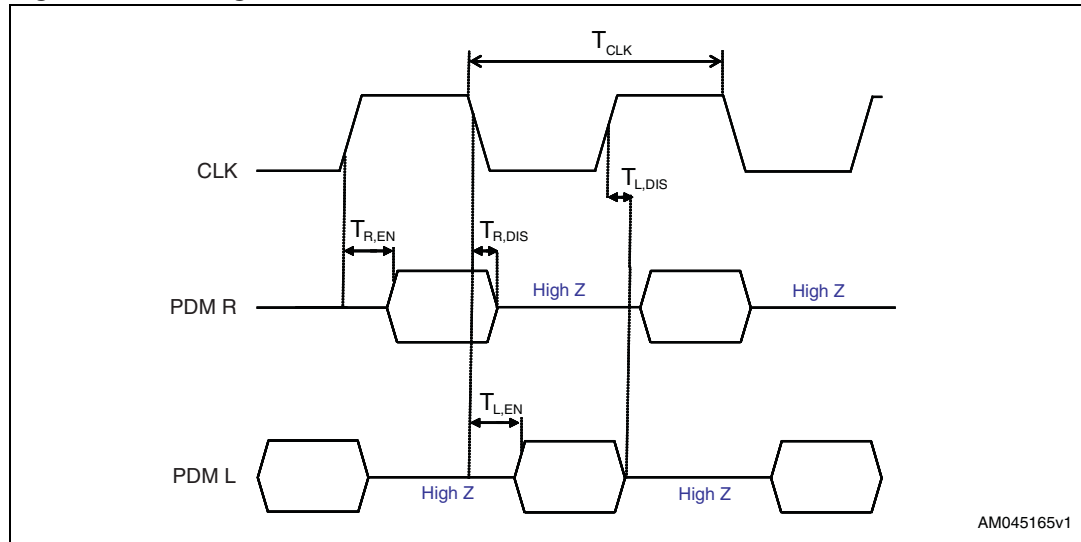
2.2 Timing characteristics

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 | 30 ⁽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 | 30 ⁽¹⁾ | | ns |
| $T_{L,DIS}$ | Data disabled on DATA line, L/R pin = 0 | | 16 ⁽¹⁾ | ns |

1. From design simulations

Figure 2. Timing waveforms



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2.3 Frequency response

Figure 3. Typical frequency response normalized at 1 kHz

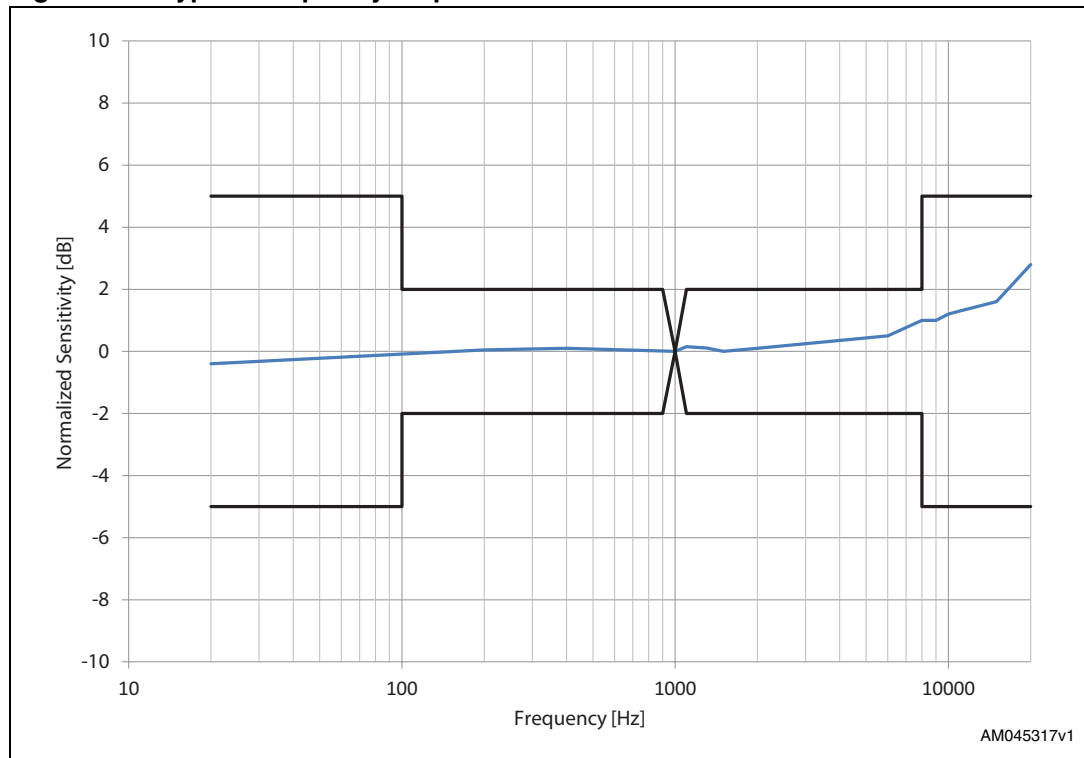


Table 6. Frequency response mask for digital microphones

| Frequency / Hz ⁽¹⁾ | Lower limit | Upper limit | Unit |
|-------------------------------|-------------|-------------|----------|
| 20...100 | -5 | +5 | dBr 1kHz |
| 100...8000 | -2 | +2 | dBr 1kHz |
| 8000...20000 | -5 | +5 | dBr 1kHz |

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

3 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.


4 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 6 | 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 | 2 (HBM) | 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.

5 Functionality

5.1 L/R channel selection

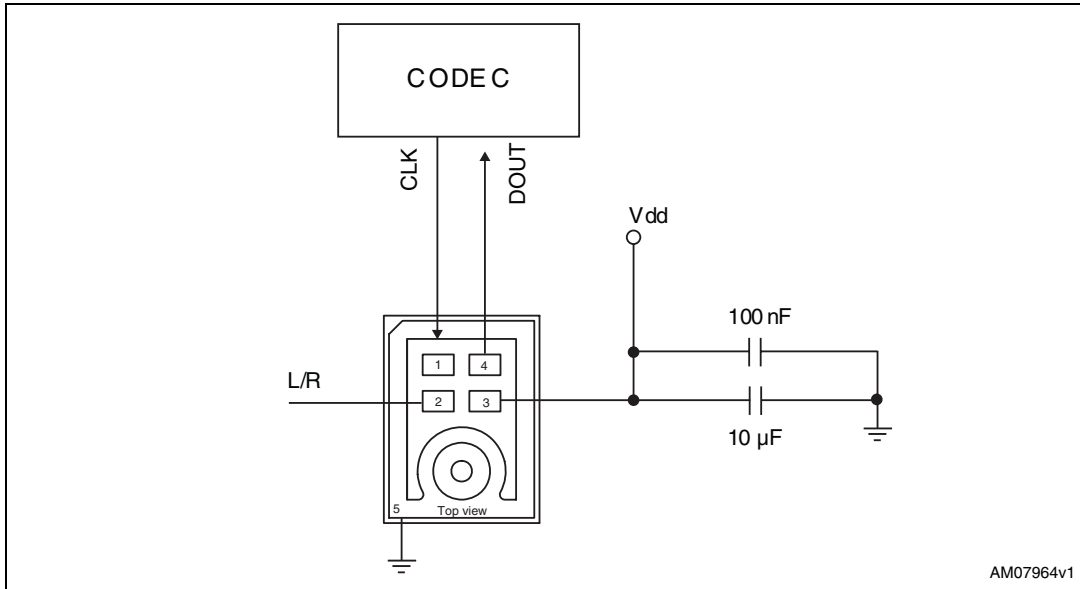
The L/R digital pad lets the user select the DOUT signal pattern as explained in [Table 8](#). The L/R pin must be connected to Vdd or GND.

Table 8. L/R channel selection

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

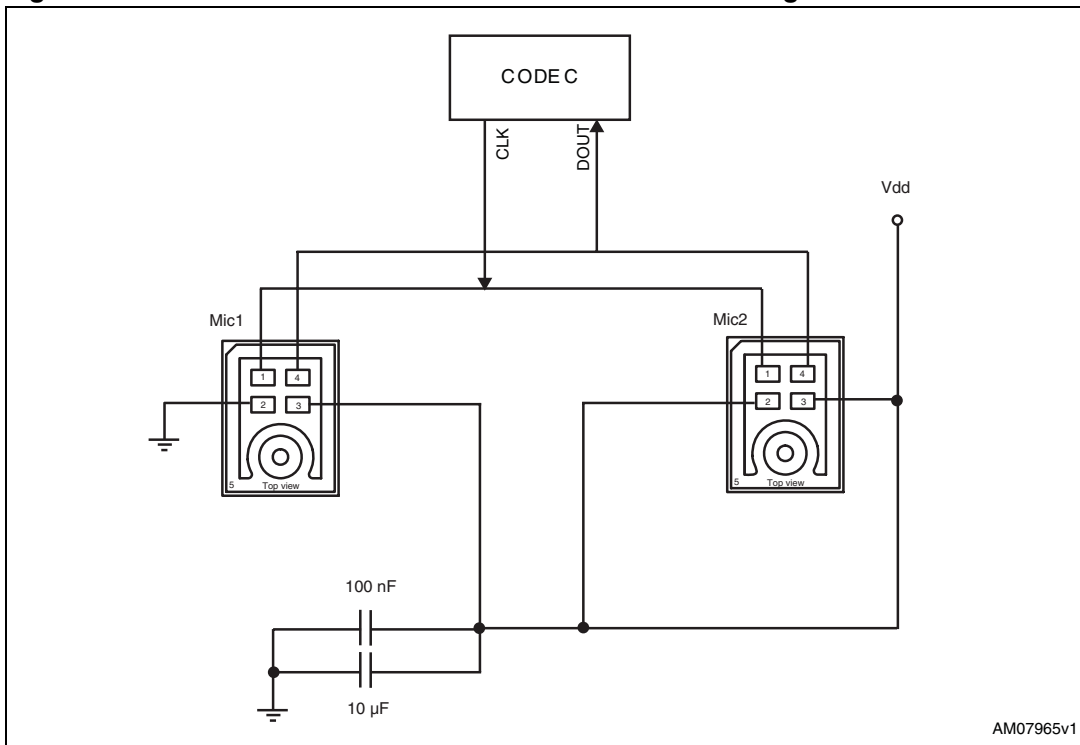
6 Application recommendations

Figure 4. MP34DB01 electrical connections



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Figure 5. MP34DB01 electrical connections for stereo configuration



AM07965v1

Power supply decoupling capacitors (100 nF ceramic, 10 µF ceramic) should be placed as near as possible to pin 3 of the device (common design practice).

The L/R pin must be connected to Vdd or GND (refer to [Table 8](#)).

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 RHLGA (3 x 4 x 1) 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

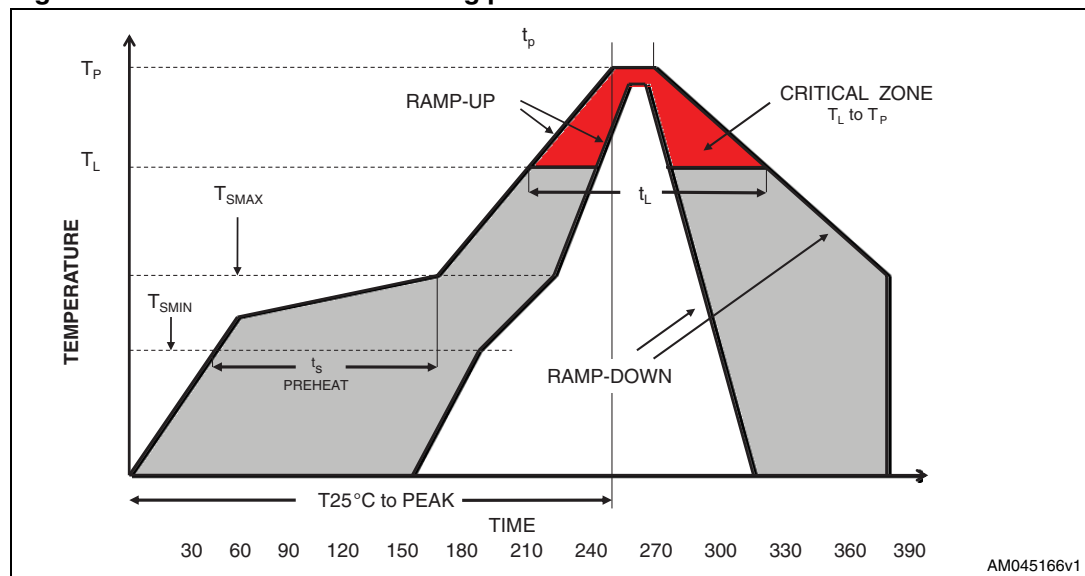


Table 9. Recommended soldering profile limits

| 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 liquidous temperature | t_L | 60 sec to 150 sec |
| Liquidous 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. RHLGA 3 mm x 4 mm x 1 mm 4-lead package outline

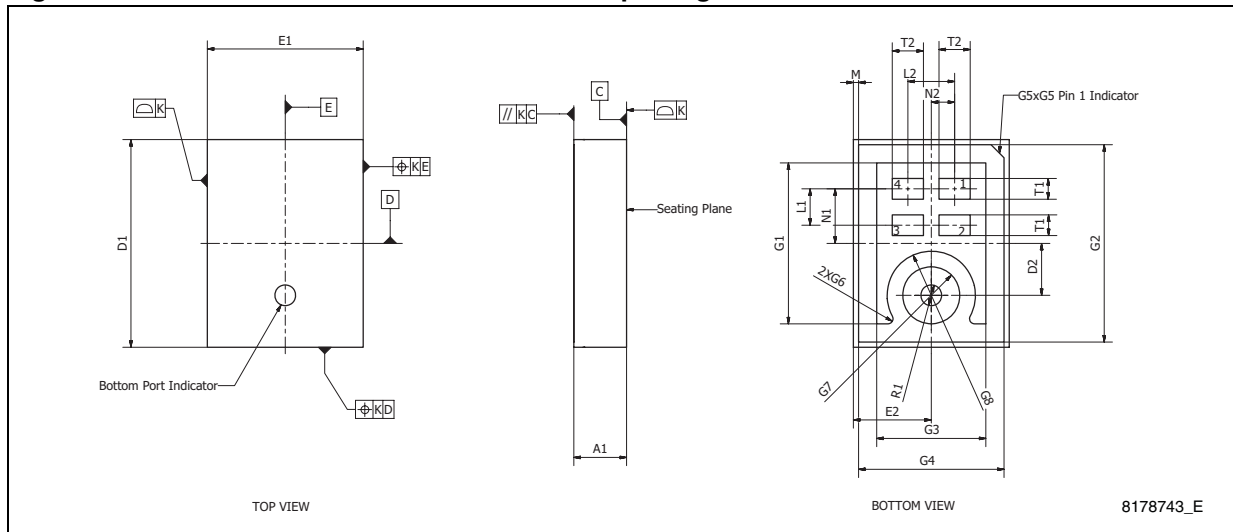


Table 10. RHLGA 3 mm x 4 mm x 1 mm 4-lead package dimensions

| Symbol | mm | | |
|--------|-------|-------|-------|
| | Min | Typ | Max |
| A1 | 0.900 | 1.000 | 1.100 |
| D1 | 3.900 | 4.000 | 4.100 |
| D2 | 0.950 | 1.000 | 1.050 |
| R1 | 0.350 | 0.400 | 0.450 |
| E1 | 2.900 | 3.000 | 3.100 |
| E2 | 1.450 | 1.500 | 1.550 |
| L1 | 0.650 | 0.700 | 0.750 |
| L2 | 0.850 | 0.900 | 0.950 |
| N1 | 1.000 | 1.050 | 1.100 |
| N2 | 0.400 | 0.450 | 0.500 |
| T1 | 0.350 | 0.400 | 0.450 |
| T2 | 0.550 | 0.600 | 0.650 |
| G1 | 3.050 | 3.100 | 3.150 |
| G2 | 3.750 | 3.800 | 3.850 |
| G3 | 2.050 | 2.100 | 2.150 |
| G4 | 2.750 | 2.800 | 2.850 |
| G5 | 0.250 | 0.300 | 0.350 |
| G6 | 0.050 | 0.100 | 0.150 |
| G7 | 0.500 | 0.550 | 0.600 |
| G8 | 0.800 | 0.850 | 0.900 |
| M | | 0.100 | |
| K | | 0.050 | |

8 Revision history

Table 11. Document revision history

| Date | Revision | Changes |
|-------------|----------|--|
| 28-Mar-2011 | 1 | Initial release |
| 05-Apr-2011 | 2 | Updated Table 3 and Table 5 |
| 21-Oct-2011 | 3 | Added max. peak temperature T_P to Table 9 |
| 18-Nov-2011 | 4 | Updated SNR typical value in Table 3 ; document promoted from preliminary to full datasheet |
| 04-Jan-2012 | 5 | Updated Features and Description Updated Figure 3: Typical frequency response normalized at 1 kHz |
| 20-Mar-2012 | 6 | Added test condition criterion to PSR in Table 3: Acoustic and electrical characteristics |
| 07-May-2012 | 7 | Added V_{IOL} , V_{IOH} to Table 3: Acoustic and electrical characteristics |
| 05-Jul-2012 | 8 | Added Section 3: Sensing element Updated operating temperature range throughout datasheet |

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