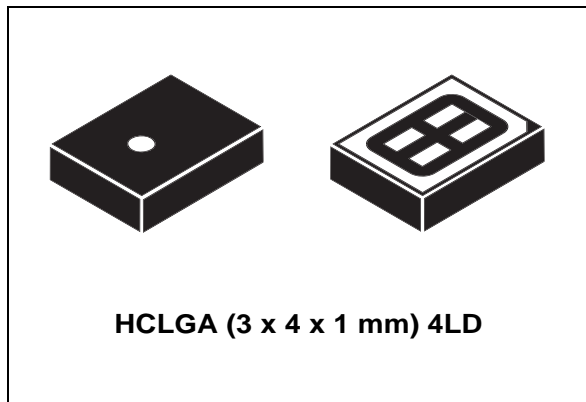


MEMS audio sensor omnidirectional digital microphone

Datasheet - production data



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

Features

- Single supply voltage
- Low power consumption
- 120 dB SPL acoustic overload point
- 63 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

Description

The MP34DT01 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 MP34DT01 has an acoustic overload point of 120 dB SPL with a 63 dB signal-to-noise ratio and -26 dBFS sensitivity.

The MP34DT01 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	Temperature range [°C]	Package	Packing
MP34DT01	-40 to +85	HCLGA (3 x 4 x 1 mm) 4LD	Tray
MP34DT01TR	-40 to +85	HCLGA (3 x 4 x 1 mm) 4LD	Tape and reel

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1 Pin description

Figure 1. Pin connections

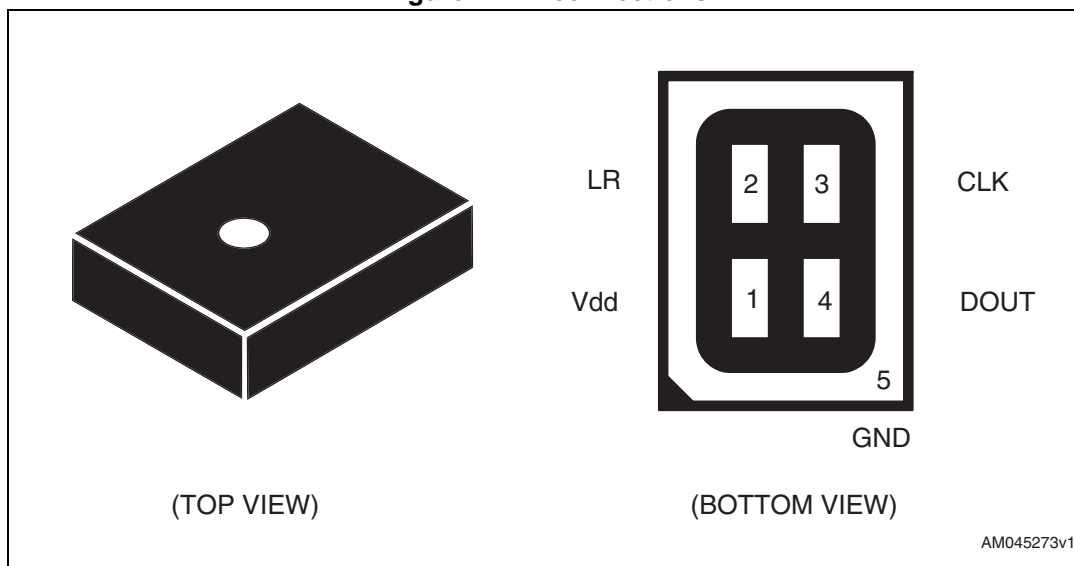


Table 2. Pin description

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		1.64	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		63		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 (50 Hz - 4 kHz)	< 1% THD + N
Distortion	115 dB SPL (1 kHz)	< 5% THD + N

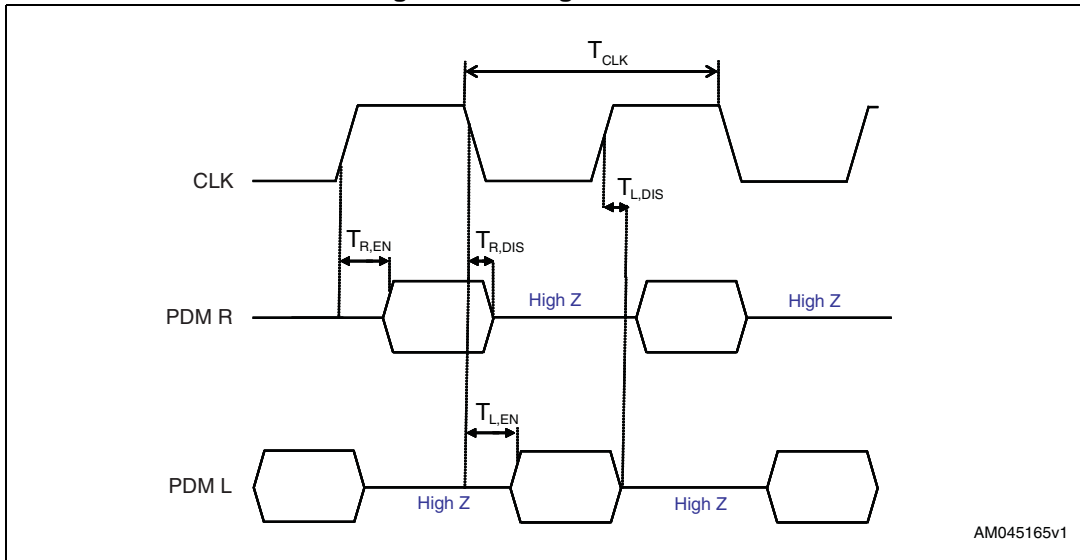
2.2 Timing characteristics

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	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 2. Timing waveforms



2.3 Frequency response

Figure 3. Frequency response and mask

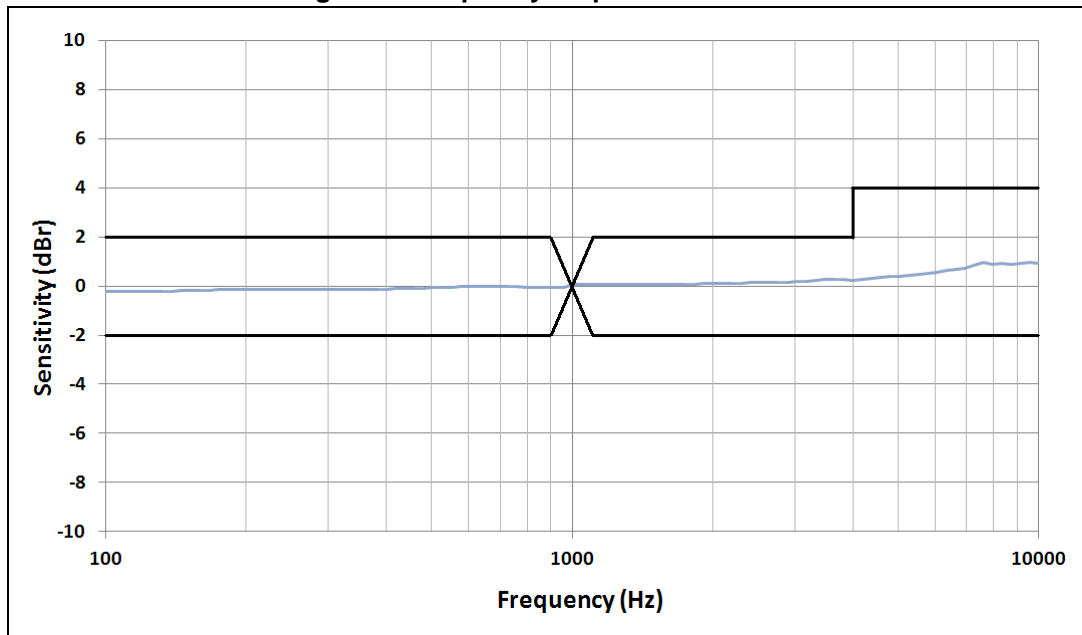


Table 6. Frequency response mask for digital microphones

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

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

3 Carrier tape mechanical specifications

Figure 4. Carrier tape without microphone-top view

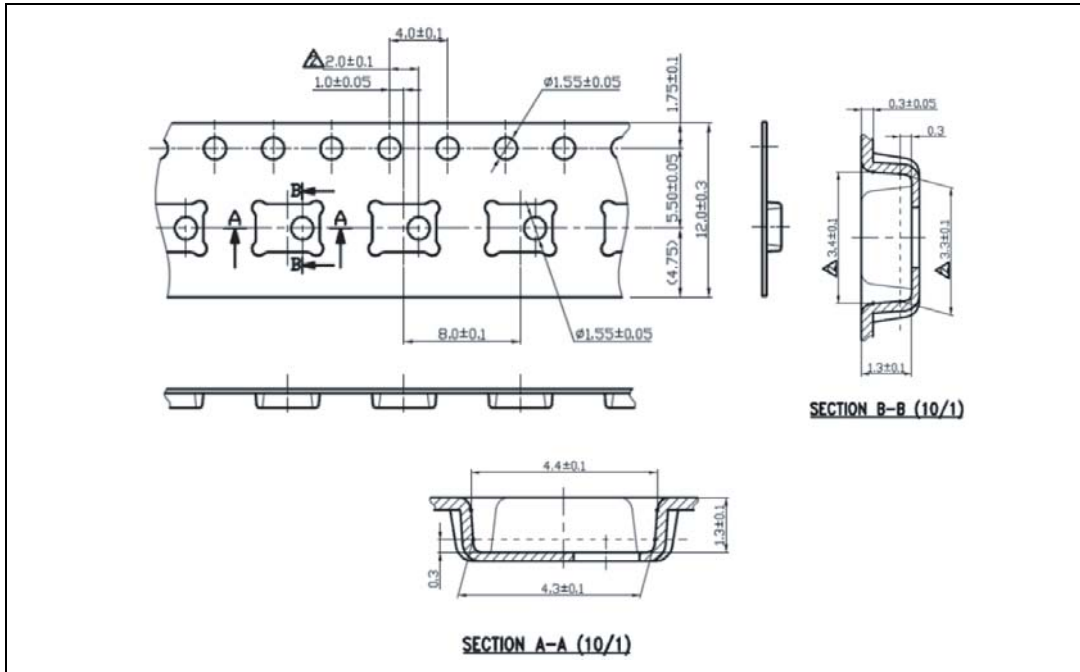
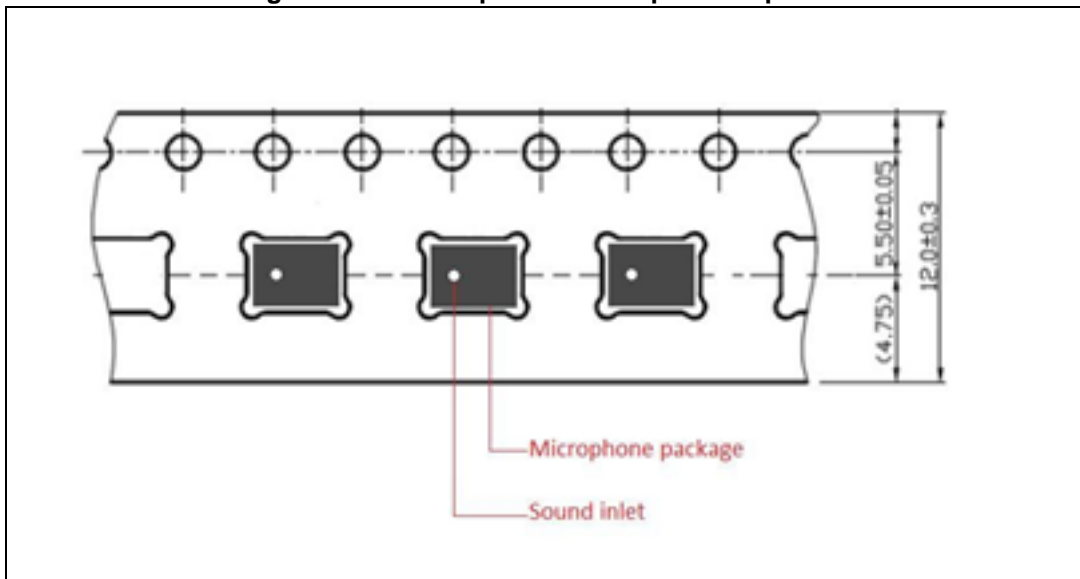


Figure 5. Carrier tape with microphone-top view

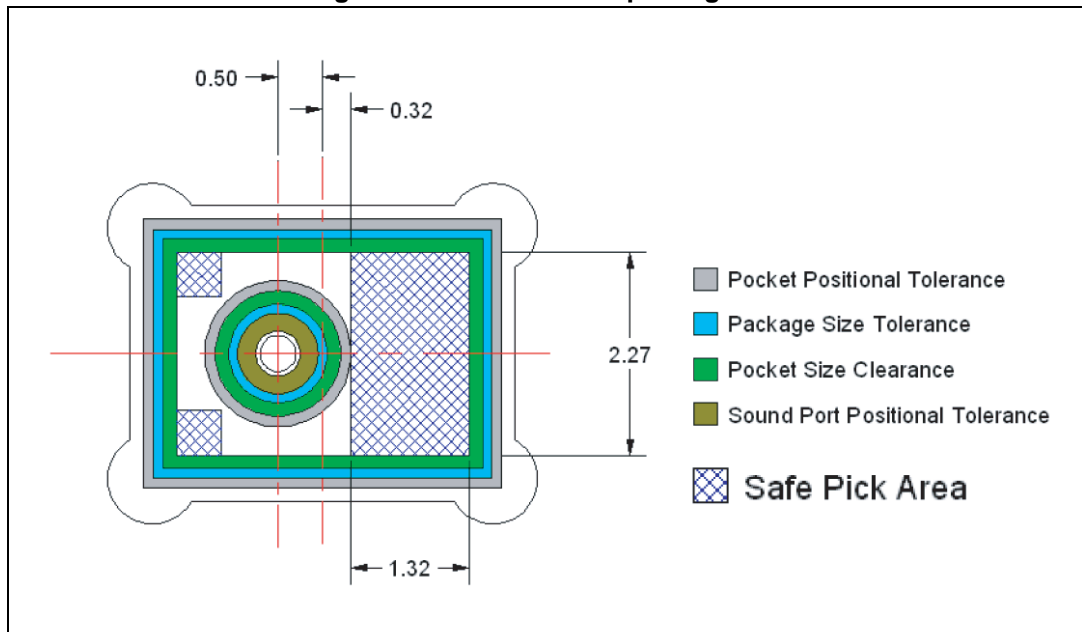


4 Process recommendations

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

- The recommended pick-up area for the MP34DT01 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 5](#). 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

Figure 6. Recommended picking area

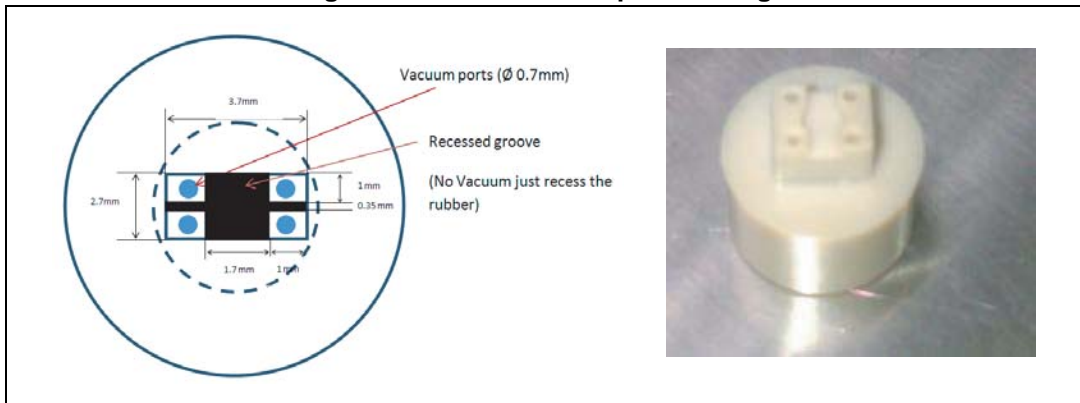


To have a safe pick-up "by design", ST it is strongly advised to an ad hoc nozzle.

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

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

Figure 7. Recommended picker design



5 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.

6 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
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



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.

7 Functionality

7.1 L/R channel selection

The L/R digital pad lets the user select the DOUT signal pattern as shown 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

8 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 (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.

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

Figure 8. Recommended soldering profile limits

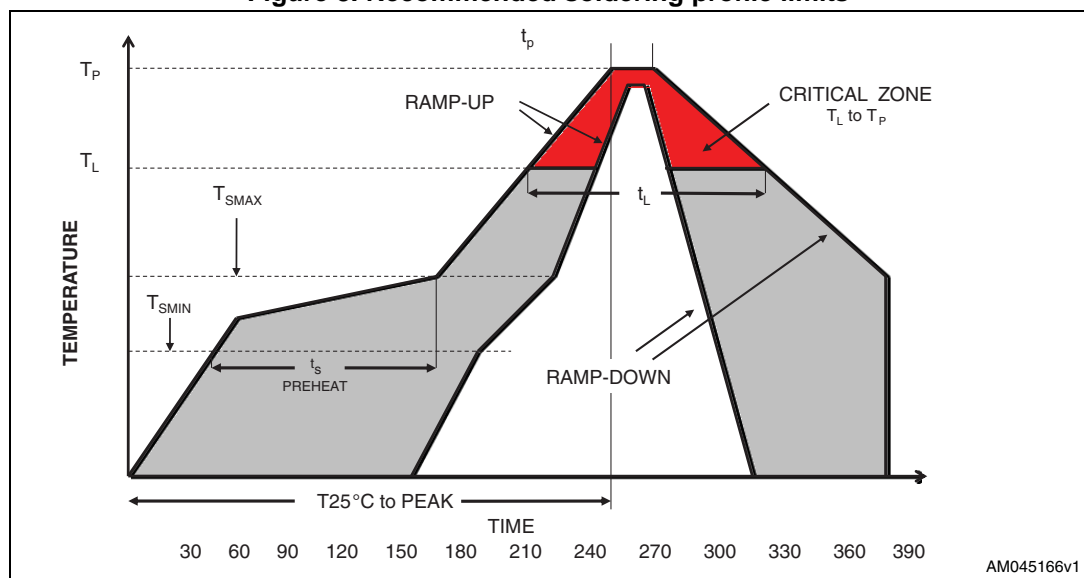


Table 9. Recommended soldering profile limits

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 liquids temperature	t_L	60 sec to 150 sec
Liquids 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 9. HCLGA (3 x 4 x 1 mm) 4-lead package outline

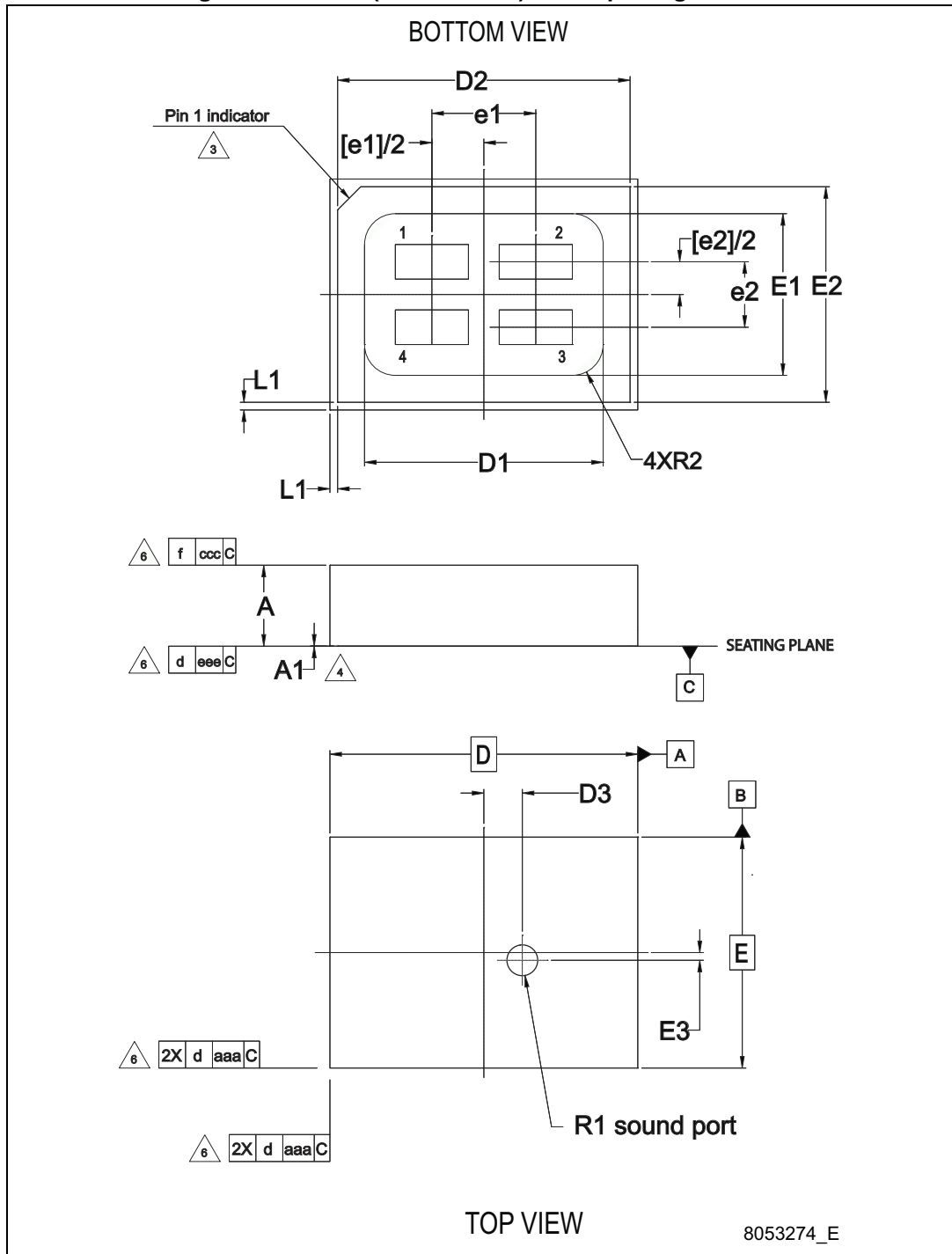
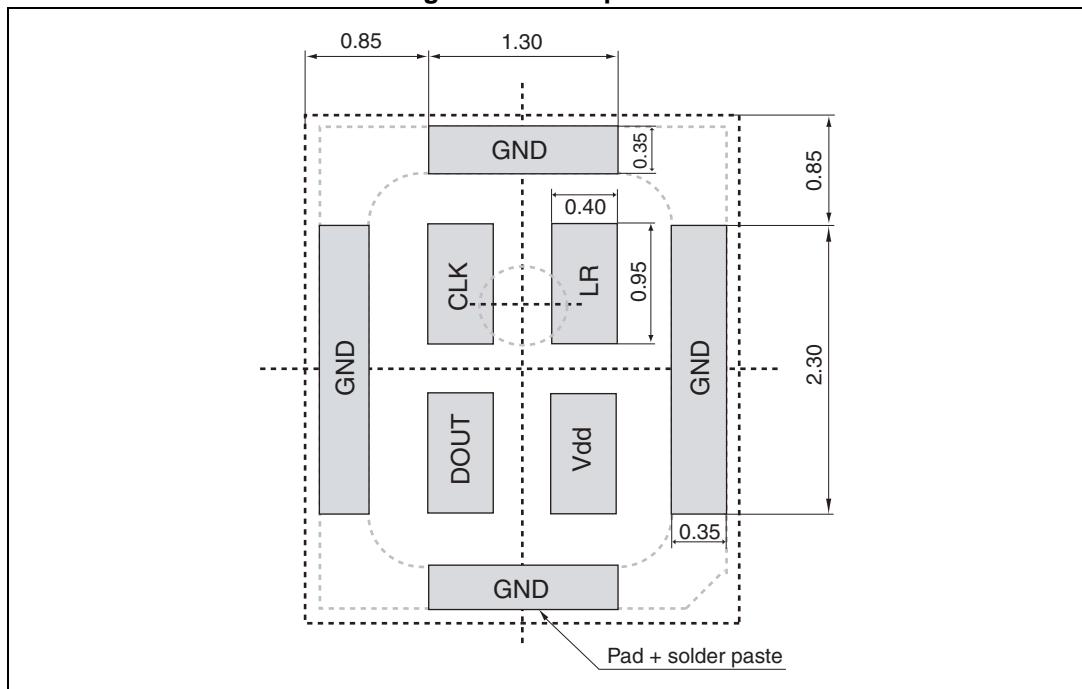


Table 10. HCLGA (3 x 4 x 1 mm) 4-lead package dimensions

Symbol	mm		
	Min.	Typ.	Max.
A	0.90	1.00	1.10
A1	0.00	-	0.05
b	0.35	0.45	0.50
D	3.90	4.00	4.10
D1	3.05	3.10	3.15
D2	3.75	3.80	3.85
D3	0.30	0.50	0.70
E	2.90	3.00	3.10
E1	2.05	2.10	2.15
E2	2.75	2.80	2.85
E3	-0.20	0.00	0.20
e1	1.30	1.35	1.40
e2	0.80	0.85	0.90
h	0.25	0.30	0.35
L	0.90	0.95	1.00
L1	-	0.10	-
N	4		
R1	0.30	0.40	0.50
R2	-	0.40	-
aaa	0.15		
ccc	0.10		
eee	0.08		

Figure 10. Land pattern



9 Revision history

Table 11. Document revision history

Date	Revision	Changes
06-Oct-2011	1	Initial release
18-Nov-2011	2	Removed "stereo" from title, Features , and Description
29-Nov-2011	3	Updated Features and Description
04-Jan-2012	4	Updated Figure : Added So limits to Table 3: Acoustic and electrical characteristics Minor textual updates
23-Mar-2012	5	Updated Figure 9: HCLGA (3 x 4 x 1 mm) 4-lead package outline Pin 1 indicator removed from top view of package on page 1 and Figure 1: Pin connections Updated Table 10: HCLGA (3 x 4 x 1 mm) 4-lead package dimensions
06-Apr-2012	6	Updated maximum supply voltage in Table 3: Acoustic and electrical characteristics
07-May-2012	7	Added V_{IOL} , V_{IOH} to Table 3: Acoustic and electrical characteristics
18-May-2012	8	Updated Table 5: Timing characteristics
05-Jul-2012	9	Added Section 5: Sensing element Added Figure 10: Land pattern Updated temperature range to -40 to +85 °C throughout datasheet
21-Feb-2013	10	Updated dimension T2 in Table 10
07-Jun-2013	11	Updated - Figure 3: Frequency response and mask - Table 6: Frequency response mask for digital microphones - HCLGA mechanical data Figure 9 on page 16 and Table 10 on page 17 Added - Section 3: Carrier tape mechanical specifications - Section 4: Process recommendations

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