

MEMS audio sensor omnidirectional digital microphone

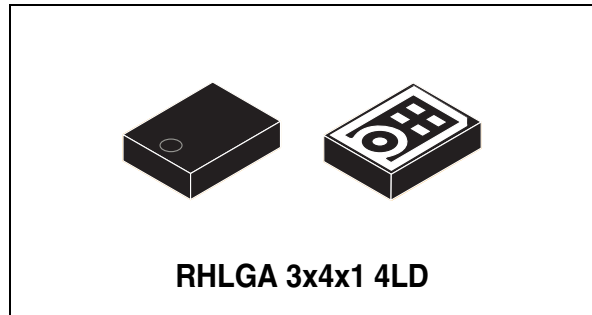
Datasheet – production data

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

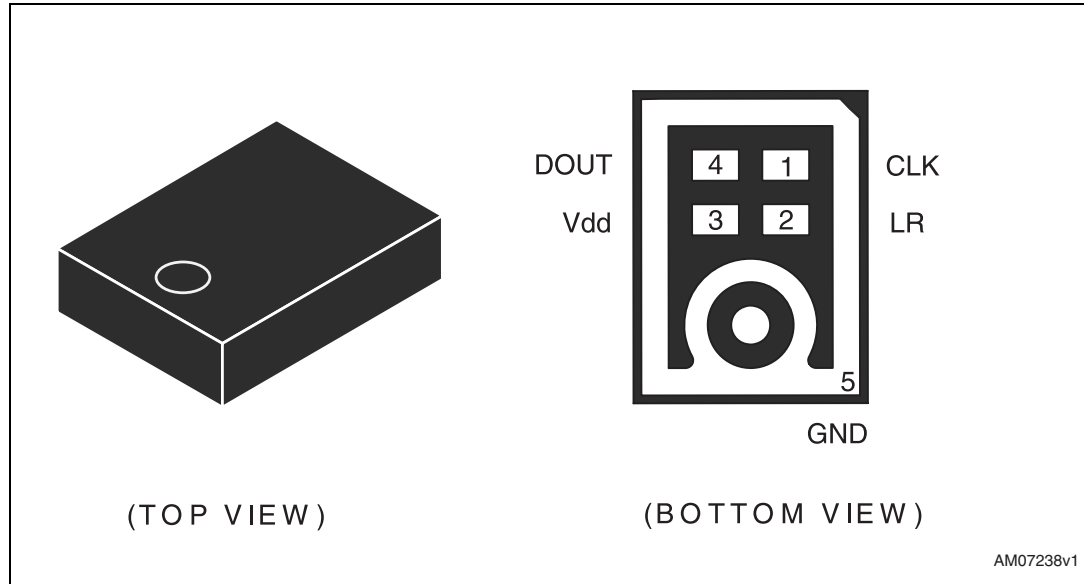


Table 2. Pin description

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

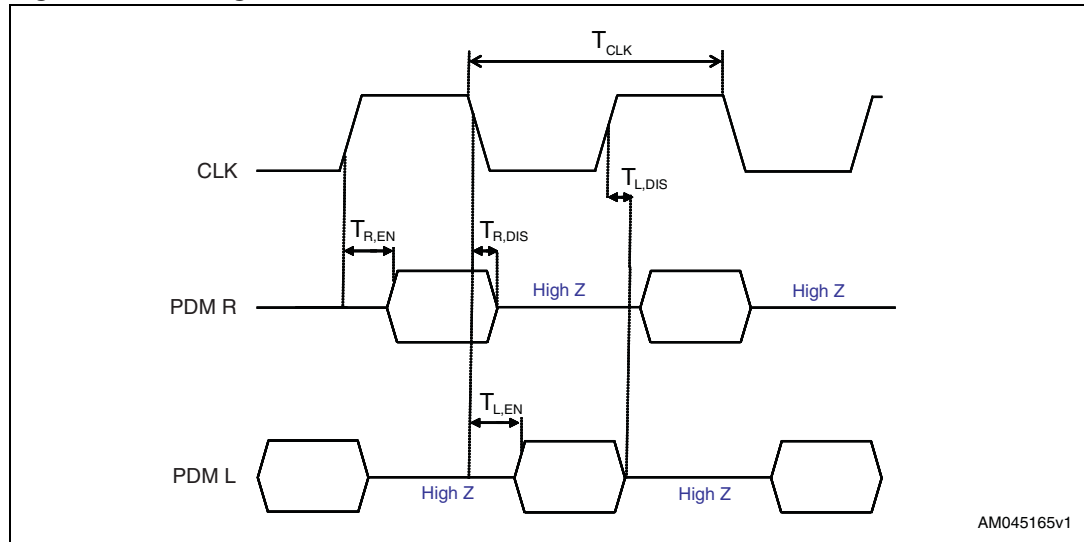
2.2 Timing characteristics

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

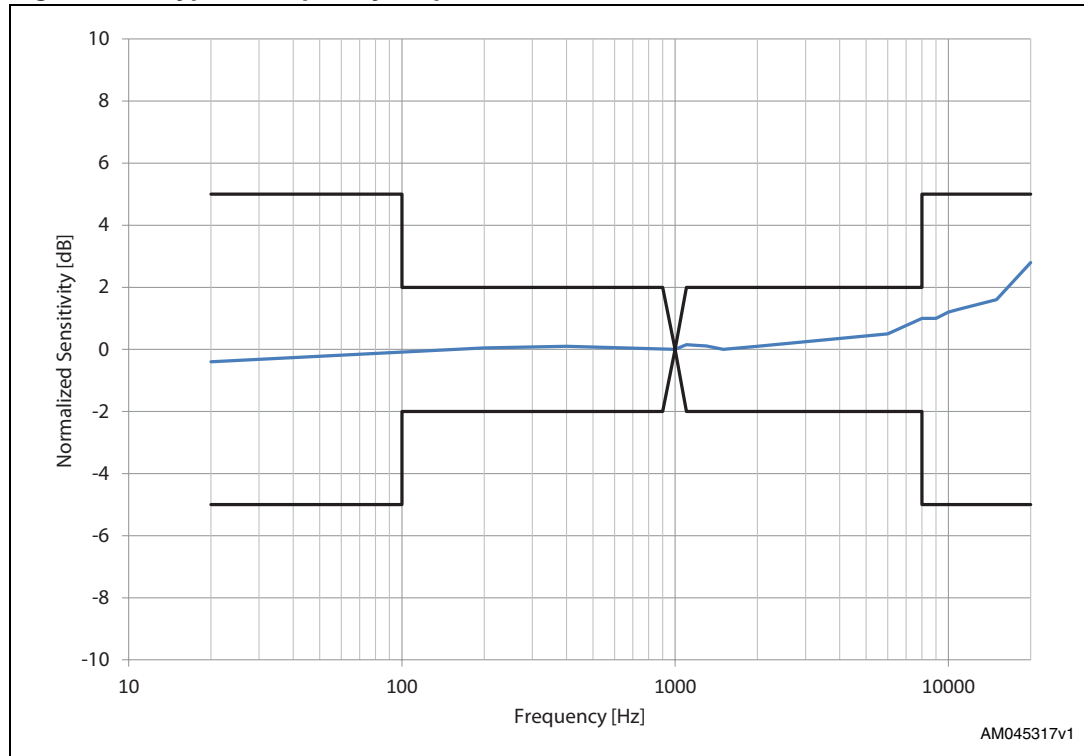


Table 6. Frequency response mask for digital microphones

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
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.

5 Functionality

5.1 L/R channel selection

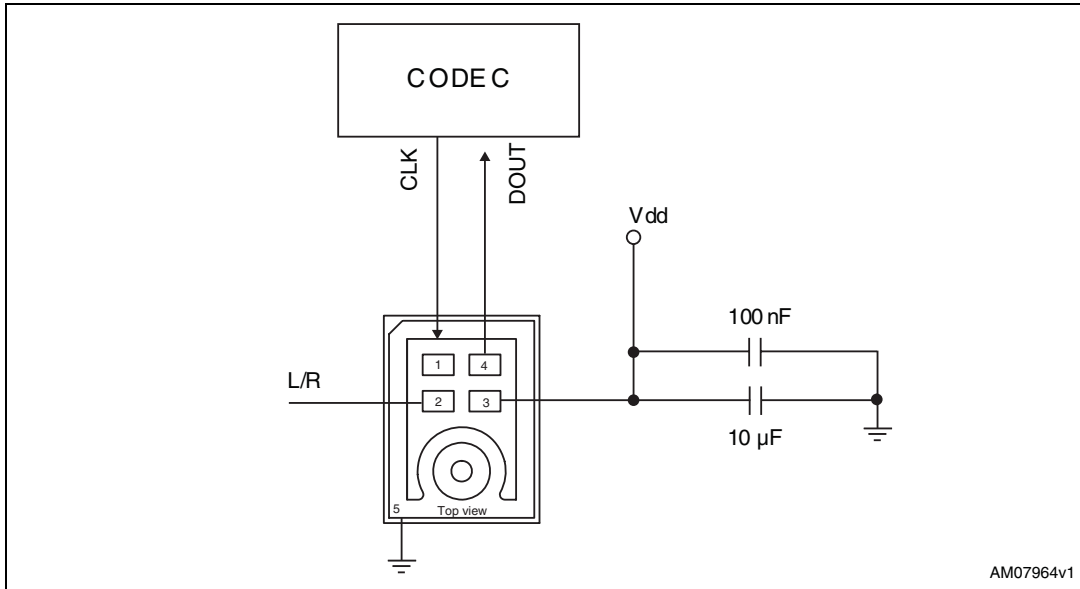
The L/R digital pad lets the user select the DOUT signal pattern as explained in [Table 8](#). The L/R pin must be connected to Vdd or GND.

Table 8. L/R channel selection

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

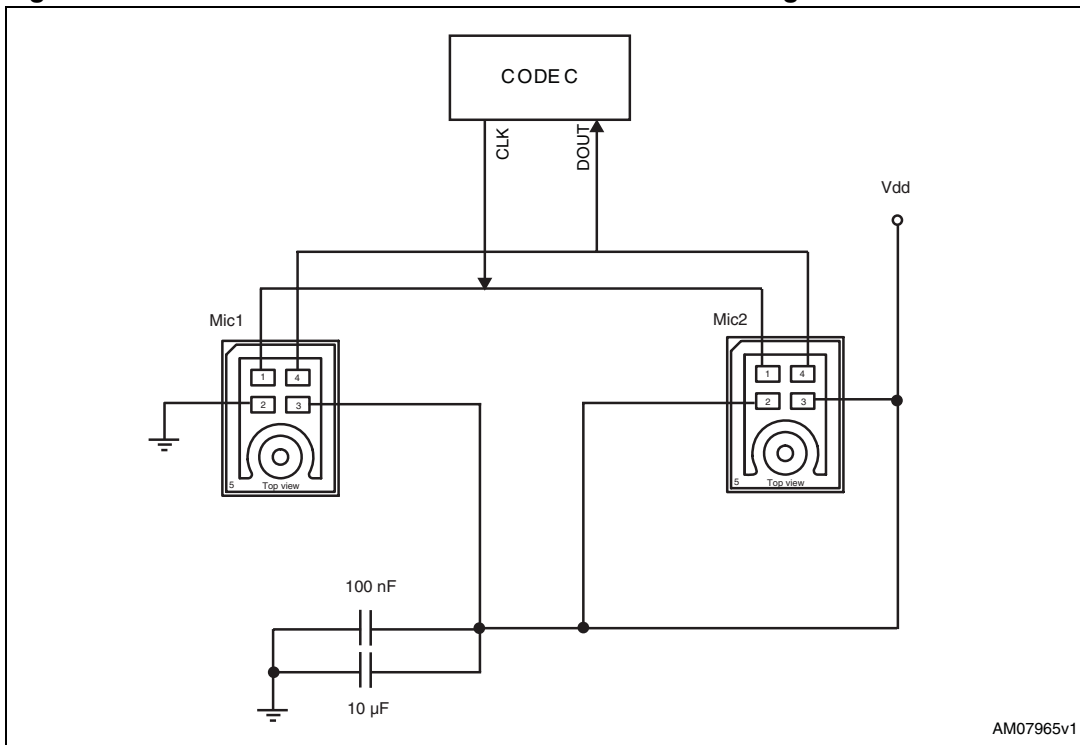
6 Application recommendations

Figure 4. MP34DB01 electrical connections



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Figure 5. MP34DB01 electrical connections for stereo configuration



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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

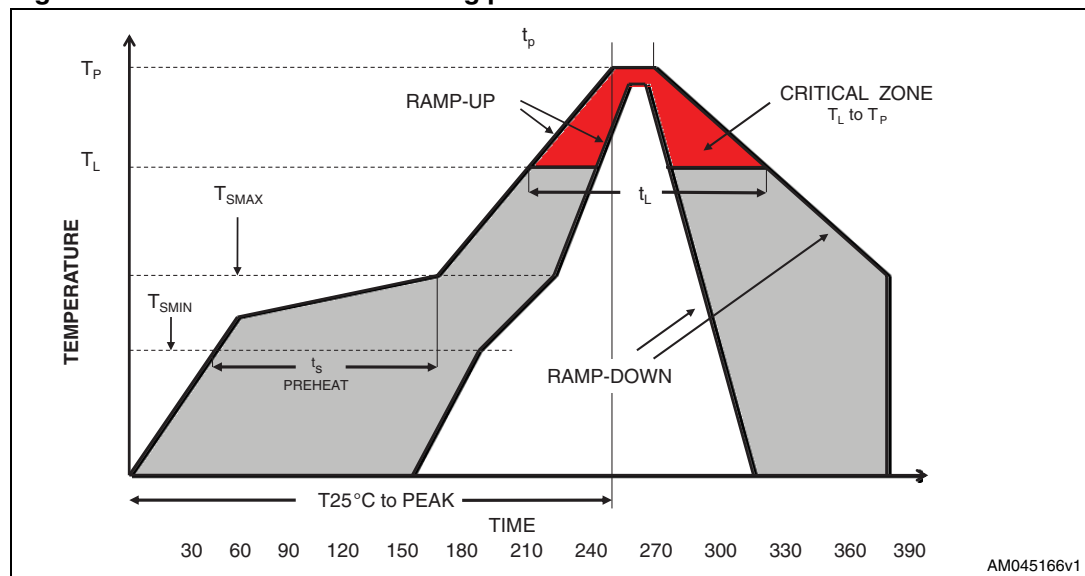


Table 9. Recommended soldering profile limits

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

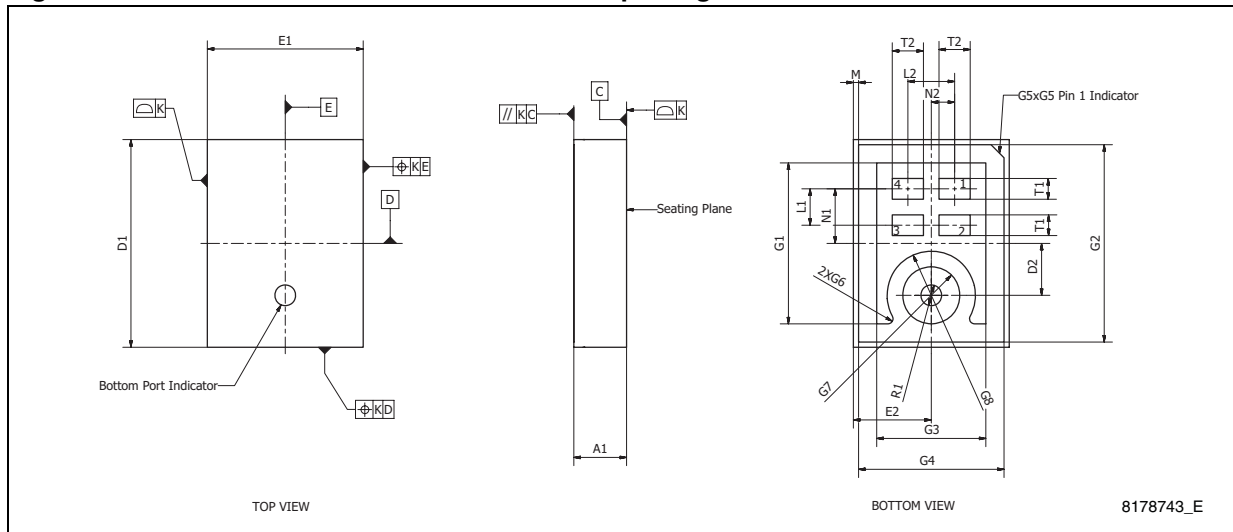


Table 10. RHLGA 3 mm x 4 mm x 1 mm 4-lead package dimensions

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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