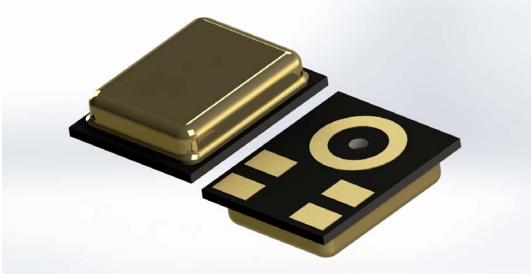
MP23ABS1

High-performance MEMS audio sensor: single-ended analog bottom-port microphone

Datasheet - production data



RHLGA metal cap 5-lead
3.5 x 2.65 x 0.98 mm

Features

- Single supply voltage operation 1.52 V - 3.6 V
- Omnidirectional sensitivity
- High signal-to-noise ratio
- High acoustic overload point: 130 dBSPL typ.
- Package compliant with reflow soldering
- Enhanced RF immunity
- Ultra-flat frequency response
- Low latency
- Ultra-low-power: 150 µA max
- ECOPACK, RoHS, and “Green” compliant

Description

The MP23ABS1 is a compact, low-power 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 to produce audio sensors.

The MP23ABS1 has an acoustic overload point of 130 dBSPL with a typical 64 dB signal-to-noise ratio.

The sensitivity of the MP23ABS1 is -38 dBV ±1 dB @ 94 dBSPL, 1 kHz.

The MP23ABS1 is available in a package compliant with reflow soldering and is guaranteed to operate over an extended temperature range from -40 °C to +85 °C.

Applications

- Mobile phones
- Wearables
- Hearables
- Smart speakers
- Active noise-canceling headsets

Table 1. Device summary

Order code	Temperature range (°C)	Package	Packing
MP23ABS1	-40 to +85	(3.5 x 2.65 x 0.98) mm	Tray
MP23ABS1TR	-40 to +85	(3.5 x 2.65 x 0.98) mm	Tape and reel

Contents

1 Pin description

Figure 1. Pin connections (bottom view)

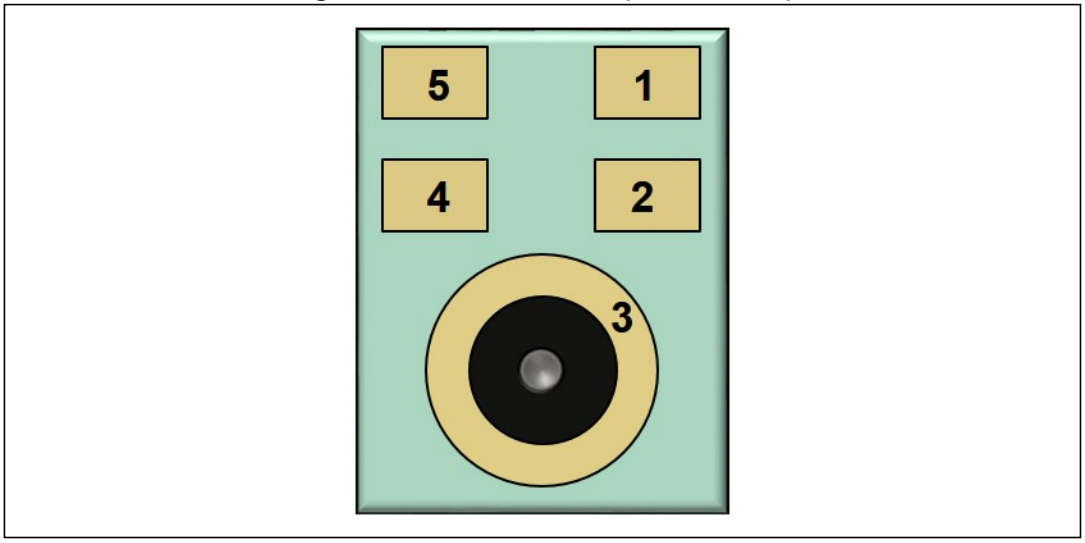


Table 2. Pin description

Pin n°	Pin name	Function
1	Out	Output
2	GND	GND
3	GND	GND
4	GND	GND
5	Vdd	Supply voltage

2 Acoustic and electrical specifications

2.1 Acoustic and electrical characteristics

The values listed in the table below are specified for Vdd = 2.75 V, no load, Tamb = 25 °C unless otherwise specified.

Table 3. Acoustic and electrical characteristics

Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
Vdd	Supply voltage		1.52	2.75	3.6	V
Idd	Current consumption			120	150	µA
So	Sensitivity	1 kHz @ 94 dBSPL	-39	-38	-37	dBV
SNR	Signal-to-noise ratio			64		dB(A)
PSRR	Power Supply Rejection	100 mVpp sine wave, 1 kHz, Vdd > 1.6 V		60		dB
AOP	Acoustic Overload Point			130		dBSPL
Rload	Load resistance(1)		15			kΩ
Top	Operating temperature range		-40		+85	°C

1. Guaranteed by design

2.2 Frequency response

Figure 2. Typical free-field frequency response normalized at 1 kHz

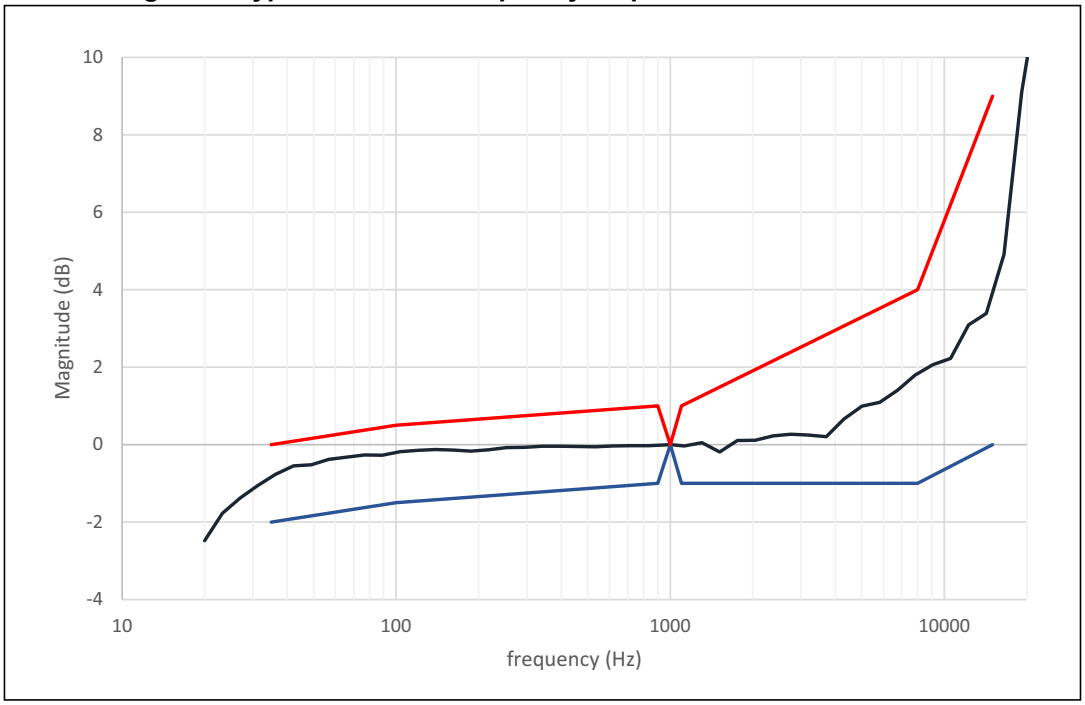


Table 4. Frequency response mask

Frequency (Hz)	LSL	USL	Unit
35	-2	0	dBr 1kHz
100	-1.5	0.5	dBr 1kHz
900	-1	1	dBr 1kHz
1000	0	0	dBr 1kHz
1100	-1	1	dBr 1kHz
8000	-1	4	dBr 1kHz
15000	0	9	dBr 1kHz

3 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 5. Absolute maximum ratings

Symbol	Ratings	Maximum value	Unit
Vdd	Supply voltage	-0.5 to 4.8	V
T_{STG}	Storage temperature range	-40 to +125	°C
Top	Operating temperature range	-40 to +105	°C

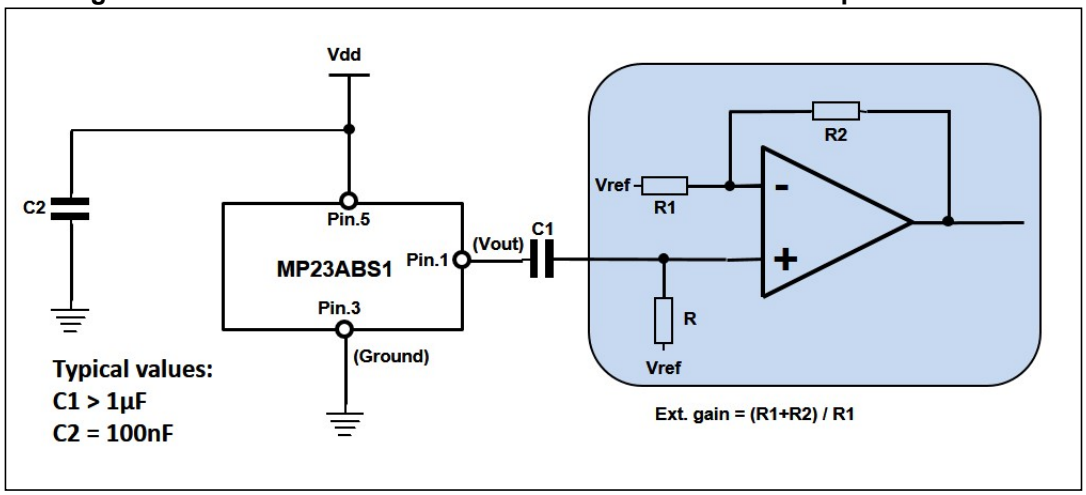
This device is sensitive to mechanical shock, improper handling can cause permanent damage to the part.

This device is sensitive to electrostatic discharge (ESD), improper handling can cause permanent damage to the part.

4 Application recommendations

4.1 MP23ABS1 schematic hints

Figure 3. MP23ABS1 electrical connections and external component values



5 Soldering information

Figure 4. Recommended soldering profile limits

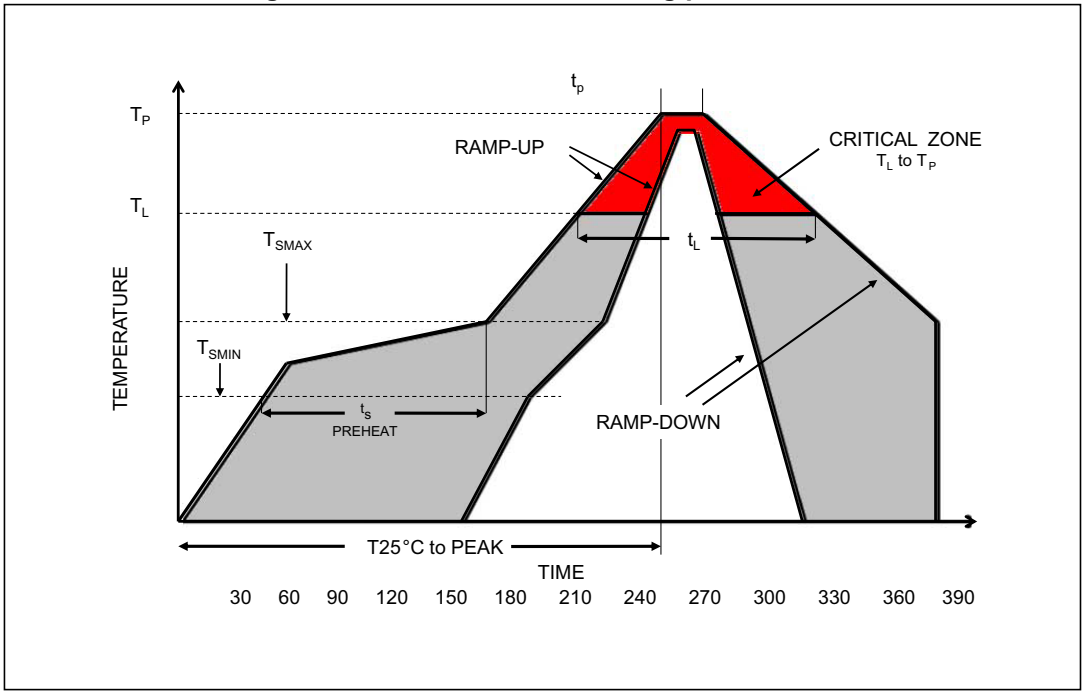


Table 6. Recommended soldering profile limits

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 liquidus temperature Liquidus 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 (t = 25 °C) to peak temperature		8 minutes max

6 Reliability tests

The device passed all reliability tests on three different assembly lots under the following conditions given in the table below.

Table 7. Reliability specifications

Test name	Description	Conditions
Electrostatic Discharge Immunity Test (ESD)	To classify ESD susceptibility the device is submitted to a high voltage peak on all his pins, simulating ESD stress according to different simulation models (GUN, HBM, MM, CDM)	ESD-GUN: 25 discharges at ±8 kV, direct contact to housing of MIC Reference specification IEC 61000-4-2
		ESD-HBM 3 discharges up to ±2 kV pin-to-pin Reference specification ANSI/ESDA/JEDEC JS001
		ESD-MM, 3 discharges up to ±200 V pin-to-pin Reference specification JEDEC JESD22-A115C
		ESD-CDM, 3 discharges up to ±750 V Reference specification ANSI/ESDA/JEDEC JS002
Latch-Up (LU)	To verify latch-up immunity the device is submitted to a current injection on I/O or supply overvoltage	±100 mA & 1.5 x Vdd @ 85 °C Reference specification JEDEC JESD78
High Temperature Operative Life (HTOL)	To simulate the worst-case application stress conditions, the device is stressed in dynamic configuration at operative max. absolute ratings	Ta 125 °C, Tj 125 °C, 1000 Hrs, @ Max Op Voltage Preconditioning (PC) before Reference specification JESD22-A108
Temperature Humidity Bias (THB)	To investigate failure mechanisms activated by electrical field and humidity, the device is biased in static or dynamic operative conditions at controlled high temperature and relative humidity	Ta 85°C, R.H. 85%, 1000 Hrs, @ Max Op Voltage Preconditioning (PC) before Reference specification JESD22-A101
Preconditioning MSL3 (PC)	To investigate effects of customer manufacturing soldering enhanced by package water absorption, the device is submitted to typical temperature profile after controlled moisture absorption	MSL3 as moisture soak conditions followed by n.3 reflow @ Tpeak 260 °C Reference specification JEDEC J-STD-020
Low Temperature Storage (LTS)	To investigate the failure mechanisms activated by extremely cold conditions, the device is stored in unbiased condition at the min. temperature allowed by the package materials	Ta = -40 °C, 1000 Hrs Reference specification JESD22-A120

Table 7. Reliability specifications (continued)

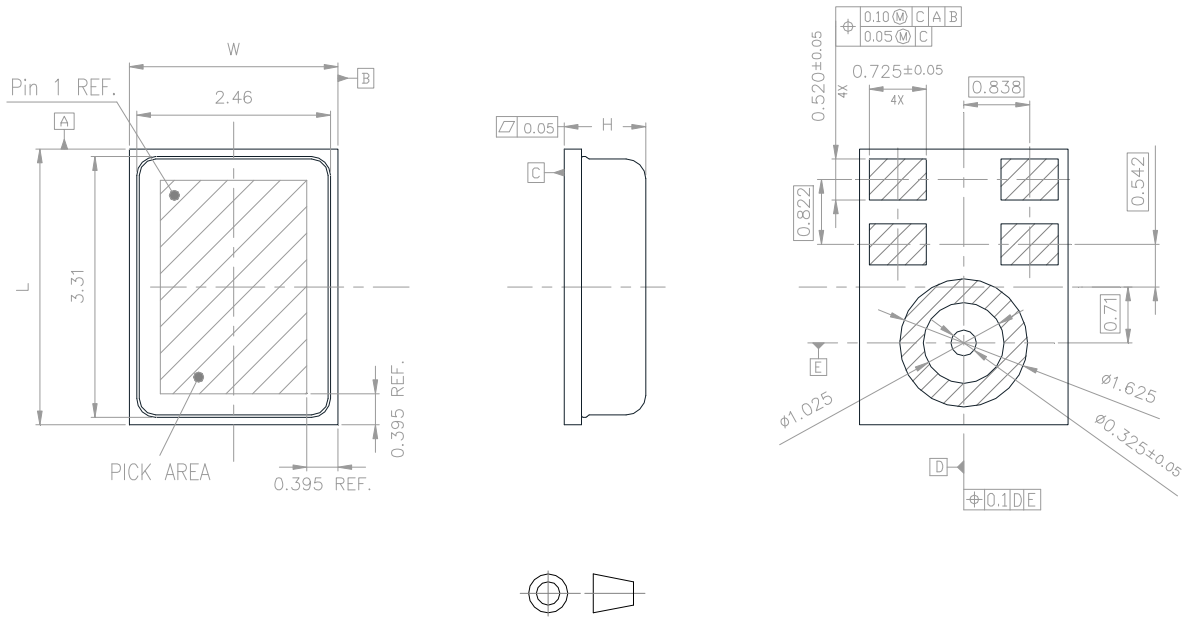
Test name	Description	Conditions
High Temperature Storage (HTS)	To investigate the failure mechanisms activated by high temperature, the device is stored in unbiased condition at the maximum temperature allowed by the package materials	Ta = 125 °C, 1000 Hrs Reference specification JESD22-A104
Temperature Cycling (TC)	To investigate failure modes related to thermo-mechanical stress, the device is submitted to cycled temperature excursions, between a hot and a cold chamber in air atmosphere	Low T = - 40 °C, High T = +125 °C, 1000 Cys Preconditioning (PC) before Reference specification JESD22-A105
Temperature Humidity Storage (THS)	To investigate degradations induced by wet conditions, the device is stored at controlled high temperature and relative humidity	Ta = 85°C, R.H. = 85%, 1000Hrs Preconditioning (PC) before Reference specification JESD22-A102
Random Free-Fall on PCB (TUMBLE)	To investigate durability to mechanical repeated drops without any preferential impact direction simulating drop effect on handheld devices	Microphone soldered on PCB which is mounted on a specific jig Random drop from 1 mt on steel base, 300 drops Reference specification IEC 60068-2-32
Guided Free-Fall on PCB (GFF)	To verify durability of the whole device to mechanical shocks, done by controlling height and impact direction simulating drop effect on handheld devices	Microphone soldered on PCB which is mounted on a specific jig Guided drop from 1.5 mt on marble base, 2 drops x 6 directions Reference specification IEC 60068-2-32
Compressed Air Test (CAT)	Test dedicated on the MEMS Microphone to check mechanical robustness of sensor membrane alone	Microphone membrane is subjected to repeated air pulses controlled on duration, rise and fall time and amplitude. Amplitude is varied with increasing steps. ST internal specification
Mechanical Shock (MS)	To verify mechanical robustness of internal structural elements (MEMS, package components) to withstand severe shocks produced by handling, transportation or field operations	Five pulses of 10,000 *g* in each of six directions with duration time 0.2 ms Reference specification MIL 883, Method 2002.5
Variable Frequency Vibration (VB)	The vibration variable frequency test is performed to determine the effect of vibration, within a specified frequency range, on the internal structural elements	Peak acceleration of 20 *g*, from 20 Hz to 2000 Hz in three perpendicular directions Reference specification MIL 883, Method 2007.3-A

7 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.

7.1 RHLGA-5L package information

Figure 5. RHLGA metal cap 5-lead (3.5 x 2.65 x 0.98 mm) package outline and mechanical data



Dimensions are in millimeter unless otherwise specified
General Tolerance is +/-0.15mm unless otherwise specified

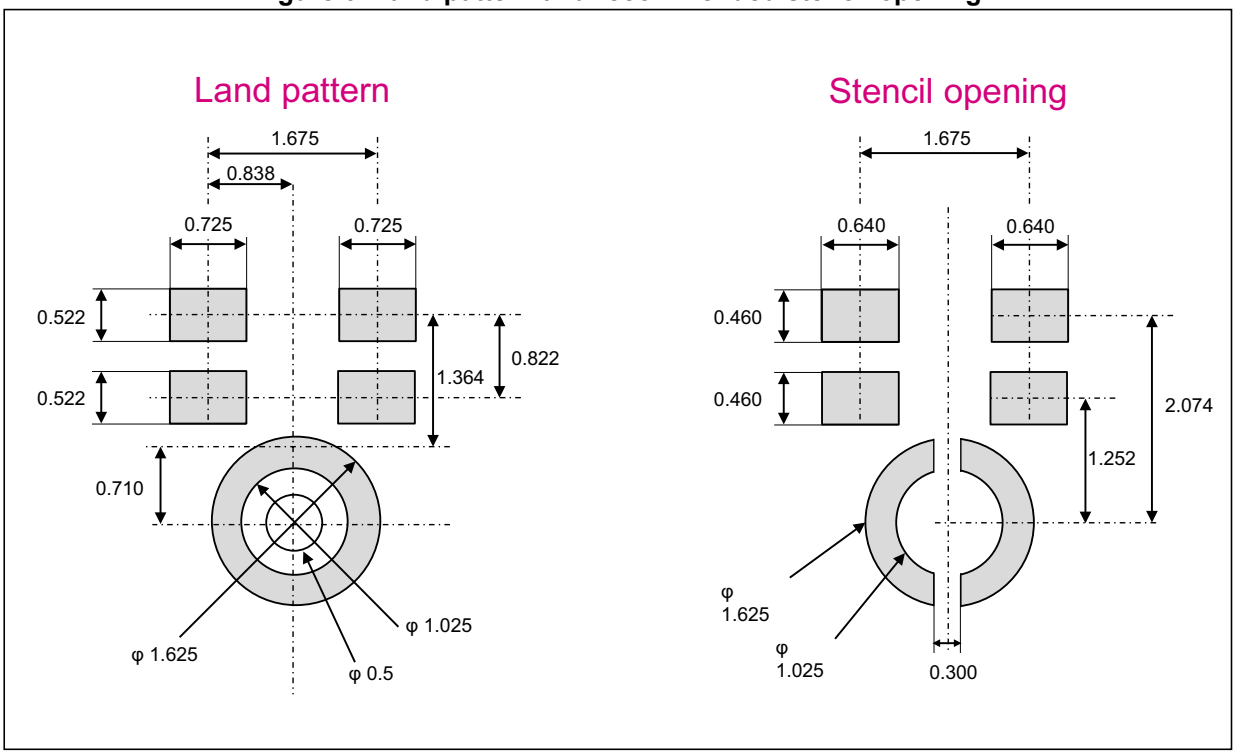
OUTER DIMENSIONS

ITEM	DIMENSION [mm]	TOLERANCE [mm]
Length [L]	3.5	±0.1
Width [W]	2.65	±0.1
Height [H]	1.08 MAX	

DM00368430_2

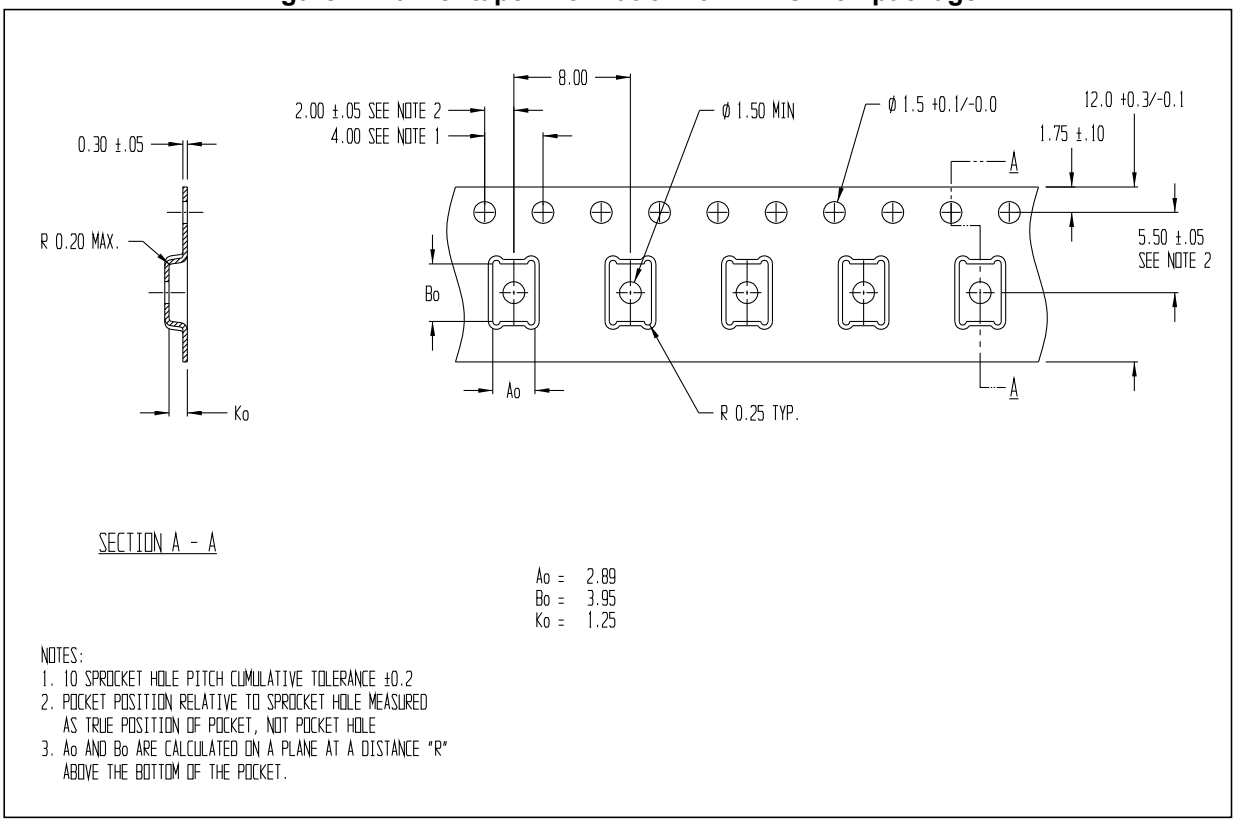
7.2 Land pattern

Figure 6. Land pattern and recommended stencil opening



7.3 RHLGA-5L packing information

Figure 7. Carrier tape information for RHLGA-5L package



8 Revision history

Table 8. Document revision history

Date	Revision	Changes
08-Nov-2017	1	Initial release
29-Jan-2018	2	Updated *Figure 2: Typical free-field frequency response normalized at 1 kHz* Added *Table 4*
27-Mar-2018	3	Document status promoted to production data Modified title of *Table 4*
29-Nov-2018	4	Updated *Table 3: Acoustic and electrical characteristics* Updated storage temperature range in *Table 5: Absolute maximum ratings* Updated *Table 7: Reliability specifications* Added *Section 7.2: Land pattern*
11-Feb-2019	5	Added *Figure 7: Carrier tape information for RHLGA-5L package*
28-Oct-2020	6	Added operating temperature range to *Table 5: Absolute maximum ratings*