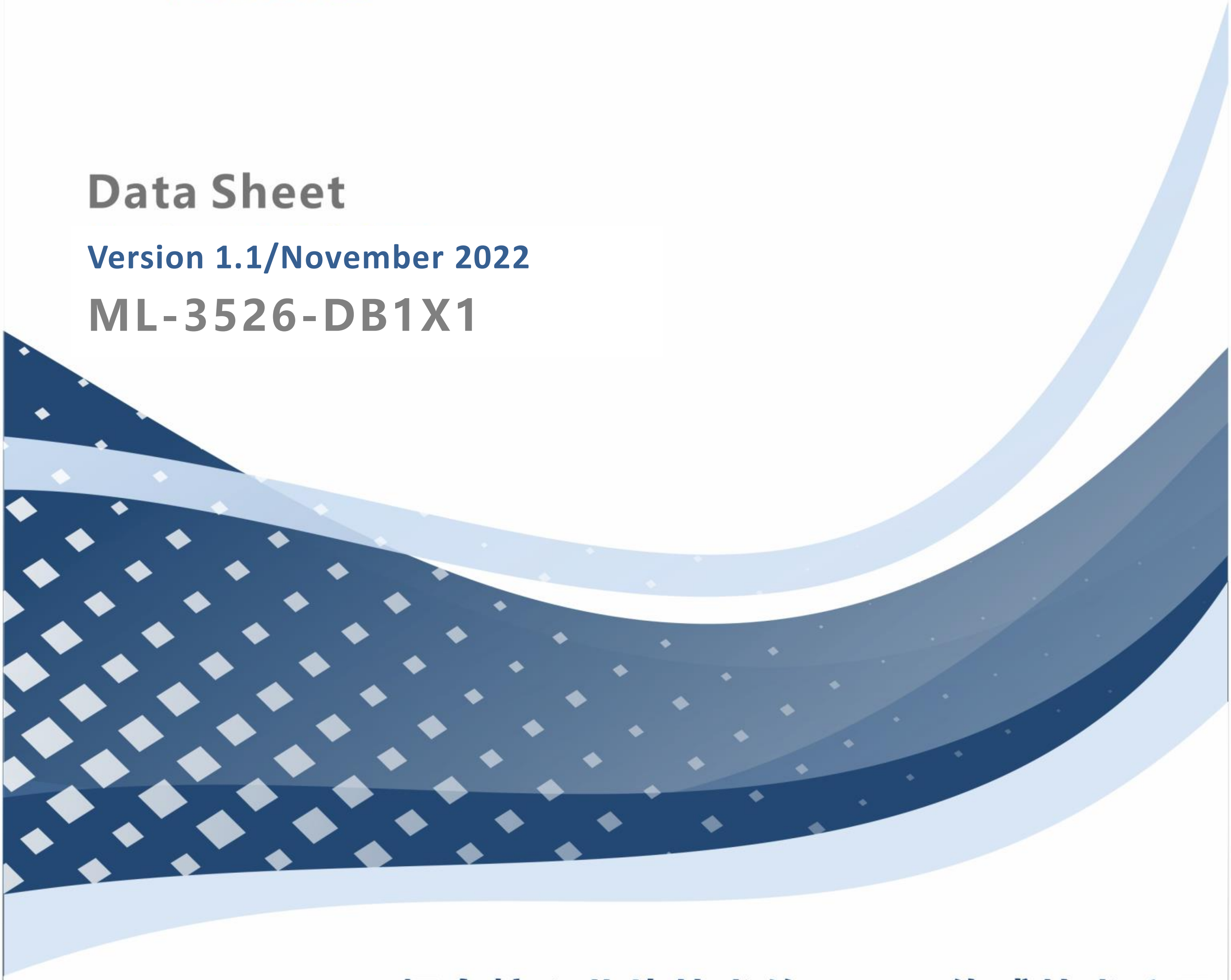
SV SensTech
华景传感科技



Data Sheet

Version 1.1/November 2022

ML-3526-DB1X1

拥有核心芯片技术的MEMS传感技术公司

A MEMS Sensor Company with Advanced Core Chip Technology

上海
芯片研发：上海张江
⬇

无锡
研发测试中心：无锡高新区
⬇

北京
华北销售中心：北京海淀
⬇

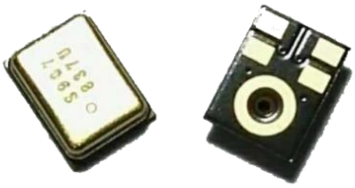
⬆
德国
芯片研发：斯图加特

⬆
苏州
封测生产：苏州高新区

⬆
深圳
华南销售中心：深圳南山

Product Specification

ML-3526-DB1X1
Bottom-port digital silicon microphone



Description

ML-3526-DB1X1 is a miniature digital bottom-port silicon microphone that receives the sound signal from the topside hole on Bottom PCB. By using our own innovative and unique MEMS microphone chip design, SV Senstech provides a series of packaged MEMS silicon microphones with compact size to achieve excellent performance such as high SNR, high AOP, excellent reliability and broadband frequency response. This series of MEMS microphones find wide applications in laptops，automotives，cell phones, TWS, wearable devices and other portable electronic devices.

Features

- Compact size of 3.50×2.65×1.10 mm^3
- Sensitivity of -37dBFS (±1dBFS)
- High signal-to-noise ratio of 65 dB
- Extreme low THD of 0.1% at 94 dB SPL
- PDM Output
- High immune to RF/EM interference
- High mechanical strength
- High temperature resistance
- Excellent reliability

Applications

Laptops, automotives, smartphones, Bluetooth headsets/headphones, TWS, wearable electronics, IoT related devices, etc.

Absolute maximum ratings

Parameter	Absolute Maximum Rating	Units
Vdd, DATA to Ground	-0.3, +5.0	V
CLOCK to Ground	-0.3, +5.0	V
SELECT to Ground	-0.3, +5.0	V
Input Current	±5	mA
Short Circuit to/from DATA	Indefinite to Ground or Vdd	sec
Temperature	-40 to +100	°C

Notes:

1) Stresses exceeding these "Absolute maximum ratings" may cause permanent damage to the device. These are stress ratings only.
2) Functional operation at these or any other conditions beyond those indicated under "Acoustic and electrical specifications" is not implied.
3) Exposure beyond those indicated under "Acoustic and electrical specifications" for extended periods may affect device reliability.

Acoustic and electrical specifications

General Microphone Specifications

Parameter		Symbol	Condition	Min.	Typ.	Max	Unit
Supply Voltage		Vdd		1.62	1.8	3.6	V
Sleep Current		Isleep	Fclock⩽1kHz		1		µA
Clock Frequency Range	Sleep Mode	Fclock		0		350	kHz
	Low Power Mode	Fclock		450	768	850	kHz
	Normal Mode	Fclock		1.38	2.4	3.3	MHz
Clock Duty Cycle				40	50	60	%
Directivity				Omnidirectional			
Data Format				1/2 Cycle 1-bit PDM			
Output Load		Cload				150	pF
Fall Asleep Time		Tslp	Fclock⩽50kHz		5		ms
Wake-up Time		Twk	Fclock>150kHz		5		ms
Power-up Time		Tpu				50	ms
Mode Change Time		Tmc				50	ms
Dimension				3.50×2.65×1.10			mm^3
Directivity				Omnidirectional			
Frequency Response		F		20~10k			Hz

Normal Mode
Test conditions: 23^{0}C±2^{0}C, 55%±5% R.H., VDD=1.8V, Fclock=2.4 MHz, SELECT grounded, no load

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Sensitivity	Sens	94dB SPL @1kHZ	-38	-37	-36	dBFS
Signal to Noise Ratio	SNR	94dB SPL @1kHZ,A-weighted, Fclock=1.536MHz		64.5		
		94dB SPL @1kHZ,A-weighted, Fclock=2.4MHz		65		
		94dB SPL @1kHz,A-weighted, Fclock=3.072MHz		65		
Current Consumption	Idd	Fclock=1.536MHz		780		µA
		Fclock=2.4MHz		1050		

		Fclock=3.072MHz		1260		
Total Harmonic Distortion	THD	94 dB SPL @ 1kHz		0.1		%
Acoustic Overload Point	AOP	10% THD @ 1kHz		130		dBSPL
Power Supply Rejection	PSR	100mVpp square wave @ 217 Hz, A-weighted		-105		dBFS(A)
Power Supply Rejection Ratio	PSRR	200mVpp sine wave @1kHz		75		dBV/FS

Low-Power Mode

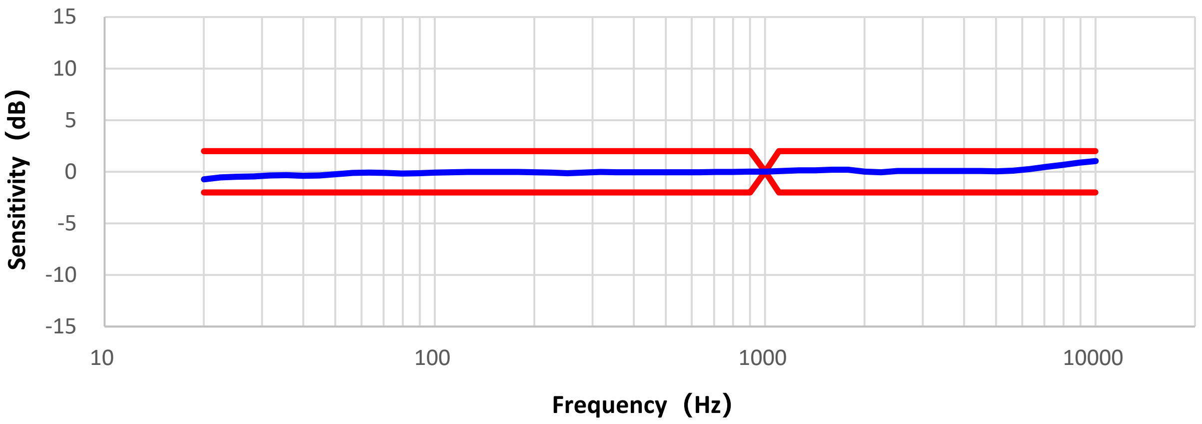
Test conditions: 23^{0}C±2^{0}C, 55%±5% R.H., VDD=1.8V, Fclock=768kHz, SELECT grounded, no load

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Sensitivity	Sens	94dB SPL @1kHz	-38	-37	-36	dBFS
Signal to Noise Ratio	SNR	94dB SPL @1kHz,A-weighted (BW=8kHz)		63.5		dB(A)
Current Consumption	Idd			360		μA
Total Harmonic Distortion	THD	94 dB SPL @1kHz		0.1		%
Acoustic Overload Point	AOP	10% THD @1kHz		130		dBSPL
Power Supply Rejection	PSR	100mVpp square wave @ 217 Hz, A-weighted		-105		dBFS(A)
Power Supply Rejection Ratio	PSRR	200mVpp sine wave @1kHz		75		dBV/FS

- ## Microphone interface specifications

Parameter	Symbol	Value			Unit
		Min	Type	Max	
Logic input High	V_{ih}	0.65×VDD		VDD+0.3	V
Logic input Low	V_{il}	-0.3		0.35×VDD	V
Logic Output High	V_{oh}	0.7×VDD			V
Logic Output Low	V_{ol}			0.3×VDD	V
Clock Duty Cycle		45		55	%

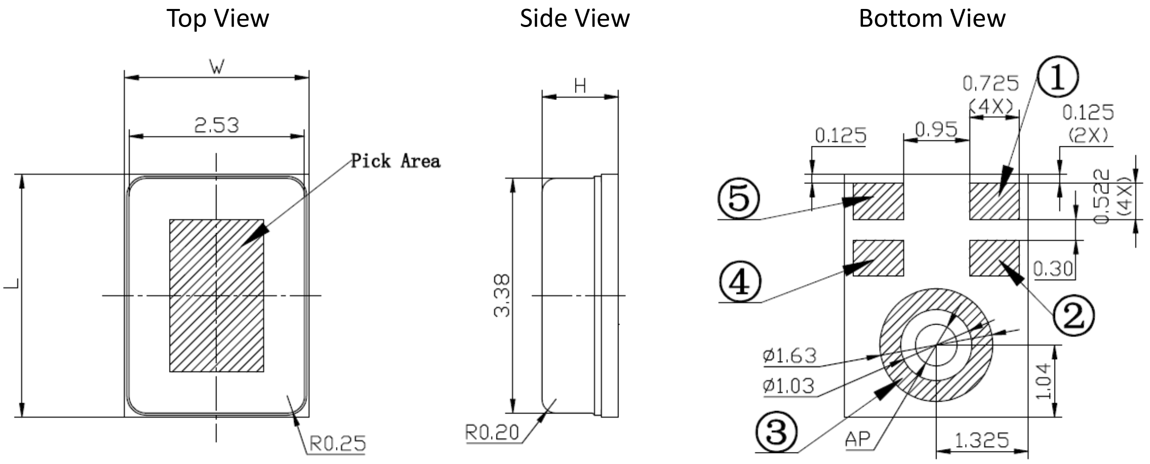
- ## Frequency response



Hz	20	100	400	900	1000	1100	3000	5000	8000	10000
USL	2	2	2	2	0	2	2	2	2	2
LSL	−2	−2	−2	−2	0	−2	−2	−2	−2	−2

Figure 1. Typical free field frequency response (normalized to 1 kHz)

- ## Mechanical specifications

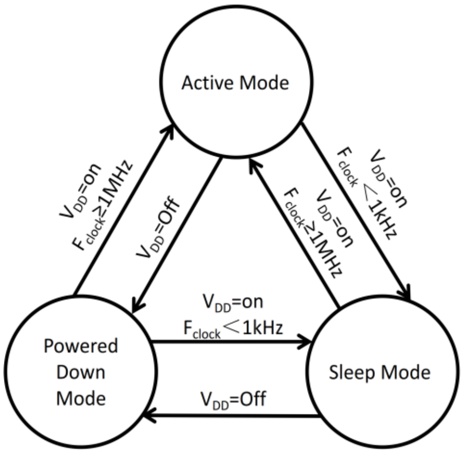


Item	Dimension	Tolerance	Units
Length(L)	3.50	±0.10	mm
Width(W)	2.65	±0.10	mm
Height(H)	1.10	±0.10	mm
Acoustic Port(AP)	ϕ0.6	±0.05	mm
AP (X)	1.325	±0.10	mm
AP (Y)	1.04	±0.10	mm

Pin#	Pin Name
1	DATA
2	SELECT
3	GROUND
4	CLOCK
5	VDD

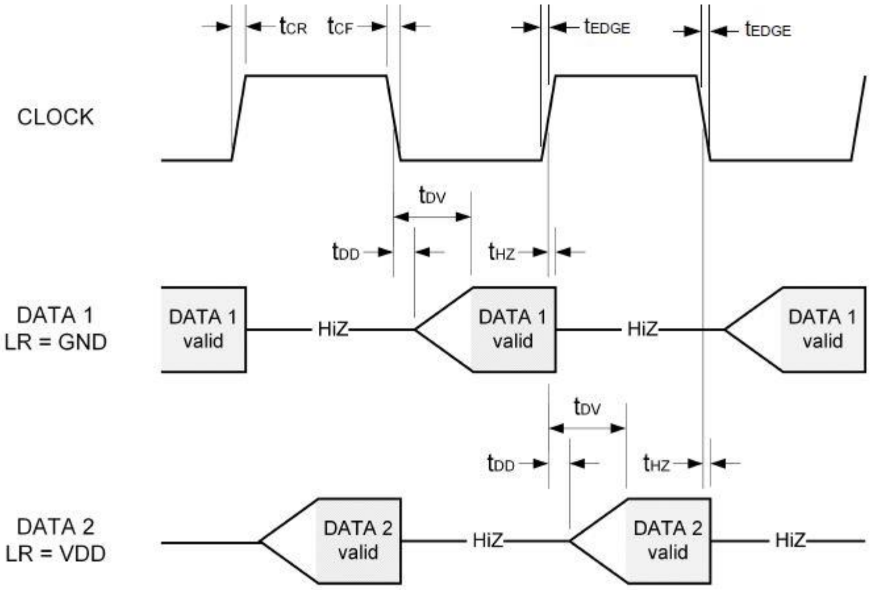
Figure 2. Detailed mechanical drawings

Device state diagram



Time diagram

Parameter	Symbol	Min	Typ	Max	Conditions
Delay time for DATA driven	T_{DD}	40 ns		80 ns	Delay time from CLOCK edge(50% VDD) to DATA driven
Delay time for DATA High-Z	T_{HZ}	5 ns		30 ns	Delay time from CLOCK edge(50% VDD) to DATA high impedance state
Delay time for DATA valid	t_{DV}			100 ns	Delay time from CLOCK edge(0.50 x VDD) to DATA valid(<0.30 x VDD or >0.70 x VDD) R_L=100KΩ, C_L=100 pF



Example land pattern

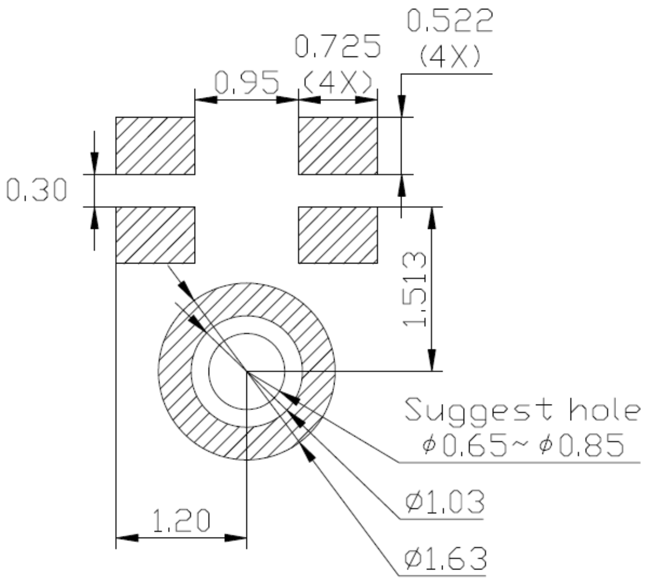
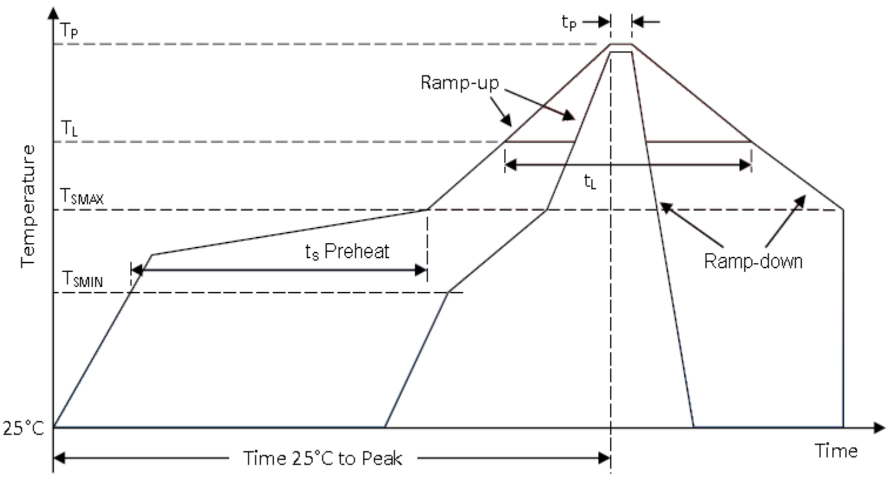


Figure 3. Recommended landing pattern on customers' PCB

Recommended reflow profile



Description		Parameter（lead-free）
Average temperature change rate (T_{SMAX} to T_P)		3^{0}C/second max.
Preheat	Minimum temperature (T_{SMIN}) Maximum temperature (T_{SMAX}) Time (T_{SMIN} to T_{SMAX}) (t_S)	150^{0}C 200^{0}C 60-180 seconds
Reflow	Temperature (T_L) Time (t_L)	217^{0}C 60-150 seconds
Peak temperature	Temperature (T_P) Time (t_P)	260^{0}C 20-40 seconds
Cooling rate(T_P to T_{SMAX})		6^{0}C/second max
Time required from 25^{0}C to peak temperature		8 minutes max

Figure 4. Recommended leadless solder reflow temperature profile

Notes:

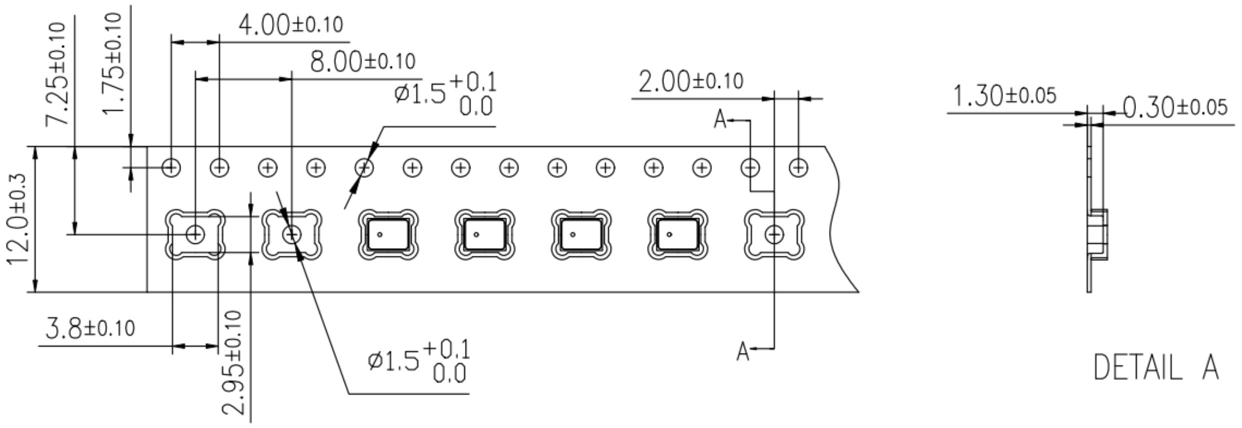
5) The air blow speed during reflow process should be low to avoid impurity entering the acoustic hole during reflow process.
6) Do not wash or clean the product to avoid impurity entering the product.
7) Do not carry out the reflow process more than 5 times. If the melting point of solders is lower, the peak temperature should be accordingly reduced.

Reliability specifications

Test Item	Description
Temperature/Humidity Bias	1,000 hours at +85℃/85% R.H. under bias (JESD22-A101A-B)
Thermal shock	100 cycles air-to-air thermal shock from -40℃ to +125℃ with 15minute soaks.(IEC 68-2-4)
High Temperature Storage	1,000 hours at +105℃ environment(IEC 68-2-2)
Low Temperature Storage	1,000 hours at -40℃ environment(IEC 68-2-1)
High Temperature Bias	1,000 hours at +105℃ under bias(IEC 68-2-2)
Low Temperature Bias	1,000 hours at -40℃ under bias(IEC 68-2-1)
Drop test	Using 150g fixture, 3 drops along each of 6 axes from 1.5m height onto slippery marble floor(IEC 68-2-27)
ESD-HBM	3 discharges of ±2 kV direct contact to I/O pins. (MIL 883E, Method 3015.7)
ESD-LID/GND	3 discharges of ±8 kV direct contact to lid while unit is grounded. (IEC 61000-4-2)
ESD-MM	3 discharges of ±200 V direct contact to I/O pins. (ESD STM5.2)
Vibration test	4 cycles of 20 to 2,000 Hz sinusoidal sweep with 20 G peak acceleration lasting 12 minutes in X, Y, and Z directions (Mil-Std-883E, Method 2007.2 A)
Reflow test	5 reflow cycles with peak temperature of +260℃
Mechanical Shock	3 pulses of 10,000 G in the X, Y, and Z direction (IEC 68-2-27, Test Ea)

Notes: After reliability tests are performed, the sensitivity of the microphones shall not deviate more than 3 dB from its initial value. After 3 reflow cycles, the sensitivity of the microphone shall not deviate more than 3dB from its initial value.

Packaging and marking detail



Model Number	Reel Diameter	Quantity Per Reel	Quantity Per Carton
ML-3526-DB1X1	13”	5,000	5,000 * 10 = 50,000Pcs

Notes:

1) Dice are packaged in black carrier band which uses anti-electrostatic material. Each volume of packaged products is 5000 pcs.
2) The space between two dice is 8mm packaged in the carrier band with 12-mm width rolled in the reel of 13-inch diameter.
3) The package requirements mentioned below is the company's standard delivery specifications. If you need special packages, please contact our sales staff.
4) All dimensions are in millimeters (mm) with tolerance of ± 0.3mm.

Materials statement

- Meets the requirements of the European RoHS directive 2011/65/EC as amended.
- Meets the requirements of the industry standard IEC 61249-2-21:2003 for halogenated substances and SV SensTech Green Materials Standards Policy section on Halogen-Free.

Remarks

- MSL (moisture sensitivity level) Class 1.
- Maximum of 3 reflow cycles is recommended.
- In order to minimize device damage:
  - Do not board wash or clean after the reflow process.
  - Do not brush board with or without solvents after the reflow process.
  - Do not directly expose to ultrasonic processing, welding, or cleaning.
  - Do not insert any object in the port hole of device at any time.
  - Do not apply over 30 psi of air pressure into the port hole.
  - Do not pull a vacuum over the port hole of microphone.
  - Do not apply a vacuum when repacking into sealed bags at a rate faster than 0.5 atm/sec.

Version updates

Version	Updated Content	Updated Date
1.0	Initial release	2022-09-05
1.1	Update PSR&PSRR	2022-11-25

Contact

SV SensTech Co.,Ltd
Address: F2, No.200,
Linghu Avenue,Wuxi,Jiangsu,
Zip code 214135
Tel.: 86-510-85622282
Email: sales@svsens.com
Website: www.svsens.com

华景传感科技(无锡)有限公司
中国传感网国际创新园
江苏省无锡市新吴区菱湖大道200号F2栋
邮编: 214135
电话: (86) 0510-85622282
邮箱: sales@svsens.com
网页: www.svsens.com