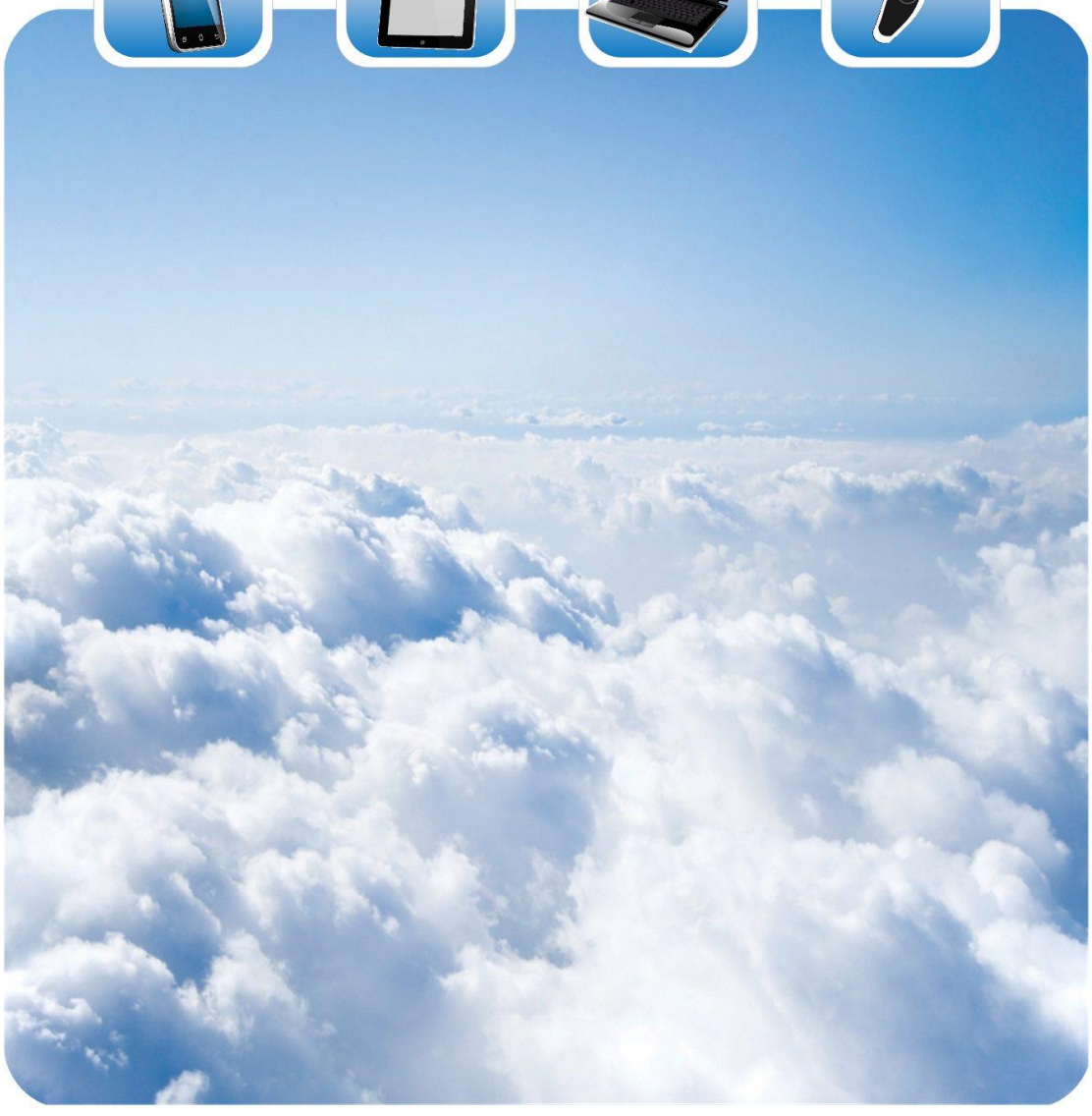
敏芯股份
MEMSensing

Data Sheet

V 1.1 / Dec. 2023

MSM261DDB020

PDM digital output MEMS microphone with Multi-modes



CONTENTS:

GENERAL DESCRIPTION

MSM261DDB020 is an omnidirectional, Bottom-ported, PDM digital output MEMS microphone. It has high performance and reliability. The MSM261DDB020 offers multiple performance modes.

MSM261DDB020 is available in a 3.50 mm × 2.65 mm ×0.98 mm metal can LGA package. It is SMT compatible with no sensitivity degradation.

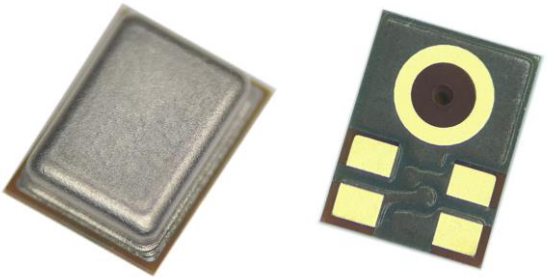
FEATURES

- ✧ Cost effective
- ✧ Fourth-order Σ-Δ modulator
- ✧ Digital PDM output
- ✧ Compatible with Sn/Pb and Pb-free solder processes
- ✧ RoHS/Halogen free compliant
- ✧ Multiple performance modes (Sleep, Low-Power, Standard Performance)
- ✧ Sensitivity Matching within +/-1dB

APPLICATIONS

- ✧ Mobile Phone
- ✧ Laptop
- ✧ Tablet computer
- ✧ Bluetooth headset
- ✧ Earphone
- ✧ Wearable intelligent equipment

PRODUCT VIEW



ABSOLUTE MAXIMUM RATINGS

Parameter	Maximum value	Unit
Supply Voltage	−0.3 to 4.0	V
Sound Pressure Level	140	dB SPL
Storage temperature	−40 to 100	°C

ACOUSTIC & ELECTRICAL SPECIFICATIONS

TEST CONDITIONS: 25 ±10°C, 50±20% R.H., VDD=1.8 V, f_{CLOCK}=2.4 MHz, L/R pin grounded, no load, unless otherwise indicate

General Microphone Specifications

Parameter		Symbol	Conditions	Min	Typ	Max	Units
Supply Voltage		V_{DD}		1.6	-	3.6	V
Clock Frequency Range	Sleep Mode			0		50	KHz
	Low-Power Mode			150		900	KHz
	Standard Performance Mode			1.1		4.8	MHz
Sleep Current		I_{SLEEP}	f_{CLOCK} ≤ 50 kHz	-	1		µA
DC Output			Fullscale = ±100	-	4	-	% FS
Directivity				Omnidirectional			
Polarity			Increasing sound	increasing density of 1's			
Data Format				½ Cycle PDM			
Short Circuit Current		I_{SC}	Grounded DATA pin	1	-	10	mA
Output Load		C_{LOAD}		-	-	200	pF
Fall-asleep Time			f_{CLOCK} ≤ 50 kHz	-	-	30	µs
Wake-up Time			f_{CLOCK} ≥ 151 kHz	-	-	20	ms
Power-up Time			V_{DD} ≥ V(min)	-	6	20	ms
Mode-Change Time				-	-	10	ms

Standard Performance Mode

TEST CONDITIONS: f_{CLOCK} = 2.4 MHz, V_{DD}=1.8 V, unless otherwise indicated

Parameter	Symbol	Conditions	Min	Typ	Max	Units
Supply Current	I_{DD}	f_{CLOCK}=2.4 MHz	-	670	-	µA
Sensitivity	S	94 dB SPL @ 1 kHz	-27	-26	-25	dBFS
Signal to Noise Ratio	SNR	20 kHz bandwidth, A-weighted f_{CLOCK}=2.4 MHz	-	64	-	dB(A)
Total Harmonic Distortion	THD	94 dB SPL @ 1 kHz, S = Typ	-	0.1	-	%
Acoustic Overload Point	AOP	10% THD @ 1 kHz, S = Typ	-	120	-	dB SPL
Power Supply Rejection Ratio	PSRR	200 mVpp sinewave @ 1 kHz	-	50	-	dBV/FS
Power Supply Rejection	PSR+N	100 mVpp square wave @ 217 Hz, A-weighted	-	-80	-	dBFS (A)

Low-Power Mode

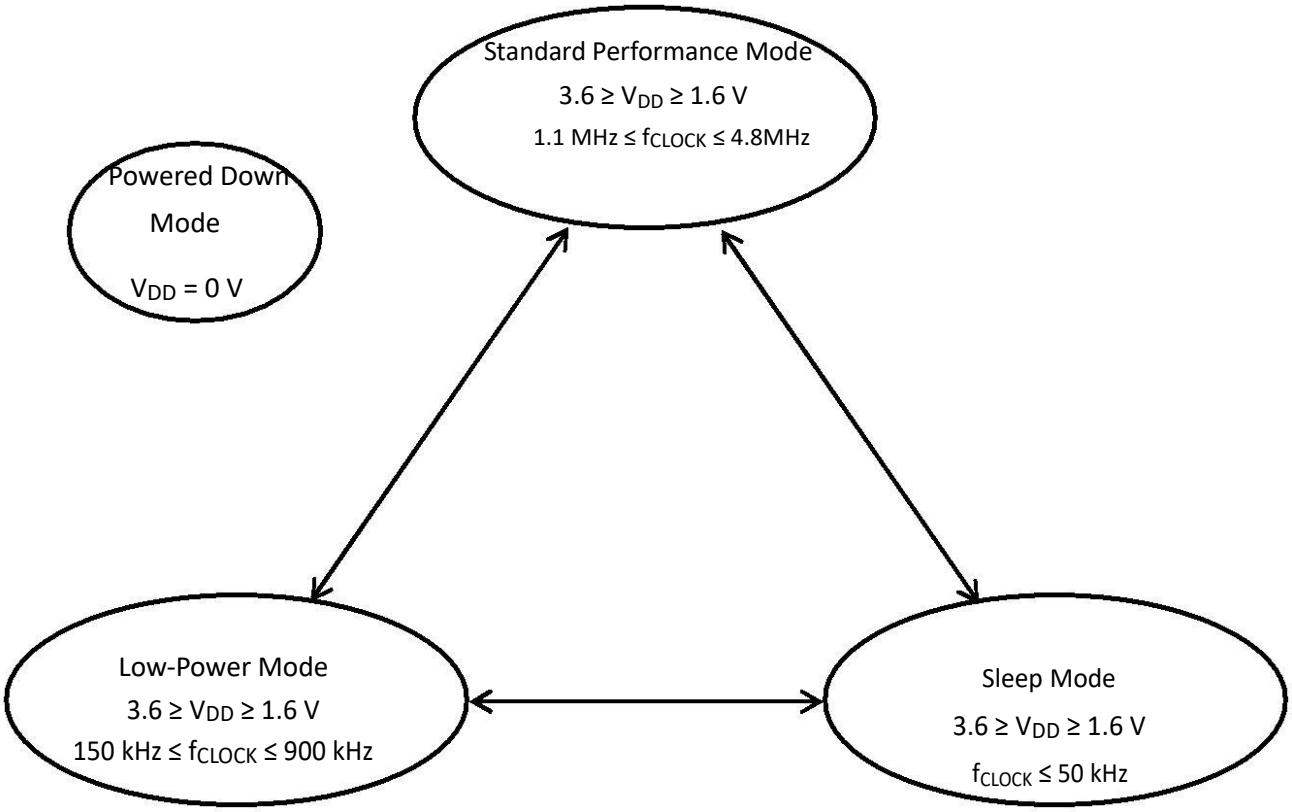
TEST CONDITIONS: f_{CLOCK} =768 kHz, V_{DD}=1.8 V, unless otherwise indicated

Parameter	Symbol	Conditions	Min	Typ	Max	Units
Supply Current	I_{DD}	f_{CLOCK}=768KHz	-	290	-	µA
Sensitivity	S	94 dB SPL @ 1 kHz	-26	-25	-24	dBFS
Signal to Noise Ratio	SNR	94 dB SPL @ 1 kHz, A-weighted(20Hz-8KHz)	-	62	-	dB(A)
Total Harmonic Distortion	THD	94 dB SPL @ 1 kHz, S = Typ	-	0.1	-	%
Acoustic Overload Point	AOP	10% THD @ 1 kHz, S = Typ	-	120	-	dB SPL
Power Supply Rejection Ratio	PSRR	200 mVpp sinewave @ 1 kHz	-	50	-	dBV/FS
Power Supply Rejection	PSR+N	100 mVpp square wave @ 217 Hz, A-weighted(20Hz-8KHz)	-	-80	-	dBFS (A)

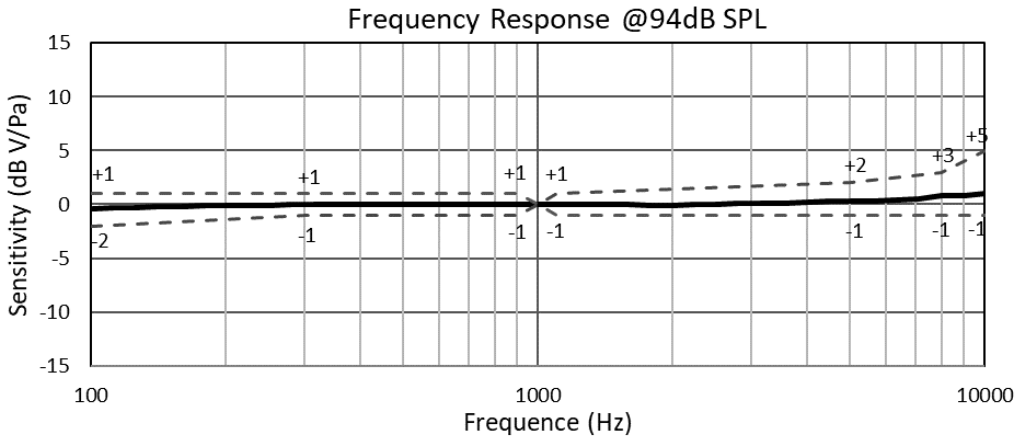
Microphone Interface Specifications

Parameter	Symbol	Conditions	Min	Typ	Max	Units
Logic Input High	V_{IH}		0.7Xv_{DD}	-	3.6	V
Logic Input Low	V_{IL}		-0.3	-	0.3Xv_{DD}	V
Logic Output High	V_{OH}	I_{OUT} = 2 mA	V_{DD} -0.45	-	-	V
Logic Output Low	V_{OL}	I_{OUT} = 2 mA	-	-	0.45	V
Clock Duty Cycle		-	40	-	60	%

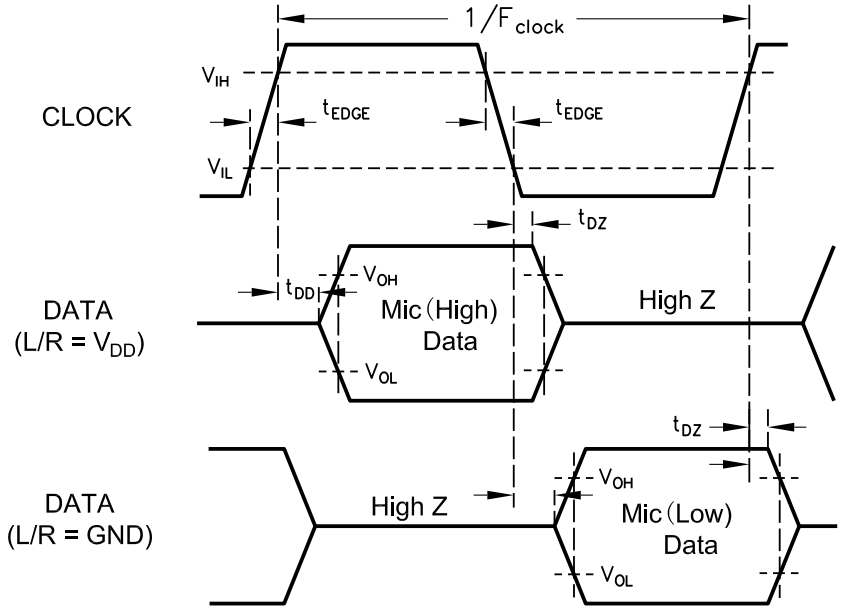
MICROPHONE STATE DIAGRAM



TYPICAL FREQUENCY RESPONSE



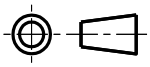
TIMING DIAGRAM

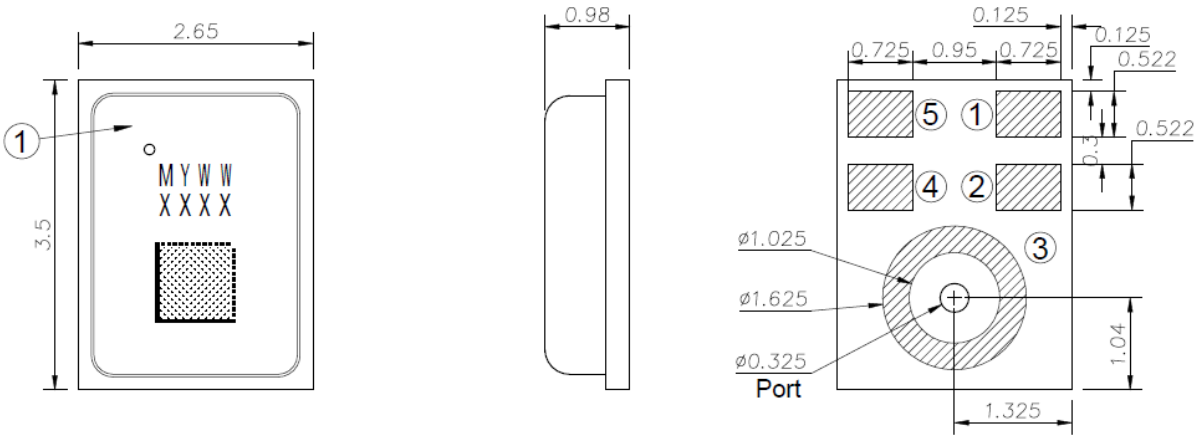


Parameter	Symbol	Min	Typ	Max
Clock Rise/Fall Time	t_{EDGE}	-	-	20ns
Delay Time to High Z	t_{DZ}	-	-	40ns
Delay Time to Data Line Driven	t_{DD}	-	-	50ns

Microphone	L/R	Asserts DATA on	Latch DATA on
Mic(High)	Vdd	CLK rising edge	CLK falling edge
Mic(Low)	Ground	CLK falling edge	CLK rising edge

OUTLINE DIMENSIONS AND PIN DEFINITION：





TOP VIEW　　SIDE VIEW　　BOTTOM VIEW

PIN function description

PIN#	Function
1	DATA
2	L/R
3	GND
4	CLK
5	VDD

Item	Dimension	Tolerance
Length (L)	3.50	±0.10
Width (W)	2.65	±0.10
Height (H)	0.98	±0.10
Acoustic Port (AP)	Ø0.325	±0.05

Dimensions are in millimeters, tolerance is ±0.15mm unless otherwise specified.

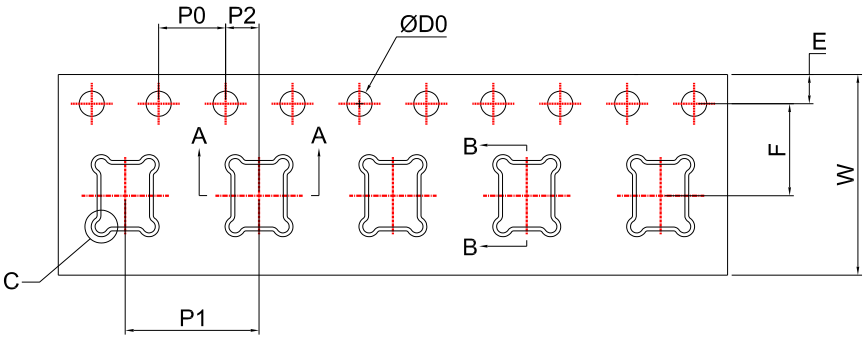
MYWW XXXX	M	Memsensing
	Y	Year(A~Z)
	WW	Week
	XXXX	Serial Number

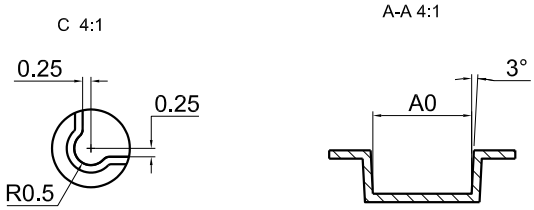
RELIABILITY SPECIFICATIONS

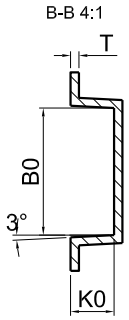
Test	Description
Thermal Shock	100 cycles air-to-air thermal shock from -40°C to +125°C with 15 minute soaks. (IEC68-2-4)
High Temperature Storage	1,000 hours at +105°C environment. (IEC68-2-2 Test Ba)
Low Temperature Storage	1,000 hours at -40°C environment. (IEC68-2-2 Test Aa)
Reflow	5 reflow cycles with peak temperature of +260°C.
ESD-HBM	3 discharges of ±2 kV direct contact to I/O pins. (IEC 61000-4-2)
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±200V direct contact to I/O pins. (IEC STM5.2)
Vibration	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)
Mechanical Shock	3 pulses of 10,000 G in the X, Y and Z direction. (IEC68-2-27 Test Ea)
High Temperature Bias	1,000 hours at +105°C under bias (IEC68-2-2 Test Ba)
Low Temperature Bias	1,000 hours at -40°C under bias （ IEC68-2-2 Test Aa）
Temperature/Humidity Bias	1,000 hours at +85°C/85% R.H. under bias. （ JESD22-A101A-B ）
Drop Test	To be no interference in operation after dropped to 1.0cm steel plate 18 times from 1.5 meter height

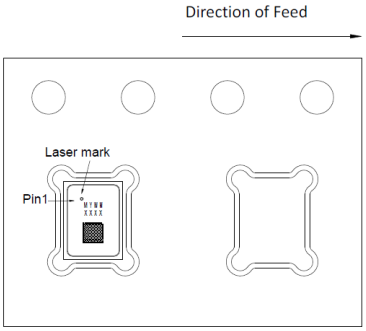
NOTE: Sensitivity should vary within ±3dB from initial sensitivity. (The measurement to be done after 2 hours of conditioning at 25 ±10°C, 50±20% R.H.)

PACKAGING & MARKING DETAIL:









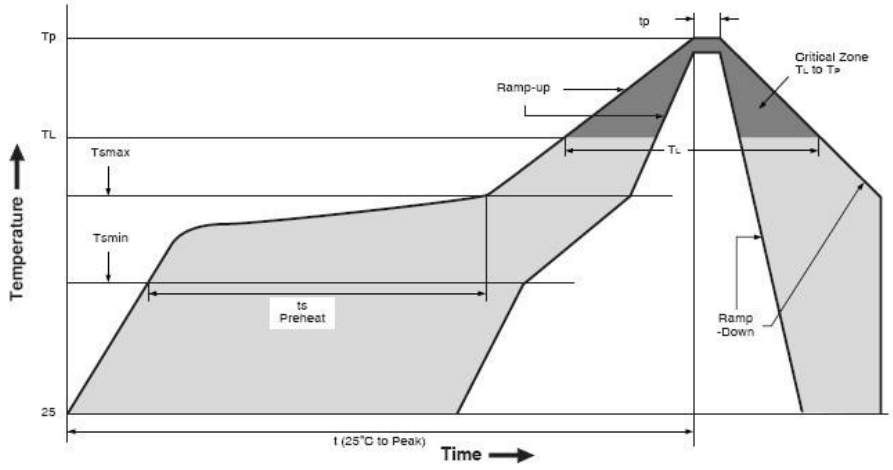
ITEM	W	E	F	ØD0	K0
DIM(mm)	12.00±0.30	1.75±0.10	5.50±0.10	$1.50^{+0.10}_{0}$	1.20±0.10
ITEM	P0	10P0	P1	A0	B0
DIM(mm)	4.00±0.10	40.00±0.20	8.00±0.10	2.90±0.10	3.75±0.10
ITEM	P2	T			
DIM(mm)	2.00±0.10	0.25±0.05			

Note:

1) Dimensions are in mm;
2) Don't put the vacuum suction nozzle alignment the port hole;
3) Tape &Reel Per EIA-481 standard;
4) Label applied to external package and direct to reel;
5) Static voltage <100V;

Model Number	Reel Diameter	Quantity Per Reel
MSM261DDB020	13 inch	5700

RECOMMEND REFLOW PROFILE:

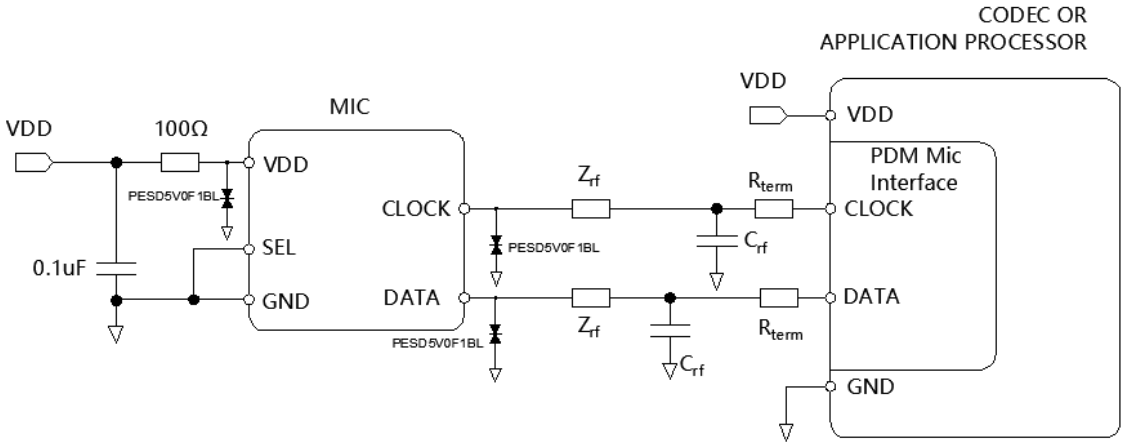


Description	Parameter	Pb-free
Average ramp rate	T_L to T_P	3 °C/sec max
Preheat		
Minimum temperature	T_{SMIN}	150 °C
Maximum temperature	T_{SMAX}	200 °C
Time(T_{SMIN} to T_{SMAX})	t_S	60 sec to 180 sec
Ramp-up rate	T_{SMAX} to T_L	1.5 ~2°C/sec
Time maintained above liquidus temperature	t_L	60 sec to 150 sec
Liquidus temperature	T_L	217 °C
Peak temperature	T_P	260 °C max
Time within 5°C of actual peak temperature	t_P	20 sec to 40 sec
Ramp-down rate	T_L to T_P	6 °C/sec max
Time 25 °C (t25 °C) to peak temperature	t	8 minutes max

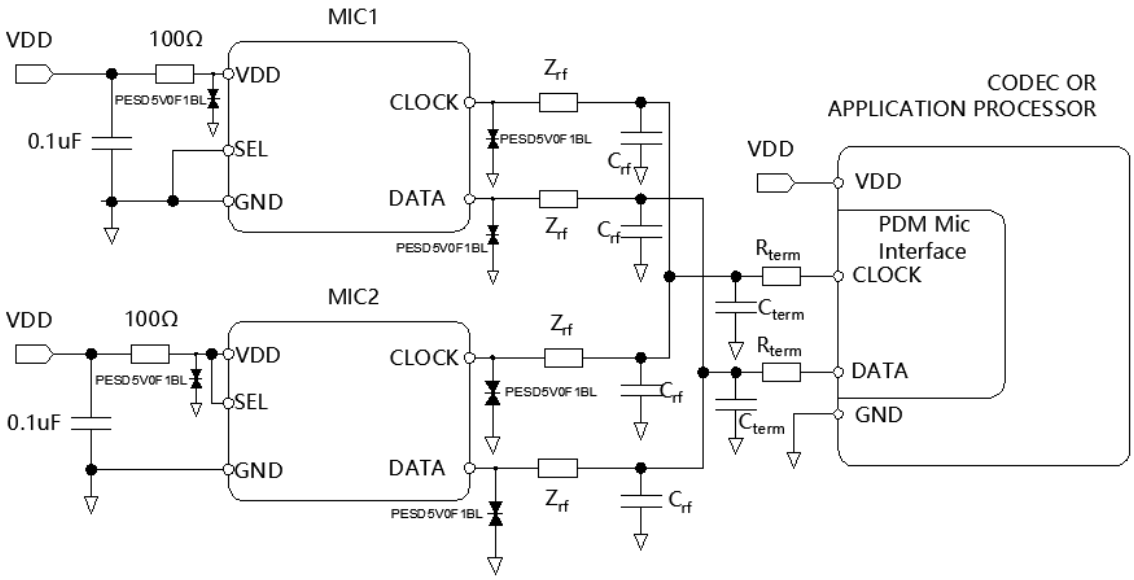
NOTE：When MEMS MIC is soldered on PCB, the reflow profile is set according to solder paste and the thickness of PCB etc.

RECOMMENDED INTERFACE CIRCUIT：

Figuer 1. MSM261DDB020 electrical connections



Figuer 2. Electrical connections for stereo configurations



Power supply decoupling capacitors (0.1uF capacitor,100Ω resistor and the TVS diode) should be placed as near as possible to VDD of the device. (common design practice)

Zrf, Crf, Zterm, and Cterm are all used for debugging. Actually their values or NC are based on the debugging result.

ADDITIONAL NOTES

(A) MSL (moisture sensitivity level) Class 1.

(B) Maximum of 3 reflow cycles is recommended.

(C) 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 port hole of device at any time.

Do not apply air pressure into the port hole.

Do not pull a vacuum over port hole of the microphone.

Do not apply a vacuum when repacking into sealed bags at a rate faster than 0.5 atm/sec.

STORAGE AND TRANSPORTATION

(A) Keep MEMS MIC in warehouse with less than 75% humidity and without sudden temperature change, acid air, any other harmful air or strong magnetic field.

Recommend floor life (out of bag) at factory no more than 4 weeks.

(B) The MEMS MIC with normal pack can be transported by ordinary conveyances. Please protect products against moist, shock, sunburn and pressure during transportation.

MATERIALS STATEMENT

Meet the requirements of MEMSensing standard on hazard substances control (including RoHS2.0+REACH+Halogen-Free, etc.), with “HSF” identification on label.

REVISION HISTORY:

Revision	Subjects (major changes since last revision)	Date
1.0	Initial Release	2022-09-22
1.1	Update Typical Frequency Response	2023-12-12

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