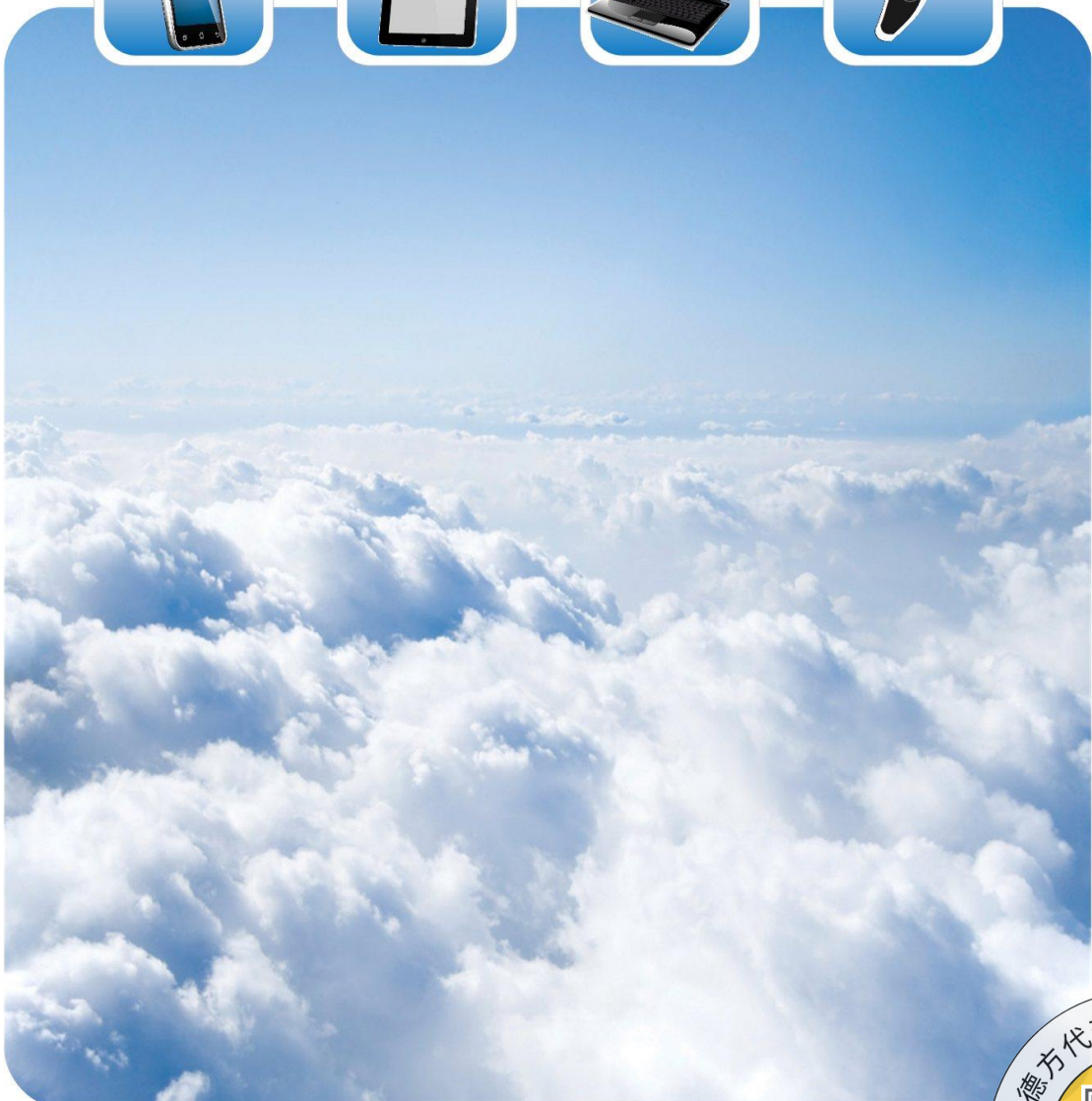


# Data Sheet

V 1.0 / Jul. 2022

MSM261DHT006

PDM digital output MEMS microphone with Multi-modes



# MSM261DHT006

PDM digital output MEMS microphone



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## MSM261DHT006

PDM digital output MEMS microphone



### GENERAL DESCRIPTION

MSM261DHT006 is an omnidirectional, Top-port, PDM digital output MEMS microphone. It has high performance and reliability.

MSM261DHT006 is available in a thin 4 mm × 3 mm × 1.05 mm proprietary LGA package. It is SMT compatible with no sensitivity degradation.

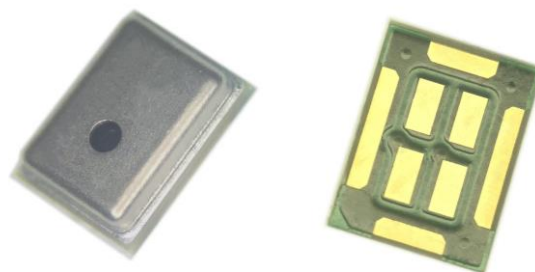
### APPLICATIONS

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

### FEATURES

- ✧ High SNR
- ✧ Fourth-order  $\Sigma$ - $\Delta$  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  $\pm 1$ dB

### PRODUCT VIEW



## MSM261DHT006

PDM digital output MEMS microphone



### 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<sub>CLOCK</sub>=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 <sub>DD</sub>    |                              | 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 <sub>SLEEP</sub> | f <sub>CLOCK</sub> ≤ 50 kHz  | -                         | 1   |     | μA    |
| DC Offset             |                           |                    | Fullscale = ±100             | -                         | 4   | -   | % FS  |
| Directivity           |                           |                    |                              | Omnidirectional           |     |     |       |
| Polarity              |                           |                    | Increasing sound             | increasing density of 1's |     |     |       |
| Data Format           |                           |                    |                              | ½ Cycle PDM               |     |     |       |
| Short Circuit Current |                           | I <sub>SC</sub>    | Grounded DATA pin            | 1                         | -   | 10  | mA    |
| Output Load           |                           | C <sub>LOAD</sub>  |                              | -                         | -   | 200 | pF    |
| Fall-asleep Time      |                           |                    | f <sub>CLOCK</sub> ≤ 50 kHz  | -                         | -   | 30  | μs    |
| Wake-up Time          |                           |                    | f <sub>CLOCK</sub> ≥ 151 kHz | -                         | -   | 200 | μs    |
| Power-up Time         |                           |                    | V <sub>DD</sub> ≥ V(min)     | -                         | 6   | 20  | ms    |
| Mode-Change Time      |                           |                    |                              | -                         | -   | 10  | ms    |



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## Standard Performance Mode

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

| Parameter                    | Symbol          | Conditions                                                           | Min | Typ | Max | Units         |
|------------------------------|-----------------|----------------------------------------------------------------------|-----|-----|-----|---------------|
| Supply Current               | $I_{\text{DD}}$ | $f_{\text{CLOCK}} = 2.4 \text{ MHz}$                                 | -   | 670 | -   | $\mu\text{A}$ |
| Sensitivity                  | S               | 94 dB SPL @ 1 kHz                                                    | -27 | -26 | -25 | dBFS          |
| Signal to Noise Ratio        | SNR             | 20 kHz bandwidth, A-weighted<br>$f_{\text{CLOCK}} = 2.4 \text{ MHz}$ | -   | 59  | -   | 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                                             | -   | 122 | -   | 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,<br>A-weighted                         | -   | -80 | -   | dBFS<br>(A)   |



**MSM261DHT006**

PDM digital output MEMS microphone

**Low-Power Mode**TEST CONDITIONS:  $f_{\text{CLOCK}} = 768 \text{ kHz}$ ,  $V_{\text{DD}} = 1.8 \text{ V}$ , unless otherwise indicated

| Parameter                    | Symbol          | Conditions                                              | Min | Typ | Max | Units         |
|------------------------------|-----------------|---------------------------------------------------------|-----|-----|-----|---------------|
| Supply Current               | $I_{\text{DD}}$ | $f_{\text{CLOCK}} = 768 \text{ KHz}$                    | -   | 290 | -   | $\mu\text{A}$ |
| Sensitivity                  | S               | 94 dB SPL @ 1 kHz                                       | -26 | -25 | -24 | dBFS          |
| Signal to Noise Ratio        | SNR             | 94 dB SPL @ 1 kHz,<br>A-weighted(20Hz-8KHz)             | -   | 57  | -   | 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                                | -   | 122 | -   | 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,<br>A-weighted(20Hz-8KHz) | -   | -80 | -   | dBFS (A)      |

**Microphone Interface Specifications**

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



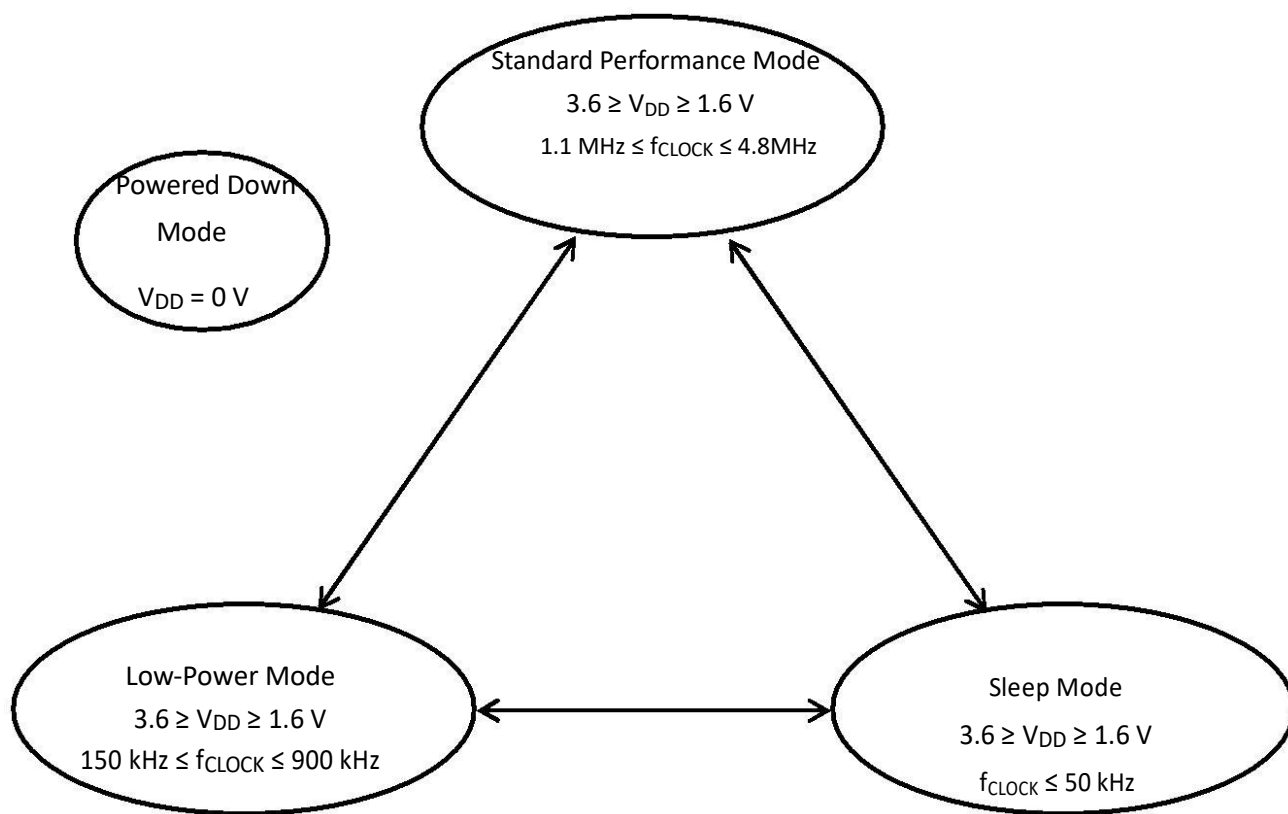


# MSM261DHT006

PDM digital output MEMS microphone



## MICROPHONE STATE DIAGRAM

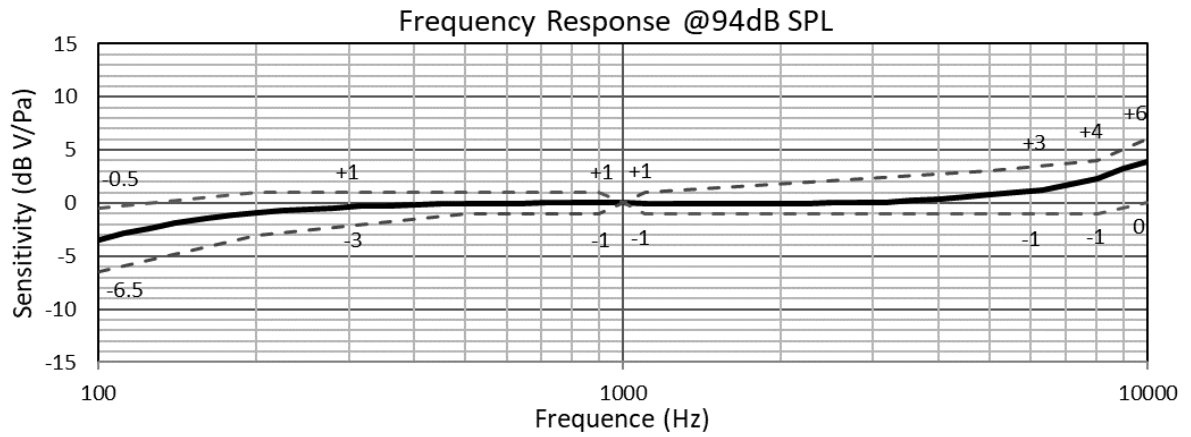


# MSM261DHT006

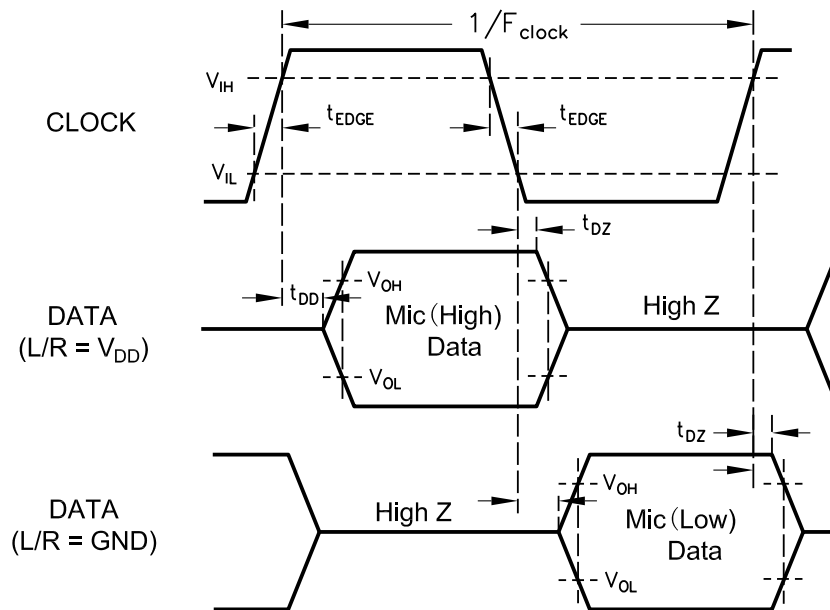
PDM digital output MEMS microphone



## TYPICAL FREQUENCY RESPONSE

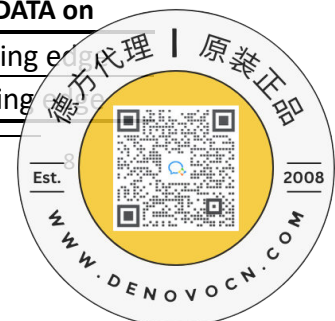


## TIMING DIAGRAM



| 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  |



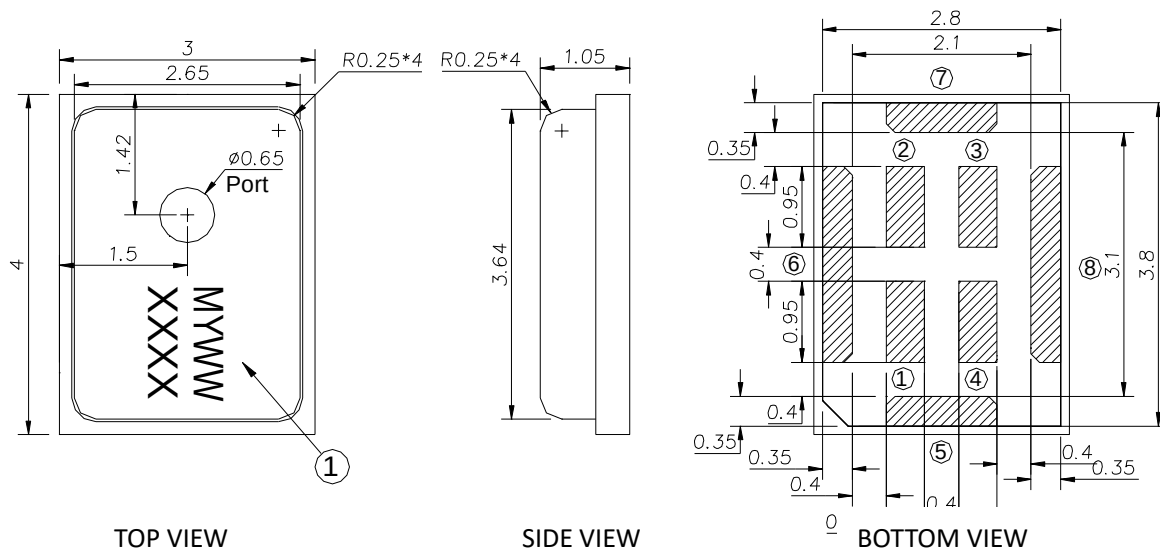
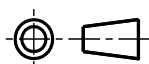


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## OUTLINE DIMENSIONS AND PIN DEFINITION:



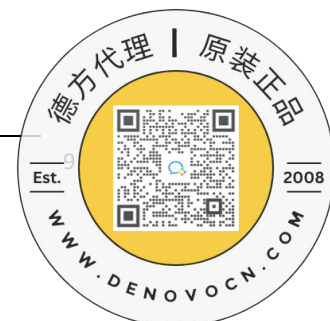
## PIN function description

| PIN#    | Function |
|---------|----------|
| 1       | VDD      |
| 2       | L/R      |
| 3       | CLK      |
| 4       | DATA     |
| 5,6,7,8 | GND      |

| Item       | Dimension          | Tolerance  |
|------------|--------------------|------------|
| Length (L) | 4.00               | $\pm 0.10$ |
| Width (W)  | 3.00               | $\pm 0.10$ |
| Height (H) | 1.05               | $\pm 0.10$ |
| Port (AP)  | $\varnothing 0.65$ | $\pm 0.05$ |

Dimensions are in millimeters, tolerance is  $\pm 0.15\text{mm}$  unless otherwise specified.

|              |      |               |
|--------------|------|---------------|
| MYWW<br>XXXX | M    | Memsensing    |
|              | Y    | Year(A~Z)     |
|              | WW   | Week          |
|              | XXXX | Serial Number |



## MSM261DHT006

PDM digital output MEMS microphone



### 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 $\pm 2$ kV direct contact to I/O pins. (IEC 61000-4-2)                                                                               |
| ESD- LID-GND              | 3 discharges of $\pm 8$ kV direct contact to lid while unit is grounded. (IEC 61000-4-2)                                                             |
| ESD-MM                    | 3 discharges of $\pm 200$ V 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  $\pm 3$  dB from initial sensitivity. (The measurement to be done after 2 hours of conditioning at  $25 \pm 10^\circ\text{C}$ ,  $50 \pm 20\%$  R.H.)

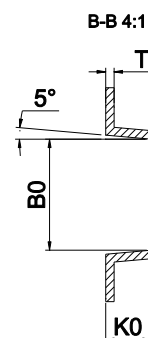
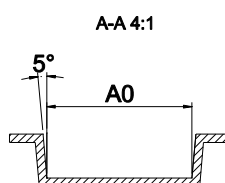
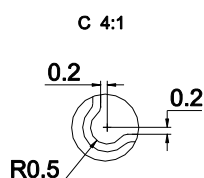
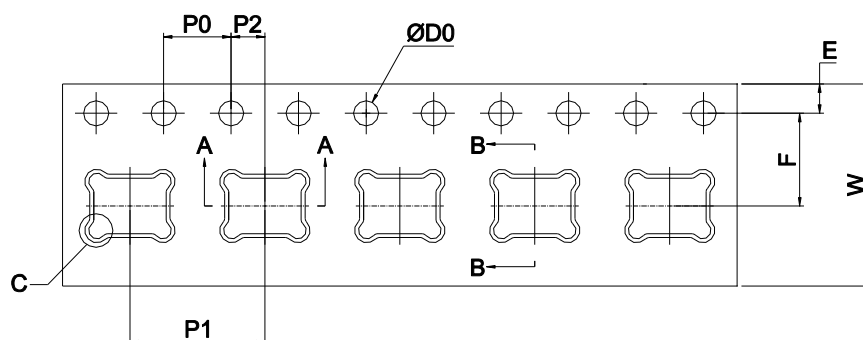


# MSM261DHT006

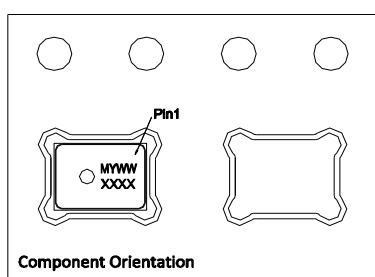
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## PACKAGING & MARKING DETAIL:



Direction of Feed

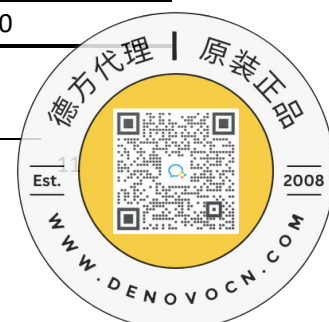


| ITEM    | W          | E          | F         | ØD0                                | K0        |
|---------|------------|------------|-----------|------------------------------------|-----------|
| DIM(mm) | 12.00±0.30 | 1.75±0.10  | 5.50±0.10 | 1.50 <sup>+0.10</sup> <sub>0</sub> | 1.35±0.10 |
| ITEM    | P0         | 10P0       | P1        | A0                                 | B0        |
| DIM(mm) | 4.00±0.10  | 40.00±0.20 | 8.00±0.10 | 4.30±0.10                          | 3.30±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 |
|--------------|---------------|-------------------|
| MSM261DHT006 | 13 inch       | 5700              |

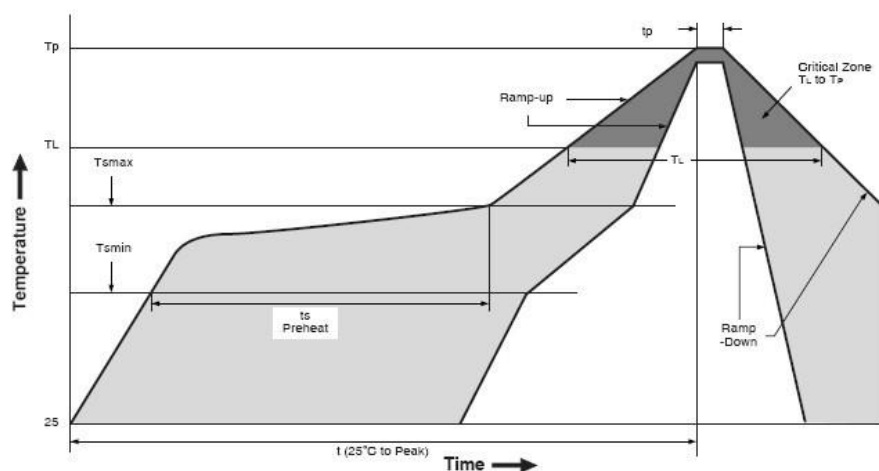


# MSM261DHT006

PDM digital output MEMS microphone



## 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.



# MSM261DHT006

PDM digital output MEMS microphone



## RECOMMENDED INTERFACE CIRCUIT:

Figure 1. MSM261DHT006 electrical connections

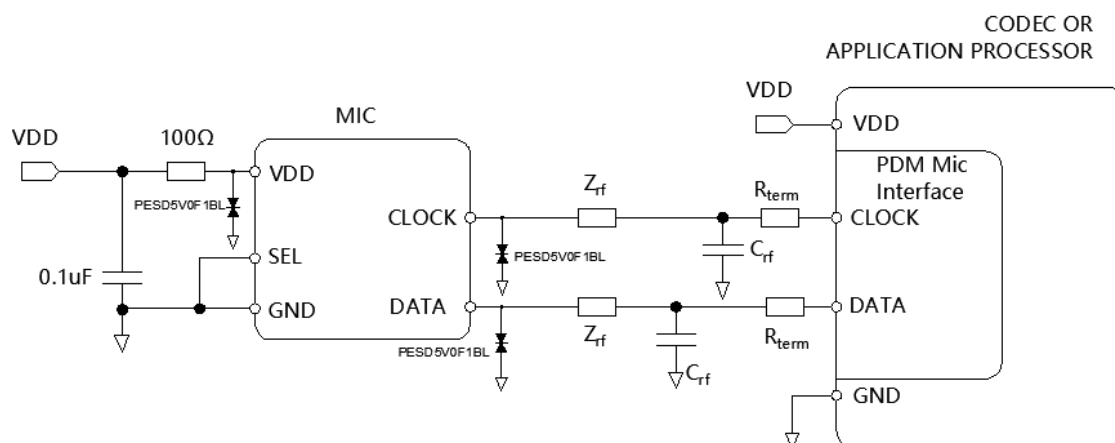
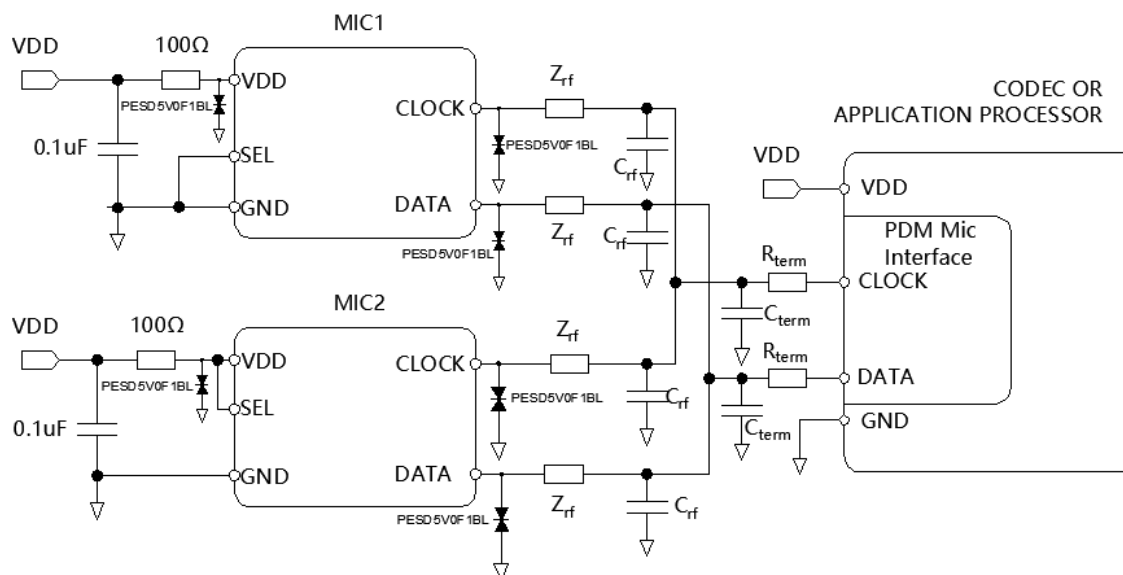
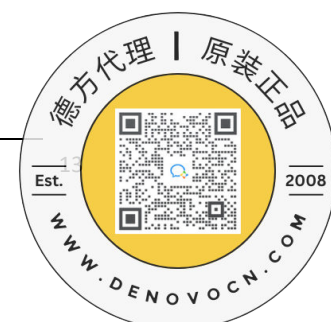


Figure 2. Electrical connections for stereo configurations



Power supply decoupling capacitors (0.1μF 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.



## MSM261DHT006

PDM digital output MEMS microphone



### 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.





# MSM261DHT006

PDM digital output MEMS microphone



## REVISION HISTORY:

| Revision | Subjects (major changes since last revision) | Date       |
|----------|----------------------------------------------|------------|
| 1.0      | Initial Release                              | 2022-07-13 |

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