



PRODUCT INFORMATION

Part Numbers **CEM-DB60221-283AD-L01CAR-00-0** **Revision** **2-2018**

Type **Omni-Directional Digital Electret Condenser Microphone**

Description This DECM (Digital electret condenser microphone) and an ECM consists of a preamplifier ,a delta sigma modulator ,and on chip voltage regulator. The A/D conversion is performed by a 4th order $\Delta\Sigma$ modulator.



Compliance ➤ **RoHS, Lead Free**
 ➤ **ISO 9001:2000**



| Date | ECN # | Rev # | Description | Page | Prepared By | Approved By |
|------|-------|-------|-------------|------|-------------|-------------|
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1. Electrical Characteristics

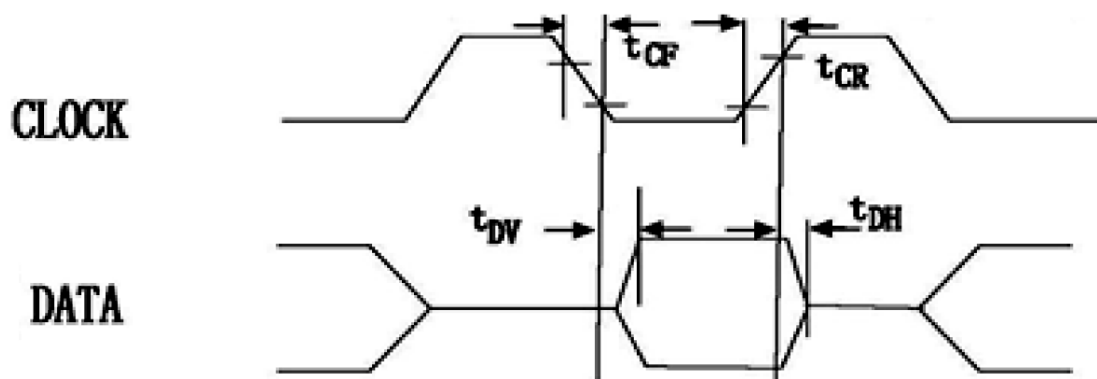
This DECM (Digital electret condenser microphone) and an ECM consists of a preamplifier ,a delta sigma modulator ,and on chip voltage regulator. The A/D conversion is performed by a 4th order $\Delta\Sigma$ modulator.

| No | Parameter | Symbol | Min | Typ | Max | Unit | Comments |
|------|------------------------------------|----------|------------|--------------|------------|------|--------------------------------------|
| 1.1 | Sensitivity(analog signals output) | S | -31 | -28 | -25 | dB | 0dB=1V/Pa, at 1kHz |
| 1.2 | Noise transfer function cut-off | NTF | | 0.055 x fCLK | | MHz | Relative to fCLK |
| 1.3 | Modulator order | | | 4 | | | Given by design |
| 1.4 | Idle mode tone frequency | fT | 22 | | | KHz | @ Fclk=1 MHz |
| 1.5 | Clock freq.(sample rate) | fCLK | 1 | 2.4 | 3 | MHz | |
| 1.6 | Clock duty cycle | fDC | 40 | 50 | 60 | % | |
| 1.7 | Jitter tolerance | δ | | | 0.5 | ns | |
| 1.8 | Output Voltage low | VIOL | -0.3 | | 0.35 X VDD | V | |
| 1.9 | Output Voltage high | VIOH | 0.65 X VDD | | VDD+0.3 | V | |
| 1.10 | Output current at high voltage | IH | 1 | | 10 | mA | Short circuit current |
| 1.11 | Extended Vdd range | | 2.4 | 3.3 | 3.63 | V | |
| 1.12 | Signal to Noise Ratio | S/N | 57 | | | dB | at 1kHz S.P.L=1Pa (A-Weighted Curve) |

2. Digital Logic Characteristics

| Symbol | Parameter | Min | Typical | Max | Units |
|-----------------|--|---------------|---------|---------------|-------|
| V_{IT+} | Positive-going input threshold voltage | | 1.82 | | V |
| V_{IT-} | Negative-going input threshold voltage | | 1.27 | | V |
| ΔV_{IT} | Input hysteresis | | 0.55 | | V |
| V_{IOL} | Data input/output logic low level | -0.3 | | $0.35*V_{DD}$ | V |
| V_{IOH} | Data input/output logic high level | $0.65*V_{DD}$ | | $V_{DD}+0.3$ | V |

| | High Impedance | Data sampled at |
|-------------|----------------|-----------------|
| DATA | Falling clock | Rising clock |



Timing diagram of CLK and DATA signals



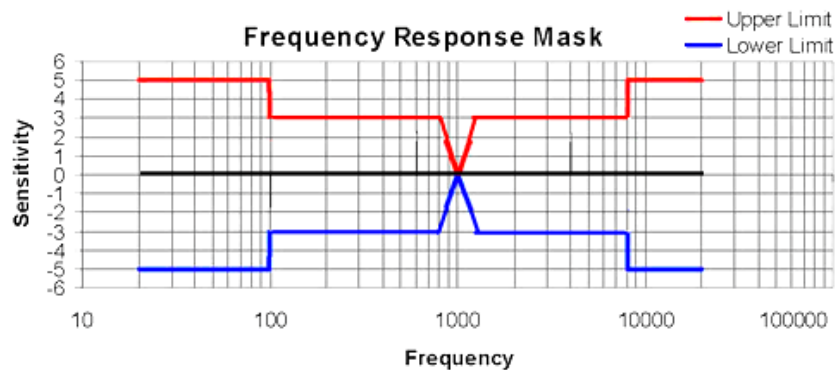
3. Frequency Response Curve

The microphone must fulfill the relative frequency response tolerance window specifications with the following measurement conditions.

- TEMPERATURE: +20°C
- ACOUSTIC STIMULUS: 1Pa (94dB SPL) - measured at 50 cm from the Hi-Fi loudspeaker. The loudspeaker must be equalized for flat frequency response.
- POSITION: The far field measurement point is located 50cm from the Hi-Fi speaker. The speaker must be positioned away from any reflecting surfaces. The 1Pa acoustic stimulus is at the microphone position.

Frequency Response Mask for Digital microphones

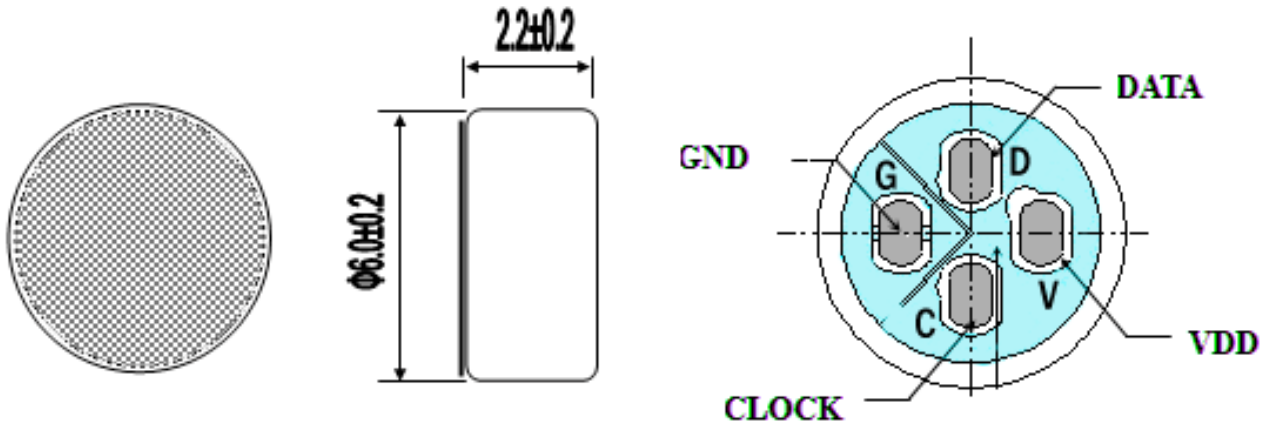
| Frequency / Hz | Lower limit | Upper limit | Unit |
|-----------------|-------------|-------------|----------|
| 20 ... 100 | -5 | +5 | dBr 1kHz |
| 100 ... 8000 | -3 | +3 | dBr 1kHz |
| 8000 ... 20 000 | -5 | +5 | dBr 1kHz |



NOTE: The distribution of the sensitivity must be a Normal Distribution and the Cpk value for the sensitivity must be at least 1.66 in all conditions.

4. Mechanical Characteristics

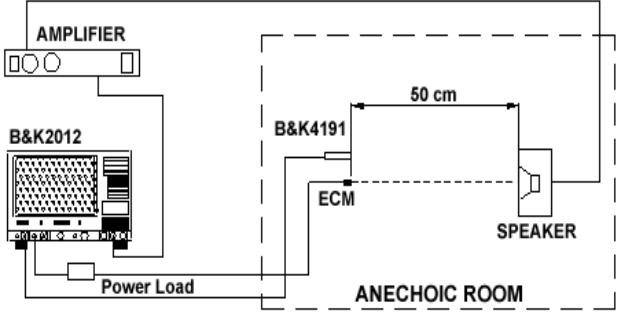
- 4.1. Weight: 0.3 grams
- 4.2. All dimensions in millimeter (mm).
- 4.3. Tolerance: as specified.
- 4.4. Microphone Dimensions: 6.0 mm x 2.2 mm



| Name | Function |
|-----------------|--|
| GND | Ground |
| CLK | User-adjustable clock input to microphone |
| DATA | Microphone PDM data output |
| V _{DD} | Power supply and IO voltage for microphone |



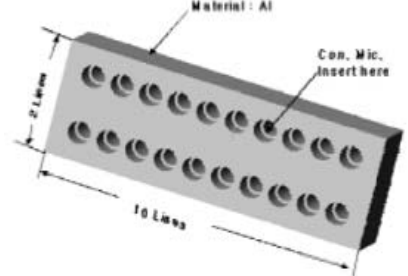
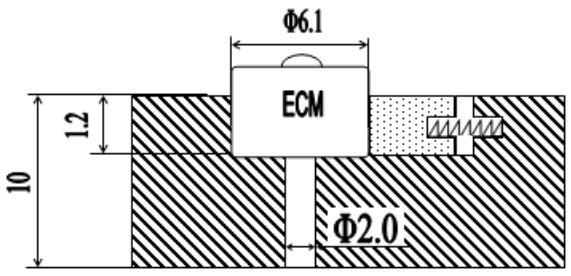
5. Measurement Circuit

| Measurement Set Up | Measurement Conditions |
|---|---|
|  <p>The diagram shows a measurement setup within an anechoic room. An amplifier is connected to a B&K2012 microphone and a speaker. A B&K4191 microphone is positioned 50 cm from the speaker. An ECM is also connected to the speaker. A power load is connected to the amplifier.</p> | <p>In Normal Weather</p> <p>Environment Temperature: 5~+35°C Relative Humidity: 45 ~ 85% Air Pressure: 86 ~ 106Kpa</p> <p>In Arbitrate Weather</p> <p>Environment Temperature: 20±2°C Relative Humidity: 60 ~ 70% Air Pressure: 86 ~ 106Kpa</p> |
| Testing Procedure | |
| <ol style="list-style-type: none"> 1. Measure the microphones under standard operating condition. 2. Put the microphone and standard microphone face to the sound source (speaker), the distance between sound source and microphone & standard microphone is 50 cm. And keep the center distance 5cm between them to ensure that the change of sound pressure should be kept within ± 1 dB. 3. Keep the sound source pressure within ± 1 dB from speaker Measured by standard microphone. 4. The sensitivity of microphone can obtain its output voltage when sound source kept within 1,000 Hz. & 0.1 Pa. | |



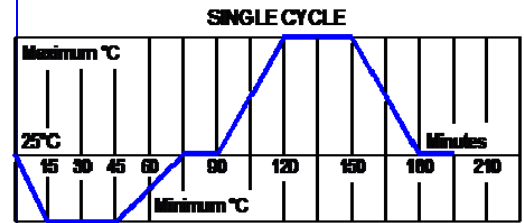
6. Soldering Condition

- 6.1. We suggest using anti-static welding machine which can control soldering temperature automatically.
- 6.2. Soldering temperature should be controlled under 320°C and soldering time for each terminal should be 1~2 seconds
- 6.3. Microphone should be fixed on the metal block (heat sink), which has high radiation effects, and heat sink shall contact with MIC tightly.
- 6.4. Microphone may easily be destroyed by the static electricity and the countermeasure for eliminating the static electricity shall be executed (worktable and human body shall be ground connection)
- 6.5. Heat Sink

| | |
|---|--|
| 6.5.a. Shape of heat sink | 6.5.b. Shape of hole at fixed part |
|  |  |

7. Reliability

| | |
|--|---|
| Thermal Operating Temperature Test | 240 hours continuous operation at Rated Voltage , at Maximum Rated Operating Temperature * 240 hours continuous operation at Rated Voltage , at Minimum Rated Operating Temperature * |
| Thermal Storage Temperature Test | 96 hours storage at Maximum Rated Storage Temperatures * 96 hours storage at Minimum Rated Storage Temperatures * |
| Temperature Shock | 30 cycles of Minimum and Maximum Operating Temperature Each cycle shall be set per diagram and is 3 hours long * |
| Highly Accelerated Temperature and Humidity Stress Test (HAST) | The DUTs are soldered onto a test PCB. The PCB is placed in the oven and the input terminal leads are brought out and connected to the electrical power supply. The test PCB is powered up using the electrical power supply that is designed to maintain a constant voltage of the maximum rated voltage for the duration of the test. The oven is programmed to maintain a temperature of 110°C , 85% RH for 264 hours with a pressure of 122 KPa introduced * |
| Humidity Test | Precondition at +25°C for 1 hour . Then expose to +70°C with 90 to 95% relative humidity for 120 hours * |
| ESD Sensitivity | Perform ESD sensitivity threshold measurements for each contact according to MIL-STD-883G, Method 3,015.7 for Human Body Model. Identify the ESD threshold levels indicating passage of 8,000V Human Body Model. * |
| Termination Strength | Maximum of 9.8 N (1.0 Kg) load pull test, applied to each terminal in axial direction for 1 minute |
| Drop Test | Samples are mounted on a test PCB. The PCB itself was then glued onto a metal fixture slightly bigger than the PCB. The fixture was dropped naturally from the 1.5 m height onto a steel surface. The test was repeated in six directions for three times , total 18 times and inspected for mechanical damage * |
| Random Vibrations | Vibrate randomly along three perpendicular directions for 30 minutes in each direction . The Power Spectral Density of the vibration had a + 3 dB/octave rise from 20 Hz to 80 Hz , a constant value of 0.053 g²/Hz from 80 Hz. to 350 Hz and finally a -3 dB/octave drop from 350 Hz to 2,000 Hz . Having subjected the units to vibration, they were tested for all electrical and acoustic parameters |
| Mechanical Shock | Subject samples to half sine shock pulses (3,000 g's ±15% for 0.3 ms) in each direction, totally 6 shocks |
| Sinusoidal Vibration | Vibrate randomly from 10 Hz to 55 Hz , 1 octave/minute with 2 mm amplitude (peak to peak) for 2 hours in each direction For this test are that the PCB must deflect at least 1mm before mechanical failure of the unit occurs |
| Life Test | Subject samples to +125°C for 168 hours under full maximum rated voltage |
| * Reliability Test Performance | Parts should conform to original performance within ±3 dB , after 3 hours of recovery period |





8. Concept of Unit

The difference between concept of “PASCAL” unit and the one unit “ μbar ” can be explained as follows: In calibrating the sensitivity of ECMs, the sensitivity is manifested differently according as the units “PASCAL” or “ μbar ”. For example:

$$-60 \text{ dB (0 dB = 1 V / } \mu\text{bar)} - -42 \text{ dB (0 dB = 1 V / Pa)}$$

9. Construction Materials

| ITEM | PART NAME | MATERIAL | QTY |
|------|---------------------|--------------|-----|
| 10 | Chip Capacitor | 100000PF | 1 |
| 9 | IC | | 1 |
| 8 | P.C.B | FR-4 | 1 |
| 7 | Copper Ring | | 1 |
| 6 | HOUSING CHAMBER | | 1 |
| 5 | ELECTRET BACK | | 1 |
| 4 | SPACER | | 1 |
| 3 | POLARIZED DIAPHRAGM | | 1 |
| 2 | CASE | AL-mg alloy | 1 |
| 1 | FELT | Fabric cloth | 1 |






10. Part Number Description

| Code | Description |
|------|----------------------------------|
| CEM | Challenge Electronics Microphone |
| - | dash |
| D | Digital |
| B | Back Electret |
| 60 | 6.0 mm diameter |
| 22 | 2.2 mm height |
| 1 | PCB Type |
| - | dash |
| 283 | Sensitivity 28 ± 3 dB |
| A | |
| D | |
| - | dash |
| L01 | Solder termination |
| CAR | Capacitor |
| - | dash |
| 00 | |
| - | dash |
| 0 | |

11. Warranty

For a period of one (1) year from date of shipping under normal handling and operations conditions
This warranty does not apply to products damaged through misuse, abuse, improper installation, alteration, rework, or attempt to repair

12. Packaging

| | | | | |
|---|--------------------------|---------------------|----------------|----------------|
| <p>100 Parts →  X 1</p> <p>↓ X 10</p> <p>1.000 Parts →  X 10</p> <p>↓ X 30</p> <p>30.000 Parts →  X 30</p> | MARKING | Small Box | | |
| | Middle Box | Dimensions | X1 | 8 cm |
| | Part Number | | Y1 | 8 cm |
| | Other PN if required | | Z1 | 1 cm |
| | Quantity | Quantity | | 100 |
| | Lot and/or Date Code | Middle Box | | |
| | Bundle Number | Dimensions | X2 | 17.5 cm |
| | Shipping Box | | Y2 | 8.5 cm |
| | Part Number | | Z2 | 5 cm |
| | Other PN (if required) | Quantity | 1,000 | |
| | Quantity | SHIPPING BOX | | |
| | Lot and/or Date Code | Dimensions | X3 | 55 cm |
| | PO Number | | Y3 | 23 cm |
| | Net Weight | | Z3 | 23.5 cm |
| | Gross Weight | Number of Bundles | | 30 |
| Box Number of Boxes | Quantity | | 30,000 | |
| Made in China | Approximate Gross Weight | | 9.9 Kg. | |

| Revision | Description | By | Date |
|----------|---|------------|------------|
| 1-2014 | Added Product Photo | W. Sargent | 7/21/2014 |
| 2-2018 | Removed L/R_SELECT from Digital Log Characteristics. Updated Timing Diagram and Mechanical Drawing. | JL | 2018-08-01 |
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