ON Semiconductor®

# 3-Channel Headset Microphone EMI Filter with ESD Protection

# CSPEMI205G

## Features

- Three channels of EMI filtering, two for earpiece speakers and one for a microphone
- Pi-style EMI filters in a capacitor-resistor-capacitor (C-R-C) network
- Chip Scale Package features extremely low parasitic inductance for optimum filter performance
- Greater than 30dB relative attenuation in the 800-2700MHz range
- ±8kV ESD protection on each channel (IEC 61000-4-2 Level 4, contact discharge)
- ±15kV ESD protection on each channel (HBM)
- 8-bump, 1.41mm X 1.430mm footprint Chip Scale Package (CSP)
- RoHS compliant (lead-free) finishing

## Applications

- EMI filtering and ESD protection for headset microphone and speaker
- Cellular / Mobile Phones
- Notebooks and Personal Computers
- Handheld PCs / PDAs / Tablets
- Wireless Handsets
- Digital Camcorders

## Product Description

The CSPEMI205G is a low-pass filter array integrating three pi-style filters (C-R-C) that reduce EMI/RFI emissions while at the same time providing ESD protection. This device is custom-designed to interface with the headset port on a cellular telephone, and contains two different filter values. Each high quality filter provides more than 30dB attenuation in the 800-2700 MHz range. These pi-style filters support bidirectional filtering, controlling EMI both to and from the microphone and speaker elements. They also support bipolar signals, enabling audio signals to pass through without distortion.

In addition, the CSPEMI205G provides a very high level of protection for sensitive electronic components that may be subject to electrostatic discharge (ESD). The input pins safely dissipate ESD strikes of ±8kV, the maximum requirement of the IEC 61000-4-2 international standard. Using the MIL-STD-883 (Method 3015) specification for Human Body Model (HBM) ESD, the device provides protection for contact discharges to greater than ±15kV.

The CSPEMI205G is particularly well suited for portable electronics (e.g., cellular telephones, PDAs, notebook computers) because of its small package format and low weight. The CSPEMI205G is available in a space-saving, low-profile Chip Scale Package with RoHS compliant lead-free finishing.


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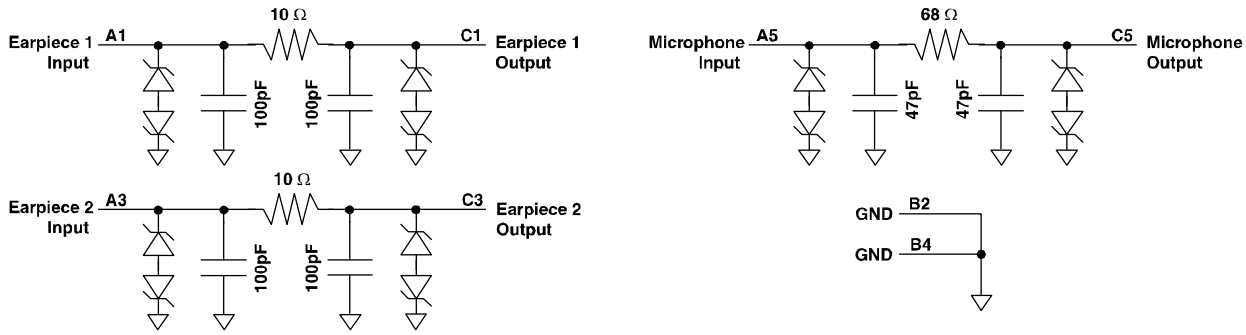
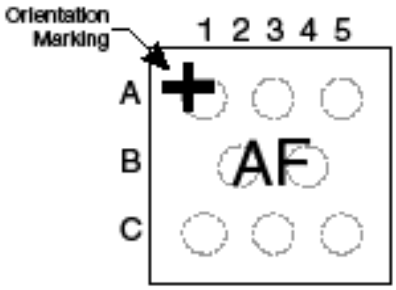
CSPEMI205G/D

## Electrical Schematic

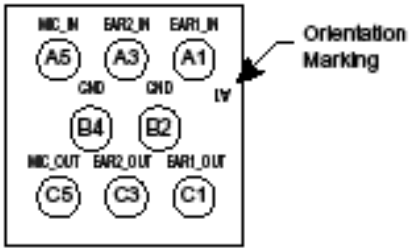



## PACKAGE / PINOUT DIAGRAMS

TOP VIEW
(Bumps Down View)




BOTTOM VIEW
(Bumps Up View)




CSPEMI205
CSP Package

Note:
1) These drawings are not to scale.

| PIN DESCRIPTIONS | | |
|---|---|---|
| **PIN** | **NAME** | **DESCRIPTION** |
| A1 | EAR1_IN | Earpiece Input 1 (from audio circuitry) |
| A3 | EAR2_IN | Earpiece Input 2 (from audio circuitry) |
| A5 | MIC_IN | Microphone Input (from microphone) |
| B2 | GND | Device Ground |
| B4 | GND | Device Ground |
| C1 | EAR1_OUT | Earpiece Output 1 (to earpiece) |
| C3 | EAR2_OUT | Earpiece Output 2 (to earpiece) |
| C5 | MIC_OUT | Microphone Output (to audio circuitry) |

## Ordering Information

| PART NUMBERING INFORMATION | | | |
|---|---|---|---|
| **Bumps** | **Package** | **Ordering Part Number[1]** | **Part Marking** |
| 8 | CSP | CSPEMI205G | AF |

Note 1: Parts are shipped in Tape & Reel form unless otherwise specified.

## Specifications

| ABSOLUTE MAXIMUM RATINGS | | |
|---|---|---|
| **PARAMETER** | **RATING** | **UNITS** |
| Storage Temperature Range | -65 to +150 | °C |
| DC Power per Resistor | 100 | mW |
| DC Package Power Rating | 300 | mW |

## STANDARD OPERATING CONDITIONS

| PARAMETER | RATING | UNITS |
|---|---|---|
| Operating Temperature Range | -40 to +85 | ℃ |

## ELECTRICAL OPERATING CHARACTERISTICS (NOTE 1)

| SYMBOL | PARAMETER | CONDITIONS | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|---|
| $R_1$ | Resistance | | 9 | 10 | 11 | Ω |
| $R_2$ | Resistance | | 54 | 68 | 75 | Ω |
| $C_1$ | Capacitance | | 80 | 100 | 120 | pF |
| $C_2$ | Capacitance | | 38 | 47 | 57 | pF |
| $I_{LEAK}$ | Diode Leakage Current | $V_{IN}$=5.0V | | | 1.0 | μA |
| $V_{SIG}$ | Signal Voltage<br>Positive Clamp<br>Negative Clamp | $I_{LOAD}$ = 10mA | <br>5<br>-15 | <br>7<br>-10 | <br>15<br>-5 | <br>V<br>V |
| $V_{ESD}$ | In-system ESD Withstand Voltage<br>a) Human Body Model, MIL-STD-883, Method 3015<br>b) Contact Discharge per IEC 61000-4-2 Level 4 | Notes 2 and 4 | <br>±15<br>±8 | | | <br>kV<br>kV |
| $V_{CL}$ | Clamping Voltage during ESD Discharge MIL-STD-883 (Method 3015), 8kV<br>Positive Transients<br>Negative Transients | Notes 2,3 and 4 | | <br>+15<br>-19 | | <br>V<br>V |
| $f_{C1}$ | Cut-off frequency 1; Note 5 | R = 10Ω, C = 100pF | | 34 | | MHz |
| $f_{C2}$ | Cut-off frequency 2; Note 5 | R = 68Ω, C = 47pF | | 63 | | MHz |

Note 1: $T_A$=25℃ unless otherwise specified.
Note 2: ESD applied to input and output pins with respect to GND, one at a time.
Note 3: Clamping voltage is measured at the opposite side of the EMI filter to the ESD pin. For example, if ESD is applied to Pin A1, then clamping voltage is measured at Pin C1.
Note 4: Unused pins are left open.
Note 5: $Z_{SOURCE}$=50Ω, $Z_{LOAD}$=50Ω

## Performance Information

**Typical Filter Performance (nominal conditions unless specified otherwise, 50 Ohm Environment)**

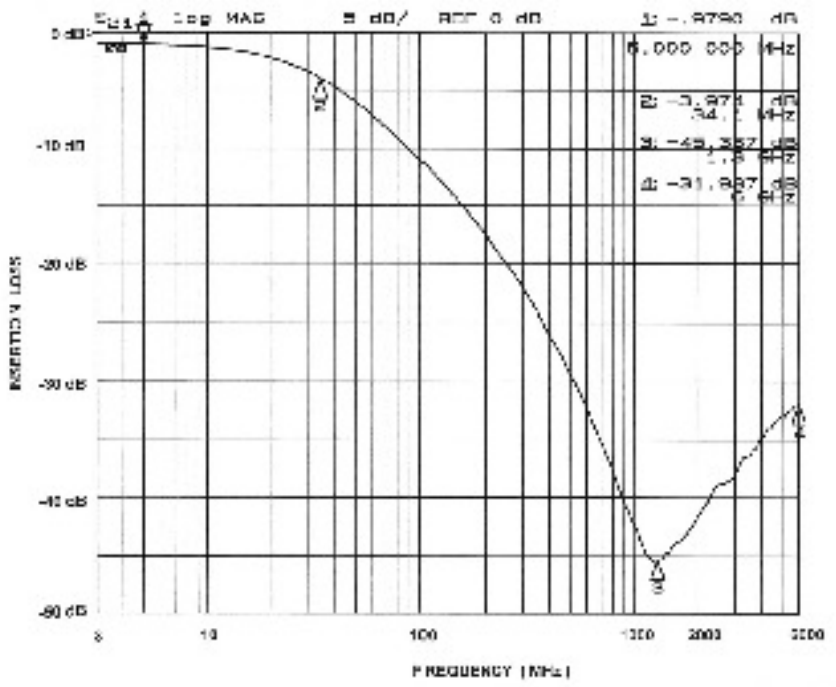



**Figure 1. Earpiece Circuit (A1-C1) EMI Filter Performance**

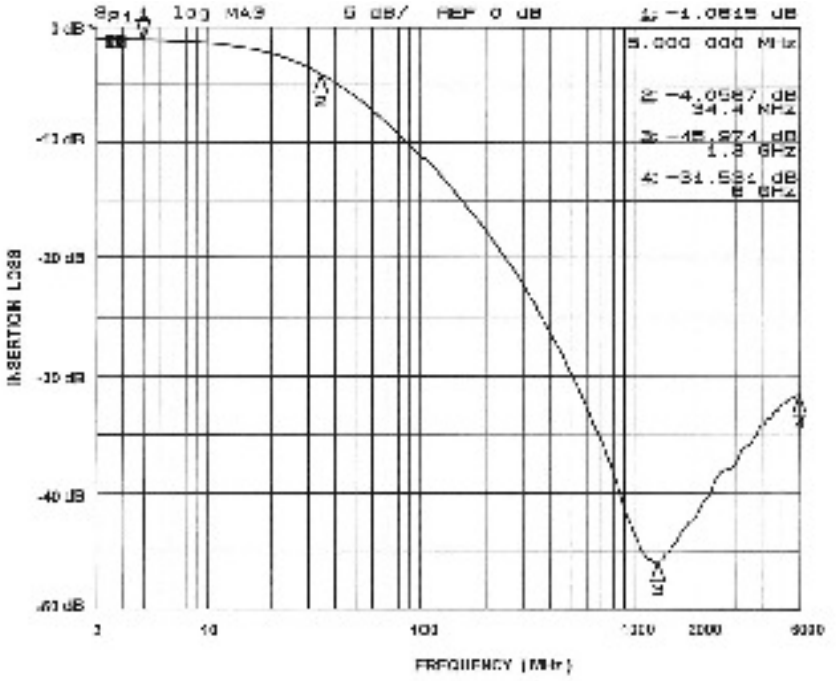



**Figure 2. Earpiece Circuit (A3-C3) EMI Filter Performance**

## Performance Information (cont'd)

**Typical Filter Performance (nominal conditions unless specified otherwise, 50 Ohm Environment)**

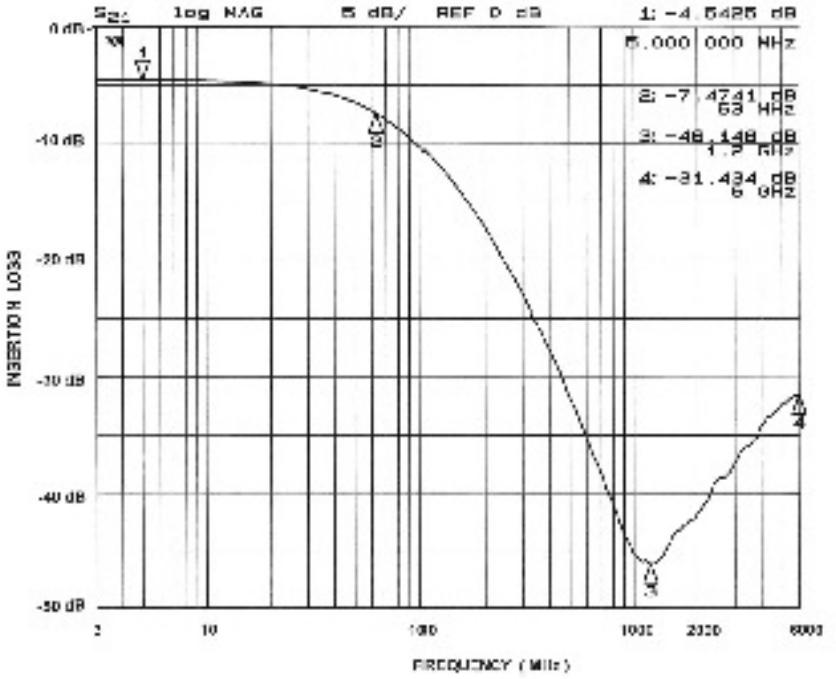



**Figure 3. Microphone Circuit (A5-C5) EMI Filter Performance**

## Application Information

| PARAMETER | VALUE |
|---|---|
| Pad Size on PCB | 0.240mm |
| Pad Shape | Round |
| Pad Definition | Non-Solder Mask defined pads |
| Solder Mask Opening | 0.290mm Round |
| Solder Stencil Thickness | 0.125mm - 0.150mm |
| Solder Stencil Aperture Opening (laser cut, 5% tapered walls) | 0.300mm Round |
| Solder Flux Ratio | 50/50 by volume |
| Solder Paste Type | No Clean |
| Pad Protective Finish | OSP (Entek Cu Plus 106A) |
| Tolerance — Edge To Corner Ball | ±50μm |
| Solder Ball Side Coplanarity | ±20μm |
| Maximum Dwell Time Above Liquidous | 60 seconds |
| Maximum Soldering Temperature for Lead-free Devices using a Lead-free Solder Paste | 260°C |

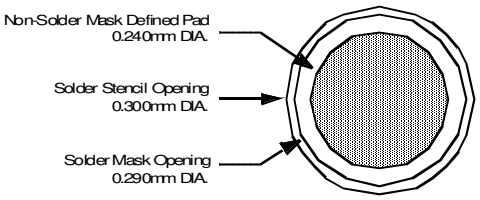



**Figure 8. Recommended Non-Solder Mask Defined Pad Illustration**

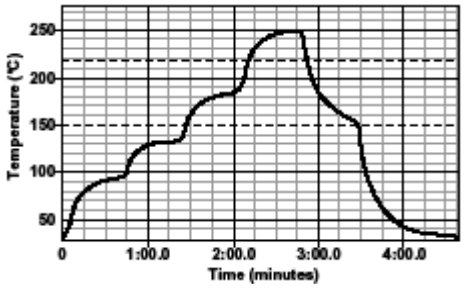


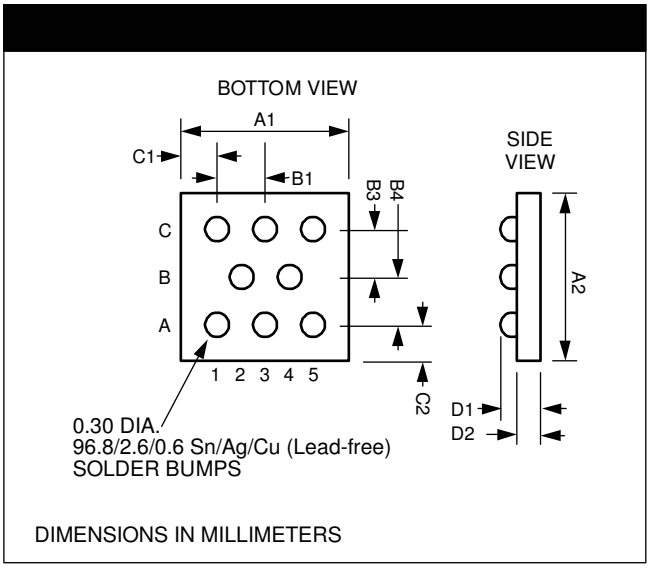

**Figure 9. Lead-free (SnAgCu) Solder Ball Reflow Profile**

## Mechanical Details

### CSP Mechanical Specifications

The CSPEMI205G is supplied in a custom Chip Scale Package (CSP). Dimensions are presented below. For complete information on CMD's chip scale packaging, see the California Micro Devices CSP Package Information document.

| PACKAGE DIMENSIONS | | | | | | |
|---|---|---|---|---|---|---|
| **Package** | Custom CSP | | | | | |
| **Bumps** | 8 | | | | | |
| **Dim** | **Millimeters** | | | **Inches** | | |
| | **Min** | **Nom** | **Max** | **Min** | **Nom** | **Max** |
| **A1** | 1.385 | 1.430 | 1.475 | 0.0545 | 0.0563 | 0.0581 |
| **A2** | 1.365 | 1.410 | 1.455 | 0.0537 | 0.0555 | 0.0573 |
| **B1** | 0.495 | 0.500 | 0.505 | 0.0195 | 0.0197 | 0.0199 |
| **B2** | 0.245 | 0.250 | 0.255 | 0.0096 | 0.0098 | 0.0100 |
| **B3** | 0.430 | 0.435 | 0.440 | 0.0169 | 0.0171 | 0.0173 |
| **B4** | 0.430 | 0.435 | 0.440 | 0.0169 | 0.0171 | 0.0173 |
| **C1** | 0.165 | 0.215 | 0.265 | 0.0065 | 0.0085 | 0.0104 |
| **C2** | 0.220 | 0.270 | 0.320 | 0.0087 | 0.0106 | 0.0126 |
| **D1** | 0.561 | 0.605 | 0.649 | 0.0221 | 0.0238 | 0.0256 |
| **D2** | 0.355 | 0.380 | 0.405 | 0.0140 | 0.0150 | 0.0160 |
| **# per tape and reel** | 3500 pieces | | | | | |
| Controlling dimension: millimeters | | | | | | |




**Package Dimensions for CSPEMI205G**
**Chip Scale Package**

## CSP Tape and Reel Specifications

| PART NUMBER | CHIP SIZE (mm) | POCKET SIZE (mm) $B_0$ X $A_0$ X $K_0$ | TAPE WIDTH W | REEL DIAMETER | QTY PER REEL | $P_0$ | $P_1$ |
|---|---|---|---|---|---|---|---|
| CSPEMI205G | 1.43 x 1.41 x 0.605 | 1.55 x 1.52 x 0.71 | 8mm | 178mm (7") | 3500 | 4mm | 4mm |

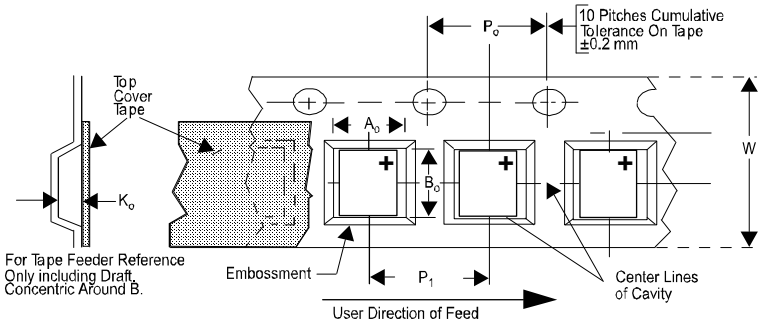



**Figure 6. Tape and Reel Mechanical Data**



**PUBLICATION ORDERING INFORMATION**

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