

## 3 Channel Headset EMI Filter with ESD Protection

### Features

- Functionally and pin compatible with California Micro Device's CSPEMI205
- Optiguard™ coated for improved reliability at assembly
- 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
- Greater than 30dB relative attenuation in the 800-2700MHz range
- $\pm 8\text{kV}$  ESD protection on each channel (IEC 61000-4-2 Level 4, contact discharge)
- $\pm 15\text{kV}$  ESD protection on each channel (HBM)
- 8-bump, 1.41mm X 1.45mm footprint
- Chip Scale Package (CSP)
- Chip Scale Package features extremely low parasitic inductance for optimum filter performance
- Lead-free version available

### 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

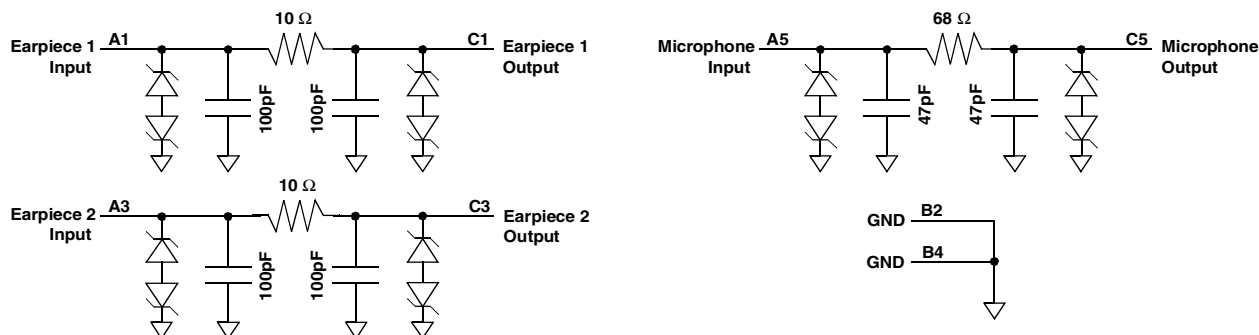
The CM1415 is a low-pass filter array integrating three pi-style filters (C-R-C) that reduce EMI/RFI emissions while at the same time providing ESD protection. This device is custom-designed to interface with the headset port on a cellular telephone, and contains two different filter values. Each high 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.

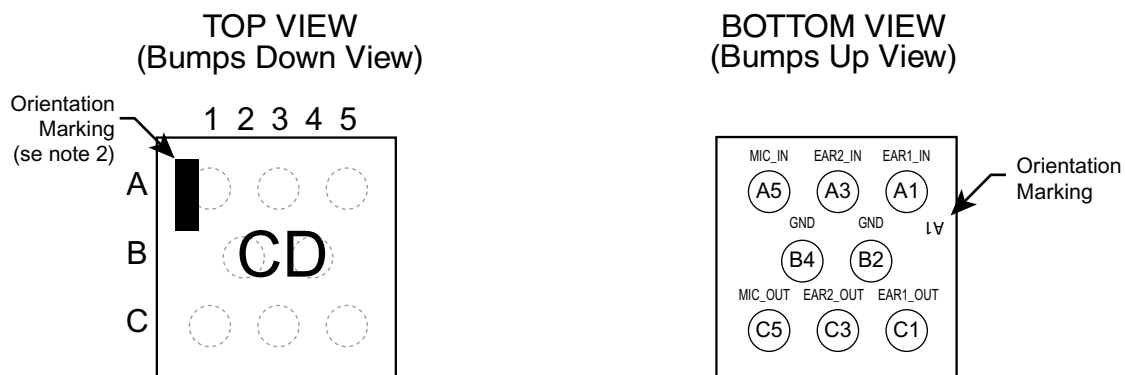
In addition, the CM1415 provides a very high level of protection for sensitive electronic components that may be subject to electrostatic discharge (ESD). The input pins are designed and characterized to safely dissipate ESD strikes of  $\pm 8\text{kV}$ , the maximum requirement of the IEC 61000-4-2 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  $\pm 15\text{kV}$ .

The CM1415 is particularly well suited for portable electronics (e.g., cellular telephones, PDAs, notebook computers) because of its small package format and low weight.

The CM1415 incorporates Optiguard™ coating which results in improved reliability at assembly. The CM1415 is available in a space-saving, low-profile Chip Scale Package with optional lead-free finishing.

### Electrical Schematic



**PACKAGE / PINOUT DIAGRAMS**


**CM1415**  
**CSP Package**

Note:

- 1) These drawings are not to scale.
- 2) Lead-free devices are specified by using a "+" character for the top side orientation mark.

**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 | Standard Finish                   |              | Lead-free Finish <sup>2</sup>     |              |
|-------|---------|-----------------------------------|--------------|-----------------------------------|--------------|
|       |         | Ordering Part Number <sup>1</sup> | Part Marking | Ordering Part Number <sup>1</sup> | Part Marking |
| 8     | CSP     | CM1415-03CS                       | CD           | CM1415-03CP                       | CD           |

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

Note 2: Lead-free devices are specified by using a "+" character for the top side orientation mark.

## 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 | °C    |

### ELECTRICAL OPERATING CHARACTERISTICS<sup>1</sup>

| SYMBOL            | PARAMETER  | CONDITIONS               | MIN       | TYP        | MAX       | UNITS    |
|-------------------|--|--------------------------|-----------|------------|-----------|----------|
| R <sub>1</sub>    | Resistance   |                          | 9         | 10         | 11        | Ω        |
| R <sub>2</sub>    | Resistance   |                          | 54        | 68         | 75        | Ω        |
| C <sub>1</sub>    | Capacitance  |                          | 80        | 100        | 120       | pF       |
| C <sub>2</sub>    | Capacitance  |                          | 38        | 47         | 57        | pF       |
| I <sub>LEAK</sub> | Diode Leakage Current  | V <sub>IN</sub> =5.0V    |           |            | 1.0       | μA       |
| V <sub>SIG</sub>  | Signal Voltage<br>Positive Clamp<br>Negative Clamp   | I <sub>LOAD</sub> = 10mA | 5<br>-5   | 7<br>-10   | 15<br>-15 | V<br>V   |
| V <sub>ESD</sub>  | In-system ESD Withstand Voltage<br>a) Human Body Model, MIL-STD-883,<br>Method 3015<br>b) Contact Discharge per IEC 61000-4-2<br>Level 4 | Notes 2,4 and 5          | ±15<br>±8 |            |           | kV<br>kV |
| V <sub>CL</sub>   | Clamping Voltage during ESD Discharge<br>MIL-STD-883 (Method 3015), 8kV<br>Positive Transients<br>Negative Transients                    | Notes 2,3,4 and 5        |           | +15<br>-19 |           | V<br>V   |
| f <sub>C1</sub>   | Cut-off frequency 1; Note 6  | R = 10Ω, C = 100pF       |           | 34         |           | MHz      |
| f <sub>C2</sub>   | Cut-off frequency 2; Note 6  | R = 68Ω, C = 47pF        |           | 63         |           | MHz      |

Note 1: T<sub>A</sub>=25°C 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: The parameters are guaranteed by design.

Note 6: Z<sub>SOURCE</sub>=50Ω, Z<sub>LOAD</sub>=50Ω

## Performance Information

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

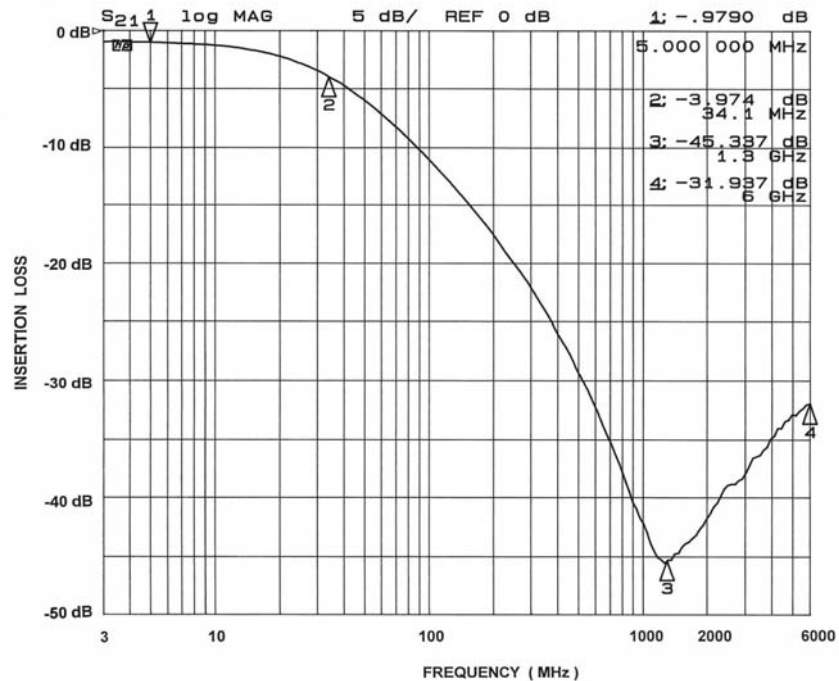


Figure 1. Earpiece Circuit (A1-C1) EMI Filter Performance

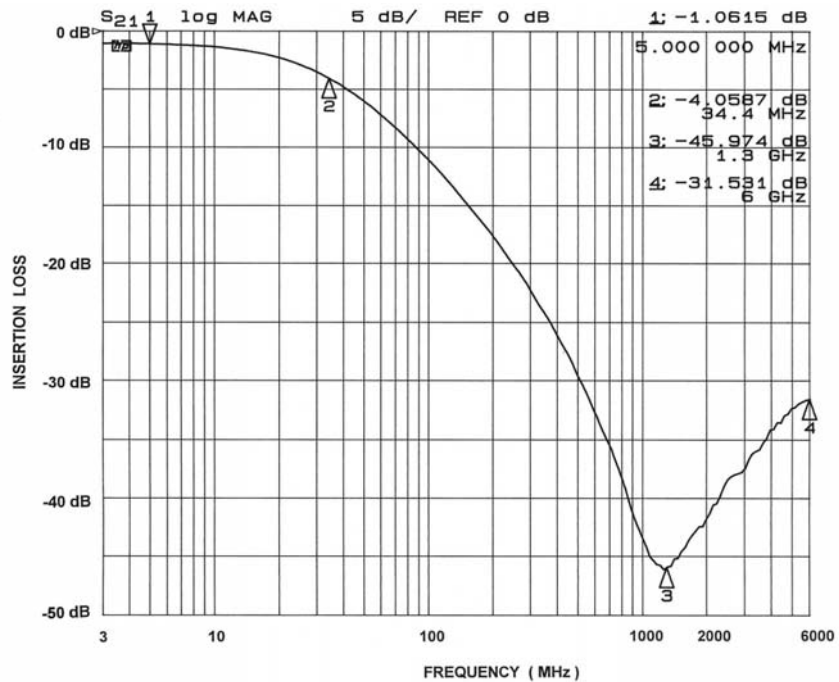


Figure 2. Earpiece Circuit (A3-C3) EMI Filter Performance

## Performance Information (cont'd)

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

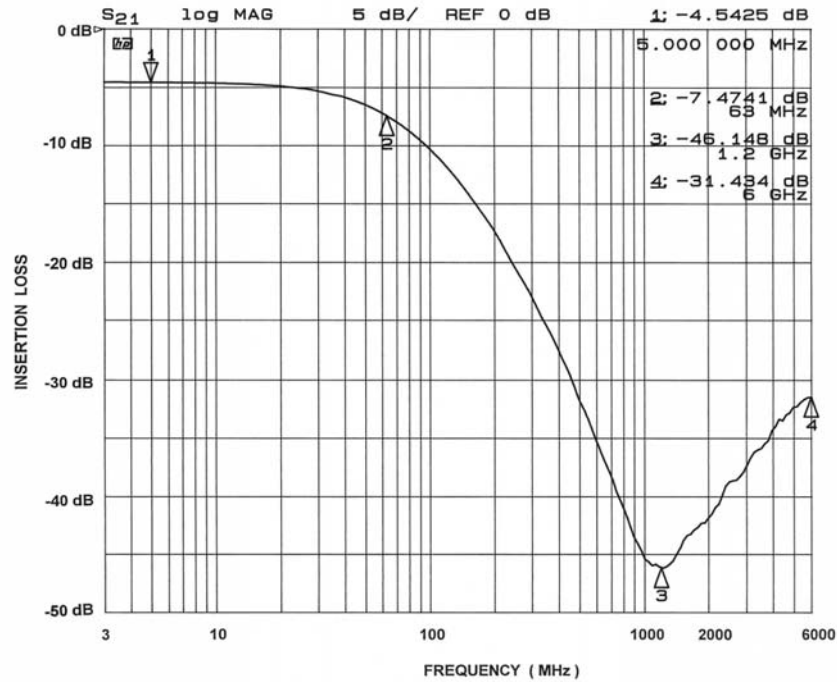


Figure 3. Microphone Circuit (A5-C5) EMI Filter Performance

## Application Information

Refer to Application Note AP-217, "The Chip Scale Package", for a detailed description of Chip Scale Packages offered by California Micro Devices.

### PRINTED CIRCUIT BOARD RECOMMENDATIONS

| PARAMETER   | VALUE                        |
|---|------------------------------|
| Pad Size on PCB   | 0.275mm Round                |
| Pad Definition  | Non-Solder Mask defined pads |
| Solder Mask Opening   | 0.325mm Round                |
| Solder Stencil Thickness                                      | 0.125 - 0.150mm              |
| Solder Stencil Aperture Opening (laser cut, 5% tapered walls) | 0.330mm 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                               | $\pm 50\mu\text{m}$          |
| Solder Ball Side Coplanarity                                  | $\pm 20\mu\text{m}$          |
| Maximum Dwell Time Above Liquidous                            | 60 seconds                   |
| Soldering Maximum Temperature                                 | 260°C                        |

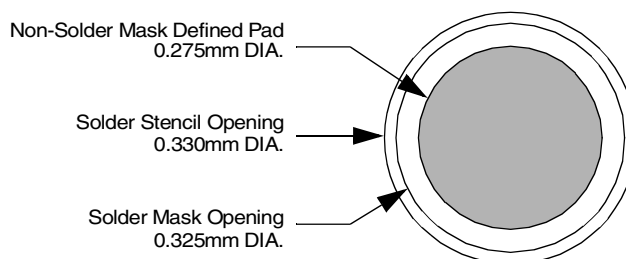


Figure 4. Recommended Non-Solder Mask Defined Pad Illustration

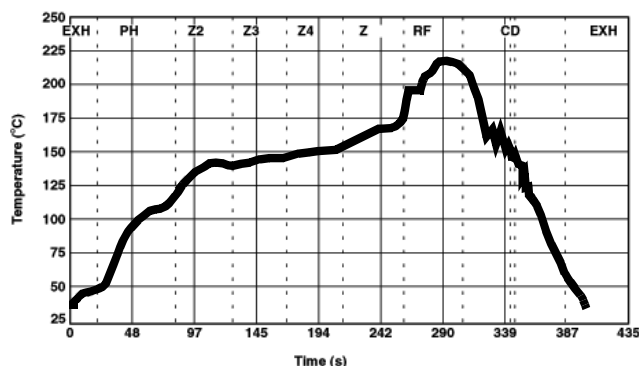


Figure 5. Eutectic (SnPb) Solder Ball Reflow Profile

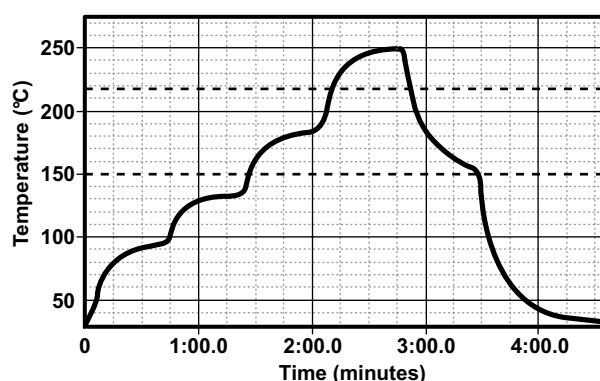


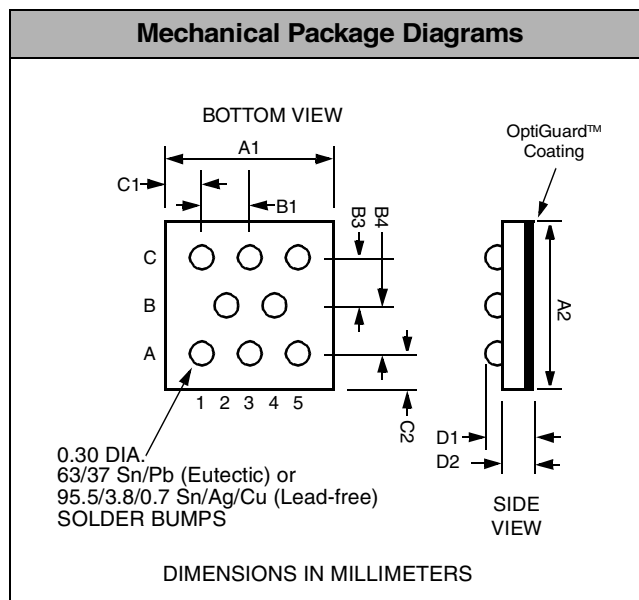
Figure 6. Lead-free (SnAgCu) Solder Ball Reflow Profile

## Mechanical Details

### CSP Mechanical Specifications

CM1415 devices are packaged in a custom Chip Scale Package (CSP). Dimensions are presented below. For complete information on CSP packaging, see the California Micro Devices CSP Package Information document.

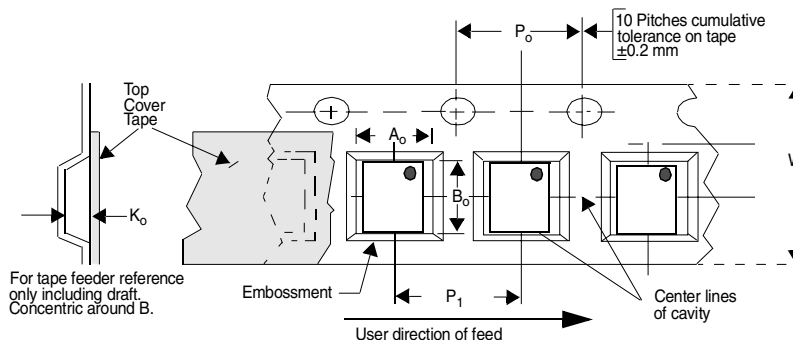
| PACKAGE DIMENSIONS                 |             |             |       |        |        |        |
|------------------------------------|-------------|-------------|-------|--------|--------|--------|
| Package                            |             | Custom CSP  |       |        |        |        |
| Bumps                              |             | 8           |       |        |        |        |
| Dim                                | Millimeters |             |       | Inches |        |        |
|                                    | Min         | Nom         | Max   | Min    | Nom    | Max    |
| A1                                 | 1.405       | 1.450       | 1.495 | 0.0553 | 0.0571 | 0.0589 |
| 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                                 | 0.175       | 0.225       | 0.275 | 0.0069 | 0.0089 | 0.0108 |
| C2                                 | 0.220       | 0.270       | 0.320 | 0.0087 | 0.0106 | 0.0126 |
| D1                                 | 0.600       | 0.670       | 0.739 | 0.0236 | 0.0264 | 0.0291 |
| D2                                 | 0.394       | 0.445       | 0.495 | 0.0155 | 0.0175 | 0.0195 |
| # per tape and reel                |             | 3500 pieces |       |        |        |        |
| Controlling dimension: millimeters |             |             |       |        |        |        |



**Package Dimensions for CM1415  
Chip Scale Package**

### CSP Tape and Reel Specifications

| PART NUMBER | CHIP SIZE (mm)    | POCKET SIZE (mm)<br>$B_0 \times A_0 \times K_0$ | TAPE WIDTH<br>W | REEL<br>DIAMETER | QTY PER<br>REEL | P <sub>0</sub> | P <sub>1</sub> |
|-------------|-------------------|---|-----------------|------------------|-----------------|----------------|----------------|
| CM1415      | 1.45 X 1.41 X 0.6 | 1.55 X 1.52 X 0.71                              | 8mm             | 178mm (7")       | 3500            | 4mm            | 4mm            |



**Figure 7. Tape and Reel Mechanical Data**