

## Praetorian™ L-C EMI Filter with ESD Protection for Headset Speaker Applications

### Features

- 2 channels of EMI filtering
- ±30kV ESD protection
- (IEC 61000-4-2, contact discharge)
- ±30kV ESD protection (HBM)
- *OptiGuard*™ Coating for improved reliability at assembly
- Greater than 35dB of attenuation at 1GHz
- 6-bump, 1.720mm x 1.220mm footprint Chip Scale Package (CSP)
- Lead-free version available

### Applications

- Headset Speaker port in mobile handsets
- I/O port protection for mobile handsets, notebook computers, PDAs etc.
- EMI filtering for data ports in cell phones, PDAs or notebook computers.

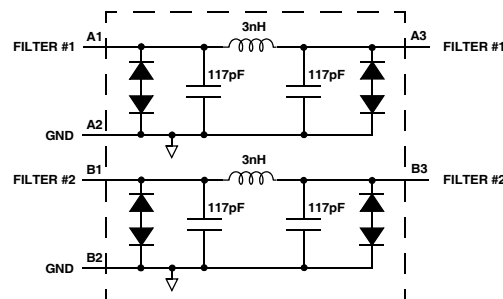
### Product Description

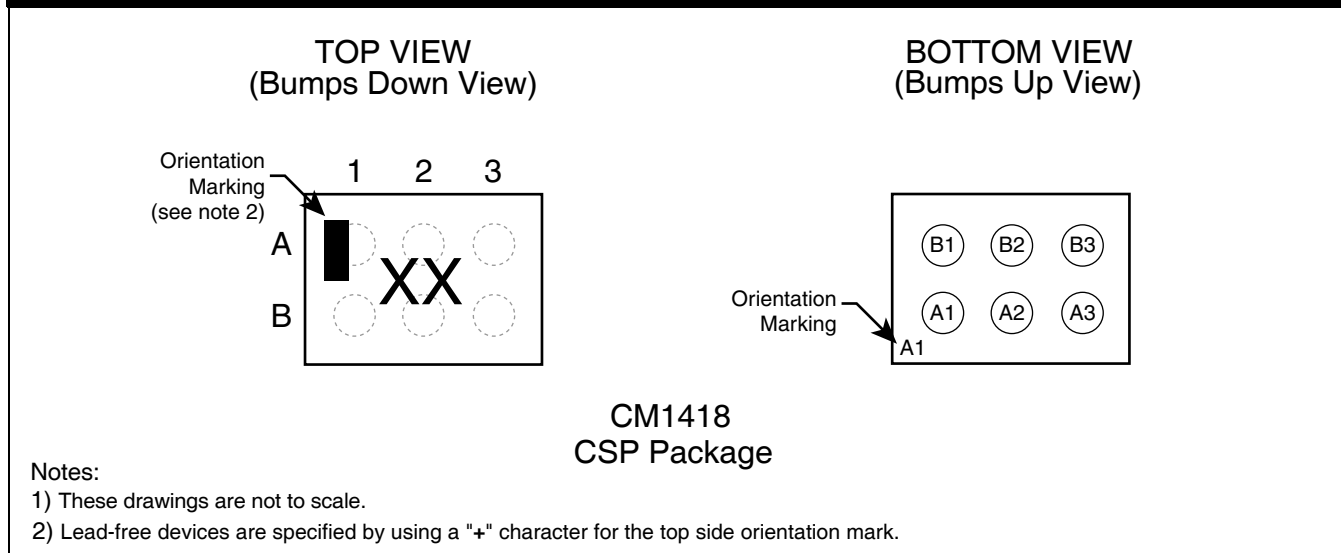
California Micro Devices' CM1418 is an L-C EMI filter array with ESD protection, which integrates two Pi-filters (C-L-C) for the headset speaker. The CM1418 has component values of 117pF-3.0nH-117pF. The parts include ESD protection diodes on all input/output pins, which provide a very high level of protection for sensitive electronic components that may be subjected to electrostatic discharge (ESD). The ESD diodes connected to the filter ports safely dissipate ESD strikes of ±30kV, beyond the maximum requirement of the IEC61000-4-2 international standard. Using the MIL-STD-883 (Method 3015) specification for Human Body Model (HBM) ESD, the pins are protected for contact discharges at greater than ±30kV.

This device is particularly well suited for portable electronics (e.g. mobile handsets, PDAs, notebook computers) because of its small package format and easy-to-use pin assignments. In particular, the CM1418 is ideal for EMI filtering and protecting speaker output lines from ESD for the headset speaker in mobile handsets. Most speakers have impedance of 8Ω and in order to maximize the power output, the resistance of an EMI filter needs to be as low as possible and the CM1418 addresses this by having a C-L-C based EMI filter where the inductor has less than 0.35Ω of resistance.

The CM1418 is available either uncoated or with *OptiGuard*™ coating resulting in improved reliability at assembly. The CM1418 is also available in a space saving, low profile Chip Scale Package with optional lead-free finishing.

### Electrical Schematic



**PACKAGE / PINOUT DIAGRAMS**

**PIN DESCRIPTIONS**

| PIN | NAME      | DESCRIPTION     |
|-----|-----------|-----------------|
| A1  | Filter #1 | Filter #1 Input |
| A2  | GND       | Device Ground   |
| A3  | Filter #1 | Filter #1 Input |
| B1  | Filter #2 | Filter #2 Input |
| B2  | GND       | Device Ground   |
| B3  | Filter #2 | Filter #2 Input |

**Ordering Information**
**PART NUMBERING INFORMATION**

| Pins | Package | OptiGuard™<br>Coating | Standard Finish                      |              | Lead-free Finish <sup>2</sup>        |              |
|------|---------|-----------------------|--------------------------------------|--------------|--------------------------------------|--------------|
|      |         |                       | Ordering Part<br>Number <sup>1</sup> | Part Marking | Ordering Part<br>Number <sup>1</sup> | Part Marking |
| 6    | CSP     | Y                     | CM1418-02CS                          | CG           | CM1418-02CP                          | CG           |
| 6    | CSP     | N                     | CM1418-0BCS                          | AL           | CM1418-0BCP                          | AL           |

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 Current per Inductor   | 30          | mA    |
| DC Package Power Rating   | 0.5         | W     |

### STANDARD OPERATING CONDITIONS

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

### ELECTRICAL OPERATING CHARACTERISTICS (SEE NOTE 1)

| SYMBOL            | PARAMETER                                                                                                                                | CONDITIONS                                            | MIN         | TYP          | MAX         | UNITS    |
|-------------------|------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------|-------------|--------------|-------------|----------|
| L                 | Inductance                                                                                                                               |                                                       |             | 3.0          |             | nH       |
| R                 | DC Channel Resistance                                                                                                                    |                                                       |             | 0.28         | 0.35        | Ω        |
| C <sub>TOT</sub>  | Total Channel Capacitance                                                                                                                | 2.5V dc; 1MHz, 30mV ac                                | 187         | 234          | 281         | pF       |
| C <sub>1</sub>    | Capacitance C <sub>1</sub>                                                                                                               | 2.5V dc; 1MHz, 30mV ac                                | 93          | 117          | 140         | pF       |
| V <sub>ST</sub>   | Stand-off Voltage                                                                                                                        | I = 10μA                                              |             | 6.0          |             | V        |
| I <sub>LEAK</sub> | Diode Leakage Current                                                                                                                    | V <sub>IN</sub> = ±3.3V                               |             | 0.1          | 1.0         | μA       |
| V <sub>SIG</sub>  | Signal Clamp Voltage<br>Positive Clamp<br>Negative Clamp                                                                                 | I <sub>LOAD</sub> = 10mA<br>I <sub>LOAD</sub> = -10mA | 5.6<br>-9.0 | 6.8<br>-6.8  | 9.0<br>-5.6 | 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 and 3                                         | ±30<br>±30  |              |             | kV<br>kV |
| R <sub>DYN</sub>  | Dynamic Resistance<br>Positive<br>Negative                                                                                               |                                                       |             | 0.95<br>0.90 |             | Ω<br>Ω   |
| f <sub>C</sub>    | Cut-off frequency<br>Z <sub>SOURCE</sub> = 50Ω, Z <sub>LOAD</sub> = 50Ω                                                                  | L = 3nH, C = 117pF                                    |             | 22           |             | MHz      |

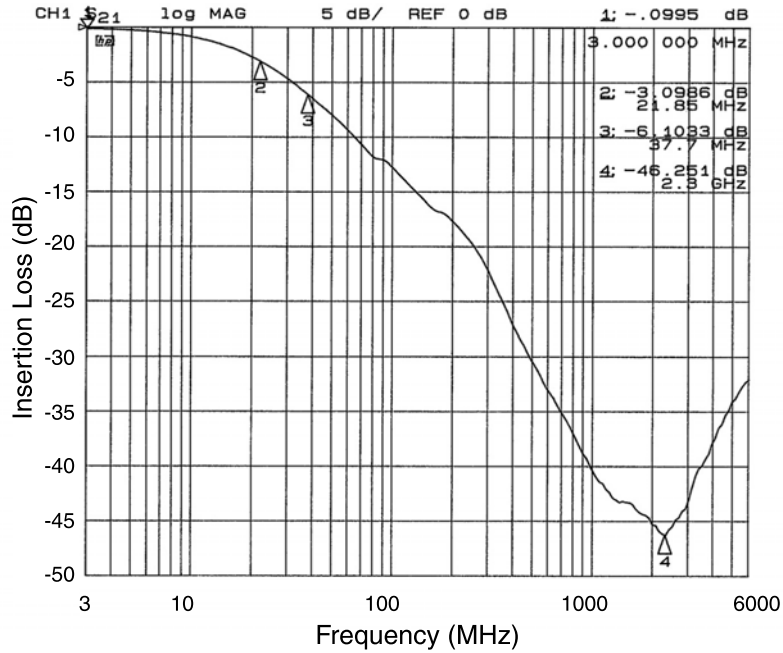
Note 1: T<sub>A</sub>=25°C unless otherwise specified.

Note 2: ESD applied to input and output pins with respect to GND, one at a time.

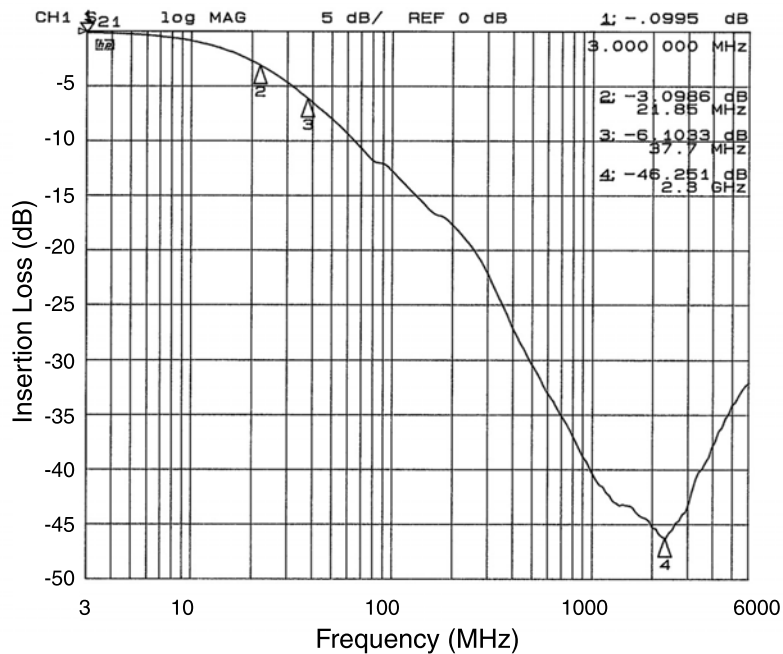
Note 3: These parameters are guaranteed by design and characterization.

**Performance Information**

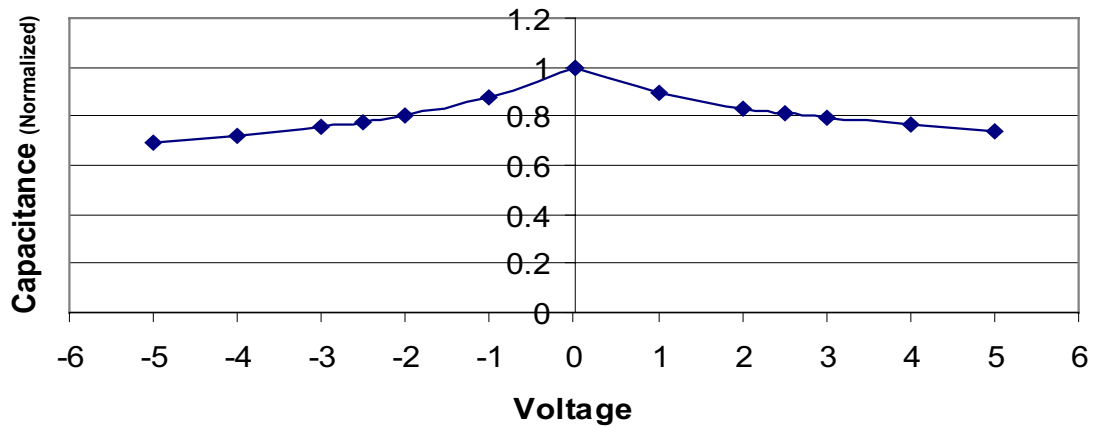
Typical Filter Performance (nominal conditions unless specified otherwise, 50 Ohm Environment)



**Figure 1. Insertion Loss vs. Frequency (Filter #1 to GND B2)**



**Figure 2. Insertion Loss vs. Frequency (Filter #2 to GND B2)**



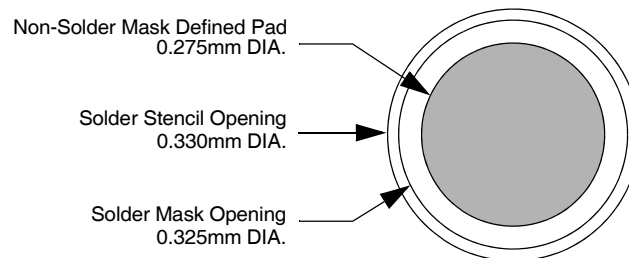
**Figure 3. Typical Diode Capacitance vs. Input Voltage (normalized to 2.5VDC)**

## Application Information

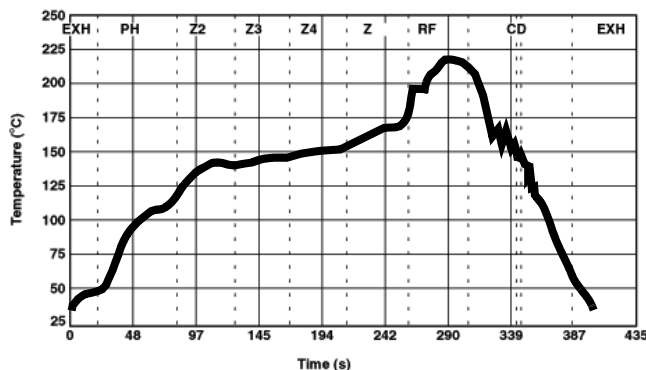
Refer to Application Note AP-217, "The Chip Scale Package", for a detailed description of Chip Scale Packages offered by California Micro Devices.

### PRINTED CIRCUIT BOARD RECOMMENDATIONS

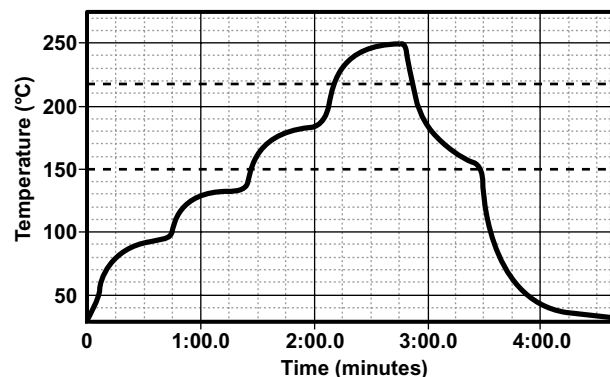
| PARAMETER                                                                          | VALUE                        |
|------------------------------------------------------------------------------------|------------------------------|
| Pad Size on PCB                                                                    | 0.275mm                      |
| Pad Shape                                                                          | 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                                                    | ±50µm                        |
| Solder Ball Side Coplanarity                                                       | ±20µm                        |
| Maximum Dwell Time Above Liquidous                                                 | 60 seconds                   |
| Maximum Soldering Temperature for Eutectic Devices using a Eutectic Solder Paste   | 240°C                        |
| Maximum Soldering Temperature for Lead-free Devices using a Lead-free Solder Paste | 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**

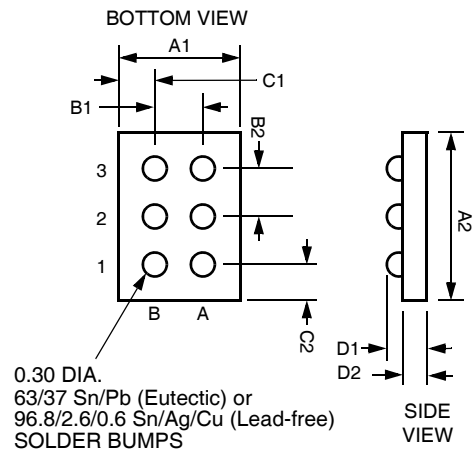
**CM1418 CSP Mechanical Specifications**

The CM1418 is supplied in 6-bump Chip Scale Package (CSP). Dimensions are presented below.

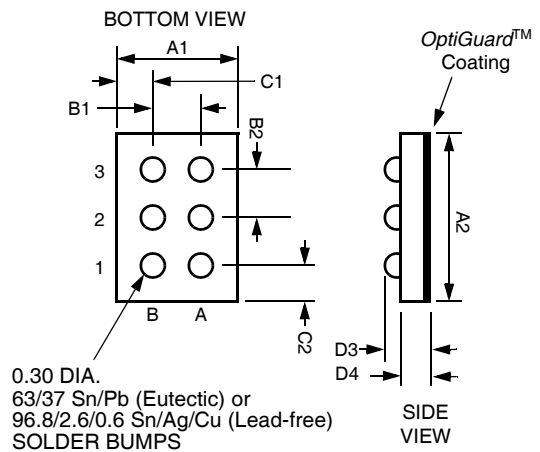
| PACKAGE DIMENSIONS                 |             |       |       |        |        |        |
|------------------------------------|-------------|-------|-------|--------|--------|--------|
| Package                            | Custom CSP  |       |       |        |        |        |
| Bumps                              | 6           |       |       |        |        |        |
| Dim                                | Millimeters |       |       | Inches |        |        |
|                                    | Min         | Nom   | Max   | Min    | Nom    | Max    |
| <b>A1</b>                          | 1.175       | 1.220 | 1.265 | 0.0463 | 0.0480 | 0.0498 |
| <b>A2</b>                          | 1.675       | 1.720 | 1.765 | 0.0659 | 0.0677 | 0.0695 |
| <b>B1</b>                          | 0.495       | 0.500 | 0.505 | 0.0195 | 0.0197 | 0.0199 |
| <b>B2</b>                          | 0.495       | 0.500 | 0.505 | 0.0195 | 0.0197 | 0.0199 |
| <b>C1</b>                          | 0.310       | 0.360 | 0.410 | 0.0122 | 0.0142 | 0.0161 |
| <b>C2</b>                          | 0.310       | 0.360 | 0.410 | 0.0122 | 0.0142 | 0.0161 |
| <b>D1</b>                          | 0.562       | 0.606 | 0.650 | 0.0221 | 0.0239 | 0.0256 |
| <b>D2</b>                          | 0.356       | 0.381 | 0.406 | 0.0140 | 0.0150 | 0.0160 |
| <b>D3</b>                          | 0.575       | 0.644 | 0.714 | 0.0226 | 0.0254 | 0.0281 |
| <b>D4</b>                          | 0.368       | 0.419 | 0.470 | 0.0145 | 0.0165 | 0.0185 |
| <b># per tape and reel</b>         | 3500 pieces |       |       |        |        |        |
| Controlling dimension: millimeters |             |       |       |        |        |        |

**Mechanical Package Diagrams**

**Non-Coated CSP**



**OptiGuard™ Coated CSP**



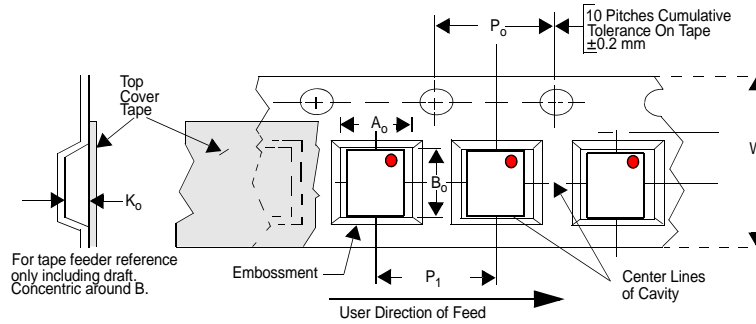
NOTE: DIMENSIONS IN MILLIMETERS

**Package Dimensions for CM1418-0xCS/CP  
6-bump Chip Scale Package**

**Mechanical Details (cont'd)**

**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 DIA.  | QTY PER REEL | $P_0$ | $P_1$ |
|----------------|--------------------|-------------------------------------------------|-----------------|------------|--------------|-------|-------|
| CM1418-02CS/CP | 1.72 X 1.22 X 0.67 | 2.08 x 1.45 x 0.71                              | 8mm             | 178mm (7") | 3500         | 4mm   | 4mm   |
| CM1418-02CS/CP | 1.72 X 1.22 X 0.61 | 2.08 x 1.45 x 0.71                              | 8mm             | 178mm (7") | 3500         | 4mm   | 4mm   |



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