# LCD EMI Filter Array with ESD Protection

## Features

- Functionally and pin compatible with CSPEMI606 (CM1420) and CSPEMI608 (CM1422) devices
- Optiguard™ coated for improved reliability at assembly
- Six and eight channels of EMI filtering
- ±15kV ESD protection on each channel (IEC 61000-4-2 Level 4, contact discharge)
- ±30kV ESD protection on each channel (HBM)
- Better than 30dB of attenuation at 1GHz to 3GHz
- Chip Scale Package features extremely low lead inductance for optimum filter and ESD performance
- 15-bump, 2.960mm x 1.330mm footprint Chip Scale Package (CM1420)
- 20-bump, 4.000mm x 1.458mm footprint Chip Scale Package (CM1422)
- Lead-free version available

## Applications

- LCD data lines in clamshell wireless handsets
- EMI filtering & ESD protection for high-speed I/O data ports
- Wireless handsets / cell phones
- Notebook computers
- PDAs / Handheld PCs
- EMI filtering for high-speed data lines

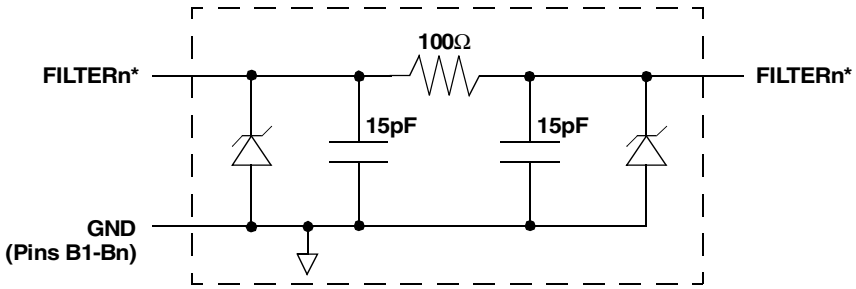
## Product Description

CAMD's CM1420 and CM1422 are EMI filter arrays with ESD protection, which integrate six and eight Pi-filters (C-R-C), respectively. The CM1420/22 has component values of 15pF-100Ω-15pF. These devices include ESD protection diodes on every pin, 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 are designed and characterized to safely dissipate ESD strikes of ±15kV, beyond 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 pins are protected for contact discharges at greater than ±30kV.

This device is particularly well suited for portable electronics (e.g. wireless handsets, PDAs, notebook computers) because of its small package format and easy-to-use pin assignments. In particular, the CM1420/22 is ideal for EMI filtering and protecting data lines from ESD for the LCD display in clamshell handsets.

The CM1420 and CM1422 incorporate Optiguard™ coating which results in improved reliability at assembly. The CM1420 and CM1422 are available in space-saving, low-profile chip-scale packages with optional lead-free finishing.

### Electrical Schematic

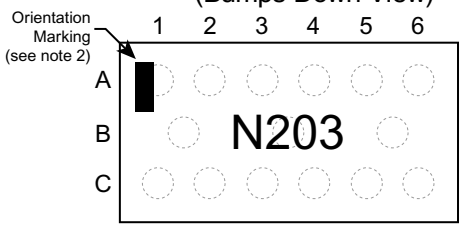



**1 of n EMI Filtering + ESD Channels**
**(n=6 for CM1420, 8 for CM1422)**

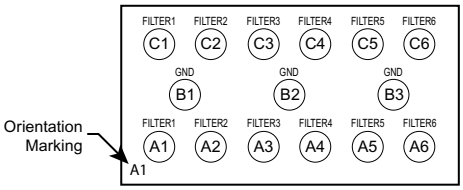
*** See Package/Pinout Diagram for expanded pin information.**

## PACKAGE / PINOUT DIAGRAMS

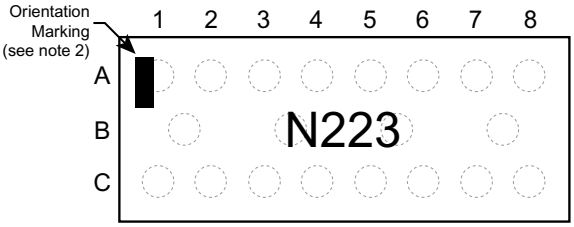
TOP VIEW
(Bumps Down View)

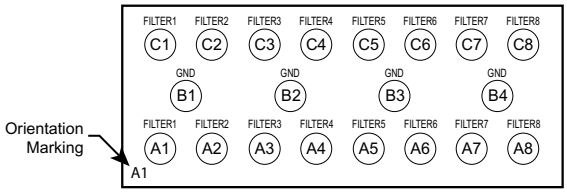



BOTTOM VIEW
(Bumps Up View)




CM1420 CSP Package




CM1422 CSP Package

Notes:
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

| CM1420 PIN(s) | CM1422 PIN(s) | NAME | DESCRIPTION | | CM1420 PIN(s) | CM1422 PIN(s) | NAME | DESCRIPTION |
|---|---|---|---|---|---|---|---|---|
| A1 | A1 | FILTER1 | Filter Channel 1 | | C1 | C1 | FILTER1 | Filter Channel 1 |
| A2 | A2 | FILTER2 | Filter Channel 2 | | C2 | C2 | FILTER2 | Filter Channel 2 |
| A3 | A3 | FILTER3 | Filter Channel 3 | | C3 | C3 | FILTER3 | Filter Channel 3 |
| A4 | A4 | FILTER4 | Filter Channel 4 | | C4 | C4 | FILTER4 | Filter Channel 4 |
| A5 | A5 | FILTER5 | Filter Channel 5 | | C5 | C5 | FILTER5 | Filter Channel 5 |
| A6 | A6 | FILTER6 | Filter Channel 6 | | C6 | C6 | FILTER6 | Filter Channel 6 |
| - | A7 | FILTER7 | Filter Channel 7 | | - | C7 | FILTER7 | Filter Channel 7 |
| - | A8 | FILTER8 | Filter Channel 8 | | - | C8 | FILTER8 | Filter Channel 8 |
| B1-B3 | B1-B4 | GND | Device Ground | | | | | |

## Ordering Information

### PART NUMBERING INFORMATION

| Bumps | Package | Standard Finish | | Lead-free Finish[2] | |
|---|---|---|---|---|---|
| | | Ordering Part Number[1] | Part Marking | Ordering Part Number[1] | Part Marking |
| 15 | CSP | CM1420-03CS | N203 | CM1420-03CP | N203 |
| 20 | CSP | CM1422-03CS | N223 | CM1422-03CP | N223 |

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 | 500 | mW |

| STANDARD OPERATING CONDITIONS | | |
|---|---|---|
| **PARAMETER** | **RATING** | **UNITS** |
| Operating Temperature Range | -40 to +85 | °C |

| ELECTRICAL OPERATING CHARACTERISTICS[1] | | | | | | |
|---|---|---|---|---|---|---|
| **SYMBOL** | **PARAMETER** | **CONDITIONS** | **MIN** | **TYP** | **MAX** | **UNITS** |
| R | Resistance | | 80 | 100 | 120 | Ω |
| C | Capacitance | At 2.5V DC, 1MHz, 30mV AC | 12 | 15 | 18 | pF |
| $V_{DIODE}$ | Diode Standoff Voltage | $I_{DIODE}$=10µA | 5.5 | | | V |
| $I_{LEAK}$ | Diode Leakage Current (reverse bias) | $V_{DIODE}$=±3.3V | | | 100 | nA |
| $V_{SIG}$ | Signal Voltage<br>Positive Clamp<br>Negative Clamp | $I_{LOAD}$ = 10mA | <br>5.6<br>-0.4 | <br>6.8<br>-0.8 | <br>9.0<br>-1.5 | <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 2,4 and 5 | <br>±30<br>±15 | | | <br>kV<br>kV |
| $V_{CL}$ | Clamping Voltage during ESD Discharge MIL-STD-883 (Method 3015), 8kV<br>Positive Transients<br>Negative Transients | Notes 2,3,4 and 5 | | <br>+12<br>-7 | | <br>V<br>V |
| $f_C$ | Cut-off Frequency<br>$Z_{SOURCE}$=50Ω, $Z_{LOAD}$=50Ω | R=100Ω, C=15pF | | 120 | | MHz |

Note 1: $T_A$=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: These parameters are guaranteed by design and characterization.

## Performance Information

**Typical Filter Performance ($T_A$=25°C, DC Bias=0V, 50 Ohm Environment)**

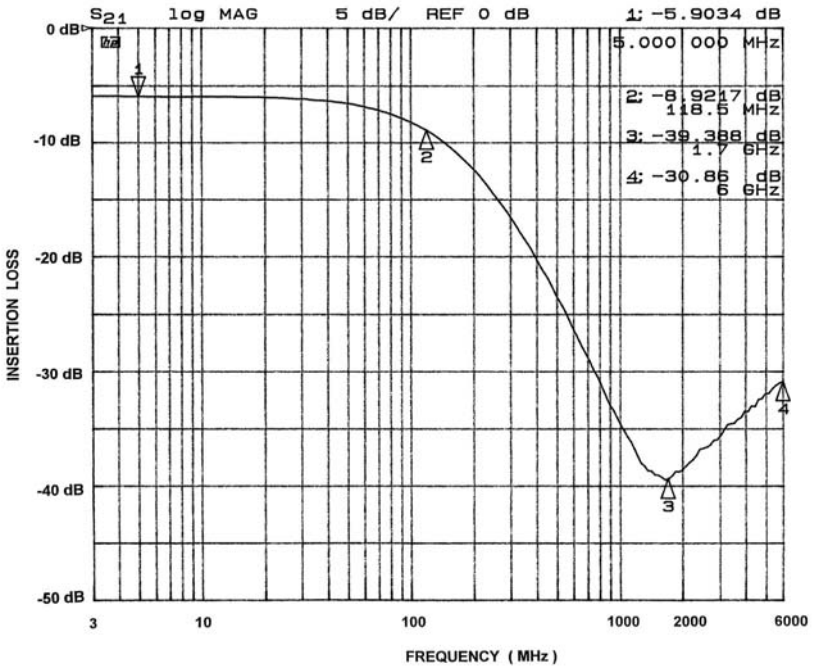



**Figure 1. Insertion Loss VS. Frequency (A1-C1 to GND B1)**

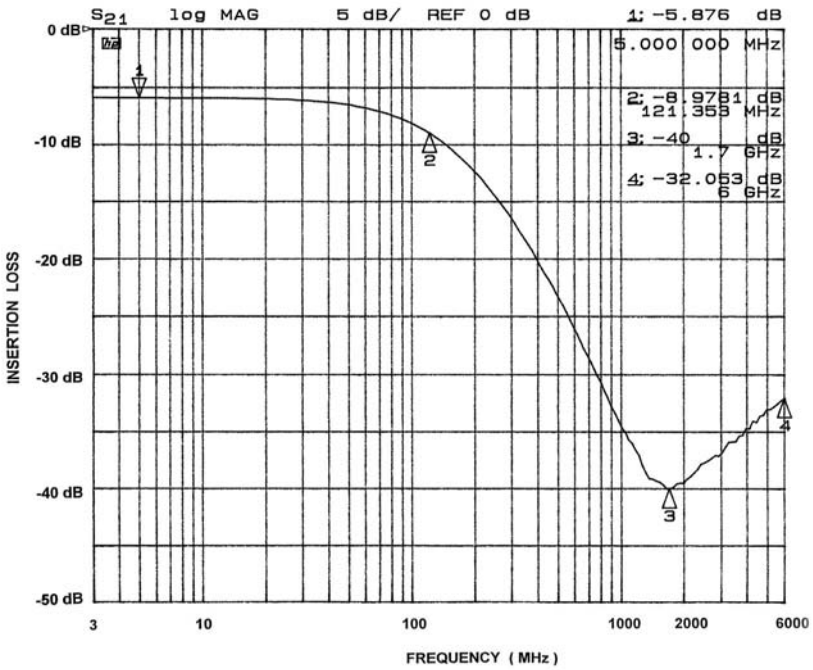



**Figure 2. Insertion Loss VS. Frequency (A2-C2 to GND B1)**

## Performance Information (cont'd)

**Typical Filter Performance ($T_A$=25°C, DC Bias=0V, 50 Ohm Environment)**

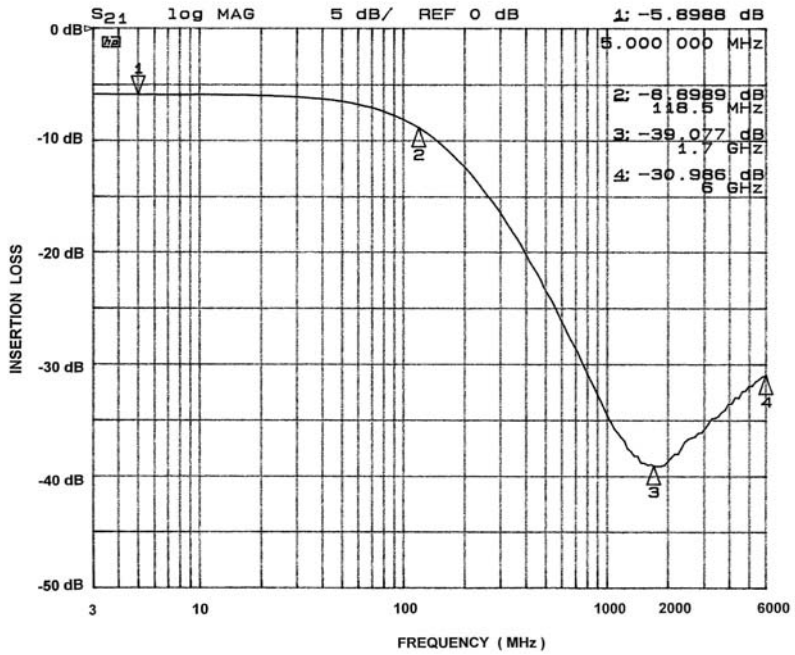



**Figure 3. Insertion Loss VS. Frequency (A3-C3 to GND B2)**

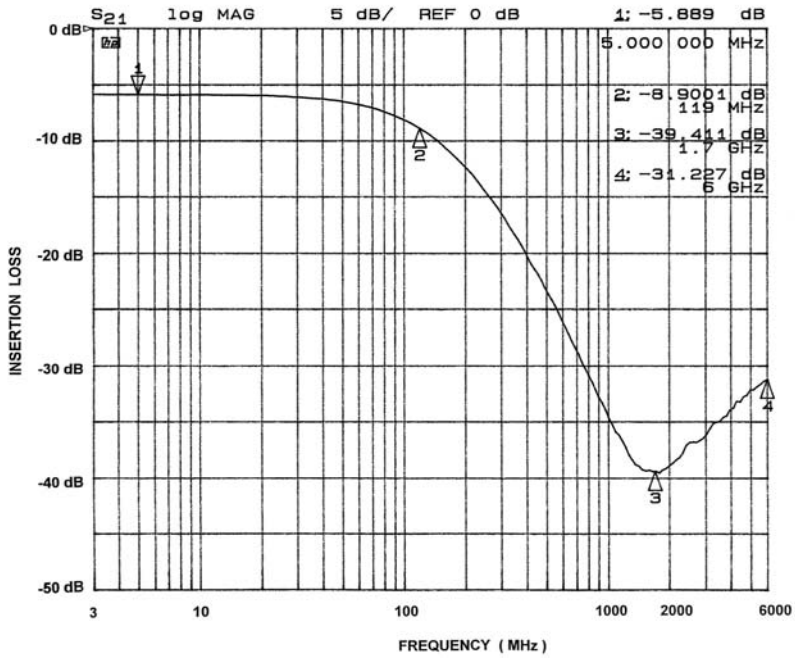



**Figure 4. Insertion Loss VS. Frequency (A4-C4 to GND B2)**

## Performance Information (cont'd)

**Typical Filter Performance ($T_A$=25°C, DC Bias=0V, 50 Ohm Environment)**

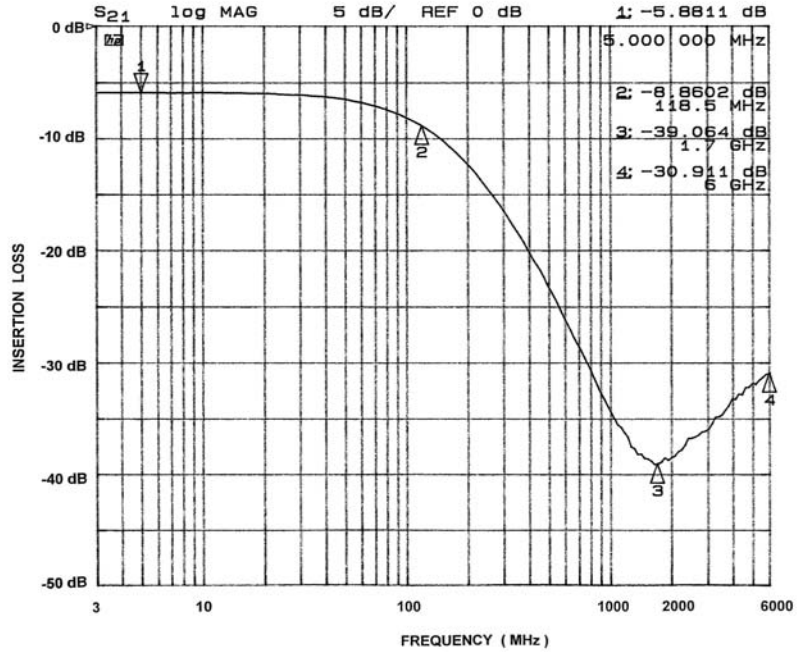



**Figure 5. Insertion Loss VS. Frequency (A5-C5 to GND B3)**

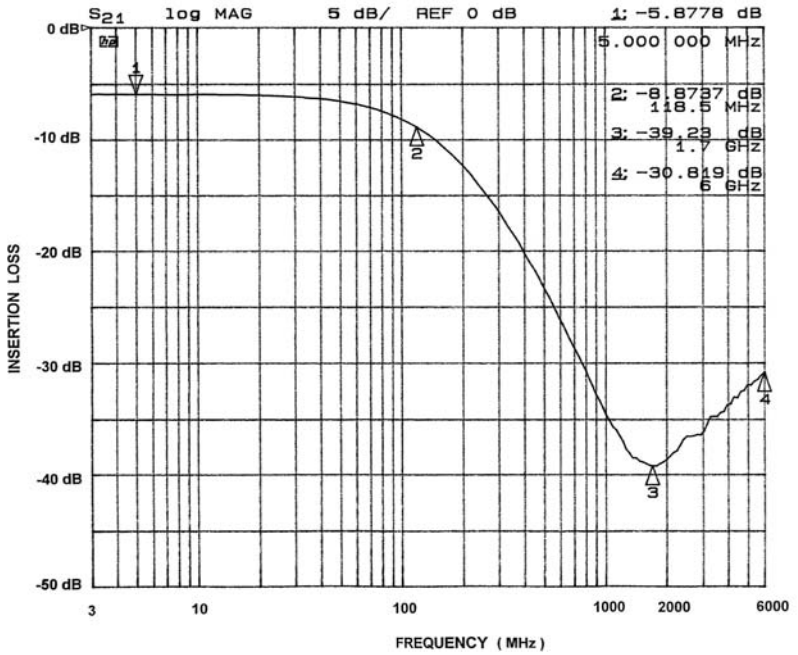



**Figure 6. Insertion Loss VS. Frequency (A6-C6 to GND B3)**

## Performance Information (cont'd)

**Typical Filter Performance ($T_A$=25°C, DC Bias=0V, 50 Ohm Environment)**

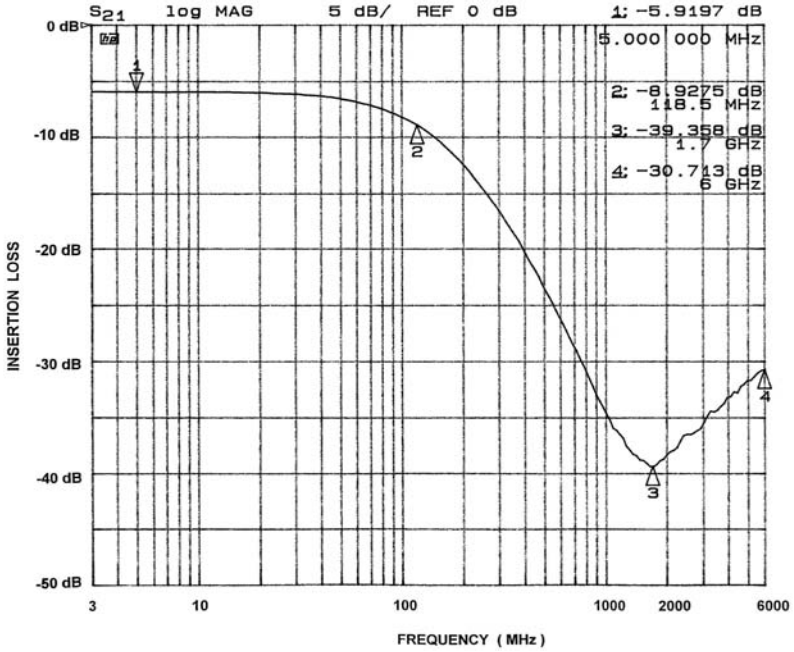



**Figure 7. Insertion Loss VS. Frequency (A7-C7 to GND B4, CM1422 Only)**

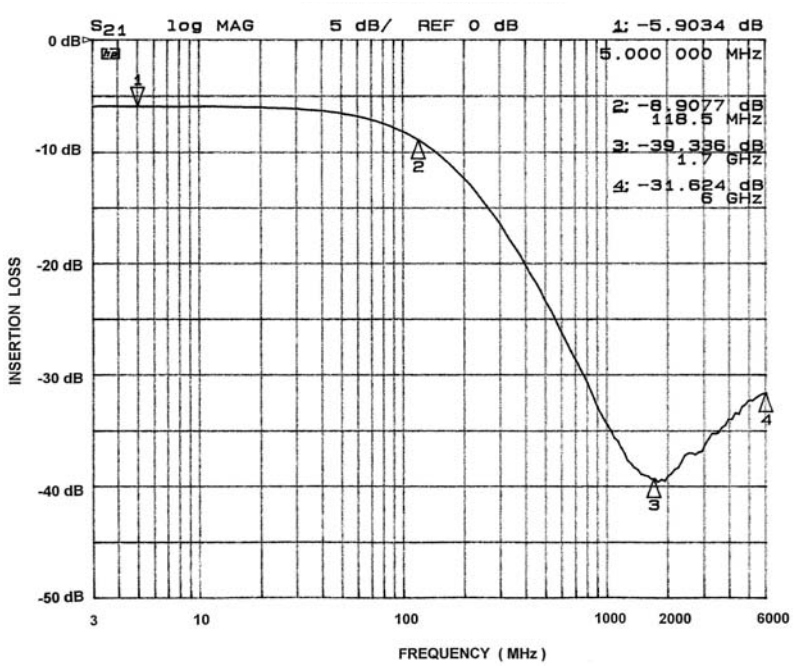



**Figure 8. Insertion Loss VS. Frequency (A8-C8 to GND B4, CM1422 Only)**

## Performance Information (cont'd)

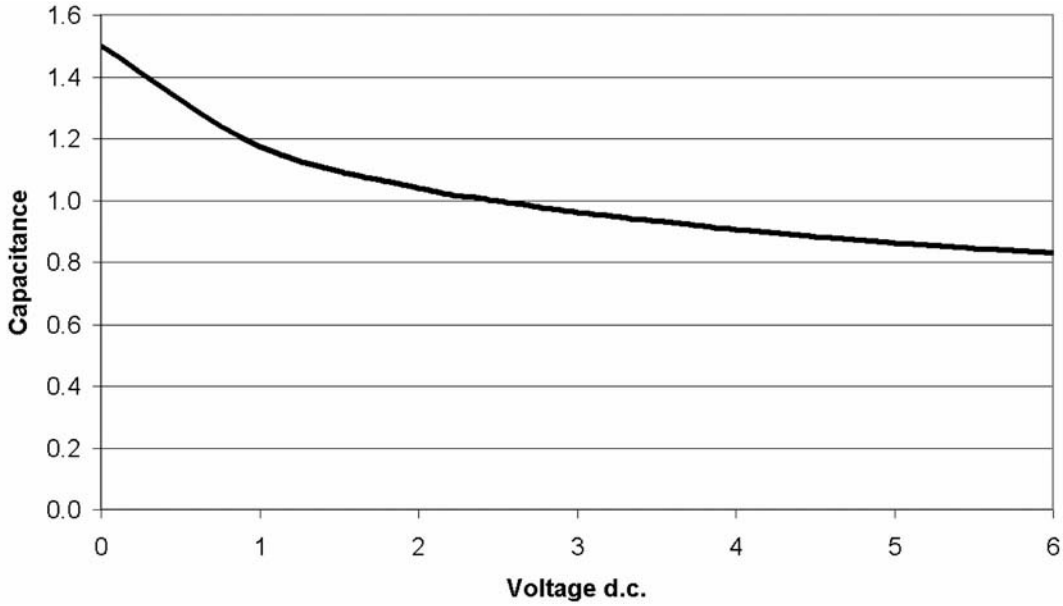



**Figure 9. Filter Capacitance vs. Input Voltage over Temperature (normalized to capacitance at 2.5VDC and 25°C)**

## 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 | 0.125mm - 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 |
| Soldering Maximum Temperature | 260°C |

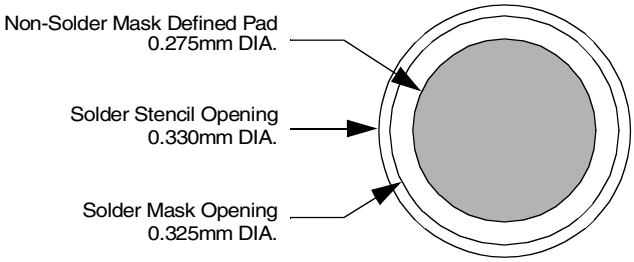



**Figure 10. Recommended Non-Solder Mask Defined Pad Illustration**

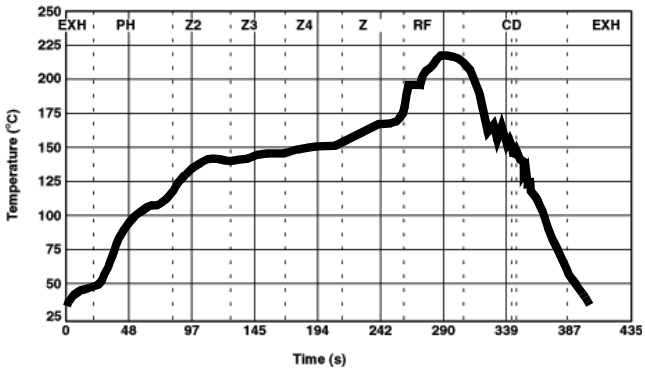



**Figure 11. Eutectic (SnPb) Solder Ball Reflow Profile**

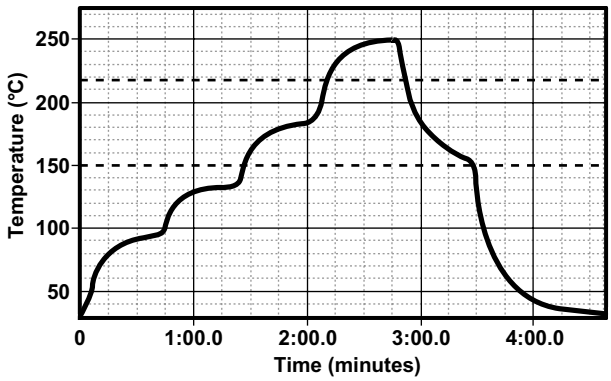



**Figure 12. Lead-free (SnAgCu) Solder Ball Reflow Profile**

## Mechanical Details

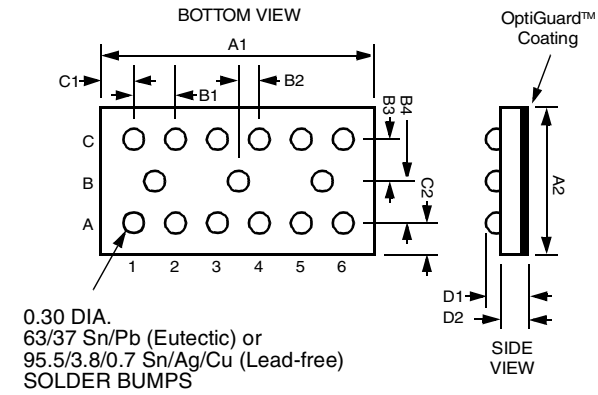
CM1420/22 devices are packaged in a custom Chip Scale Packages (CSP). Dimensions for each of these devices are presented in the following pages.

### CM1420 Mechanical Specifications

The package dimensions for the CM1420 are presented below.

| PACKAGE DIMENSIONS | | | | | | |
|---|---|---|---|---|---|---|
| **Package** | Custom CSP | | | | | |
| **Bumps** | 15 | | | | | |
| **Dim** | **Millimeters** | | | **Inches** | | |
| | **Min** | **Nom** | **Max** | **Min** | **Nom** | **Max** |
| **A1** | 2.915 | 2.960 | 3.005 | 0.1148 | 0.1165 | 0.1183 |
| **A2** | 1.285 | 1.330 | 1.375 | 0.0506 | 0.0524 | 0.0541 |
| **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** | 0.180 | 0.230 | 0.280 | 0.0071 | 0.0091 | 0.0110 |
| **C2** | 0.180 | 0.230 | 0.280 | 0.0071 | 0.0091 | 0.0110 |
| **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 | | | | | | |

**Mechanical Package Diagrams**




**Package Dimensions for CM1420 Chip Scale Package**

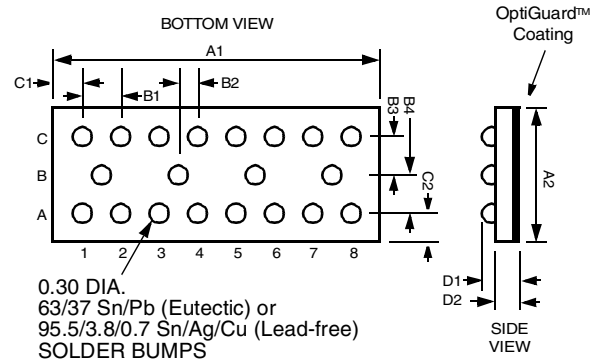
## Mechanical Details (cont'd)

### CM1422 Mechanical Specifications

The package dimensions for the CM1422 are presented below.

| PACKAGE DIMENSIONS | | | | | | |
|---|---|---|---|---|---|---|
| **Package** | Custom CSP | | | | | |
| **Bumps** | 20 | | | | | |
| **Dim** | **Millimeters** | | | **Inches** | | |
| | **Min** | **Nom** | **Max** | **Min** | **Nom** | **Max** |
| **A1** | 3.955 | 4.000 | 4.045 | 0.1557 | 0.1575 | 0.1593 |
| **A2** | 1.413 | 1.458 | 1.503 | 0.0556 | 0.0574 | 0.0592 |
| **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** | 0.200 | 0.250 | 0.300 | 0.0079 | 0.0098 | 0.0118 |
| **C2** | 0.244 | 0.294 | 0.344 | 0.0096 | 0.0116 | 0.0135 |
| **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 | | | | | | |

**Mechanical Package Diagrams**




DIMENSIONS IN MILLIMETERS

**Package Dimensions for CM1422 Chip Scale Package**

## Mechanical Details (cont'd)

### 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 | $P_0$ | $P_1$ |
|---|---|---|---|---|---|---|---|
| CM1420 | 2.96 X 1.33 X 0.6 | 3.10 X 1.45 X 0.74 | 8mm | 178mm (7") | 3500 | 4mm | 4mm |
| CM1422 | 4.00 X 1.46 X 0.6 | 4.11 X 1.57 X 0.76 | 8mm | 178mm (7") | 3500 | 4mm | 4mm |

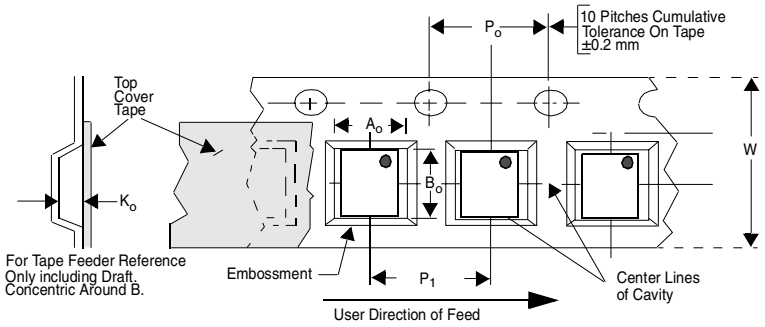



**Figure 13. Tape and Reel Mechanical Data**