

## Secure Digital (SD) Card EMI Filter Array with ESD Protection

### Features

- Provides EMI filtering and ESD protection for an SD port on a mobile device
- Six channels of EMI filtering with ESD protection
- Four channels of ESD protection
- ±15kV ESD protection on all I/O pins (IEC 61000-4-2, contact discharge)
- ±30kV ESD protection (HBM)
- Better than 25dB of attenuation at 1GHz for 12pF-100Ω -12pF filter configuration
- Integrates 34 components into small form factor CSP solution
- 20-bump, 4.000mm x 1.458mm footprint Chip Scale Package
- Chip Scale Package features extremely low lead inductance for optimum filter and ESD performance
- Available with OptiGuard™ coated version for improved reliability at assembly
- Lead-free version available

### Applications

- Secure Digital (SD) Card data lines in mobile handsets
- SD Card interface protection for other mobile electronics such as MP3 players, PDAs and digital cameras
- I/O port protection for mobile handsets, notebook computers, PDAs etc.
- EMI filtering for data ports in cell phones, PDAs or notebook computers.

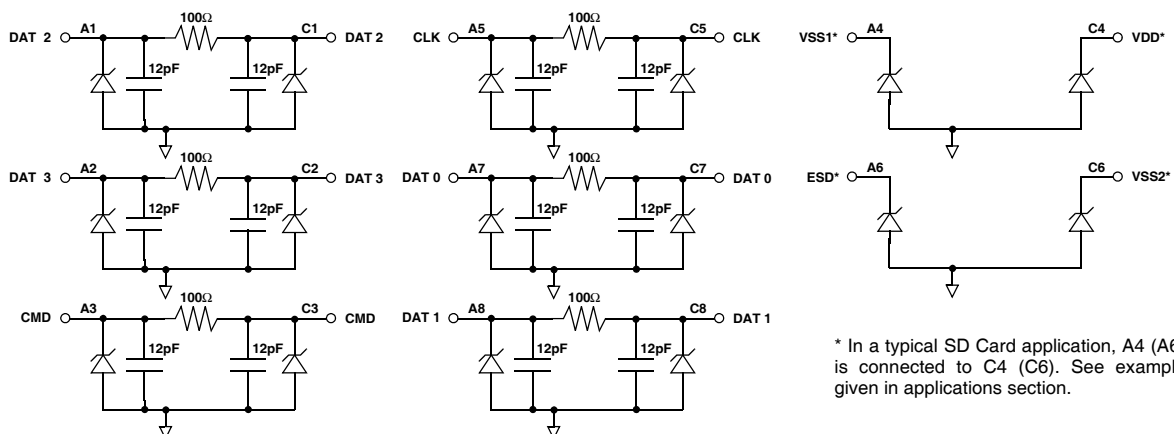
### Product Description

California Micro Devices's CM1423 is an EMI filter array with ESD protection, which integrates six Pi-filters (C-R-C) and four channels of ESD protection. The CM1423's filters have component values of 12pF-100Ω-12pF. The part includes 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). All the ESD diodes 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.

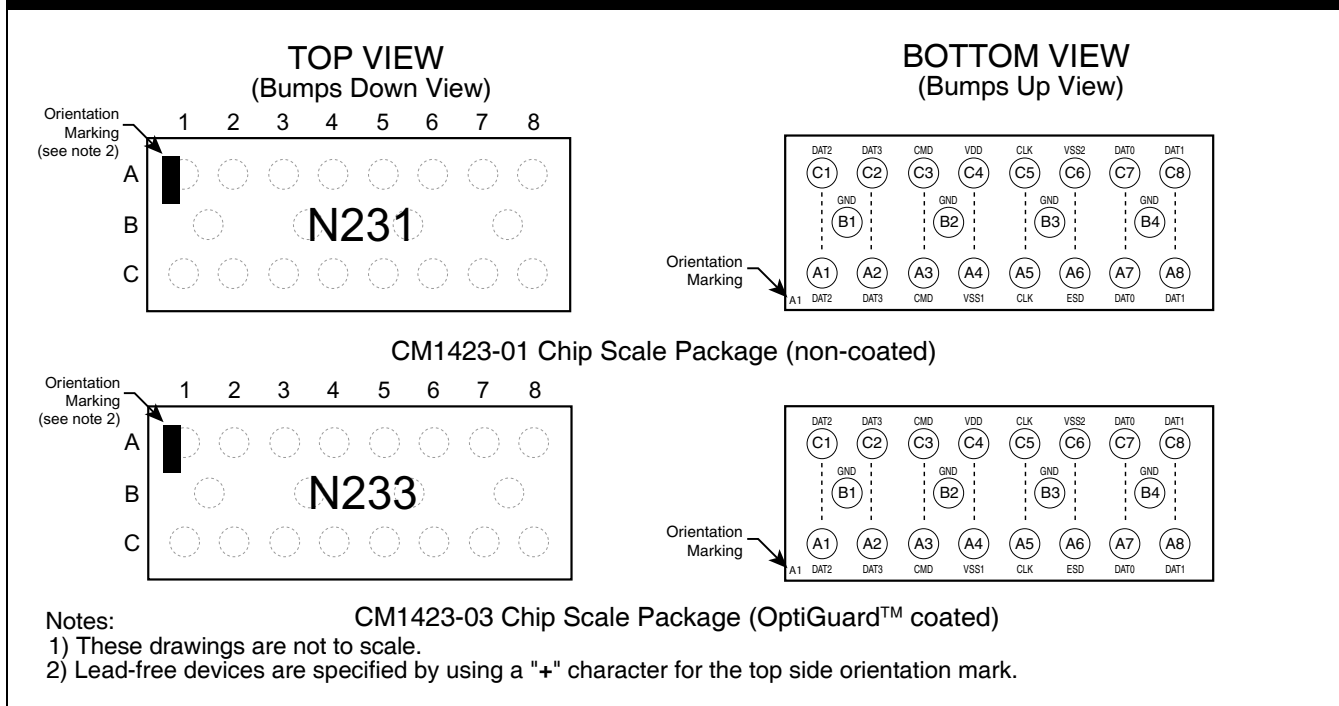
This device is particularly well suited for portable electronics (e.g. mobile handsets, PDAs, notebook computers) because of its small package format and easy-to-use pin assignments. In particular, the CM1423 is ideal for EMI filtering and protecting data lines from ESD for the Secure Digital (SD) Card interface slot in mobile handsets. The CM1423 is an all-inclusive solution for the SD card interface since its EMI filters provide the proper cut-off frequency to attenuate unwanted signals.

The CM1423 is manufactured in a space-saving, low-profile, chip-scale package, and is optionally available with OptiGuard™ coating for improved reliability. It is also available with lead-free finishing.

### Electrical Schematic



**PACKAGE / PINOUT DIAGRAMS**



**PIN DESCRIPTIONS**

| PIN(s) | NAME | DESCRIPTION                                | PIN(s) | NAME | DESCRIPTION                                 |
|--------|------|--|--------|------|---|
| A1     | DAT2 | DATA2 Filter+ESD Channel, System Side      | C1     | DAT2 | DATA2 Filter+ ESD Channel, SD Card Side     |
| A2     | DAT3 | DATA3 Filter+ESD Channel, System Side      | C2     | DAT3 | DATA3 Filter+ ESD Channel, SD Card Side     |
| A3     | CMD  | CMD Signal Filter+ESD Channel, System Side | C3     | CMD  | CMD Signal Filter+ESD Channel, SD Card Side |
| A4     | VSS1 | ESD-only Channel, Supply Voltage Ground    | C4     | VDD  | ESD-only Channel, Supply Voltage            |
| A5     | CLK  | Clock Filter + ESD Channel                 | C5     | CLK  | Clock Filter + ESD Channel                  |
| A6     | ESD  | ESD-only Channel                           | C6     | VSS2 | Supply Voltage Ground                       |
| A7     | DAT0 | DATA0 Filter+ ESD Channel, System Side     | C7     | DAT0 | DATA0 Filter+ ESD Channel, SD Card Side     |
| A8     | DAT1 | DATA1 Filter+ ESD Channel, System Side     | C8     | DAT1 | DATA1 Filter+ ESD Channel, SD Card Side     |
| B1-B4  | GND  | Device Ground                              |        |      |   |

**Ordering Information**

**PART NUMBERING INFORMATION**

| Bumps | PKG | Standard Finish                   |              |                                   |              | Lead-free Finish <sup>2</sup>     |              |                                   |              |
|-------|-----|-----------------------------------|--------------|-----------------------------------|--------------|-----------------------------------|--------------|-----------------------------------|--------------|
|       |     | No Coating                        |              | Optiguard™ Coated                 |              | No Coating                        |              | Optiguard™ Coated                 |              |
|       |     | Ordering Part Number <sup>1</sup> | Part Marking | Ordering Part Number <sup>1</sup> | Part Marking | Ordering Part Number <sup>1</sup> | Part Marking | Ordering Part Number <sup>1</sup> | Part Marking |
| 20    | CSP | CM1423-01CS                       | N231         | CM1423-03CS                       | N233         | CM1423-01CP                       | N231         | CM1423-03CP                       | N233         |

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 (SEE NOTE 1)

| SYMBOL             | PARAMETER  | CONDITIONS  | MIN         | TYP         | MAX         | UNITS    |
|--------------------|--|---|-------------|-------------|-------------|----------|
| R                  | Resistance   |   | 80          | 100         | 120         | Ω        |
| C                  | Capacitance  | At 2.5V DC, 1MHz, 30mV AC                             | 9           | 12          | 15          | pF       |
| V <sub>DIODE</sub> | Diode Standoff Voltage   | I <sub>DIODE</sub> = 10μA                             | 5.5         |             |             | V        |
| I <sub>LEAK</sub>  | Diode Leakage Current (reverse bias)   | V <sub>DIODE</sub> = 3.3V                             |             | 100         |             | nA       |
| V <sub>SIG</sub>   | Signal Voltage<br>Positive Clamp<br>Negative Clamp   | I <sub>LOAD</sub> = 10mA<br>I <sub>LOAD</sub> = -10mA | 5.6<br>-1.5 | 6.8<br>-0.8 | 9.0<br>-0.4 | V<br>V   |
| V <sub>ESD</sub>   | 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                                       | ±30<br>±15  |             |             | 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                                     |             | +12<br>-7   |             | V<br>V   |
| f <sub>C</sub>     | Cut-off Frequency<br>Z <sub>SOURCE</sub> =50Ω, Z <sub>LOAD</sub> =50Ω  | R = 100Ω, C = 12pF;<br>Note 5                         |             | 145         |             | 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.

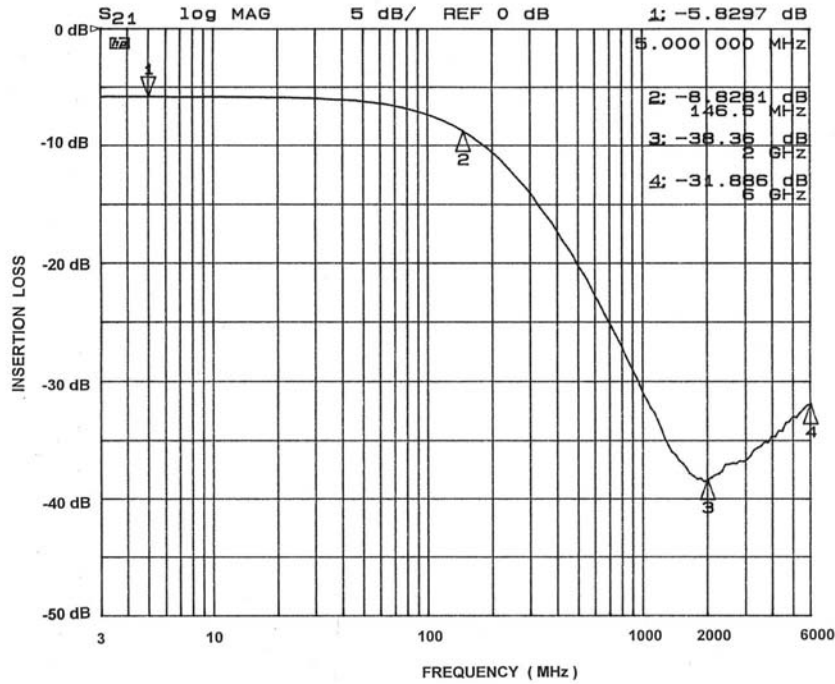
Note 3: Clamping voltage is measured at the opposite side of the EMI filter to the ESD pin. For example, if ESD is applied to Pin A1, then clamping voltage is measured at Pin C1.

Note 4: Unused pins are left open

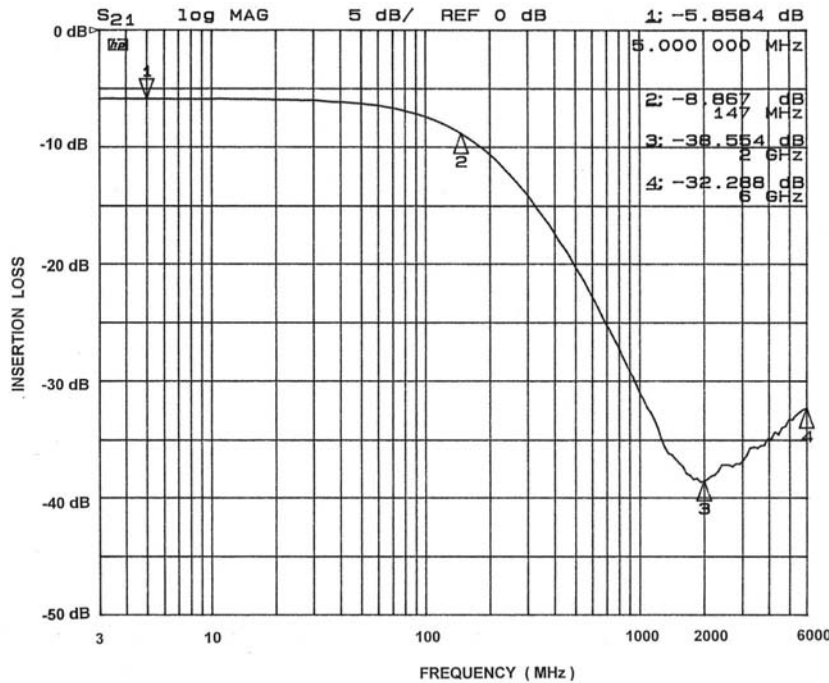
Note 5: These parameters are guaranteed by design and characterization.

**Performance Information**

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



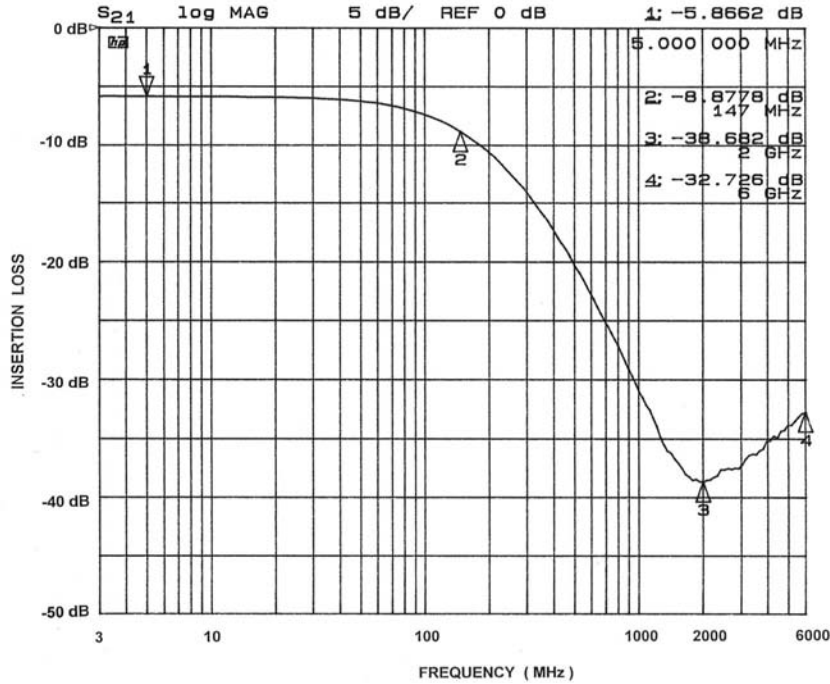
**Figure 1. A1-C1 EMI Filter Performance**



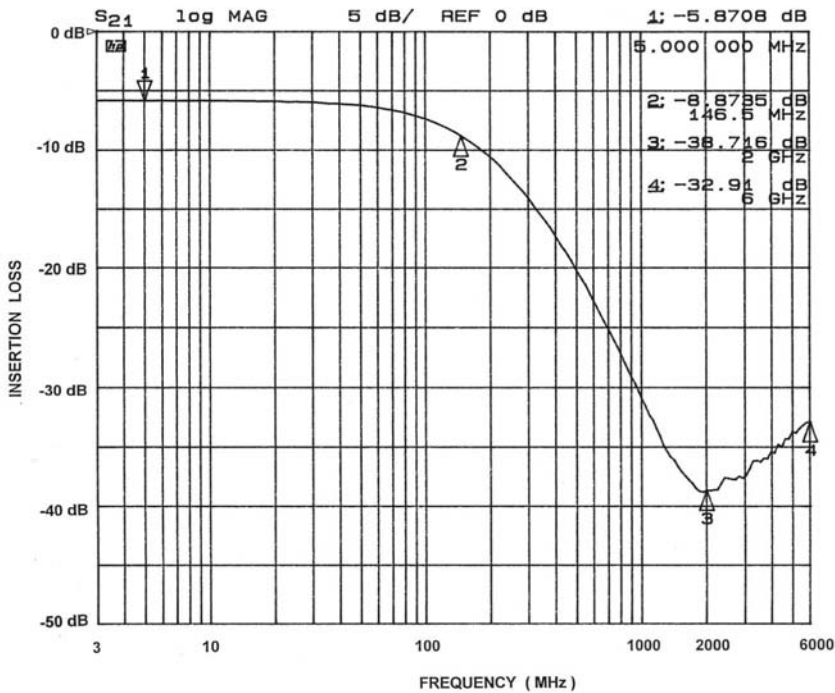
**Figure 2. A2-C2 EMI Filter Performance**

**Performance Information (cont'd)**

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



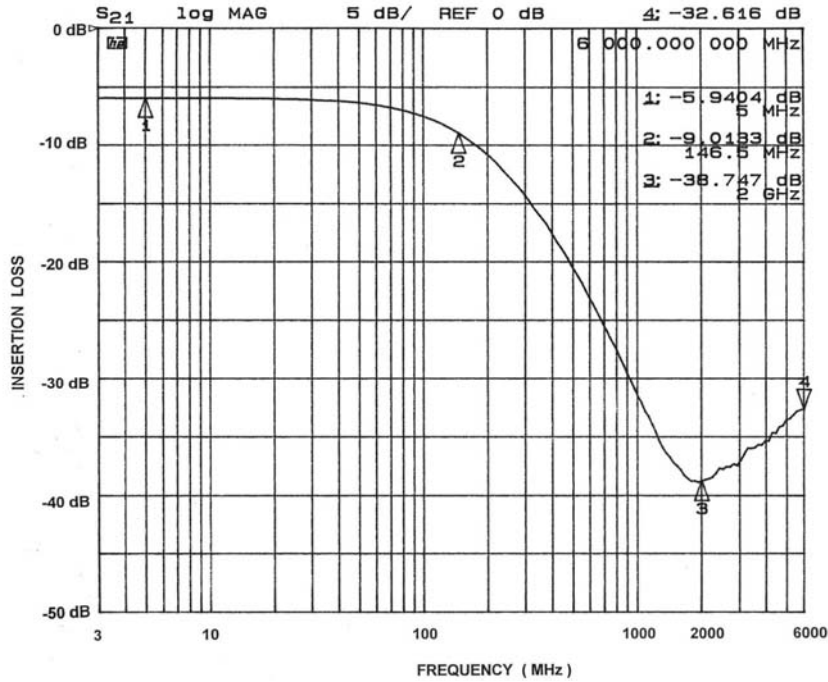
**Figure 3. A3-C3 EMI Filter Performance**



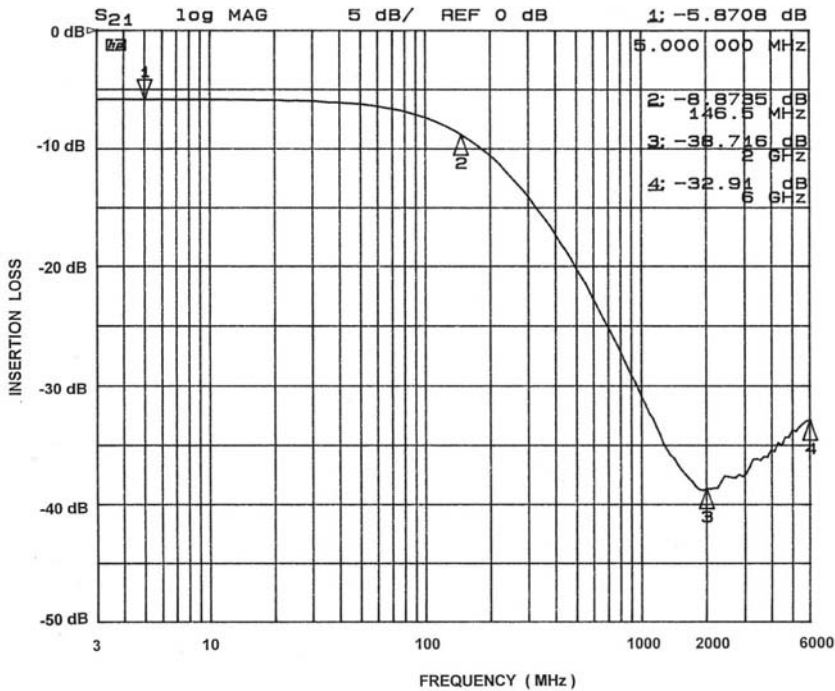
**Figure 4. A5-C5 EMI Filter Performance**

**Performance Information (cont'd)**

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

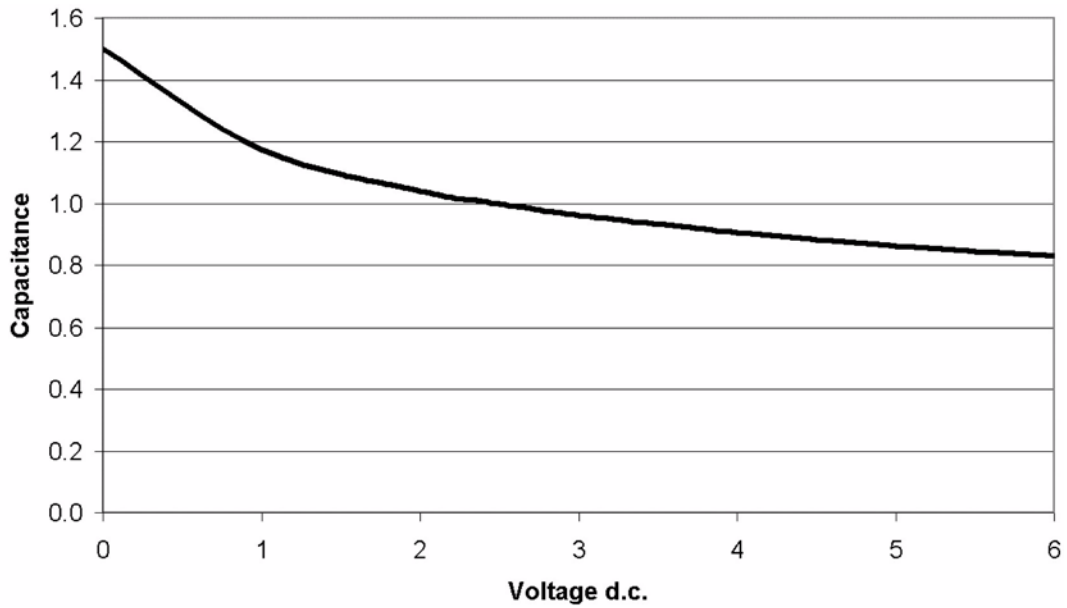


**Figure 5. A7-C7 EMI Filter Performance**



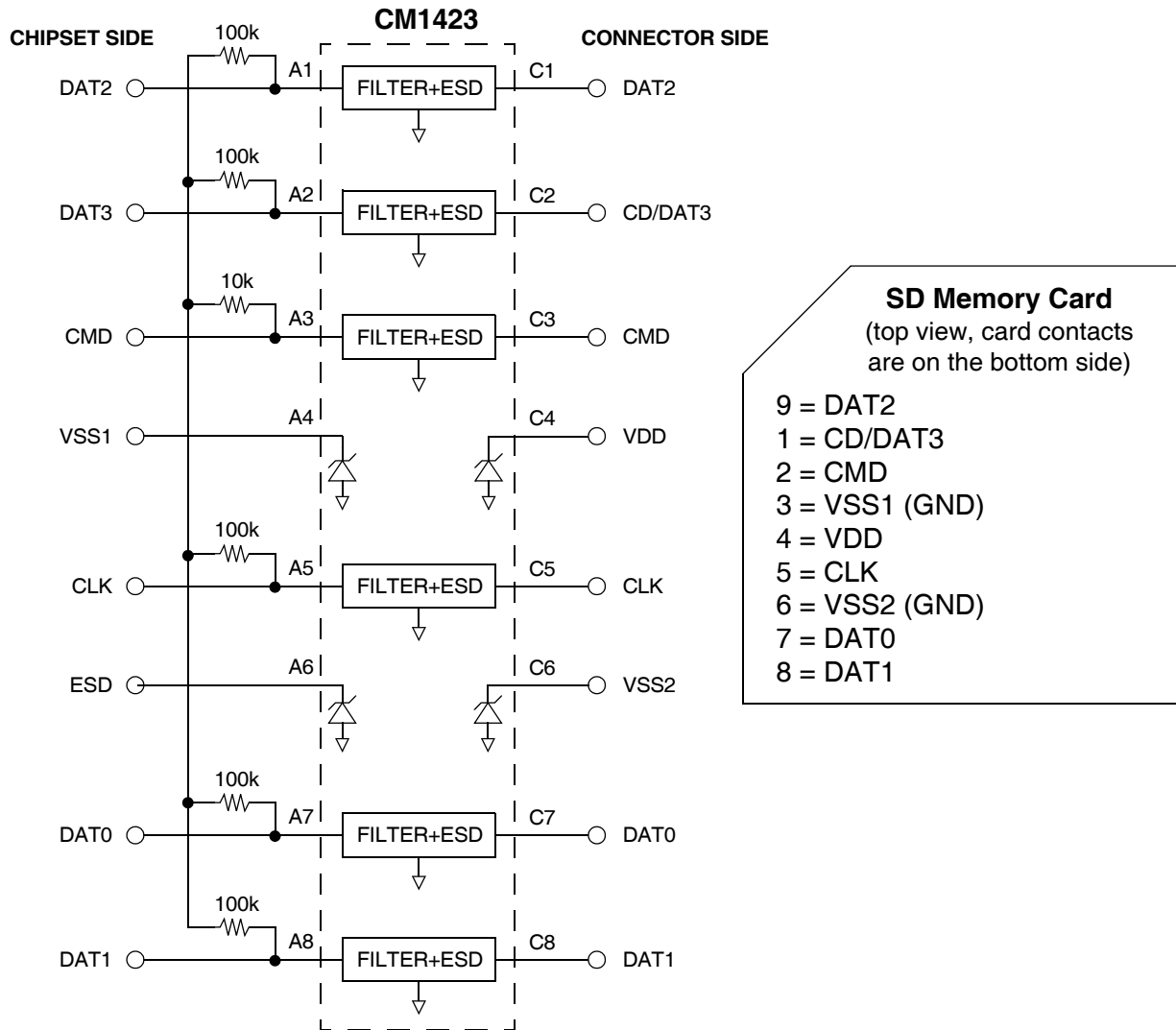
**Figure 6. A8-C8 EMI Filter Performance**

**Performance Information**



**Figure 7. Filter Capacitance vs. Input Voltage over Temperature  
(normalized to capacitance at 2.5VDC and 25°C)**

**Application Information**



Note: 100kΩ and 10kΩ pull-up resistors are not included in CM1423. Designer will need to determine the appropriate pull-up resistor value for each design.

**Figure 8. Typical SD Card Application**



### Application Information (cont'd)

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                               | $\pm 50\mu\text{m}$          |
| Solder Ball Side Coplanarity                                  | $\pm 20\mu\text{m}$          |
| Maximum Dwell Time Above Liquidous                            | 60 seconds                   |
| Soldering Maximum Temperature                                 | 260°C                        |

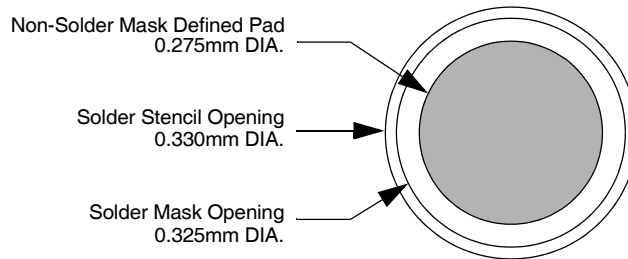


Figure 9. Recommended Non-Solder Mask Defined Pad Illustration

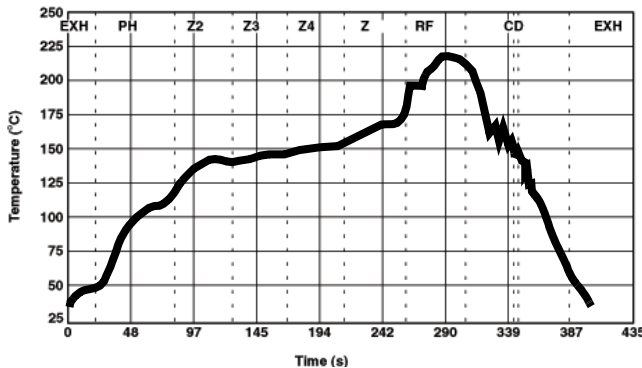


Figure 10. Eutectic (SnPb) Solder Ball Reflow Profile

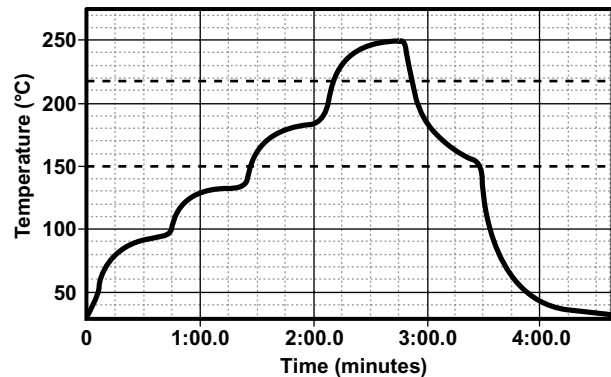


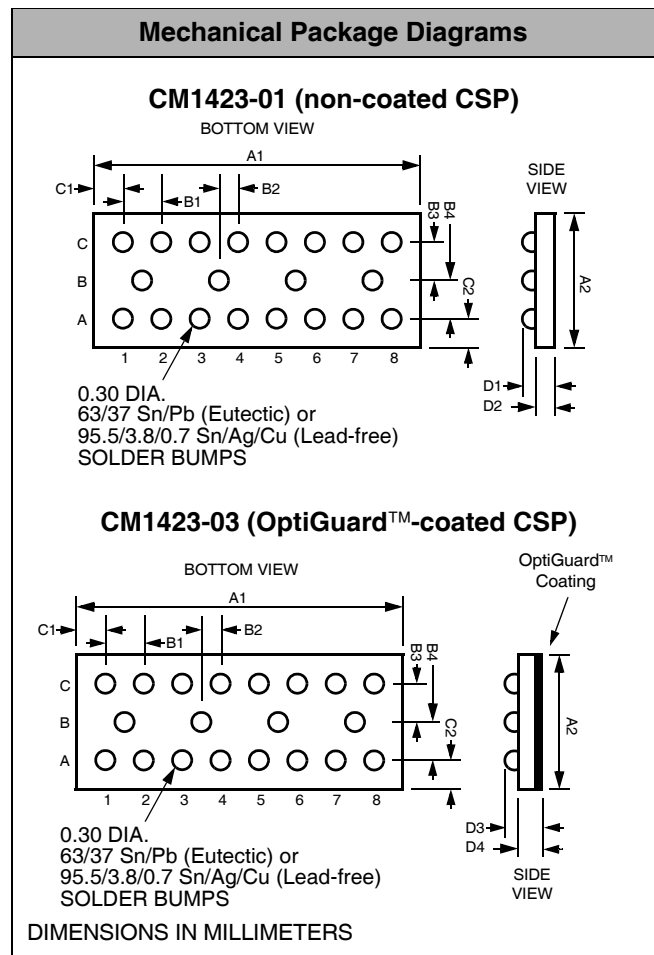
Figure 11. Lead-free (SnAgCu) Solder Ball Reflow Profile

## Mechanical Details

### CM1423 Mechanical Specifications

The package dimensions for the CM1423-01 and the CM1423-03 are presented below.

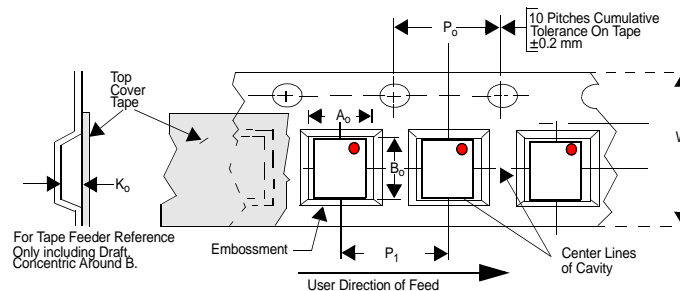
| PACKAGE DIMENSIONS                 |             |       |       |        |        |        |
|------------------------------------|-------------|-------|-------|--------|--------|--------|
| Package                            | Custom CSP  |       |       |        |        |        |
| Bumps                              | 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                                 | 0.561       | 0.605 | 0.649 | 0.0221 | 0.0238 | 0.0255 |
| D2                                 | 0.355       | 0.380 | 0.405 | 0.0140 | 0.0150 | 0.0159 |
| D3                                 | 0.600       | 0.670 | 0.739 | 0.0236 | 0.0264 | 0.0291 |
| D4                                 | 0.394       | 0.445 | 0.495 | 0.0155 | 0.0175 | 0.0195 |
| # per tape and reel                | 3500 pieces |       |       |        |        |        |
| Controlling dimension: millimeters |             |       |       |        |        |        |



### Package Dimensions for CM1423 Chip Scale Package

### CSP Tape and Reel Specifications

| PART NUMBER | CHIP SIZE (mm)     | POCKET SIZE (mm)<br>B <sub>0</sub> X A <sub>0</sub> X K <sub>0</sub> | TAPE WIDTH<br>W | REEL<br>DIAMETER | QTY PER<br>REEL | P <sub>0</sub> | P <sub>1</sub> |
|-------------|--------------------|--|-----------------|------------------|-----------------|----------------|----------------|
| CM1423-01   | 4.00 X 1.46 X 0.60 | 4.11 X 1.57 X 0.76   | 12mm            | 330mm (13")      | 3500            | 4mm            | 4mm            |
| CM1423-03   | 4.00 X 1.46 X 0.67 | 4.11 X 1.57 X 0.76   | 12mm            | 330mm (13")      | 3500            | 4mm            | 4mm            |



**Figure 12. Tape and Reel Mechanical Data**