

6 Channel EMI Filter Array with ESD Protection

Features

- Six channels of EMI filtering for data ports
- Pi-style EMI filters in a capacitor-resistor-capacitor (C-R-C) network
- $\pm 30\text{kV}$ ESD protection on each channel (IEC 61000-4-2 Level 4, contact discharge)
- $\pm 30\text{kV}$ ESD protection on each channel (HBM)
- Greater than 35dB attenuation (typical) at 1 GHz
- 15-bump, 0.4mm pitch, 2.360mm x 1.053mm footprint Chip Scale Package (CSP)
- Chip Scale Package features extremely low lead inductance for optimum filter and ESD performance
- *OptiGuard*TM coated for improved reliability at assembly
- Lead-free version available

Applications

- LCD and Camera data lines 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.
- Wireless handsets
- Handheld PCs/PDAs
- LCD and camera modules

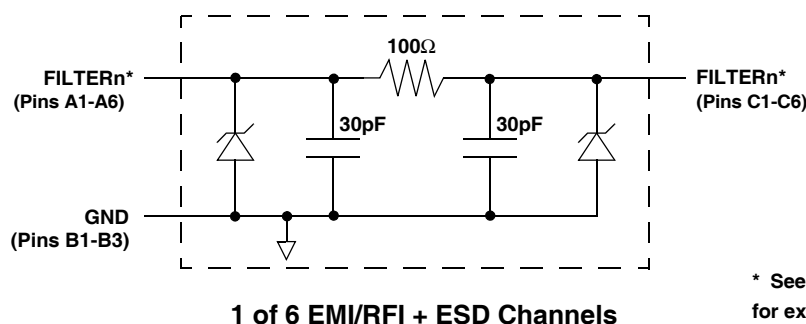
Product Description

The CM1440 is a six channel low-pass EMI filter array with ESD protection that reduces EMI/RFI emissions while providing robust protection from ESD strikes. Each EMI filter channel integrates a high quality pi-style filter (30pF-100 Ω -30pF) which provides greater than 30dB of attenuation in the 800MHz to 2.7GHz frequency range. The parts include avalanche-type ESD 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 protection diodes connected to the filter ports safely dissipate ESD strikes of $\pm 30\text{kV}$, 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 $\pm 30\text{kV}$.

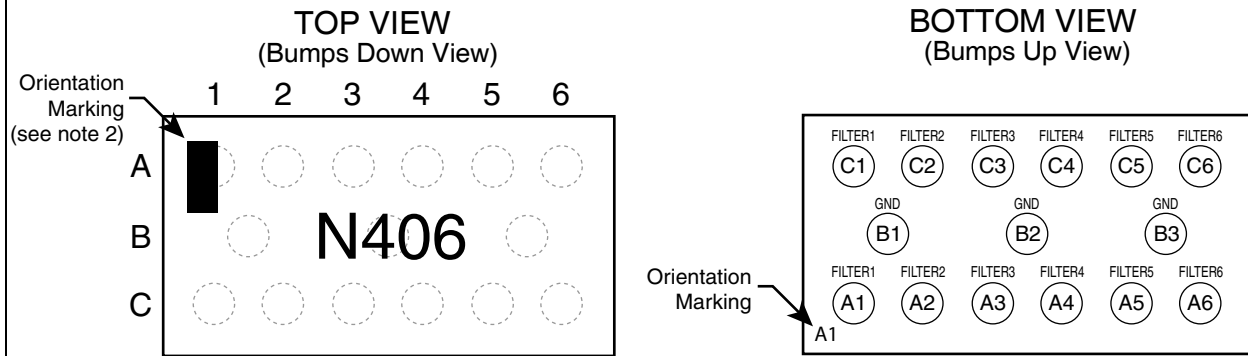
This device is particularly well-suited for portable electronics (e.g. wireless handsets, PDAs, notebook computers) because of its small package and easy-to-use pin assignments. In particular, the CM1440 is ideal for EMI filtering and protecting data and control lines for the I/O data ports, LCD display and camera interface in mobile handsets.

The CM1440 incorporates *OptiGuard*TM which results in improved reliability at assembly. The CM1440 is available in a space saving, low profile Chip Scale Package with optional lead-free finishing. It is manufactured with a 0.40mm pitch and 0.25mm CSP solder ball to provide up to 28% board space savings versus competing CSP devices with 0.50mm pitch and 0.30mm CSP solder ball.

Electrical Schematic



* See Package/Pinout Diagram for expanded pin information.

PACKAGE / PINOUT DIAGRAMS


CM1440-06CS/CP
15 Bump 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

| PIN(s) | NAME | DESCRIPTION |
|--------|---------|------------------|
| A1 | FILTER1 | Filter Channel 1 |
| A2 | FILTER2 | Filter Channel 2 |
| A3 | FILTER3 | Filter Channel 3 |
| A4 | FILTER4 | Filter Channel 4 |
| A5 | FILTER5 | Filter Channel 5 |
| A6 | FILTER6 | Filter Channel 6 |
| B1-B3 | GND | Device Ground |
| C1 | FILTER1 | Filter Channel 1 |
| C2 | FILTER2 | Filter Channel 2 |
| C3 | FILTER3 | Filter Channel 3 |
| C4 | FILTER4 | Filter Channel 4 |
| C5 | FILTER5 | Filter Channel 5 |
| C6 | FILTER6 | Filter Channel 6 |

Ordering Information
PART NUMBERING INFORMATION

| Pins | Package | Standard Finish | | Lead-free Finish ² | |
|------|---------|-----------------------------------|--------------|-----------------------------------|--------------|
| | | Ordering Part Number ¹ | Part Marking | Ordering Part Number ¹ | Part Marking |
| 15 | CSP | CM1440-06CS | N406 | CM1440-06CP | N406 |

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 NOTE1)

| SYMBOL | PARAMETER | CONDITIONS | MIN | TYP | MAX | UNITS |
|--------------------|--|--------------------------------------|-------------|-------------|-------------|----------|
| R | Resistance | | 80 | 100 | 120 | Ω |
| C _{TOTAL} | Total Channel Capacitance | At 2.5VDC Reverse Bias, 1MHz, 30mVAC | 48 | 60 | 72 | pF |
| C | Capacitance C1 | At 2.5VDC Reverse Bias, 1MHz, 30mVAC | 24 | 30 | 36 | pF |
| V _{DIODE} | Standoff Voltage | I _{DIODE} =10μA | | 6.0 | | V |
| I _{LEAK} | Diode Leakage Current (reverse bias) | V _{DIODE} =+3.3V | | 0.1 | 1 | μA |
| V _{SIG} | Signal Clamp Voltage Positive Clamp Negative Clamp | I _{LOAD} = 10mA | 5.6 -1.5 | 6.8 -0.8 | 9.0 -0.4 | V V |
| V _{ESD} | In-system ESD Withstand Voltage a) Human Body Model, MIL-STD-883, Method 3015 b) Contact Discharge per IEC 61000-4-2 Level 4 | Notes 2 and 3 | ±30 ±30 | | | kV kV |
| R _{DYN} | Dynamic Resistance Positive Negative | | | 2.3 0.9 | | Ω Ω |
| f _C | Cut-off Frequency Z _{SOURCE} =50Ω, Z _{LOAD} =50Ω | R=100Ω, C=30pF | | 60 | | 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: These parameters are guaranteed by design and characterization.

Performance Information

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

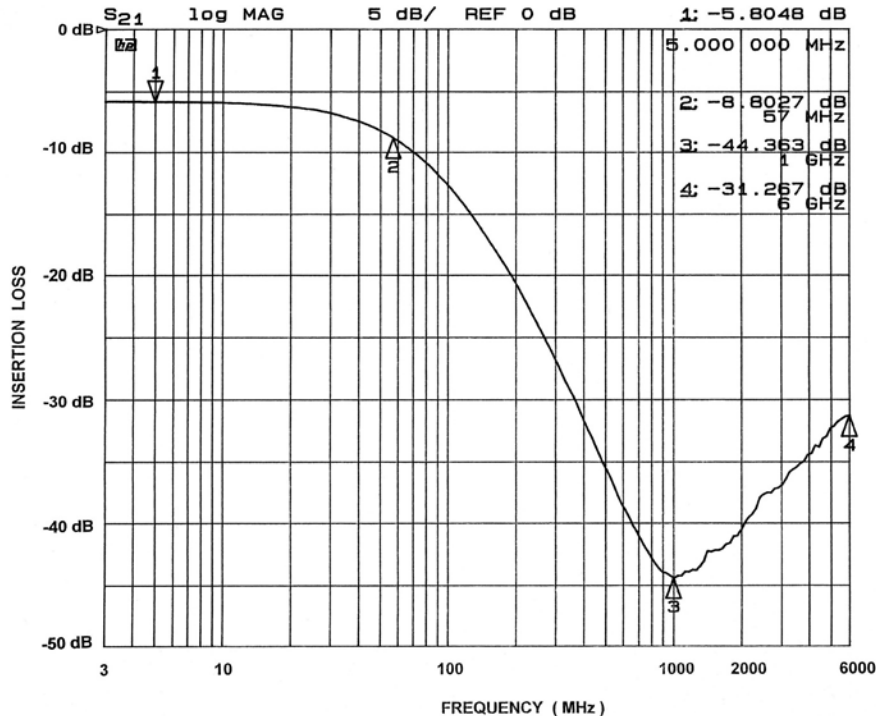


Figure 1. Insertion Loss vs. Frequency (A1-C1 to GND B1)

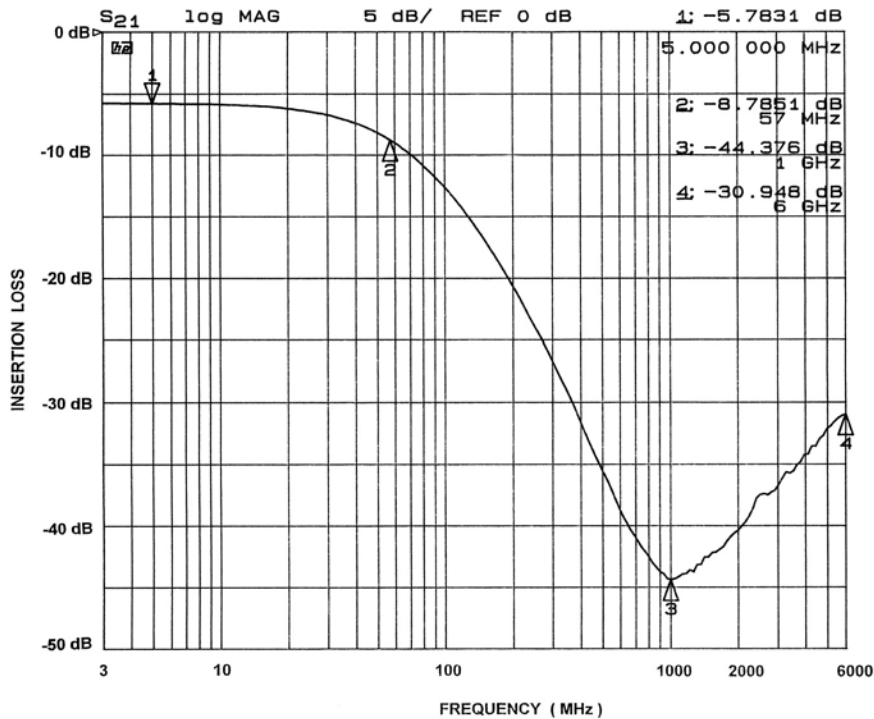


Figure 2. Insertion Loss vs. Frequency (A2-C2 to GND B1)

Performance Information (cont'd)

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

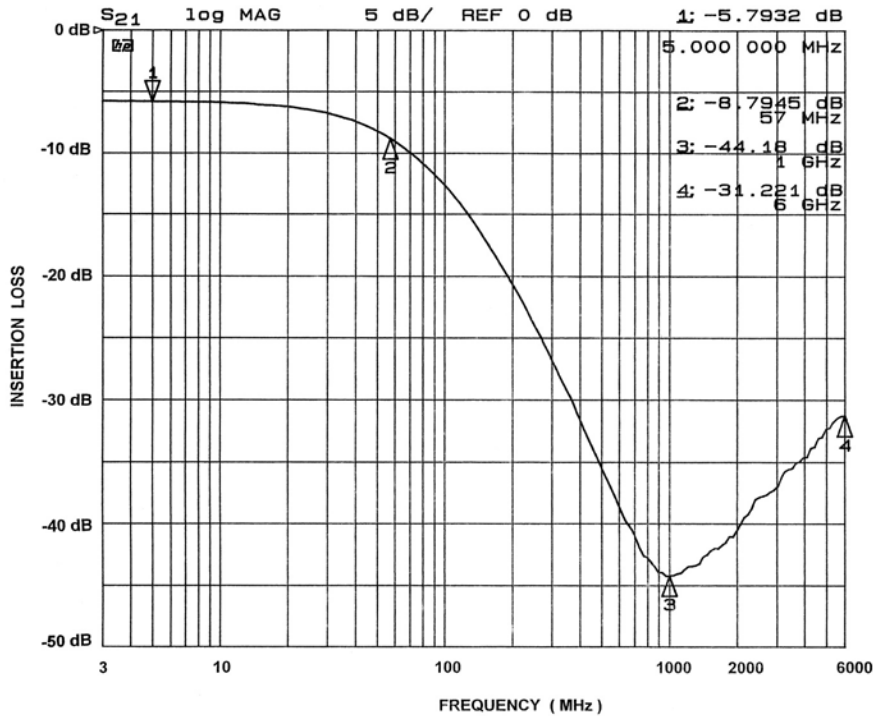


Figure 3. Insertion Loss vs. Frequency (A3-C3 to GND B2)

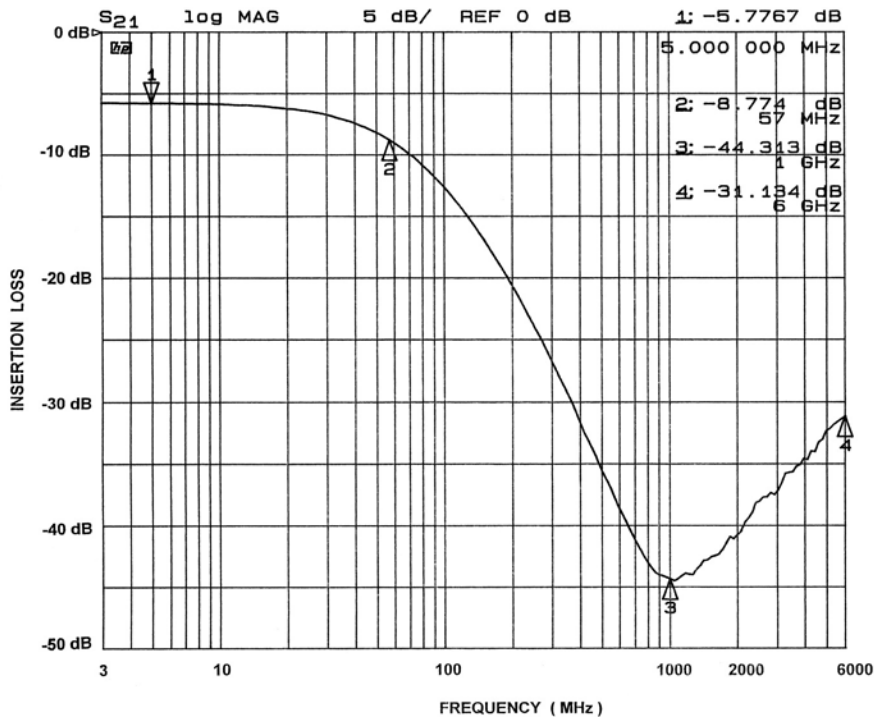


Figure 4. Insertion Loss vs. Frequency (A4-C4 to GND B2)

Performance Information (cont'd)

Typical Filter Performance ($T_A=25^\circ\text{C}$, DC Bias=0V, 50 Ohm Environment)

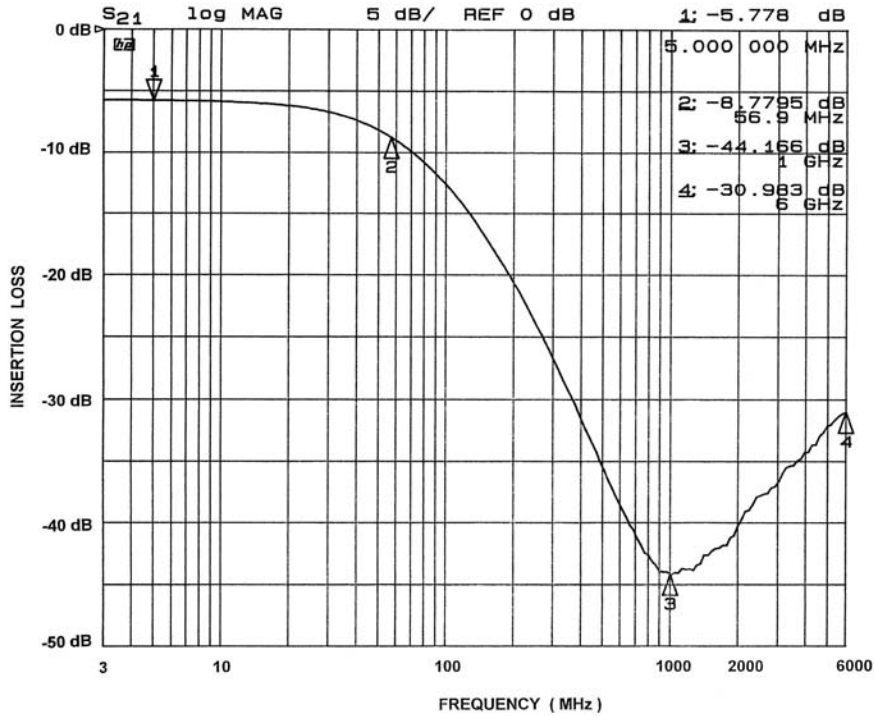


Figure 5. Insertion Loss vs. Frequency (A5-C5 to GND B3)

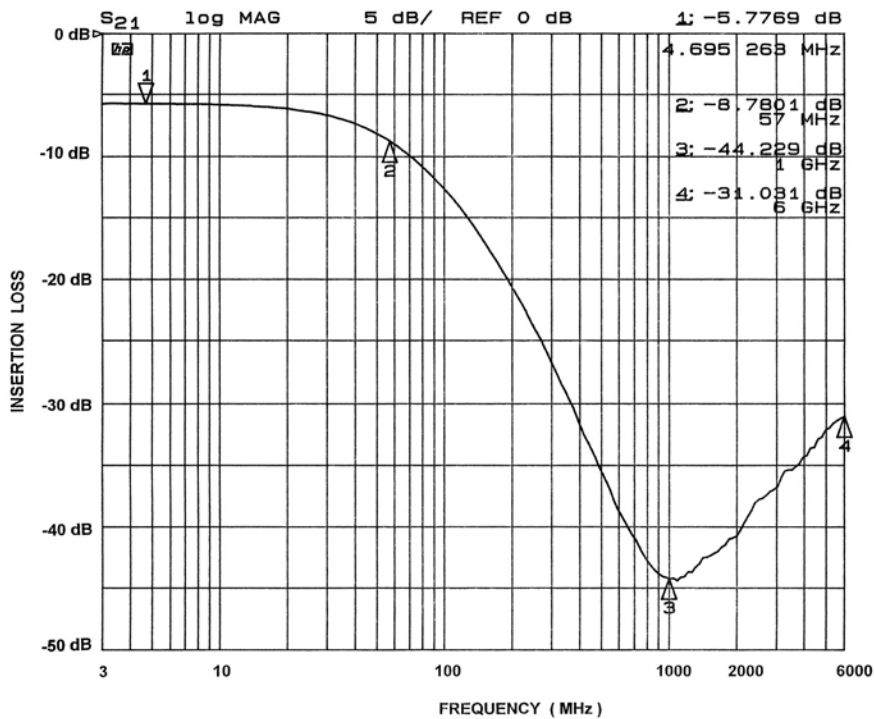
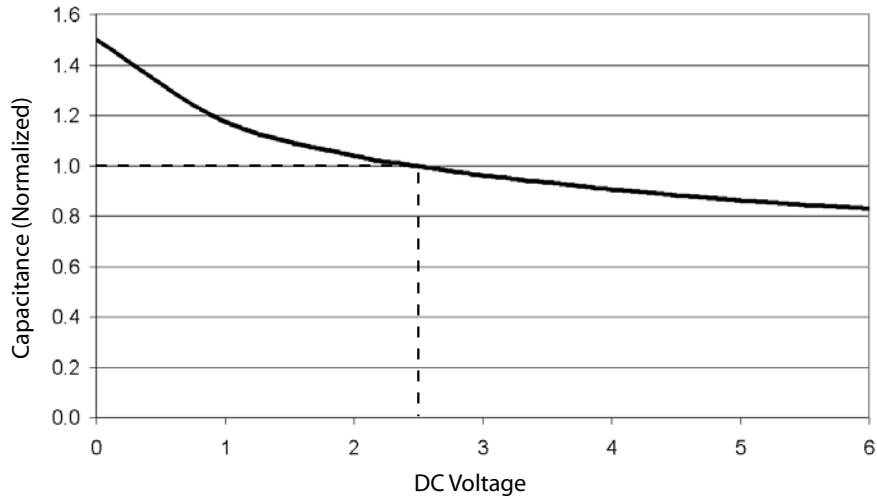


Figure 6. Insertion Loss vs. Frequency (A6-C6 to GND B3)

Performance Information (cont'd)

Typical Diode Capacitance vs. Input Voltage



**Figure 7. Filter Capacitance vs. Input Voltage
(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 | 0.240mm |
| 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 (183°C) | 60 seconds |
| Maximum Soldering Temperature for a Eutectic Device using Eutectic Solder Paste | 240°C |
| Maximum Soldering Temperature for a Lead-free Device using Lead-free Solder Paste | 260°C |

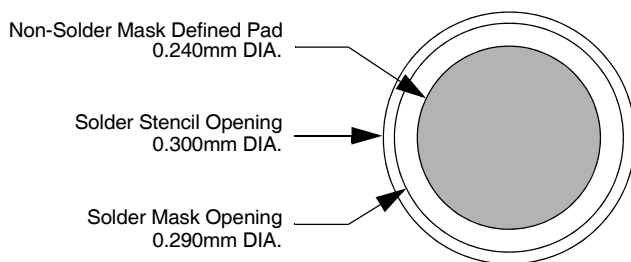


Figure 8. Recommended Non-Solder Mask Defined Pad Illustration

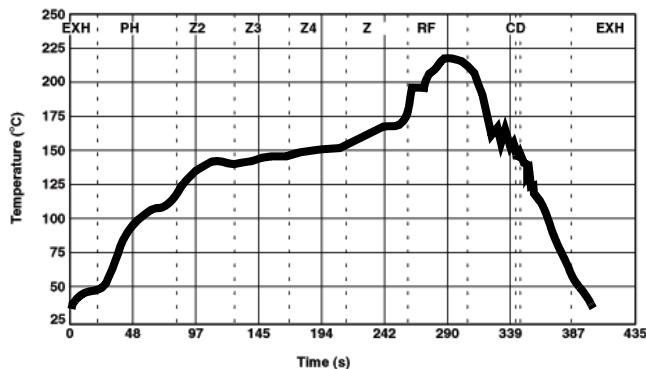


Figure 9. Eutectic (SnPb) Solder Ball Reflow Profile

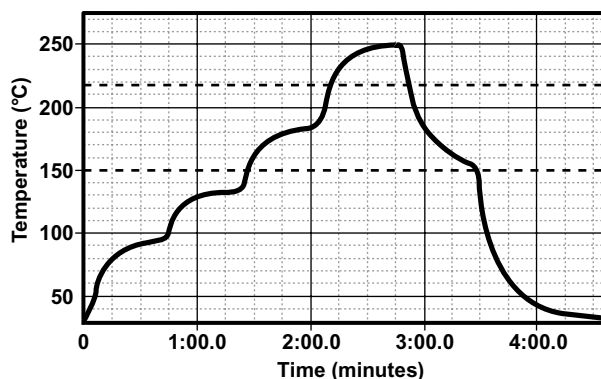


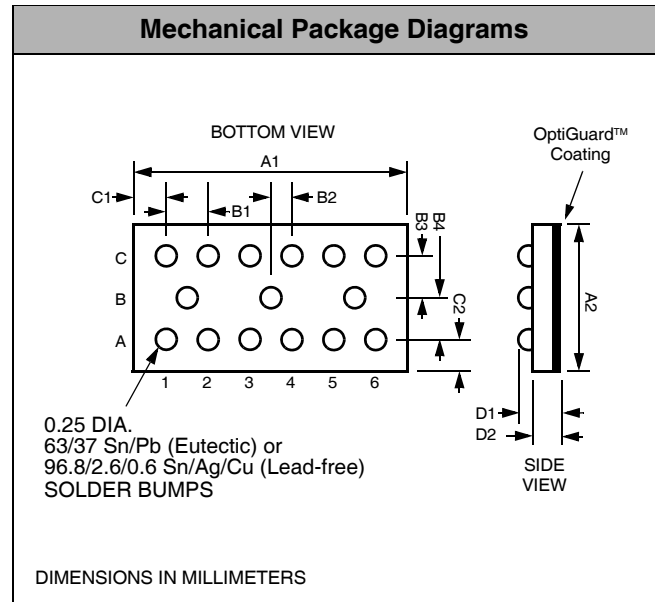
Figure 10. Lead-free (SnAgCu) Solder Ball Reflow Profile

Mechanical Details

CSP Mechanical Specifications

CM1440 devices are supplied 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 | 15 | | | | | |
| Dim | Millimeters | | | Inches | | |
| | Min | Nom | Max | Min | Nom | Max |
| A1 | 2.3150 | 2.3600 | 2.4050 | 0.911 | 0.0929 | 0.0947 |
| A2 | 1.008 | 1.053 | 1.098 | 0.0397 | 0.0415 | 0.0432 |
| B1 | 0.395 | 0.4000 | 0.405 | 0.0156 | 0.0157 | 0.0159 |
| B2 | 0.195 | 0.2000 | 0.205 | 0.0076 | 0.0078 | 0.0080 |
| B3 | 0.3415 | 0.3465 | 0.3515 | 0.0134 | 0.0136 | 0.0138 |
| B4 | 0.3415 | 0.3465 | 0.3515 | 0.0134 | 0.0136 | 0.0138 |
| C1 | 0.130 | 0.1800 | 0.230 | 0.0051 | 0.0071 | 0.0091 |
| C2 | 0.130 | 0.1800 | 0.230 | 0.0051 | 0.0071 | 0.0091 |
| D1 | 0.575 | 0.644 | 0.714 | 0.0226 | 0.0254 | 0.0281 |
| D2 | 0.368 | 0.419 | 0.470 | 0.0145 | 0.0165 | 0.0185 |
| # per tape and reel | 3500 pieces | | | | | |
| Controlling dimension: millimeters | | | | | | |



**Package Dimensions for
CM1440 Chip Scale Package**

CSP Tape and Reel Specifications

| PART NUMBER | CHIP SIZE (mm) | POCKET SIZE (mm) $B_0 \times A_0 \times K_0$ | TAPE WIDTH W | REEL DIAMETER | QTY PER REEL | P_0 | P_1 |
|-------------|----------------------|---|-----------------|------------------|-----------------|-------|-------|
| CM1440 | 2.36 X 1.053 X 0.644 | 2.62 X 1.12 X 0.76 | 8mm | 178mm (7") | 3500 | 4mm | 4mm |

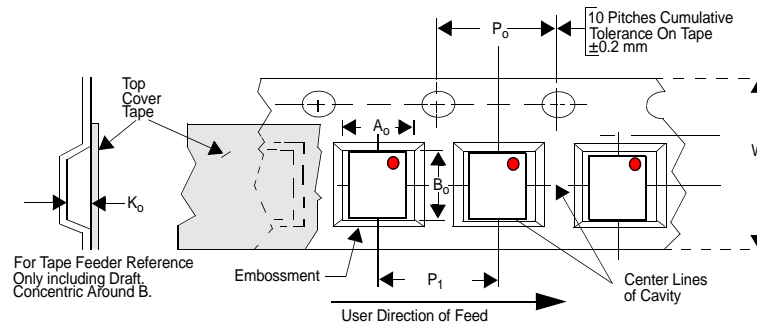


Figure 11. Tape and Reel Mechanical Data