



# Praetorian III® 4, 6, 8-Channel EMI Filter Array with ESD Protection

## CM1457

### Features

- Four, six, or eight channels of EMI filtering
- $\pm 15\text{kV}$  ESD protection (IEC 61000-4-2, contact discharge) at external pins
- Greater than -40dB of attenuation at 1GHz MIL\_STD\_883 international ESD standard
- Chip Scale Package (CSP) with 0.40mm pitch and 0.25mm CSP solder ball which features extremely low parasitic inductance for optimum filter and ESD performance
- *OptiGuard*™ coating for improved reliability at assembly
- RoHS-compliant, lead-free finishing

### 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 computer
- Wireless handsets
- Handheld PCs/PDAs
- LCD and camera modules

Note: Refer to Application Note AP-217, "The Chip Scale Package", for a detailed description of Chip Scale Packages offered by California Micro Devices. See <http://www.wlcsforum.org/documents/pdf/ap-217.pdf> for download.

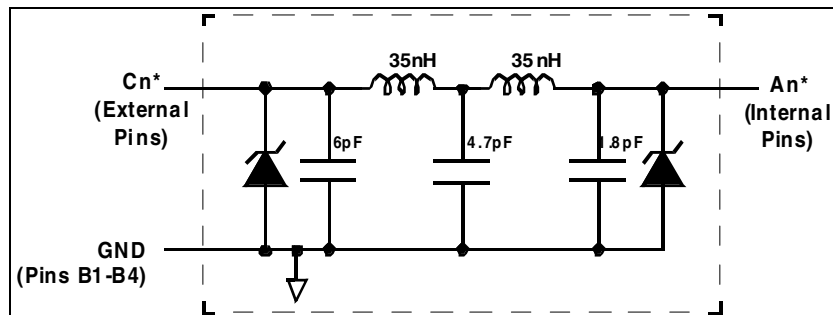
### Functional Description

The CM1457 is an inductor-based (L-C) EMI filter array with ESD protection, which integrates four, six, or eight filters in a CSP form factor with 0.40mm pitch. Each EMI filter channel of the CM1457 is implemented with the component value of 6pF-35nH-4.7pF-35nH-1.8pF. The cut-off frequency at -3dB attenuation is 300MHz and can be used in applications where the data rates are as high as 160Mbps, while providing greater than -35dB attenuation over the 800MHz to 2.7GHz frequency range. The parts include ESD diodes on every I/O pin and provide a high level of protection against electrostatic discharge (ESD). The ESD protection diodes connected to the external filter ports are designed and characterized to safely dissipate ESD strikes of  $\pm 15\text{kV}$ , which is beyond the maximum requirement of the IEC61000-4-2 international standard.

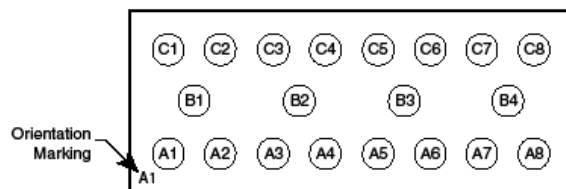
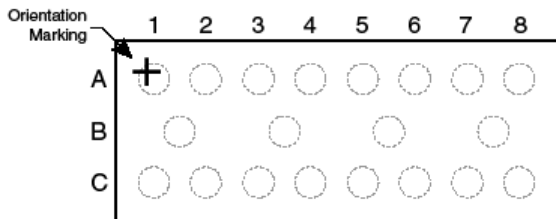
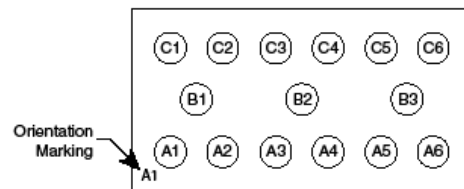
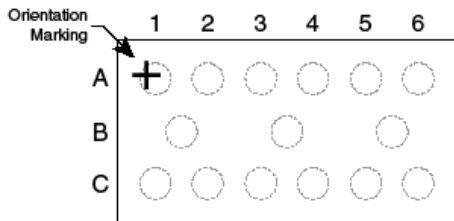
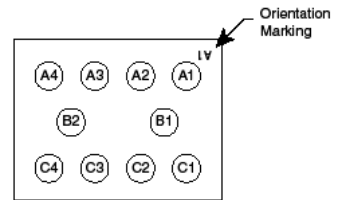
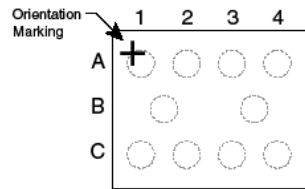
This device is particularly well suited for wireless handsets, mobile LCD modules and PDAs because of its small package format and easy-to-use pin assignments. In particular, the CM1457 is ideal for EMI filtering and protecting data and control lines for the LCD display and camera interface in mobile handsets.

The CM1457 incorporates OptiGuard™ which results in improved reliability at assembly. It is manufactured with a 0.40mm pitch and 0.25mm CSP solder ball to provide up to 28% board space savings vs. competing CSP devices with 0.50mm pitch and 0.30mm CSP solder ball.

### Block Diagram



Pin Configurations



TO  
Bumps

# CM1457

## Pin Descriptions

| PIN NUMBER |     |     | PIN DESCRIPTION      | PIN NUMBER |     |     | PIN DESCRIPTION      |
|------------|-----|-----|----------------------|------------|-----|-----|----------------------|
| -04        | -06 | -08 |                      | -04        | -06 | -08 |                      |
| A1         | A1  | A1  | Filter #1 (Internal) | C1         | C1  | C1  | Filter #1 (External) |
| A2         | A2  | A2  | Filter #2 (Internal) | C2         | C2  | C2  | Filter #2 (External) |
| A3         | A3  | A3  | Filter #3 (Internal) | C3         | C3  | C3  | Filter #3 (External) |
| A4         | A4  | A4  | Filter #4 (Internal) | C4         | C4  | C4  | Filter #4 (External) |
|            | A5  | A5  | Filter #5 (Internal) |            | C5  | C5  | Filter #5 (External) |
|            | A6  | A6  | Filter #6 (Internal) |            | C6  | C6  | Filter #6 (External) |
|            |     | A7  | Filter #7 (Internal) |            |     | C7  | Filter #7 (External) |
|            |     | A8  | Filter #8 (Internal) |            |     | C8  | Filter #8 (External) |
| B1         | B1  | B1  | GND                  |            |     |     |                      |
| B2         | B2  | B2  | GND                  |            |     |     |                      |
|            | B3  | B3  | GND                  |            |     |     |                      |
|            |     | B4  | GND                  |            |     |     |                      |

## Ordering Information

| Bumps | Package | Ordering Part Number <sup>1</sup> | Part Marking <sup>2</sup> |
|-------|---------|-----------------------------------|---------------------------|
| 10    | CSP     | CM1457-04CP                       | N57 (w)                   |
| 15    | CSP     | CM1457-06CP                       | N57 (yww)                 |
| 20    | CSP     | CM1457-08CP                       | N57 (yyww)                |

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

Note 2: (w/yww/yyww) = date code

## Absolute Maximum Ratings

| PARAMETER                 | RATING      | UNITS |
|---------------------------|-------------|-------|
| Storage Temperature Range | -65 to +150 | °C    |
| DC current per Inductor   | 15          | 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    |
|-----------------|---|---|---------------------|-------------|-------------|----------|
| $L_{TOT}$       | Total Channel Inductance  |   |                     | 70          |             | nH       |
| $R_{TOT}$       | Total Channel DC Resistance   |   |                     | 45          |             | $\Omega$ |
| $C_{TOT\_0V}$   | Total Channel Capacitance, 0V bias  | 0V dc; 1MHz, 30mV rms                   |                     | 20          | 24          | pF       |
| $C_{TOT\_2.5V}$ | Total Channel Capacitance, 2.5V bias  | 2.5V dc; 1MHz, 30mV rms                 |                     | 12.5        |             | pF       |
| $V_{ST}$        | Stand-off Voltage   | $I = 10\mu A$                           | 5.5                 |             |             | V        |
| $I_{LEAK}$      | Diode Leakage Current   | $V_{IN} = +3.3V$                        |                     | 0.1         | 0.5         | $\mu A$  |
| $V_{SIG}$       | Signal Clamp Voltage<br>Positive Clamp<br>Negative Clamp  | $I_{LOAD} = 10mA$<br>$I_{LOAD} = -10mA$ | 5.6<br>-1.5         | 6.8<br>-0.8 | 9.0<br>-0.4 | V<br>V   |
| $V_{ESD}$       | In-system ESD Withstand Voltage<br>a) Contact discharge per IEC 61000-4-2 standard, Level 4 <b>(External Pins)</b><br>b) Contact discharge per IEC 61000-4-2 standard, Level 4 <b>(Internal Pins)</b> | Notes 2 and 3                           | $\pm 15$<br>$\pm 2$ |             |             | kV<br>kV |
| $f_c$           | Cut-off frequency<br>$Z_{SOURCE} = 50\Omega$ , $Z_{LOAD} = 50\Omega$  |   |                     | 300         |             | MHz      |

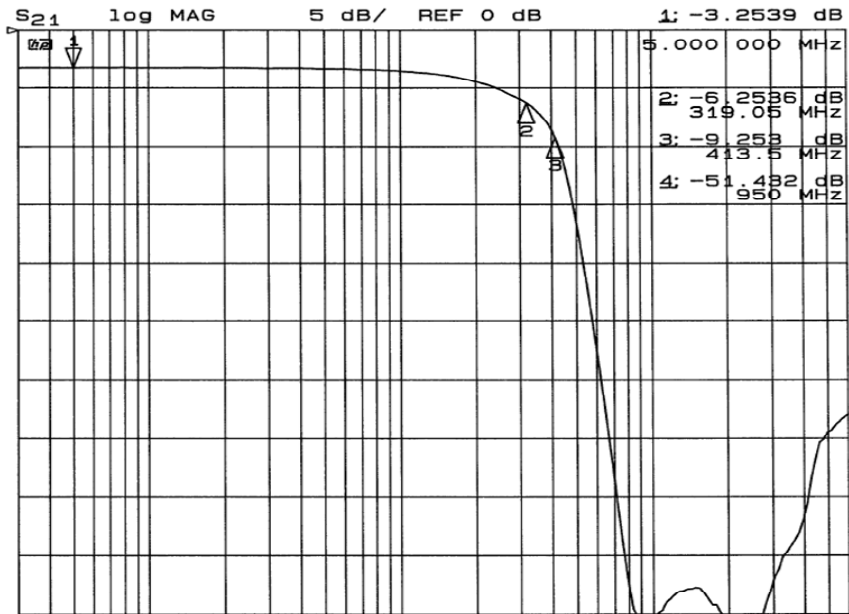
Note 1:  $T_A = 25^\circ C$  unless otherwise specified.

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

Note 3: Unused pins are left open.

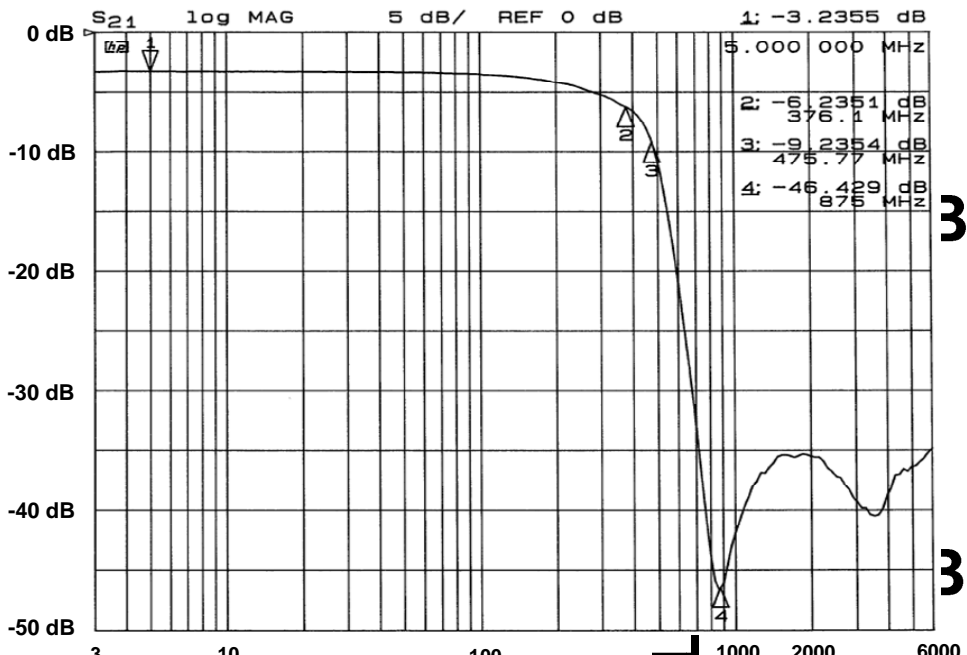
# CM1457

## Performance Information



**0 dB**

Insertion Loss Vs. Frequency (0V Bias)



**3**

**3**

FREQUENCY (MHz)

Insertion Loss Vs. Frequency (2.5V Bias)

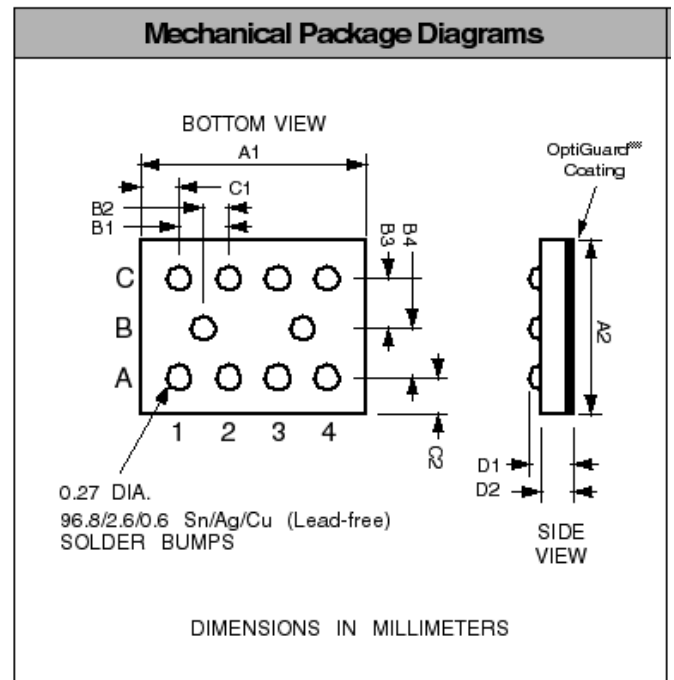
**INSERTION LOSS**

**-30 dB**

## CM1457-04CP Mechanical Specifications

The 10-bump CM1457-04CP package dimensions are shown below.

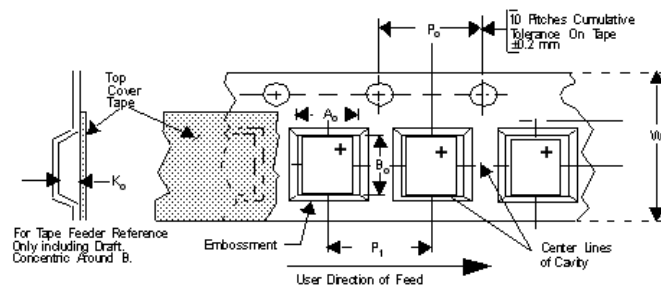
| Package Specifications                    |             |       |       |        |        |        |
|---|-------------|-------|-------|--------|--------|--------|
| Package                                   | Custom CSP  |       |       |        |        |        |
| Bumps                                     | 10          |       |       |        |        |        |
| Dim                                       | Millimeters |       |       | Inches |        |        |
|   | Min         | Nom   | Max   | Min    | Nom    | Max    |
| A1  | 1.627       | 1.672 | 1.717 | 0.0641 | 0.0658 | 0.0676 |
| A2  | 1.008       | 1.053 | 1.098 | 0.0397 | 0.0415 | 0.0432 |
| B1  | 0.395       | 0.400 | 0.405 | 0.0156 | 0.0157 | 0.0159 |
| B2  | 0.195       | 0.200 | 0.205 | 0.0077 | 0.0079 | 0.0081 |
| B3  | 0.342       | 0.347 | 0.352 | 0.0135 | 0.0137 | 0.0139 |
| B4  | 0.342       | 0.347 | 0.352 | 0.0135 | 0.0137 | 0.0139 |
| C1  | 0.186       | 0.236 | 0.286 | 0.0073 | 0.0093 | 0.0113 |
| C2  | 0.130       | 0.180 | 0.230 | 0.0051 | 0.0071 | 0.0090 |
| D1  | 0.545       | 0.615 | 0.685 | 0.0215 | 0.0242 | 0.0270 |
| D2  | 0.378       | 0.419 | 0.460 | 0.0149 | 0.0165 | 0.0181 |
| <b>Controlling dimension: millimeters</b> |             |       |       |        |        |        |



**Package Dimensions for CM1457-04CP 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 DIAMETER | QTY PER REEL | $P_0$ | $P_1$ |
|-------------|---------------------|---|-----------------|---------------|--------------|-------|-------|
| CM1457-04CP | 1.67 X 1.05 X 0.615 | 1.80 X 1.27 X 0.73                              | 8mm             | 178mm (7")    | 3500         | 4mm   | 4mm   |

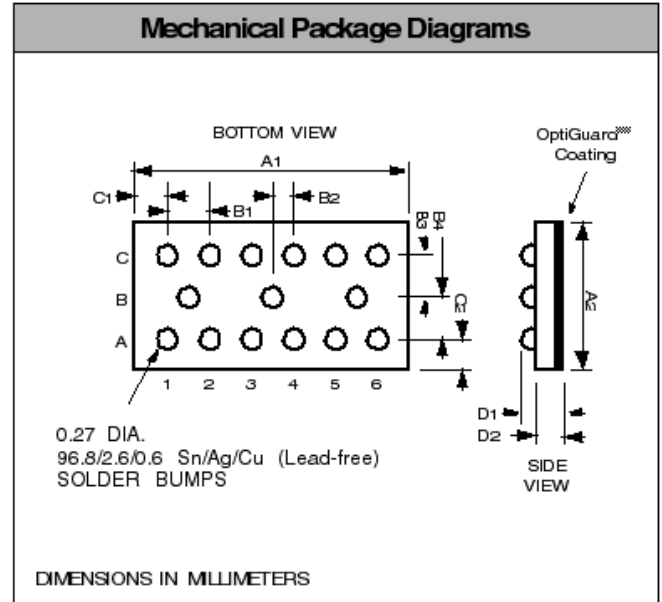


# CM1457

## CM1457-04CP Mechanical Specifications

The 15-bump CM1457-06CP package dimensions are shown below.

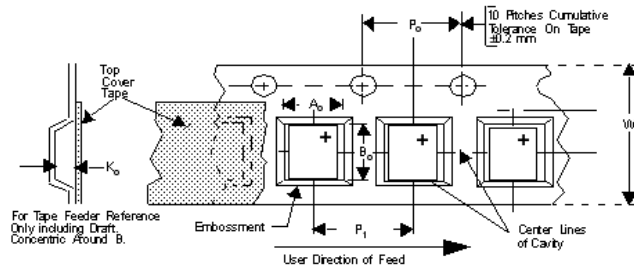
| Package Specifications             |             |       |       |        |        |        |
|------------------------------------|-------------|-------|-------|--------|--------|--------|
| Package                            | Custom CSP  |       |       |        |        |        |
| Bumps                              | 15          |       |       |        |        |        |
| Dim                                | Millimeters |       |       | Inches |        |        |
|                                    | Min         | Nom   | Max   | Min    | Nom    | Max    |
| A1                                 | 2.427       | 2.472 | 2.517 | 0.0956 | 0.0973 | 0.0992 |
| A2                                 | 1.008       | 1.053 | 1.098 | 0.0397 | 0.0415 | 0.0432 |
| B1                                 | 0.395       | 0.400 | 0.405 | 0.0156 | 0.0157 | 0.0159 |
| B2                                 | 0.195       | 0.200 | 0.205 | 0.0077 | 0.0079 | 0.0081 |
| B3                                 | 0.342       | 0.347 | 0.352 | 0.0135 | 0.0137 | 0.0139 |
| B4                                 | 0.342       | 0.347 | 0.352 | 0.0135 | 0.0137 | 0.0139 |
| C1                                 | 0.187       | 0.237 | 0.287 | 0.0074 | 0.0093 | 0.0113 |
| C2                                 | 0.130       | 0.180 | 0.230 | 0.0051 | 0.0071 | 0.0090 |
| D1                                 | 0.545       | 0.615 | 0.685 | 0.0215 | 0.0242 | 0.0270 |
| 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 CM1457-06CP Chip Scale Package

## CSP Tape and Reel Specifications

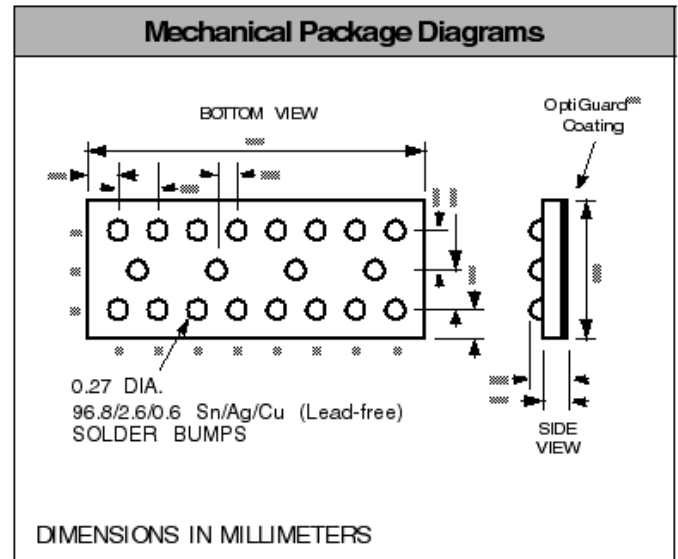
| PART NUMBER | CHIP SIZE (mm)      | POCKET SIZE (mm)<br>$B_0 \times A_0 \times K_0$ | TAPE WIDTH<br>W | REEL DIAMETER | QTY PER REEL | $P_0$ | $P_1$ |
|-------------|---------------------|---|-----------------|---------------|--------------|-------|-------|
| CM1457-06   | 2.47 X 1.05 X 0.615 | 2.59 X 1.27 X 0.73                              | 8mm             | 178mm (7")    | 3500         | 4mm   | 4mm   |



## CM1457-08CP Mechanical Specifications

The 20-bump CM1457-08CP package dimensions are shown below.

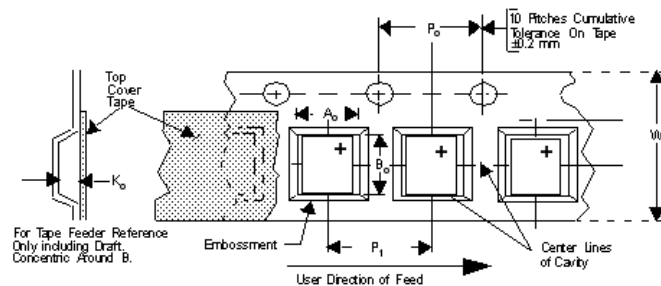
| Package Specifications             |             |       |       |        |        |        |
|------------------------------------|-------------|-------|-------|--------|--------|--------|
| Package                            | Custom CSP  |       |       |        |        |        |
| Bumps                              | 20          |       |       |        |        |        |
| Dim                                | Millimeters |       |       | Inches |        |        |
|                                    | Min         | Nom   | Max   | Min    | Nom    | Max    |
| A1                                 | 3.227       | 3.272 | 3.317 | 0.1270 | 0.1288 | 0.1306 |
| A2                                 | 1.008       | 1.053 | 1.098 | 0.0397 | 0.0415 | 0.0432 |
| B1                                 | 0.395       | 0.400 | 0.405 | 0.0156 | 0.0157 | 0.0159 |
| B2                                 | 0.195       | 0.200 | 0.205 | 0.0077 | 0.0079 | 0.0081 |
| B3                                 | 0.342       | 0.347 | 0.352 | 0.0135 | 0.0137 | 0.0139 |
| B4                                 | 0.342       | 0.347 | 0.352 | 0.0135 | 0.0137 | 0.0139 |
| C1                                 | 0.186       | 0.236 | 0.286 | 0.0073 | 0.0093 | 0.0113 |
| C2                                 | 0.130       | 0.180 | 0.230 | 0.0051 | 0.0071 | 0.0090 |
| D1                                 | 0.545       | 0.615 | 0.685 | 0.0215 | 0.0242 | 0.0270 |
| 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 CM1457-08CP 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 DIAMETER | QTY PER REEL | $P_0$ | $P_1$ |
|-------------|---------------------|---|-----------------|---------------|--------------|-------|-------|
| CM1457-08CP | 3.27 X 1.05 X 0.615 | 3.40 X 1.27 X 0.73                              | 12mm            | 330mm (13")   | 3500         | 4mm   | 4mm   |





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