



**THE DATASHEET OF  
CM1401-32CP**





# 4-Channel ESD/EMI Filter Array Plus 4-Channel ESD Array for USB

## CM1401-32CP

### Features

- Functionally and pin-compatible with CSPEMI307A device
- *OptiGuard* coated for improved reliability at assembly
- Four channels of combined EMI/RFI filtering + ESD protection
- Four additional channels of ESD-only protection
- 40dB absolute attenuation (typical) at 1GHz
- 35dB attenuation (typical) at 1GHz relative to pass band
- $\pm 15$ kV ESD protection on all channels (IEC 61000-4-2 Level 4, contact discharge)
- $\pm 30$ kV ESD protection on all channels (HBM)
- 15-bump, 2.960mm X 1.330mm footprint
- Chip Scale Package (CSP) features extremely low lead inductance for optimum filter and ESD performance
- RoHS-compliant (lead-free) finishing

### Applications

- EMI filtering and ESD protection for both data and I/O ports
- Outer four channels provide ESD protection for USB lines and other I/O port applications
- Wireless handsets
- Handheld PCs / PDAs
- MP3 players
- Notebooks
- Desktop PCs

### Product Description

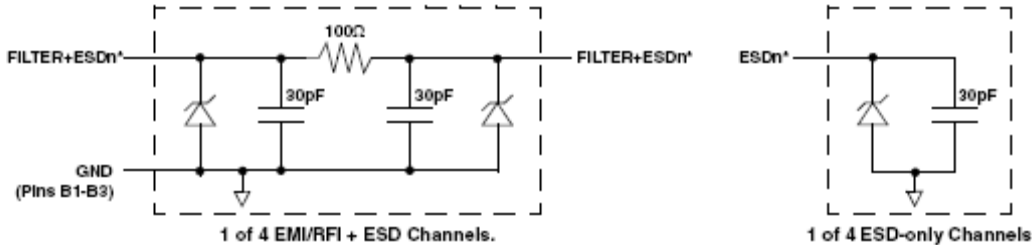
The CM1401-32CP is a multichannel array with four low-pass filter + ESD channels and four ESD-only channels. The CM1401-32CP reduces EMI/RFI emissions on a data port and protects against ESD on a USB port. Each EMI/RFI channel integrates a high quality pi-style filter (C-R-C) that provides greater than 30dB attenuation in the 800-2700 MHz range relative to the pass band attenuation. These pi-style filters are bidirectional, controlling EMI both to and from a data port connector.

The CM1401-32CP provides a high-level of ESD protection on all eight channels for sensitive electronic components that may be subjected to electrostatic discharge (ESD). The input pins safely dissipate ESD strikes of  $\pm 15$ kV, exceeding 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 device provides protection for contact discharges to greater than  $\pm 30$ kV.

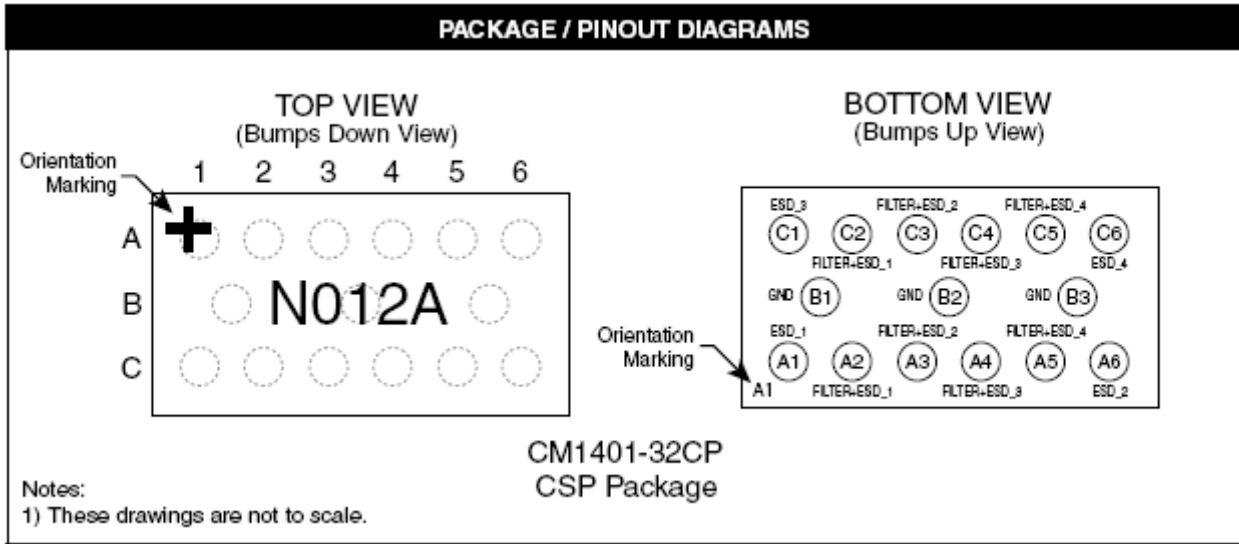
The CM1401-32CP is particularly well suited for portable electronics (e.g., cellular telephones, PDAs, notebook computers) because of its small package footprint and low weight.

The CM1401-32CP incorporates *OptiGuard*<sup>™</sup> coating for improved reliability at assembly and comes in a space-saving, low-profile Chip Scale Package with RoHS-compliant lead-free finishing.

**Electrical Schematic**



\* See Package/Pinout Diagram for expanded pin information



# CM1401-32CP

## PIN DESCRIPTIONS

| PIN(s) | NAME         | DESCRIPTION            |
|--------|--------------|------------------------|
| A1     | ESD_1        | ESD Channel 1          |
| A2     | FILTER+ESD_1 | Filter + ESD Channel 1 |
| A3     | FILTER+ESD_2 | Filter + ESD Channel 2 |
| A4     | FILTER+ESD_3 | Filter + ESD Channel 3 |
| A5     | FILTER+ESD_4 | Filter + ESD Channel 4 |
| A6     | ESD_2        | ESD Channel 2          |
| B1-B3  | GND          | Device Ground          |
| C1     | ESD_3        | ESD Channel 3          |
| C2     | FILTER+ESD_1 | Filter + ESD Channel 1 |
| C3     | FILTER+ESD_2 | Filter + ESD Channel 2 |
| C4     | FILTER+ESD_3 | Filter + ESD Channel 3 |
| C5     | FILTER+ESD_4 | Filter + ESD Channel 4 |
| C6     | ESD_4        | ESD Channel 4          |

## Ordering Information

### PART NUMBERING INFORMATION

| Pins | Package | Variation | Ordering Part Number <sup>1</sup> | Part Marking |
|------|---------|-----------|-----------------------------------|--------------|
| 15   | CSP     | SAC387    | CM1401-32CP                       | N012A        |

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

**Specifications**

| <b>ABSOLUTE MAXIMUM RATINGS</b> |               |              |
|---------------------------------|---------------|--------------|
| <b>PARAMETER</b>                | <b>RATING</b> | <b>UNITS</b> |
| Storage Temperature Range       | -65 to +150   | °C           |
| DC Power per Resistor           | 100           | mW           |
| DC Package Power Rating         | 600           | mW           |

| <b>STANDARD OPERATING CONDITIONS</b> |               |              |
|--------------------------------------|---------------|--------------|
| <b>PARAMETER</b>                     | <b>RATING</b> | <b>UNITS</b> |
| Operating Temperature Range          | -40 to +85    | °C           |

# CM1401-32CP

## ELECTRICAL OPERATING CHARACTERISTICS (SEE NOTE1)

| SYMBOL      | PARAMETER  | CONDITIONS            | MIN                  | TYP         | MAX         | UNITS    |
|-------------|--|-----------------------|----------------------|-------------|-------------|----------|
| R           | Resistance   |                       | 80                   | 100         | 120         | $\Omega$ |
| C           | Capacitance  | At 2.5V DC            | 24                   | 30          | 36          | pF       |
| TCR         | Temperature Coefficient of Resistance  |                       |                      | 1200        |             | ppm/°C   |
| TCC         | Temperature Coefficient of Capacitance   | At 2.5V DC            |                      | -300        |             | ppm/°C   |
| $V_{DIODE}$ | Diode Voltage (reverse bias)   | $I_{DIODE}=10\mu A$   |                      | 6.0         |             | V        |
| $I_{LEAK}$  | Diode Leakage Current (reverse bias)   | $V_{DIODE}=3.3V$      |                      |             | 100         | nA       |
| $V_{SIG}$   | Signal Voltage<br>Positive Clamp<br>Negative Clamp   | $I_{LOAD} = 10mA$     | 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) Human Body Model, MIL-STD-883,<br>Method 3015<br>b) Contact Discharge per IEC 61000-4-2<br>Level 4 | Note 3                | $\pm 30$<br>$\pm 15$ |             |             | kV<br>kV |
| $V_{CL}$    | Clamping Voltage during ESD Discharge<br>MIL-STD-883 (Method 3015), 8kV<br>Positive Transients<br>Negative Transients                    | Notes 2 and 3         |                      | +10<br>-5   |             | V<br>V   |
| $f_c$       | Cut-off Frequency<br>$Z_{SOURCE}=50\Omega, Z_{LOAD}=50\Omega$  | $R=100\Omega, C=30pF$ |                      | 58          |             | 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: Clamping voltage is measured at the opposite side of the EMI filter to the ESD pin. For example, if ESD is applied to Pin A2, then clamping voltage is measured at Pin C2.

Performance Information

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

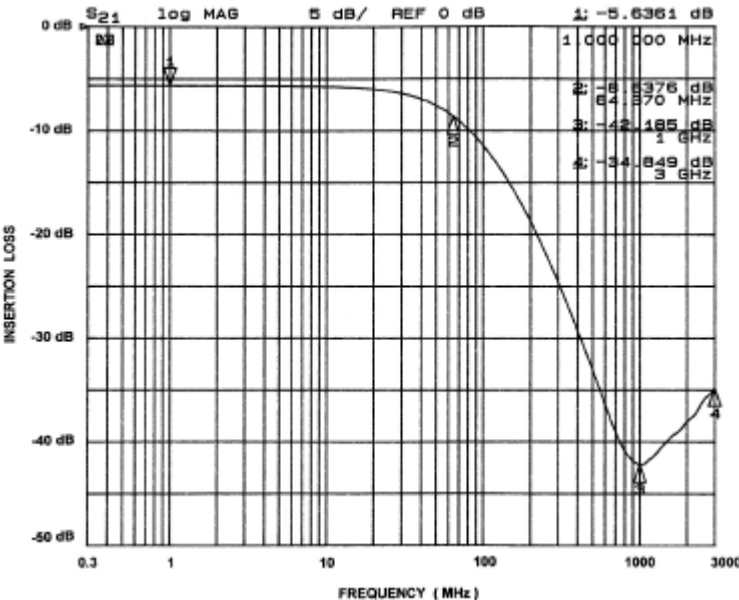


Figure 1. Insertion Loss vs. Frequency (A1-C1 to GND B2)

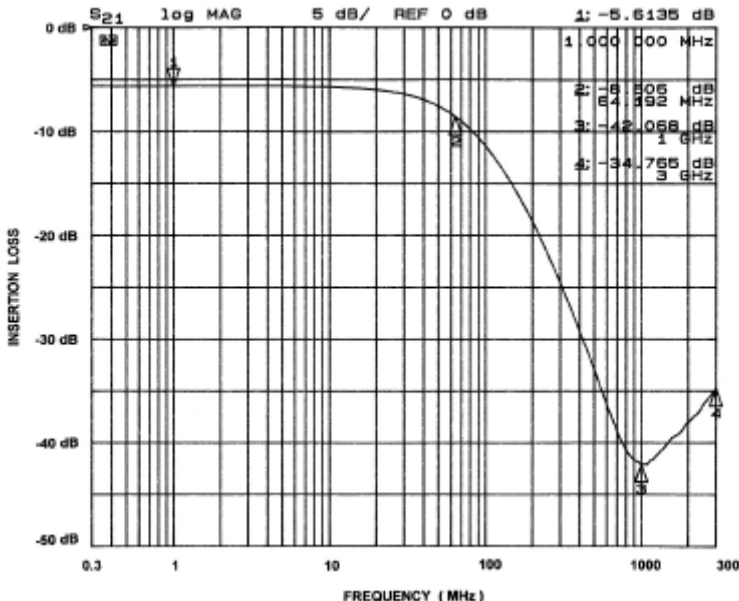


Figure 2. Insertion Loss vs. Frequency (A2-C2 to GND B2)

Performance Information (cont'd)

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

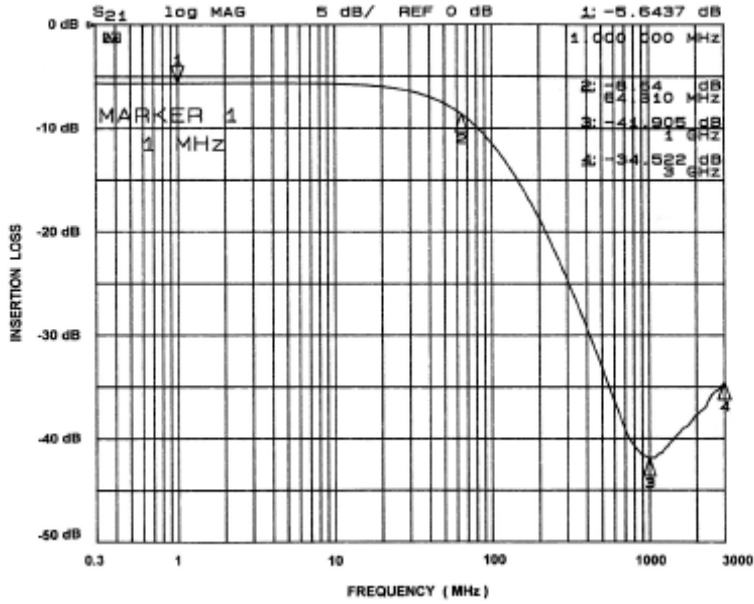


Figure 3. Insertion Loss vs. Frequency (A3-C3 to GND B2)

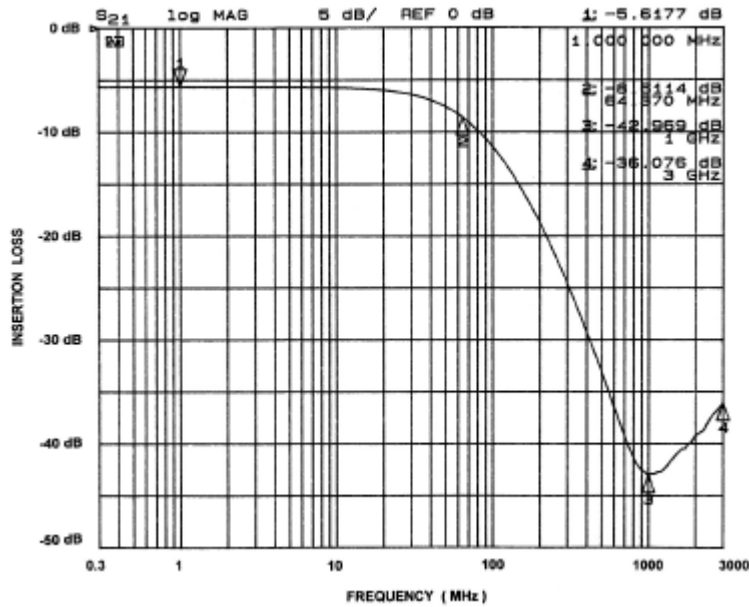


Figure 4. Insertion Loss vs. Frequency (A4-C4 to GND B2)

Performance Information (cont'd)

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

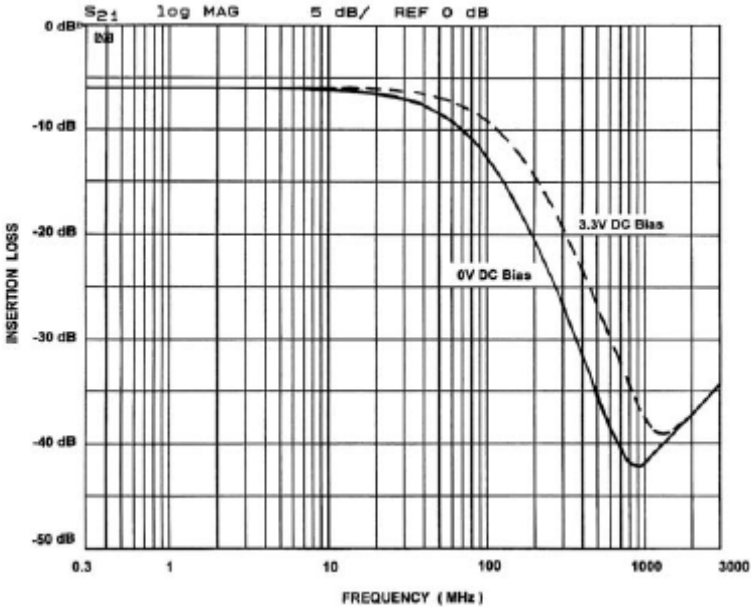


Figure 5. Comparison of Filter Response Curves for CM1400-32CP with DC Bias

Performance Information (cont'd)

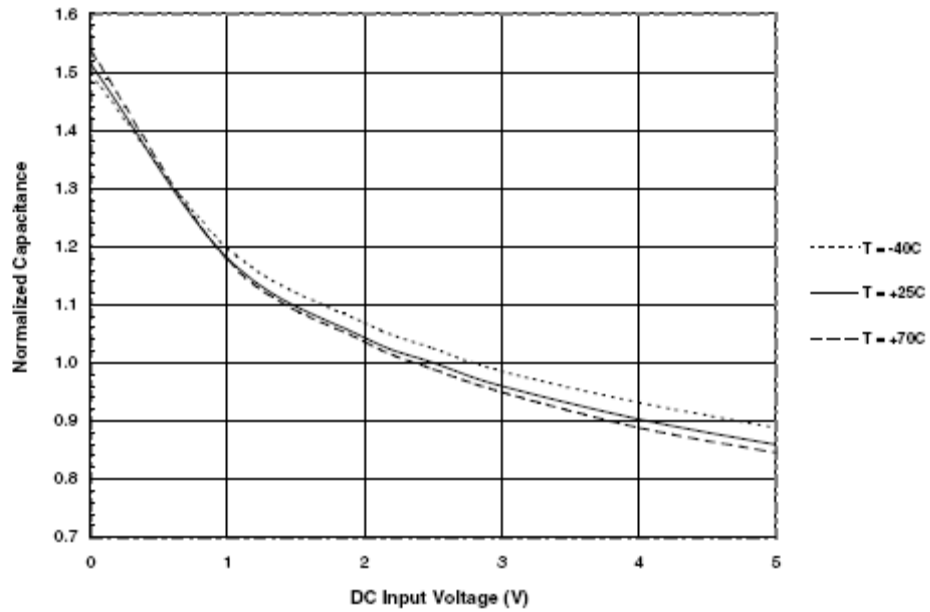


Figure 6. Filter Capacitance vs. Input Voltage over Temperature (normalized to capacitance at 2.5VDC and 25°C)

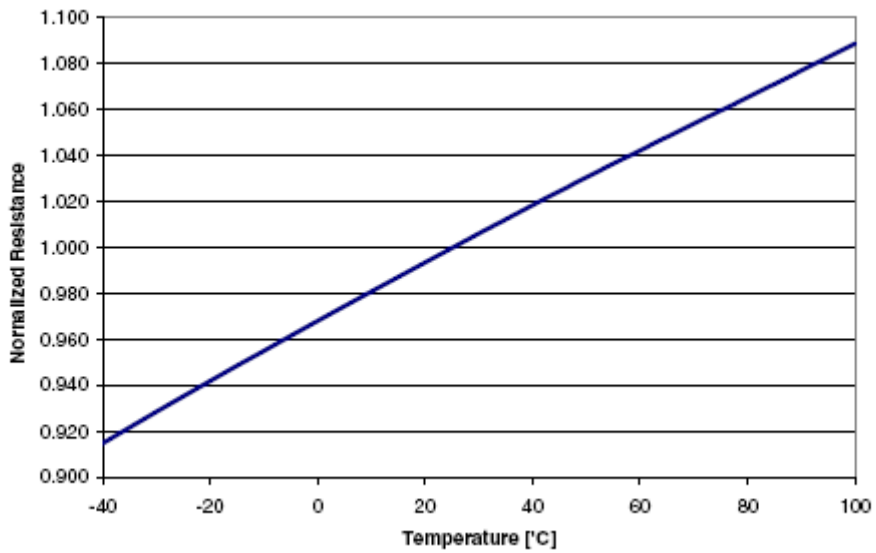
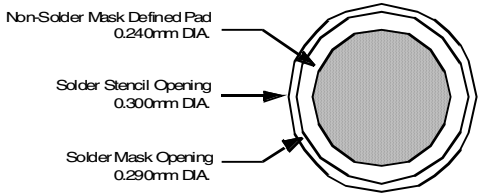


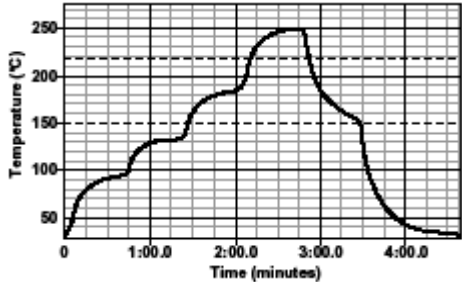
Figure 7. Resistance vs. Temperature (normalized to resistance at 25°C)

**Application Information**

| 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 Lead-free Devices using a Lead-free Solder Paste | 260°C                        |



**Figure 1. Recommended Non-Solder Mask Defined Pad Illustration**



**Figure 2. Lead-free (SnAgCu) Solder Ball Reflow Profile**

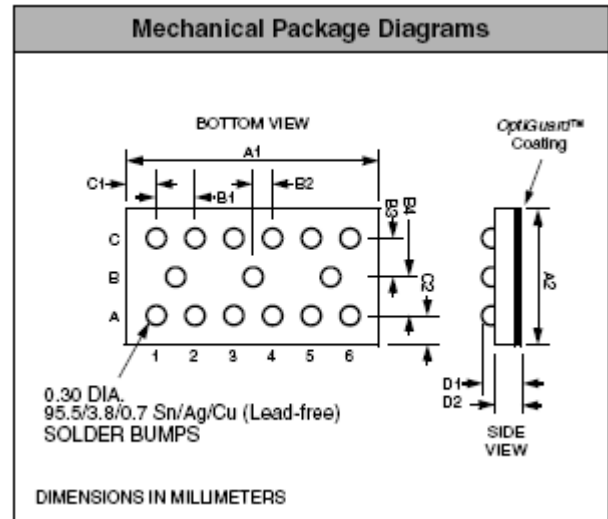
# CM1401-32CP

## Mechanical Details

### CSP Mechanical Specifications

The CM1401-32CP is supplied in a custom Chip Scale Package (CSP). Dimensions are presented below.

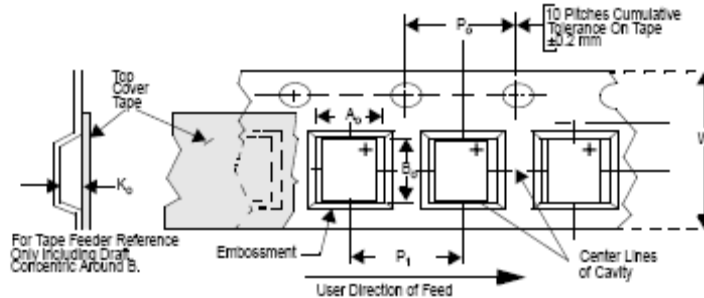
| PACKAGE DIMENSIONS                 |             |       |       |        |        |        |
|------------------------------------|-------------|-------|-------|--------|--------|--------|
| Package                            | Custom CSP  |       |       |        |        |        |
| Bumps                              | 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                                 | 0.575       | 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  
CM1401-32CP 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> |
|-------------|---------------------|--|-----------------|------------------|-----------------|----------------|----------------|
| CM1401-32CP | 2.96 X 1.33 X 0.644 | 3.10 X 1.45 X 0.74   | 8mm             | 178mm (7")       | 3500            | 4mm            | 4mm            |



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

ON Semiconductor and  are registered trademarks of Semiconductor Components Industries, LLC (SCILLC). SCILLC reserves the right to make changes without further notice to any products herein. SCILLC makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does SCILLC assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. "Typical" parameters which may be provided in SCILLC data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. SCILLC does not convey any license under its patent rights nor the rights of others. SCILLC products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the SCILLC product could create a situation where personal injury or death may occur. Should Buyer purchase or use SCILLC products for any such unintended or unauthorized application, Buyer shall indemnify and hold SCILLC and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that SCILLC was negligent regarding the design or manufacture of the part. SCILLC is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

**PUBLICATION ORDERING INFORMATION**

**LITERATURE FULFILLMENT:**  
Literature Distribution Center for ON Semiconductor  
P.O. Box 5163, Denver, Colorado 80217 USA  
**Phone:** 303-675-2175 or 800-344-3860 Toll Free USA/Canada  
**Fax:** 303-675-2176 or 800-344-3867 Toll Free USA/Canada  
**Email:** [orderlit@onsemi.com](mailto:orderlit@onsemi.com)

**N. American Technical Support:** 800-282-9855  
Toll Free USA/Canada  
**Europe, Middle East and Africa Technical Support:**  
**Phone:** 421 33 790 2910  
**Japan Customer Focus Center**  
**Phone:** 81-3-5773-3850

ON Semiconductor Website: [www.onsemi.com](http://www.onsemi.com)  
Order Literature: <http://www.onsemi.com/orderlit>  
For additional information, please contact your local Sales Representative

## Looking for pricing, stock, or lifecycle information?

Click below to explore more details on WIN SOURCE:

 [View CM1401-32CP](#) on WIN SOURCE

 [ON Semiconductor](#) Information

## Optimize Your Supply Chain with WIN SOURCE Solutions

-  Global Sourcing Solution
-  Obsolete Management
-  Cost Control Management
-  Shortage Management
-  Alternative Solution
-  Excess Inventory Management