



# 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

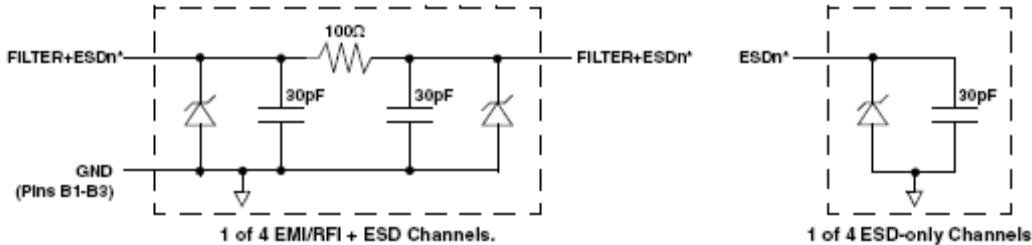
The CM1401-32CP is a multichannel array with four low-pass filter + ESD channels and four ESD-only channels. The CM1401-32CP reduces EMI/RFI emissions on a data port and protects against ESD on a USB port. Each EMI/RFI channel integrates a high quality pi-style filter (C-R-C) that provides greater than 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.

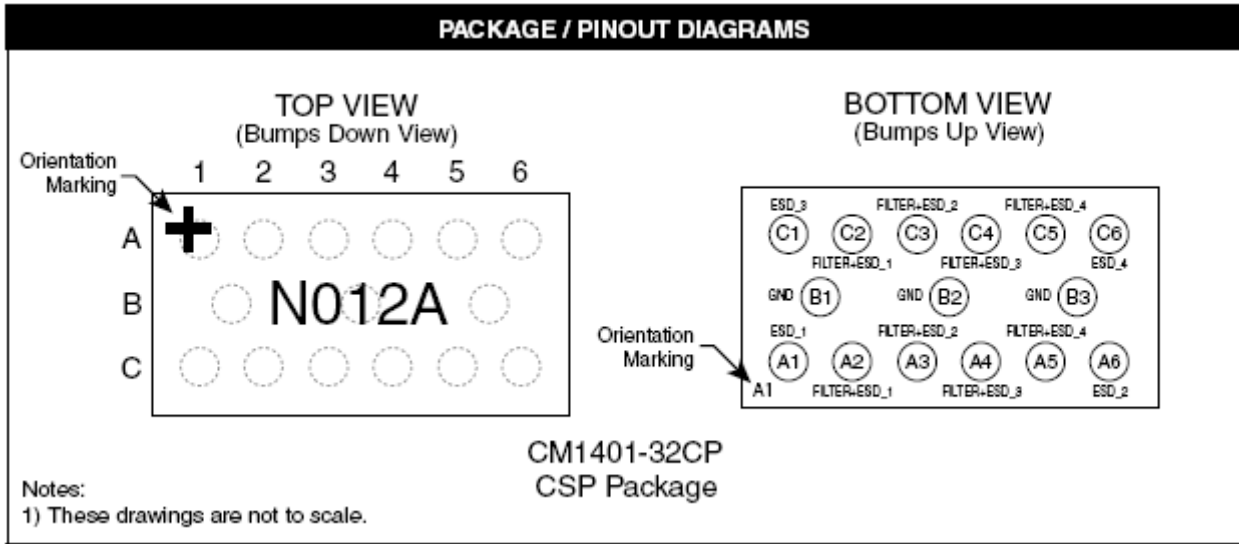
The CM1401-32CP is particularly well suited for portable electronics (e.g., cellular telephones, PDAs, notebook computers) because of its small package footprint and low weight.

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 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	Note 3	$\pm 30$ $\pm 15$			kV kV
$V_{CL}$	Clamping Voltage during ESD Discharge MIL-STD-883 (Method 3015), 8kV Positive Transients Negative Transients	Notes 2 and 3		+10 -5		V V
$f_c$	Cut-off Frequency $Z_{SOURCE}=50\Omega, Z_{LOAD}=50\Omega$	$R=100\Omega, C=30pF$		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)

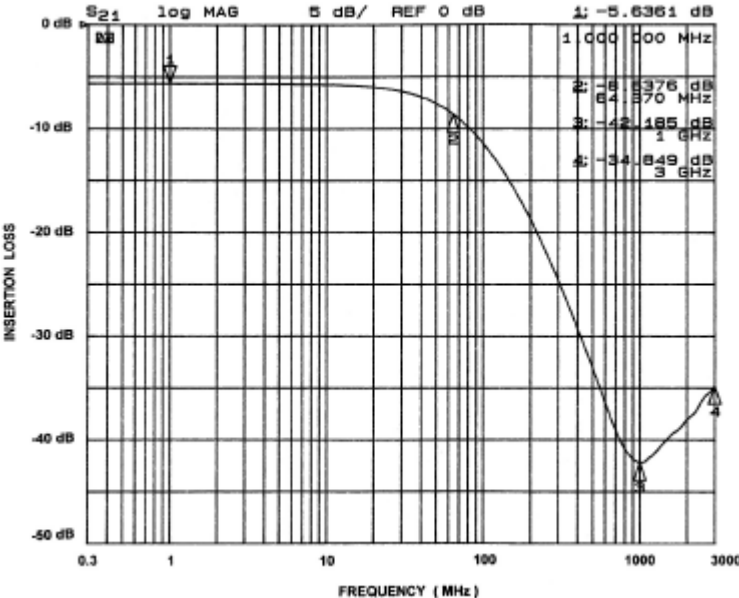


Figure 1. Insertion Loss vs. Frequency (A1-C1 to GND B2)

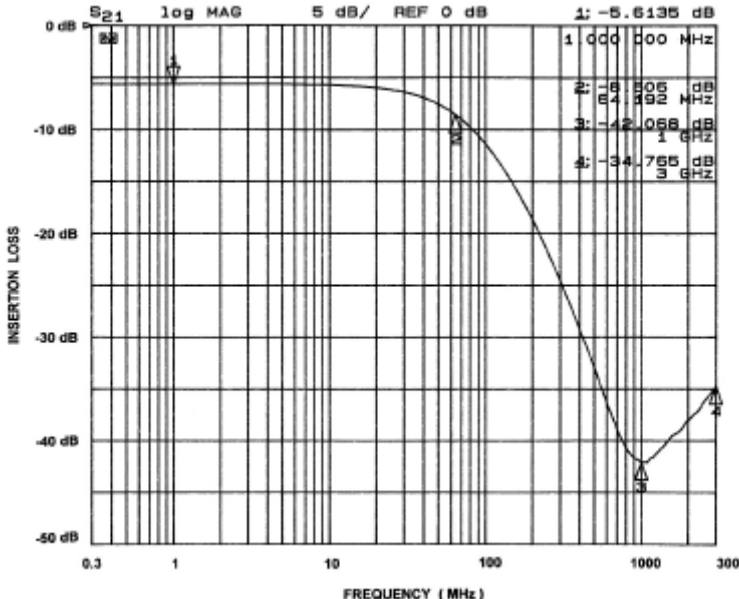


Figure 2. Insertion Loss vs. Frequency (A2-C2 to GND B2)

Performance Information (cont'd)

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

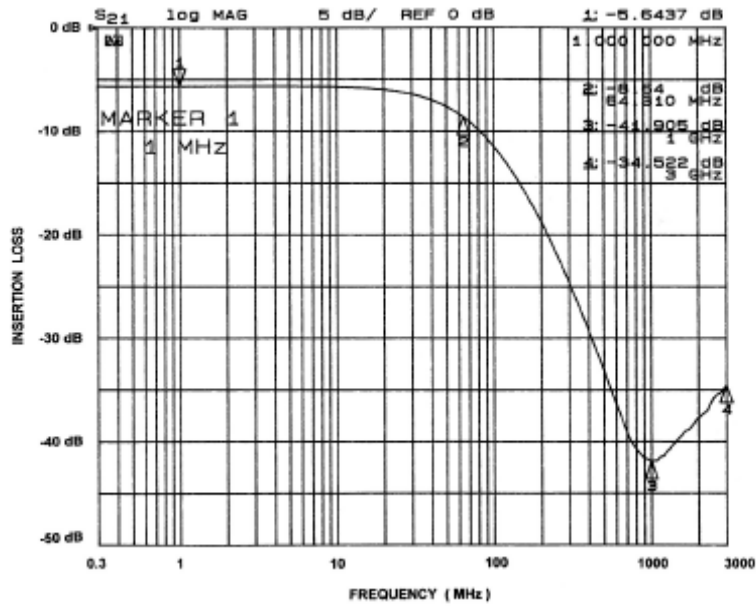


Figure 3. Insertion Loss vs. Frequency (A3-C3 to GND B2)

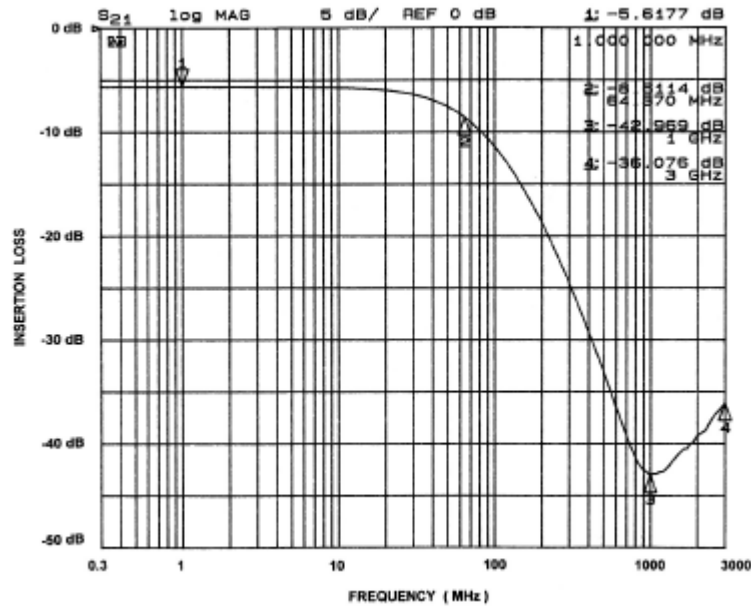


Figure 4. Insertion Loss vs. Frequency (A4-C4 to GND B2)

Performance Information (cont'd)

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

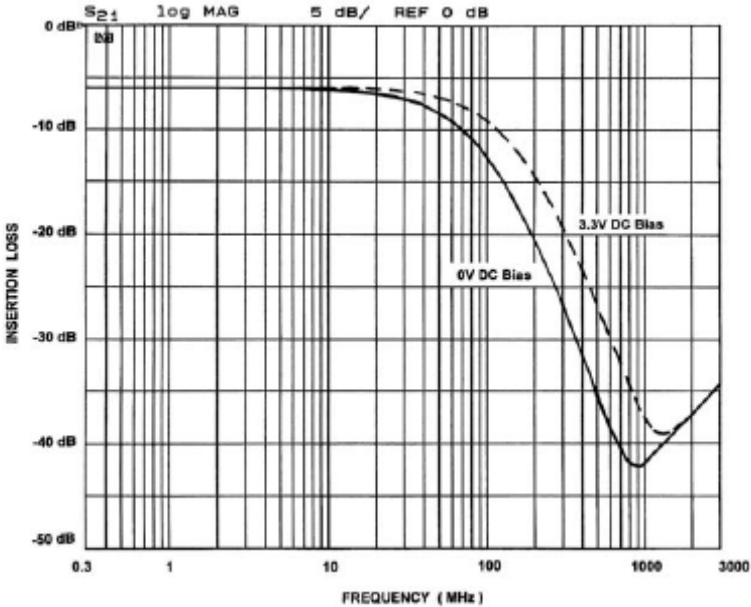


Figure 5. Comparison of Filter Response Curves for CM1400-32CP with DC Bias



Performance Information (cont'd)

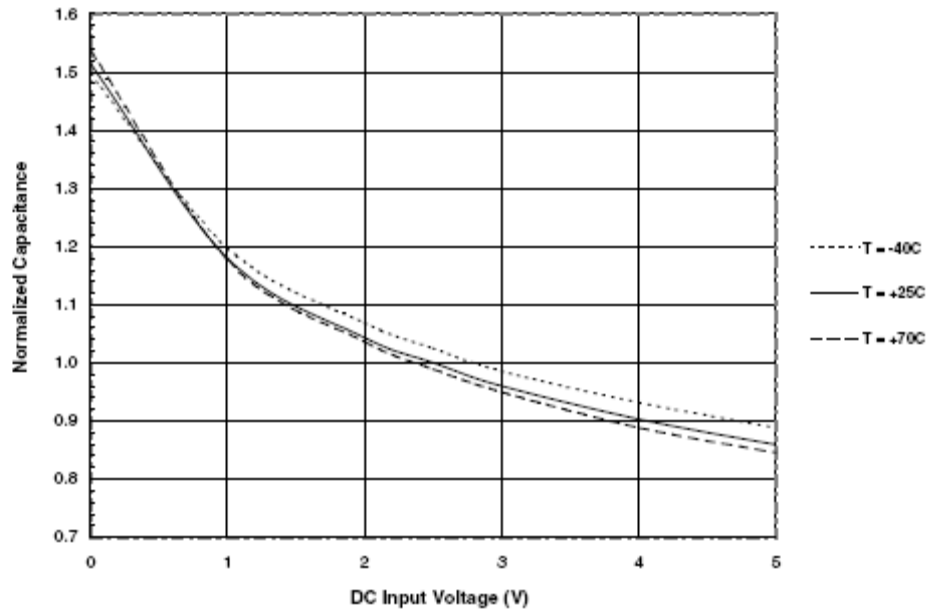


Figure 6. Filter Capacitance vs. Input Voltage over Temperature (normalized to capacitance at 2.5VDC and 25°C)

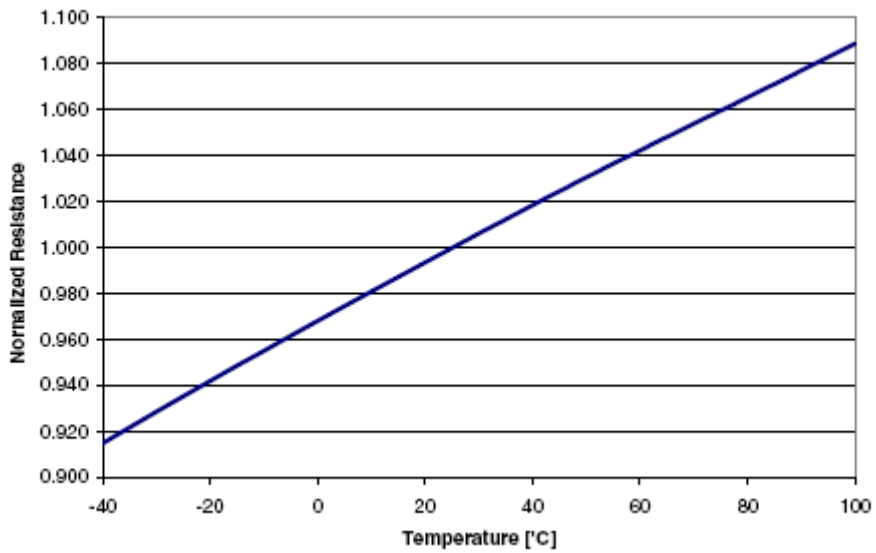
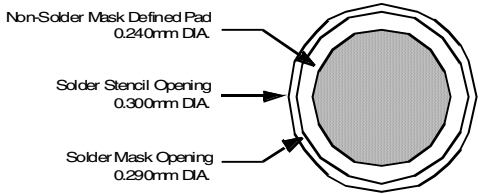


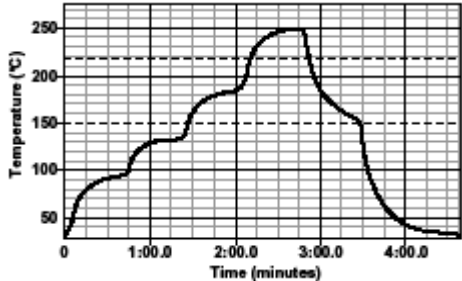
Figure 7. Resistance vs. Temperature (normalized to resistance at 25°C)

**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**

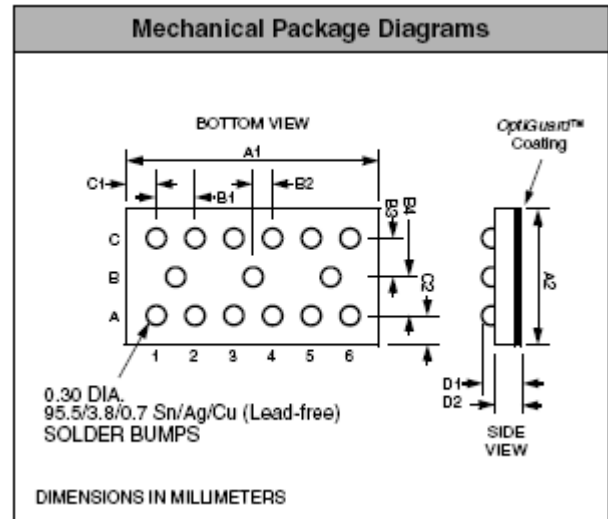
# CM1401-32CP

## Mechanical Details

### CSP Mechanical Specifications

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

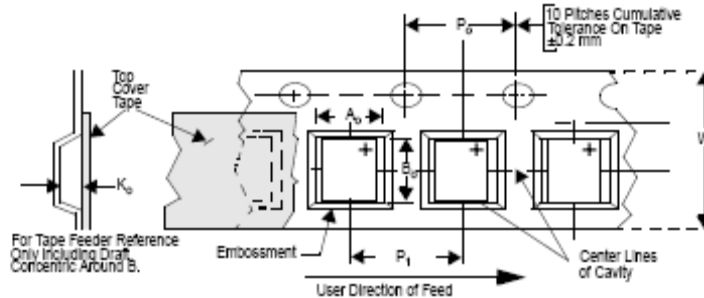
PACKAGE DIMENSIONS						
Package	Custom CSP					
Bumps	15					
Dim	Millimeters			Inches		
	Min	Nom	Max	Min	Nom	Max
A1	2.915	2.960	3.005	0.1148	0.1165	0.1183
A2	1.285	1.330	1.375	0.0506	0.0524	0.0541
B1	0.495	0.500	0.505	0.0195	0.0197	0.0199
B2	0.245	0.250	0.255	0.0096	0.0098	0.0100
B3	0.430	0.435	0.440	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) B <sub>0</sub> X A <sub>0</sub> X K <sub>0</sub>	TAPE WIDTH W	REEL DIAMETER	QTY PER 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