

## LCD & Camera EMI Filter Array with ESD Protection

### Features

- High bandwidth, high RF rejection filter array
- Six channels of EMI filtering
- Utilizes *Praetorian*™ inductor-based design technology for true L-C filter implementation
- *OptiGuard*™ coating for improved reliability
- $\pm 15\text{kV}$  ESD protection on each channel (IEC 61000-4-2 Level 4, contact discharge)
- $\pm 30\text{kV}$  ESD protection on each channel (HBM)
- Better than 40dB of attenuation at 1GHz
- Chip Scale Package features extremely low lead inductance for optimum filter and ESD performance
- 15-bump, 3.006mm x 1.376mm footprint Chip Scale Package (CM1451-06CS/CP)
- 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 phones in cell phones, PDAs or notebook computers
- Wireless handsets / cell phones
- Wireless Handsets
- Handheld PCs/PDAs
- LCD and camera modules

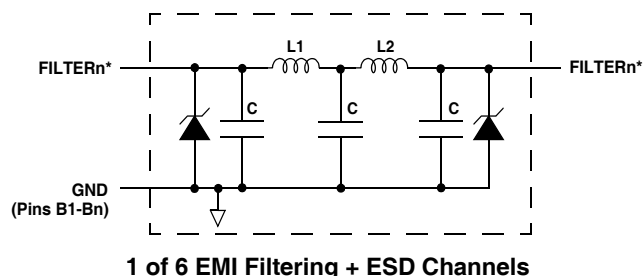
### Product Description

The CM1451 is an inductor-capacitor (L-C) based EMI filter array with integrated ESD protection in CSP form factor. The CM1451-06 is configured in a 6 channel format. Each EMI filter channel of the CM1451 is implemented as a 5-pole L-C filter where the component values are 10pF-17nH-10pF-17nF-10pF. The CM1451's roll-off frequency at -10dB attenuation is 400MHz and can be used in applications where the data rates are as high as 120Mbps while providing greater than 35dB over the 800MHz to 2.7GHz frequency range. The parts integrate 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). The ESD protection diodes connected to the filter ports are designed and characterized to safely dissipate ESD strikes of  $\pm 15\text{kV}$ , beyond the Level 4 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) because of its small package format and easy-to-use pin assignments. In particular, the CM1451 is ideal for EMI filtering and protecting data and control lines for the LCD display and camera interface in wireless handsets.

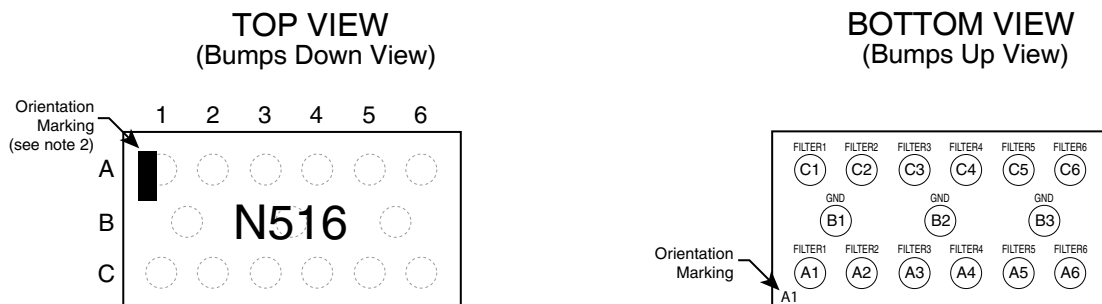
The CM1451 incorporates *OptiGuard*™ which results in improved reliability at assembly. The CM1451 is available in a space saving, low profile Chip Scale Package with optional lead-free finishing.

### Electrical Schematic



\* See Package/Pinout Diagram for expanded pin information.

# PACKAGE / PINOUT DIAGRAMS



CM1451-06CS/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	PIN(s)	NAME	DESCRIPTION
A1	FILTER1	Filter Channel 1	C1	FILTER1	Filter Channel 1
A2	FILTER2	Filter Channel 2	C2	FILTER2	Filter Channel 2
A3	FILTER3	Filter Channel 3	C3	FILTER3	Filter Channel 3
A4	FILTER4	Filter Channel 4	C4	FILTER4	Filter Channel 4
A5	FILTER5	Filter Channel 5	C5	FILTER5	Filter Channel 5
A6	FILTER6	Filter Channel 6	C6	FILTER6	Filter Channel 6
B1-B3	GND	Device Ground			

## Ordering Information

# PART NUMBERING INFORMATION

Bumps	Package	Standard Finish		Lead-free Finish <sup>2</sup>	
		Ordering Part Number <sup>1</sup>	Part Marking	Ordering Part Number <sup>1</sup>	Part Marking
15	CSP	CM1451-06CS	N516	CM1451-06CP	N516

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 (NOTE 1)

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
$L_{TOT}$	Total Channel Inductance ( $L_1 + L_2$ )			34		nH
$L_1, L_2$	Inductance			17		nH
$C_{TOT}$	Total Channel Capacitance ( $C_1 + C_2 + C_3$ )	At 2.5V DC, 1MHz, 30mV AC	24	30	36	pF
$C_1, C_2, C_3$	Capacitance	At 2.5V DC, 1MHz, 30mV AC	8	10	12	pF
$f_C$	Cut-off Frequency $Z_{SOURCE}=50\Omega, Z_{LOAD}=50\Omega$			200		MHz
$f_C$	Roll-off Frequency at -10dB Attenuation $Z_{SOURCE}=50\Omega, Z_{LOAD}=50\Omega$			400		MHz
$V_{DIODE}$	Diode Standoff Voltage	$I_{DIODE}=10\mu A$	5.5			V
$I_{LEAK}$	Diode Leakage Current (reverse bias)	$V_{DIODE}=\pm 3.3V$		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	Notes 2,4 and 5	$\pm 30$ $\pm 15$			kV kV
$V_{CL}$	Clamping Voltage during ESD Discharge MIL-STD-883 (Method 3015), 8kV Positive Transients Negative Transients	Notes 2,3,4 and 5		+12 -7		V V

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

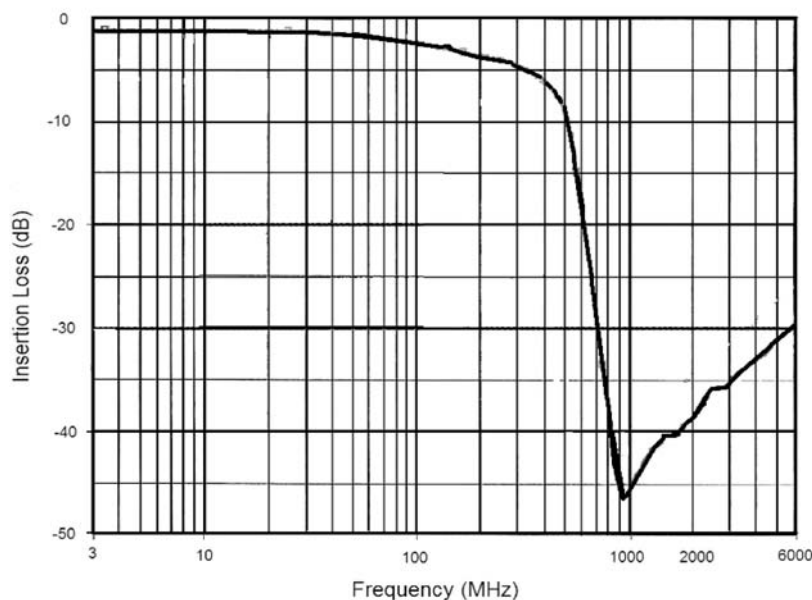


Figure 1. Insertion Loss VS. Frequency (A1-C1 to GND B1)

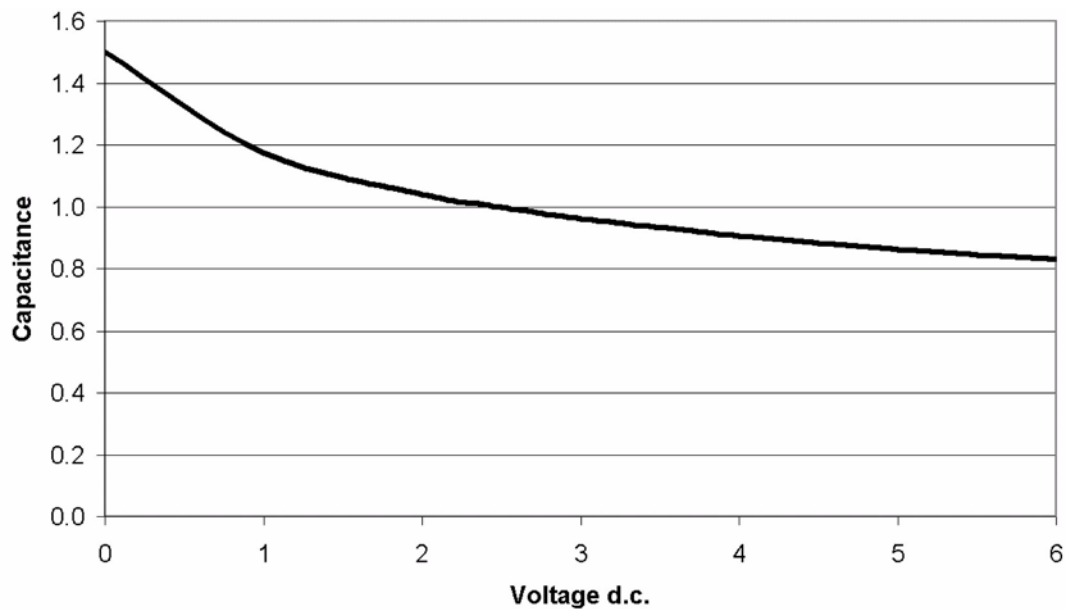
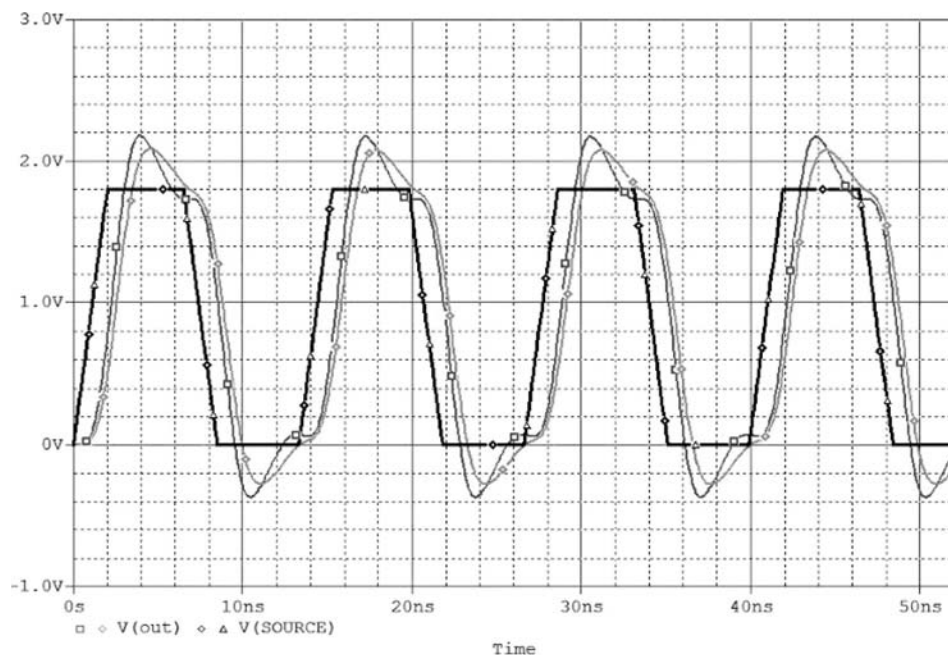


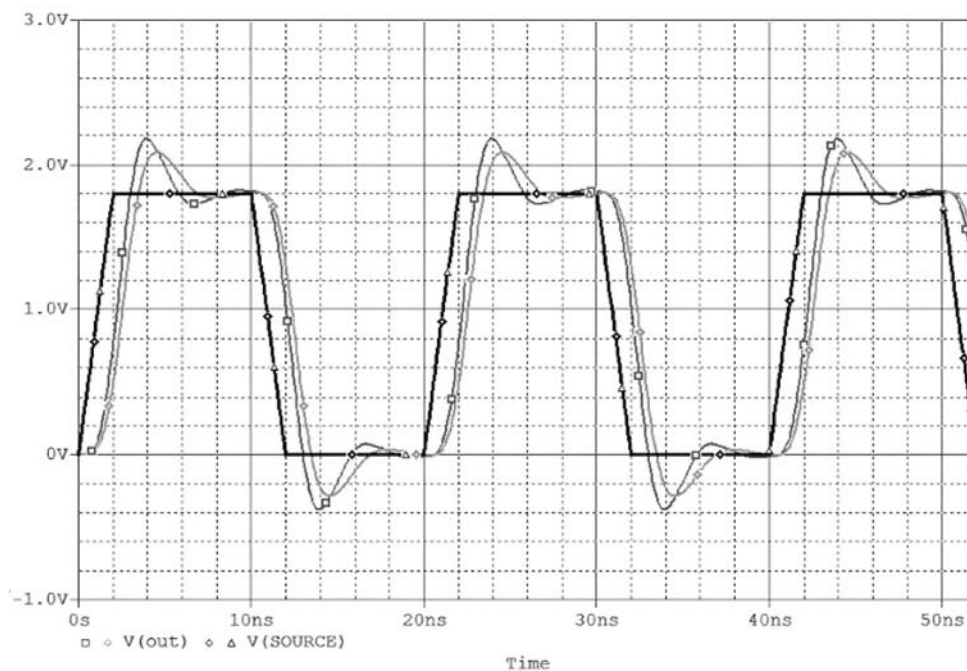
Figure 2. Filter Capacitance vs. Input Voltage over Temperature (normalized to capacitance at 2.5VDC and  $25^\circ\text{C}$ )

## Performance Information (cont'd)

### AC Characteristics



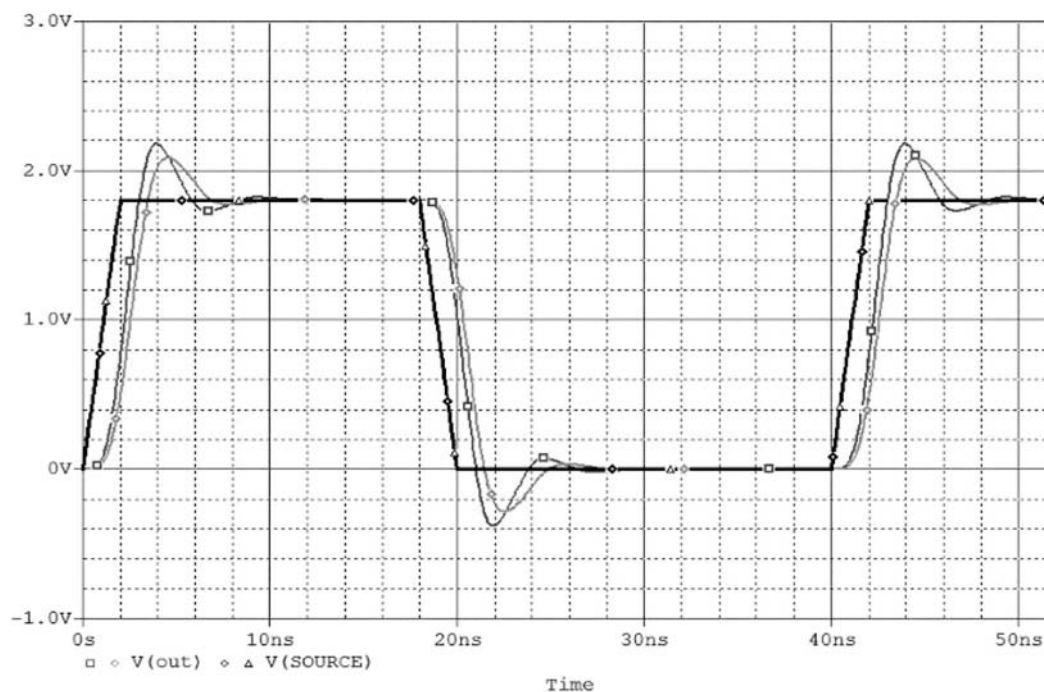
**Figure 3. 2ns Rise and Fall Times of Signals Clocked at 75MHz through CM1451 Filter Array (Simulation)**



**Figure 4. 2ns Rise and Fall Times of Signals Clocked at 50MHz through CM1451 Filter Array (Simulation)**

## Performance Information (cont'd)

### AC Characteristics



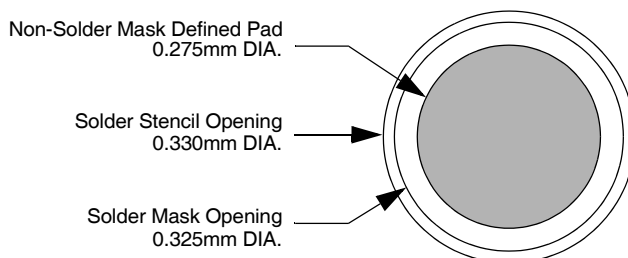
**Figure 5. 2ns Rise and Fall Times of Signals Clocked at 25MHz through CM1451 Filter Array (Simulation)**

## Application Information

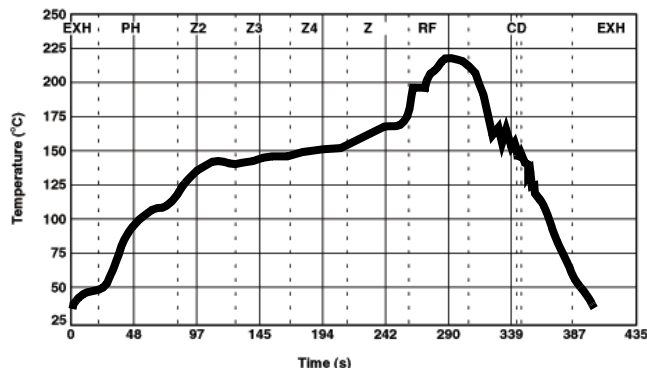
Refer to Application Note AP-217, "The Chip Scale Package", for a detailed description of Chip Scale Packages offered by California Micro Devices.

### PRINTED CIRCUIT BOARD RECOMMENDATIONS

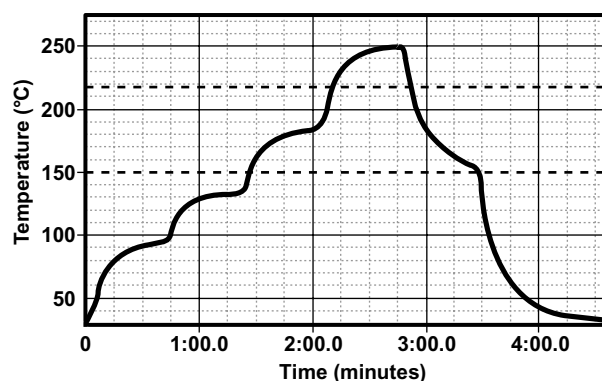
PARAMETER	VALUE
Pad Size on PCB	0.275mm
Pad Shape	Round
Pad Definition	Non-Solder Mask defined pads
Solder Mask Opening	0.325mm Round
Solder Stencil Thickness	0.125mm - 0.150mm
Solder Stencil Aperture Opening (laser cut, 5% tapered walls)	0.330mm Round
Solder Flux Ratio	50/50 by volume
Solder Paste Type	No Clean
Pad Protective Finish	OSP (Entek Cu Plus 106A)
Tolerance — Edge To Corner Ball	±50µm
Solder Ball Side Coplanarity	±20µm
Maximum Dwell Time Above Liquidous (183°C)	60 seconds
Soldering Maximum Temperature	260°C



**Figure 6. Recommended Non-Solder Mask Defined Pad Illustration**



**Figure 7. Eutectic (SnPb) Solder Ball Reflow Profile**



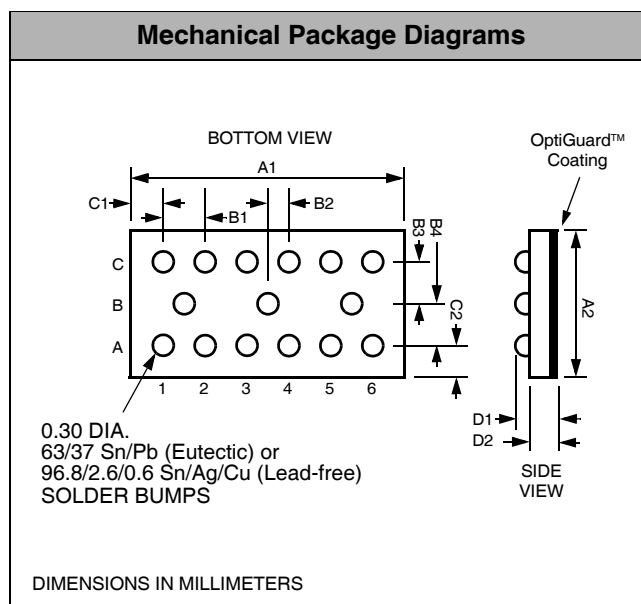
**Figure 8. Lead-free (SnAgCu) Solder Ball Reflow Profile**

## Mechanical Details

### CM1450-06CS/CP CSP Mechanical Specifications

CM1451-06CS/CP devices are packaged 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.

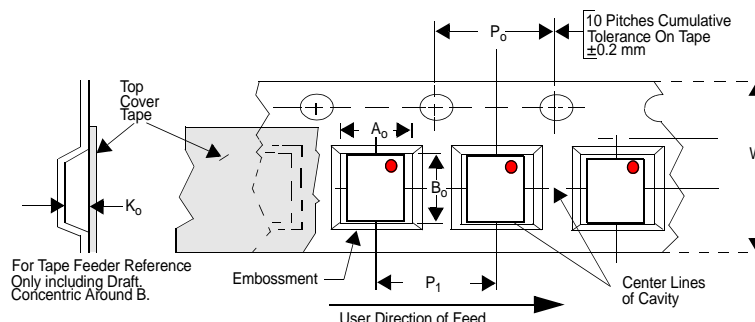
PACKAGE DIMENSIONS						
Package		Custom CSP				
Bumps		15				
Dim	Millimeters			Inches		
	Min	Nom	Max	Min	Nom	Max
A1	2.915	2.960	3.005	0.1148	0.1165	0.1183
A2	1.285	1.330	1.375	0.0506	0.0524	0.0541
B1	0.495	0.500	0.505	0.0195	0.0197	0.0199
B2	0.245	0.250	0.255	0.0096	0.0098	0.0100
B3	0.430	0.435	0.440	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	0.600	0.670	0.739	0.0236	0.0264	0.0291
D2	0.394	0.445	0.495	0.0155	0.0175	0.0195
# per tape and reel		3500 pieces				
Controlling dimension: millimeters						



**Package Dimensions for  
CM1451CS/CP 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	$P_0$	$P_1$
CM1451-06	2.96 X 1.33 X 0.6	3.10 X 1.45 X 0.74	8mm	178mm (7")	3500	4mm	4mm



**Figure 9. Tape and Reel Mechanical Data**