



# 2 Channel Headset Speaker EMI Filter with ESD Protection

## CSPEMI201AG

### Features

- Two channels of EMI filtering
- Pi-style EMI filters in a capacitor-resistor-capacitor (C-R-C) network
- Greater than 40dB attenuation at 1GHz
- $\pm 8$ kV ESD protection on each channel (IEC 61000-4-2 Level 4, contact discharge)
- $\pm 15$ kV ESD protection in each channel (HBM)
- Supports AC signals—ideal for audio applications
- Extremely low lead inductance for optimum filter and ESD performance
- 5-bump, 0.930mm X 1.410mm footprint Chip Scale Package (CSP)
- RoHS compliant (lead-free) finishing

### Applications

- EMI filtering and ESD protection for headset speaker ports
- Wireless Handsets
- Handheld PCs / PDAs
- MP3 Players
- Digital Camcorders
- Notebooks
- Desktop PCs

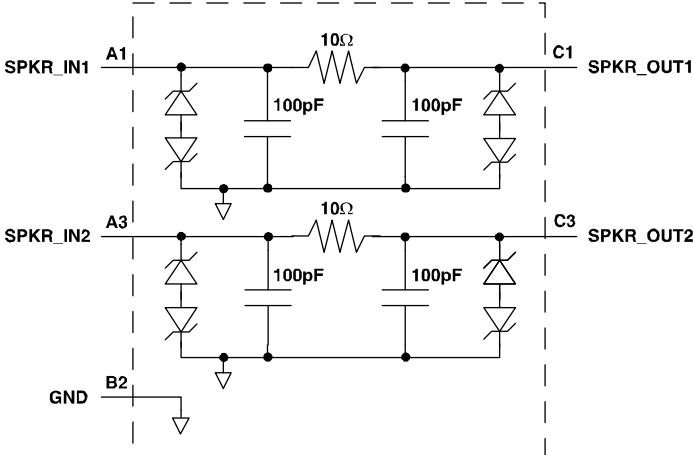
### Product Description

The CSPEMI201AG is a dual low-pass filter array integrating two pi-style filters (C-R-C) that reduce EMI/RFI emissions while at the same time providing ESD protection. This part is custom-designed to interface with a speaker port on a cellular telephone or similar device. Each high quality filter provides more than 35dB attenuation in the 800-2700 MHz range. These pi-style filters support bidirectional filtering, controlling EMI both to and from a speaker element. They also support bipolar signals with a cutoff frequency of 31MHz, enabling audio signals to pass through without distortion.

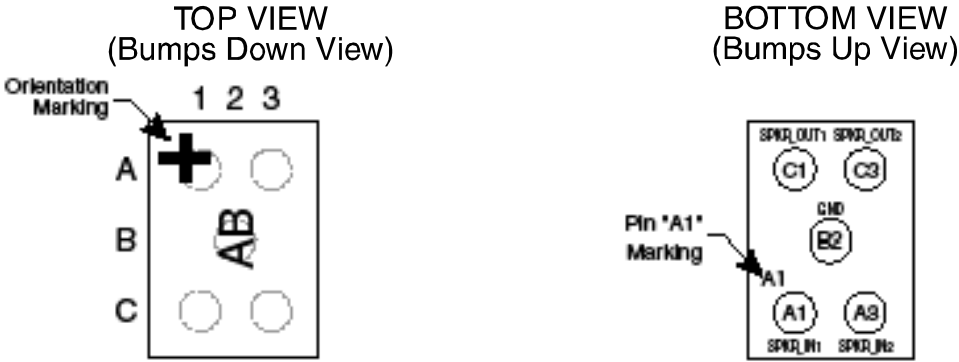
In addition, the CSPEMI201AG provides a very high level of protection for sensitive electronic components that may be subjected to electrostatic discharge (ESD). The CSPEMI201AG can safely dissipate ESD strikes of  $\pm 8$ kV, the maximum requirement of the IEC 61000-4-2 international standard. Using the MIL-STD-883 (Method 3015) specification for Human Body Model (HBM) ESD, the device provides protection for contact discharges to greater than  $\pm 15$ kV.

The CSPEMI201AG is particularly well-suited for portable electronics (e.g., cellular telephones, PDAs, notebook computers) because of its small package and low weight. The CSPEMI201AG is available in a space-saving, low-profile Chip Scale Package with RoHS compliant lead-free finishing.

Electrical Schematic



PACKAGE / PINOUT DIAGRAMS



CSPEMI201A  
CSP Package

Notes:  
1) These drawings are not to scale.

# CSPEMI201AG

## PIN DESCRIPTIONS

PIN	NAME	DESCRIPTION
A1	SPKR_IN1	Speaker Input 1 (from audio circuitry)
A3	SPKR_IN2	Speaker Input 2 (from audio circuitry)
B2	GND	Device Ground
C1	SPKR_OUT1	Speaker Output 1 (to speaker)
C3	SPKR_OUT2	Speaker Output 2 (to speaker)

## Ordering Information

### PART NUMBERING INFORMATION

Pins	Package	Ordering Part Number <sup>1</sup>	Part Marking
5	CSP	CSPEMI201AGG	AB

Note 1: Parts are shipped in Tape & 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	200	mW

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

## ELECTRICAL OPERATING CHARACTERISTICS<sup>1</sup>

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
R	Resistance		9	10	11	$\Omega$
C	Capacitance		80	100	120	pF
$I_{LEAK}$	Diode Leakage Current	$V_{IN}=5.0V$			1.0	$\mu A$
$V_{SIG}$	Signal Voltage Positive Clamp Negative Clamp	$I_{LOAD} = 10mA$	5 -15	7 -10	15 -5	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 2	$\pm 15$ $\pm 8$			kV kV
$V_{CL}$	Clamping Voltage during ESD Discharge MIL-STD-883 (Method 3015), 8kV Positive Transients Negative Transients	Notes 2 and 3		+15 -19		V V
$f_c$	Cut-off frequency $Z_{SOURCE} = 50\Omega$ , $Z_{LOAD} = 50\Omega$	$R = 10\Omega$ , $C = 100pF$		31		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 A1, then clamping voltage is measured at Pin C1.

### Performance Information

Typical Filter Performance (nominal conditions unless specified otherwise, 50 Ohm Environment)

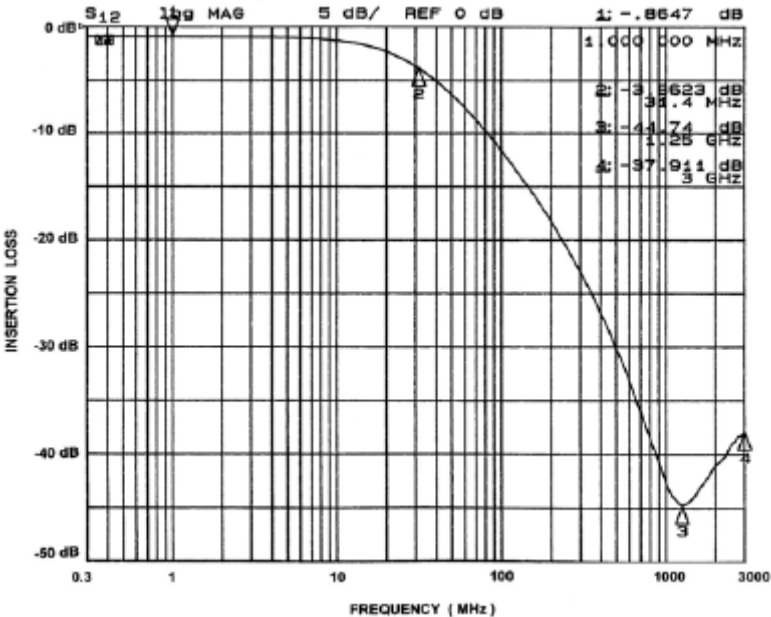


Figure 1. Insertion Loss VS. Frequency (A1-C1 to GND B2)

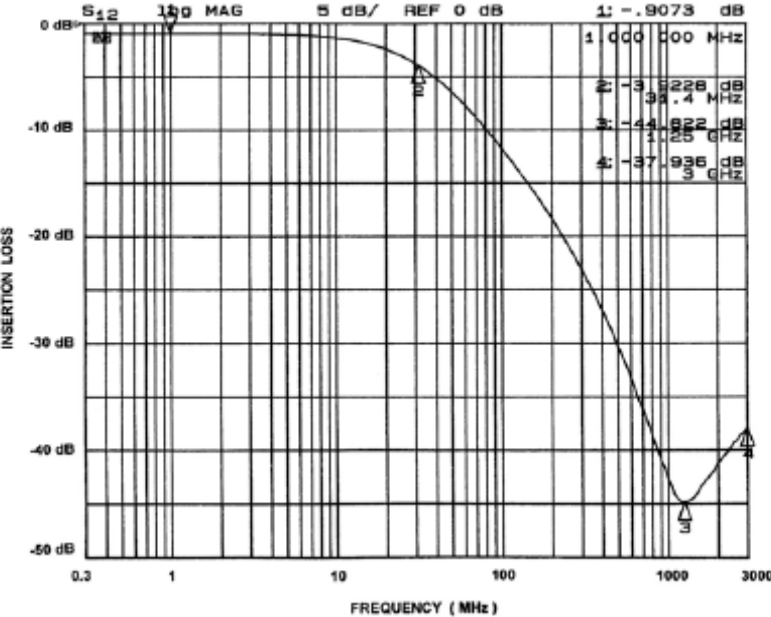


Figure 2. Insertion Loss VS. Frequency (A3-C3 to GND B2)

## 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	$\pm 50\mu\text{m}$
Solder Ball Side Coplanarity	$\pm 20\mu\text{m}$
Maximum Dwell Time Above Liquidous	60 seconds
Maximum Soldering Temperature for Lead-free Devices using a Lead-free Solder Paste	260°C

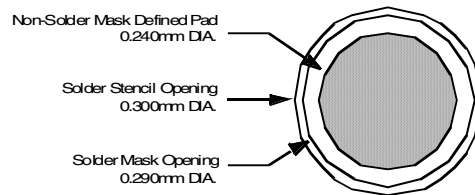


Figure 8. Recommended Non-Solder Mask Defined Pad Illustration

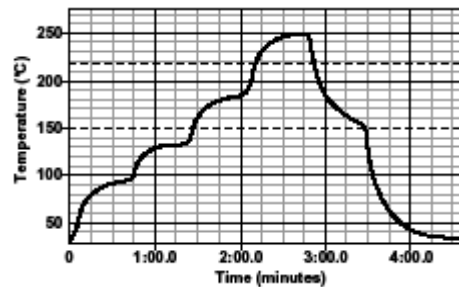


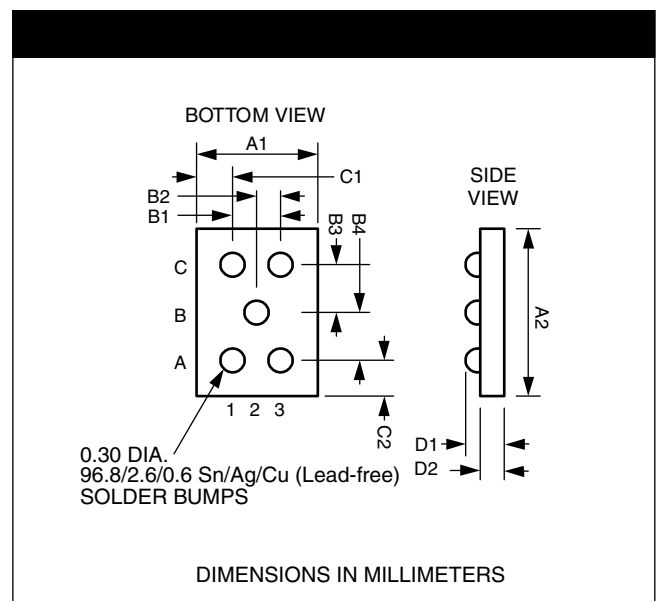
Figure 9. Lead-free (SnAgCu) Solder Ball Reflow Profile

## Mechanical Details

### CSP Mechanical Specifications

The CSPEMI201AG is available in a custom Chip Scale Package (CSP). Dimensions are presented below. For complete information on CSP, see the California Micro Devices CSP Package Information document.

PACKAGE DIMENSIONS						
Package	Custom CSP					
Bumps	5					
Dim	Millimeters			Inches		
	Min	Nom	Max	Min	Nom	Max
A1	0.885	0.930	0.975	0.0348	0.0366	0.0384
A2	1.365	1.410	1.455	0.0537	0.0555	0.0573
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	0.165	0.215	0.265	0.0065	0.0085	0.0104
C2	0.220	0.270	0.320	0.0087	0.0106	0.0126
D1	0.562	0.606	0.650	0.0221	0.0239	0.0256
D2	0.356	0.381	0.406	0.0140	0.0150	0.0160
# per tape and reel	3500 pieces					
Controlling dimension: millimeters						



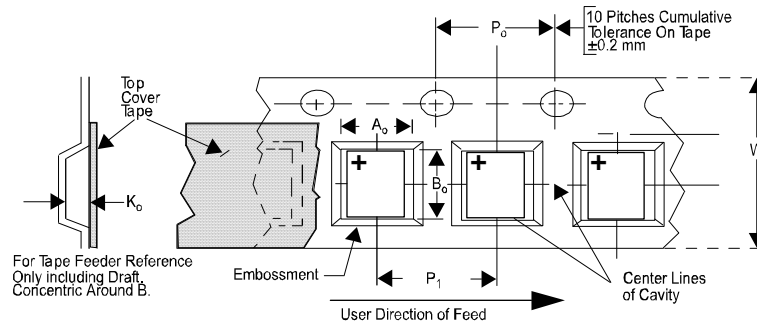
**Package Dimensions for  
CSPEMI201AG Chip Scale Package**



# CSPEMI201AG

## 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	$P_0$	$P_1$
CSPEMI201AGG	1.41 X 0.93 X 0.606	1.52 X 1.07 X 0.72	8mm	178mm (7")	3500	4mm	4mm



**Figure 5. Tape and Reel Mechanical Data**

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