

2 Channel Headset Speaker EMI Filter with ESD Protection

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
- $\pm 8\text{kV}$ ESD protection on each channel
- (IEC 61000-4-2 Level 4, contact discharge)
- $\pm 15\text{kV}$ 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, 0.950mm X 1.410mm footprint
- Chip Scale Package (CSP)
- Lead-free version available

Applications

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

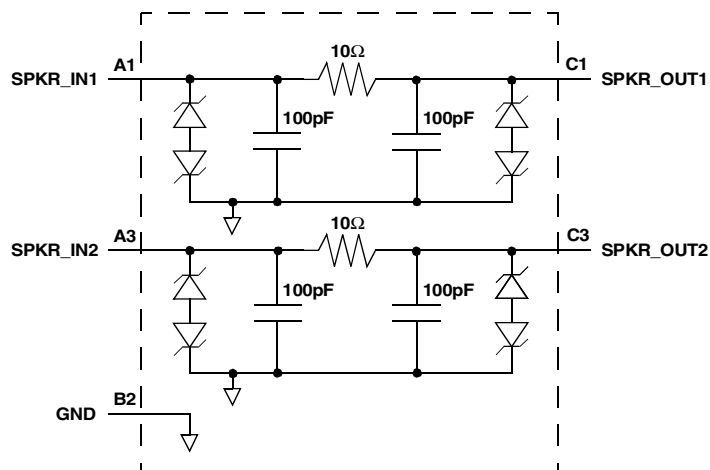
Product Description

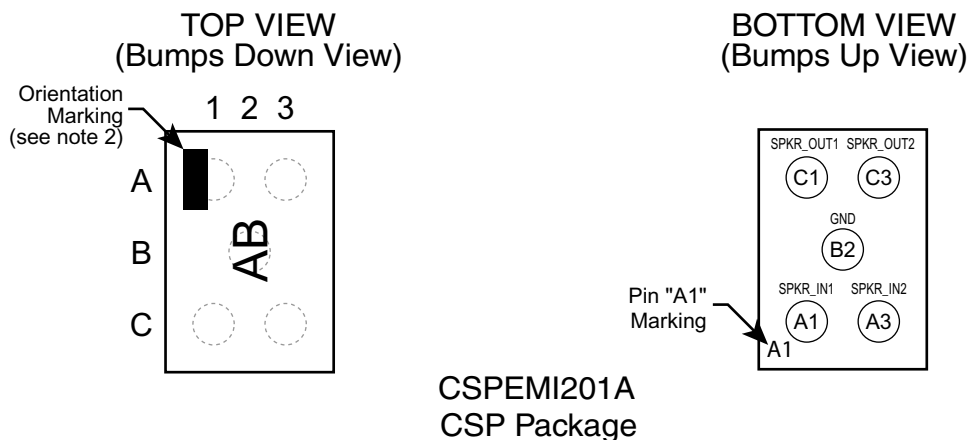
The CSPEMI201A is a dual low-pass filter array integrating two pi-style filters (C-R-C) that reduce EMI/RFI emissions while at the same time providing ESD protection. This part is custom-designed to interface with a speaker port on a cellular telephone or similar device. Each high quality filter provides 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 CSPEMI201A provides a very high level of protection for sensitive electronic components that may be subjected to electrostatic discharge (ESD). The CSPEMI201A can safely dissipate ESD strikes of 8kV, 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 15kV.

The CSPEMI201A is particularly well suited for portable electronics (e.g., cellular telephones, PDAs, notebook computers) because of its small package format and low weight. The CSPEMI201A is available in a space-saving, low-profile Chip Scale Package with optional lead-free finishing.

Electrical Schematic



PACKAGE / PINOUT DIAGRAMS

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 | 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 | Standard Finish | | Lead-free Finish ² | |
|------|---------|-----------------------------------|--------------|-----------------------------------|--------------|
| | | Ordering Part Number ¹ | Part Marking | Ordering Part Number ¹ | Part Marking |
| 5 | CSP | CSPEMI201A | AB | CSPEMI201AG | AB |

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 | 200 | mW |

STANDARD OPERATING CONDITIONS

| PARAMETER | RATING | UNITS |
|-----------------------------|------------|-------|
| Operating Temperature Range | -40 to +85 | °C |

ELECTRICAL OPERATING CHARACTERISTICS¹

| SYMBOL | PARAMETER | CONDITIONS | MIN | TYP | MAX | UNITS |
|-------------------|--|--------------------------|-----------|------------|-----------|----------|
| R | Resistance | | 9 | 10 | 11 | Ω |
| C | Capacitance | | 80 | 100 | 120 | pF |
| I _{LEAK} | Diode Leakage Current | V _{IN} =5.0V | | | 1.0 | μA |
| V _{SIG} | Signal Voltage Positive Clamp Negative Clamp | I _{LOAD} = 10mA | 5 -5 | 7 -10 | 15 -15 | 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 | ±15 ±8 | | | 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 | | +15 -19 | | V V |
| f _C | Cut-off frequency Z _{SOURCE} = 50Ω, Z _{LOAD} = 50Ω | R = 10Ω, C = 100pF | | 31 | | MHz |

Note 1: T_A=25°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 (nominal conditions unless specified otherwise, 50 Ohm Environment)

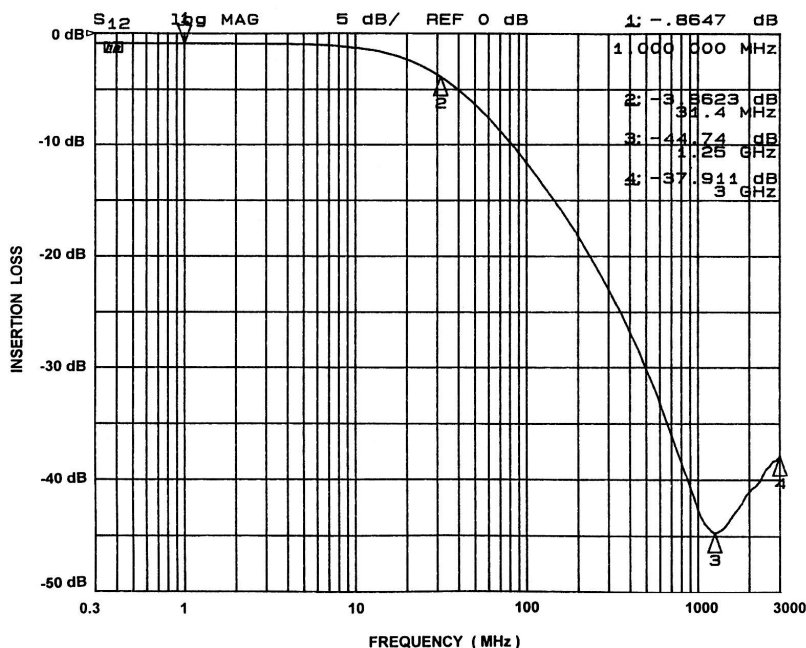


Figure 1. Insertion Loss VS. Frequency (A1-C1 to GND B2)

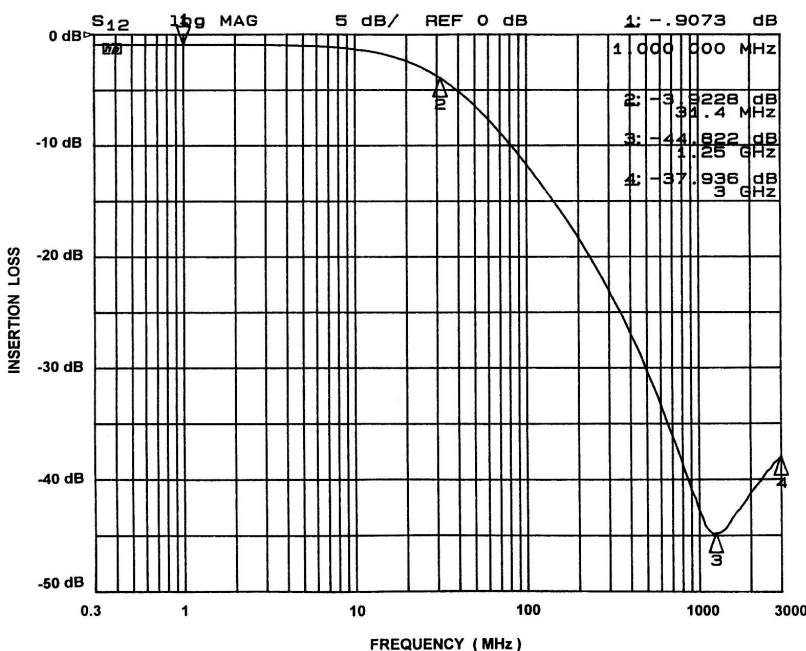


Figure 2. Insertion Loss VS. Frequency (A3-C3 to GND B2)

Application Information

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 | 0.125 - 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 | $\pm 50\mu\text{m}$ |
| Solder Ball Side Coplanarity | $\pm 20\mu\text{m}$ |
| Maximum Dwell Time Above Liquidous | 60 seconds |
| Soldering Maximum Temperature | 260°C |

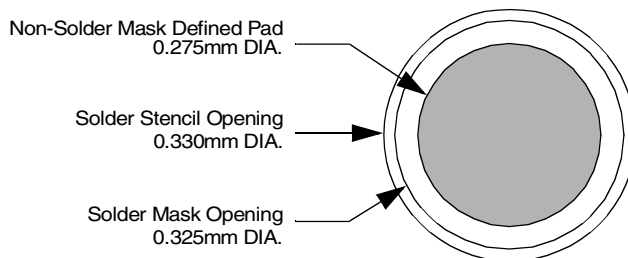


Figure 3. Recommended Non-Solder Mask Defined Pad Illustration

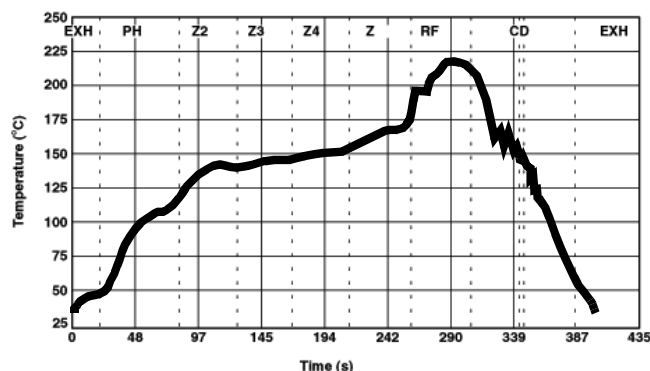


Figure 4. Eutectic (SnPb) Solder Ball Reflow Profile

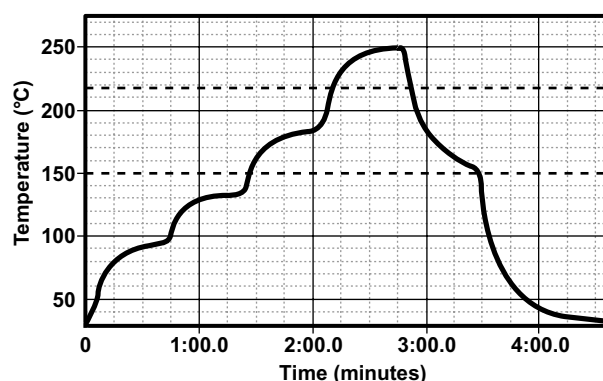


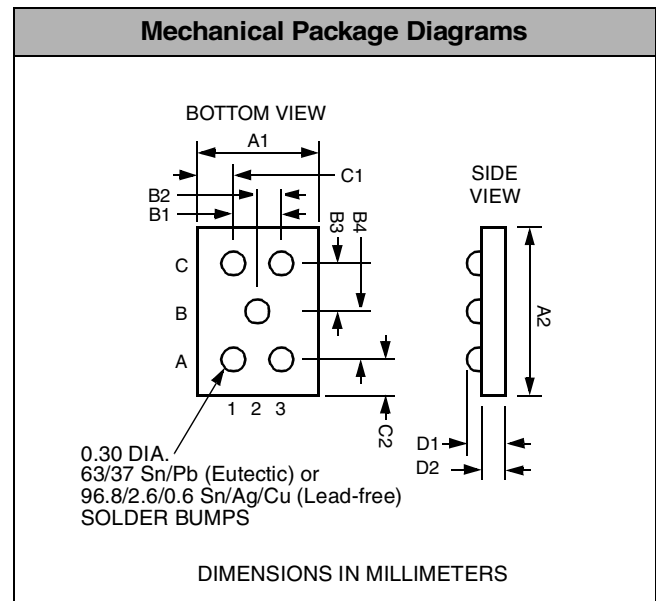
Figure 5. Lead-free (SnAgCu) Solder Ball Reflow Profile

Mechanical Details

CSP Mechanical Specifications

CSPEMI201A 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 | | 5 | | | | |
| Dim | Millimeters | | | Inches | | |
| | Min | Nom | Max | Min | Nom | Max |
| A1 | 0.905 | 0.950 | 0.995 | 0.0356 | 0.0374 | 0.0392 |
| 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 | 0.175 | 0.225 | 0.275 | 0.0069 | 0.0089 | 0.0108 |
| C2 | 0.220 | 0.270 | 0.320 | 0.0087 | 0.0106 | 0.0126 |
| D1 | 0.561 | 0.605 | 0.649 | 0.0221 | 0.0238 | 0.0255 |
| D2 | 0.355 | 0.380 | 0.405 | 0.0140 | 0.0150 | 0.0159 |
| # per tape and reel | | 3500 pieces | | | | |
| Controlling dimension: millimeters | | | | | | |



**Package Dimensions for
CSPEMI201A 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 |
|-------------|-------------------|---|-----------------|------------------|-----------------|----------------|----------------|
| CSPEMI201A | 1.41 X 0.95 X 0.6 | 1.52 X 1.07 X 0.72 | 8mm | 178mm (7") | 3500 | 4mm | 4mm |

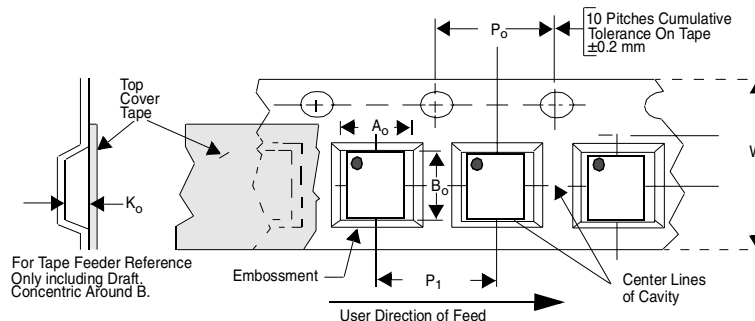


Figure 6. Tape and Reel Mechanical Data