

LCD EMI Filter Array with ESD Protection

Features

- Six and eight channels of EMI filtering
- $\pm 15\text{kV}$ 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 30dB of attenuation at 1GHz for 15pF-100 Ω -15pF filter configuration
- 15-bump, 2.960mm x 1.330mm footprint Chip Scale Package (CSPEMI606)
- 20-bump, 4.000mm x 1.458mm footprint Chip Scale Package (CSPEMI608)
- Chip Scale Package features extremely low lead inductance for optimum filter and ESD performance

Applications

- LCD data lines in clamshell wireless handsets
- EMI filtering & ESD protection for high-speed I/O data ports
- Wireless handsets / cell phones
- Notebook computers
- PDAs / Handheld PCs
- EMI filtering for high-speed data lines

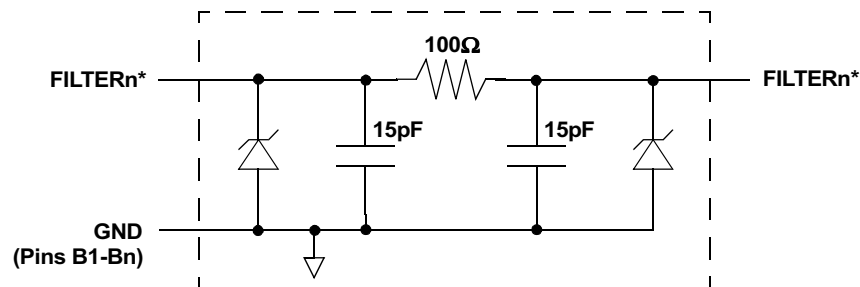
Product Description

CAMD's CSPEMI606 and CSPEMI608 are EMI filter arrays with ESD protection, which integrates six and eight Pi- filters (C-R-C), respectively. The CSPEMI60x has component values of 15pF-100 Ω -15pF. These devices include 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 diodes connected to the filter ports are designed and characterized to safely dissipate ESD strikes of $\pm 15\text{kV}$, beyond 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 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, notebook computers) because of its small package format and easy-to-use pin assignments. In particular, the CSPEMI60x is ideal for EMI filtering and protecting data lines from ESD for the LCD display in clamshell handsets.

The CSPEMI606 and CSPEMI608 are available in space-saving, low-profile chip-scale packages.

Electrical Schematic

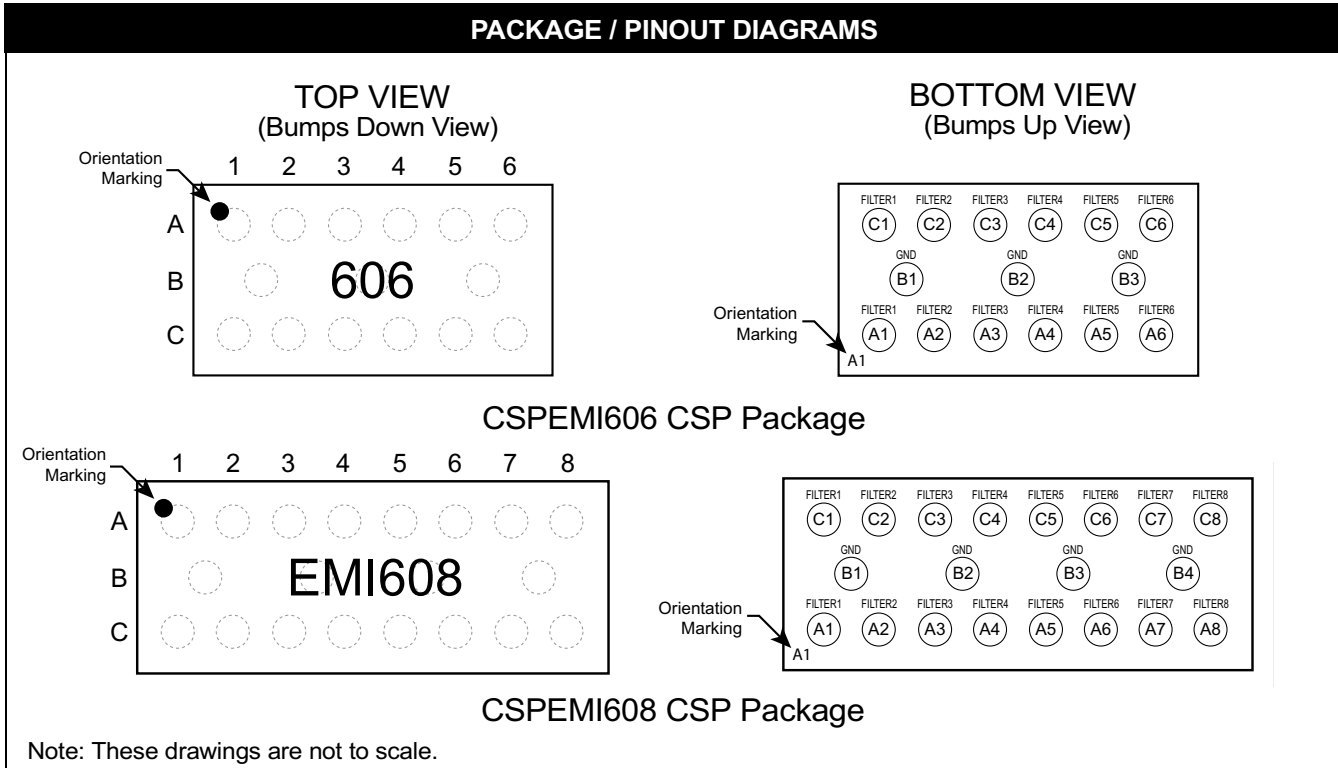


1 of n EMI/RFI + ESD Channels
(n=6 for CSPEMI606, 8 for CSPEMI608)

* See Package/Pinout Diagram for expanded pin information.



PACKAGE / PINOUT DIAGRAMS



PIN DESCRIPTIONS

| CSPEMI606 | CSPEMI608 | NAME | DESCRIPTION | CSPEMI606 | CSPEMI608 | NAME | DESCRIPTION |
|-----------|-----------|---------|------------------|-----------|-----------|---------|------------------|
| PIN(s) | PIN(s) | NAME | DESCRIPTION | PIN(s) | PIN(s) | NAME | DESCRIPTION |
| A1 | A1 | FILTER1 | Filter Channel 1 | C1 | C1 | FILTER1 | Filter Channel 1 |
| A2 | A2 | FILTER2 | Filter Channel 2 | C2 | C2 | FILTER2 | Filter Channel 2 |
| A3 | A3 | FILTER3 | Filter Channel 3 | C3 | C3 | FILTER3 | Filter Channel 3 |
| A4 | A4 | FILTER4 | Filter Channel 4 | C4 | C4 | FILTER4 | Filter Channel 4 |
| A5 | A5 | FILTER5 | Filter Channel 5 | C5 | C5 | FILTER5 | Filter Channel 5 |
| A6 | A6 | FILTER6 | Filter Channel 6 | C6 | C6 | FILTER6 | Filter Channel 6 |
| - | A7 | FILTER7 | Filter Channel 7 | - | C7 | FILTER7 | Filter Channel 7 |
| - | A8 | FILTER8 | Filter Channel 8 | - | C8 | FILTER8 | Filter Channel 8 |
| B1-B4 | B1-B3 | GND | Device Ground | | | | |

Ordering Information

PART NUMBERING INFORMATION

| Pins | Package | Ordering Part Number ¹ | Part Marking |
|------|---------|-----------------------------------|--------------|
| 15 | CSP | CSPEMI606 | 606 |
| 20 | CSP | CSPEMI608 | EMI608 |

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



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 CHARACTERISTICS¹

| SYMBOL | PARAMETER | CONDITIONS | MIN | TYP | MAX | UNITS |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------|---------------------------|-------------|-------------|-------------|----------|
| R | Resistance | | 80 | 100 | 120 | Ω |
| C | Capacitance | At 2.5V DC, 1MHz, 30mV AC | 12 | 15 | 18 | pF |
| V _{DIODE} | Diode Standoff Voltage | I _{DIODE} =10μA | 5.5 | | | 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 -0.4 | 6.8 -0.8 | 9.0 -1.5 | 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 | Notes 2,4 and 5 | ±30 ±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 |
| f _C | Cut-off Frequency Z _{SOURCE} =0Ω, Z _{LOAD} =50Ω | R=100Ω, C=15pF | | 120 | | 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 (T_A=25°C, DC Bias=0V, 50 Ohm Environment)

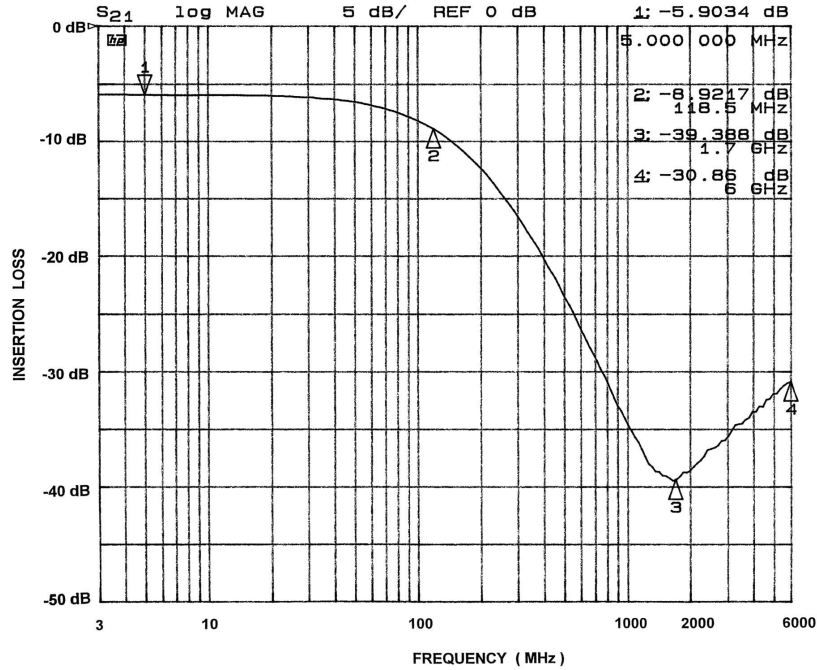


Figure 1. Insertion Loss VS. Frequency (A1-C1 to GND B1)

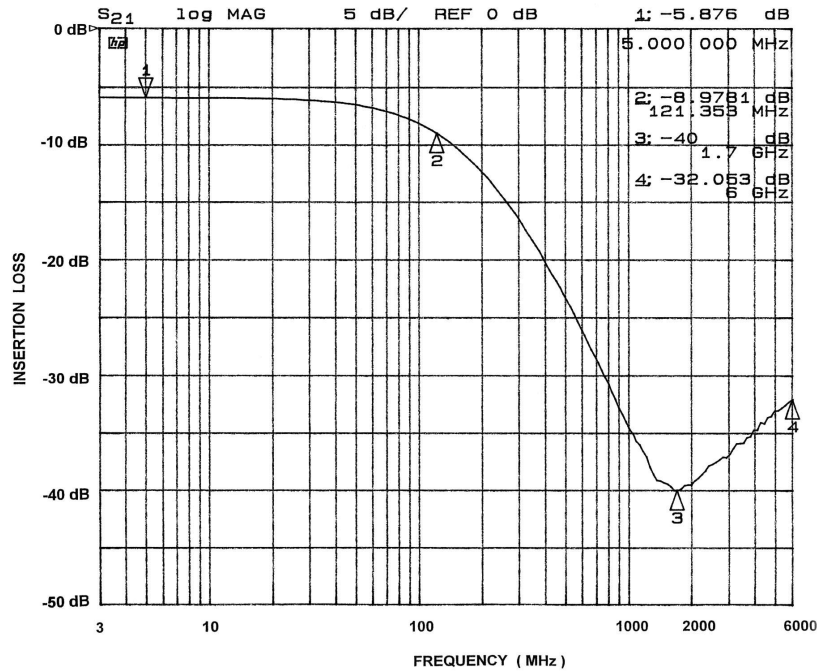


Figure 2. Insertion Loss VS. Frequency (A2-C2 to GND B1)

Performance Information (cont'd)

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

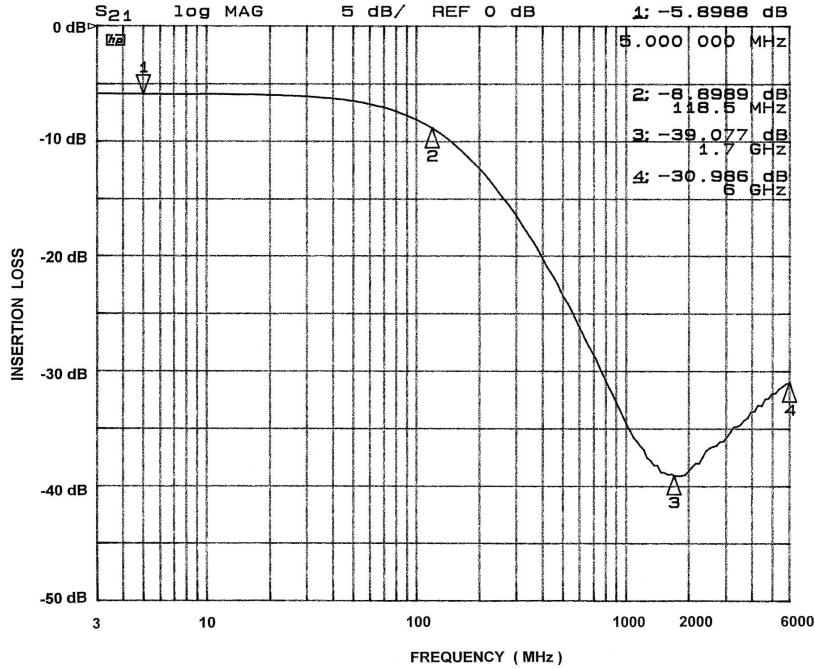


Figure 3. Insertion Loss VS. Frequency (A3-C3 to GND B2)

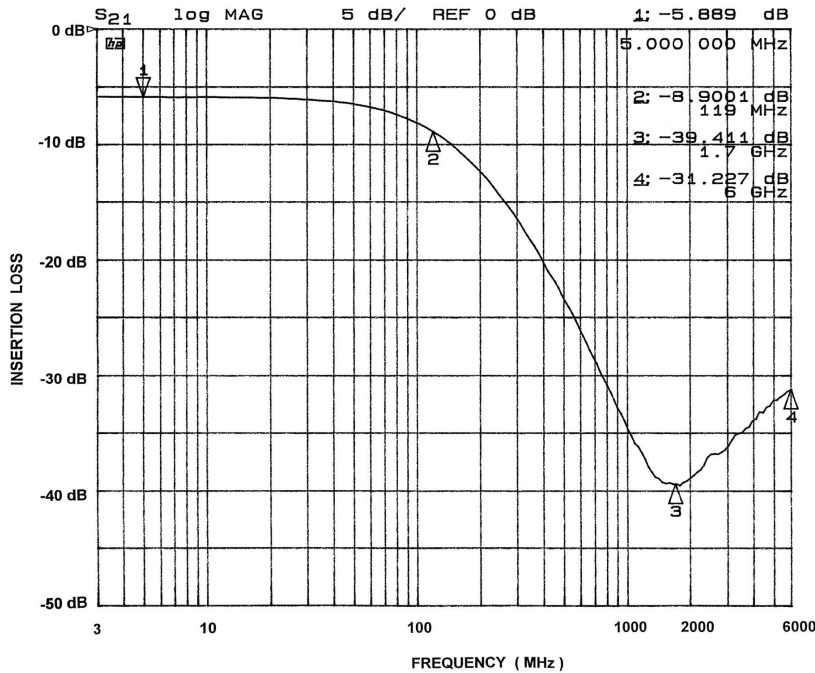


Figure 4. Insertion Loss VS. Frequency (A4-C4 to GND B2)

Performance Information (cont'd)

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

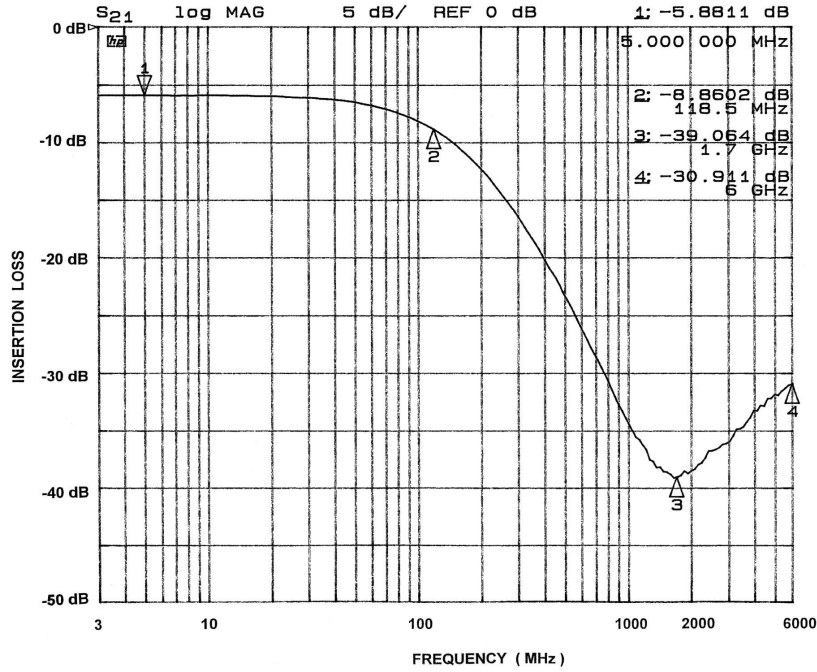


Figure 5. Insertion Loss VS. Frequency (A5-C5 to GND B3)

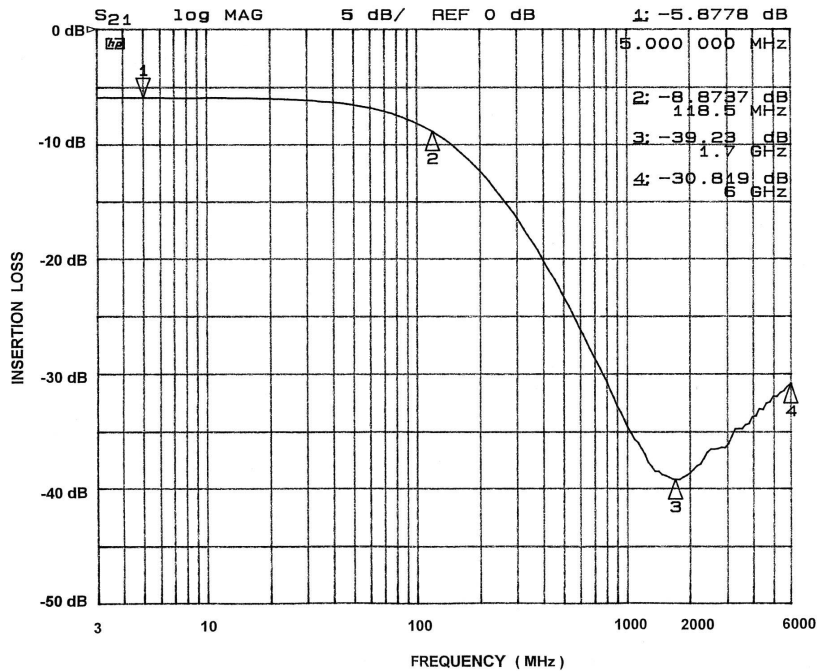


Figure 6. Insertion Loss VS. Frequency (A6-C6 to GND B3)

Performance Information (cont'd)

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

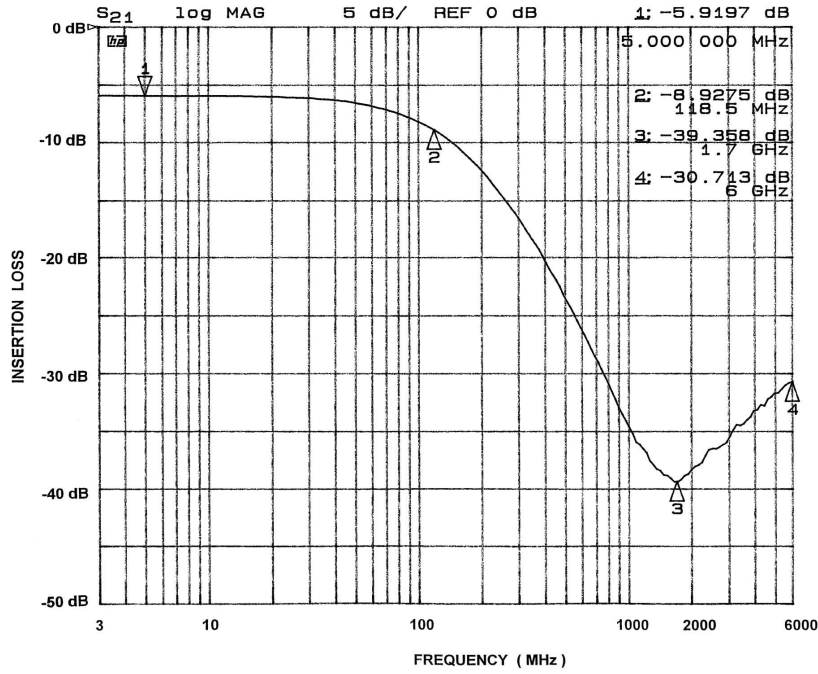


Figure 7. Insertion Loss VS. Frequency (A7-C7 to GND B4, CSPEMI608 Only)

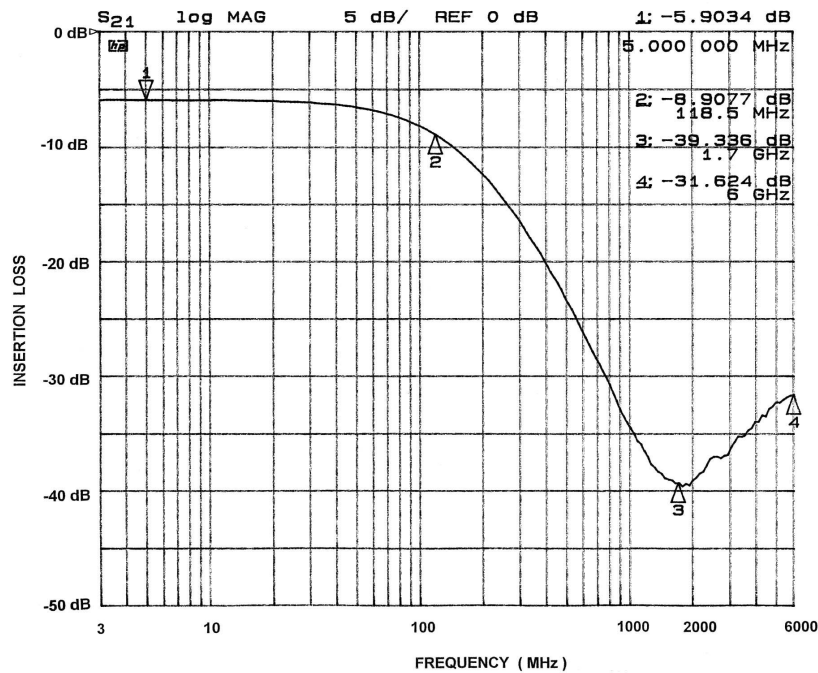
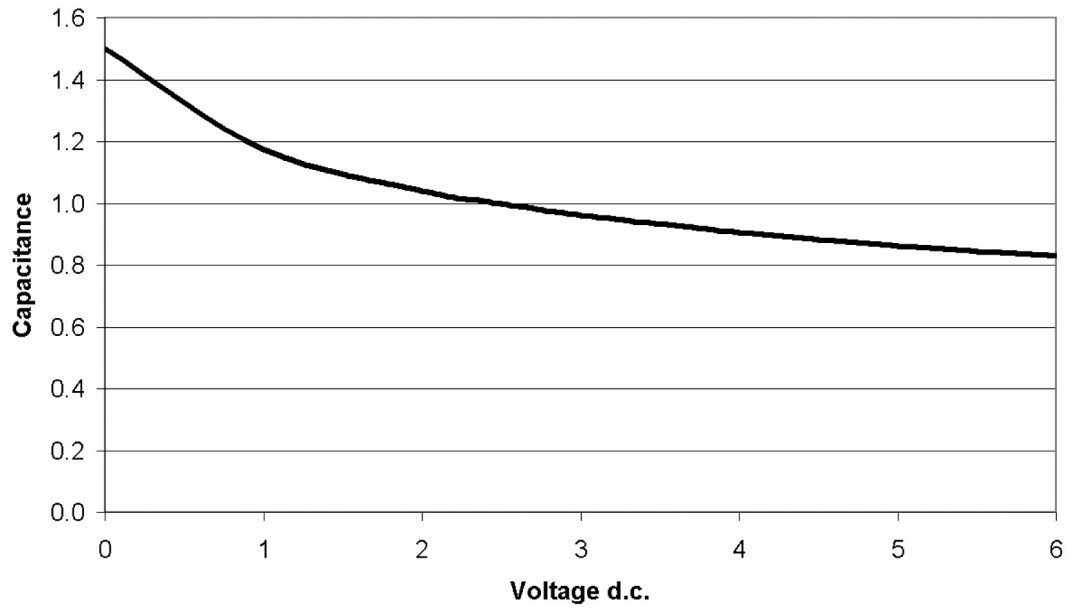


Figure 8. Insertion Loss VS. Frequency (A8-C8 to GND B4, CSPEMI608 Only)



Performance Information (cont'd)



**Figure 9. Filter Capacitance vs. Input Voltage over Temperature
(normalized to capacitance at 2.5VDC and 25°C)**

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 | 240°C |

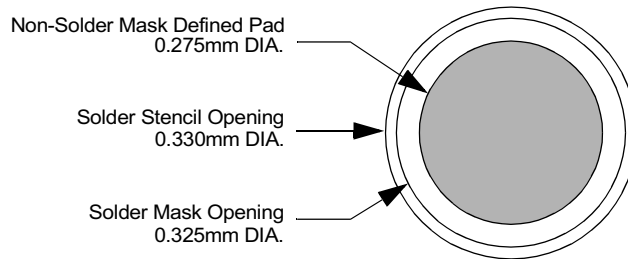


Figure 10. Recommended Non-Solder Mask Defined Pad Illustration

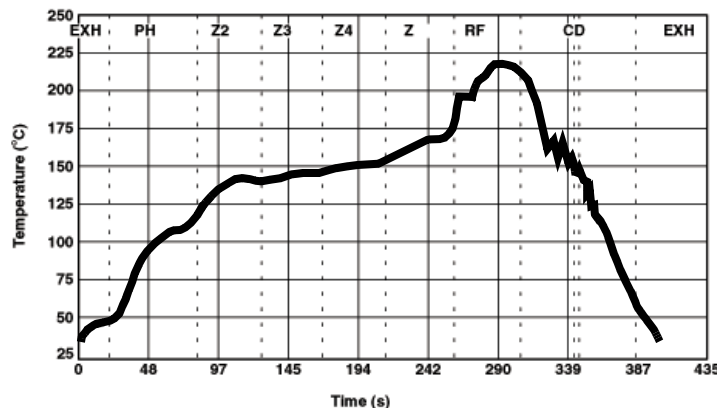


Figure 11. Solder Reflow Profile

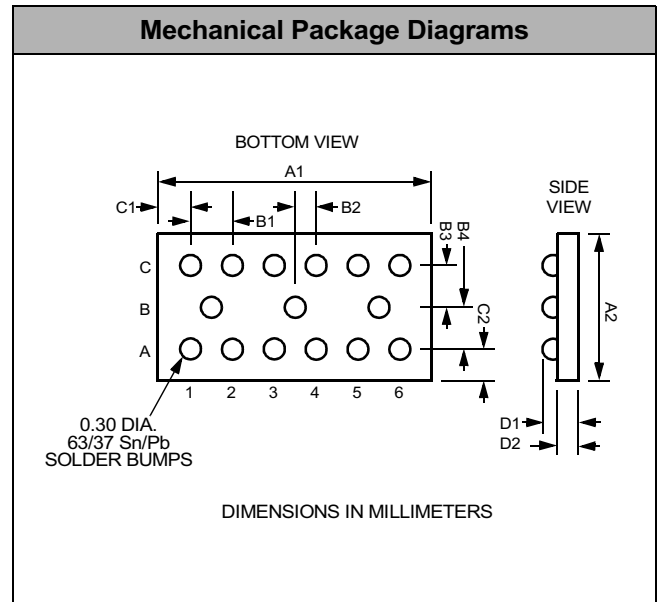
Mechanical Details

CSPEMI606/608 devices are packaged in a custom Chip Scale Packages (CSP). Dimensions for each of these devices are presented in the following pages.

CSPEMI606 Mechanical Specifications

The package dimensions for the CSPEMI606 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 | 0.561 | 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 | | | | | | |



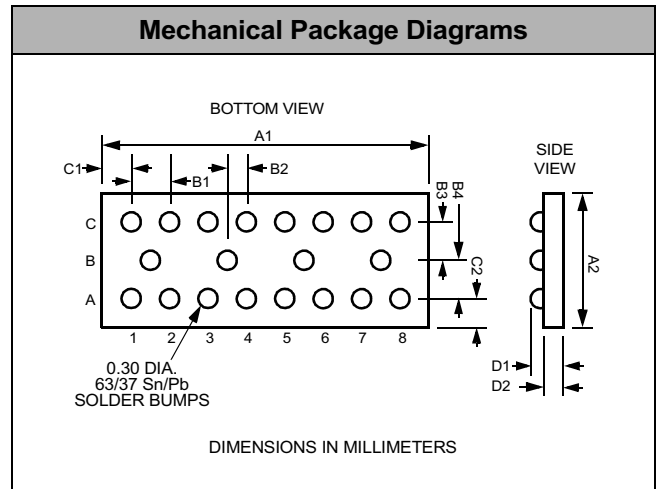
**Package Dimensions for
CSPEMI606 Chip Scale Package**

Mechanical Details (cont'd)

CSPEMI608 Mechanical Specifications

The package dimensions for the CSPEMI608 are presented below.

| PACKAGE DIMENSIONS | | | | | | |
|------------------------------------|-------------|-------|-------|--------|--------|--------|
| Package | Custom CSP | | | | | |
| Bumps | 20 | | | | | |
| Dim | Millimeters | | | Inches | | |
| | Min | Nom | Max | Min | Nom | Max |
| A1 | 3.955 | 4.000 | 4.045 | 0.1557 | 0.1575 | 0.1593 |
| A2 | 1.413 | 1.458 | 1.503 | 0.0556 | 0.0574 | 0.0592 |
| 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 | 0.200 | 0.250 | 0.300 | 0.0079 | 0.0098 | 0.0118 |
| C2 | 0.244 | 0.294 | 0.344 | 0.0096 | 0.0116 | 0.0135 |
| 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
CSPEMI608 Chip Scale Package**

Mechanical Details (cont'd)

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 |
|-------------|-------------------|-------------------------------------------------|-----------------|------------------|-----------------|-------|-------|
| CSPEMI606 | 2.96 X 1.33 X 0.6 | TBD | 8mm | 178mm (7") | 3500 | 4mm | 4mm |
| CSPEMI608 | 4.00 X 1.46 X 0.6 | TBD | 8mm | 178mm (7") | 3500 | 4mm | 4mm |

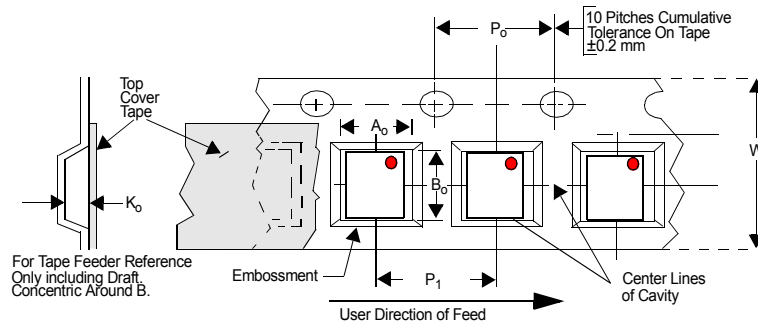


Figure 12. Tape and Reel Mechanical Data