

## 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 to 3GHz
- 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
- RoHS compliant (lead-free) finishing available

### 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

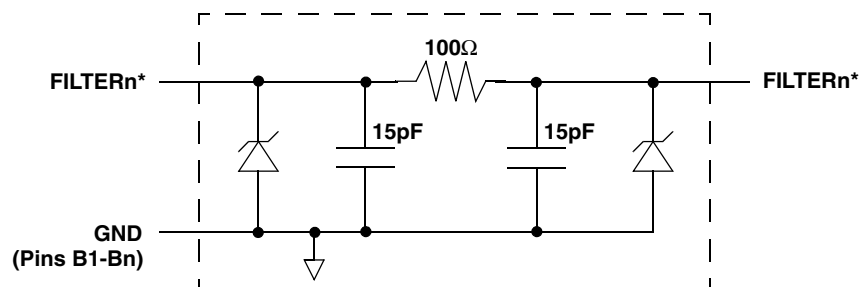
### Product Description

CMD's CSPEMI606 and CSPEMI608 are EMI filter arrays with ESD protection, which integrate six and eight Pi- filters (C-R-C), respectively. The CSPEMI60x has component values of 15pF-100 $\Omega$ -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  $\pm 30\text{kV}$ .

These devices are particularly well suited for portable electronics (e.g. wireless handsets, PDAs, notebook computers) because of their small package format and easy-to-use pin assignments. They are ideal for EMI filtering and protecting data lines from ESD for the LCD display in clamshell handsets.

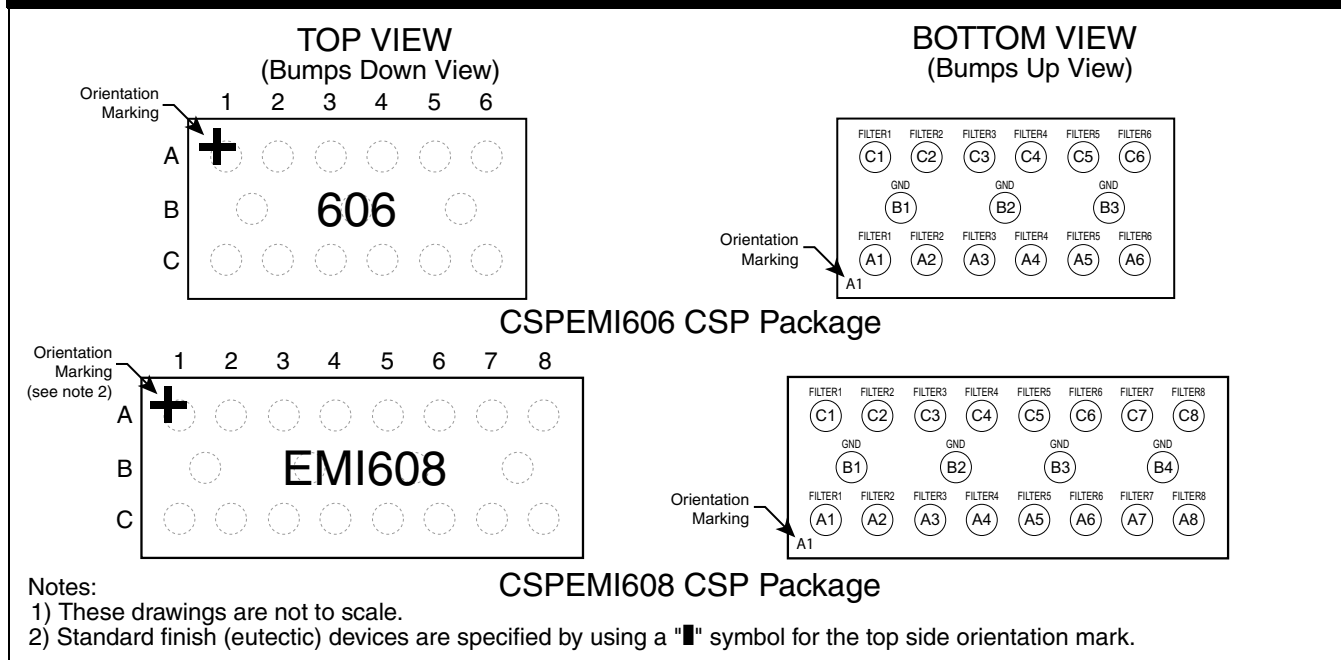
The CSPEMI606 and CSPEMI608 are available in space-saving, low-profile chip-scale packages.

### Electrical Schematic



1 of 6 or 8 EMI Filtering + ESD Channels

\* 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-B3	B1-B4	GND	Device Ground				

**Ordering Information**
**PART NUMBERING INFORMATION**

Bumps	Package	Lead-free Finish		Standard (Eutectic) Finish <sup>2</sup>	
		Ordering Part Number <sup>1</sup>	Part Marking	Ordering Part Number <sup>1</sup>	Part Marking
15	CSP	CSPEMI606G	606	-	-
20	CSP	CSPEMI608G	EMI608	CSPEMI608 <sup>3</sup>	EMI608

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

Note 2: Standard finish (Eutectic) devices are specified by using a "■" symbol for the top side orientation mark.

Note 3: The Eutectic version of the CSPEMI608 is being obsoleted by end of Q2CY08.

## 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<sup>1</sup>

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 <sub>DIODE</sub>	Diode Standoff Voltage	I <sub>DIODE</sub> =10μA		6.0		V
I <sub>LEAK</sub>	Diode Leakage Current (reverse bias)	V <sub>DIODE</sub> =3.3V			200	nA
V <sub>SIG</sub>	Signal Voltage Positive Clamp Negative Clamp	I <sub>LOAD</sub> = 10mA	5.6 -1.5	6.8 -0.8	9.0 -0.4	V V
V <sub>ESD</sub>	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 <sub>CL</sub>	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 <sub>C</sub>	Cut-off Frequency Z <sub>SOURCE</sub> =50Ω, Z <sub>LOAD</sub> =50Ω	R=100Ω, C=15pF		120		MHz

Note 1: T<sub>A</sub>=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 ( $T_A=25^\circ\text{C}$ , DC Bias=0V, 50 Ohm Environment)

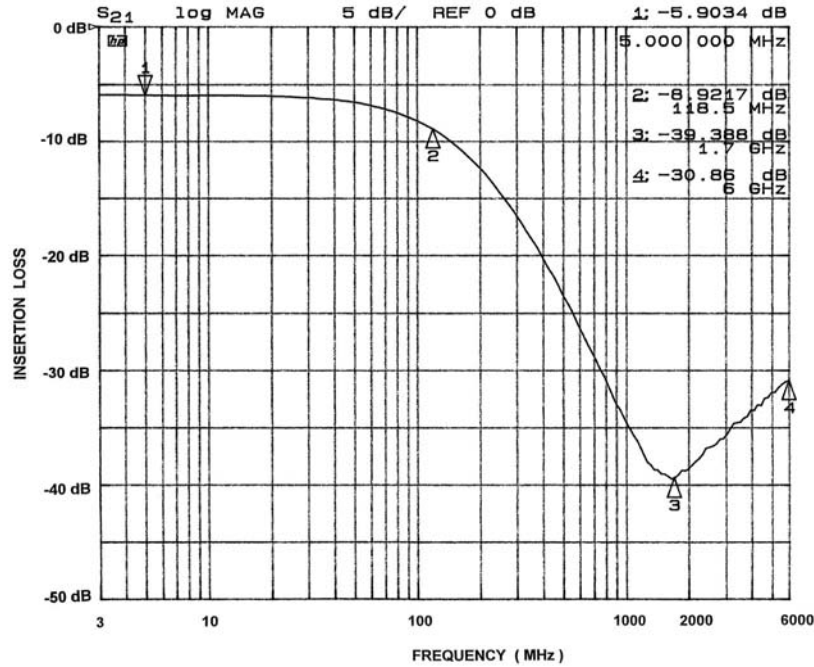


Figure 1. Insertion Loss VS. Frequency (A1-C1 to GND B1)

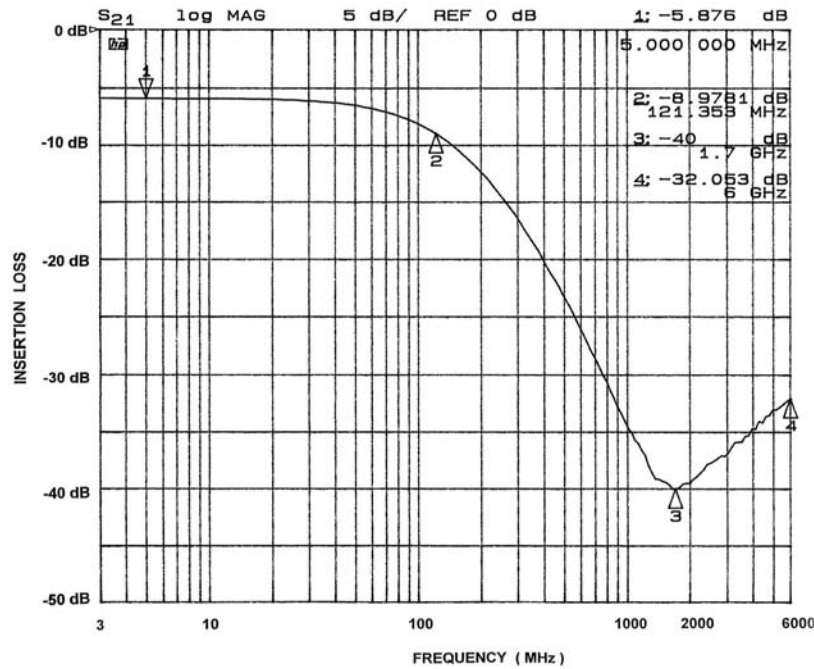
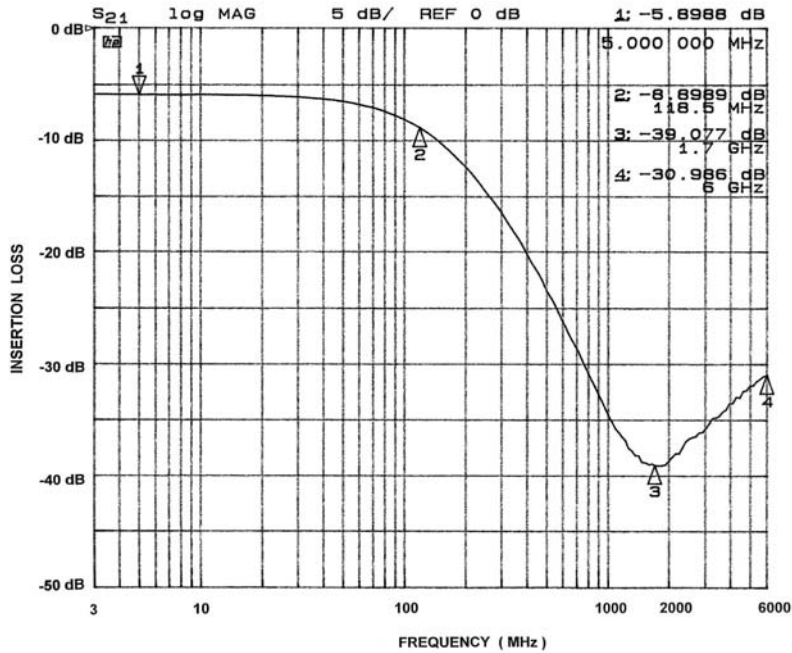


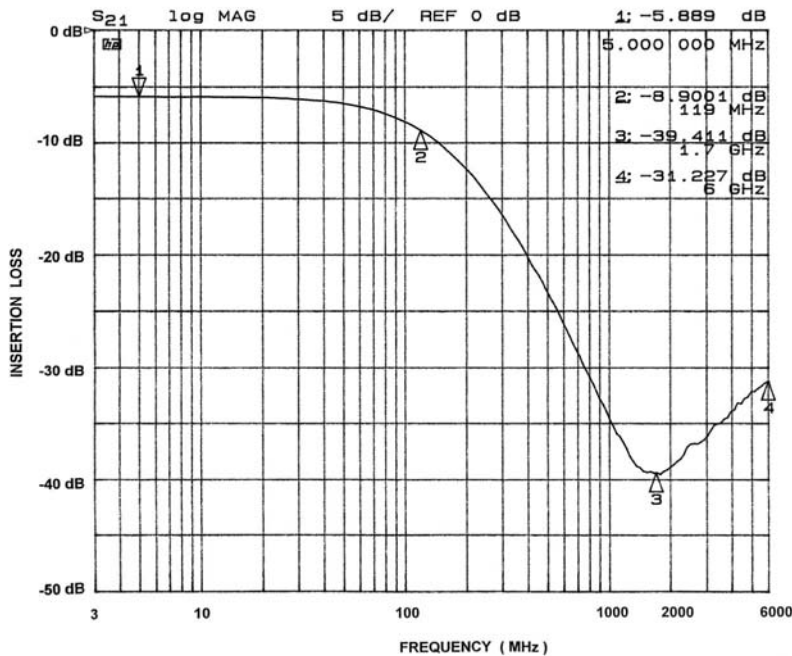
Figure 2. Insertion Loss VS. Frequency (A2-C2 to GND B1)

**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)

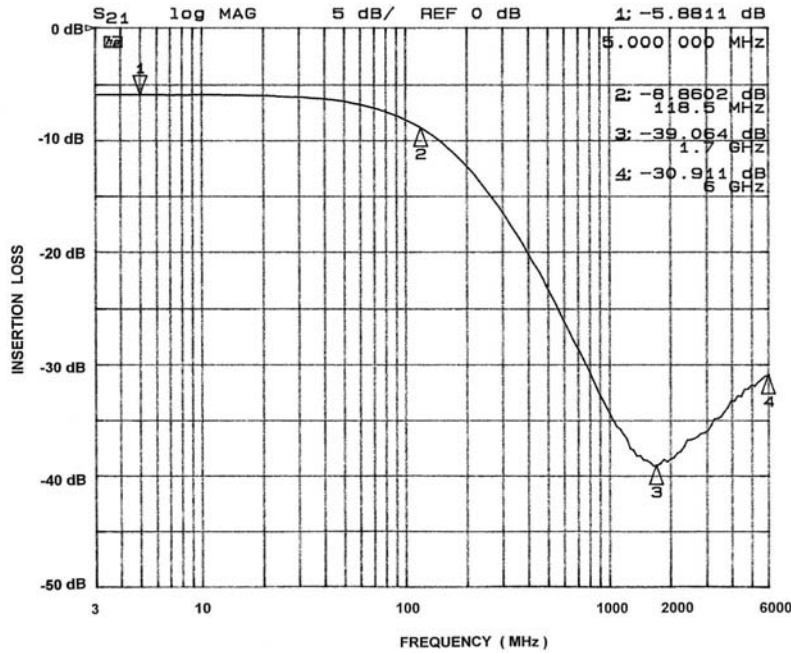


Figure 5. Insertion Loss VS. Frequency (A5-C5 to GND B3)

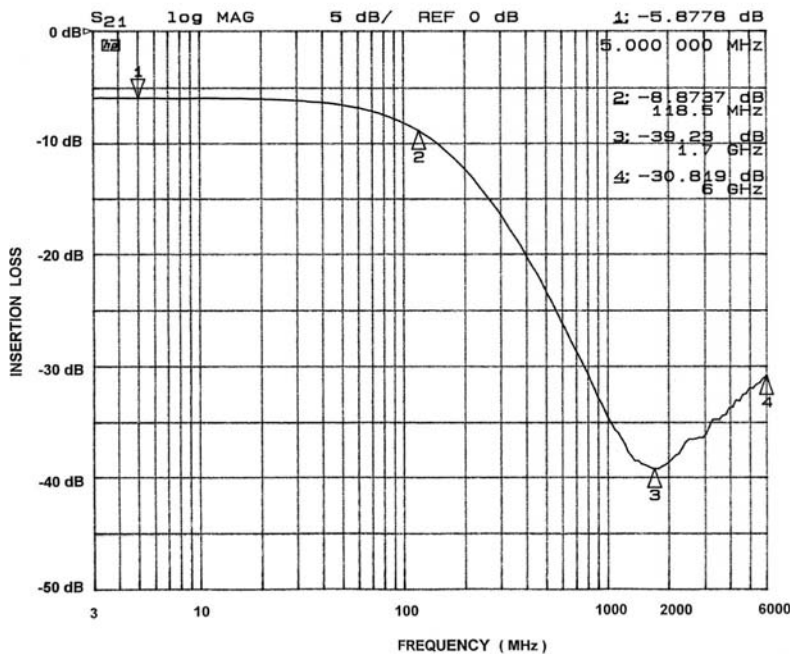
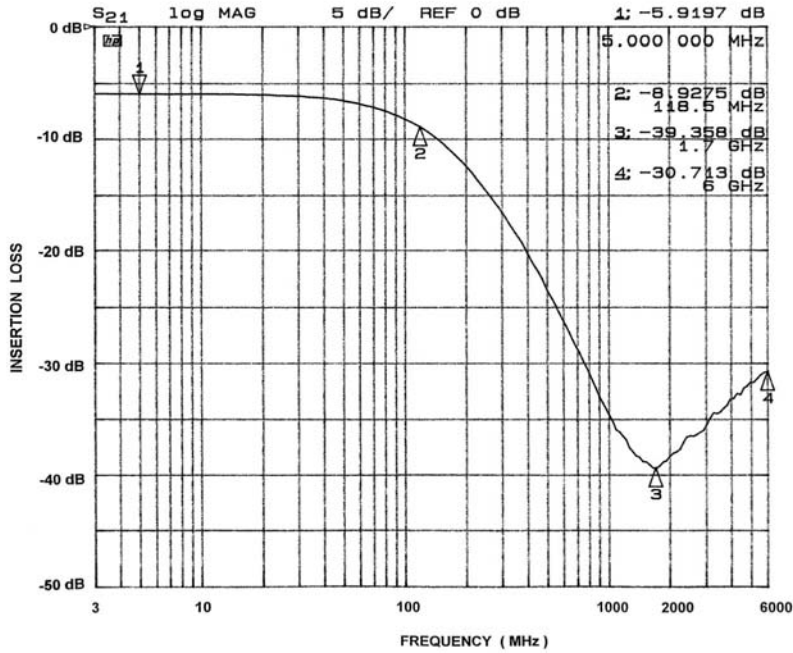


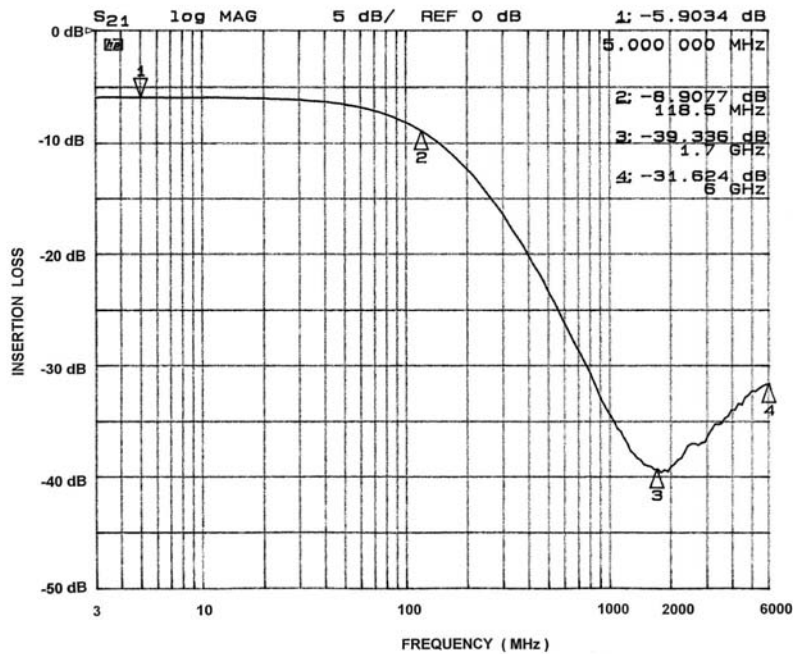
Figure 6. Insertion Loss VS. Frequency (A6-C6 to GND B3)

**Performance Information (cont'd)**

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

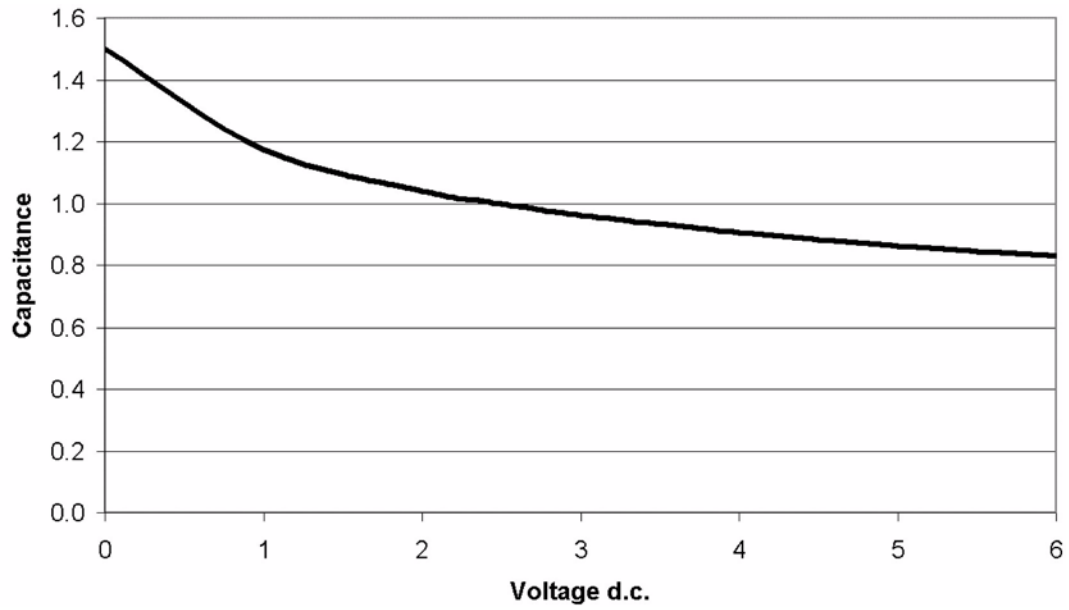


**Figure 7. Insertion Loss VS. Frequency (A7-C7 to GND B4, CSPEMI608 Only)**



**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	60 seconds
Maximum Soldering Temperature for Eutectic Devices using Eutectic Solder Paste	240°C
Maximum Soldering Temperature for Lead-free Devices using Lead-free Solder Paste	260°C

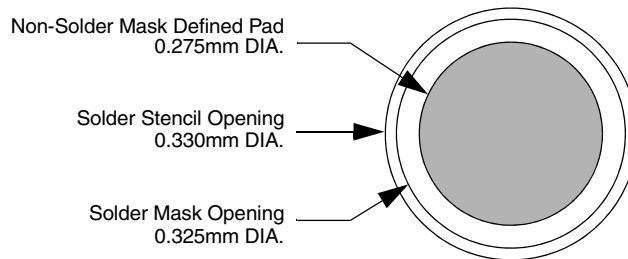


Figure 10. Recommended Non-Solder Mask Defined Pad Illustration

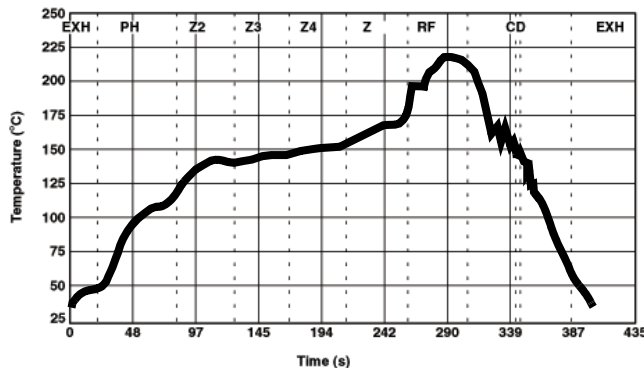


Figure 11. Eutectic (SnPb) Solder Ball Reflow Profile

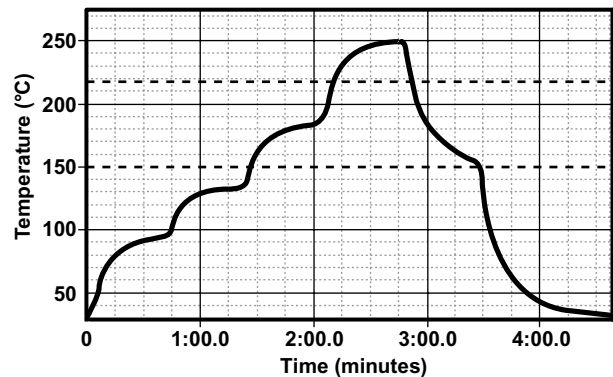


Figure 12. Lead-free (SnAgCu) Solder Ball Reflow Profile

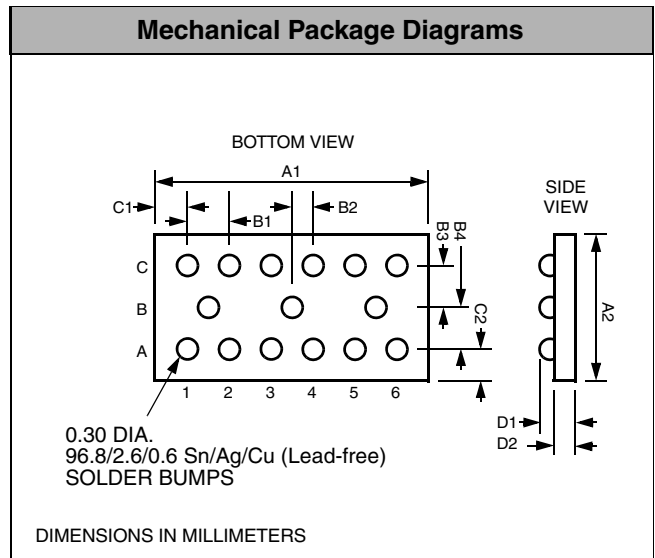
### Mechanical Details

The CSPEMI606/608 is supplied in custom Chip Scale Packages (CSP). Dimensions are presented below.

#### 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	0.0256
D2	0.355	0.380	0.405	0.0140	0.0150	0.0160
# per tape and reel	3500 pieces					
Controlling dimension: millimeters						



Package Dimensions for CSPEMI606 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>
CSPEMI606	2.96 X 1.33 X 0.605	3.10 X 1.45 X 0.74	8mm	178mm (7")	3500	4mm	4mm

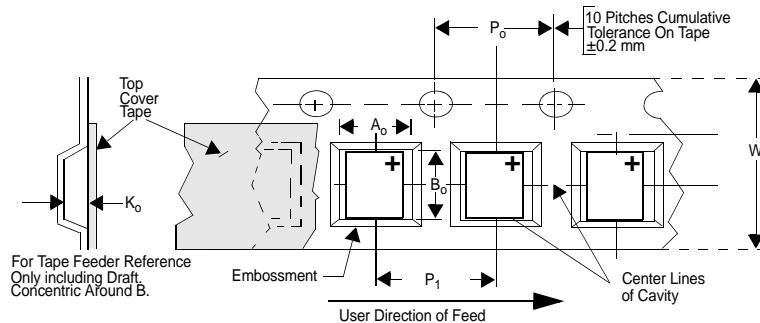


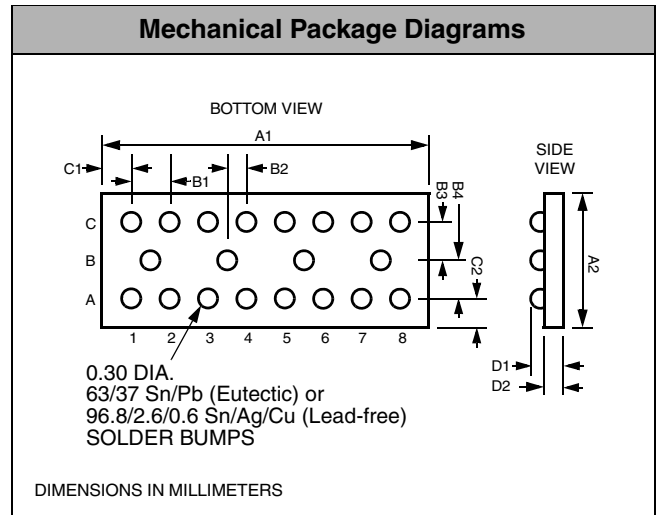
Figure 13. Tape and Reel Mechanical Data

### Mechanical Details (cont'd)

#### CSPEMI608 Mechanical Specifications

The package dimensions for the CSPEMI608 are presented below.

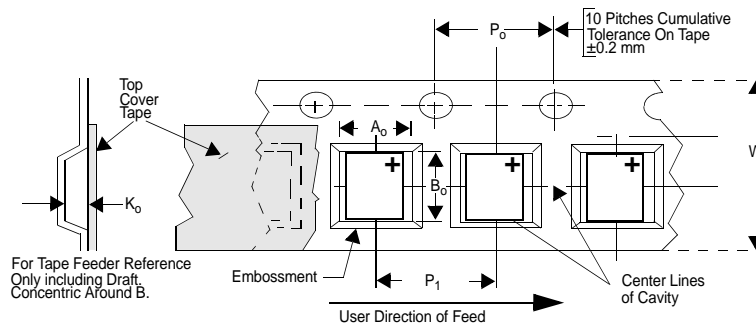
PACKAGE DIMENSIONS						
Package	Custom CSP					
Bumps	20					
Dim	Millimeters			Inches		
	Min	Nom	Max	Min	Nom	Max
A1	3.955	4.000	4.045	0.1557	0.1575	0.1593
A2	1.413	1.458	1.503	0.0556	0.0574	0.0592
B1	0.495	0.500	0.505	0.0195	0.0197	0.0199
B2	0.245	0.250	0.255	0.0096	0.0098	0.0100
B3	0.430	0.435	0.440	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	0.0256
D2	0.355	0.380	0.405	0.0140	0.0150	0.0160
# per tape and reel	3500 pieces					
Controlling dimension: millimeters						



Package Dimensions for CSPEMI608 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>
CSPEMI608	4.00 X 1.46 X 0.605	4.11 X 1.57 X 0.76	8mm	178mm (7")	3500	4mm	4mm



Note: Eutectic devices are specified by using a "E" symbol for the top side orientation mark.

Figure 14. Tape and Reel Mechanical Data