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# CM1442

## LCD and Camera EMI Filter Array with ESD Protection

### Product Description

The CM1442 is a family of pi-style EMI filter arrays with ESD protection, which integrates six and eight filters (C-R-C) in Chip Scale Package form factor with 0.40 mm pitch. The CM1442 has component values of 15 pF – 100 Ω – 15 pF per channel. The CM1442 has a cut-off frequency of 120 MHz and can be used in applications where the data rates are as high as 48 Mbps. The parts include avalanche-type ESD 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 safely dissipate ESD strikes of ±15 kV, well beyond the maximum 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 ±30 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 CM1442 is ideal for EMI filtering and protecting data and control lines for the I/O data ports, LCD display and camera interface in mobile handsets.

The CM1442 incorporates *OptiGuard™* which results in improved reliability at assembly. The CM1442 is available in a space-saving, low-profile Chip Scale Package with RoHS compliant lead-free finishing. It is manufactured with a 0.40 mm pitch and 0.25 mm CSP solder ball to provide up to 28% board space saving versus competing CSP devices with 0.50 mm pitch and 0.30 mm CSP solder ball.

### Features

- Six and Eight Channels of EMI Filtering with Integrated ESD Protection
- 0.4 mm Pitch, 15-Bump, 2.360 mm x 1.053 mm Footprint Chip Scale Package (CM1442-06)
- 0.4 mm Pitch, 20-Bump, 3.160 mm x 1.053 mm Footprint Chip Scale Package (CM1442-08)
- Pi-Style EMI Filters in a Capacitor-Resistor-Capacitor (C-R-C) Network
- ±15 kV ESD Protection on Each Channel (IEC 61000-4-2 Level 4, Contact Discharge)
- ±30 kV ESD Protection on Each Channel (HBM)
- These Devices are Pb-Free and are RoHS Compliant

### Applications

- LCD and Camera Data Lines in Mobile Handsets
- I/O Port Protection for Mobile Handsets, Notebook Computers, PDAs, etc.
- Wireless Handsets
- Greater than 30 dB Attenuation (Typical) at 1 GHz
- Chip Scale Package Features Extremely Low Lead Inductance for Optimum Filter and ESD Performance
- *OptiGuard™* Coated for Improved Reliability at Assembly
- EMI Filtering for Data Ports in Cell Phones, PDAs or Notebook Computers
- Handheld PCs/PDAs
- LCD and Camera Modules



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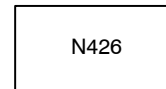


WLCSP15  
CP SUFFIX  
CASE 567BP



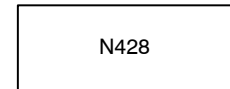
WLCSP20  
CP SUFFIX  
CASE 567BU

### MARKING DIAGRAM



CM1442-06

15-Bump CSP Package



CM1442-08

20-Bump CSP Package

N426 = CM1442-06CP

N428 = CM1442-08CP

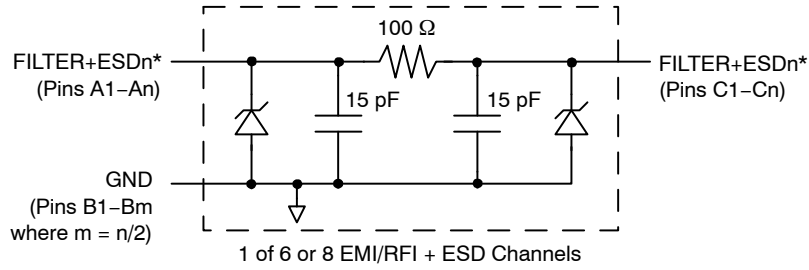
### ORDERING INFORMATION

| Device      | Package             | Shipping†        |
|-------------|---------------------|------------------|
| CM1442-06CP | CSP-15<br>(Pb-Free) | 3500/Tape & Reel |
| CM1442-08CP | CSP-20<br>(Pb-Free) | 3500/Tape & Reel |

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specification Brochure, BRD8011/D.

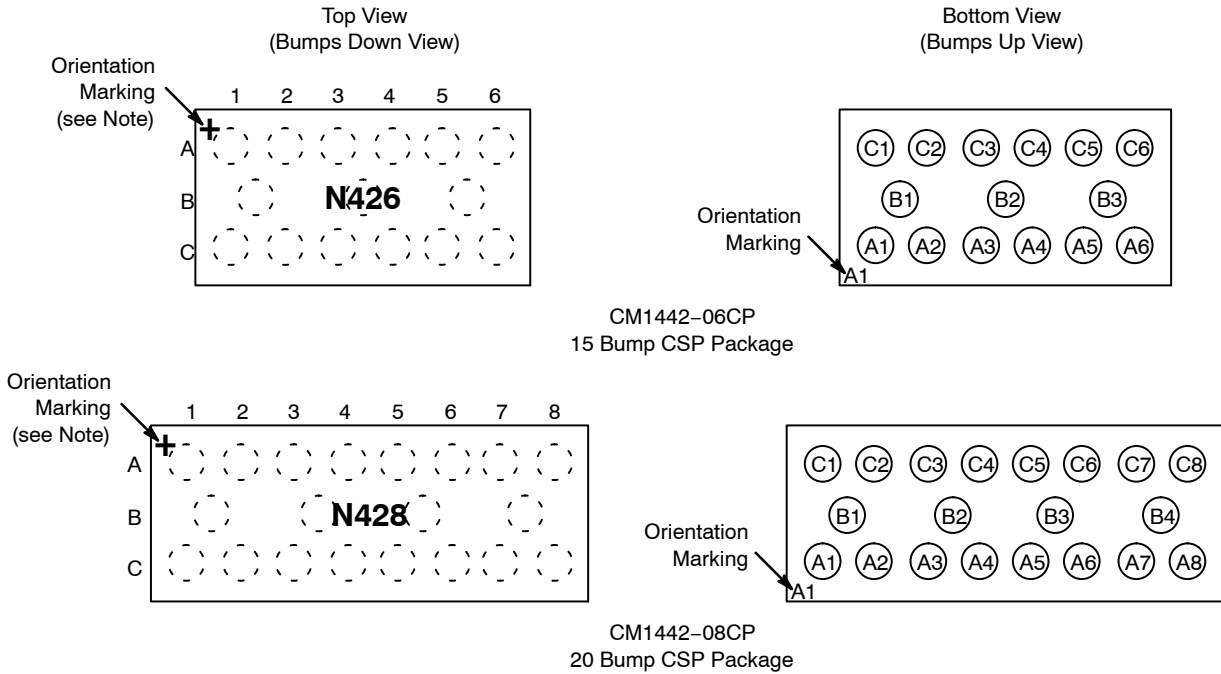
# CM1442

## BLOCK DIAGRAM



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

## PACKAGE / PINOUT DIAGRAMS



Note: Lead-free devices are specified by using a "+" character for the top side orientation mark.

**Table 1. PIN DESCRIPTIONS**

| Pins  | Name    | Description            | Pins | Name    | Description            |
|-------|---------|------------------------|------|---------|------------------------|
| A1    | FILTER1 | Filter + ESD Channel 1 | C1   | FILTER1 | Filter + ESD Channel 1 |
| A2    | FILTER2 | Filter + ESD Channel 2 | C2   | FILTER2 | Filter + ESD Channel 2 |
| A3    | FILTER3 | Filter + ESD Channel 3 | C3   | FILTER3 | Filter + ESD Channel 3 |
| A4    | FILTER4 | Filter + ESD Channel 4 | C4   | FILTER4 | Filter + ESD Channel 4 |
| A5    | FILTER5 | Filter + ESD Channel 5 | C5   | FILTER5 | Filter + ESD Channel 5 |
| A6    | FILTER6 | Filter + ESD Channel 6 | C6   | FILTER6 | Filter + ESD Channel 6 |
| A7    | FILTER7 | Filter + ESD Channel 7 | C7   | FILTER7 | Filter + ESD Channel 7 |
| A8    | FILTER8 | Filter + ESD Channel 8 | C8   | FILTER8 | Filter + ESD Channel 8 |
| B1-B4 | GND     | Device Ground          |      |         |                        |

# CM1442

## SPECIFICATIONS

**Table 2. 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    |

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

**Table 3. STANDARD OPERATING CONDITIONS**

| Parameter                   | Rating     | Units |
|-----------------------------|------------|-------|
| Operating Temperature Range | -40 to +85 | °C    |

**Table 4. ELECTRICAL OPERATING CHARACTERISTICS** (Note 1)

| Symbol             | Parameter  | Conditions  | Min         | Typ         | Max         | Units |
|--------------------|--|---|-------------|-------------|-------------|-------|
| R                  | Resistance   |   | 80          | 100         | 120         | Ω     |
| C <sub>TOTAL</sub> | Total Channel Capacitance  | At 2.5 VDC Reverse Bias,<br>1 MHz, 30 mVAC              | 24          | 30          | 36          | pF    |
| C                  | Capacitance C1   | At 2.5 VDC Reverse Bias,<br>1 MHz, 30 mVAC              | 12          | 15          | 18          | pF    |
| V <sub>DIODE</sub> | Standoff Voltage   | I <sub>DIODE</sub> = 10 μA                              |             | 6.0         |             | V     |
| I <sub>LEAK</sub>  | Diode Leakage Current (reverse bias)   | V <sub>DIODE</sub> = 3.3 V                              |             | 0.1         | 1           | μA    |
| V <sub>SIG</sub>   | Signal Clamp Voltage<br>Positive Clamp<br>Negative Clamp   | I <sub>LOAD</sub> = 10 mA<br>I <sub>LOAD</sub> = -10 mA | 5.6<br>-1.5 | 6.8<br>-0.8 | 9.0<br>-0.4 | V     |
| V <sub>ESD</sub>   | In-system ESD Withstand Voltage<br>a) Human Body Model, MIL-STD-883, Method 3015<br>b) Contact Discharge per IEC 61000-4-2 Level 4 | (Notes 2 and 3)   | ±30<br>±15  |             |             | kV    |
| R <sub>DYN</sub>   | Dynamic Resistance<br>Positive<br>Negative   |   |             | 2.3<br>0.9  |             | Ω     |
| f <sub>C</sub>     | Cut-off Frequency<br>Z <sub>SOURCE</sub> = 50 Ω, Z <sub>LOAD</sub> = 50 Ω  | R = 100 Ω, C = 15 pF                                    |             | 115         |             | MHz   |

1. T<sub>A</sub> = 25°C unless otherwise specified.
2. ESD applied to input and output pins with respect to GND, one at a time.
3. Unused pins are left open.

# CM1442

## PERFORMANCE INFORMATION

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

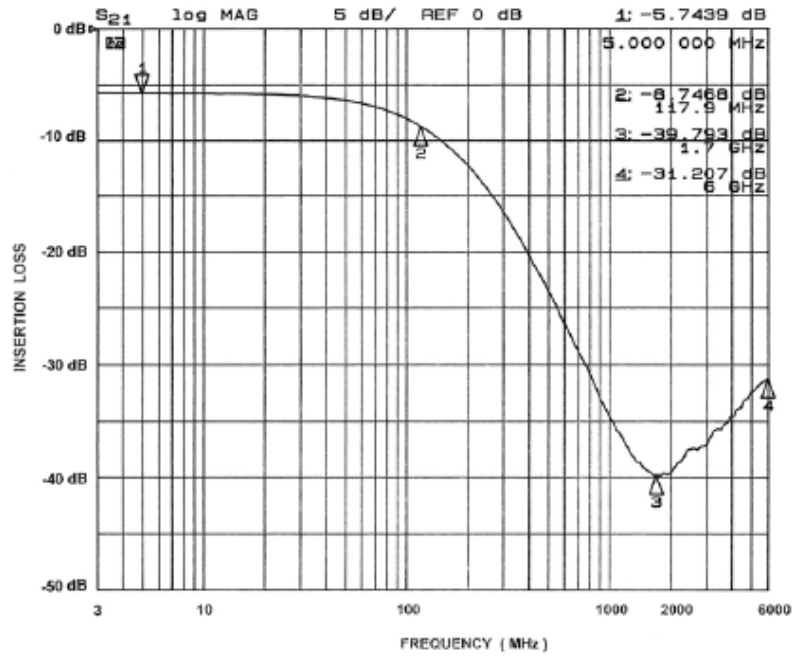


Figure 1. Insertion Loss vs. Frequency (A1-C1 to GND B1)

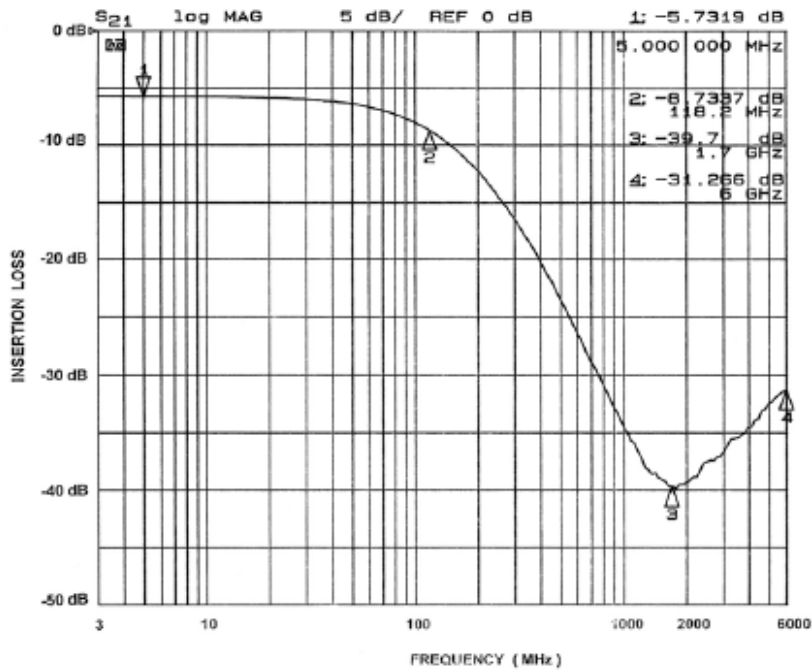


Figure 2. Insertion Loss vs. Frequency (A2-C2 to GND B1)

PERFORMANCE INFORMATION (Cont'd)

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

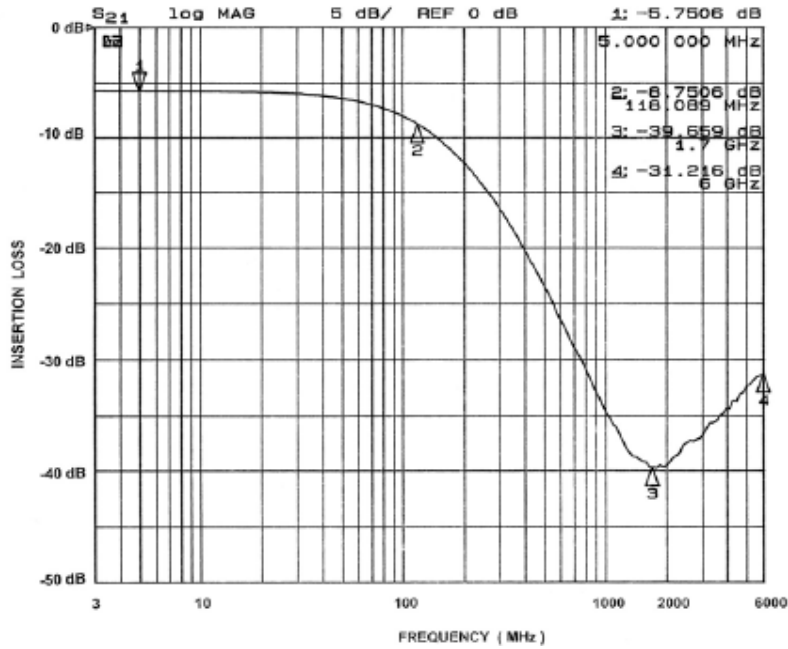


Figure 3. Insertion Loss vs. Frequency (A3-C3 to GND B2)

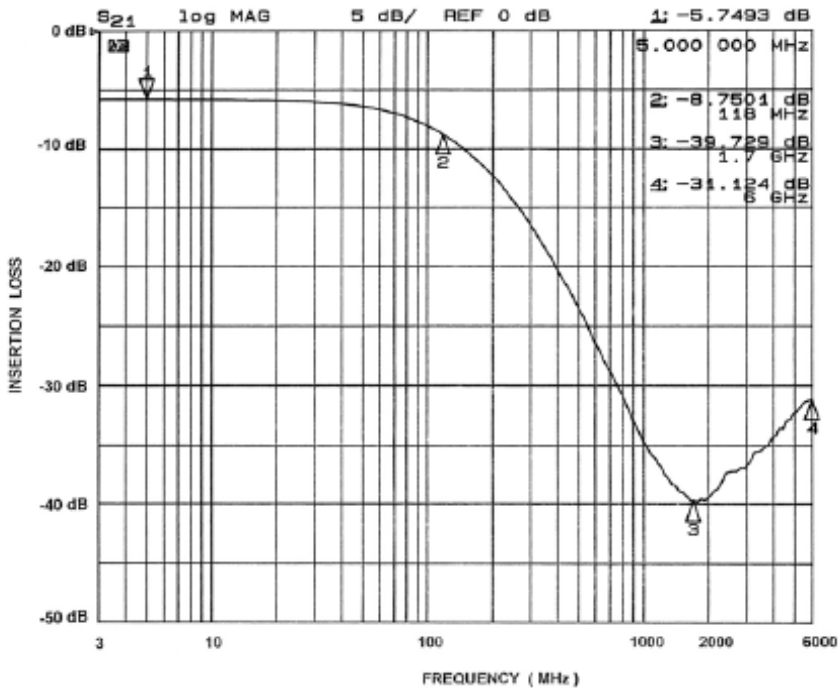


Figure 4. Insertion Loss vs. Frequency (A4-C4 to GND B2)

# CM1442

## PERFORMANCE INFORMATION (Cont'd)

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

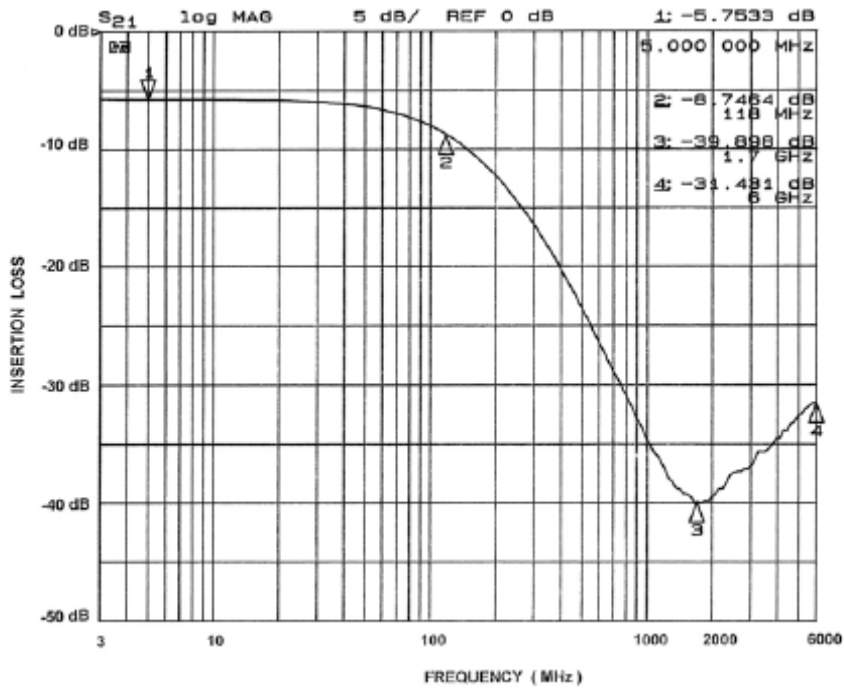


Figure 5. Insertion Loss vs. Frequency (A5-C5 to GND B3)

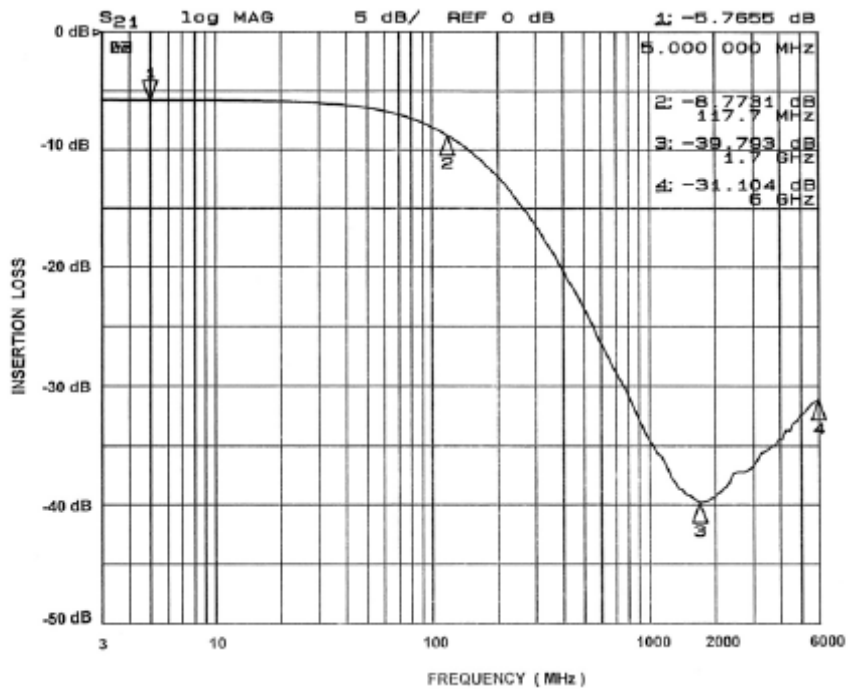


Figure 6. Insertion Loss vs. Frequency (A6-C6 to GND B3)

# CM1442

## PERFORMANCE INFORMATION (Cont'd)

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

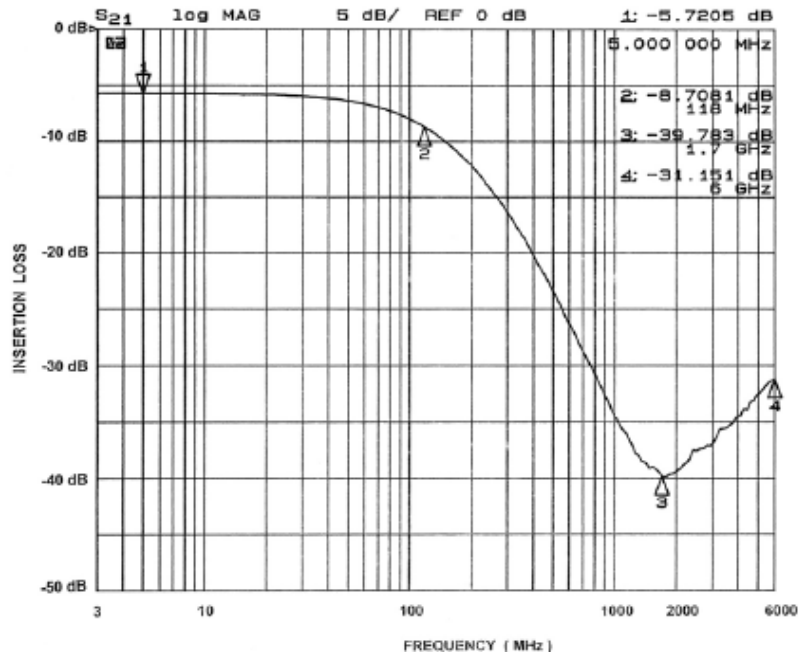


Figure 7. Insertion Loss vs. Frequency (A7-C7 to GND B4, CM1442-08CP Only)

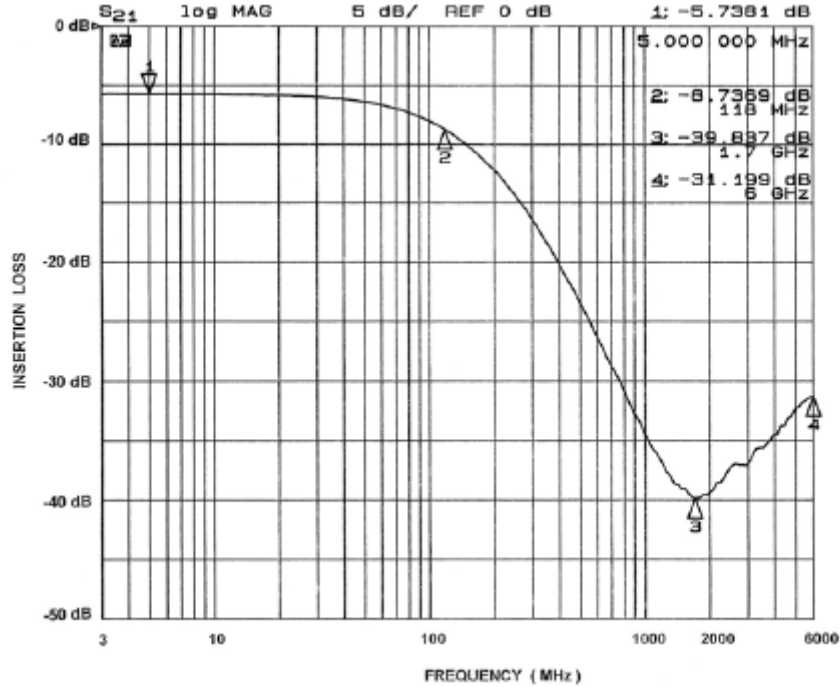


Figure 8. Insertion Loss vs. Frequency (A8-C8 to GND B4, CM1442-08CP Only)



PERFORMANCE INFORMATION (Cont'd)

Typical Diode Capacitance vs. Input Voltage

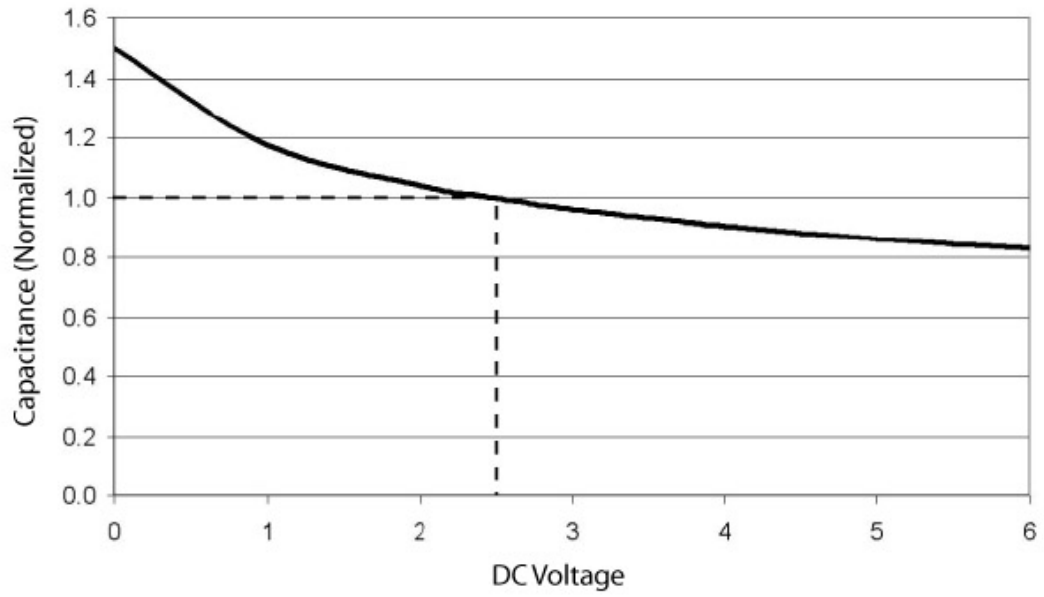


Figure 9. Filter Capacitance vs. Input Voltage  
(normalized to capacitance at 2.5 VDC and 25°C)

APPLICATION INFORMATION

Table 5. PRINTED CIRCUIT BOARD RECOMMENDATIONS

| Parameter  | Value                        |
|--|------------------------------|
| Pad Size on PCB  | 0.240 mm                     |
| Pad Shape  | Round                        |
| Pad Definition   | Non-Solder Mask defined pads |
| Solder Mask Opening  | 0.290 mm Round               |
| Solder Stencil Thickness   | 0.125 – 0.150 mm             |
| Solder Stencil Aperture Opening (laser cut, 5% tapered walls)                      | 0.300 mm 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  | ±50 μm                       |
| Solder Ball Side Coplanarity   | ±20 μm                       |
| Maximum Dwell Time Above Liquidous   | 60 seconds                   |
| Maximum Soldering Temperature for Lead-free Devices using a Lead-free Solder Paste | 260°C                        |

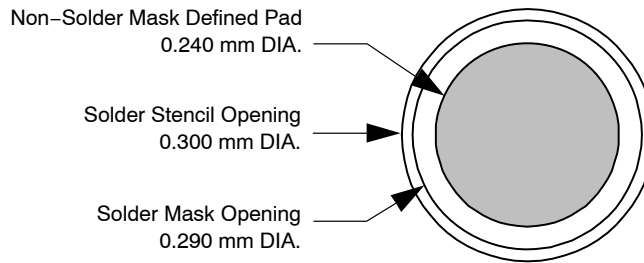


Figure 10. Recommended Non-Solder Mask Defined Pad Illustration

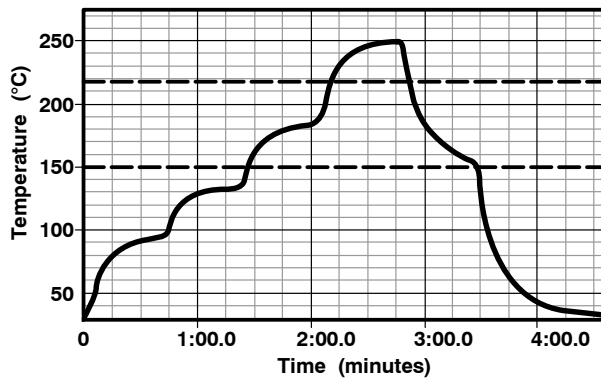
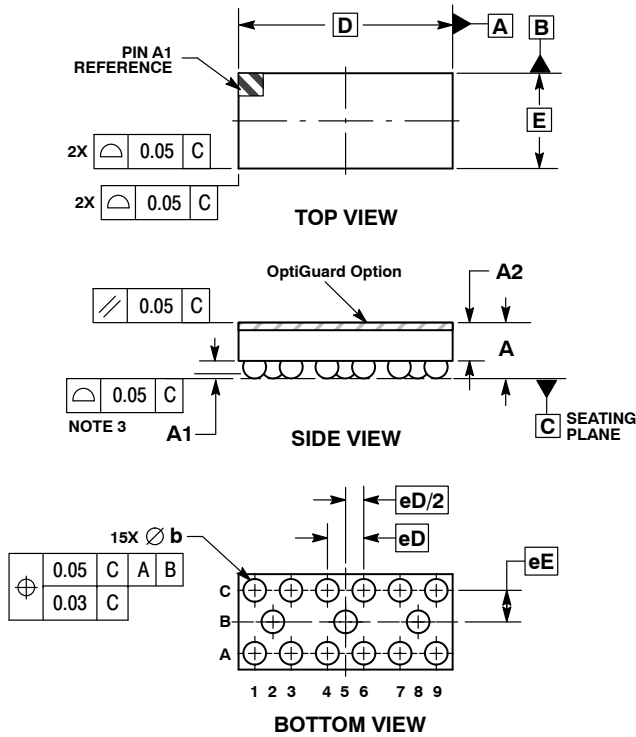


Figure 11. Lead-free (SnAgCu) Solder Ball Reflow Profile

# CM1442

## PACKAGE DIMENSIONS

WLCSP15, 2.36x1.05  
CASE 567BP-01  
ISSUE O

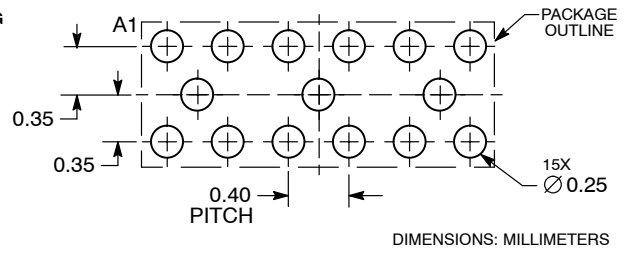


NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. COPLANARITY APPLIES TO SPHERICAL CROWNS OF SOLDER BALLS.

| DIM | MILLIMETERS |      |
|-----|-------------|------|
|     | MIN         | MAX  |
| A   | 0.57        | 0.72 |
| A1  | 0.17        | 0.24 |
| A2  | 0.42 REF    |      |
| b   | 0.24        | 0.29 |
| D   | 2.36 BSC    |      |
| E   | 1.05 BSC    |      |
| eD  | 0.400 BSC   |      |
| eE  | 0.347 BSC   |      |

### RECOMMENDED SOLDERING FOOTPRINT\*

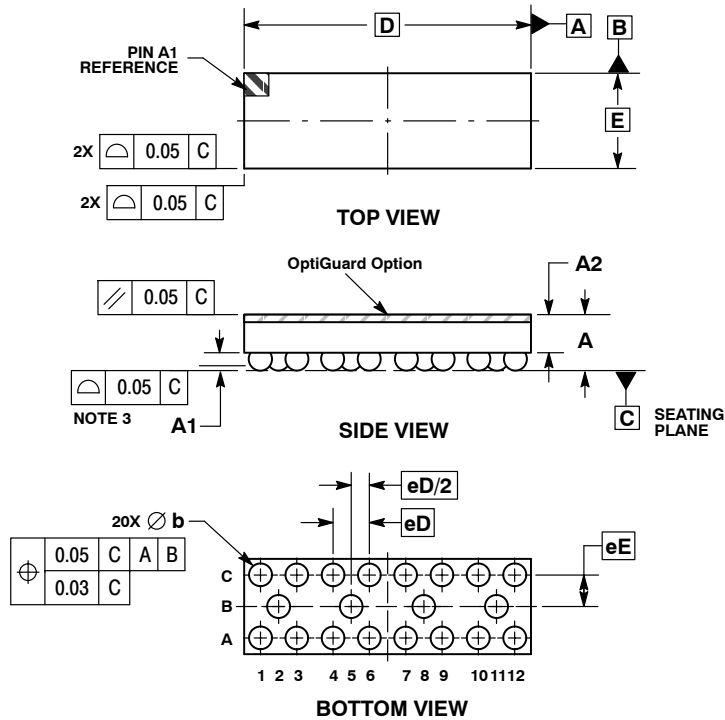


\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

# CM1442

## PACKAGE DIMENSIONS

WLCSP20, 3.16x1.05  
CASE 567BU-01  
ISSUE O

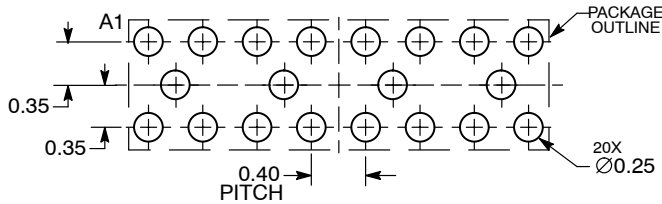


**NOTES:**

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2. CONTROLLING DIMENSION: MILLIMETERS.
3. COPLANARITY APPLIES TO SPHERICAL CROWNS OF SOLDER BALLS.

| DIM | MILLIMETERS |      |
|-----|-------------|------|
|     | MIN         | MAX  |
| A   | 0.54        | 0.69 |
| A1  | 0.17        | 0.24 |
| A2  | 0.42 REF    |      |
| b   | 0.24        | 0.29 |
| D   | 3.16 BSC    |      |
| E   | 1.05 BSC    |      |
| eD  | 0.400 BSC   |      |
| eE  | 0.347 BSC   |      |

### RECOMMENDED SOLDERING FOOTPRINT\*



\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

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