

# CM1440

## 6-Channel EMI Filter Array with ESD Protection

### Product Description

The CM1440 is a six channel low-pass EMI filter array with ESD protection that reduces EMI/RFI emissions while providing robust protection from ESD strikes. Each EMI filter channel integrates a high quality pi-style filter (30 pF – 100  $\Omega$  – 30 pF) which provides greater than 30 dB of attenuation in the 800 MHz to 2.7 GHz frequency range. 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 connected to the filter ports safely dissipate ESD strikes of  $\pm 30$  kV, 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  $\pm 30$  kV.

This device is particularly well-suited for portable electronics (e.g. wireless handsets, PDAs, notebook computers) because of its small package and easy-to-use pin assignments. In particular, the CM1440 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 CM1440 incorporates *OptiGuard*<sup>™</sup> which results in improved reliability at assembly. The CM1440 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 savings versus competing CSP devices with 0.50 mm pitch and 0.30 mm CSP solder ball.

### Features

- Six Channels of EMI Filtering for Data Ports
- Pi-Style EMI Filters in a Capacitor-Resistor-Capacitor (C-R-C) Network
- $\pm 30$  kV ESD Protection on Each Channel (IEC 61000-4-2 Level 4, Contact Discharge)
- $\pm 30$  kV ESD Protection on Each Channel (HBM)
- Greater than 35 dB Attenuation (Typical) at 1 GHz
- 15-Bump, 0.4 mm pitch, 2.360 mm X 1.053 mm Footprint Chip Scale Package (CSP)
- Chip Scale Package Features Extremely Low Lead Inductance for Optimum Filter and ESD Performance
- *OptiGuard*<sup>™</sup> Coated for Improved Reliability at Assembly
- 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.
- EMI Filtering for Data Ports in Cell Phones, PDAs or Notebook Computers
- Wireless Handsets
- Handheld PCs / PDAs
- LCD and Camera Modules



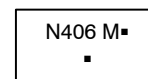
**ON Semiconductor®**

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**WLCSP15  
CP SUFFIX  
CASE 567BP**

### MARKING DIAGRAM



N406 = CM1440-06CP  
M = Date Code  
▪ = Pb-Free Package  
(Note: Microdot may be in either location)

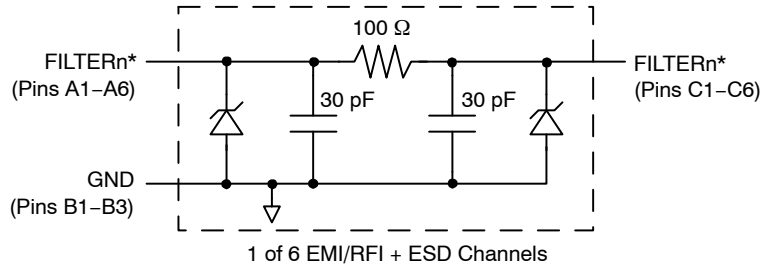
### ORDERING INFORMATION

| Device      | Package             | Shipping <sup>†</sup> |
|-------------|---------------------|-----------------------|
| CM1440-06CP | CSP-15<br>(Pb-Free) | 3500/Tape & Reel      |

<sup>†</sup>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.

# CM1440

## BLOCK DIAGRAM

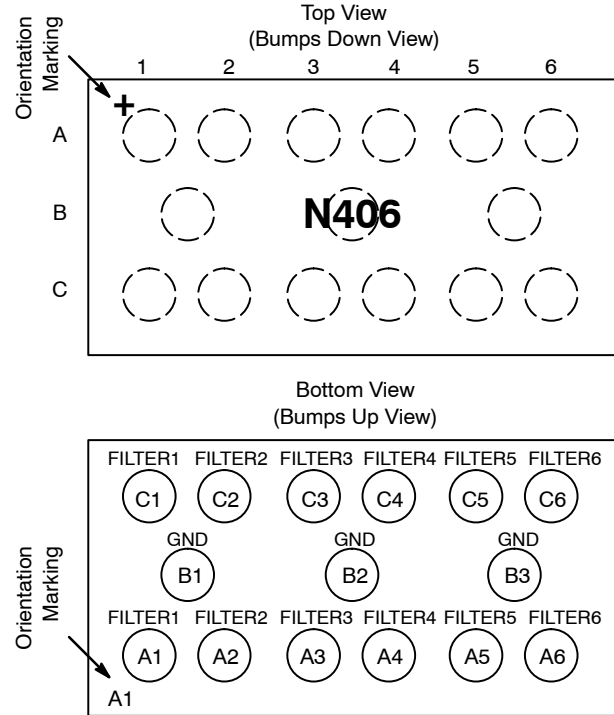


\*See Package/Pinout Diagrams for expanded pin information.

**Table 1. PIN DESCRIPTIONS**

| 15-bump CSP Package |         |                  |
|---------------------|---------|------------------|
| Pin                 | Name    | Description      |
| A1                  | FILTER1 | Filter Channel 1 |
| A2                  | FILTER2 | Filter Channel 2 |
| A3                  | FILTER3 | Filter Channel 3 |
| A4                  | FILTER4 | Filter Channel 4 |
| A5                  | FILTER5 | Filter Channel 5 |
| A6                  | FILTER6 | Filter Channel 6 |
| B1-B3               | GND     | Device Ground    |
| C1                  | FILTER1 | Filter Channel 1 |
| C2                  | FILTER2 | Filter Channel 2 |
| C3                  | FILTER3 | Filter Channel 3 |
| C4                  | FILTER4 | Filter Channel 4 |
| C5                  | FILTER5 | Filter Channel 5 |
| C6                  | FILTER6 | Filter Channel 6 |

## PACKAGE / PINOUT DIAGRAMS



CM1440-06CP  
15 Bump CSP Package

## 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    |

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

| Symbol             | Parameter                                                                                                                                | Conditions                                 | Min                  | Typ         | Max         | Units    |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|----------------------|-------------|-------------|----------|
| R                  | Resistance                                                                                                                               |                                            | 80                   | 100         | 120         | $\Omega$ |
| C <sub>TOTAL</sub> | Total Channel Capacitance                                                                                                                | At 2.5 VDC Reverse Bias,<br>1 MHz, 30 mVAC | 48                   | 60          | 72          | pF       |
| C                  | Capacitance                                                                                                                              | At 2.5 VDC Reverse Bias,<br>1 MHz, 30 mVAC | 24                   | 30          | 36          | pF       |
| V <sub>DIODE</sub> | Standoff Voltage                                                                                                                         | I <sub>DIODE</sub> = 10 $\mu$ A            |                      | 6.0         |             | V        |
| I <sub>LEAK</sub>  | Diode Leakage Current (reverse bias)                                                                                                     | V <sub>DIODE</sub> = 3.3 V                 |                      | 0.1         | 1.0         | $\mu$ A  |
| V <sub>SIG</sub>   | Signal Voltage<br>Positive Clamp<br>Negative Clamp                                                                                       | 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,<br>Method 3015<br>b) Contact Discharge per IEC 61000-4-2<br>Level 4 | (Note 2)                                   | $\pm 30$<br>$\pm 30$ |             |             | kV       |
| R <sub>DYN</sub>   | Dynamic Resistance<br>Positive<br>Negative                                                                                               |                                            |                      | 2.3<br>0.9  |             | $\Omega$ |
| f <sub>C</sub>     | Cut-off Frequency<br>Z <sub>SOURCE</sub> = 50 $\Omega$ , Z <sub>LOAD</sub> = 50 $\Omega$                                                 | R = 100 $\Omega$ , C = 30 pF               |                      | 60          |             | 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.

PERFORMANCE INFORMATION

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

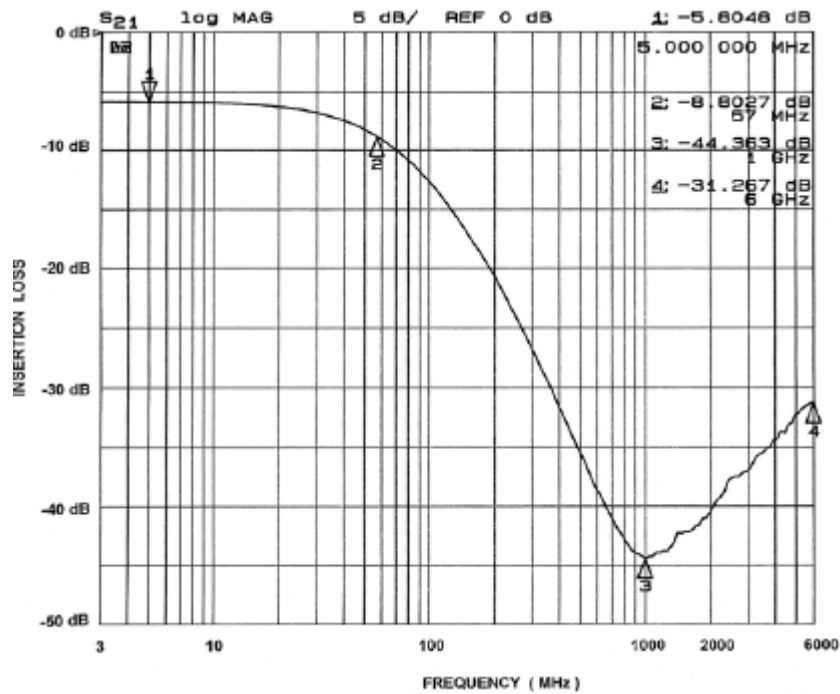


Figure 1. Insertion Loss vs. Frequency (A1-C1 to GND B1)

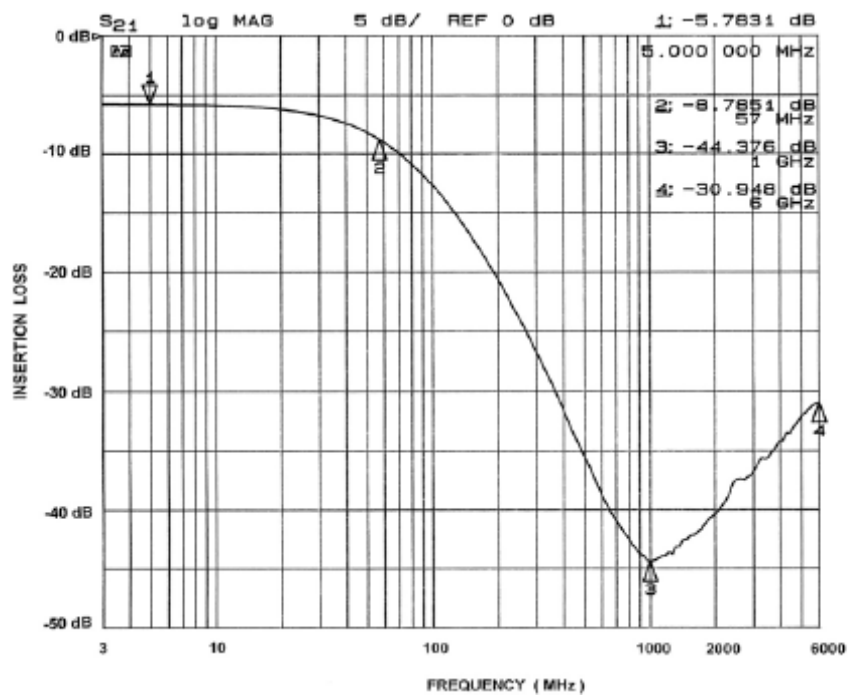


Figure 2. Insertion Loss vs. Frequency (A2-C2 to GND B1)

PERFORMANCE INFORMATION (Cont'd)

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

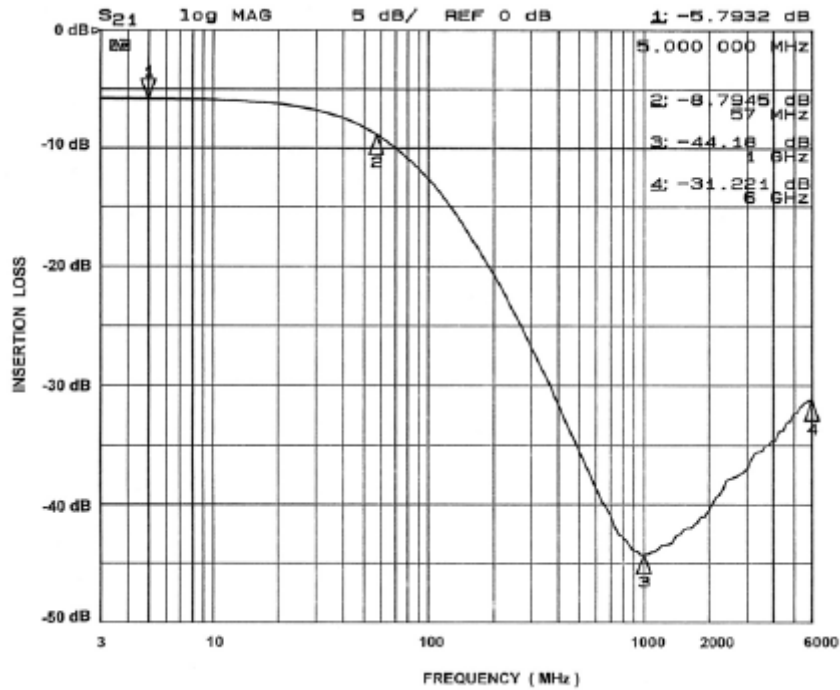


Figure 3. Insertion Loss vs. Frequency (A3-C3 to GND B2)

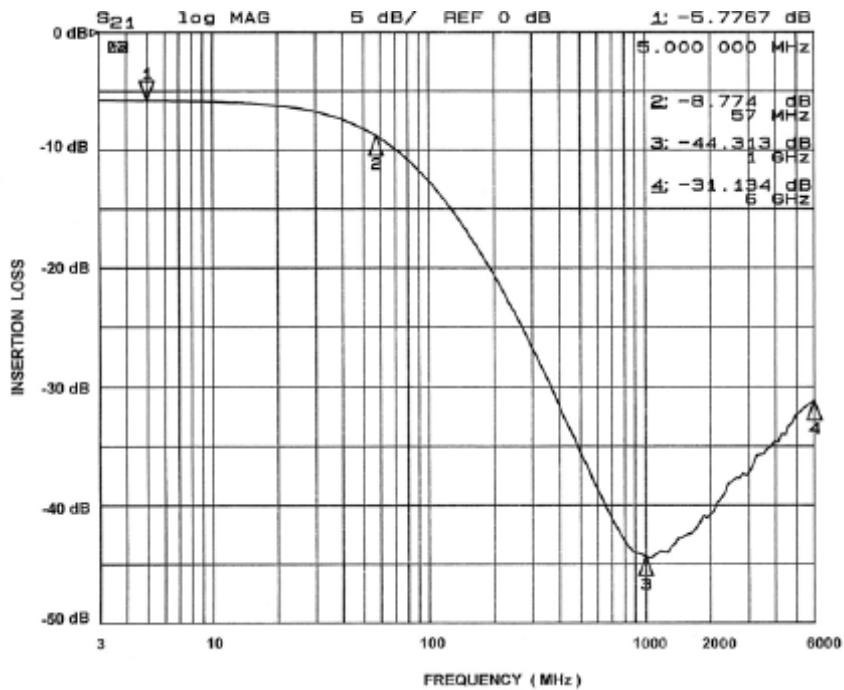


Figure 4. Insertion Loss vs. Frequency (A4-C4 to GND B2)

PERFORMANCE INFORMATION (Cont'd)

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

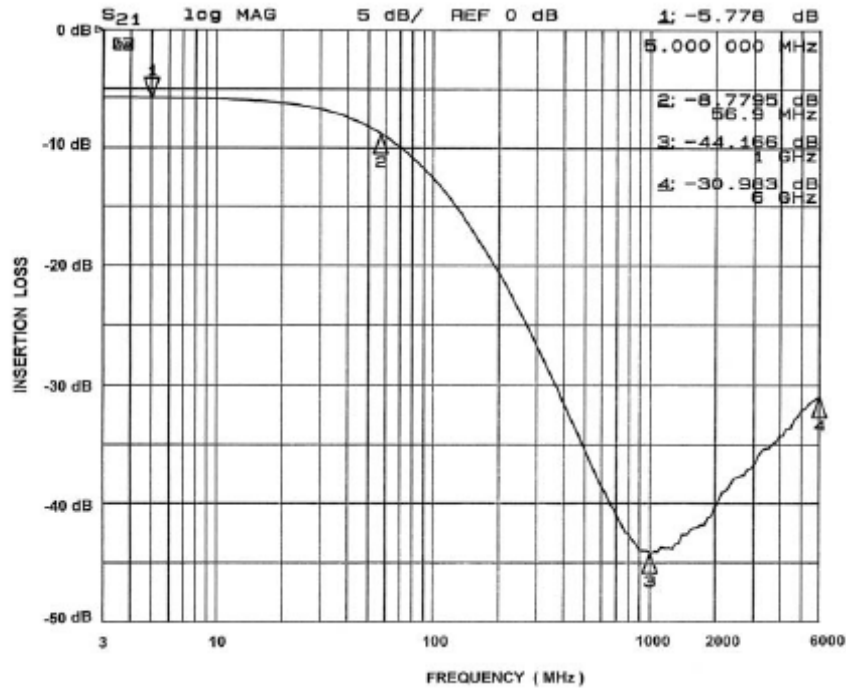


Figure 5. Insertion Loss vs. Frequency (A5-C5 to GND B3)

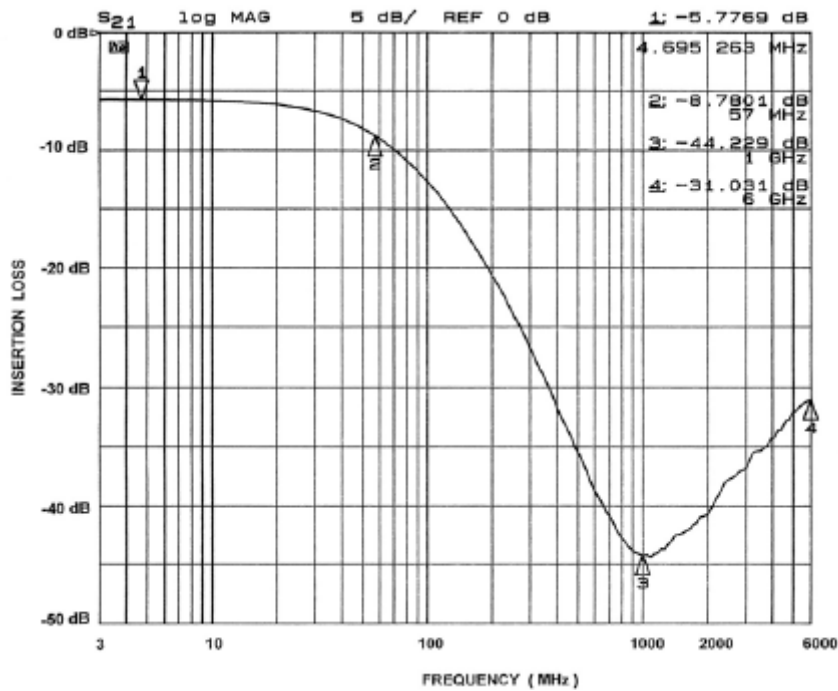
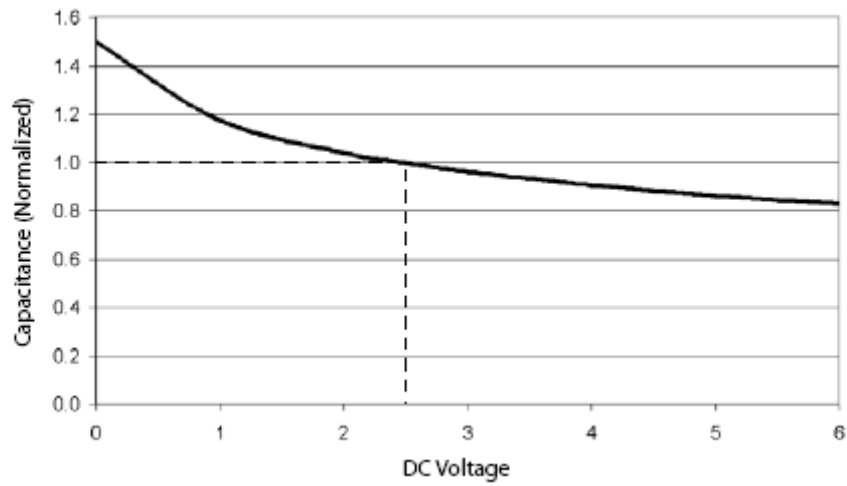


Figure 6. Insertion Loss vs. Frequency (A6-C6 to GND B3)

## PERFORMANCE INFORMATION (Cont'd)

## Typical Diode Capacitance vs. Input Voltage



**Figure 7. 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                                                    | $\pm 50\ \mu\text{m}$        |
| 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                        |

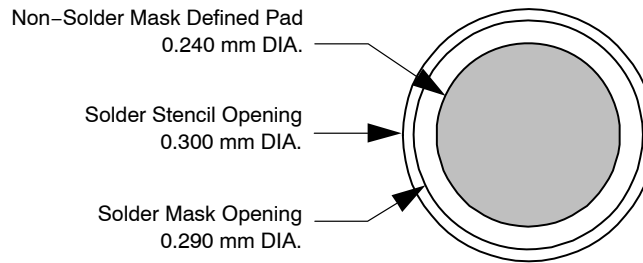


Figure 8. Recommended Non-Solder Mask Defined Pad Illustration

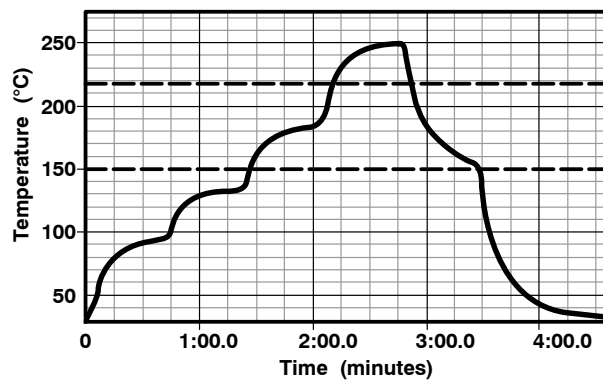


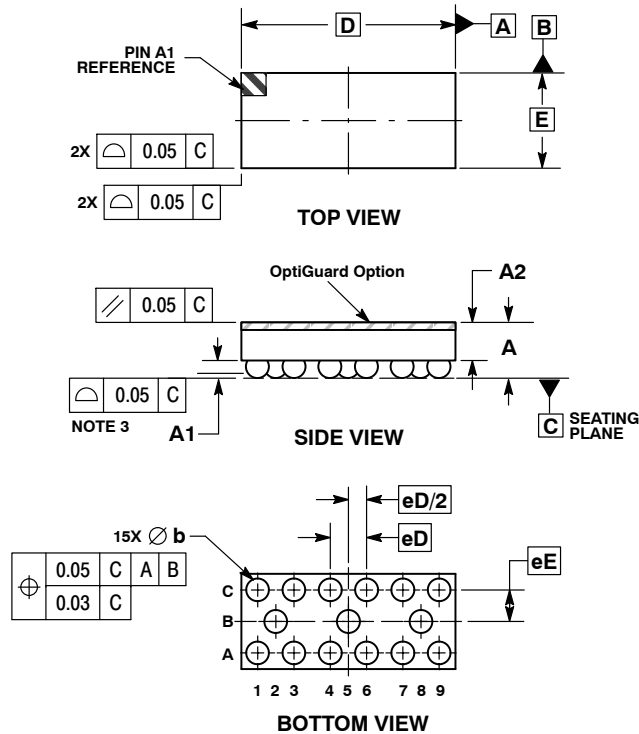
Figure 9. Lead-free (SnAgCu) Solder Ball Reflow Profile



SCALE 4:1

**WLCSP15, 2.36x1.05**  
CASE 567BP  
ISSUE O

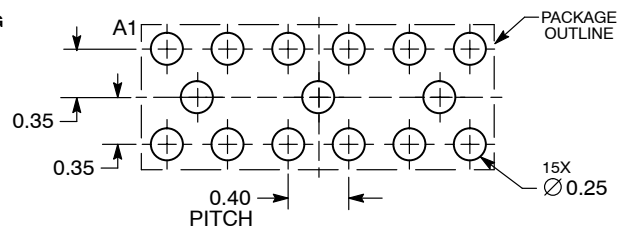
DATE 26 JUL 2010



## 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\***


DIMENSIONS: MILLIMETERS

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

|                         |                           |                                                                                                                                                                                  |
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