

# CM1401-03

## 4-Channel ESD/EMI Filter Array Plus 4-Channel ESD Array for USB

### Product Description

The CM1401-03 is a multichannel array with four low-pass filter + ESD channels and four ESD-only channels. The CM1401-03 reduces EMI/RFI emissions on a data port and protects against ESD on a USB port. Each EMI/RFI channel integrates a high quality pi-style filter (C-R-C) that provides greater than 30 dB attenuation in the 800-2700 MHz range relative to the pass band attenuation. These pi-style filters are bidirectional, controlling EMI both to and from a data port connector.

The CM1401-03 provides a high-level of ESD protection on all eight channels for sensitive electronic components that may be subjected to electrostatic discharge (ESD). The input pins safely dissipate ESD strikes of  $\pm 15$  kV, exceeding 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  $\pm 30$  kV.

The CM1401-03 is particularly well suited for portable electronics (e.g., cellular telephones, PDAs, notebook computers) because of its small package footprint and low weight.

The CM1401-03 incorporates *OptiGuard*<sup>™</sup> coating for improved reliability at assembly and comes in a space-saving, low-profile Chip Scale Package with RoHS-compliant lead-free finishing.

### Features

- Functionally and Pin-Compatible with CSPEMI307A Device
- *OptiGuard*<sup>™</sup> Coated for Improved Reliability at Assembly
- Four Channels of Combined EMI/RFI Filtering + ESD Protection
- Four Additional Channels of ESD-Only Protection
- 40 dB Absolute Attenuation (Typical) at 1 GHz
- 35 dB Attenuation (Typical) at 1 GHz Relative to Pass Band
- $\pm 15$  kV ESD Protection on All Channels (IEC 61000-4-2 Level 4, Contact Discharge)
- $\pm 30$  kV ESD Protection on All Channels (HBM)
- 15-Bump, 2.960 mm X 1.330 mm Footprint
- Chip Scale Package (CSP) Features Extremely Low Lead Inductance for Optimum Filter and ESD Performance
- These Devices are Pb-Free and are RoHS Compliant

### Applications

- EMI Filtering and ESD Protection for Both Data and I/O Ports
- Outer Four Channels Provide ESD Protection for USB Lines and Other I/O Port Applications
- Wireless Handsets
- Handheld PCs / PDAs
- MP3 Players
- Notebooks
- Desktop PCs



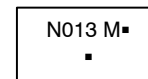
ON Semiconductor<sup>®</sup>

<http://onsemi.com>



WLCSP15  
CP SUFFIX  
CASE 567BS

### MARKING DIAGRAM



N013 = CM1401-03CP  
M = Date Code  
▪ = Pb-Free Package  
(Note: Microdot may be in either location)

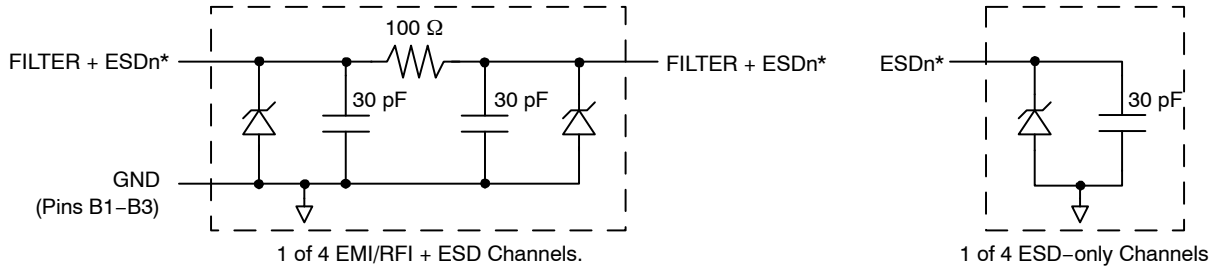
### ORDERING INFORMATION

| Device      | Package          | Shipping <sup>†</sup> |
|-------------|------------------|-----------------------|
| CM1401-03CP | CSP-15 (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.

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## BLOCK DIAGRAM

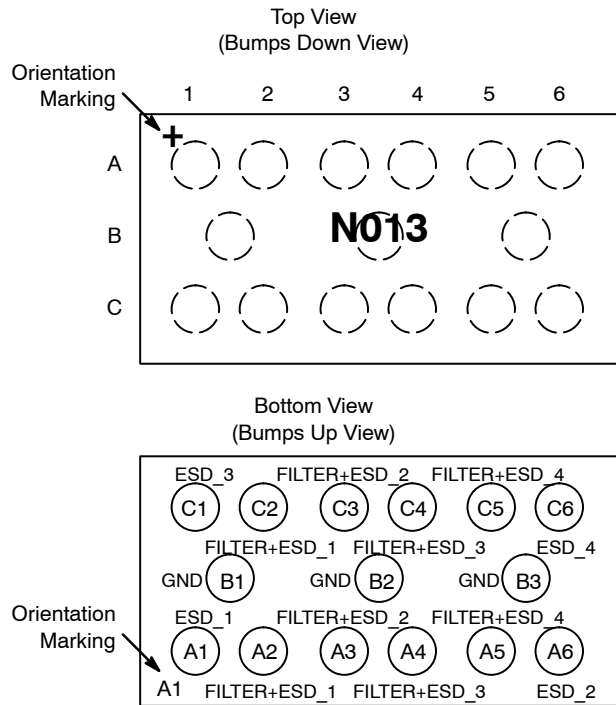


\*See Package/Pinout Diagram for expanded pin information.

**Table 1. PIN DESCRIPTIONS**

| 15-bump CSP Package |                |                        |
|---------------------|----------------|------------------------|
| Pin                 | Name           | Description            |
| A1                  | ESD_1          | ESD Channel 1          |
| A2                  | FILTER + ESD_1 | Filter + ESD Channel 1 |
| A3                  | FILTER + ESD_2 | Filter + ESD Channel 2 |
| A4                  | FILTER + ESD_3 | Filter + ESD Channel 3 |
| A5                  | FILTER + ESD_4 | Filter + ESD Channel 4 |
| A6                  | ESD_2          | ESD Channel 2          |
| B1-B3               | GND            | Device Ground          |
| C1                  | ESD_3          | ESD Channel 3          |
| C2                  | FILTER + ESD_1 | Filter + ESD Channel 1 |
| C3                  | FILTER + ESD_2 | Filter + ESD Channel 2 |
| C4                  | FILTER + ESD_3 | Filter + ESD Channel 3 |
| C5                  | FILTER + ESD_4 | Filter + ESD Channel 4 |
| C6                  | ESD_4          | ESD Channel 4          |

## PACKAGE / PINOUT DIAGRAMS



CM1401-03  
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   | 600         | 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                  | Capacitance  | At 2.5 V DC                     | 24                   | 30          | 36          | pF                |
| TCR                | Temperature Coefficient of Resistance  |                                 |                      | 1200        |             | ppm/ $^{\circ}$ C |
| TCC                | Temperature Coefficient of Capacitance   | At 2.5 V DC                     |                      | -300        |             | ppm/ $^{\circ}$ C |
| V <sub>DIODE</sub> | Diode Voltage (reverse bias)   | 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      |                      |             | 100         | nA                |
| 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>$\pm$ 15 |             |             | kV                |
| V <sub>CL</sub>    | Clamping Voltage during ESD Discharge<br>MIL-STD-883 (Method 3015), 8 kV<br>Positive Transients<br>Negative Transients                   | (Notes 2 and 3)                 |                      | +10<br>-5   |             | V                 |
| 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    |                      | 58          |             | MHz               |

1. T<sub>A</sub> = 25 $^{\circ}$ C unless otherwise specified.
2. ESD applied to input and output pins with respect to GND, one at a time.
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 A2, then clamping voltage is measured at Pin C2.

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## PERFORMANCE INFORMATION

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

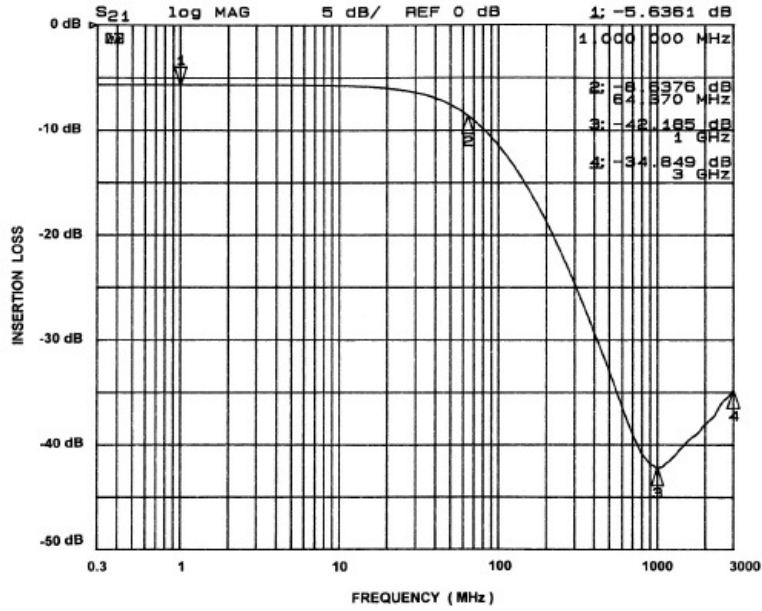


Figure 1. Insertion Loss vs. Frequency (A2-C2 to GND B2)

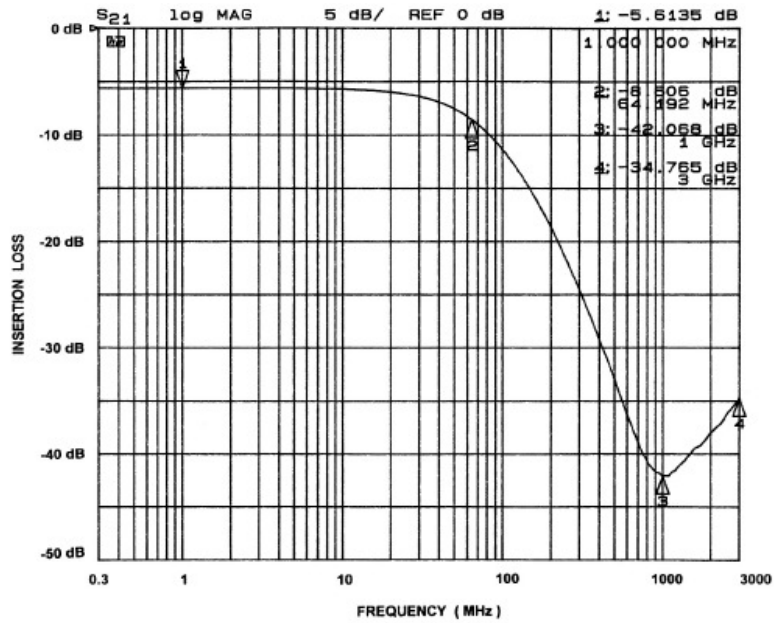


Figure 2. Insertion Loss vs. Frequency (A3-C3 to GND B2)

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## PERFORMANCE INFORMATION (Cont'd)

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

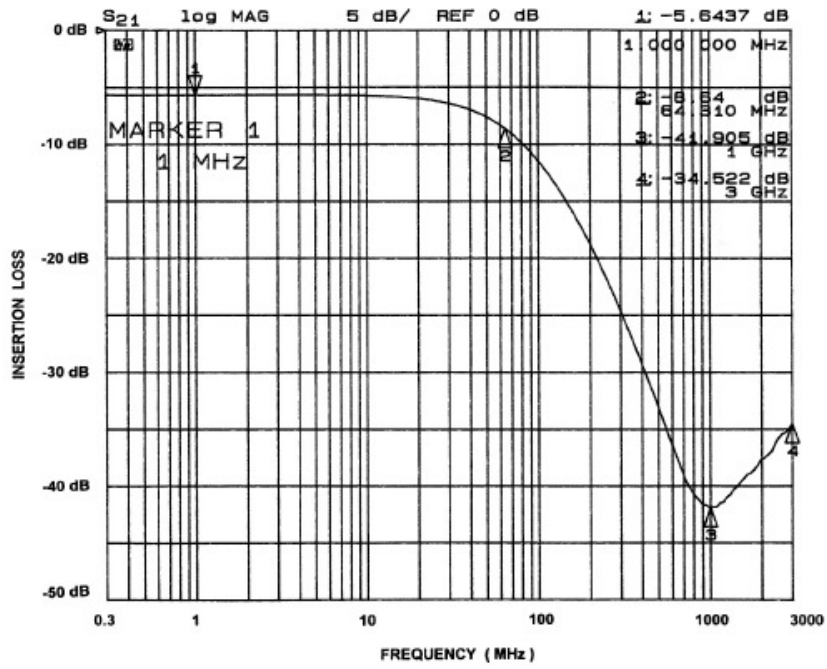


Figure 3. Insertion Loss vs. Frequency (A4-C4 to GND B2)

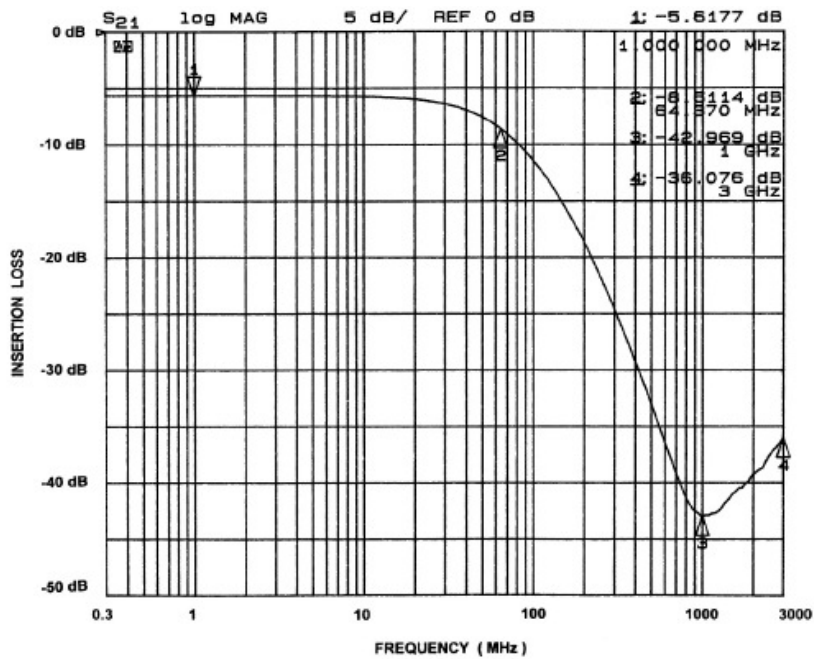


Figure 4. Insertion Loss vs. Frequency (A5-C5 to GND B2)

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## PERFORMANCE INFORMATION (Cont'd)

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

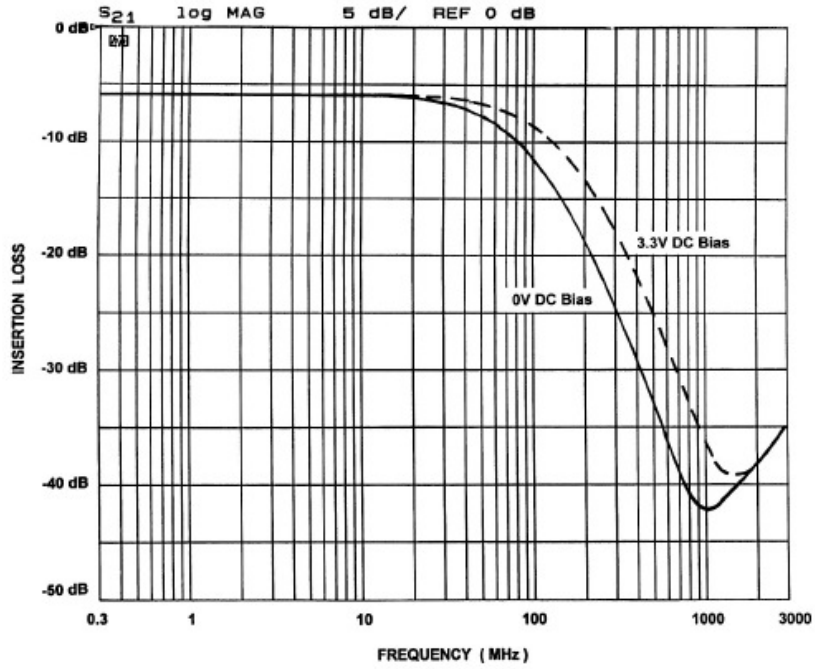


Figure 5. Comparison of Filter Response Curves for CM1401-03CS with DC Bias

PERFORMANCE INFORMATION (Cont'd)

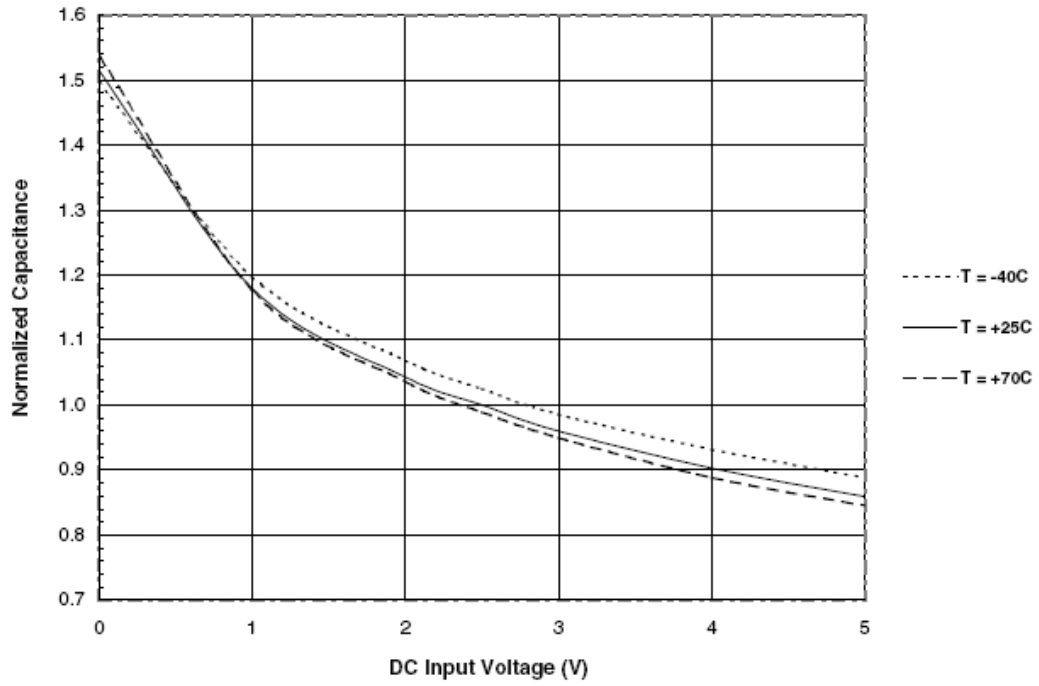


Figure 6. Filter Capacitance vs. Input Voltage over Temperature (normalized to capacitance at 2.5 VDC and 25°C)

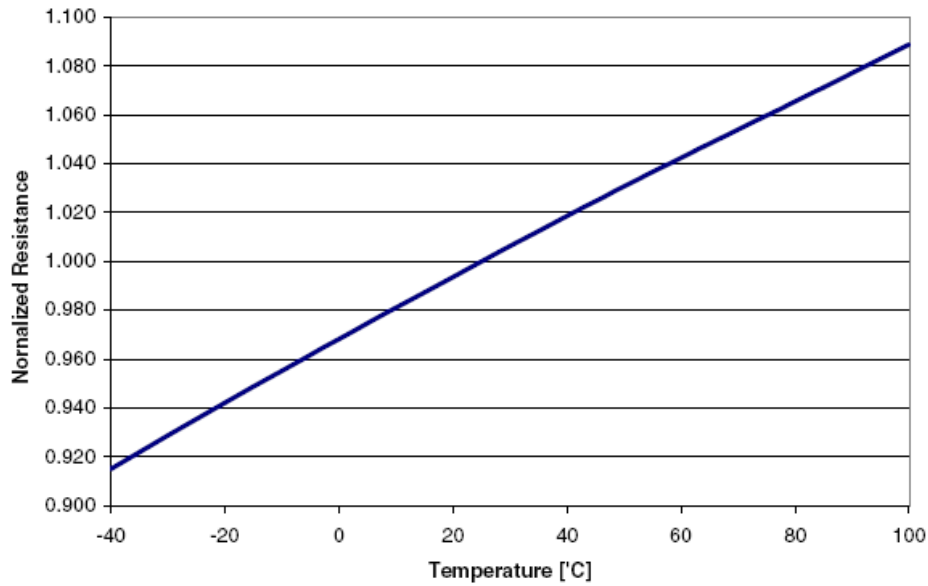


Figure 7. Resistance vs. Temperature (normalized to resistance at 25°C)

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 (183°C)   | 60 seconds                   |
| Maximum Soldering Temperature for Lead-free Devices using a Lead-free Solder Paste | 260°C                        |

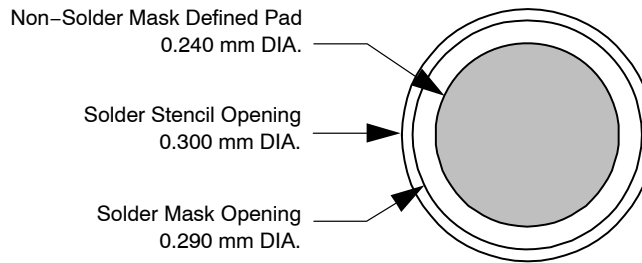


Figure 8. Recommended Non-Solder Mask Defined Pad Illustration

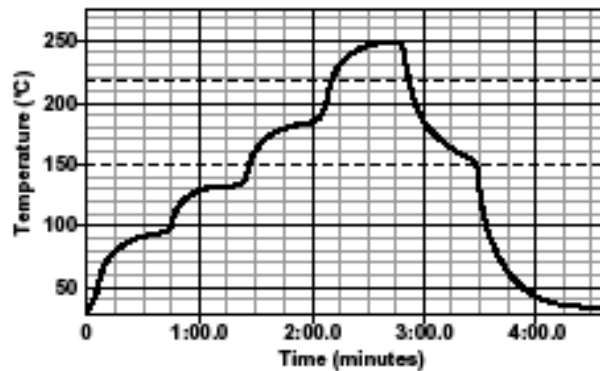


Figure 9. Lead-free (SnAgCu) Solder Ball Reflow Profile



# MECHANICAL CASE OUTLINE

## PACKAGE DIMENSIONS

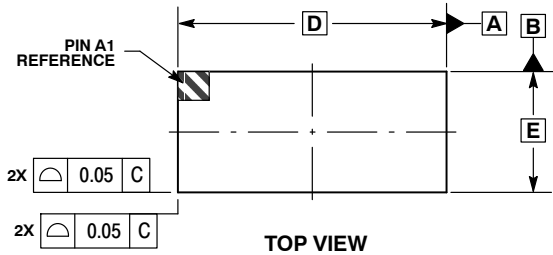
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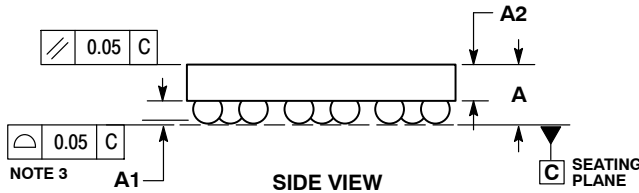
SCALE 4:1

**WLCSP15, 2.96x1.33**  
CASE 567BS-01  
ISSUE O

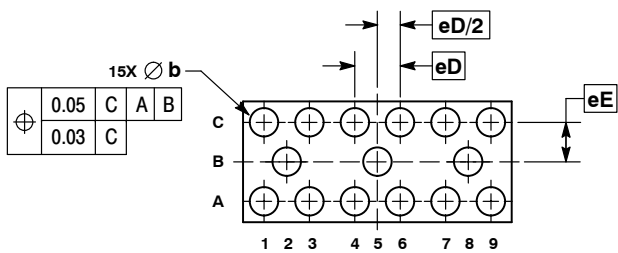
DATE 26 JUL 2010



TOP VIEW



SIDE VIEW



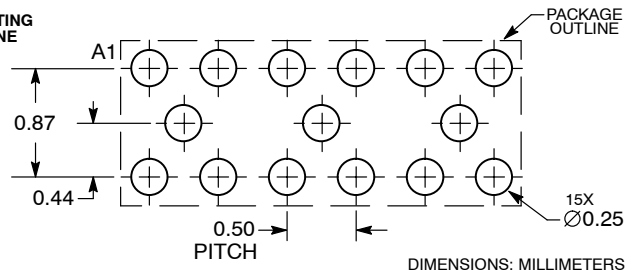
BOTTOM VIEW

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   | 0.56        | 0.65 |
| A1  | 0.21        | 0.27 |
| A2  | 0.40 REF    |      |
| b   | 0.29        | 0.35 |
| D   | 2.96 BSC    |      |
| E   | 1.33 BSC    |      |
| eD  | 0.50 BSC    |      |
| eE  | 0.435 BSC   |      |

**RECOMMENDED SOLDERING FOOTPRINT\***



DIMENSIONS: MILLIMETERS

\*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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