# CM1402

# SIM Card EMI Filter Array with ESD Protection

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**WLCSP10**
**CP SUFFIX**
**CASE 567BL**

### Product Description

The CM1402 is an EMI filter array with ESD protection, which integrates three pi filters (C−R−C) and two additional channels of ESD protection. The CM1402 has component values of 20 pF − 47 Ω − 20 pF, and 20 pF − 100 Ω − 20 pF. 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 diodes connected to the filter ports are designed and characterized to safely dissipate ESD strikes of ±10 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 ±25 kV.

The ESD diodes on pins A4 and C4 ports are designed and characterized to safely dissipate ESD strikes of ±10 kV, well beyond the maximum requirement of the IEC 61000−4−2 international standard.

This device is particularly well suited for portable electronics (e.g. mobile handsets, PDAs, notebook computers) because of its small package format and easy−to−use pin assignments. In particular, the CM1402 is ideal for EMI filtering and protecting data lines from ESD for the SIM card slot in mobile handsets.

The CM1402 incorporates *OptiGuard*™ coating which results in improved reliability at assembly. The CM1402 is available in a space−saving, low−profile Chip Scale Package.

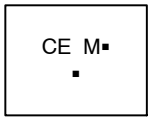
### Features

- Functionally and Pin−Compatible with CSPEMI400 Device
- *OptiGuard*™ Coated for Improved Reliability at Assembly
- Three Channels of EMI Filtering, Each with ESD Protection
- Two Additional Channels of ESD−Only Protection
- ±10 kV ESD Protection (IEC 61000−4−2, Contact Discharge) on All Pins
- ±25 kV ESD Protection (HBM)
- Greater than 30 dB of Attenuation at 1 GHz
- 10−Bump, 1.960 mm x 1.330 mm Footprint Chip Scale Package (CSP)
- Chip Scale Package Features Extremely Low Lead Inductance for Optimum Filter and ESD Performance
- These Devices are Pb−Free and are RoHS Compliant

### Applications

- SIM Card Slot 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

### MARKING DIAGRAM




CE = CM1402−03CP
M = Date Code
▪ = Pb−Free Package
(Note: Microdot may be in either location)

### ORDERING INFORMATION

| Device | Package | Shipping† |
|---|---|---|
| CM1402−03CP | CSP−10 (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.

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## ELECTRICAL SCHEMATIC

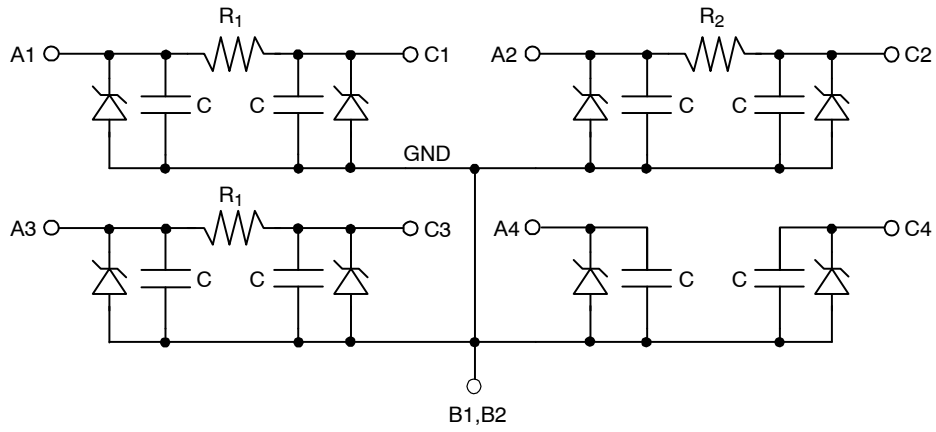
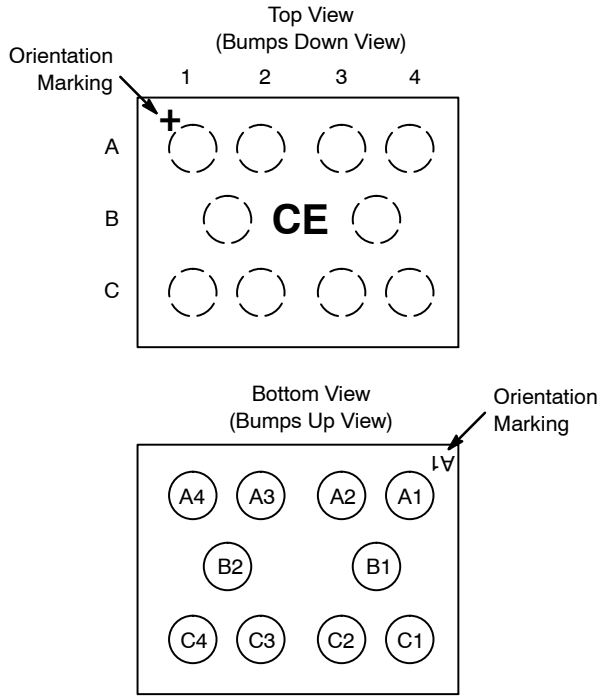



**Table 1. PIN DESCRIPTIONS**

| 10−bump CSP Package | | |
|---|---|---|
| **Type** | **Pin** | **Description** |
| EMI Filter | A1 | EMI Filter with ESD Protection for RST Signal |
| | C1 | EMI Filter with ESD Protection for RST Signal |
| EMI Filter | A2 | EMI Filter with ESD Protection for CLK Signal |
| | C2 | EMI Filter with ESD Protection for CLK Signal |
| Device Ground | B1 | Device Ground |
| | B2 | Device Ground |
| EMI Filter | A3 | EMI Filter with ESD Protection for DAT Signal |
| | C3 | EMI Filter with ESD Protection for DAT Signal |
| ESD Channel | A4 | ESD Protection Channel – $V_{CC}$ Supply |
| ESD Channel | C4 | ESD Protection Channel |

## PACKAGE / PINOUT DIAGRAMS




CM1402
CSP Package with OptiGuard coating

## 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 | 300 | 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 |
|---|---|---|---|---|---|---|
| $R_1$ | Resistance of $R_1$ | | 80 | 100 | 120 | Ω |
| $R_2$ | Resistance of $R_2$ | | 38 | 47 | 56 | Ω |
| C | Capacitance | VIN = 2.5 VDC, 1 MHz, 30 mV ac | 16 | 20 | 24 | pF |
| $V_{STANDOFF}$ | Stand–off Voltage | I = 10 μA | | 6.0 | | V |
| $I_{LEAK}$ | Diode Leakage Current | $V_{BIAS}$ = 3.3 V | | 0.1 | 1.0 | μA |
| $V_{SIG}$ | Signal Voltage<br>Positive Clamp<br>Negative Clamp | <br>$I_{LOAD}$ = 10 mA<br>$I_{LOAD}$ = –10 mA | <br>5.6<br>–1.5 | <br>6.8<br>–0.8 | <br>9.0<br>–0.4 | V |
| $V_{ESD}$ | In–system ESD Withstand Voltage<br>a) Human Body Model, MIL–STD–883, Method 3015<br>b) Contact Discharge per IEC 61000–4–2 | (Notes 2 and 4) | <br>±25<br>±10 | | | kV |
| $V_{CL}$ | Clamping Voltage during ESD Discharge MIL–STD–883 (Method 3015), 8 kV<br>Positive Transients<br>Negative Transients | (Notes 2, 3 and 4) | | | <br>+12<br>–7 | V |
| $f_{C1}$ | Cut–off Frequency<br>$Z_{SOURCE}$ = 50 Ω, $Z_{LOAD}$ = 50 Ω | R = 100 Ω, C = 20 pF | | 77 | | MHz |
| $f_{C2}$ | Cut–off Frequency<br>$Z_{SOURCE}$ = 50 Ω, $Z_{LOAD}$ = 50 Ω | R = 47 Ω, C = 20 pF | | 85 | | MHz |

1. $T_A$ = 25°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 A1, then clamping voltage is measured at Pin C1.
4. Unused pins are left open.

## PERFORMANCE INFORMATION

### Typical Filter Performance (nominal conditions unless specified otherwise, 50 Ω Environment)

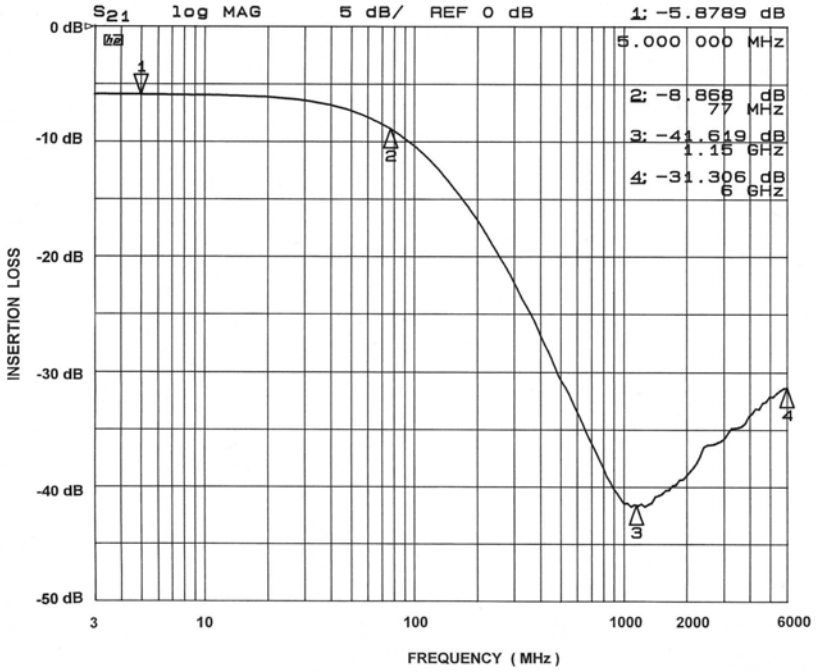



**Figure 1. A1−C1 EMI Filter Performance**

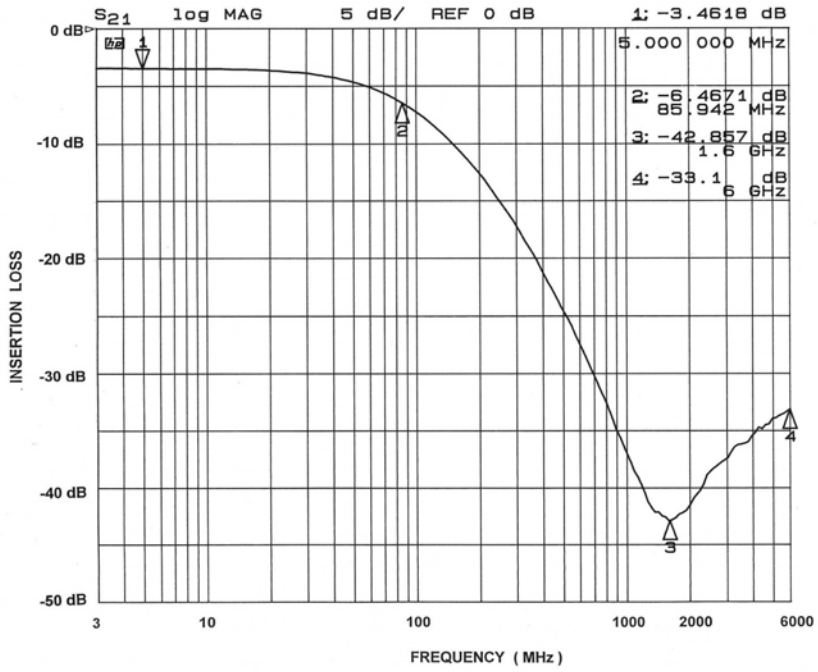



**Figure 2. A2−C2 EMI Filter Performance**

## PERFORMANCE INFORMATION (Cont'd)

### Typical Filter Performance (nominal conditions unless specified otherwise, 50 Ω Environment)

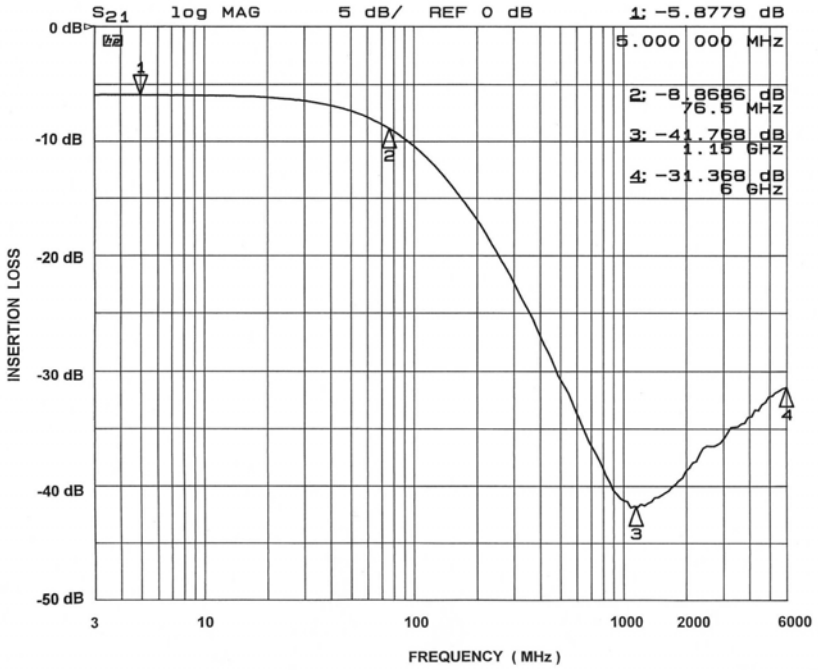



**Figure 3. A3−C3 EMI Filter Performance**

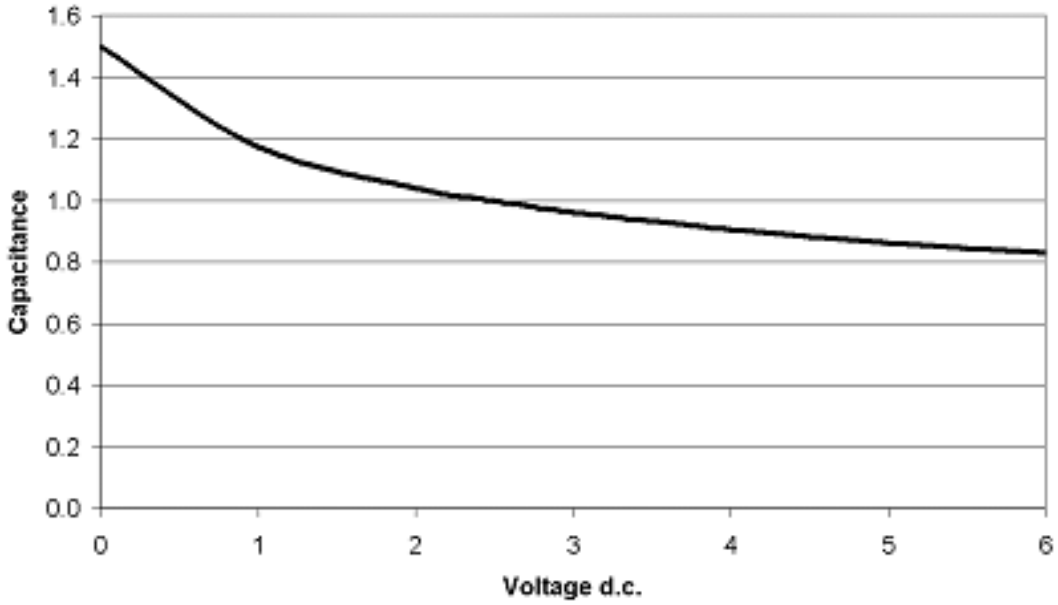
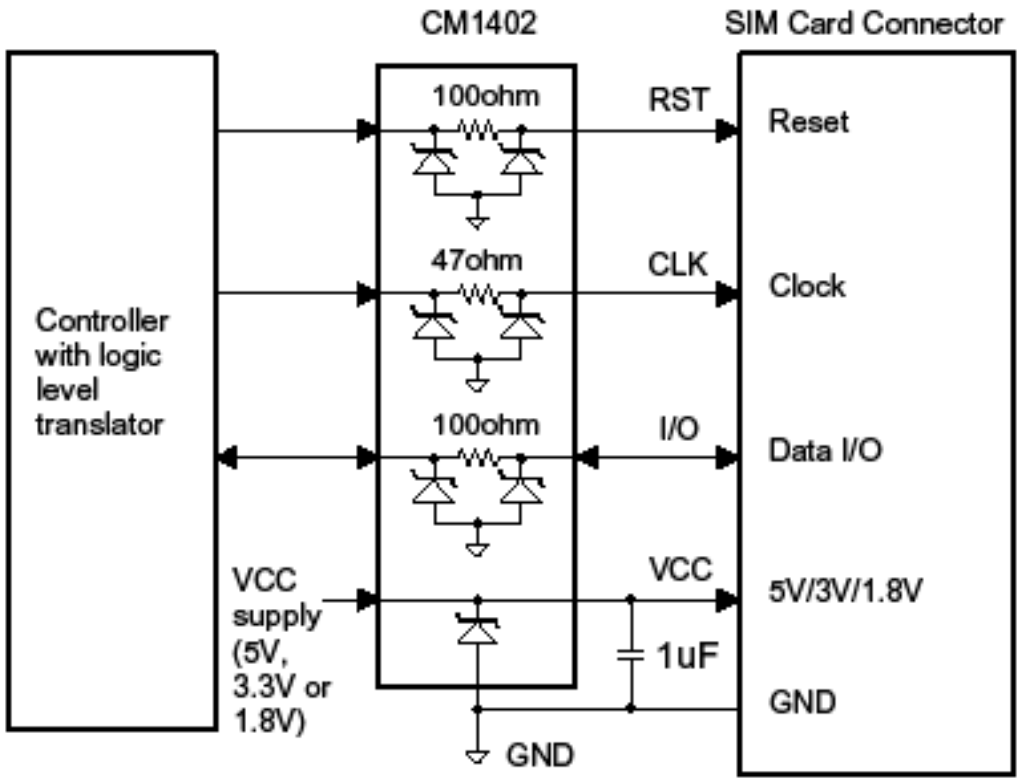



**Figure 4. Typical Diode Capacitance vs. Input Voltage (normalized to 2.5 VDC)**

## APPLICATION INFORMATION

The CM1402 provides a bidirectional filter and protector for all the signals and the power line on the SIM (subscriber identity module) card connector. SIM cards are found in all GSM cellular phones and in some other handheld devices or card readers. The ESD diodes protect the controller against possible ESD strikes that may occur when the connector pins are exposed during direct contact, or during insertion of the SIM card into the card slot. The EMI filter suppresses all high−frequency noise, preventing the unwanted EMI signals from both entering and exiting the main board. The signals that interface with the SIM card are the Reset, the Clock and the bidirectional data I/O, as shown in Typical Application Diagram for the SIM Card Interface.




Note: One channel of the CM1402 with a zener diode is not shown on the diagram.

**Figure 5. Typical Application Diagram for the SIM Card Interface**

For best filter and ESD performance, both GND bumps (B1, B2) of the CM1402 should be directly connected to the Ground plane. A small capacitor of about 1 μF is required next to the $V_{CC}$ pin of the SIM connector in order to improve stability of the SIM card supply rail.

For information on the assembly of the CM1402 to the PCB (printed circuit board), please refer to the Chip Scale Package (CSP) Application Note AP217, or contact factory at 800−282−9855 for technical support.

## 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 |

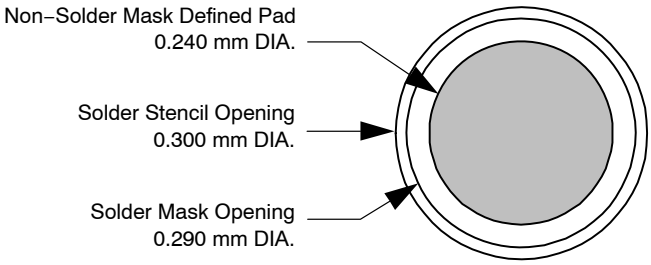



**Figure 6. Recommended Non−Solder Mask Defined Pad Illustration**

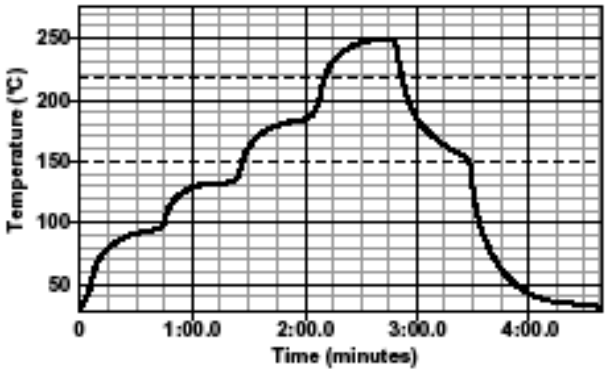



**Figure 7. Lead−free (SnAgCu) Solder Ball Reflow Profile**

**SCALE 4:1**

**WLCSP10, 1.96x1.33**
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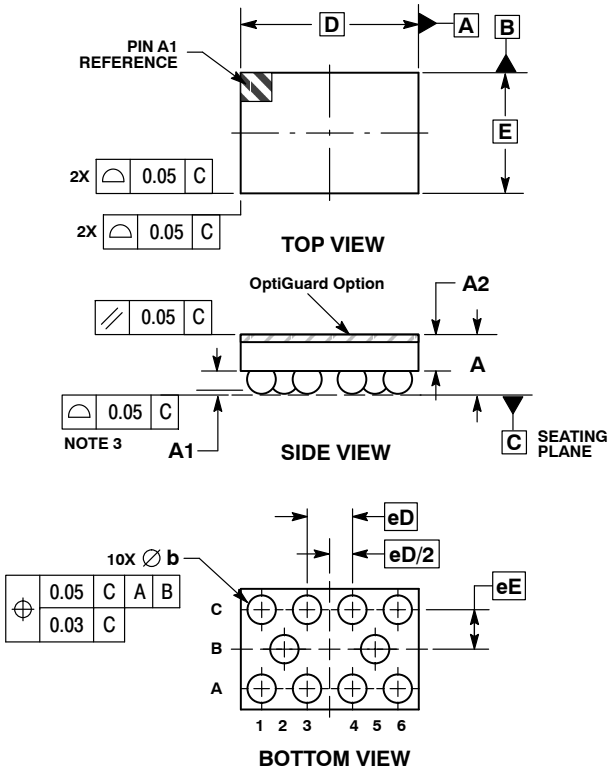
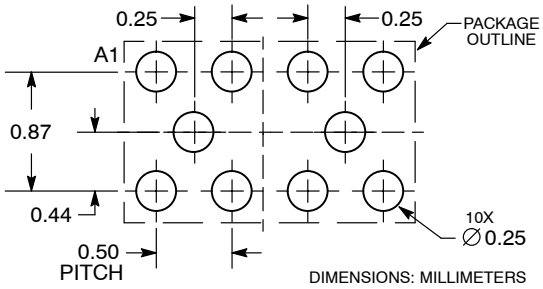



NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. COPLANARITY APPLIES TO SPHERICAL CROWNS OF SOLDER BALLS.

| | MILLIMETERS | |
|---|---|---|
| DIM | MIN | MAX |
| A | 0.56 | 0.72 |
| A1 | 0.21 | 0.27 |
| A2 | 0.40 REF | |
| b | 0.29 | 0.35 |
| D | 1.96 BSC | |
| E | 1.33 BSC | |
| eD | 0.50 BSC | |
| eE | 0.435 BSC | |

**RECOMMENDED SOLDERING FOOTPRINT***




*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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