CM1401-03

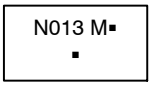
4-Channel ESD/EMI Filter Array Plus 4-Channel ESD Array for USB

ON Semiconductor®

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†
CM1401−03CP	CSP−15 (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.

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 ±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 ±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*™ 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*™ 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
- ±15 kV ESD Protection on All Channels (IEC 61000−4−2 Level 4, Contact Discharge)
- ±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

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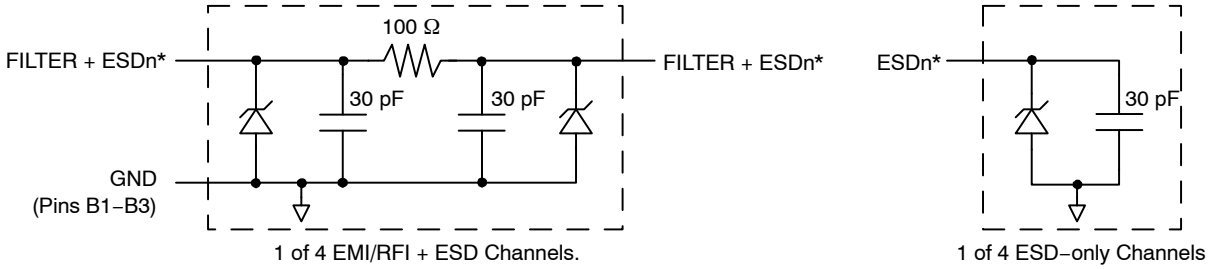
BLOCK DIAGRAM

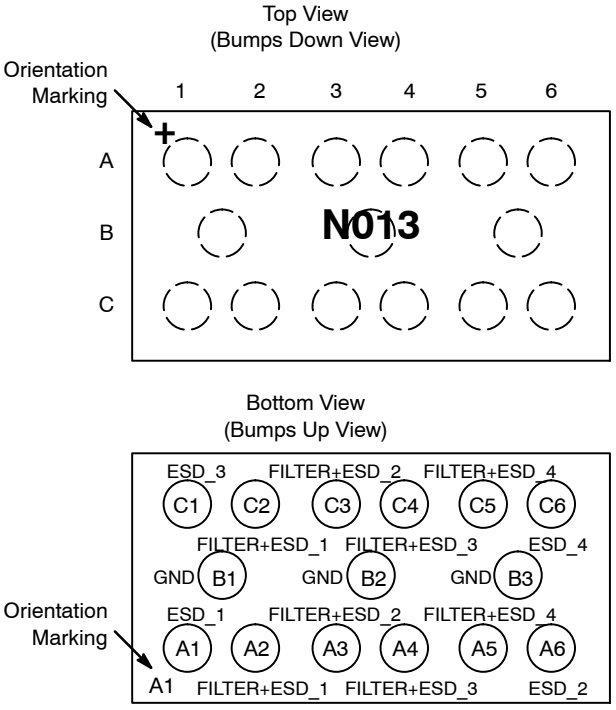


*See Package/Pinout Diagram for expanded pin information.

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

Table 4. ELECTRICAL OPERATING CHARACTERISTICS (Note 1)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
R	Resistance		80	100	120	Ω
C	Capacitance	At 2.5 V DC	24	30	36	pF
TCR	Temperature Coefficient of Resistance			1200		ppm/°C
TCC	Temperature Coefficient of Capacitance	At 2.5 V DC		−300		ppm/°C
V_{DIODE}	Diode Voltage (reverse bias)	I_{DIODE} = 10 μA		6.0		V
I_{LEAK}	Diode Leakage Current (reverse bias)	V_{DIODE} = 3.3 V			100	nA
V_{SIG}	Signal Voltage Positive Clamp Negative Clamp	I_{LOAD} = 10 mA	 5.6 −1.5	 6.8 −0.8	 9.0 −0.4	V
V_{ESD}	In−system ESD Withstand Voltage a) Human Body Model, MIL−STD−883, Method 3015 b) Contact Discharge per IEC 61000−4−2 Level 4	(Note 2)	 ±30 ±15			kV
V_{CL}	Clamping Voltage during ESD Discharge MIL−STD−883 (Method 3015), 8 kV Positive Transients Negative Transients	(Notes 2 and 3)		 +10 −5		V
f_C	Cut−off Frequency Z_{SOURCE} = 50 Ω, Z_{LOAD} = 50 Ω	R = 100 Ω, C = 30 pF		 58		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 A2, then clamping voltage is measured at Pin C2.

PERFORMANCE INFORMATION

Typical Filter Performance (T_A = 25°C, DC Bias = 0 V, 50 Ω Environment)

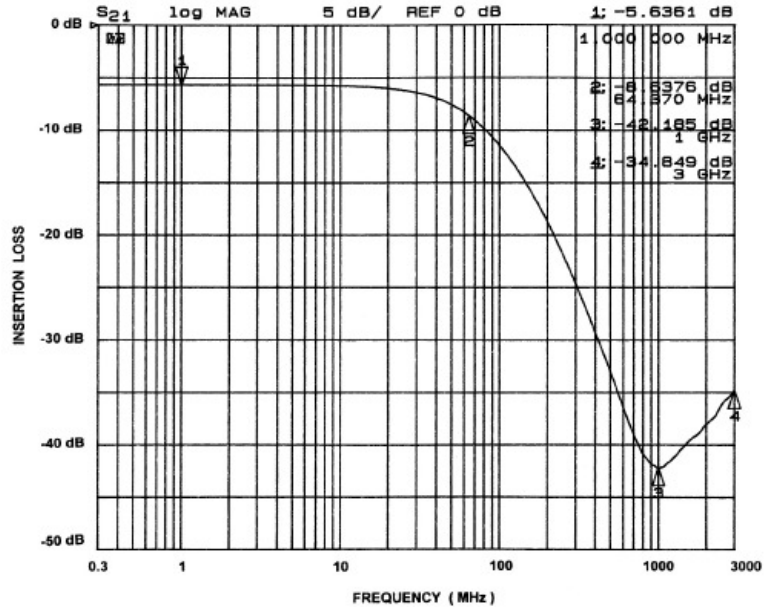


Figure 1. Insertion Loss vs. Frequency (A2−C2 to GND B2)

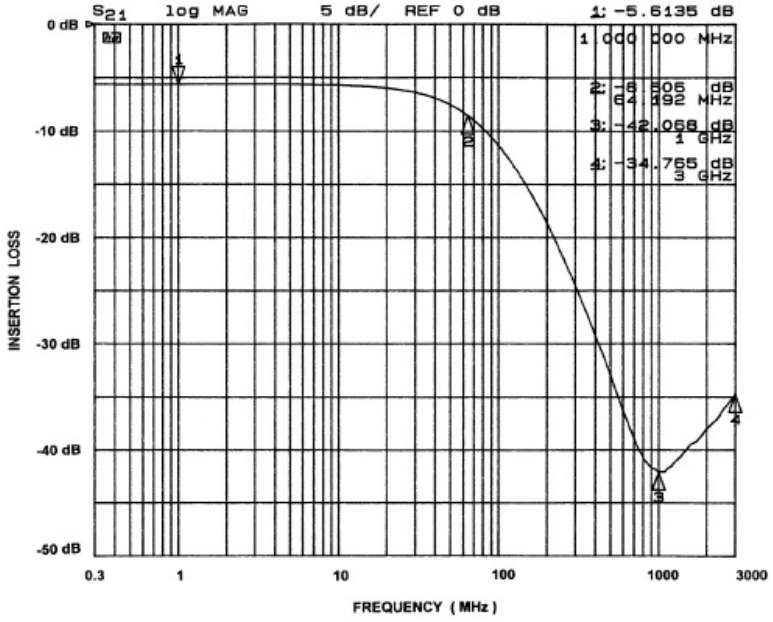


Figure 2. Insertion Loss vs. Frequency (A3−C3 to GND B2)

PERFORMANCE INFORMATION (Cont'd)

Typical Filter Performance (T_A = 25°C, DC Bias = 0 V, 50 Ω Environment)

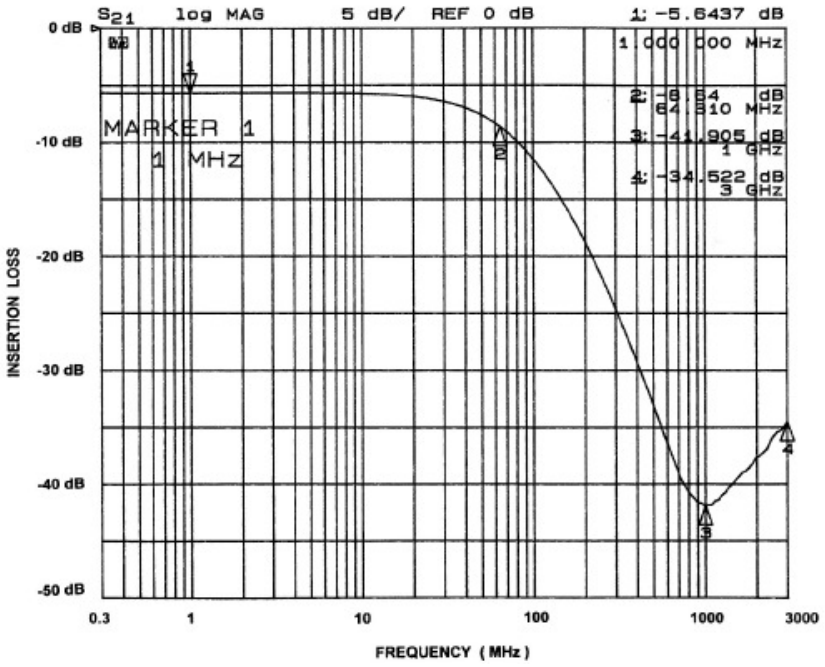


Figure 3. Insertion Loss vs. Frequency (A4−C4 to GND B2)

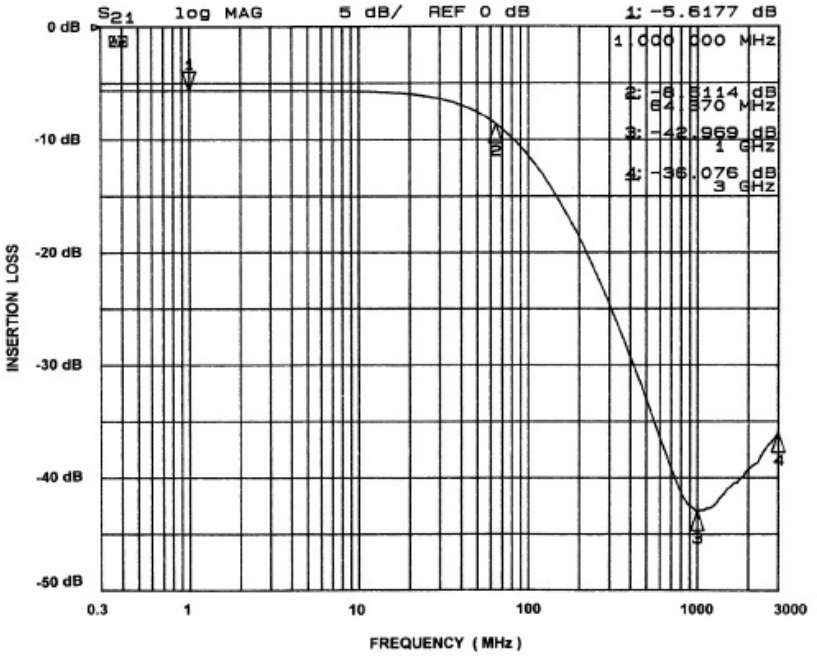


Figure 4. Insertion Loss vs. Frequency (A5−C5 to GND B2)

PERFORMANCE INFORMATION (Cont'd)

Typical Filter Performance (T_A = 25°C, 50 Ω Environment)

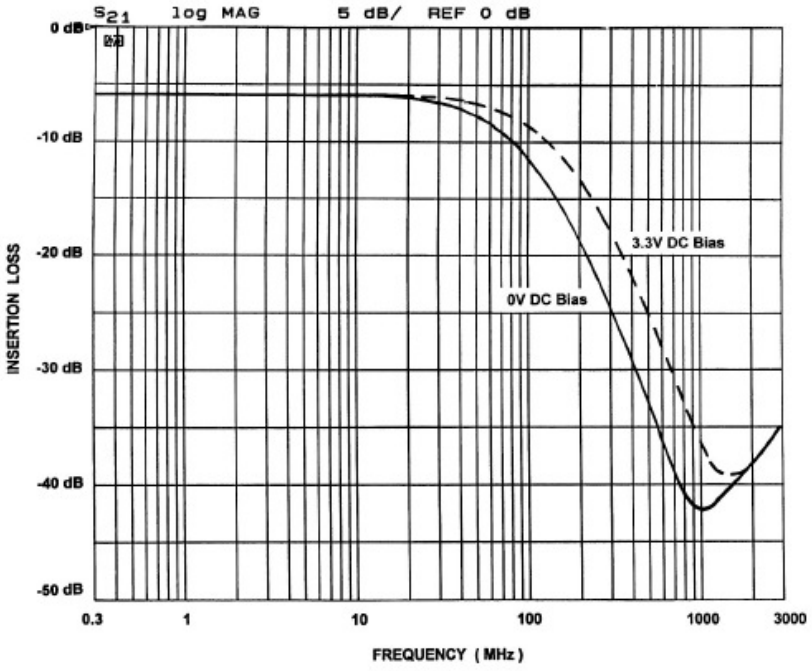


Figure 5. Comparison of Filter Response Curves for CM1401−03CS with DC Bias

PERFORMANCE INFORMATION (Cont'd)

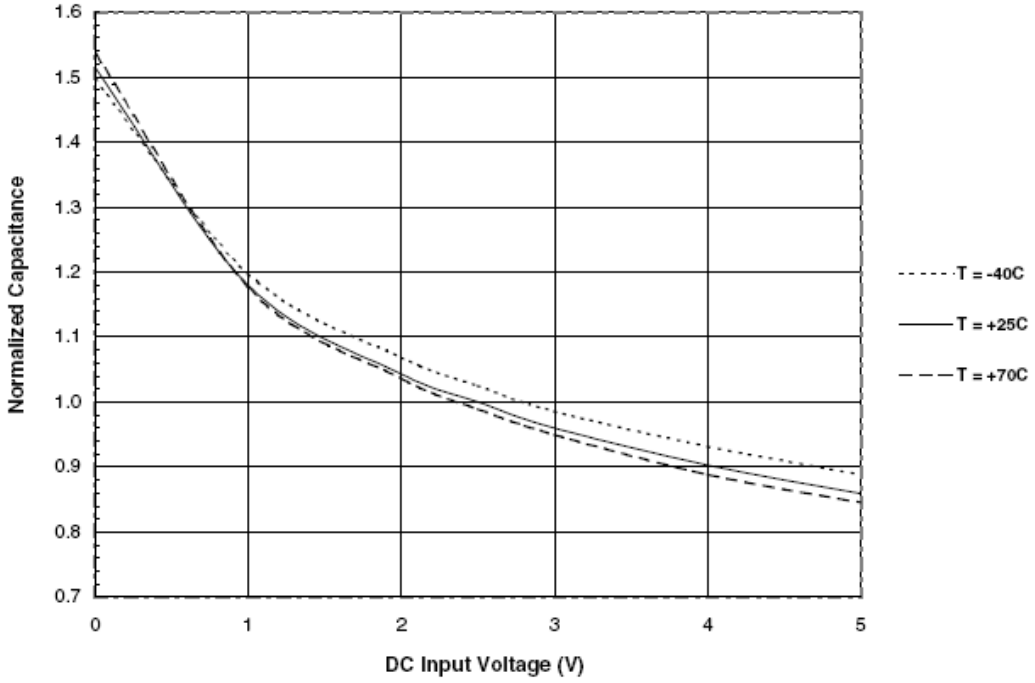


Figure 6. Filter Capacitance vs. Input Voltage over Temperature (normalized to capacitance at 2.5 VDC and 25°C)

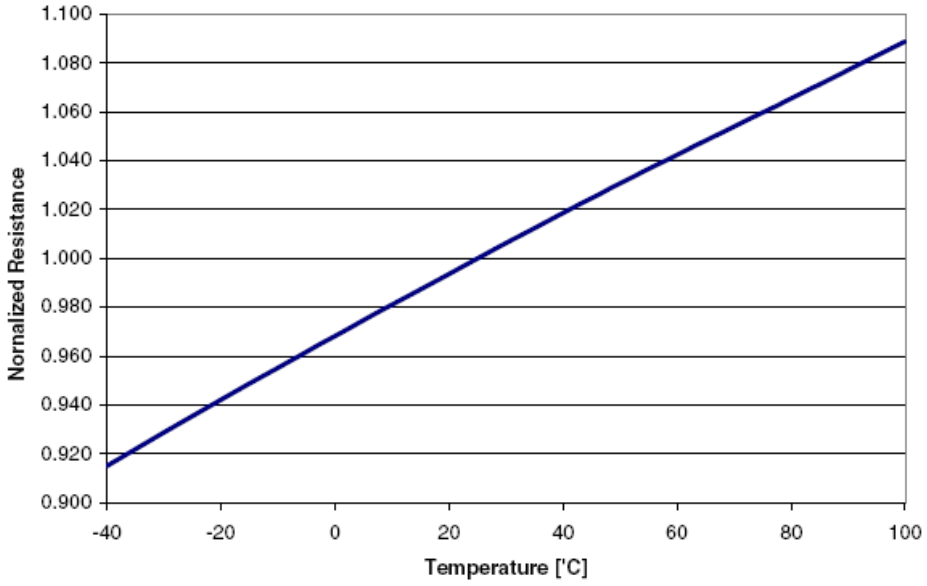


Figure 7. Resistance vs. Temperature (normalized to resistance at 25°C)

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

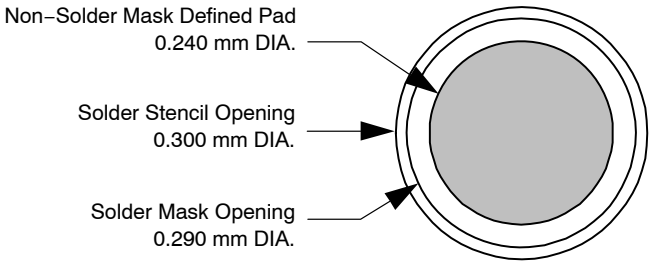


Figure 8. Recommended Non−Solder Mask Defined Pad Illustration

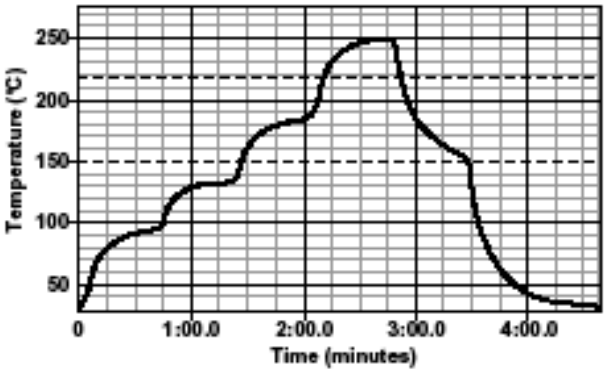


Figure 9. Lead−free (SnAgCu) Solder Ball Reflow Profile

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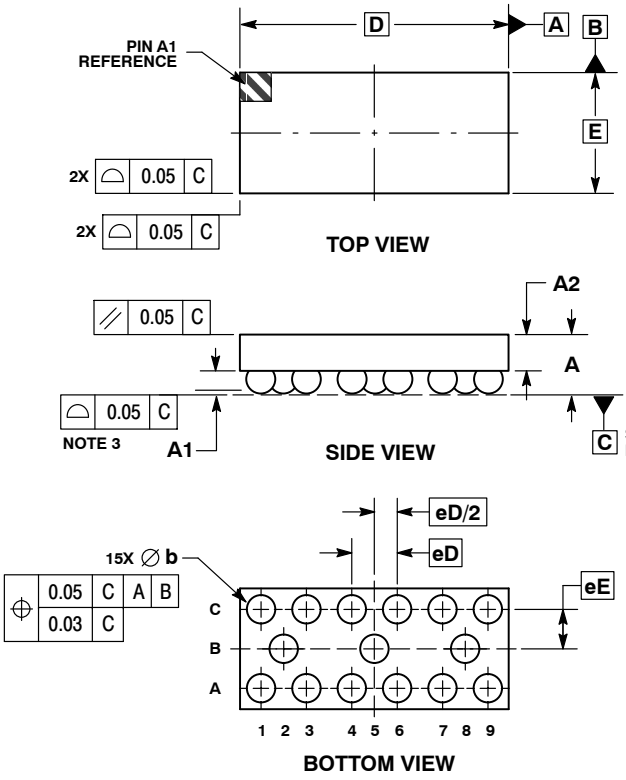
SCALE 4:1

WLCSP15, 2.96x1.33
CASE 567BS
ISSUE O

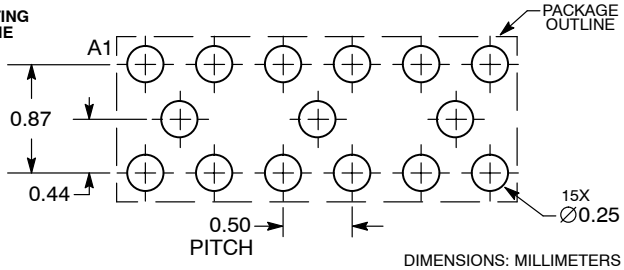
DATE 26 JUL 2010



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

	MILLIMETERS	
DIM	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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