



## Features

- Four, six and eight channels of EMI filtering with integrated ESD protection
- Pi-style EMI filters in a capacitor-resistor-capacitor (C-R-C) network
- $\pm 15\text{kV}$  ESD protection on each channel (IEC 61000-4-2 Level 4, contact discharge)
- $\pm 30\text{kV}$  ESD protection on each channel (HBM)
- Greater than 25dB attenuation (typical) at 1 GHz
- UDFN package with 0.40mm lead pitch:
  - 4-ch. = 8-lead UDFN
  - 6-ch. = 12-lead UDFN
  - 8-ch. = 16-lead UDFN
- Tiny UDFN package size:
  - 8-lead: 1.7mm x 1.35mm x 0.5mm
  - 12-lead: 2.5mm x 1.35mm x 0.5mm
  - 16-lead: 3.3mm x 1.35mm x 0.5mm
- Increased robustness against vertical impacts during manufacturing process
- Lead-free version available

## 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

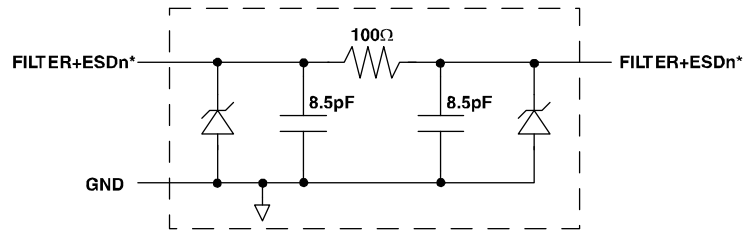
## Product Description

The CM1630 is a family of pi-style EMI filter arrays with ESD protection, which integrates four, six and eight filters (C-R-C) in small form factor UDFN 0.40mm pitch packages. The CM1630 has component values of 8.5pF-100 $\Omega$ -8.5pF per channel. The CM1630 has a cut-off frequency of 200MHz and can be used in applications with data rates up to 80Mbps. The parts include 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  $\pm 15\text{kV}$ , 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  $\pm 30\text{kV}$ .

These devices are particularly well-suited for portable electronics (e.g. wireless handsets, PDAs, notebook computers) because of their small package and easy-to-use pin assignments. In particular, the CM1630 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.

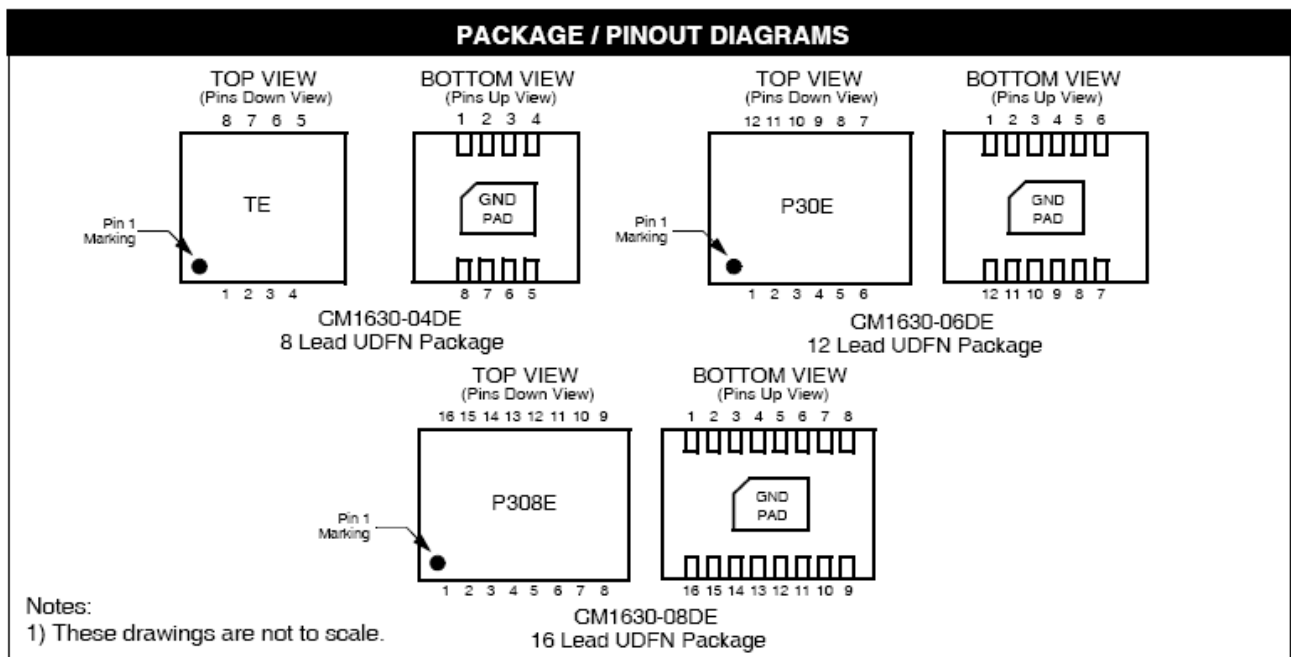
The CM1630 is housed in space-saving, low-profile 8-, 12- and 16-lead UDFN packages with a 0.4mm pitch and is available with lead-free finishing. This new small UDFN package provides up to 42% board space savings vs. the 0.50mm pitch UDFN packages.

Electrical Schematic



1 of 4, 6 or 8 EMI/RFI Filter Channels with Integrated ESD Protection

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



# CM1630

## PIN DESCRIPTIONS

| DEVICE PIN(s) |     |     | NAME    | DESCRIPTION            | DEVICE PIN(s) |     |     | NAME    | DESCRIPTION            |
|---------------|-----|-----|---------|------------------------|---------------|-----|-----|---------|------------------------|
| -04           | -06 | -08 |         |                        | -04           | -06 | -08 |         |                        |
| 1             | 1   | 1   | FILTER1 | Filter + ESD Channel 1 | 8             | 12  | 16  | FILTER1 | Filter + ESD Channel 1 |
| 2             | 2   | 2   | FILTER2 | Filter + ESD Channel 2 | 7             | 11  | 15  | FILTER2 | Filter + ESD Channel 2 |
| 3             | 3   | 3   | FILTER3 | Filter + ESD Channel 3 | 6             | 10  | 14  | FILTER3 | Filter + ESD Channel 3 |
| 4             | 4   | 4   | FILTER4 | Filter + ESD Channel 4 | 5             | 9   | 13  | FILTER4 | Filter + ESD Channel 4 |
|               | 5   | 5   | FILTER5 | Filter + ESD Channel 5 |               | 8   | 12  | FILTER5 | Filter + ESD Channel 5 |
|               | 6   | 6   | FILTER6 | Filter + ESD Channel 6 |               | 7   | 11  | FILTER6 | Filter + ESD Channel 6 |
|               |     | 7   | FILTER7 | Filter + ESD Channel 7 |               |     | 10  | FILTER7 | Filter + ESD Channel 7 |
|               |     | 8   | FILTER8 | Filter + ESD Channel 8 |               |     | 9   | FILTER8 | Filter + ESD Channel 8 |
| GND PAD       |     |     | GND     | Device Ground          |               |     |     |         |                        |

## Ordering Information

### PART NUMBERING INFORMATION

| Pins | Package | Lead-free Finish                  |              |
|------|---------|-----------------------------------|--------------|
|      |         | Ordering Part Number <sup>1</sup> | Part Marking |
| 8    | UDFN-8  | CM1630-04DE                       | TE           |
| 12   | UDFN-12 | CM1630-06DE                       | P30E         |
| 16   | UDFN-16 | CM1630-08DE                       | P308E        |

Note 1: Parts are shipped in Tape & Reel form unless otherwise specified.

## Specifications

### 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    |

**STANDARD OPERATING CONDITIONS**

| PARAMETER                   | RATING     | UNITS |
|-----------------------------|------------|-------|
| Operating Temperature Range | -40 to +85 | °C    |

**ELECTRICAL OPERATING CHARACTERISTICS** (SEE NOTE1)

| SYMBOL                     | PARAMETER  | CONDITIONS  | MIN         | TYP         | MAX | UNITS    |
|----------------------------|--|---|-------------|-------------|-----|----------|
| R                          | Resistance   |   | 80          | 100         | 120 | Ω        |
| C <sub>TOTAL</sub>         | Total Channel Capacitance  | At 2.5VDC Reverse Bias, 1MHz, 30mVAC  | 14          | 17          | 22  | pF       |
| C                          | Capacitance C1   | At 2.5VDC Reverse Bias, 1MHz, 30mVAC  | 7           | 8.5         | 11  | pF       |
| V <sub>DIODE</sub>         | Standoff Voltage   | I <sub>DIODE</sub> =10μA  |             | 6.0         |     | V        |
| I <sub>LEAK</sub>          | Diode Leakage Current (reverse bias)   | V <sub>DIODE</sub> =+3.3V   |             | 0.1         | 1.0 | μA       |
| V <sub>SIG</sub>           | Signal Clamp Voltage<br>Positive Clamp<br>Negative Clamp   | I <sub>LOAD</sub> = 10mA<br>I <sub>LOAD</sub> = -10mA                                 | 5.6<br>-0.4 | 6.8<br>-0.8 |     | V<br>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 | Note 2  | ±30<br>±15  |             |     | kV<br>kV |
| R <sub>DYN</sub>           | Dynamic Resistance<br>Positive<br>Negative   |   |             | 2.3<br>0.9  |     | Ω<br>Ω   |
| f <sub>C</sub>             | Cut-off Frequency<br>Z <sub>SOURCE</sub> =50Ω, Z <sub>LOAD</sub> =50Ω  | Channel R = 100Ω,<br>Channel C = 8.5pF  |             | 200         |     | MHz      |
| A <sub>1GHz</sub>          | Absolute Attenuation @ 1GHz from 0dB Level   | Z <sub>SOURCE</sub> = 50Ω, Z <sub>LOAD</sub> = 50Ω,<br>DC Bias = 0V;<br>Notes 1 and 3 |             | 30          |     | dB       |
| A <sub>800MHz - 6GHz</sub> | Absolute Attenuation @ 800MHz to 6GHz from 0dB Level   | Z <sub>SOURCE</sub> = 50Ω, Z <sub>LOAD</sub> = 50Ω,<br>DC Bias = 0V;<br>Notes 1 and 3 |             | 25          |     | dB       |

Note 1: T<sub>A</sub>=25°C unless otherwise specified.

Note 2: ESD applied to input and output pins with respect to GND, one at a time.

Note 3: Attenuation / RF curves characterized by a network analyzer using microprobes.

## Performance Information

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

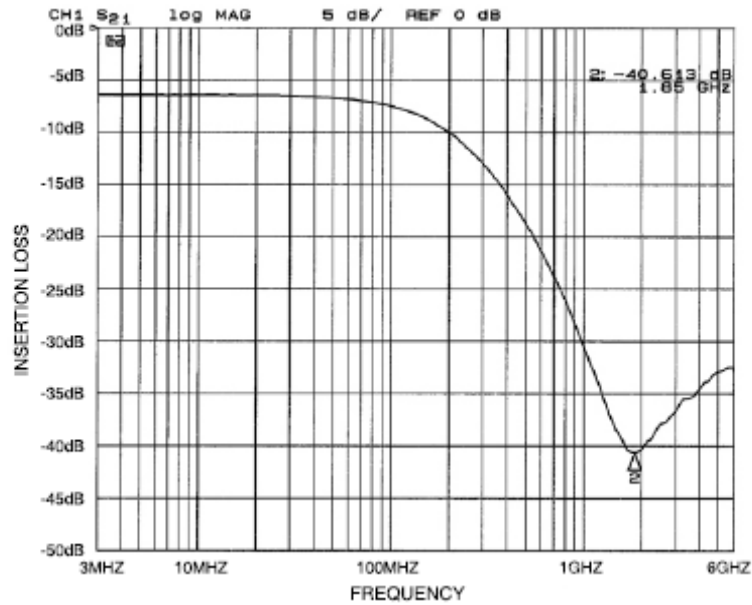


Figure 1. Insertion Loss vs. Frequency (FILTER1 Input to GND, CM1436-04DE)

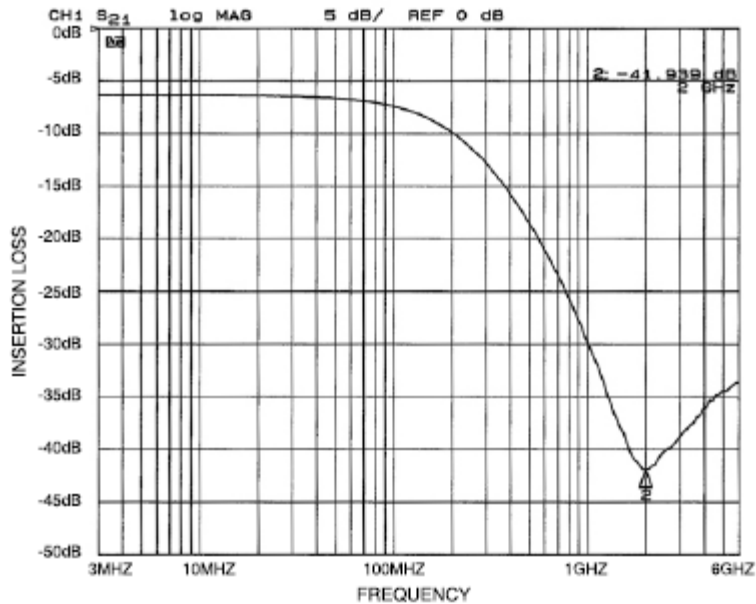


Figure 2. Insertion Loss vs. Frequency (FILTER2 Input to GND, CM1436-04DE)

## Performance Information (cont'd)

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

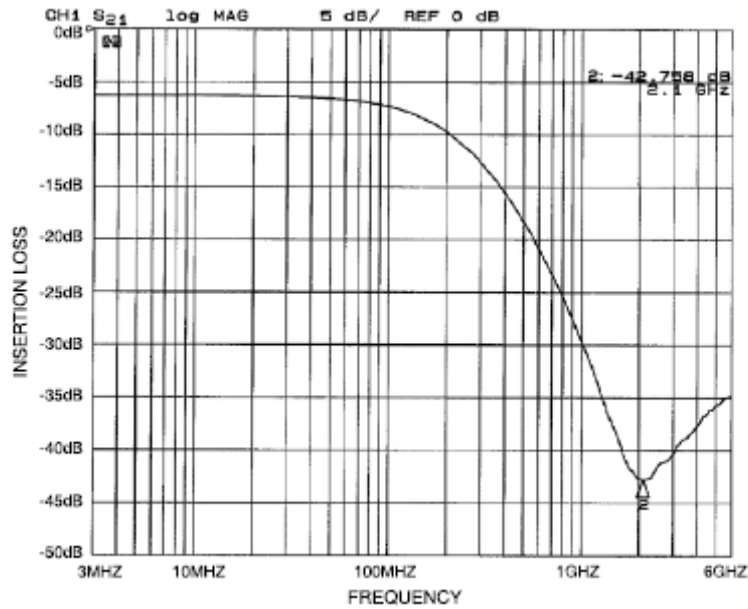


Figure 3. Insertion Loss vs. Frequency (FILTER3 Input to GND, CM1436-04DE)

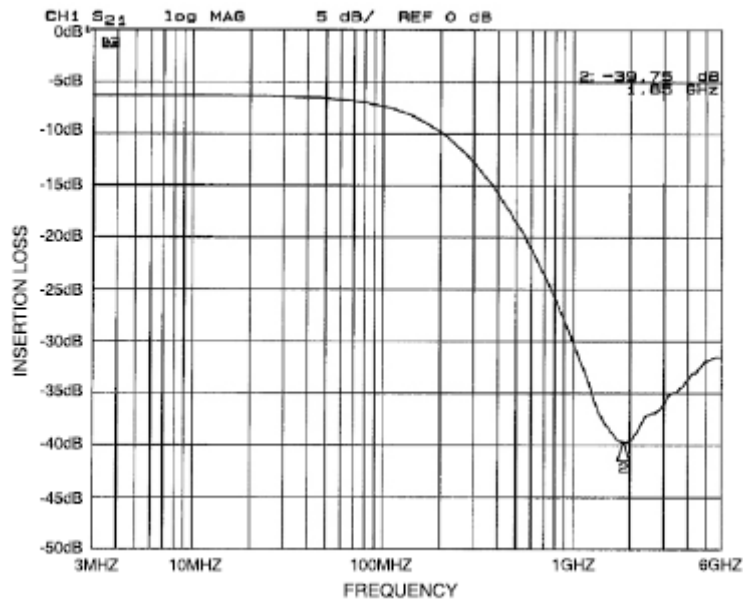


Figure 4. Insertion Loss vs. Frequency (FILTER4 Input to GND, CM1436-04DE)

Performance Information (cont'd)

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

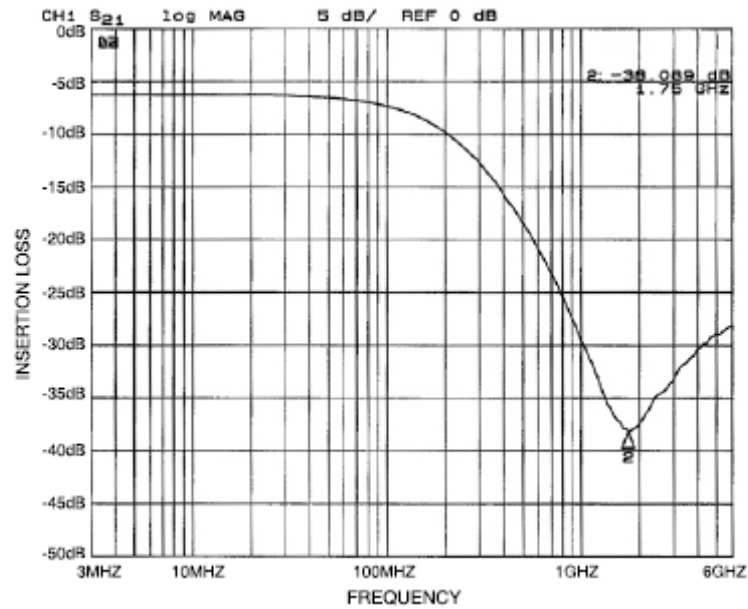


Figure 5. Insertion Loss vs. Frequency (FILTER1 Input to GND, CM1436-06DE)

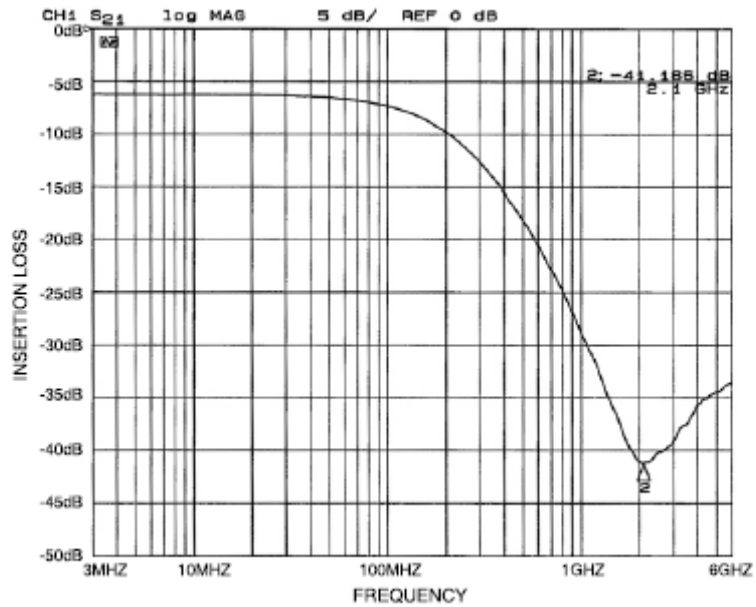


Figure 6. Insertion Loss vs. Frequency (FILTER2 Input to GND, CM1436-06DE)

## Performance Information (cont'd)

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

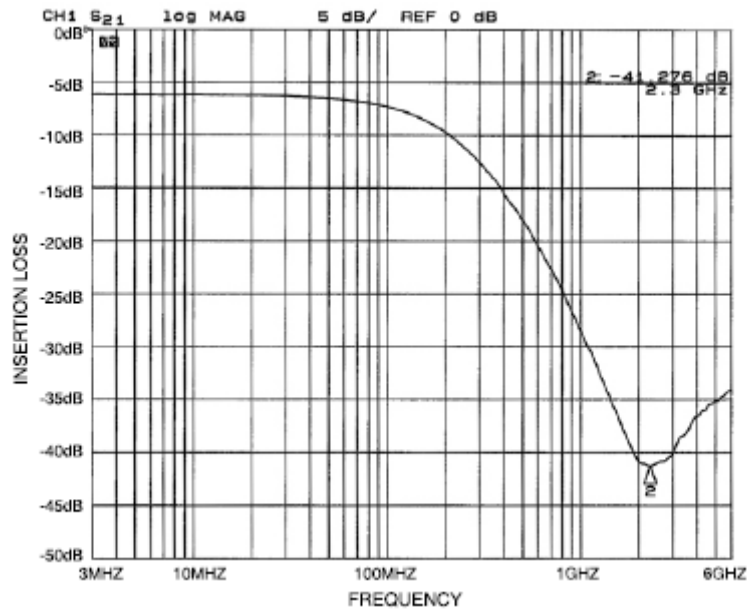


Figure 7. Insertion Loss vs. Frequency (FILTER3 Input to GND, CM1436-06DE)

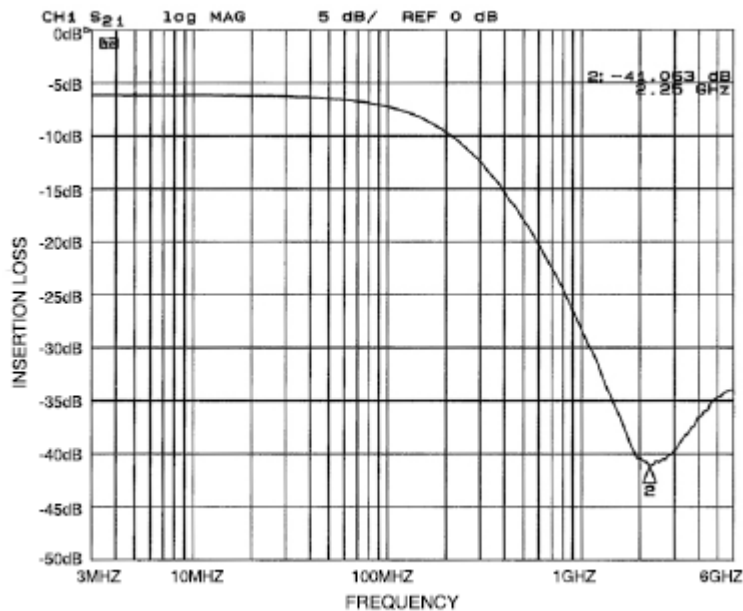


Figure 8. Insertion Loss vs. Frequency (FILTER4 Input to GND, CM1436-06DE)



## Performance Information (cont'd)

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

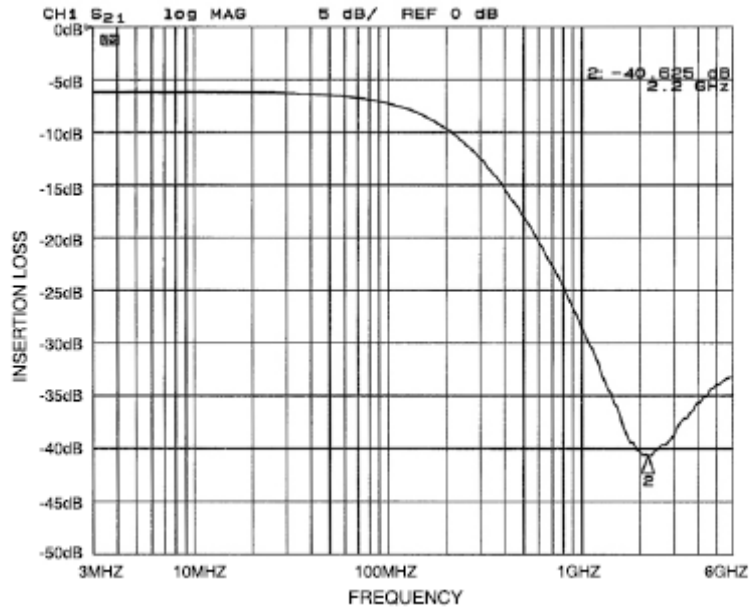


Figure 9. Insertion Loss vs. Frequency (FILTER5 Input to GND, CM1436-06DE)

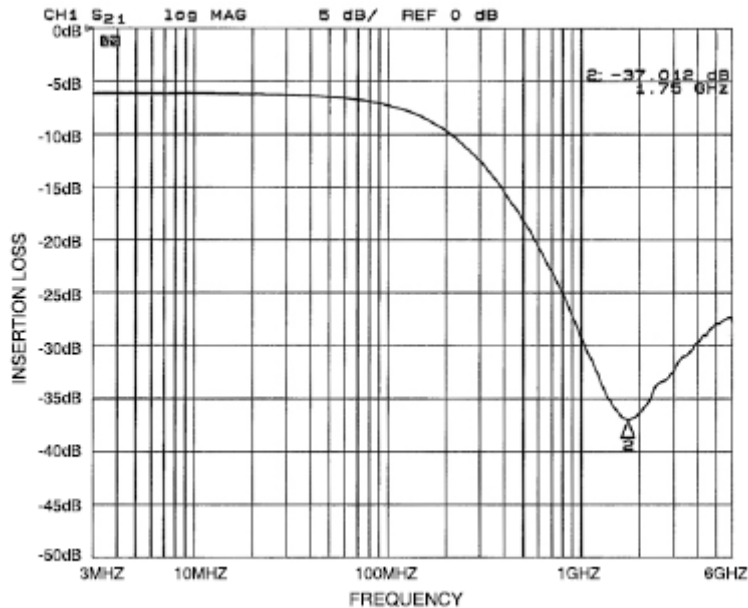


Figure 10. Insertion Loss vs. Frequency (FILTER6 Input to GND, CM1436-06DE)

## Performance Information (cont'd)

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

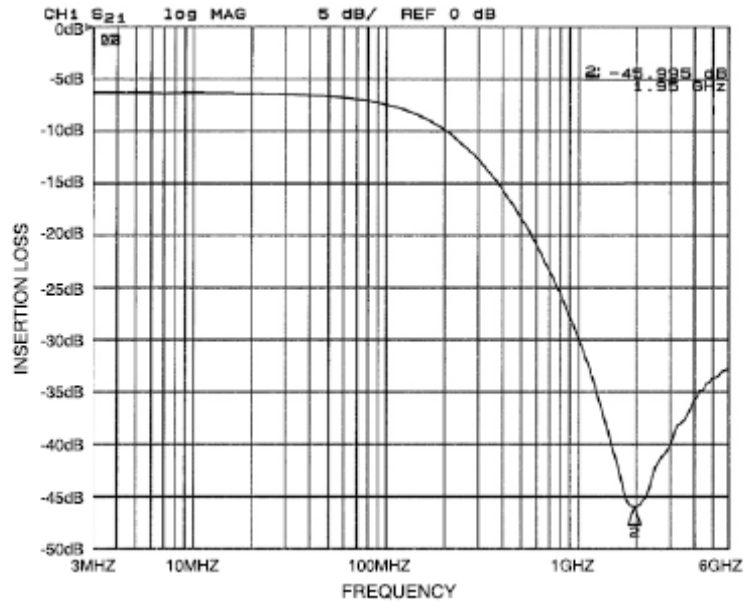


Figure 11. Insertion Loss vs. Frequency (FILTER1 Input to GND, CM1436-08DE)

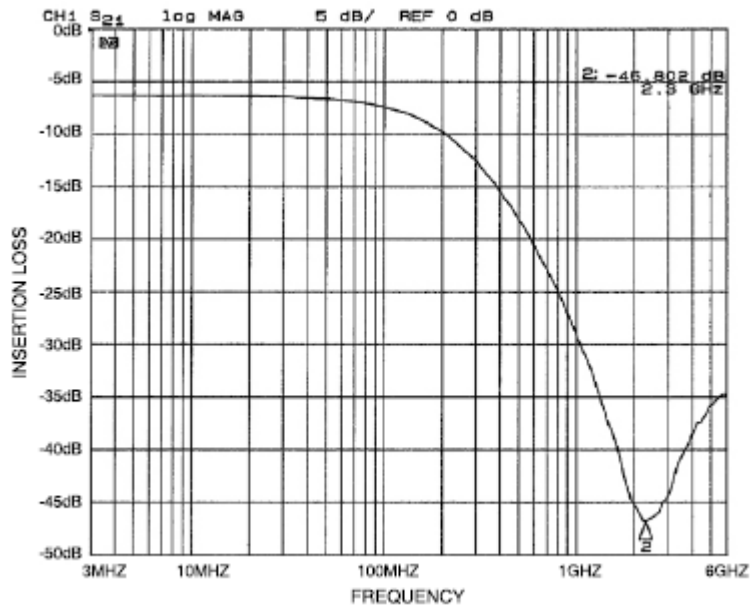


Figure 12. Insertion Loss vs. Frequency (FILTER2 Input to GND, CM1436-08DE)

Performance Information (cont'd)

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

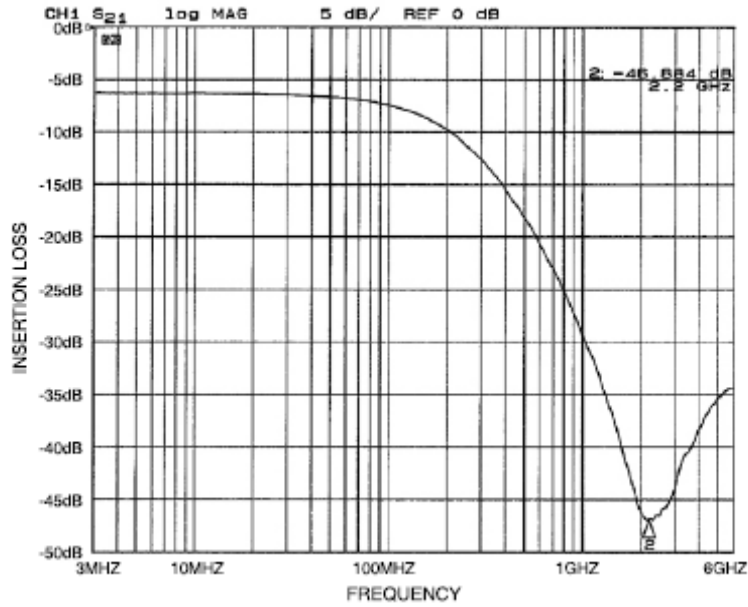


Figure 13. Insertion Loss vs. Frequency (FILTER3 Input to GND, CM1436-08DE)

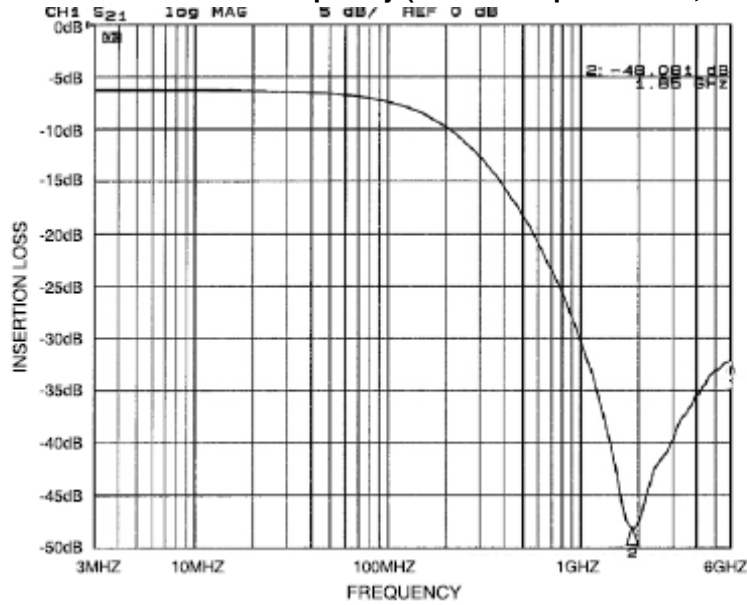


Figure 14. Insertion Loss vs. Frequency (FILTER4 Input to GND, CM1436-08DE)

## Performance Information (cont'd)

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

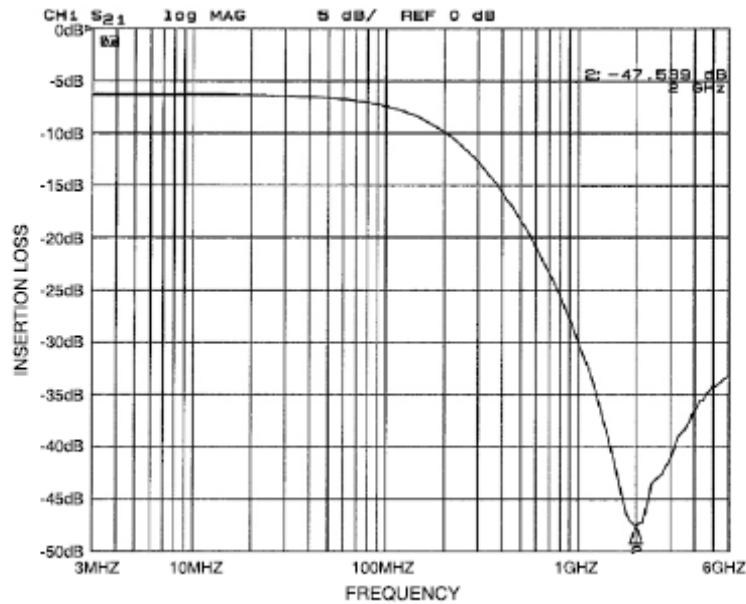


Figure 15. Insertion Loss vs. Frequency (FILTER5 Input to GND, CM1436-08DE)

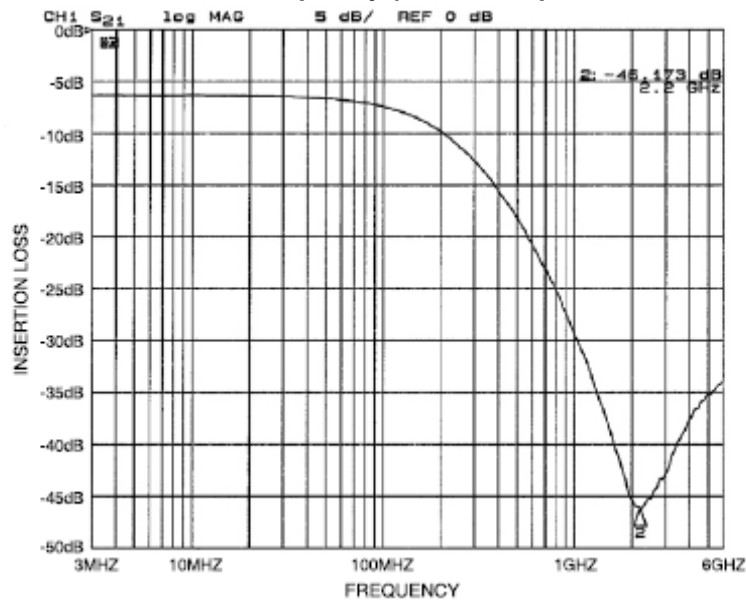


Figure 16. Insertion Loss vs. Frequency (FILTER6 Input to GND, CM1436-08DE)

## Performance Information (cont'd)

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

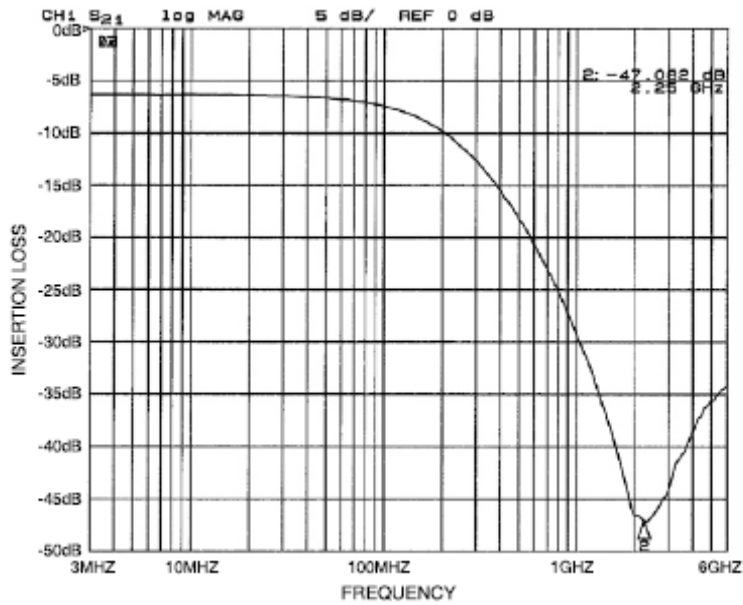


Figure 17. Insertion Loss vs. Frequency (FILTER7 Input to GND, CM1436-08DE)

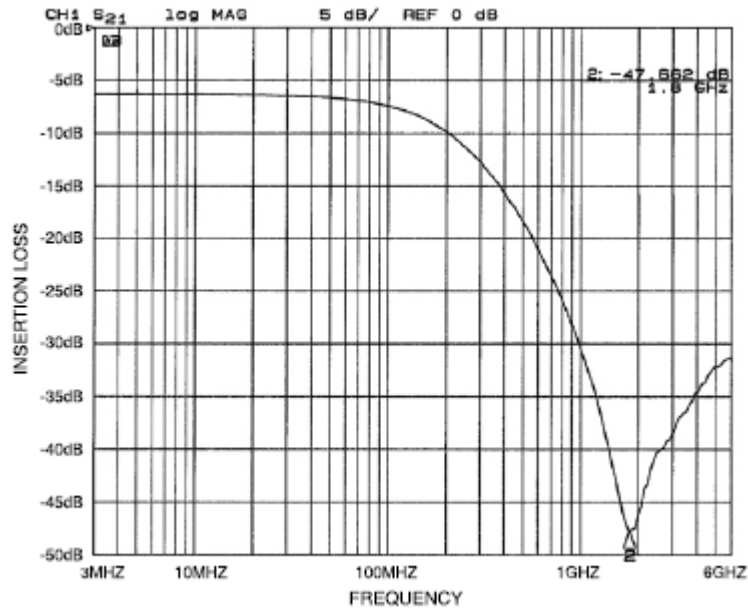


Figure 18. Insertion Loss vs. Frequency (FILTER8 Input to GND, CM1436-08DE)

Performance Information (cont'd)

Typical Diode Capacitance vs. Input Voltage

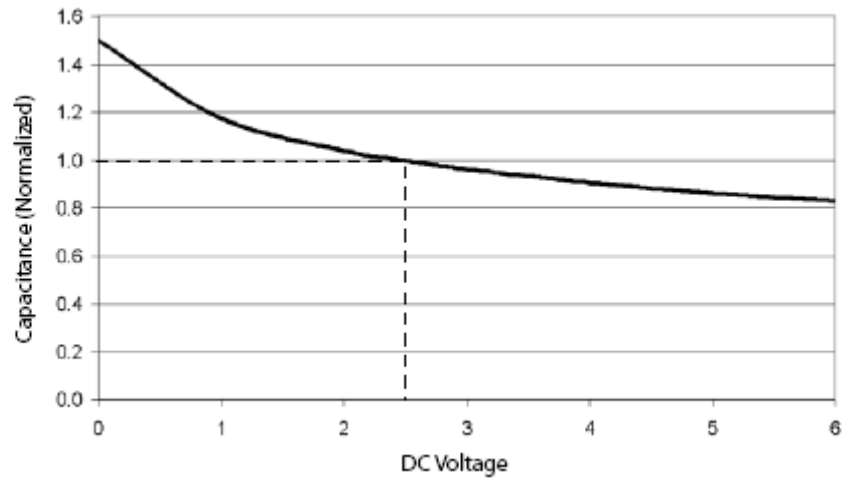


Figure 19. Filter Capacitance vs. Input Voltage (normalized to capacitance at 2.5VDC and 25°C)

# CM1630

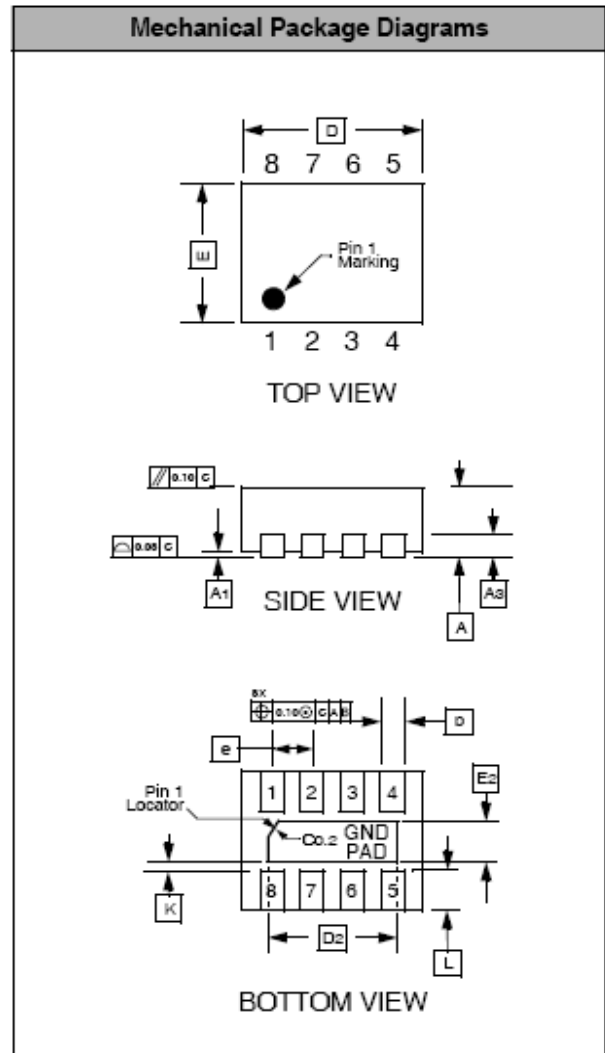
## Mechanical Details

### UDFN-08 Mechanical Specifications

Dimensions for the CM1630 supplied in a 8-lead, 0.4mm pitch UDFN package are presented below.

| PACKAGE DIMENSIONS                 |                      |      |      |           |       |       |
|------------------------------------|----------------------|------|------|-----------|-------|-------|
| Package                            | UDFN                 |      |      |           |       |       |
| JEDEC No.                          | MO-229C <sup>†</sup> |      |      |           |       |       |
| Leads                              | 8                    |      |      |           |       |       |
| Dim.                               | Millimeters          |      |      | Inches    |       |       |
|                                    | Min                  | Nom  | Max  | Min       | Nom   | Max   |
| A                                  | 0.45                 | 0.50 | 0.55 | 0.018     | 0.020 | 0.022 |
| A1                                 | 0.00                 | 0.02 | 0.05 | 0.000     | 0.001 | 0.002 |
| A3                                 | 0.127 REF            |      |      | 0.005 REF |       |       |
| b                                  | 0.15                 | 0.20 | 0.25 | 0.006     | 0.008 | 0.010 |
| D                                  | 1.60                 | 1.70 | 1.80 | 0.063     | 0.067 | 0.071 |
| D2                                 | 1.10                 | 1.20 | 1.30 | 0.043     | 0.047 | 0.051 |
| E                                  | 1.25                 | 1.35 | 1.45 | 0.049     | 0.053 | 0.057 |
| E2                                 | 0.30                 | 0.40 | 0.50 | 0.012     | 0.016 | 0.020 |
| e                                  | 0.40 BSC             |      |      | 0.016 BSC |       |       |
| K                                  | 0.20                 |      |      | 0.008     |       |       |
| L                                  | 0.15                 | 0.25 | 0.35 | 0.006     | 0.010 | 0.014 |
| # per tape and reel                | 3000 pieces          |      |      |           |       |       |
| Controlling dimension: millimeters |                      |      |      |           |       |       |

<sup>†</sup>This package is compliant with JEDEC standard MO-229C with the exception of the "D", "D2", "E", "E2", "K" and "L" dimensions as called out in the table above.



Dimensions for 8-Lead, 0.4mm pitch UDFN package

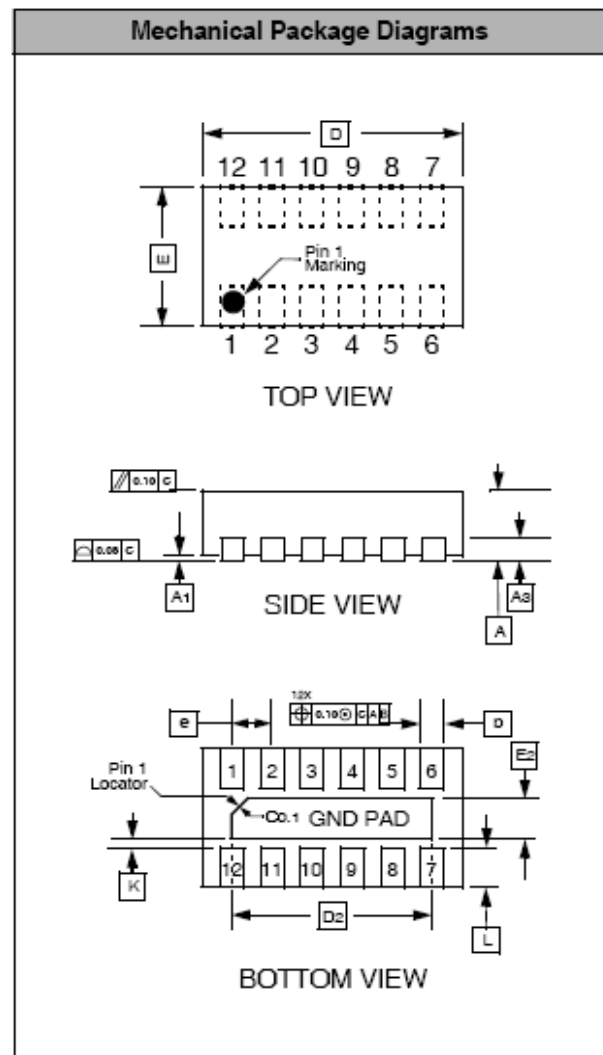
## Mechanical Details (cont'd)

### UDFN-12 Mechanical Specifications

Dimensions for the CM1630 supplied in a 12-lead, 0.4mm pitch UDFN package are presented below.

| PACKAGE DIMENSIONS                 |                      |      |      |           |       |       |
|------------------------------------|----------------------|------|------|-----------|-------|-------|
| Package                            | UDFN                 |      |      |           |       |       |
| JEDEC No.                          | MO-229C <sup>†</sup> |      |      |           |       |       |
| Leads                              | 12                   |      |      |           |       |       |
| Dim.                               | Millimeters          |      |      | Inches    |       |       |
|                                    | Min                  | Nom  | Max  | Min       | Nom   | Max   |
| A                                  | 0.45                 | 0.50 | 0.55 | 0.018     | 0.020 | 0.022 |
| A1                                 | 0.00                 | 0.02 | 0.05 | 0.000     | 0.001 | 0.002 |
| A3                                 | 0.127 REF            |      |      | 0.005 REF |       |       |
| b                                  | 0.15                 | 0.20 | 0.25 | 0.006     | 0.008 | 0.010 |
| D                                  | 2.40                 | 2.50 | 2.60 | 0.094     | 0.098 | 0.102 |
| D2                                 | 1.90                 | 2.00 | 2.10 | 0.075     | 0.079 | 0.083 |
| E                                  | 1.25                 | 1.35 | 1.45 | 0.049     | 0.053 | 0.057 |
| E2                                 | 0.30                 | 0.40 | 0.50 | 0.012     | 0.016 | 0.020 |
| e                                  | 0.40 BSC             |      |      | 0.016 BSC |       |       |
| K                                  | 0.20                 |      |      | 0.008     |       |       |
| L                                  | 0.15                 | 0.25 | 0.35 | 0.006     | 0.010 | 0.014 |
| # per tape and reel                | 3000 pieces          |      |      |           |       |       |
| Controlling dimension: millimeters |                      |      |      |           |       |       |

<sup>†</sup>This package is compliant with JEDEC standard MO-229C with the exception of the "D", "D2", "E", "E2", "K" and "L" dimensions as called out in the table above.



**Dimensions for 12-Lead, 0.4mm pitch UDFN package**



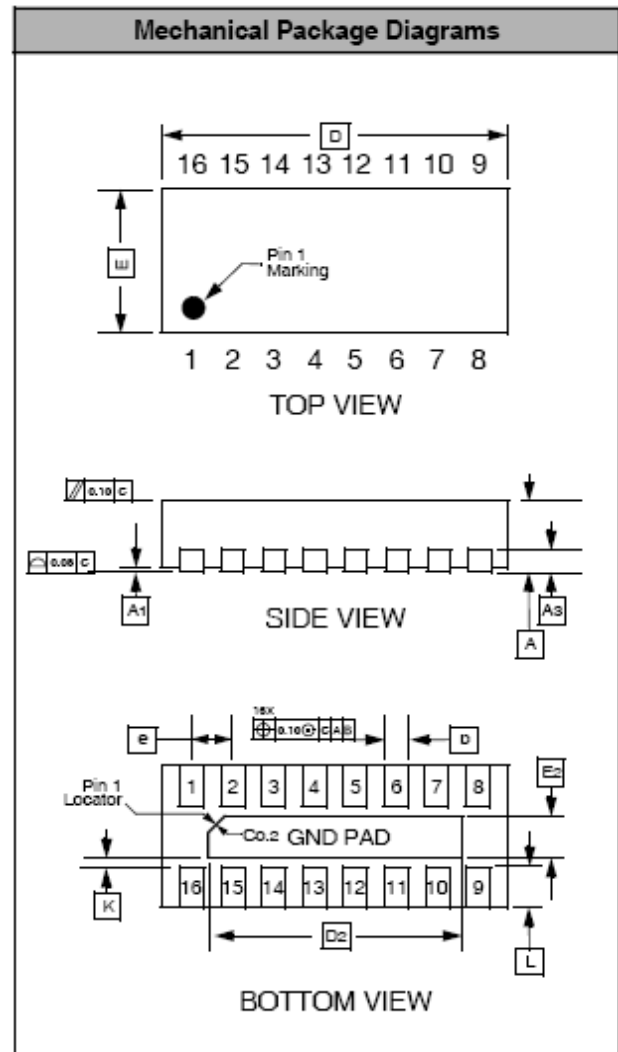
# CM1630

## Mechanical Details (cont'd)

### UDFN-16 Mechanical Specifications


Dimensions for the CM1630 supplied in a 16-lead, 0.4mm pitch UDFN package are presented below.

| PACKAGE DIMENSIONS                 |                      |      |      |           |       |       |
|------------------------------------|----------------------|------|------|-----------|-------|-------|
| Package                            | UDFN                 |      |      |           |       |       |
| JEDEC No.                          | MO-229C <sup>†</sup> |      |      |           |       |       |
| Leads                              | 16                   |      |      |           |       |       |
| Dim.                               | Millimeters          |      |      | Inches    |       |       |
|                                    | Min                  | Nom  | Max  | Min       | Nom   | Max   |
| A                                  | 0.45                 | 0.50 | 0.55 | 0.018     | 0.020 | 0.022 |
| A1                                 | 0.00                 | 0.02 | 0.05 | 0.000     | 0.001 | 0.002 |
| A3                                 | 0.127 REF            |      |      | 0.005 REF |       |       |
| b                                  | 0.15                 | 0.20 | 0.25 | 0.006     | 0.008 | 0.010 |
| D                                  | 3.20                 | 3.30 | 3.40 | 0.126     | 0.130 | 0.134 |
| D2                                 | 2.70                 | 2.80 | 2.90 | 0.106     | 0.110 | 0.114 |
| E                                  | 1.25                 | 1.35 | 1.45 | 0.049     | 0.053 | 0.057 |
| E2                                 | 0.30                 | 0.40 | 0.50 | 0.012     | 0.016 | 0.020 |
| e                                  | 0.40 BSC             |      |      | 0.016 BSC |       |       |
| K                                  | 0.20                 |      |      | 0.008     |       |       |
| L                                  | 0.15                 | 0.25 | 0.35 | 0.006     | 0.010 | 0.014 |
| # per tape and reel                | 3000 pieces          |      |      |           |       |       |
| Controlling dimension: millimeters |                      |      |      |           |       |       |



Dimensions for 16-Lead, 0.4mm pitch UDFN package

<sup>†</sup> This package is compliant with JEDEC standard MO-229C with the exception of the "D", "D2", "E", "E2", "K" and "L" dimensions as called out in the table above.

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