# 4 and 8 Channel EMI Filter Arrays with ESD Protection

## Features

- Four and eight channels of EMI filtering with ESD protection
- Greater than 25dB of attenuation from 800MHz to 3GHz
- ±15kV ESD protection (IEC 61000-4-2, contact discharge)
- ±30kV ESD protection (MIL-STD-883, Method 3015, HBM)
- Fabricated with *Centurion*™ advanced low capacitance zener process technology
- Space saving, low profile 8 and 16-lead TDFN packages
- Lead-free version available

## Applications

- I/O port protection for mobile handsets, notebook computers, PDAs etc.
- EMI filtering for data ports in cell phones, PDAs or notebook computers.
- EMI filtering for LCD, camera and chip-to-chip data lines

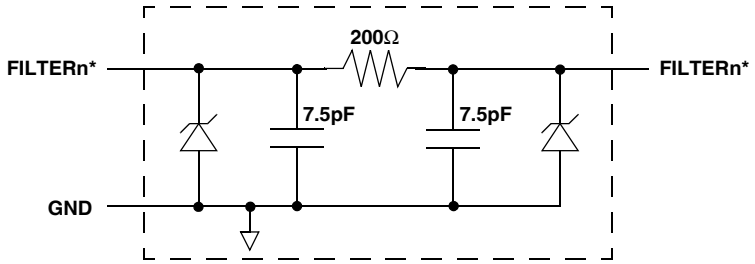
## Product Description

California Micro Devices's CM1407 is an EMI filter array with ESD protection, which integrates either four or eight pi filters (C-R-C). The CM1407 has component values of 7.5pF-200Ω-7.5pF. The parts include ESD protection diodes on every pin, providing 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 safely dissipate ESD strikes of ±15kV contact discharge, twice the specification requirement of the IEC 61000-4-2, Level 4 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 ±30kV.

This device is particularly well-suited for portable electronics (e.g. mobile handsets, PDAs, notebook computers) because of its small package and easy-to-use pin assignments. In particular, the CM1407 is ideal for EMI filtering and protecting data lines from ESD in wireless handsets.

The CM1407 is available in space-saving, low-profile, 8 and 16-lead TDFN packages. It is fabricated with California Micro Devices' *Centurion*™ process and available with optional lead-free finishing.

### Electrical Schematic

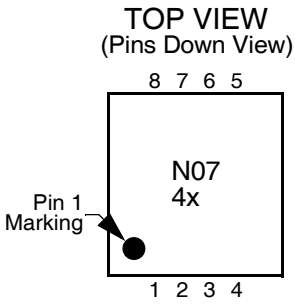


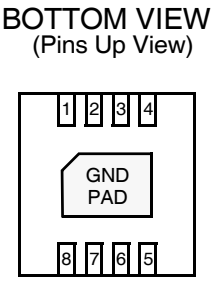

**1 of 4/8 EMI Filtering + ESD Channels**

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

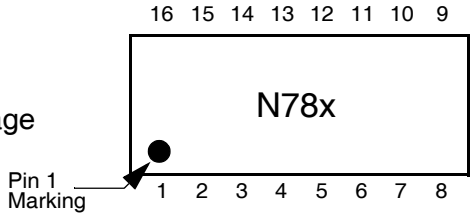
## PACKAGE / PINOUT DIAGRAMS

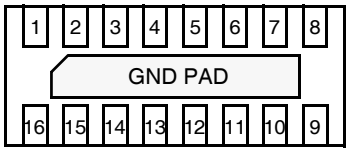
CM1407-04DE/DF
8-Lead TDFN Package




CM1407-08DE/DF
16-Lead TDFN Package




Notes:
1) This drawing is not to scale.
2) See Ordering Information section below for device specific marking.

## PIN DESCRIPTIONS

| Pins | | | | | Pins | | | |
|---|---|---|---|---|---|---|---|---|
| CM1407 -04Dx | CM1407 -08Dx | NAME | DESCRIPTION | | CM1407 -04Dx | CM1407 -08Dx | NAME | DESCRIPTION |
| 1 | 1 | FILTER1 | Filter Channel 1 | | 8 | 16 | FILTER1 | Filter Channel 1 |
| 2 | 2 | FILTER2 | Filter Channel 2 | | 7 | 15 | FILTER2 | Filter Channel 2 |
| 3 | 3 | FILTER3 | Filter Channel 3 | | 6 | 14 | FILTER3 | Filter Channel 3 |
| 4 | 4 | FILTER4 | Filter Channel 4 | | 5 | 13 | FILTER4 | Filter Channel 4 |
| | 5 | FILTER5 | Filter Channel 5 | | | 12 | FILTER5 | Filter Channel 5 |
| | 6 | FILTER6 | Filter Channel 6 | | | 11 | FILTER6 | Filter Channel 6 |
| | 7 | FILTER7 | Filter Channel 7 | | | 10 | FILTER7 | Filter Channel 7 |
| | 8 | FILTER8 | Filter Channel 8 | | | 9 | FILTER8 | Filter Channel 8 |
| GND Pad | | GND | Device Ground | | | | | |

## Ordering Information

### PART NUMBERING INFORMATION

| | | Standard Finish | | Lead-free Finish | |
|---|---|---|---|---|---|
| Leads/Pins | Package | Ordering Part Number[1] | Part Marking | Ordering Part Number[1] | Part Marking |
| 8 | TDFN-08 | CM1407-04DF | N07 4F | CM1407-04DE | N07 4E |
| 16 | TDFN-16 | CM1407-08DF | N78F | CM1407-08DE | N78E |

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 Rating per Resistor | 100 | mW |
| Package DC Power Rating | 300 | mW |

| STANDARD OPERATING CONDITIONS | | |
|---|---|---|
| **PARAMETER** | **RATING** | **UNITS** |
| Operating Temperature Range | -40 to +85 | °C |

| ELECTRICAL OPERATING CHARACTERISTICS (SEE NOTE 1) | | | | | | |
|---|---|---|---|---|---|---|
| **SYMBOL** | **PARAMETER** | **CONDITIONS** | **MIN** | **TYP** | **MAX** | **UNITS** |
| R | Resistance | | 160 | 200 | 240 | Ω |
| C | Capacitance | At 2.5V DC, 1MHz, 30mV AC | 6 | 7.5 | 9 | pF |
| $V_{DIODE}$ | Diode Standoff Voltage | $I_{DIODE}$ = 10μA | | 6.0 | | V |
| $I_{LEAK}$ | Diode Leakage Current (reverse bias) | $V_{DIODE}$ = 3.3V | | 0.1 | 1 | μA |
| $V_{SIG}$ | Signal Voltage<br>Positive Clamp<br>Negative Clamp | <br>$I_{LOAD}$ = 10mA<br>$I_{LOAD}$ = -10mA | <br>5.6<br>-1.5 | <br>6.8<br>-0.8 | <br>9.0<br>-0.4 | <br>V<br>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 Level 4 | Notes 2 and 3 | <br>±30<br>±15 | | | <br>kV<br>kV |
| $f_C$ | Cut-off Frequency<br>$Z_{SOURCE}$=50Ω, $Z_{LOAD}$=50Ω | R = 200Ω, C = 15pF;<br>Note 3 | | <br>210 | | <br>MHz |

Note 1: $T_A$=25°C unless otherwise specified.
Note 2: ESD applied to input and output pins with respect to GND, one at a time.
Note 3: These parameters are guaranteed by design and characterization.

## Performance Information

**Typical Filter Performance** (nominal conditions unless specified otherwise, 0V DC Bias, 50 Ohm Environment)

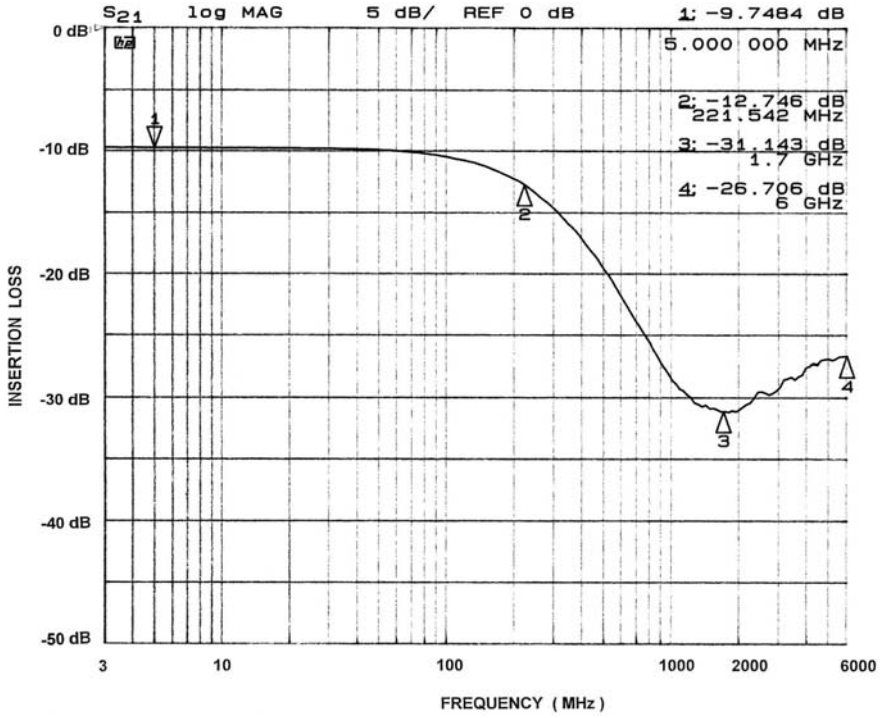



**Figure 1. Channel 1 EMI Filter Performance (CM1407-04)**

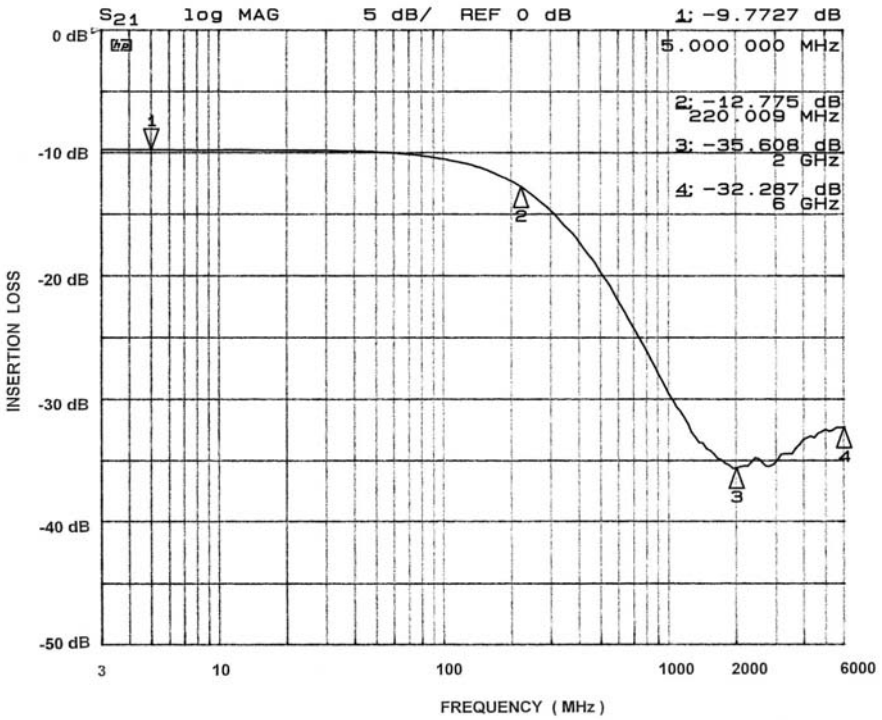



**Figure 2. Channel 2 EMI Filter Performance (CM1407-04)**

## Performance Information (cont'd)

**Typical Filter Performance** (nominal conditions unless specified otherwise, 0V DC Bias, 50 Ohm Environment)

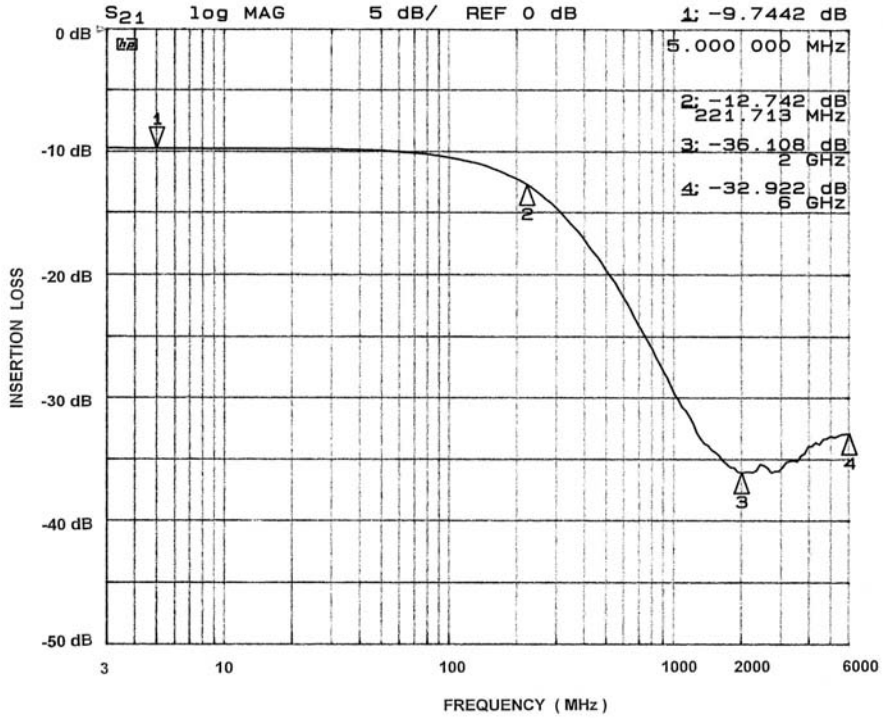



**Figure 3. Channel 3 EMI Filter Performance (CM1407-04)**

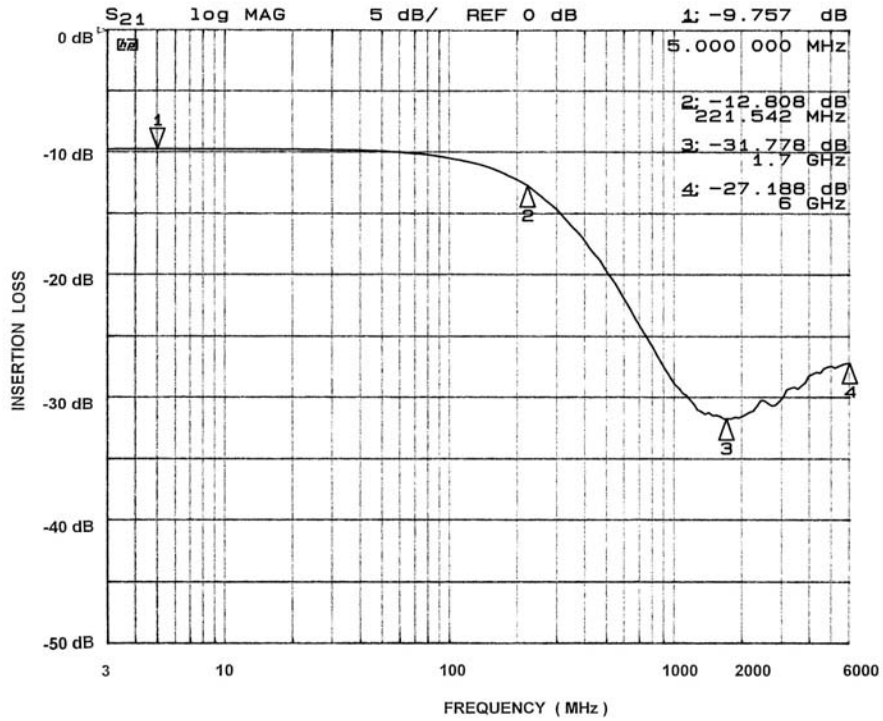



**Figure 4. Channel 4 EMI Filter Performance (CM1407-04)**

## Performance Information (cont'd)

**Typical Filter Performance** (nominal conditions unless specified otherwise, 0V DC Bias, 50 Ohm Environment)

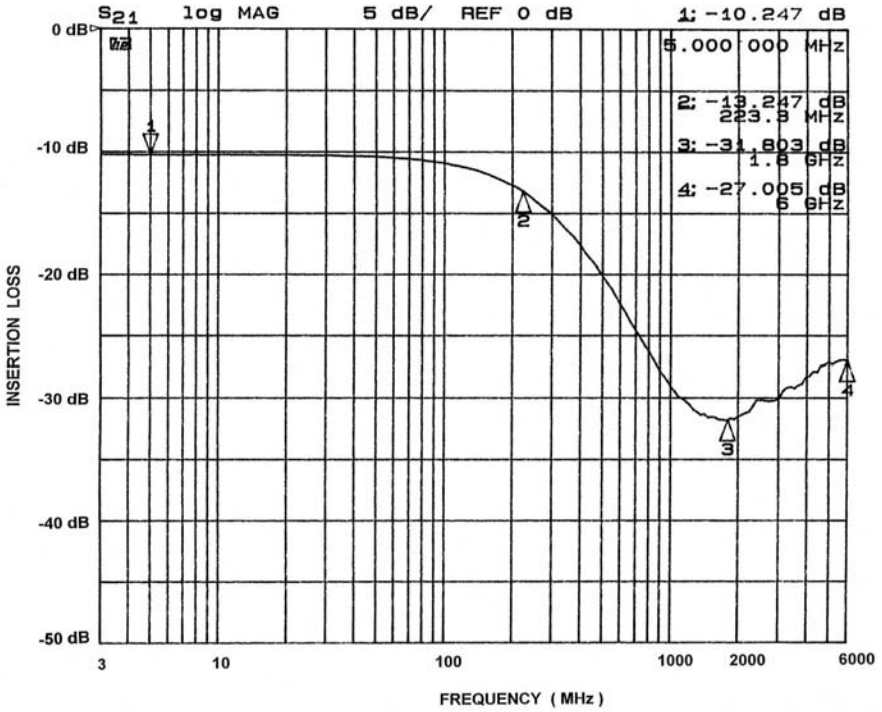



**Figure 5. Channel 1 EMI Filter Performance (CM1407-08)**

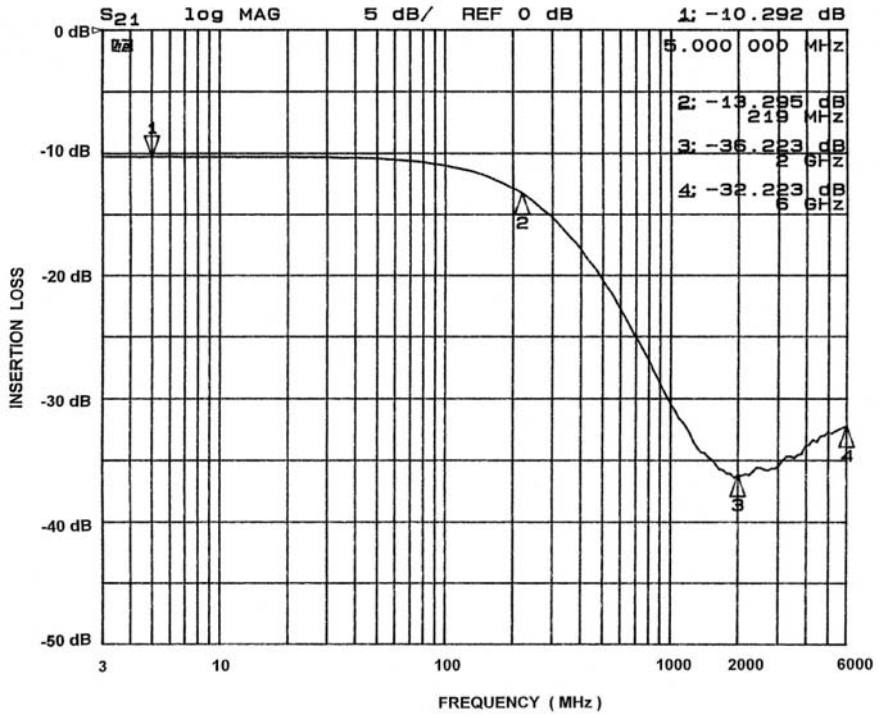



**Figure 6. Channel 2 EMI Filter Performance (CM1407-08)**

## Performance Information (cont'd)

**Typical Filter Performance** (nominal conditions unless specified otherwise, 0V DC Bias, 50 Ohm Environment)

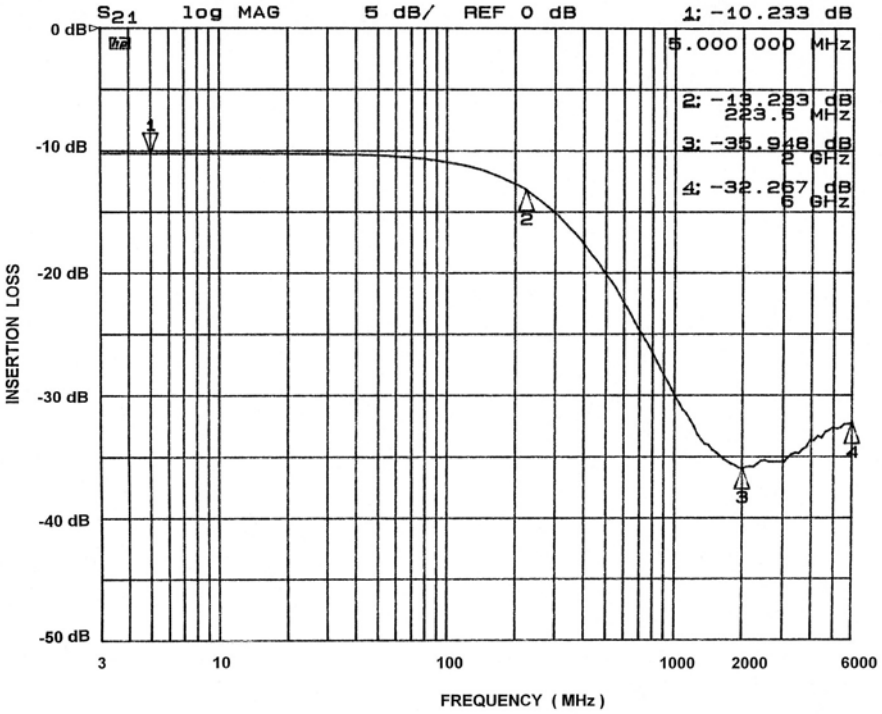



**Figure 7. Channel 3 EMI Filter Performance (CM1407-08)**

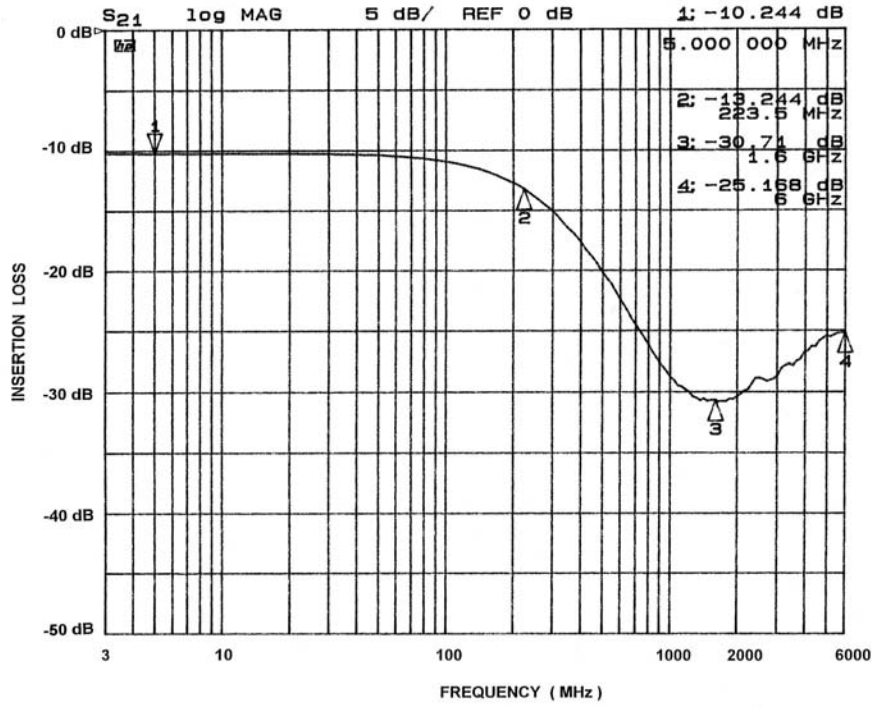



**Figure 8. Channel 4 EMI Filter Performance (CM1407-08)**

## Performance Information (cont'd)

**Typical Filter Performance** (nominal conditions unless specified otherwise, 0V DC Bias, 50 Ohm Environment)

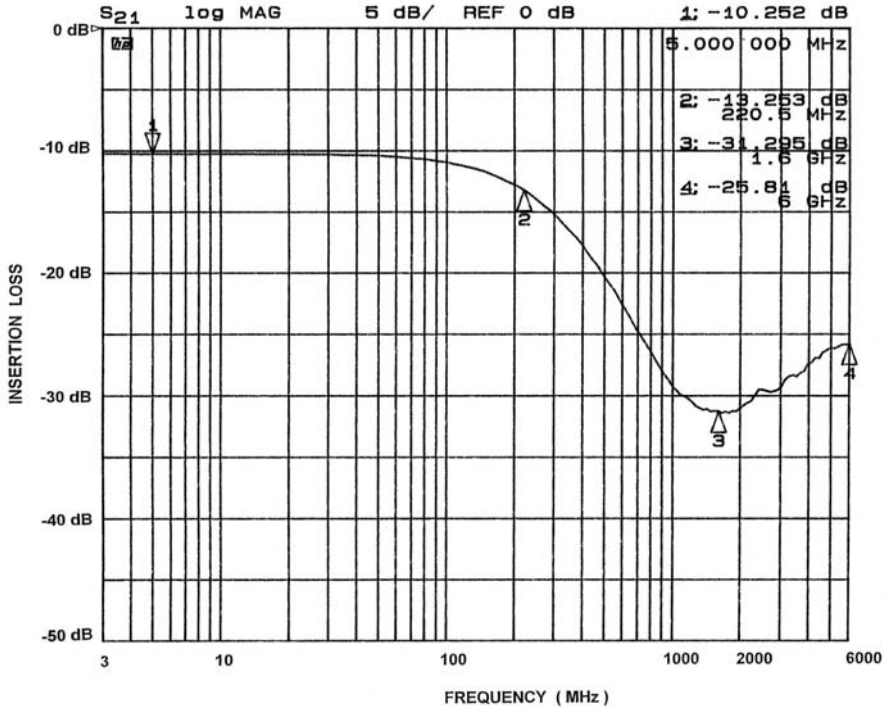



**Figure 9. Channel 5 EMI Filter Performance (CM1407-08)**

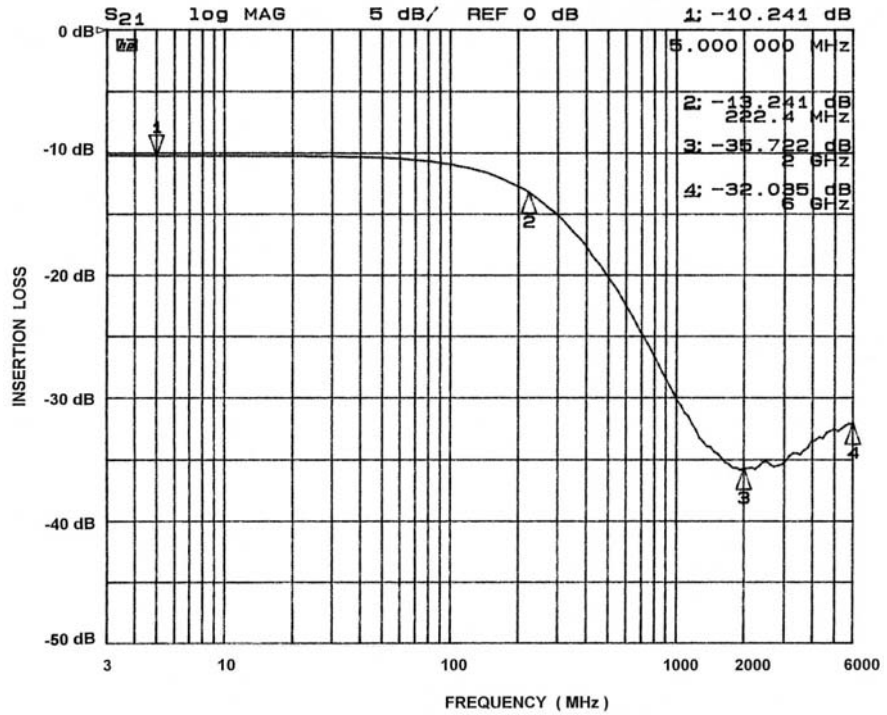



**Figure 10. Channel 6 EMI Filter Performance (CM1407-08)**

## Performance Information (cont'd)

**Typical Filter Performance** (nominal conditions unless specified otherwise, 0V DC Bias, 50 Ohm Environment)

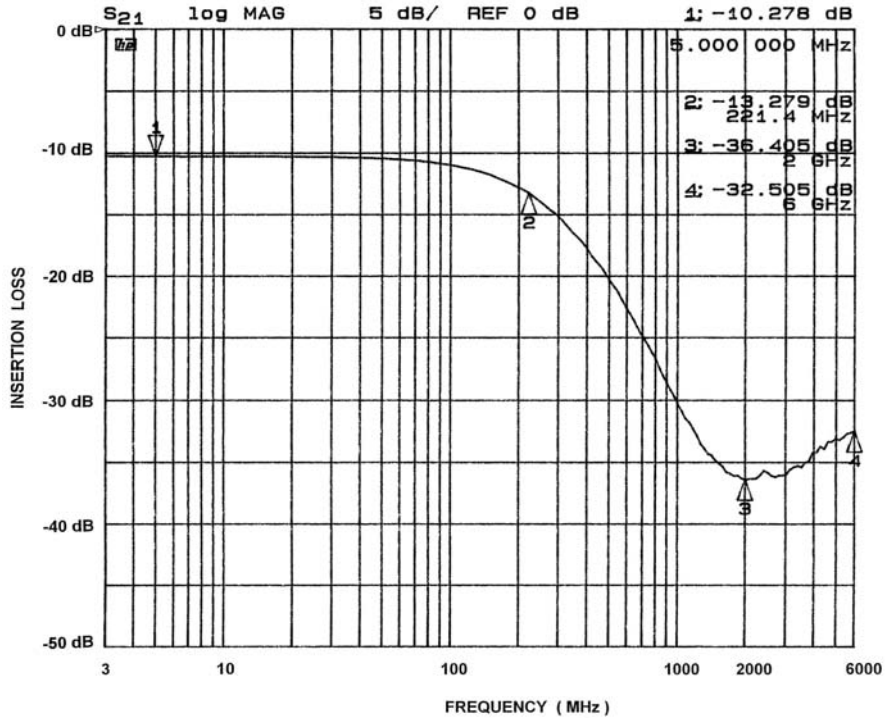



**Figure 11. Channel 7 EMI Filter Performance (CM1407-08)**

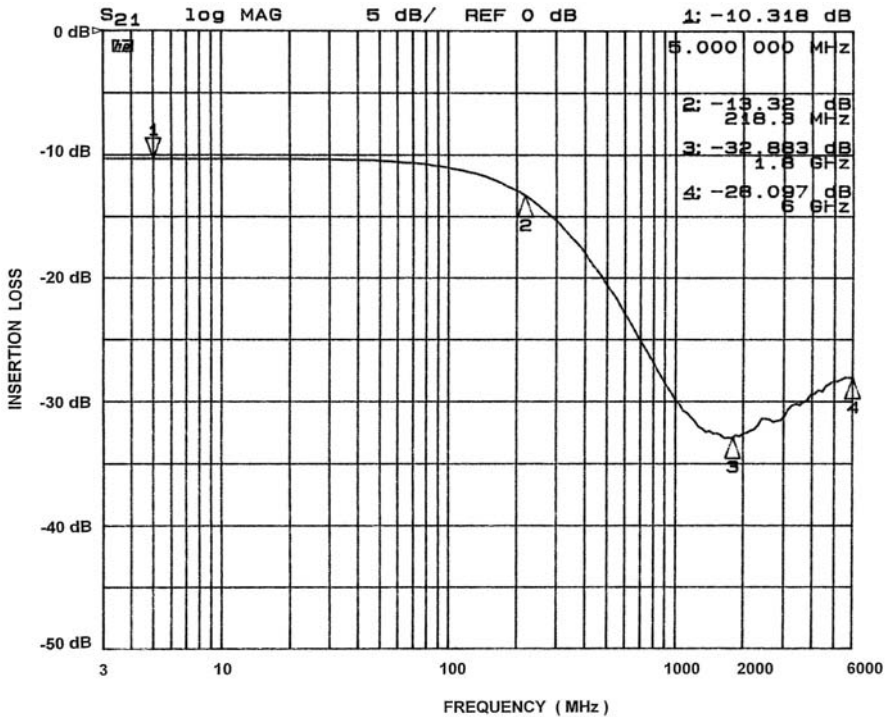



**Figure 12. Channel 8 EMI Filter Performance (CM1407-08)**

## Performance Information (cont'd)

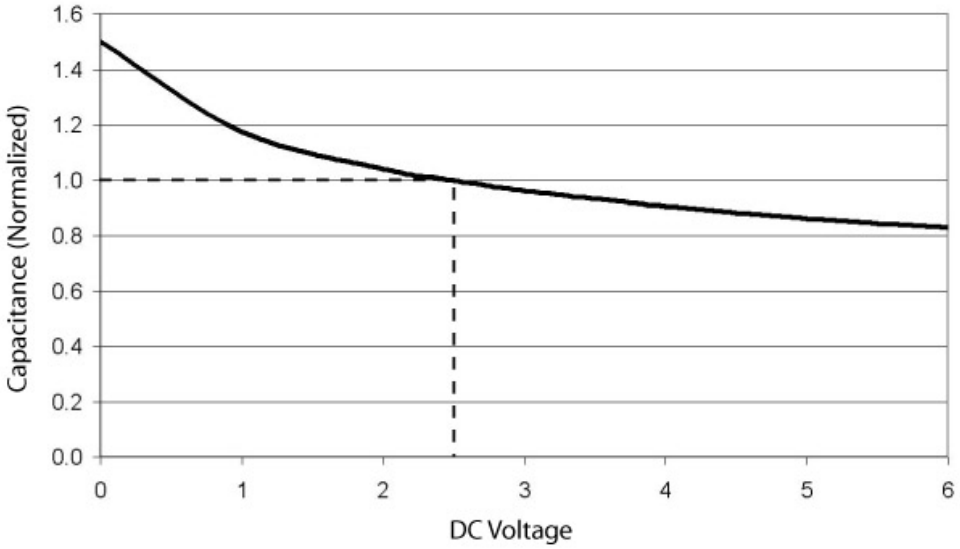



**Figure 13. Filter Capacitance vs. Input Voltage over Temperature (normalized to capacitance at 2.5VDC and 25°C)**

## Mechanical Details

### TDFN-08 Mechanical Specifications

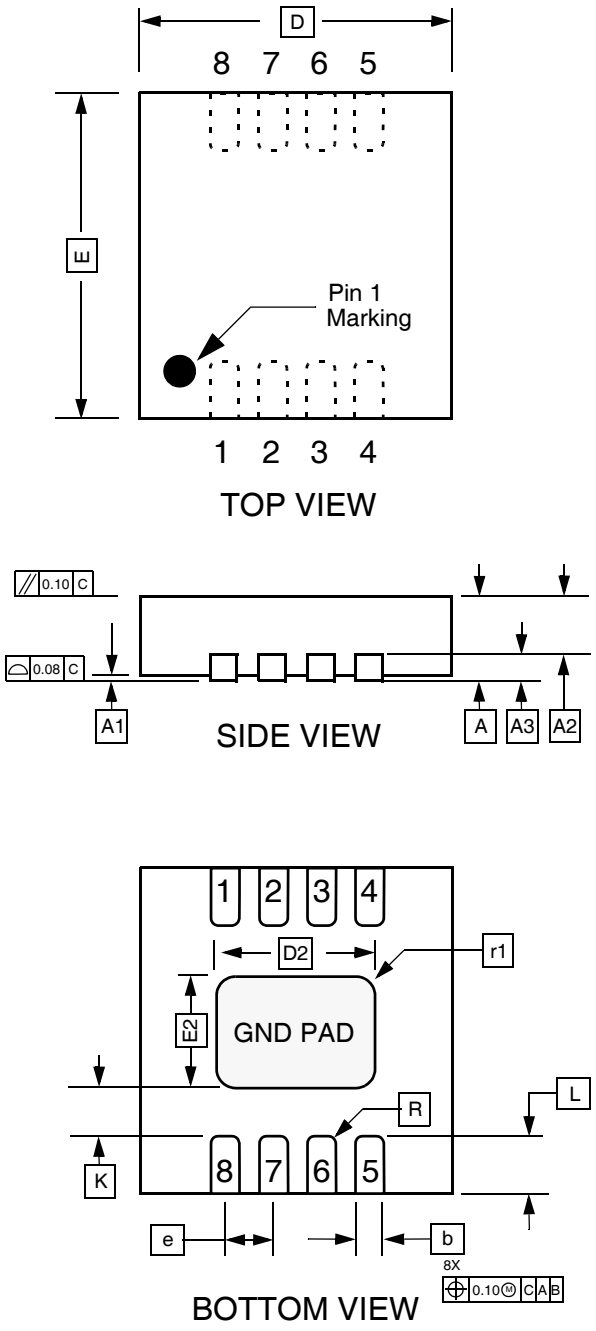
Dimensions for the CM1407 device packaged in an 8-lead TDFN package are presented below.

For complete information on the TDFN-08, see the California Micro Devices TDFN Package Information document.

| PACKAGE DIMENSIONS | | | | | | |
|---|---|---|---|---|---|---|
| **Package** | TDFN | | | | | |
| **JEDEC No.** | MO-229 (Var. VCCD-3)† | | | | | |
| **Leads** | 8 | | | | | |
| **Dim.** | **Millimeters** | | | **Inches** | | |
| | **Min** | **Nom** | **Max** | **Min** | **Nom** | **Max** |
| **A** | 0.80 | 0.90 | 1.00 | 0.031 | 0.035 | 0.039 |
| **A1** | 0.00 | 0.02 | 0.05 | 0.000 | 0.001 | 0.002 |
| **A2** | 0.55 | 0.65 | 0.80 | 0.022 | 0.026 | 0.031 |
| **A3** | | 0.20 | | | 0.008 | |
| **b** | 0.18 | 0.25 | 0.30 | 0.007 | 0.010 | 0.012 |
| **D** | | 2.00 | | | 0.079 | |
| **D2** | 0.88 | 0.98 | 1.08 | 0.035 | 0.039 | 0.043 |
| **E** | | 2.00 | | | 0.079 | |
| **E2** | 0.46 | 0.56 | 0.66 | 0.018 | 0.022 | 0.026 |
| **e** | | 0.50 | | | 0.020 | |
| **K** | 0.20 | | | 0.008 | | |
| **L** | 0.20 | 0.30 | 0.45 | 0.008 | 0.012 | 0.018 |
| **R** | | 0.075 | | | 0.003 | |
| **r1** | | 0.075 | | | 0.003 | |
| **# per tube** | NA | | | | | |
| **# per tape and reel** | 3000 pieces | | | | | |
| Controlling dimension: millimeters | | | | | | |

†This package is compliant with JEDEC standard MO-229, variation VCCD-3 with exception of the "D2" and "E2" dimensions as called out in the table above and the "r1" dimension which is not specified in the MO-229 standard.

**Mechanical Package Diagrams**




**Package Dimensions for 8-Lead TDFN**

## Mechanical Details (cont'd)

### TDFN-16 Mechanical Specifications

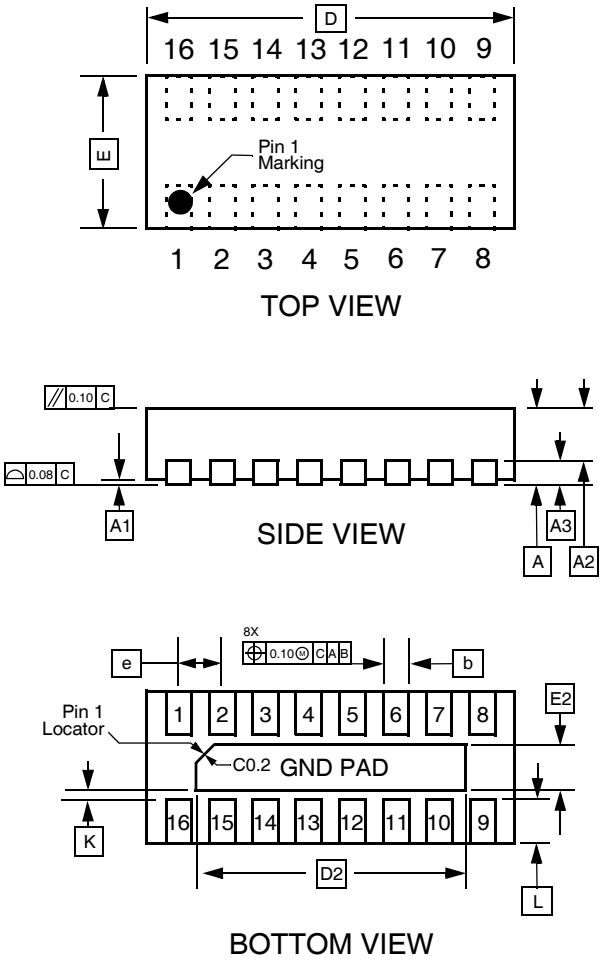
Dimensions for the CM1407 supplied in a 16-lead TDFN package are presented below.

For complete information on the TDFN-16, see the California Micro Devices TDFN Package Information document.

| PACKAGE DIMENSIONS | | | | | | |
|---|---|---|---|---|---|---|
| **Package** | TDFN | | | | | |
| **JEDEC No.** | MO-229C† | | | | | |
| **Leads** | 16 | | | | | |
| **Dim.** | **Millimeters** | | | **Inches** | | |
| | **Min** | **Nom** | **Max** | **Min** | **Nom** | **Max** |
| **A** | 0.70 | 0.75 | 0.80 | 0.028 | 0.030 | 0.031 |
| **A1** | 0.00 | 0.02 | 0.05 | 0.000 | 0.001 | 0.002 |
| **A2** | 0.45 | 0.55 | 0.65 | 0.018 | 0.022 | 0.026 |
| **A3** | | 0.20 | | | 0.008 | |
| **b** | 0.20 | 0.25 | 0.30 | 0.008 | 0.010 | 0.012 |
| **D** | 3.90 | 4.00 | 4.10 | 0.154 | 0.157 | 0.161 |
| **D2** | 3.10 | 3.20 | 3.30 | 0.122 | 0.126 | 0.130 |
| **E** | 1.50 | 1.60 | 1.70 | 0.059 | 0.063 | 0.067 |
| **E2** | 0.30 | 0.40 | 0.50 | 0.012 | 0.016 | 0.020 |
| **e** | | 0.50 | | | 0.020 | |
| **K** | 0.10 | 0.30 | 0.50 | 0.004 | 0.012 | 0.020 |
| **L** | 0.20 | 0.30 | 0.40 | 0.008 | 0.012 | 0.016 |
| **# per tube** | NA | | | | | |
| **# per tape and reel** | 3000 pieces | | | | | |
| Controlling dimension: millimeters | | | | | | |

†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.

**Mechanical Package Diagrams**




**Package Dimensions for 16-Lead TDFN**